TEKELEC
TEMEX

MICROWAVE & RF DEVICES,

CERAMICS & CAPACITORS

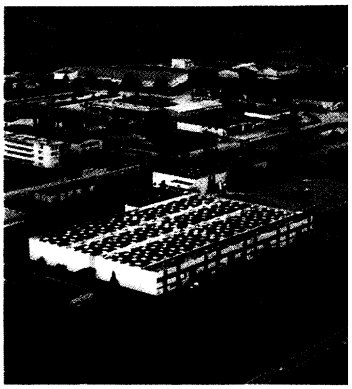
TIME & FREQUENCY COMPONENTS

TEKELEC TEMEX
Industrial centres

MONTREUIL (PARIS)

LES ULIS (PARIS)

PESSAC (BORDEAUX)



TROYES

Our facilities of BORDEAUX and LISBON are the TEKELEC TEMEX expert in ceramic and capacitors solutions. Spread over 9000 m², they are manufacturing ceramic capacitors, tuning capacitors, dielectric and ferrite materials, mica and tantalum capacitors, filters and duplexers under ISO 9000 Quality system.

Our facilities of TROYES and NEUCHATEL are the TEKELEC TEMEX expert in ultra stable frequency sources. Spread over 3000 m², they are manufacturing crystal resonators, crystal filters, crystal oscillators and rubidium frequency standards under ISO 9000 Quality system.

Our facilities of PARIS are the European leader for Microwave devices. Spread over 5000 m², they are manufacturing ferrite devices, RF & Microwave modules and Silicon microwave diodes under ISO 9000 Quality system.

SALES OFFICES

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TEKELEC TEMEX

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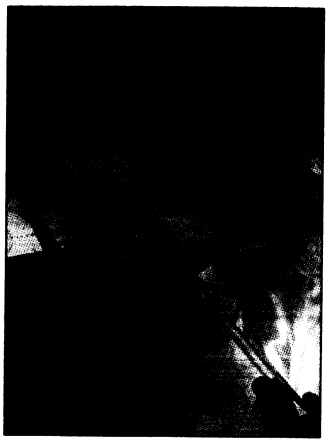
INTRODUCTION

Founded in 1958, the TEKELEC Group has based its success on bringing to the International markets the most innovative products and technologies. Today, TEKELEC plays a major role in the electronics, computer and telecommunications industries.



The Group consists of 20 companies employing over 2000 people in Europe, the USA and Japan, and has an overall turnover of 1.5 Billion US$.

TEKELEC has two main companies: one specialized in distribution and one dedicated to manufacturing electronic products, TEKELEC TEMEX, which includes three branches: Components, Systems and Telecom.

The Components Branch employs 600 people split in three divisions, specialized in « RF & Microwave components and modules », « Time & Frequency devices », and « Ceramics & Capacitors ». Each division has its own R & D, marketing and production facilities and they have a common sales organization and information system. They also share the same values and corporate goals: customer service, quality, innovation, international market penetration, focus on strategic markets.

This policy has generated for TEKELEC TEMEX a substantial growth, so that it is now a recognized leader among the European sources of components for the booming wireless telecommunication market.

It is also a major partner for military applications, and one of the few European sources of space qualified components.

We look forward to serve the world market and have established subsidiaries and appointed representatives in a growing number of countries.

Let us share your success in your new applications.

Jean-Pierre EUVRARD
President
Tekelec Temex

Etienne PAILLARD
General Manager
Components Branch

HISTORY

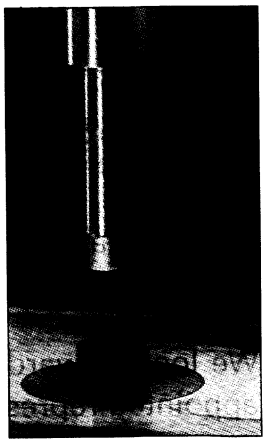
The TEKELEC Group started by distributing Electronic components. It has extended its activity to manufacturing in 1971.

The first plant was established in the Bordeaux area, in the South West of France, for trimmer capacitors production. Since that time, the industrial activity never stopped growing with new creations and acquisitions of facilities. A new plant was created in Portugal for the Tantalum capacitors production, and RF & microwave components and crystal divisions were established by acquisition.

This evolution was complemented in 1996 with the merge of the two industrial branches TEKELEC COMPONENTS and TEKELEC TELECOM into a new company: TEKELEC TEMEX.

MARKETS, APPLICATIONS & PRODUCT LINES

TEKELEC TEMEX - Components Branch - has more than 25 years of experience in manufacturing and marketing RF & Microwave components and modules, Capacitors and Crystal products. In order to sustain its continuous growth, TEKELEC TEMEX - Components Branch - has decided to focus its production in very specific field such as:



- **TELECOMMUNICATIONS**: Cellular phone, radio links, telephone exchanges, pagers, satellites and cable TV,
- **MILITARY**: Radars, frequency hopping radios, missiles,
- **SCIENTIFIC**: Microwave heatings, radiotherapy, NMR, imaging, particle acceleration,
- **SPACE.**

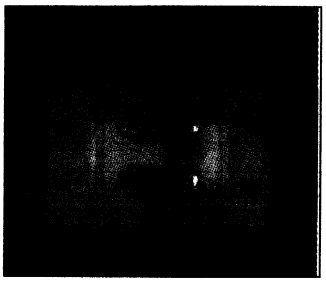
TEKELEC TEMEX - Components Branch - main product lines consists of: Quartz resonators, quartz filters, quartz oscillators, rubidium master clock, microwave diodes, ferrite devices, RF & microwave modules, ceramic capacitors, tuning capacitors, filters and duplexers, dielectric and ferrite materials, tantalum capacitors and mica capacitors. This data-book presents all the TEKELEC TEMEX - Components Branch - products, and certain subsystems from our other Branches.

All information contained in the data-book are subject to change without notice.

TECHNOLOGIES

Ceramic, silicon or quartz: the expertise in basic materials

The performance of electronic components depends largely on the quality of basic materials; TEKELEC TEMEX is one of few European manufacturers which not only transforms the material they use, but also completely process them from the beginning. This ensures the total independence from outside sources and allows a technological advantage in front of a constantly changing market.

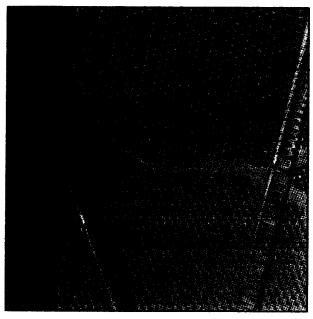


CERAMICS: TEKELEC TEMEX makes its own powders, from basic chemicals, and then performs atomizing pressing, flowing, and sintering operations.

SILICON: Material of average quality do not suit the level of performances which is required by microwave products. This is why TEKELEC TEMEX grows its own silicon wafers in its epitaxy facility.

QUARTZ: In order to reach utmost stability, TEKELEC TEMEX masters the whole manufacturing process, from specifying and cutting crystal bars. Three resonator manufacturing processes are now used: mechanical lapping, ion, beam etching and chemical etching. This exceptional capability allows to select the technology best suited for the highest performance to cost ratio.

MECHANICAL PARTS: TEKELEC TEMEX' top level machining capabilities (CNC Machining centers, high precision watchmaking lathes...) enable the achievement of the extremely accurate mechanical parts that are needed in many of the high performace passive components.



QUALITY

Our Quality system encompasses the complete product life cycle, from conception to design, build and final customer satisfaction.

The policy of TEKELEC TEMEX - Components Branch - is outlined in the Quality Manual.

TEKELEC TEMEX manufactures to and in accordance with:

- ISO 9001 and 9002 standards,
- AQAP 110 to 150 publications,
- ESA SCC series 20000,
- CECC 00114

Quality is an essential part of the duties of our people and covers both product and system qualifications.

Our objectives:

- **offer products matching customer requirements on time**
- every plant to comply with ISO 9000 standards
- Quality awareness from the preliminary design stage
- improve manufacturing capability by utilization of SPC
- continous Quality awareness through in-house training

HOMOLOGATION AND CERTIFICATIONS

• **Pessac industrial center:**	ISO 9001	N° 029-92
	ISO 9001	N° 1992/474
	CECC 00114	
	QUALITY CONTRACT	
• **Cascais industrial center:**	ISO 9002	N° 001-93
• **Montreuil industrial center:**	RAQ1 - AQAP 1 (Otan)	N° RAQ1 / 1-91-045
	ISO 9001	N° 1997/7423
• **Troyes industrial center:**	ISO 9002	N° 1996/6633

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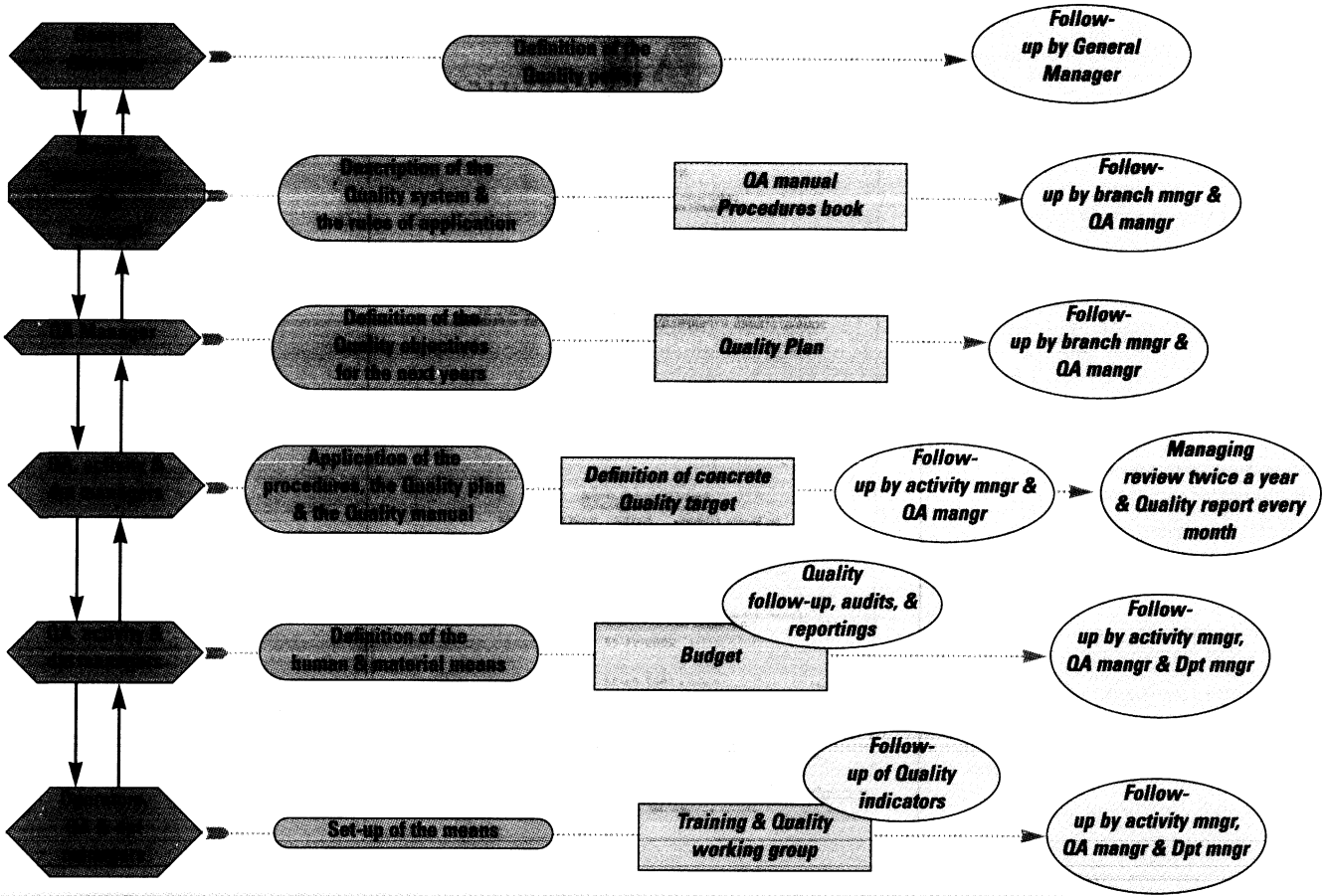
	NF	CECC	CEI	ESA
Tantalum capacitors*	83112	30201	30 201/FR001	3011
	83113	30801	-	-
Trimmer capacitors*	93171	In progress	-	3010
Ceramic capacitors*	-	32101	-	In progress
Diodes*	-	-	-	5010
Circulators**	96316	-	-	-
Ferrites**	-	-	CEI556	-
Dielectrics**	-	-	In progress	-

* : Given by official monitoring authority
** : Given by customers following official standards

How does our Quality system work ?



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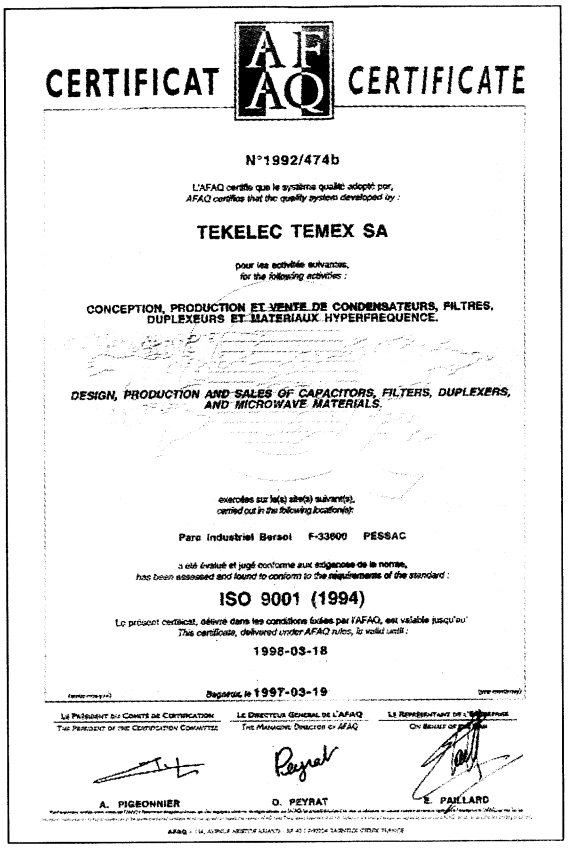
TEKELEC TEMEX Certifications



CERTIFICAT AFAQ CERTIFICATE

N°1992/474b

L'AFAQ certifie que le système qualité adopté par,
AFAQ certifies that the quality system developed by :

TEKELEC TEMEX SA

pour les activités suivantes,
for the following activities :

CONCEPTION, PRODUCTION ET VENTE DE CONDENSATEURS, FILTRES, DUPLEXEURS ET MATERIAUX HYPERFREQUENCE.

DESIGN, PRODUCTION AND SALES OF CAPACITORS, FILTERS, DUPLEXERS, AND MICROWAVE MATERIALS.

exercées sur le(s) site(s) suivant(s),
carried out in the following location(s):

Parc Industriel Bersol F-33600 PESSAC

a été évalué et jugé conforme aux exigences de la norme,
has been assessed and found to conform to the requirements of the standard :

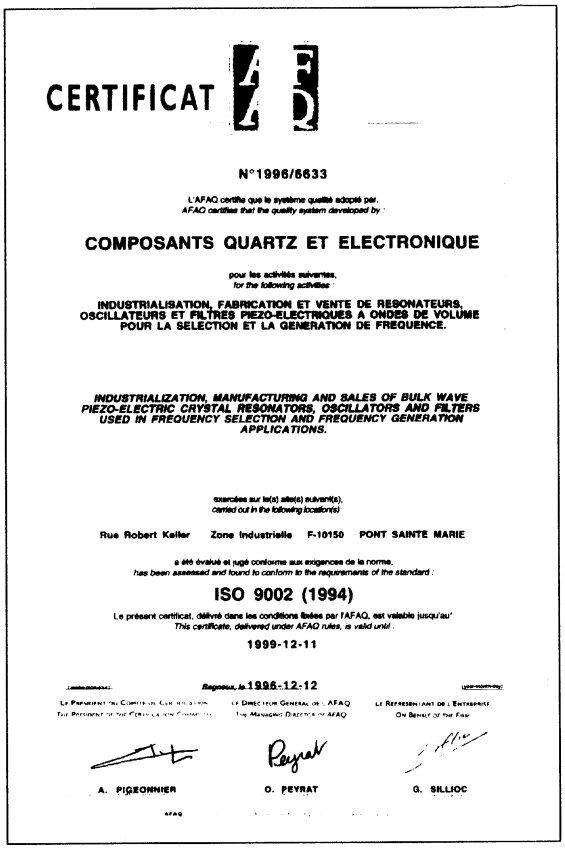
ISO 9001 (1994)

Le présent certificat, délivré dans les conditions fixées par l'AFAQ, est valable jusqu'au*
This certificate, delivered under AFAQ rules, is valid until :

1998-03-18

Registered le 1997-03-19

Le Président du Comité de Certification / The President of the Certification Committee	Le Directeur Général de l'AFAQ / The Managing Director of AFAQ	Le Représentant de l'Entreprise / On Behalf of the Firm
A. PIGEONNIER	O. PEYRAT	E. PAILLARD



CERTIFICAT AFAQ

N°1996/6633

L'AFAQ certifie que le système qualité adopté par,
AFAQ certifies that the quality system developed by :

COMPOSANTS QUARTZ ET ELECTRONIQUE

pour les activités suivantes,
for the following activities :

INDUSTRIALISATION, FABRICATION ET VENTE DE RESONATEURS, OSCILLATEURS ET FILTRES PIEZO-ELECTRIQUES A ONDES DE VOLUME POUR LA SELECTION ET LA GENERATION DE FREQUENCE.

INDUSTRIALIZATION, MANUFACTURING AND SALES OF BULK WAVE PIEZO-ELECTRIC CRYSTAL RESONATORS, OSCILLATORS AND FILTERS USED IN FREQUENCY SELECTION AND FREQUENCY GENERATION APPLICATIONS.

exercées sur le(s) site(s) suivant(s),
carried out in the following location(s)

Rue Robert Keller Zone Industrielle F-10150 PONT SAINTE MARIE

a été évalué et jugé conforme aux exigences de la norme,
has been assessed and found to conform to the requirements of the standard :

ISO 9002 (1994)

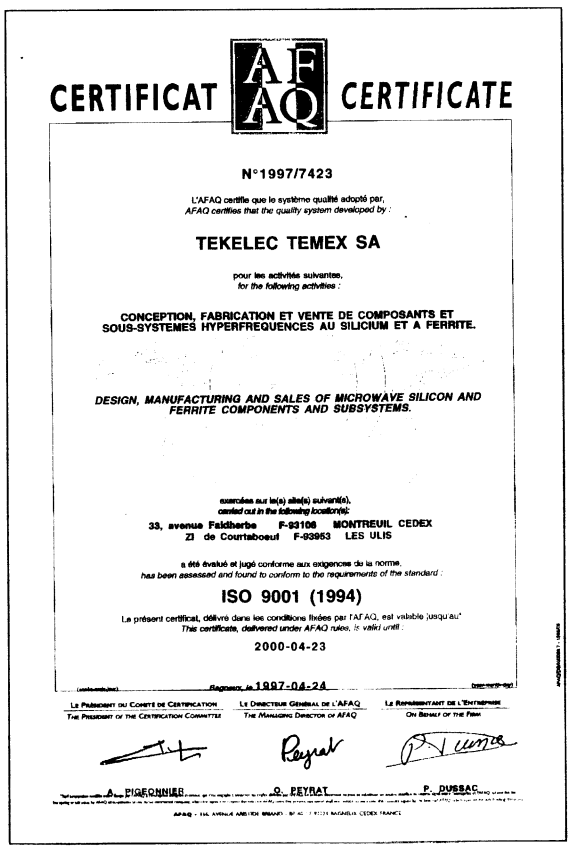
Le présent certificat, délivré dans les conditions fixées par l'AFAQ, est valable jusqu'au*
This certificate, delivered under AFAQ rules, is valid until :

1999-12-11

Registered le 1996-12-12

Le Président du Comité de Certification / The President of the Certification Committee	Le Directeur Général de l'AFAQ / The Managing Director of AFAQ	Le Représentant de l'Entreprise / On Behalf of the Firm
A. PIGEONNIER	O. PEYRAT	G. SILLIOC

AFAQ



CERTIFICAT AFAQ CERTIFICATE

N°1997/7423

L'AFAQ certifie que le système qualité adopté par,
AFAQ certifies that the quality system developed by :

TEKELEC TEMEX SA

pour les activités suivantes,
for the following activities :

CONCEPTION, FABRICATION ET VENTE DE COMPOSANTS ET SOUS-SYSTEMES HYPERFREQUENCES AU SILICIUM ET A FERRITE.

DESIGN, MANUFACTURING AND SALES OF MICROWAVE SILICON AND FERRITE COMPONENTS AND SUBSYSTEMS.

exercées sur le(s) site(s) suivant(s),
carried out in the following location(s):

33, avenue Faidherbe F-93108 MONTREUIL CEDEX
ZI de Courtaboeuf F-93953 LES ULIS

a été évalué et jugé conforme aux exigences de la norme,
has been assessed and found to conform to the requirements of the standard :

ISO 9001 (1994)

Le présent certificat, délivré dans les conditions fixées par l'AFAQ, est valable jusqu'au*
This certificate, delivered under AFAQ rules, is valid until :

2000-04-23

Registered le 1997-04-24

Le Président du Comité de Certification / The President of the Certification Committee	Le Directeur Général de l'AFAQ / The Managing Director of AFAQ	Le Représentant de l'Entreprise / On Behalf of the Firm
A. PIGEONNIER	O. PEYRAT	P. DUSSAC

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SPAIN: +34 (0) 1 320 41 60
NL: +31 (0) 793461430
UK: +44 (0) 1256 883340

TEKELEC TEMEX Certifications

european space agency
agence spatiale européenne

Certificate of Qualification No. 129 C

This is to certify that TEKELEC, Passac, France

has been qualified by ESA for the supply of Capacitors, Concentric Trimmers, Variable

for use in ESA space programmes, according to ESA/SCC Generic Specification 3010 and Detail Specifications 3010/004, 3010/006, 3010/008, 3010/010, 3010/011, 3010/012 and 3010/013

as recommended by the Space Components Coordination Group.
This certificate is valid until November 1995.

Head of Product Assurance and Safety Department

Date
23rd November 1993

european space agency
agence spatiale européenne

Certificate of Qualification No. 186 A

This is to certify that TEKELEC, Cascais, Portugal

has been qualified by ESA for the supply of Capacitors, Chip, Tantalum, Solid Electrolyte

for use in ESA space programmes, according to ESA/SCC Generic Specification 3011 and Detail Specifications 3011/001, 3011/002, 3011/003, 3011/004, 3011/005, 3011/006, 3011/007 & 3011/008

as recommended by the Space Components Coordination Group.
This certificate is valid until January 1997.

Head of Product Assurance and Safety Department

Date
9th January 1995

european space agency
agence spatiale européenne

Certificate of Qualification No. 225

This is to certify that TEKELEC, Montreuil, France

has been qualified by ESA for the supply of Diodes, Microwave, Silicon, Multiplier Varactor, Type DH 267

for use in ESA space programmes, according to ESA/SCC Generic Specification 5010 and Detail Specification 5512/016

as recommended by the Space Components Coordination Group.
This certificate is valid until June 1997.

Head of Product Assurance and Safety Department

Date
9th June 1995

european space agency
agence spatiale européenne

Certificate of Qualification No. 226

This is to certify that TEKELEC, Montreuil, France

has been qualified by ESA for the supply of Diodes, Microwave, Schottky, Mixer, Silicon, Type DH 315

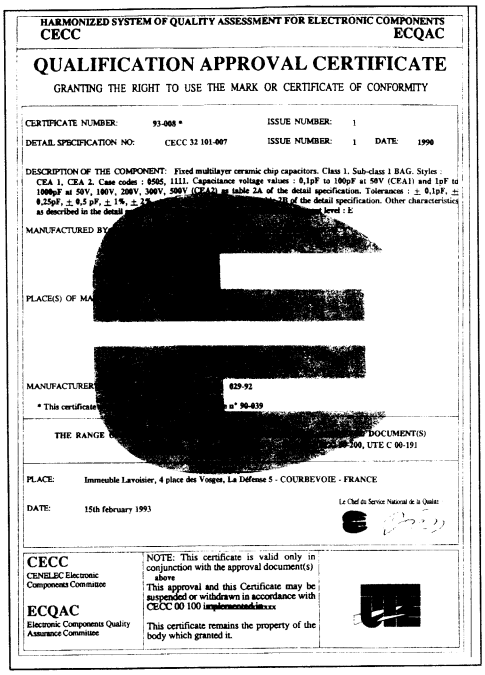
for use in ESA space programmes, according to ESA/SCC Generic Specification 5010 and Detail Specification 5512/017

as recommended by the Space Components Coordination Group.
This certificate is valid until June 1997.

Head of Product Assurance and Safety Department

Date
9th June 1995

TEKELEC TEMEX Certifications



HARMONIZED SYSTEM OF QUALITY ASSESSMENT FOR ELECTRONIC COMPONENTS
CECC ECQAC

QUALIFICATION APPROVAL CERTIFICATE

GRANTING THE RIGHT TO USE THE MARK OR CERTIFICATE OF CONFORMITY

CERTIFICATE NUMBER: 93-068 * ISSUE NUMBER: 1

DETAIL SPECIFICATION NO: CECC 32 101-007 ISSUE NUMBER: 1 DATE: 1990

DESCRIPTION OF THE COMPONENT: Fixed multilayer ceramic chip capacitors. Class 1. Sub-class 1 BAG. Styles : CEA 1, CEA 2. Case codes : 0505, 1111. Capacitance voltage values : 0,1pF to 100pF at 50V (CEA1) and 1pF to 1000pF at 50V, 100V, 200V, 300V, 500V (CEA2) as table 2A of the detail specification. Tolerances : ± 0,1pF, ± 0,25pF, ± 0,5 pF, ± 1%, ± 2% ... of the detail specification. Other characteristics as described in the detail ... level : E

MANUFACTURED BY [redacted]

PLACE(S) OF MA[redacted]

MANUFACTURER[redacted] 029-92

* This certificate [redacted] n° 90-039

THE RANGE [redacted] DOCUMENT(S) [redacted]-200, UTE C 00-191

PLACE: Immeuble Lavoisier, 4 place des Vosges, La Défense 5 - COURBEVOIE - FRANCE

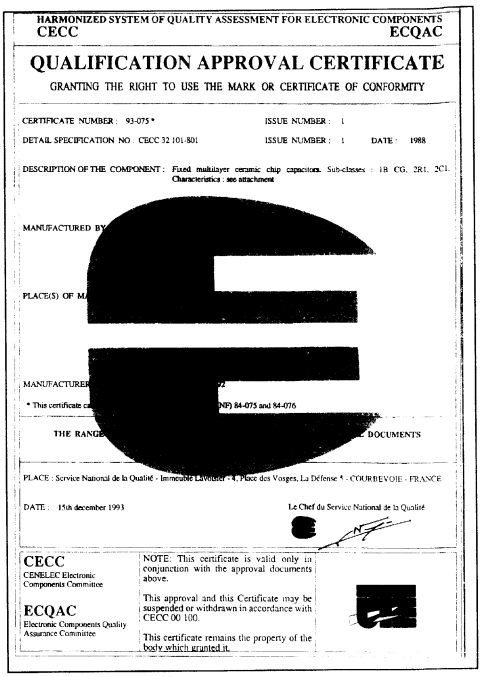
DATE: 15th february 1993

Le Chef du Service National de la Qualité

CECC
CENELEC Electronic Components Committee

ECQAC
Electronic Components Quality Assurance Committee

NOTE: This certificate is valid only in conjunction with the approval document(s) above
This approval and this Certificate may be suspended or withdrawn in accordance with CECC 00 100 [redacted]
This certificate remains the property of the body which granted it.



HARMONIZED SYSTEM OF QUALITY ASSESSMENT FOR ELECTRONIC COMPONENTS
CECC ECQAC

QUALIFICATION APPROVAL CERTIFICATE

GRANTING THE RIGHT TO USE THE MARK OR CERTIFICATE OF CONFORMITY

CERTIFICATE NUMBER: 93-075 * ISSUE NUMBER: 1

DETAIL SPECIFICATION NO: CECC 32 101-801 ISSUE NUMBER: 1 DATE: 1988

DESCRIPTION OF THE COMPONENT: Fixed multilayer ceramic chip capacitors. Sub-classes : 1B CG, 2R1, 2C1. Characteristics : see attachment

MANUFACTURED BY [redacted]

PLACE(S) OF MA[redacted]

MANUFACTURER[redacted]

* This certificate [redacted] [redacted]NF) 84-075 and 84-076

THE RANGE [redacted] DOCUMENTS

PLACE : Service National de la Qualité - Immeuble Lavoisier - 4, Place des Vosges, La Défense 5 - COURBEVOIE - FRANCE

DATE : 15th december 1993

Le Chef du Service National de la Qualité

CECC
CENELEC Electronic Components Committee

ECQAC
Electronic Components Quality Assurance Committee

NOTE: This certificate is valid only in conjunction with the approval documents above.
This approval and this Certificate may be suspended or withdrawn in accordance with CECC 00 100.
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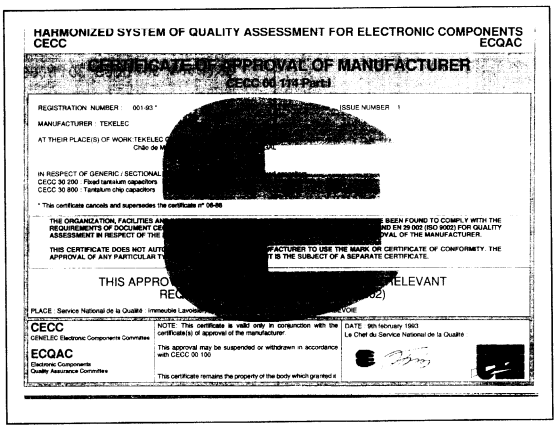


HARMONIZED SYSTEM OF QUALITY ASSESSMENT FOR ELECTRONIC COMPONENTS
CECC ECQAC

CERTIFICATE OF APPROVAL OF MANUFACTURER

CECC 00 114 Part 1

REGISTRATION NUMBER : 001-03 * ISSUE NUMBER : 1

MANUFACTURER : TEKELEC

AT THEIR PLACE(S) OF WORK TEKELEC [redacted]

IN RESPECT OF GENERIC / SECTIONAL SPECIFICATION(S)
CECC 30 200 : Fixed tantalum capacitors
CECC 30 800 : Tantalum chip capacitors

* This certificate cancels and supersedes the certificate n° 06-88

THE ORGANIZATION, FACILITIES AND [redacted] HAVE BEEN FOUND TO COMPLY WITH THE REQUIREMENTS OF DOCUMENT CE[redacted] AND EN 29 003 (ISO 9002) FOR QUALITY ASSESSMENT IN RESPECT OF THE [redacted] APPROVAL OF THE MANUFACTURER.

THIS CERTIFICATE DOES NOT AUT[redacted] MANUFACTURER TO USE THE MARK OR CERTIFICATE OF CONFORMITY. THE APPROVAL OF ANY PARTICULAR T[redacted] IS THE SUBJECT OF A SEPARATE CERTIFICATE.

THIS APPRO[redacted] RELEVANT RE[redacted] 02)

PLACE : Service National de la Qualité - Immeuble Lavoi[redacted]

DATE : 9th february 1993
Le Chef du Service National de la Qualité

CECC
CENELEC Electronic Components Committee

ECQAC
Electronic Components Quality Assurance Committee

NOTE: This certificate is valid only in conjunction with the certificate(s) of approval of the manufacturer.
This approval may be suspended or withdrawn in accordance with CECC 00 100
This certificate remains the property of the body which granted it

MINISTÈRE DE LA DÉFENSE

DGA

SERVICE DE LA SURVEILLANCE INDUSTRIELLE DE L'ARMEMENT

ATTESTATION RAQ-1

Le système d'assurance de la qualité dont le champ d'action est défini au paragraphe 1 ci-apres a ete evalué comme repondant aux exigences du Réglement sur l'Assurance de la Qualite RAQ-1, pour les fournitures du ressort de la surveillance du SIAR dont la nature est précisée au paragraphe 2. L'efficacite de ce système est appréciee par la surveillance exercée par le SIAR chez le fournisseur

1 - Societe **TEKELEC AIRTRONIC**
Branche Tekelec Components
Division de Montreuil

Etablissement(s) - 33 avenue Faidherbe
93106 MONTREUIL
- Z.I Courtaboeuf
29 rue de la Baltique
91953 LES ULIS

2 - Fournitures Etudes, développements et fabrications dans les domaines Radio Fréquences, Hautes Frequences et Hyperfrequences de
- dispositifs à ferrite
- composants semi-conducteurs diodes et capacites MOS
- sous-ensembles

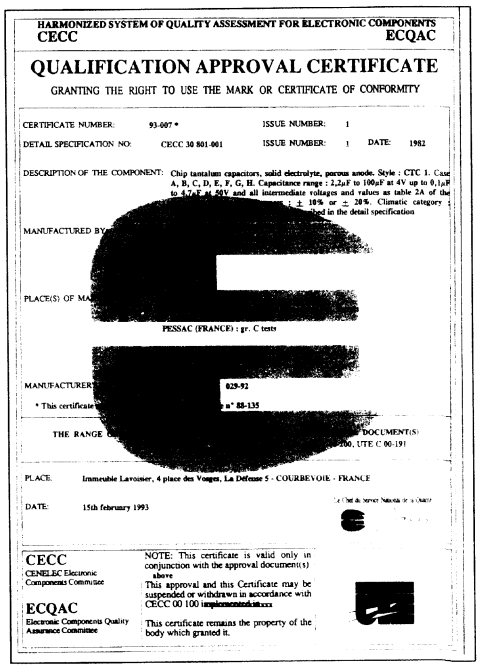
Les exigences du RAQ-1 en matiere d'assurance de la qualite sont equivalentes à celles du document AQAP-1 de l'OTAN

La presente attestation est valable jusqu'au 14.01.1997 , sauf annulation notifiée entre temps

A Paris le 12 janvier 1994

Attestation n° RAQ-1/1-91-045

(Renouvellement et transfert de l'attestation delivree sous le même numéro [redacted])



HARMONIZED SYSTEM OF QUALITY ASSESSMENT FOR ELECTRONIC COMPONENTS
CECC ECQAC

QUALIFICATION APPROVAL CERTIFICATE

GRANTING THE RIGHT TO USE THE MARK OR CERTIFICATE OF CONFORMITY

CERTIFICATE NUMBER: 93-007 * ISSUE NUMBER: 1

DETAIL SPECIFICATION NO: CECC 30 801-001 ISSUE NUMBER: 1 DATE: 1982

DESCRIPTION OF THE COMPONENT: Chip tantalum capacitors, solid electrolyte, porous anode. Style : CTC 1. Case A, B, C, D, E, F, G, H. Capacitance range : 2,2µF to 100µF at 4V up to 0,1µF to 4,7µF at 50V and all intermediate voltages and values as table 2A of the [redacted] ± 10% or ± 20%. Climatic category [redacted] detail specification

MANUFACTURED BY [redacted]

PLACE(S) OF MA[redacted]

PESSAC (FRANCE) : gr. C tests

MANUFACTURER[redacted] 029-92

* This certificate [redacted] n° 88-135

THE RANGE [redacted] DOCUMENT(S) [redacted]200, UTE C 00-191

PLACE: Immeuble Lavoisier, 4 place des Vosges, La Défense 5 - COURBEVOIE - FRANCE

DATE: 15th february 1993

Le Chef du Service National de la Qualité

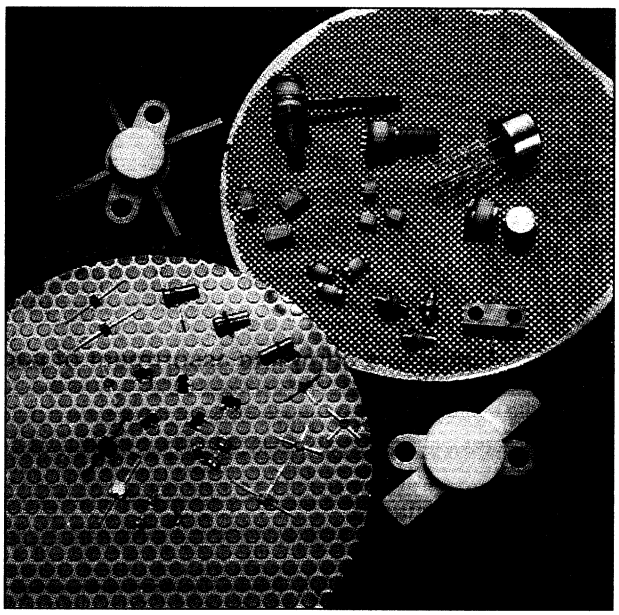
CECC
CENELEC Electronic Components Committee

ECQAC
Electronic Components Quality Assurance Committee

NOTE: This certificate is valid only in conjunction with the approval document(s) above
This approval and this Certificate may be suspended or withdrawn in accordance with CECC 00 100 [redacted]
This certificate remains the property of the body which granted it.

MICROWAVE SILICON COMPONENTS

CONTENTS



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INTRODUCTION

This part of the Microwave section presents TEKELEC TEMEX's product lines including:

- receiving diodes
- control diodes
- tuning varactors
- multiplier varactors
- step recovery diodes
- high voltage PIN diodes

TEKELEC TEMEX's products are available in a complete assortment of packages including:

- chips
- standard
- surface mount ceramic and plastic
- non magnetic
- custom

IN-HOUSE PRODUCTION

The silicon slice is the in-house starting point of TEKELEC TEMEX's product manufacturing. From the virgin wafer, TEKELEC TEMEX performs all functions, including:

- epitaxy
- diffusion
- photomasking
- metallization
- passivation
- dicing
- packaging
- control and burn-in

TEKELEC TEMEX uses and controls ten separate silicon-related technologies, e.g. all Schottky metallurgies, all junction passivations, and all mesa operations.

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SYMBOLS

C_b	Case Capacitance
C_j	Junction Capacitance
C_T	Total Capacitance
C_X/C_Y	Tuning Ratio
f	Test Frequency
F_{CO}	Cut-off Frequency
F_I	Frequency Input
F_{IF}	Intermediate Frequency
F_O	Output Frequency
F_{oper}	Operating frequency
I_F	Forward Continuous Current
I_R	Reverse Continuous Current
I_{RP}	Reverse Pulse Current
L	Conversion Loss
N/A	Not Applicable
NF_{SSB}	Single Sideband Noise Figure
NF_{IF}	Noise Figure of Intermediate Frequency
∅	Gold Contact Diameter
P_{CW}	CW Power Capability
P_{diss}	Power Dissipation
P_{in}	Power Input
P_L	Limiting Threshold
P_{LO}	Local Oscillator Power
P_O	Output Power
P_{RF}	RF Power
Q_{-X}	Figure of Merit
R_{SF}	Forward Series Resistance
R_{th}	Thermal Resistance
R_V	Video Resistance
τ_l	Minority Carrier Lifetime
T_{CR}	Reverse Switching Time
T_j	Junction Temperature
t_{SO}	Snap-off Time
T_{SS}	Tangential Sensitivity
V_{BR}	Breakdown Voltage
V_F	Forward Continuous Voltage
V_R	Applicable Voltage (RF + bias)
VSWR	Voltage Standing Wave Ratio
V_T	Forward Threshold Voltage
V_{TO}	Threshold Voltage
Z_{IF}	Impedance at Intermediate Frequency
Z_O	Output Impedance

SILICON PIN DIODES

Selection Guide

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HOW TO SPECIFY A PIN DIODE

To obtain the PIN diodes best suited for a specific application, consider the following:

1. Application
   - switch
   - attenuator
   - limiter
2. Frequency and bandwidth requirements
3. Power characteristics
   - peak
   - average
   - pulse duration and duty cycle
4. Switching time
5. Bias conditions
   - forward
   - reverse
6. Circuit impedance
7. Shunt or series assembly
8. Maximum loss expected
9. Minimum isolation needed
10. VSWR and distortion requirements
11. Power applied to the diode
    - forward biased
    - reverse biased
    - during switching
12. Static characteristics
    - applicable voltage: V_R
    - total capacitance: C_T (in space charge)
    - forward series resistance: R_{SF}
    - carrier lifetime τl
    - thermal resistance: R_{th}
13. Mechanical and packaging constraints

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SOT23 SURFACE MOUNT SWITCHING SILICON PIN DIODES

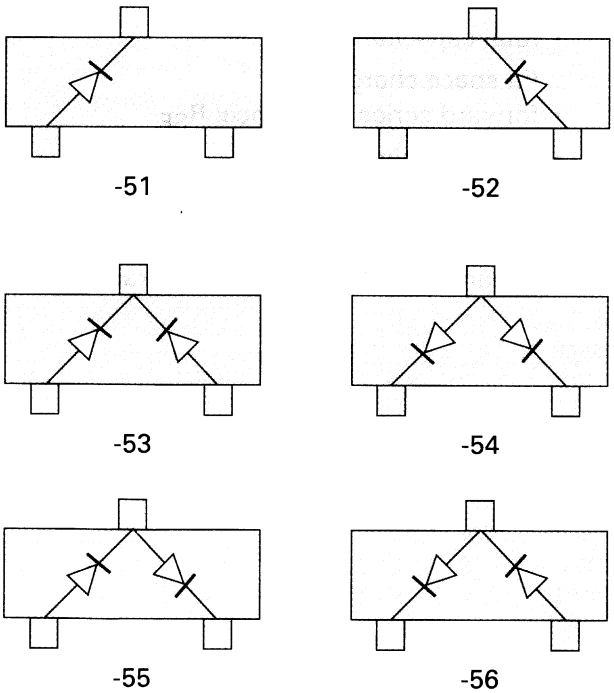
Features

- Low series resistance
- Low capacitance
- Fast switching diodes
- Surface mount package
- Tape and reel packaging available

Description

TEKELEC TEMEX uses its proprietary technology to manufacture its Silicon PIN diodes in **SOT23**.
This product family is designed for a low cost, medium to high volume market that may be supplied in tape and reel for automated pick and place assembly on surface mount circuit boards.
The use of this technology eliminates wire bonding directly on to the chips.

Outline drawing



(Top view)

Nota: Other plastic packages available.

Applications

The DH50XXX series PIN diodes are offered in large selection of capacitance range (.30 pF to 1.2 pF) and breakdown voltage (35 V to 200 V). They provide low loss (low series resistance), low switching time and low switching current.
TEKELEC TEMEX's components are designed to cover a broad range of CW low power (up to 2 W), medium peak power, RF and microwave applications (up to 3 GHz).
Main applications include: SPST and SPDT switches, antenna (Wireless Communication Systems) and filter switches, Phase Shifters...

Note: To reduce the distortion, it is necessary to verify and design with the following formula:

$$\frac{\hat{I}_{HF}}{\pi \tau_I I_{DC} F} << 1$$

$\hat{I}_{HF}$: RF peak current (A)
τ_I : Diode minority carrier lifetime (s)
I_{DC} : DC bias current (A)
F : Application frequency (Hz)

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Electrical characteristics at 25° C

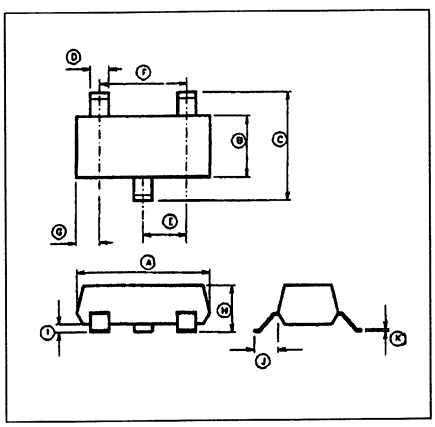
PACKAGED DIODES				
	Breakdown Voltage V_{BR} (1)	**Total capacitance C_T (2)**	**Series Resistance R_{SF}**	**Minority Carrier lifetime τ_l**
Test conditions	**I_R = 10 µA**	**F = 1 MHz V_R = 50 V**	**I_F = 10 mA F = 120 MHz**	**I_F = 10 mA I_R = 6 mA**
Type (3)	**V min**	**pF max**	**Ω max**	**ns typ.**
DH50051-XX	35	0.3 (5)	2.5 (4)	150
DH50058-XX	35	1 (5)	0.5	200
DH50053-XX	50	0.35 (6)	1.5	200
DH50103-XX	100	0.35	3	1000
DH50109-XX	100	1.2	0.6	1000
DH50203-XX	200	0.35	3	1000

(1) : Other breakdown value on request
(2) : other capacitance values on request
(3) : -XX Digits for internal electrical configuration
(4) : R_{SF} at I_F = 5 mA
(5) : V_R = 5 V at F = 1 MHz
(6) : V_R = 20 V at F = 1 MHz

Temperature ranges:

Operating junction (T_j) : -55° C to +150° C
Storage : -65° C to +150° C

Case style



Symbol	min Millimeters	max Millimeters	min Inches	max Inches
K	0.1	0.13	0.004	0.005
J	0.53	0.56	0.021	0.022
I	0.05	0.1	0.002	0.0004
H	1.07	1.14	0.042	0.045
G	0.43	0.46	0.017	0.018
F	1.78	2.04	0.070	0.080
E	0.94 typ.		0.037 typ.	
D	0.43	0.45	0.017	0.020
C	2.36	2.49	0.093	0.098
B	1.3	1.35	0.051	0.053
A	2.84	3.02	0.112	0.119

SURFACE MOUNT ATTENUATING SILICON PIN DIODES

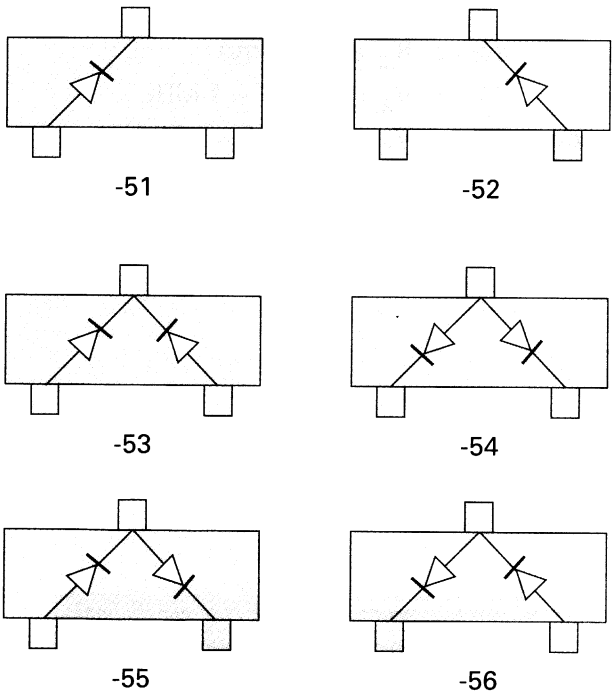
Features

- Large dynamic range
- Low harmonic distortion
- High minority carrier lifetime
- Surface mount package
- Tape and reel packaging available

Description

TEKELEC TEMEX uses its proprietary technology to manufacture its Silicon chips in **SOT23**.
This products family is designed for a low cost medium to high volume market that may be supplied in tape and reel for automated pick and place assembly on surface mount circuit boards.
The use of this technology eliminates wire bonding directly on to the chips.

Outline drawing



(Top view)

Nota: Other plastic packages available.

Applications

Typical applications include variable RF attenuators and AGC (Automatic Gain Control) circuits, from MHz to several GHz. The attenuating PIN diode uses properties of variation of forward series resistance versus the DC forward bias current. In order to obtain the best dynamic range, a single diode attenuator may be used in series or shunt configuration or designed as a multiple diode circuit (T or π circuit), where the device may be matched through the attenuation range.

Note: To reduce the distortion, it is necessary to verify and design with the following formula:

$$\frac{\hat{I}_{HF}}{\pi \tau_l I_{DC} F} << 1$$

$\hat{I}_{HF}$: RF peak current (A)
τ_l : Diode minority carrier lifetime (s)
I_{DC} : DC bias current (A)
F : Application frequency (Hz)

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Electrical characteristics at 25° C

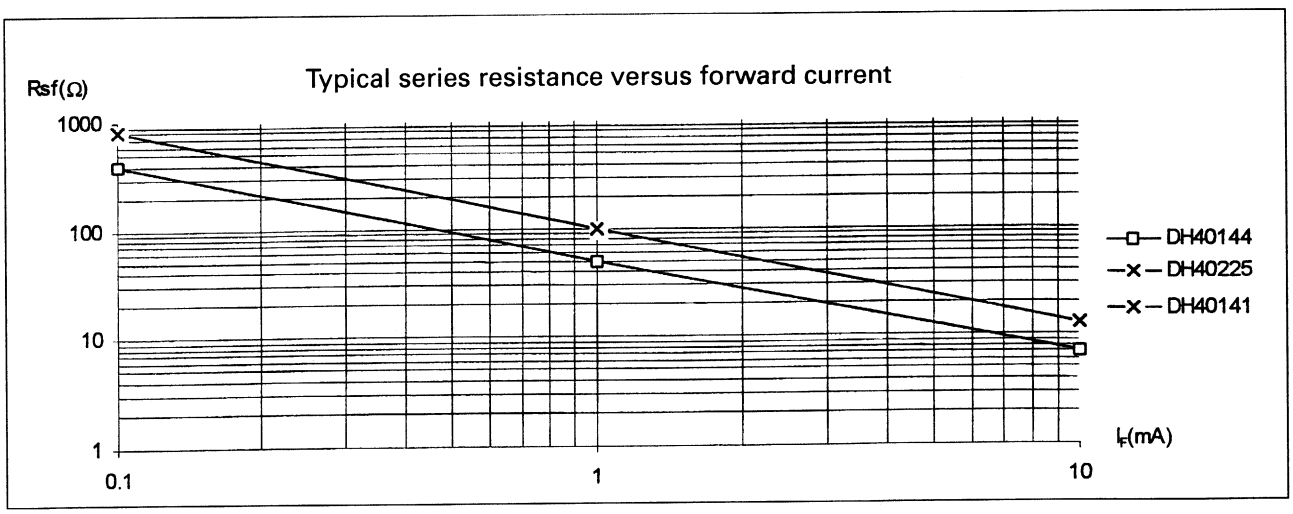
Electrical Parameters	I Zone thickness (1)	Series Resistance						Junction capacitance C_j (2)		Reverse current I_R	Carrier lifetime τ_l
Test conditions	µm	F = 120 MHz						F = 1 MHz		V_R = 100 V	I_F = 10 mA I_R = 6 mA
Type (3)		I_F = 0.1 mA		I_F = 1 mA		I_F = 10 mA		pF		µA	µs
	typ.	min	max	min	max	min	max	typ.	max	max	typ.
DH40141-XX	140	400	800	50	100	6.5	13.0	0.05	0.10	10	2.5
DH40144-XX	140	200	400	25	50	3.5	7.0	0.10	0.30	10	5
DH40225-XX(4)	220	400	800	50	100	6.5	13.0	0.10	0.30	10	7

(1) Other I zone thicknesses on request
(2) Other capacitance values on request
(3) -XX digits for internal electrical configuration
(4) New products, please call your local sales offices.

Temperature ranges:

Operating juction (T_j) : - 55° C to + 150° C
Storage : - 65° C to + 150° C

Typical performance curve



LOW COST SQUARE CERAMIC PACKAGE PIN DIODES

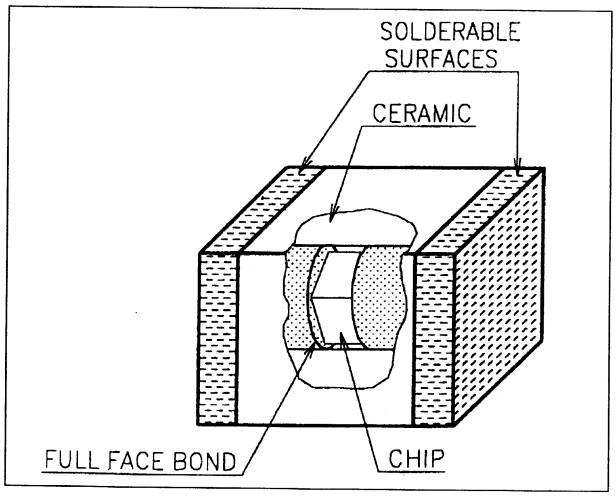
Features

- Low loss, low distortion
- Low inductance
- High reliability
- Hermetically sealed package
- Non rolling MELF design
- Pick and place compatibility

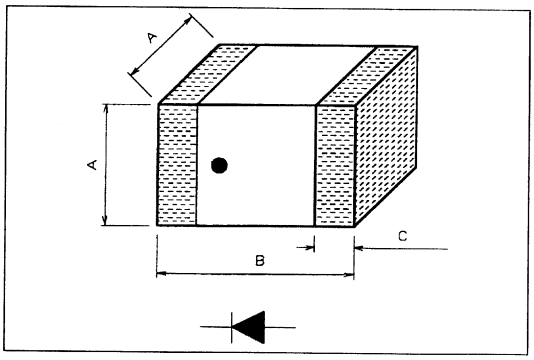
Description

TEKELEC TEMEX is manufacturing a square PIN diode for surface mount applications. The chip inside is passivated to ensure high reliability and very low leakage current. These diodes ensure high power switching at frequencies from HF to few GHz. This package utilizes ceramic package technology with low inductance and leadless faced package. The design simplifies automatic pick and place indexing and assembly. The termination contacts are tin plated for vapor or reflow circuit board soldering. The active area is a PIN glass passivated chip which can be designed to customer specifications.

Pinning



Outline drawing



Package	Symbol	Millimiters min	Millimiters max	Inches min	Inches max
SMD4	A	2	2.3	.079	.091
	B	2.9	3.5	.114	.138
	C	0.3	0.8	.012	.031
SMD6	A	2.5	2.8	.098	.0110
	B	4.7	5.2	.185	.205
	C	0.3	0.8	.012	.031
SMD8	A	3.50	3.81	.138	.150
	B	4.70	5.2	.185	.205
	C	0.20	0.38	.008	.015

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Applications

TEKELEC TEMEX square ceramic diodes are particularly suitable for high volume tape and reel assembly. Several values of total capacitance are available, together with a low forward series resistance. These components are designed to meet the low distortion specification required by all the mobile radio applications. Due to the specific design, these devices offer low loss and low thermal resistance performance and are characterized for high power handling. The electrical properties are ideal for use in antenna switches, filters, phase shifters, in all mobile radio applications from few MHz to GHz frequencies.

Electrical characteristics at 25° C

Electrical Parameter	Package	Applicable voltage V	Total capacitance C_T		Forward series resistance R_{SF}		Minority carrier lifetime τ_l	Power dissipation
Test conditions		I_R < 10 µA	f = 1 MHz V_R = 50 V		f = 120 MHz I_F = 10 mA		I_F = 10 mA I_R = 6 mA	Contact surface (1)
Type	Type	V	pF		Ω		µs	W
		max	typ.	max	typ.	max	min	max
SQM1050	SMD4 (2)	50	0.6	0.7	0.7	0.9	1	3.0
SQM1150	SMD4	200	1	1.2	0.25	0.35	1	3.0
SQM1250	SMD4	50	0.9	1.2	0.5	0.75	2	4.0
SQM1350	SMD4 (2)	50	1.5	1.7	0.4	0.6	3.5	4.5
SQM1450	SMD8	50	1.8	2.5	0.5	0.75	5	8.0

(1) diode brazed on infinite copper heat sink at 25° C
(2) standard package SMD4 also available in SMD6

Temperature ranges:

Operating junction (T_j) : -55° C to +150° C
Storage : -65° C to +150° C
Soldering : 230° C 5 Sec.

SQUARE CERAMIC SURFACE MOUNTABLE PIN DIODES

Description

These PIN diodes are manufactured in a square package (SMD) for surface mount applications. These packages utilize ceramic package technology with low inductance and axial terminations. This design simplifies automatic pick and place indexing and assembly. The termination contacts are tin lead plated for vapour or reflow circuit board soldering on Printed Circuit Boards.

These diodes are particularly suited for applications in frequency hopping radios, low loss, low distorsion, and filters in HF, VHF and UHF frequencies.

Electrical characteristics

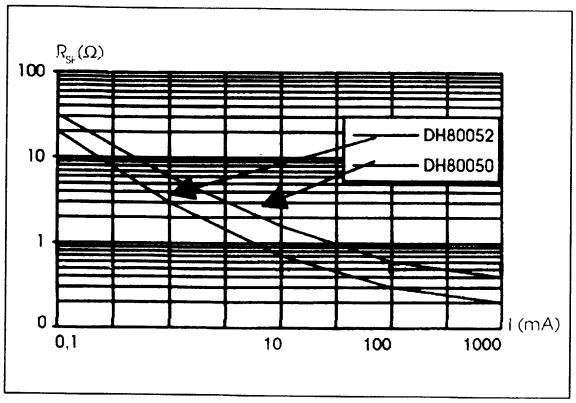
Characteristics at 25° C	Applicable Voltage V	Break-down V_{BR}	Total Capacitance C_T		Forward Series Resistance R_{SF}		Minitory Carrier τ_l	Max Power Dissipation 25° C	
TEST CONDITIONS	I < 10 µA	I < 10 µA	f = 1 MHz V_R = 50 V		f = 120 MHz I_F		I_F = 10 mA I_R = 6 mA	CONTACT SURFACE (1)	FREE AIR (2)
TYPE (3)	V	V	pF		Ω max		µs	W	W
	max	typ.	typ.	max	I=100mA	I=200mA	min	max	max
DH80050-XX	500	550	0.40	0.45	0.70	0.65	1.1	3.0	1.2
DH80051-XX	500	550	0.55	0.65	0.60	0.55	1.5	3.5	1.2
DH80052-XX	500	550	0.85	1.05	0.40	0.35	2.0	4.0	1.2
DH80053-XX	500	550	1.05	1.20	0.35	0.30	2.5	4.0	1.5
DH80054-XX	500	550	1.25	1.35	0.30	0.27	3.0	4.5	1.5
DH80055-XX	500	550	1.45	1.55	0.25	0.22	3.5	4.5	1.5

(1) Diode brazed on infinite copper heat sink
(2) Diode brazed on epoxy circuit (PCB)
(3) - XX digits for package
- 06 = SMD4 and - 20 = SMD6

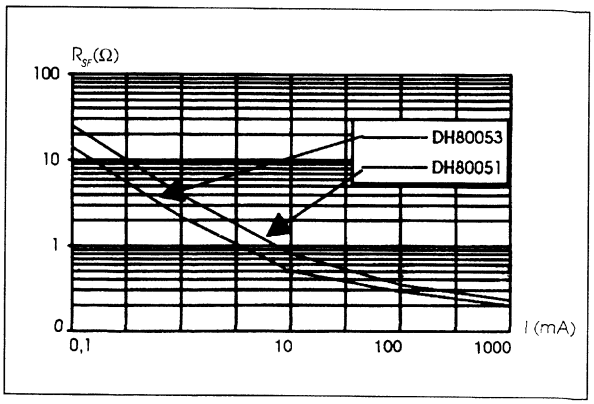
Temperature ranges:

Operating Junction (T_j) : -55° C to +175° C
Storage : -65° C to +125° C

Series Resistance vs. Forward Current



Series Resistance vs. Forward Current



NON MAGNETIC SQUARE CERAMIC PACKAGE 500 VOLTS PIN DIODES

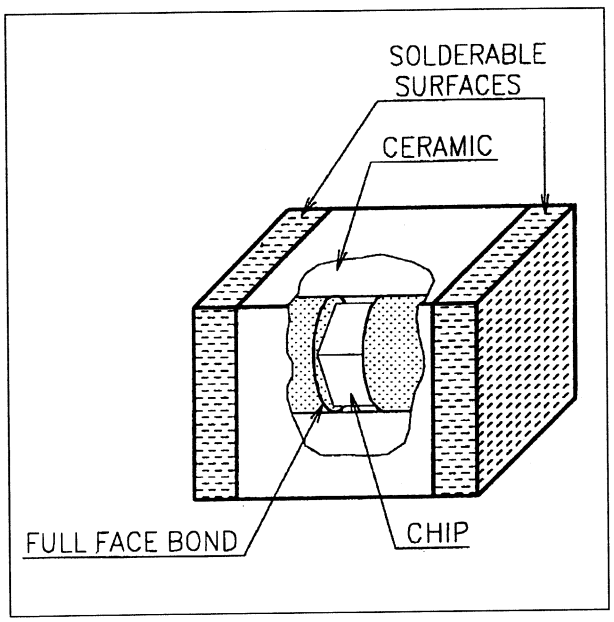
Features

- Non magnetic package
- Low loss, low distortion
- Low inductance
- High reliability
- Hermetically sealed package
- Glass passivated PIN diode chip
- Non rolling MELF design
- Pick and place compatibility

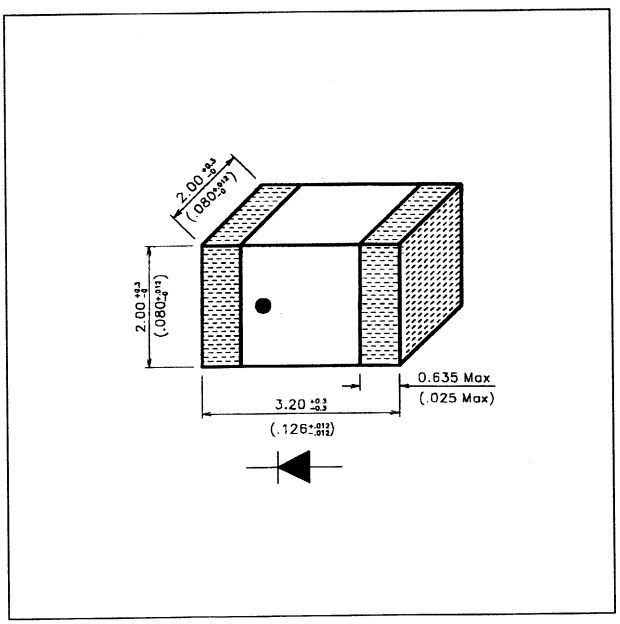
Description

TEKELEC TEMEX is manufacturing a non magnetic square PIN diode for surface mount applications. The properties of non magnetism prevent interference in the magnetic field of the imaging system. The chip inside is passivated to ensure high reliability and very low leakage. These diodes ensure high power switching at frequencies from 1 MHz to several GHz. This package utilizes ceramic package technology with low inductance and axial terminations. The design simplifies automatic pick and place indexing and assembly. The termination contacts are tin plated for vapor or reflow circuit board soldering. The active area is a PIN high power glass passivated chip which can be designed to customer specifications.

Pinning



Outline drawing



SILICON PIN DIODES

Non magnetic square ceramic package 500 volts PIN diodes

TEKELEC TEMEX

Applications

TEKELEC TEMEX non magnetic SQP diodes are particularly suitable for Magnetic Resonance Imaging applications. The maximum operating breakdown voltage is 550 V. Several values of total capacitance are available (beginning at 0.40 pF), together with a low forward series resistance.
These devices are characterized for high power handling, low loss and low distortion (long carrier lifetime design). The electrical properties are ideal for use in RF coils which must produce a homogeneous electromagnetic field in the MRI system for frequencies from a few MHz to over 100 MHz.

Maximum ratings

OPERATING JUNCTION	STORAGE	SOLDERING
- 55° C + 175° C	- 55° C + 125° C	230° C 5 sec.

Electrical characteristics

STANDARD RATINGS - MAXIMUM LIMITS OF ELECTRICAL PARAMETERS PACKAGED DIODES								
Characteristics at 25° C	Applicable Voltage V	Breakdown Voltage V_{BR}	Total Capacitance C_T		Forward Series Resistance R_F		Minitory Carrier Lifetime τ_l	Power Dissipation
Test Conditions	I_R < 10 µa	I_r < 10 µa	f = 1 MHz V_R = 50 V		f = 120 MHz I_F as below		I_F = 10 mA I_R = 6 mA	Contact Surface (1)
TYPE	V	V	pF		Ω max		µs	W
	max	typ.	typ.	max	I_F=100mA	I_F=200mA	min	max
DH80050-40	500	550	0.40	0.45	0.70	0.65	1.1	3.0
DH80051-40	500	550	0.55	0.65	0.60	0.55	1.5	3.5
DH80052-40	500	550	0.85	1.05	0.40	0.35	2.0	4.0
DH80053-40	500	550	1.05	1.20	0.35	0.30	2.5	4.0
DH80054-40	500	550	1.25	1.35	0.30	0.27	3.0	4.5
DH80055-40	500	550	1.45	1.55	0.25	0.22	3.5	4.5

(1) diode brazed on infinite copper heat sink

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HIGH VOLTAGE PIN DIODES

Applications

These devices are most often used to control Radio Frequency (RF) and microwave signals. Typically, high-voltage PIN diodes are found in high power switches and phase shifters.

TEKELEC TEMEX's high-voltage PIN diode products are designed for very high reliability, high power handling capabilities, high isolation, and low signal distortion, especially in the HF and VHF bands. High-power multithrow switch modules are available for frequencies in the 1 MHz to 1 GHz range.

All high-voltage PIN diode products can be configured on chips or in various packages: e.g. series, shunt, flat mount, stud mount, surface mount (SMD) and (on request) non-magnetic.

Characteristics

The controlling element of a PIN diode is its Intrinsic (I) layer. The diode itself is a sandwich, i.e. a high resistivity I layer between highly doped layers of P and N materials. With negative bias on the I layer, the PIN diode exhibits very high parallel resistance, e.g. acting as a switch in the OFF position. A positive bias causes the diode to conduct, with very low series resistance. Certain applications impose specific objectives on diode construction (e.g. in the HF and VHF band, low signal distortion can be achieved with high Minority Carrier Lifetime τl).

Silicon PIN diodes for switching & phase shifting applications (medium & high power)

Description

This series of high power, high voltage PIN diodes incorporates ceramic-glass passivated mesa technology. A broad range of products is available, in terms of breakdown voltages, junction capacitances, and series resistances, to suit a large variety of applications, from 1 MHz to several GHz. These diodes are available in non-magnetic packages.

Electrical characteristics

CHIP DIODES					CHIP AND PACKAGED DIODES				
Characteristics at 25°C	Chip Dimensions		Applicable Voltage V_R	Break-down V_{BR}	Junction Capacitance C_j (1)		Forward Series Resistance R_{SF}		Minitory Carrier Lifetime τ_l
Test Conditions	N/A		I<10µA	I<10µA	V_R = 50 V f = 1 MHz		f=120 MHz I_F AS SHOWN		I_F=10mA I_R=6mA
TYPE	µm typ.		V	V	pF		Ω MAX		µs
PIN	Gold dia	per side	min	typ.	typ.	max	I_F = 100 mA	I_F = 200 mA	min
EH80050	0.13	0.6	500	550	0.15	0.20	0.70	0.65	1.1
EH80051	0.15	0.6	500	550	0.30	0.40	0.60	0.55	1.5
EH80052	0.25	0.8	500	550	0.60	0.70	0.40	0.30	2.0
EH80053	0.27	0.8	500	550	0.80	0.90	0.30	0.25	2.5
EH80055	0.34	0.9	500	550	1.2	1.3	0.25	0.22	3.0
EH80080	0.13	0.8	800	850	0.15	0.20	0.80	0.70	2.0
EH80083	0.27	0.9	800	850	0.80	0.90	0.40	0.30	3.0
EH80086	0.55	1.4	800	850	1.4	1.7	0.35	0.28	5.0
EH80100	0.23	0.9	1000	1100	0.30	0.40	0.70	0.60	3.0
EH80102	0.30	0.9	1000	1100	0.60	0.75	0.40	0.35	4.0
EH80106	0.55	1.4	1000	1100	1.40	1.70	0.35	0.30	7.0
					V_R = 100V		I_F = 200 mA	I_F = 300 mA	
EH80120	0.25	0.9	1200	1300	0.30	0.40	0.60	0.55	6.0
EH80124	0.65	1.5 H (2)	1200	1300	1.00	1.20	0.45	0.35	10.0
EH80126	0.75	1.7 H (2)	1200	1300	1.40	1.70	0.40	0.30	12.0
EH80129	1.25	2.2	1200	1300	2.00	2.30	0.30	0.25	15.0
EH80154	0.65	1.5	1500	1600	1.00	1.20	0.45	0.35	10.0
EH80159	1.25	2.2	1500	1600	2.00	2.30	0.30	0.25	15.0
					V_R = 200V		I_F = 200 mA	I_F = 300 mA	
EH80182	0.75	1.5	1800	1900	0.60	0.80	0.60	0.50	12.0
EH80189	1.4	2.6 H (2)	1800	1900	2.00	2.40	0.35	0.30	18.0
EH80204	0.85	1.7	2000	2100	1.00	1.30	0.50	0.40	14.0
EH80209	1.4	2.6 H (2)	2000	2100	2.00	2.40	0.35	0.30	18.0
EH80210	1.5	3 H (2)	2000	2100	3.00	3.40	0.20	0.15	25.0

(1) Other capacitance values available on request
(2) Hexagonal chips (between opposite flats)

TYPE	PACKAGED DIODES			THERMAL RESISTANCE R_{TH} (4) P_{DISS} = 1 W	TYPICAL OPERATING CONDITIONS VSWR < 1.5 Z_0 = 50 Ω CHIP CONFIGURATION	
	STANDARD CASE (3)			°C/W	FREQUENCY	POWER
PIN	Shunt	Isolated stud	Flat mounted	max	MHz	W
DH80050	F 27d	BH301	BH202	20.0	50 - 20000	50
DH80051	F 27d	BH301	BH202	18.0	30 - 15000	80
DH80052	F 27d	BH301	BH202	15.0	20 - 10000	100
DH80053	F 27d	BH301	BH202	12.0	20 - 3000	100
DH80055	F 27d	BH301	BH202	10.0	10 - 1000	250
DH80080	F 27d	BH301	BH202	18.0	50 - 20000	60
DH80083	F 27d	BH301	BH202	12.0	20 - 10000	80
DH80086	BH35	BH301	BH202	8.0	10 - 500	200
DH80100	F 27d	BH301	BH202	15.0	20 - 10000	80
DH80102	F 27d	BH301	BH202	12.0	20 - 3000	100
DH80106	BH35	BH300	BH202	5.5	10 - 500	500
DH80120	F 27d	BH301	BH202	15.0	10 - 8000	100
DH80124	BH35	BH300	BH200	8.0	10 - 2000	250
DH80126	BH35	BH300	BH200	6.0	10 - 500	500
DH80129	BH141	BH300	BH200	4.5	5 - 200	1000
DH80154	BH141	BH300	BH200	8.0	10 - 2000	250
DH80159	BH141	BH300	BH200	4.5	5 - 200	1000
DH80182	BH35	BH300	BH200	10	10 - 50	
DH80189	BH141	BH300	BH200	4.5	15 - 200	1000
DH80204	BH141	BH300	BH200	8.0	10 - 1000	250
DH80209	BH141	BH300	BH200	4.5	1.5 - 200	1000
DH80210	BH141	BH300	BH200	2.5	1.5 - 50	1000

(3)Custom cases available on request (4) R_{TH} is measured in a standard shunt case, grounded on an infinite heatsink

Temperature ranges: Operating junction (T_j): -55° C to +175° C Storage: -65° C to +200° C

SILICON PIN DIODES

High voltage PIN diodes

Two & three port RF PIN switch modules

Description

This series of SP2T and SP3T RF switches uses high voltage PIN diodes, from the EH80000 family, to achieve very low loss and distortion.

Theses switches can be used from 1.5 to 1000 MHz, and can handle power levels up to 1000 W.

Electrical characteristics

CHARACTERISTICS AT 25°C			FREQUENCY RANGE	LOSS L	ISOLATION I	INPUT POWER P_{in}	SUGGESTED BIAS CONDITIONS	
TEST CONDITIONS			N/A	f (MHz) I_F (mA)	f (MHz) V_R (V)	CW	FORWARD	REVERSE
Type	Case	Switch Type	MHz	dB	dB	W	mA	V
(1)		(2)	typ.	max	min	max	typ.	typ.
				200 MHz 100 mA	**100 MHz 0 V**			
SH90101	TO39	SP2T	10 - 600	0.35	35	10	100	50
SH91101	TO39	SP2T	10 - 600	0.35	35	10	100	50
				400 MHz 100 mA	**200 MHz 0 V**			
SH90103	BH203	SP2T	20 - 1000	0.35	25	100	200	150
SH91103	BH203	SP2T	20 - 1000	0.35	25	100	200	150
SH92103	BH204	SP3T	20 - 1000	0.35	25	100	200	150
SH93103	BH204	SP3T	20 - 1000	0.35	25	100	200	150
				100 MHz 200 mA	**200 mA 100 V**			
SH91107	BH403a	SP2T	20 - 500	0.20	33	1000	400	600
				10 MHz 200 mA	**10 MHz 200 V**			
SH90207	BH405	SP2T	1.5 - 50	0.15	37	1000	1000	700
SH91207	BH405	SP2T	1.5 - 50	0.15	37	1000	1000	700

(1) Series 90 and 92 : common anode
Series 91 and 93 : common cathode

(2) Custom configurations available on request

Temperature ranges:

Operating juction (T_j) : - 55° C to + 150° C

Storage : - 65° C to + 175° C

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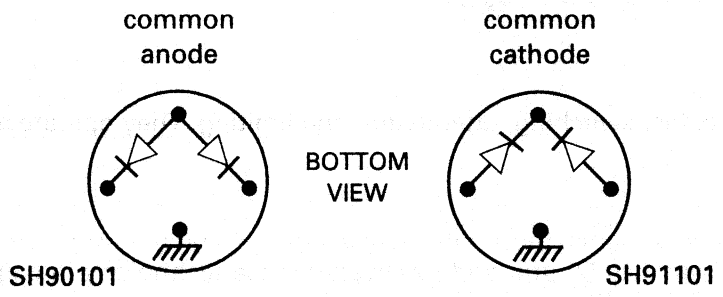
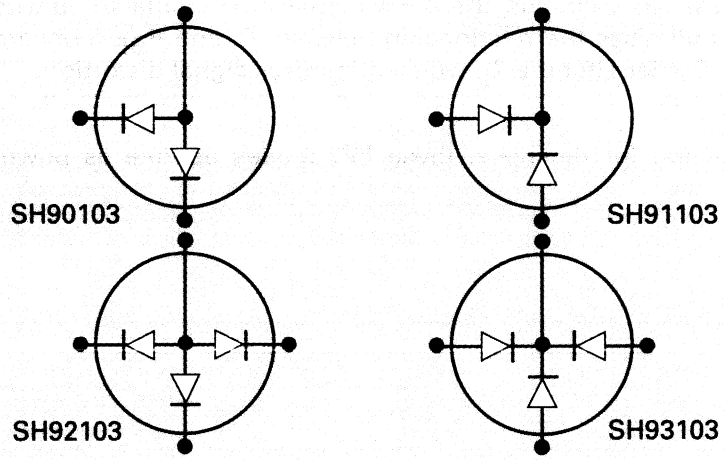
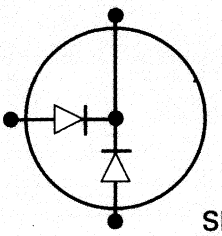
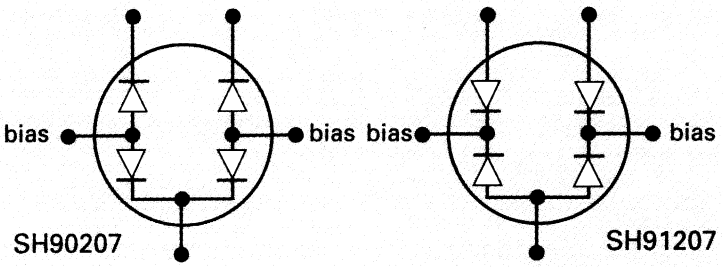
Internal wiring diagrams



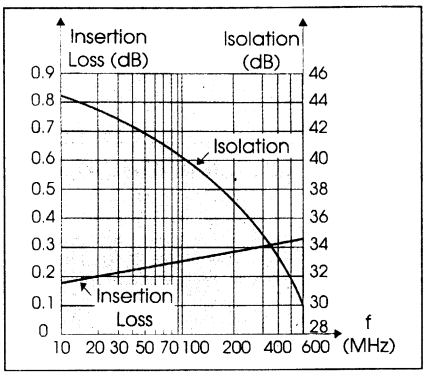


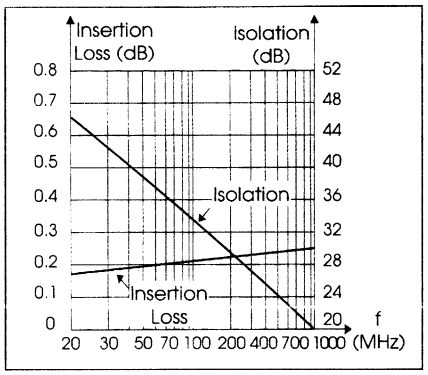


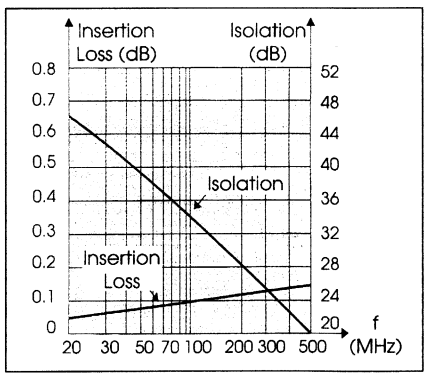


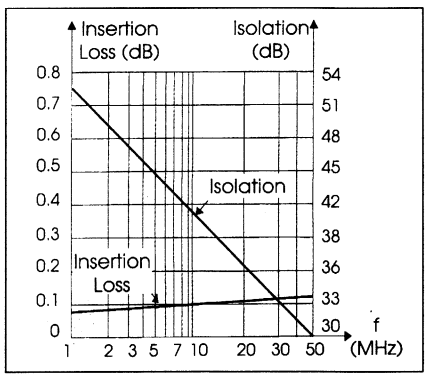
Typical performances

INSERTION LOSS AND ISOLATION VERSUS FREQUENCY









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MICROWAVE APPLICATIONS

Low and medium voltage PIN diode applications

The most common uses of these devices are: fast switching, attenuation and limiting. They operate at frequencies from a few MHz to 100 GHz.

In switching applications, e.g. timing digital bit streams, these PIN diodes support signal power levels below 30 W, up to 100 GHz. Thin I layers, from 1 to 50 µm, and passivated mesa technology in chip configurations, yield very low junction capacitance (C_j), i.e. below 0.025 pF.

As attenuators, e.g. in Automatic Gain Control (AGC) circuits, these PIN diodes are manufactured with a proprietary technology. This technology optimises the relationship between C_j and R_{SF} (Forward Series Resistance), offering a high Minority Carrier Lifetime τ_l, which minimises signal distortion.

In limiting applications, e.g. passive protection for receivers, these PIN diodes operate as power dependent variable resistors.

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Ultrafast switching silicon PIN diodes

Description

For ultrafast switching, these passivated mesa diodes have a thin I layer (< 10 µm).

Electrical characteristics

CHIP DIODES	CHIP AND PACKAGED DIODES							PACKAGED DIODES			
Characteristics at 25°C	Gold Dia	Breakdown Voltage	Junction Capacitance		Series Resistance	Minority Carrier Lifetime	Reverse Switching Time				Thermal Resistance
	ø	V_{BR}	C_j		R_{SF}	τ_l	T_{CR}				R_{th}
Test Conditions		I_R = 10 µA	V_R = 6 V f = 1 MHz		I_F = 10 mA f = 120 MHz	I_F = 10 mA I_R = 6 mA	I_F = 20 mA V_R = 10 V 50 Ω				P_{diss} 1 W F 27 d
Type	µm	V	pF		Ω	ns	ns	Type	Standard Cases (1)		°C/W
Case C2a (1)	typ.	min	typ.	max	max	typ.	typ.		C_b = 0.18 pF (2)	C_b = 0.12 pF (2)	max
EH50033	25	30	0.08	0.12	1.8	20	2.0	DH50033	F27d	M208	80
EH50034	30	30	0.12	0.17	1.5	20	2.0	DH50034	F27d	M208	80
EH50035	35	30	0.17	0.23	1.0	25	2.5	DH50035	F27d	M208	70
EH50036	55	30	0.23	0.40	0.9	30	3.0	DH50036	F27d	M208	60
EH50037	65	30	0.40	0.60	0.7	40	4.0	DH50037	F27d	M208	50
EH50052	30	50	0.06	0.08	1.6	30	3.0	DH50052	F27d	M208	80
EH50053	35	50	0.08	0.12	1.4	30	3.0	DH50053	F27d	M208	70
EH50054	40	50	0.12	0.17	1.1	35	4.0	DH50054	F27d	M208	60
EH50055	50	50	0.17	0.23	1.0	40	4.0	DH50055	F27d	M208	50
EH50056	65	50	0.23	0.40	0.9	50	5.0	DH50056	F27d	M208	45
EH50057	80	50	0.40	0.60	0.7	60	6.0	DH50057	F27d	M208	45
EH50071	35	70	0.04	0.06	2.0	50	5.0	DH50071	F27d	M208	70
EH50072	40	70	0.06	0.08	1.7	50	5.0	DH50072	F27d	M208	70
EH50073	45	70	0.08	0.12	1.6	60	6.0	DH50073	F27d	M208	60
EH50074	50	70	0.12	0.17	1.4	60	6.0	DH50074	F27d	M208	50
EH50075	60	70	0.17	0.23	1.0	100	10.0	DH50075	F27d	M208	45
EH50076	80	70	0.23	0.40	0.9	100	10.0	DH50076	F27d	M208	40
EH50077	100	70	0.40	0.60	0.7	150	15.0	DH50077	F27d	M208	40
EH50101	45	100	0.04	0.06	1.9	150	15.0	DH50101	F27d	M208	60
EH50102	50	100	0.06	0.08	1.7	150	15.0	DH50102	F27d	M208	60
EH50103	60	100	0.08	0.12	1.4	200	20.0	DH50103	F27d	M208	55
EH50104	70	100	0.12	0.17	1.2	250	25.0	DH50104	F27d	M208	50
EH50105	90	100	0.17	0.23	1.0	300	30.0	DH50105	F27d	M208	40
EH50106	110	100	0.23	0.40	0.8	400	40.0	DH50106	F27d	M208	35
EH50107	130	100	0.40	0.60	0.6	500	50.0	DH50107	F27d	M208	35

(1) Custom cases available on request

(2) $C_T = C_j + C_b$

Temperature ranges:

Operating Junction (T_j) : -55° C to +175° C

Storage : -65° C to +200° C

SILICON PIN DIODES

Microwave applications

TEKELEC TEMEX

Fast switching silicon PIN diodes

Description

For fast switching, these passivated mesa diodes have a medium I layer (< 50 µm).

Electrical characteristics

CHIP DIODES		CHIP AND PACKAGED DIODES						PACKAGED DIODES			
Characteristics at 25°C	Gold Dia	Breakdown Voltage	Junction Capacitance		Series Resistance	Minority Carrier Lifetime	Reverse Switching Time				Thermal Resistance
	ø	V_{BR}	C_j		R_{SF}	τ_l	T_{CR}				R_{th}
Test Conditions		I_R = 10 µA	V_R = 50 V f = 1 MHz		I_F = 10 mA f = 120 MHz	I_F = 10 mA I_R = 6 mA	I_F = 20 mA V_R = 10 V 50 Ω				P_{diss} 1 W F27 d
Type	µm	V	pF		Ω	ns	ns	Type	Standard Cases (2)		°C/W
Case C2a (1)	typ.	min	typ.	max	max	typ.	typ.		C_b = 0.18 pF (2)	C_b = 0.12 pF (2)	max
EH50151	55	150	0.04	0.06	2.0	200	20	DH50151	F27d	M208	50
EH50152	60	150	0.06	0.08	1.7	230	23	DH50152	F27d	M208	50
EH50153	70	150	0.08	0.12	1.5	300	30	DH50153	F27d	M208	45
EH50154	90	150	0.12	0.17	1.4	500	50	DH50154	F27d	M208	40
EH50155	110	150	0.17	0.23	1.0	550	55	DH50155	F27d	M208	35
EH50156	130	150	0.23	0.40	0.8	800	80	DH50156	F27d	M208	30
EH50157	150	150	0.40	0.60	0.6	950	95	DH50157	F27d	M208	30
EH50201	60	200	0.04	0.06	2.3	300	30	DH50201	F27d	M208	45
EH50202	65	200	0.06	0.08	2.1	400	40	DH50202	F27d	M208	45
EH50203	75	200	0.08	0.12	1.5	500	50	DH50203	F27d	M208	40
EH50204	100	200	0.12	0.17	1.3	650	65	DH50204	F27d	M208	35
EH50205	120	200	0.17	0.23	1.0	800	80	DH50205	F27d	M208	30
EH50206	150	200	0.23	0.40	0.8	950	95	DH50206	F27d	M208	30
EH50207	170	200	0.40	0.60	0.7	1050	100	DH50207	F27d	M208	25
EH50251	65	250	0.04	0.06	2.4	330	33	DH50251	F27d	M208	40
EH50252	75	250	0.06	0.08	2.2	500	50	DH50252	F27d	M208	40
EH50253	100	250	0.08	0.12	2.0	900	90	DH50253	F27d	M208	35
EH50254	130	250	0.12	0.17	1.4	900	90	DH50254	F27d	M208	30
EH50255	160	250	0.17	0.23	0.9	1000	100	DH50255	F27d	M208	30
EH50256	180	250	0.23	0.40	0.8	1150	110	DH50256	F27d	BH142	25
EH50401	80	400	0.04	0.06	2.5	700	70	DH50401	F27d	M208	35
EH50402	90	400	0.06	0.08	2.3	800	80	DH50402	F27d	M208	35
EH50403	120	400	0.08	0.12	2.1	1000	100	DH50403	F27d	M208	30
EH50404	150	400	0.12	0.17	1.8	1500	150	DH50404	F27d	BH142	25
EH50405	200	400	0.17	0.23	1.6	2000	200	DH50405	F27d	BH142	20

(1) Chip presentation C2a, except:
C2b forEH50256, EH50404 and EH50405

(2) Custom cases available on request

(3) $C_T = C_j + C_b$

Temperature ranges:

Operating junction (T_j) : -55° C to +175° C

Storage : -65° C to +200° C

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Attenuator silicon PIN diodes

Description

The table below presents a single set of values from the variety of customer options available for this series of passivated PIN diodes. TEKELEC TEMEX uses its proprietary technology, which enables the customer to incorporate characteristics specific to the application involved, e.g. capacitance and I zone thickness. Typical applications include variable RF attenuators and AGC (Automatic Gain Control) circuits, from a few MHz to several GHz.

Electrical characteristics

CHIP DIODES		CHIP AND PACKAGED DIODES												PACKAGED DIODES	
Charact. at 25°C	Configuration	I Zone Thickness (1)	Series Resistance R_{SF}						Junction Capacitance C_j (2)		Reverse Current I_R	Minority Carrier Lifetime τ_l			
Test Conditions			F = 120 MHz						F = 1 MHz V_R = 50 V		V_R = 100 V	I_F = 10 mA I_R = 6 mA			
Type		µm	I_F = 0.1 mA Ω		I_F = 1 mA Ω		I_F = 10 mA Ω		pF		µA	µs		Type	Standard Package (3)
		typ.	min	max	min	max	min	max	typ.	max	max	min	typ.		
EH40073	C4c	70	70	140	8	16	1.0	2.0	0.30	0.50	10	1.5	2.0	DH40073	F 27d
EH40141	C4a	140	400	800	50	100	6.5	13.0	0.05	0.10	10	1.5	2.5	DH40141	F 27d
EH40144	C4c	140	200	400	25	50	3.5	7.0	0.10	0.30	10	4.0	5.0	DH40144	F 27d
EH40225	C4d	220	400	800	50	100	6.5	13.0	0.10	0.30	10	5.5	7.0	DH40225	F 27d

(1) Other I zone thicknesses available on request

(2) Other capacitance values available on request

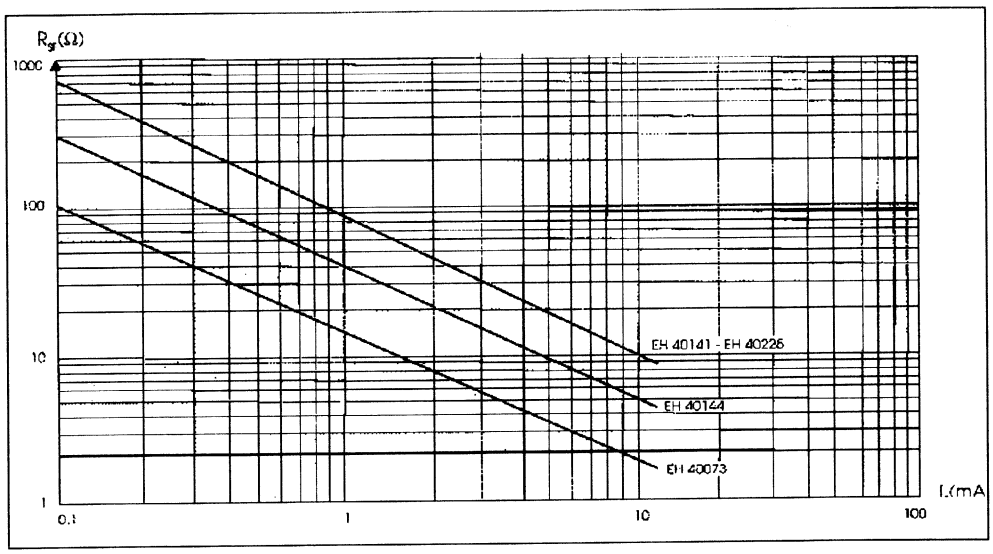
(3) Custom cases available on request

Temperature ranges:

Operating junction (T_j) : -55° C to +175° C

Storage : -65° C to +200° C

Typical series resistance vs forward current



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Silicon limiter PIN diodes

Description

These passivated mesa PIN diodes have a thin I layer. This series of diodes is available as chips and in hermetic ceramic packages. They operate as power dependent variable resistances and provide passive receiver protection (low noise amplifiers, mixers, and detectors).

Electrical characteristics

CHIP DIODES			PACKAGED DIODES						
CHARACTERISTICS AT 25°C		GOLD DIA Ø	BREAKDOWN VOLTAGE V_{BR}		JUNCTION CAPACITANCE C_{j0}	JUNCTION CAPACITANCE $C_{j\text{-}6}$ (1)		SERIES RESISTANCE R_{SF}	MINORITY CARRIER LIFETIME τ_1
TEST CONDITIONS			I_R = 10 µA		V_R = 0 V f = 1 MHz	V_R = 6 V f = 1 MHz		I_F = 10 mA f = 120 MHz	I_F = 10 mA I_R = 6 mA
TYPE	CASE	µm	V		pF	pF		Ω	ns
		typ.	min	max	typ.	min	max	max	typ.
EH60033	C2a	25	25	50	0.14	0.08	0.12	1.8	20
EH60034	C2a	30	25	50	0.20	0.12	0.17	1.5	20
EH60035	C2a	35	25	50	0.28	0.17	0.23	1.0	25
EH60036	C2a	55	25	50	0.45	0.23	0.40	0.9	30
EH60037	C2a	65	25	50	0.70	0.40	0.60	0.7	40
EH60052	C2a	30	50	70	0.10	0.06	0.08	1.8	30
EH60053	C2a	35	50	70	0.14	0.08	0.12	1.4	30
EH60054	C2a	40	50	70	0.20	0.12	0.17	1.1	35
EH60055	C2a	50	50	70	0.28	0.17	0.23	1.0	40
EH60056	C2a	65	50	70	0.45	0.23	0.40	0.9	50
EH60057	C2a	80	50	70	0.70	0.40	0.60	0.8	60
EH60072	C2a	40	70	90	0.10	0.06	0.08	1.7	50
EH60074	C2a	50	70	90	0.20	0.12	0.17	1.4	60
EH60076	C2a	80	70	90	0.45	0.23	0.40	0.9	100
EH60102	C2a	50	90	120	0.10	0.06	0.08	1.7	150
EH60104	C2a	70	90	120	0.20	0.12	0.17	1.2	250
EH60106	C2a	110	90	120	0.45	0.23	0.40	0.8	400

(1) Other values of capacitance available on request

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PACKAGED DIODES			NOMINAL MICROWAVE CHARACTERISTICS					
CHARACTERISTICS AT 25°C			THERMAL RESISTANCE R_{TH}	THRESHOLD P_L	LEAKAGE POWER P_{OUT}	INSERTION LOSS L	PEAK POWER P_{IN}	CW POWER P_{IN}
TEST CONDITIONS			P_{diss} = 1W case F 27d	f = 2.7 GHz 1dB Limiting	f = 2.7 GHz	f = 2.7 GHz P_{IN} = -10 dBm	1 µs Pulse 1% DC	
TYPE	STANDARD CASE (2)		°C/W	dBm	dBm	dB	dBm	W
	C_b = 0.18 pF (3)	C_b = 0.12 pF (3)	max	typ.	typ.	typ.	max	max
DH60033	F 27d	M208	80	+ 10	+ 20	0.1	+ 50	2.0
DH60034	F 27d	M208	80	+ 10	+ 20	0.1	+ 50	2.0
DH60035	F 27d	M208	70	+ 10	+ 21	0.1	+ 52	2.5
DH60036	F 27d	M208	60	+ 10	+ 22	0.2	+ 53	3.0
DH60037	F 27d	M208	50	+ 10	+ 23	0.2	+ 56	4.0
DH60052	F 27d	M208	80	+ 15	+ 24	0.1	+ 52	2.5
DH60053	F 27d	M208	70	+ 15	+ 24	0.1	+ 52	2.5
DH60054	F 27d	M208	60	+ 15	+ 25	0.1	+ 53	3.0
DH60055	F 27d	M208	50	+ 15	+ 26	0.1	+ 54	3.5
DH60056	F 27d	M208	45	+ 15	+ 27	0.2	+ 57	4.0
DH60057	F 27d	M208	45	+ 15	+ 28	0.2	+ 58	5.0
DH60072	F 27d	M208	70	+ 18	+ 27	0.1	+ 54	3.0
DH60074	F 27d	M208	50	+ 18	+ 30	0.2	+ 55	4.0
DH60076	F 27d	M208	40	+ 18	+ 32	0.2	+ 58	5.0
DH60102	F 27d	M208	60	+ 20	+ 31	0.2	+ 56	3.5
DH60104	F 27d	M208	50	+ 20	+ 33	0.2	+ 59	5.0
DH60106	F 27d	M208	35	+ 20	+ 35	0.3	+ 61	7.0

(2) Other capacitance values available on request

(3) $C_T = C_j + C_b$

Temperature ranges:

Operating junction (T_j) : -55° C to +125° C

Storage : -65° C to +200° C

SILICON SCHOTTKY DIODES

Selection Guide

SILICON SCHOTTKY BARRIER DETECTOR DIODES

Description

Silicon Schottky barrier detector diodes are available as:

- packaged diodes
- chip

They are optimised for wide band applications, in the frequency range from 1 to 18 GHz.

Electrical characteristics packaged diodes

CHARACTERISTICS AT 25°C		FREQUENCY RANGE F_{oper}	TANGENTIAL SENSITIVITY T_{ss}	VIDEO RESISTANCE R_V		RF POWER P_{RF}	FORWARD CONTINUOUS CURRENT I_F	BREAKDOWN VOLTAGE V_{BR}
TEST CONDITIONS		N/A	Video bandwidth = 1 MHz I_F = 30 µA			CW	N/A	I_R = 10 µA
TYPE	CASE (1)	GHz	dBm	kΩ		mW	mA	V
			min	min	max	max	max	typ.
DH340	F51	2 - 12 12 - 18	- 54 - 51	1	2	250	50	3

(1) Custom cases available on request

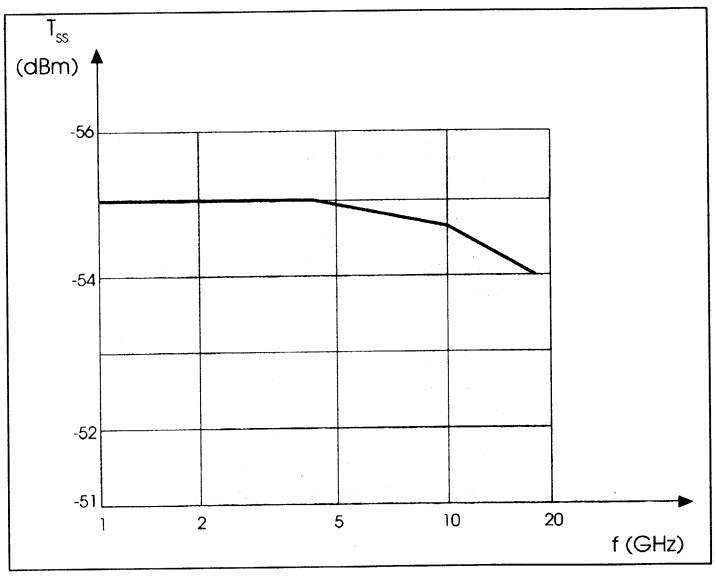
Temperature ranges:

Operating junction (T_j) : -55° C to +150° C

Storage : -65° C to +175° C

- T = + 25° C
- I_F = 30 µA
- Video bandwidth = 1 MHz

Typical tangential sensitivity vs frequency



SILICON SCHOTTKY BARRIER MIXER DIODES

Description

Silicon Schottky barrier mixer diodes are available in the following configurations:

- packaged
- chip

Low barrier diodes are required for applications where the Local Oscillator (LO) drive level is between -10 dBm and +10 dBm. Medium barrier diodes are required for applications where the LO drive level is between -5 dBm and +15 dBm. The use of a passivated planar construction contributes to high reliability.

Electrical characteristics packaged diodes

CHARACTERISTICS AT 25°C		FREQUENCY RANGE F_{oper}	SSB NOISE FIGURE NF_{SSB}	VSWR (RATIO)		IF IMPEDANCE Z_{IF}		TEST PULSE ENERGY	BREAKDOWN VOLTAGE V_{BR}	TOTAL CAPACITANCE C_{TO}
TEST CONDITIONS		N/A	(1)	N/A		f = 30 MHz P_{LO} = 1 mW		PULSE = 3 ns	I_R = 10 µA	F = 1 MHz V_R = 0 V
TYPE	CASE (2)	GHz	dB	ratio		Ω		Ergs	V	pF
			max	typ.	max	min	max	max	typ.	typ.
DH301	F51	1 - 6	6.5	1.5	2	200	400	5	3	0.40
DH302	F51	1 - 6	6.0	1.5	2	200	400	5	3	0.40
DH303	F51	1 - 6	5.5	1.5	2	200	400	5	3	0.40
DH312	F51	6 - 12	7.0	1.5	2	200	400	5	3	0.25
DH313	F51	6 - 12	6.5	1.5	2	200	400	5	3	0.25
DH314	F51	6 - 12	6.0	1.5	2	200	400	5	3	0.25
DH315	F51	6 - 12	5.5	1.5	2	200	400	5	3	0.25
DH322	F51	12 - 18	7.5	1.5	2	200	400	5	3	0.17
DH323	F51	12 - 18	7.0	1.5	2	200	400	5	3	0.17
DH324	F51	12 - 18	6.5	1.5	2	200	400	5	3	0.17
DH325	F51	12 - 18	6.0	1.5	2	200	400	5	3	0.17

RF Power max: 250 mW CW

Temperature ranges:

Operating junction (T_j) : -55° C to +150° C

Storage : -65° C to +175° C

(1) Noise figure measurement conditions:
P_{LO} = 1 mW
f_{IF} = 30 MHz
NF_{IF} = 1.5 dB
noise tube: 15.6 dB
dc load = 10 Ω
test frequencies: 3.0, 9.3 or 15.0 GHz

(2) Custom cases available on request

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TEKELEC TEMEX

TUNING VARACTOR

Selection Guide

A tuning varactor is a P-N diode that acts as a voltage controlled capacitor. These devices perform the same function as the familiar, bulky, air dielectric stacked capacitors featured in traditional broadcast band receivers.

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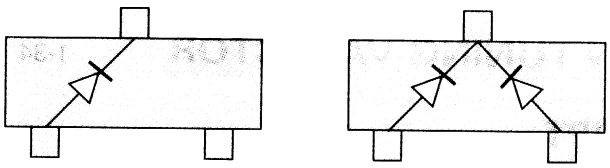
SOT23 surface mount silicon abrupt tuning varactor

Features

- High quality factor
- Low leakage current
- Passivated silicon mesa technology
- Surface mount package
- Tape and reel packaging available

Outline drawing



-51 -53

(Top view)

Nota: Other plastic packages available.

Description

TEKELEC TEMEX silicon abrupt tuning varactors have an epitaxial mesa design with a high temperature passivation. This technology is used to produce abrupt tuning varactor in SOT23 package. This family is designed for a low cost medium to high volume market that may be supplied in tape and reel for automated pick and place assembly on surface mount circuit boards.

Applications

The DH71000 series abrupt tuning varactor are offered in a large selection of capacitance range. They provide the highest Q factor (low reverse series resistance) available for a 30 volts silicon device.

Typical applications include low noise narrow and moderate frequency bandwidth applications (VCO mainly) from HF to Microwave frequencies (up to 3 GHz).

Other applications are voltage tuned filters, phase shifters, delay lines ....

NOTE: Variation of the junction capacitance versus reverse voltage follows this equation:

$$C_j(V_r) = \frac{C_j(0\ V)}{\left[1 + \frac{V_r}{\phi}\right]^{\gamma}}$$

V_r : Reverse voltage

ϕ : Built-in potential .7V for Si

γ : .5 for abrupt tuning varactor

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Electrical characteristics at 25° C

Electrical Parameters	Breakdown Voltage V_{BR}	Junction Capacitance C_j (1) (2)	Tuning Ratio	Figure of Merite Q
Test Conditions	I_R = 10 µA	F = 1 MHz V_R = 4 V	C_{j0}/C_{j30}	V_R = 4 V F = 50 MHz
Type (3)	V min	pF ± 20 %	typ.	typ.
DH71010-XX	30	1	4	4300
DH71016-XX	30	1.6	4.5	4100
DH71020-XX	30	2	4.6	3900
DH71030-XX	30	3	4.7	3400
DH71045-XX	30	4.5	4.8	3000
DH71067-XX	30	6.7	4.9	2600
DH71100-XX	30	10	5	2200

(1) Other tolerance on request

(2) DH71067-XX & DH71100-XX: Tolerance on C_j ± 10 %

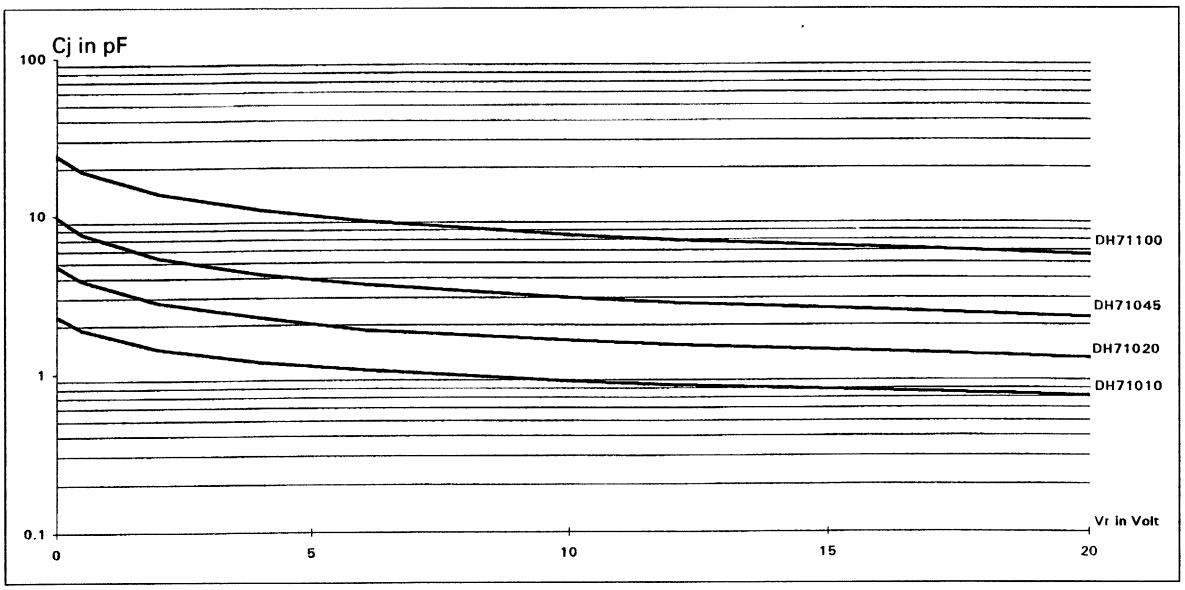
(3) -XX digits for internal electrical configuration

Temperature ranges:

Operating junction (T_j) : -55° C to +150° C

Storage : -65° C to +150° C

Typical performance curve



HIGH Q SILICON ABRUPT JUNCTION TUNING VARACTOR

V_{BR} 30 V

Description

This series of high Q epi-junction microwave tuning varactors (30 V) incorporates a passivated mesa technology. It is well suited for frequency tuning applications up to Ku band.

CHIP DIODES			CHIP AND PACKAGED DIODES		PACKAGED DIODES (1)				
			V_{BR} (10 µA) ≥ 30 V		STANDARD CASES			OTHER CASES	
CHARACTERISTICS AT 25°C		GOLD DIA Ø	Junction Capacitance C_j	FIG. OF Merit Q			Tuning Ratio C_{TO}/C_{T30}		Tuning Ratio C_{TO}/C_{T30}
Test Conditions			V_R = 4 V f = 1 MHz	V_R = 4 V f = 50 MHz		CASE CAPACITANCE C_b		CASE CAPACITANCE C_b	
TYPE	CASE	µm	pF		TYPE	CASE		CASE	
		typ.	± 20 % (2)	min		C_b= 0.18 pF (3)	min	C_b= 0.12 pF (3)	min
EH71004	C2a	50	0.4	4500	DH71004	F27d	3.0	M208	3.3
EH71006	C2a	60	0.6	4500	DH71006	F27d	3.4	M208	3.7
EH71008	C2a	70	0.8	4400	DH71008	F27d	3.7	M208	4.0
EH71010	C2a	80	1.0	4300	DH71010	F27d	4.0	M208	4.3
EH71012	C2a	90	1.2	4200	DH71012	F27d	4.3	M208	4.5
EH71016	C2a	100	1.6	4100	DH71016	F27d	4.5	M208	4.6
EH71020	C2a	110	2.0	3900	DH71020	F27d	4.6	M208	4.7
EH71025	C2a	120	2.5	3600	DH71025	F27d	4.6	M208	4.8
EH71030	C2a	140	3.0	3400	DH71030	F27d	4.7	M208	4.8
EH71037	C2a	150	3.7	3200	DH71037	F27d	4.7	M208	4.8
EH71045	C2a	170	4.5	3000	DH71045	F27d	4.8	M208	4.9
EH71054	C2a	180	5.4	2800	DH71054	F27d	4.8	M208	4.9
			± 10 % (2)			C_b= 0.18 pF (3)		C_b= 0.2 pF (3)	
EH71067	C2a	200	6.7	2600	DH71067	F27d	4.9	BH142	4.9
EH71080	C2b	220	8.0	2400	DH71080	F27d	5.0	BH142	5.0
EH71100	C2b	250	10.0	2200	DH71100	F27d	5.0	BH142	5.0
EH71120	C2b	270	12.0	2000	DH71120	F27d	5.1	BH142	5.1
EH71150	C2b	300	15.0	1800	DH71150	F27d	5.1	BH142	5.1
EH71180	C2b	330	18.0	1700	DH71180	F27d	5.2	BH142	5.2
EH71200	C2b	350	20.0	1500	DH71200	F27d	5.2	BH142	5.2
EH71220	C2b	370	22.0	1400	DH71220	F27d	5.2	BH142	5.2
EH71270	C2b	410	27.0	1300	DH71270	F27d	5.2	BH142	5.2
EH71330	C2c	450	33.0	1200	DH71330	F27d	5.2	BH142	5.2
EH71390	C2c	500	39.0	950	DH71390	F27d	5.2	BH142	5.2
EH71470	C2c	540	47.0	750	DH71470	F27d	5.2	BH142	5.2
EH71560	C2c	590	56.0	650	DH71560	F27d	5.2	BH142	5.2
EH71680	C2c	650	68.0	500	DH71680	F27d	5.2	BH142	5.2
EH71820	C2d	720	82.0	400	DH71820	F27d	5.2	BH142	5.2
EH71999	C2d	800	100.0	300	DH71999	F27d	5.2	BH142	5.2

(1) Custom cases available on request

(2) Closer capacitance tolerances available on request

(3) $C_T = C_j + C_b$

Temperature ranges:

Operating junction (T_j) : -55° C to +150° C

Storage : -65° C to +175° C

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V_{BR} 45 V

Description

This series of high Q epi-junction microwave tuning varactors (45 V) incorporates a passivated mesa technology. It is well suited for frequency tuning applications up to X band.

Chip Diodes			Chip and Packaged Diodes		Packaged Diodes (1)				
			V_{BR} (10 µA) ≥ 45 V		Standard Cases			Other Cases	
Characteristics at 25° C		Gold Dia Ø	Junction Capacitance C_j	Fig. of Merit Q			Tuning Ratio C_{T0}/C_{T45}		Tuning Ratio C_{T0}/C_{T45}
Test Conditions			V_R = 4 V f = 1 MHz	V_R = 4 V f = 50 MHz		Case Capacitance C_b		Case Capacitance C_b	
TYPE	CASE	µm	pF		TYPE	CASE		CASE	
		typ.	± 20 % (2)		min	C_b = 0.18 pF (3)	min	C_b = 0.12 pF (3)	min
EH72004	C2a	60	0.4	3000	DH72004	F27d	3.5	M208	3.7
EH72006	C2a	80	0.6	2900	DH72006	F27d	3.9	M208	4.1
EH72008	C2a	90	0.8	2800	DH72008	F27d	4.2	M208	4.5
EH72010	C2a	110	1.0	2700	DH72010	F27d	4.5	M208	4.7
EH72012	C2a	110	1.2	2700	DH72012	F27d	4.7	M208	4.9
EH72016	C2a	120	1.6	2600	DH72016	F27d	5.0	M208	5.2
EH72020	C2a	140	2.0	2500	DH72020	F27d	5.2	M208	5.5
EH72025	C2a	150	2.5	2400	DH72025	F27d	5.4	M208	5.6
EH72030	C2a	170	3.0	2300	DH72030	F27d	5.5	M208	5.7
EH72037	C2a	190	3.7	2200	DH72037	F27d	5.6	M208	5.7
EH72045	C2a	210	4.5	2000	DH72045	F27d	5.7	M208	5.8
EH72054	C2a	230	5.4	1900	DH72054	F27d	5.8	M208	5.9
			± 10 % (2)			C_b = 0.18 pF (3)		C_b = 0.2 pF (3)	
EH72067	C2b	250	6.7	1800	DH72067	F27d	5.9	BH142	6.0
EH72080	C2b	280	8.0	1700	DH72080	F27d	5.9	BH142	6.0
EH72100	C2b	310	10.0	1600	DH72100	F27d	6.0	BH142	6.0
EH72120	C2b	340	12.0	1500	DH72120	F27d	6.0	BH142	6.0
EH72150	C2b	380	15.0	1400	DH72150	F27d	6.0	BH142	6.0
EH72180	C2b	420	18.0	1300	DH72180	F27d	6.0	BH142	6.0
EH72200	C2b	440	20.0	1200	DH72200	F27d	6.0	BH142	6.0
EH72220	C2c	470	22.0	1100	DH72220	F27d	6.0	BH142	6.0
EH72270	C2c	520	27.0	1000	DH72270	F27d	6.0	BH142	6.0
EH72330	C2c	570	33.0	900	DH72330	F27d	6.0	BH142	6.0
EH72390	C2c	620	39.0	800	DH72390	F27d	6.0	BH142	6.0
			± 10 % (2)			C_b = 0.18 pF (3)		C_b = 0.4 pF (3)	
EH72470	C2d	680	47.0	700	DH72470	BH28	6.0	BH157	6.0
EH72560	C2d	740	56.0	600	DH72560	BH28	6.0	BH157	6.0
EH72680	C2d	820	68.0	450	DH72680	BH28	6.0	BH157	6.0
			± 10 % (2)			C_b = 0.4 pF (3)		C_b = 0.4 pF (3)	
EH72820	C2g	900	82.0	350	DH72820	BH141	6.0	BH157	6.0
EH72999	C2g	1000	100.0	250	DH72999	BH141	6.0	BH157	6.0

(1) Custom cases available on request

(2) Closer capacitance tolerances available on request

(3) $C_T = C_j + C_b$

Temperature ranges:

Operating junction (T_j) : -55° C to +150° C

Storage : -65° C to +175° C

SILICON HYPERABRUPT JUNCTION TUNING VARACTOR

Description

This series of silicon tuning varactors consists of hyperabrupt epitaxial devices. They incorporate a passivated mesa technology. Packaged or chip devices are available for VHF linear electronic tuning.

CHIP DIODES			CHIP AND PACKAGED DIODES					PACKAGED DIODES	
CHARACTERISTICS AT 25°C		GOLD DIA Ø	BREAKDOWN VOLTAGE V_{BR}	TOTAL CAPACITANCE CT	FIG. OF MERIT Q	BIAS VOLTAGE V_R	TUNING RATIO C_{T0}/C_{T20}		
TEST CONDITIONS			I_R=10µA	f=1MHz V_R	f=50MHz V_R		f=1MHz		
TYPE	CASE	µm	V	pF				TYPE	STANDARD CASE (1)
		min	min	typ.	min	V	typ.		C_b=0.18pF
EH724	C2b	200	25	15	100	4	10	DH724	F27d
EH726	C2b	220	25	13	100	6	9	DH726	F27d
EH728	C2b	250	25	12	150	8	8	DH728	F27d
EH730	C2b	270	25	10	250	10	8	DH730	F27d
EH732	C2b	300	25	10	250	12	7	DH732	F27d

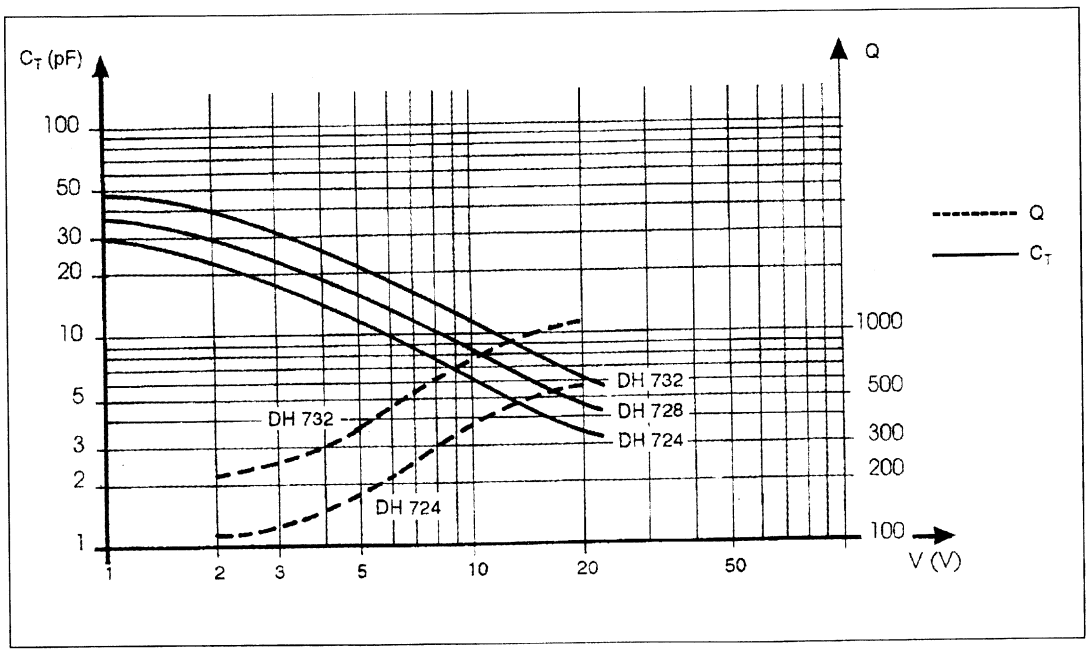
(1) Custom cases available on request

Temperature ranges:

Operating junction (T_j) : -55° C to +150° C

Storage : -65° C to +150° C

Typical total capacitance and Q versus reverse voltage



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MICROWAVE SILICON HYPERABRUPT JUNCTION TUNING VARACTOR

Description

This series of silicon tuning varactors consists of hyperabrupt epitaxial devices. They incorporate a passivated mesa technology. Packaged or chip devices are available for linear electronic tuning up to Ku band.

Chip Diodes			Chip and Packaged Diodes					Packaged Diodes	
Characteristics at 25°C		Gold Dia ∅	Breakdown Voltage V_{BR}	Total Capacitance C_T	Fig. of Merit Q	Tuning Ratio C_{T0}/C_{T20}			
Test Conditions			I_R = 10 µA	f = 1 MHz V_R = 6 V	f = 1 GHz V_R = 6 V	f = 1 MHz			
TYPE	CASE	µm	V	pF			TYPE	Standard Case (1)	
		min	min	typ.	typ.	min		C_b = 0.18 pF	C_b = 0.12 pF
EH733	C2a	60	20	0.8	180	5	DH733	F27d	M208
EH734	C2a	80	20	1.2	160	5	DH734	F27d	M208
EH735	C2a	100	20	1.8	150	5	DH735	F27d	M208
EH736	C2a	160	20	2.7	100	6	DH736	F27d	M208
EH737	C2a	180	20	3.9	85	6	DH737	F27d	M208
EH738	C2a	200	20	4.7	70	6	DH738	F27d	M208

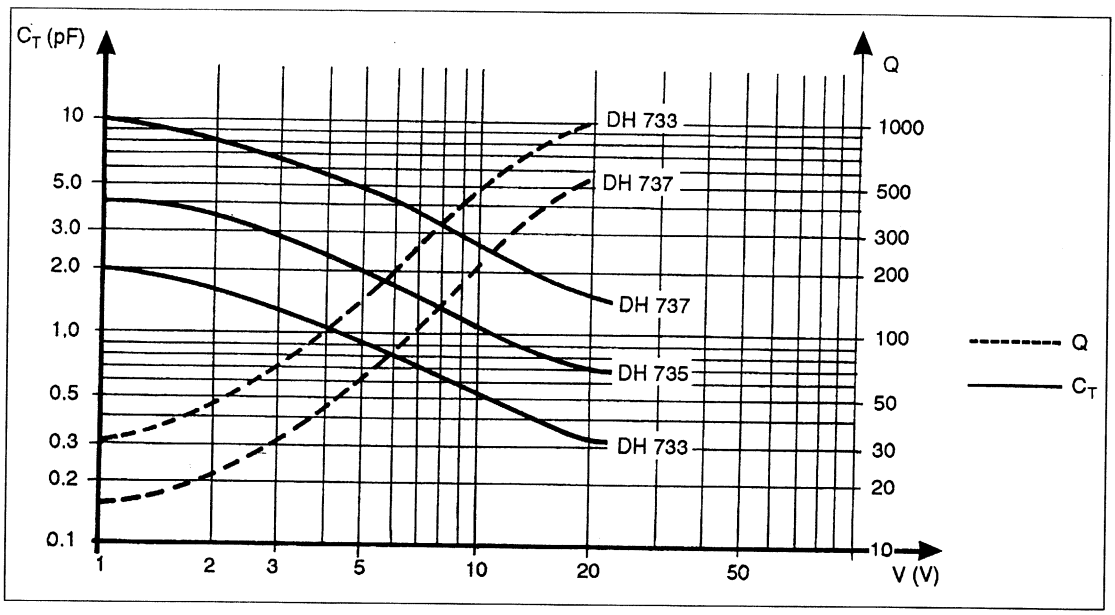
(1) Custom cases available on request

Temperature ranges:

Operating junction (T_j) : -55° C to +150° C

Storage : -65° C to +175° C

Typical total capacitance and Q versus reverse voltage



POWER GENERATION DIODES

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STEP RECOVERY DIODES AND MULTIPLIER VARACTOR APPLICATIONS

A step recovery diode (SRD) generates pulses that can be used to multiply frequencies, and to set up reference points, e.g. for synchronising test instruments.

This device operates by alternately producing and consuming a charge, based on the frequency of its input signal. During forward bias, the SRD conducts and builds up its charge. During reverse bias, the SRD maintains conduction by consuming its charge. When the charge has been fully consumed, the SRD snaps off, i.e. very quickly reverts to zero conduction.

This device acts as a switch, controlling current flow by alternately storing and releasing its charge, forming pulses at a repetition rate equal to the frequency of its input.

The output of a step recovery diode is most often used in two ways:

- a pulse train can be applied to resonant circuits, which provides output power at a frequency above that of the original input,
- a pulse train can be used to develop a series of frequencies at multiples of the original input frequencies.

Typical applications of step recovery diodes include oscillators, power transmitters and drivers, for telecommunications, telemetry, radar and test equipments.

In choosing a SRD, the significant characteristics include:

Output Frequency (f_o) ; Breakdown Voltage (V_{BR}) ; Junction Capacitance (C_j) ; Minority Carrier Lifetime (τ_l); Snap-off Time (t_{so}) ; Thermal Resistance (R_{th}) and Output Power (P_o).

Multiplier varactors

A multiplier varactor is a physical stack of series-connected SRD units. This configuration is capable of multiplying power.

Packages for multiplier varactors are designed to dissipate the power yield $\left(\frac{\text{Power out}}{\text{Power in}}\right)$

Most of these packages hold from 2 to 4 chips, this type of components are available on customer request.

STEP RECOVERY DIODES (SRD)

Description

These diodes use mesa technology and oxide passivation. They support fast switching and multiplier applications:

- very short pulse generation,
- ultra fast waveform shaping,
- comb generation,
- high order multiplication, at moderate power ratings.

CHIP DIODES			CHIP AND PACKAGED DIODES					PACKAGED DIODES				
CHARACTERISTICS AT 25°C		GOLD DIA ∅	BREAKDOWN VOLTAGE V_{BR}	JUNCTION CAPACITANCE C_j	MIN. CAR. LIFETIME τ_l	SNAP-OFF TIME t_{SO}				THERMAL RESISTANCE R_{TH}		
TEST CONDITIONS		N/A	I_R=10 µA	V_R=6 V f= 1 MHz	I_F=10mA I_R = 6 mA	I_F=10 mA V_R=10 V				P_{diss}=1 W in F27d		
TYPE	CASE	µm	V	pF	ns	ps		TYPE	CASE (1)	°C/W	Other cases (1)	
		typ.	min	max	min	typ.	max		C_b=0.1pF (2)	max	C_b=0.18pF (2)	C_b=0.18pF (2)
EH541	C2a	160	30	1.5	25	90	140	DH541	A22e	30	F27d	M208
EH542	C2a	220	50	1.5	40	150	250	DH542	A22e	25	F27d	M208
EH543	C2a	110	30	1.0	20	90	140	DH543	A22e	40	F27d	M208
EH544	C2a	140	50	1.0	35	150	250	DH544	A22e	35	F27d	M208
EH545	C2a	55	25	0.4	10	75	100	DH545	A22e	70	F27d	M208
EH546	C2a	40	15	0.3	6	60	80	DH546	A22e	100	F27d	M208

(1) Custom cases available on request

(2) $C_T = C_j + C_b$

Temperature ranges:

Operating junction (T_j) : -55° C to +150° C

Storage : -65° C to +175° C

SILICON MULTIPLIER VARACTORS

Description

These silicon multiplier varactors (from 0.2 to 25 GHz) are designed for harmonic generation of high power levels (stack configuration) and/or at high multiplication orders.

Packaged diodes

Characteristics @ 25°C		Varactor Chips per Package	Output Freq. F_0	Breakdown Voltage V_{BR}		Junction Capacit. C_j		Min. Car. Lifetime τ_i	Snap-Off Time t_{so}	Thermal Resistance R_{th}	Power Output P_0	
Test Conditions			N/A	I_R = 10 µA		V_R = 6 V f = 1 MHz		I_F = 10 mA I_R = 6 mA	I_F = 10 mA V_R = 10 V	N/A	$f_0 = (n)f_i$	
TYPE	CASE		GHz	V		pF		ns	ps	°C/W	W	
				min	max	min	max	min	max	max	typ.	(n)
DH294	DO7	1	0.2 - 2	45	70	4.0	7.0	125	400	300	0.5	2
DH200	F49	1	0.5 - 2	90	140	5.5	7.0	250	1000	8	20.0	2
DH270	S268-W1	1	2 - 3	80	110	4.0	5.5	160	700	10	15.0	2
DH110	F27d	1	2 - 4	60	90	3.0	4.0	100	400	25	9.0	2
DH293	F60d	1	3 - 6	50	70	2.0	3.0	60	250	30	6.0	2
DH252	F27d	1	2 - 8	40	60	0.9	2.0	35	200	50	3.0	2
DH256	F27d	1	5 - 12	30	45	0.5	1.1	20	120	60	2.0	2
DH292	F27d	1	8 - 16	20	35	0.2	0.5	10	75	70	0.6	2
DH267	F27d	1	10 - 25	15	25	0.2	0.3	6	60	100	0.2	2

Temperature ranges:

Operating junction (T_j) : -55° C to +150° C

Storage : -65° C to +175° C

MOS CAPACITORS CHIPS & ARRAYS

Selection Guide

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TOP PROCESS / HIGH PERFORMANCE

TEKELEC TEMEX M.O.S. (Metal - Oxide - Silicon) chips and arrays capacitors feature small size and high Q performances making them ideally suited for hybrid microwave circuits up to 30 GHz.

The dielectric (Silicon dioxide) thermally grown on a silicon wafer has a very low dielectric constant ($\epsilon_1 = 3.9\ \epsilon_0$) and very stable temperature coefficient allowing a complete range of stable capacitance values (0.1 to 100 pF).

The dielectric thickness determines the rated voltage for a given capacitance value:

- V_R = 40 V e = 0.15 µm
- V_R = 100 V e = 0.25 µm
- V_R = 200 V e = 0.50 µm
- V_R = 400 V e = 1.0 µm
- V_R = 500 V e = 1.8 µm

The metallization areas which are the terminations of the capacitors are obtained with photo-masking technics and are made of sputtered titanium (≈ 700 Å) and gold (≈ 6000 Å).

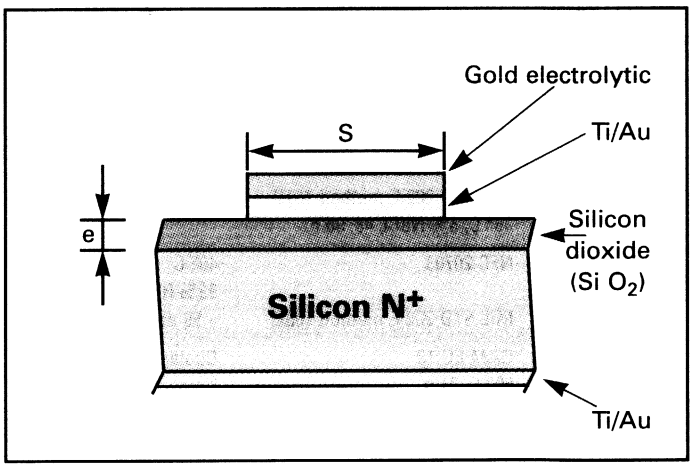
An electrolytic gold layer of 1.5 µm is made on top termination to ensure the best contact with the external circuits:

- Bottom termination attachment technics:
  Eutectic Au-Sn (80/20) Melting point 280° C
  " " Au-Ge (88/12) Melting point 350° C
  Conductive epoxy
- Top termination:
  Thermocompression, Thermosonic and wedge bonding may be used.

Applications

- DC Block, RF by-pass
- Source by-pass
- Impedance matching - Trimming
- Filters
- Decoupling for Ga-As FET

Physical description



The capacitance is given by $C = \epsilon_1 \times \frac{S}{e}$

$\epsilon_1 = 3.9\ \epsilon_0$
S = surface of the top termination
e = thickness of the oxide

SINGLE-PAD CHIP CAPACITOR CS SERIES

General characteristics

Capacitance range (C_R): 0.1 to 100 pF.

See tables 1 & 2.

Tolerance capacitance:

- Standard : ± 20 % (CS, CJ, CB)
- Others : ± 10, ± 5, ± 2 % (consult us)

Rated voltage (U_R): See tables 1, 2 & 3.

Note: *Voltage and capacitance values being tightly linked to dielectric thickness and top termination area means, special requirements may be achieved by our engineers. Please consult us.*

Voltage proof (25° C): 1.5 x U_R

Insulation resistance (R_i): $R_i \geq 10^5$ MΩ.

(at rated voltage and 25° C)

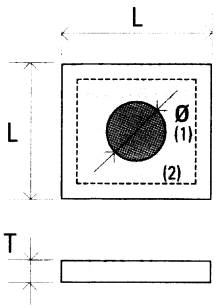
Temperature coefficient: 50 ppm°/C (typical) (over temperature range)

Storage and operating temperature range: - 55° C to + 200° C.

Environmental characteristics

CONSTRAINT		
CONSTRAINT	**STANDARD / CONDITIONS**	**Experimental results before first failure**
SALT SPRAY	NFC 20711: 35° C, 5 % NaCl, 16, 24, 48, 96, 168, 336, 672 h. MIL STD 202 F, method 101D 35° C, 5 % NaCl, 48, 96 h.	35° C 5 % NaCl > 400 hours
DAMP HEAT	NFC 20703 MIL STD 202 F, method 103B	40° C 93 % RH > 56 days
CONTAMINENTS	GAM EG 13 50° C, 24 h. 65° C, 165 h.	Coolanol Kerozene Glycol > 1 000 hours
THERMAL	NFC 20714 Temperature/nb of cycles specific	- 55 / + 125° C > 5 000 hours
SHOCK	MIL STD 202 F, method 107G N° cycles: 5, 25, 50, 100 A : - 55 / + 85° C B : - 65 / + 125° C C : - 65 / + 200° C D : - 65 / + 150° C	- 65 / + 175° C > 5 000 hours
RADIATION	On study	

Dimensions (in µm)



Case size	L min - max	T typical
MC106	340 - 400	200
MC107	540 - 600	200
MC108	740 - 800	200
MC110	940 - 1000	200

Note 1: *ø is indicated in table 1 for each capacitance value.*

Note 2: *Square termination may also be achieved. Please consult us.*

Table 1: Top termination diameter (µm) versus Capacitance / Voltage range

C_R	MC106	MC107	MC108	MC110
0.22 pF				
0.27 pF				
0.33 pF				
0.39 pF				
0.47 pF				
0.56 pF				
0.68 pF				
0.82 pF				400
1.0 pF	220			
1.2 pF	250			
1.5 pF	270			100
1.8 pF	300			
2.2 pF				40
2.7 pF				
3.3 pF				
3.9 pF	220			
4.7 pF	240			
5.6 pF	270			
6.8 pF	290			
8.2 pF	220			
10 pF	250	350		
12 pF	270	390		
15 pF	310	430		
18 pF		340		
22 pF		370	520	
27 pF		410	580	
33 pF		450	640	
39 pF		490	700	
47 pF			540	
56 pF			590	
68 pF			660	
82 pF				720
100 pF				780

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MULTI-PADS CAPACITOR ARRAYS CJ SERIES

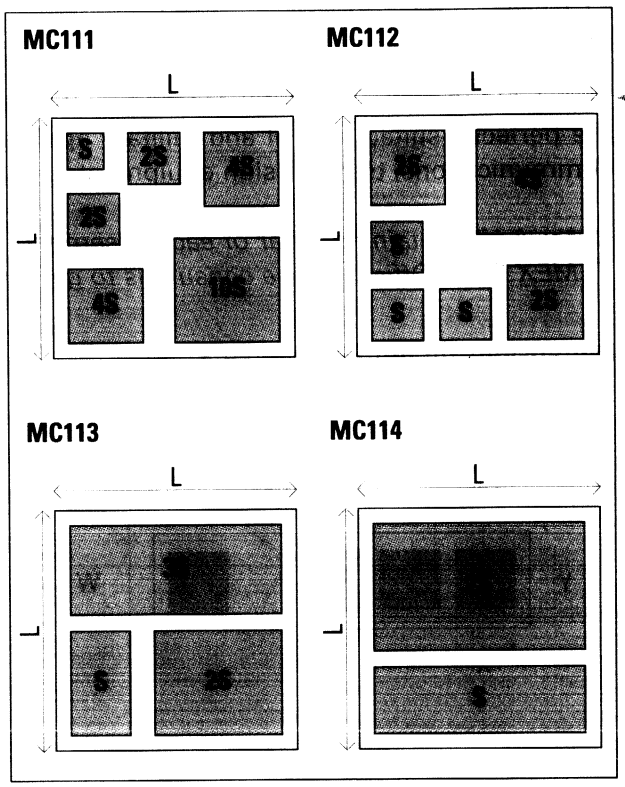
These capacitor arrays are intended for fine and precise adjustments in circuits which need to be tuned and kept tuned whatever the mechanical and environmental conditions are.

Note: *These capacitor arrays are made of several pads per case size.*
— For each case size, the unit and basic capacitance value is "S".
— This is also the value of the step capacitance.
— The number of steps is obtained with alll combinations to be achieved with the basic capacitance pad "S" and the other pads made of "2S", "4S", "10S"...
— The area of the minimum capacitance value "S" is given herebelow for each case size.

MC111	: S	=	(70 x 70)	μm^2
MC112	: S	=	(90 x 90)	μm^2
MC113	: S	=	(180 x 270)	μm^2
MC114	: S	=	(115 x 400)	μm^2

— For special designs, please consult us.

Dimensions (in µm)



Case size	L min - max	T typical
MC111	400 - 500	200
MC112	400 - 500	200
MC113	650 - 750	200
MC114	450 - 550	200

Table 2: Capacitance / Voltage range

Note: *Standard tolerance: ± 20% (M).*

Case Size	C min "S"	Number of steps	C max	Voltage (V_R)
MC111	0.125 pF	23	2.875 pF	400 V
MC111	0.25 pF	23	5.75 pF	200 V
MC111	0.50 pF	23	11.5 pF	100 V
MC112	0.2 pF	11	2.2 pF	400 V
MC112	0.4 pF	11	4.4 pF	200 V
MC112	0.8 pF	11	8.8 pF	100 V
MC113	10 pF	6	60 pF	40 V
MC114	10 pF	3	30 pF	40 V

MULTI-PADS BAR CAPACITORS CB SERIES

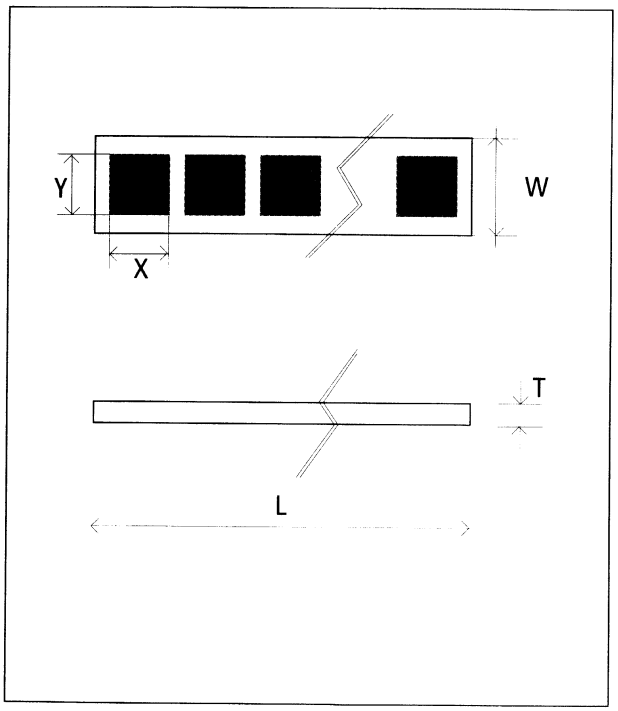
These capacitor arrays are primarily intended for mounting in Ga-As integrated circuit packaging for by-pass, decoupling and matching purposes.

They can also be used in hybrid circuits where high performance and stable capacitors are required.

The stable characteristics of these devices (temperature coefficient, low inductance, low insertion loss) are perfectly suited to civil and military applications in the SHF and VHF application ranges (radar, communications, transmission equipments).

Note: *A kit containing 1 bar of each assembly (3, 4 and 5 pads of 100 pF) is available from TEKELEC TEMEX Sales Office. Please consult us to get a free "MOS-BAR" kit sample.*

Dimensions (in mm): See table 3



Multi-pads arrays

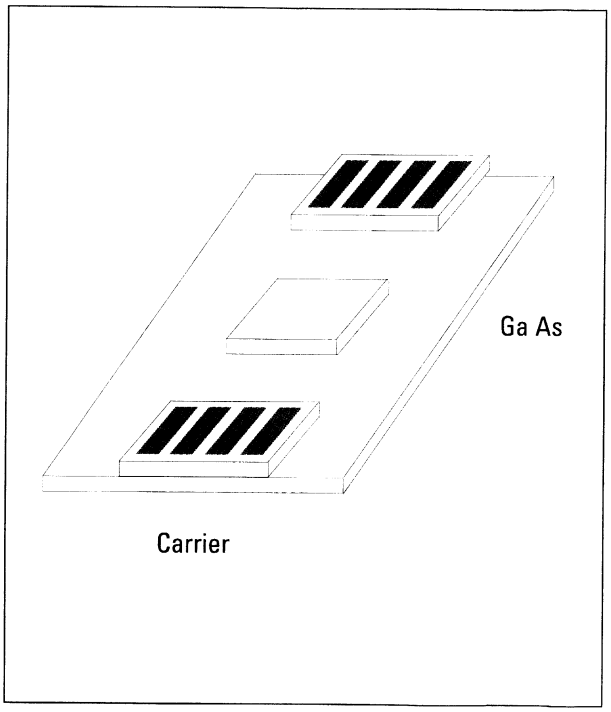


Table 3: Capacitance / Voltage range and dimensions (µm)

Note: *Standard tolerance: ± 20% (M).*

Case Size	Number of pads	Cr max per pad (pF)						L	W	T	X	Y
		500V	400V	200V	100V	40V	25V	± 125	max	typ.	max	max
MC130	3							1650				
MC140	4	8	10	20	40	68	100	2160	980	200	400	850
MC150	5							2675				

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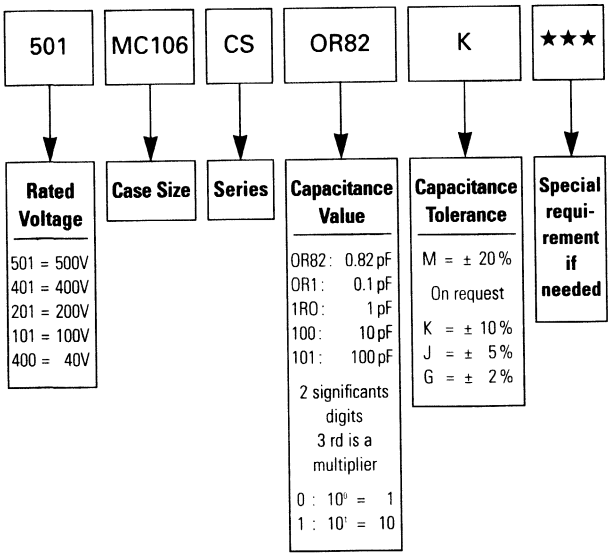
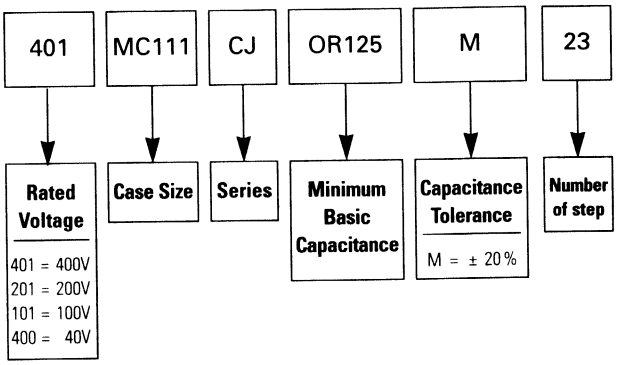
How to order

A - Single-pad chip capacitors

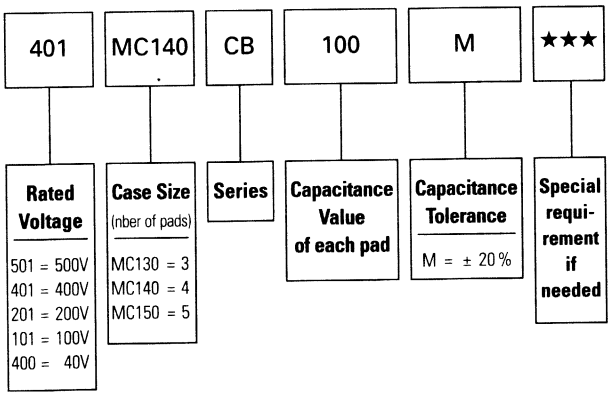


B - Multi-pads arrays capacitors



Ex.: MC111
0.125 pF min ± 20 % - 400V
23 steps (C max = 2.875 pF)

C - Multi-pads bar capacitors



Designer kit: MOS-KIT

In order to back-up engineers in their design purposes, TEKELEC TEMEX proposes a kit made of following parts:

Case Size	Capacitance value
MC106	0.22 - 0.47 - 0.82 - 1 - 2.2 - 3.3 - 4.7 - 10 pF
MC107	6.8 - 15 - 33 pF
MC108	15 - 33 - 68 pF
MC110	100 pF
MC111	0.125 - 0.25 - 0.5 pF (C min)
MC112	0.2 - 0.4 - 0.8 pF (C min)
MC113	10 pF
MC114	10 pF

Capacitance tolerance: ± 20 %

Please order: MOS-KIT

AMERICA: +1 (602) 780 1995 / ASIA PACIFIC: +852 2813 9826 / EUROPE: +33 (0) 1 49 88 49 00 / AFRICA: +33 (0) 1 49 88 49 00
BELGIUM: +32 (0) 2 715 90 20
FRANCE: +33 (0) 1 49 88 49 00
GERMANY: +49 (0) 895164-0
ITALY: +39 (0) 2 58 01 91 06
NORDIC: +46 (0) 8 590 303 00
SPAIN: +34 (0) 1 320 41 60
NL: +31 (0) 793461430
UK: (44) 1256 883340

CASE STYLES

General Purpose

Surface Mount Devices

Power

Strip Line / Micro Strip

Chip version

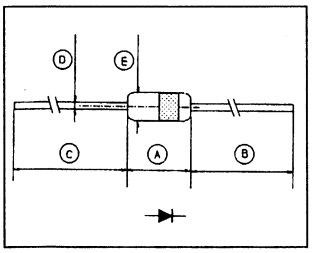
SALES OFFICES & WEB SITE: http://www.tekelec-temex.com

AMERICA: +1 (602) 780 1995 / ASIA PACIFIC: +852 2813 9826 / EUROPE: +33 (0) 1 49 88 49 00 / AFRICA: +33 (0) 1 49 88 49 00

BELGIUM: +32 (0) 2 715 90 20
FRANCE: +33 (0) 1 49 88 49 00
GERMANY: +49 (0) 895164-0
ITALY: +39 (0) 2 58 01 91 06
NORDIC: +46 (0) 8 590 303 00
SPAIN: +34 (0) 1 320 41 60
NL: +31 (0) 793461430
UK: (44) 1256 883340

A22e

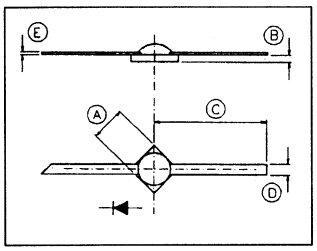
C_b=0.1pF



E	Ø 1.7	Ø 2.1	.067 DIA	.083 DIA
D	Ø 0.35	Ø 0.41	.014 DIA	.016 DIA
C	25.4		1	
B	25.4		1	
A	4	4.4	.157	.173
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH15

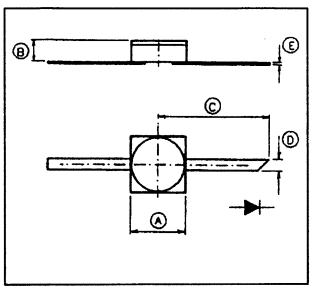
C_b=0.1pF



E	0.09	0.11	.0035	.0043
D	0.28	0.48	.011	.019
C	3.82	4.58	.15	.18
B	0.15	0.35	.006	.014
A	1.17	1.37	.046	.054
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH16

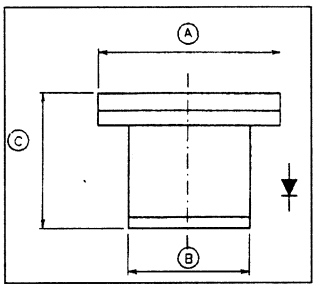
C_b=0.16pF



E	0.08	0.12	.003	.005
D	0.45	0.55	.018	.022
C	4.58	5.58	.180	.220
B	0.66	0.86	.026	.034
A	2.4	2.6	.094	.102
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH28

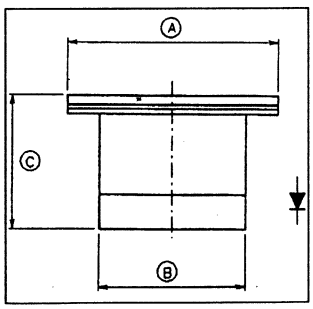
C_b=0.2pF



C	2.04	2.50	.080	.098
B	Ø 1.93	Ø 2.13	.076 DIA	.084 DIA
A	Ø 3.00	Ø 3.20	.118 DIA	.126 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH32

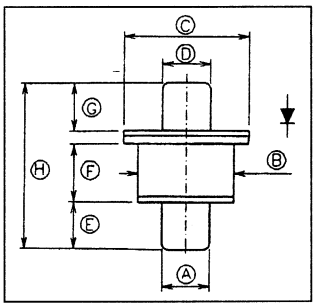
C_b=0.2pF



C	3.5	3.9	.138	.154
B	Ø 3.86	Ø 4.26	.152 DIA	.168 DIA
A	Ø 5.64	Ø 6.04	.222 DIA	.238 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH35

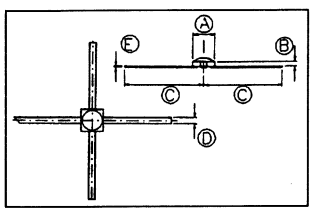
C_b=0.25pF



H	5.14	5.93	.202	.233
G	1.37	1.77	.054	.070
F	1.78	1.98	.070	.078
E	1.37	1.77	.054	.070
D	Ø 1.52	Ø 1.62	.060 DIA	.064 DIA
C	Ø 3.96	Ø 4.16	.156 DIA	.164 DIA
B	Ø 3.05	Ø 3.25	.120 DIA	.128 DIA
A	Ø 1.52	Ø 1.62	.060 DIA	.064 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH36

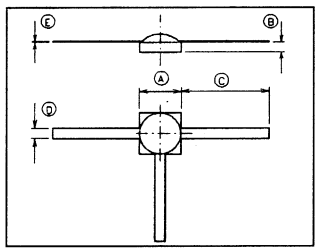
C_b=0.1pF



E	0.08	0.12	.003	.005
D	0.4	0.6	.016	.024
C	5.7	5.9	.224	.232
B	0.28	0.48	.011	.019
A	1.7	1.9	.067	.075
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH100

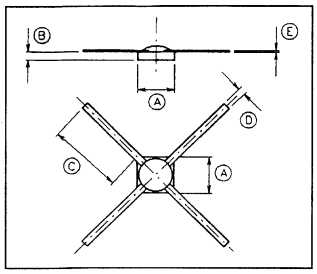
C_b=0.25pF



E	0.05	0.10	.002	.004
D	0.55	0.65	.022	.026
C	5		.197	
B	6.30	6.40	.248	.252
A	2.35	2.45	.093	.096
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH101

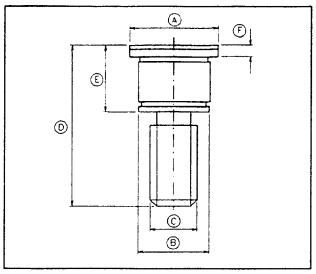
C_b=0.15pF



E	0.05	0.15	.002	.006
D	0.55	0.65	.022	.026
C	5		.197	
B	0.28	0.48	.011	.019
A	2.3	2.7	.091	.106
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH141

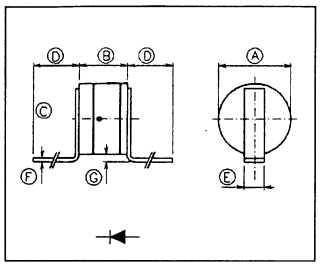
C_b=0.4pF



F		0.70		.028
E	4.70	5.10	.185	.201
D	12.8	13.4	.504	.526
C		6. 40 UNF-3A		
B	∅ 5.20	∅ 5.40	.205 DIA	.203 DIA
A	∅ 6.50	∅ 6.70	.256 DIA	.263 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH142a

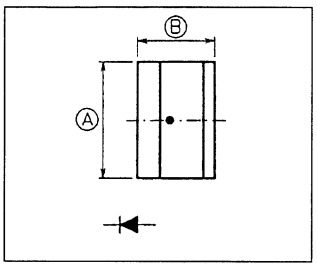
C_b=0.2pF



G	0.1	0.5	.004	.020
F	0.06	0.10	.0024	.0039
E	0.55	0.65	.022	.026
D	2.5		.098	
C	2.10	2.70	.083	.106
B	1.24	1.58	.049	.062
A	∅ 1.90	∅ 2.20	.075 DIA	.087 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH142b

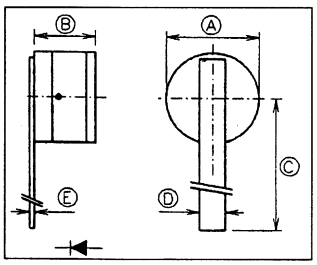
C_b=0.2pF



B	1.24	1.58	.049	.062
A	∅ 1.90	∅ 2.20	.075 DIA	.087 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH142c

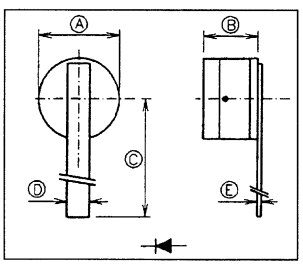
C_b=0.2pF



E	0.06	0.10	.0024	.0039
D	0.55	0.65	.022	.026
C	5		.197	
B	1.24	1.58	.049	.062
A	∅ 1.90	∅ 2.20	.075 DIA	.087 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH142d

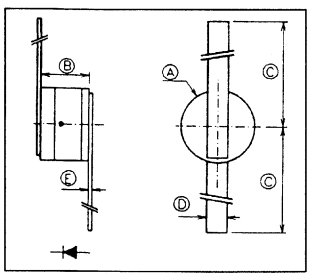
C_b=0.2pF



E	0.06	0.10	.0024	.0039
D	0.55	0.65	.022	.026
C	5		.197	
B	1.24	1.58	.049	.062
A	∅ 1.90	∅ 2.20	.075 DIA	.087 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH142e

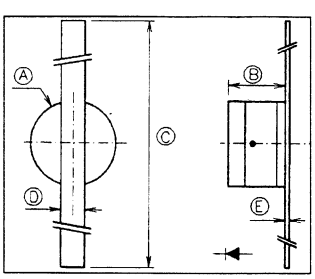
C_b=0.2pF



E	0.06	0.10	.0024	.0019
D	0.55	0.65	.022	.026
C	5		.197	
B	1.24	1.58	.049	.062
A	∅ 1.90	∅ 2.20	.075 DIA	.087 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH142f

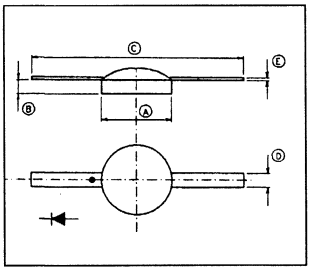
C_b=0.2pF



E	0.06	0.10	.0024	.0039
D	0.55	0.65	.022	.026
C	10		.394	
B	1.24	1.58	.049	.062
A	∅ 1.90	∅ 2.20	.075 DIA	.087 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH143

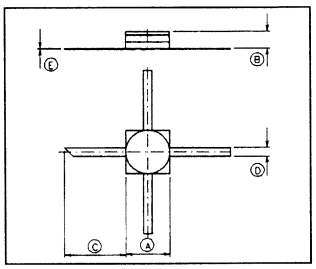
C_b=0.1pF



E	0.08	0.12	.003	.005
D	0.45	0.55	.094	.102
C	7.60		.299	
B	0.45	0.55	.018	.022
A	∅ 2.40	∅ 2.60	.094	.102
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH146

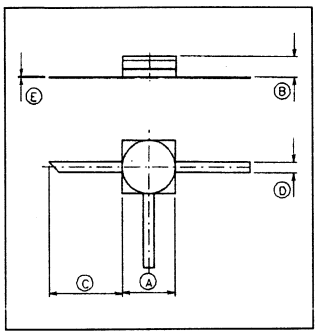
C_b=0.25pF



E	0.08	0.12	.003	.005
D	0.48	0.52	.019	.020
C	3.75		.148	
B	0.86	1.06	.034	.042
A	2.3	2.7	.091	.106
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH147

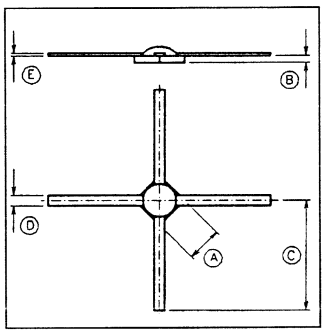
C_b=0.25pF



E	0.08	0.12	.003	.005
D	0.48	0.52	.019	.020
C	3.75		.148	
B	0.86	1.06	.034	.042
A	2.3	2.7	.091	.106
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH151

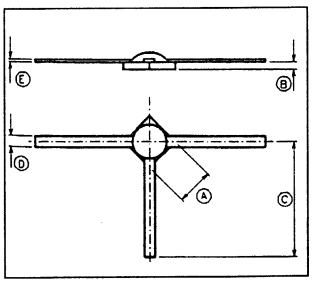
C_b=0.25pF



E	0.08	0.12	.003	.005
D	0.35	0.45	.014	.018
C	3.70	4.30	.147	.169
B	0.20	0.30	.008	.012
A	1.17	1.37	.046	.054
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH152

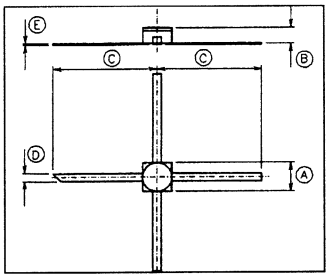
C_b=0.05pF



E	0.08	0.12	.003	.005
D	0.35	0.45	.014	.018
C	3.70	4.30	.147	.169
B	0.20	0.30	.008	.012
A	1.17	1.37	.046	.054
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH153

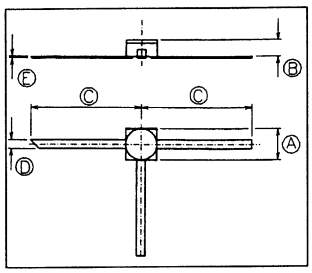
C_b=0.13pF



E	0.08	0.12	.003	.005
D	0.45	0.55	.018	.022
C	6.15	6.55	.242	.258
B	0.91	1.01	.036	.040
A	1.68	1.88	.066	.074
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH154

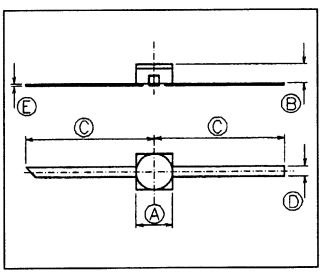
C_b=0.13pF



E	0.08	0.12	.003	.005
D	0.45	0.55	.018	.022
C	6.15	6.55	.242	.258
B	0.91	1.01	.036	.040
A	1.68	1.88	.066	.074
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH155

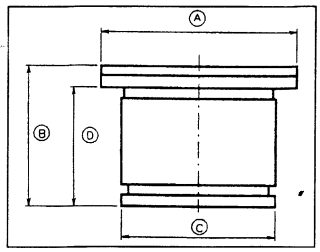
C_b=0.13pF



E	0.08	0.12	.003	.005
D	0.45	0.55	.018	.022
C	6.15	6.55	.242	.258
B	0.91	1.01	.036	.040
A	1.68	1.88	.066	.074
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

C_b=0.4pF

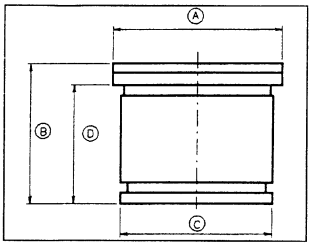
BH158



D	4.00	4.50	.157	.177
C	∅ 5.10	∅ 5.50	.200 DIA	.216 DIA
B	4.90	5.30	.193	.209
A	∅ 6.50	∅ 6.70	.256 DIA	.264 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

C_b=0.4pF

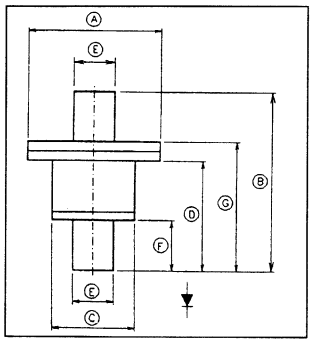
BH158am



D	4.1	4.4	.16	.173
C	∅ 5.2	∅ 5.5	.204 DIA	.216 DIA
B	4.7	5.2	.185	.205
A	∅ 5.7	∅ 6.1	.224 DIA	.240 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

C_b=0.12pF

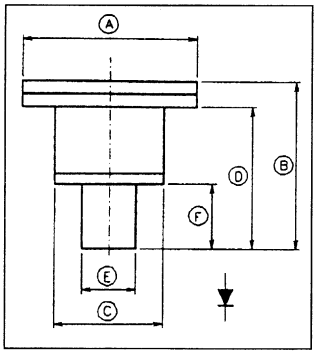
BH165



G	1.95	2.22	.077	.087
F	0.71	0.81	.028	.032
E	∅ 0.61	∅ 0.66	.024 DIA	.026 DIA
D	1.53	1.78	.060	.070
C	∅ 1.22	∅ 1.32	.048 DIA	.052 DIA
B	2.65	3.04	.104	.120
A	∅ 2.00	∅ 2.06	.079 DIA	.081 DIA
SYM	min	max	min	max
BOL	MILLIMETER		INCHES	

C_b=0.12pF

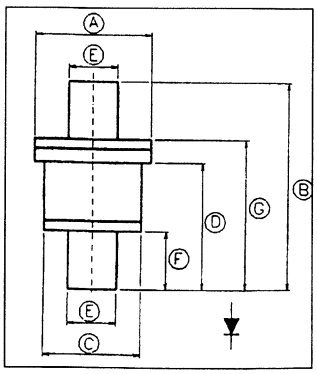
BH165s



F	0.71	0.81	.028	.032
E	∅ 0.61	∅ 0.66	.024 DIA	.026 DIA
D	1.53	1.78	.060	.070
C	∅ 1.22	∅ 1.32	.048 DIA	.052 DIA
B	1.95	2.22	.077	.087
A	∅ 2.00	∅ 2.06	.079 DIA	.081 DIA
SYM	min	max	min	max
BOL	MILLIMETER		INCHES	

C_b=0.12pF

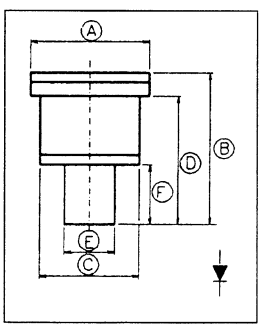
BH167



G	1.86	2.06	.073	.081
F	0.71	0.81	.028	.032
E	∅ 0.61	∅ 0.66	.024 DIA	.026 DIA
D	1.55	1.75	.060	.070
C	∅ 1.22	∅ 1.32	.048 DIA	052 DIA
B	2.57	2.87	.101	.113
A	∅ 1.42	∅ 1.62	.056 DIA	.064 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

C_b=0.12pF

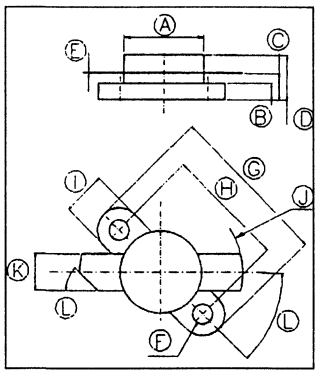
BH167s



F	0.71	0.81	.028	.032
E	∅ 0.61	∅ 0.66	.024 DIA	.026 DIA
D	1.55	1.75	.061	.069
C	∅ 1.22	∅ 1.32	.048 DIA	.052 DIA
B	1.86	2.06	.073	.081
A	∅ 1.42	∅ 1.62	.056 DIA	.064 DIA
SYM	min	max	min	max
BOL	MILLIMETER		INCHES	

BH200a

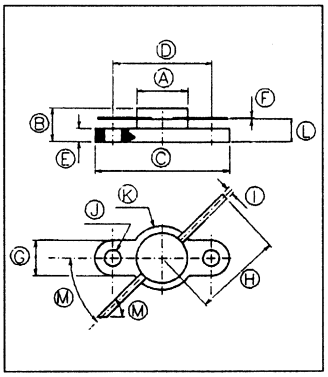
C_b=0.4pF



L	43°	47°	43°	47°
K	5.49	5.89	.216	.232
J	∅ 30.48	∅ 31.50	1.200 DIA	1.240 DIA
I	6.30	6.40	.248	.252
H	18.26	18.67	.719	.735
G	24.64	24.89	.970	.980
F	∅ 3.10	∅ 3.25	.122 DIA	.128 DIA
E	0.10	0.127	.004	.005
D	6.78	7.19	.267	.283
C	3.86	4.27	.152	.168
B	2.50	2.667	.098	.105
A	∅ 12.50	∅ 12.90	.492 DIA	.508 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH202

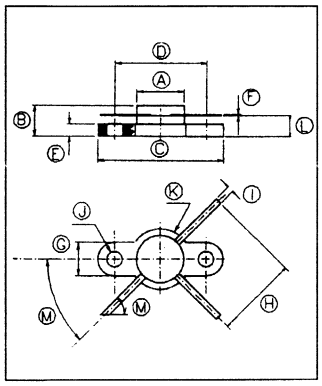
C_b=0.15pF



M	43°	47°	43°	47°
L	4.12	4.52	.162	.178
K	∅ 12.14	∅ 12.24	.478 DIA	.482 DIA
J	∅ 3.10	∅ 3.25	.122 DIA	.128 DIA
I	1.25	1.29	.049	.051
H	16.30	16.70	.642	.658
G	6.30	6.40	.248	.252
F	0.23	0.27	.009	.011
E	2.50	2..67	.098	.105
D	18.26	18.67	.719	.735
C	24.64	24.89	.970	.980
B	6.78	7.19	.267	.283
A	∅ 9.4	∅ 9.64	.370 DIA	.380 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH203a

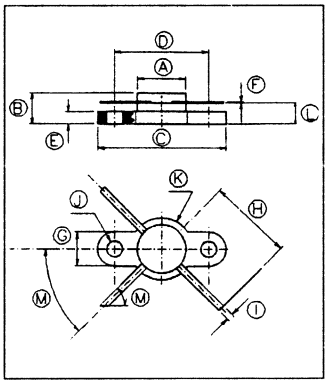
C_b=0.15pF



M	43°	47°	43°	47°
L	4.12	4.52	.162	.178
K	∅ 12.14	∅ 12.24	.478 DIA	.482 DIA
J	∅ 3.10	∅ 3.25	.122 DIA	.128 DIA
I	1.25	1.29	.049	.051
H	16.30	16.70	.642	.658
G	6.30	6.40	.248	.252
F	0.23	0.27	.009	.011
E	2.50	2.67	.098	.105
D	18.26	18.67	.719	.735
C	24.64	24.89	.970	.980
B	6.78	7.19	.267	.283
A	∅ 9.4	∅ 9.64	.370 DIA	.380 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH203b

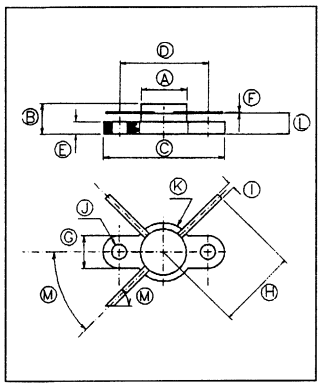
C_b=0.15pF



M	43°	47°	43°	47°
L	4.12	4.52	.162	.178
K	∅ 12.14	∅ 12.24	.478 DIA	.482 DIA
J	∅ 3.10	∅ 3.25	.122 DIA	.128 DIA
I	1.25	1.29	.049	.051
H	16.30	16.70	.642	.658
G	6.30	6.40	.248	.252
F	0.23	0.27	.009	.011
E	2.50	2.67	.098	.105
D	18.26	18.67	.719	.735
C	24.64	24.89	.970	.980
B	6.78	7.19	.267	.283
A	∅ 9.4	∅ 9.64	.370 DIA	.380 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH203c

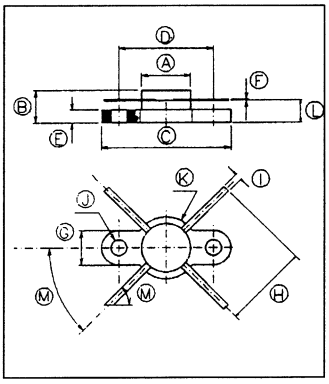
C_b=0.15pF



M	43°	47°	43°	47°
L	4.12	4.52	.162	.178
K	∅ 12.14	∅ 12.24	.478 DIA	.482 DIA
J	∅ 3.10	∅ 3.25	.122 DIA	.128 DIA
I	1.25	1.29	.049	.051
H	16.30	16.70	.642	.658
G	6.30	6.40	.248	.252
F	0.23	0.27	.009	.011
E	2.50	2.67	.098	.105
D	18.26	18.67	.719	.735
C	24.64	24.89	.970	.980
B	6.78	7.19	.267	.283
A	∅ 9.4	∅ 9.64	.370 DIA	.380 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

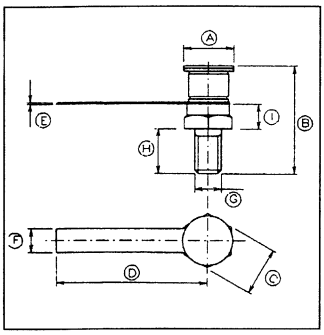
BH204

C_b=0.15pF



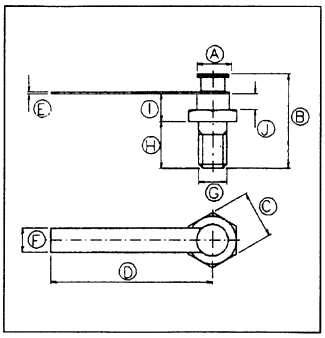
M	43°	47°	43°	47°
L	4.12	4.52	.162	.178
K	∅ 12.14	∅ 12.24	.478 DIA	.482 DIA
J	∅ 3.10	∅ 3.25	.122 DIA	.128 DIA
I	1.25	1.29	.049	.051
H	16.30	16.70	.642	.658
G	6.30	6.40	.248	.252
F	0.23	0.27	.009	.011
E	2.50	2.67	.098	.105
D	18.26	18.67	.719	.735
C	24.64	24.89	.970	.980
B	6.78	7.19	.267	.283
A	∅ 9.4	∅ 9.64	.370 DIA	.380 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

BH300 C_b=0.4pF



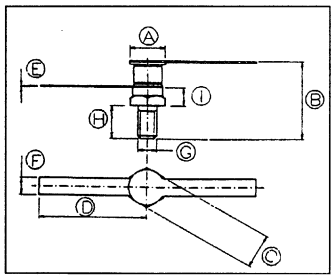
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	
I	3.25	3.45	.128	.136
H	5.60	6.00	.220	.236
G	6 - 32 UNC - 3A			
F	2.97	3.38	.177	.133
E	0.20	0.30	.008	.012
D	20	-	.787	-
C	6.30	6.40	.248	.252
B	13.95	15.05	.549	.593
A	∅ 6.5	∅ 6.7	.256 DIA	.264 DIA

BH301 C_b=0.2pF



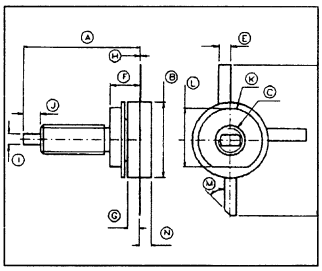
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	
J	1.52	1.62	.060	.064
I	2.82	3.02	.111	.119
H	4.42	4.82	.174	.190
G	4 - 40 UNC - 3A			
F	2.16	2.56	.85	.101
E	0.18	0.20	.007	.008
D	15.67	16.18	.617	.637
C	4.70	4.80	.185	.189
B	9.46	10.54	.372	.415
A	∅ 3.00	∅ 3.20	.118 DIA	.126 DIA

BH303 C_b=0.4pF



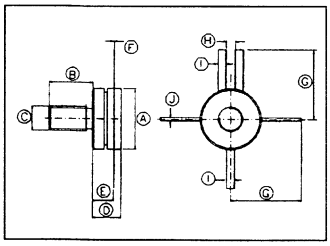
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	
I	3.25	3.45	.128	.136
H	5.60	6.00	.220	.236
G	6 - 32 UNC - 3A			
F	2.97	3.38	.177	.133
E	0.20	0.30	.008	.012
D	20	-	.787	-
C	6.30	6.40	.248	.252
B	13.95	15.05	.549	.593
A	∅ 6.5	∅ 6.7	.256 DIA	.264 DIA

BH403a C_b=0.3pF



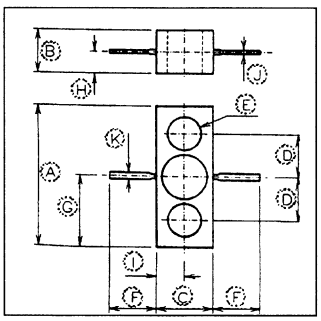
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	
N	-	3	-	.120
M	Typical : 45°			
L	9.68	10.08	.381	.397
K	∅ 10.46	∅ 10.87	.412 DIA	.428 DIA
J	2.72	3.12	.107	.123
I	1.57	1.98	.062	.078
H	0.10	0.15	.004	.006
G	1.78	2.03	.070	.080
F	4.39	4.64	.173	.183
E	1.90	2.16	.075	.085
D	25.4	-	1	-
C	10 - 32 UNF 3A			
B	∅ 12.50	∅ 12.90	.492 DIA	.508
A	18.67	19.43	.735	.765

BH405 C_b=0.4pF



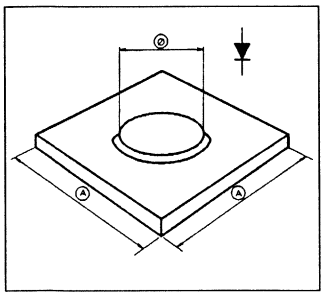
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	
J	0.97	1.07	.038	.042
I	2.49	2.59	.098	.102
H	2.9	3.1	.114	.122
G	22.4	22.6	.882	.890
F	0.20	0.30	.0079	.0118
E	6.1	6.5	.240	.256
D	9.2	9.6	.362	.378
C	5/16 - 24 UNF - 2A			
B	14	14.2	.551	.559
A	∅ 19.6	∅ 19.8	.772 DIA	.780 DIA

BMH76 C_b=0.15pF



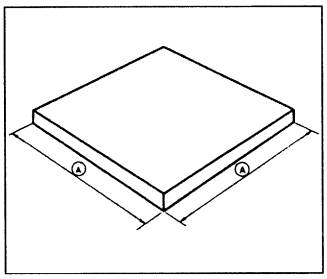
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	
K	0.50	0.70	.020	.028
J	0.20	0.24	.008	.010
I	1.95	2.15	.077	.085
H	1.47	1.67	.058	.066
G	5.1	5.3	.201	.209
F	3.18	3.68	.125	.145
E	∅ 2.36	∅ 2.52	.093 DIA	.099 DIA
D	3.1	3.3	.122	.130
C	4	4.2	.157	.165
B	3.02	3.22	.119	.127
A	10.3	10.5	.406	.413

C2



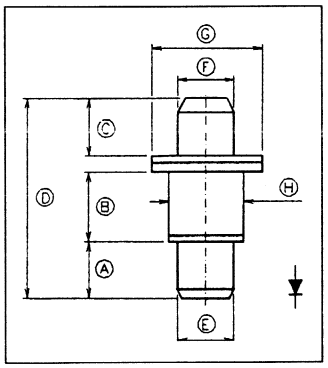
C2J	1740	1800	68.50	70.87
C2H	1440	1500	56.69	59.06
C2G	1140	1200	44.88	47.24
C2E	940	1000	37.01	39.37
C2D	840	900	33.07	35.43
C2C	740	800	29.13	31.50
C2B	540	600	21.26	23.62
C2A	340	400	13.39	15.75
CON	min	max	min	max
FIG	A (µm)		A (µ")	

C4



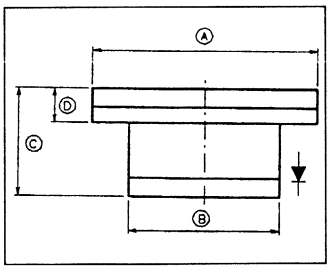
C4G	1500	2500	59.06	98.43
C4F	1000	1500	39.37	59.06
C4E	700	1000	27.56	39.37
C4D	500	700	19.69	27.56
C4C	400	500	15.75	19.69
C4B	300	400	11.81	15.75
C4A	200	300	7.87	11.81
CON	min	max	min	max
FIG	A (µm)		A (µ")	

F27d C_b=0.18pF



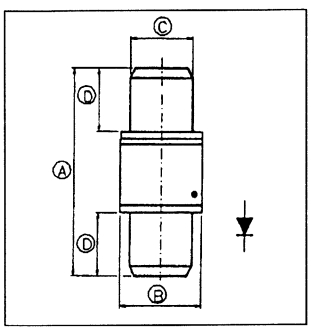
H	∅ 2.01	∅ 2.05	.079 DIA	.081 DIA
G	∅ 2.95	∅ 3.15	.116 DIA	.124 DIA
F	∅ 1.55	∅ 1.59	.061 DIA	.063 DIA
E	∅ 1.55	∅ 1.59	.061 DIA	.063 DIA
D	5.15	5.65	.202	.222
C	1.55	1.59	.061	.063
B	1.74	1.82	.069	.072
A	1.55	1.59	.061	.063
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

F30 C_b=0.25pF



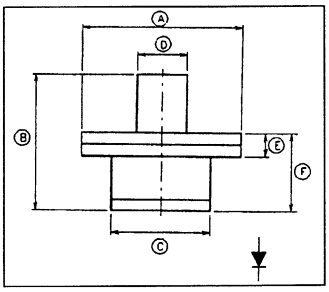
D	0.4	0.6	.016	.024
C	1.4	1.6	.055	.063
B	∅ 1.93	∅ 2.13	.076 DIA	.084 DIA
A	∅ 2.94	∅ 3.14	.116 DIA	.124 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

F51 C_b=0.1pF



D	1.47	1.67	.058	.066
C	∅ 1.47	∅ 1.67	.058 DIA	.066 DIA
B	∅ 1.93	∅ 2.13	.076 DIA	.084 DIA
A	4.9	5.3	.193	.209
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

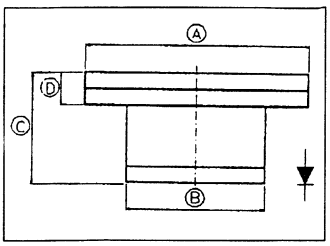
F54 C_b=0.2pF



F	1.0	1.2	.039	.047
E	0.40	0.47	.016	.019
D	∅ 0.61	∅ 0.66	.024 DIA	.029 DIA
C	∅ 1.19	∅ 1.35	.047 DIA	.053 DIA
B	1.70	2.00	.067	.079
A	∅ 2.00	∅ 2.16	.079 DIA	.085 DIA
SYM	min	max	min	max
BOL	MILLIMETER		INCHES	

F54s

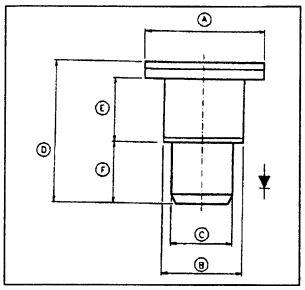
C_b=0.2pF



D	0.36	0.46	.014	.018
C	0.84	0.94	.073	.047
B	∅ 1.19	∅ 1.35	.047 DIA	.053 DIA
A	∅ 2.00	∅ 2.16	.079 DIA	.085 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

F60

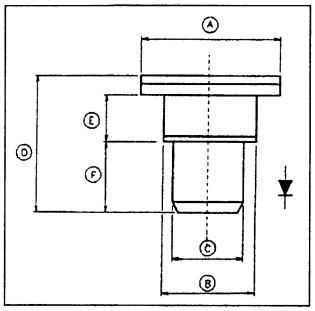
C_b=0.2pF



F	1.51	1.63	.059	.064
E	1.81	1.95	.071	.077
D	3.76	4.21	.148	.166
C	∅ 1.52	∅ 1.62	.060 DIA	.064 DIA
B	∅ 1.93	∅ 2.13	.076 DIA	.084 DIA
A	∅ 2.95	∅ 3.15	.116 DIA	.124 DIA
SYM	min	max	min	max
BOL	MILLIMETER		INCHES	

F60d

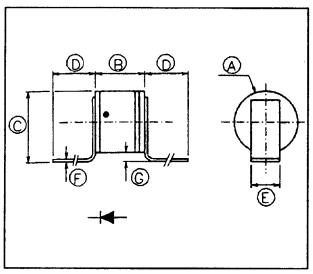
C_b=0.25pF



F	1.52	1.64	.060	.065
E	0.95	1.09	.037	.043
D	2.91	3.36	.115	.132
C	∅ 1.52	∅ 1.62	.060 DIA	.064 DIA
B	∅ 1.93	∅ 2.13	.076 DIA	.084 DIA
A	∅ 2.95	∅ 3.15	.116 DIA	.124 DIA
SYM	min	max	min	max
BOL	MILLIMETER		INCHES	

M208a

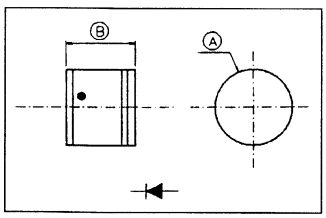
C_b=0.12pF



G	0.1	0.4	.004	.015
F	0.06	0.1	.0024	.004
E	0.55	0.65	.022	.026
D	2.5		.100	
C	1.3	1.7	.052	.068
B	0.95	1.35	.037	.053
A	∅ 1,07	∅ 1,47	.042 DIA	.058 DIA
SYM	min	max	min	max
BOL	MILLIMETER		INCHES	

M208b

C_b=0.12pF



B	0.95	1.35	.037	.053
A	∅ 1.07	∅ 1.47	.042 DIA	.058 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

M208c

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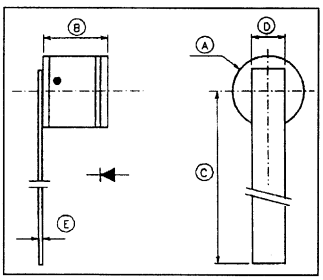

E	0.06	0.1	.0024	.004
D	0.55	0.65	.022	.026
C	5		.200	
B	0.95	1.35	.037	.053
A	∅ 1.07	∅ 1.47	.042 DIA	.058 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

M208d

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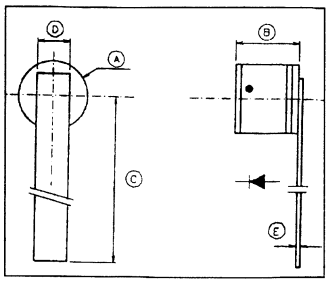

E	0.06	0.1	.0024	.004
D	0.55	0.65	.022	.026
C	5		.200	
B	0.95	1.35	.037	.053
A	∅ 1.07	∅ 1.47	.042 DIA	.058 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

M208e

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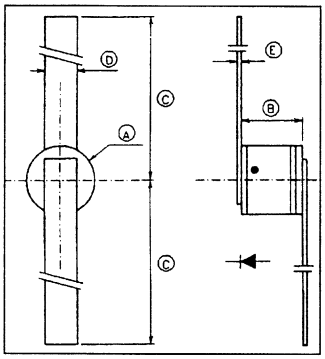

E	0.06	0.1	.0024	.004
D	0.55	0.65	.022	.026
C	5		.200	
B	0.95	1.35	.037	.053
A	∅ 1.07	∅ 1.47	.042 DIA	.058 DIA
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

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M208f

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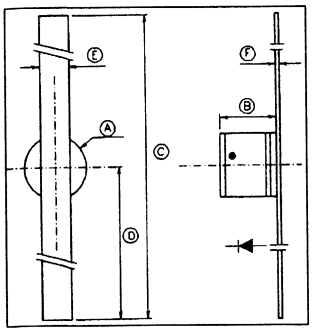

SYM	min	max	min	max
F	0.06	0.1	.0024	.004
E	0.55	0.65	.022	.026
D	5		.200	
C	9.8	10.2	.392	.408
B	0.95	1.35	.037	.053
A	∅ 1.07	∅ 1.47	.042 DIA	.058 DIA
BOL	MILLIMETER		INCHES	

S268/W1

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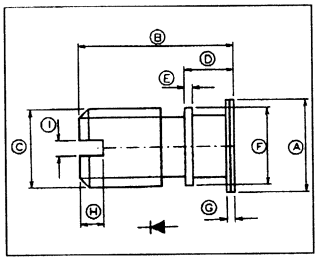
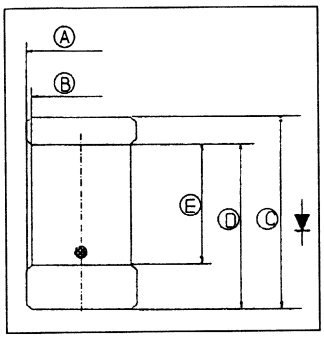


SYM	min	max	min	max
I	0.38	0.62	.015	.024
H	0.64	0.88	.025	.035
G	0.51	0.60	.020	.024
F	∅ 2.44	∅ 2.64	.096 DIA	.104 DIA
E	0.21	0.31	.008	.012
D	1.71	2.00	.067	.079
C	3 - 48 UNC 2A			
B	5.01	5.46	.197	.215
A	∅ 2.85	∅ 3.25	.112 DIA	.128 DIA
BOL	MILLIMETER		INCHES	

SMD3

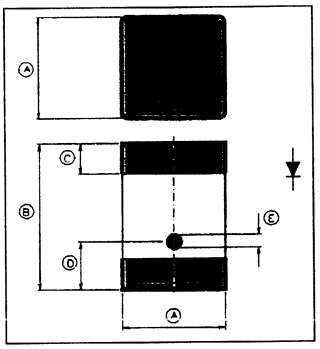
C_b=0.11pF



SYM	min	max	min	max
E	2.69	2.89	.106	.114
D	3.71	3.91	.146	.154
C	4.4	4.6	.173	.181
B	∅ 2.19	∅ 2.39	.086 DIA	.094 DIA
A	∅ 2.44	∅ 2.64	.096 DIA	.104 DIA
BOL	MILLIMETERS		INCHES	

SMD4

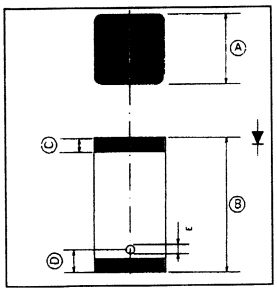
C_b=0.24pF



SYM	min	max	min	max
E	Typical 0,2		Typical .008	
D	Typical 1		Typical .039	
C	0.3	0.8	.012	.031
B	2.9	3.5	.114	.138
A	2	2.3	.079	.091
BOL	MILLIMETERS		INCHES	

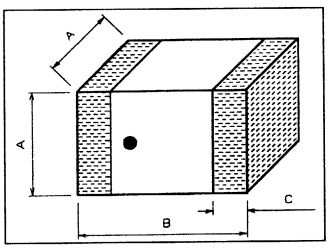
SMD6

C_b=0.24pF



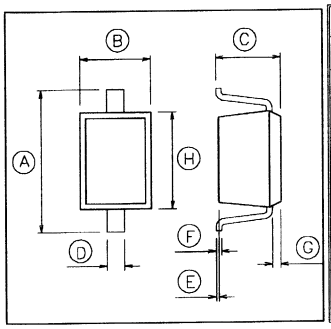
SYM	min	max	min	max
E	Typical 0,20		Typical .008	
D	Typical 1.20		Typical .047	
C	0.3	0.8	.012	.031
B	4.70	5.2	.185	.205
A	2.5	2.8	.098	.110
BOL	MILLIMETERS		INCHES	

SMD8



SYM	min	max	min	max
B	4.70	5.2	.185	.205
C	0.20	0.38	.008	.015
BOL	MILLIMETERS		INCHES	

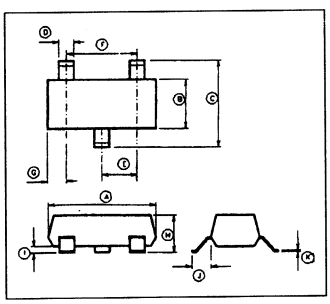
SOD323



SYM	Typical	Typical
H	1.70	.0669
G	0.20	.0078
F	0.15	.0059
E	0.05	.0020
D	0.30	.0118
C	1.10	.043
B	1.25	.049
A	2.50	.098
BOL	MILLIMETERS	INCHES

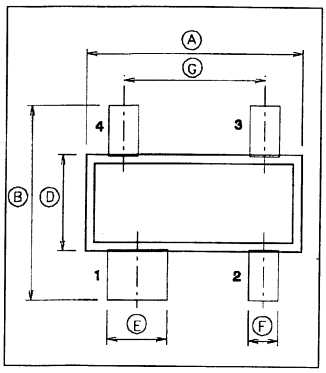
SOT23

C_b=0.2pF



SYM	min	max	min	max
K	0.1	0.13	0.004	0.005
J	0.53	0.56	0.021	0.022
I	0.05	0.1	0.002	0.0004
H	1.07	1.14	0.042	0.045
G	0.43	0.46	0.017	0.018
F	1.78	2.04	0.070	0.080
E	0.94 typ.		0.037 typ.	
D	0.43	0.45	0.017	0.020
C	2.36	2.49	0.093	0.098
B	1.3	1.35	0.051	0.053
A	2.84	3.02	0.112	0.119
BOL	Millimeters	Millimeters	Inches	Inches

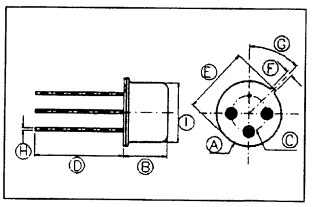
SOT143



J	max 8°	
I	0.10	.0039
H	0.12	.0047
G	1.90	.0075
F	0.40	.0157
E	0.80	.0315
D	1.30	.051
C	1.10	.043
B	2.60	.102
A	2.90	.114
SYM	Typical	Typical
BOL	MILLIMETERS	INCHES

TO39

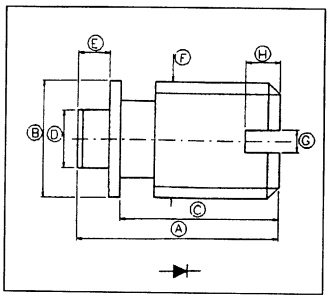
C_b=0.2pF



I	∅ 8.3	∅ 8.5	.327 DIA	.335 DIA
H	∅ 0.41	∅ 0.48	.016 DIA	.019 DIA
G	44°	46°	44°	46°
F	0.71	0.81	.028	.032
E	9.40	10.40	.370	.409
D	12.7		.500	
C	4.98	5.18	.196	.204
B	6.30	6.40	.248	.252
A	∅ 9.10	∅ 9.30	.358 DIA	.366 DIA
SYM	min	max	min	max
BOL	MILLIMETER		INCHES	

W2

C_b=0.15pF



H	0.71	0.81	.028	.032
G	0.45	0.55	.020	.022
F	3 - 48 UNC - 3A			
E	0.61	0.81	.024	.032
D	∅ 1.17	∅ 1.37	.046 DIA	.054 DIA
C	3.40	3.60	.134	.142
B	∅ 2.46	∅ 2.66	.097 DIA	.105 DIA
A	4.38	4.68	.172	.184
SYM	min	max	min	max
BOL	MILLIMETERS		INCHES	

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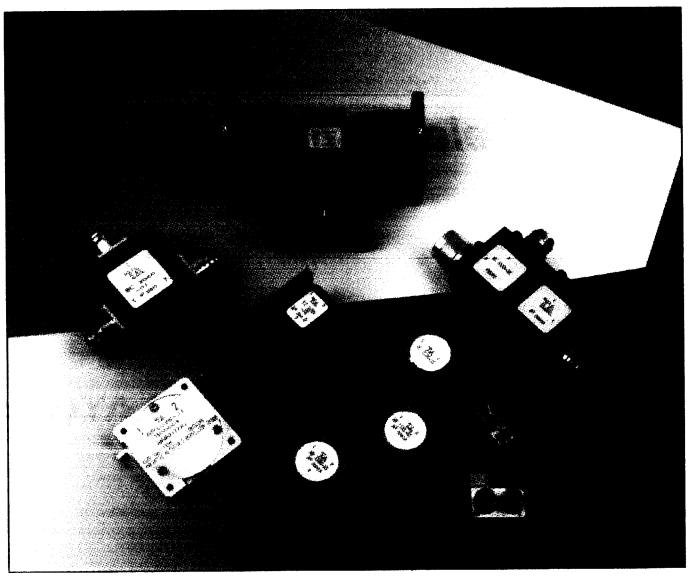
FERRITE DEVICES

CONTENTS



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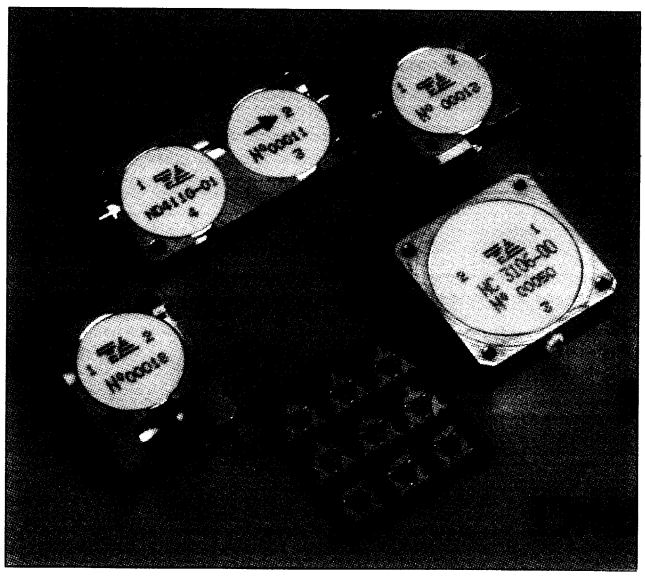
DROP-IN CIRCULATORS & ISOLATORS

Selection Guide



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Introduction

For more than 10 years, TEKELEC TEMEX designs miniaturised drop-in circulators and isolators.

Today, patented designs, space qualified drop-in assemblies and time proven circulators and isolators are available.

Current production of drop-in devices is covering frequency ranges from HF, VHF, UHF and up to 18 GHz.

New technologies of drop-in devices have been developed these last couple of years:

- Patented designs with magnetical and electrical shieldings,
- Wide band devices,
- Operating with various substrates,
- Integrated substrates,
- Double cell circulator designs,
- Integrated functions (diode limitors, ...),
- Low mass sub-systems for satellite pay-load integration,
- Technological process (SMD & micro-electronic applications MMIC compatible)...

Automated brazing benches, cycling and ageing benches, S-parameters networks analysers with automated test benches are the basic tools used by TEKELEC TEMEX for mass production capacity. In addition, test set-up for 3rd order intermodulation products for VHF/UHF frequency bands, power handling capability and clean room for space components and assemblies are available in our facility.

Custom components

TEKELEC TEMEX's capability has broadened to custom sub-systems which integrate circulators, terminations, limitors, detectors, etc...

Furthermore, the following presentation of some products is only a resume of our expertise and our engineering staff stands ready to design and produce custom components to state-of-art specification.

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LOW COST SMD CIRCULATORS & ISOLATORS

Under reduced dimensions, circulators have a rectangular shape looking like a capacitor, assuming good electrical features needed under severe environmental conditions.

Connections are made for SMD or micro-electronic circuitry with 50 impedance, for thick film technology (MMIC compatible) or with boundings.

Typical electrical features

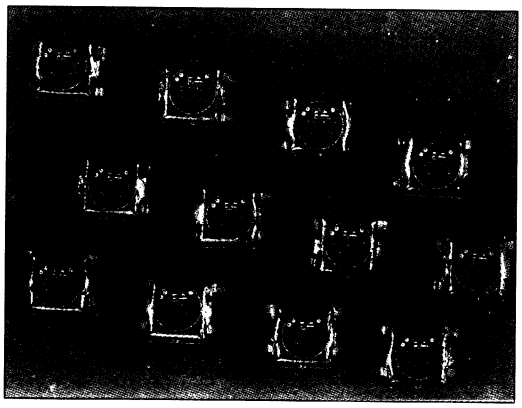
These new range of circulators and isolators are under development thanks to the strong involvement of TEKELEC TEMEX in the R & D fields, including fundamental research in the ferrite materials, new assembly process, internally developed software and finite element calculation.

Following are preliminary specifications for circulators. Electrical and mechanical features rely upon the technology report process to be defined with the user.

Please contact us for your specific application.

MODEL	Frequency range	Isolation min dB	Inse. loss max dB	VSWR max	Avg. power max W	Peak power max W	Case (max mm)	Reflect power max (W)	Temperature range
UB1001	380 - 430 MHz	15	0.8	1.40	10	-	15 x 15 x 7	5	-10° to +60° C
UB1002	380 - 430 MHz	15	1	1.40	15	-	10 x 10 x 6	3	-10° to +60° C
UC3000	900 MHz BW 4 %	15	1	1.40	5	-	7.5 x 7.5 x 4	-	-10° to +60° C
UC1000	900 MHz	15	1	1.40	5	-	7.5 x 7.5 x 4	3	-10° to +60° C
UD3000	1800 MHz BW 4 %	15	1	1.40	3	-	7.5 x 7.5 x 4	-	-10° to +60° C
UD1000	1800 MHz	15	1	1.40	3	-	7.5 x 7.5 x 4	3	-10° to +60° C
UE3000	3 GHz BW 10 %	18	0.6	1.30	1	10	7 x 7 x 3	-	-30° to +70° C
UI3000	9 GHz BW 10 %	18	0.6	1.30	0.5	5	5 x 5 x 2	-	-30° to +70° C

NEW !



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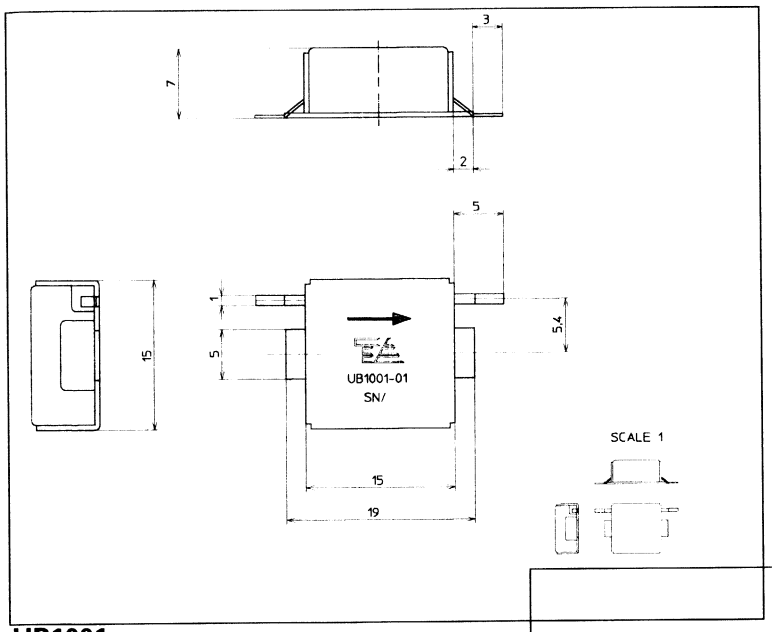
Outlines drawings



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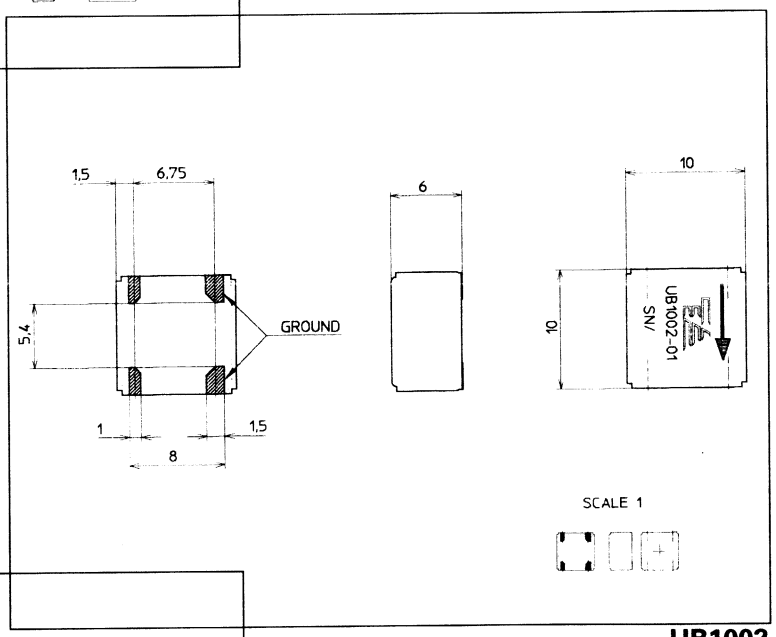

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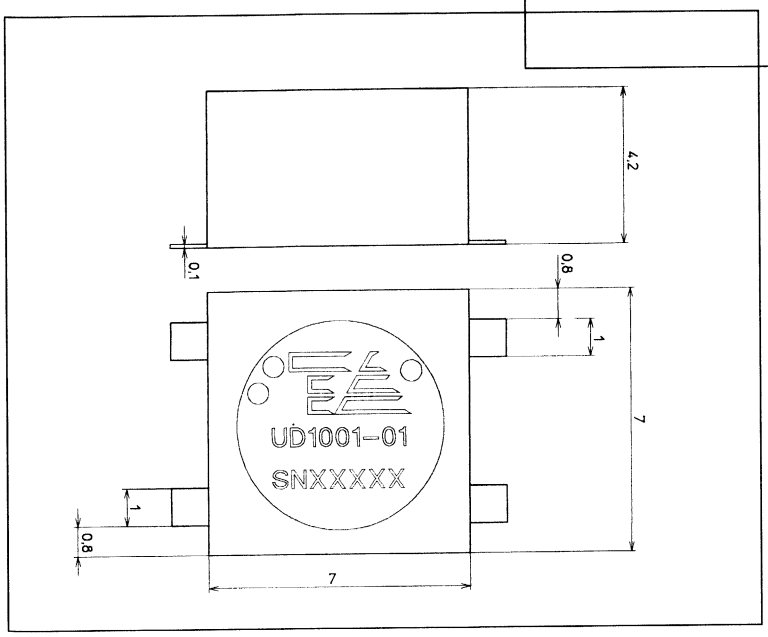

UC1000
UD1000

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MINIATURIZED DROP-IN CIRCULATORS & ISOLATORS

TEKELEC TEMEX has designed a line of miniaturized drop-in circulators and isolators covering the frequency ranges from **75 MHz** to **18 GHz**.

These circulators and isolators are designed to be used for applications where **space saving** and **magnetic shielding** are required, to avoid any detuning when operating close to magnetic field or ferrous materials:

- Cellular applications such as **NMT**, **AMPS**, **CT-1**, **CT-2**, **TACS**, **E-TACS**, **GSM**, **JDC**, **DECT**, **DCS**, **PCS**, **WLAN** and any communication base stations: **TFTS**, **INMARSAT**...
- Broadcasting applications: **DAB**, ...
- Microstrip sub-systems
- Airborne equipment
- Missiles
- Radars / phase array antennas
- Satellite pay loads
- Earth stations

Circulators and isolators are available under standard packages with "standard inch" dimensions.

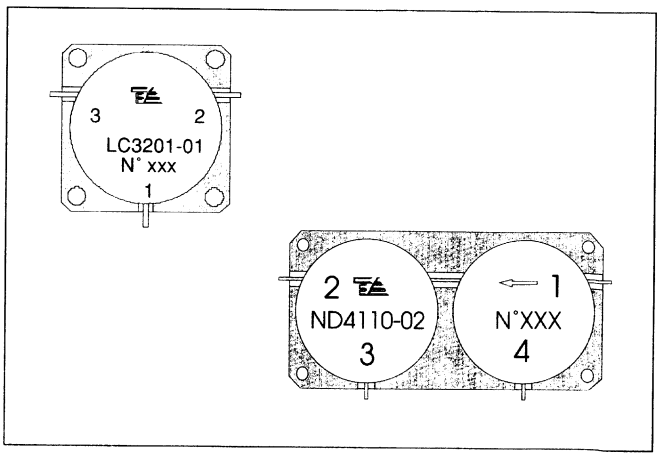
Isolators integrate the load which is:

- Up to 60 W-CW power handling capability for VHF/UHF bands,
- 1 W-CW power handling capability for microwave frequency bands.

For microwave applications, circulators are available in round package. Isolators are available in flange type package with or without through mounting holes.

Depending on the requested isolation, one or two cell designs are available in the VHF/UHF band as standard packages.

The drop-in design allows easy and fast installation into stripline and microstrip assemblies with mounting screws or soldering with conductive epoxy glue.



Test jigs for different packages are available for customer's incoming inspection.

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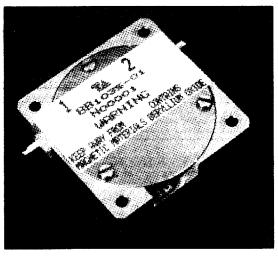
3-Port circulators & isolators

Model		Frequency range	Isolation (dB)		Insertion loss (dB)		V.S.W.R.	Power (W-CW)		Case	Operating temperature
Circulator	Isolator	(MHz)	typ.	min	typ.	max	max	Input	Load*		° C
	BA1032	73-78	16	14	0.8	1	1.50	50	30	T52	-20 to +70
BA3017		216-230	32	30	0.3	0.5	1.15	250	-	T0	+20 to +70
BA3039		216-230	26	20	0.2	0.4	1.25	325	-	T0	+20 to +70
	BB1027	405-470	18	16	0.6	0.75	1.37	100	30	T50	-20 to +70
BB3037	BB1037	405-520	20	18	0.4	0.6	1.30	100	30	T54	-10 to +55
BB3035	BB1035	460-470	23	21	0.3	0.4	1.25	100	30	T54	-10 to +55
NC3104	NC1104	890-960	23	20	0.3	0.4	1.25	100	60	T42	-10 to +55
NC3106	NC1106	925-960	25	23	0.3	0.35	1.25	100	60	T42	-10 to +55
ND3100	ND1100	1030-1090	22	20	0.4	0.5	1.25	100	10	T42	-10 to +55
ND3141	ND1141	1270-1400	22	20	0.4	0.5	1.25	30	3	T42	-10 to +55
ND3161	ND1161	1452-1492	22	20	0.3	0.4	1.25	30	0.3	T42	-10 to +55
ND3162	ND1162	1525-1661	22	20	0.4	0.5	1.25	30	3	T42	-10 to +55
ND3183	ND1183	1710-1785	22	20	0.3	0.4	1.25	30	3	T44	-10 to +55
ND3184	ND1184	1805-1880	22	20	0.3	0.4	1.25	50	50	T44	-10 to +55
ND3181	ND1181	1805-1880	23	20	0.3	0.4	1.25	50	50	T42	-10 to +55
ND3186	ND1186	1930-1990	23	20	0.3	0.4	1.25	50	50	T44	-10 to +55
ND3182	ND1182	1930-1990	23	20	0.3	0.4	1.25	50	50	T42	-10 to +55
	NE1101	2100-2300	23	20	0.3	0.4	1.25	10	1	T44	-10 to +55
	NE1120	2300-2500	23	20	0.3	0.4	1.25	10	1	T44	-10 to +55
	NE1130	2700-2900	23	20	0.3	0.4	1.25	150	15	T44	-30 to +70
	NF1100	2700-3100	23	20	0.4	0.5	1.3	150	15	T44	-30 to +70
NG3142		5400 - 5900	22	20	0.3	0.4	1.22	1	1	T53	-30 to +70
NG3140	NG1140	5650 - 5850	25	23	0.3	0.4	1.25	10	1	T45	-30 to +70
	NJ1101	7900 - 8400	20	17	0.5	0.6	1.50	10	1	NJ1	-40 to +85
	NJ1111	8500 - 9500	20	17	0.6	0.7	1.50	10	1	NJ1	-40 to +85
	NJ1123	9000 - 10000	20	17	0.6	0.6	1.50	1	1	NJ1	-40 to +85
	NJ1124	9100 - 10000	22	20	0.3	0.4	1.25	0.5	1	NJ1	-54 to +95
	NJ1139	9820- 12600	18	16	0.6	0.7	1.45	1	1	NJ1	-40 to +85
NJ3132		11000- 11500	22	20	0.4	0.5	1.25	20		NJ3	-40 to +85
NJ3151		13000- 14000	22	20	0.4	0.5	1.25	30		NJ3	-40 to +90
	NJ1141	13000- 14000	22	20	0.6	0.8	1.50	10	2	NJ1	-45 to +125
	NJ1161	14000- 14500	22	20	0.5	0.6	1.25	20	1	NJ1	-45 to +125
	NJ1162	14500- 15500	22	20	0.5	0.6	1.50	10	1	NJ1	-40 to +85
	NJ1160	15500 - 16000	22	20	0.5	0.6	1.50	10	1	NJ1	-40 to +85

* Notes:

- For an isolator: power of the integrated load, 10 W-load optional,
- For a circulator: reflected power handling capability.



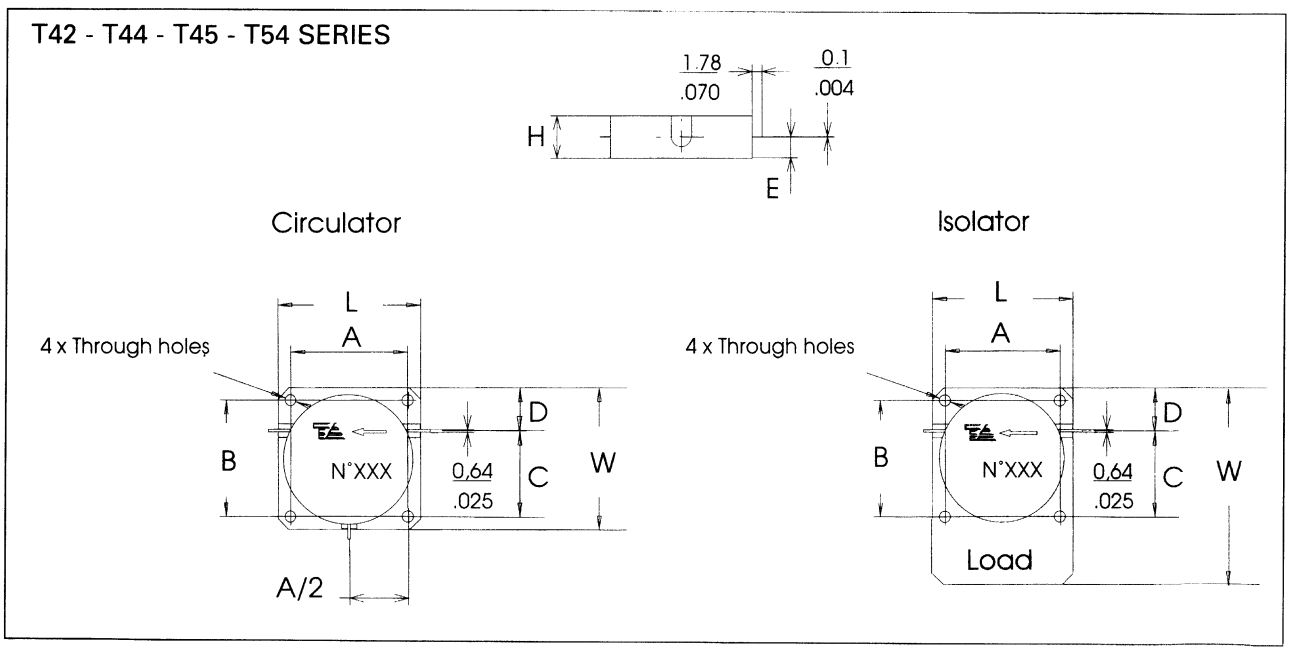
Outline drawings

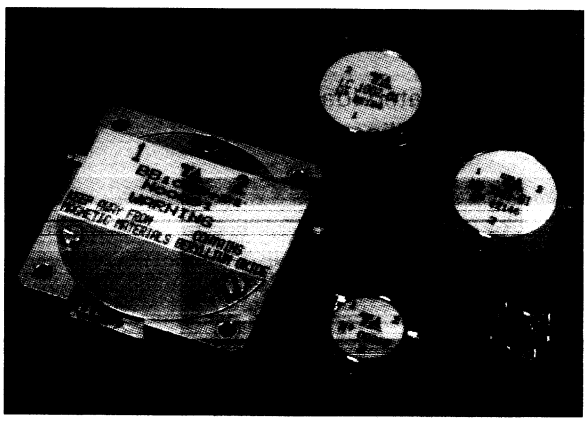
3-Port circulators & isolators

Dimensions in mm

Case	L	W	H	A	B	C	D	E	F	G	ø Holes
T42	25.4	Circ.: 25.4 Iso.: 31.75 max	7.62	20.83	20.83	15.36	7.75	3.81	0.64	1.78	2.1
T44	19.05	Circ.: 19.05 Iso.: max 25.4	6.35	14.50	14.50	10.57	6.20	3.13	0.64	1.78	2.03
T45	12.7	Circ.: 12.7 Iso.: max 12.7	6.35	9.65	9.65	6.85	4.32	3	0.63	1.8	1.9 or M2.5
T54	51.5	51.5	12	41.8	41.8	34.15	12.5	3.5	2	5	3.3

T42 - T44 - T45 - T54 SERIES





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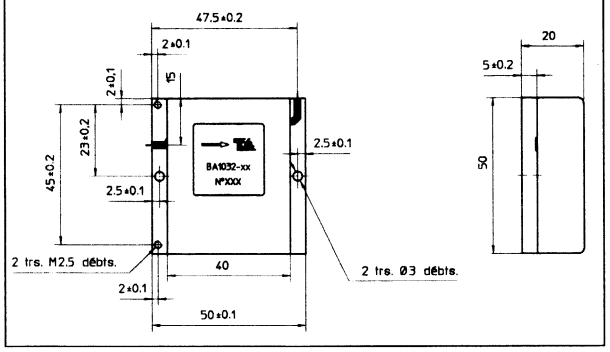
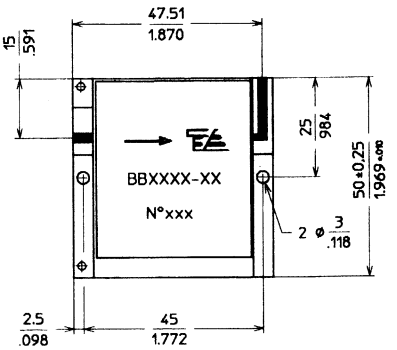
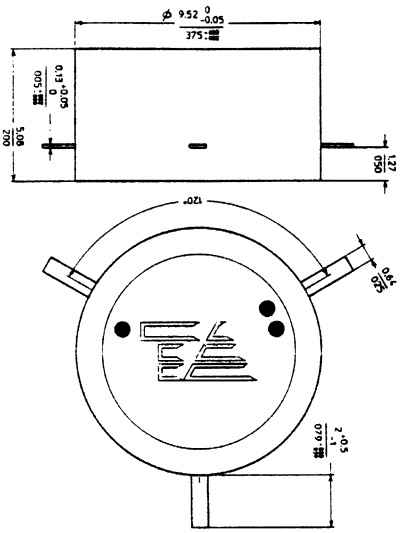
T52 SERIES



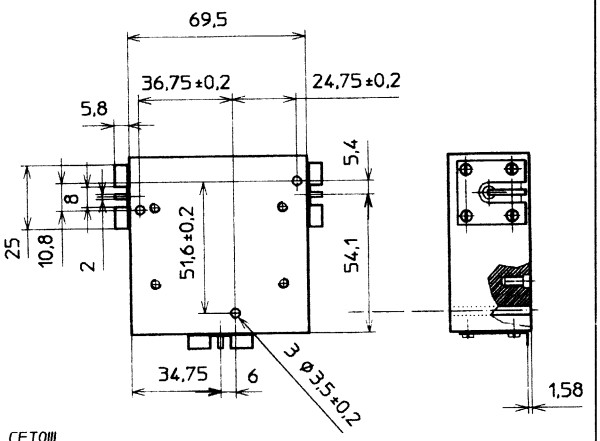
T50 SERIES



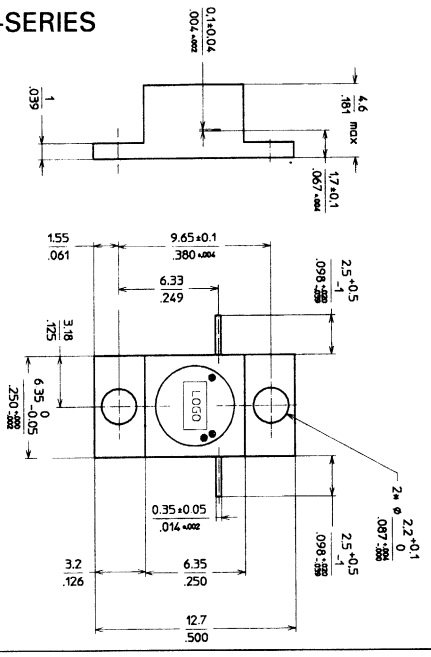
T53 SERIES



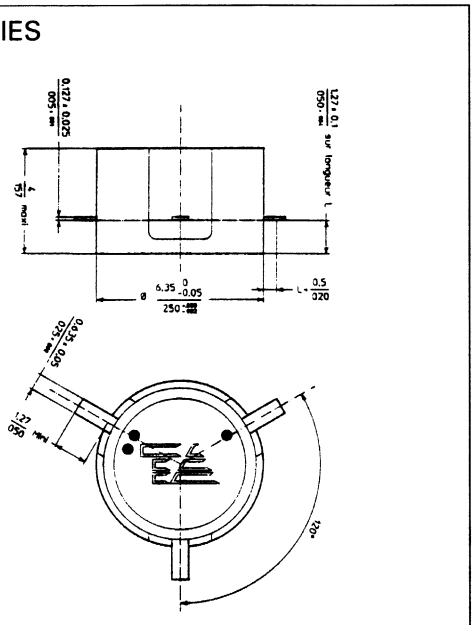
T0 SERIES



NJ1-SERIES



NJ3-SERIES



DROP-IN CIRCULATORS & ISOLATORS

Miniaturized drop-in circulators & isolators

4-Port circulators

Model	Frequency range	Isolation (dB)		Insertion loss (dB)		V.S.W.R.		Power (W-CW)	Case	Operating temperature
Circulator	(MHz)	typ.	min	typ.	max	typ.	max	Input		
NC4113	824-894	46	40	0.6	0.7	1.20	1.25	30	P42	-10° to +55° C
NC4116	925-960	46	40	0.6	0.7	1.20	1.25	30	P42	-10° to +55° C
ND4110	1805-1880	46	40	0.6	0.5	1.20	1.25	30	P44	-10° to +55° C
NG4123	5400-5900	40	40	0.6	0.6	1.22	1.22	1	H53	-30° to +70° C

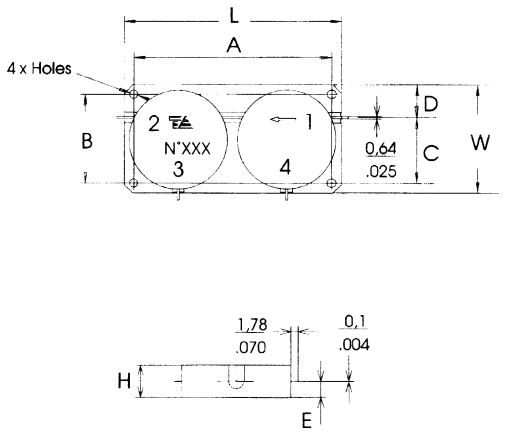
Customized devices available

Outline drawings

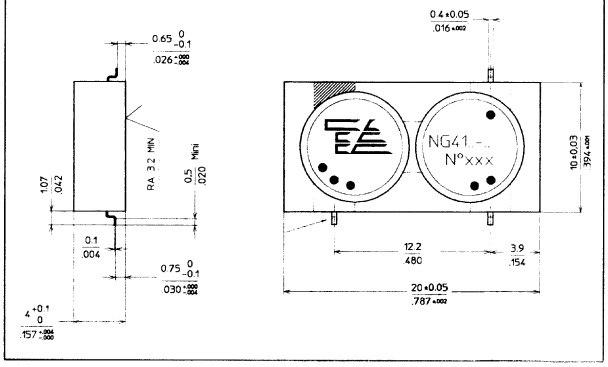
Dimensions in mm

Case	L	W	H	A	B	C	D	E	F	G	ø Holes
P42	50.8	25.40	7.62	46.23	20.83	15.36	7.75	3.81	3.81	3.81	2.1
P44	38.1	19.05	6.35	33.50	14.50	10.57	6.35	2.00	2.00	2.00	2.5

P42 - P44 SERIES



H53-SERIES



How to order

Please specify:

- ❑ Model number,
- ❑ Center frequency and desired bandwidth, or frequency range,
- ❑ Direction of circulation (clockwise or counter clockwise).

Test jig

Drop-in miniaturized circulators and isolators are measured in custom designed test jigs, in order to simulate operating environmental conditions. Special customer application and environmental details must be specified when ordering, to avoid correlation problems between TEKELEC TEMEX's tests and customer results.TEKELEC TEMEX's test jig is recommanded to verify product performances.

COAXIAL DEVICES

Selection Guide

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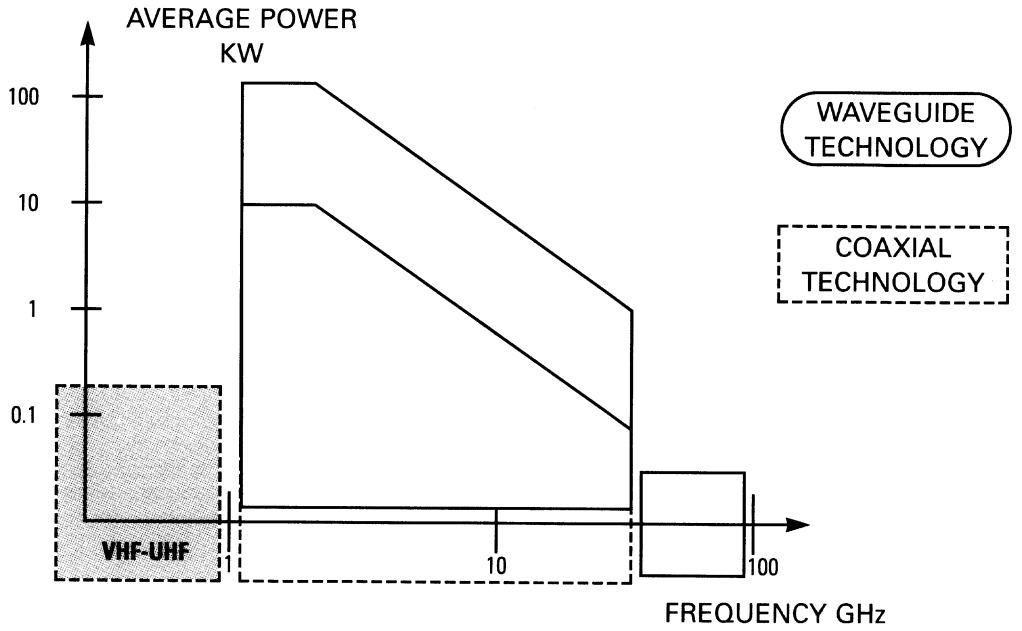
VHF / UHF COAXIAL CIRCULATORS & ISOLATORS



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General description

TEKELEC TEMEX supplies a wide range of coaxial HF/VHF and UHF circulators covering the frequency range down to 27 MHz.

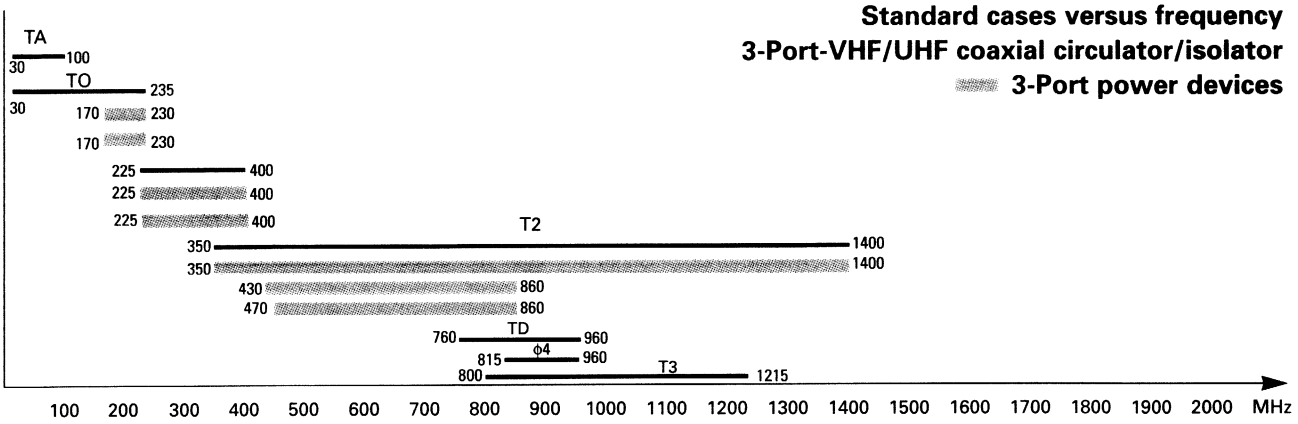
TEKELEC TEMEX uses only in-house produced ferrite materials and therefore offers state-of-the-art features such as low-insertion loss, high isolation in various rugged and space saving packages:

- **The "T" Series** is our standard design for three port junctions. Circulators are equipped with KMR/SMA connectors and isolators with an internal load of 1 W average/60 W peak, N female connectors for input power higher than 60 W-CW.
- Wide-band ferrite device, such as those in **the λ series** package, enables coverage of the 225 - 400 MHz band for high power up to 300 W-CW/1 kW peak.

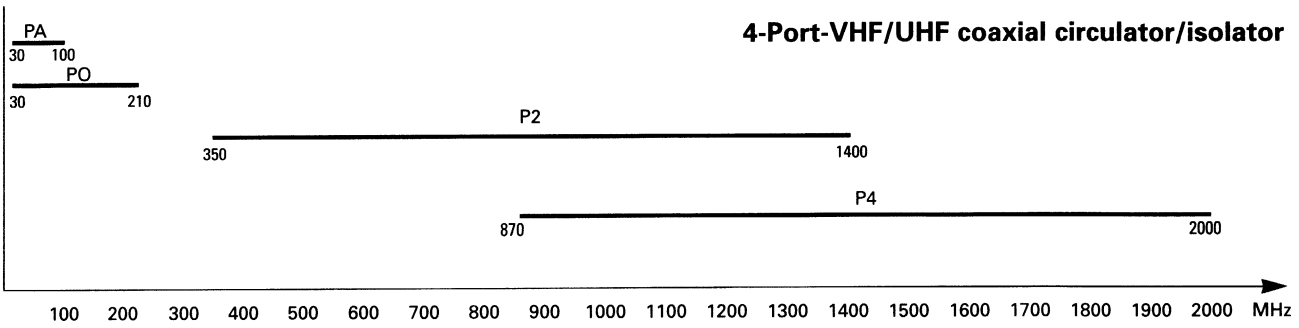
Designed for the wide-band application in the 170 to 1215 MHz frequency range, TEKELEC TEMEX's power circulators ϕ **series** provide low insertion loss and high isolation. They are specifically designed to feature low 3rd order intermodulation products with power up to 2000 W-CW.
They are suitable for telecommunication and broadcasting applications.

- In order to improve isolation, **four-port circulators and isolators** are produced by optimally integrating two single-junction circulators in a single package. The insertion loss of four-port circulators includes two pass-through ferrite junctions.
  They are typically used in tele-communications and radio-telephone applications.
- Options such as configuration, frequency range, connector type and location, tab (drop-in) configuration, wider temperature range, high power, etc... are available upon request.

Standard cases versus frequency
3-Port-VHF/UHF coaxial circulator/isolator
3-Port power devices



4-Port-VHF/UHF coaxial circulator/isolator



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3-Port Circulators & Isolators

Circulator	Isolator	Frequency range (MHz)	Avg. power max W	Peak power max kW	Specifications at 25° C			Spec. in temperature range			Temperature range ° C	Outline drawing	Connector (female)
					Isolation min dB	Inse. loss max dB	VSWR max	Isolation min dB	Ins. loss max dB	VSWR max			
BA3038		27	60		15	1.0	1.40	15	1.0	1.40	-40 to +70	T0	N[3]
BA3011	BA1011	62-72	20		18	0.8	1.30	17	1	1.35	-10 to +55	T0	SMA
BA3021		68-88	100		18	0.8	1.30	17	1	1.35	-10 to +55	T0	N[3]
BA3015	BA1015	72-88	50		18	0.8	1.30	17	1	1.35	-10 to +55	T0	SMA
BA3010	BA1010	88-108	100		18	0.8	1.30	17	1	1.35	-10 to +55	T0	N[3]
BA3012	BA1012	105-145	50		18	0.8	1.30	16	1	1.40	-10 to +55	T0	SMA
BA3040		138-155	250		23	0.35	1.20	22	0.4	1.25	0 to +70	T0	N[3]
BA3013		155-174	250		23	0.35	1.20	22	0.4	1.25	0 to +70	T0	N[3]
BA3016	BA1016	165-200	100		18	0.8	1.30	17	1	1.35	-10 to +55	T0	N[3]
BA3029		174-225	100		18	0.8	1.30	17	1	1.35	-10 to +55	T0	N[3]
BA3017	BA1017	200-235	100		18	0.8	1.30	17	1	1.35	-10 to +55	T0	N[3]
BA3017		216-230	250	1.00	32	0.3	1.12	30	0.5	1.15	+20 to +70	T0	N[3]
BA3039		216-230	325	1.20	26	0.2	1.18	20	0.4	1.25	+20 to +70	T0	N[3]
BB3028	BB1028	200-400[5]	250		25	0.3	1.20	20	0.4	1.25	-20 to +70	T57	N
BB3001[2]	BB1001[2]	225-400	60	0.25	20	0.8	1.25	16	0.8	1.40	-40 to +70	λ1	SMA
BB3006[2]	BB1006[2]	225-400	100	0.25	20	0.8	1.25	17	0.8	1.40	-40 to +70	λ1	N
BB3007[1,2]		225-400	200	1.00	17	0.7	1.35	14	0.8	1.50	-40 to +60	λ2	N
BB3011[2]		225-400	300	1.00	14	1	1.50	14	1	1.50	-40 to +80	T56	N[3]
BB3019	BB1019	350-400	200[4]		20	0.3	1.25	18	0.6	1.30	-10 to +55	T2	N[3]
BB3080	BB1080	378-512	200[4]		20	0.3	1.25	18	0.6	1.30	-10 to +55	T2	N[3]
BB3025	BB1025	405-450	200[4]		20	0.3	1.25	18	0.6	1.30	-10 to +55	T2	N[3]
BB3038	BB1038	405-470			16	0.75	1.37	16	0.75	1.37		T50	SMA
BB3023	BB1023	415-430	100		18	0.6	1.30	18	0.6	1.30	-10 to +55	T2	N[3]
BB3031	BB1031	415-454			19	0.7	1.30	19	0.7	1.30	-30 to +60	T50	SMA
BB3026	BB1026	450-500	200[4]		20	0.3	1.25	18	0.6	1.30	-10 to +55	T2	N[3]
BB3022	BB1022	470-600	100		18	0.6	1.30	18	0.6	1.30	-10 to +55	T2	N[3]
BC3040	BC1040	600-800	200[4]		20	0.3	1.25	18	0.6	1.30	-10 to +55	T2	N[3]
BC3019		610-960	50		15	1.1	1.55	15	1.1	1.55	-40 to +95	TD	SMA/INT
BC3904	BC1904	610-960	200[4]		20	0.3	1.25	18	0.6	1.30	-10 to +55	T2	N[3]
BC3041	BC1041	700-860	200[4]		20	0.3	1.25	18	0.6	1.30	-10 to +55	T2	N[3]
BC3019		760-960	50		19	0.5	1.30	16	0.5	1.45	-40 to +95	TD	SMA
BC3006	BC1006	800-960	50		20	0.4	1.25	18	0.5	1.30	-10 to +55	T3	SMA
BC3902		800-1000	100		18	0.6	1.30	18	0.6	1.30	-10 to +55	T2	N[3]
BC3035	BC1035	935-960	200[4]		20	0.3	1.25	18	0.6	1.30	-10 to +55	T2	N[3]
BD3003	BD1003	960-1215	50		19	0.4	1.30	17	0.5	1.35	-40 to +85	T3	SMA
BD3040		960-1215	100	10.00	20	0.45	1.25	20	0.45	1.25	-10 to +65	T2	N[3]

[1] high power device
[2] specifications are absolute maximum ratings at high power. (listed Avg. power)
[3] with SMA, N connectors or tab integrations depending on max power level request
[4] 200 W-CW on 3: 1 continuous load VSWR. Permanent short circuit duration: 3 sec. max
100 W-CW on permanent short circuit handling, cooling by conduction via a heat sink (R_{TH} = 0.4° C/W max)
[5] 10 % bandwidth

For more than 50 W-CW input power, cooling is necessary by conduction via heat sink (R_{TH}= 0.4° C/W max)

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Electrical characteristics

Type	Frequency range MHz	Avg. power max W	Specifications at 25° C			Spec. in temperature range			Temperature range ° C	Outline drawing	Connector female
			Isolation min. dB	Inser. loss max dB	VSWR max	Isolation min. dB	Inser. loss max dB	VSWR max			
BA4140	138 - 155	250	45	0.8	1.25	45	0.8	1.25	0 to +70	P0	N
BA4113	155 - 174	250	45	0.8	1.25	45	0.8	1.25	0 to +70	P0	N
BA4217	200 - 207	100	50	1	1.30	45	1	1.30	-10 to +55	P0	N
BB4111	406 - 470	100	40	0.8	1.25	40	0.8	1.25	-10 to +55	P2	N
BB4112	424 - 428	100	50	0.5	1.25	45	0.5	1.25	-10 to +55	P2	N
BB4113	460 - 468	100	50	0.5	1.25	45	0.5	1.25	-10 to +55	P2	N
BB4003	470 - 600	50	35	1.1	1.30	35	1.1	1.30	-10 to +55	P2	N
BC4005	600 - 800	50	35	1.1	1.30	35	1.1	1.30	-10 to +55	P2	N
BC4107	870 - 960	50	45	0.7	1.25	40	0.8	1.30	-10 to +55	P4	N
BC4108	917 - 960	65	50	0.5	1.20	50	0.5	1.20	-10 to +55	P4	N
BC4109	935 - 960	65	50	0.5	1.20	50	0.5	1.20	-10 to +55	P4	N
BD4013	960 - 1215	100	38	1	1.30	35	1.2	1.35	-30 to +70	P2	N

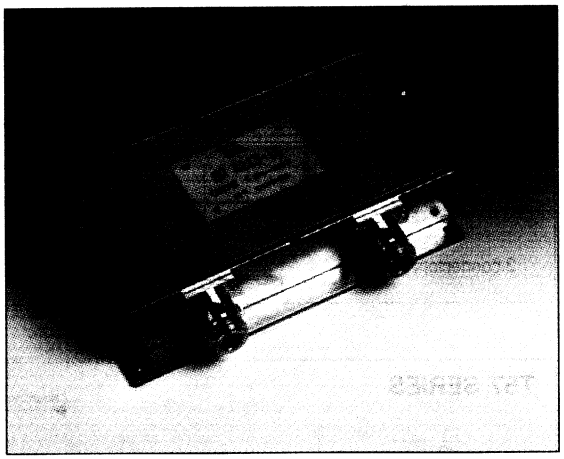
For more 50 W-CW input power, cooling is necessary by conduction via heat sink (R_{TH} = 0.4° C / W max)

Customized devices available

How to order

Please specify:

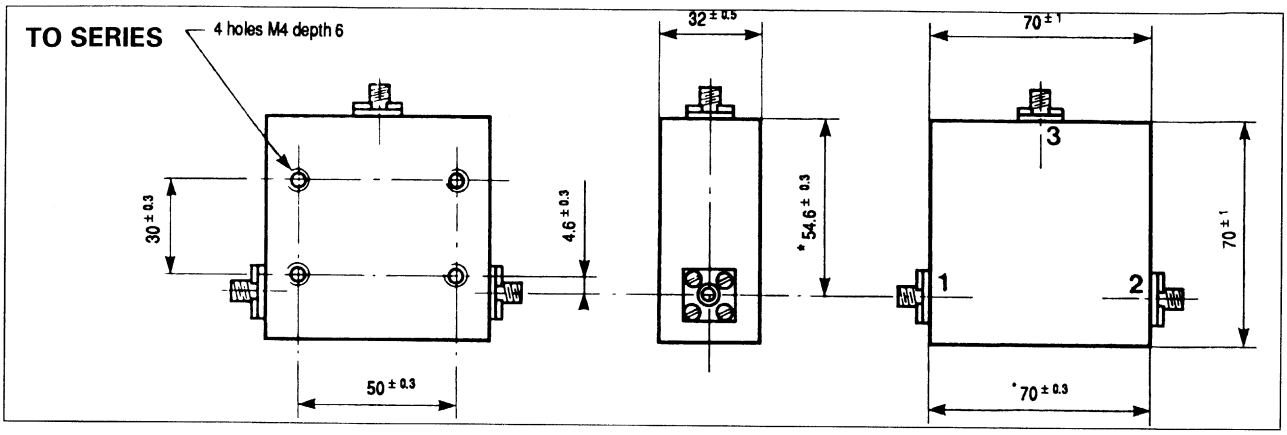
- ❑ Model number,
- ❑ Center frequency and desired bandwidth, or frequency range,
- ❑ Direction of circulation (clockwise or counter clockwise).

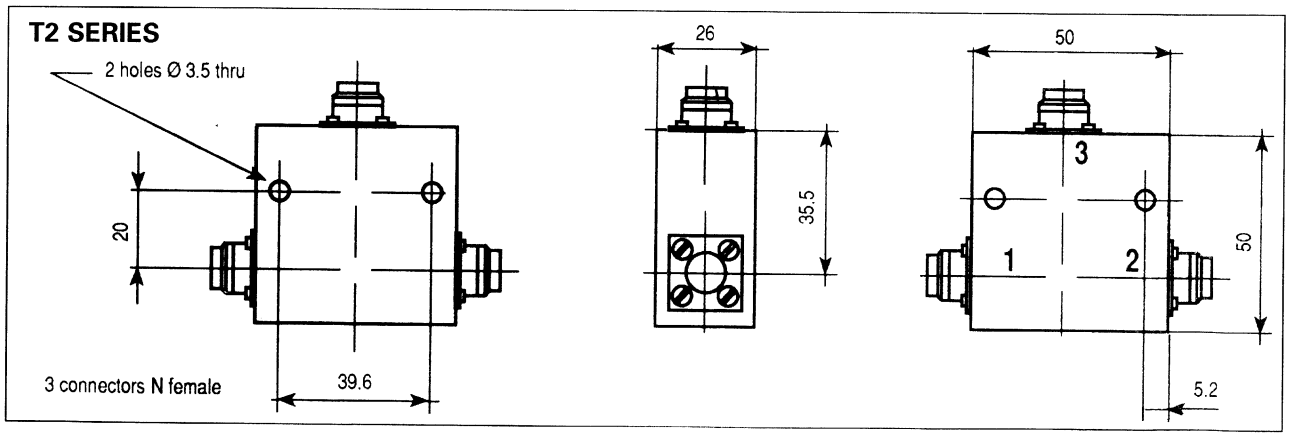


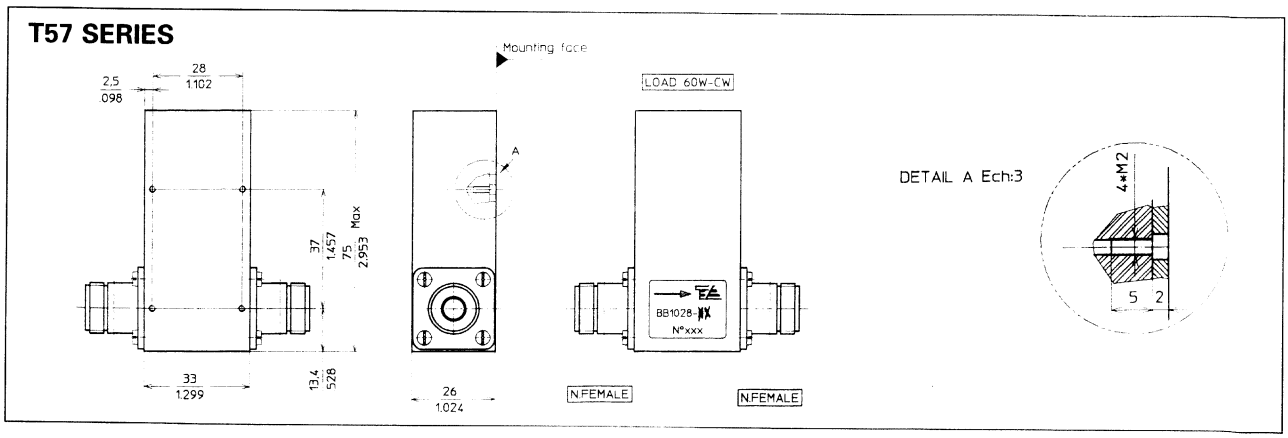
VHF / UHF 3-Port devices - packages

NOTE:

On request: reverse direction
Dimensions in mm
Tolerances ± 0.5







All dimensions supporting an asterisk (*) are measured "under flanges".

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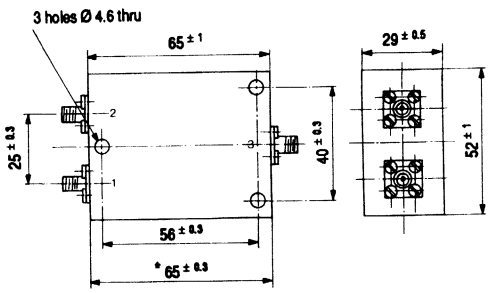
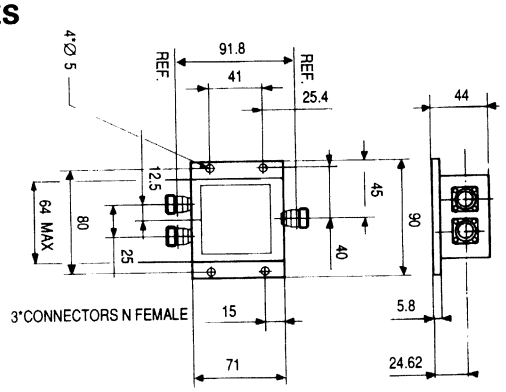
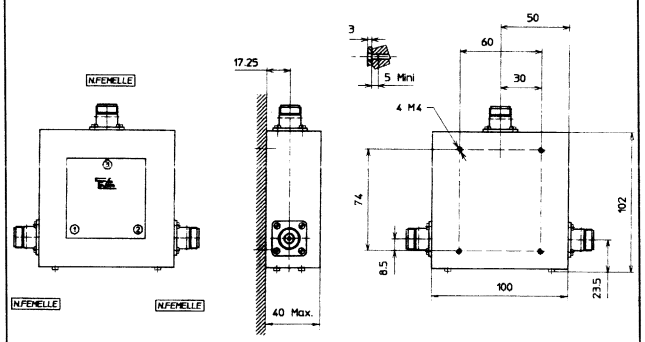
λ1 SERIES



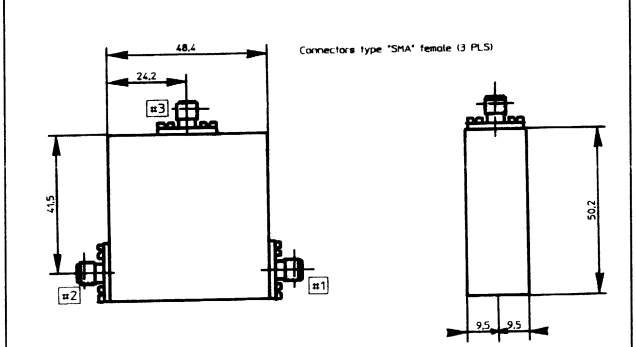
λ2 SERIES



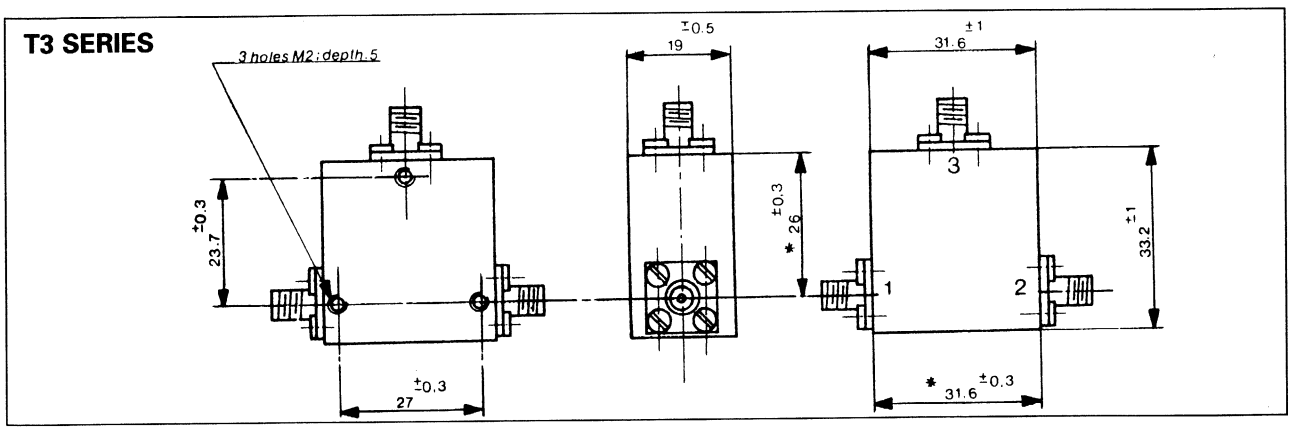
T56 SERIES



TD SERIES



T3 SERIES



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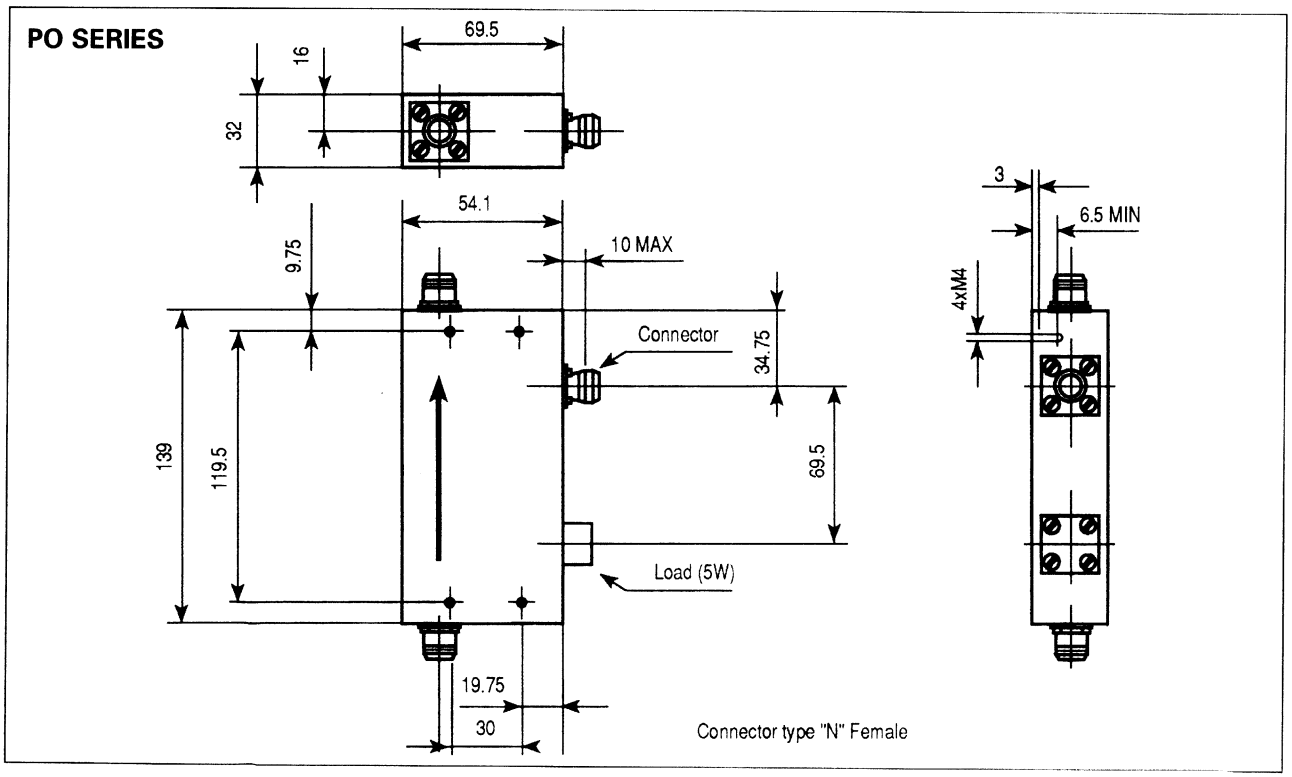
VHF / UHF 4-Port devices - packages

Features

- KMR/SMA female connectors
  (except where noted)
- KMR/SMA male connectors
  available upon request
- Tabs for microstrip or stripline applications available upon request
  (IT50 - IT17 - IT27)

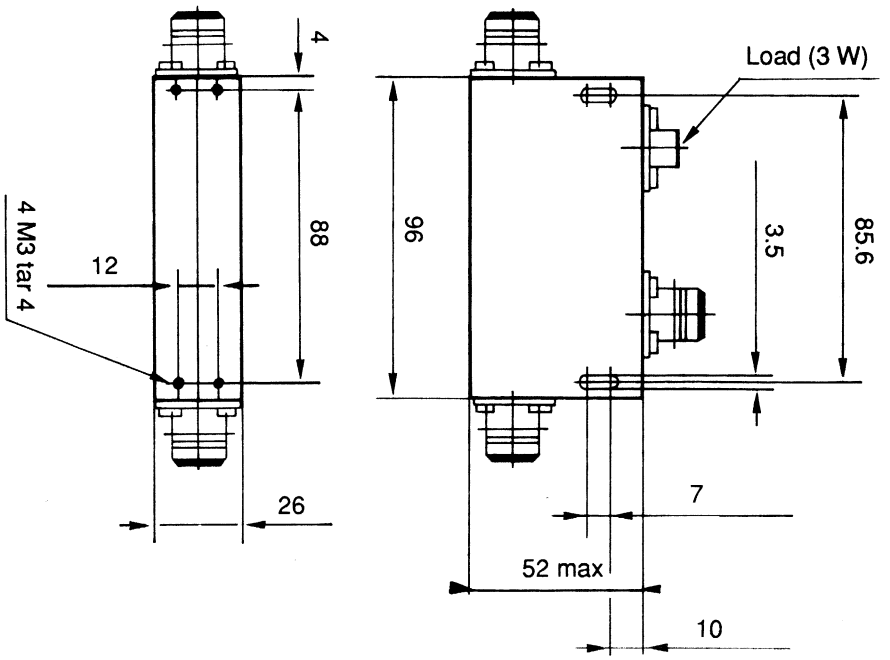
NOTE:

On request: reverse direction
Dimensions in mm
Tolerances ± 0.5
On request "H" configuration

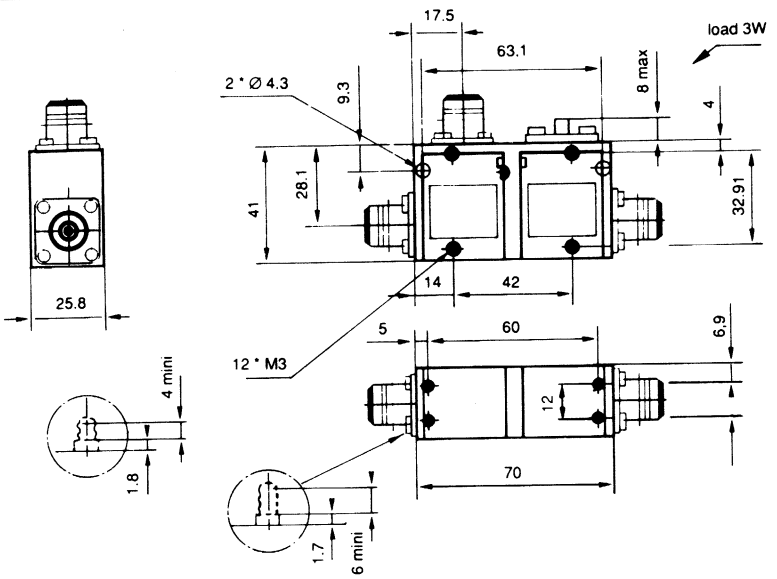


All dimensions supporting an asterisk (*) are measured "under flanges".

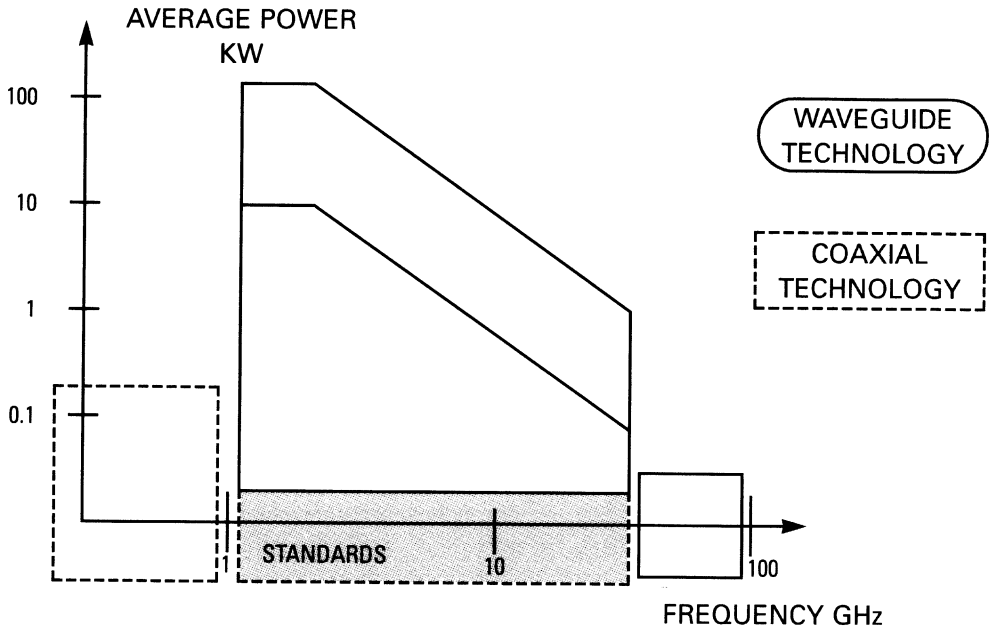
P2 SERIES



P4 SERIES



STANDARD COAXIAL DEVICES 1 TO 18 GHz



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General information

TEKELEC TEMEX offers the worldwide market a broad range of coaxial circulators and isolators, covering the frequency range 1 GHz to 18 GHz.

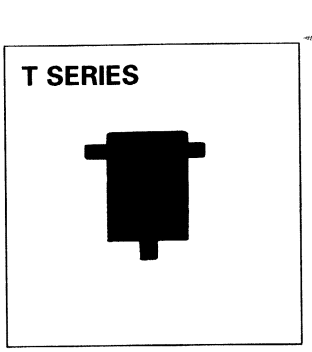
This catalog describes standard three-port circulators and isolators.

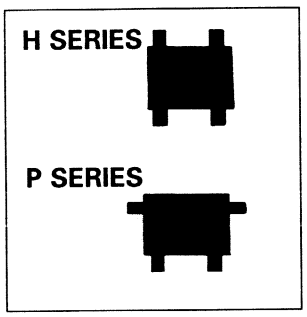
General description

4-port are available upon request, based on standard 3-port designs. Please consult your local sales offices for further information.

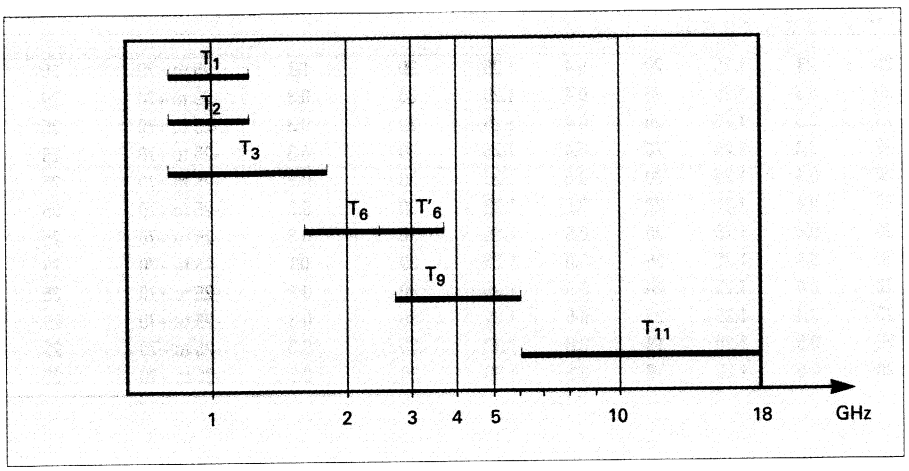
These devices are used for popular bandwidths, with an average power of 10, 20, 30, 50 W depending on the frequency.

- Seven standards "T" packages.
- The standard unit has KMR/SMA female connectors and when used as an isolator, an internal 60 W peak/1 W AVG termination on port 3.
- T1 and T2 series are dedicated to high average power applications.





Standard cases versus frequency



COAXIAL DEVICES

Standard coaxial devices 1 to 18 GHz

TEKELEC TEMEX

Electrical specifications

Type		Frequency range (GHz)	Specifications at 25° C			Spec. in temperature range			Circulator		Temperature range ° C	Weight g. approx.
Circulator	Isolator		Isolation min. dB	Inser. loss max dB	VSWR max	Isolation min. dB	Inser. loss max dB	VSWR max	Avg. power max W	Peak power max kW		
Outline drawing		**T1: 50.8 x 50.3 x 32 mm approx.**										
BD3037(1,2)	-	1.452 - 1.492	22	0.2	1.20	20	0.3	1.25	250	2.5	0 to +55	450
BD3063(1, 2)	-	1.452 - 1.492	20	0.2	1.22	18	0.3	1.30	350	4	0 to +55	450
Outline drawing		**T2: 50 x 50 x 26 mm approx.**										
BD3064(1, 2)		1.452 - 1.492	22	0.2	1.20	20	0.3	1.25	100	1	0 to +55	380
Outline drawing		**T3: 31.6 x 33.2 x 19 mm approx.**										
BD3017	BD1017	1.2 - 1.4	19	0.4	1.30	18	0.5	1.30	50	1	-10 to +55	110
BD3018	BD1018	1.4 - 1.7	19	0.4	1.30	18	0.5	1.30	50	1	-10 to +55	110
Outline drawing		**T6: 25.4 x 25.8 x 13.7 mm approx.**										
BD3019	BD1019	1.7 - 1.9	20	0.4	1.25	18	0.5	1.30	10	0.5	-10 to +55	60
BD3015	BD1015	1.7 - 2.1	20	0.4	1.25	18	0.5	1.30	10	0.5	-10 to +55	60
BD3020	BD1020	1.8 - 2.1	20	0.4	1.25	18	0.5	1.30	10	0.5	-10 to +55	60
BE3021	BE1021	2 - 2.2	20	0.4	1.25	18	0.5	1.30	10	0.5	-10 to +55	60
BE3022	BE1022	2.1 - 2.3	20	0.4	1.25	18	0.5	1.30	10	0.5	-10 to +55	60
BE3023	BE1023	2.2 - 2.4	20	0.4	1.25	18	0.5	1.30	10	0.5	-10 to +55	60
BE3024	BE1024	2.3 - 2.5	20	0.4	1.25	18	0.5	1.30	10	0.5	-10 to +55	60
Outline drawing		**T'6: 25.4 x 25.8 x 13.7 mm approx.**										
BE3034	BE1034	2 - 2.5	20	0.4	1.25	18	0.5	1.30	10	0.5	-10 to +55	60
BE3025	BE1025	2.5 - 2.9	20	0.4	1.25	18	0.5	1.30	10	0.1	-10 to +55	60
BE3026	BE1026	2.7 - 3.1	20	0.4	1.25	18	0.5	1.30	10	0.1	-10 to +55	60
BF3004	BF1004	2.9 - 3.5	19	0.5	1.30	18	0.6	1.30	10	0.1	-10 to +55	60
Outline drawing		**T9: 22 x 25 x 14 mm approx.**										
BE3027	BE1027	2.8 - 3.1	23	0 3	1 20	20	0.4	1.25	20	0.5	-10 to +70	55
BF3005	BF1005	3.1 - 3.5	23	0.3	1.20	20	0.4	1.25	20	0.5	-10 to +70	55
BF3006	BF1006	3.4 - 3.9	23	0.3	1.20	20	0.4	1.25	20	0.5	-10 to +70	55
BF3007	BF1007	3.7 - 4.2	23	0.3	1.20	20	0.4	1.25	20	0.5	-10 to +70	55
BG3002	BG1002	4 - 4.6	23	0.3	1.20	20	0.4	1.25	20	0.5	-10 to +70	55
BG3003	BG1003	4.4 - 5	23	0.3	1.20	20	0.4	1.25	20	0.5	-10 to +70	55
BG3004	BG1004	4.8 - 5.4	23	0.3	1.20	20	0.4	1.25	20	0.5	-10 to +70	55
BG3005	BG1005	5.4 - 5.9	23	0 3	1 20	20	0.4	1.25	20	0.5	-10 to +70	55
Outline drawing		**T11: 12.7 x 17.2 x 12.8 mm approx.**										
BH3005	BH1005	5.9 - 6.4	20	03	1 25	20	0.4	1.25	30	03	-25 to +70	25
BH3006	BH1006	6.4 - 7.1	20	0.3	1.25	20	0.4	1.25	30	0.3	-25 to +70	25
BH3007	BH1007	7.1 - 7.8	20	0.3	1.25	20	0.4	1.25	30	0.3	-25 to +70	25
BI3003	BI1003	7.8 - 8.7	20	0.3	1.25	20	0.4	1.25	30	0.3	-25 to +70	25
BI3004	BI1004	8.5 - 9.6	20	0.4	1.25	20	0.5	1.25	30	0.3	-25 to +70	25
BJ3011	BJ1011	9.6 - 10.6	20	0.4	1.25	20	0.5	1.25	30	0.3	-25 to +70	25
BJ3012	BJ1012	10.6 - 11.7	20	0.4	1.25	20	0.5	1.25	30	0.3	-25 to +70	25
BJ3013	BJ1013	11.5 - 12.5	20	0.4	1.25	20	0.5	1.25	30	03	-25 to +70	25
BJ3014	BJ1014	12.5 - 13.5	20	0.4	1.25	20	0.5	1.25	30	0.3	-25 to +70	25
BJ3009	BJ1009	13.5 - 14.5	20	0.4	1.25	20	0.5	1.25	30	0.3	-25 to +70	25
BJ3018	BJ1018	14 - 16	20	0.5	1.25	18	0.6	1.30	30	0.3	-25 to +70	25
BJ3019	BJ1019	16 - 18	20	0.5	1.25	18	0.6	1.30	30	0.3	-25 to +70	25

Notes:

(1) With tab integrations (ITN1/ITN2) or N types connectors

(2) Devices need to be mounted on an heat suite with thermal resistance of 0.4° C/W max

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Packages

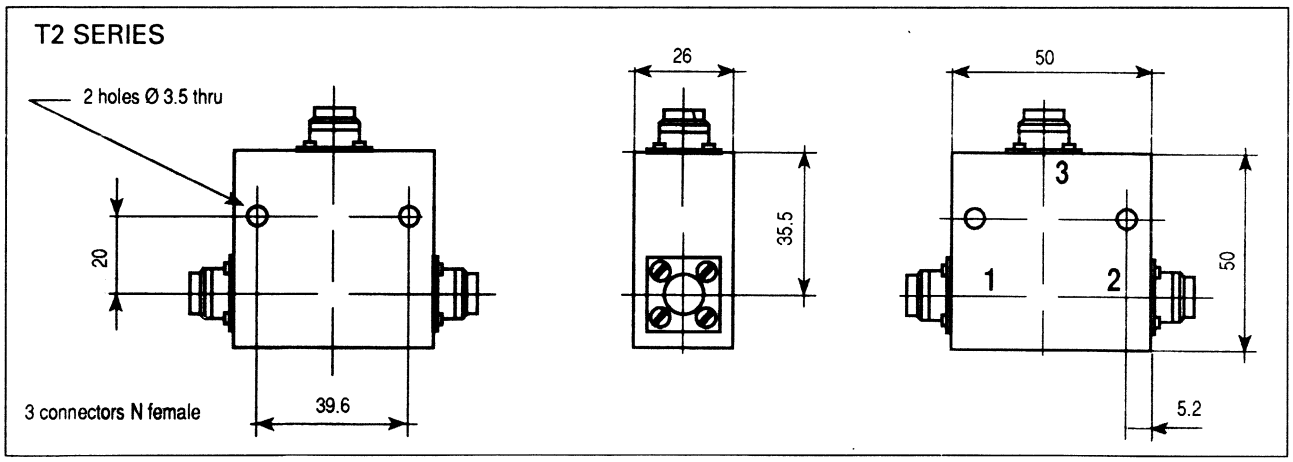
Features

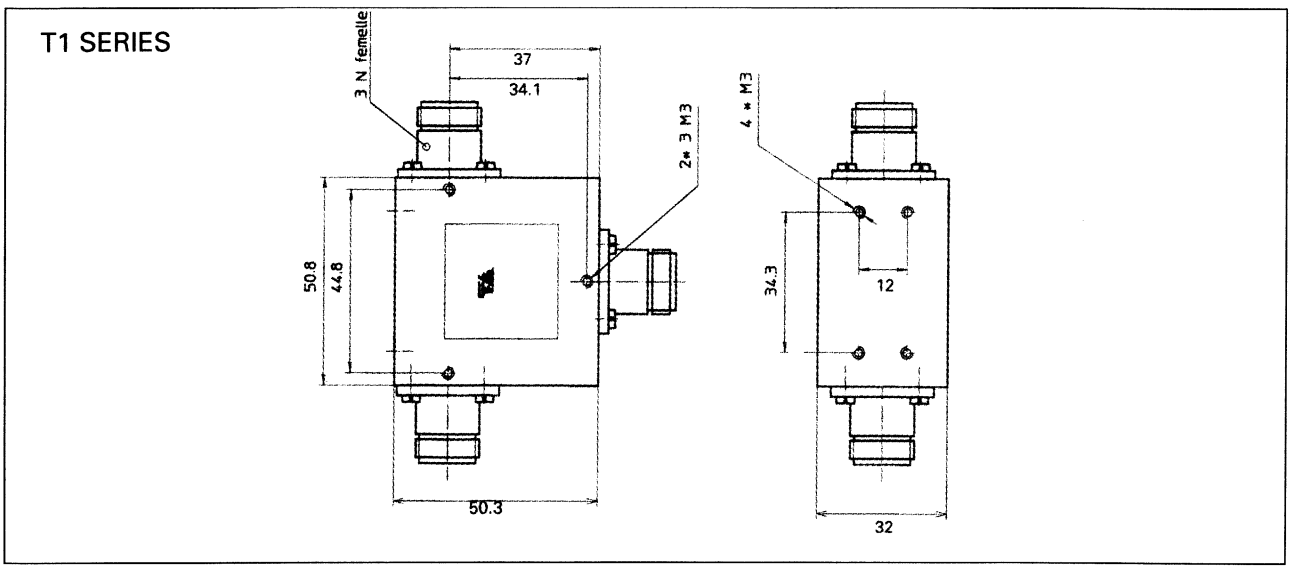
- KMR/SMA female connectors (except where noted)
- KMR/SMA male connectors available upon request
- Tabs for microstrip or stripline applications available upon request (IT50 - IT17 - IT27) (see page 2-25).

T1 Series
T2 Series

All dimensions in mm

Case	L	W	H	A	B	C	D	E	F	G	Ø Holes
T1	50.8	50.3	32	44.8	34.1	0	37	25.4	3 (2 plces up) 25.4 (1 plce dwn)	4	3 x M3
T2	50	50	26	39.6	-	20	35.5	25	5.2	Through	2 x 3.5





Packages

Features

- KMR/SMA female connectors (except where noted)
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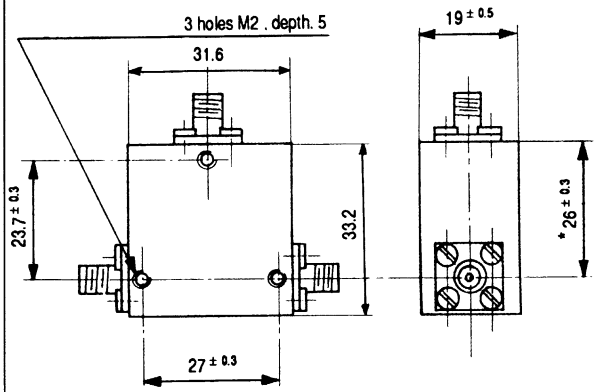
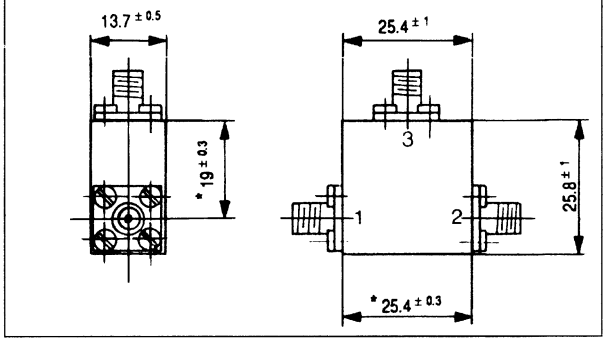
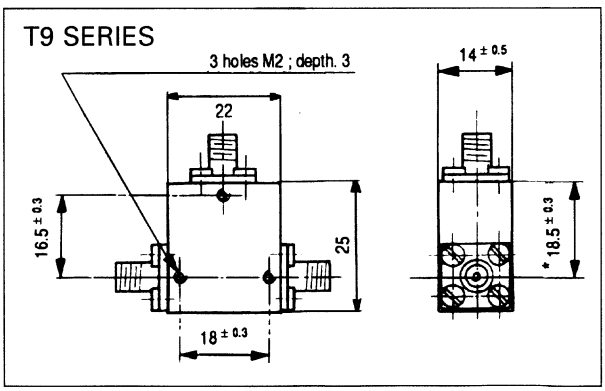
T3 SERIES



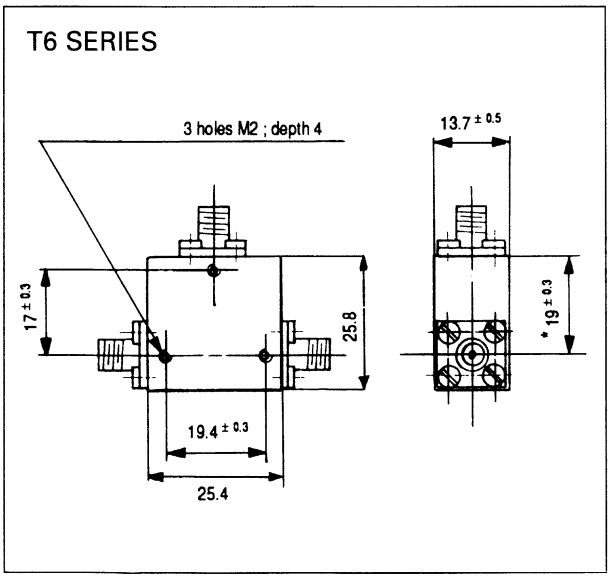
T'6 SERIES



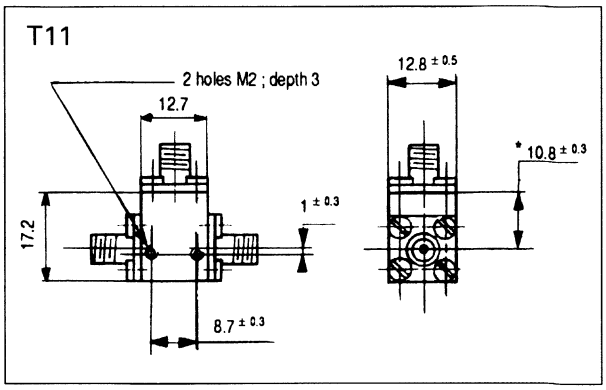
T9 SERIES



T6 SERIES



T11



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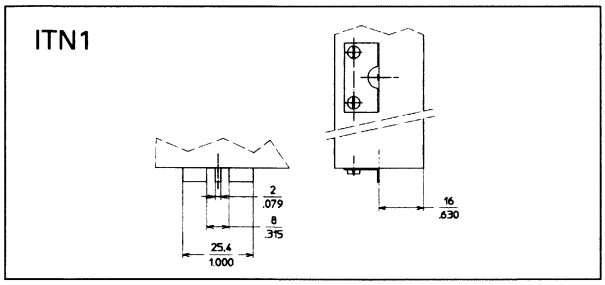
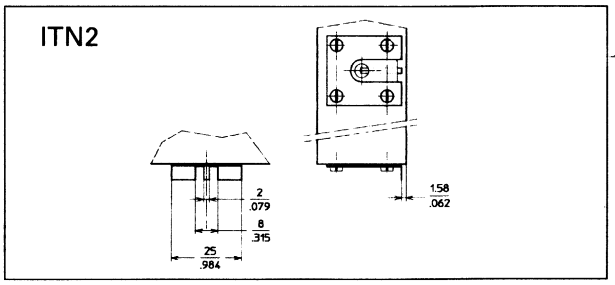
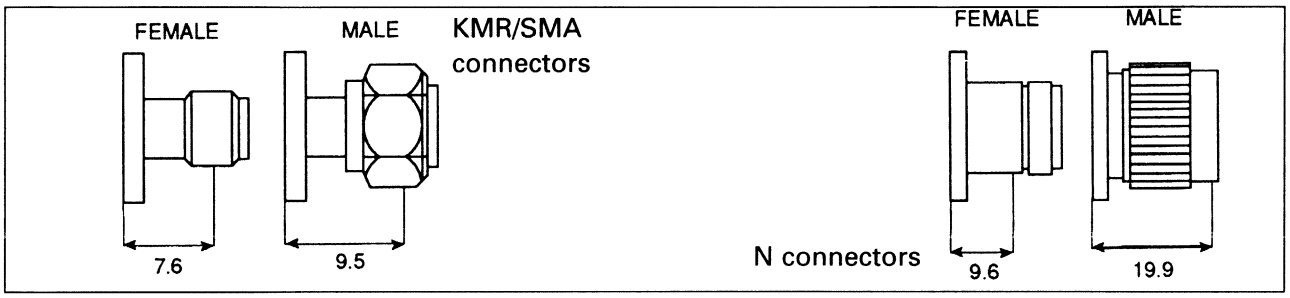
CONNECTORS & TABS

Depending on power handling, connectorised devices are available with integrations any place, instead of the N connectors: on requirements, we can offer devices with, N, SMA or TAB style connections.

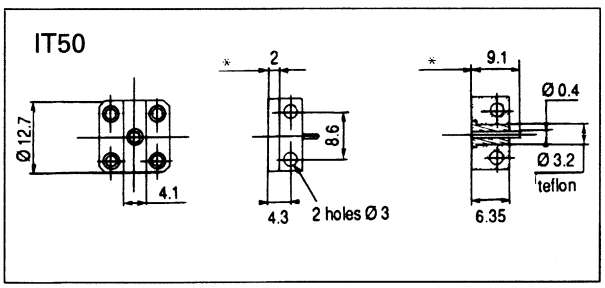


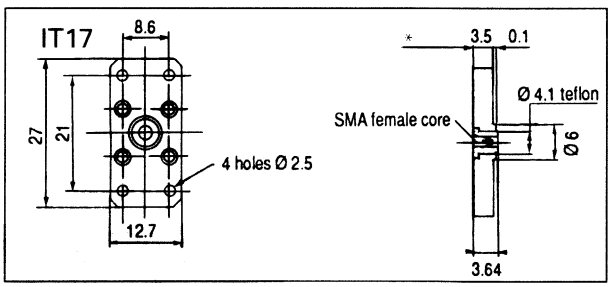


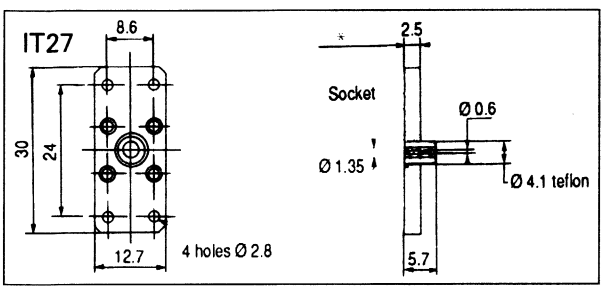
Connectors

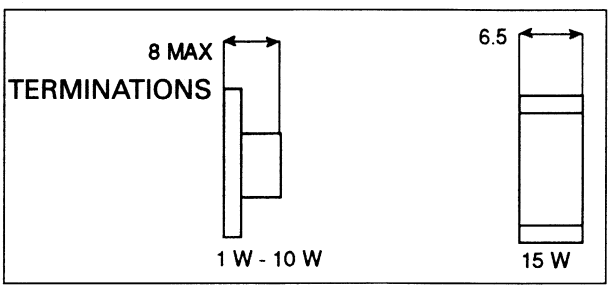


Tabs and terminations



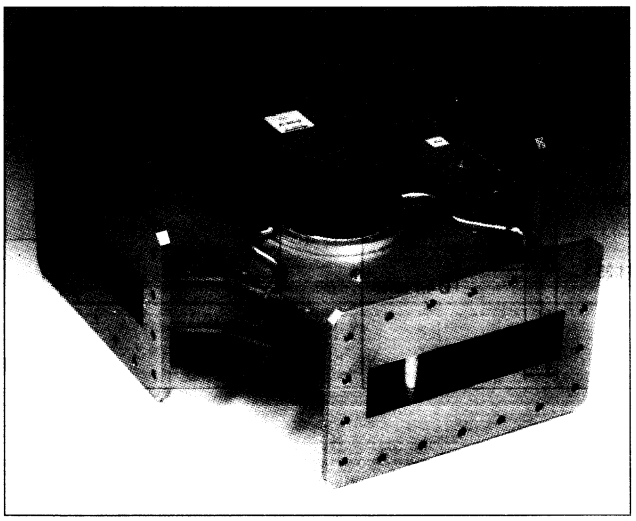




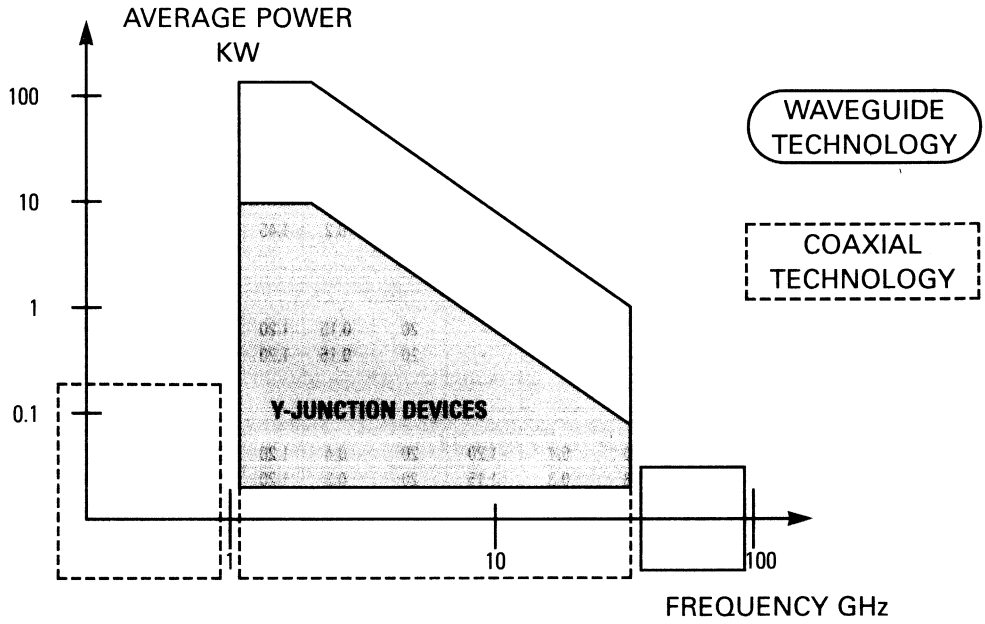


WAVEGUIDE DEVICES

Selection Guide



Y-JUNCTION WAVEGUIDE DEVICES 352 MHz TO 18 GHz



General description

TEKELEC TEMEX's success in ferrite material and ferrite component manufacturing is due largely to our approach towards computer-aided engineering design and advanced manufacturing technology (numerical controlled fabrication).

Low-insertion loss and high isolation are not the only criteria to consider when designing junction circulators. Broadband, high power handling capability, low 3rd order intermodulation products and low RF leakage are also important.

TEKELEC TEMEX's R & D teams have developed new materials and technologies, thereby increasing the average power handling for most of the junction circulators. Over the past years, CW-power handling has tripled.

Three-port junctions are available in T- or Y- configurations in the most popular waveguide standards. Circulators can be cascaded to form four- or five-port devices.
Water cooling is required on several of the high-power devices.

When size is critical, TEKELEC TEMEX supplies compact and miniaturized isolators. They work on narrow-band and low-power applications of up to 10 W mean power.
Y-junction circulators are either cast or machined.

Options such as direction of circulation, frequency range, temperature range, and magnetic and electrical shieldings are available upon request.

Electrical characteristics

Notes	Type	Frequency range (GHz)	Band-width (MHz)	Avg. power max W	Peak power max kW	Specifications at 25° C			Spec. in temperature range			Temparature range ° C	Flange	Dimensions mm approx.	Weight kg. approx.
						Isolation min. dB	Ins. loss max dB	VSWR max	Isolation min. dB	Ins. loss max dB	VSWR max				
WR2300 waveguide					**(R3)**										
	FB3002	0.352	±10	1300 K	1300	-	-	-	20	0.15	1.20	+25	UDR 3	2000 x 1600 x 800	1300
WR1800 waveguide					**(R5)**										
4-8	FB3001	0.4333	±0.5	200 K	6000	-	-	-	25	0.2	1.10	+30	UDR 5	1500 x 1500 x 700	1500
WR975 waveguide					**(R9)**										
	FC3003	0.915	± 2	50 K	50	18	0.2	1.30	15	0.2	1.45	25 ± 5	UDR 9	500 x 389 x 213	41
WR340 waveguide					**(R26)**										
4-5	FE3005	2.450	± 25	3 K	3	-	-	-	20	0.15	1.20	+5 to +45	UG 554/U	180 x 190 x 105	6
1-4-5	FE3002	2.450	± 25	6 K	6	-	-	-	20	0.15	1.20	+10 to +40	UG554/U	180 x 190 x 127	6
WR284 waveguide					**(R32)**										
	FE3003	2.700 - 2.900	FULL	700	700	20	0.4	1.20	20	0.4	1.20	-20 to +60	CMR284	145 x 163 x 190	4.1
	FE3007	2.850 - 3.300	FULL	1.5 K	100	23	0.3	1.15	20	0.3	1.20	0 to +55	CMR284	180 x 160 x 99	4.5
	FE3004	2.900 - 3.100	FULL	700	700	20	0.4	1.20	20	0.4	1.20	-20 to +60	CMR284	145 x 163 x 190	4.1
1-2-4-5	FE3001	2.998	± 5	2.5 K	2500	-	-	-	30	0.15	1.10	+35 to +45	CPR284 F	203 x 155 x 182	8
WR229 waveguide					**(R40)**										
	FF3004	3.4 - 3.8	FULL	150	10	30	0.2	1.07	26	0.2	1.10	0 to +50	CMR229	127 x 121 x 51	0.5
	FF3003	3.7 - 4.2	FULL	150	10	30	0.2	1.07	26	0.2	1.10	0 to +50	CMR229	127 x 121 x 51	0.5
WR187 waveguide					**(R48)**										
	FG3004	4.4 - 5	FULL	25	-	28	0.2	1.10	28	0.2	1.10	0 to +50	UER48	118 x 115 x 47	0.5
	FG3005	4.4 - 5	FULL	1.5 K	-	25	0.2	1.15	20	0.3	1.15	-10 to +55	UER48	120 x 120 x 74	1.9
	FG3007	5.4 - 5.9	FULL	1.5 K	70	23	0.3	1.15	23	0.3	1.15	0 to +60	UG407	120 x 120 x 95	1.9
WR137 waveguide					**(R70)**										
	FH3013	5.925 - 6.425	FULL	300	-	32	0.1	1.05	28	0.1	1.08	+5 to +50	CMR137F	83 x 83 x 40	0.23
	FH3008	5.925 - 6.425	FULL	1 K	-	25	0.15	1.15	20	0.2	1.15	-10 to +50	CMR137F	83 x 83 x 75	0.4
3-4	FH3006	5.850 - 6.425	FULL	3.5 K	-	25	0.15	1.15	25	0.15	1.15	-10 to +50	CPR137F	83 x 125 x 86	
3-4	FH3007	5.850 - 6.425	FULL	6 K	-	25	0.15	1.15	25	0.15	1.15	-10 to +50	CPR137F	83 x 125 x 86	1.4
7	FH3001	5.925 - 7.110	FULL	30	-	28	0.1	1.08	28	0.1	1.10	0 to +50	CMR137F	83 x 82 x 40	0.23
	FH3009	6.425 - 7.110	FULL	25	10	32	0.1	1.05	28	0.1	1.08	0 to +55	CMR137F	83 x 82 x 40	0.23
	FH3010	6.425 - 7.110	FULL	25	10	32	0.1	1.05	28	0.1	1.08	0 to +55	CMR137F	120 x 90 x 39	0.23
	FH3011	7.110 - 7.700	FULL	25	-	30	0.15	1.06	28	0.15	1.08	0 to +55	CMR137F	83 x 80 x 50	0.7
WR112 waveguide					**(R84)**										
	FH3003	7.5 - 8.5	FULL	25	5	25	0.2	1.15	20	0.3	1.20	0 to +60	UBR84	68 x 67 x 51	0.3
4	FI3002	7.9 - 8.4	FULL	200	-	25	0.2	1.15	20	0.3	1.20	0 to +60	UBR84	68 x 67 x 51	0.3
3-4	FI3005	7.9 - 8.4	FULL	4.3 K	-	25	0.15	1.15	25	0.15	1.15	-10 to +60	UBR84	68 x 67 x 77	0.55

Notes:

1 Water cooled
2 Pressurization SF_6 - 10 PSIG
3 Forced air cooled
4 Into external load 2: 1 continuous
5 Short circuit handling 10 ms duration
6 Max. avg. power into matched load only
7 Low third order intermodulation products
8 Water cooled at 30° C and Pressurization SF_6 - 1.5 PSIG

Outline drawings see page 2-30 and following.

Notes	Type	Frequency range (GHz)	Band-width (MHz)	Avg. power max W	Peak power max kW	Specifications at 25° C			Spec. in temperature range			Temperature range °C	Flange	Dimensions mm approx.	Weight kg. approx.
						Isolation min. dB	Ins. loss max dB	VSWR max	Isolation min. dB	Ins. loss max dB	VSWR max				
WR90 Waveguide					**(R100)**										
	FI3007	8.2 -10.5	FULL	25	5	21	0.3	1.20	20	0.4	1.20	-20 to +85	UG 39/U	60 x 52 x 41	0.2
2	FI3004	8.5 - 9.6	FULL	300	110	22	0.4	1.20	18	0.5	1.30	-40 to +85	UG 39/U	60 x 52 x 41	0.2
	FI3001	9.4 - 9.7	FULL	20	5	26	0.3	1.10	26	0.3	1.10	-30 to +80	UG 39/U	57 x 57 x 41	0.3
	FJ3019	10.5 - 12.2	FULL	25	5	25	0.3	1.15	20	0.5	1.20	-10 to +50	UG 39/U	60 x 52 x 41	0.2
WR75 Waveguide					**(R120)**										
	FJ3020	10.7 - 11.7	FULL	25	5	30	0.2	1.07	26	0.2	1.12	-20 to +60	UBR120	44.5 x 44.5 x 38	0.19
	FJ3021	11.7 - 12.5	FULL	25	5	30	0.2	1.07	26	0.2	1.12	-20 to +60	UBR120	44.5 x 44.5 x 38	0.16
	FJ3022	12.5 - 13.5	FULL	25	5	30	0.2	1.07	26	0.2	1.12	-20 to +60	UBR120	44.5 x 44.5 x 38	0.14
	FJ3018	14 - 14.5	FULL	25	5	30	0.2	1.07	26	0.2	1.12	-20 to +60	UBR120	44.5 x 44.5 x 38	0.15
3-6	FJ3017	14 - 14.5	FULL	450	0.5	25	0.1	1.15	25	0.1	1.15	-10 to +60	UBR120	44.5 x 44.5 x 51.2	0.18
3-6	FJ3011	14 - 14.5	FULL	200	0.2	28	0.25	1.05	25	0.25	1.15	-10 to +50	UDR120	61 x 55 x 58	0.7
3-6	FJ3010	14 - 14.5	FULL	2 K	2	28	0.25	1.05	25	0.25	1.15	-10 to +50	UDR120	61 x 63 x 90	0.7
WR62 Waveguide					**(R140)**										
	FJ3023	12.5 - 14	FULL	15	5	22	0.3	1.20	20	0.3	1.20	-40 to +70	UG419/U	38 x 40 x 35	0.14
	FJ3004	15.5 - 17	FULL	15	5	22	0.3	1.20	20	0.3	1.20	0 to +60	UG419/U	38 x 40 x 35	0.14
8	FJ3025	16 - 17	FULL	55	55	22	0.4	1.20	18	0.5	1.30	-40 to +90	UG419/U	38 x 40 x 35	0.14
WR51 Waveguide					**(R180)**										
	FJ3001	17.7 -19.7	FULL	-	-	25	0.3	1.15	23	0.3	1.15	0 to + 50	SPECIAL	38 x 40 x 32	0.1

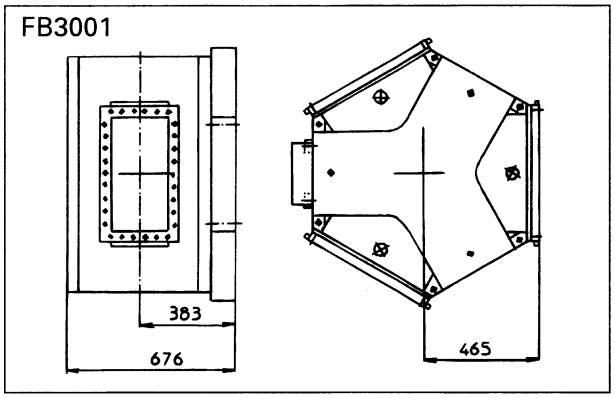
Notes:

1 Water cooled
2 Pressurization air - 15 PSIG
3 Forced air cooled
4 Into external load 2 : 1 continuous
5 Short circuit handling 10 ms duration
6 Max. avg. power into matched load only
7 Low third order intermodulation products
8 Pressurization air 30 PSIG

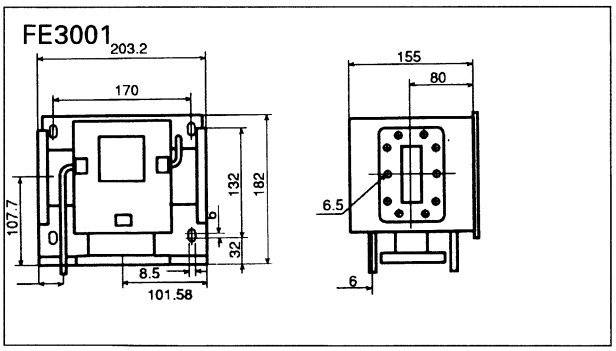
Outline drawings see page 2-30 and following.

Outline drawings

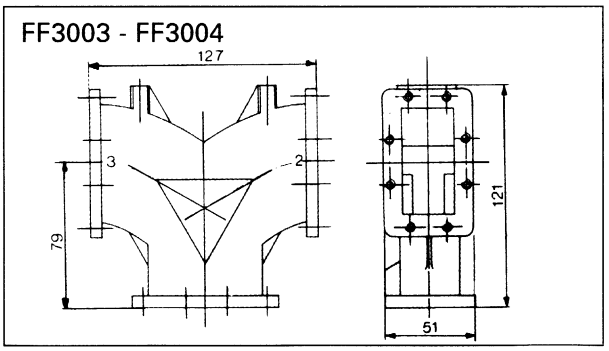
R5
WR1800 waveguide



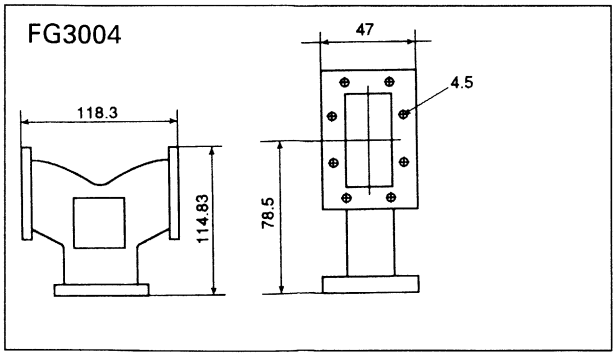
R32
WR284 waveguide

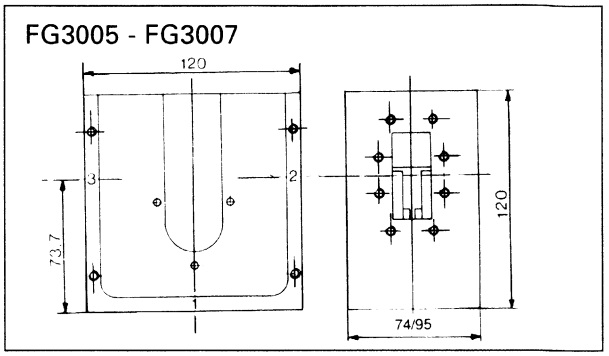


R40
WR229 waveguide



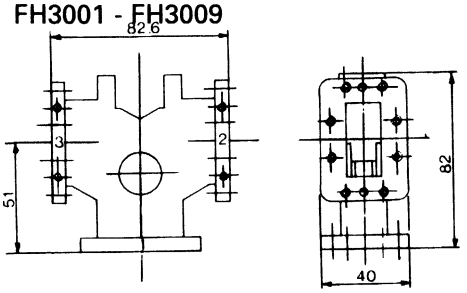
R48
WR187 waveguide



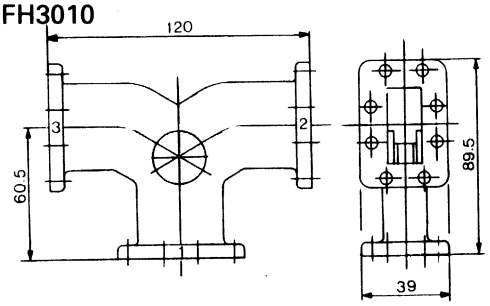


R70
WR137 waveguide

FH3001 - FH3009

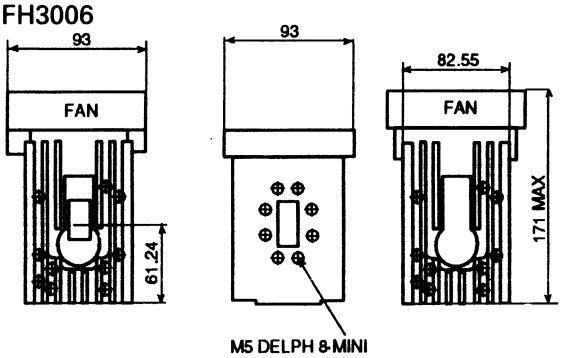


FH3010

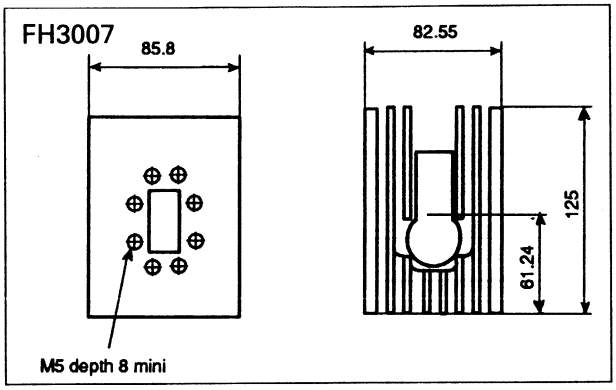


R70
WR137 waveguide

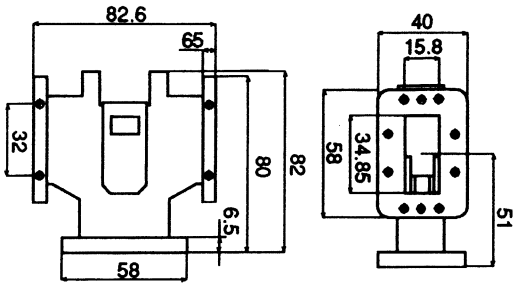
FH3006



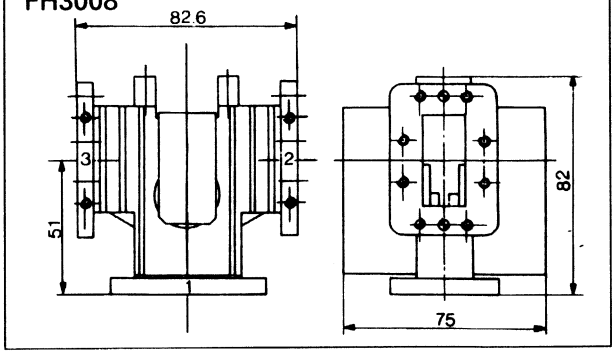
FH3007



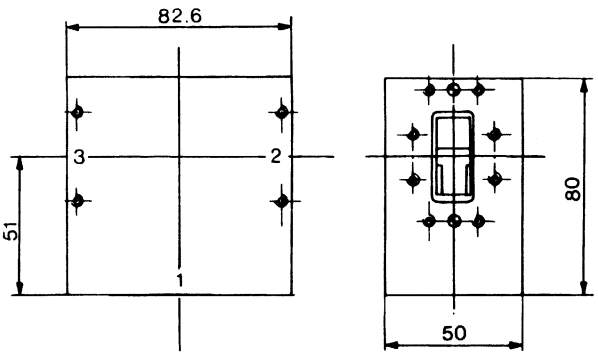
FH3013



FH3008

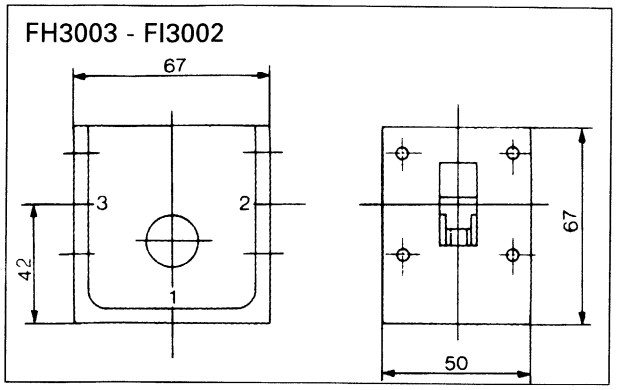


FH3011

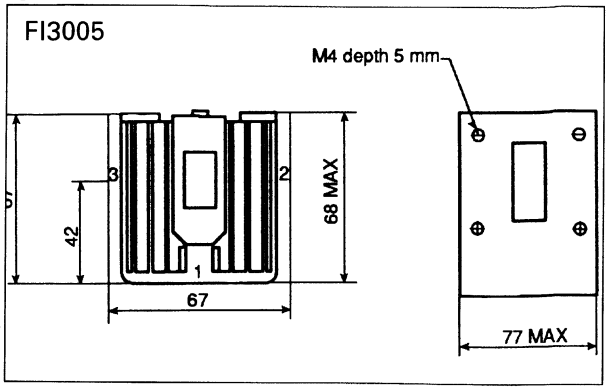


R84
WR112 waveguide

FH3003 - FI3002

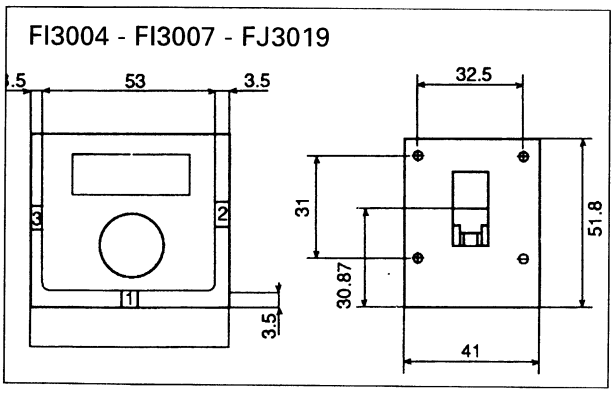


FI3005

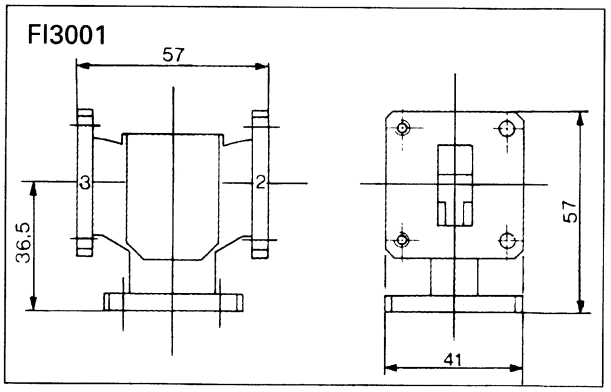


R100
WR90 waveguide

FI3004 - FI3007 - FJ3019

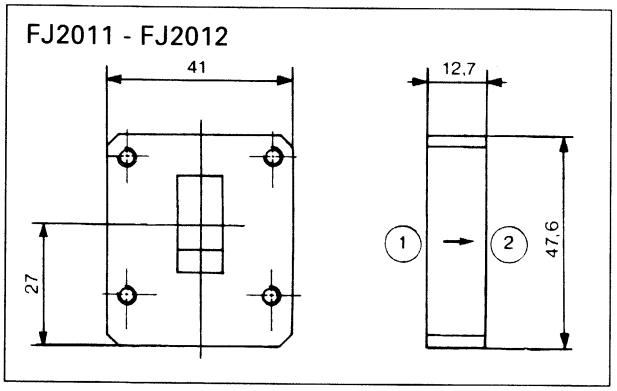


FI3001



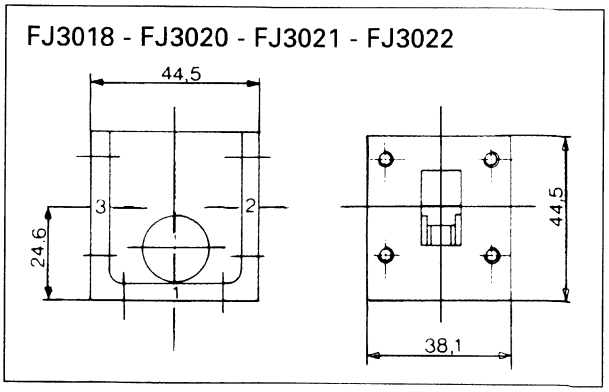
R100
WR90 waveguide

FJ2011 - FJ2012



R120
WR75 waveguide R180

FJ3018 - FJ3020 - FJ3021 - FJ3022



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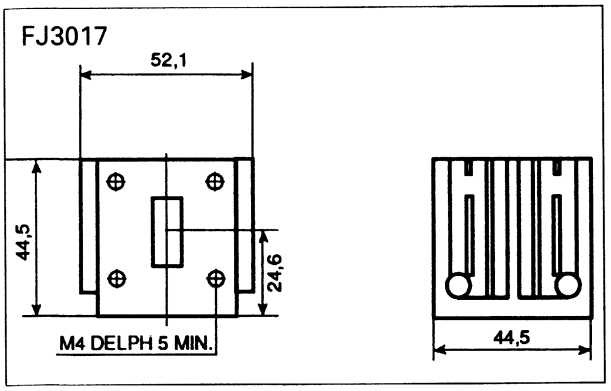
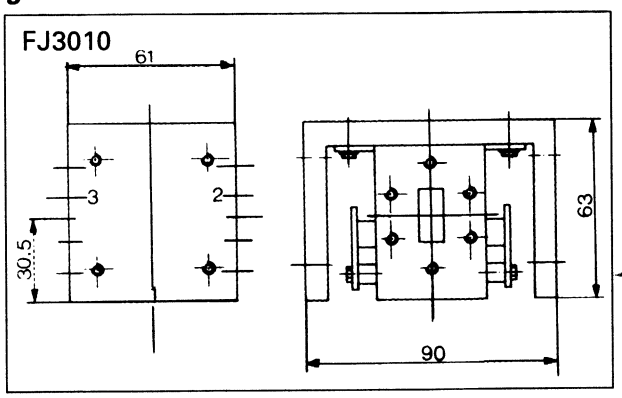
NORDIC: +46 (0) 8 590 303 00
SPAIN: +34 (0) 1 3204160
NL: +31 (0) 793461430
UK: +44 (0) 1256 883340

R120
WR75 waveguide

FJ3017

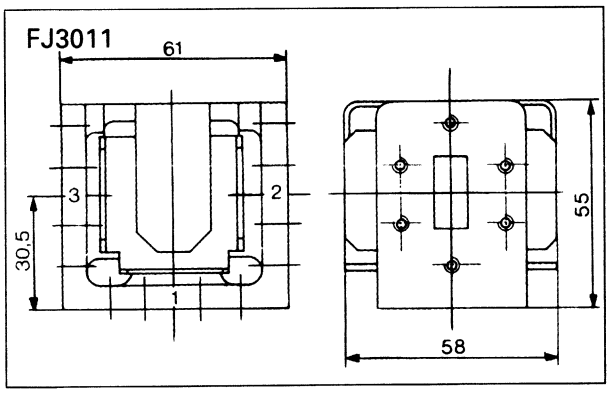


FJ3010



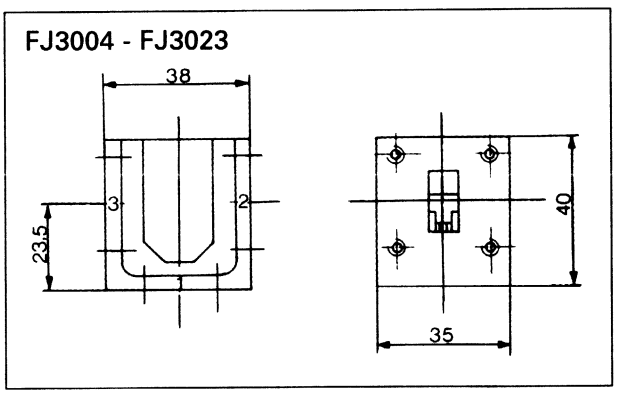
R120
WR75 waveguide

FJ3011



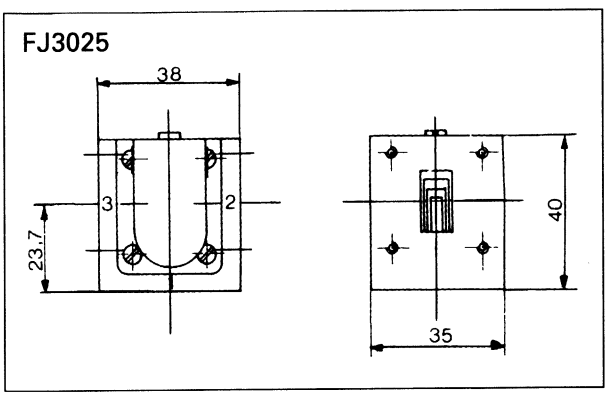
R140
WR62 waveguide

FJ3004 - FJ3023



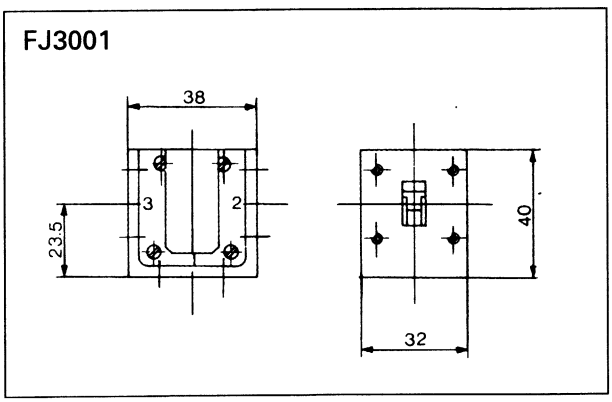
R140
WR62 waveguide

FJ3025

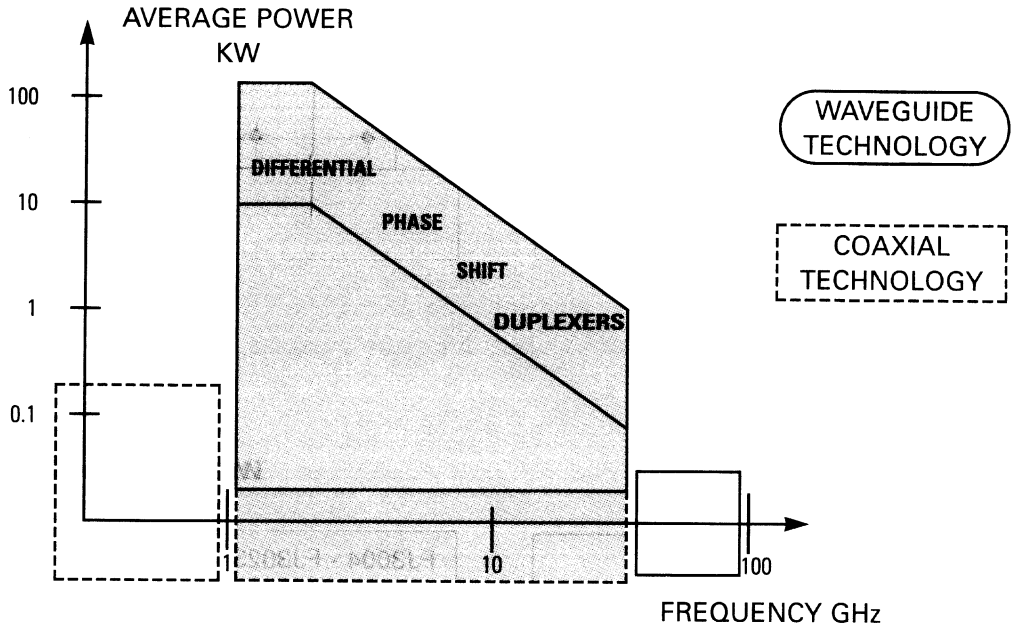


R180
WR51 waveguide

FJ3001



4-PORT WAVEGUIDE DIFFERENTIAL PHASE SHIFT CIRCULATORS (DUPLEXERS)



General description

Designed for use in both high-peak and high-mean power applications, TEKELEC TEMEX's differential phase shift circulators offer high isolation while maintaining low-insertion loss.

These ruggedly constructed circulators can operate under the most severe environmental conditions, according to MIL-SPEC.

The addition of specific heat sinks, or liquid cooling jackets increases mean power handling; for example, of up to 200 kW-CW at 1.250 GHz.

Casting techniques can be used for pressurized waveguide in order to reduce leakage and weight, especially for airborne radars.

In-house ferrite materials facilities, computer-aided design, and experienced research and development teams, allow TEKELEC TEMEX to offer customers specific designs with optimal features.

With the addition of a suitable waveguide load and a dummy load on the appropriate port, a 4-port differential phase shift circulator may be operated as a high-power isolator.

The reflected power which will be absorbed in the dummy load, or the output mismatch - (V.S.W.R.) - should be specified when ordering.

Options such as direction of circulation, mechanical output ports E-bend or H-bend are available upon request.

4-Port waveguide differential phase shift circulators (Duplexers)

Electrical characteristics

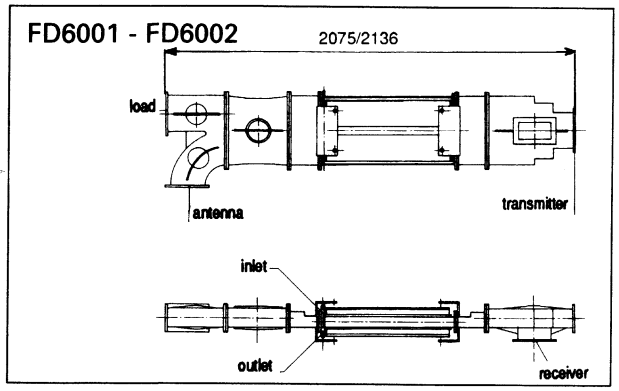
Notes	Type	Frequency range (GHz)	Band-width (MHz)	Avg. power max W	Peak power max kW	Specifications at 25° C			Spec. in temperature range			Temperature range °C	Flange	Length mm approx.	Weight kg. approx.
						Isolation. min dB	Inse. loss max dB	VSWR max	Isolation. min dB	Inse. loss max dB	VSWR max				
WR975 waveguide					**(R9)**										
1-5	FC6001	1.000	-	350 K	350	-	-	-	20	0.15	1.10	25 ± 3	UDR 9	3044	-
WR650 waveguide					**(R14)**										
1-4	FD6001	1.250-1.350	FULL	6 K	6500	20	0.5	1.15	20	0.5	1.15	-10 to +50	CPR 650	2075	80
1-7	FD6002	1.250-1.350	FULL	200 K	2000	20	0.2	1.15	20	0.2	1.15	+10 to +40	CPR 650	2136	130
WR340 waveguide					**(R26)**										
1	FE6002	2.450	± 25	50 K	50	23	0.2	1.15	20	0.25	1.20	+10 to +30	UG 554A/U	1125	43
WR284 waveguide					**(R32)**										
2-4	FE6004	2.700-2.900	FULL	3 K	1500	25	0.4	1.20	25	0.4	1.20	0 to +65	SPECIAL	600	25
1	FE6005	2.900-3.100	FULL	10 K	660	25	0.4	1.20	25	0.4	1.20	0 to +50	SPECIAL	965	19
1-5-7	FE6001	2.900-3.100	FULL	6 K	6000	20	0.3	1.15	20	0.3	1.15	0 to +50	CPR 284F	635	40
1-6	FE6003	2.995-3.005	FULL	7 K	15000	20	0.2	1.05	20	0.2	1.05	+15 to +30	SPECIAL	902	80
WR187 waveguide					**(R48)**										
2	FG4201	4.4-5	FULL	2 K	2	23	0.2	1.12	23	0.2	1.12	-10 to +40	UER 48	588	8
WR137 waveguide					**(R70)**										
2	FH6002	5.925-6.425	FULL	1.5 K	-	22	0.15	1.07	20	0.2	1.15	-10 to +65	CPR 137	418	4.8
2	FH6000	5.925-6.425	FULL	3 K	-	22	0.15	1.07	20	0.2	1.15	-10 to +65	CPR 137	418	4.8
WR112 waveguide					**(R84)**										
	FI6006	7.9-8.4	FULL	1.8 K	-	30	0.2	1.10	30	0.2	1.10	-10 to +70	UG 138/U	324	1.6
2-4	FI6007	8.5-9.6	FULL	300	250	25	0.5	1.15	23	0.5	1.15	0 to +60	UG 138/U	324	1.6
2-4	FI6003	8.8-9.4	FULL	250	250	25	0.5	1.15	25	0.5	1.15	0 to +60	UG 138/U	254	0.7
WR90 waveguide					**(R100)**										
2-4	FI6001	8.5-9.6	FULL	300	250	20	0.5	1.20	20	0.5	1.20	-40 to +70	UG 135/U	176	0.52
3	FI6008	9-9.6	FULL	540	180	22	0.4	1.20	20	0.5	1.20	-40 to +70	UG 135/U	152	0.52
	FJ6008	9.9-10.5	FULL	500	-	22	0.3	1.20	20	0.5	1.20	-30 to +60	UG 135/U	207	1
1	FJ6004	10-10.25	FULL	25 K	-	25	0.25	1.10	20	0.35	1.15	0 to +60	UG 39/U	246	2.1
WR75 waveguide					**(R120)**										
1	FJ6007	11.7-12.5	FULL	1 K	2	25	0.25	1.15	20	0.3	1.20	0 to +60	UBR 120	257	2.2
WR62 waveguide					**(R140)**										
2	FJ6001	14-14.5	FULL	2.5 K	2.5	25	0.25	1.15	22	0.3	1.20	-10 to +55	UG 419/U	223	3.2
	FJ6009	15.7-17	FULL	150	60	20	0.4	1.15	20	0.4	1.15	-10 to +70	UG 419/U	171	0.55

Notes:

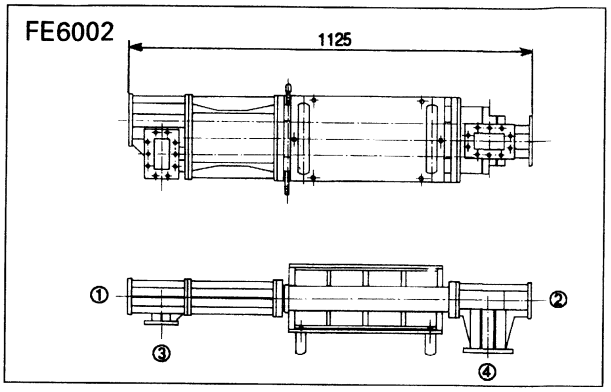
1 Water cooled
2 Air cooled
3 Air cooled pressurized 30 PSIG (2 kg)
4 Pressurized 15 PSIG (1.1 kg)
5 Can operate with permanent short circuit
6 Pressurized SF_6 (45 PSIG)
7 Pressurised SF_6 (15 PSIG)

Outline drawings

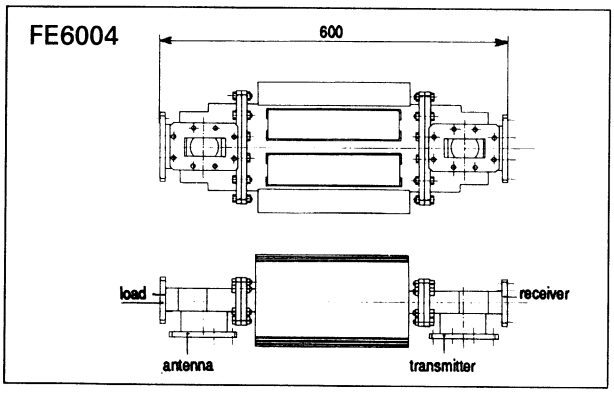
R14
WR650 waveguide

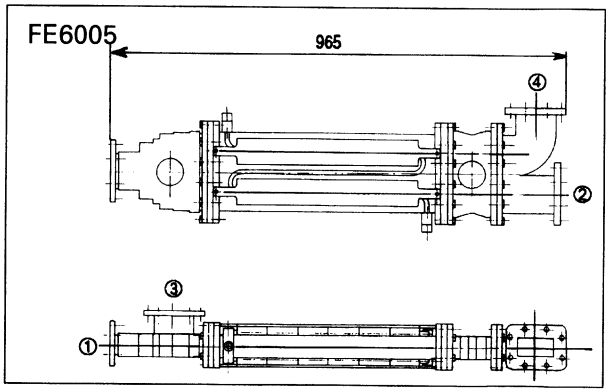


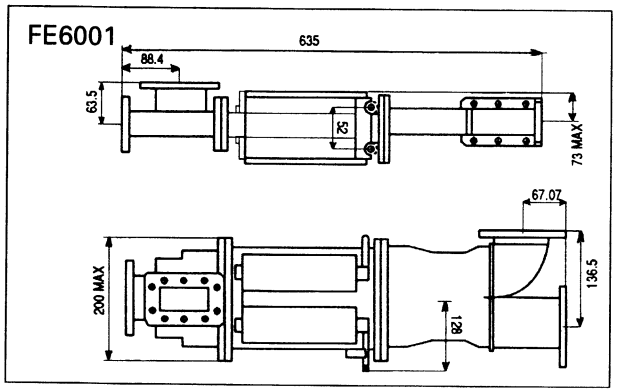
R26
WR340 waveguide

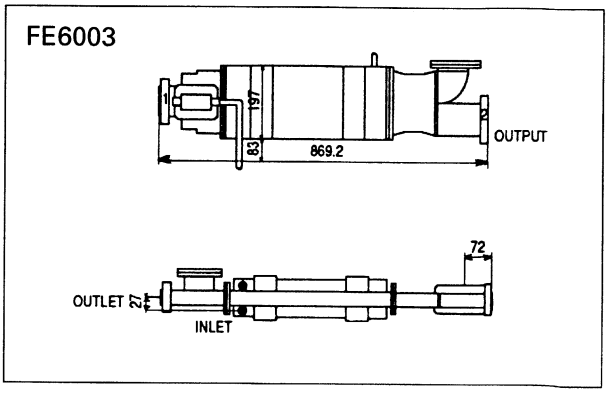


R32
WR284 waveguide









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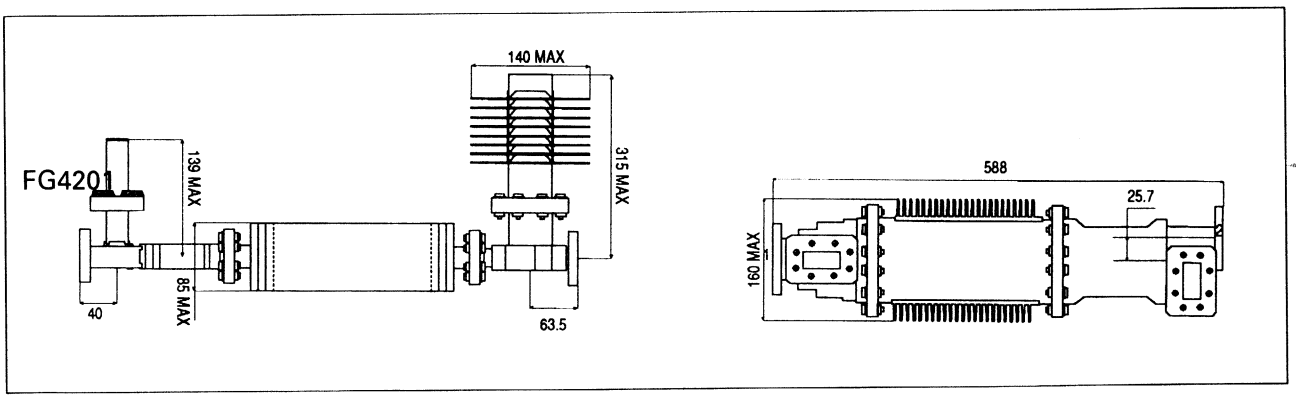
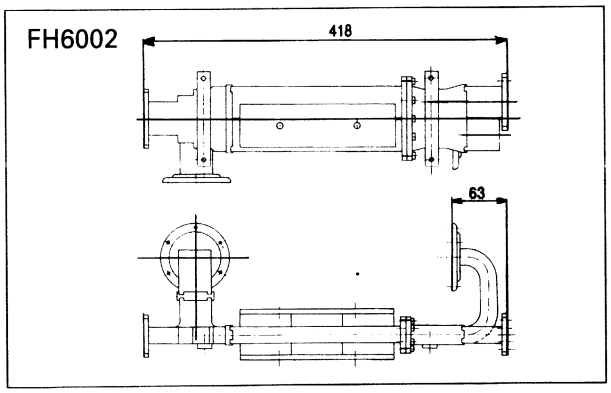
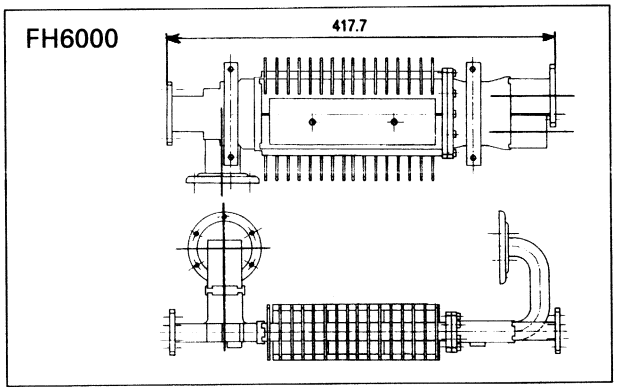
R48
WR187 waveguide

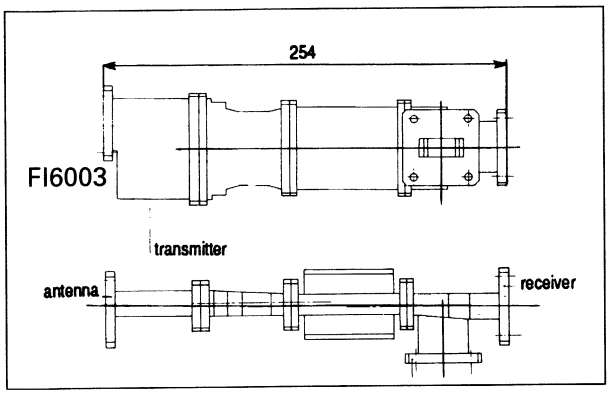


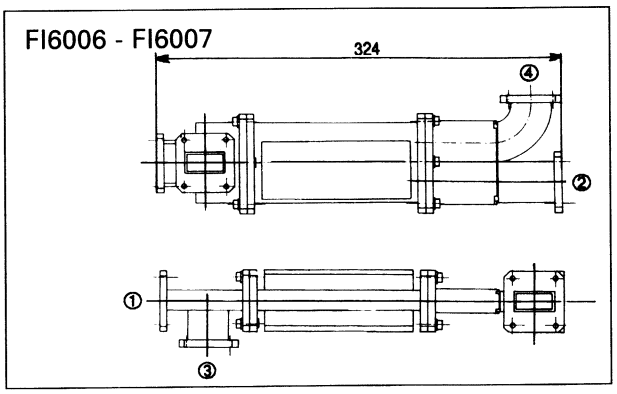
R70
WR137 waveguide





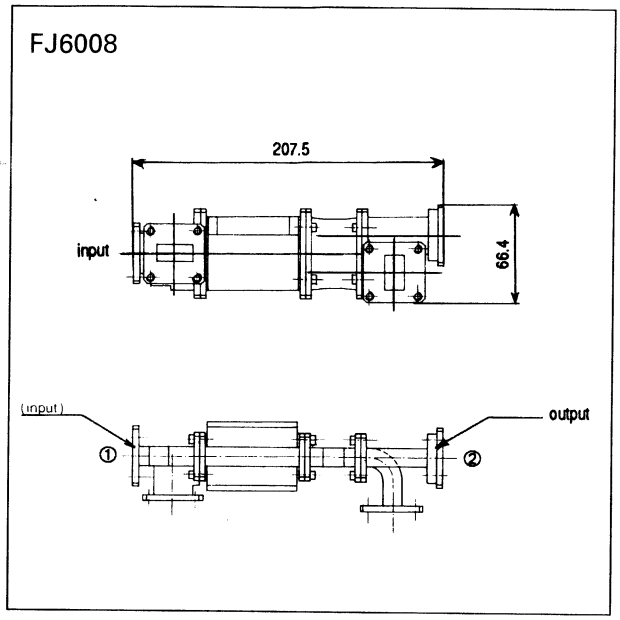
R84
WR112 waveguide



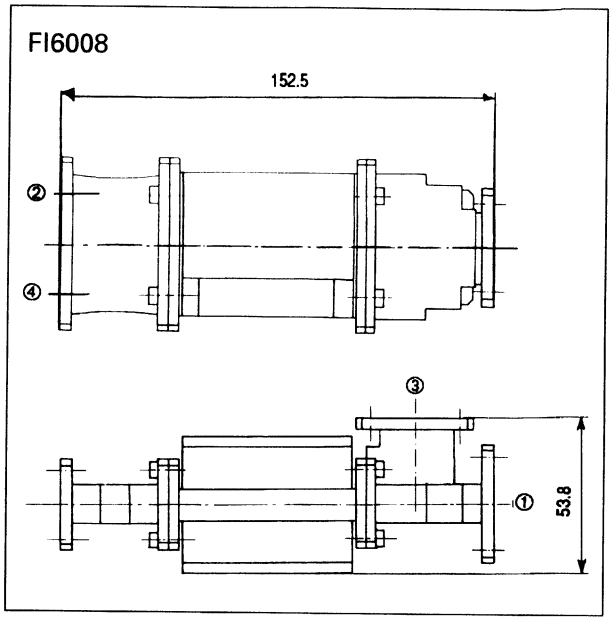


R100
WR90 waveguide

FJ6008

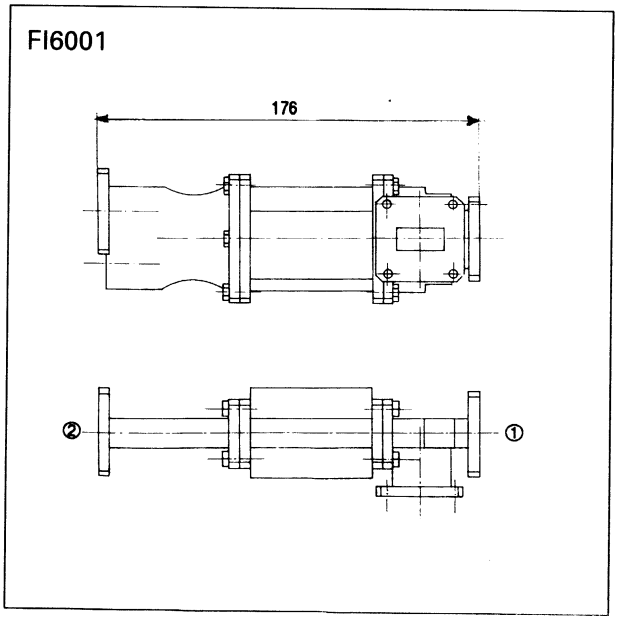


FI6008

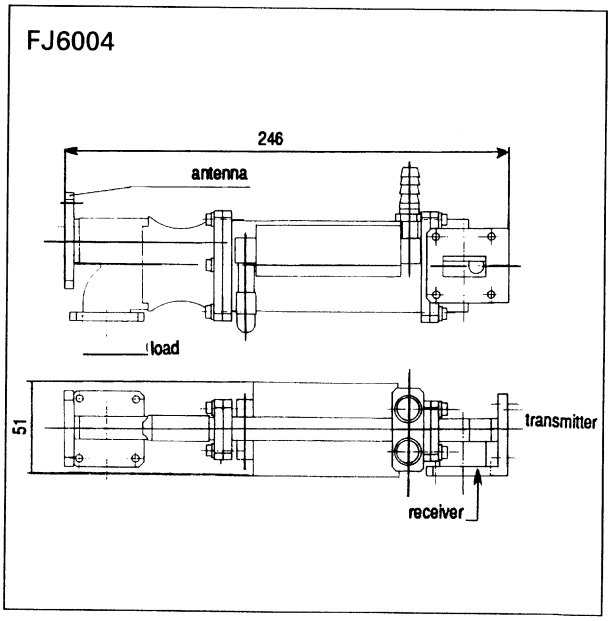


R100
WR90 waveguide

FI6001



FJ6004



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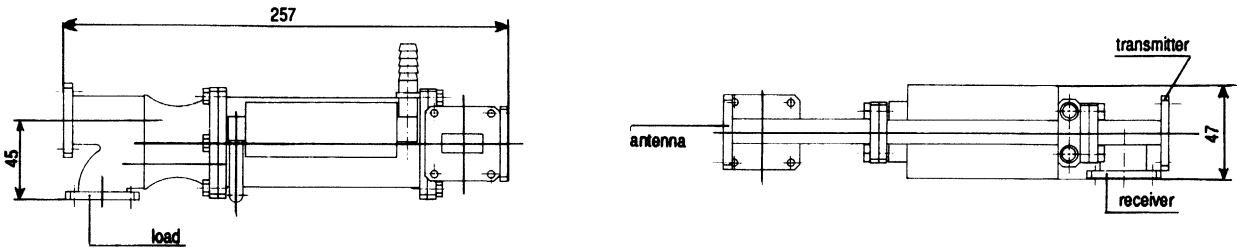
NL: NL: +31 (0) 79 3461430
+31 UK: +44 (0) 1256 883340

R120
WR75 waveguide

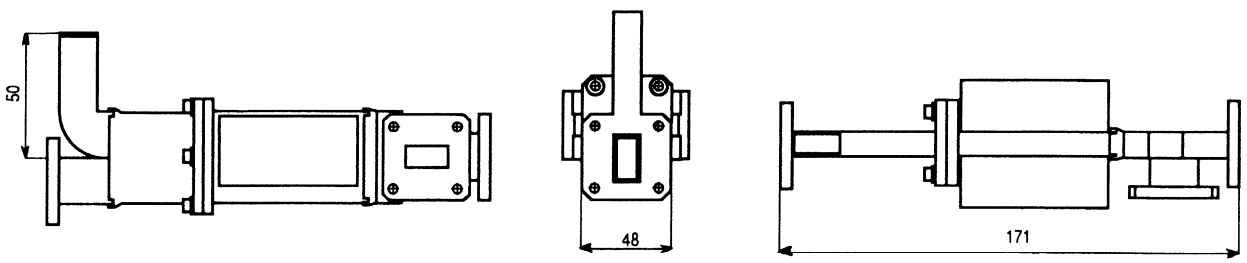
FJ6007



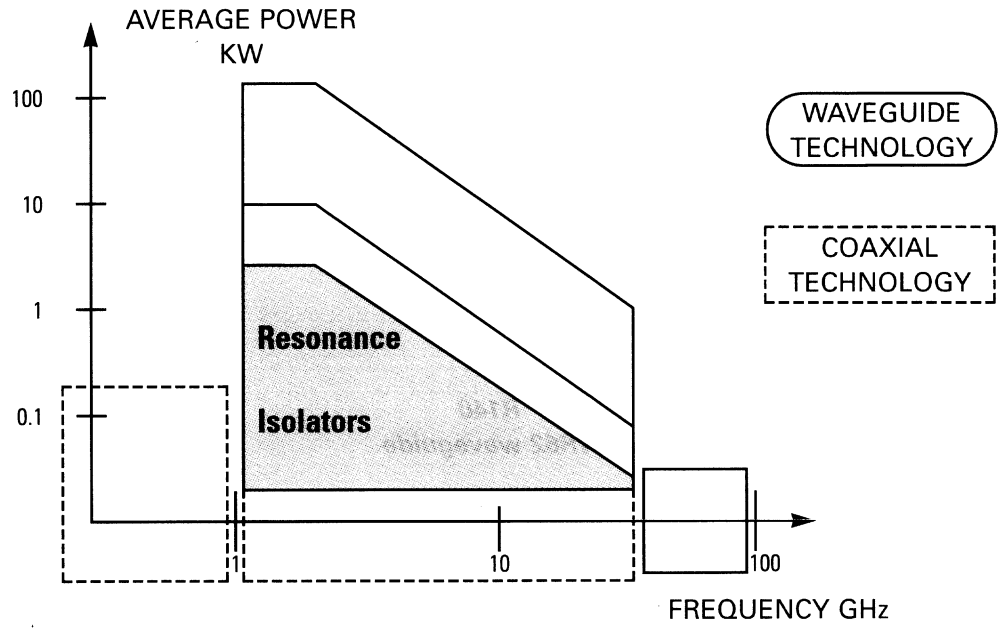
R140
WR62 waveguide

FJ6001

FJ6009



RESONANCE ISOLATORS WAVEGUIDE DEVICES



General description

TEKELEC TEMEX supplies resonance absorption isolators. These devices provide excellent electrical performances at high power levels. Their minimal size make them suitable for limited space requirements. They are used in a "straight-through" configuration. Water cooling is required for the high-power devices (FD2001 and FE2001).

When ordering, please specify the reflected power that will be absorbed in the isolator or the output mismatch-(V.S.W.R.).

The following table includes only a small sample of our capability.

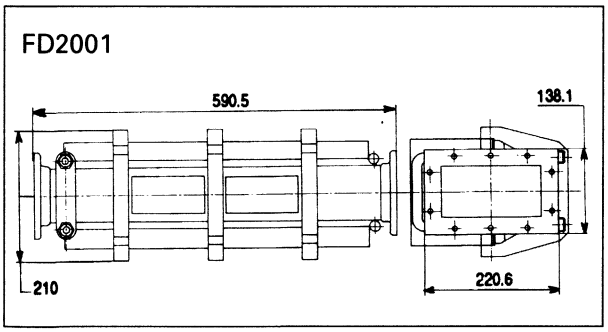
Electrical characteristics

Type	Frequency range (GHz)	Avg. power max W	Peak power max kW	Specifications at 25° C			Spec. in temperature range			Operating temperature range ° C	Flange	Length mm approx.	Weight kg. approx.
				Isolation min dB	Inse. loss max dB	VSWR max	Isolation min dB	Inse. loss max dB	VSWR max				
WR 650 waveguide			**(R14)**										
FD2001	1.215 - 1.385	5 K	3000	10	0.65	1.20	10	0.65	1.20	0 to +50	UG417A/U	590.5	41
WR 284 Waveguide			**(R32)**										
FE2001	2.950 - 3.050	2 K	1000	20	0.35	1.10	20	0.5	1.10	0 to +50	CMR284	250	15
WR 112 Waveguide			**(R84)**										
FI2004	8.6 - 9.6	300	300	10	0.5	1.10	10	0.5	1.10	- 40 to +100	UG51/U	63.5	1.2
FI2001	9.27 - 9.47	80	80	20	0.35	1.10	20	0.4	1.10	- 30 to +85	UG51/U	80	1.5
WR 62 Waveguide			**(R140)**										
FJ2010	16 - 17	150	75	15	0.5	1.10	15	0.5	1.10	0 to +60	UBR140	65	1.2

Outline drawings

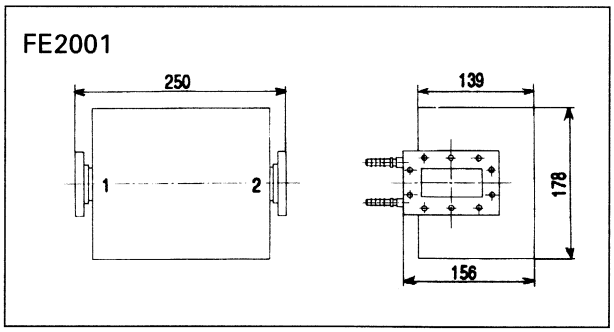
R14
WR650 waveguide

FD2001



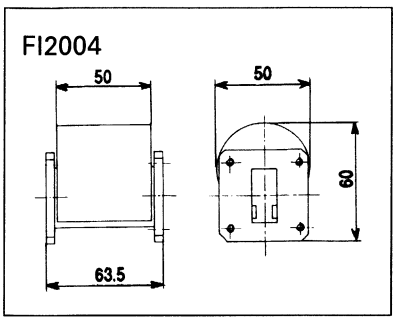
R32
WR284 waveguide

FE2001

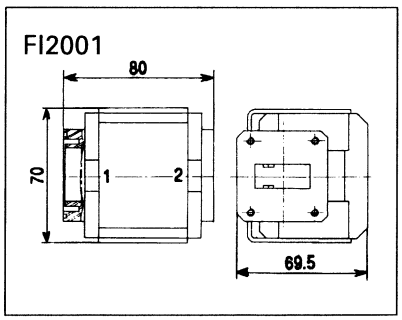


R84
WR112 waveguide

FI2004

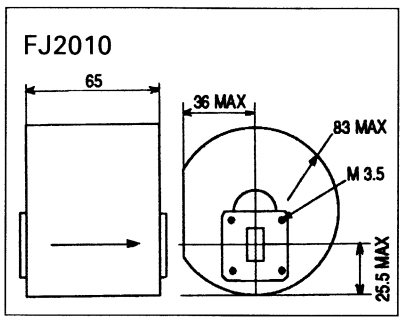


FI2001

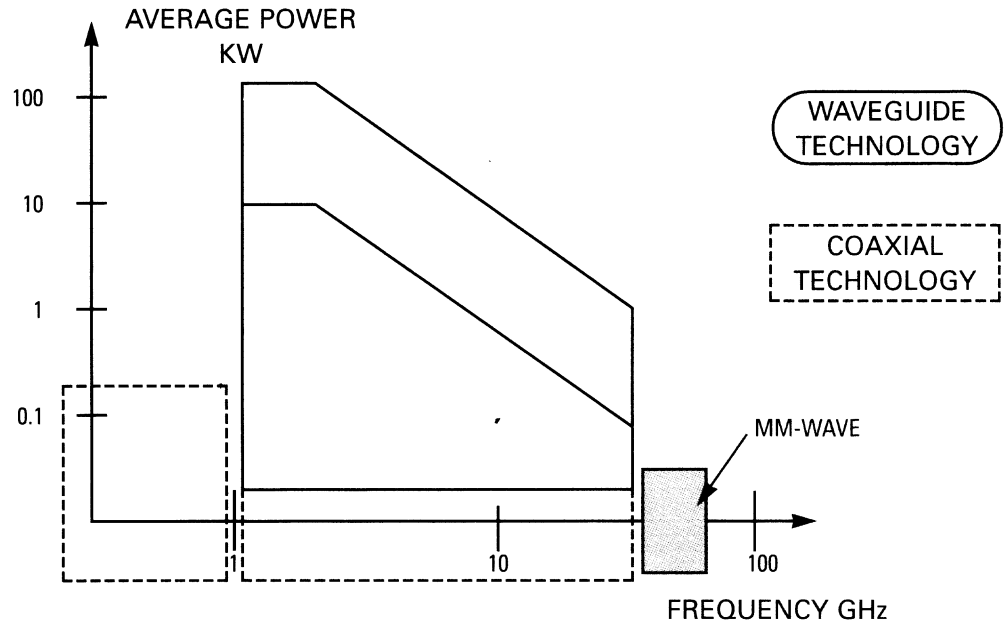


R140
WR62 waveguide

FJ2010



MILLIMETER WAVEGUIDE DEVICES 18 TO 40 GHz



General information

TEKELEC TEMEX is actively involved in the in-house development of ferrite materials used in millimeter wave circulators, isolators and duplexers.

Our proprietary CAD software is the result of years of microwave device design experience. This has enabled us to optimize technological features in three product lines:

- Y-junction circulators (H-plane configuration)
- Miniature isolators (these are Y-junctions with an internal termination)
- 4-port differential phase shift circulators

These devices cover 18 to 94 GHz in seven standard waveguide sizes with an average power up to 1500 W at 30 GHz.

Options such as direction of circulation, Y- or T- shaped junctions, compact size, specific flanges and cascaded devices are available upon request.

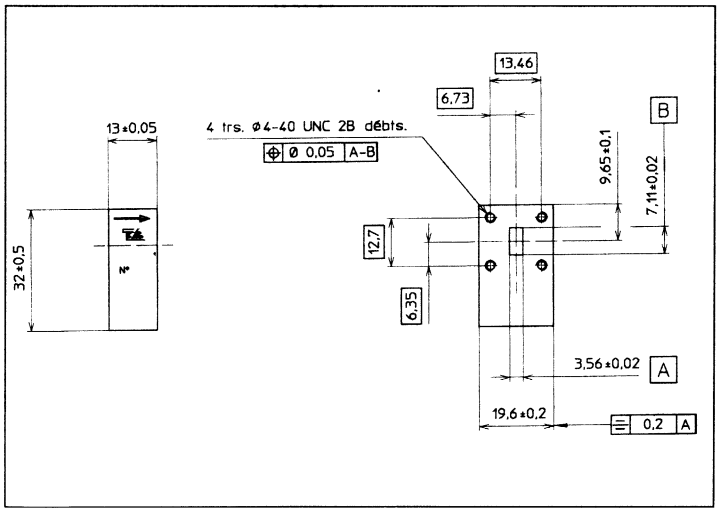
Electrical characteristics

Notes	Type	Frequency range (GHz)	Band-width (MHz)	Avg. power max W	Peak power max kW	Specifications at 25° C			Spec. in temperature range			Temperature range °C	FLANGE	DIMENSIONS mm approx.	WEIGHT g. approx.
						Isolation min. dB	Inse. loss max dB	VSWR max	Isolation min. dB	Inse. loss max dB	VSWR max				
WR42 waveguide					**(R220)**										
2	FJ3008	18-21	FULL	15	2	23	0.4	1.15	20	0.5	1.20	-40 to +70	UG 597/U	32 x 32 x 26	80
WR34 waveguide					**(R260)**										
3	FK6002	27.5-30	FULL	1500	1.5	2	0.6	1.20	20	0.6	1.20	0 to +55	SQUARE	194 x 176 x 127	-
WR28 waveguide					**(R320)**										
2	FK3001	27-32	FULL	2	2	20	0.4	1.25	20	0.5	1.25	-10 to +60	UG599/U	30 x 31 x 24	80
2	FK3007	33-37	FULL	2	2	20	0.4	1.25	20	0.5	1.25	-10 to +60	UG599/U	30 x 31 x 24	80
3-4	FK6001	34.5-35.5	FULL	50	50	20	0.5	1.20	20	0.5	1.20	-10 to +85	UG599/U	127 x 44 x 35	320
2	FK3002	35-40	FULL	2	2	20	0.4	1.25	20	0.5	1.25	-10 to +60	UG599/U	30 x 31 x 24	80
1	FK1016	37-39.5	FULL	1	-	20	0.3	1.20	17	0.5	1.25	-30 to +80	UG599/U	13 x 32 x 19.6	-
1	FK3016	37-39.5	FULL	1	-	20	0.3	1.20	17	0.5	1.25	-30 to +80	UG599/U	13 x 32 x 19.6	-

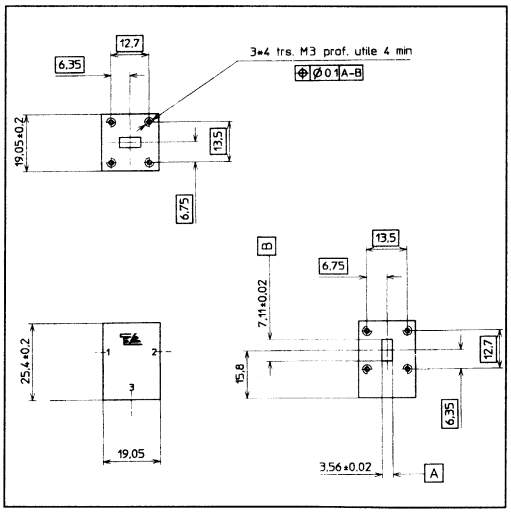
NOTES:

(1) Miniature isolator
(2) Y-Junction circulator
(3) 4-port differential phase shift circulator (duplexer)
(4) Air cooled pressurized 2 kg

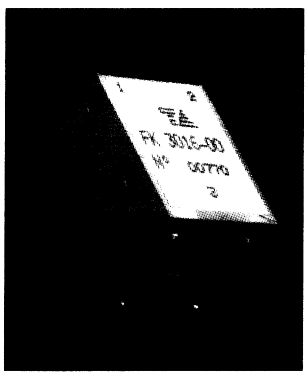
Outline drawings



FK1016-01



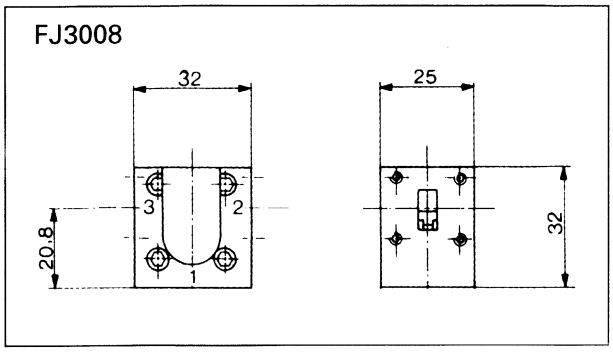
FK3016-01



Outline drawings

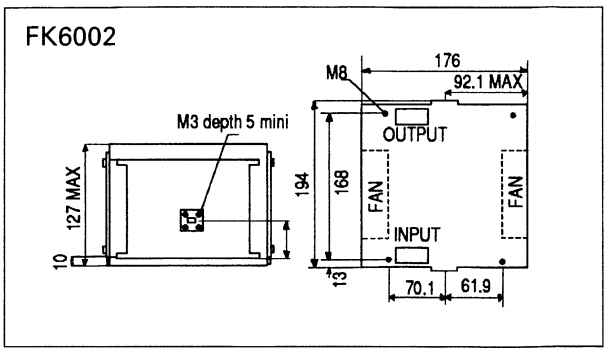
R220
WR42 waveguide

FJ3008



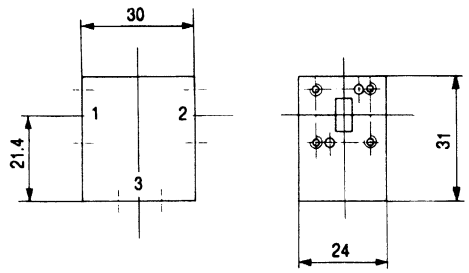
R260
WR34 waveguide

FK6002



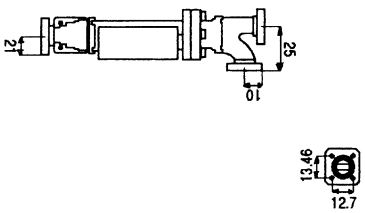
R320
WR28 waveguide

FK3001 - FK3007 - FK3002

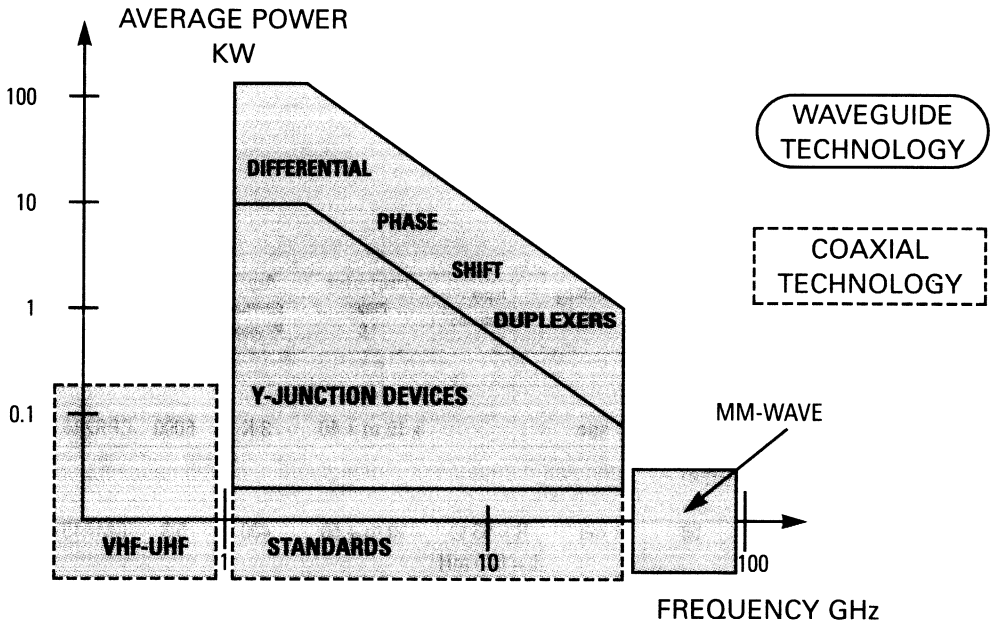


R320
WR28 waveguide

FK6001



WAVEGUIDE FERRITE SWITCHES



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General description

TEKELEC TEMEX's high-performance ferrite switches are designed to handle a variety of extremely high-power applications. They are suitable for use in high reliability waveguide systems, such as satellite payloads, military radars and scientific applications.

The following production devices represent only a sample of our capability in for both technologies:

- 3-port junctions,
- 4-port phase shift switches.

The time-proven devices are current-drive operated, with fast switching speed and exellent electrical performances.

Electrical characteristics

Type	Frequency range (GHz)	Isolation dB min	Inser. loss dB max	V.S.W.R.	Control current mA max	Switching time	Input impedance	Temperature range °C	Avg. power W max	Peak power kW max	Flange	Dimensions mm approx.	Weight kg. approx.
WR284 waveguide					**(R32)**								
FE7102[1]	2.998	20	0.3	1.15	500	1 sec		+ 10 to + 40	3 K	6000	CPR284 F	635x273x194	45
WR159 waveguide					**(R58)**								
FG7100	5.2 - 5.4	20	0.15	1.15	58	1 ms	R = 55 Ω L = 675 mH	- 10 to + 50	400	5.3	CMR159	82 x 84 x 96	0.9
WR112 waveguide					**(R84)**								
FI7101[2]	9 - 9.2	30	0.4	1.15	500	30 ms		- 10 to + 60	250	250	UG51/U	80 x 90 x 242	1.7
WR62 waveguide					**(R140)**								
FJ7101	16 BW: 4.4%	20	0.3	1.20	200	1 ms	R = 6.5 Ω L: 16.5 mH	- 40 to + 70	100	2	UG419/U	40 x 46 x 50	0.22

Notes:
(1) Pressurized SF_6 (15 PSIG) (2) Pressurized air (15 PSIG)

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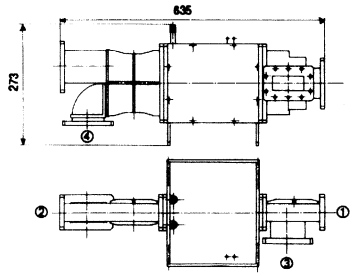
Outline drawings

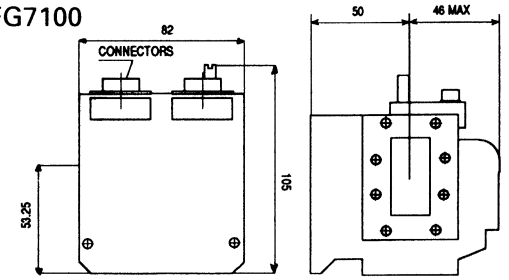
R32
WR284 waveguide

FE7102



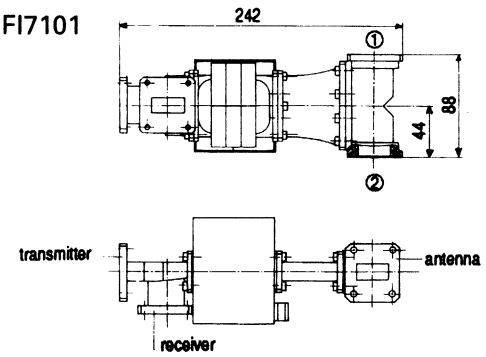
R58
WR159 waveguide

FG7100



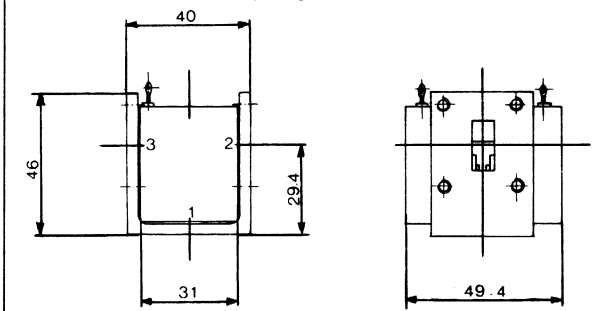
R84
WR112 waveguide

FI7101



R140
WR62 waveguide

FJ7101



DESIGN AID

Selection Guide

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INTERNATIONAL DESIGNATIONS FOR STANDARD RECTANGULAR WAVEGUIDES

	FREQUENCY RANGE (TE_{01} MODE) GHz	WAVEGUIDE SIZE						NORM: MIL - W - 85 (USA)						NORM: NATO		
		OUTER DIMENSIONS mm		INNER DIMENSIONS mm		TOLERANCES WALL THICKNESS ±mm	mm	DESIGNATION M - 85 - ( )						DESIGNATION NGW - ( )		
		WIDTH (a)	HEIGHT (b)	WIDTH (a)	HEIGHT (b)			Ag	Cu	BRASS or (Cu + Ag)*	ALUMINIUM ALLOY 1100	6061	6063	Al 1100	Ag	BRASS
1	0.320 - 0.490	593.8	301.7	584.2	292.1		3.18				1-001	1-002	1-161			
2	0.340 - 0.535	543.0	276.3	533.4	266.7		3.18				1-003	1-004	1-162			
3	0.410 - 0.620	436.6	235.0	457.2	228.6		3.18				1-005	1-006	1-163	1-A01		
4	0.490 - 0.750	387.6	196.9	381.0	190.5		3.18				1-007	1-008	1-164	1-A02		
5	0.640 - 0.975	298.5	152.4	292.1	146.05		3.18				1-009	1-010	1-165	1-A03		
6	0.755 - 1.150	254.0	130.2	247.65	123.82		3.18				1-011	1-012	1-166	1-A04		
7	0.960 - 1.46	195.6	97.8	195.58	97.79		3.18				1-013	1-014	1-167	1-A05		
8	1.13 - 1.73	169.2	86.6	165.10	82.55	0.33	2.03		1-015	1-017	1-018	1-019	1-168	1-A06		3A06
9	1.45 - 2.20	133.6	68.8	129.54	64.77	0.26	2.03		1-021	1-023	1-025	1-026	1-169			
10	1.72 - 2.61	113.3	58.7	109.22	54.61	0.22	2.03		1-027	1-031	1-029	1-030	1-170	1-A08		3A08
11	2.12 - 3.20			88.9	44.45	0.17	2.03									
12	2.17 - 3.30	90.42	47.24	86.36	43.18	0.17	2.3		1-033	1-037	1-035	1-036	1-171	1-A09		3A09
13	2.60 - 3.95	76.20	38.10	72.14	34.04	0.14	2.03		1-039	1-043	1-041	1-042	1-172	1-A10		3A10
14	3.22 - 4.90	61.42	32.33	58.17	29.08	0.12	1.63		1-045	1-049	1-047	1-048	1-173			
15	3.95 - 6.00	50.80	25.40	47.55	22.15	0.095	1.63		1-0.51	1-055	1-053	1-054	1-174	1-A12		3A12
16	4.65 - 7.05	43.64	23.44	40.39	20.19	0.081	1.63		1-057	1-061	1-059	1-060	1-175			
17	5.4 - 8.2	38.10	19.05	34.85	15.80	0.070	1.63		1-063	1-067	1-065	1-066	1-176	1-A14		3A14
18	6.55 - 10.0	31.75	15.88	28.50	12.62	0.06	1.63		1-069	1-073	1-071	1-072	1-177	1-A15		3A15
19	8.2 - 12.5	25.40	12.70	22.86	10.16	0.05	1.27		1-075	1-079	1-077	1-078	1-078	1-A16		3A16
20	9.8 - 15.0	21.59	12.06	19.05	9.52	0.04	1.27		1-081	1-085	1-083	1-084	1-179			
21	11.9 - 18.0	17.83	9.93	15.80	7.90	0.03	1.02	1-093	1-087	1-089	1-090	1-091	1-180	1-A18	6-A18	3A18
22	14.5 - 22.0	14.99	8.51	12.95	6.48	0.026	1.02		1-094	1-096	1-097	1-098	1-181			
23	18.0 - 26.5	12.70	6.35	10.67	4.32	0.022	1.02	1-106	1-100	1-102	1-103	1-104	1-182	1-A20	6-A20	3A20
24	22.0 - 33.0	10.67	6.35	8.64	4.32	0.020	1.02	1-113	1-107	1-109	1-110	1-111	1-183			
25	26.5 - 40.0	9.14	5.59	7.11	3.56	0.020	1.02	3-006	3-007	3-008*		3-009			6-A22	
26	33.0 - 50.0	7.72	4.88	5.69	2.845	0.020	1.02	3-010	3-012	3-013*		3-013			6-A23	
27	40.0 - 60.0	6.81	4.42	4.78	2.39	0.020	1.02	3-014	3-015	3-016*						
28	50.0 - 75.0	5.79	3.91	3.79	1.88	0.020	1.02	3-017	3-018	3-019*					6-A25	
29	60.0 - 90.0	5.13	3.58	3.10	1.55	0.015	1.02	3-020	3-021	3-022*					6-A26	
30	75.0 - 110.0	4.57	3.30	2.54	1.27	0.010	1.02	3-023	3-024	3-025*						
31	90.0 - 140.0	3.56	2.54	2.032	1.016	0.008	0.76	3-026	3-027	3-028*						
32	110.0 - 170.0	3.175	2.35	1.651	0.826	0.0064	0.76	3-029	3-030	3-031*						
33	140.0 - 220.0	2.819	2.172	1.296	0.648	0.0064	0.76	3-032	3-033	3-034*						
34	170.0 - 260.0	2.616	2.070	1.092	0.546	0.0051	0.76	3-035	3-036	3-037*						
35	220.0 - 325.0	2.388	1.956	0.864	0.432	0.0051	0.76	3-038	3-039	3-040*						

(2) Pulse length: 1µs - Breakdown strength (dry air): 15 KV/cm - P = 15 psia

DESIGN AID

International designations for standard rectangular waveguides

	NORM: UK	NORM: JAN (USA)			NORM: EIA (USA)	E.I.C. OFFICIAL NORM	TE_{10} MODE CUT-OFF FREQUENCY	THEORICAL ATTENUATION		THEORICAL max PEAK POWER		COPPER GUIDE ($\Delta T = 110°C$) MAX MEAN POWER	
	DESIGNATION WG - ( )	DESIGNATION RG - ( )			DESIGNATION WR - ( )	OFFICIAL DESIGNATION R - ( )	GHz	dB/100m		AT: MW		AT: KW	
		BRASS Ag	*Cu-Ag	Al **Cu				$1.25f_c$	$1.9f_c$	$1.25f_c$	$1.9f_c$	$1.25f_c$	$1.9f_c$
1	00			290	2300	3	0.256	0.164	0.099	153	212	5900	8500
2	0			291	2100	4	0.281	0.173	0.109	120	173	4500	6800
3	1			201	1800	5	0.328	0.180	0.122	93.4	132	3200	4900
4	2			202	1500	6	0.393	0.220	0.160	67.6	93.3	2100	3100
5	3			203	1150	8	0.513	0.336	0.240	35	53.8	1150	1700
6	4			204	975	9	0.605	0.440	0.305	27	38.5	760	1200
7	5			205	770	12	0.766	0.635	0.436	17.2	24.1	450	700
8	6		69	103	650	14	0.908	0.88	0.58	118	17.1	300	480
9	7		337	338	510	18	1.157	1.123	0.84	7.5	10.6	180	270
10	8		104	105	430	22	1.373	1.63	1.08	5.2	7.5	115	190
11	9						1.686						
12	9A		112	113	340	26	1.737	2.21	1.54	3.4	4.7	72	110
13	10		48	75	284	32	2.078	2.40	1.64	2.18	3.1	45	67
14	11A		340	341	229	40	2.579	3.92	2.78	1.56	2.14	30	46
15	12		49	95	187	48	3.155	5.79	4.00	0.94	1.32	18	24
16	13		343	344	159	58	3.714	6.62	6.00	0.754	0.983	12	19
17	14		50	106	137	70	4.285	8.19	6.47	0.554	0.696	8	12
18	15		51	68	112	84	5.260	11.5	8.91	0.355	0.454	51	7.6
19	16		52	67	90	100	6.560	17.9	12.4	0.206	0.896	32	4.5
20	17		346	347	75	120	7.873	21.2	14.8	0.166	0.229	24	3.4
21	18	107	91	349	62	140	9.490	26.7	19.6	0.119	0.157	16	2.2
22	19	353	**352	351	51	180	11.578	36.5	36.4	0.079	0.106	100	1.4
23	20	66	53	121	42	220	14.080	57.1	42	0.043	0.058	0.53	0.8
24	21		*357		34	260	17.368	53	36.8	0.034	0.047	0.4	0.6
25	22	96	*271		28	320	21.100	72	49.2	0.023	0.32	0.28	0.4
26	23	97	**272		22	400	26.350	101	68	0.014	0.020	0.17	0.26
27	24		*358		19	500	31.410	127	89	0.010	0.014	0.14	0.20
28	25	98	*273		15	620	39.900	188	128	0.0063	0.0090		
29	26	99	*274		12	740	48.400	257	172	0.0042	0.060		
30	27		*359		10	900	59.050	330	232	0.0028	0.0040		
31	28	138	*278		8	1200	73.840	500	325	0.0018	0.0026		
32	29	136	*276		7	1400	90.485	715	449	0.0012	0.0017		
33	30	135	*275		5	1800	115.75	1010	633	0.00071	0.00107		
34	31	137	*277		4	2200	137.52	1260	833	0.00052	0.00075		
35	32	139			3	2600	173.29	1660	1140	0.00035	0.00047		

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INTERNATIONAL DESIGNATIONS FOR FLANGES

	FLANGES											WAVEGUIDE		CIRCULAR PIN FLANGE	
	OFFICIAL DESIGNATIONS: IEC NORM FLANGE: C(1) / IEC-P(2) / U(3) — A B C D E F WAVEGUIDE: R - ( )											NORM: EIA WR - ( )	NORM: IEC R - ( )	NORM: EIA WR - ( ) BRASS	NORM: EIA WR - ( )
	CA-R( )	CB-R( )	PA-R( )	PB-R( )	PC-R( )	PD-R( )	PF-R( )	UA-R( )	UB-R( )	UD-R( )	UE-R( )				
1						X				X		2300	3		
2						X				X		2100	4		
3						X				X		1800	5		
4						X				X		1500	6		
5						X				X		1150	8		
6						X				X		975	9		
7						X				X		770	12		
8						X				X		650	14		
9						X				X		510	18		
10						X				X		430	22		
11						X				X		340	26		
12	X		X			X		X		X	X	284	32		
13						X				X	X	229	40		
14	X		X			X		X		X	X	187	48		
15	X		X			X		X		X	X	159	58		
16	X		X			X		X		X	X	137	70		
17		X		X		X			X	X	X	112	84		
18		X		X		X			X	X	X	90	100		
19				X		X			X	X		75	120		
20		X		X		X			X	X		62	140		
21						X				X		51	180		
22		X		X	X				X			42	220		
23					X							34	260		
24		X		X	X				X			28	320	381	67 B005
25					X							22	400	383	67 B006
26					X							19	500	383 N	67 B007
27							X					15	620	385	67 B008
28							X					12	740	387	67 B009
29							X					10	900	387 M	67 B010
30							X					8	1200	387 M	74 - 001
31												7	1400	387 M	74 - 002
32												5	1800	387 M	74 - 003
33												4	2200		
34												3	2600		
35								UH-R							
36								X					35		
37								X					41		

NOTES:

(1) pressurizable with "choke flanges"
(2) pressurizable
(3) no-pressurizable

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	FLANGES											
	NORM: JAN UG - ( ) / U										NORM: EIA CPR - ( ) F: FLAT G: GROOVE	NORM: EIA CMR - ( ) F: FLAT
	"STANDARD"								"CHOKE FLANGE"			
	BRASS				ALUMINIUM ALLOY				BRASS	ALUMINIUM ALLOY		
	"FLAT"	~ CMR	~ CPR-F	~ CPR-G	"FLAT"	~ CMR	~ CPR-F	~ CPR-G				
1											2300	
2											2100	
3											1800	
4											1500	
5											1150	
6											975	
7											770	
8	417 B		1714	1362	418 B		1720	1343			650	
9			1715	1718			1717	1719			510	
10	435 A B		1716	1344	437 A		1711	1345			430	
11	553 A		1712	1346	554 A		1713	1747			340	
12	53	1479	1724	1348	584	1484	1725	1349	54 A	585 A	284	284
13			1726	1350			1727	1351			229	229
14	149 A	1475	1728	1352	407	1480	1729	1353	148 B C	406 A B	187	187
15			1730	1354			1731	1355			159	159
16	344	1476	1732	1356	441	1481	1733	1357	343 A B	440 A B	137	137
17	51	1477	1734	1358	138	1482	1735	1359	52 A B	137 A	112	112
18	39	1478	1736	1360	135	1483	1737	1371	40 A	136 A	90	90
19												
20	419				1665				541 A	1666		
21					597				596 A	596 A		
22	505											
23												
24	599								600 A B			
25	599 N	1521										
26	599 N											
27	599 M	1523										
28	599 M	1522										
19												
30												
31												
32												
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36												
37												

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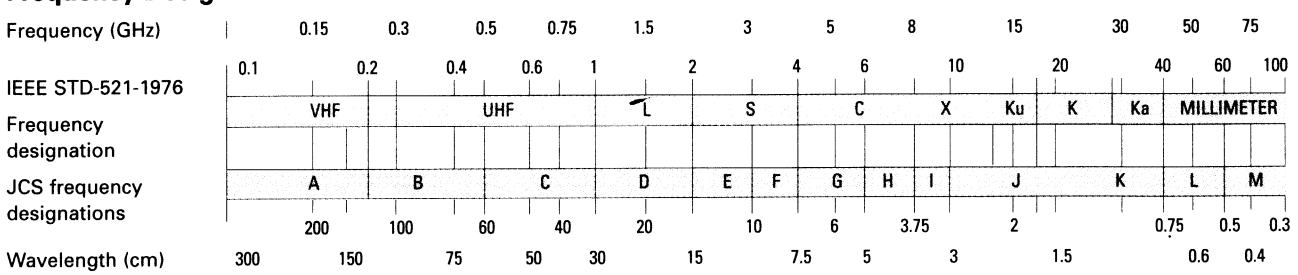
EFFECT OF V.S.W.R. ON TRANSMITTED POWER

V.S.W.R.	V.S.W.R. dB	RETURN LOSS dB	TRANS. LOSS dB	VOLT REFL. COEFF.	POWER TRANS %	POWER REFL. %	V.S.W.R.	V.S.W.R. dB	RETURN LOSS dB	TRANS. LOSS dB	VOLT REFL. COEFF.	POWER TRANS %	POWER REFL. %
1.00	.0	∞	.000	.00	100.0	.0	1.64	4.3	12.3	.263	.24	94.1	5.9
1 01	.1	46.1	.000	.00	100.0	.0	1.66	4.4	12.1	.276	.25	93.8	6.2
1.02	.2	40.1	.000	.01	100.0	.0	1.68	4.5	11.9	.289	.25	93.6	6.4
1 03	.3	36.6	.001	.01	100.0	.0	1.70	4.5	11.7	.302	.26	93.3	6.7
1 04	.3	34.2	.002	.02	100.0	.0	1.72	4.7	11.5	.315	.26	93.0	7.0
1.05	.4	32.3	.003	.02	99.9	.1	1.74	4.8	11.4	.329	.27	92.7	7.3
1.06	.5	30.7	.004	.03	99.9	.1	1.76	4.9	11.2	.342	.28	92.4	7.6
1.07	.6	29.4	.005	.03	99.9	.1	1.78	5.0	11.0	.356	.28	92.1	7.9
1.08	.7	28.3	.006	.04	99.9	.1	1.80	5.1	10.9	.370	.29	91.8	8.2
1.09	.7	27.3	.008	.04	99.8	.2	1.82	5.2	10.7	.384	.29	91.5	8.5
1.10	.8	26.4	.010	.05	99.8	.2	1.84	5.3	10.6	.398	.30	91.3	8.7
1.11	.9	24.7	.012	.05	99.7	.3	1.86	5.4	10.4	.412	.30	91.0	9.0
1.12	1.0	24.9	.014	.06	99.7	.3	1.88	5.5	10.3	.426	.31	90.7	9.3
1 13	1.1	24.3	.016	.06	99.6	.4	1.90	5.6	10.2	.440	.31	90.4	9.6
1.14	1.1	23.7	.019	.07	99.6	.4	1.92	5.7	10.0	.454	.32	90.1	9.9
1.15	1.2	23.1	.021	.07	99.5	.5	1.94	5.8	9.9	.468	.32	89.8	10.2
1.16	1.3	22.6	.024	.07	99.5	.5	1.96	5.8	9.8	.483	.32	89.5	10.5
1.17	1.4	22.1	.027	.08	99.4	.6	1.98	5.9	9.7	.497	.33	89.2	10.8
1.18	1.4	21.7	.030	.08	99.3	.7	2.00	6.0	9.5	.512	.33	88.9	11.1
1.19	1.5	21.2	.033	.09	99.2	.8	2.50	8.0	7.4	.881	.43	81.6	18.4
1.20	1.6	20.8	.036	.09	99.2	.8	3.00	9.5	6.0	1.249	.50	75.0	25.0
1.21	1.7	20.4	.039	.10	99.1	.9	3.50	10.9	5.1	1.603	.56	69.1	30.9
1.22	1.7	20.1	.043	.10	99.0	1.0	4.00	12.0	4.4	1.938	.60	64.0	36.0
1.23	1.8	19.7	.046	.10	98.9	1.1	4.50	13.1	3.9	2.255	.64	59.5	40.5
1.24	1.9	19.4	.050	.11	98.9	1.1	5.00	14.0	3.5	2.553	.67	55.6	44.4
1.25	1.9	19.1	.054	.11	98.9	1.2	5.50	14.8	3.2	2.834	.69	52.1	47.9
1.26	2.0	18.8	.058	.12	98.7	1.3	6.00	15.6	2.9	3.100	.71	49.0	51.0
1.27	2.1	18.5	.062	.12	98.6	1.4	6.50	16.3	2.7	3.351	.73	46.2	53.8
1.28	2.1	18.2	.066	.12	98.5	1.5	7.00	16.9	2.5	3.590	.75	43.7	56.2
1.29	2.2	17.9	.070	.13	98.4	1.6	7.50	17.5	2.3	3.817	.76	41.5	58.5
1.30	2.3	17.7	.075	.13	98.3	1.7	8.00	18.1	2.2	4.033	.78	39.5	60.5
1.32	2.4	17.2	.083	.14	98.1	1.9	8.50	18.6	2.1	4.240	.79	37.7	62.3
1.34	2.5	16.8	.093	.15	97.9	2.1	9.00	19.1	1.9	4.437	.80	36.0	64.0
1.36	2.7	16.3	.102	.15	97.7	2.3	9.50	19.6	1.8	4.626	.81	34.5	65.5
1.38	2.8	15.9	.112	.16	97.5	2.5	10.00	20.0	1.7	4.807	.82	33.1	66.9
1.40	2.9	15.6	.122	.17	97.2	2.8	11.00	20.8	1.6	5.149	.83	30.6	69.4
1.42	3.0	15.2	.133	.17	97.0	3.0	12.00	21.6	1.5	5.466	.85	28.4	71.6
1.44	3.2	14.9	.144	.18	96.7	3.3	13.00	22.3	1.3	5.762	.86	26.5	73.5
1.46	3.3	14.6	.155	.19	96.5	3.5	14.00	22.9	1.2	6.040	.87	24.9	75.1
1.48	3.4	14.3	.166	.19	96.3	3.7	15.00	23.5	1.2	6.301	.88	23.4	76.6
1.50	3.5	14.0	.177	.20	96.0	4.0	16.00	24.1	1.1	6.547	.88	22.1	77.9
1.52	3.6	13.7	.189	.21	95.7	4.3	17.00	24.6	1.0	6.780	.89	21.0	79.0
1.54	3.8	13.4	.201	.21	95.5	4.5	18.00	25.1	1.0	7.002	.89	19.9	80.1
1.56	3.9	13.2	.213	.22	95.2	4.8	19.00	25.6	.9	7.212	.90	19.0	81.0
1.58	4.0	13.0	.225	.22	94.9	5.1	20.00	26.0	.9	7.413	.90	18.1	81.9
1.60	4.1	12.7	.238	.23	94.7	5.3	25.00	28.0	.7	8.299	.92	14.8	85.2
1.62	4.2	12.5	.250	.24	94.4	5.6	30.00	29.5	.6	9.035	.94	12.5	87.5

Frequency Designation Chart



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HOW TO ORDER

FOR INSTANCE: B J 1 0 0 9 - 0 0

X X X X X X - X X

TECHNOLOGY

B COAXIAL DEVICE

F WAVEGUIDE DEVICE

L, N DROP-IN DEVICE

U SMD DEVICE

FREQUENCY RANGE

USING JCS FREQUENCY DESIGNATION
ex: J = 10 to 20 GHz

MODEL

1 ISOLATOR

2 "UNILINE" WITHOUT CIRCULATOR

3 3-PORT CIRCULATOR

4 4-PORT CIRCULATOR

5 5-PORT CIRCULATOR

6 DIFFERENTIAL PHASE SHIFT CIRCULATOR

7 SWITCH/MODULATOR/PHASE SHIFTER/ATTENUATOR

8 SUBSYSTEM

9 DUMMY LOAD (Low and High Power)

NUMBER OF LOADS/FEATURE

1 WITH 1 LOAD

2 WITH 2 LOADS

3 MODULATOR

5 PHASE SHIFTER

7 ATTENUATOR

8 VERY LOW LOSS DEVICE

9 WIDE BAND DEVICE

INTERNAL PACKAGE SERIAL NUMBER

CUSTOMER'S PART - NUMBER

00 CATALOG REFERENCE

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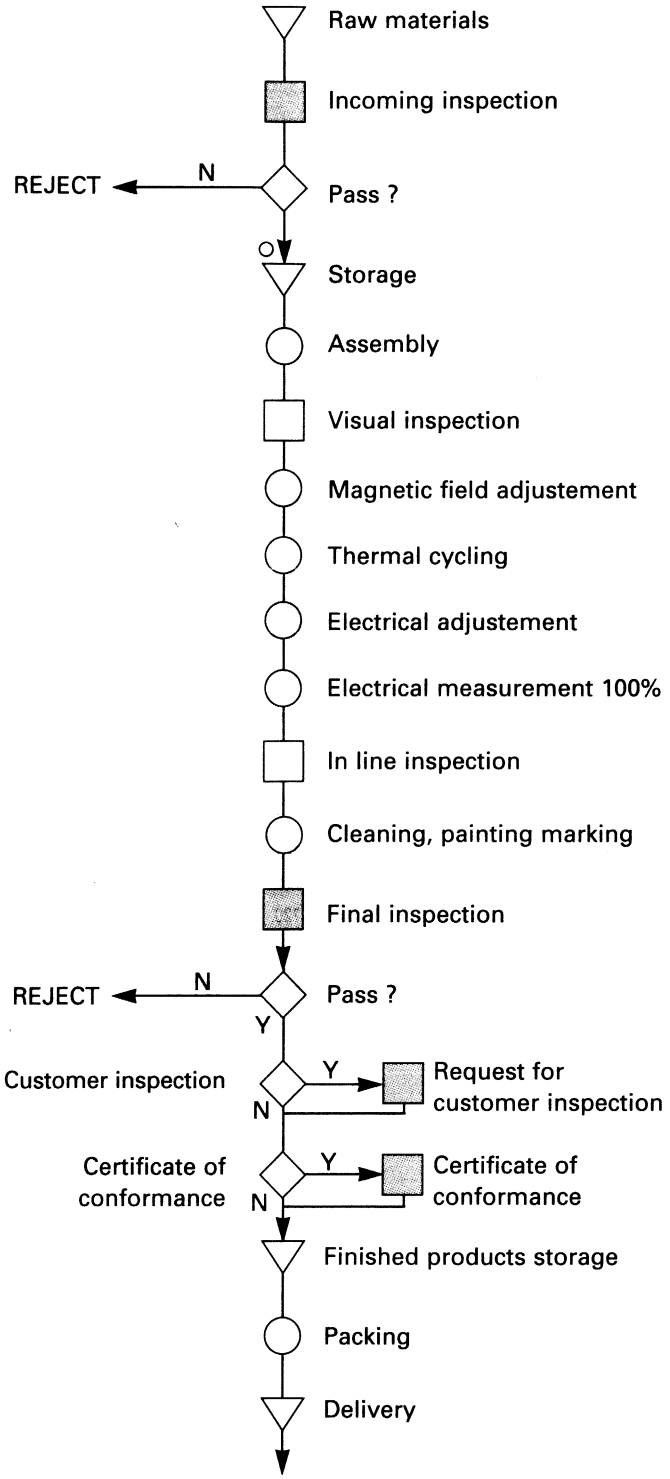
QUALITY ASSURANCE

Manufacturing flow-chart



Overview

TEKELEC TEMEX's Quality assurance programme is based on the requirements of ISO9001. Beyond these requirements, TEKELEC TEMEX defines "quality" as customer satisfaction; and to assure that, the TEKELEC TEMEX Quality Assurance Group works closely with engineering and production groups.

The Company is actively involved in industry task groups concerned with microwave component standards, i.e:

- electrical measuring methods and test conditions: i.e NFC 96-316 (for microwave devices, circulators and isolators).

The high quality of our custom designs is the result of close cooperation between the engineering teams of the customer and those at TEKELEC TEMEX.

Reproducability is ensured by rigorous control of all procedures and operations, per MIL Q 9858A.

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After temperature stabilization, the quality level of delivered models is periodically checked by sampling, according to the tests hereunder and the testing procedures defined in the relevant specifications.

TESTS \ CONDITIONS		5	6	7	8	DOCUMENTS		
						NFC	IEC	MIL-STD
K L	Thermal shocks	- 25°C + 70°C 5 cycles - 30 mn	-40°C +85°C 5 cycles - 30 mn	-40°C +100°C 5 cycles - 30 mn	-55°C +125°C 5 cycles - 30 mn	20-714 Na Test Nb Test	68-2-14 Na Test Nb Test	202 F Method 107 F
M	Mechanical shocks	30g 11 ms 3 shocks 3 axes	50g 11 ms 3 shocks 3 axes	100g 6 ms 3 shocks 3 axes	Detail SP	20-727 Ea Test	68-2-27 Ea Test	202 F Method 202 D
N	Sinusoïdal vibrations	10 Hz 55 Hz 10 g 3 axes 5 cycles 15 mn	10 Hz 500 Hz 10 g 3 axes 5 cycles 15 mn	10 Hz 2000 Hz 10 g 3 axes 5 cycles 20 mn	10 Hz 2000 Hz 20 g 3 axes 5 cycles 20 mn	20-706 Fc Test	68-2-6 Fc Test	202 F Method 201 A
P	Constant acceleration	20 g 3 axes 5 mn	50 g 3 axes 5 mn	100 g 3 axes 1 mn	200 g 3 axes 1 mn	20-707 Ga Test	68-2-7 Ga Test	202 F Method 212 A
R	Seal	Method 1 Qk test	Method 2 Qc test	Not applicable	Detail SP	20-717 Q Test	68-2-17 Q Test	202 F Method 112 C
S	Damp heat steady state	4 days 40°C - 93%	10 days 40°C - 93%	21 days 40°C - 93%	Detail SP	20-703 Ca Test	68-2-3 Ca Test	202 F Method 103 B
T	Solderability	Soldering heat Method Tb 260°C(1)	Tab termination solderability method Ta 235°C(2)	Not applicable	Detail SP	20-720 Tb Test Method 1A Ta Test Method 1	68-2-20 A(1) 68-2-20(2)	202 F Method 208 F

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GLOSSARY AND TECHNICAL INFORMATION

TECHNOLOGY

Y-Junction circulator

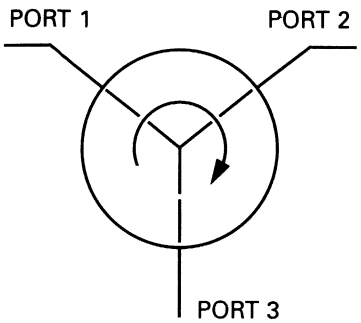

FIG. 1

The Y-junction circulator uses spinel ferrites or garnet ferrites in the presence of a magnetic bias field, to provide a non-reciprocal effect. A 3-port circulator (shown in figure 1) is the basic model which can be used to explain how it operates.

If a signal is applied at port # 1, it will emerge from port # 2 with a loss characteristic called insertion loss. Typical values of insertion loss 0.1 to 0.5 dB.

In the reverse direction, there will be leakage at port # 3 from the incoming signal at port # 1. This leakage called isolation is typically 20 dB below incoming power at port # 1.

Due to the "3rd order symmetry" of the Y-junction the behaviour is the same for the other ports, with respect to port # 1 to port # 2; port # 2 to port # 3 and port # 3 to port # 1. The circulator's role is to pass energy, for instance, in the RF-head of a radar, assuring high isolation between the high power transmitter and the sensitive low power receiver (figure 2).

The Y-junction exists in three main technologies:

- Coaxial devices: these feature triplate technology with coaxial connectors.
- Drop-in circulators: in triplate or microstrip technology.
- Waveguide devices: These consist of three waveguides forming an H-plane junction in either a "T" or a "Y"-symmetrical structure.

When very high power is needed, the technology uses a four-port differential phase shift duplexer.

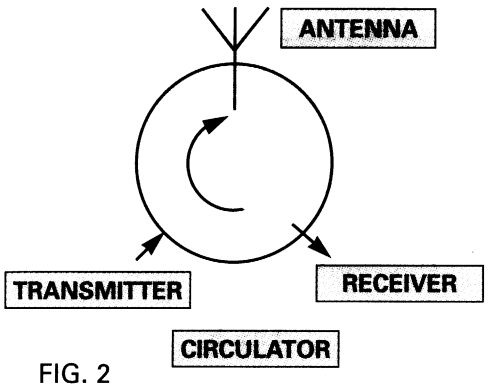

FIG. 2

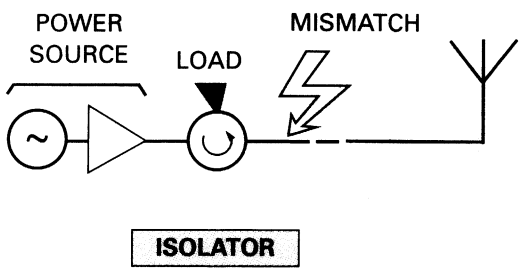

FIG. 3

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A Y-junction circulator can be made into an isolator by adding an internal termination on port # 3, for example.

The device passes signals with low loss (port # 1 to port # 2) and with high loss in the opposite direction.

It is used to "isolate" one microwave device from another. It can, for example, protect expensive, high-power RF sources from variations in loading conditions or mismatching (see figure 3).

4-Port differential phase shift circulator

This four-port-device is normally used with one load, such as a high-power circulator (duplexer); or with two dummy loads, such as a high-power isolator.

This circulator consists of three basic parts:

- hybrid folded magic tee
- twin parallel ferrite phase shift sections
- 3 dB coupler

Resonance isolator - Waveguide devices

By magnetically biasing a ferrite inside a waveguide, the non-reciprocal effect is obtained: with low losses in one direction and high losses (isolation) in the opposite direction.

Those isolators are only used for low and medium power (see figure 4).

The ferrite material has to dissipate the return power due to mismatch.

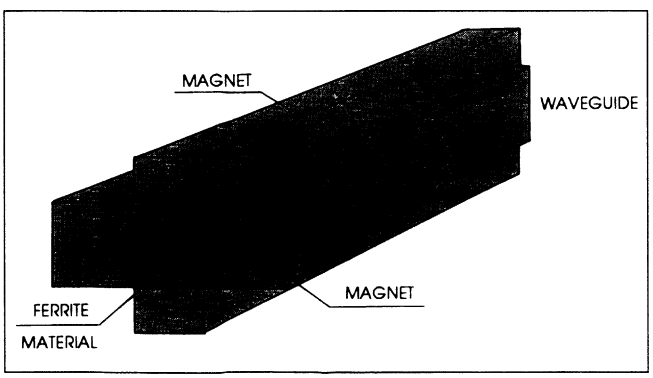

FIG .4

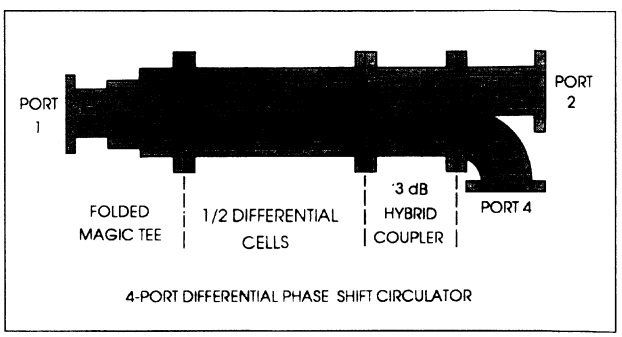

FIG. 5

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Ferrite switches

These devices change the polarity of the magnetic bias (N → S) and the RF-signal direction of circulation. This is made by a coil instead of a magnet. This technology is used for ferrite switches in both product lines:

- Y-junction
- 4 port differential phase shift device

ELECTRICAL FEATURES

All the parameters - insertion loss, isolation, VSWR, power - given in this section are absolute maximum ratings assured in the operating temperature range. Typical values are obviously better.

Insertion loss (I.L.)

If a signal is applied at port # 1, it will emerge from port # 2 with a loss characteristic called insertion loss which will be the ratio of the output signal to the input signal expressed in dB:

$$\text{I.L dB} = 10 \log_{10} \left[\frac{P_{in}}{P_{out}} \right]$$

Typical values: 0.1 to 0.4 dB.

Isolation

- For an isolator:

  If a signal is applied at port # 2, it will emerge from port # 1 with a high insertion loss called isolation which is also expressed in dB. (ratio of the output signal to the input signal).

- For a circulator:

  It should be noted that in the case of a circulator this parameter is not applicable. But it is common to use this parameter as if the circulator could be made into an isolator by terminating one port (e.g. port # 3) with a matched load. The isolation measured is dependent on the VSWR of both the termination and the circulator port.

Typical values: -20 to -30 dB

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VSWR

The reflection coefficient magnitude $|\rho|$ characterizes the reflective property of each port of an isolator or circulator (see Fig. 6).

$$|\rho| = \sqrt{\frac{P_{reff}}{P_{in}}}$$

It is useful to use the voltage standing wave ratio (VSWR)

$$VSWR = \frac{1 + |\rho|}{1 - |\rho|}$$

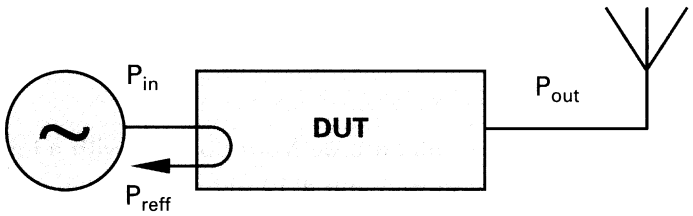

FIG. 6

Typical values: 1.07: 1 to 1.25: 1

Effect of an isolator on VSWR (see Fig.7)

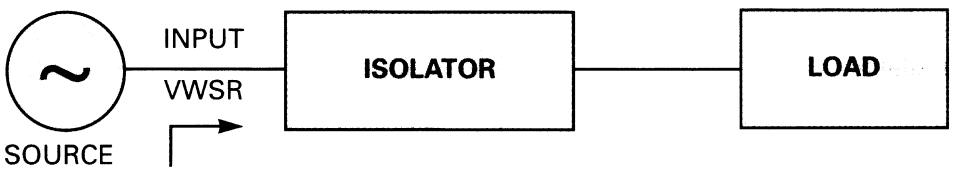

FIG. 7

The effective input VSWR of an isolator will vary at a function of the load VSWR. If the output load mismatch is increased, energy is reflected at the termination port, attenuated by the isolation and then reflected back to the input. This effect increases the total input VSWR observed at the input.

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The chart (Fig. 9) shows the effect of an isolator, to improve the input VSWR with a bad load VSWR:

Example:

The load VSWR is 10: 1, the isolator has 18 dB isolation, which improves the input VSWR to 1.20: 1.

Temperature range

The performance of a circulator or isolator is limited by ferrite and magnet material behaviour in the operating temperature range.

In this catalog, for each device the main specifications are given:

- at room temperature: 25°C
- over a specified temperature range.

Power rating

The input power to a ferrite device can be supplied from a CW or a pulsed source.
For pulsed source, peak and average power should be specified, pulse duration and duty cycle are also needed in order to determine an adequate safety margin.

Average Power

For high power products, average power is limited by the dissipation in the ferrite. Adequate cooling is necessary to insure the ferrite material does not reach excessive temperature.
There are three kinds of cooling: liquid, forced air, or natural convection.

Peak power

To avoid breakdown or arcing, special ferrite materials are designed.
Frequency of operation and peak-power level determine whether the waveguide circulator should be pressurized or unpressurized with dry air or gas (N_2 or SF_6).

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Load VSWR

Power rating of a ferrite device depends upon the mismatch at the output port (load VSWR); for instance for an isolator if load VSWR is 2: 1, more than 10% of the input power is reflected inside the ferrite device to the internal load.

In case of short-circuit (infinite load VSWR) the ferrite device has to handle the equivalent of twice the input CW-power, and the equivalent of a peak power equal to 4 times the input power, based on the higher internal voltage levels.

Therefore, the time-duration of short circuit or high load VSWR, is needed in order to determine an adequate safety margin.

Third order intermodulation products (IMP_{32})

Harmonics and third order intermodulation products appear when non-linear elements are used such as ferrite materials, metal welds, surface finish...

When two tones - F_1 and F_2 - are applied to a ferrite device, the relative amplitudes of $2F_1 - F_2$ and $2F_2-F_1$ are critical in some communication systems and should be specified when ordering (see Fig. 8).

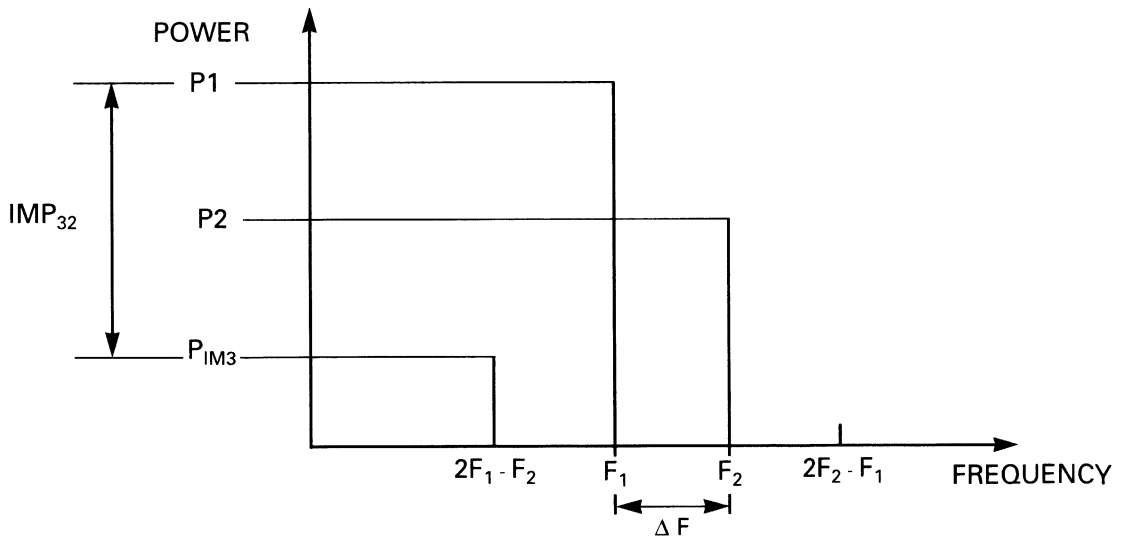


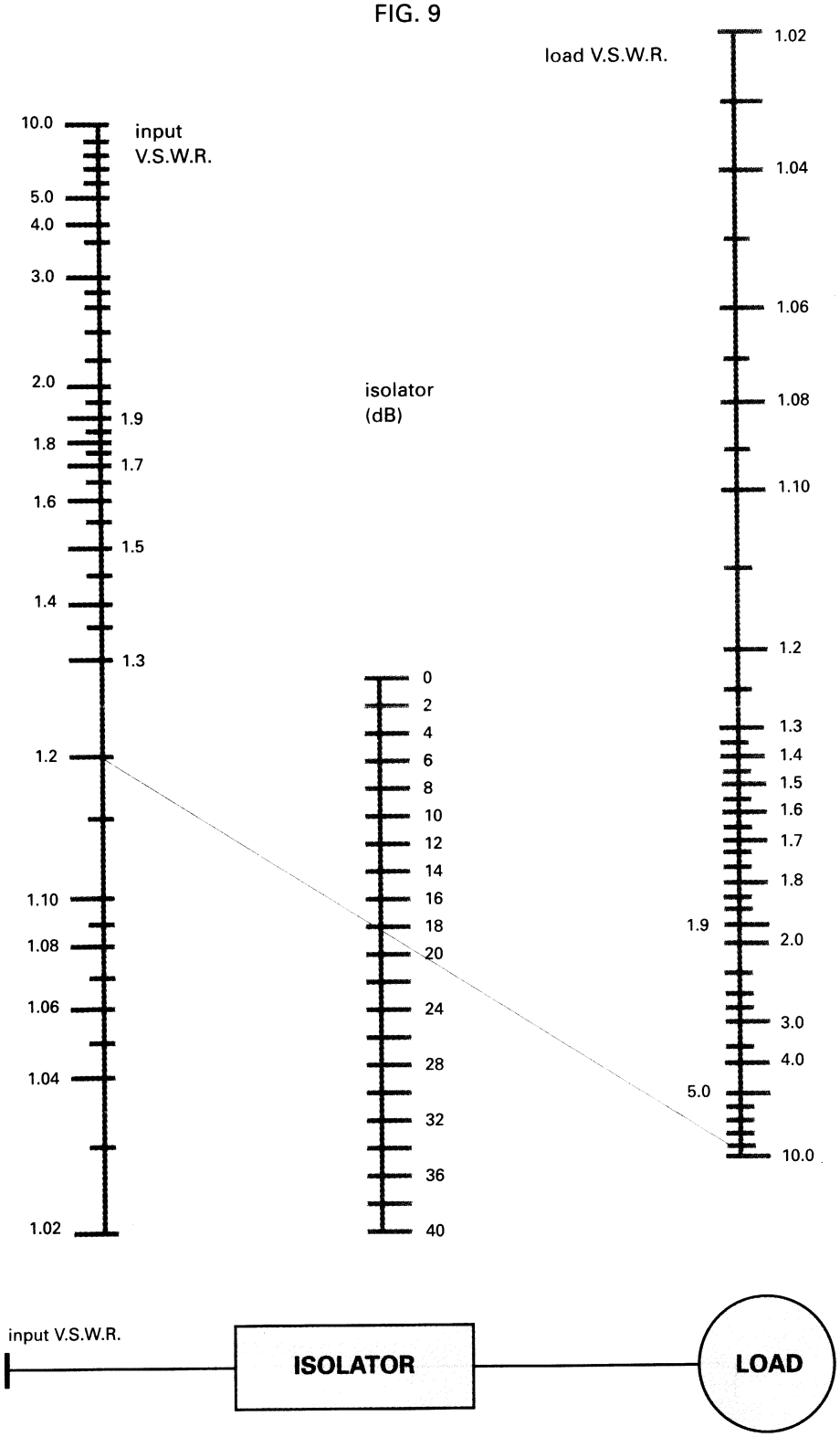
FIG. 8

- Test conditions (to be specified)
  - F_1 and F_2
  - P_1 and P_2 in W or dBm

- Third order intermodulation products
  - P_{IM3} in dBm or,
  - $IMP_{32} = P_{IM3} - P_1$ in dBc

Effect on an isolator on V.S.W.R

FIG. 9



ex: load V.S.W.R.: 10 Isolator isolation: 18 dB

By means of this nomograph we read the input V.S.W.R.: 1.2

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ISOLATOR AND CIRCULATOR SPECIFIC REQUEST

PART NUMBER (if existing) :
OPERATING FREQUENCY :
PACKAGE/DIMENSIONS :
AVERAGE POWER :
PEAK POWER :
PULSE LENGTH :
LOADS Qty :
Power rating :

STORAGE TEMPERATURE min: max:	ROOM TEMPERATURE	OPERATING TEMPERATURE min: max:
Insertion loss	dB	dB
Isolation	dB	dB
VS.W.R.		

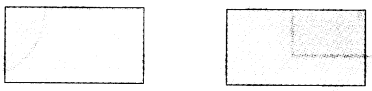
PRESSURIZATION air ❑ SF6 ❑
COOLING air ❑ water ❑
Cooling flow (l/min):
POSSIBLE SHORT CIRCUIT NO ❑
Duration: YES ❑
max V.S.W.R. on output port:

❑ COAXIAL
❑ WAVEGUIDE
Waveguide reference:

CONNECTORS (or flanges) AND TERMINATIONS

Port # 1: Port # 3:
Port # 2: Port # 4:

PORT CONFIGURATION



Direction of circulation (outline):

ENVIRONMENTAL CONDITIONS

SPACE ❑
MILITARY ❑
COMMERCIAL ❑
AIRBORNE ❑
NAVAL ❑

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RF & MICROWAVE MODULES

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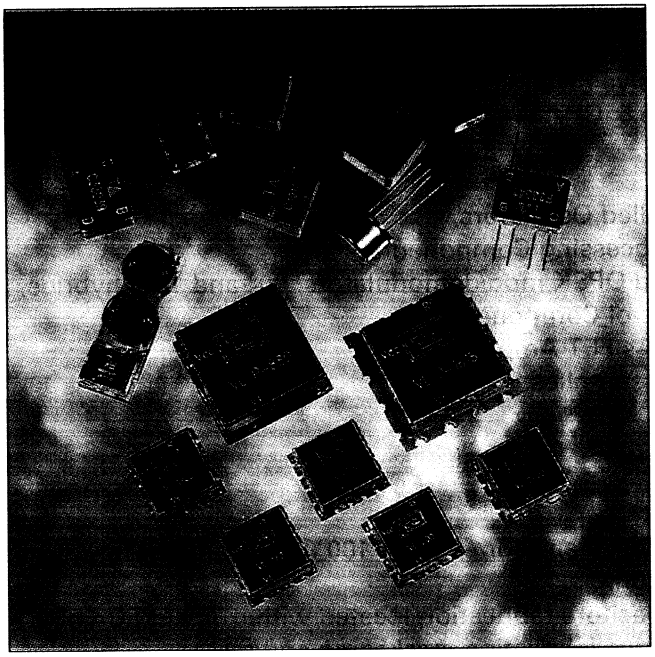

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Introduction

TEKELEC TEMEX designs, develops and manufactures standard and custom IF, RF and microwave modules for military and professional applications. TEKELEC TEMEX has the engineering ressources and production capacity of a large company, as well as the flexibility to rapidly deliver small quantities of catalog and custom products.

TEKELEC TEMEX manufacturing expertise includes both soft board solder assembly as well as thick and thin film: MIC assembly performed in a class 10,000 clean room with class 100 available under laminar flow. Comprehensive RF and Microwave test capabilities include noise figure and S-Parameter characterisation up to 26.5 GHz. With these process and test features, TEKELEC TEMEX product offering includes:

- Voltage Controlled Oscillators,
- RF/IF Signal Processing Components
  (mixers, I/Q and QPSK mod/demodulators, 90° and 180° hybrids, phase detectors),
- PIN Diode Control Components,
- Si BJT and GaAs FET Amplifiers,
- Customs subassemblies.

Facilities

- 500 square meters,
- MIC Class 10,000 clean room - Class 100 under laminar flow,
- Toroid fabrication,
- Microwave capacitors fabrication located within TEKELEC TEMEX,
- Microwave diodes fabrication, packaging and test,
- Engineering CAS - Touchstone, MDS, Autocad, etc...,
- PWB solder and MIC assembly
- Environmental test

Assembly and process

- Solder assembly - Soft board
- MIC assembly - Hard and soft substrates
- Substrate attach
  - Eutectic - Solder
  - Epoxy
- Die attach
  - Epoxy
  - Eutectic - Solder
- Wire bonding (manual and automatic)
- Ribbon bonding
- Wet etching

Test

- HP 8350 sweep oscillators,
- HP 83620A synthesied sweepers,
- HP 8970 noise figure meter,
- Wiltron 6409 network analyser,
- Wiltron 561 network analysers,
- HP 8510B network analyser,
- Wiltron 6646 Sweep generators,
- HP 8663, 8566 spectrum analyser,
- HP 85047 S parameter test set,
- HP 8563 network analysers,
- HP 8753 C network analysers,
- HP 8515S parameter test set.

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Quality

TEKELEC TEMEX Signal Processing Components are designed to meet the environmental specifications indicated below:

CLASS	TEST	SEVERITY			DOCUMENTS		
		1	2	3	NFC	IEC	METHOD
A	Temperature cycling	-55°C +100°C 5 cycles	-55°C +100°C 5 cycles	-55°C +85°C 5 cycles	20-714 Na test	66-2-14 Na test	MIL-STD 202 107
B	Thermal shock	0°C +100°C 5 cycles	-40°C +85°C 5 cycles	Detail specification	20-714 Nc test	20-714 Nc test	MIL-STD 750 1056
C	Mechanical shock	11 ms - 60 g 3 shocks 6 axis	1 ms - 500 g 3 shocks 6 axis	Detail specification	20-727 Ea test	68-2-17 Ea test	MIL-STD 202 213
D	Sinusoïdal vibration	10 Hz - 500 Hz 10 g - 3 axis 3 cycles-15mn	20 Hz - 2000 Hz 20 g - 3 axis 3 cycles-15mn	Resonance 20 g - 3 axis 1 cycle-60 mn	20-706 Fc test	66-2-6 Fc test	MIL-STD 202 204
E	Acceleration (steady state)	200 g 3 axis - 5 mn	2000 g 3 axis - 5 mn	20 000 g 3 axis - 1 mn	20-707 Ga test	66-2-7 Ga test	MIL-STD 202 212
F	Seal test	Qc test method 2	Helium FC 43 Lead testing liquid	Detail specification	20-717 Q test	66-2-17 Q test	MIL-STD 883 1014/A 1014/C
G	Damp heat	10 days +40°C - 95 %	21 days +40°C - 95 %	Climatic combined test	20-703 Ca test	66-2-3 Ca test	MIL-STD 202 103
H	Dry heat	H.T.R.B	Power burn-in	Detail spec	20-702 Ba test	66-3-2 Ba test	MIL-STD 750 1038

PACKAGE TYPE	ENVIRONMENTAL SPECIFICATION
TO-5 /TO-8 / Flat pack / SMD	A2 - B2 - C2 - D2 - E2 - F1 - G2 - H3
Relay header	A1 - B1 - C1 - D1 - E1 - F1 - G1 - H3
Plastic	A3 - B2 - C1 - D1 - E1 - G1 - H3 Hermeticity non applicable

External visual inspection of hermetically packaged devices is performed according to MIL - STD 883 Method 2009.9

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TEST	DROP-IN		TIGHT PACKAGED		UNTIGHT PACKAGED		Method
	Without driver	With driver	Without driver	With driver	Without driver	With driver	
Seal test gross leak	5.10^{-4} b/cm³ s	5.10^{-4} b/cm³ s	5.10^{-4} b/cm³ s	5.10^{-4} b/cm³ s			MIL-STD 883 1014/A 1014/C
Humidity	56 days + 40°C 95 % R.H.	56 days - 40°C 95 % R.H.	56 days + 40° C 95 % R.H.	56 days - 40° C 95 % R.H.			MIL-STD 202 103/D
Temperature cycling	-55°C +125°C 100 cycles	-55°C +115°C 100 cycles	-55°C +125°C 100 cycles	-55°C +115°C 100 cycles	-55°C -125°C 100 cycles	-45°C -115°C 100 cycles	MIL-STD 202 107
Storage	+125°C 1000 h -55°C 1000 h	-115°C 1000 h -55°C 1000 h	-115°C 1000 h -55°C 1000 h	-115°C 1000 h -45°C 1000 h	-125°C 1000 h -55°C 1000 h	-115°C 1000 h -45°C 1000 h	MIL-STD 810 501 502
Sinus vibration	20 Hz-2000 Hz 20 g 3 axis	20 Hz-2000 Hz 20 g 3 axis	20 Hz-2000 Hz 20 g 3 axis	20 Hz-2000 Hz 20 g 3 axis	20 Hz-2000 Hz 20 g 3 axis	20 Hz-2000 Hz 20 g 3 axis	MIL-STD 202 204/D
Random vibration	20 Hz-2000 Hz 0.6 g²/Hz	20 Hz-2000 Hz 0.6 g²/Hz	20 Hz-2000 Hz 0.3 g²/Hz	20 Hz-2000 Hz 0.3 g²/Hz	20 Hz-2000 Hz 0.3 g²/Hz	20 Hz-2000 Hz 0.3 g²/Hz	MIL-STD 202 214
Mechanical shock	100 g - 6 ms Half-time 3 shocks 6 axis	100 g - 6 ms Half-time 3 shocks 6 axis	50 g - 11 ms Half-time 3 shocks 6 axis	50 g - 11ms Half-time 3 shocks 6 axis	50 g - 11ms Half-time 3 shocks 6 axis	50 g - 11ms Half-time 3 shocks 6 axis	MIL-STD 202 213
Barometric pressure (reduced)	0.315 inch.Hg	0.315 inch.Hg	3.44 inch.Hg	3.44 inch.Hg			MIL-STD 202 105
Acceleration steady state	10.000 g 1 mn	10.000 g 1 mn	100 g 5 mn	100 g 5 mn	100 g 5 mn	100 g 5 mn	MIL-STD 202 212

MICROWAVE MODULES

TEST	Technology SMD		Methods	Technology Hybrids Modules		Methods
	QC1	QC2		Class B	Class S	
Seal test fine gross leak		5.10^{-8} b/cm³ s	MIL-STD 883 1014/A 1014/C	5.10^{-8} b/cm³ s	5.10^{-8} b/cm³ s	MIL-STD 883 1014/A 1014/C
Temperature cycling	-40°C + 85°C 10 cycles	- 40°C + 85°C 10 cycles	MIL-STD 883 1010	- 55°C - 125°C 100 cycles	- 55°C - 125°C 100 cycles	MIL-STD 883 1010
Humidity		10 days - 40°C 95 % R.H	MIL-STD 202 103 A	56 days - 40°C 95 % R.H	56 days - 40°C 95 % R.H	MIL-STD 202 103 D
Storage	+ 85°C 1000 h	- 85°C 1000 h	MIL-STD 883 1008	- 125°C 1000 h	- 125°C 1000 h	MIL-STD 883 1008 B
Sinusoïdal vibration		20 - 2000 Hz 20 g 3 axis	MIL-STD 202 204 D	20 - 2000 Hz 20 g 3 axis	20 - 2000 Hz 20 g 3 axis	MIL-STD 883 2007
Random vibration				20 - 2000 Hz 0.5 g²/Hz 3 axis	20 - 2000 Hz 0.5 g²/Hz 3 axis	MIL-STD 883 2026
Mechanical shock		30 g 11 ms 1000 shocks 3 shocks/s 6 axis	MIL-STD 202 213 J	100 g 6 ms Half-time 5 shocks 6 axis	100 g 6 ms Half-time 5 shocks 6 axis	MIL-STD 883 2002
Barometric pressure (reduced)		8.88 inch.Hg	MIL-STD 202 105 A	8.88 inch.Hg	8.88 inch.Hg	MIL-STD 883 1001 B
Acceleration				10.000 g 1mn 3 axis	10.000 g 1 mn 3 axis	MIL-STD 883 2001
Burn-in					168 h to T max	MIL-STD 883 1015

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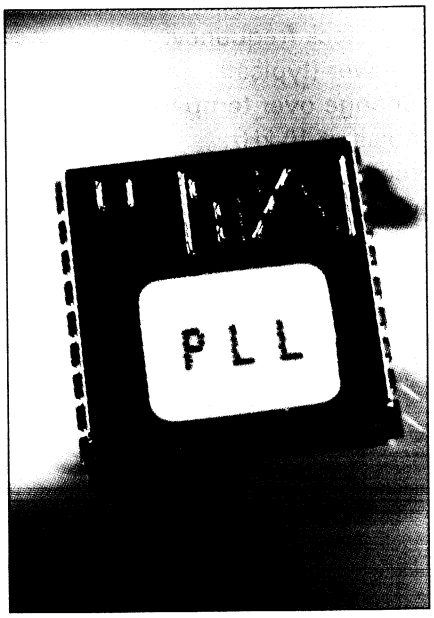
NEW !

PHASE LOCKED LOOPS - SURFACE MOUNT, LOW COST

Features

- RF Frequency up to 2.5 GHz
- Excellent Phase Noise
- Low Spurious
- 0.75" X 0.75"
- Surface Mount package
- Tape and reel packaging available



Applications

- Wireless Communications systems
- Base Stations
- CATV

Pin Out for PLA

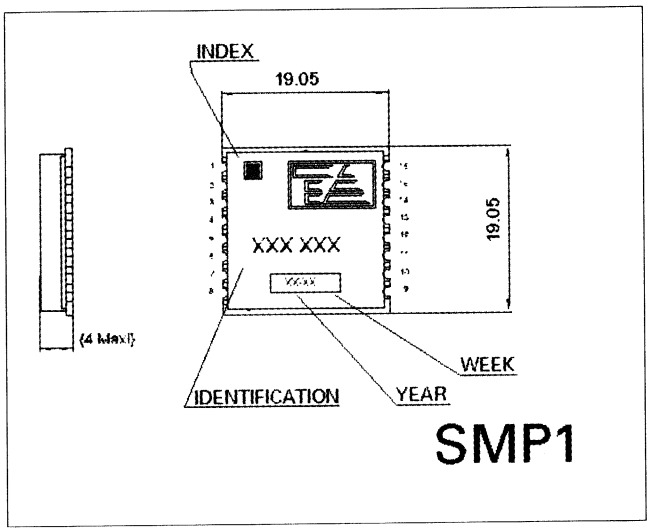
Pin	Application	Pin	Application
1	OSC in	9	Vcc (VCO)
2	Enable	11	RF Out
3	Data	15	Vcc (Chip)
4	Clock	16	Lock Detect

Description

This product family is designed for a low cost, medium to high volume market that may be supplied in tape and reel for automated pick and place assembly on surface mount circuit boards. This PLL includes a VCO, a module prescaler, a phase comparator and a loop filter.The crystal reference source is external.

Available PCB with software for testing

Case drawing



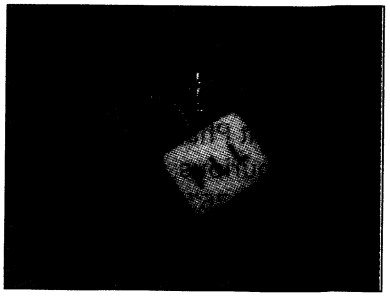
PHASE LOCKED LOOPS

Surface mount, Low cost

TEKELEC TEMEX

Electrical characteristics

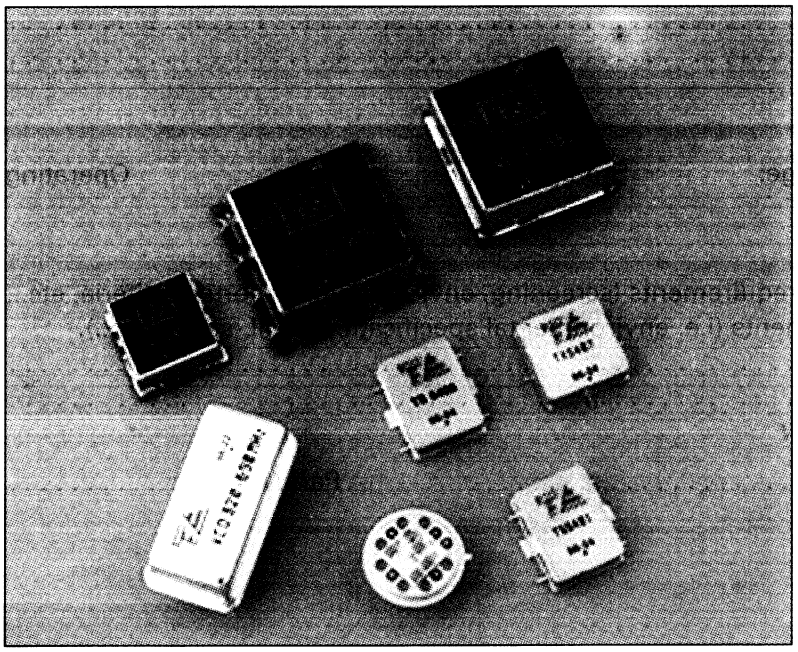
- Frequency range: up to 2.5 GHz
- Step size: 30 kHz to 1 MHz
- Reference clock frequency: 40 MHz max.
- Output power (typical): 0 dBm
- Power change over temperature: ± 2dB
- Phase noise at 10 kHz: -90 dBc/Hz min.
- Harmonics: -15 dBc min.
- Spurious: -65 dBc min.
- Supply voltage VCO: 5 V / 25 mA max.
- Supply voltage chip: 3 V / 15mA max.
- Operating temperature: -35° C to +85° C



MODEL N°	FREQ. RANGE (MHz)	STEP SIZE (KHz)	POWER OUTPUT (dBm)	PHASE NOISE @ 10 KHz (dBc/Hz)	2nd HARM-ONIC (dBc)	SIDEBANDS (dBc)
PLA190F	190	N/A	0	-115	-20	-70
PLA180	180-200	30	0	-115	-20	-70
PLA330	330-370	30	0	-110	-20	-70
PLA445	445-495	30	0	-107	-20	-70
PLA809	809-845	30	0	-109	-20	-70
PLA925	925-960	30	0	-108	-20	-70
PLA1075	1075-1115	30	0	-107	-20	-70
PLA1650	1600-1700	200	0	-93	-15	-65
PLA2400	2400-2500	1 M	0	-90	-15	-65

VOLTAGE CONTROLLED OSCILLATORS

Selection guide



Please photocopy this form to fax us your request

Voltage Controlled Oscillators
Specific request

APPLICATION

Military ❑ Industrial / Professional ❑ Radiotelephone ❑ Low cost ❑

ELECTRICAL PARAMETERS

Frequency range (MHz):. . . . . .
Output power at 25° C (dBm): . . . . . .
Total variation (temp. and frequency) (dB):. . . . . .
Frequency drift (over temperature range) (MHz): . . . . . .
Pulling (vs return loss) (MHz): . . . . . .
Pushing (vs power supply) (MHz / V): . . . . . .
Second harmonic level (dBc): . . . . . .
Phase noise (dBc / Hz) at 10 KHz: . . . . . .
100 KHz: . . . . . .
1 MHz:. . . . . .
Tuning voltage:. . . . . .
Input capacitor:. . . . . .
Power supply:. . . . . .
Operating temperature: . . . . . .

PACKAGE

Specifiy package type: . . . . . .
(Connectors ?, Flat-pack ?, SMD ?, Relay header ?, Hermetic ?, Dimensions ?):
. . . . . .
. . . . . .

ENVIRONMENT

Temperature range: Storage: ..... Operating: .....

OTHERS

Indicate specific requirements (screening, environment, important criteria, etc...). When possible, give necessary documents (i.e. environmental specifications, MIL-spec., etc...).
. . . . . .
. . . . . .

CROSS REFERENCE

Manufacturer: . . . . . Part Number: . . . . . .

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VOLTAGE CONTROLLED OSCILLATORS
SURFACE MOUNT - LOW COST
VL SERIES

Features

- Miniature Surface Mount package
- Frequency range: 430 to 2500 MHz

Operating characteristics

- Operating temperature: -10° C / + 75° C
- Power supply: 5 V ; 25 mA
  NEW ! 3 V

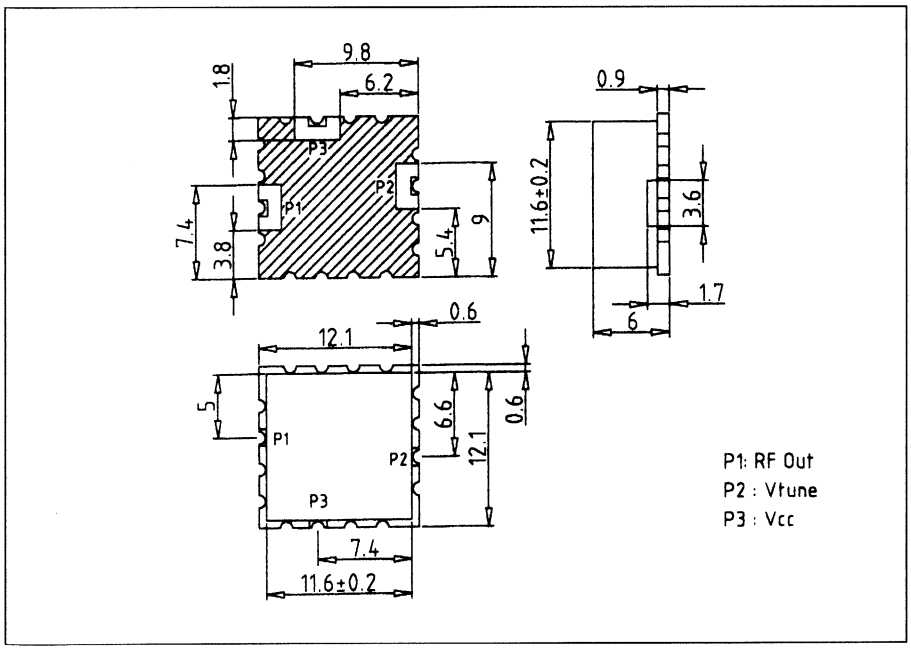
Applications

- VHF / UHF communications
- CATV
- RF modems

Pin configuration

P1	*P2*	*P3*
RF out	Control voltage	Supply voltage

Case drawing



SM1

VOLTAGE CONTROLLED OSCILLATORS

Surface mount - Low cost

TEKELEC TEMEX

Electrical characteristics

Model N°	Frequency range (MHz)	Power output (dBm)	Tuning voltage	Phase noise @10 KHz (dBc/Hz)	Phase noise @100 KHz (dBc/Hz)	2nd harmonic (dBc)	Average gain (MHz / V)
VL430	430 - 450	6	+ 0.5 to + 5	- 90	- 110	- 10	5
VL460	445 - 485	5	+ 0.5 to + 5	- 90	- 110	- 15	9
VL500	500 - 600	4	+ 0.5 to + 5	- 88	- 108	- 15	22
VL600	600 - 700	4	+ 0.5 to + 5	- 88	- 108	- 15	22
VL700	700 - 800	4	+ 0.5 to + 5	- 88	- 108	- 15	22
VL730	715 - 745	5	+ 0.5 to + 5	- 88	- 108	- 15	7
VL800	800 - 920	4	+ 0.5 to + 5	- 88	- 108	- 15	27
VL830	815 - 845	4	+ 0.5 to + 5	- 90	- 110	- 15	7
VL840	840 - 970	4	+ 0.5 to + 5	- 88	- 108	- 15	30
VL900	900 - 1025	4	+ 0.5 to + 5	- 88	- 108	- 15	28
VL1025	1025 - 1100	4	+ 0.5 to + 5	- 88	- 108	- 15	17
VL1050	1050 - 1200	4	+ 0.5 to + 5	- 88	- 108	- 15	33
VL1060	1060 - 1160	4	+ 0.5 to + 5	- 88	- 108	- 15	22
VL1200	1200 - 1350	4	+ 0.5 to + 5	- 85	- 105	- 15	33
VL1300	1300 - 1430	4	+ 0.5 to + 5	- 85	- 105	- 10	30
VL1350	1350 - 1500	4	+ 0.5 to + 5	- 85	- 105	- 15	33
VL1400	1400 - 1550	4	+ 0.5 to + 5	- 85	- 105	- 15	33
VL1500	1500 - 1650	4	+ 0.5 to + 5	- 85	- 105	- 15	33
VL1700	1700 - 1860	3	+ 0.5 to + 5	- 85	- 105	- 15	35
VL1850	1850 - 1975	3	+ 0.5 to + 5	- 85	- 105	- 15	28
VL1900	1900 - 2100	3	+ 0.2 to + 7	- 85	- 105	- 15	28
VL2100	2100 - 2300	0	+ 0.3 to + 5	- 83	- 103	- 20	42
VL2250	2250 - 2380	0	+ 0.5 to + 5	- 83	- 103	- 15	28
VL2350	2350 - 2600	0	+ 0.3 to + 5	- 83	- 103	- 15	53
VL2400	2400 - 2500	0	+ 0.5 to + 5	- 83	- 103	- 15	22

Notes: 1. Pushing (4.5 to 5.5 V): 5 MHz max.
2. Pulling (12 dB return loss): 20 MHz

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VOLTAGE CONTROLLED OSCILLATORS SURFACE MOUNT - LOW COST FOR WIRELESS APPLICATIONS

Features

- Exceptional phase noise
- Surface Mount package
- 3 V power supply available

Electrical characteristics

MODEL N°	FREQ. RANGE (MHz)	POWER OUTPUT (dBm) typ.	TUNING VOLTAGE (V)	PHASE NOISE @ 10 KHz (dBc/Hz)	PHASE NOISE @ 100 KHz (dBc/Hc)	PHASE NOISE @ 800 KHz (dBc/Hz)	2nd HARM-ONIC (dBc)	POWER SUPPLY (V/mA)	PACKAGE
VLA195	195-220	8	1 to 14	-110	-130		-8	12 / 20	SM1
VLA255	255-320	0	1 to 9	-100	-120		-10	8 / 20	SM1
VLA335	335-385	0	0 to 10	-85	-105		-20	5 / 25	SM1
VLA360	360-440	5	1 to 5	-100	-120		-10	5 / 25	SM1
VLA390	380-400	0	0 to 5	-117	-137		-12	5 / 15	SM1
VLA380	380-430	0	0 to 5	-112	-132		-12	5 / 15	SM1
VLA408	408-470	2	1 to 8	-100	-120		-10	8 / 25	SM1
VLA445	445-495	0	0 to 10	-85	-105		-20	5 / 25	SM1
VLA809	809-845	5	0.5 to 5	-115	-135	-154	-12	5 / 25	SM1
VLA900	900-1000	5	0.5 to 5	-88	-108		-12	5 / 25	SM1
VLA925	925-960	3	1.5 to 6.5	-115	-135	-154	-12	5 / 25	SM1
VLA950	950-986	3	1 to 6	-115	-135	-154	-12	5 / 25	SM1
CR960	960 ± 10	2	1 to 4.5	-105	-125		-10	4.5 / 15	SM1
VLA1250	1250-1350	3	1 to 8	-100	-120		-12	8 / 25	SM1
VLA1450	1450-1550	3	1 to 8	-105	-125	-145	-12	5 / 25	SM1
VLA1500	1500-1650	1	1 to 8	-97	-117	-137	-12	8 / 16	SM1
VLA1511	1511-1586	4	1 to 8	-105	-125	-145	-12	5 / 25	SM1
VLA1594	1594-1669	3	1 to 6.5	-105	-125	-145	-15	5 / 25	SM1
VLA1750	1750-1900	1	1 to 8	-97	-117	-137	-12	8 / 16	SM1
VLW1800	1800-2700	1	0 to 19	-85	-105		-8	12 / 25	SM1
CR1877	1877 ± 10	-2	0 to 10	-100	-120		-10	5 / 10	SM1
VLA2430	2430-2470	2	0 to 12	-95	-115		-12	8 / 20	SM1
VLA2650	2650-2850	2	0 to 12	-90	-110		-12	8 / 20	SM1
VL2-240	240-400	3	1 to 15	-105	-125		-10	12 / 12	SM2
VL2-681	681-716	0	1 to 8	-115	-135	-154	-15	8 / 20	SM2
VL2-746	746-785	0	1 to 8	-115	-135	-154	-15	8 / 20	SM2
VL2-820	820-880	3	1.5 to 8	-100	-120		-12	9 / 30	SM2
VL2-880	880-915	6	1 to 8	-100	-120		-12	8 / 40	SM2
VL2-960	960-1600	11	1 to 14	-95	-115		-10	4 / 45	SM2
VL2-990	990-1050	3	1.5 to 8	-100	-120		-12	9 / 30	SM2
VL2-1079	1079-1114	5	1 to 8	-110	-130	-154	-10	5 / 40	SM2
VL2-1100	1100-1160	3	1.5 to 8	-100	-120		-12	9 / 30	SM2
VL2-1170	1170-1230	4	1 to 8	-110	-130		-15	8 / 20	SM2
VL2-1450	1450-1850	11	1 to 12	-95	-115		-12	12 / 25	SM2
VL2-1480	1480-1600	8	2 to 10	-98	-118		-15	12 / 30	SM2
VL2-1615	1615-1715	8	2 to 10	-98	-118		-15	12 / 30	SM2
VL2-1800	1800-2300	11	1 to 13	-95	-115		-12	12 / 25	SM2
VL2-2200	2200-2600	10	1 to 13	-95	-115		-12	12 / 25	SM2

VOLTAGE CONTROLLED OSCILLATORS

Surface mount - Low cost

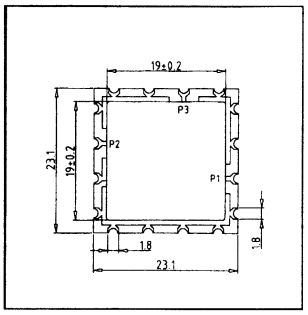
Applications

- Base stations

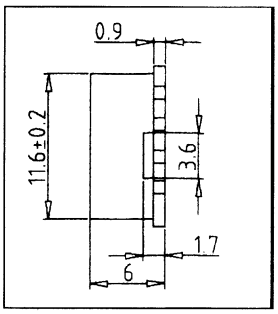
Other packages available, see page 3-59 !

Pin configuration

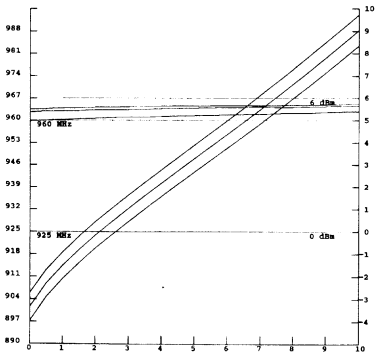
Case	RF out	V tune	VCC	Case Ground
SM1	P1	P2	P3	-
SM2	P1	P2	P3	-



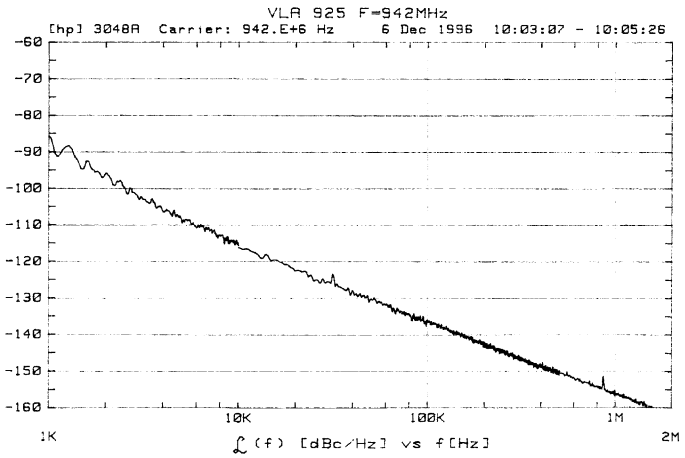
SM2

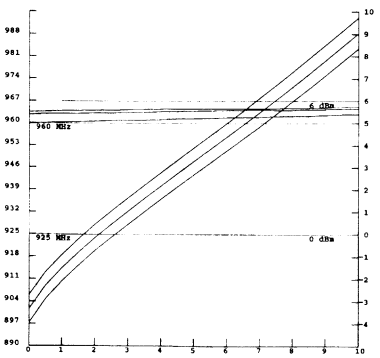


SM1

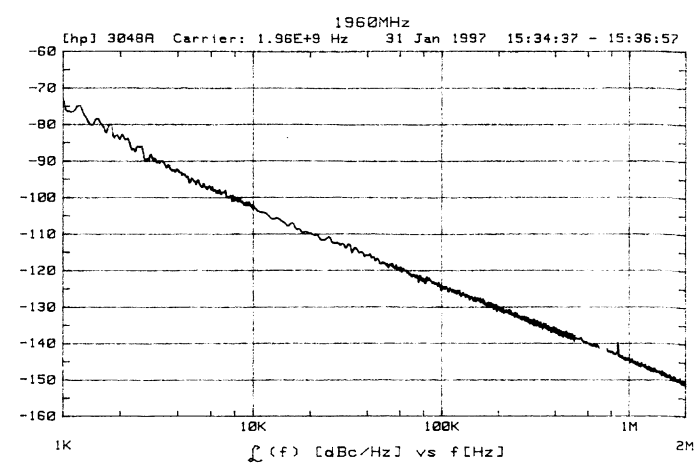


VLA925





VLA1904



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VOLTAGE CONTROLLED OSCILLATORS
OCTAVE TUNING BANDWIDTH - VD SERIES
NARROW BANDWIDTH - V5D SERIES

Features

- Frequency range: 25 to 2500 MHz
- Ultra broadband
- Very good linearity

Operating characteristics

- Pulling: 0 - 5 %
- Operating temperature range: - 40 to + 85° C
- DC voltage: 16 V max.
- Input capacitor: 1 nF on models up to VCO 0.9-1.6 GHz
- Input capacitor: 560 pF on types 1 - 2 GHz and above *

  ** Other values available on request*

- «Bufferized» VCOs

  - all these VCOs are available with integral isolating amplifiers (except VD1500)
  - pulling for BVCOs is 0 - 0.5 %. All other specifications are the same as the VCO series
  - BVCOs up to 900 MHz are available in case D.
  - to specify a BVCO, select desired VCO and add «B» (for example: BVD25)

- All VCOs and BVCOs can be supplied with modulating input and coupled output

- VCO type 500: any frequency from 30 MHz to 2 GHz with 6 % of bandwidth (case D)

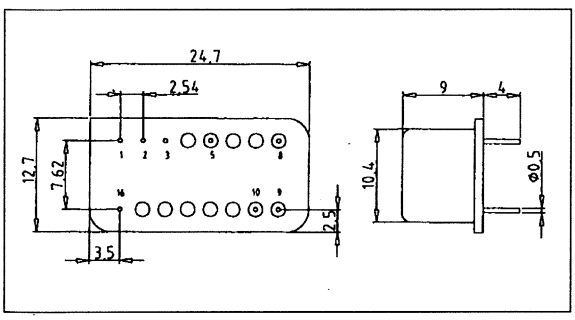
Applications

- Military and commercial telecom

Ordering information

VD25	:	Case D
V5DXXX	:	Type 500, Case D
BVD400	:	Buffer, Case D

Case drawing



D

VOLTAGE CONTROLLED OSCILLATORS

Octave tuning & narrow bandwidth

TEKELEC TEMEX

Pin configuration

Case	RF out	V tune	VCC	Ground	Coupled output	Buffer supply	Modu-lation
D	8	5	10	1, 2, 3, 16	9	-	1

Electrical characteristics

MODEL N° / CASE D	Frequency range (MHz)	Power output (dBm)	Tuning voltage (V)	FM noise @100 KHz offset (dBc/Hz) max.	Harmonics (dBc) max.	Pushing (MHz/V) max.	Drift vs temp. (KHz/°C) max	DC supply (V/mA)
VD25	25 - 50	12	0 - 12	- 125	- 16	0.10	50	+ 15 / 30
VD40	40 - 80	12	0 - 12	- 123	- 16	0.10	50	+ 15 / 30
VD50	50 - 100	12	0 - 12	- 122	- 16	0.50	50	+ 15 / 30
VD75	75 - 150	12	0 - 12	- 122	- 16	0.50	50	+ 15 /50
VD100	100 - 200	11.7	0 - 12	- 122	- 20	1.00	100	+ 15 / 25
VD150	150 - 300	11.3	0 - 12	- 116	- 20	1.00	100	+ 15 / 25
VD200	200 - 400	12	0 - 12	- 114	- 20	2.00	200	+ 15 / 25
VD300	300 - 600	12	0 - 12	- 112	- 20	3.00	300	+ 15 / 25
VD400	400 - 900	11	0 - 12	- 111	- 18	5.00	400	+ 15 / 35
VD900	900 -1600	11.7	0 - 12	- 108	- 16	10.00	500	+ 15 / 45
VD902	900 - 2000	11.7	0 - 15	- 105	- 16	18.00	500	+ 15 / 45
VD1000	1000 - 2000	10.7	2 - 20	- 105	- 18	18.00	700	+ 15 / 45
VD1500	1500 - 2500	12	2 - 15	- 102	- 17	20.00	800	+ 15 / 45
V5D500	485 - 515	13	0 - 10	- 118	- 20	0.10	10	+ 15 / 30

VOLTAGE CONTROLLED OSCILLATORS
SURFACE MOUNT - THIN FILM
TX SERIES

Features

- Frequency range: 300 to 3200 MHz
- Hermetic package
- Vapor phase

Operating characteristics

- Temperature range: - 40 to + 100° C

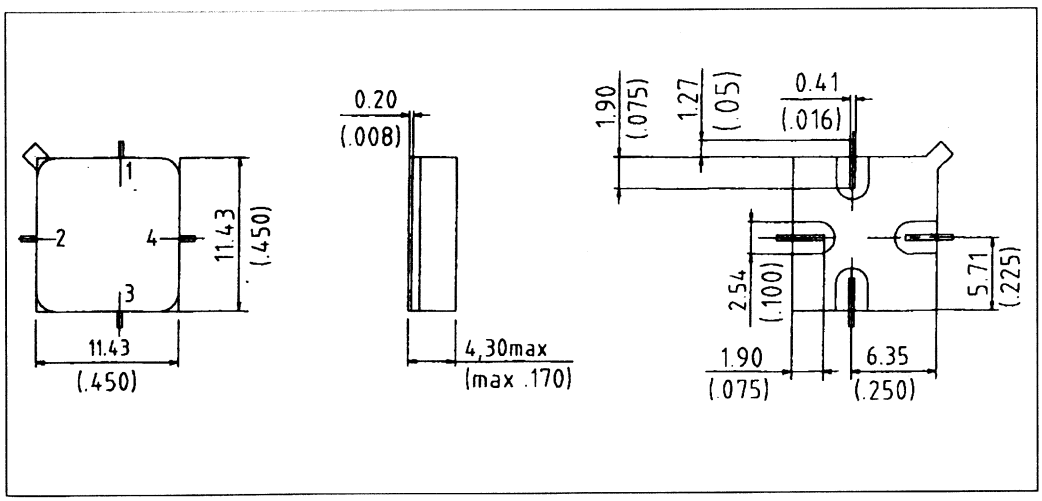
Applications

- Military
- Space telecom

Pin configuration

Case	RF out	V tune	VDC	Ground	NC
SMM2	1	3	2	4	-

Case drawing



SMM2

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VOLTAGE CONTROLLED OSCILLATORS

Surface mount - Thin film

TEKELEC TEMEX

Electrical characteristics

Model N°	Frequency range (MHz)	Power output (dBm)	Power variation (dB) max -40° C to +100° C		Tuning voltage (V)	FM noise @ 50KHz offset (dBc/Hz) max.	Input cap. (control) (pF)	Pulling (MHz) max.	Drift (MHz) max. (-40° C to +100° C)	DC supply (V/mA)
			vs freq.	vs temp.						
TX5201	300 - 500	+ 13	2	2	0 - 20	- 90	330	21	20	15 / 50
TX5301*	470 - 900	+ 7	2	2	0 - 20	- 90	95	20	20	12 / 45
TX5402	800 - 1200	+ 12	2	2	0 - 15	- 90	95	15	56	12 / 50
TX5403*	900 - 1600	+ 12	2	2	0 - 40	- 90	95	45	30	12 / 45
TX5401	1050 - 2000	+ 12	2	3	0 - 15	- 90	80	70	35	12 / 50
TX5404	1100 - 1800	+ 12	2	2	0 - 30	- 90	80	70	20	12 / 50
TX5405	1200 - 1500	+ 12	2	2	0 - 15	- 90	100	60	20	12 / 45
TX5406	1500 - 2000	+ 12	2	2	0 - 15	- 90	80	70	35	12 / 45
TX5407	1500 - 2100	+12	2	2	0 - 15	- 90	80	35	60	12 / 50
TX5408	1600 - 1700	+ 12	2	3	0 - 15	- 95	80	35	60	12 / 40
TX5501*	1600 - 2500	+ 11	2	3	0 - 15	- 90	80	80	30	12 / 45
TX5502	2100 - 2600	+ 12	2	2	0 - 15	- 90	80	30	85	12 / 45
TX5505	2500 - 3200	+ 10	2	2	0 - 20	- 90	80	60	50	12 / 45
TX5601	3700 - 4500	+ 10	2	2.5	0 - 20	- 85	80	60	100	12 / 40

* Temperature range: - 40° C to + 85° C

VOLTAGE CONTROLLED OSCILLATORS
THIN FILM
F57, TO5 & TF5 SERIES

Features

- Frequency range: 100 to 5600 MHz
- Hermetic package

Operating characteristics

- Temperature range: - 40 to + 100° C

Applications

- Military
- Space telecom

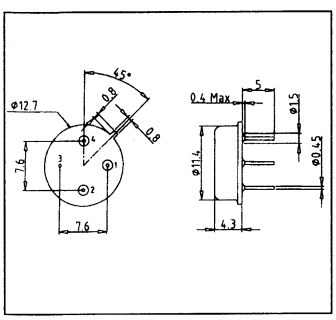
Ordering information

F57XXX: TO8 144 package
TO5XXX: TO8 124 & TO8 144 package
TF5XXX: BMH161 (flatpack) package

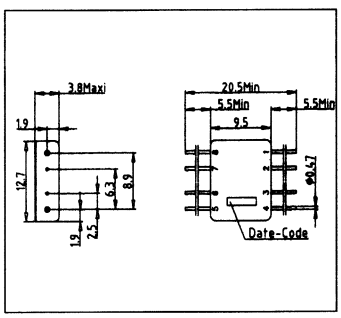
Pin configuration

Case	RF out	V tune	VDC	Ground	NC
TO8 124	4	2	1	3	-
TO8 144	4	2	1	3	-
BMH161	4	5	1	2, 3, 6, 7	8

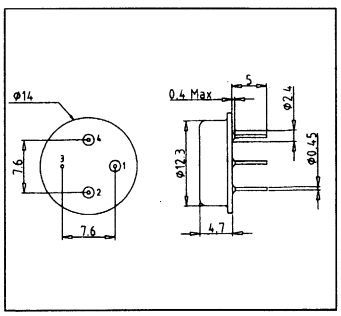
Case drawings



TO8 124



BMH161



TO8 144

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VOLTAGE CONTROLLED OSCILLATORS

Thin film

TEKELEC TEMEX

Electrical characteristics

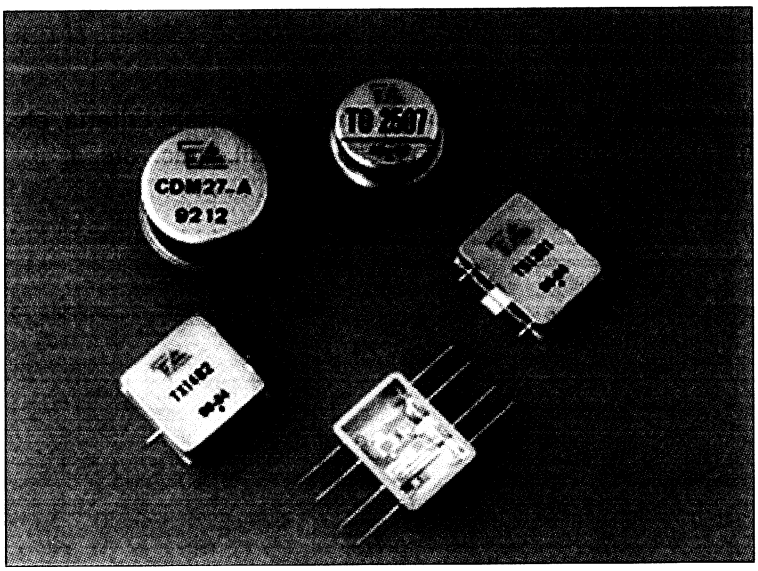
Model N°	Frequency range (MHz)	Power output (dBm)	Power vs freq. (dB) max -40° C to +100° C	Variation vs temp. (dB) max -40° C to +100° C	Tuning voltage (V)	FM noise @ 50 KHz offset (dBc/Hz) max.	Input cap. (control) (pF)	Pulling (MHz) max. (vswr: 1.7)	Drift (MHz) max. (-40° C to +100° C)	DC supply (V/mA)	Case
TO5101	100 - 130	12	2	1	0 - 15	-100	470	15	8	+ 12 / 45	TO8 144
TO5103	125 - 175	10	1.5	1.5	0 - 20	-100	470	15	8	+ 15 / 35	TO8 144
TO5102	175 - 225	12	2	1	0 - 15	-100	330	15	10	+ 12 / 40	TO8 144
TO5204	200 - 300	11	2	2	0 - 15	-100	470	20	15	+ 12 / 40	TO8 144
TO5203*	250 - 500	11	2	2	0 - 20	-100	330	15	12	+ 12 / 40	TO8 124
F57535	400 - 600	12	2	2	0 - 15	- 90	95	20	30	+ 15 / 50	TO8 144
TO5304*	400 - 750	10	2	2	0 - 20	- 90	95	20	20	+ 12 / 45	TO8 124
F57515*	470 - 900	7	2	2	0 - 20	- 90	95	20	20	+ 12 / 45	TO8 144
TO5301	600 - 1000	11	2	2	0 - 30	- 90	95	30	28	+ 12 / 45	TO8 124
TO5303	650 - 1200	10	3	3	0 - 15	- 90	95	25	25	+ 15 / 60	TO8 144
F57516	800 - 1200	12	2	2	0 - 15	- 90	95	15	56	+ 12 / 50	TO8 144
TO5405	800 - 1400	18	3	2	0 - 20	- 90	80	25	100	+ 15 / 80	TO8 124
F57511*	900 - 1600	12	2	2	0 - 40	- 90	95	30	45	+ 12 / 45	TO8 144
TO5410*	950 - 1600	10	2.5	2	0 - 15	- 90	None	25	30	+ 15 / 100	TO8 124
TO5402	960 - 1215	13	2	2	0 - 10	- 90	95	25	50	+ 12 / 45	TO8 124
F57532	1050 - 2000	12	2	3	0 - 15	- 90	80	35	70	+ 12 / 50	TO8 144
F57517	1100 - 1800	12	2	2	0 - 30	- 90	80	20	70	+ 12 / 50	TO8 144
F57518	1300 - 1500	12	2	2	0 - 20	- 90	80	20	56	+ 12 / 45	TO8 144
TO5401	1300 - 1500	12	2	2	1 - 10	- 90	80	25	56	+ 12 / 45	TO8 144
F57520	1500 - 2000	12	2	2	0 - 15	- 90	80	35	70	+ 12 / 45	TO8 144
TO5501	1600 - 2500	11	2	3	1.5 - 40	- 90	80	30	80	+ 12 / 45	TO8 124
TO5510*	2000 - 4000	10	3	3	0 - 15	- 85	80	35	130	+ 15 / 35	TO8 124
TO5502	2100 - 2600	12	2	2	0 - 15	- 90	80	30	85	+ 12 / 45	TO8 124
TO5503	2250 - 2900	12	2	3	3 - 15	- 85	80	35	110	+ 12 / 45	TO8 144
F57526	2500 - 3200	10	2	2	0 - 20	- 90	80	50	60	+ 12 / 45	TO8 144
TO5601*	3700 - 4500	10	2	2.5	1 - 20	- 85	80	60	100	+ 12 / 40	TO8 124
TO5602*	4500 - 5300	10	2	4	0 - 20	- 80	80	80	150	+ 12 / 40	TO8 124
TO5610*	4600 - 5600	10	2	3	0 - 15	- 80	47	80	150	+ 12 / 45	TO8 124
TF5202	250 - 500	13	2	3	0 - 20	-100	80	20	20	+ 15 / 22	BMH161
TF5412	1000 - 2000	12	2	3	0 - 20	- 90	80	25	50	+ 15 / 22	BMH161
TF5404	1200 - 1500	12	2	2	0 - 15	- 90	100	20	60	+ 12 / 45	BMH161
TF5504*	2100 - 2600	12	2	3	0 - 10	- 90	80	35	100	+ 12 / 50	BMH161
TF5602*	4600 - 5600	10	2	3	0 - 15	- 80	47	80	150	+ 12 / 45	BMH161

Note: *Please consult our sales office for SM package*

* Temperature range: - 40° C to + 85° C

AMPLIFIERS

Selection guide



Please photocopy this form to fax us your request

Amplifiers Specific request

APPLICATION

Military ❑ Industrial / Professional ❑ Commercial ❑

ELECTRICAL PARAMETERS

Frequency range (MHz): .....
Temperature range (° C):
Gain at 25° C (dB):
- Ripple over frequency range (dB): .....
- Gain variation over temperature (dB): .....

Noise figure at 25° C (dB):
- NF over temperature range (dB): .....

Output power at 1 dB compression at 25° C (dBm): .....
Intercept point (IMP3) typical (dBm): .....
VSWR input and output:
Power supply:
- Voltage (V): .....
- Current (mA): .....

PACKAGE

Specifiy package type: .....
(Connectors ?, Flat-pack ?, SMD ?, Relay header ?, Hermetic ?, Dimensions ?):
.....
.....

ENVIRONMENT

Temperature range: Storage: ..... Operating: .....

OTHERS

Indicate specific requirements (screening, environment, important criteria, etc...). When possible, give necessary documents (i.e. environmental specifications, MIL-spec., etc...).
.....
.....

CROSS REFERENCE

Manufacturer: ..... Part Number: .....

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AMPLIFIERS
SURFACE MOUNT - THIN FILM - GaAs FET
TX1000 & TX2000 SERIES

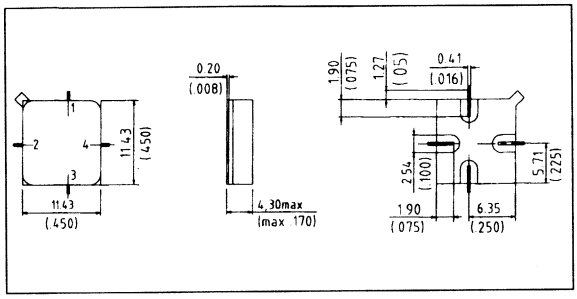
Description

- Medium power amplifiers

Applications

- Military and space
- Telecommunications

Case drawing



SMM2

Features

- New products with + 5 VDC supply
- Frequency range: 5 to 2700 MHz
- Hermetic package
- Vapor phase

Operating characteristics

- Impedance: 50 Ω nominal
- Temperature range: - 40° C to + 100° C

Pin configuration

Case	Input	Output	VDC	Ground	N.C
SMM2	3	1	2	4	-

Electrical characteristics

Model N°	Frequency range (MHz)		Power output @ 1 dB comp. (dBm)	Noise figure (dB) max	Gain (dB) min	3rd order inter. point (dBm)	Flat (± dB) max	VSWR max	DC supply	
	min	max							(V)	(mA)
TX1301	100	1800	14	8	9	27	1	2	12	50
TX1401	100	2000	13.5	7.5	9	28	1	2	12	50
TX1403	1000	1200	6	5	10	-	0.5	1.6	5	12
TX2401	1200	2400	8	7	10	19	1	2	15	50
TX1402	1620	1670	-2	4	12.5	8	0.5	1.5	5	6
TX1501	1960	2040	-2	4.3	17	8	0.2	1.5	5	12
TX1404	1620	1670	-2	4.3	17	8	0.2	1.5	5	12
TX2402	1400	1600	18	3	12	30	0.2	1.5	5	90
TX2501	2050	2300	18	4	11	30	0.2	1.5	5	90
TX2502	2050	2300	13	6	18	24	0.2	1.5	5	70
TX2504	2100	2600	18	4.5	9	30	0.5	1.5	12	120
TX2601	3500	4500	19	5	8	28	1	2	12	130

AMPLIFIERS
THIN FILM - GaAs FET
T02000 SERIES

Description

- Medium power amplifiers

Features

- Frequency range: 400 to 4500 MHz
- Hermetic package

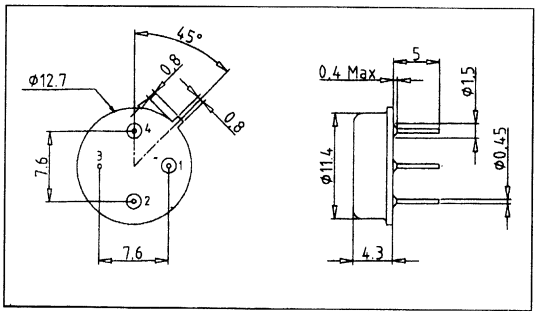
Applications

- Military and space
- Telecommunications

Operating characteristics

- Impedance: 50 Ω nominal
- Temperature range: - 40° C to + 110° C

Case drawing



T08 124

Pin configuration

Input	Output	VDC	Ground
2	4	1	3

Electrical characteristics

Model N°	Frequency range (MHz)		Power output @ 1 dB comp. (dBm)	Noise figure (dB) max.	Gain (±dB) min.	3rd order inter. point (dBm)	Flat (± dB) max.	VSWR max.	DC supply	
	min.	max.							(V)	(mA)
T02502	400	2500	15	5.2	8	28	1	2	8 - 16	70
T02507*	600	2400	18	5	9	33	1	2	8 - 16	110
T02501*	600	3600	19	6	9	30	1	2	12	115
T02504*	1000	3500	18	5.5	9	30	1	2	8 - 16	120
T02505	1000	3500	10	4.5	7	17	1	2	8 - 16	40
T02506	1300	2700	16	4.3	8	30	1	2	8 - 16	70
T02503	1300	3000	10	4.4	7	23	1	2	8 - 16	35
T02401	1350	1850	7.5	4.2	9	15	1	2	12	20
T02406	1350	1850	20	5	11	30	1	1.7	12	115
T02601*	3500	4500	20	5.5	7	30	1	2	12	130
T02602*	4000	4400	18	5.2	9	30	1	2	8 - 16	120

* T = -40° C to +85° C

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AMPLIFIERS
THIN FILM - BIPOLAR
T01000 & F56300 SERIES

Description

- Low noise amplifier
- Medium power amplifier

Features

- Frequency range: 1 to 2100 MHz
- Hermetic package

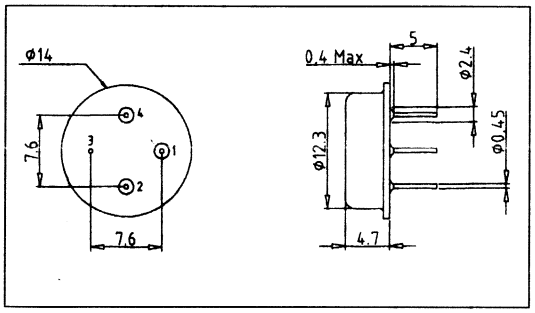
Applications

- Military and space
- Telecommunications

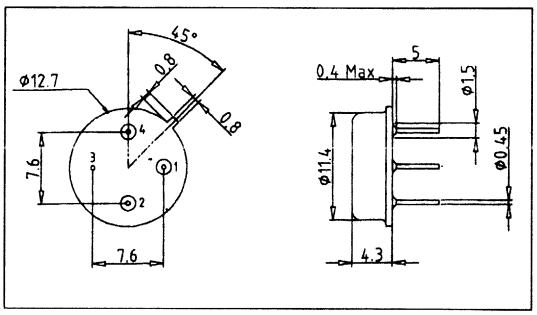
Operating characteristics

- Impedance: 50 Ω nominal
- Temperature range: - 40° C to + 110° C

Case drawing



TO8 144



TO8 124

Pin configuration

Case	Input	Output	VDC	Ground
TO8 144	2	4	1	3
TO8 124	2	4	1	3

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AMPLIFIERS

Thin film - Bipolar

TEKELEC TEMEX

Electrical characteristics

Model N°	Frequency range (MHz)		Power output @ 1 dB comp. (dBm)	Noise figure (dB) max	Gain (±dB) min	3rd order inter. point (dBm)	Flat (± dB) max	VSWR max	DC supply		Case type
	min	max							(V)	(mA)	
F56341	1	150	17	8	12.5	28	0.5	2	15	65	TO8 144
F56342 B	1	250	11	6	14.5	21	1	2	15	30	TO8 144
F56341 B*	1	800	17	8.5	12	28	1	2	15	65	TO8 144
F56334	5	500	7	6	15	21	1	2	12	24	TO8 144
TO1211**	5	500	8	3.5	9.5	19	1	2	15	32	TO8 144
F56335 A*	5	1000	18	10	9.5	30	1.3	2	15	75	TO8 144
F56336 A	5	1000	4	5	13	15	1	2	12	17	TO8 144
F56337 A	5	1000	7	6	12	21	1	2	12	24	TO8 144
F56338 A	5	1000	14	7	12.5	28	1	2	12	44	TO8 144
F56338	100	1100	14	7	12	28	1	2	12	44	TO8 144
F56336	100	1100	4	5.5	13	15	1	2	12	17	TO8 144
F56345 B	100	1800	15	7.5	9	27	1	2	12	45	TO8 144
F56344 A	800	1400	17	12	7	30	1	2	12	60	TO8 144
F56345 A	800	1400	14	9.5	11	28	1	2	12	42	TO8 144
F56346	900	1400	7	7	9	20	1	2	12	26	TO8 144
TO1104	5	250	10	2.7	19	21	1	2	15	28	TO8 124
TO1209*	5	400	24	10	13	37	1	2	12	120	TO8 124
TO1215	5	500	20	8	12	32	1	2	12	80	TO8 124
TO1205*	5	500	22	8	12	34	1	2	15	100	TO8 124
TO1207	5	500	18.5	7.5	29	29	1	2	12	120	TO8 124
TO1208	5	500	18	3.7	13	33	1	2	12	53	TO8 124
TO1216	5	600	2	2.5	11	20	1	2	12	9	TO8 124
TO1206	5	600	4.5	2.5	11	20	1	2	15	11.5	TO8 124
TO1212	5	600	14.5	7	14	30	1	2	15	56	TO8 124
TO1313	5	1000	20	10	9	32	1	2	12	80	TO8 124
TO1304*	5	1000	22	10	9	34	1	2	15	100	TO8 124
TO1305*	5	1000	17	13	9	31	1	2	15	60	TO8 124
TO1306	5	1000	0	3	13	18	1	2	12	11	TO8 124
TO1307***	5	1000	10	3.7	13	27	1	2	12	24	TO8 124
TO1308	5	1000	12.5	3.8	24	25	1	2	15	48	TO8 124
TO1106	10	100	12	2.7	21	21	1	2	15	36	TO8 124
TO1103	10	150	23	4	13.5	32	0.5	2	15	90	TO8 124
TO1105	10	300	11	3	19	21	1	2	12	30	TO8 124
TO1301	100	1100	7	6	12.5	21	1	2	12	24	TO8 124
TO1311	100	1500	7	5	19	19	1.5	2	15	50	TO8 124
TO1404	100	2000	14.5	7	9.5	28	1	2	12	45	TO8 124
TO1406	300	1300	20	8.5	7	34	1.5	2	12	80	TO8 124
TO1401*	300	1300	22	9	7	36	1.5	2	15	100	TO8 124
TO1405	300	2100	16	9	7.5	28	1	2	12	40	TO8 124
TO1403	800	1300	3	3.5	13	14	1	2	12	15	TO8 124

Note : Please consult our sales office for 5 V DC Supply

* T = - 40° C + 85° C

** 30 dB typ. reverse isolation

*** Gain variation typ. < 0.5 dB (T = - 40° C + 110° C)

AMPLIFIERS
THIN FILM - FLAT PACK
TF0000, TF1000 & TF2000 SERIES

Description

- Low noise amplifiers
- Medium power amplifiers

Features

- Frequency range: 1 to 2000 MHz
- Hermetic package
- Bipolar and GaAs Fet

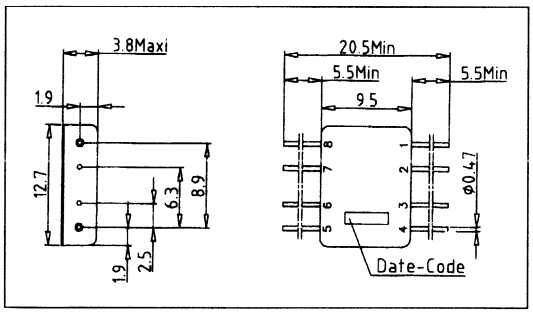
Applications

- Military and space
- Telecommunications

Operating characteristics

- Impedance: 50 Ω nominal
- Temperature range: - 40° C to + 110° C

Case drawing



BMH161

Pin configuration

Input	Output	VDC	Ground
5	4	1	2, 3, 6, 7

Electrical characteristics

Model N°	Frequency range (MHz)		Power output @ 1 dB comp. (dBm)	Noise figure (± dB) max.	Gain (dB) min.	3rd order inter. point (dBm)	Flat (± dB) max.	VSWR max.	DC supply	
	min.	max.							(V)	(mA)
TF0342 B	1	300	11	6	14	21	1	2	15	30
TF1207	5	500	18.5	7.5	29	28	1	2	12	120
TF1206	5	600	2	2.5	11	20	1	2	12	9
TF1308	5	1000	12.5	3.8	24	25	2	2.6	15	48
TF1103	10	150	23	4	13.5	32	0.5	2	15	90
TF1404	10	1400	15	6.5	9	28	1	2	12	42
TF0336	100	1100	4	5.5	13	15	1	2	12	17
TF0337	100	1100	7	6	12.5	21	1	2	12	24
TF0338	100	1100	14	7	12	28	1	2	12	44
TF1401	300	1300	20	8.5	7.5	34	1.5	2	12	80
TF1313	650	1400	7	5.2	17	20	1.6	2	15	50
TF1403	800	1300	3	3.5	13	14	1	2	12	15
TF0345 A	800	1400	14	9.5	11	28	1	2	12	42
TF2506	1500	2000	16	4.5	9	30	1	2	12	70
TF1409	1600	2000	11	4.5	12	25	0.5	2	12	30

AMPLIFIERS
THICK FILM - CS SERIES

Description

- Medium power amplifiers

Features

- Frequency range: 5 to 600 MHz
- High ICP3

Applications

- Military
- Telecommunications

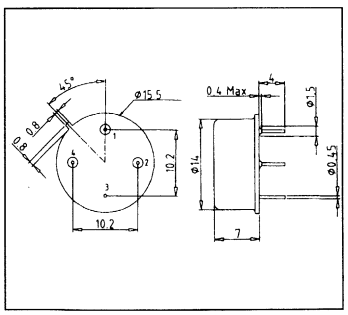
Operating characteristics

- Impedance: 50 Ω nominal
- Temperature range: - 40° C to + 85° C

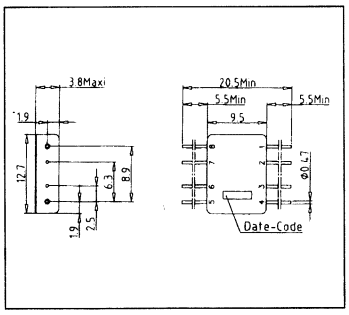
Pin configuration

Case	Input	Output	VDC	Ground
A	2	4	1	3
F	5	1	4	2, 3, 6, 7, 8
G	5	10	1.6	2, 3, 4, 7, 8, 9

Case drawings



A



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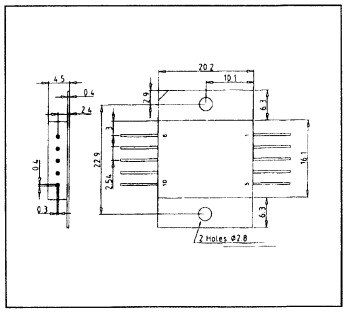


G

Electrical characteristics

Model N°	Frequency range (MHz)		Power output @ 1 dB comp. (dBm)	Noise figure (dB) max.	Gain (dB) min.	3rd order inter. point (dBm)	Flat (± dB) max.	VSWR max.	DC supply		Case type
	min.	max.							(V)	(mA)	
CS74	10	150	23	4.5	14	39	0.5	1.5	12	105	A
CS12 M	10	200	18	3	8.5	37	0.3	1.7	15	38	A
CS32	500	600	11	3	15.8	23	0.3	1.5	15	21	A
CS24	10	100	12	2.5	20	29	0.5	1.5	12	25	F
CS04	5	200	24	3	29	40	1	1.5	24	157	G
CS04-02	20	300	28	3	22.5	41	1	1.6	15	190	G
CS05	20	500	28	4.5	20	41	1	1.7	15	190	G

MODULAR AMPLIFIERS
CDM SERIES

Description

- General purpose amplifiers

Features

- Frequency range: 0.05 to 3000 MHz
- High reverse isolation

Application

- Commercial
- Telecommunications
- Military

Electrical characteristics

- Impedance: 50 Ω nominal
- Temperature range: - 40° C to + 85° C
- Max input power: + 20 dBm CW

How to order

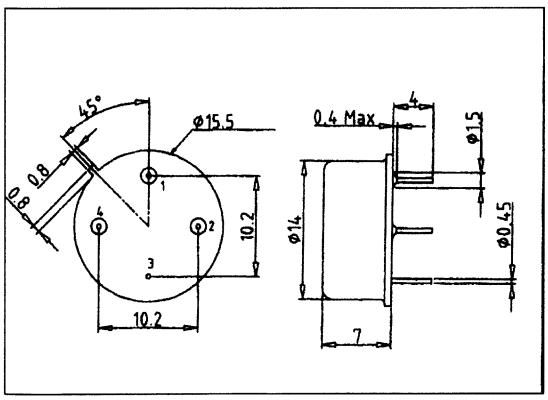
Add the case type to the P/N

Example: CDM27K

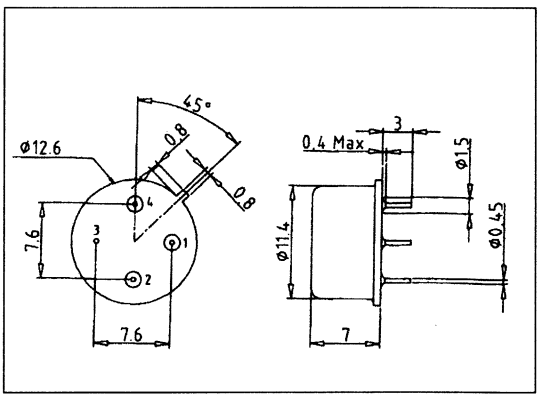
Pin configuration

Case	Input	Output	VDC	Ground
A	2	4	1	3
K	2	4	1	3

Case drawings



A



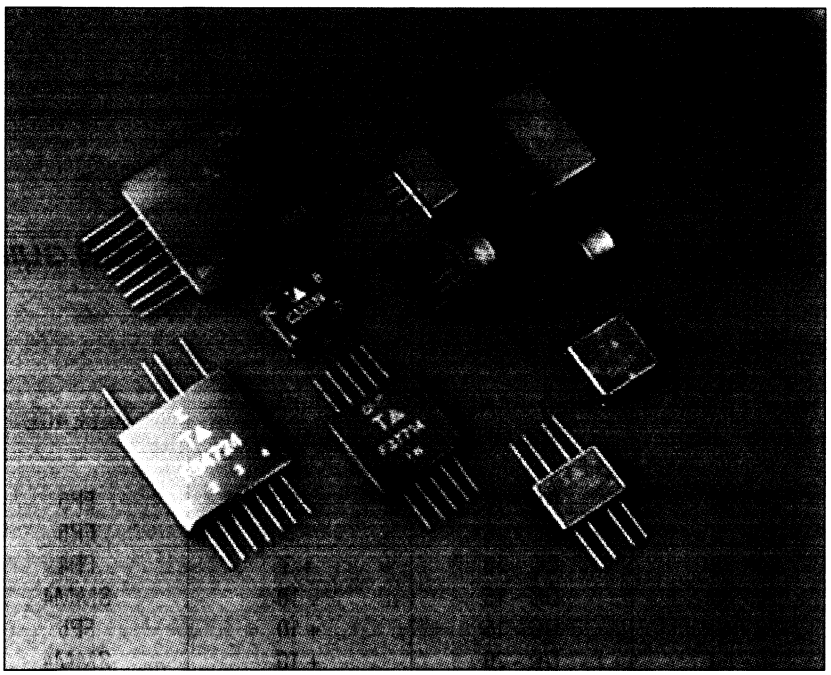
K

Electrical characteristics

Model N°	Frequency range (MHz)		Power output @ 1 dB comp. (dBm)	Noise figure (dB) max.	Gain (dB) min.	3rd order inter. point (dBm)	Flat (± dB) max.	VSWR out max.	DC supply		Case type
	min.	max.							(V)	(mA)	
CDM28-1	0.05	100	+ 12	3.8	15	+ 23	1.5	2	+ 15	40	A
CDM40	10	100	+ 16.5	1.8	11.5	+ 29	1.5	1.7	+ 12	15	K
CDM45	25	95	+ 20	1.8	11.5	+ 34	1.5	1.7	+ 12	30	K
CDM27	1	30	+ 16	2.4	17.5	+ 30	1.4	2	+ 15	50	A or K
CDM24	10	100	+ 10	2.1	19	+ 23	1.5	1.7	+ 12	25	A or K
CDM01	10	500	+ 3	3	10.5	+ 17	1.7	1.5	+ 12	10	A or K
CDM11	10	1000	0	2.6	12	+ 15	1.7	2.2	+ 12	10	A or K
CDM14	10	1000	+ 1	2.6	13	+ 16	2	2	+ 12	10	A or K
CDM21	10	1000	+ 16	5.5	12	+ 29	2	2.5	+ 12	60	A or K
CDM02	20	200	+ 8	2	8.5	+ 23	1.5	1.5	+ 12	10	A or K
CDM03	20	200	+ 11	3	8.5	+ 27	1.7	1.7	+ 12	15	A or K
CDM23	20	250	+ 10	1.6	8.5	+ 22	1.5	1.5	+ 12	10	A or K
CDM36	20	2000	+ 4	5.5	12.5	+ 10	2	3	+ 12	20	A or K
CDM12	30	300	+ 16	2.5	8.5	+ 30	1.7	1.7	+ 12	25	A or K
CDM04	30	900	+ 1	3.6	10	+ 16	2	2	+ 12	10	A or K
CDM06	30	900	+ 11	4	10.5	+ 26	1.5	1.6	+ 12	30	A or K
CDM16	30	100	+ 8	2.3	14	+ 24	1.5	1.5	+ 12	20	A or K
CDM30	50	300	+ 19	3	8.5	+ 30	1.7	2	+ 12	50	A or K
CDM35	50	400	+ 16	3	18.5	+ 30	2	2	+ 12	45	A or K
CDM09	900	1400	+ 12	3.5	8.5	+ 22	2	2.1	+ 12	25	A or K
CDM20	1000	2000	+ 10	3.6	10.5	+ 24	2.5	2.5	+ 12	30	A or K
CDM29	2000	2500	+ 8	4.5	10	+ 21	2.5	2	+ 12	25	A or K

SIGNAL PROCESSING MODULES

Selection guide: page 3-30 to 3-31



Specific request sheets: page 3-32 to 3-34

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MIXERS SELECTION GUIDE (Mixers are available in SMM2 package)

PART NUMBER	FREQ. RANGE (LO-RF MHz)	FREQ. RANGE (IF MHz)	LO POWER (dBm)	PACKAGE	PAGE NUMBER
C56691	0.5-500	DC-500	+ 3	SMM1	3-38
C56692	1-1000	DC-1000	+ 3	SMM1	3-38
C56682	10-1500	DC-1500	+ 3	SMM1	3-38
C56662	0.5-500	DC-500	+ 7	SMM1	3-38
C56650	1-1000	DC-1000	+ 7	SMM1	3-38
C56669	15-1500	DC-1000	+ 7	SMM1	3-38
C56660	600-3000	DC-1000	+ 7	SMM1	3-38
C4010	10-4000	1-1000	+ 13	SMM2	3-38
C56664	0.5-500	DC-500	+ 17	SMM1	3-38
C56685	1-1000	DC-1000	+ 17	SMM1	3-38
C56688	15-1500	DC-1000	+ 17	SMM1	3-38

I/Q MODULATORS / DEMODULATORS SELECTION GUIDE

PART NUMBER	FREQ. RANGE (LO-RF MHz)	FREQ. RANGE (I & Q)	LO POWER (dBm)	PACKAGE	PAGE NUMBER
F56010-01	54 - 66	DC - 10	+ 3	FP5	3-40
F56010-02	66 - 78	DC - 15	+ 3	FP5	3-40
F56011-02	66 - 78	DC - 10	+ 3	FP4	3-40
C56010	20 - 40	DC - 15	+ 10	SMM4	3-40
F56010	20 - 40	DC - 15	+ 10	FP5	3-40
C56011	40 - 80	DC - 20	+ 10	SMM4	3-40
F56011	40 - 80	DC - 20	+ 10	FP4	3-40
C56012	80 - 160	DC - 40	+ 10	SMM4	3-40
F56012	80 - 160	DC - 40	+ 10	FP5	3-40
C56013	110 - 250	DC - 50	+ 10	SMM4	3-40
F56013	110 - 250	DC - 50	+ 10	FP5	3-40
C56014	250 - 500	DC - 50	+ 10	SMM4	3-40
F56014	250 - 500	DC - 50	+ 10	FP5	3-40
C56015	850 - 950	DC - 50	+ 10	SMM4	3-40
F56015	850 - 950	DC - 50	+ 10	FP5	3-40

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POWER SPLITTERS SELECTION GUIDE
(Power splitters are available in SMM2 package)

PART NUMBER	FREQ. RANGE	COMMENTS	PACKAGE	PAGE NUMBER
C54701	10 - 500	2-Way	SMM1	3-41
C54702	10 - 2000	2-Way	SMM1	3-41
F54709	1 - 200	2-Way	TO39-1	3-41
F54701	10 - 500	2-Way	FP3	3-41
F54751	10 - 500	2-Way	TO39-1	3-41
F54726	10 - 500	2-Way	TO8-1	3-41
F54702	10 - 2000	2-Way	FP3	3-41
C54725	5 - 500	3-Way	SMM3	3-43
C54727	1 - 300	3-Way	SMM3	3-43
C54730	200 - 1000	3-Way	SMM3	3-43
F54727	1 - 300	3-Way	FP4	3-43
F54730	200 - 1000	3-Way	FP4	3-43
C54722	0.1 - 400	4-Way	SMM4	3-44

90° POWER SPLITTERS SELECTION GUIDE
(Power splitters are available in SMM2 package)

PART NUMBER	FREQ. RANGE min. - max	PACKAGE	PAGE NUMBER
C53008-01	20 - 40	SMM1	3-42
F53008-01	20 - 40	FP2	3-42
C53008-05	30 - 60	SMM1	3-42
F53008-05	30 - 60	FP2	3-42
C53008-09	30 - 90	SMM1	3-42
F53008-09	30 - 90	FP2	3-42
C53008-08	40 - 80	SMM1	3-42
F53008-08	40 - 80	FP2	3-42
C53008-22	50 - 130	SMM1	3-42
F53008-22	50 - 130	FP2	3-42
C53008-07	66 - 78	SMM1	3-42
F53008-07	66 - 78	FP2	3-42
C53008-03	80 - 160	SMM1	3-42
F53008-03	80 - 160	FP2	3-42
C53008-04	100 - 200	SMM1	3-42
F53008-04	100 - 200	FP2	3-42
C53008-10	110 - 250	SMM1	3-42
F53008-10	110 - 250	FP2	3-42
C53008-20	120 - 160	SMM1	3-42
F53008-20	120 - 160	FP2	3-42
C53008-25	250 - 500	SMM1	3-42
F53008-25	250 - 500	FP2	3-42
F53008-16	1000 - 2000	FP2	3-42

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TEKELEC TEMEX

Please photocopy this form to fax us your request

Mixers
Specific request

APPLICATION

Military ❑ Industrial / Professional ❑ Commercial ❑

ELECTRICAL PARAMETERS

Frequency range: RF: ..... LO: ..... IF: .....

Dynamic range parameters:.....
Are there dynamic specifications ? Please specify below:

.....

- Low power available: .....
- RF input at 1 dB compression level: .....
- Intercept point, 3rd order: ..... Input ❑ Output ❑
- Two-Tone, 3rd order IM..... dB ..... at dBm, RF input

Specify measurement conditions (i.e. with two-tone intermodulation: LO level and LO frequency, levels and frequencies of RF signals):

.....
.....

Maximum conversion loss: .....

Isolation: LO-RF (min)..... LO-IF (min)..... RF-IF (min) .....

PACKAGE

Specifiy package type: .....
(Connectors ?, Flat-pack ?, SMD ?, Relay header ?, Hermetic ?, Dimensions ?):

.....
.....

ENVIRONMENT

Temperature range: Storage:..... Operating: .....

OTHERS

Indicate specific requirements (screening, environment, important criteria, etc...). When possible, give necessary documents (i.e. environmental specifications, MIL-spec., etc...).

.....
.....

CROSS REFERENCE

Manufacturer: ..... Part Number: .....

Please photocopy this form to fax us your request

Power splitters Specific request

APPLICATION

Military ❑ Industrial / Professional ❑ Commercial ❑

ELECTRICAL PARAMETERS

Number of way: 2 ❑ 3 ❑ 4 ❑

0° ❑ 90° ❑ 180° ❑

Frequency range: .....
Phase unbalance (degree max): .....
Amplitude unbalance (dB max): .....
Isolation between ports (dB min): .....
Return-loss or VSWR on input and output ports: .....
Insertion loss (above ideal dB min): .....

The following chart indicates the ideal loss of a power splitter:

No of way	2	3	4
Ideal loss (dB)	3.01	4.78	6.02

Internal load dissipation (Watt): .....
Input maximum power (Watt): .....

PACKAGE

Specifiy package type: .....
(Connectors ?, Flat-pack ?, SMD ?, Relay header ?, Hermetic ?, Dimensions ?):
.....
.....

ENVIRONMENT

Temperature range: Storage: ..... Operating: .....

OTHERS

Indicate specific requirements (screening, environment, important criteria, etc...). When possible, give necessary documents (i.e. environmental specifications, MIL-spec., etc...).
.....
.....

CROSS REFERENCE

Manufacturer: ..... Part Number: .....

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FREQUENCY MIXERS GENERAL INFORMATION

Description

- RF double-balanced mixers

Features

- Frequency range: 0.5 to 5000 MHz
- From + 3 dBm to + 23 dBm LO power
- High IP3, High isolation
- Surface mount, low cost packages
- Custom products
- Screening option

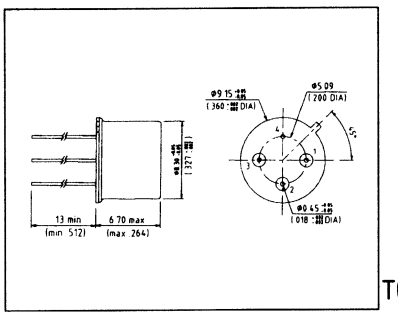
Main characteristics

- Operating and storage temperature: - 55° C / + 100° C
- Soldering heat: 10 s at 265° C
- Impedance: 50 Ω

Applications

- Commercial, Cellular telephone, Wireless LAN's
- Military

Case outline



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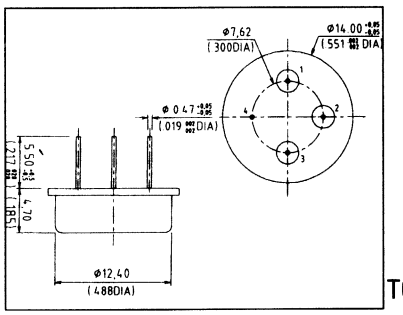

T08-1

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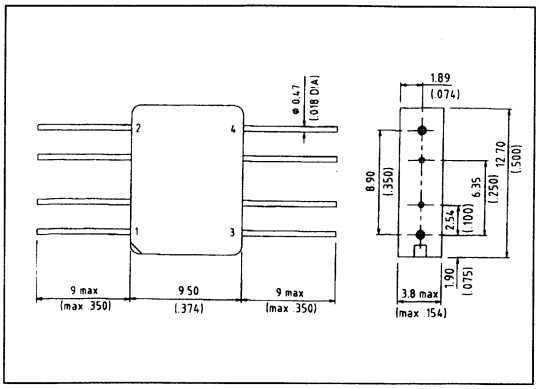
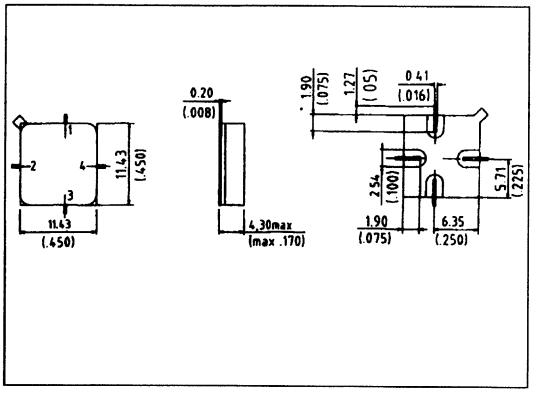
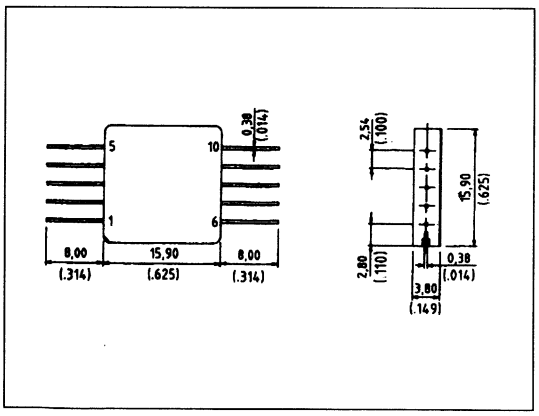
Other packages



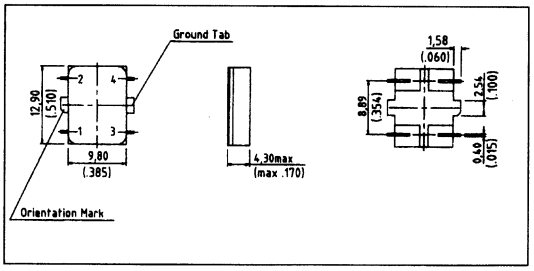
FP1



SMM2



FP4



SMM1

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Pin connection

LEVEL 3

Series	LO	RF	IF	GND
C56682	3	4	2	Other pins
C56691	3	4	2	Other pins
C56692	3	4	2	Other pins

LEVEL 7

Series	LO	RF	IF	Internal GND	External GND
C56650	3	4	2	Other pins	
C56660	3	4	2	Other pins	
C56662	3	4	2	Other pins	
C56669	3	4	2	Other pins	

LEVEL 13

Series	LO	RF	IF	GND
C4010	1	3	2	4

LEVEL 17

Series	LO	RF	IF	Internal GND	External GND
C56664	3	4	2	Other pins	
C56685	3	4	2	Other pins	
C56688	3	4	2	Other pins	

FREQUENCY MIXERS

Features

Model N°	Frequency (MHz)		Conversion Loss (dB)		LO - RF Isolation (dB)			LO - IF Isolation (dB)		
	LO - RF FL - Fu	IF	Mid Band Typ. / Max.	Total Range Typ. / Max.	L Typ. / Max.	M Typ. / Max.	U Typ. / Max.	L Typ. / Max.	M Typ. / Max.	U Typ. / Max.
Level 3 - SMM1 package										
• + 3 dBm LO power • Up to 0 dBm RF • 3rd order intercept point L band: 16 dBm M and U band: 11 dBM typ.										
C56691	0.5-500	DC-500	5/6.5	6/7.5	50/45	40/30	30/25	55/50	35/30	30/25
C56692	1-1000	DC-1000	6/7.5	7/8.5	50/45	40/30	30/25	55/45	35/30	30/20
C56682	10-1500	DC-1500	6/7.5	7/9	45/40	40/35	30/25	45/40	35/30	25/20
Level 7 - SMM1 package										
• + 7 dBm LO power • Up to 0 dBm RF • 3rd order intercept point L band: 18 dBm typ. M and U band: 13 dBM typ.										
C56662	0.5-500	DC-500	5.5/6	5.5/7	60/50	50/40	40/35	55/45	40/35	30/25
C56650	1-1000	DC-1000	5/7	6/8	50/45	40/30	35/30	45/40	35/30	30/22
C56669	15-1500	DC-1000	5/7	7/9	50/45	35/30	35/30	45/40	40/30	30/25
C56660	600-3000	DC-1000	6/8	7/9		35/30	25/20		25/20	20/18
Level 13 - SMM2 package										
• + 13 dBm LO power • Up to 7 dBm RF • 3rd order intercept point L band: 22 dBm typ. M and U band: 17 dBm typ.										
C4010	10-4000	1-1000	6.5/7.5	8/9	45/35	30/25	30/20	55/30	30/20	25/20
Level 17 - SMM1 package										
• + 17 dBm LO power • Up to 15 dBm RF • 3rd order intercept point L band: 30 dBm typ. M and U band: 25 dBm typ.										
C56664	0.5 - 500	DC - 500	5/6.5	5/7	55/50	45/40	40/35	50/45	45/30	35/25
C56685	1 - 1000	DC - 1000	6/7	7/9	55/50	45/40	40/30	50/45	35/30	30/25
C56688	15 -1500	DC - 1000	6/7	8/9	55/45	45/35	35/30	45/40	35/30	30/25

L = Low range (FL to 10 FL) *M = Mid range (10 FL to FU / 2)* *U = Upper range (FU / 2 to FU)*

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I/Q MODULATORS / DEMODULATORS

Features

- Octave bandwidth
- Good phase and amplitude balance

Main characteristics

• Operating and storage temperature	:	- 55° C / + 100° C
• Soldering heat	:	10 s at 265° C
• Total input power	:	1 W
• Impedance	:	50 Ω nominal
• LO Carrier suppression	:	30 dBc minimum
• SSB rejection	:	30 dBc minimum

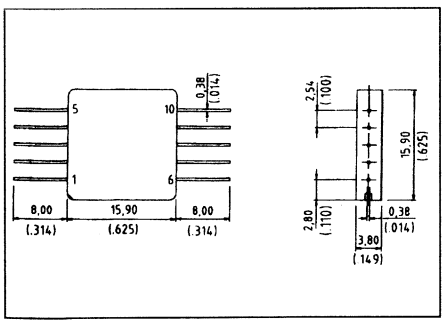
Ordering information

- To specify a demodulator, add a «D» at the end of the part number.

Example : F56010-01D

- To specify a QPSK modulator or demodulator, please consult our local sales office.

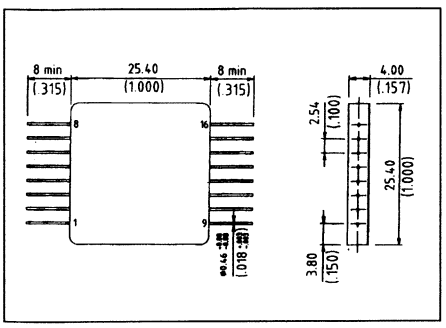
Case drawings



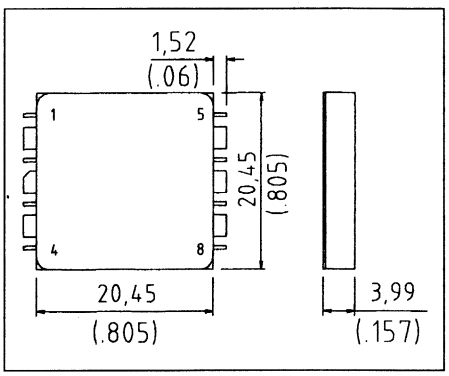
FP4

Pin connection

	FP4	FP5	SMM4
LO	5	8	1
RF	1	1	4
I	6	9	8
Q	10	16	5
GND	Others	Others	Others



FP5



SMM4

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Level 3 (+ 3 dBm Carrier Level)

Model N°	Frequency (MHz)		Conversion loss	Amplitude unbalance		Phase unbalance		Isolation (dB)		Package
	LO-RF FL-FU	I / Q	(dB) Max.	(dB) Typ.	(dB) Min.	(Deg) Typ.	(Deg) Max.	FO-RF Min.	LO-IF Min.	
F56010-01	55 - 66	DC - 10	10.5	0.15	0.4	1	2	40	35	FP5
F56010-02	66 - 78	DC - 15	10.5	0.15	0.4	1	2	40	35	FP5
F56011-02	66 - 78	DC - 10	10.5	0.15	0.4	1	2	40	35	FP4

LO Carrier Suppresion : 30 dBc minimum
SSB Rejection : 30 dBc minimum

Level 10 (+ 10 dBm Carrier Level)

Model N°	Frequency (MHz)		Conversion loss	Amplitude unbalance		Phase unbalance		Isolation (dB)		Package
	LO-RF FL-FU	I / Q	(dB) max.	(dB) Typ.	(dB) Min.	(Deg) Typ.	(Deg) Max.	FO-RF Min .	LO-IF Min.	
F56011	40-80	DC-20	10.5	0.15	0.4	1	2	40	35	FP4
F56010	20-40	DC-15	10.5	0.15	0.4	1	2	40	35	FP5
F56012	80-160	DC-40	10.5	0.5	1	1	3	35	30	FP5
F56013	110-250	DC-50	10.5	0.5	1	1	3	35	30	FP5
F56014	250-500	DC-50	10.5	0.5	1	1	4	35	30	FP5
F56015	850-950	DC-50	10.5	0.5	1	1	4	35	30	FP5
C56010	20-40	DC-15	10.5	0.15	0.4	1	2	40	35	SMM4
C56011	40-80	DC-20	10.5	0.15	0.4	1	2	40	35	SMM4
C56012	80-160	DC-40	10.5	0.5	1	1	3	35	30	SMM4
C56013	110-250	DC-50	10.5	0.5	1	1	3	35	30	SMM4
C56014	250-500	DC-50	10.5	0.5	1	1	4	35	30	SMM4
C56015	850-950	DC-50	10.5	0.5	1	1	4	35	30	SMM4

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POWER SPLITTERS - 2 WAY 0°

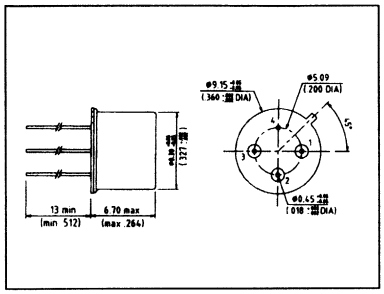
Features

- Broadband frequency range
- High isolation
- Surface Mount package available

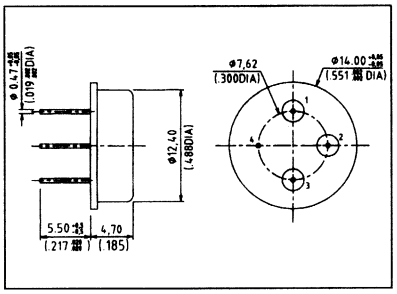
Operating characterstics

- Operating and storage temperature: - 55° C / + 100° C
- Total input power: 1 W
- Soldering heat: 10 s at 265° C
- Impedance: 50 Ω nominaL

Case drawings



T039-1



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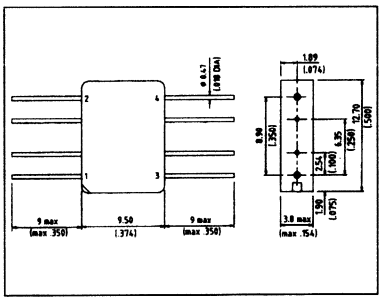
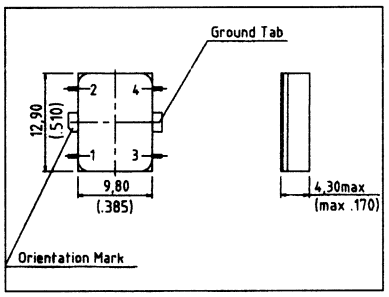


FP3



SMM1

Model N°	Freq. range (MHz)	Isolation (dB)			Insertion loss (dB)			Amplitude unbalance (dB)			Phase unbalance (deg)			Package
		L Typ/Min	M Typ/Min	U Typ/Min	L Typ/Max	M Typ/Max	U Typ/Max	L Max	M Max	U Max	L Max	M Max	U Max	
F54701	10-500	35/30	40/30	30/25	0.25/0.5	0.3/0.6	0.3/0.6	0.2	0.2	0.2	0.5	1	1	FP3
F54702	10-2000	30/25	25/20	20/15	1.1	1.3	1.8	0.3	0.4	0.6	3	4	5	FP3
C54701	10-500	35/30	40/30	30/25	0.2/0.5	0.3/0.6	0.3/0.6	0.2	0.2	0.2	1	1.5	1.5	SMM1
C54702	10-2000	28/23	22/18	18/12	1.1	1.3	1.8	0.3	0.4	0.6	4	6	8	SMM1
F54709	1-200	35/30	40/35	35/30	0.2/0.4	0.2/0.5	0.3/0.6	0.2	0.2	0.2	1	1	1.5	T039-1
F54751	10-500	35/30	40/30	30/25	0.2/0.5	0.3/0.6	0.3/0.6	0.2	0.2	0.2	0.5	1	1	T039-1
F54726	10-500	35/30	40/30	30/25	0.2/0.5	0.3/0.6	0.3/0.6	0.2	0.2	0.2	0.5	1	1	T08-1

POWER SPLITTERS - 2 WAY 90°

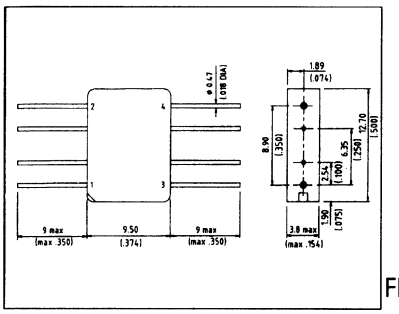
Features

- Broadband frequency range
- High isolation
- Surface Mount package available

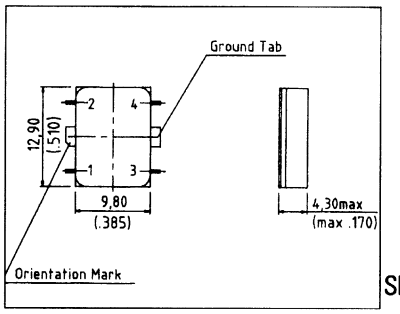
Operating characteristics

- Operating and storage temperature: - 55° C / + 100° C
- Soldering heat: 10 s at 265° C

Case drawings



FP2



SMM1

Model N°	Freq. range (MHz)		Insertion loss (dB)		Amplitude unbalance (dB)		Quadrature deviation (degree)		Isolation (dB)		Package
	min.	max.	typ.	max.	typ.	max.	typ.	max.	typ.	min.	
F53008-01	20	40	0.3	0.5	0.5	0.75	0.5	2	30	20	FP2
F53008-05	30	60	0.6	0.75	0.5	0.75	1	2	28	20	FP2
F53008-09	30	90	0.6	0.8	0.6	1	1.1	2	25	18	FP2
F53008-08	40	80	0.3	0.5	0.4	0.75	1	2	25	20	FP2
F53008-22	50	130	0.75	1	0.9	1	1	2	22	16	FP2
F53008-07	66	78	0.6	0.75	0.1	0.2	1	2	25	20	FP2
F53008-03	80	160	0.5	0.75	0.6	1	1	2	30	20	FP2
F53008-04	100	200	0.6	0.75	0.6	1	0.5	2	25	20	FP2
F53008-10	110	250	0.75	1	0.7	1	1	2	25	20	FP2
F53008-20	120	160	0.5	0.75	0.2	0.4	0.8	2	25	20	FP2
F53008-25	250	500	0.2	0.5	0.5	1	1	2	25	20	FP2
F53008-16	1000	2000	0.2	0.3	0.5	1	1	3	25	20	FP2
C53008-01	20	40	0.3	0.5	0.5	0.75	0.5	2	30	20	SMM1
C53008-05	30	60	0.6	0.75	0.5	0.75	1	2	28	20	SMM1
C53008-09	30	90	0.6	0.8	0.6	1	1.1	2	25	18	SMM1
C53008-08	40	80	0.3	0.5	0.4	0.75	1	2	25	20	SMM1
C53008-22	50	130	0.75	1	0.9	1	1	3	22	16	SMM1
C53008-07	66	78	0.6	0.75	0.1	0.2	1	2	25	20	SMM1
C53008-03	80	160	0.5	0.75	0.6	1	1	2	30	20	SMM1
C53008-04	100	200	0.6	0.75	0.6	1	0.8	2	25	20	SMM1
C53008-10	110	250	0.75	1	0.7	1	1	2	25	20	SMM1
C53008-20	120	160	0.5	0.75	0.2	0.4	0.8	2	25	20	SMM1
C53008-25	250	500	0.2	0.5	0.5	1	1	3	25	20	SMM1

POWER SPLITTERS - 3 WAY 0°

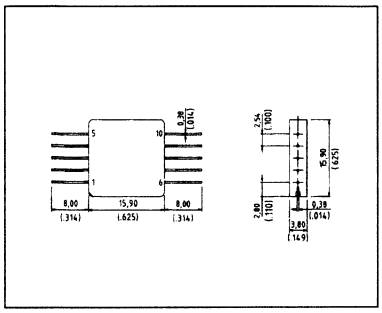
Features

- Broadband frequency range
- High isolation
- Surface Mount package available

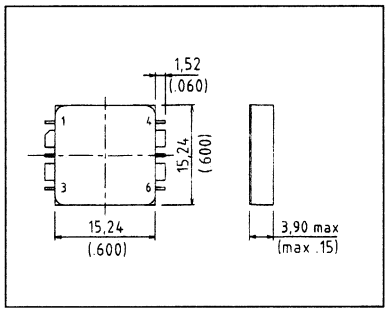
Operating characteristics

- Operating and storage temperature: - 55° C / + 100° C
- Total input power: 1 W
- Soldering heat: 10 s at 265° C
- Impedance: 50 Ω nominal

Case drawings



FP4



SMM3

Model N°	Freq. range (MHz)	Isolation (dB)			Insertion loss (dB)			Amplitude unbalance (dB)			Phase unbalance (deg)			Package
		L Typ/Min	M Typ/Min	U Typ/Min	L Typ/Max	M Typ/Max	U Typ/Max	L Max	M Max	U Max	L Max	M Max	U Max	
F54727	1-300	35/30	35/30	30/20	0.3/0.7	0.3/0.7	0.5/1	0.25	0.25	0.25	2	2	3	FP4
F54730	200-1000	20/15	25/20	25/20	0.3/0.5	0.7/1	0.8/1.5	0.3	0.6	0.6				FP4
C54727	1-300	35/30	35/30	30/20	0.3/0.7	0.3/0.7	0.5/1	0.25	0.25	0.25	2	2	3	SMM3
C54725	5-500	35/30	30/25	25/20	0.3/0.7	0.8/1.2	0.8/1.2	0.3	0.6	0.6	0.5	1.1	2.5	SMM3
C54730	200-1000	20/15	25/20	25/20	0.3/0.5	0.7/1	0.8/1.5	0.3	0.6	0.6				SMM3

POWER SPLITTERS - 4 WAY 0°

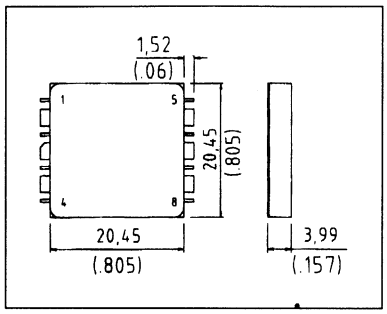
Features

- Broadband frequency range
- High isolation
- Surface Mount package available

Operating characteristics

- Operating and storage temperature: - 55° C / + 100° C
- Total input power: 1 W
- Soldering heat: 10 s at 265° C
- Impedance: 50 Ω nominaL

Case drawings



SMM4

Model N°	Freq. range (MHz)	Isolation (dB)			Insertion loss (dB)			Amplitude unbalance (dB)			Phase unbalance (deg)			Package
		L Typ/Min	M Typ/Min	U Typ/Min	L Typ/Max	M Typ/Max	U Typ/Max	L Max	M Max	U Max	L Max	M Max	U Max	
C54722	0.1-400	40/35	30/25	30/25	0.4/0.6	0.6/1	0.8/1.5	0.2	0.4	0.6	2	3	4	SMM4

L = Low range (FL to 10 FL) *M = Mid range (10 FL to FU / 2)* *U = Upper range (FU / 2 to FU)*

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Pin connection **2-WAY 0°**

Series	E	S1	S2	GND
C54701	1	2	4	Other pins
C54702	1	2	4	Other pins
F54701	1	2	4	Other pins
F54702	1	2	4	Other pins
F54709	2	1	3	4
F54726	2	1	3	4
F54751	2	1	3	4

Pin connection **2-WAY 90° HYBRID**

Packages	A	B	C	D	GND
FP2	1	2	4	3	Other pins
SMM1	1	2	4	3	Other pins

Phasing diagram **2-WAY 90°**

IN / OUT	A	B	C	D
A		Isolated	0°	-90°
B	Isolated		-90°	0°
C	0°	-90°		Isolated
D	-90°	0°	Isolated	

Pin connection **3-WAY 0°**

Series	E	S1	S2	S3	GND
C54725	2	4	5	6	Other pins
C54727	2	4	5	6	Other pins
C54730	2	4	5	6	Other pins
F54727	3	6	3	5	Other pins
F54730	3	6	8	10	Other pins

Pin connection **4-WAY 0°**

Series	E	S1	S2	S3	S4	GND
C54722	1	2	4			Other pins

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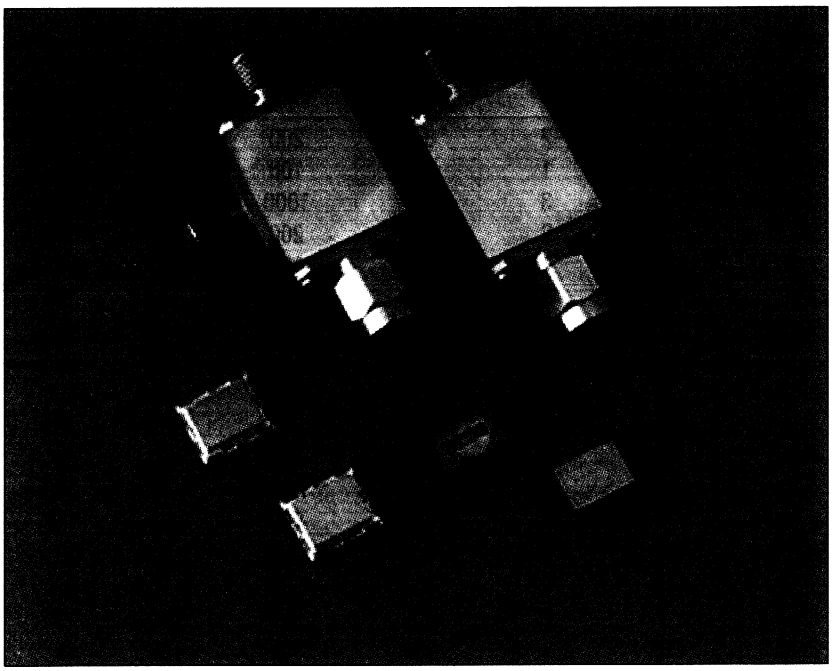
CONTROL COMPONENTS

Selection guide



REFLECTIVE LIMITERS - MH300 & KA7 SERIES

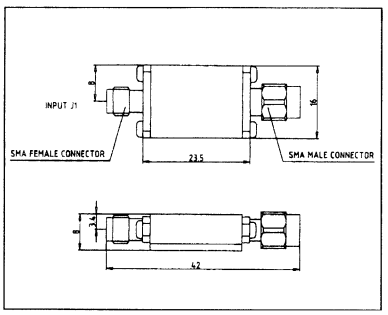
Features

- Broadband frequency range
- High power, low loss

Operating characteristics

- Peak power: Rating is defined at 1 µs pulse width/duty cycle: 10^{-3} and 25° C
- Spike leakage: 0.2 ERGS (typical)
- Operating temperature: - 55° C to + 125° C
- Maximum flat leakage is tested at 1 µs pulse width/duty cycle: 10^{-3} and 25° C with external DC return of less than 1 Ω

Case drawings



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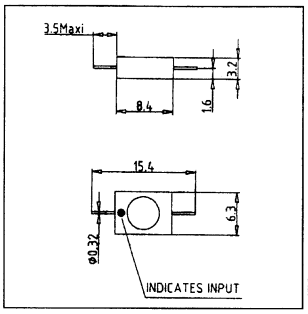


BMH16

Electrical characteristics

Model N°	Frequency range (GHz)	1 dB comp. point (dBM)	CW power max. (W)	Insertion loss (dB) max.	Peak power (W) max.	Leakage power (mW)		Package
						CW max. (1)	Peak max.(2)	
MH305	0.5-2	7	2	0.6	200	80	150	BMH2
KA7120	0.5-2	10	1	0.7	100	50	55	BMH2
KA7130	0.5-2	10	3	0.7	1000	100	200	BMH2
MH306	2-4	7	2	0.8	200	80	150	BMH2
KA7220	2-4	10	1	1	100	50	55	BMH2
KA7230	2-4	10	3	1.1	1000	100	200	BMH2
MH303	2-12	7	2	1.7	200	80	150	BMH2
KA7620	2-12	10	1	1.7	100	50	55	BMH2
KA7630	2-12	10	3	2	1000	100	200	BMH2
MH307	4-8	7	2	1.4	200	80	150	BMH2
KA7320	4-8	10	1	1.4	100	50	55	BMH2
KA7330	4-8	10	3	1.6	1000	100	200	BMH2
MH308	8-12	7	2	1.7	200	80	150	BMH2
KA7420	8-12	10	1	1.7	100	50	55	BMH2
KA7430	8-12	10	3	2	1000	100	200	BMH2
MH310	8-18	7	2	2.5	200	80	150	BMH2
KA7720	8-18	10	1	2.5	100	50	55	BMH2
KA7730	8-18	10	3	2.6	1000	100	200	BMH2
MH309	12-18	7	2	2.5	200	80	150	BMH2
KA7520	12-18	10	1	2.5	100	50	55	BMH2
KA7530	12-18	10	3	2.6	1000	100	200	BMH2

- Leakage power:
  1. Measured with 1 W CW input power
  2. Measured with 100 W, 1 µs pulse for MH300 and KA7*20 series
  . Measured with 1 KW, 1 µs pulse for KA7*30 series

Model N°	Frequency range (GHz)	1 dB comp. point (dBM)	CW power max. (W)	Insertion loss (dB) max.	Peak power (W) max.	VSWR max.	Leakage power (mW)		Package
							CW max. (1)	Peak max.(2)	
MH341A	0.5-2	7	2	0.5	200	1.5	80	150	BMH16
MH381A	0.5-2	10	1	0.6	100	1.5	50	55	BMH16
MH383A	0.5-2	10	3	0.6	1000	1.5	100	200	BMH16
MH341B	2-4	7	2	0.8	200	1.6	80	150	BMH16
MH381B	2-4	10	1	1	100	1.6	50	55	BMH16
MH383B	2-4	10	3	1	1000	2	100	200	BMH16
MH341J	2-8	7	2	1.25	200	1.7	80	150	BMH16
MH381J	2-8	10	1	1.25	100	1.8	50	55	BMH16
MH383J	2-8	10	3	1.5	1000	2	100	200	BMH16
MH341F	2-12	7	2	1.6	200	1.9	80	150	BMH16
MH381F	2-12	10	1	1.6	100	2	50	55	BMH16
MH383F	2-12	10	3	2	1000	2	100	200	BMH16
MH341H	2-18	7	2	2.4	200	2	80	150	BMH16
MH381H	2-18	10	1	2.4	100	2	50	55	BMH16
MH383H	2-18	10	3	2.5	1000	2.2	100	200	BMH16
MH341C	4-8	7	2	1.25	200	1.7	80	150	BMH16
MH381C	4-8	10	1	1.25	100	1.8	50	55	BMH16
MH383C	4-8	10	3	1.5	1000	2	100	200	BMH16
MH341D	8-12	7	2	1.6	200	1.9	80	150	BMH16
MH381D	8-12	10	1	1.6	100	2	50	55	BMH16
MH383D	8-12	10	3	2	1000	2	100	200	BMH16
MH341G	8-18	7	2	2.4	200	2	80	150	BMH16
MH381G	8-18	10	1	2.4	100	2	50	55	BMH16
MH383G	8-18	10	3	2.5	1000	2.2	100	200	BMH16
MH341E	12-18	7	2	2.4	200	2	80	150	BMH16
MH381E	12-18	10	1	2.4	100	2	50	55	BMH16
MH383E	12-18	10	3	2.5	1000	2.2	100	200	BMH16

- Leakage power:
  1. Measured with 1 W CW input power
  2. Measured with 100 W, 1 µs pulse for MH341 and MH381 series
  . Measured with 1 KW, 1 µs pulse for MH383 series

REFLECTIVE ATTENUATORS - MH128 & KB8 SERIES

Features

- Wide dynamic range
- Hermetic package

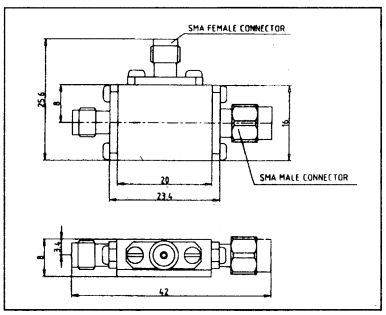
Operating characteristics

- Bias requirements: Normal bias: - insertion loss: 0 V
  - attenuation: 0 to + 100 mA ; maximum ratings + 150 mA
  Inverse bias: - Insertion loss: 0 V
  - attenuation: 0 to - 100 mA ; maximum ratings - 150 mA
- RF power: CW: 5 W Peak: 500 W @ 1 µs max. pulse width Duty cycle: 10^{-3}
  CW: 4 W Peak: 400 W @ 1 µs max. pulse width Duty cycle: 10^{-3} (*)

(*) for KB and KS 8131 ; MH128 A

- Operating temperature: - 55° C to + 125° C

Case drawings



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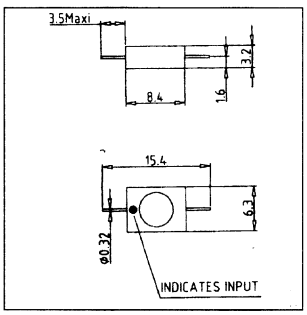


BMH16

Electrical characteristics

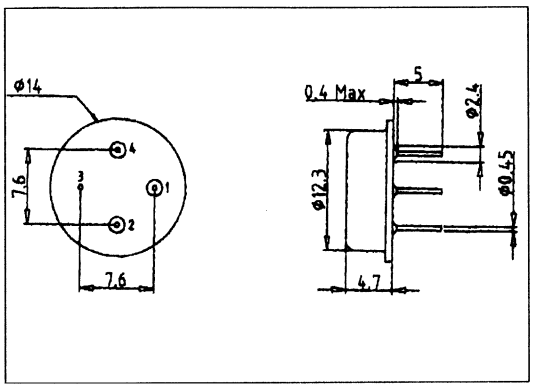
Model N°	Frequency range (GHz)	Insertion loss (dB) max.	Attenuat. dynamic range (dB) min.	VSWR max.	Transition time 10-90 / 90-10 (µs)	Package
KB8135	0.5-2	0.6	35	1.4	1	BMH16
KB8235	2-4	0.8	40	1.5	1	BMH16
KB8935	2-8	1.2	40	1.6	1	BMH16
KB8635	2-12	1.7	40	1.9	1	BMH16
KB8835	2-18	2.1	40	2.1	1	BMH16
KB8335	4-8	1.2	45	1.6	1	BMH16
KB8435	8-12	1.7	48	1.9	1	BMH16
KB8735	8-18	2.1	48	2.1	1	BMH16
KB8535	12-18	2.1	48	2.1	1	BMH16
MH128A	0.5-2	0.6	35	1.4	1	BMH3
MH128B	2-4	0.8	40	1.5	1	BMH3
MH128J	2-8	1.2	40	1.6	1	BMH3
MH128F	2-12	1.7	40	1.9	1	BMH3
MH128H	2-18	2.1	40	2.1	1	BMH3
MH128C	4-8	1.2	45	1.6	1	BMH3
MH128D	8-12	1.7	48	1.9	1	BMH3
MH128G	8-18	2.1	48	2.1	1	BMH3
MH128E	12-18	2.1	48	2.1	1	BMH3

VOLTAGE CONTROLLED ATTENUATORS & LIMITERS

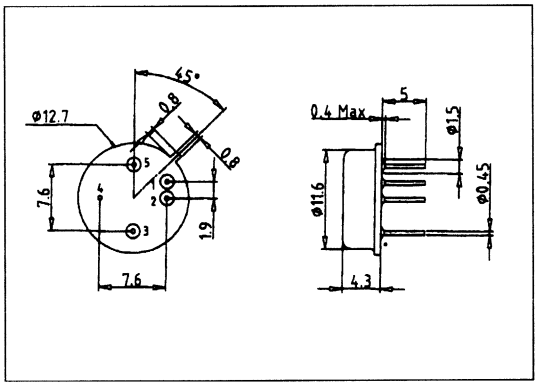
Operating characteristics

- Operating temperature: -40° C to + 100° C
- Storage: -55° C to + 125° C

Case drawings



TO8 144



TO8 125

Electrical characteristics (limiters)

Model N°	Frequency range (MHz)	Control voltage (V)	VSWR Max.	Ins. loss (dB) T=25° C Max.	Input power (dBm) Max.	Limiting output level vs control volt. (dBm) typ.				Package
						5V	10V	15V	20V	
F57903	1-1500	5-20	2	3.5	+25	-10	-5	-2	+0.3	TO8 144
F57902	30-1500	5-20	2	3.5	+25	-10	-5	-2	+0.3	TO8 144

Electrical characteristics (attenuators)

Model N°	Frequency range (MHz)	Insertion loss (dB) Max.	Attenuation (dB) Min.	VSWR Max.	DC supply		Control voltage (V)	Package
					(V)	(mA)		
F57102	5-1500	2.5	20	2	12	15	0-12	TO8 125
F57101	50-1500	3	22	2	12	15	0-12	TO8 125

(*) Input power (-1 dB) compr.:

+ 19 dBm from 50 to 100 MHz
+ 26 dBm from 100 to 1500 MHz

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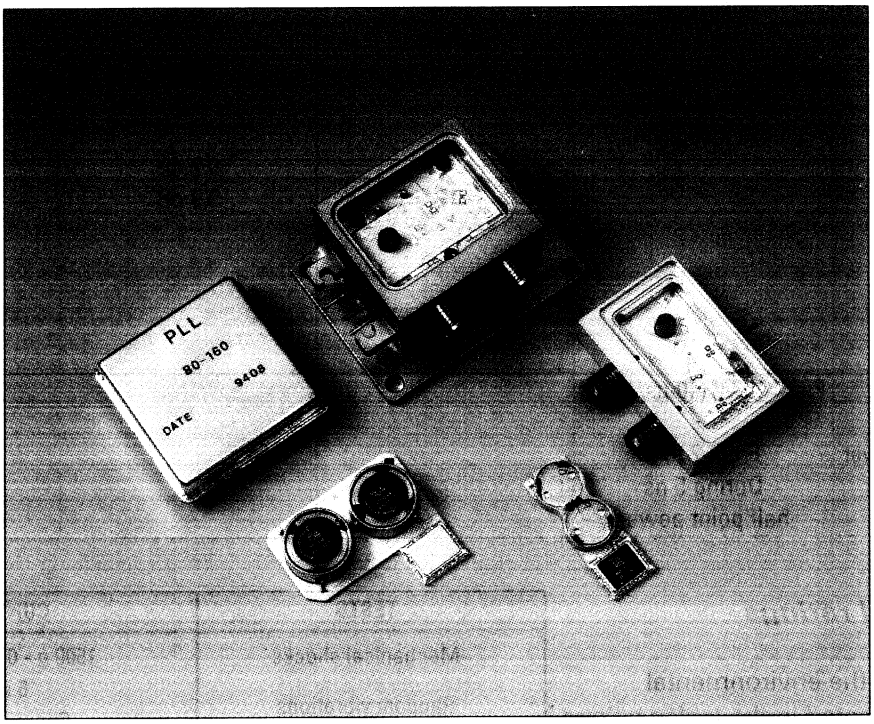
CUSTOM SUBASSEMBLIES

Selection guide



CIRCULATOR + ISOLATOR + LIMITER
C BAND - ULTRALIGHT

Description

- Integrated duplexer and limiter
- Ideally suited for use in Phased Array systems
- Optimized for size and weight
- Can be designed at other frequency

This 3-port device includes a circulator, an isolator and a limiter on a single Kovar baseplate. It is designed to be used in Phased Array active modules where insertion loss, weight and size have to be optimized.

Features

- 5.3 GHz
- 0.2 dB typ. insertion loss for Tx
- 0.9 dB typ. insertion loss for Rx
- VSWR less than 1.2:1
- Flat leakage less than + 13 dBm (Pin = + 40 dBm)
- Weight < 3 grams !
- Size < 1.1" x 0.4" x 0.2"

Performance guaranteed over a temperature range of - 40° C to + 85° C

Applications

- Space radar
- Military radar

Maximum absolute ratings

- Max. input power (40 µs +10 %): 15 W
- Operating temperature: - 40 ; + 85° C
- Storage temperature: - 55 ; + 125° C

Electrical characteristics

Characteristics	Conditions	Min.	Typ.	Max.
Frequency range		5.3 GHz		5.36 GHz
Bandwidth			2 %	
VSWR	Pin = 20 dBm		1.2	
Insertion loss:	Pin = 20 dBm			
from 1 to 2			0.2 dB	0.3 dB
from 2 to 3			0.9 dB	1.1 dB
Isolation:				
from 2 to 1				25
from 3 to 2				40
from 1 to 3				25
from 3 to 1				15
Flat leakage	Pin = 10 W (40 µs/10 %)			20 mW
Recovery time				500 ns
1dB compr. input power	From 2 to 3			+ 7 dBm
Spike leakage	During 5 ns half point power			10 nJ

Environmental ratings

Our devices meet the environmental specifications indicated in the tables below:

TESTS	CONDITIONS
Mechanical shocks	1500 g - 0.5 ms - axe Y_1
Random vibrations	5 shocks Overall: 50 g RMS
Temperature cycling	20 - 2000 Hz -55° C / +125 ° C 200 cycles

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CIRCULATOR + ISOLATOR + LIMITER
S BAND - ULTRALIGHT - SPACE & MILITARY APPLICATIONS

Description

- Integrated duplexer and limiter
- Ideally suited for use in Phased Array systems
- Optimized for size and weight
- Can be designed at other frequency

This 3-port device includes a circulator, an isolator and a limiter on a single Kovar baseplate. It is designed to be used in Phased Array active modules where insertion loss, weight and size have to be optimized.

Features

- 3 GHz
- 0.35 dB typ. insertion loss for Tx
- 1.1 dB typ. insertion loss for Rx
- VSWR less than 1.2:1
- Flat leakage less than + 13 dBm (Pin = + 40 dBm)
- Weight < 13 grams !
- Size < 1.1" x 0.4" x 0.2"

Performance guaranteed over a temperature range of - 40° C to + 85° C

Applications

- Space radar
- Military radar

Maximum absolute ratings

- Max. input power (40 µs+10 %): 15 W
- Operating temperature: - 40 ; + 85° C
- Storage temperature: - 55 ; + 125° C

Electrical characteristics

Characteristics	Conditions	Min.	Typ.	Max.
Frequency range		3 GHz		3.3 GHz
Bandwidth			2 %	
VSWR	Pin = 20 dBm		1.2	
Insertion loss:	Pin = 20 dBm			
from 1 to 2			0.35 dB	0.4 dB
from 2 to 3			1.1 dB	1.2 dB
Isolation:				
from 2 to 1				18
from 3 to 2				36
from 1 to 3				18
from 3 to 1				15
Flat leakage	Pin = 10 W (40 µs/10 %)			20 mW
Recovery time				500 ns
1 dB compr. input power	From 2 to 3			+ 7 dBm
Spike leakage	During 5 ns half point power			10 nJ

Environmental ratings

Our devices meet the environmental specifications indicated in the tables below:

TESTS	CONDITIONS
Mechanical shocks	1500 g - 0.5 ms - axe Y_1
Random vibrations	5 shocks Overall: 50 g RMS1
Temperature cycling	100 - 2000 Hz -55° C / +125 ° C 10 cycles

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D.R.O.

Features

- Frequency: 4 to 24 GHz
- High stability
- Low phase noise
- Low amplitude noise
- Mechanical and electrical tuning
- Phase lockable

Description

This range of Dielectric Resonator Oscillators (DRO) has been designed to meet the most exacting requirements in terms of phase noise and frequency stability. The use of very low 1/F noise transistors and very high Q dielectric resonators gives rise to state of the art performance.

These DROs are used as local oscillators in transmitters and receivers for a wide range of systems. The end use of these systems includes satellite telecommunications, microwave radio-links, Doppler radars, FMCW Doppler radars, radio-altimeters and counter measures.

These sources are developped to meet specific customer requirements from a set of standard models.

Different options may be specified by the customer: the precise fixed operating frequency, mechanical and electronic tuning and auxiliary coupled outputs. The coupled output together with the electronic tuning allows the device to be phase locked to a stable frequency reference (quartz).

The use of thin film gold on alumina technology in hermetic enclosures ensures the operation of the DROs in hostile environments.

The phase noise of the products can be specified whilst the oscillator is subject to mechanical vibration.

Silicon bipolar transistors are used for low frequency devices up to around 8 GHz, whereas GaAs FETs are used at higher frequencies. These choices give the optimum phase noise performance for a given frequency. The output is protected by a buffer amplifier or a passive isolator so as to minimise the frequency pulling due to load variations. Output power levels between 10 dBm and 25 dBm may be specified.

TEKELEC TEMEX's capability also include microwave sources.

DELAY LINE FREQUENCY DISCRIMINATORS

Features

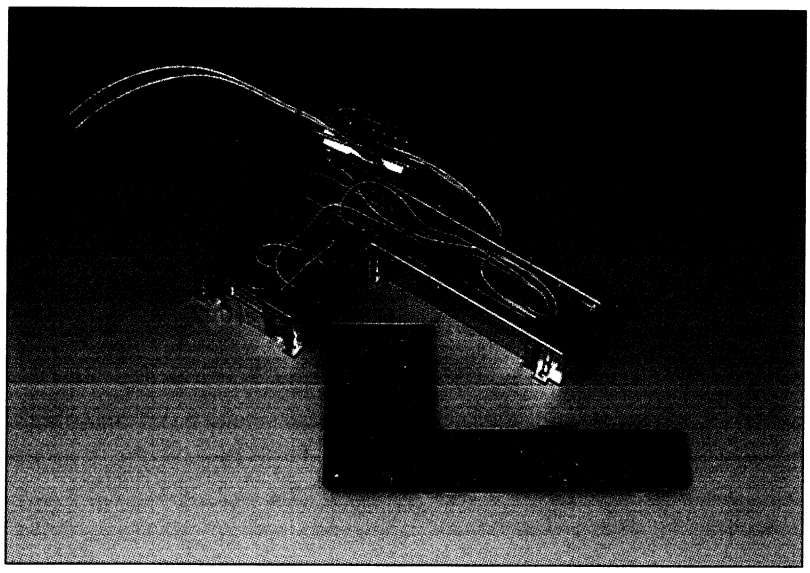
- For radar signal processing
- High speed frequency measurement
- Pulse or Cw operation

Description

I/Q mixer based system. The input signal is delayed by a coaxial line and compared with an un-delayed version of the signal in the I/Q mixer. The I/Q mixer measures the relative phase (= Arctan Q/I). The delay has linear phase response so that input frequency is proportional to phase.

Characteristics

• Operating bandwidth:	Octave
• Center frequency:	from 50 MHz to 1 GHz
• Frequency accuracy:	< ±1 MHz (50 ns line at 300 MHz)
• Frequency accuracy at amb. temp.:	< ± 0.3 MHz (50 ns line at 300 MHz)
• 2 % settling time:	< 90 ns (50 ns line)



UP/DOWN CONVERTER

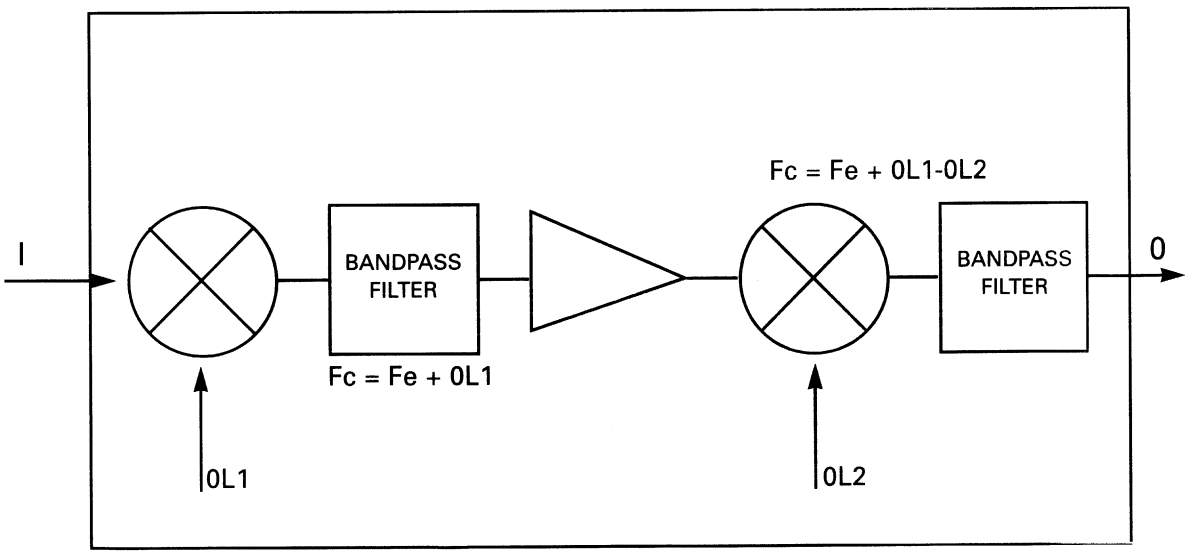
Transposition of base band signal to microwave frequency and inverse.

Applications

Telecoms and radar simulation

Very good image (- 65 dBc) and parasitic response (- 80 dBc)

Typical block diagram:



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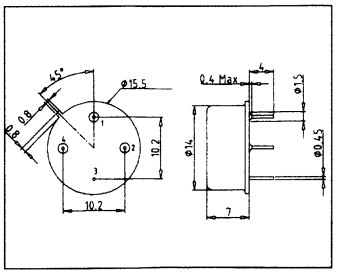
PACKAGES

PACKAGES



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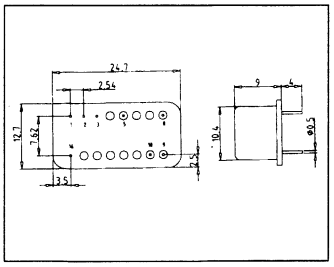

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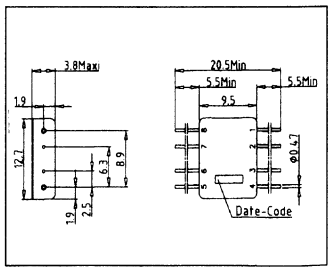

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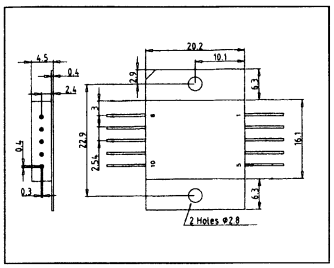

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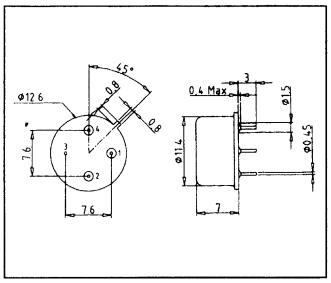

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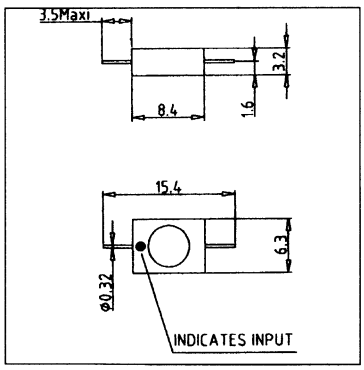

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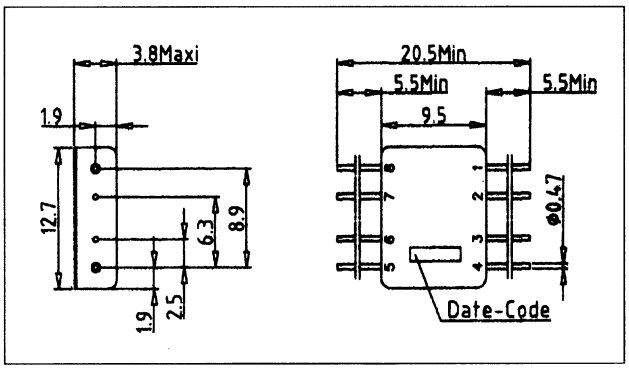

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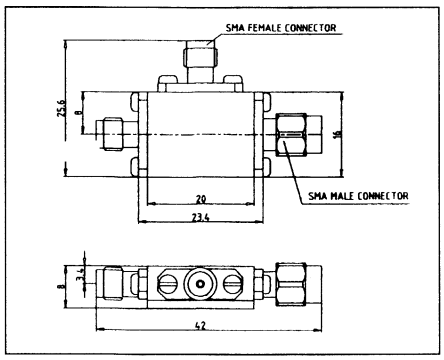

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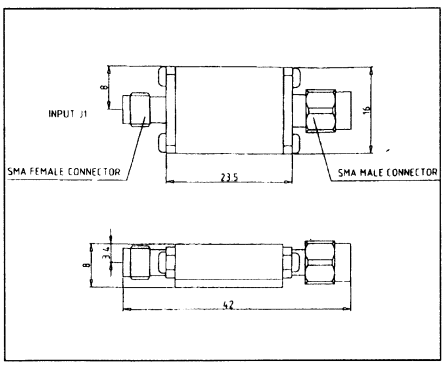

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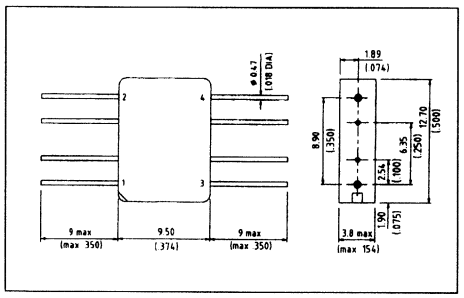

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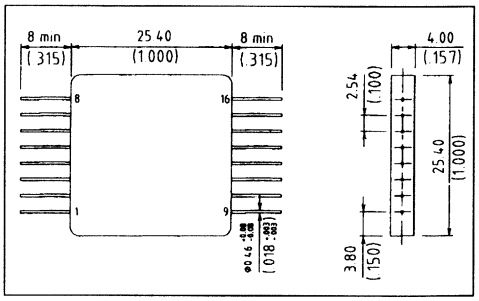
FP2
FP3



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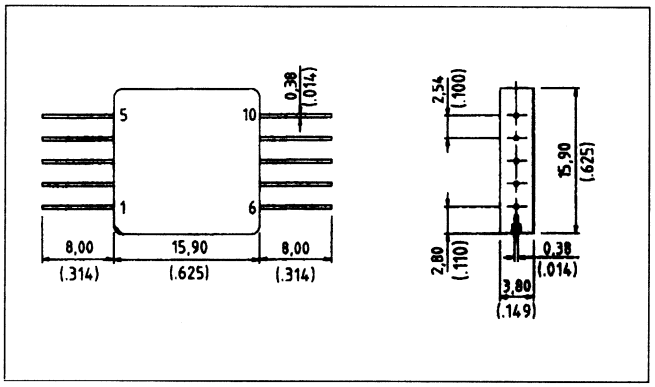

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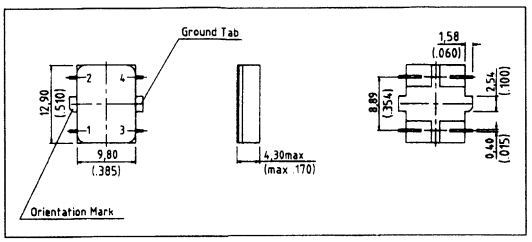
PACKAGES



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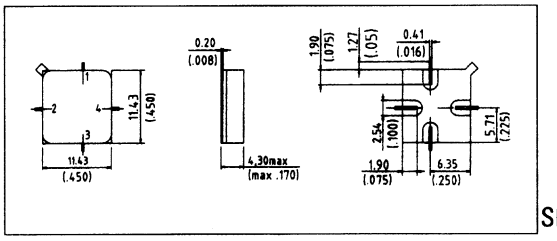

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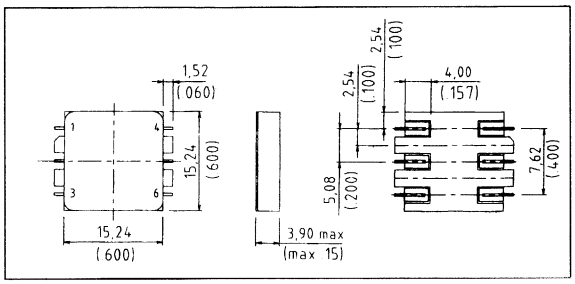

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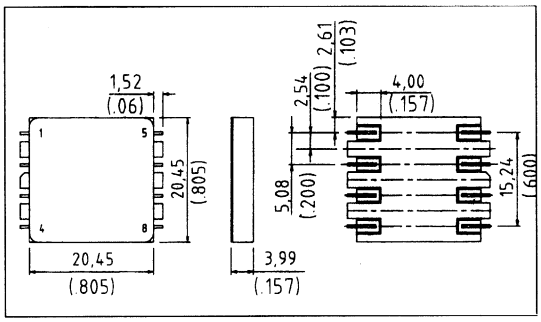

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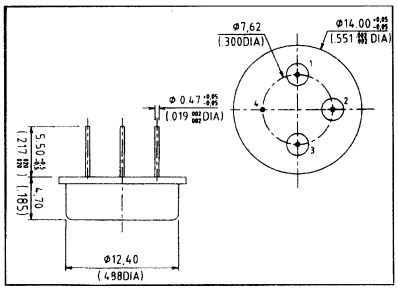

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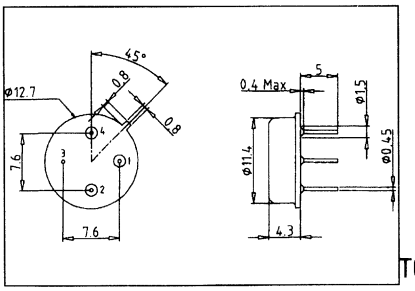

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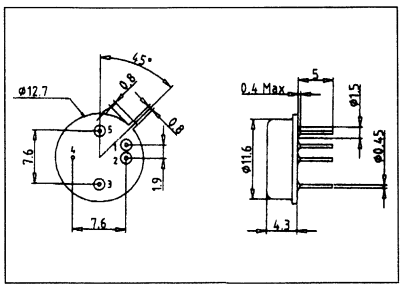

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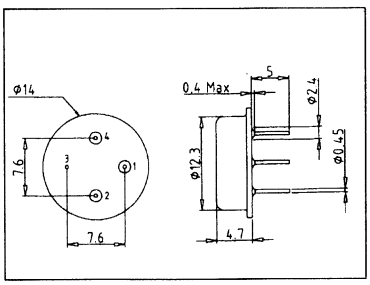

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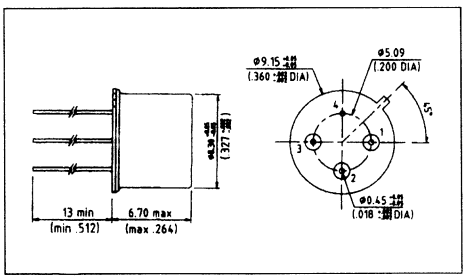

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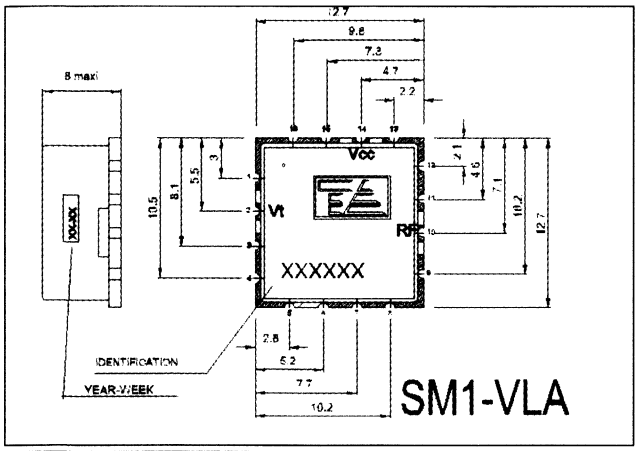
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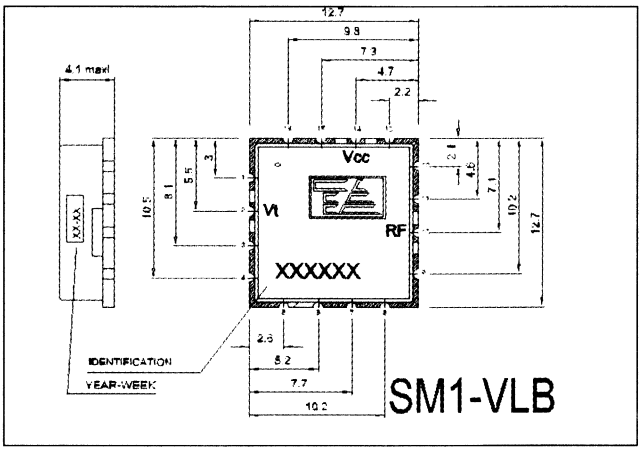
9.8
7.3
4.7
2.2
8 maxi
Vcc
Vt
RF
XXXXXX
XX-XX
IDENTIFICATION
YEAR-WEEK
2.6
5.2
7.7
10.2
SM1-VLA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4.1 maxi
Vcc
Vt
RF
XXXXXX
XX-XX
IDENTIFICATION
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2.6
5.2
7.7
10.2
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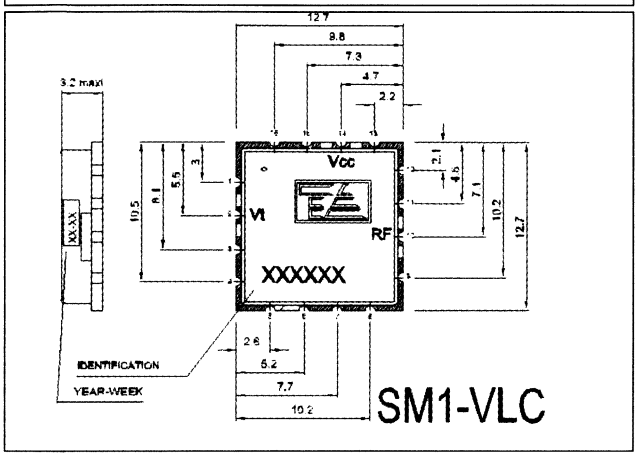
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9.8
7.3
4.7
2.2
3.2 maxi
Vcc
Vt
RF
XXXXXX
XX-XX
IDENTIFICATION
YEAR-WEEK
2.6
5.2
7.7
10.2
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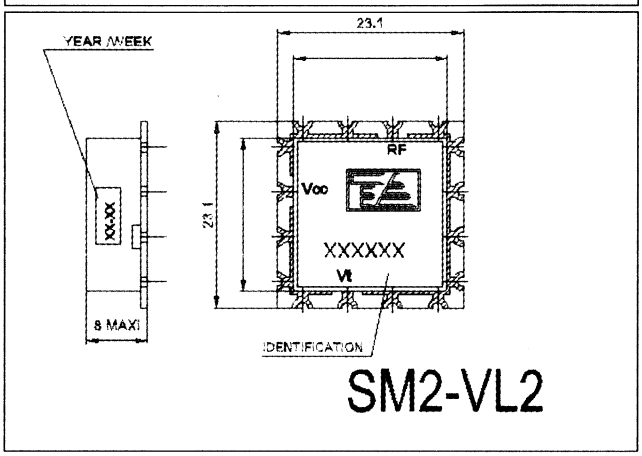
YEAR /WEEK
23.1
RF
Vcc
XXXXXX
Vt
XX-XX
8 MAXI
IDENTIFICATION
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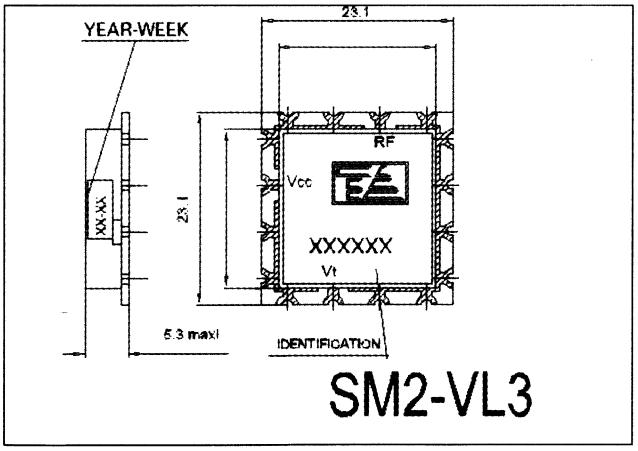
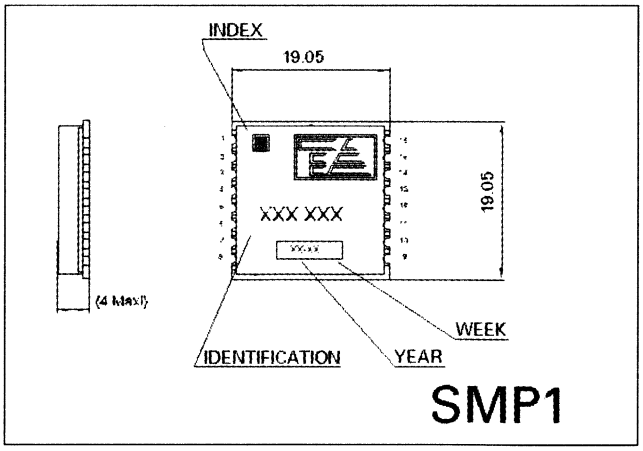

YEAR-WEEK
23.1
RF
Vcc
XXXXXX
Vt
XX-XX
5.3 maxi
IDENTIFICATION
SM2-VL3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19.05
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XX-XX
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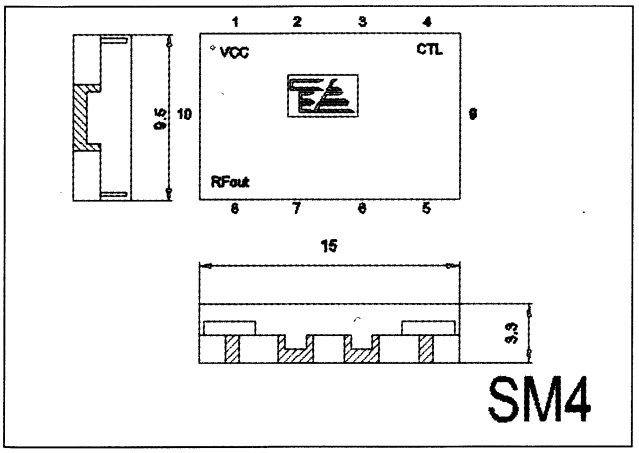
(4 MAXI)
WEEK
IDENTIFICATION
YEAR
SMP1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3
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CTL
9.5
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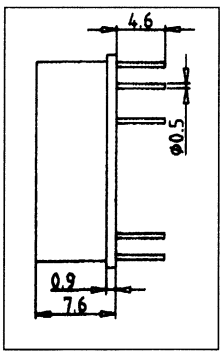
8
RFout
8
7
6
5
15
3.3
SM4


4.6
Ø0.5
0.9
7.6
PM1

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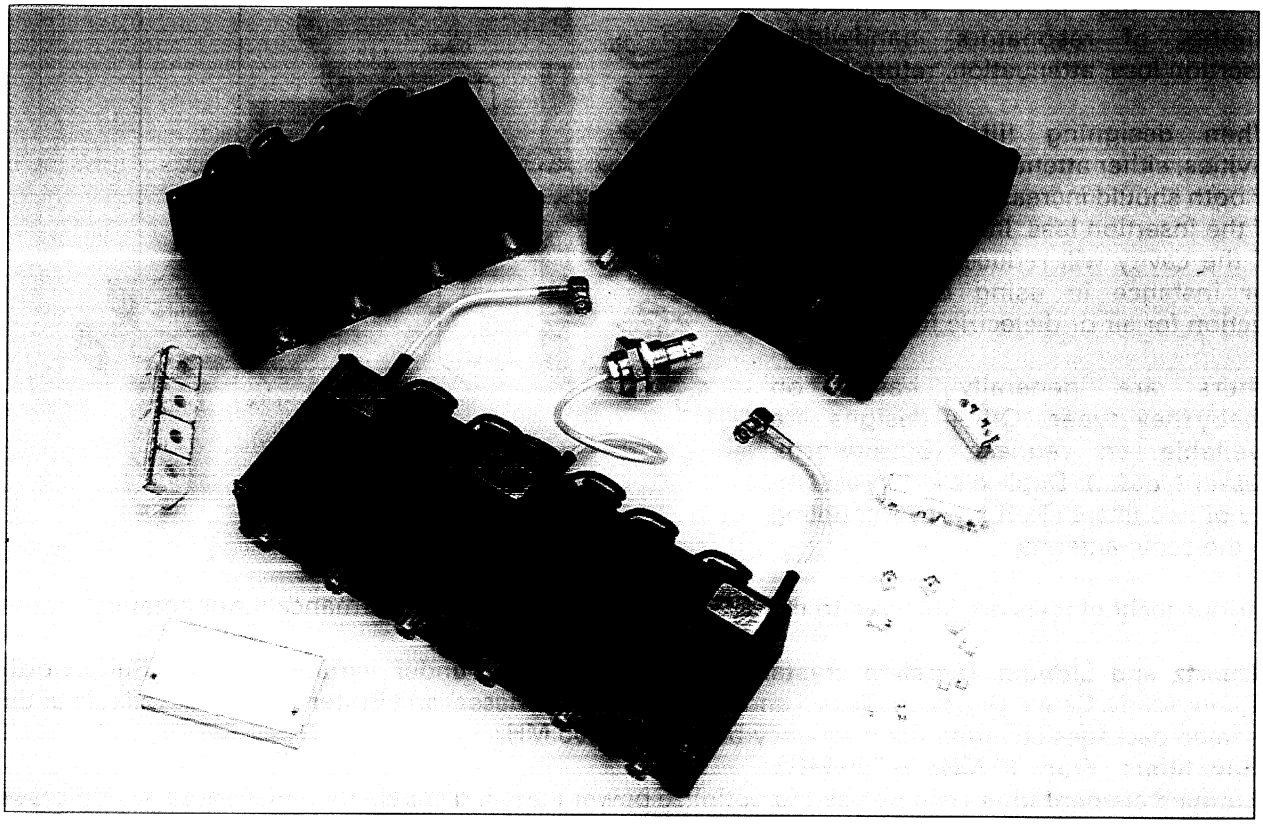
FILTERS, DUPLEXERS & CERAMIC RESONATORS

CONTENTS



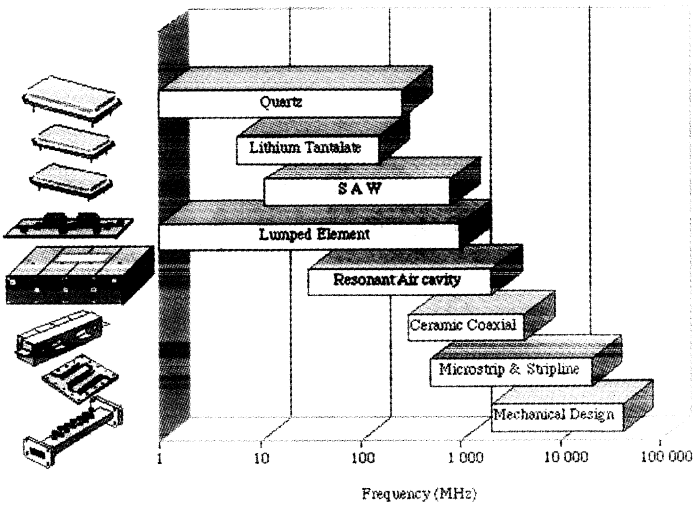
GENERAL INFORMATION

TEKELEC TEMEX designs and manufactures a complete range of filters and duplexers operating in the frequency bands from a few MHz up to 40 GHz.

Filters are made by coupling several resonators, with the best compromise between the different parameters: number of resonators, bandwidth, insertion loss, attenuation, return loss.

When designing filter with more cavities, either attenuation or bandwidth or both should increase with an increase of the insertion loss. Improving Q-factor of the cavity will reduce insertion loss, for instance in using bigger cavity section for air or dielectric filters.

Filters are generally based on Chebyshev types. Other designs are available on request (Butterworth, Bessel types...). Duplexer is the assembly of two filters (Tx/Rx) with a coupling to the same antenna.



Various technologies are involved to meet the highest quality and performance requirements:

- **Quartz and Lithium Tantalate crystal filters** are proposed under various designs: Butterworth, Chebyschev, Cauer, Gaussian, Bessel and combinations of Bessel and Butterworth are available under sealed packages covering the frequency bands 1 to 200 MHz.
- **Saw filters : From 10 MHz to 700 MHz**
- **Lumped element filters** can be used to optimize power handling capability under space saving cases, including SMD packages operating **up to 1000 MHz** frequency bands.

- **Resonant air cavity filters and duplexers** are manufactured with line or helicoïd resonators with a theoretical length of l/4. Designs are integrating low cost packages with a range of cavity sections: 27 x 27, 42 x 42, 50 x 50 and 100 x 100 mm to improve Q-factor in the frequency bands from **30 to 2000 MHz**. Tunable filters for any customer field tuning are also available. Duplexers can be optimized with additional zeros reducing number of cavity when keeping this attenuation.

- **Ceramic coaxial filters** are designed with external and internal metallization to make the cavity and the line of the resonator. The expertise in dielectric materials and metallization are mandatory to propose the lowest insertion loss features. Frequency range is **300 to 4000 MHz.**

- **Microstrip & stripline filters** are based either on ceramic substrates (alumina, ...) with multilayer thick film technologies or soft substrates (Teflon®, glass reinforced Teflon®, ceramic loaded polycarbonate, cyanate ester, ...). Process technologies are used to reduce cost for mass series. Integration of additional microwave and RF functions (circulators, isolators, couplers, detectors, ...) can be performs for customer designs. Frequency range is **500 MHz to 20 GHz.**

- **Mechanical filters** such as waveguide or combline designs cover the microwave frequency bands from **2 GHz to 40 GHz**. Designing is based on customer design.

Filters and duplexers are conform to ISO9001 ;
Clean room and dedicated staff are used for space products.

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FILTERS

Selection guide

PROFESSIONAL CRYSTAL FILTERS

Selection Guide

Main features	Frequency range	Designation	Page
Temp. range: -55° C to +125° C **Insertion loss: 1 to 6 dB** **Spurious: 15 to 80 dB**	1 to 200 MHz	**QUARTZ Filter** **General** **Data**	4-5
Bandwidth: 1.10^{-4} to 4.10^{-3} of F0 Ripple: < 3 dB Shape factor: ≤ 1.2	1 to 200 MHz	**QUARTZ Crystal filter** **Butterworth, Chebyschev,** **Cauer Chebyschev,...**	4-6
Bandwidth: 1.10^{-4} to 2.10^{-3} of F0 Ripple: n.a. Shape factor: ≤ 6	1 to 200 MHz	**Linear Phase** **QUARTZ Crystal filter** **Gaussian, Bessel,...**	4-6
Bandwidth: 1.10^{-4} to 2.10^{-3} of F0 Shape factor: ≤ 3	1 to 200 MHz	**Semi-linear Phase** **QUARTZ Crystal filter** **Combinaiton of Bessel and Butterworth**	4-7
Temp. range: -55° C to +125° C **Insertion loss: 2 to 8 dB** **Spurious: 15 to 60 dB**	1 to 200 MHz	**LITHIUM TANTALATE** **filter** **General Data**	4-8
Bandwidth: 4.10^{-3} to 5.10^{-2} of F0 Ripple: < 3 dB Shape factor: ≤ 2	1 to 200 MHz	**LITHIUM TANTALATE** **Crystal filter** **Butterworth, Chebyschev,** **Cauer Chebyschev...**	4-10
Bandwidth: 4.10^{-3} to $2.5.10^{-2}$ of F0 Ripple: n.a. Shape factor: ≤ 6	1 to 200 MHz	**Linear Phase** **LITHIUM TANTALATE** **Crystal filter** **Bessel...**	4-10
Bandwidth: 4.10^{-3} to $2.5.10^{-2}$ of F0 Shape factor: ≤ 3	1 to 200 MHz	**Semi-linear Phase** **LITHIUM TANTALATE** **Crystal filter** **Combination of Besel and Butterworth**	4-9

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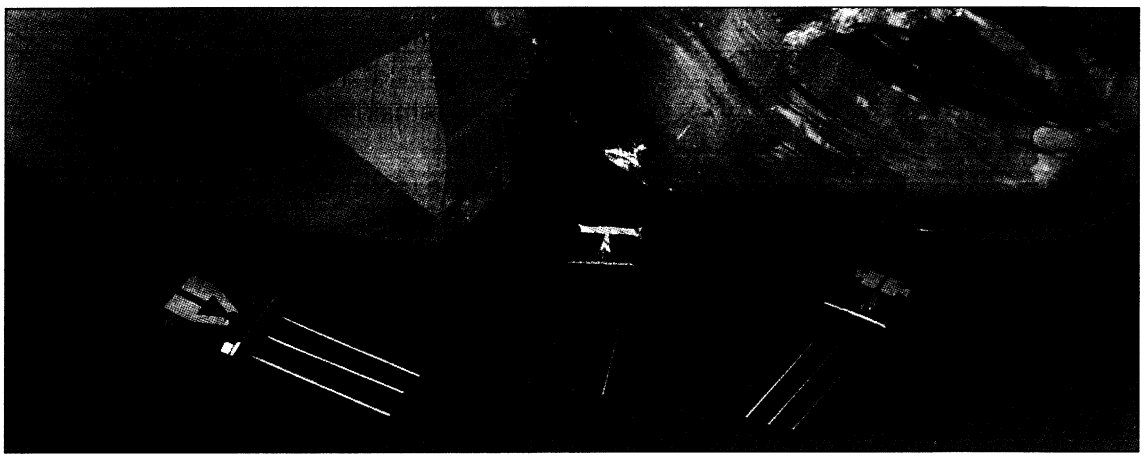
Quartz filter general data

	QUARTZ CRYSTAL FILTER
Frequency range	1 to 200 MHz
Mode	fundamental mode or overtone 3 and 5
Insertion loss	1 to 6 dB depending on F0, width and number of poles
Spurious	15 to 80 dB depending on F0, width and number of poles generaly for 100 kHz ≤ F0 ≤ 500 kHz
Continuous input power	Up to +10 dBm
Maximum input power	Up to +10 dBm
Working temperature range	-55° C to +125° C max
Storage temperature range	-55° C to +125° C max
VRT	-55° C to +125° C max., 5 cycles, Gt = 25° C/min.
Vibration test (sinewave)	Sine: 10 Hz to 2000 Hz / 20 g / Random: 0.1 g2 / Hz
Shock test	100 g, 6 ms
Humidity	56 days / Hr: 95 %
Salt spray	48 Hs 5 % NaCl
Number of poles	1 to 12
Marking	CQE + date code + reference



Quartz Crystal Filter

TRANSFERT FUNCTIONS	BUTTERWORTH, CHEBYSCHEV, CAUER CHEBYSCHEV....
Bandwidth	1.10^{-4} to 4.10^{-3} of frequency F0 (limited to $2.5.10^{-3}$ for monolithic filter)
Ripple	≤ 3 dB depending on width and number of poles
Shape factor	≤ 1.2 (ratio of 60 to 3 dB bandwidth)
Out of band rejection	from 20 dB to 100 dB depending on case, frequency and number of poles
Applications	IF, Antenna and general applications

Linear Phase Filter

TRANSFERT FUNCTIONS	GAUSSIAN, BESSEL...
Bandwidth	1.10^{-4} to 2.10^{-3} of frequency F0 (limited to $1.5.10^{-3}$ for monolithic filter)
Shape factor	≤ 6 (ratio of 60 to 3 dB bandwidth)
Out of band rejection	from 20 dB to 80 dB depending on case frequency and number of poles
Phase linearity	5 % to 80 % of 3 dB bandwidth and 10 % on of the remaining 3 dB bandwidth
Group delay	$\tau°$: depending on bandwidth and number of poles $\Delta\tau°$: 5 % on 80 % of 3 dB bandwidth $\Delta\tau°$: 10 % on the remaining 3 dB bandwidth
Applications	Linear phase (data transmission)

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Quartz Semi-linear Phase Filter (SLP)

TRANSFERT FUNCTIONS	COMBINATION OF BESSEL AND BUTTERWORTH...
Bandwidth	1.10^{-4} to 2.10^{-3} of frequency F° (limited to $1.5 .10^{-3}$ for monolithic filter)
Ripple	see attached curve
Shape factor	≤ 3 (ratio of 60 to 3 dB bandwidth)
Out of band rejection	from 20 dB to 80 dB depending on case frequency and number of poles
Phase linearity	10 % on 70 % of 3 dB bandwidth
Group delay	τ°: depending on bandwidth and number of poles Δτ°: 10 % on 70 % of 3 dB bandwidth
Applications	Data transmission

Lithium Tantalate Filter General Data

TRANSFERT FUNCTIONS	LITHIUM TANTALATE CRYSTAL FILTER
Frequency range	10 to 200 MHz
Mode	fundamental mode
Insertion loss	2 to 8 dB depending on F0, width and number of poles
Spurious	15 to 60 dB depending on F0, width and number of poles
Continuous input power	Up to +10 dBm
Maximum input power	Up to +10 dBm
Working temperature range	-55° C to +125° C max
Storage temperature range	-55° C to +125° C max
VRT	-55° C to +125° C max, 5 cycles, Gt = 25° C/min
Vibration test (sinewave)	Sine: 10 Hz to 2000 Hz / 20 g / Random: 0.1 g2 / Hz
Shock test	100 g, 6 ms
Humidity	56 days / Hr: 95 %
Salt spray	48 Hs 5 % NaCl
Number of poles	2 to 8
Marking	CQE + date code + reference

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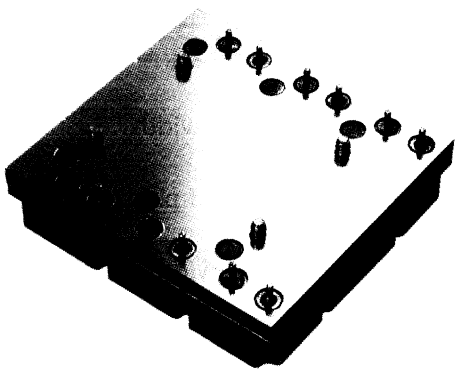
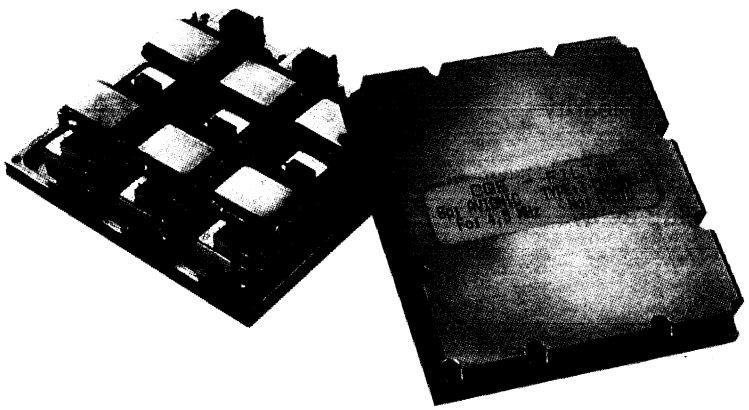
Lithium Tantalate Semi-Linear Phase Filter (SLP)

TRANSFERT FUNCTIONS	COMBINATION OF BESSEL AND BUTTERWORTH...
Bandwidth	4.10^{-3} to $2.5.10^{-2}$ of frequency F°
Ripple	see attached curve
Shape factor	≤ 3 (ratio of 60 to 3 dB bandwidth)
Out of band rejection	from 20 dB to 80 dB depending on case frequency and number of poles
Phase linearity	10 % on 70 % of 3 dB bandwidth
Group delay	τ°: depending on bandwidth and number of poles $\Delta\tau$°: 10 % on 70 % of 3 dB bandwidth
Applications	Data transmission





PROFESSIONAL CRYSTAL FILTERS

Lithium Tantalate crystal filter and linear Phase Tantalate Filter

Lithium Tantalate Crystal Filter

TRANSFERT FUNCTIONS	BUTTERWORTH, CHEBYSCHEV, CAUER CHEBYSCHEV....
Bandwidth	4.10^{-3} to 5.10^{-2} of frequency F0
Ripple	≤ 3 dB depending of width and number of poles
Shape factor	≤ 2 (ratio of 60 to 3 dB bandwidth)
Out of band rejection	from 20 dB to 80 dB depending on case frequency and number of poles
Applications	IF, Antenna and general applications

Linear Phase Filter

TRANSFERT FUNCTIONS	GAUSSIAN, BESSEL...
Bandwidth	4.10^{-3} to $2.5.10^{-2}$ of frequency F0
Shape factor	≤ 6 (ratio of 60 to 3 dB bandwidth)
Out of band rejection	from 20 dB to 80 dB depending on case, frequency and number of poles
Phase linearity	on to 80 % of 3 dB bandwidth and 10 % on of the remaining 3 dB bandwidth
Group delay	$\tau°$: depending of bandwidth and number of poles $\Delta\tau°$: 5 % on 80 % of 3 dB bandwidth $\Delta\tau°$: 10 % on the remaining 3 dB bandwidth
Applications	Linear phase (data transmission)

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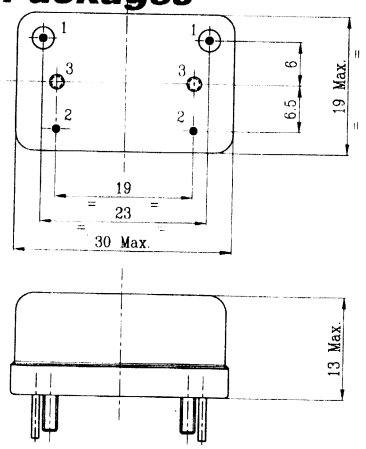
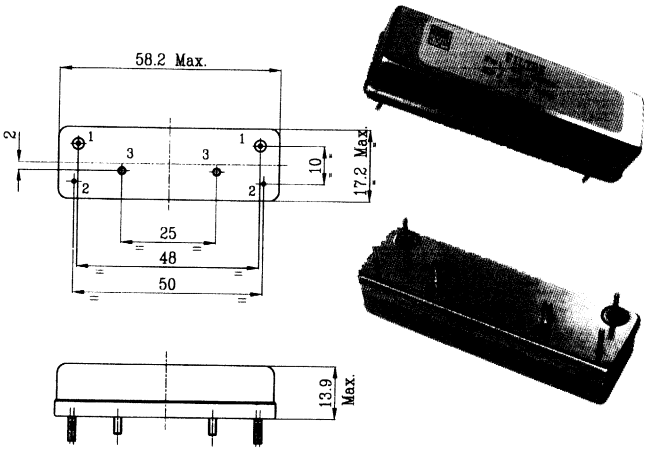
Packages



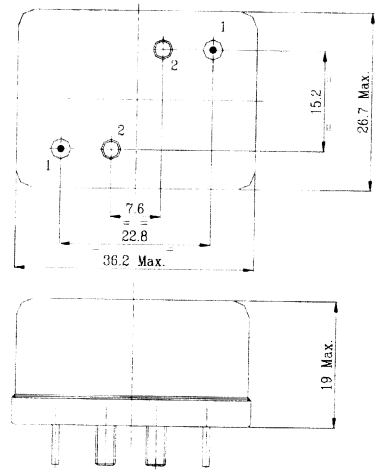
1 - 2 Insulating pin Ø 1 x 6.5
2 - 2 Ground pins Ø 1 x 6.5
3 - 2 Screw Ø M2 x 4.5

BF1



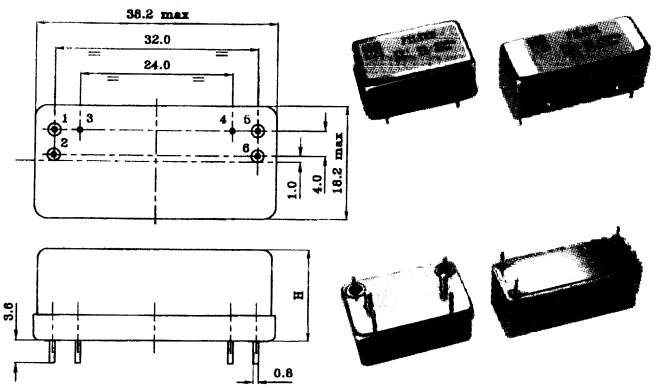
1 - 2 Insulating pin Ø 1 x 6.5
2 - 2 Ground pins Ø 1 x 6.5
3 - 2 Screw Ø M2 x 4.5

BF2



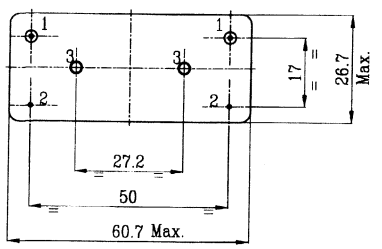
1 - 2 Insulating pin Ø 1 x 6.5
2 - 2 Screw Ø 3 x 6.5

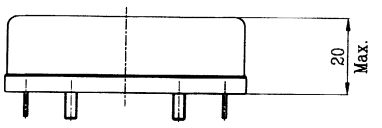
BF3



1 : Insulating pin Ø 0.8 x 3.6
2 : Ground pins Ø 1 x 6.5
3 : GND pin Ø 0.8 x 3.6
4 : GND pin Ø 0.8 x 3.6
5 : OUT or GND pin Ø 0.8 x 3.6
6 : OUT or GND pin Ø 0.8 x 3.6

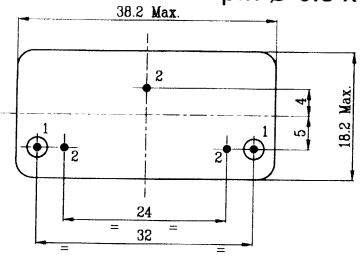
BF9/12

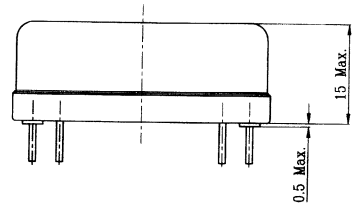




1 - 2 Insulating pin Ø 1.3 x 6
2 - 2 Ground pins Ø 1.3 x 6
3 - 2 Screw Ø M3 x 6.5

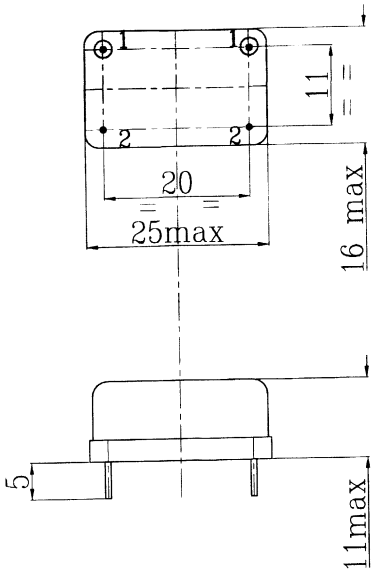
BF5





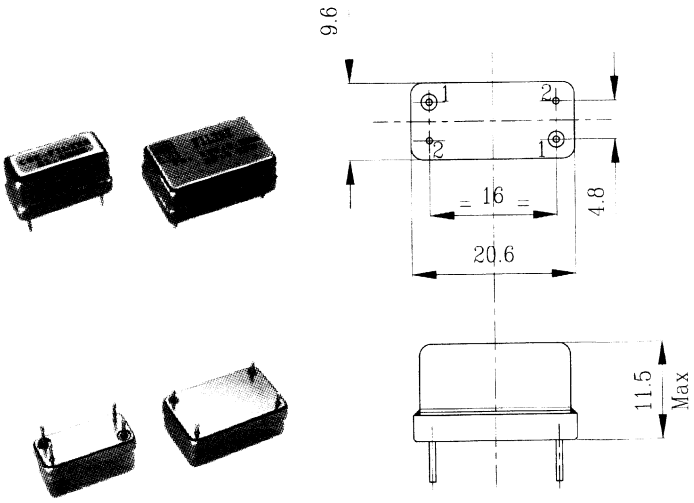
1 - 2 Insulating pin Ø 1 x 6.5
2 - 3 Ground pins Ø 1 x 6.5

BF9



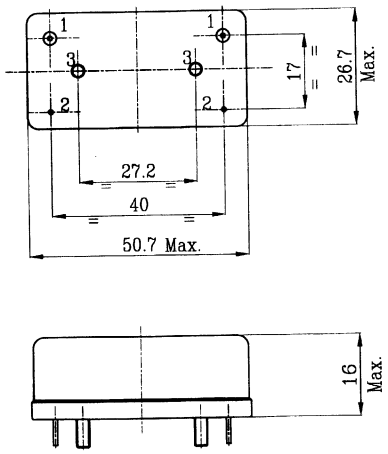
1 - 2 Insulating pin Ø 0.8 x 5
2 - 2 Ground pins Ø 0.8 x 5

BF12

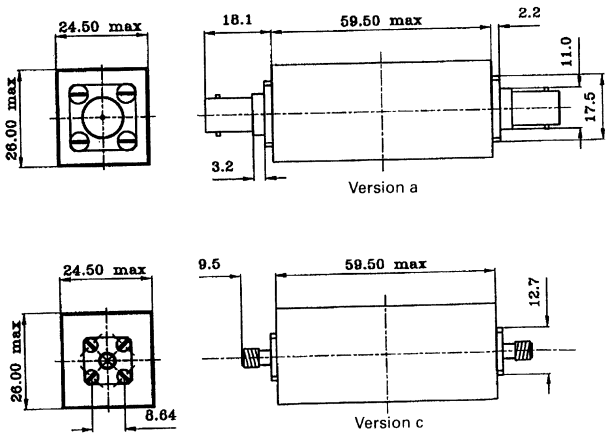


1 - 2 Insulating pin Ø 0.8 x 5
3 - 2 Ground pins Ø 0.8 x 5

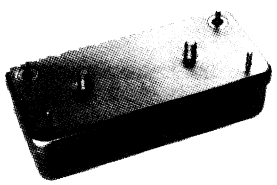
BF13



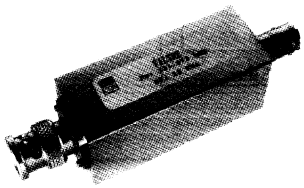
1 - 2 Insulating pin Ø 1 x 6.5
2 - 2 Ground pins Ø 1 x 6.5
3 - 2 Screw Ø M3 x 6.5



Package for Antenna filter



BF6



BF23

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HOW TO SPECIFIY A CRYSTAL FILTER ?

A - Electrical characteristics

1. Reference frequency .....MHz
2. Central frequency vs. reference frequency .....Hz
3. Pass band width .....kHz .....at .....dB
4. Insertion loss (max of transmission) .....dB
5. Ripple peak to peak .....dB
6. Stopband relative to IL:
   from .....kHz, to .....kHz ≥ .....dB
   from .....kHz, to .....kHz ≥ .....dB
   from .....kHz, to .....kHz ≥ .....dB
7. Spurious attenuation:
   from .....kHz, to .....kHz ≥ .....dB
8. Input level (continuous or peak) .....dB
9. Matching:
   50 Ω or input R L C
   output R L C
10. Percentage phase lineary over: .....% of 3 dB bandwidth
11. Differential group delay over: .....% of 3 dB bandwith
12. Third order interception point: .....dBm
    Two tones : .....dBm / kHz

B - Package

Length .....mm
Width .....mm
Height .....mm
Pin out .....
Marking .....

C - Environmental characteristics

1. Operating temperature range: .....°C to .....°C
2. Storage : .....°C to .....°C
3. Shock .....
4. Sinusoidal vibrations: from .....Hz to .....kHz, ...g
5. Randoms vibrations: from .....Hz to .....kHz .....g
   operating / non operating
6. Others

Our technical expert are of course ready to advise customer on their approach and to supply all the information needed to reach the best possible agreement.

STANDARD CRYSTAL FILTERS

Selection Guide

Main features	Frequency range	Designation	Page
Monolithic Crystal Filters Standard Channel spacing 12.5/20/25/50 kHz	10.7 MHz	**TE 5000 to TE 5150**	4-16
Monolithic Crystal Filters Standard	21.4 MHz	**TE 5180 to TE 5330**	4-17
Monolithic Crystal Filters Subminiature	21.4 MHz	**TE 5360 to TE 5500**	4-18
Monolithic Crystal Filters Standard	45.0 MHz	**TE 9420 and TE 9310**	4-19
Monolithic Crystal Filters Standard	45.0 MHz	**TE 7420 to TE 7450**	4-19
Monolithic Crystal Filters Standard	45.0 MHz	**TE 7730 and TE 7740**	4-19
Monolithic Crystal Filters Standard	70.0 MHz	**TE 10400 to TE 10430**	4-20
Monolithic Crystal Filters Standard	90.0 MHz	**TE 10440 to TE 10480**	4-20

Our complete range of standard crystal filters is designed and manufactured in the United States by TEMEX ELECTRONICS Inc., a subsidiary of TEKELEC TEMEX.

Over 13 years expertise in crystal filter and discriminator design, extensive use of CAD and industrial manufacturing allow TEMEX to deliver extremely competitive priced components that best suit the purposes of its customers.

Ordering information

Please state the part number + package type. Example:

TE5280M3

TEMEX filter prototyping kits

You can start your prototyping phase now !
We deliver filter prototyping kits in 10.7, 21.4, 45, 70, and 90 MHz, each containing:

- 10.7 MHz or 21.4 MHz centre frequency:

  7.5 kHz 3 dB BW: 2 x 2 poles and 2 x 4 poles
  13 kHz 3 dB BW : 2 x 2 poles and 2 x 4 poles
  15 kHz 3 dB BW : 2 x 2 poles and 2 x 4 poles
  30 kHz 3 dB BW : 2 x 2 poles and 2 x 4 poles

- 45 MHz centre frequency:

  7.5 kHz 3 dB BW: 2 x 2 poles and 2 x 4 poles
  15 kHz 3 dB BW : 2 x 2 poles and 2 x 4 poles
  30 kHz 3 dB BW : 2 x 2 poles and 2 x 4 poles

- 70 MHz centre frequency:

  15 kHz 3 dB BW : 2 x 2 poles and 2 x 4 poles
  20 kHz 3 dB BW : 2 x 2 poles and 2 x 4 poles

- 90 MHz centre frequency:

  15 kHz 3 dB BW : 2 x 2 poles and 2 x 4 poles
  20 kHz 3 dB BW : 2 x 2 poles and 2 x 4 poles
  30 kHz 3 dB BW : 2 x 4 poles

Ordering codes:

- 10.7 MHz: MCFPK-1 0.7
- 21.4 MHz: MCFPK-21.4
- 45 MHz: MCFPK-45
- 70 MHz: MCFPK-70
- 90 MHZ: MCFPK-90

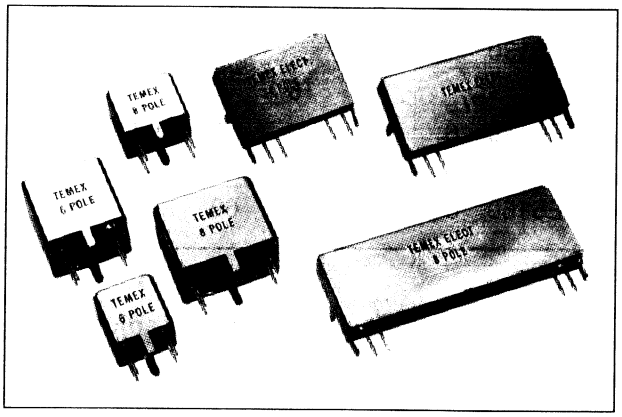
Refills available

Filter design and manufacturing capability

Should Your application require custom designed filters not listed in this documentation, please don't hesitate to contact our sales desk. Our company designs and produces a very wide range of filters using quartz or lithium tantalate resonators with frequencies ranging from about 1 MHz to 400 MHz.

One of our areas of expertise is time domain crystal filters: guaranteed group delay and group delay variation, matched sets on a wide operating temperature range, phase tracking and amplitude matching.

We design and manufacture filters for space application too: earth-observation SPOT program and military programs.



STANDARD CRYSTAL FILTERS

10.7 MHz for channel spacing 12.5 / 20 / 25 / 50 kHz

Part no.	No. poles	Passband		Stopband attenuation				Insertion loss	Ripple	Ultimate rejection	Termination	Package
		dB	± kHz	dB	± kHz	dB	± kHz	dB	over -20/+70°C dB max	dB min	Ω//pF±3pF	
TE5000	2	3	3.75	20	18.0	-	-	2	1.0	50	1800 // +4	M3 or M4
TE5010	4			30	14.0	-	-	3	2.0	60	1500 // +3	2 x (M3 or M4) M5 to M9
TE5020	6	6		60	12.5	-	-	4		70		3 x (M3 or M4) M5, M6, M8 or M9
TE5030	8			60	10.0	90	12.5	5		80		4 x (M3 or M4) M6 or M9
TE5040	2	3	6.5	20	30.0	-	-	1	1.0	50	2700 // 0	M3 or M4
TE5050	4			30	15.0	-	-	2	2.0	75	3100 // 0	2 x (M3 or M4) M5 to M9
TE5060	6	6		60	19.5	-	-	3		90		3 x (M3 or M4) M5, M6, M8 or M9
TE5070	8			60	13.0	80	17.5	4		100		4 x (M3 or M4) M6 or M9
TE5080	2	3	7.5	20	35.0	-	-	1	1.0	50	3000 // 0	M3 or M4
TE5090	4			30	17.5	-	-	2	2.0	75	3300 // 0	2 x (M3 or M4) M5 to M9
TE5100	6	6		60	22.5	-	-	3		90		3 x (M3 or M4) M5, M6, M8 or M9
TE5110	8			60	15.0	80	20.0	3		100		4 x (M3 or M4) M6 or M9
TE5120	2	3	15	20	70.0	-	-	1	1.0	35	5000 // -1	M3 or M4
TE5130	4			30	35.0	-	-	2	2.0	60		2 x (M3 or M4) M5 to M9
TE5140	6	6		60	45.0	-	-	2		90		3 x (M3 or M4) M5, M6, M8 or M9
TE5150	8			60	30.0	80	40.0	3		100		4 x (M3 or M4) M6 or M9

Notes:

- Parallel termination capacity is adjusted for optimum filter response.
- These models are available in other packages not shown in this brochure

How to order

PART NUMBER and PACKAGE TYPE: Example: TE5000M4

STANDARD CRYSTAL FILTERS

21.4 MHz

Part no.	No. poles	Passband		Stopband attenuation				Insertion loss	Ripple	Ultimate rejection	Termination	Package
		dB	± kHz	dB	± kHz	dB	± kHz	dB	over -20/+70°C dB max	dB min	Ω//pF±3pF	
TE5180	2	3	3.75	15	12.5	-	-	2	1.0	50	850 // +6	M1, M2 or M3
TE5190	4			30	12.5	-	-	3	2.0	70	850 // +5	2x(M1, M2 or M3) M5, M6, M7, M8, M9
TE5200	6	6		60	12.5	-	-	4		90		3x(M1, M2 or M3) M5, M6, M8 or M9
TE5210	8			60	10.0	80	12.5	5		100		4x(M1, M2 or M3) M6 or M9
TE5220	2	3	6.5	15	20.0	-	-	2	1.0	50	1300 // +2	M1, M2 or M3
TE5230	4			30	22.5	-	-	3	2.0	70	1400 // 0	2x(M1, M2 or M3) M5, M6, M7, M8, M9
TE5240	6	6		60	22.5	-	-	4		90		3x(M1, M2 or M3) M5, M6, M8 or M9
TE5250	8			60	17.5	80	22.5	4		100		4x(M1, M2 or M3) M6 or M9
TE5260	2	3	7.5	15	25.0	-	-	2	1.0	50	1500 // 0	M1, M2 or M3
TE5270	4			30	25.0	-	-	3	2.0	70	1600 // 0	2x(M1, M2 or M3) M5, M6, M7, M8, M9
TE5280	6	6		60	25.0	-	-	4		90		3x(M1, M2 or M3) M5, M6, M8 or M9
TE5290	8			60	20.0	80	25.0	4		100		4x(M1, M2 or M3) M6 or M9
TE5300	2	3	15	15	50.0	-	-	2	1.0	45	3000 // 0	M1, M2 or M3
TE5310	4			30	45.0	-	-	3	2.0	60	3000 // -1	2x(M1, M2 or M3) M5, M6, M7, M8, M9
TE5320	6	6		60	45.0	-	-	3		90		3x(M1, M2 or M3) M5, M6, M8 or M9
TE5330	8			60	33.0	80	45.0	4		100		4x(M1, M2 or M3) M6 or M9

Notes:

- Parallel termination capacity is adjusted for optimum filter response.
- These models are available in other packages not shown in this brochure

How to order

PART NUMBER and PACKAGE TYPE: Example: TE5220M2

STANDARD CRYSTAL FILTERS

Subminiature 21.4 MHz

Part no.	No. poles	Passband		Stopband attenuation				Insertion loss	Ripple	Ultimate rejection	Termination	Package
		dB	± kHz	dB	± kHz	dB	± kHz	dB	over -20/+70°C dB max	dB min	Ω//pF±3pF	
TE5360	4	3	3.75	30	12.5	-	-	3	1.0	70	850 // +5	SM1, SM2, SM3 SM4, SM5, SM6
TE5370	6	6		60				4	2.0	90		SM2, SM3 SM5, SM6
TE5380	8				10.0	80	12.5	5		100		SM3 or SM6
TE5390	4	3	6.5	30	22.5	-	-	3	1.0	70	1400 // 0	SM1, SM2, SM3 SM4, SM5, SM6
TE5400	6	6		60				4	2.0	90		SM2, SM3 SM5, SM6
TE5410	8				17.5	80	22 5	4		100		SM3 or SM6
TE5420	4	3	7.5	30	25.0			3	1.0	70	1600 // 0	SM1, SM2, SM3 SM4, SM5, SM6
TE5430	6	6		60				4	2.0	90		SM2, SM3 SM5, SM6
TE5440	8				20.0	80	25.0	4		100		SM3 or SM6
TE5450	4	3	15	30	45.0	-	-	3	1.0	60	3000 // -1	SM1, SM2, SM3 SM4, SM5, SM6
TE5460	6	6		60				3	2.0	90		SM2, SM3 SM5, SM6
TE5470	8				33.0	80	43.0	4		100		SM3 or SM6
TE5480	4	3	18	30	48.0			3	1.0	60	3300 // -1	SM1, SM2, SM3 SM4, SM5, SM6
TE5490	6	6		60				3	2.0	90		SM2, SM3 SM5, SM6
TE5500	8				35.0	80	45.0	3		100		SM3 or SM6

Notes :

- Parallel termination capacity is adjusted for optimum filter response.
- These models are available in other packages not shown in this brochure

How to order

PART NUMBER and PACKAGE TYPE: Example: TE5420SM1

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FRANCE: +33 (0) 1 49884900 ITALY: +39 (0) 2 58 01 91 06 SPAIN: +34 (0) 1 3204160 UK: +44 (0) 1256 883340

Part no.	No. poles	Mode	Passband		Stopband attenuation		Insertion loss	Ripple	Ultimate rejection	Termination	Package
			dB	± kHz	dB	± kHz	dB	over -20/+70°C dB max	dB min	Ω//pF±3pF	
TE9420	2	3rd OT	3	3.75	18	16.0	3	1	40	2000 // -1.0	M2 or M3
TE9310	4				30	12.5	3		70		2 x (M2 or M3) M5, M6, M7 or M8
TE7420	2			7.5	18	28.0	2		40	3000 // -1.0	M2 or M3
TE7430	4				40	30.0	3		70		2 x (M2 or M3) M5, M6, M7 or M8
TE7440	2			15	15	47.0	2		40	8000 // -1.5	M2 or M3
TE7450	4				30	50.0	3		70		2 x(M2 or M3) M5, M6, M7 or M8
TE7730	2	Fund.			15	50.0	2		40	1100 // +1.5	M2 or M3
TE7740	4				40	60.0	3		70	800 // +1.0	2 x (M2 or M3) M5, M6, M7 or M8

Notes :

- Parallel termination capacity is adjusted for optimum filter response.
- These models are available in other packages not shown in this brochure. Standard package of the 2-pole types is M2
- 50Ω I/O impedance available in our M5 or larger packages

How to order

PART NUMBER and PACKAGE TYPE:

Example: TE7430M6 for standard or,
TE7430SM1 for subminiature

STANDARD MONOLITHIC CRYSTAL FILTERS

70.0 MHz and 90.0 MHz

70.0 MHz MONOLITHIC CRYSTAL FILTERS

NO. POLES	MODE	TEMEX P/N	PASSBAND dB	PASSBAND ± kHz	STOPBAND dB	STOPBAND ± kHz	STOPBAND dB	STOPBAND kHz	LOSS dB	RIPPLE dB	TERM. Ω / pF
2	3-OT	TE10400	3	7.5	18	30	35	-910	2	1	2000//-1
4	3-OT	TE10410	3	7.5	35	25	80	-910	3	1	2000//-1
2	3-OT	TE10420	3	10	15	30	35	-910	2	1	2500//-1
4	3-OT	TE10430	3	10	35	40	80	-910	3	1	2500//-1

90.0 MHz MONOLITHIC CRYSTAL FILTERS

NO. POLES	MODE	TEMEX P/N	PASSBAND dB	PASSBAND ± kHz	STOPBAND dB	STOPBAND ± kHz	STOPBAND dB	STOPBAND kHz	LOSS dB	RIPPLE dB	TERM. Ω / pF
2	3-OT	TE10440	3	7.5	18	30	35	-910	2	1	2000//-1
4	3-OT	TE10450	3	7.5	35	25	80	-910	3	1	2000//-1
2	3-OT	TE10460	3	10	15	30	35	-910	2	1	2500//-1
4	3-OT	TE10470	3	10	35	40	80	-910	3	1	2500//-1
4	3-OT	TE10480	3	15	30	50	80	-910	3	1	4000//-1

NOTES:

1. Maximum inband ripple over temperature range - 20° C to 70° C
2. Parallel termination capacity is adjusted for optimum filter response Nominal parallel capacity, Cp: ± 3 pf Impedance, Rp specified above.
3. A tandem set is a combination of matched 2 pole filter units making up multipole filters (example: 4 pole response: (2) 2 pole units - matches).
4. These models are available in other packages not shown below. Consult our sales office.
5. Most types available in 50 Ω. Consult our sales office.

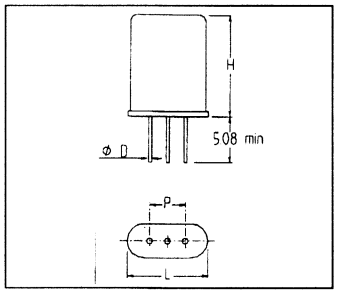
≠ poles	package selection
2	M2
4	M2(x2),M5, 6, 7, 8 or 9

How to order

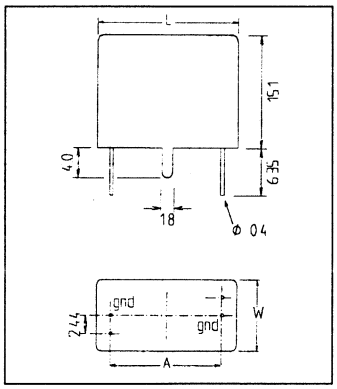
PART NUMBER and PACKAGE TYPE:

Example: TE10400M2 for standard or,
TE10400SM11 for subminiature

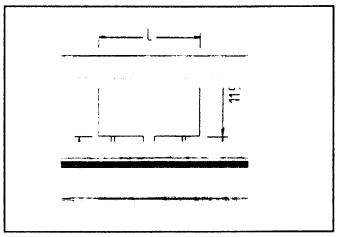
PACKAGES



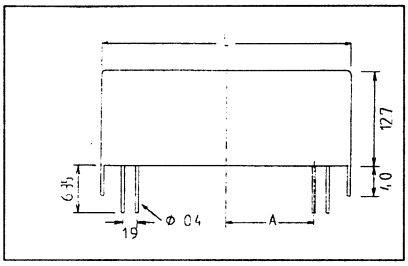
pkg	L	W	H	P	D	equivalent
M1	7.62	2.54	7.87	2.90	0.4	HC-44/3
M2	7.87	3.18	8.76	3.76	0.4	HC-45/3
M3	11.0	4.70	11.4	4.88	0.4	HC-49/3
M4	19.0	8.90	19.0	12.3	0.76	HC-6/3



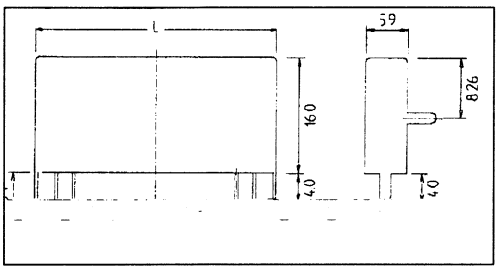
pkg	L	W	A
M5	15.0	12.0	9.0
M6	18.92	12.6	13.41



pkg	L max.	A
SM1	8.51	4.45
SM2	11.0	7.39
SM3	13.46	9.53



pkg	L max.	A
SM4	17.02	3.94
SM5	25.4	7.87
SM6	33.27	11.81



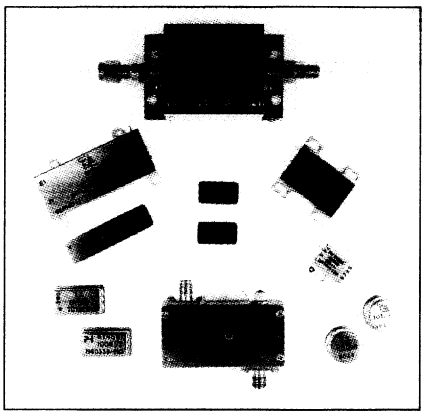
pkg	L max.	A
M7	22.6	5.49
M8	33.53	11.05
M9	44.45	16.61

Please consult our sales desk for your custom filter requirements.

Important notices

- drawings not to scale
- all specifications subject to change without notice.

SAW BANDPASS FILTERS



FB70-.12

FB70-.12 is a filter which fills a niche between crystal and conventional SAW filters. It has linear phase and offers noise bandwidth less than 150 KHz with excellent rejection characteristics.

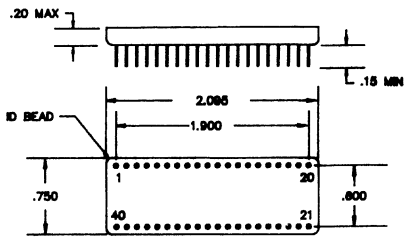
Features

- Center frequency: 70 MHz
- Linear phase
- Ultimate rejection: > 80 dB
- Bulk spurious rejection > 50 dB

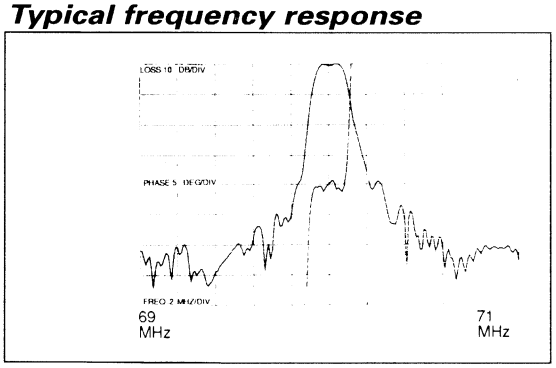
Specification

	Units	Specification	Typical
Center frequency	MHz	70, defined	70 ± .02
Bandwidth -3 dB	MHz	.12, minimum	.145 ± .005
Bandwidth -40 dB	MHz	.48, maximum	.40-.01, +.05
Phase in 3 dB BW	DEG	6 P-P	3 P-P
Insertion loss	dB	20	18.5 ± 1
Ultimate rejection	dB	65	80
Temp. coefficient		.03 ppm/°C²	
Tuning in/out		Series L	
Source/load Z	Ω	50	
Input/input return	Pins	5/3	
Output/output return	Pins	36/38	

Package

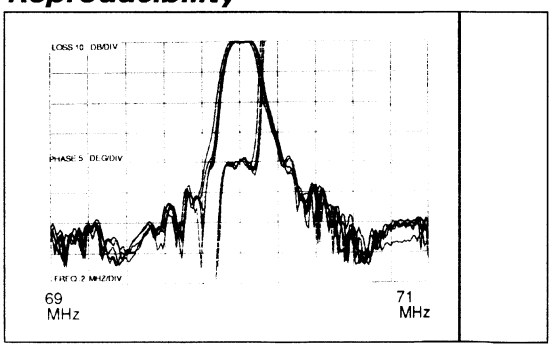


Typical frequency response

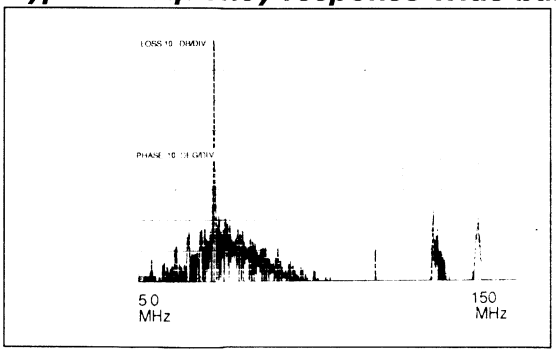


Ref. Loss (dB)
-10
-20
-30
-40
-50
-60
-70
-80

Reproducibility

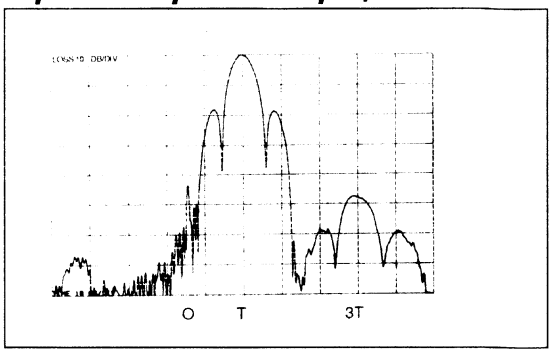


Typical frequency response wide band



Ref. Loss (dB)
-10
-20
-30
-40
-50
-60
-70
-80

Inpulse response 10 µs / Div.



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FB30.4-.174

FB30.4-.174 is centered at 30.4 MHz, has a -3 dB bandwidth of 174 KHz and offers > 65dB rejection including bulk spurious.

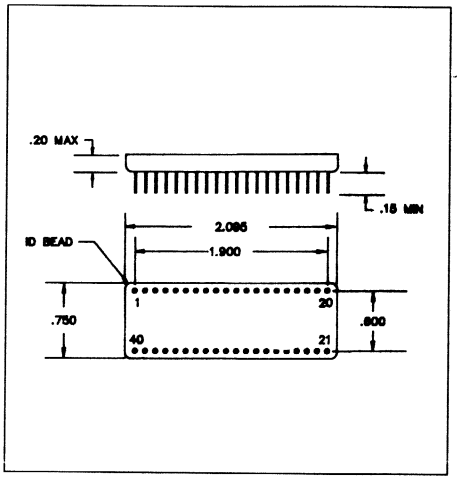
Features

- Center frequency: 30.4 MHz
- Ultimate rejection: > 80 dB
- Linear phase
- Bulk spurious rejection > 65 dB

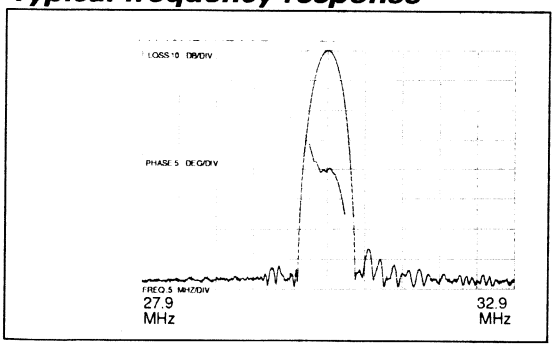
Specification

	Units	Specification	Typical
Center frequency	MHz	30.4, defined	30.4 ± .02
Bandwidth -3 dB	MHz	.174, minimum	.199 ± .005
Bandwidth -40 dB	MHz	.7, maximum	.645-.01, +.05
Phase in 3 dB BW	DEG	3 P-P	1 P-P
Insertion loss	dB	26.5	24-1, + 2
Ultimate rejection	dB	65	80
Temp. coefficient		.03 ppm/°C²	
Tuning in/out		Internal	
Source/load Z	Ω	50	
Input/input return	Pins	18/19	
Output/output return	Pins	38/39	

Package

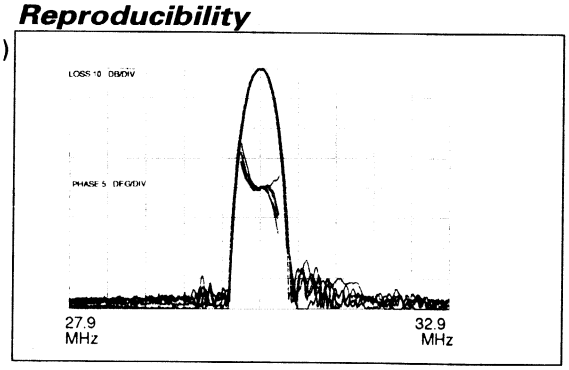


Typical frequency response

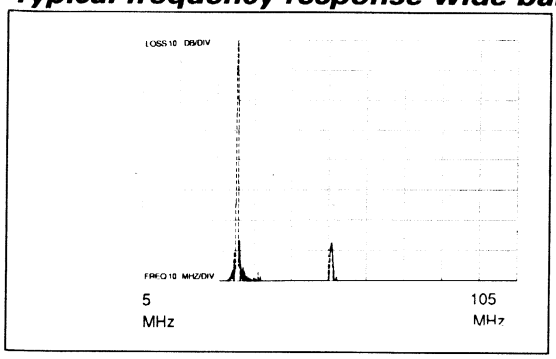


Ref. Loss (dB)
-10
-20
-30
-40
-50
-60
-70
-80

Reproducibility

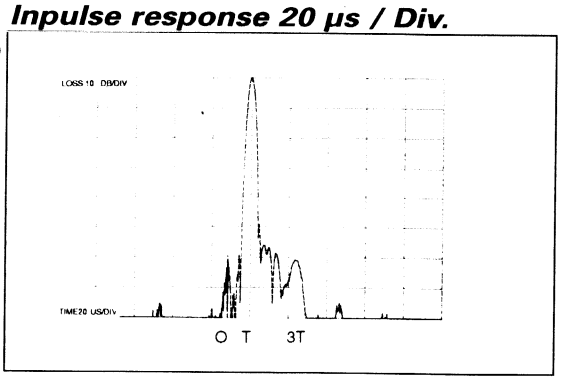


Typical frequency response wide band



Ref. Loss (dB)
-10
-20
-30
-40
-50
-60
-70
-80

Inpulse response 20 µs / Div.



TEKELEC TEMEX

Other products

TEKELEC TEMEX manufactures RF signal processing components and subsystems based upon surface acoustic wave (SAW) technology. Hereunder is an listing of catalog devices.

Model	Center Frequency MHz	Bandwidth MHz	Model	Center Frequency MHz	Bandwidth MHz
FB10.7-5	10.7	.5	FB160-5	160	5
FB29.75-6	29.75	6	FB160-20	160	20
FB30-2	30	2	FB160-50	160	50
FB30.4-.174	30.4	.174	FB161.85-3.7	161.85	3.7
FB35-4.9	35	4.9	FB165.55-3.7	165.55	3.7
FB36.375-7.5	36.375	7.5	FB169.25-3.7	169.25	3.7
FB38-1.65	38	1.65	FB172.95-3.7	172.95	3.7
FB40-.23	40	.23	FB175-50	175	50
FB40-2	40	2	FB176.65-3.7	176.65	3.7
FB60-3	60	3	FB178.1-2	178.1	2
FB60-12	60	12	FB178.1-6	178.1	6
FB70-.12	70	12	FB178.1-12	178.1	12
FB70-.215	70	.215	FB178.1-24	1	24
FB70-.7	70	.7	FB180-6.3	180	6.3
FB70-2	70	2	FB180-12	180	13
FB70-5	70	5	FB180-11/20	180	11
FB70-10	70	10	FB180.35-3.7	180.35	3.7
FB70-12.6	70	12.6	FB184.05-3.7	184.05	3.7
FB70-16	70	16	FB187.75-3.7	187.75	3.7
FB70-20.5	70	20.5	FB199.5-6	199.5	6
FB70-24	70	24	FB230-20	230	20
FB70-40	70	40	FB274.2-36	274.2	36
FB71-.3	71	.3	FB282-8.8	282	8.8
FB75-2	75	2	FB300.2-16	300.2	16
FB75-6.25	75	6.25	FB312.2-8	312.2	8
FB90.1-2	90.1	2	FB314-.8	314	.8
FB132.25-3.7	132.25	3.7	FB317.7-3	317.7	3
FB135.95-3.7	135.95	3.7	FB326.7-3	326.7	3
FB139.65-3.7	139.65	3.7	FB332.2-8	332.2	8
FB143.35-3.7	143.35	3.7	FB340-7.5	340	7.5
FB147.05-3.7	147.05	3.7	FB344.2-16	344.2	16
FB150-3	150	3	FB350-.5	350	.5
FB150.75-3.7	150.75	3.7	FB370.2-36	370.2	36
FB154.45-3.7	154.45	3.7	FB400-1	400	1
FB158.15-3.7	158.15	3.7	FB420-.5	420	.5
FB160-.68	160	.68	FB575-1	575	1
FB160-1.3	160	1.3	FB700-36	700	36
FB160-2	160	2	FB708-18	708	18

AIR CAVITY FILTERS

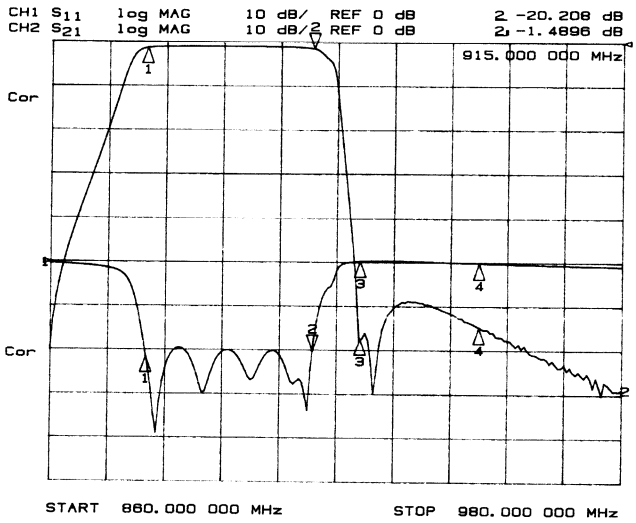
900 MHz frequency ; E GSM band ; CFL-900-35-xx series

Features

- This band pass filter has been specially developed for the GSM band: 900 MHz frequency range.
- This filter is designed for the new extended bandwidth of 35 MHz.
- The filters are delivered factory adjusted on that frequencies.
- The standard connectors used are SMA model on cables or directly on filter, other connectors are available.This filter is a 7 air cavity with tunable lines.

Mechanical specifications

Length	mm	177
Width	mm	90
Height	mm	27
Mass	g	500



Electrical characteristics

Center frequency	MHz	897.5
Bandwidth	MHz	35
Insertion loss	dB	1.4
Return losses	MHz	16
Attenuation f < 860 MHz	dB	53
Attenuation 925 < f < 1.2 GHz	dB	53
Attenuation 1.2 < f < 3 GHz	dB	40
Operating temperature	°C	- 10° to + 55°
Storage temperature	°C	- 20° to + 70°
Max. power	W	50
Standard connector		SMA

For special electrical or mechanical specifications, please contact your local sales office.

AIR CAVITY FILTERS

Tunable filter ; 450-470 MHz frequency ; Passband

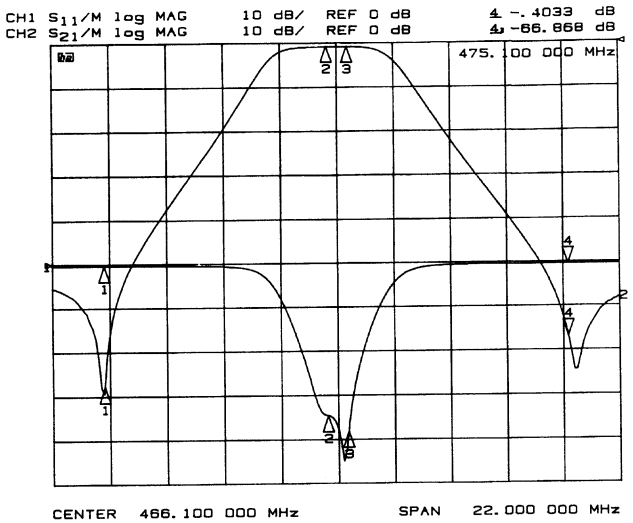
450-470 MHz frequency ; Passband ; CFLA-450-04-xx series

Features

- This filter can be tuned from 450 to 470 MHz, with a bandwidth of 0.8 MHz.
- The filters are delivered factory adjusted on frequencies specified on order, but can be tuned by customer on a network analyser.
- The standard connectors used are N model directly on filter, other connectors are available.This filter is a 4 air cavity filter with tunable lines.

Mechanical specifications

- Private, public, trunked networks (P.M.R., 3 R P)
- Mobiles (Austria, Portugal)
- Base stations (for two ways radio)
- Repeaters for cellular networks



Electrical characteristics

Center Frequency (fo)	MHz	450-470
Bandwidth	MHz	± 0.4
Insertion losses	dB	< 1.0
Return losses	MHz	16
Attenuation f=fo ± 9 MHz	dB	> 50
Attenuation f=fo ± 11 MHz	dB	> 50
Attenuation fo -11 > f > fo +11	dB	> 30
Operating temperature	°C	- 10° to + 65°
Storage temperature	°C	- 20° to + 70°
Max. power	W	120
Standard connector		N

Mechanical specifications

Length	mm	153
Width	mm	100
Height	mm	103
Mass	g	1200

Electrical specifications

- Frequency tunable
- Bandwidth tunable
- Low losses
- High attenuation

Filters can be delivered pretuned by TEKELEC TEMEX or can be easily tuned by the customer.

For special electrical or mechanical specifications, please contact your local sales office.

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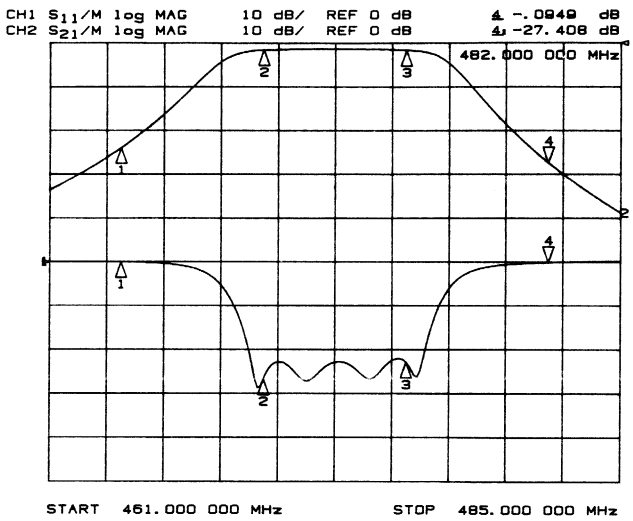
470-606 MHz frequency ; TV band ; CFLA-470-04-xx series

Features

- This filter can be tuned on part of the TV range from 470 to 606 MHz, with a bandwidth of 6 or 8 MHz.
- Special adjustement of attenuation can be made upon request.
- The filters are delivered factory adjusted on frequencies specified on order, but can be tuned by customer on a network analyser.
- The standard connectors used are SMA model on cables or directly on filter, other connectors are available.This filter is a 4 air cavity filter with tunable lines.

Applications

- Private, public, trunked networks (P.M.R., 3 R P)
- Mobiles (Austria, Portugal)
- Base stations (for two ways radio)
- Repeaters for cellular networks



Electrical characteristics

Center Frequency (fo)	MHz	470-603
Bandwidth	MHz	6 to 8
Insertion losses	dB	< 1.6
Return losses	MHz	20
Attenuation f=fo ± 9 MHz	dB	> 20
Attenuation f=fo ± 12 MHz	dB	> 30
Attenuation f=fo ± 70 MHz	dB	> 60
Operating temperature	°C	- 10°to + 65°
Storage temperature	°C	- 20°to + 70°
Max. power	W	50
Standard connector		SMA

Mechanical specifications

Length	mm	104
Width	mm	135
Height	mm	27
Mass	g	400

Electrical specifications

- Frequency tunable
- Bandwidth tunable
- Low losses
- High attenuation

Filters can be delivered pretuned by TEKELEC TEMEX or can be easily tuned by the customer.

For special electrical or mechanical specifications, please contact your local sales office.

AIR CAVITY FILTERS

Tunable filter ; 606-860 MHz frequency ; TV band

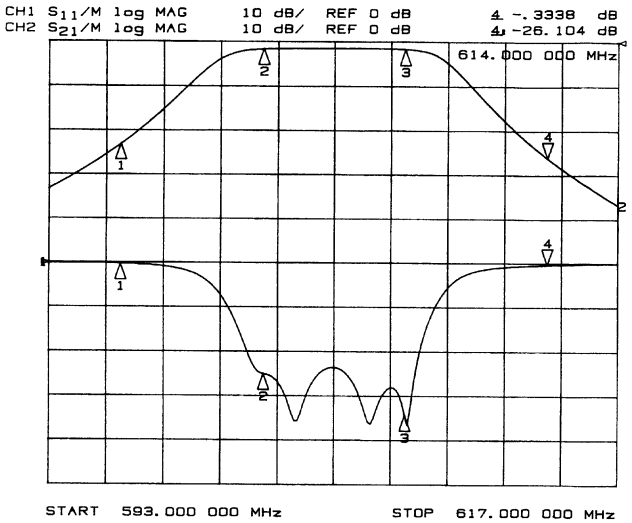
606-860 MHz frequency ; TV band ; CFLA-606-04-xx series

Features

- This filter can be tuned on part of the TV range from 606 to 860 MHz, with a bandwidth of 6 or 8 MHz.
- Special adjustement of attenuation can be made upon request.
- The filters are delivered factory adjusted on frequencies specified on order, but can be tuned by customer on a network analyser.
- The standard connectors used are SMA model on cables or directly on filter, other connectors are available.This filter is a 4 air cavity filter with tunable lines.

Applications

- Private, public, trunked networks (P.M.R., 3 R P)
- Mobiles (Austria, Portugal)
- Base stations (for two ways radio)
- Repeaters for cellular networks



Electrical characteristics

Center Frequency (fo)	MHz	606-860
Bandwidth	MHz	6 to 8
Insertion losses	dB	< 1.6
Return losses	MHz	20
Attenuation f=fo ± 9 MHz	dB	> 20
Attenuation f=fo ± 12 MHz	dB	> 30
Attenuation fo = ± 70 MHz	dB	> 60
Operating temperature	°C	- 10°to + 65°
Storage temperature	°C	- 20°to + 70°
Max. power	W	50
Standard connector		SMA

Mechanical specifications

Length	mm	104
Width	mm	100
Height	mm	27
Mass	g	400

Electrical specifications

- Frequency tunable
- Bandwidth tunable
- Low losses
- High attenuation

Filters can be delivered pretuned by TEKELEC TEMEX or can be easily tuned by the customer.

For special electrical or mechanical specifications, please contact your local sales office.

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FILTERS
SPECIFIC REQUEST

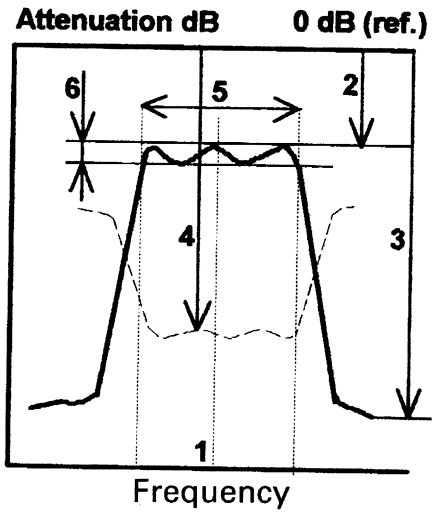
FREQUENCY RANGE: from 138 to 2000 MHz
POWER: up to 400 Watt

How to define a filter ?

Frequency (MHz): .....
Bandwidth (MHz): .....
Insertion loss in bandwidth (dB): .....
Attenuation at Fo + ... MHz: .....
Attenuation at Fo - ... MHz: .....
Return loss (dB): .....
Input power (Watt): .....

General electrical specifications

1	Center frequency
2	Insertion loss
3	Attenuation
4	Return loss
5	Bandwidth
6	Ripple



How to order

CFH	*900*	*35*	*07*	*ZZ*
Cavity Helicoïdal Filter	Center Frequency in MHz	Bandwidth	Number of cavities	Mechanical specification

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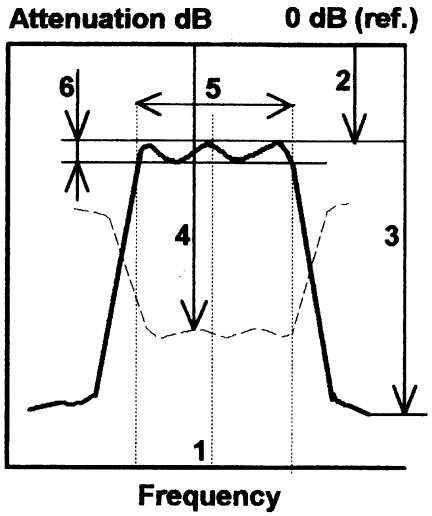
NL: +31 (0) 79 3461430
UK: +44 (0) 1256 883340

BANDPASS CERAMIC COAXIAL FILTERS

General electrical specifications

1	Center frequency
2	Insertion loss
3	Attenuation
4	Return loss
5	Bandwidth
6	Ripple

Absolute maximum ratings
Operating temperature: -10° to +55° C



• *With bandwidth ≤ 3 %*

Ceramic cavity filter
Max. power handling capability: 2W-CW

Model	Center frequency (MHz)	Bandwidth (MHz)	Insertion Loss (dB)	Return Loss (dB)	Attenuation (dB)	Dimensions (3) (mm)
CF06T6-301-xxxx	301	± 8 MHz @ 1 dB	≤ 3.0 (1)(2)	≥ 14	≥ 15 dB @ 280 MHz ≥ 45 dB @ 322 MHz	40 x 42 x 12.5
CF06T3-420-xxxx	420	0.700	≤ 2.0	≥ 14	≥ 30 dB @ Fo ± 90 MHz	19 x 7 x 24
CF06T6-905-xxxx	905	± 5 MHz @ 1 dB	≤ 6.0 (1)	≥ 10	≥ 86 dB @ 865 MHz ≥ 30 dB @ 1005 MHz	47 x 10 x 25.4
CF06T3-897-xxxx	897.5	± 12.5	≤ 1.5	≥ 15	≥ 20 dB @ 937.5 MHz	19 x 7 x 17
CF06T3-947-xxxx	947.5	± 12.5	≤ 1.5	≥ 15	≥ 20 dB @ 987.5 MHz	19 x 7 x 17
CF06T3-1030-xxx	1030	± 12.5	≤ 1.5	≥ 15	≥ 20 dB @ Fo ± 40 MHz	17 x 7 x 14
CF12T4-1030-xxxx	1030 or 1090	±12 MHz @ 3 dB	≤ 1.0 (1)	≥ 15dB @ ±15 MHz	≥ 20 dB @ Fo ± 40 MHz ≥ 40 dB @ Fo ± 60 MHz	49 x 13.5 x 12
CF06T3-1472-xxxx	1472	± 10 MHz	≤ 1.2	≥ 13	≥ 30 dB @ 1350 MHz ≥ 22 dB @ 1529 MHz	19 x 7 x 12
CF12V3-1472-xxxx	1472	± 10 MHz	≤ 0.7	≥ 13	≥ 30 dB @ 1350 MHz ≥ 22 dB @ 1529 MHz	37.5 x 13.5 x 14
CF12V4-1550-xxxx	1550	± 3	≤ 2.0	≥ 15	≥ 35 dB @ Fo ± 26 MHz	49.4 x 13.5 x 14
CF12V4-1643-xxxx	1643	± 3	≤ 2.0	≥ 15	≥ 35 dB @ Fo ± 26 MHz	49.4 x 13.5 x 14
CF06T3-1747-xxxx	1747.5	± 5	≤ 1.6	≥ 16	≥ 20 dB @ Fo ± 40 MHz	19 x 7 x 13
CF06T3-1842-xxxx	1842.5	± 5	≤ 1.6	≥ 16	≥ 20 dB @ Fo ± 40 MHz	19 x 7 x 13
CF06T3-1880-xxxx	1880	± 5	≤ 1.6	≥ 16	≥ 20 dB @ Fo ± 40 MHz	19 x 7 x 13
CF06T3-1960-xxxx	1960	± 5	≤ 1.6	≥ 16	≥ 20 dB @ Fo ± 40 MHz	19 x 7 x 13

• *With bandwidth ≥ 3 %*

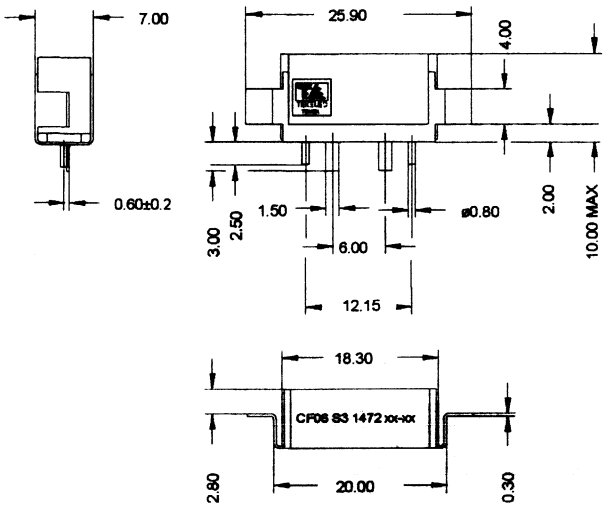
Model	Center frequency (MHz)	Bandwidth (MHz)	Insertion Loss (dB)	Return Loss (dB)	Attenuation (dB)	Dimensions (3) (mm)
CF06T7-1500-xxxx	1500	± 50	≤ 3	≥ 14	≥ 40 dB @ Fo ± 125 MHz	52 x 12 x 7
CF04V10-3500-xxxx	3500	± 250	≤ 4	≥ 13.5	≥ 40 dB @ Fo ± 385 MHz	60 x 9 x 5

Notes:
(1) Insertion loss @ Fo
(2) Ripple ≤ ± 0.1 dB
(3) Max. dimension without tab or ground tab.

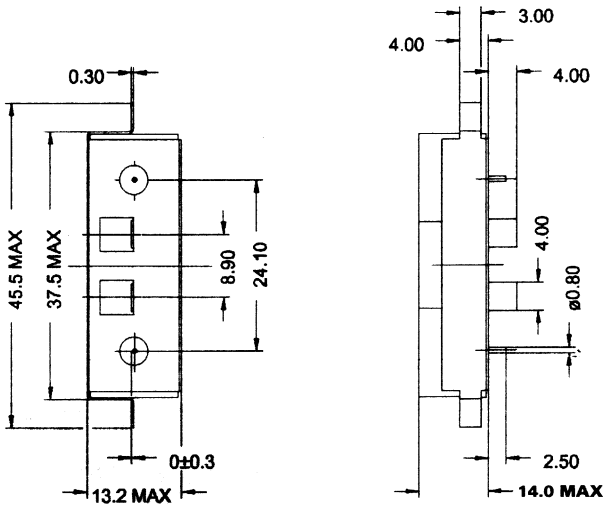
Test jig

Ceramic and drop-in filters are measured in custom designed test jigs, in order to simulate operating environmental conditions. Special customer application and environmental details must be specified when ordering, to avoid correlation problems between TEKELEC TEMEX's tests and customer results. TEKELEC TEMEX's test jig is recommanded to verify product performances.

Outline drawings

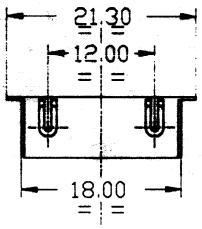


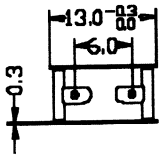
Ceramic Cavity Filter: CF06T3-1472-xxx

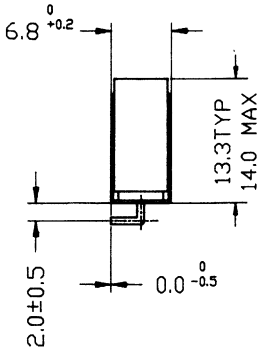


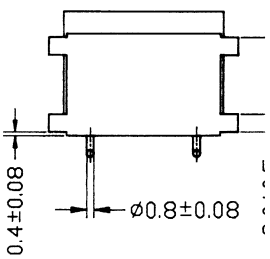
Ceramic Cavity Filter: CF12V3-1472-xxx

Filters are also available with integration tabs for SMD application

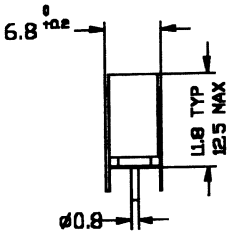


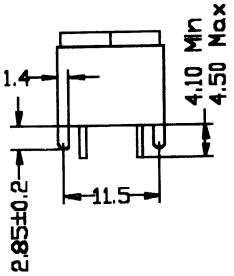






SMD ceramic cavity filters CF06T3-1030

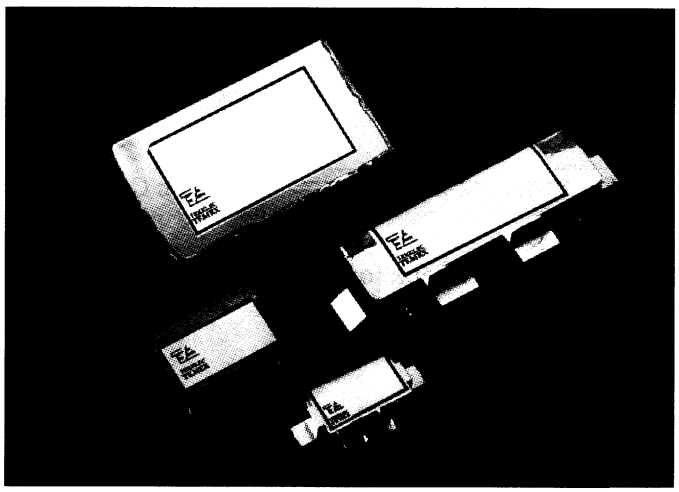




Ceramic cavity filters CF06T2-1200-xxx

How to order

CF	06	T	6	900	ZZZ
Ceramic Filter	Resonator square size in mm 04 06 08 12	Dielectric constant: V for ε = 21 T for ε = 37 S for ε = 82	Number of resonators 2 3 4 ...	Center frequency in MHz	Specification



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LOW COST MULTILAYER THICK FILM CERAMIC FILTERS

DC block devices - High pass filters

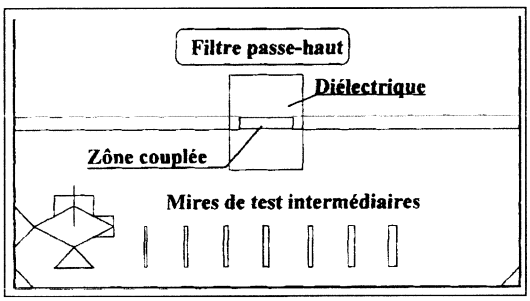
These integrated filters are manufactured using thick film technology on ceramic substrates. Different dielectric constant values are available according to specifications or particular applications. These devices are designed for consumer, industrial or military applications.

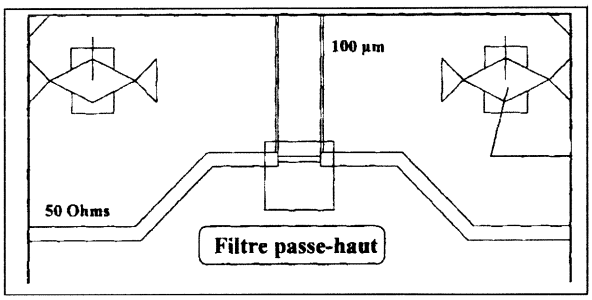
Low profile packaging is designed to minimize clearance and save space on circuit boards.

Typical applications

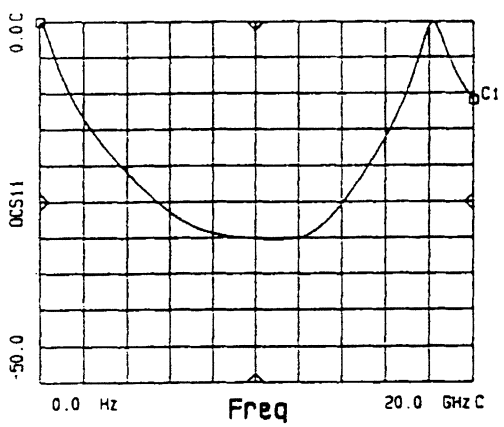
- Wide band DC block:
  This filter can be integrated upon request with a wide band Tee for bias polarisation of active devices (amplifiers, oscillators, etc.)

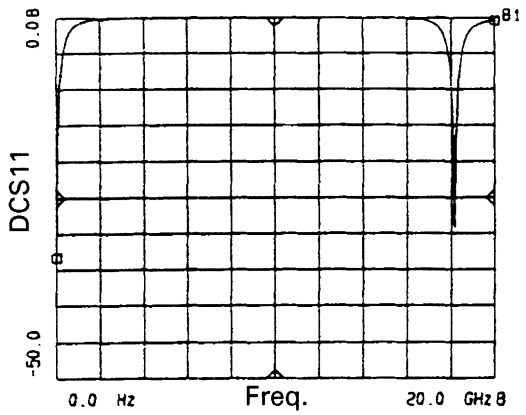
- High pass filter:
  The high pass filter is made with short circuit stub technology, allowing filtering with high rejection. It is combined with the DC blocking function.





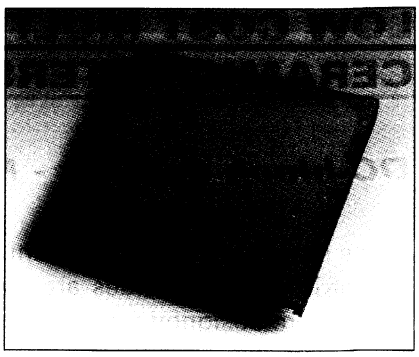
DC BLOCK 18 GHz





Above figures are representative of our capabilities.
Please contact us for specific applications.

SOFTBOARD TRIPLATE FILTERS



Operating frequency range: 1 to 20 GHz

Main advantages of these filters are:

- low mass
- space saving packages
- cost reduction

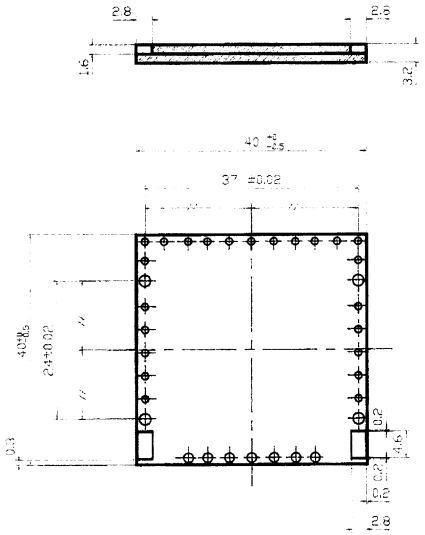
A complete range of filters is under development. Insertion losses are function of the materials chosen.

Various technological processes are under evaluation and characterization, for consumer, industrial and military applications.

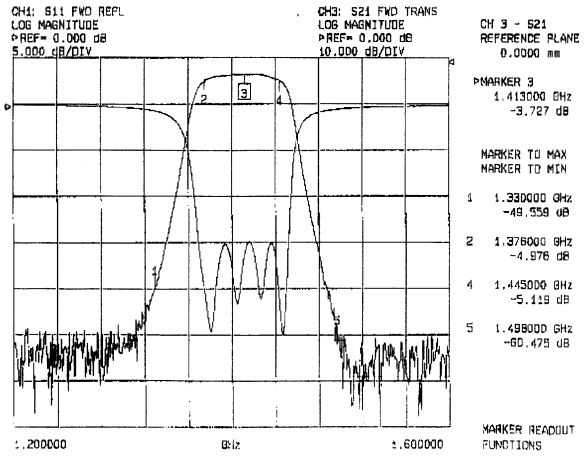
Fully qualified materials are used for these technologies, such as Teflon®, glass reinforced Teflon®, ceramic loaded Teflon®, ceramic loaded polycarbonate, cyanate ester, etc.

Example of realization:

Integration / Dimensions



Typical curves



Above figures are representative of our capabilities.
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DUPLEXERS

Selection guide

SPECIFIC REQUEST

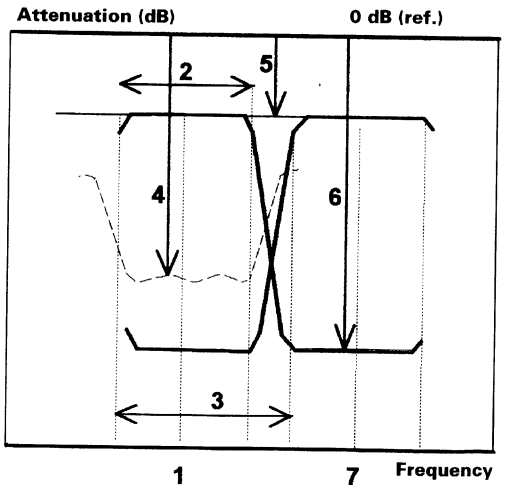
FREQUENCY RANGE: from 35 to 1800 MHz
POWER: up to 400 Watt

How to define a duplexer ?

Frequency "low" (MHz): .....
Bandwidth "low" (MHz): .....
Insertion loss "low" / Aut. (dB): .....
Attenuation in bandwidth "high" filter (dB): .....
Frequency separation (MHz): .....
Frequency "high" filter (MHz): .....
Bandwidth "high" filter (MHz): .....
Insertion loss "high" filter / Aut. (dB): .....
Attenuation in bandwidth "low": .....
Return loss (dB): .....
Input power (Watt) .....

General electrical specifications

1	Filter "low"
2	Bandwidth "low"
3	Frequency separation
4	Return loss
5	Insertion loss
6	Attenuation
7	Filter "high"



How to order:

CDHA	*406*	*G*	*B*	*001*
Tunable helicoïdal cavity duplexer **C**avity **D**uplexer **H**elicoïdal **A**djustable	Frequency range in MHz 066 140 175 340 406	Mechanical specification for mounting plate Ex: A: without plate B: with BNC connector on plate...	Connector specification A for SMB B for BNC E for SMA	Electrical specification 001 to 999

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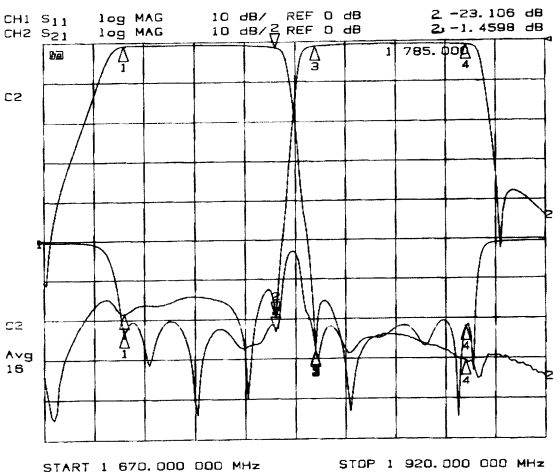
1800 MHz FREQUENCY
DCS 1800 / PCN BAND
CDL-1710-95-14-XX SERIES

Features

- This duplexer has been specially developed for the 1800 MHz cellular network.
- The frequency separation is 95 MHz for an extended bandwidth of 75 MHz.
- On this duplexer the transmitter can be connected on High or Low.
- The duplexers are delivered factory adjusted on that frequencies.
- The standard connectors used are SMA model, other connectors are avalaible upon request. This duplexer is a 14 cavity duplexer, made with two band pass filters.

Mechanical specifications

Length	mm	177
Width	mm	50
Height	mm	54
Mass	g	700



Electrical characteristics

LOW Freq.	MHz	1710 - 1785
HIGH Freq.	MHz	1805 - 1880
Bandwidth	MHz	75
Attenuation	dB	60
Frequency separation	MHz	95
Insertion losses	dB	1.6
Return losses	dB	18
Max. power	W	50
Operating temperature	°C	- 10° to + 55°
Storage temperature	°C	- 20° to + 70°
Standard connector		SMA

Attenuation on harmonic 3: 50 dB

For special electrical or mechanical specifications, please contact your local sales office.

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DUPLEXER 900 MHz FREQUENCY

E-GSM band - 14 cavities

TEKELEC TEMEX

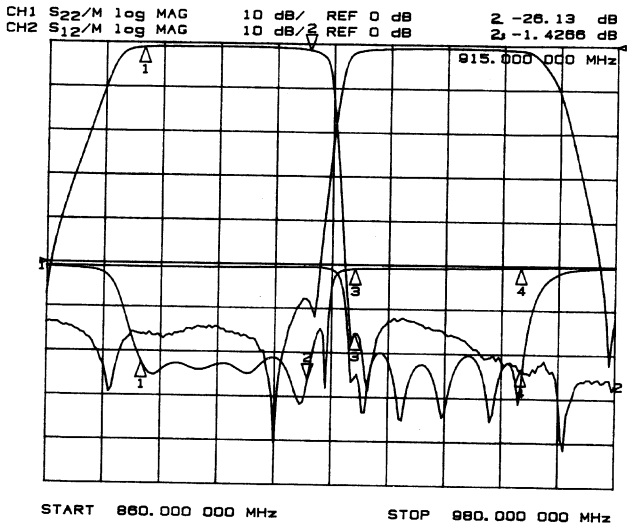
900 MHz FREQUENCY
E GSM BAND
CDL-880-45-14-XX SERIES

Features

- This duplexer has been specially developed for the GSM band: 900 MHz frequency range.
- The frequency separation is 45 MHz for an extended bandwidth of 35 MHz.
- On this duplexer the transmitter can be connected on High or Low.
- The duplexers are delivered factory adjusted on that frequencies.
- The standard connectors used are SMA model, other connectors are avalaible upon request. This duplexer is a 14 cavity duplexer, made with two band pass filters.

Mechanical specifications

Length	mm	177
Width	mm	90
Height	mm	56
Mass	g	1000



Electrical characteristics

LOW Freq.	MHz	880 - 915
HIGH Freq.	MHz	925 - 960
Bandwidth	MHz	35
Attenuation	dB	56
Frequency separation	MHz	45
Insertion losses	dB	1.5
Return losses	dB	16 min.
Max. power	W	30
Operating temperature	°C	- 10° to + 55°
Storage temperature	°C	- 20° to + 70°
Standard connector		SMA

Attenuation on harmonic 3: 45 dB
Attenuation on harmonic 5: 50 dB

For special electrical or mechanical specifications, please contact your local sales office.

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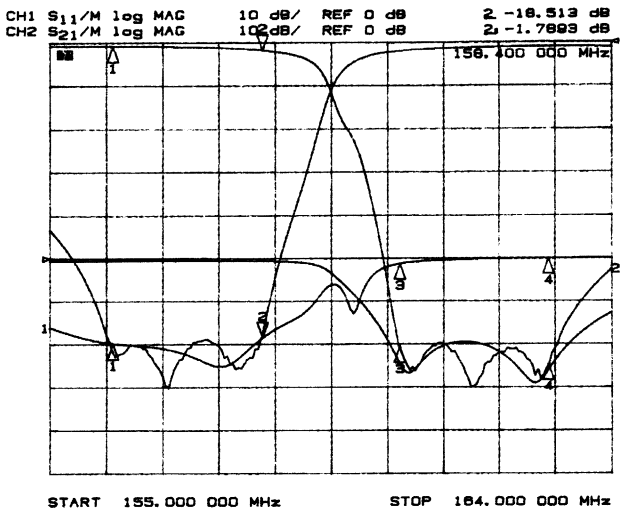
156 MHz FREQUENCY MARINE BAND CDV-156-05-08-XX SERIES

Features

- This duplexer has been specially developed for the marine band: 156 MHz frequency range.
- The frequency separation is 4.6 MHz for an extended bandwidth of 2.4 MHz.
- On this duplexer the transmitter can be connected on High or Low.
- The duplexers are delivered factory adjusted on that frequencies.
- The standard connectors used are SMB model. This duplexer is a 8 cavity duplexer, made with two band reject filters.

Mechanical specifications

Length	mm	131
Width	mm	63
Height	mm	30
Mass	g	170



Electrical characteristics

LOW Freq.	MHz	156
HIGH Freq.	MHz	160.6
Bandwidth	MHz	2.4
Attenuation	dB	60
Frequency separation	MHz	4.6
Insertion losses	dB	1.9
Return losses	dB	14 min.
Max. power	W	30
Operating temperature	°C	- 10° to + 55°
Storage temperature	°C	- 20° to + 70°
Standard connector		SMB

For special electrical or mechanical specifications, please contact your local sales office.

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DUPLEXER 40 MHz FREQUENCY

8 cavities

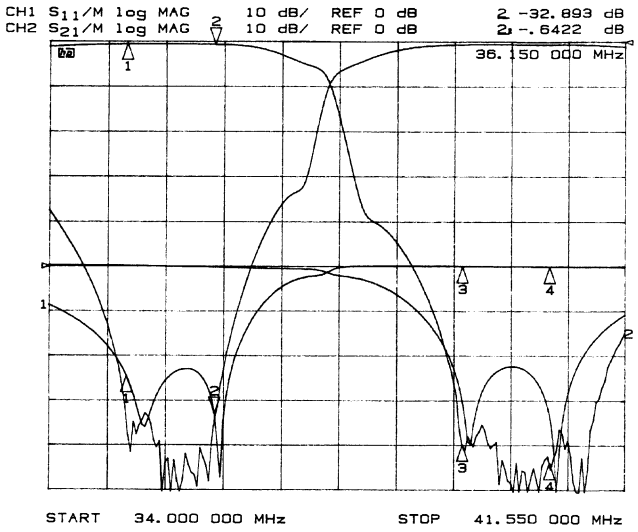
40 MHz FREQUENCY
CDH-036-05-08-XX SERIES

Features

- This duplexer has been specially developed for the 40 MHz frequency range.
- The frequency separation is 4.4 MHz for a bandwidth of 1.15 MHz.
- On this duplexer the transmitter can be connected on High or Low.
- If the frequencies are stated when ordering, the duplexers are delivered factory adjusted.
- The standard connectors used are SMB model. This duplexer is a 8 cavity duplexer, made with two band reject filters.

Mechanical specifications

Length	mm	200
Width	mm	131
Height	mm	103
Mass	g	3600



Electrical characteristics

LOW Freq.	MHz	35.0
HIGH Freq.	MHz	39.4
Bandwidth	MHz	1.15
Attenuation	dB	75
Frequency separation	MHz	4.4
Insertion losses	dB	0.9
Return losses	dB	14 min.
Max. power	W	50
Operating temperature	°C	- 20° to + 60°
Storage temperature	°C	- 20° to + 70°
Standard connector		SMB

For special electrical or mechanical specifications, please contact your local sales office.

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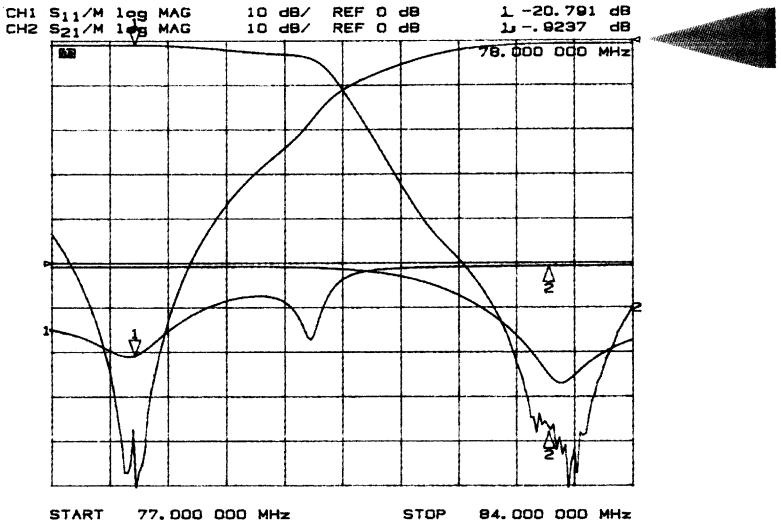
66-88 MHz FREQUENCY
CDHA-66-ZZ-NNN SERIES

Features

- This duplexer can be tuned on the range of 66 - 88 MHz.
- The frequency separation is from 4 to 8 MHz for a bandwidth from 0 to 1 MHz.
- On this duplexer the transmitter can be connected on High or Low.
- If the frequencies are stated when ordering, the duplexers are delivered factory adjusted.
- The standard connectors used are BNC model. The standard duplexer is a 6 cavity duplexer.

Applications

- Private, public, trunked networks (P.M.R., 3 R P)
- Mobiles (Austria, Portugal)
- Base stations (for two ways radio)
- Repeaters for cellular networks



Electrical characteristics

Frequency range	MHz	66-88
Bandwidth	MHz	0-1 max.
Attenuation	dB	85
Frequency separation	MHz	4 min. 8 max.
Insertion losses	dB	1
Return losses	dB	14 min.
Max. power	W	50
Operating temperature	°C	- 10° to + 55°
Storage temperature	°C	- 20° to + 70°
Standard connector		BNC

Specify operating frequencies when ordering.

Electrical specifications

- Frequency tunable
- Duplex space tunable
- Bandwidth tunable
- Low losses
- High attenuation

Duplexers can be delivered pretuned by TEKELEC TEMEX or can be easily tuned by the customer.

Mechanical specifications

Length	mm	154
Width	mm	88
Height	mm	27
Mass	g	370

For special electrical or mechanical specifications, please contact your local sales office.

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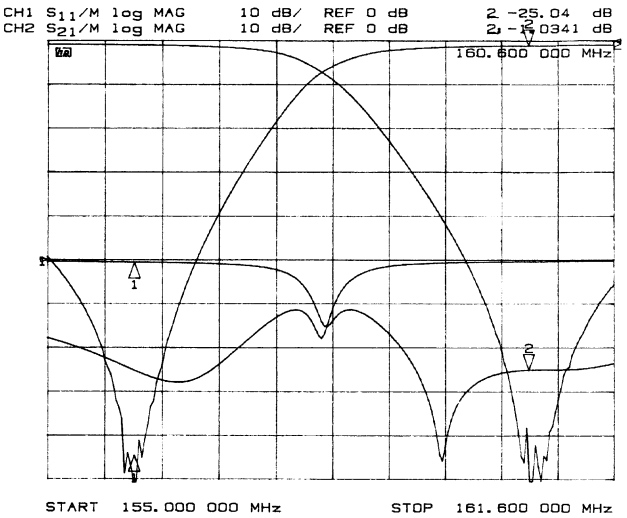
138-175 MHz FREQUENCY
6 CAVITIES
CDHA-140-ZZ-NNN SERIES

Features

- This duplexer can be tuned on the range of 138 - 175 MHz.
- The frequency separation is from 4.5 to 10 MHz for a bandwidth from 0 to 1.5 MHz.
- On this duplexer the transmitter can be connected on High or Low.
- If the frequencies are stated when ordering, the duplexers are delivered factory adjusted.
- The standard connectors used are SMB model. Other connectors (BNC, N, SMA are available upon request. The standard duplexer is a 6 cavity duplexer. A 4 cavity duplexer is also available (see page 4-13).

Mechanical specifications

- Private, public, trunked networks (P.M.R., 3 R P)
- Mobiles (Austria, Portugal)
- Base stations (for two ways radio)
- Repeaters for cellular networks



Electrical characteristics

Frequency range	MHz	138-175
Bandwidth	MHz	0-15 max.
Attenuation	dB	90
Frequency separation	MHz	4.5 min. 10 max.
Insertion losses	dB	1.2
Return losses	dB	14 min.
Max. power	W	50
Operating temperature	°C	- 10° to + 55°
Storage temperature	°C	- 20° to + 70°
Standard connector		SMB

Electrical specifications

- Frequency tunable
- Duplex space tunable
- Bandwidth tunable
- Low losses
- High attenuation

Duplexers can be delivered pretuned by TEKELEC TEMEX or can be easily tuned by the customer.

For special electrical or mechanical specifications, please contact your local sales office.

Mechanical specifications

Length	mm	154
Width	mm	78
Height	mm	27
Mass	g	370

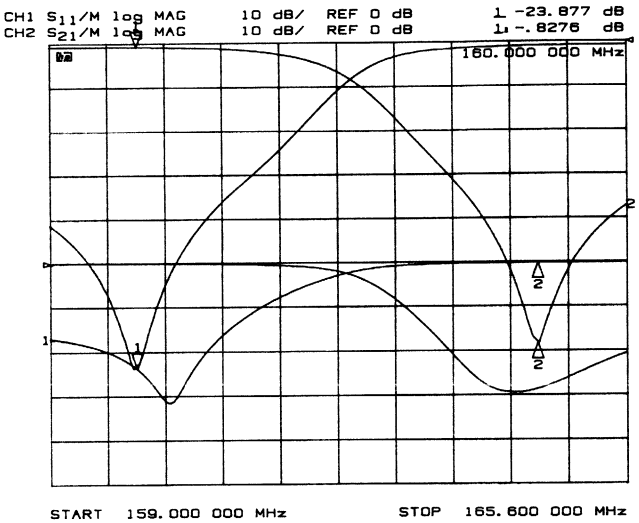
138-175 MHz FREQUENCY
4 CAVITIES
CDH4A-140-ZZ-NNN SERIES

Features

- This duplexer is specially designed for applications where low insertion losses are preferred to high attenuation.
- This duplexer can be tuned on the range of 138 - 175 MHz.
- The frequency separation is from 4.5 to 10 MHz for a bandwidth from 0 to 1.5 MHz.
- On this duplexer the transmitter can be connected on High or Low.
- If the frequencies are stated when ordering, the duplexers are delivered factory adjusted.
- The standard connectors used are SMB model. Other connectors (BNC, N, SMA are available upon request.This duplexer is a 4 cavity duplexer.

Mechanical specifications

- Private, public, trunked networks (P.M.R., 3 R P)
- Mobiles (Austria, Portugal)
- Base stations (for two ways radio)
- Repeaters for cellular networks



Electrical characteristics

Frequency range	MHz	138-175
Bandwidth	MHz	0-15 max.
Attenuation	dB	70
Frequency separation	MHz	4.5 min. 10 max.
Insertion losses	dB	0.9
Return losses	dB	14 min.
Max. power	W	30
Operating temperature	°C	- 10° to + 55°
Storage temperature	°C	- 20° to + 70°
Standard connector		SMB

Specify operating frequencies when ordering.

Mechanical specifications

Length	mm	104
Width	mm	78
Height	mm	27
Mass	g	300

Electrical specifications

- Frequency tunable
- Duplex space tunable
- Bandwidth tunable
- Low losses
- High attenuation

Duplexers can be delivered pretuned by TEKELEC TEMEX or can be easily tuned by the customer.

For special electrical or mechanical specifications, please contact your local sales office.

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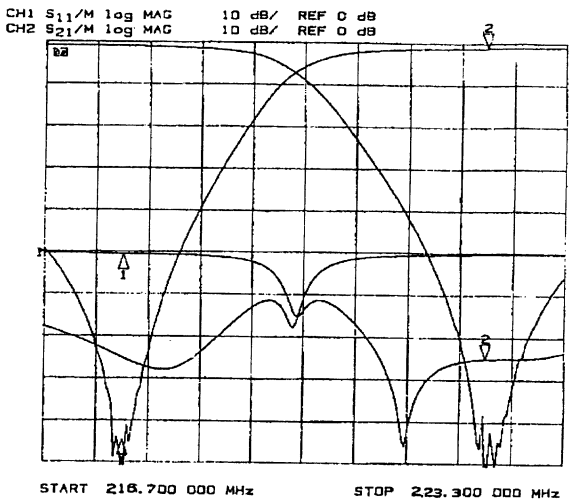
175-220 MHz FREQUENCY
CDHA-175-ZZ-NNN SERIES

Features

- This duplexer can be tuned on the range of 175 - 220 MHz.
- The frequency separation is from 5 to 10 MHz for a bandwidth from 0 to 3.2 MHz.
- On this duplexer the transmitter can be connected on High or Low.
- If the frequencies are stated when ordering, the duplexers are delivered factory adjusted.
- The standard connectors used are SMB model. Other connectors (BNC, N, SMA are available upon request). The standard duplexer is a 6 cavity duplexer. A 4 cavity duplexer is also available.

Mechanical specifications

- Private, public, trunked networks (P.M.R., 3 R P)
- Mobiles (Austria, Portugal)
- Base stations (for two ways radio)
- Repeaters for cellular networks



Electrical characteristics

Frequency range	MHz	175-220
Bandwidth	MHz	0-15 max.
Attenuation	dB	90
Frequency separation	MHz	5 min. 10 max.
Insertion losses	dB	1.0
Return losses	dB	14 min.
Max. power	W	50
Operating temperature	°C	- 10° to + 55°
Storage temperature	°C	- 20° to + 70°
Standard connector		SMB

Specify operating frequencies when ordering.

Mechanical specifications

Length	mm	154
Width	mm	78
Height	mm	27
Mass	g	370

Electrical specifications

- Frequency tunable
- Duplex space tunable
- Bandwidth tunable
- Low losses
- High attenuation

Duplexers can be delivered pretuned by TEKELEC TEMEX or can be easily tuned by the customer.

For special electrical or mechanical specifications, please contact your local sales office.

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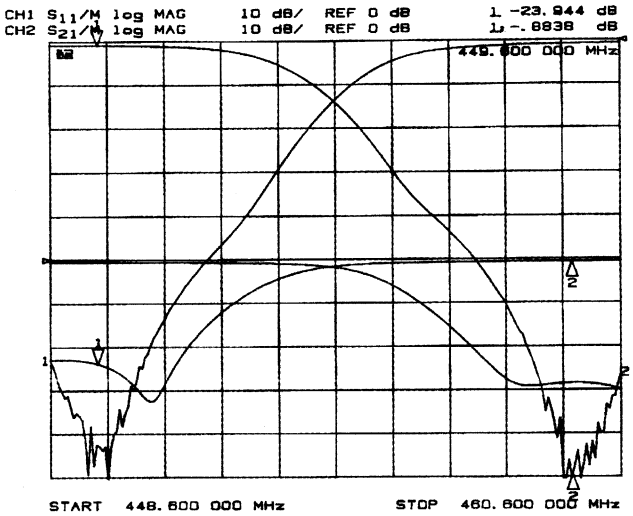
406-470 MHz FREQUENCY
CDHA-406-ZZ-NNN SERIES

Features

- This duplexer can be tuned on the range of 406 - 470 MHz.
- The frequency separation is from 5 to 10 MHz for a bandwidth from 0 to 3.2 MHz.
- On this duplexer the transmitter can be connected on High or Low.
- If the frequencies are stated when ordering, the duplexers are delivered factory adjusted.
- The standard connectors used are SMB model. Other connectors (BNC, N, SMA are available upon request. The standard duplexer is a 6 cavity duplexer. A 4 cavity duplexer is also available (see page 4-16).

Mechanical specifications

- Private, public, trunked networks (P.M.R., 3 R P)
- Mobiles (Austria, Portugal)
- Base stations (for two ways radio)
- Repeaters for cellular networks



Electrical characteristics

Frequency range	MHz	406-470
Bandwidth	MHz	0-3.2 max.
Attenuation	dB	90
Frequency separation	MHz	5 min. 20 max.
Insertion losses	dB	0.9
Return losses	dB	14 min.
Max. power	W	50
Operating temperature	°C	- 10° to + 55°
Storage temperature	°C	- 20° to + 70°
Standard connector		SMB

Specify operating frequencies when ordering.

Mechanical specifications

Length	mm	154
Width	mm	78
Height	mm	27
Mass	g	370

Electrical specifications

- Frequency tunable
- Duplex space tunable
- Bandwidth tunable
- Low losses
- High attenuation

Duplexers can be delivered pretuned by TEKELEC TEMEX or can be easily tuned by the customer.

For special electrical or mechanical specifications, please contact your local sales office.

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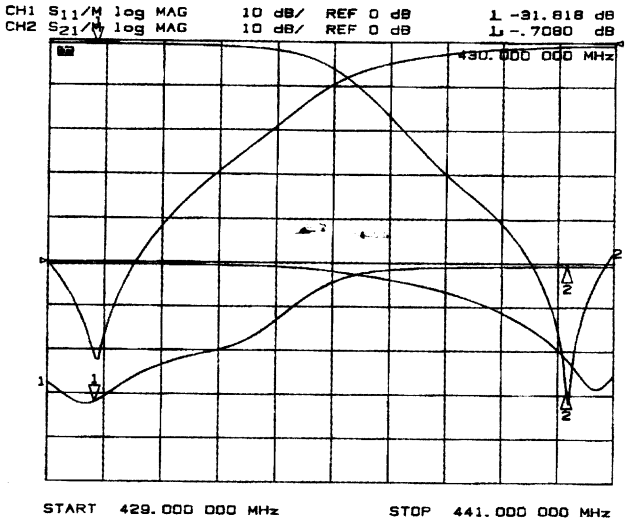
406-470 MHz FREQUENCY
4 CAVITIES
CDH4A-406-ZZ-NNN SERIES

Features

- This duplexer is specially designed for applications where low insertion losses are preferred to high attenuation.
- This duplexer can be tuned on the range of 406 - 470 MHz.
- The frequency separation is from 5 to 20 MHz for a bandwidth from 0 to 3.2 MHz.
- On this duplexer the transmitter can be connected on High or Low.
- If the frequencies are stated when ordering, the duplexers are delivered factory adjusted.
- The standard connectors used are SMB model. Other connectors (BNC, N, SMA are available upon request. This duplexer is a 4 cavity duplexers.

Mechanical specifications

- Private, public, trunked networks (P.M.R., 3 R P)
- Mobiles (Austria, Portugal)
- Base stations (for two ways radio)
- Repeaters for cellular networks



Electrical characteristics

Frequency range	MHz	406-470
Bandwidth	MHz	0-3.2 max.
Attenuation	dB	70
Frequency separation	MHz	5 min. 20 max.
Insertion losses	dB	0.8
Return losses	dB	14 min.
Max. power	W	50
Operating temperature	°C	- 10° to + 55°
Storage temperature	°C	- 20° to + 70°
Standard connector		SMB

Specify operating frequencies when ordering.

Mechanical specifications

Length	mm	104
Width	mm	78
Height	mm	27
Mass	g	300

Electrical specifications

- Frequency tunable
- Duplex space tunable
- Bandwidth tunable
- Low losses
- High attenuation

Duplexers can be delivered pretuned by TEKELEC TEMEX or can be easily tuned by the customer.

For special electrical or mechanical specifications, please contact your local sales office.

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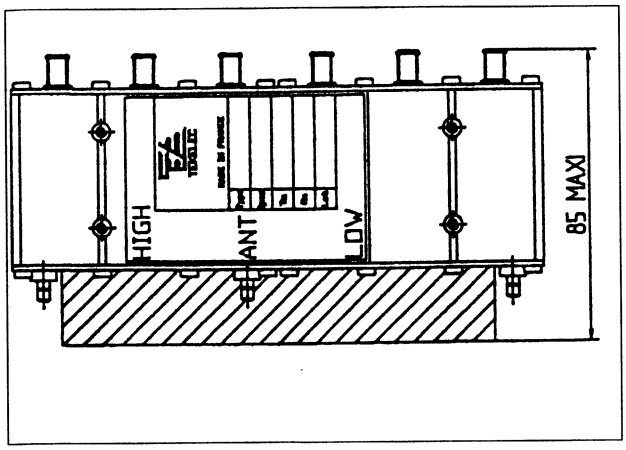
MECHANICAL ADAPTATIONS FOR TUNABLE DUPLEXERS

CDHA-406-AA-xxx



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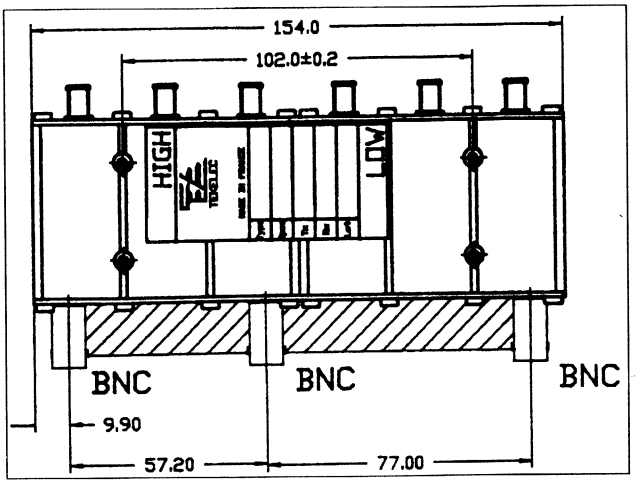
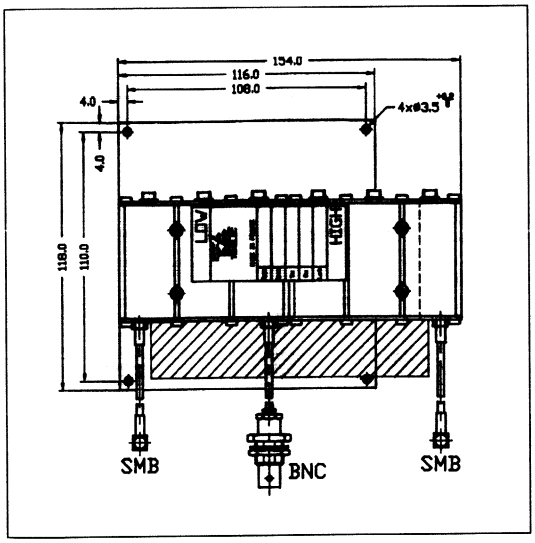


CDHA-140-ED-xxx



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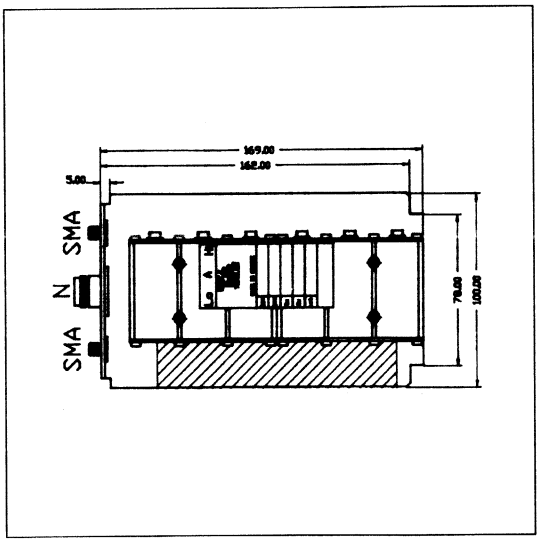

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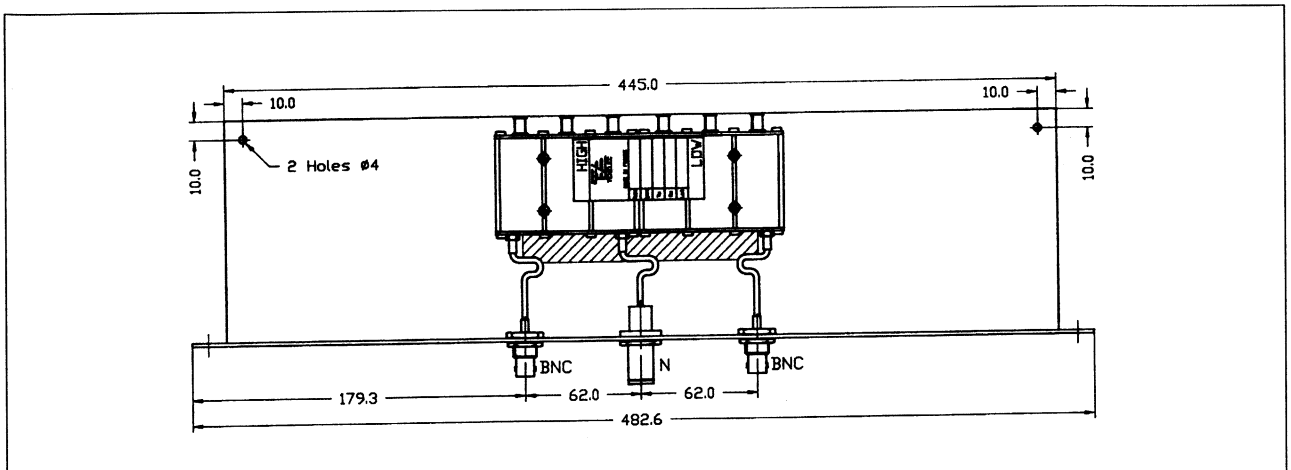

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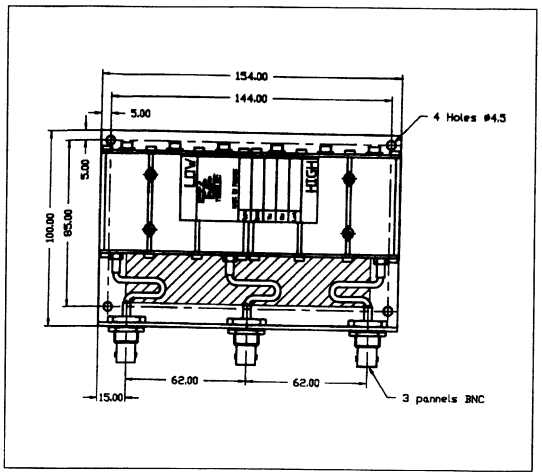
TUNABLE DUPLEXERS

Mechanical adaptations

CDHA-406-BB-xxx



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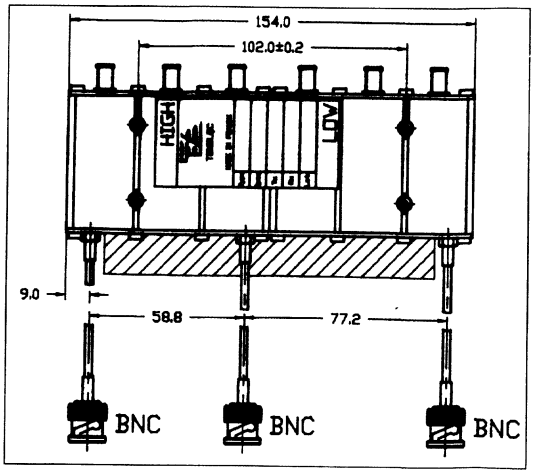

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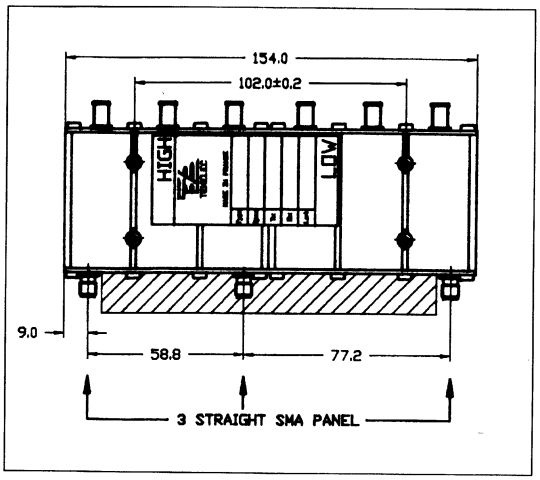

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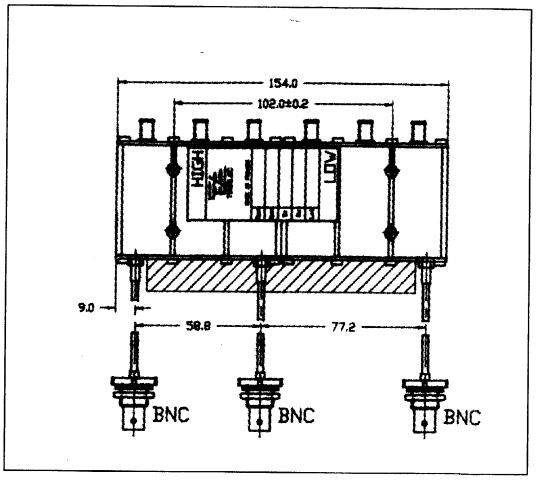

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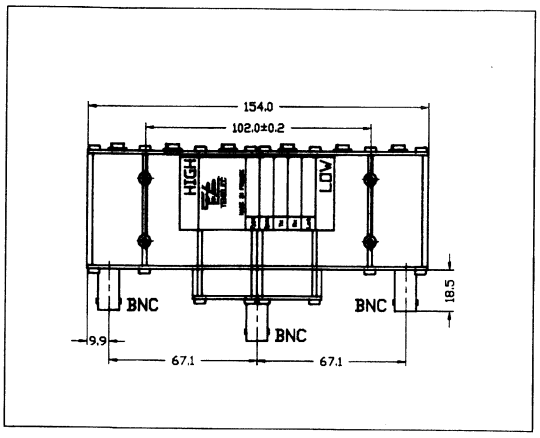

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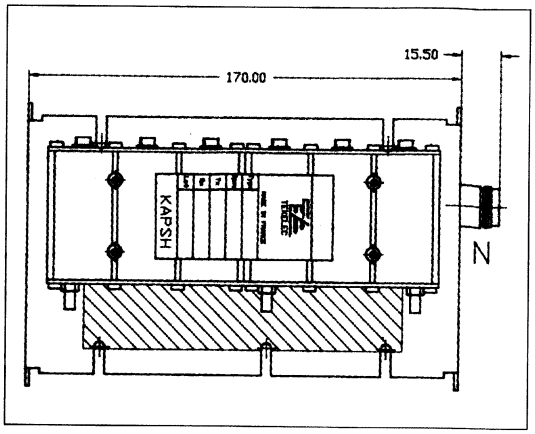

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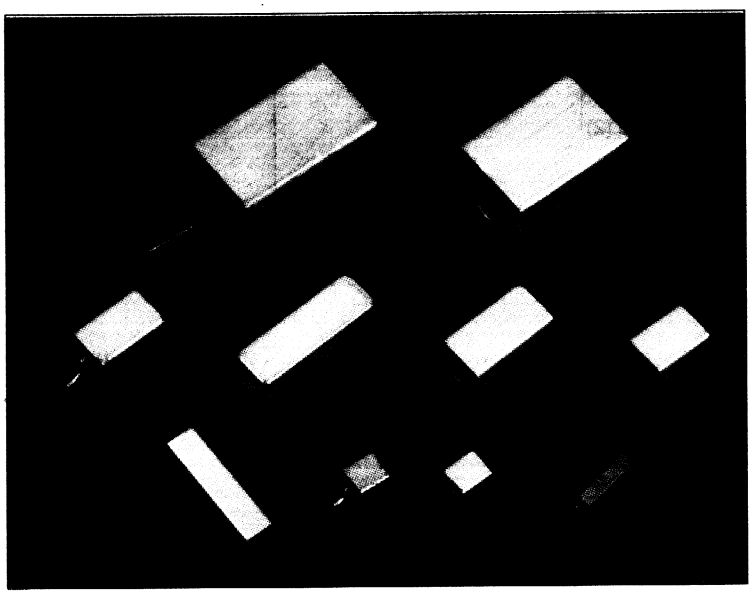
CERAMIC COAXIAL RESONATORS

Selection guide



Main features

Frequency:	**250 MHz to 5 GHz**
Size:	**4 to 12 mm**
Dielectric constant:	**ε82, ε37, ε21**

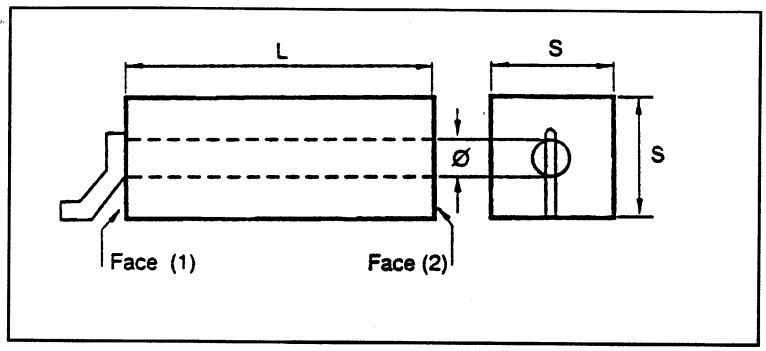
QUARTER WAVELENGTH
OR HALF WAVELENGTH
WITH OR WITHOUT CONNECTION

CERAMIC COAXIAL RESONATORS SPECIFIC REQUEST

Electrical characteristics:

Frequency: .....
Frequency tolerance: .....

Mechanical characteristics:



Resonator size:

Length : L = ... mm max.
Square : S = ... mm max.

Tab size:

l1 = ... mm
l2 = ... mm
e = ... mm

How to order

CR	S	06	T	Q	1500	F	S	1	E
Coaxial Resonator	Shape S: Square	Size in mm	Material S: εr = 82 T: εr = 37 V: εr = 21	Application Q: λ / 4 H: λ / 2	Resonant frequency (MHz)	Frequency tolerance D = ± 0.5 % F = ± 1 % 1 = ± 1 MHz 5 = ± 5 MHz	Metallization S: silver C: copper covered by silver	Connection 1: one 0: none	Tape & reel

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CERAMIC COAXIAL RESONATORS

General characteristics

- **Dimensions and configurations**

The TEKELEC TEMEX coaxial resonators are available over a frequency range of 250 to 5000 MHz with four preferred square cross section sizes having side length of 4, 6, 8 and 12 mm.

Other square section dimensions (S) and circular request can be obtained upon request (please consult your local sales office).

Table 2 summarizes the choice of sizes and dielectric materials which are available.

The length of the component (L) can be determined from the chosen frequency and dielectric constant (εr) as follows:

($\lambda/4$ application) ($\lambda/2$ application)

$$L = \frac{\lambda o}{4\sqrt{\varepsilon r}} \qquad L = \frac{\lambda o}{2\sqrt{\varepsilon r}}$$

$$\text{with } \lambda o = \frac{3 \times 10^{11}}{F} \quad \text{mm}$$

A simplified formula for $\lambda/4$ applications:

$\varepsilon r = 21$	$L = \frac{16.37}{F\ (GHz)}$
$\varepsilon r = 37$	$L = \frac{12.3}{F(GHz)}$
$\varepsilon r = 82$	$L = \frac{8.28}{F(GHz)}$

- **Impedance Z**

The impedance of a coaxial resonator used in TEM mode is a direct function of its dimensions and of the permittivity of the dielectric material.

Table 2 indicates for each standard side length, and for each dielectric constant, the impedance value, independant of the resonator length

CERAMIC COAXIAL RESONATORS

General characteristics

Applications

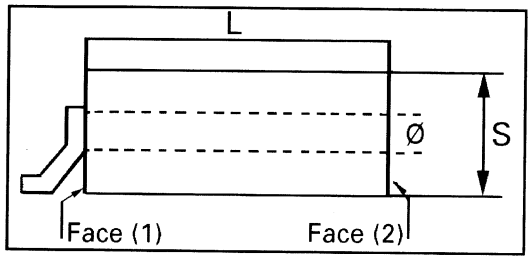
TEKELEC TEMEX coaxial ceramic resonator provide the users with «High Q» higher parallel resonant impedance and better temperature characteristics than inductor coils and associated lumped constant elements used in RF amplifiers and oscillators circuits.

These coaxial resonators are perfectly suitable for:

- DRO/VCO oscillators
- cordless telephone
- cellular telephone
- tuned oscillators
- UHF (LC) coupled amplifiers
- narrow band filters
- Global Positioning systems (GPS)
- duplexers

Table 1: Dimensions

with simplified formula for L (mm)



S (mm)	4	6	8	12
Ø (mm)	1.5	2.5	2.75	4

Note:

(λ/4 application): all faces but (1) are metallized
(λ/2 application): all faces but (1) and (2) are metallized

Table 2: Impedance

S =	4 mm	6 mm	8 mm	12 mm
εr = 21	13.8 Ω	12.5 Ω	15.0 Ω	15.4 Ω
εr = 37	10.4 Ω	9.4 Ω	11.3 Ω	11.6 Ω
εr = 82	7.0 Ω	6.3 Ω	7.6 Ω	7.8 Ω

Table 3: General characteristics

Cross section square	❐	Standard S = 4, 6, 8, 12mm
Dielectric constant	εr	21 ± 2 37 ± 1 82 ± 2
Temperature cœfficient of the dielectric (Standard values)	τf	21 = +2 ± 3 ppm 37 = 0 ± 3 ppm 82 = +7 ± 3 ppm
Resonant freq. range	Fo	see tables
Frequency tolerance		Standard: ± 0.5 % (D) ± 1 % (F) Other on request
Quality factor	Q	see tables and curves
Impedance	Z	see table 2
Metallization		Standard: Silver

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Application notes

- **Soldering recommendations**

Before any soldering operation is implemented, the coaxial resonator must be preheated in order to avoid a thermal shock and a subsequent mechanical stress liable to initiate failure mechanism. TEKELEC TEMEX recommends a minimum preheating time of 2 minutes at 120° C with a maximum heating rate of 2° C / sec.

- **Frequency adjustment**

When the frequency tuning adjustment is needed, two solutions can be adopted:

a) mechanical lapping of the ceramic,
(in this case the frequency will increase),

b) using a TEKELEC TEMEX air or sapphire dielectric tuning capacitor («Air trimmer or Gigatrim»): in this case, the frequency may be increased or decreased depending on the trimmer capacitance range.

This provides an additional advantage ofmounting / terminating resonator to the assembly by utilising the leg configuration of the tuning capacitor.

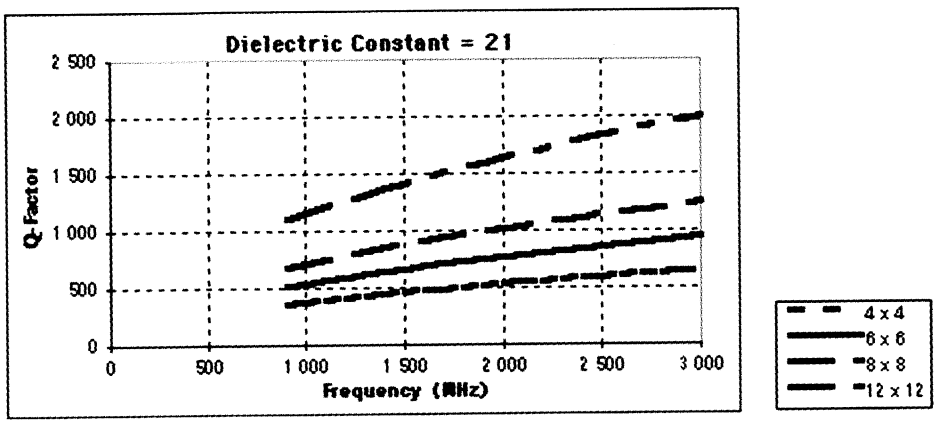
QUALITY FACTOR Q

The Q factor of a coaxial resonator is essentially determined by the metallization.

The dielectric material, having low losses, does not have a direct effect on the "Q" (secondary influence).

The table and the curves show the range of «Q» factor versus resonator size and frequency range.

Curves show that Q min. increases as frequency increases (proportionally to $\sqrt{Fo}$).



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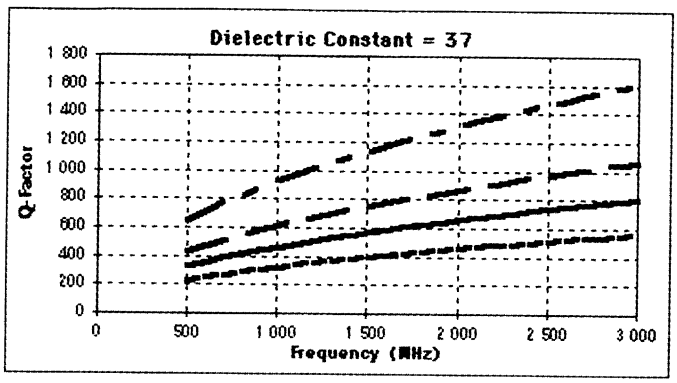

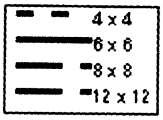

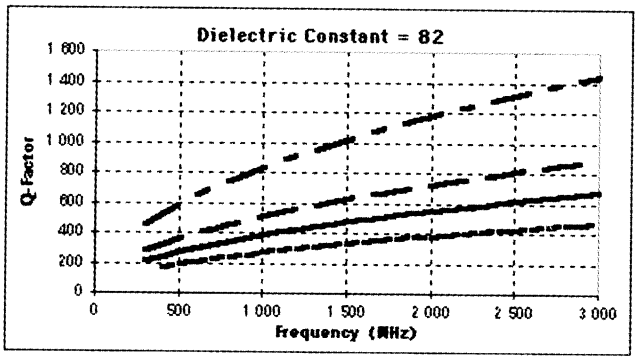

NOTES :

* Q factor versus frequency range for silver metallization.
* For Silver over coffer metallization (chemical process), Q factor is above curves minus 10 %.

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RUBIDIUM FREQUENCY STANDARDS

CONTENTS

SELECTION GUIDE

MODEL	LPFRS	MCFRS-01	HPFRS-01
Dimensions	76 x 77 x 36.5 mm 3 x 3.03 x 1.44 inch	50 x 57 x 90 mm 2 x 2.25 x 3.5 inch	76 x 51 x 10.2 mm 3 x 2 x 4 inch
Volume, weight	0.22 liter, 290 g	0.26 liter, 470 g	0.40 liter, 490 g
Stability	1 x 10^{-10} / month	4 x 10^{-11} / month	4 x 10^{-11} / month
Pin compatilility with other industry std	yes	no	yes

THE LOW COST AND ULTRA HIGH STABILITY MINIATURE ATOMIC STANDARD - TYPE MCFRS

for communication, navigation, instrumentation and timing systems

Product characteristics:

• Small volume	:	2 x 2.25 x 3.5 in.
• Frequency offset over temp. range	:	$< 1.10^{-10}$
• Stability	:	1.10^{-12} / 100 sec.
• Long term stability	:	5.10^{-10} / year
• Low warm-up current	:	< 0.6 A

Main features:

- Very low temperature sensitivity
- Excellent short term stability
- Low power consumption
- Fast warm-up
- Small volume / low profile
- Rb lamp extended life expectancy (20 years)
- Industry standard pin out
- RS232 interface for centre frequency adjustment and monitoring of the working parameters

Main applications:

- Synchronisation telecommunications (SDH, SONET, SS7, GSM, TETRA)
- Digital Audio Broadcast
- TV transmissions (analog & digital)
- Military communications
- Navigation
- Instrumentation
- Tracking and guidance control

Parameters accessible through RS232

The working and monitoring parameters of the MCFRS are accessible for read and write operations through the serial RS-232 port (1200 bits/sec., no parity, 1 start bit, 8 data bits, 1 stop bit).
There are three different commands, which are: *M, Cxx* and *Fxx* followed by a carriage return.

M: monitors the basic factory adjustments of the atomic clock.
The returned answer looks like

HH GG FF EE DD CC BB AA <CR>

Where each returned byte is an ASCII coded hexadecimal value, separated by a <Space> character. All parameters are coded at full scale.

HH: DC-Voltage of the photocell (0 to 5 V)
GG: peak voltage of Rb-signal (0 to 5 V)
FF: not used
EE: varactor control voltage (0 to 5 V)
DD: Readback of the user provided frequency adjustment voltage on pin (0 to 5 V)
CC: Rb-lamp heating current (0 to 500 mA)
BB: Rb-cell heating current (0 to 500 mA)
AA: Automatic gain control voltage of the rubidium RF section (0 to 15 V)

Cxx: output frequency correction through the synthesizer, by steps of 2×10^{-10}, where xx is a signed 8 bits word. This value is automatically storeed in a EEPROM.

Fxx: output frequency correction through C-field, by steps of 1×10^{-11}, where xx is a signed 8 bits word.

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LOW COST AND ULTRA HIGH STABILITY MINIATURE ATOMIC STANDARD

Electrical characteristics

Type		MCFRS01 / 02	
		Standard version	**Options**
Frequency		10 MHz	Optional 20 MHz / 5 MHz
Frequency change within operating temperature range (Thermal chamber with air flow)	MCFRS-01	$\leq 2 \times 10^{-10}$ over -0° C to +60° C ($< \pm 1 \times 10^{-10}$ **typical** ref. to 25° C)	$\leq \pm 1.5 \times 10^{-10}$ over -20° C to +65° C operating range **(option code E)** $\leq \pm 1 \times 10^{-10}$ over -25° C to +65° C operating range **(option code G)**
	MCFRS-02	$\leq 3 \times 10^{-10}$ over -5° C to +60° C ($< \pm 1.5 \times 10^{-10}$ **typical** ref. to 25° C)	Same option as MCFRS-01
Long term stability	MCFRS-01	$\pm 4 \times 10^{-11}$ / month	$\pm 1 \times 10^{-11}$ / month **(option code A)**
	MCFRS-02	$\pm 1 \times 10^{-10}$ / month	
(Measured after 2 months of continuous operation)			
Short term stability		3×10^{-11} / 1 s 1×10^{-11} / 10 s 3×10^{-12} / 100 s	Improved short term stability **(option code S)** 1×10^{-11} / 1 s 3×10^{-12} /10 s 1×10^{-12} / 100s
Phase noise (10 MHz)		-70 dBc/Hz at 1 Hz -80 dBc/Hz at 10 Hz -115 dBc/Hz at 100 Hz -135 dBc/Hz at 1 kHz -140 dBc/Hz at 10 kHz	-80 dBc/Hz at 1 Hz -100 dBc/Hz at 10 Hz **(option code S)**
Frequency retrace (in stable temperature, gravity, pressure and magnetic field conditions)		$< 2 \times 10^{-11}$ within 1 h after 24 h off	
Warm-up time		standard version 5×10^{-10} after 10' at +25° C	fast warm-up **(option code F)** 5×10^{-10} after 5' at +25° C
Analog frequency adjustment For stable operation, an external voltage adjust. value shall be applied (DC voltage of 0 to 5 V) Typically: the cursor pin of a 10 kΩ variable resistor connected between pins 3 and 8 can provide this adjustment voltage.		$2.5 \times 10^{-9} \pm 20$ %	Large analog freq. tunning **(option code O)** $5 \times 10^{-9} \pm 20$ %
Digital frequency adjustment through serial RS-232 port.		$\pm 2.5 \times 10^{-8}$ (resolution: 2×10^{-10}) 2.5×10^{-9} (resolution: 1×10^{-11}) ± 20 %	
Output level		sinewave 0.5 Vrms ± 10 %, 50 Ω	
Return loss		-20 dB	
Harmonics		< -30 dBc	
Spurious f_0 + 100 kHz		< -80 dBc	
Subharmonics		< -60 dBc	
Supply voltage		22 to 28 V	
Input power		warm up: 15 W at 24 V -20° C: < 10 W +25° C: < 8 W +65° C: < 5 W	warm up: 25 W at 24 V **(with option code F)** -20° C:< 10 W +25° C: < 8 W +65° C: < 5 W
Electrical protection			
	power +24 V	An internal diode protects against reverse polarity connection	
	heating +24 V	Protected against a reversed polarity connection < 0.5 s	
	RF output	ESD and short-cut protected	
	T x D output	ESD and short-cut protected	
	xtal mon. output	ESD and short-cut protected	
	5 V ref output	ESD and short-cut protected	
	R x D input	ESD protected	
	freq. adj. input	ESD protected	
	lock monitor	Over current protected	

LOW COST AND ULTRA HIGH STABILITY MINIATURE ATOMIC STANDARD

TEKELEC TEMEX

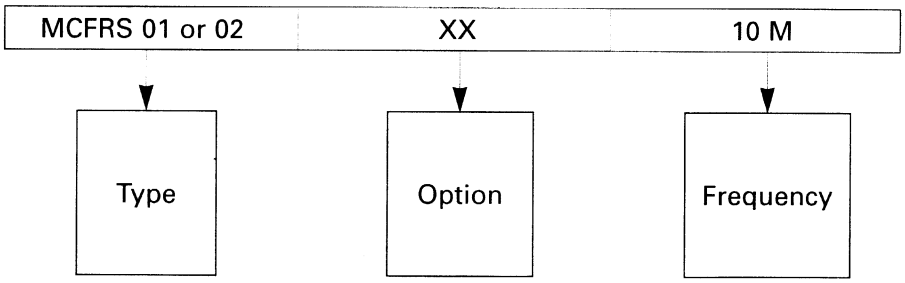
ENVIRONMENTAL (for other environmental qualifications, consult sales offices)

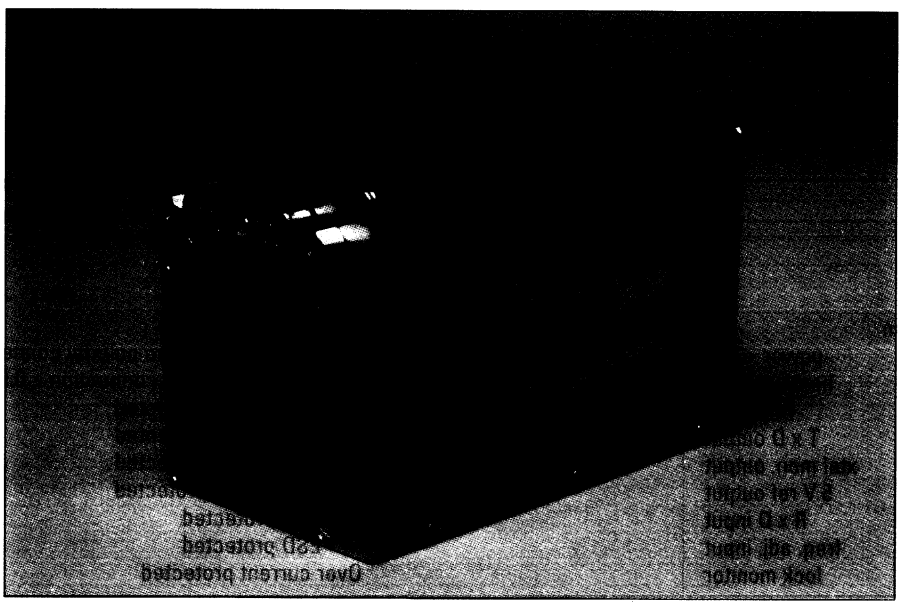
Magnetic field sensitivity	$< 5 \times 10^{-11}$ / Gauss
Storage temperature	-55° C to +85° C
Operating temperature	-25° C to +65° C (65° C is the maximal temperature of the thermal chamber with air flow around the unit)
Overall Environment Effects * (Altitude, Vibration, Shocks)	Meets or exceeds MIL-T-28800B for Type III, class 5 equipment
Helium concentration sensitivity	$< 1 \times 10^{-10}$ per ppm of Helium concentration changes
g-tip-over test	$< 2 \times 10^{-11}$ / g on x or y-axis $< 6 \times 10^{-11}$ / g on z-axis

PHYSICAL

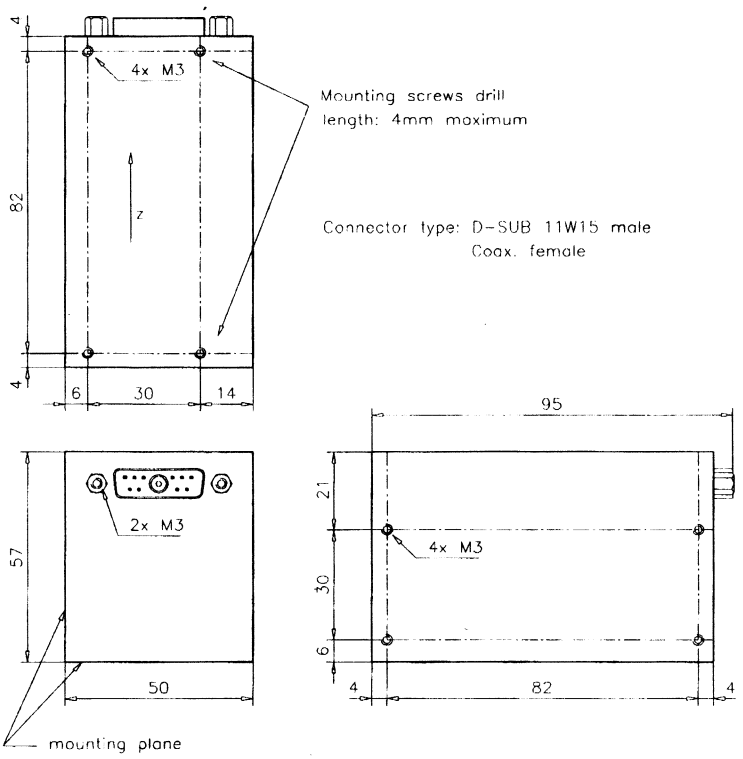
Size	50 x 57 x 90 mm.	(2.0 x 2.25 x 3.5 inches)
Weight	470 g max.	(1.025 Lbs. max)
Volume	1/4 liter	(16 cubic inches)
Connector	10 male contacts / 1 female coaxial contact Mate with ITT Cannon Series DAM11W1	

How to order

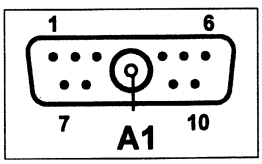


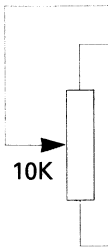


Package: (all dimensions in mm)



Connector front view:





1 :	lock monitor	Out	Lock indicator (open coll.) Open = locked
2 :	frequency adj.	In	Analog center frequency adjestment (0-5 V)
3 :	GND	I/O	Voltage frequency adjustment return
4 :	TXD (TTL)	Out	Transmit pin for RS232 operation
5 :	RXD (TTL)	In	Receive pin for RS232 operation
6 :	heating + 24V	In	Heaters power supply
7 :	xtal monitor	Out	Status: indicates the VCXO voltage
8 :	+ 5 V ref.	Out	Reference for frequency adjustment
9 :	power + 24V	In	Electronics power supply
10 :	GND	I/0	Supply return line
A1:	freq. output	OUT	Frequency output

LOW COST AND LOW PROFILE ULTRA STABLE RUBIDIUM CLOCK - TYPE LPFRS

for communication, navigation, instrumentation and timing systems

Product characteristics

• Small volume	:	13 in^3.
• Frequency offset over temp. range	:	< 1.10^{-10}
• Stability	:	1.10^{-12} / 100 sec.
• Long term stability	:	5.10^{-10} / year
• Low warm-up current	:	< 0.9 A

Main features:

- Very low temperature sensitivity
- Excellent short term stability
- Low power consumption
- Fast warm-up
- Small volume / low profile
- Rb lamp extended life expectancy (20 years)
- Industry standard pin out
- RS232 interface for centre frequency adjustment and monitoring of the working parameters

Main applications:

- Synchronisation telecommunications (SDH, SONET, SS7, GSM, TETRA)
- Digital Audio Broadcast
- TV transmissions (analog & digital)
- Military communications
- Navigation
- Instrumentation
- Tracking and guidance control

Parameters accessible through RS232

The working and monitoring parameters of the LPFRS are accessible for read and write operations through the serial RS-232 port (1200 bits/sec., no parity, 1 start bit, 8 data bits, 1 stop bit).
There are three different commands, which are: *M, Cxx* and *Fxx* followed by a carriage return.

M: monitors the basic factory adjustments of the atomic clock.
The returned answer looks like

HH GG FF EE DD CC BB AA <CR>

Where each returned byte is an ASCII coded hexadecimal value, separated by a <Space> character. All parameters are coded at full scale.

HH: DC-Voltage of the photocell (0 to 5 V)
GG: peak voltage of Rb-signal (0 to 5 V)
FF: not used
EE: varactor control voltage (0 to 5 V)
DD: readback of the user provided frequency adjustment voltage on pin 2 (0 to 5 V)
CC: Rb-lamp heating current (0 to 500 mA)
BB: Rb-cell heating current (0 to 500 mA)
AA: Automatic gain control voltage of the Rubidium RF section (0 to 5 V)
Cxx: output frequency correction through the synthesiser, by steps of 2 x 10^{-10}, where xx is a signed 8 bits word. This value is automatically stored in a EEPRON.
Fxx: output frequency correction through C-field, by steps of 1 x 10^{-11}, where xx is a signed 8 bits word.

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Preliminary electrical characteristics

Type	**LPFRS-01**	
	Standard version	**Options**
Frequency	10 MHz	Optional 20 MHz, 5 MHz
Frequency change within operating temperature range (Thermal chamber with air flow)	≤ ± 1.5 x 10^{-10} over -5° C to + 50° C	TBD
Long term stability (Measured after 2 months of continuous operation)	±1 x10^{-10} / month	± 3 x 10^{-11} / month **(option code A)**
Short term stability	3 x 10^{-11} / 1 s 1 x 10^{-11} / 10 s 3 x 10^{-12} / 100 s	Improved short term stability **(option code S)** 1 x 10^{-11} / 1 s 3 x 10^{-12} / 10 s 1 x10^{-12}/ 100 s
Phase noise (10 MHz)	-70 dBc/Hz at 1 Hz -80 dBc/Hz at 10 Hz -115 dBc/Hz at 100 Hz -135 dBc/Hz at 1 kHz -140 dBc/Hz at 10 kHz	-80 dBc/Hz at 1 Hz -100 dBc/Hz at 10 Hz **(option code S)**
Frequency retrace (in stable temperature, gravity, pressure and magnetic field conditions)	< 5 x 10^{-11} within 1 h after 24 h off	
Warm-up time	standard version 5 x 10^{-10} after 15' at +25° C	fast warm-up **(option code F)** 5 x 10^{-10} after 7' at +25° C
Analog frequency adjustment For stable operation, an external voltage adjust. value shall be applied (DC voltage of 0 to 5 V) Typically: the cursor pin of a 10 kΩ variable resistor connected between pins 3 and 8 can provide this adjustment voltage.	2.5 x 10^{-9} ± 20 %	Large analog freq. tuning **(option code O)** 5 x 10^{-9} ± 20 %
Digital frequency adjustment through serial RS232 port.	± 1.2 x 10^{-7} (resolution 1 x 10^{-9}) 2.5 x 10^{-9} (resolution 1 x 10^{-11}) ± 20 %	
Output level	sinewave 0.5 Vrms ± 10 % 50 Ω	
Return loss	-20 dB	
Harmonics	< -25 dBc	
Spurious f_0 ± 100 kHz	< -80 dBc	
Subharmonics	< -60 dBc	
Supply voltage	**24 V option:** 18 to 32 V	**12 V option:** 11 to 18 V
Input power	warm up: typical 20 W at 12 V typical 25 W at 24 V -5° C: < 13 W +25° C: < 10 W +50° C: < 7 W	warm up: < 32 W **(with option code F)**
Electrical protection power +24 V (12V)	An internal diode protects against reverse polarity connection	
RF output	ESD and short-cut protected	
T x D output	ESD and short-cut protected	
5 V (Vref) output	ESD and short-cut protected	
R x D input	ESD protected	
freq. adjustment input	ESD protected	
lock indicator	Over current protected	

LOW COST AND LOW PROFILE
ULTRA STABLE RUBIDIUM CLOCK

TEKELEC TEMEX

ENVIRONMENTAL

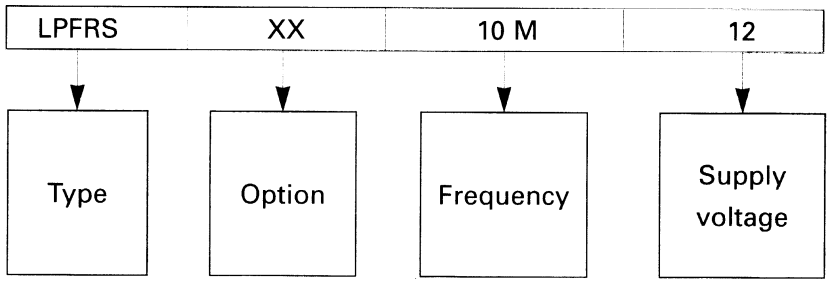
Magnetic field sensitivity	TBD
Storage temperature	-55° C to +85° C
Operating temperature	-5° C to +50° C (50° C is the maximal temperature of the thermal chamber with air flow around the unit)
Overall Environment Effects * (Altitude, Vibration, Shocks)	Meets or exceeds MIL-T-28800B for Type III, class 5 equipment
Helium concentration sensitivity	$< 1 \times 10^{-10}$ per ppm of Helium concentration changes
g-tip-over test	TBD

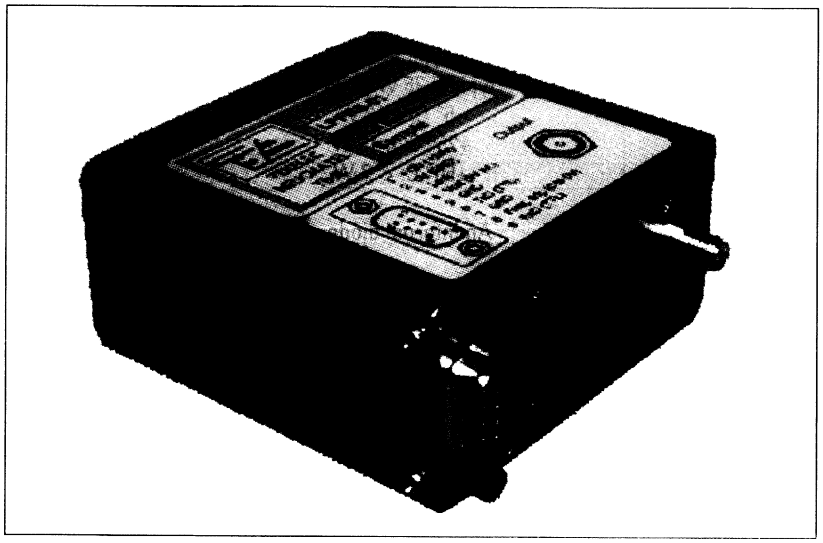
(for other environmental qualification, consult sales offices)

PHYSICAL

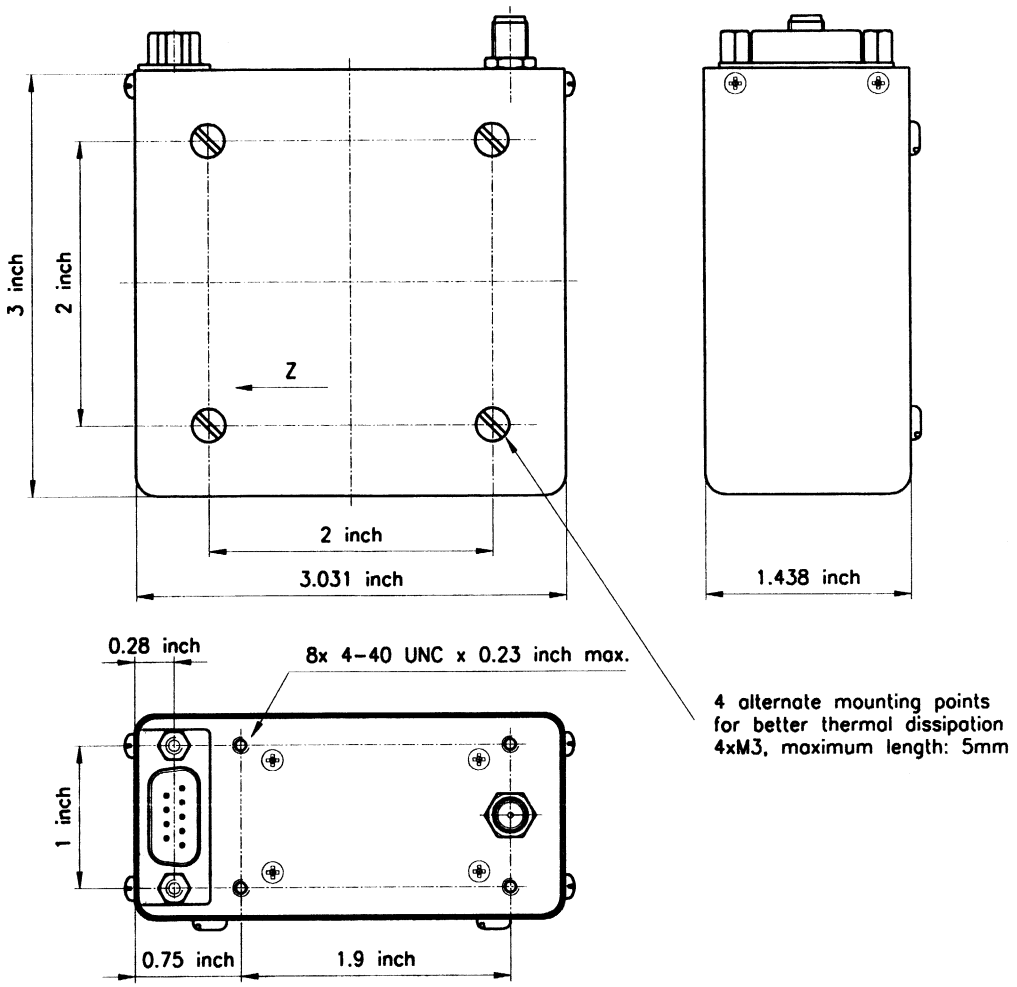
Size	76 x 77 x 36.5 mm.	(3.0 x 3.03 x 1.44 inches)
Weight	290g max.	(1.025 Lbs. max)
Volume	1/5 liter	(13 cubic inches)
Connector	9 male contacts Mate with ITT Cannon Series DB9 + SMA coaxial	

How to order



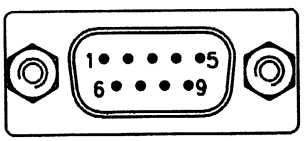


Package: (all dimensions in inch)



Connector front view:

D-Sub 9 pins male



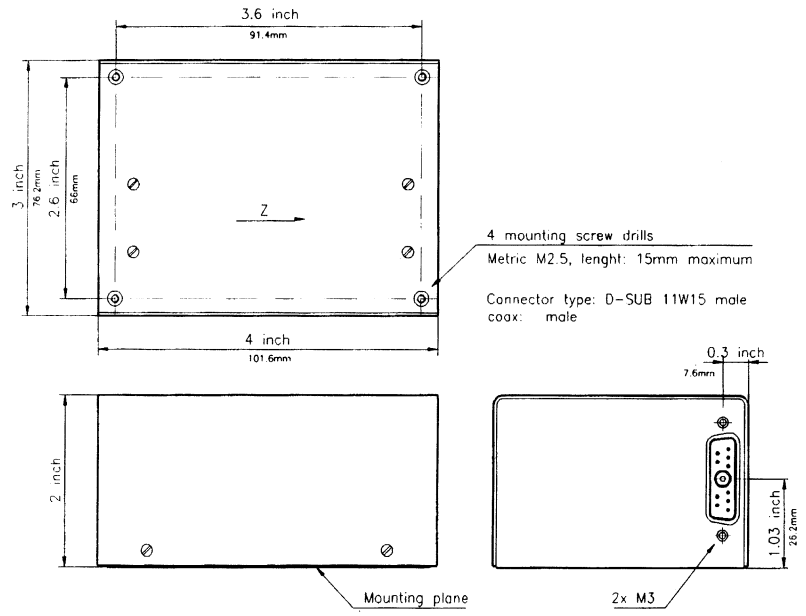
PIN	FUNCTION
1	+ 24 V (+12 V)
2	0 V (GND)
3	Lock indicator (open coll.)
4	Vref (5 V hi-stability ref.)
5	GND
6	T x D (RS232 transmit, TTL)
7	GND
8	Frequency adjust. (0 to 5 V)
9	R x D (RS232 receive, TTL)

ULTRA HIGH STABILITY
MINIATURE ATOMIC STANDARD - TYPE HPFRS
Form, fit and function compatible with industry standard

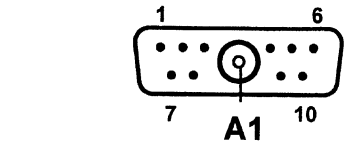
Specifications:

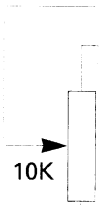
Same as MCFRS-01 or 02 without RS 232 monitoring functions.
Other differences: TTL Lock monitor output: 0 V = locked / 5 V = unlocked

Package:

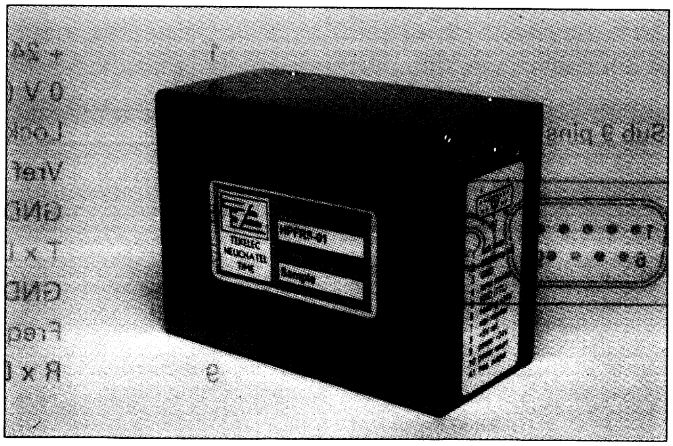


Connector front view:





1 : lock monitor TTL
2 : frequency adj.
3 : GND
4 : lamp monitor
5 : RXD (TTL)
6 : heating +24V
7 : xtal monitor
8 : +5V ref.
9 : power +24V
10 : power return
A1: freq. output



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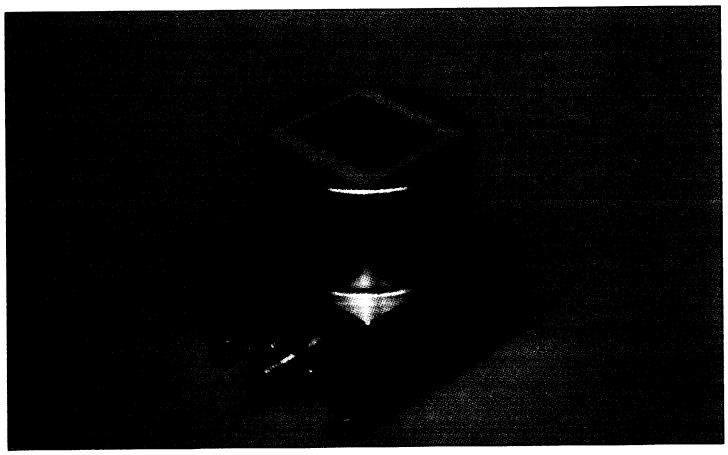
SPACE QUALIFIED CRYSTAL OSCILLATOR TYPE MO4D-SC

See page 15-17 of this data book.



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TIME & FREQUENCY DEVICES

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CODIFICATION SYSTEM

a) General introduction

From the commercial reference derived from the coding system, it is possible to determine the principal parameters of the oscillator.

Therefore, for a given set of parameters, an end user can create a commercial reference for a standard product.

b) Catalogue oscillators

The TEKELEC TEMEX oscillator commercial reference is made up in the following manner:

AAA BBB-CDEF xxx,xxx MHz GGGHHJJJ

AAA	**Product family:**
FTF:	Generic BAW crystal filter
FTO:	Generic crystal oscillator
QA / QB:	Standard crystal resonator to UTE 93-611
QE:	Professional crystal resonator
QEN:	Clock oscillator (XO)
QEV:	Voltage controlled oscillator (VCXO)
QEA:	Temperature compensated crystal oscillator (TCXO)
QED:	Digitally compensated crystal oscillator (DTCXO)
QEO:	Oven controlled crystal oscillator (OCXO)
MOT:	High stability oven controlled crystal oscillator (OCXO)
TE:	Standard BAW crystal filter
QEM:	MCXO
BBB	**Holder:**
	See holder family selection list.
C	**Production code:**
	This letter designates the internal method of construction.
D	**Output signal:**
T:	TTL output
C:	CMOS output
H:	HCMOS output
E:	ECL output
S:	TTL SCHOTTKY gates
O:	Sine wave

Example: **QEN 49-AH**: «H» signifies **HCMOS / ACMOS** output signal

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E.F **Option code:**

Designates available options:

I:	Validation of output signal on control pin
L:	Pulling linearity
T:	Connection to internal trimmer
P:	XO: Inverted output, TCXO: External potentiometer
C:	Frequency adjustment by variable capacitor (external or internal)
V:	Frequency adjustment by voltage variation (voltage source to be advised)
R:	Duty cycle
J:	Tri-state option
O:	Frequency adjustment by external resistance

xxx,xxx MHz **Nominal frequency (F_N) in MHz**

GGG **Frequency pulling** *(concerns only VCXO)*

Numerical value given by 2 or 3 digits indicating the required frequency pulling range.

Example: **QEV 55-AH 100**: «**100**» signifies **an excursion of ± 100 ppm** either side of the nominal frequency.

HH **Operating temperature range:**

The code consists of two letters as given below ; the **first letter** indicates the **lower temperature**, the **second letter** gives the **upper temperature** of the operating temperature range.

Lower temperature			**Upper temperature**		
A	=	-55° C	M	=	+50° C
B	=	-50° C	N	=	+55° C
C	=	-45° C	O	=	+60° C
D	=	-40° C	P	=	+65° C
E	=	-35° C	Q	=	+70° C
F	=	-30° C	R	=	+75° C
G	=	-25° C	S	=	+80° C
H	=	-20° C	T	=	+85° C
I	=	-15° C	U	=	+90° C
J	=	-10° C	V	=	+95° C
K	=	-5° C	W	=	+100° C
L	=	0° C	X	=	+105° C
			y	=	+125° C

Example:

LM	.....	0° C	to	+50° C
HQ	.....	-20° C	to	+70° C
DT	.....	-40° C	to	+85° C

Where it is not possible to codify the operating temperature range by above. The oscillator can be attributed a ZZ code and a specified temperature range applied.

JJJ **Frequency stability:**

Numerical value consisting of 2 or 3 digits expressing the frequency precision in ppm (10E6).

Two specific cases need to be considered:

- Time base (XO),
- Other oscillators (VCXO, TCXO, OCXO)

1. **Time base (XO)**

The JJJ code indicates the following frequency in accuracy due to the following causes:

- Frequency adjustment tolerance at ambient temperature,
- Frequency shift over the temperature range,
- Variations due to change of supply voltage,
- Variations due to change of oscillator load.

Example: **LQ100**: **«100»** indicated **± 100 ppm** over the temperature range 0° C to +70° C

2. **Other types of oscillators (VCXO, TCXO, OCXO)**

The JJJ code indicates, unless otherwise stated, the frequency deviation over the specified operating temperature range expressed as follows:

Example: **DT57**: signifies **± 5.10^{-7}** over the temperature range -40° C to +85° C

c) Marking

Generally the following information is mechanically engraved on the holder:

CQE + Date Code + Reference

On request the engraving can be replaced by a label.

NB: **Non-Standard Filter Identification**

- FTF: Generic filter code
- XXXX: Demotes chronological sequence
- YYY,YYY: Nominal centre frequency (MHz)

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Quality Assurance Program

Screening tests

After sealing and for 72 hours, all pieces are subject to the following storage conditions:

- +85°C for products working in temperature range equal or below -40° to +85° C (GT1)
- +125°C for products working in temperature range greater than -40° to +85° C (GT2).

Hybrid clock oscillator type DIP DH, BH, CH and QEN 79-AH (metallic or ceramic package)

For standard products class 2 applies.

When requested, TEKELEC-CQE will perform screening test.
For class B or S precap. and stabilization bake at +150° C are performed before sealing.

TABLE 1

Screen test	CEI Ref.	OPTIONS				
		Class 2	Class 3	Class 4		Class 6
				B	S	
Leak Test (Gross / Fine)	68-2-17 Qc + Qk Met 1	X	X	X	X	X
Thermal cycling (GT1)	68-2-14 Met Nb					
	-40 to +110°C Tg: 5°C/mn		X	X	X	X
Thermal cycling (GT2)	68-2-14 Met Nb					
	-55 to +125°C Tg: 5°C/mn		X			X
Burn in operating	68-2-2 160 Hs 125°C			X		
	68-2-2 240 Hs 125°C				X	
Acceleration Z* axis	68-2-7 g = 5000 g			X	X	
Thermal shocks	68-2-14 Met Na					
	-55 to +125°C T2: 30 S				X	
X-Ray					X	
Pind Test	MIL STD 883 Met 2020				X	

*: Z axis is perpendicular to the package major surface

Other TEKELEC-CQE oscillators and filters

When requested, class 6 applies with sealing limited to gross leak test.

*** At maximum specified operating temperature

More stringent requirements can be achieved on customer request.

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Standard environmental conditions

TEKELEC-CQE products are designed and manufactured to withstand the following environmental conditions:

TABLE 2

Tests	**Hybrid Oscillators metallic or ceramic package**	**Other TEKELEC-CQE oscillators and filters**
Shock	CEI 68-2-27 100g / 6 ms	CEI 68-2-27 30 g / 11 ms
Sine Vibrations	CEI 68-2-6 test Fc 10 g from 10 Hz to 2000 Hz	CEI 68-2-6 test Fc 5 g from 10 to 500 Hz
Random Vibrations	CEI 68-2-34 test Fd 10 grms from 20 to 2000 Hz	NA
Acceleration	5000 g Z axis	NA
Storage temperature	-55 to 125° C	-55 to +85° C
Operating temperature	per product specification	per product specification
Sealing	CEI 68-2-17 Test Qk and Qc	CEI 68-2-17 Test Qc, NA for products which are not fully sealed
Terminal strength	CEI 68-2-21	CEI 68-2-21
Bends test	Test Ub excepted for ceramic package	Test Ub
Humidity	CEI 68-2-3, 96 Hours	CEI 68-2-3, 96 Hours
Altitude	CEI 68-2-13, 30000 M	CEI 68-2-13, 30000 M

More stringent requirements can be achieved for most products type.

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PROFESSIONAL CRYSTAL RESONATORS

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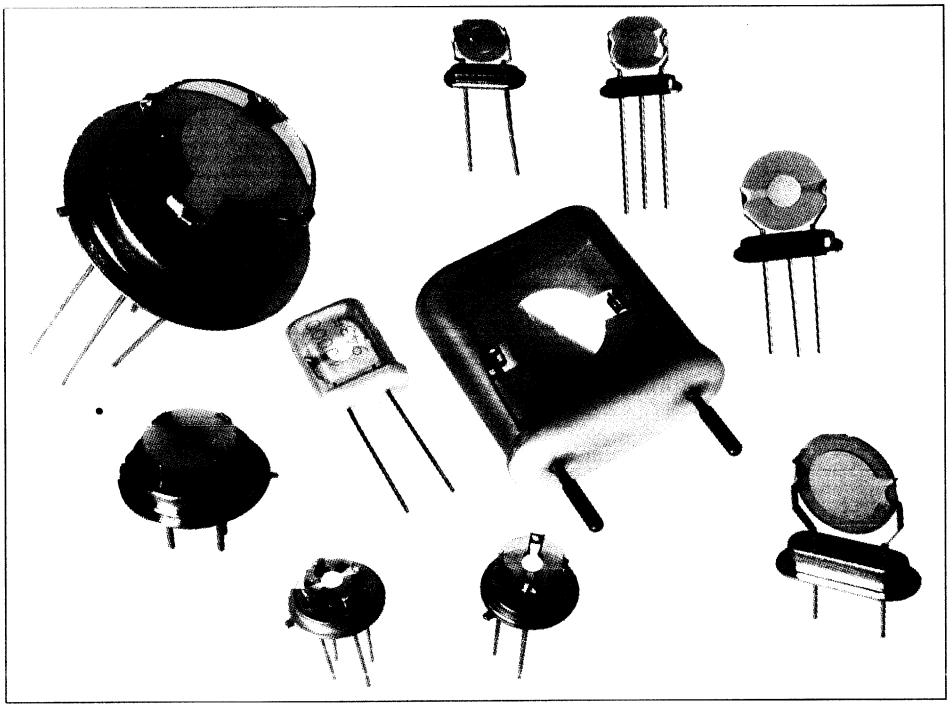

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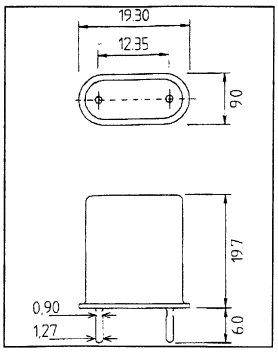
PROFESSIONAL CRYSTAL RESONATORS

Selection Guide

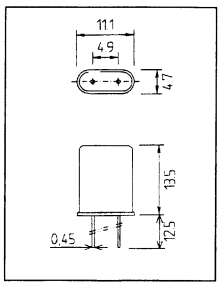
PACKAGE	FREQUENCY RANGE	OVERTONE	OBSERVATIONS	TYPE	PAGE
HC-48/U	0.8 MHz to 125 MHz	1 to 5	UTE C 93-611	QA/QB	6-5
HC-49/U	5 MHz to 90 MHz	1 to 3	UTE C 93-611	QA/QB	6-5
HC-49/U	50 MHz to 130 MHz	5	UTE C 93-611	QA/QB	6-6
HC-50/U	2.9 MHz to 61 MHz	1 to 3	UTE C 93-611	QA	6-6
HC-35/U	16 MHz to 90 MHz	1 to 3	UTE C 93-611	QB	6-6
HC-35/U	30 MHz to 130 MHz	3 to 5	UTE C 93-611	QB	6-7
HC-37/U	3 MHz to 60 MHz	1 to 3	UTE C 93-611	QB	6-7
HC-40/U	1 MHz to 10 MHz	1	UTE C 93-611	QB	6-8
HC-45/U	16 MHz to 130 MHz	1 to 5	UTE C 93-611	QB/QM	6-8
General informations on SC-cut resonators (doubly rotated)					
Crystal holders and frequency ranges					6-9
General information on AT-cut resonators for professional applications					
Crystal holders and frequency ranges					6-12
HC-51/U Flat holder	1 MHz to 125 MHz	1 to 5	resistance-welded holder	QE 02·	6-14
HC-48/U Flat holder	1 MHz to 125 MHz	1 to 5	resistance-welded holder	QE 03.	6-15
HC-49/U Flat holder	3 MHz to 125 MHz	1 to 5	resistance-welded holder	QE 05.	6-16
HC-50/U Flat holder	3 MHz to 125 MHz	1 to 5	resistance-welded holder	QE 09.	6-17
HC-35/U Cylindrical holder	8 MHz to 250 MHz	1 to 5	cold-welded holder	QE 12.	6-18
HC-37/U Cylindrical holder	3 MHz to 100 MHz	1 to 5	cold-welded holder	QE 15.	6-19
HC-40/U Cylindrical holder	1 MHz to 30 MHz	1 to 5	cold-welded holder	QE 16.	6-20
HC-45/U Flat holder	10 MHz to 300 MHz	1 to 57	resistance-welded holder	QE 17.	6-21
LCCC Ceramic 40 pads	6 MHz to 125 MHz	1 to 5	3-point structure of crystal mount	QE 47.	6-22
Ceramic flat pack 26 leads	1 MHz to 50 MHz	1 to 5	4-point structure of crystal mount	QE 76.	6-23

GENERAL INFORMATION

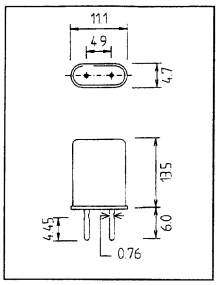
HC-48/U



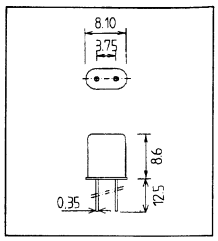
HC-49/U



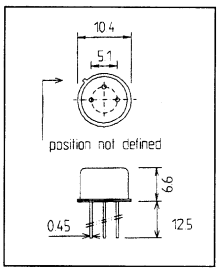
HC-50/U



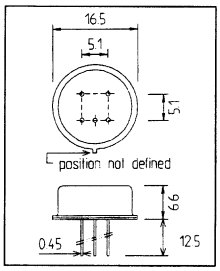
HC-45/U



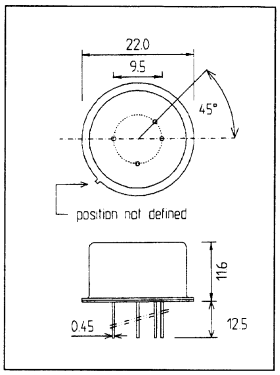
HC-35/U



HC-37/U (wires)



HC-40/U (wires)



Standard crystals

We currently manufacture the entire range of quartz crystal resonators to the French national specifications UTE C 93-611. The characteristics are tabulated on the following pages. Where applicable, many of these specifications are included on the MUAHAG, GAMT1 and LNZ preferred parts lists. Products used in military application can be released with a SIAR certificate. We can also supply to many of the European and American standard specifications.

Customized crystals

We are prepared to examine and in many cases cooperate in generating a specification suitable for a particular application. Our engineering team is widely experienced using either single or double rotation cuts in the frequency range 0.8 to 300 MHz.
Depending on the utilisation our units can be encapsulated in resistance welded or cold welded metal holders. In the case of very demanding long term requirements we employ glass holders.

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STANDARD CRYSTALS TO UTE C 93-611

reference	preferred parts list	overtone	frequency range (MHz)	load cap. CL (pF)	calibration tol. (ppm)	freq. dev. (ppm)	operating temp. (°C)
Enclosure : HC-48/U or HC-36/U)							
QA 18A		1	0.8 to 20	32	n.a	*± 50	-55 to +105
QA 19A		1	0.8 to 20	∞	n.a	*± 50	-55 to +105
QA 27A		1	0.8 to 20	32	± 20	± 5	+70 to +80
QA 28A		1	0.8 to 20	∞	± 20	± 5	+70 to +80
QA 35A		1	0.8 to 20	∞	± 20	± 5	+80 to +90
QA 36A		1	0.8 to 20	32	± 20	± 5	+80 to +90
QB 501	LNZ	1	0.8 to 30	30	± 15	± 35	-55 to +105
QB 502	LNZ	1	0.8 to 30	30	± 10	± 10	-20 to +70
QB 613		1	2 to 20	30	± 10	± 7.5	-10 to +70
QB 614		1	2 to 20	30	± 10	± 25	-40 to +85
QB 615	LNZ	1	2 to 20	30	± 10	± 30	-55 to +100
QB 616		1	1 to 20	30	± 10	± 5	+5 to +55
QB 617	LNZ	1	1 to 20	30	± 10	± 10	-10 to +70
QB 618	GAMT1	1	1 to 20	30	± 10	± 30	-40 to +85
QB 619		1	1 to 20	30	± 10	± 40	-55 to +100
QM 01	LNZ **	1	1 to 6	30	± 30	± 50	-10 to +70
QA 52A		3	10 to 61	∞	n.a	*± 50	-55 to +105
QA 32A		3	10 to 52	∞	± 20	± 5	+70 to +80
QA 32A		5	52 to 75	∞	± 20	± 5	+70 to +80
QA 54A		5	50 to 125	∞	n.a	*± 50	-55 to +105
Enclosure : HC-49/U (HC-43/U)							
QA 60A		1	5 to 20	∞	n.a	*± 50	-55 to +105
QA 64	LNZ	1	4 to 20	30	n.a.	*± 50	-55 to +105
QB 504	LNZ	1	3.7 to 30	30	± 10	± 25	-55 to +105
QB 620		1	5 to 30	30	± 10	± 4	+5 to +55
QB 621		1	5 to 30	30	± 10	± 5	-10 to +70
QB 622	LNZ	1	5 to 30	30	± 10	± 25	-40 to +85
QB 623	LNZ	1	5 to 30	30	± 10	± 30	-55 to +100
QB 624		1	3 to 30	30	± 10	± 5	+5 to +55
QB 625	LNZ	1	3 to 30	30	± 10	± 10	-10 to +70
QB 626	GAMT1	1	3 to 30	30	± 10	± 30	-40 to +85
QB 627	GAMT1	1	3 to 30	30	± 10	± 40	-55 to +100
QM 02		1	3 to 35	30	± 30	± 50	-10 to +70
QA 55		3	17 to 61	∞	n.a.	*± 50	-55 to +105
QA 61		3	17 to 61	∞	± 20.	± 5	+80 to +90
QB 628		3	30 to 90	∞	± 10	± 4	+5 to +55
QB 629		3	30 to 90	∞	± 10	± 4	-10 to +70
QB 630	GAMT1	3	30 to 90	∞	± 10	± 25	-40 to +85
QB 631	GAMT1	3	30 to 90	∞	± 10	± 30	-55 to +100
QB 632		3	30 to 90	∞	± 10	± 5	+5 to +55
QB 633	LNZ	3	30 to 90	∞	± 10	± 10	-10 to +70
QB 634	LNZ	3	30 to 90	∞	± 10	± 30	-40 to +85
QB 635		3	30 to 90	∞	± 10	± 40	-55 to +100

* inclusive of frequency tolerance

** enclosure HC-51/U (wires) instead of HC-48/U

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PROFESSIONAL CRYSTAL RESONATORS

Standard crystals to UTE C 93-611

TEKELEC TEMEX

reference	preferred parts list	overtone	frequency range (MHz)	load cap. CL (pF)	calibration tol. (ppm)	freq. dev. (ppm)	operating temp. (°C)
Enclosure : HC-49/U (HC-43/U)							
QA 56A		5	50 to 125	∞	n.a	*±50	-55 to +105
QA 59A		5	50 to 125	∞	± 20	± 5	+80 to +90
QB 503		5	50 to 125	∞	± 10	± 25	-55 to +105
QB 636		5	60 to 130	∞	± 10	± 4	+5 to +55
QB 637		5	60 to 130	∞	± 10	± 4	-10 to +70
QB 638	GAMT1	5	60 to 130	∞	± 10	± 25	-40 to +85
QB 639	GAMT1	5	60 to 130	∞	± 10	± 30	-55 to +100
QB 640		5	60 to 130	∞	± 10	± 5	+5 to +55
QB 641	LNZ	5	60 to 130	∞	± 10	± 10	-10 to +70
QB 642	LNZ	5	60 to 130	∞	± 10	± 30	-40 to +85
QB 643		5	60 to 130	∞	± 10	± 40	-55 to +100
Enclosure HC-50/U (HC-42/U)							
QA 78		1	2.9 to 20	30	n.a.	*±50	-55 to +105
QA 79		1	2.9 to 20	∞	n.a	*±50	-55 to +105
QA 81		3	17 to 61	∞	n.a	*±50	-55 to +105
QA 81Z		3	17 to 61	∞	n.a	*±50	-55 to +105
Enclosure : HC-35/U							
QB 684		1	16 to 35	30	± 10	± 4	+5 to +55
QB 685		1	16 to 35	30	± 10	± 4	-10 to +70
QB 686		1	16 to 35	30	± 10	± 25	-40 to +85
QB 687		1	16 to 35	30	± 10	± 30	-55 to +100
QB 688		1	10 to 35	30	± 10	± 5	+5 to +55
QB 689		1	10 to 35	30	± 10	± 10	-10 to +70
QB 690	GAMT1	1	10 to 35	30	± 10	± 30	-40 to +85
QB 691	GAMT1	1	10 to 35	30	± 10	± 40	-55 to +100
QB 722	GAMT1	1	12 to 35	∞	± 10	± 30	-40 to +85
QB 723	GAMT1	1	12 to 35	∞	± 10	± 40	-55 to +100
QB 724	GAMT1	1	12 to 35	30	± 10	± 30	-40 to +85
QB 725	GAMT1	1	12 to 35	30	± 10	± 40	-55 to +100
QB 700		3	30 to 90	∞	± 10	± 4	+5 to +55
QB 701		3	30 to 90	∞	± 10	± 4	-10 to +70
QB 702		3	30 to 90	∞	± 10	± 25	-40 to +85
QB 703	GAMT1	3	30 to 90	∞	± 10	± 30	-55 to +100

* inclusive of frequency tolerance at reference temperature

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PROFESSIONAL CRYSTAL RESONATORS

Standard crystals to UTE C 93-611

reference	preferred parts list	overtone	frequency range (MHz)	load cap. CL (pF)	calibration tol. (ppm)	freq. dev. (ppm)	operating temp. (°C)
Enclosure : HC-35/U							
QB 704		3	30 to 90	∞	± 10	± 5	+5 to +55
QB 705		3	30 to 90	∞	± 10	± 10	-10 to +70
QB 706	GAMT1	3	30 to 90	∞	± 10	± 30	-40 to +85
QB 707		3	30 to 90	∞	± 10	± 40	-55 to +100
QB 726	GAMT1	3	30 to 90	∞	± 10	± 25	-40 to +85
QB 727	GAMT1	3	30 to 90	∞	± 10	± 30	-55 to +100
QB 708		5	60 to 130	∞	± 10	± 4	+5 to +55
QB 709		5	60 to 130	∞	± 10	± 4	-10 to +70
QB 710		5	60 to 130	∞	± 10	± 25	-40 to +85
QB 711	GAMT1	5	60 to 130	∞	± 10	± 30	-55 to +100
QB 712		5	60 to 130	∞	± 10	± 5	+5 to +55
QB 713		5	60 to 130	∞	± 10	± 10	-10 to +70
QB 714	GAMT1	5	60 to 130	∞	± 10	± 30	-40 to +85
QB 715		5	60 to 130	∞	± 10	± 40	-55 to +100
QB 728	GAMT1	5	60 to 130	∞	± 10	± 25	-40 to +85
QB 729	GAMT1	5	60 to 130	∞	± 10	± 30	-55 to +100
Enclosure : HC-37/U							
QB 676		1	4 to 20	30	± 10	± 4	+5 to +55
QB 677		1	4 to 20	30	± 10	± 4	-10 to +70
QB 678		1	4 to 20	30	± 10	± 25	-40 to +85
QB 679		1	4 to 20	30	± 10	± 30	-55 to +100
QB 680		1	3 to 20	30	± 10	± 5	+5 to +55
QB 681	LNZ	1	3 to 20	30	± 10	± 10	-10 to +70
QB 682	GAMT1	1	3 to 20	30	± 10	± 30	-40 to +85
QB 683	GAMT1	1	3 to 20	30	± 10	± 40	-55 to +100
QB 718	GAMT1	1	3 to 20	∞	± 10	± 30	-40 to +85
QB 719	GAMT1	1	3 to 20	∞	± 10	± 40	-55 to +100
QB 720	GAMT1	1	3 to 20	30	± 10	± 30	-40 to +85
QB 721	GAMT1	1	3 to 20	30	± 10	± 40	-55 to +100
QB 692		3	20 to 60	∞	± 10	± 4	+5 to +55
QB 693		3	20 to 60	∞	± 10	± 4	-10 to +70
QB 694	GAMT1	3	20 to 60	∞	± 10	± 25	-40 to +85
QB 695	GAMT1	3	20 to 60	∞	± 10	± 30	-55 to +100
QB 696		3	20 to 60	∞	± 10	± 5	+5 to +55
QB 697		3	20 to 60	∞	± 10	± 10	-10 to +70
QB 698		3	20 to 60	∞	± 10	± 30	-40 to +85
QB 699		3	20 to 60	∞	± 10	± 40	-55 to +100

PROFESSIONAL CRYSTAL RESONATORS

Standard crystals to UTE C 93-611

TEKELEC TEMEX

reference	preferred parts list	overtone	frequency range (MHz)	load cap. CL (pF)	calibration tol. (ppm)	freq. dev. (ppm)	operating temp. (°C)
Enclosure : HC-40/U (please specify wires or pins)							
QB 668		1	2 to 10	30	± 10	± 4	+5 to +55
QB 669		1	2 to 10	30	± 10	± 4	-10 to +70
QB 670		1	2 to 10	30	± 10	± 25	-40 to +85
QB 671	GAMT1	1	2 to 10	30	± 10	± 30	-55 to +100
QB 672		1	1 to 10	30	± 10	± 5	+5 to +55
QB 673		1	1 to 10	30	± 10	± 10	-10 to +70
QB 674	GAMT1	1	1 to 10	30	± 10	± 20	-40 to +85
QB 675	GAMT1	1	1 to 10	30	± 10	± 40	-55 to +100
Enclosure : HC-45/U							
QB 644		1	16 to 35	30	± 10	± 4	+5 to +55
QB 645		1	16 to 35	30	± 10	± 4	-10 to +70
QB 646		1	16 to 35	30	± 10	± 25	-40 to +85
QB 647		1	16 to 35	30	± 10	± 30	-55 to +100
QB 648		1	16 to 35	30	± 10	± 5	+5 to +55
QB 649		1	16 to 35	30	± 10	± 10	-10 to +70
QB 650	GAMT1	1	16 to 35	30	± 10	± 30	-40 to +85
QB 651	GAMT1	1	16 to 35	30	± 10	± 40	-55 to +100
QM 03	LNZ	1	16 to 35	30	± 10	± 50	-10 to +70
QB 652		3	30 to 90	∞	± 10	± 4	+5 to +55
QB 653		3	30 to 90	∞	± 10	± 4	-10 to +70
QB 654	GAMT1	3	30 to 90	∞	± 10	± 15	-40 to +85
QB 655	GAMT1	3	30 to 90	∞	± 10	± 30	-55 to +100
QB 656		3	30 to 90	∞	± 10	± 5	+5 to +55
QB 657		3	30 to 90	∞	± 10	± 10	-10 to +70
QB 658		3	30 to 90	∞	± 10	± 30	-40 to +85
QB 659		3	30 to 90	∞	± 10	± 40	-55 to +100
QB 716		3	30 to 90	∞	± 10	± 25	-40 to +85
QB 717	GAMT1	3	30 to 90	∞	± 10	± 30	-55 to +100
QB 660		5	60 to 130	∞	± 10	± 4	+5 to +55
QB 661		5	60 to 130	∞	± 10	± 4	-10 to +70
QB 662	GAMT1	5	60 to 130	∞	± 10	± 25	-40 to +85
QB 663	GAMT1	5	60 to 130	∞	± 10	± 30	-55 to +100
QB 664		5	60 to 130	∞	± 10	± 5	+5 to +55
QB 665		5	60 to 130	∞	± 10	± 10	-10 to +70
QB 666		5	60 to 130	∞	± 10	± 30	-40 to +85
QB 667		5	60 to 130	∞	± 10	± 40	-55 to +100

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SC-CUT RESONATORS (DOUBLY ROTATED)

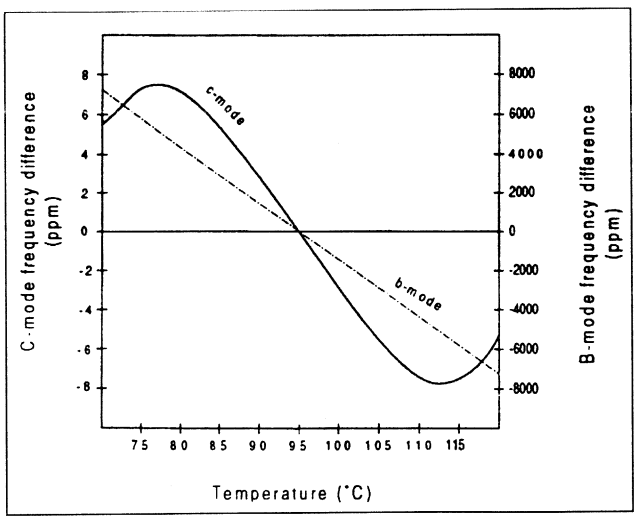
The SC-cut (stress compensated) resonator is a doubly rotated element designed to reduce frequency changes due to both thermal and mechanical stress bias, thus giving rise to advantages over the conventional single rotated units such as the AT and BT cuts.

Some of the advantages

- an improved frequency-temperature characteristic especially near the inversion points
- better frequency stability with time (ageing) both long and short term due to reduced effects of thermal and mounting stress
- reduced non-linear effects, better drive level sensitivity
- improved warm-up characteristic, giving faster thermal equilibrium and less overshoot
- freedom of coupled modes. These can produce activity perturbations with change of temperature
- lower acceleration sensitivity
- high Q-factor
- reduced radiation effects

Typical specification for a GPS receiver

Frequency	:	6.5 MHz
Holder	:	HC-27/U
Turnover temperature	:	+85° C ± 5° C
Resistance	:	≤ 90 Ω on C mode
Motional capacitance	:	0.17 fF ± 10%
Shunt capacitance	:	≤ 4 pF
Initial accuracy	:	≤ 2 ppm at turnover temperature
Vibration order	:	3rd overtone
Quality factor	:	> 1.5×10^6



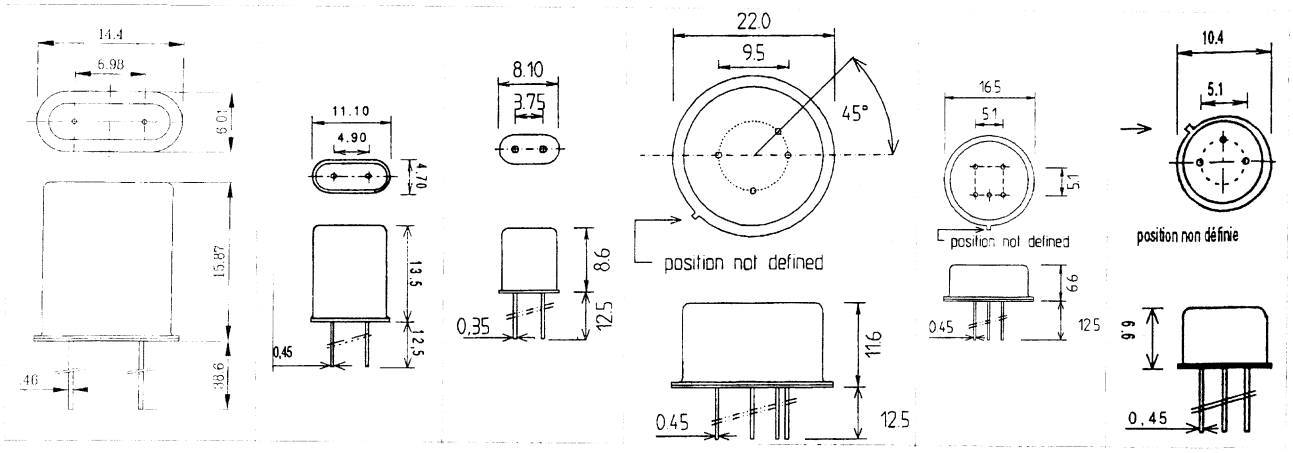
Typical specifications for use as a sensor in geophysical drilling application

Frequency	:	5.175 MHz (mode C)
Holder	:	HC-40/U
Operational temp. range	:	-10° C to +175° C
Frequency stability	:	better ± 50 ppm (mode C) over operational temp. range
Quality factor	:	> 1.5×10^6

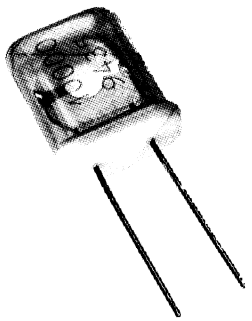
PROFESSIONAL CRYSTAL RESONATORS

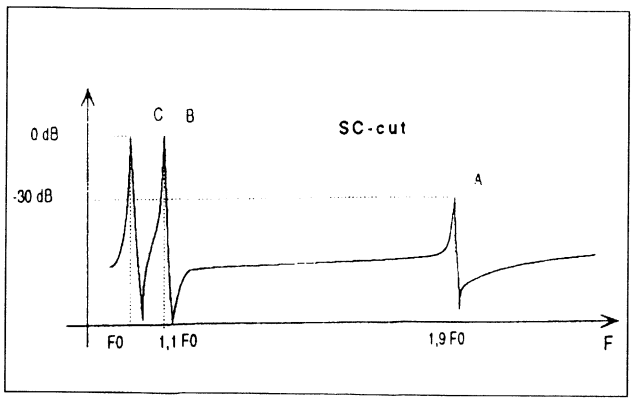
SC-cut resonators (doubly rotated)

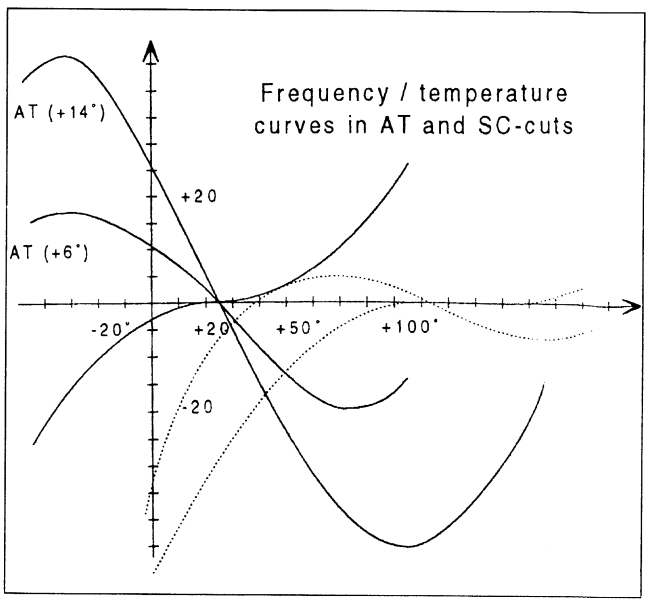
Crystal holders and frequency ranges



Metal holder **HC-36/U** Glass holder **HC-27/U**	Metal holder **HC-43/U** Glass holder **HC-26/U**	Metal holder **HC-45/U** **UM-1**	Metal holder **HC-40/U**	Metal holder **HC-37/U**	Metal holder **HC-46/U**
fundamental **n.a.**	10 to 20 MHz	20 to 35 MHz	3 to 10 MHz	10 to 20 MHz	5 to 10 MHz
3rd overtone **5 to 10 MHz**	30 to 80 MHz	40 to 80 MHz	5 to 10 MHz	30 to 50 MHz	8 to 15 MHz







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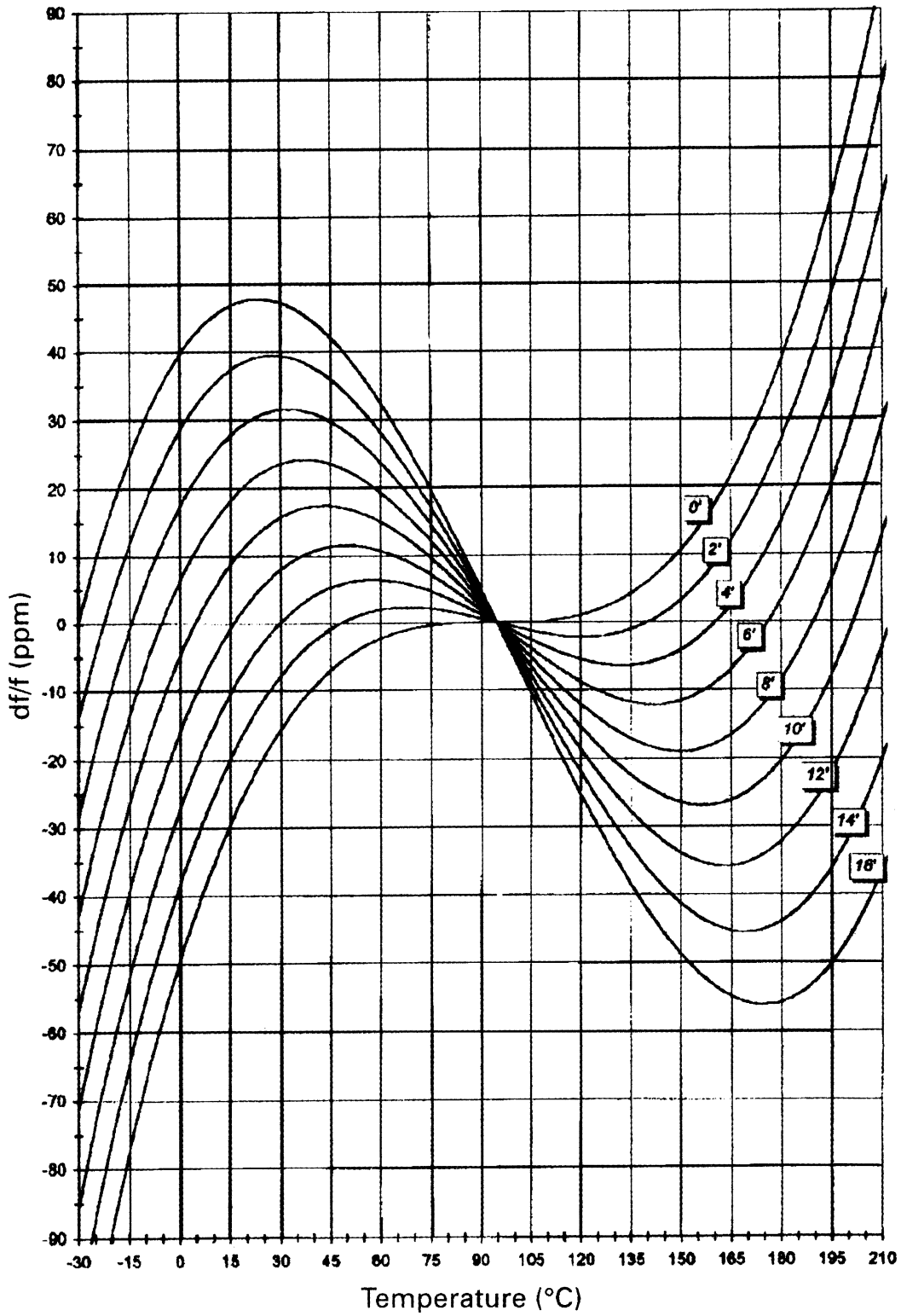
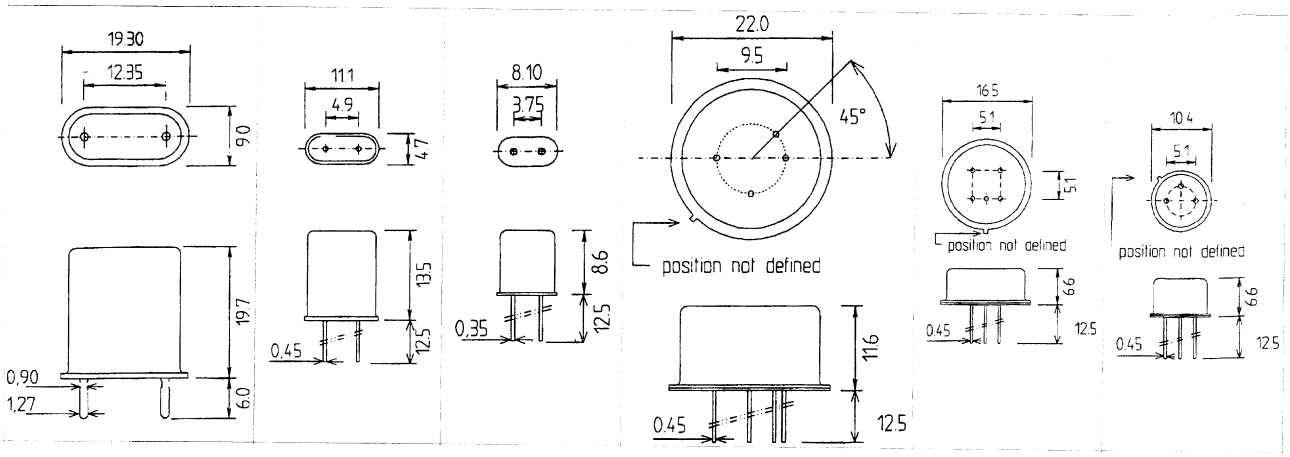
Feasability graph SC-cut temperature shift

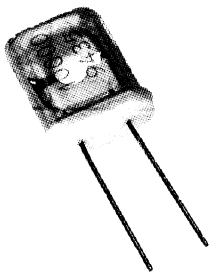


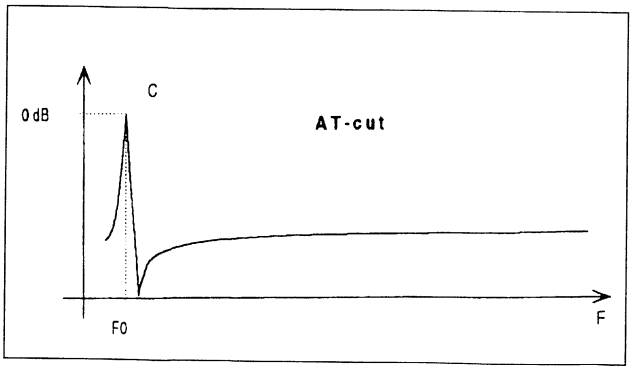
AT-CUT RESONATORS

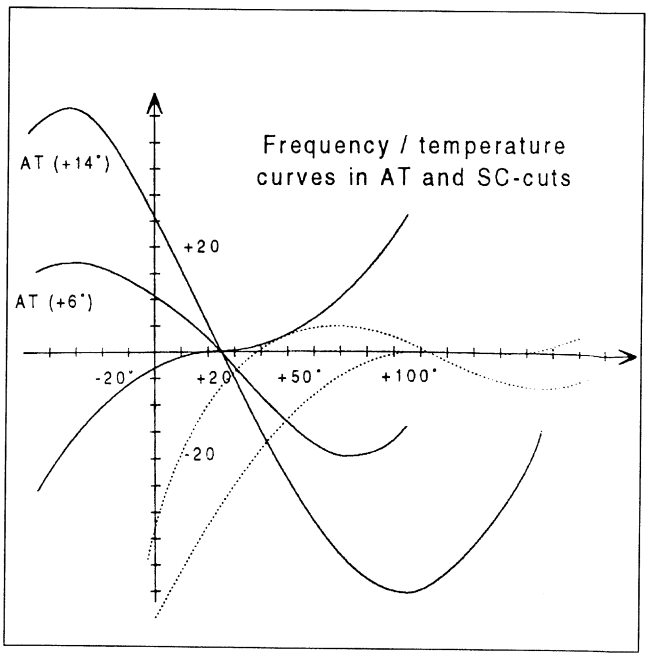
Crystal holders and frequency ranges



Metal holder **HC-48/U** Glass holder **HC-27/U**	Metal holder **HC-49/U** Glass holder **HC-26/U**	Metal holder **HC-45/U** **UM-1**	Metal holder **HC-40/U**	Metal holder **HC-37/U**	Metal holder **HC-35/U**
fundamental **0.8 to 30 MHz**	3 to 35 MHz	16 to 35 MHz	0.8 to 10 MHz	3 to 20 MHz	10 to 35 MHz
3rd overtone **10 to 65 MHz**	15 to 110 MHz	30 to 80 MHz	5 to 30 MHz	15 to 60 MHz	20 to 100 MHz
5rd overtone **50 to 125 MHz**	50 to 150 MHz	50 to 100 MHz	5 to 30 MHz	50 to 100 MHz	50 to 200 MHz







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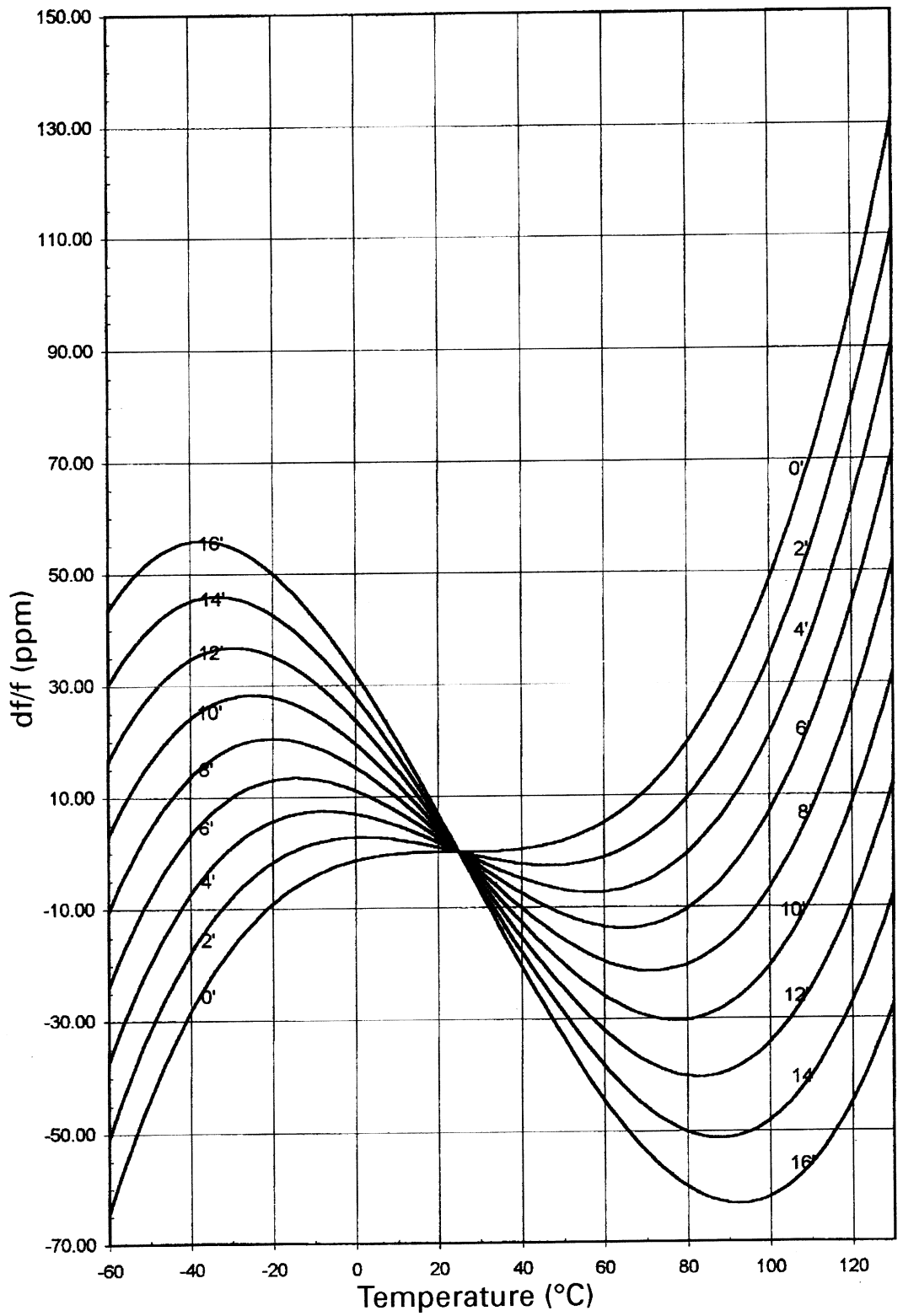
Feasability graph AT-cut temperature shift

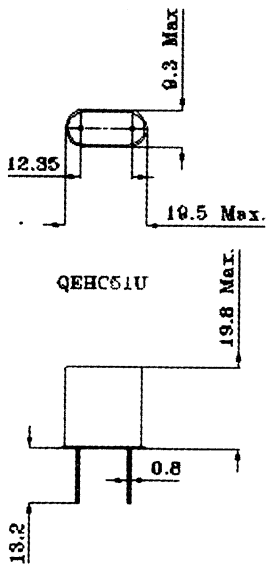


General purpose resonators in AT-cut

- Moderate-cost crystal range, suited to civilian professional or military use.
- Resistance-welded, hermetically sealed holder.
- This holder can be used for high-frequency crystals, especially for maintenance purposes. However, we advise using this holder for frequencies not exceeding 10 MHz.

MIL : HC-51/U
IEC / CECC : DZ
replaces : HC-33/U
: HC-47/U

reference	QE HC 51U		
frequency range	0.8 MHz to 30 MHz	10 MHz to 65 MHz	50 MHz to 125 MHz
overtone	fundamental	3rd overtone	5th overtone
initial accuracy	≤±5 ppm (tightest value), ≤±10 ppm (standard) at +25°C ± 1°C		≤±10 ppm at +25°C ±1°C
frequency drift vs. temperature	ΔF/F, please refer to feasibility graph		
resonance mode	parallel or series (please state when ordering)		series
load capacitance	parallel resonance : please state capacitance value when ordering (30pF± 0.5pF default value) series resonance : infinite capacitance (code 00)		
static capacitance	C0 ≤ 7 pF		
ageing	≤ 3 ppm / year		
measurement method	passive according to IEC 444-1		
storage temperature	-55° C to +100° C		
ordering information	reference according to scheme below + frequency example : QE 02.1.05.AW.075.30, frequency = 16,384 MHz		



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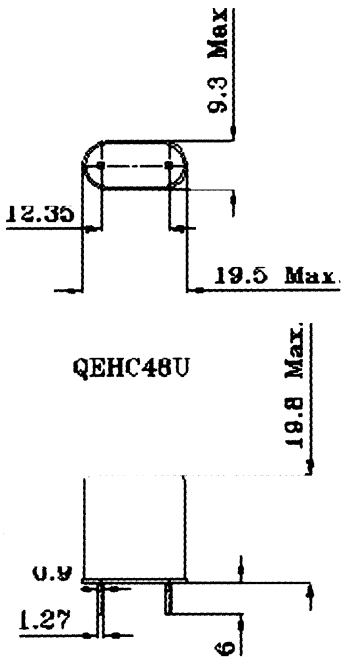
PROFESSIONAL CRYSTAL RESONATORS

General purpose resonators in AT-cut

- Moderate-cost crystal range, suited to civilian professional or military use.
- Resistance-welded, hermetically sealed holder.
- This holder can be used for high-frequency crystals, especially for maintenance purposes. However, we advise using this holder for frequencies not exceeding 10 MHz.

MIL : HC-48/U
IEC / CECC : DN
replaces HC-36/U
: HC-6/U

reference	**QE HC 48U**		
frequency range	0.8 MHz to 30 MHz	10 MHz to 65 MHz	50 MHz to 125 MHz
overtone	fundamental	3rd overtone	5th overtone
initial accuracy	≤±5 ppm (tightest value), ≤±10 ppm (standard) at +25°C ± 1°C		≤±10 ppm at +25°C ± 1°C
frequency drift vs. temperature	ΔF/F, please refer to feasibility graph		
resonance mode	parallel or series (please state when ordering)		series
load capacitance	parallel resonance : please state capacitance value when ordering (30 pF + 0.5 pF default value) series resonance : infinite capacitance (code 00)		
static capacitance	C0 ≤ 7 pF		
ageing	≤ 3 ppm / year		
measurement method	passive according to IEC 444-1		
storage temperature	-55° C to +100° C		
ordering information	reference according to scheme below + frequency example : QE 03.1.05.AW.075.30, frequency = 16.384 MHz		



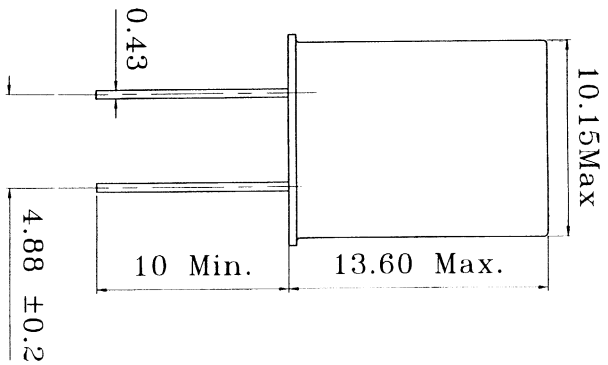
PROFESSIONAL CRYSTAL RESONATORS

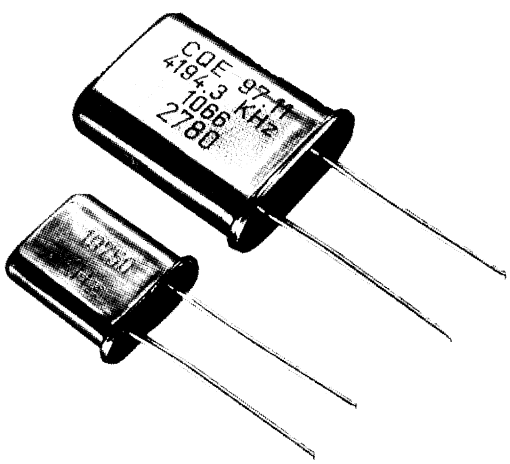
General purpose resonators in AT-cut

- Moderate-cost crystal range, suited to civilian professional or military use.
- Resistance-welded, hermetically sealed holder.

MIL : HC-49/U
CEI / CECC : DP
replaces HC-43/U
: HC-18/U

reference	**QE HC 49U**		
frequency range	3 MHz to 35 MHz	15 MHz to 110 MHz	50 MHz to 150 MHz
overtone	fundamental	3rd overtone	5 th overtone
initial accuracy	≤± 5 ppm (tightest value), ≤± 10 ppm (standard) at +25° C ± 1° C		
frequency drift vs. temperature	ΔF/F, please refer to feasibility graph		
resonance mode	parallel or series (please state when ordering)		series
load capacitance	parallel resonance : please state capacitance value when ordering (30 pF + 0.5 pF default value) series resonance : infinite capacitance (code 00)		
static capacitance	C0 ≤ 6 pF		
ageing	≤ 3 ppm / year		
measurement method	up to 125 MHz : passive according to IEC 444-1 above 125 MHz : passive with C0-compensation		
storage temperature	-55° C to +100° C		
ordering information	reference according to scheme below + frequency example : QE 05.1.05.AW.075.30, frequency = 16.384 MHz		





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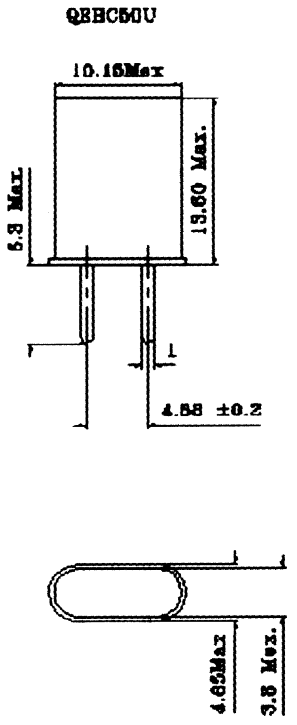
PROFESSIONAL CRYSTAL RESONATORS

General purpose resonators in AT-cut

- Moderate-cost crystal range, suited to civilian professional or military use.
- Resistance-welded, hermetically sealed holder intended for socket-mounting

MIL : HC-50/U
IEC / CECC : DQ
replaces HC-36/U
: HC-6/U

reference	**QE HC 50U**		
frequency range	3.5 MHz to 25 MHz	15 MHz to 110 MHz	50 MHz to 125 MHz
overtone	fundamental	3rd overtone	5 th overtone
initial accuracy	≤± 5 ppm (tightest value), ≤± 10 ppm (standard) at +25° C ± 1° C		
frequency drift vs. temperature	ΔF/F, please refer to feasibility graph		
resonance mode	parallel or series (please state when ordering)		series
load capacitance	parallel resonance : please state capacitance value when ordering (30 pF + 0.5 pF default value) series resonance : infinite capacitance (code 00)		
static capacitance	C0 ≤ 6 pF		
ageing	≤ 3 ppm / year		
measurement method	passive according to IEC 444-1		
storage temperature	-55° C to +100° C		
ordering information	reference according to scheme below + frequency example : QE 09.1.05.AW.075.30, frequency = 16.384 MHz		



PROFESSIONAL CRYSTAL RESONATORS

General purpose resonators in AT-cut

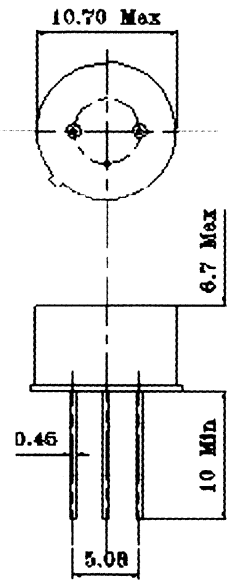
- This crystal range provides an extremly high shock and vibration resistance, together with a low ageing-rate. It is especially well suited for high frequency airborne applications.

MIL	:	**HC-35/U**
IEC / CECC	:	**CK**
JEDEC	:	TO-5

- Cold-weleded, hermetically sealed holder.

reference	**QE HC 35U**			
frequency range	6 MHz to 35 MHz	20 MHz to 100 MHz	50 MHz to 200 MHz	140 MHz to 250 MHz
overtone	fundamental	3rd overtone	5 th overtone	7 th overtone
initial accuracy	≤± 5 ppm (tightest value), ≤± 10 ppm (standard) at +25° C ± 1° C			≤±10 ppm at +25°C ± 1°C
frequency drift vs. temperature	ΔF/F, please refer to feasibility graph			
resonance mode	parallel or series (please state when ordering)		series	
load capacitance	parallel resonance : please state capacitance value when ordering (30 pF + 0.5 pF default value) series resonance : infinite capacitance (code 00)			
static capacitance	CO ≤ 6 pF			
ageing	≤ 3 ppm / year			
measurement method	up to 125 Mhz : passive according to IEC 444-1 above 125 MHz : passive with CO-compensation			
storage temperature	-55° C to +100° C			
ordering information	reference according to scheme below + frequency example : QE 12.1.05.AW.075.30, frequency = 16.384 MHz			

QEHC35U



PROFESSIONAL CRYSTAL RESONATORS

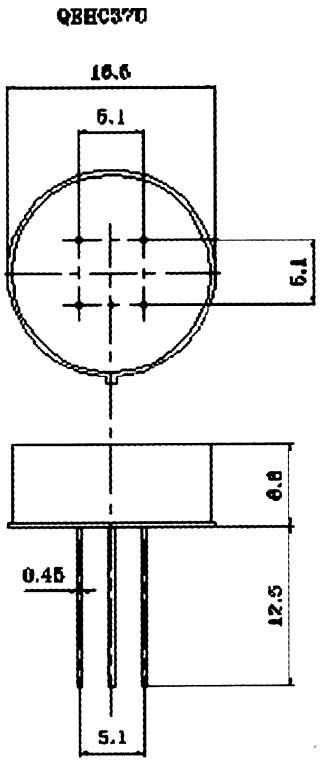
General purpose resonators in AT-cut

- This crystal range provides an extremly high shock and vibration resistance, together with a low ageing-rate. It is especially well suited for use in airborne environment

MIL : HC-37/U
IEC / CECC : CR
JEDEC : TO-8

- Cold-welded, hermetically sealed holder.

reference	QE HC 37U		
frequency range	3 MHz to 20 MHz	15 MHz to 60 MHz	50 MHz to 100 MHz
overtone	fundamental	3rd overtone	5 th overtone
initial accuracy	≤± 5 ppm (tightest value), ≤± 10 ppm (standard) at +25° C ± 1° C		
frequency drift vs. temperature	ΔF/F, please refer to feasibility graph		
resonance mode	parallel or series (please state when ordering)		series
load capacitance	parallel resonance : please state capacitance value when ordering (30 pF + 0.5 pF default value) series resonance : infinite capacitance (code 00)		
static capacitance	C0 ≤ 6 pF		
ageing	≤ 3 ppm / year		
measurement method	passive according to IEC 444-1		
storage temperature	-55° C to +100° C		
ordering information	reference according to scheme below + frequency example : QE 15.1.05.AW.075.30, frequency = 16.384 MHz		



PROFESSIONAL CRYSTAL RESONATORS

General purpose resonators in AT-cut

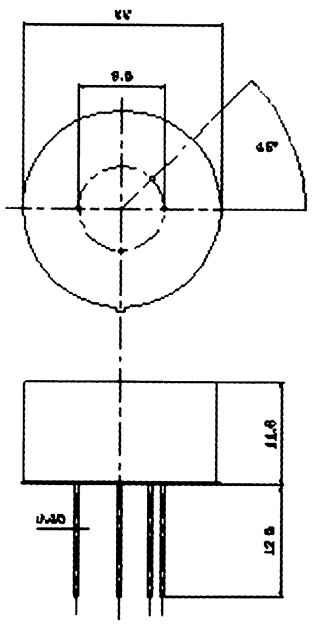
- This crystal range provides an extremly high shock and vibration resistance, together with a low ageing-rate. It is especially well suited to hi-rel, hi-stability ovenised applications

MIL : HC-40/U

equivalent : TO-3

- Cold-welded, hermetically sealed holder.

reference	**QE HC 40U**		
frequency range	0.8 MHz to 10 MHz	5 MHz to 30 MHz	10 MHz to 30 MHz
overtone	fundamental	3rd overtone	5 th overtone
initial accuracy	≤± 5 ppm (tightest value), ≤± 10 ppm (standard) at +25°C ± 1°C		≤± 10 ppm at +25°C ± 1°C
	≤± 5 ppm at turnover-point temperature ±5° C (ovenised crystals)		
frequency drift vs. temperature	ΔF/F, please refer to feasibility graph		
resonance mode	parallel or series (please state when ordering)		series
load capacitance	parallel resonance : please state capacitance value when ordering (30 pF + 10pF default value) series resonance : infinite capacitance (code 00)		
static capacitance	C0 ≤ 6 pF		
ageing	≤ 3 ppm / year		
measurement method	passive according to IEC 444-1		
storage temperature	-55° C to +100° C		
ordering information	reference according to scheme below + frequency example : QE 16.3.05.AW.075.30, frequency = 16.384 MHz		



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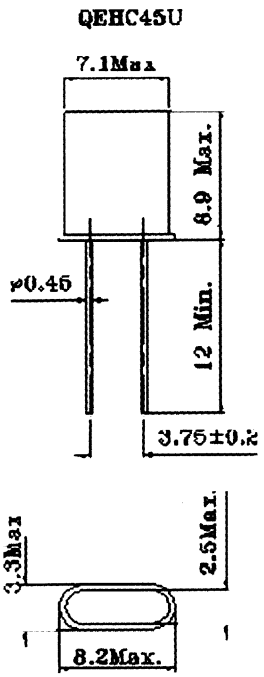
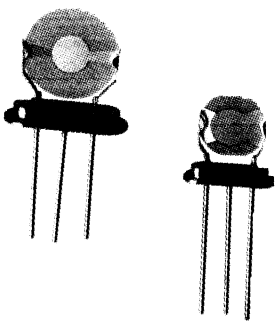
- Resistance-welded, hermetically sealed holder
- This holder takes up a very little room and is well suited to high frequencies. Many variants are available on request : 3-point mounting, reduced height, clip for surface-monting.

MIL : HC-45/U
IEC / CECC : EB

reference	**QE HC 45U**			
frequency range	10 MHz to 50 MHz	50 MHz to 200 MHz	50 MHz to 200 MHz	130 MHz to 250 MHz
overtone	fundamental	3rd overtone	5 th overtone	7 th overtone
initial accuracy	≤± 10 ppm at +25° C ±1° C			
frequency drift vs. temperature	ΔF/F, please refer to feasibility graph			
resonance mode	parallel or series (please state when ordering)		series	
load capacitance	parallel resonance : please state capacitance value when ordering (30 pF ± 0.5pF default value) series resonance : infinite capacitance (code 00)			
static capacitance	C0 ≤ 6 pF			
ageing	≤ 3 ppm / year			
measurement method	up to 125 MHz : passive according to IEC 444-1 above 125 MHz : passive with C0-compensation			
storage temperature	-55° C to +100° C			
ordering information	reference according to scheme below + frequency example : QE 17.1.05.AW.075.30, frequency = 16.384 MHz			



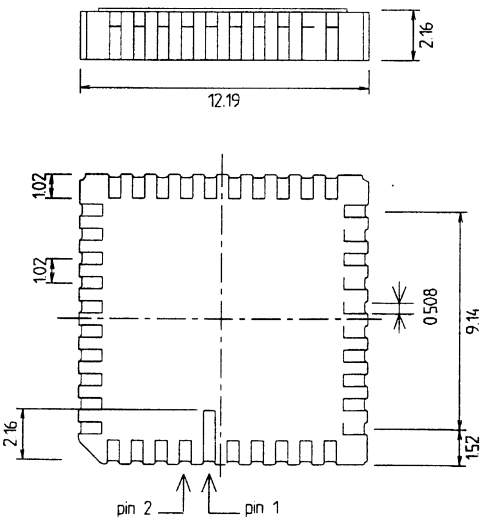


SPECIAL RESONATORS

- This holder should be soldered only on substrates exhibitng a compatible expansion cœfficient with ceramic.
- The 3-point structure of the crystal mount provides for very high mechanical characteristics. Evacuated holder hermetically sealed by means of tin-gold eutectic solder.
- European MUAHAG-Listed

LCCC holder
ceramic 40 pads

reference	QE SM 47.1	QE SM 47.3	QE SM 47.5	QE SM 47.7
frequency range	6 MHz to 40 MHz	20 MHz to 120 MHz	50 MHz to 220 MHz	140 MHz to 280 MHz
overtone	fundamental	3rd overtone	5 th overtone	7 th overtone
initial accuracy	≤± 10 ppm at +25° C ± 1° C			
frequency drift vs. temperature	≤± 50 ppm or ≤± 100 ppm from -55° C to +125° C ΔF/F, please refer to feasibility graph			
resonance mode	parallel or series (please state when ordering)		series	
load capacitance	parallel resonance : please state capacitance value when ordering (30 pF ± 0.5pF default value) series resonance : infinite capacitance (code 00)			
static capacitance	C0 ≤ 6 pF			
ageing	≤ 2 ppm / year			
measurement method	up to 125 MHz : passive according to IEC 444-1 above 125 MHz : passive with C0-compensation			
storage temperature	-55° C to +100° C			
ordering information	reference according to scheme below + frequency example : QE 47.1.05.AW.075.30, frequency = 16.384 MHz			



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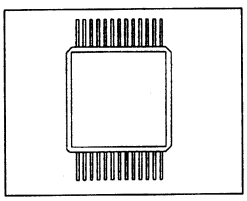
HIGH Q RESONATORS

- The 4-point structure of the crystal mount provides for very high mechanical characteristics. Evacuated holder hermetically sealed by means of tin-gold eutectic solder.

holder type : no. 76
(proprietary)

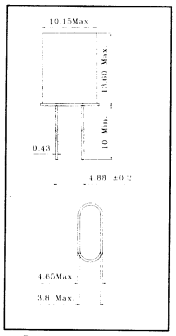
reference .	**QE SM 76.1**	**QE SM 76.3**	**QE SM 76.5**
frequency range	3 MHz to 10 MHz	5 MHz to 30 MHz	15 MHz to 50 MHz
overtone	fundamental	3th overtone	5th overtone
initial accuracy	≤± 5 ppm at +25° C ± 1 ° C ≤± 5 ppm at turnover temperature (ovenised use)		
frequency drift vs. temperature	ΔF/F, please refer to feasibility graph		
resonance mode	parallel or series (please state when ordering)		
load capacitance	parallel resonance: please state capacitance value when ordering (30 pF ± 0.5 pF default value) series resonance: infinite capacitance (code 00)		
static capacitance	C0 ± 7 pF		
ageing	≤ 1ppm/year	≤ 0.1 ppm/year	
measurement method	passive according to IEC 444-1		
storage temperature	-55° C to +125° C		
ordering information	reference according to scheme below + frequency example : QE.76.3.05.AW.075.30, frequency = 16.384 MHz		



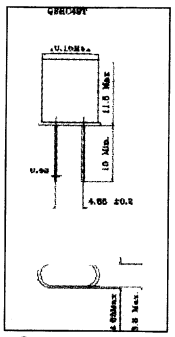
HC49 TYPE

reference	QEHC49U	QEHC49T	QEHC49H1	QHEC49H2	QESM49H3	QESM49H4
Frequency range MHz	1.8 to 200	1.8 to200	3.2 to 70	8 to 70	8 to 50	8 to 50
Frequency tolerance @ 25° C	±30 ppm	±30ppm	±50 ppm	±50 ppm	±50 ppm	±50 ppm
Frequency stability	±50 ppm					
Operating temp. range	-20 to +70°C	-20 to +70°C	-10 to +60°C	-10 to +60°C	-10 to +60°C	-10 to +60°C
Shunt capacitance	8.0 pF max					
Drive level	0.1 mW max					
Ageing per year at 25° C	± 5 ppm					

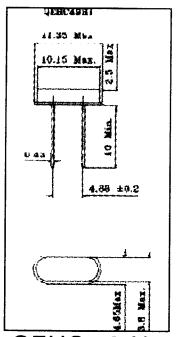
Standard frequency range in MHz	
1.8432200	10.738630
2.000000	11.000000
2.457600	11.059200
3.000000	11.981350
3.276800	12.000000
3.579545	12.288000
3.686400	14.000000
3.932160	14.318180
4.000000	14.745600
4.032000	15.000000
4.096000	15.974400
4.433619	16.000000
4.500000	16.615000
4.608000	17.430000
4.915200	17.734500
5.000000	18.000000
5.068800	18.432000
6.000000	18.868000
6.144000	19.066080
6.400000	20.000000
6.553600	24.000000
7.159090	16.095000
7.200000	26.800000
7.372800	27.045000
8.000000	27.145000
8.192000	33.100000
8.867238	36.000000
9.216000	49.860000
9.830400	
10.000000	
10.240000	
10.245000	



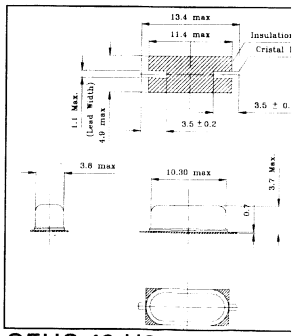
QEHC 49 U



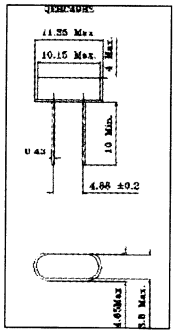
QEHC 49 T



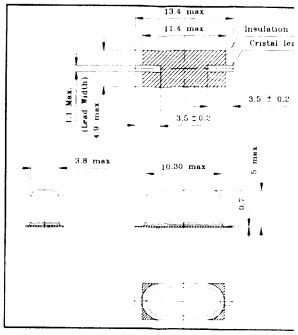
QEHC 49 H1



QEHC 49 H2



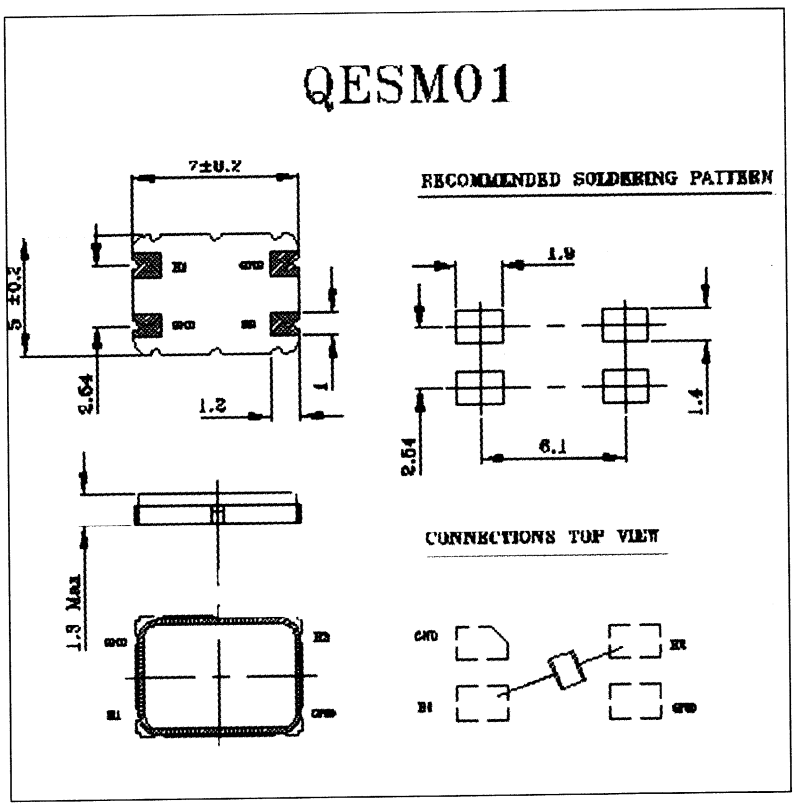
QESM 49 H3



QESM 49 H4

SMD TYPE

Reference	QESM01
Frequency range	10 to 30 MHz 30 to 70 MHz
Vibration mode	AT, Fundamental, P3
Frequency tolerance @ 25°C (25°C ≠ 3°C)	≠10, ≠15, ≠20, ≠30, ≠50 ppm
Temp. range	-10° C to 60° C
Stability frequency	≠10, ≠15, ≠20, ≠30, ≠50 ppm
Equivalent series resistance	40 Ω max. (fond) 60 Ω max. (P3)
Dive level	50 µW
Ageing	≠1, ≠2, ≠5 ppm / per year



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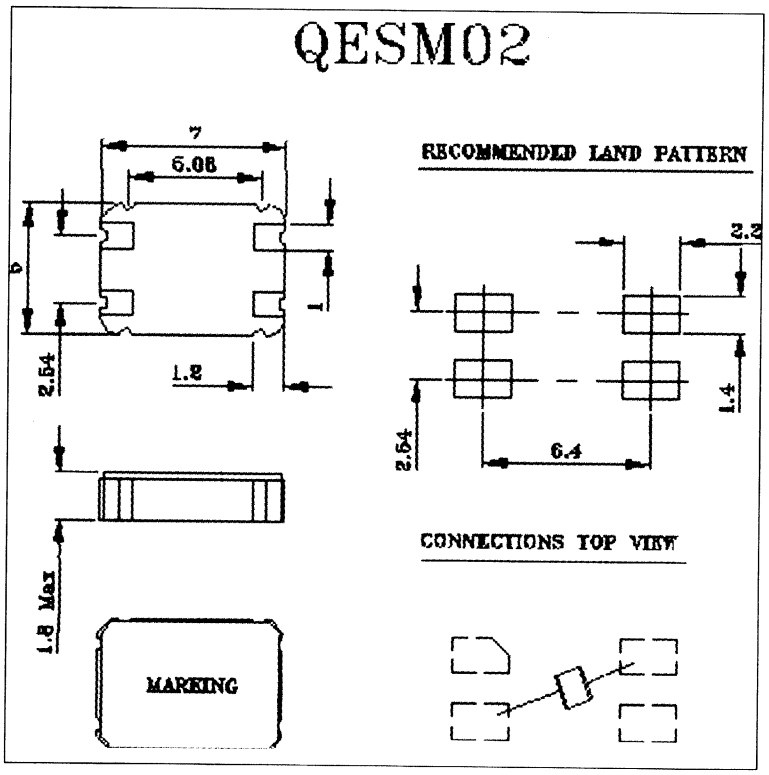
STANDARD CRYSTAL RESONATORS

SMD type

reference	QESM02
Frequency range	9 to 40 MHz 40 to 70 MHz
Vibration mode	AT, Fundamental, P3
Frequency tolerance @ 25° C (25° C ≠ 3° C)	≠50, ≠100 ppm
Temp. range	-10° C to 60° C
Stability frequency	≠50, ≠100 ppm
Equivalent series resistance	60 Ω max. (fund)
Dive level	-10 to 100 µW
Ageing	≠5 ppm / per year @ 25° C



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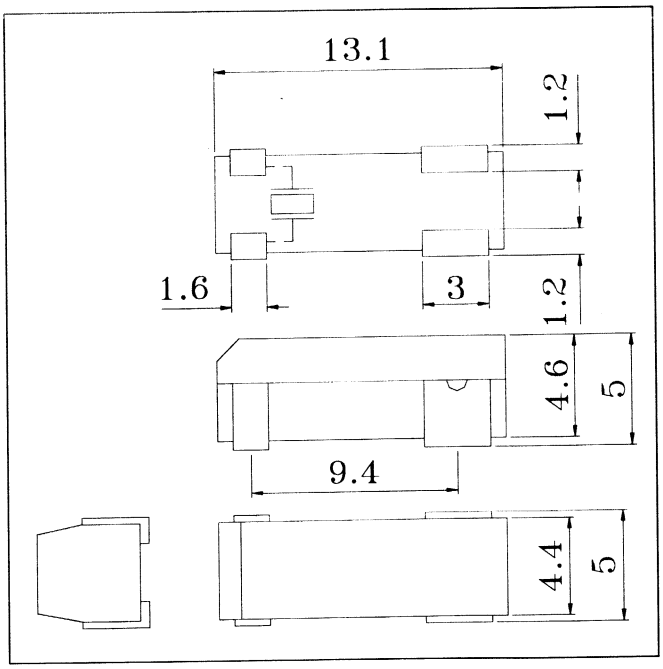
STANDARD CRYSTAL RESONATORS

SMD type

reference	QESM03
Frequency range MHz	3.57 to 70
Frequency tolerance @ 25° C	± 50 ppm
Frequency stability	± 100 ppm
Operating temp. range	-10 to +70° C
Shunt capacitance	5.0 pF max
Load capacitance	12 / 16 / 20 / 30 pF/series
Drive level	0.1 mW max
Ageing per year at 25° C	± 5 ppm

Standard frequency range in MHz	
1.8432200	10.738630
2.000000	11.000000
2.457600	11.059200
3.000000	11.981350
3.276800	12.000000
3.579545	12.288000
3.686400	14.000000
3.932160	14.318180
4.000000	14.745600
4.032000	15.000000
4.096000	15.974400
4.433619	16.000000
4.500000	16.615000
4.608000	17.430000
4.915200	17.734500
5.000000	18.000000
5.068800	18.432000
6.000000	18.868000
6.144000	19.066080
6.400000	20.000000
6.553600	24.000000
7.159090	16.095000
7.200000	26.800000
7.372800	27.045000
8.000000	27.145000
8.192000	33.100000
8.867238	36.000000
9.216000	49.860000
9.830400	
10.000000	
10.240000	
10.245000	



QESM03

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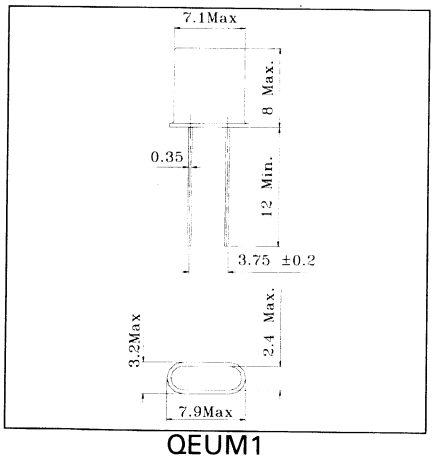
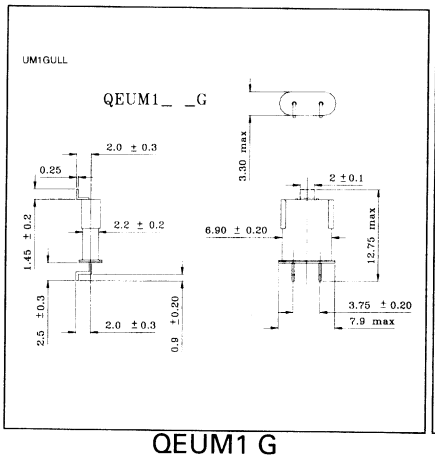
UM TYPE

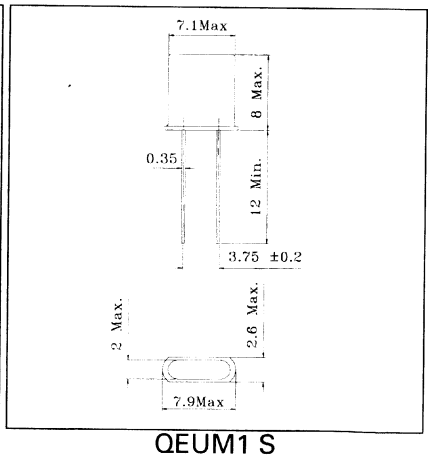
reference	QEUM1 QEUM1G/1S	QEUM4	QEUM5 QUEM5G
Frequency range MHz	3.57 to 200		10 to 200
Frequency tolerance @ 25° C	±5 ppm to ±30 ppm		
Frequency stability	From 5 to 100 ppm depending upon operating temp. range		
Operating temp. range	-40 to +85° C		
Storage temp. range	-40 to +85° C		
Load capacitance	12 / 16 / 20 / 30 pF series		
Shunt capacitance	7.0 pF max		
Drive level	0.1 mW max		
Ageing per year at 25° C	± 5 ppm		



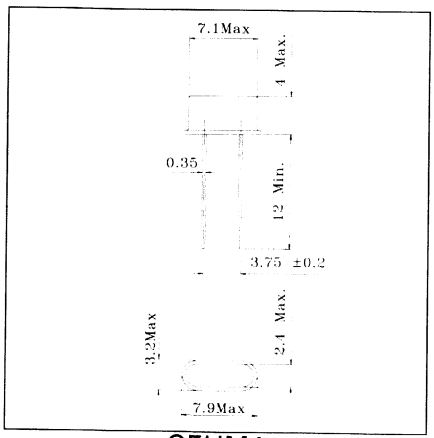
QEUM1



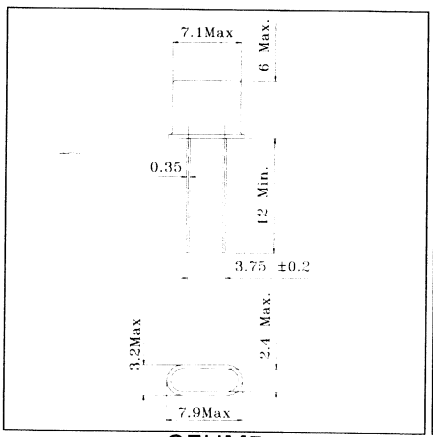
QEUM1 G



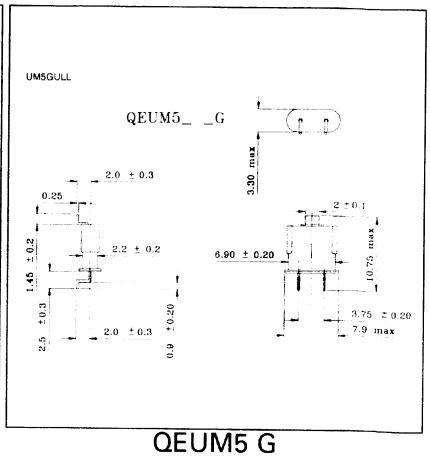
QEUM1 S



QEUM4



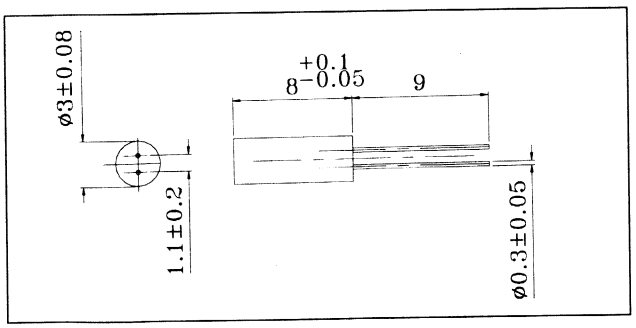
QEUM5



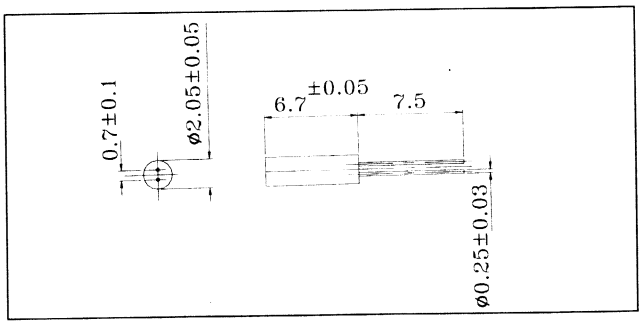
QEUM5 G

TUNING FORK TYPE

reference	QETF38	QETF26
Frequency range KHz	32.768 KHz	
Frequency tolerance	±30 ppm	
Quality factor	60 K typical	50 K typical
Turnover temperature	25° C ± 5° C	
Temp. Coefficient	-0.035 ppm/°C 2	
Operating temperature range	-10° C to +60° C	
Storage temperature range	-40 to 85° C	-20° C to 70° C
Equivalent temperature range	35 KΩ	
Load capacitance	12.5 pF	
Shunt capacitance	1.6 pF max.	1.5 pF max.
Drive level	1 µW max.	
Ageing per year at 25° C	± 3 ppm max.	



QETF 38



QETF 26

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How to choose your holder code ?

TEKELEC TEMEX

HOW TO CHOOSE YOUR HOLDER CODE ?

LABEL	PACKAGE	TYPE	HEIGHT	WIDTH	PROFIL	PAGE
QE	UM	1	X	X	X	6-28
QE	UM	1	X	S	X	6-28
QE	UM	1	X	X	G	6-28
QE	UM	4	X	X	X	6-28
QE	UM	5	X	X	X	6-28
QE	UM	5	X	X	G	6-28
QE	HC	35	U	X	X	6-18
QE	HC	37	U	X	X	6-19
QE	HC	40	U	X	X	6-20
QE	HC	45	U	X	X	6-21
QE	HC	48	U	X	X	6-15
QE	HC	49	U	X	X	6-16
QE	HC	49	T	X	X	6-24
QE	HC	49	H1	X	X	6-24
QE	HC	49	H3	X	X	6-24
QE	HC	50	U	X	X	6-17
QE	HC	50	T	X	X	-
QE	HC	51	U	X	X	6-14
QE	TF	26	X	X	X	6-29
QE	TF	38	X	X	X	6-29
QE	SM	01	X	X	X	6-25
QE	SM	02	X	X	X	6-26
QE	SM	03	X	X	X	6-27
QE	SM	49	H2	X	X	6-24
QE	SM	49	H4	X	X	6-24

U	=	Standard holder
T	=	Standard holder
H1	=	2.5 mm height max.
H2	=	3.7 mm height max.
H3	=	4.0 mm height max.
H4	=	5.0 mm height max.

X	=	Not available
HC	=	Holder UM
UM	=	Holder HC
TF	=	Tuning Fork Type
SM	=	Holder SMD
G	=	Gullwin
S	=	Slimeline

Example: QE.UM.1.G

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HOW TO ORDER

To define a crystal, we need the frequency and other other parameter as following:

Holder code	Overtone	Tolerance @ 25° C	Lower temperature ° C	Upper temperature ° C	Max. freq. drift vs. operating temperature	Load pF	RΩ
QEUM1 QEUM1S QEUM1G QEUM4 QEUM5 QEUM5G QEHC35U QEHC37U QEHC40U QEHC45U QEHC48U QEHC49U QEHC49T QEHC49H1 QEHC49H2 QEHC50U QEHC50T QEHC51U QEHC52U QETF26 QETF38 QESM01 QESM02 QESM03 QESM49H3 QESM49H4	1 = Fund 2 = P3 3 = P5	05 ≤ 5 ppm 07 ≤ 7 ppm 10 ≤ 10 ppm 15 ≤ 15 ppm 30 ≤ 30 ppm	A = -55° C B = -50° C C = -45° C D = -40° C E = -35° C F = -30° C G = -25° C H = -20° C I = -15° C J = -10° C K = -5° C L = 0° C	M = +50° C N = +55° C O = +60° C P = +65° C Q = +70° C R = +75° C S = +80° C T = +85° C U = +90° C V = +95° C W = +100° C X = +105° C Y = +125° C	Value in clear Example: 010 = ±10 ppm	20 30 00 = ∞	

For example: HC49/U.1.30.HQ.50.30.60 at 8.000 MHz

Standard stability versus temperature range

Stability in fundamental mode (Referency at 25° C)

	± 3	± 5	± 7.5	± 10	± 15	± 20	± 30	± 50
0 ≈ +50° C	√	√	√	√	√	√	√	√
-5 ≈ +55° C		√	√	√	√	√	√	√
-10 ≈ +60° C			√	√	√	√	√	√
-15 ≈ +65° C			√	√	√	√	√	√
-20 ≈ +70° C			√	√	√	√	√	√
-25 ≈ +75° C				√	√	√	√	√
-30 ≈ +80° C					√	√	√	√
-40 ≈ +90° C						√	√	√
-55 ≈ +105° C							√	√

Stability in partial mode (Referency at 25° C)

	± 3	± 5	± 7.5	± 10	± 15	± 20	± 30	± 50
0 ≈ +50° C	√	√	√	√	√	√	√	√
-5 ≈ +55° C	√	√	√	√	√	√	√	√
-10 ≈ +60° C		√	√	√	√	√	√	√
-15 ≈ +65° C			√	√	√	√	√	√
-20 ≈ +70° C			√	√	√	√	√	√
-25 ≈ +75° C				√	√	√	√	√
-30 ≈ +80° C					√	√	√	√
-40 ≈ +90° C					√	√	√	√
-55 ≈ +105° C							√	√

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CRYSTAL OSCILLATORS

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CLOCK OSCILLATORS (XO)

Selection Guide

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Families selection guide - XO: Crystal oscillators

FREQUENCY RANGE	OUTPUT	HOLDER	MODEL	PAGE	CIVIL	INDUS.	STD MILITARY	AIRBORNE MILITARY	SPATIAL
1.8 MHz to 67 MHz	HCMOS/TTL	SMD	QEN 62-AH	7.4	X	X	X		
1.8 MHz to 67 MHz	HCMOS/TTL	SMD	QEN 62-AT	7.4	X	X	X		
3.5 kHz to 70 MHz	HCMOS/TTL	SMD	QEN 79-AH	7-6		X	X	X	
1 MHz to 100 MHz	HCMOS/TTL	SMD	QEN 92-AH	7-8	X	X	X		
1 MHz to 70 MHz	HCMOS/TTL	SMD	QEN 92-BH	7-11	X	X	X		
3.5 kHz to 40 MHz	HCMOS/TTL	LCCC 40	QEN 47-BH	7-12			X	X	X
14 MHz to 70 MHz	HCMOS/TTL	LCCC 40	QEN 47-CH	7-14			X	X	X
250 kHz to 70 MHz	HCMOS/TTL	DIL (4 pins)	QEN 14-H	7-16	X	X			
3.5 kHz to 40 MHz	HCMOS/TTL	DIL (14 pins)	QEN 49-BH	7-18			X	X	X
14 MHz to 70 MHz	ACMOS/TTL	DIL (14 pins)	QEN 49-CH	7-20			X	X	X
1 MHz to 70 MHz	HCMOS/TTL	DIL (14 pins)	QEN 49-DH	7-22		X	X	X	
10 MHz to 30 MHz	HCMOS/TTL	DIL (14 pins)	QEN 49-FH	7-24		X	X	X	
20 MHz to 160 MHz	ACMOS/TTL	DIL (14 pins)	QEN 49-EH	7-26		X	X	X	
14 MHz to 160 MHz	ECL 10 KH	DIL (14 pins)	QEN 49-AE	7-28		X	X	X	
14 MHz to 160 MHz	ECL 10 KH	DIL (4 pins)	QEN 49-BE	7-28		X	X	X	
3.5 kHz to 40 MHz	HCMOS/TTL	DIL (4 pins)	QEN 55-BH	7-18			X	X	X
14 MHz to 70 MHz	ACMOS/TTL	DIL (4 pins)	QEN 55-CH	7-20			X	X	X
1 MHz to 70 MHz	HCMOS/TTL	DIL (4 pins)	QEN 55-DH	7-22		X	X	X	
20 MHz to 160 MHz	ACMOS/TTL	DIL (4 pins)	QEN 55-EH	7-26		X	X	X	
14 MHz to 160 MHz	ECL 10 KH	DIL (4 pins)	QEN 55-AE	7-28		X	X	X	
14 MHz to 160 MHz	ECL 10 KH	DIL (4 pins)	QEN 55-BE	7-28		X	X	X	
3.5 MHz to 70 MHz	HCMOS/TTL	1/2 DIL(4 pins)	QEN 4-H	7-30	X	X			
To be advised	All	All	On specification		X	X	X	X	

CLOCK OSCILLATORS (XO)

SMD clock oscillators with HCMOS / TTL-compatibility

NEW !

TEKELEC TEMEX

TYPE QEN 62-AH/AT

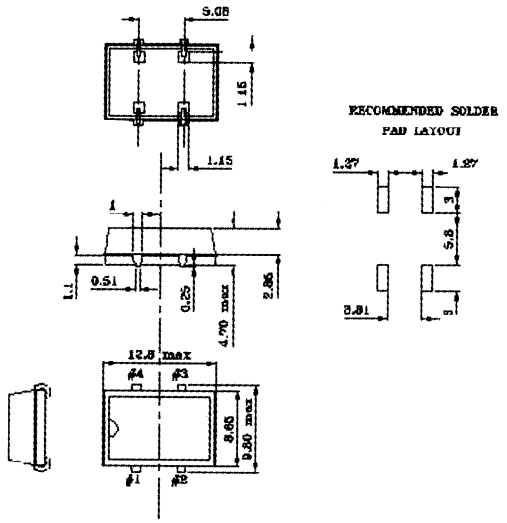
Applications

This range of oscillators is intended for civil applications.

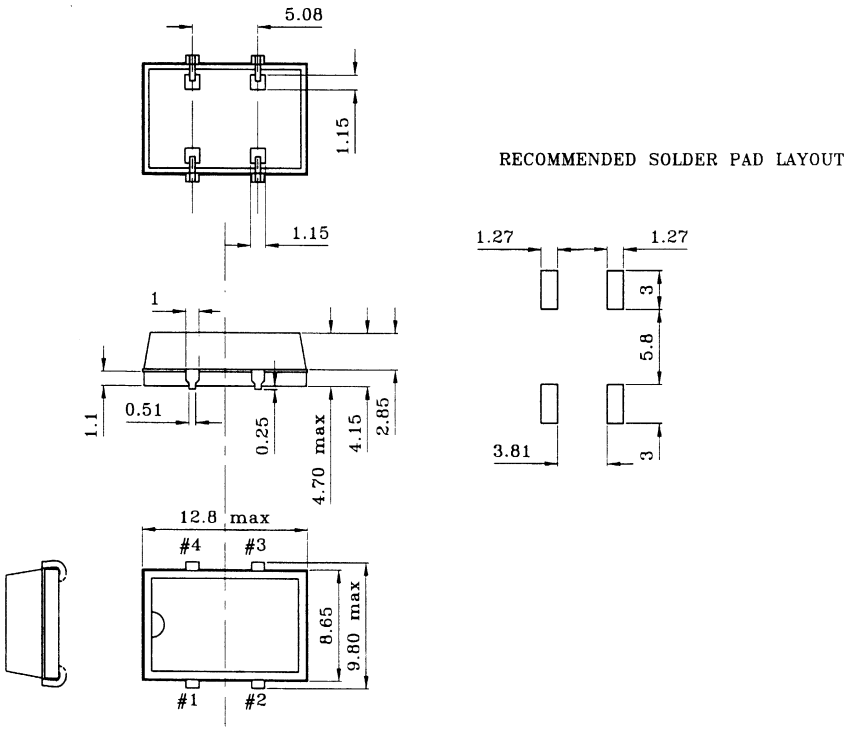
Features

- Frequency: **1.8 MHz to 67 MHz,**
- Temperature range up to **-10° C to +70° C,**
- Frequency stability: ≤ **± 100 ppm**
- Plastic molded SMD
- Tri-state enable / disable oscillator.

Package



Package n° 62



Pad connections

ENABLE/DISABLE FUNCTION	
INH (Pin #1)	OUTPUT (Pin #3)
Open	Active
«1» ($V_{IH} \geq 2.2$ V)	Active
«0» ($V_{IH} \leq 0.8$ V)	High Z

Pin connections	
#1	E/D
#2	GND
#3	OUT
#4	V_{DD}

type	**QEN 62-AH/AT**		
frequency range	1.8 MHz to 32 MHz	32 MHz to 50 MHz	50 MHz to 67 MHz
frequency stability	code JQ . . . . . .-10° C to 70° C.....≤ ± 100 ppm inclusive of 25° C calibration, temperature, Vcc and load change, ageing, shock and vibration		
storage temperature	- 40° C to +85° C		
supply voltage	5 V ± 0.5 V		
input current wo. load AH AT	≤ 27 mA ≤ 22 mA	≤ 45 mA ≤ 26 mA	< 60 mA
output levels AH AT	"0" ≤ 0.5 V / "1" ≥ 4.5 V "0" ≤ 0.4 V / "1" ≥ 2.4 V		
maximal load AH AT	10 N-TTL-gates / 50 pF 10-N TTL-gates		
rise / fall time	≤ 10 ns (max. load)		
duty cycle	at Vcc/2, max. load		50 / 50 ± 20 %
start-up time	10 ms typ. / 0 V to 5 V		
package	n° 62 (plastic molded)		
marking	CQE + date code + reference		
ordering information	reference + frequency + temperature code example: QEN 62-AH 15.000 MHz JQ		

CLOCK OSCILLATORS (XO)

SMD clock oscillators with HCMOS / TTL-compatibility

TYPE QEN 79-AH

Applications

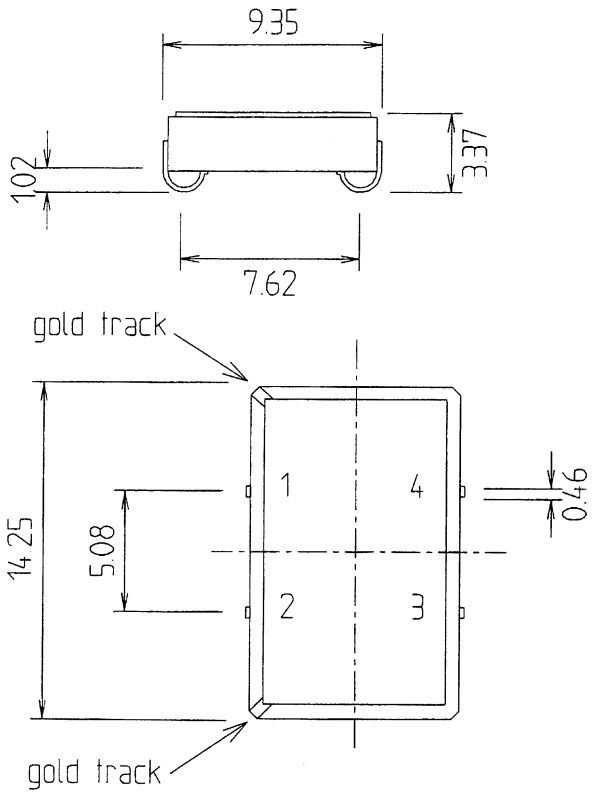
This range of oscillators is intended for military and airborne applications.

Extended temperature range -55° C to +125° C according to internal qualification tests.

Features

- Frequency: **3.5 kHz to 70 MHz,**
- Temperature range up to **-55° C to +125° C,**
- Frequency stability: ≤ **± 25 ppm to** ≤ **± 150 ppm,**
- **Low input current.**

Package

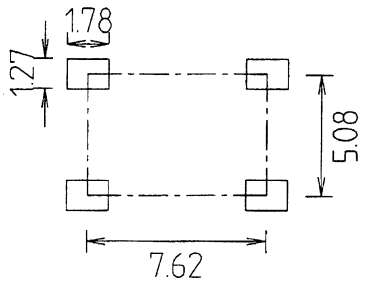


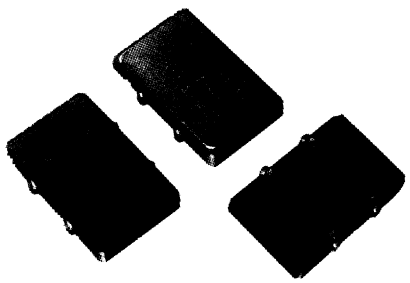
Package n° 79

Pad connections

1 = N.C. (no option)
= enable/disable (option I)
2 = GND
3 = HF output
4 = power supply

suggested pad size





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type	QEN 79-AH			
frequency range	3.5 kHz ≤ F < 4 MHz	4 MHz ≤ F < 14 MHz	14 MHz ≤ F < 20 MHz	20 MHz ≤ F < 70 MHz
frequency stability **	code DT ..... -40° C to + 85° C ..... ≤±25 or ±50 or ±75 or ±100 ppm code AY ..... -55° C to +125° C ..... ≤±50 or ±75 or ±100 or ±150 ppm inclusive of 25° C calibration, temperature, Vcc and load change			
ageing (at 25° C ± 2° C)	≤ ± 3 ppm / year			
supply voltage	5 V ± 5 %			
input current wo. load	≤ 10 mA	≤ 15 mA	≤ 20 mA	≤ 35 mA
output levels	"0" ≤ 0.5 V			
Vcc = 5V, max. load	"1" ≥ 4.5 V			
maximal load	2 TTL-gates / 15 pF		6 TTL-gates / 25 pF	
rise / fall time	≤ 10 ns (max. load)		≤ 5 ns (max. load)	
duty cycle	50 / 50 ± 10 % (± 5 % if option R)		50 / 50 ± 20 % (± 10 % if option R)	
	at Vcc/2, max. load			
options	**code R** : duty cycle 50 / 50 ± 10 % or ± 5 % depending on frequency range (see above) **code I** : output enable "0" on pin 1 ..... pin 3 inactive "1" on pin 1 ..... pin 3 active output		From 3.5 KHz < F < 1 MHz "0" on pin 1 ..... pin 3 active "1" on pin 1 ..... pin 3 inactive	
	should pin 1 not be used, please always tie it to +Vcc			
package	n° 79 (ceramic with 4 gold-plated j-leads, tinned pads on request)			
marking	CQE + date code + reference			
ordering information	reference + option code + frequency + temperature code + frequency stability example: QEN 79-AHR 15.000 MHz AY 100 [SB*] * *Insert SB if B screening class applicable*			

** note: extended temperature range -55° C to +125° C according to internal qualification tests

CLOCK OSCILLATORS (XO)

SMD clock oscillators with HCMOS / TTL-compatibility in 5 V

TYPE QEN 92-AH

Applications

The oscillators of the QEN 92-AH are designed to operate at operating temperatures up to -40° C to +85° C and withstand tough mechanical environment. They are particularly suitable for civil applications.

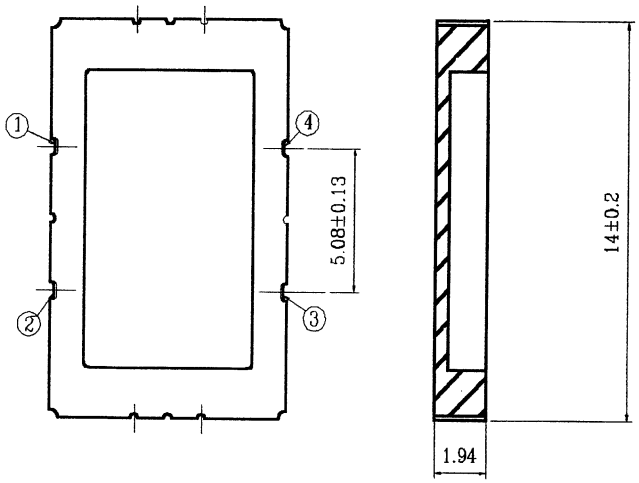
Features

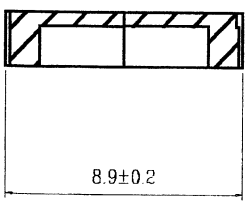
- Frequency: **1 MHz to 100 MHz**
- Temperature range up to **-40° C to +85° C**
- Frequency stability: ≤ **± 50 ppm to** ≤ **± 100 ppm**
- **Tri-state** output

Associated models

Oscillators of the same design offering TTL compatibility and a supply voltage at **V = 3.3 V** exist under **QEN 92-BH**. For extended temperature range up to **-55° C to +125° C**, please refer to **QEN 79-AH**.

Package

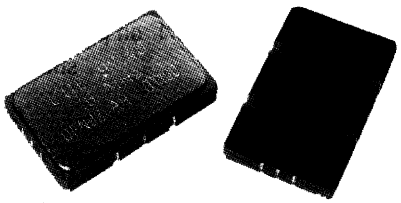


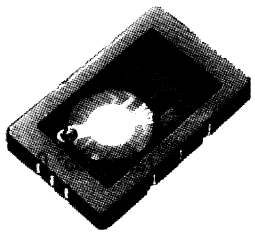


Package n° 92

Pad connections

1 = Tri-state
2 = GND
3 = HF output
4 = power supply





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SMD clock oscillators with HCMOS / TTL-compatibility in Vs = 5 V

type	QEN 92-AH		
frequency range	1 MHz ≤ F < 42 MHz	42 MHz ≤ F < 77 MHz	77 MHz ≤ F ≤ 100 MHz
frequency stability	code HQ ..... -20 ° C to +70 ° C ..... ≤ ± 50 ppm or ≤ ± 75 ppm or ≤ 100 ppm code DT ..... -40 ° C to +85 ° C ..... ≤ ± 50 ppm or ≤ ± 75 ppm or ≤ 100 ppm Other temperature ranges and stabilities available		
ageing (at 25° C ± 2° C)	≤ ± 3 ppm / year		
storage temperature	- 55 ° C to +105 ° C		
supply voltage	5 V ± 5 %		
Input current typ. max. load 15 pF tri-state = open	20 / 40 mA	33 / 50 mA	44 / 71 mA
output levels with max. output current	VoL ≤ 0.4 V / VoH ≥ 4 V		
max. output current and max. load	± 16 mA / 50 pF / 10 TTL-gates		
rise / fall time at 15 pF	≤ 4.6 ns	≤ 3 ns	≤ 3 ns
duty cycle at 15 pF	50 / 50 ± 20 % (± 10 % if option R)		
start-up time	≤ 10 ms at Vcc = 4.75 V		
options	code R: duty cycle 50 / 50 ± 10 %		
package	n° 92 (ceramic with 4 gold-plated leads)		
marking	CQE + date code + reference		
ordering information	reference + option code + frequency + temperature code + frequency stability example: QEN 92-AHR 20 MHz DT 50		
Tri-state	tri-state output enable on pin 1 «L» high impedance V_{IH} > 2 V, V_{IL} < 0.8 V output disable time < 150 ns		

SMD clock oscillators with HCMOS / TTL-compatibility in 3.3 V

TYPE QEN 92-BH

Applications

The oscillators of the **QEN 92-BH** are designed to operate at operating temperatures up to -40° C to +85° C and withstand tough mechanical environment. They are particularly suitable for civil applications.

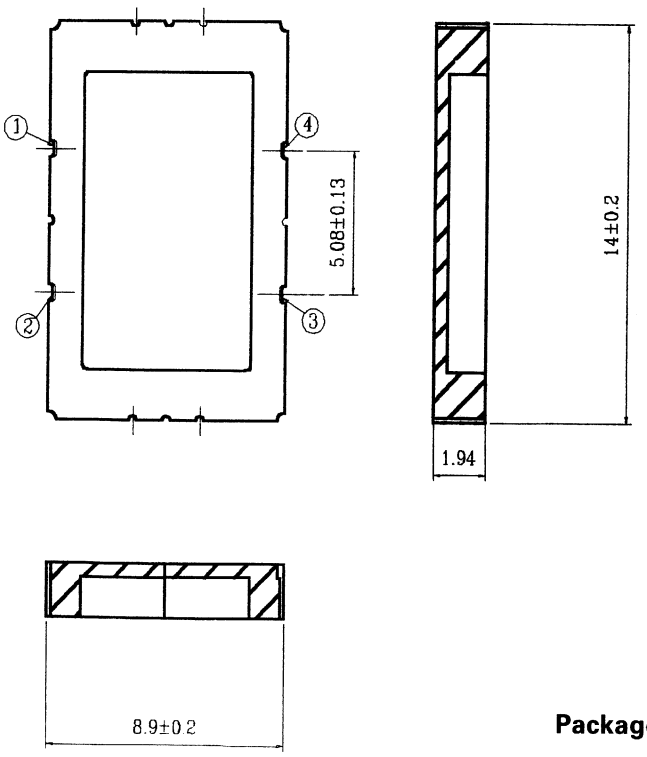
Features

- Frequency: **1 MHz to 70 MHz**
- Temperature range up to **-40° C to +85° C**
- Frequency stability: ≤ **± 50 ppm to** ≤ **± 100 ppm**
- **Tri-state** output

Associated models

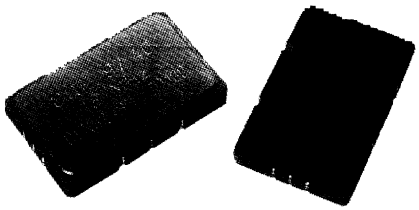
Oscillators of the same design offering TTL compatibility and a supply voltage at **V = 5 V** exist under **QEN 92-AH**. For extended temperature range up to **-55° C to +125° C**, please refer to **QEN 79-AH**.

Package



Pad connections

1 = Tri-state
2 = GND
3 = HF output
4 = power supply



Package n° 92

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SMD clock oscillators with HCMOS / TTL-compatibility in Vs = 3.3V

type	QEN 92-BH
frequency range	1 MHz ≤ F < 70 MHz
frequency stability	code HQ . . . . . -20° C to +70° C . . . . . ≤ ± 50 ppm or ≤ ± 75 ppm or ≤ 100 ppm code DT . . . . . -40° C to +85° C . . . . . ≤ ± 50 ppm or ≤ ± 75 ppm or ≤ 100 ppm Other temperature ranges and stabilities available
ageing (at 25° C ± 2° C)	≤ ± 3 ppm / year
storage temperature	- 55 ° C to +105 ° C
supply voltage	3.3 V ± 5 %
Input current typ. max. load 15 pF tri-state = open	17 / 28 mA
output levels with max. output current	VoL ≤ 0.4 V / IoL = 8 mA VoH > 2.8 V / IoH = 8 mA
max. output current and max. load	± 8 mA / 50 pF
rise / fall time at 15 pF	≤ 4.6 ns (10 % - 90 %)
duty cycle at 15 pF	50 / 50 ± 20 % (± 10 % if option R)
start-up time	≤ 10 ms at Vcc = 3.3 V
option	code R: duty cycle 50 / 50 ± 10 %
package	n° 92 (ceramic with 4 gold-plated leads)
marking	CQE + date code + reference
ordering information	reference + option code + frequency + temperature code + frequency stability example: QEN 92-BHR 20 MHz DT 50
Tri-state	tri-state output enable on pin 1 "L" high impedance V_{IH} > 2 V, V_{IL} < 0.8 V output disable time < 150 ns

CLOCK OSCILLATORS (XO)

HCMOS / TTL-compatible clock oscillators in LCCC40

TYPE QEN 47-BH

Applications

The oscillator **QEN 47-BH** is intended for military airborne and space applications.
The oscillator **QEN 47-BH** uses HCMOS active circuit technology and has an option output enable / disable.

Features

- Frequency: **3.5 kHz to 40 MHz**
- Temperature range: **-55° C to +125° C**
- Frequency stability: ≤ **± 35 ppm to** ≤ **± 150 ppm**
- Output **enable/disable** up to 14 MHz
- **Small volume**
- Supply voltage: **5 V**

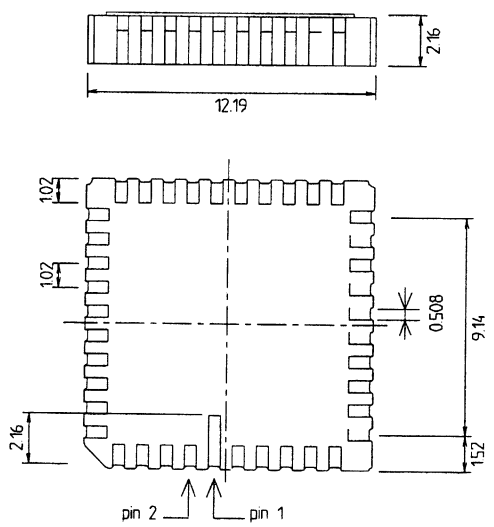
Associated model

The oscillator type **QEN 47-CH** covered by a separate data sheet operates over the frequency range of 14 MHz to 70 MHz with the equivalent performance and reliability.
In the overlap range between 14 MHz and 40 MHz, the choice of the type depends on the other options available such as duty-cycle tolerance, readjustment of frequency by external trimmer and the tri-state output.

Important

Always apply supply voltage before inputting any signal on pin 30 (enable/disable). This holder should be soldered only on substrates exhibiting a coefficient of expansion compatible with ceramic.

Package



Package n° 47

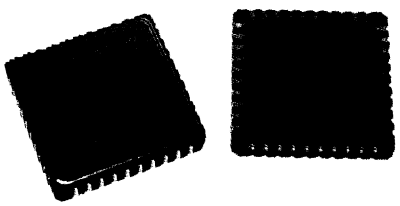
Pad connections

4	-	+ 5 V supply *
10	-	+ 5 V supply *
30	-	N.C.(no option) ; enable/disable (option I)
31	-	GND **
37	-	GND **
39	-	signal output

other pads: N.C.

* pads 4 and 10 are internally connected

** pads 31 and 37 are internally connected



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type	QEN 47-BH		
frequency range	3.5 kHz ≤ F ≤ 1 MHz	1 MHz ≤ F < 4 MHz	4 MHz ≤ F < 40 MHz above 40 MHz, see type QEN 47-CH
frequency stability other temperature ranges and stabilities available	code DT ..... -40 ° C to +85 ° C ..... ≤ ± 35 or ± 50 or± 75 or ± 100 ppm code AY ..... -55 ° C to+125 ° C ..... ≤ ± 50 or ± 75 or± 100 or ± 150 ppm inclusive of 25° C calibration, temperature, Vcc and load change		
ageing	< ± 5 ppm / 1 st. year at +85° C max.		
storage temperature	- 65 ° C to +125 ° C		
supply voltage	5 V ± 5 %		
input current without load at +25° C	≤ 10 mA	≤ 15 mA	≤ 20 mA
output levels Vcc = 5V, max. load	"0" ≤ 0.5 V "1" ≥ 4.5 V		
maximal load	3 TTL-gates or 25 pF		
rise / fall time	≤ 10 ns (max. load)		
duty cycle	50 / 50 ± 10 % (± 5 % if option R) up to 14 MHz	50 / 50 ± 20 % (± 10 % if option R) from 14 MHz	
	at Vcc / 2, max. load		
start-up time	10 ms typ. at Vcc = 4.75 V		
screening	screening B or S(*) in accordance with MIL 55310 on request		
acceleration (steady state)	5000 g in the Y1 direction (only if screening B or S required)		
PIND-test	only if screening S required		
options	**code R**: duty cycle 50 / 50 ± 10 % or ± 5 % depending on frequency range (see above) **code I**: output enable, only between 3.5 kHz and 14 MHz lead-time ≤ 100 ns, minimal pulse width 50 ns "0" on pad 30 ..... active output pad 39 "1" on pad 30 ..... output pad 39 "0" state **Attention:** should pad 30 not be used, please always tie to GND		
package	n° 47 with gold plated pads (tinned pads on request)		
marking	CQE + date code + reference		
ordering information	reference + option code + frequency + temperature code + frequency stability example: QEN 47-BHR 15.000 MHz AY 100[SB*] **SB or SS = B or S screening class. Insert SB or SS if applicable*		

TYPE QEN 47-CH

Applications

The oscillator **QEN 47-CH** is intended for military airborne and space applications.

The oscillator **QEN47-CH** uses **ACMOS** active circuit technology and has option tri-state output with enable / disable.

Associated model

As the same build-standard **QEN 47-BH**, it completes the frequency range 40 MHz to 70 MHz with the equivalent performance and reliability.

Features

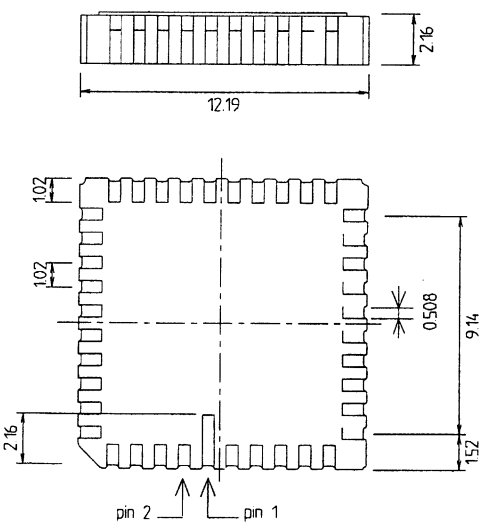
- Frequency: **14 MHz to 70 MHz,**
- Temperature range: **-55° C to +125° C**
- Frequency stability: ≤ **± 35 ppm to** ≤ **± 150 ppm**
- **Tri-state** output
- **Small volume**
- Supply voltage: **5 V**

Important

Always apply supply voltage ***before*** inputting any signal on pin 30 (enable / disable).

This holder should be soldered only on substrates exhibiting a coefficient of expansion compatible with ceramic.

Package



Package n° 47

Pad connections

4 - + 5 V supply *

10 - + 5 V supply *

30 - N.C. (no option)
- tri-state (option J)

31 - GND**

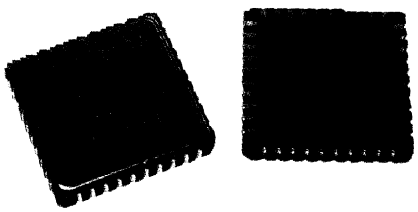
37 - GND**

39 - signal output

other pads: N.C.

* pads 4 and 10 are internally connected

** pads 31 and 37 are internally connected



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CLOCK OSCILLATORS (XO)

ACMOS / TTL-compatible clock oscillators in LCCC40

type	QEN 47-CH	
frequency range	14 MHz ≤ F ≤ 40 MHz below 14 MHz, see type QEN 47-BH	40 MHz ≤ F ≤ 70 MHz
frequency stability	code DT ..... -40 ° C to +85 ° C ..... ≤ ±35 or ± 50 or± 75 or ± 100 ppm code AY ..... -55 ° C to+125 ° C ..... ≤ ± 50 or ± 75 or±100 or ± 150 ppm inclusive of 25° C calibration, temperature, Vcc and load change	
ageing	≤ ± 5 ppm / 1 st. year at +85° C max.	
storage temperature	- 65 ° C to +125 ° C	
supply voltage	5 V ± 5 %	
input current (without load at +25° C)	≤ 20 mA (≤ 30 mA with tri-state option)	≤ 40 mA (≤ 50 mA with tri-state option)
output levels Vcc = 5V, max. load	"0" ≤ 0.5 V "1" ≥ 4.5 V	
maximal load	10 TTL-gates or 25 pF	10 TTL-gates or 15 pF
rise / fall time	≤ 5 ns (max. load)	
duty cycle	50 / 50 ≤ 20 % (± 10 % if option R) at Vcc / 2, max. load	
start-up time	10 ms typ. at Vcc = 4.75 V	
screening	screening B or S(*) in accordance with MIL 55310 on request	
acceleration (steady state)	5000 g in the Y1 (only if screening B or S requested)	
PIND-test	only if screening S requested	
options	**code R**: duty cycle 50 / 50 ± 10 % **code J**: tri-state output enable on pad 30 "1" on pad 30 ..... output pad n° 39 hi-Z "0" on pad 30 ..... output pad n° 39 active lead-time between input signal and output reaction ≤ 20 ns **Attention:** should pad 30 not be used, please always tie it to GND	
package	n° 47 with gold plated pads (tinned pads on request)	
marking	CQE + date code + reference	
ordering information	reference + option code + frequency + temperature code + frequency stability example: QEN 47-CHR 15,000 MHz AY 100 [SB*] ** SB or SS = B or S screening class. Insert SB or SS if applicable*	

CLOCK OSCILLATORS (XO)

DIL-packaged clock oscillators HCMOS

TYPE QEN 14-H

Applications

The oscillators of the **QEN 14-H** series are designed to operate at operating temperatures up to -40 ° C to +85 ° C and withstand tough mechanical environment. They are particularly suitable for airborne inboard applications (e.g. cockpit displays), railroad security equipment and every outdoor electronics.

Associated models

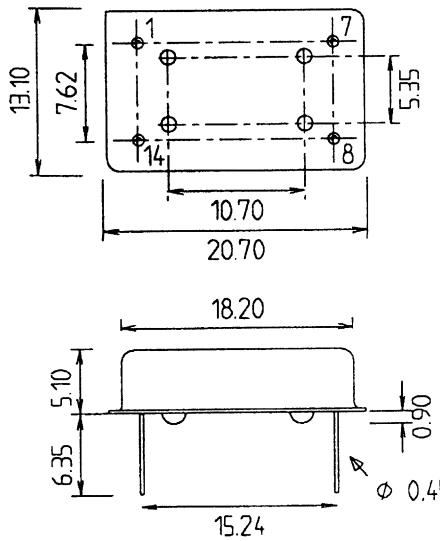
For extended temperature range up to -55 ° C to +125 ° C, please refer to **QEN 55-DH**.

If withstanding to very high vibration levels is of primary concern, we offer DIL package with 14 pins under reference **QEN 49-DH**.

Features

- Frequency: **250 kHz to 70 MHz,**
- Temperature range: **-40° C to +85° C**
- Frequency stability: ≤ **± 15 ppm to** ≤ **± 100 ppm**
- **Tri-state** output (option J)
- **Low input current**

Package



Package n° 55

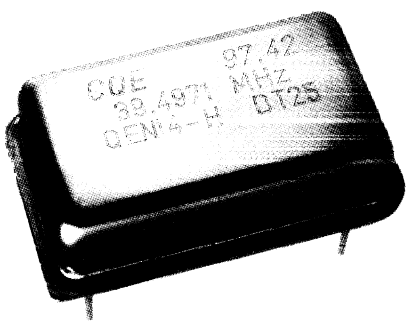
Pad connections

1 : N.C. (no option)
tri-state output (option J)

7 : GND

8 : output

14 : + 5 V supply



reference	QEN 14-H series		
frequency range	250 kHz to 3.499 MHz	3.5 to 29.9 MHz	30 to 70 MHz
frequency tolerance other temperature ranges and stabilities available	code LQ ..... 0° C to +70° C ..... ≤ ± 15 or ± 25 or ± 50 or ± 100 ppm code HQ..... -20° C to+70° C ..... ≤ ± 15 or ± 25 or ± 50 or ± 75 or ±100 ppm code DT ..... -40° C to+85° C ..... ≤ ± 25 or ± 50 or ± 75 or ± 100 ppm inclusive of 25° C calibration, temperature, Vcc and load change		
ageing	≤ ± 5 ppm / 1st year at +85° C max.		
storage temperature	- 55 ° C to +105 ° C		
supply voltage	5 V ± 10 %		
input current (without load)	≤ 45 mA	≤ 15 mA	≤ 30 mA
output levels (max. load)	"0" ≤ 0.5 V "1" ≥ 4.5 V		
maximum load	15 pF		
rise / fall time (max. load)	≤ 25 ns	≤ 10 ns	
duty cycle	50 / 50 ± 20 % (± 10 % optional) at 2.5 V		
start-up time	10 ms typ. at Vcc = 4.75 V		
option	**code R**: duty cycle 50/50% ± 10 % L **code J**: tri-state output enable on pin 1 «I» on pin 1... output pin n° 8 hi-Z «O» on pin 1... output pin n° 8 active		
package	n° 55 (4 tinned pins)		
marking	CQE + date code + reference		
ordering information	reference + option code + frequency + temperature code + frequency stability example: QEN 14-HR 15.000 MHz DT100		

CLOCK OSCILLATORS (XO)

DIL-packaged HCMOS / TTL-compatible clock oscillators

TYPES QEN 49-BH / QEN 55-BH

Applications

The oscillator **QEN 49-BH** and **QEN 55-BH** are intended for military airborne and space applications.

The oscillator **QEN49-BH** and **QEN 55-BH** use **HCMOS** active circuit technology and have option output with enable / disable.

Associated models

Types **QEN 49-CH** and **QEN 55-CH** cover the frequency range 14 MHz to 70 MHz with the equivalent performance and reliability.

In the overlap range between 14 MHz and 40 MHz, the choice of the type depends on the other options available such as duty-cycle tolerance, readjustment of frequency by external trimmer and the tri-state output.

Features

- Frequency: **3.5 kHz to 40 MHz,**
- Temperature range: **-55° C to +125° C**
- Frequency stability: ≤ **± 25 ppm to** ≤ **± 150 ppm**
- **HCMOS** output
- **Enable/disable** to 14 MHz

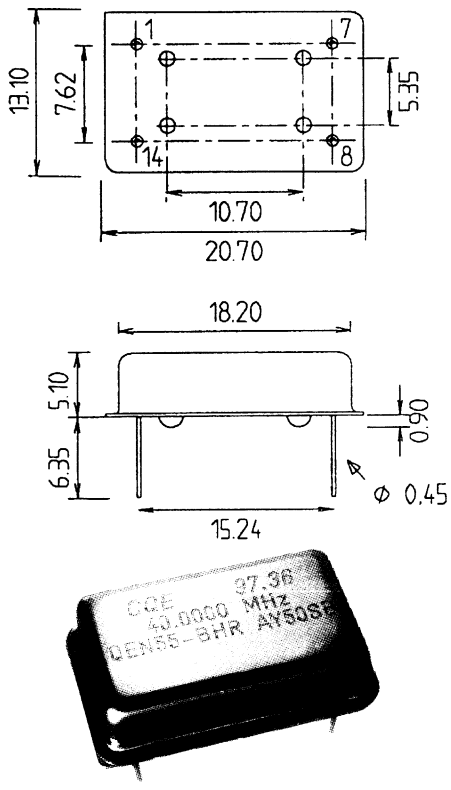
Important

Always apply supply voltage ***before*** inputting any signal on pin 1 (enable / disable).

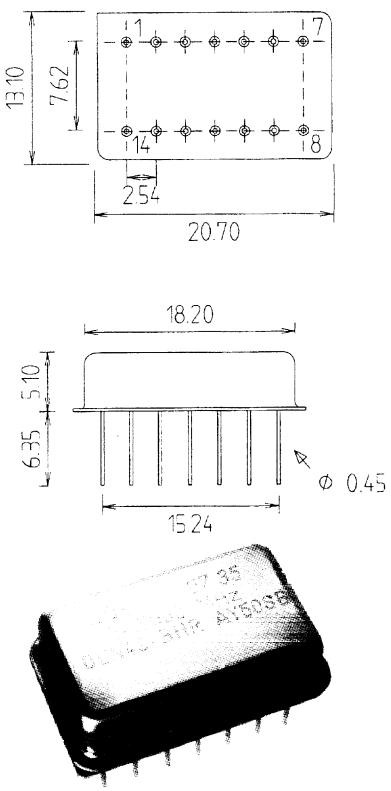
Pad connections

1	:	N.C. (no option)
	:	enable / disable (option I)
	:	external trimmer (option T)
2 to 6	:	N.C.
9 to 13	:	N.C.
7	:	GND
8	:	output
14	:	+ 5 V

Package



Package n° 55



Package n° 49

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type	**QEN 49-BH** (14 pins) **QEN 55-BH** (4 pins)		
frequency range	3.5 kHz ≤ F ≤ 1 MHz	1 MHz ≤ F ≤ 4 MHz	4 MHz ≤ F ≤ 40 MHz above 40 MHz, see types QEN 49-CH or 55-CH
frequency stability other temperature ranges and stabilities available	code DT ..... -40° C to +85° C ..... ≤ ± 25 or ± 50 or ± 75 or ± 100 ppm code AY ..... -55° C to +125° C ..... ≤ ± 50 or ± 75 or ± 100 or ± 150 ppm inclusive of 25° C calibration, temperature, Vcc and load change		
ageing	≤ ± 5 ppm / 1st year at +85° C max.		
storage temperature	- 65° C to +125° C		
supply voltage	5 V ± 5 %		
input current without load at +25° C	≤ 10 mA	≤ 15 mA	≤ 20 mA
output levels Vcc = 5 V, max. load	"0" ≤ 0.5 V "1" ≥ 4.5 V		
maximal load	3 TTL-gates or 25 pF		
rise / fall time	≤ 10 ns (max. load)		
duty cycle	50 / 50±10 % (±5 % with option R) up to 14 MHz	50/50 ±20 % (±10 % with option R) from 14 MHz	
start-up time	at Vcc/2, max. load 10 ms typ. at 4.75 V		
screening	screening B or S (*) in accordance with MIL 55310 on request		
shock test	IEC 68-2-27: 3 x 3 shocks 100 g, half-sine, 6 ms		
vibration test (sinewave)	IEC 68-2-6: 5 Hz to 2 kHz / 50 g - 3 axes		
acceleration (steady state)	5000 g in the Y1 direction (only if screening B or S required)		
PIND-test	only if screening S required		
options	**code R**: duty cycle 50 / 50 ±10 % or ± 5 % according to frequency range (see above) **code T**: connection to external trimmer 3 to 20 pF on pin 1 (up to 30 MHz only) **code I**: output enable, only between 3.5 kHz and 14 MHz lead time ≤ 100 ns, minimal pulse width 50 ns "0" on pin 1 ..... pin 8 active output "1" on pin 1 ..... pin 8 low should pin 1 not be used, please always tie it to GND **Attention,** options T and I using the same pin, they are mutually exclusive		
package	n° 49: QEN 49-BH: DIL with 14 pins n° 55: QEN 55-BH: DIL with 4 pins (gold plated pins standard, tinned pins on request)		
marking	CQE + date code + reference		
ordering information	reference + option code + frequency + temperature code + frequency stability example: QEN 49-BH 15,000 MHz AY 100 [SB*] ** SB or SS = B or S screening class. Insert SB or SS if applicable*		

CLOCK OSCILLATORS (XO)

DIL-packaged ACMOS clock oscillators
HCMOS & TTL-compatible

TYPES QEN 49-CH / QEN 55-CH

Applications

The oscillators **QEN 49-CH** and **QEN 55-CH** are intended for military airborne and space applications. They use a **ACMOS** active circuit technology. Option tri-state output with enable / disable is available.

Features

- Frequency: **14 MHz to 70 MHz**
- Temperature range: **-55° C to +125° C**
- Frequency stability: ≤ **± 25 ppm to** ≤ **± 150 ppm**
- **Tri-state** (option J), **external trimmer** (option T)
- **ACMOS** output

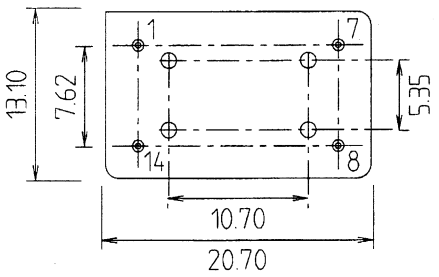
Associated models

Of the same build-standard as **QEN 49-BH** and **QEN 55-BH**, they permit frequency range extensions from 40 MHz to 70 MHz with equivalent performance and reliability.

Important

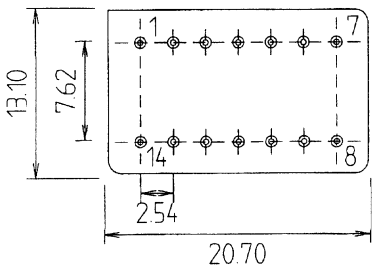
Always apply supply voltage ***before*** inputting any signal on pin 1 **(enable / disable)**.

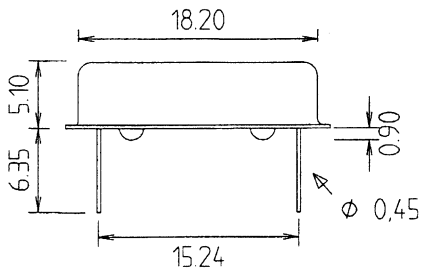
Packag

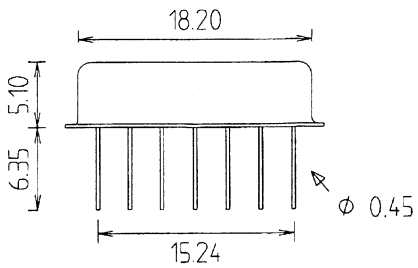


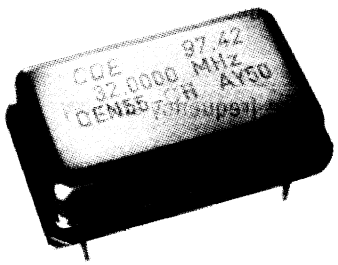
Pad connections

1	:	N.C. if no option
	:	enable / disable if option J
	:	external trimmer if option T
2 to 6	:	N.C.
9 to 13	:	N.C.
7	:	GND
8	:	output
14	:	+ 5 V

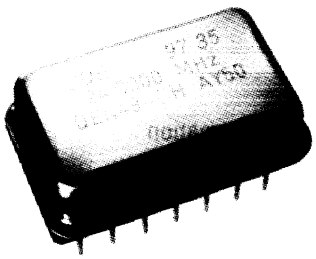








Package n° 55



Package n° 49

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type	**QEN 49-CH** (14 pins) **QEN 55-CH** (4 pins)	
frequency range	14 MHz ≤ F ≤ 40 MHz below 14 MHz, see type QEN 49-BH	40 MHz ≤ F < 70 MHz
frequency stability other temperature ranges and stabilities available	code DT ..... -40° C to +85° C ..... ≤ ± 25 or ± 50 or ± 75 or ± 100 ppm code AY ..... -55° C to +125° C ..... ≤ ± 50 or ± 75 or ± 100 or ± 150 ppm inclusive of 25° C calibration, temperature, Vcc and load change	
ageing	≤ ± 5.10^{-6} / 1 st. year at +85° C max.	
storage temperature	- 65° C to +125° C	
supply voltage	5 V ± 5 %	
input current (without load at +25° C ±2° C)	≤ 20 mA (≤ 30 mA with tri-state output)	≤ 40 mA (≤ 50 mA with tri-state output)
output levels Vcc = 5V, max. load	"0" ≤ 0.5 V "1" ≥ 4.5 V	
maximal load	10 TTL-gates or 25 pF	10 TTL-gates or 15 pF
rise / fall time	≤ 10 ns (max load)	
duty cycle	50 / 50 ± 20 % (±10 % if option R) at Vcc/2, max. load	
start-up time	10 ms typ. at Vcc = 4.75 V	
screening	screening B or S (*) in accordance with MIL 55310 on request	
shock test	IEC 68-2-27: 3 x 3 shocks 100 g, half-sine, 6 ms	
vibration test (sinewave)	IEC 68-2-6: 5 Hz to 2 kHz / 50 g / 3 axes	
constant acceleration	5 000 g in the Y1 direction (only if screening B or S requested)	
PIND-test	only if screening S required	
options	**code R**: duty cycle 50 / 50 ±10 % **code T**: connection to external trimmer 3 to 20 pF on pin 1 (up to 30 MHz only) **code J**: tri-state output enable on pin 1 "1" on pin 1 ..... output pin no. 8 hi-Z "0" on pin 1 ..... output pin no. 8 active should pin 1 not be used, please always tie it to GND lead-time between input signal and output reaction ≤ 20 ns **Attention,** options T and J using the same pin, they are mutually exclusive	
package	n° 49: QEN 49-CH: DIL with 14 pins n° 55: QEN 55-CH: DIL with 4 pins gold plated pins standard, tinned pins on request	
marking	CQE + date code + reference	
ordering information	reference + option code(s) + frequency + temperature code + frequency stability example: QEN 49-CHT 15,000 MHz AY 100[SB*] ** SB or SS = B or S screening class. Insert SB or SS if applicable*	

TYPES QEN 49-DH / QEN 55-DH

Applications

The oscillators **QEN 49-DH** and **QEN 55-DH** are intended for military airborne and space applications.

They are however of a more economical build-standard than **QEN 49-BH** or **QEN 49-CH** which are considered as hi-rel devices.

***Note: Extended temperature range -55° C to +125° C according to internal qualification test.*

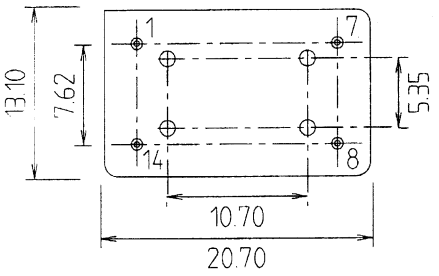
Features

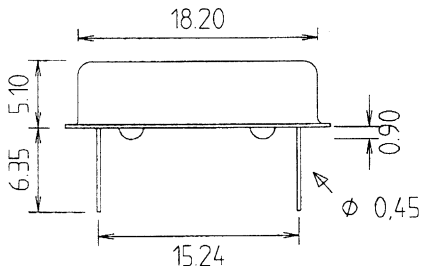
- Frequency: **1 MHz to 70 MHz**
- Temperature range: **-55° C to +125° C**
- Frequency stability: ≤ **± 25 ppm to** ≤ **± 150 ppm**
- **Enable/disable** (option I)
- **External trimmer** up to 33 MHz (option T)
- **HCMOS** output
- **High vibration resistance**

Important

Always apply supply voltage ***before*** inputting any signal on pin 1 (**enable / disable**).

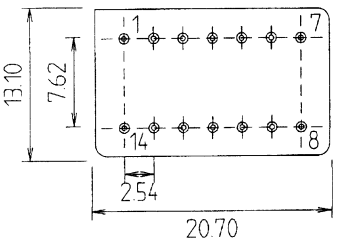
Package

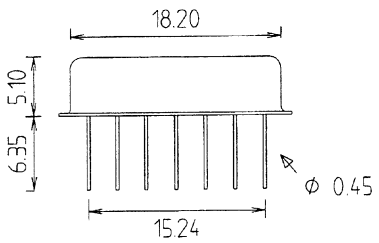


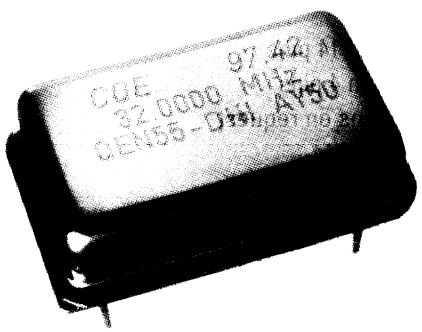


Pad connections

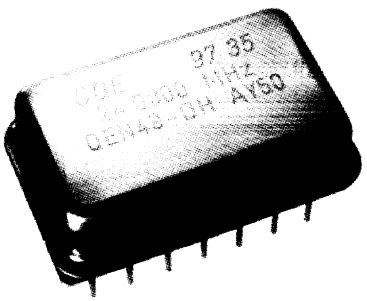
1	:	N.C. if no option : enable / disable if option I : external trimmer if option T
2 to 6	:	N.C.
9 to 13	:	N.C.
7	:	GND
8	:	output
14	:	+ 5 V







Package n° 55



Package n° 49

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DIL-packaged HCMOS / TTL-compatible clock oscillators

type	**QEN 49-DH** (14 pins) **QEN 55-DH** (4 pins)			
frequency range	1 MHz ≤ F < 4 MHz	4 MHz ≤ F < 14 MHz	14 MHz ≤ F < 20 MHz	20 MHz ≤ F < 70 MHz
frequency stability **	code DT ..... -40° C to +85° C ..... ≤ ± 25 or ± 50 or± 75 or ± 100 ppm code AY ..... -55° C to +125° C ..... ≤ ± 50 or ± 75 or ± 100 or ± 150 ppm inclusive of 25° C calibration, temperature, Vcc and load change			
ageing	≤±5 ppm / 1 st. year at +85° C max.			
storage temperature	- 65 ° C to +125° C			
supply voltage	5 V ± 5 %			
input current wo. load (at +25° C, Vcc = 5V)	≤10 mA	≤15 mA	≤20 mA	≤30 mA
output levels Vcc = 5V, max. load	"0" < 0.5 V "1" ≥ 4.5 V			
maximal load	2 TTL-gates / 15 pF		6 TTL-gates / 25 pF	
rise / fall time	≤ 10 ns (max. load)		≤ 5 ns (max. load)	
duty cycle	50 / 50 ± 10 % (± 5 % if option R)		50 / 50 ± 20 % (± 10 % if option R)	
	at Vcc/2, max. load			
start-up time	10 ms typ. at Vcc = 4.75 V			
shock test	IEC 68-2-27: 3 x 3 shocks 100 g, half-sine, 6 ms			
vibration test (sinewave)	IEC 68-2-6: 5 Hz to 2 kHz / 20 g / 3 axes			
options	**code R**: duty cycle 50 / 50 ± 10 % or ± 5% depending on frequency range (see above) **code T**: connection to external trimmer 3 to 20 pF on pin 1 (up to 33 MHz only) **code I**: output enable "0" on pin 1 ..... pin 8 inactive "1" on pin 1 ..... pin 8 active output should pin 1 not be used, please always tie it to +Vcc **Attention:** options T and I using the same pin, they are mutually exclusive			
package	n° 49: QEN 49-DH: DIL with 14 pins N° 55: QEN 55-DH: DIL with 4 pins gold plated pins standard, tinned pins on request			
marking	CQE + date code + reference			
ordering information	reference + option code + frequency + temperature code + frequency stability example: QEN 49-DHR 15.000 MHz AY 100			

CLOCK OSCILLATORS (XO)

DIL-packaged HCMOS clock oscillators with divided outputs

TYPE QEN 49-FH

Applications

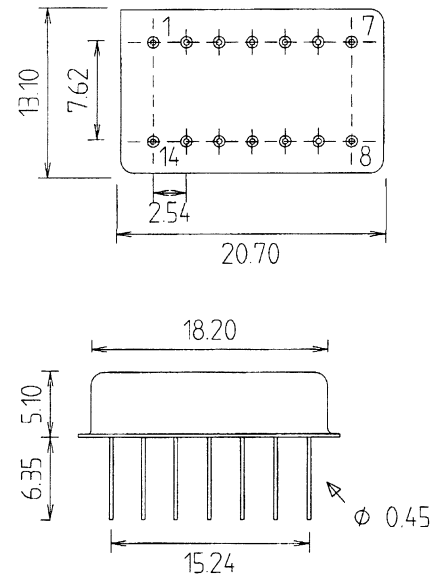
This range of oscillators is intended for military and airborne applications, where one frequency F0 and divided outputs F/2, F/4, F/8 and F/16 are needed.

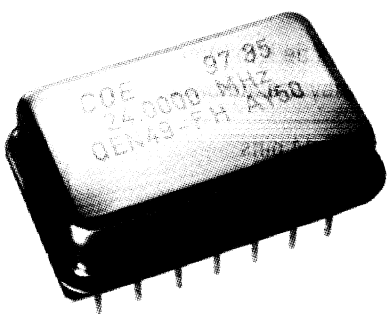
N.B.: extended temperature range -55° C to +125° C according to internal qualification test.

Features

- Frequency: **10 MHz to 30 MHz**
- Temperature range: **-55° C to +125° C**
- Frequency stability: ≤ **± 25 ppm to** ≤ **± 150 ppm**
- **Enable / disable** (option I)
- **External trimmer** (option T)
- **HCMOS** with divided output

Package





Package n° 49

Important

Always apply supply voltage ***before*** inputting any signal on pin 1 (**enable / disable**).

Pad connections

1	:	N.C. (no option) : enable/disable (option I)
2 - 4	:	N.C.
5	:	F0
6	:	External trimmer (option T)
7	:	GND + case
8	:	F/16
9	:	F/8
10	:	F/4
11	:	F/2
12	:	N.C.
13	:	N.C.
14	:	+ 5 V

CLOCK OSCILLATORS (XO)

DIL-packaged HCMOS clock oscillators with divided outputs

type	QEN 49-FH (14 pins)		
frequency range (F0 output on pin 5)	10MHz ≤ FO < 14 MHz	14 MHz ≤ FO < 20 MHz	20 MHz ≤ FO < 30 MHz
frequency stability	code DT ..... -40° C to +85° C ..... ≤ ± 25 to ≤ ± 150 ppm code AY ..... -55° C to +125° C ..... ≤ ± 50 to ≤ ± 150 ppm inclusive of +25° C calibration tolerance, temperature, Vcc and load change		
ageing	≤ ± 5 ppm/1st. year at +85° C max.		
storage temperature	- 65 ° C to +125 ° C		
supply voltage	5 V + 5 %		
input current (at +25° C ±2° C and without load)	≤ 15 mA	≤ 20 mA	≤ 30 mA
output levels Vcc = 5 V, max. load	"0" ≤ 0.5 V "1" ≥ 4.5 V		
maximal load	2 TTL gates / 15 pF on each output		
rise / fall time	≤ 10 ns (max. load)		
duty cycle (max. load)	50 / 50 ± 20 % (± 10 % if option R) at Vcc/2 on FO output 50 / 50 ± 10 % (± 5 % if option R) at Vcc/2 on divided outputs F/2 through F/16		
start-up time	10 ms typ. at Vcc = 4.75 V		
screening	screening B (*) in accordance with MIL 55310 on request		
shock test	IEC 68-2-27: 3 x 3 shocks 100 g, half-sine, 6 ms		
vibration test (sinewave)	IEC 68-2-6: 5 Hz to 2 kHz / 20 g / 3 axes		
options	code R : duty cycle 50 / 50 ± 10 % or ± 5 % (see above) code T : frequency adjustment by external trimmer 3 pF to 15 pF code I : output enable "0" on pin 1 . pins 5, 8, 9, 10, 11 low state "1" on pin 1 . pins 5, 8, 9, 10, 11 active outputs should pin 1 not be used, please always tie it to +Vcc		
package	no. 49 (14 gold plated pins standard, tinned pins on request)		
marking	CQE + date code + reference		
ordering information	reference + option code(s) + frequency + temperature code + frequency stability example: QEN 49-FHRTI 15.000 MHz AY 100 [SB*] ** SB = B screening class. Insert SB if applicable*		

TYPES QEN 49-EH / QEN 55-EH

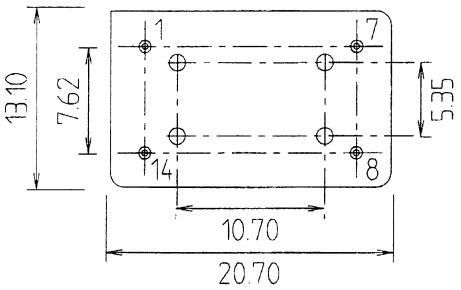
Applications

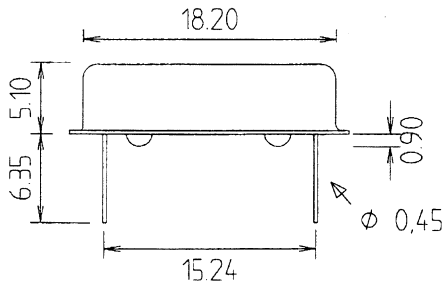
The oscillators **QEN 49-EH** and **QEN 55-EH** are intended for military airborne and space applications. They use **ACMOS** active circuit technology. They allow an upper frequency of 160 MHz, as opposed to the classic HCMOS types which are limited to much lower frequencies.

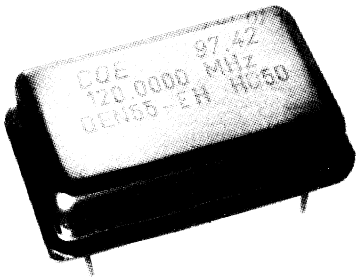
Features

- Frequency: **14 MHz to 160 MHz**
- Temperature range:
  -40° C to +85° C
  -55° C to +125° C up to 70 MHz only
- Frequency stability: ≤ **± 25 ppm to** ≤ **± 100 ppm**
- **ACMOS** output

Package



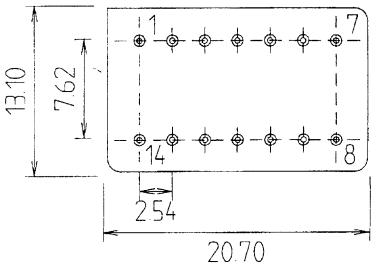


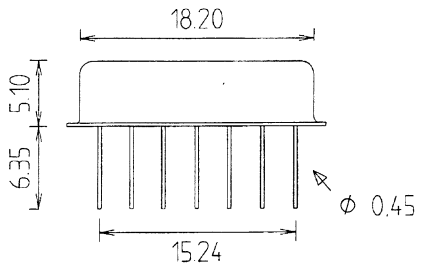


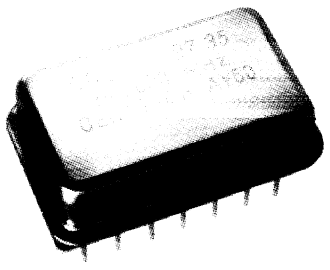
Package n° 55

Pad connections

1 to 6 : N.C.
9 to 13: N.C.
7 : GND
8 : output
14 : + 5 V







Package n° 49

type	**QEN 49-EH** (14 pins) **QEN 55-EH** (4 pins)	
frequency range	14 MHz ≤ F ≤ 70 MHz	70 MHz ≤ F ≤ 160 MHz
frequency stability other temperature ranges and stabilities available	code LM ..... 0° C to +50° C ..... ± 25 ppm or ± 50 ppm or ± 100 ppm code JO ..... -10° C to +50° C ..... ± 25 ppm or ± 50 ppm or ± 100 ppm code HQ ..... -20° C to +70° C ..... ± 25 ppm or ± 50 ppm or ± 100 ppm code DT ..... -40° C to +85° C ..... ± 25 ppm or ± 50 ppm or ± 100 ppm code AY* ..... -55° C to +125° C ..... ± 50 ppm or ± 100 ppm * temperature range feasible up to 70 MHz only inclusive of 25° C calibration, temperature, Vcc and load change	
ageing	≤± 5 ppm / 1st. year at +85° C max.	
storage temperature	-65° C to +125° C	
supply voltage	5 V / ± 5 %	
input current w/o load	≤ 20 mA up to 40 MHz ≤ 40 mA from 40 MHz to 70 MHz	≤ (50 mA +0.2 F (MHz) at +25° C, Vcc = 5 V
output levels (max. load)	"0" ≤ 0.5 V "1" ≥ 4.5 V	"0" ≤ 0.44 V "1" ≥ 3.7 V
maximal output	10 TTL-gates or 25 pF	± 24 mA up to 85° C ± 15 mA from +85 to +125° C
rise / fall time (max. load)	≤ 10 ns from 20 MHz to 70 MHz ≤ 2 ns from 70 MHz to 160 MHz between 20 % and 80 % of the actual signal amplitude, at + 25° C ± 2° C	
duty cycle	50 / 50 ± 20 % at Vcc/2	
start-up time	10 ms typ. at Vcc = 4.75 V	
screening	screening B or S (*) in accordance with MIL 55310 on request	
shock test	IEC 68-2-27: 3 x 3 shocks 100 g, half-sine,6 ms	
vibration test (sinewave)	IEC 68-2-6: 5 Hz to 2 kHz / 50 g / 3 axes	
acceleration (steady state)	5000 g in the Y1 direction (only if screening B or S requested)	
PIND-test	only if screening S requested	
package	n° 49: DIL with 14 pins n° 55: DIL with 4 pins gold plated pins standard, tinned pins on request	
marking	CQE + date code + reference	
ordering information	reference + option code + frequency + temperature code + frequency stability example: QEN 49-EH 68.736 MHz AY100 [SB*] ** SB or SS = B or S screening class. Insert SB or SS if applicable*	

TYPES QEN 49-AE & QEN 55-AE ; QEN 49-BE & QEN 55-BE

Applications

The oscillators **QEN 49/55-AE** and **QEN49/55-BE** are intended for military airborne applications. They use ECL10 kH active circuit technology. They allow an upper frequency of 160 MHz, as opposed to the classic HCMOS types which are limited to much lower frequencies.

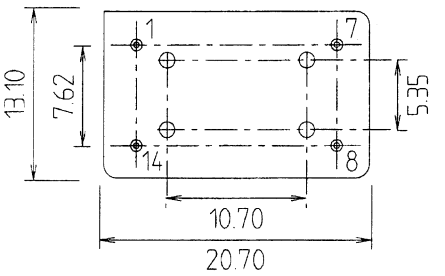
Features

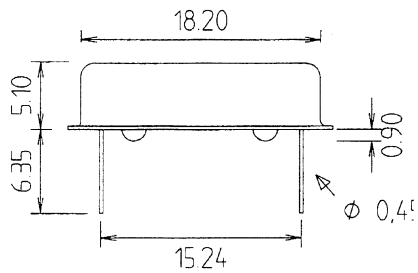
- Frequency: **14 MHz to 160 MHz**
- Temperature range: **-55° C to +125° C**
- Frequency stability: ≤ **± 25 ppm to** ≤ **± 100 ppm**
- ECL 10 kH output
- Supply voltage: **+ 5 V** (type QEN 49/55-AE)
  -5.2 V (type QEN 49/55-BE)

Associated models

For frequencies up to 160 MHz, we manufacture the oscillators types **QEN 49-EH and QEN 55-EH** that deliver an **ACMOS** output signal.

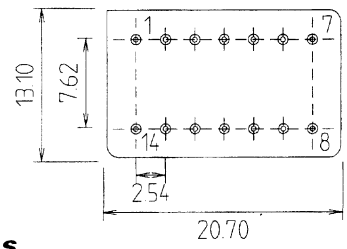
Package





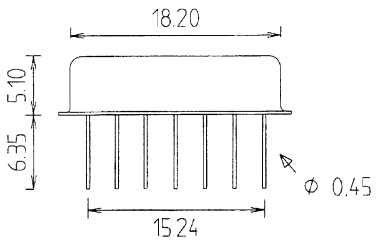
Pad connections
QEN 49-AE
QEN 55-AE

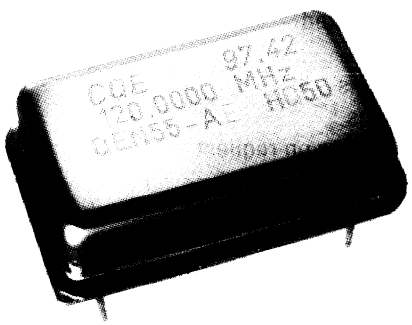
1	: N.C. (or inverted output) (option P)
2 to 6	: N.C.
9 to 13	: N.C.
7	: GND / case
8	: output
14	: + 5 V



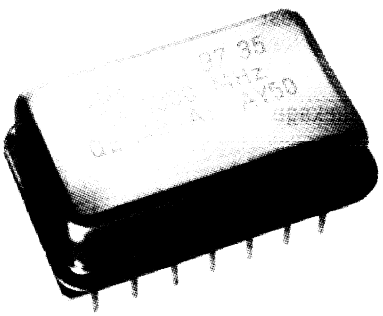
Pad connections
QEN 49-BE
QEN 55-BE

1	: N.C. (or inverted output) (option P)
2 to 6	: N.C.
9 to 13	: N.C.
7	: -5.2 V / case
8	: output
14	: GND





Package n° 55



Package n° 49

type	**QEN 49-AE** (14 pins) **QEN 55-AE** (4 pins)	**QEN 49-BE** (14 pins) **QEN 55-BE** (4 pins)
frequency range	14 MHz ≤ F ≤ 160 MHz	
frequency stability other temperature ranges and stabilities available	code LM ..... 0° C to +50° C ..... ± 25 ppm or ± 50 ppm or ± 100 ppm code JO .....-10° C to +60° C ..... ± 25 ppm or ± 50 ppm or ± 100 ppm code HQ .....-20° C to +70° C ..... ± 25 ppm or ± 50 ppm or ± 100 ppm code DT .....-40° C to +85° C ..... ± 25 ppm or ± 50 ppm or ± 100 ppm code AY.....-55° C to +125° C ..... ± 50 ppm or ± 100 ppm inclusive of 25° C calibration, temperature, Vcc and load change	
ageing	≤± 5 ppm /1st. year at +85° C max.	
storage temperature	-65° C to +125° C	
supply voltage	+ 5 V ± 5 %	-5.2 V ± 5 %
input current (w/o load)	≤ (50 mA + 0.2 F (MHz)) at +25° C + 2° C, V_{cc} = 5 V	
output levels (max. load)	3.92 V ≤ high level ≤ 4.37 V 3.05 V ≤ low level ≤ 3.4 V	-1.08 V ≤ high level ≤ -0.63 V -1.6 V ≤ low level ≤ -1.95 V
output current	≤ 50 mA	
maximal load	50 Ω at 3V	50 Ω at -2V
rise / fall time (max. load)	≤ 2 ns between 20 % and 80 % of the actual output level, at +25° C ± 2° C	
duty cycle	50 / 50 ± 20 % at (VLO+ VHI) / 2	50 / 50 ± 20 % at (VLO+ VHI) / 2
start-up time	≤ 10 ms at V_{cc} = 5 V	≤ 10 ms at V_{ee} = -5.2 V
screening	screening B or S (*) in accordance with MIL 55310 on request	
shock test	IEC 68-2-27: 3 x 3 shocks 100 g, half-sine, 6 ms	
vibration test (sinewave)	IEC 68-2-6: 10 Hz to 2 kHz / 50 g / 3 axes	
acceleration (steady state)	5000 g in the Y1 direction (only if screening B or S requested)	
option	**code P**: inverted output on pin 1	
package	n° 49: DIL package with 14 pins n° 55: DIL package with 4 pins gold plated pins standard, tinned pins on request	
marking	CQE + date code + reference	
ordering information	reference + option code + frequency + temperature code + frequency stability example: QEN 49-BE 100,000 MHz AY75 [SB*] ** SB or SS = B or S screening class. Insert SB or SS if applicable*	

CLOCK OSCILLATORS (XO)

Half-size DIL-packaged HCMOS clock oscillators

TEKELEC TEMEX

TYPE QEN 4-H

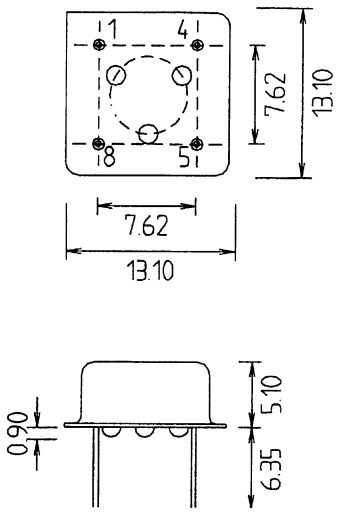
Applications

The oscillators of the **QEN 4-H** series are designed to operate at temperatures up to -40° C to +85° C and withstand tough mechanical environment. They are particularly suitable for civil airborne inboard applications (e.g. cockpit displays), railroad security equipment and every outdoor electronics.

Features

- Frequency: **3.5 MHz to 70 MHz**
- Temperature range: **-40° C to +85° C**
- Frequency stability: ≤ **± 15 ppm to** ≤ **± 100 ppm**
- **Tri-state** output (option J)
- Max. load current: **15 pF**
- **Low input current**

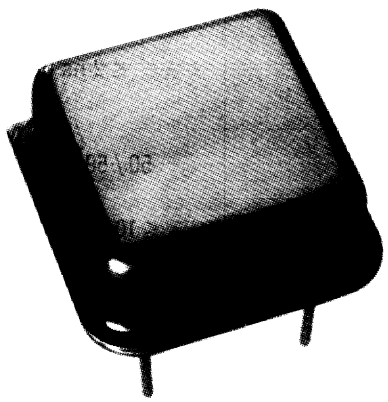
Package



Package n° 64

Pad connections

1 : N.C. (no option)
Tri-state output (option J)
4 : GND
5 : output
8 : + 5 V supply



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SPAIN: +34 (0) 1 320 41 60
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UK: +44 (0) 1256 883340

type	QEN 4-H	
frequency range	3.5 MHz to 29.99 MHz	30 MHz to 70 MHz
frequency tolerance other temperature ranges and stabilities available	code LQ ..... 0° C to + 70° C..... ≤ ± 15 or ± 25 or ± 50 or ± 100 ppm code HQ ..... 20° C to + 70° C..... ≤ ± 15 or ± 25 or ± 50 or ± 75 or ± 100 ppm code DT .....-40° C to + 85° C..... ≤ ± 25 or ± 50 or ± 75 or ± 100 ppm	
ageing	≤ ± 5 ppm / year at +85° C ± 2° C	
storage temperature	- 55° C to +105° C	
supply voltage	5 V ± 10 %	
input current (without load)	≤ 15 mA	≤ 30 mA
output levels (max. load)	"0" ≤ 0.5 V "1" ≥ 4.5 V	
maximum load	15 pF	
rise / fall time	≤10 ns (max. load)	
duty cycle	50/50 ± 20 % (± 10 % optional) at 2.5 V	
start-up time	10 ms typ. at Vcc = 4.75 V	
shock test	IEC 68-2-27: 3 x 3 shocks 100 g, half-sine, 6 ms	
vibration test (sinewave)	IEC 68-2-6: 10 Hz to 500 Hz / 5 g	
option	**code R**: duty cycle 50/50 % ± 10 % **code J**: tri-state output enable on pin 1 «1» on pin 1.. output N° 8 high impedance «0» on pin 1... output N° 8 active	
package	n° 64 (1/2 DIL 4 tinned pins)	
marking	CQE + date code + reference	
ordering information	reference + option code + frequency + temperature code + frequency stability example: QEN 4-HR 15.000 MHz DT100	

VOLTAGE-CONTROLLED OSCILLATORS (VCXO)

Selection Guide

Package	Temperature range up to	Frequency range	Output	Type	PAGE
DIL package	-40° C to +85° C	1 MHz to 45 MHz	HCMOS output *Advanced information*	**QEVT 49-AH** **QEVT 55-AH**	7-34
SMD ceramic package	-40° C to +85° C	1 MHz to 32 MHz	HCMOS output	**QEV 79-AH**	7-36
SMD ceramic package	0° C to +70° C	50 MHz to 160 MHz	TTL output PLL technique	**QEV 92-AH**	7-38
DIL package	-40° C to +85° C	1 MHz to 45 MHz	HCMOS output	**QEV 14-KH (4pins)** **QEV 55-KH (4 pins)**	7-40
DIL package	-40° C to +85° C	1 MHz to 41 MHz	HCMOS output	**QEV 55-AH (4pins)**	7-42
DIL package	-55° C to +125° C	14 MHz to 36 MHz	HCMOS output	**QEV 49-BH (14pins)** **QEV 55-BH (4 pins)**	7-44
DIL package	0° C to +70° C	50 MHz to 160 MHz	ACMOS output PLL technique *Advanced information*	**QEV 55-AT (4pins)**	7-46
Small package (20 x 20 mm)	-40° C to +85° C	14 MHz to 120 MHz	ACMOS output	**QEV 51-KH**	7-48
Small package (20 x 20 mm)	-40° C to +75° C	14 MHz to 200 MHz	Sine output	**QEV 51-KO**	7-50
36 x 27 x 10 mm package	-40° C to +85° C	10 MHz to 120 MHz	Sine output	**QEV 67-AO**	7-52
36 x 27 x 16 mm package	0° C to +70° C	139.264 MHz and 155.520 MHz	Sine output ≥ **50 kHz**	**QEV 63-AO**	7-54

Family Selection guide - V.C.X.O.: Voltage Controlled Crystal Oscillators

FREQUENCY RANGE	OUTPUT	HOLDER	MODEL	PAGE	CIVIL	INDUS.	STD MILITARY	AIRBORNE MILITARY	SPATIAL
1 MHz to 32 MHz	HCMOS/TTL	SMD	QEV 79-AH	7-36	X	X	X		
50 MHz to 160 MHz	TTL	SMD	QEV 92-AH	7-38	X	X			
1 MHz to 45 MHz	HCMOS	DIL (4 pins)	QEVT 55-AH	7-34	X	X	X		
1 MHz to 41 MHz	HCMOS/TTL	DIL (4 pins)	QEV 55-KH	7-40	X	X			
1 MHz to 41 MHz	HCMOS/TTL	DIL (4 pins)	QEV 55-AH	7-42	X	X			
14 MHz to 36 MHz	HCMOS/TTL	DIL (4 pins)	QEV 55-BH	7-44	X	X	X	X	
1 MHz to 41 MHz	HCMOS/TTL	DIL (4 pins)	QEV 14-KH	7-40	X	X			
50 MHz to 160 MHz	TTL	DIL (4 pins)	QEV 55-AT	7-46	X	X			
1 MHz to 45 MHz	HCMOS	DIL (14 pins)	QEVT 49-AH	7-34	X	X	X		
14 MHz to 36 MHz	HCMOS/TTL	DIL (14 pins)	QEV 49-BH	7-44	X	X	X	X	
14 MHz to 120 MHz	ACMOS/TTL	20 x 20 mm	QEV 51-KH	7-48	X	X	X		
14 MHz to 200 MHz	SINE	20 x 20 mm)	QEV 51-KO	7-50	X	X	X		
10 MHz to 200 MHz	SINE	36 x 27 mm	QEV 67-AO	7-52	X	X			
139.264&155.520MHz	SINE	36 x 27 mm	QEV 63-AO	7-54	X	X			
To be advised	All	All	On specification		X	X	X	X	X

DIL package VCXO with HCMOS output

TYPE QEVT 49-AH and QEVT 55-AH

Applications

These oscillators QEVT 49-AH and QEVT 55-AH are intented for professionnal and military applications.

There are design to operate at temperature up to -40° C to +85° C and propose an exceptionnal pulling range of more than 1500 ppm for specific applications.

Features

- Frequency: **10 MHz to 45 MHz**
- Temperature range: **-40° C t +85° C**
- Pulling range: **more than 1500 ppm**
- HCMOS output
- Supply voltage: **5 V**

Package

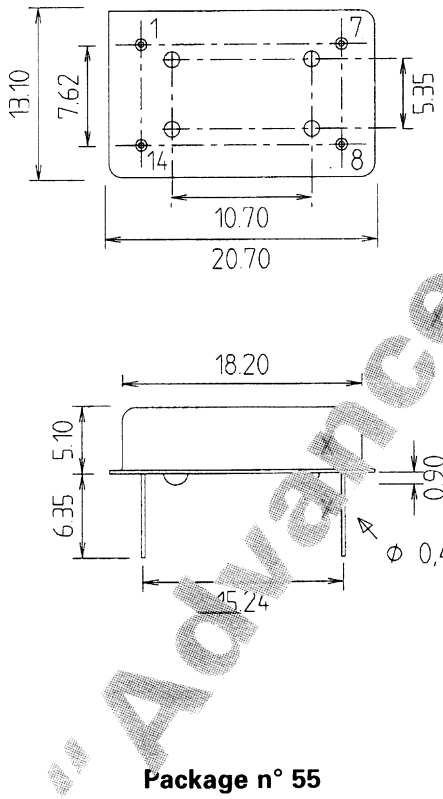
Pad connect

1 : control voltage

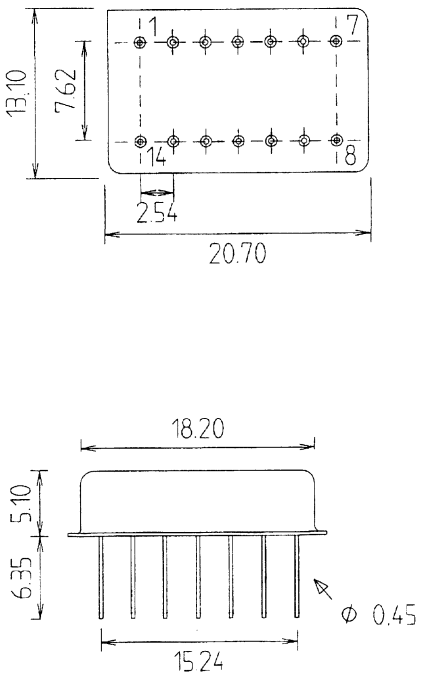
7 : GND

8 : output

14 : 5 V



Package n° 55



Package n° 49

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VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

DIL package VCXO with HCMOS output

type	QEVT 49-BH (14 pins) and QEVT 55-BH (4 pins)
frequency range	10 MHz to 45 MHz
pulling range relative to F (+25° C)	≥ ± 1500 ppm
control voltage	0 V to 5 V, centre value at 2.5 V (Z > 10 kΩ, positive slope)
frequency stability vs. temperature relative to F (+25° C) (peak to peak)	code LQ... 0° C to + 70° C... ≤ 400 ppm code LQ... -40° C to + 85° C... ≤ 600 ppm other temperature ranges and stabilities available including calibration tolerance
ageing at 25° C	≤ ± 20 ppm / year
frequency stability vs. other factors	± 50 ppm with 5 V ± 5 % voltage change ± 10 ppm with nominal load change ± 10 %
supply voltage	5 V ± 5 %
input current without load at +25° C ± 2° C	≤ 35mA
output levels	"0" < 0.5 V / "1" > 4.5 V (HCMOS compatible)
nominal / max. load	15 pF
rise / fall time	≤ 10 ns on nominal load
duty cycle	50 / 50 ± 20 % at Vcc / 2 V (HCMOS)
start-up time	10 ms typ. at Vcc = 4.75 V
storage temperature	-40° C to +85° C
shock test	IEC 68-2-27 : 3 x 3 shocks 500 g, half-sine, 6 ms
vibration test (sinewave)	IEC 68-2-6 : 10 Hz to 2000 Hz / 10 g / 3 axes
package	n° 55: DIL package (4 pins) n° 49 / DIL package (14 pins)
marking	CQE + date code + reference
ordering information	type + frequency + pulling range + temperature stability example : QEVT 49-BH 10.000 MHz 400LQ15

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

SMD packaged VCXO
HCMOS output

TYPE QEV 79-AH

Applications

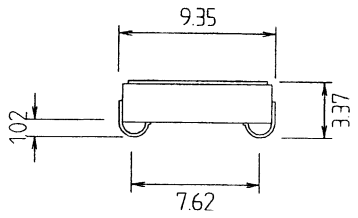
These VCXO's are particularly aimed at the civil and military communication market.

They are designed to operate over the temperature range of -40° C to +85° C.

Features

- Output clock frequencies **up to 32 MHz**
- Temperature range: **-40° C to +85° C**
- SMD package
- HCMOS / TTL-compatible output
- Duty of 50 ± 20 % up to 32 MHz

Package



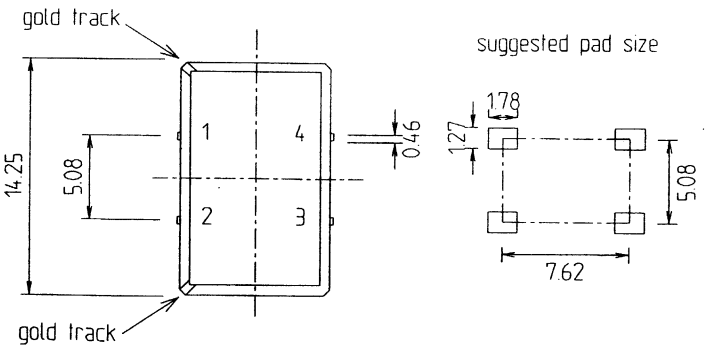
Pad connections

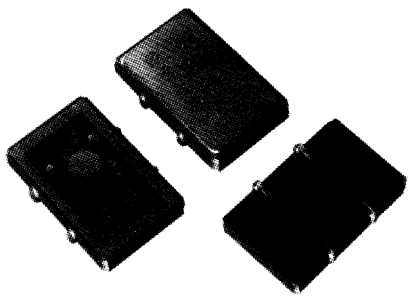
Control voltage

GND

HF output

power supply





Package n° 79

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VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

SMD packaged VCXO
HCMOS output

type	QEV 79-AH		
frequency range	1 MHz to 10 MHz	10 MHz to 20 MHz	20 MHz to 32 MHz
pulling range	≥ ± 75 or ≥ ± 100 ppm relative to F (+25° C)		
control voltage	0.5 V to 4.5 V, centre value at 2.5 V (≥ 10 kΩ, positive slope)		
calibration tolerance	± 20 ppm (+25° C ± 2° C, control voltage 2.5 V ± 5 mV, Vcc = 5 V ± 50 mV nominal load)		
frequency stability vs. temperature relative to F(+25° C)	code LQ ..... 0° C to +70° C ..... ≤ ± 15 or ± 25 or ± 50 ppm code HQ .....-20° C to +70° C ..... ≤ ± 20 or ± 40 ppm code DT .....-40° C to +85° C ..... ≤ ± 25 or ± 50 ppm other temperature ranges and stabilities available		
ageing at 25° C	≤ ± 3 ppm 1st year ≤ ± 10 ppm over 10 year		
frequency stability vs. other factors	± 6 ppm with voltage change 5 V ± 5 % ± 2 ppm with nominal load change ± 10 %		
supply voltage	5 V ±5 %		
load at +25° C + 2° C	≤ 10 mA	≤ 15 mA	≤ 20 mA
output levels	"0" ≤ 0.5 V "1" ≥ 4.5 V		
nominal load	2 TTL-LS or 15 pF		
maximal load	10 TTL-LS or 50 pF		
rise / fall time	≤ 10 ns on nominal load (10 % - 90 %)		
duty cycle	50 / 50 ± 20 % at Vcc / 2		
start-up time	10 ms typ. at Vcc = 4.75 V		
storage temperature	-55 ° C to +105° C		
shock test	IEC 68-2-27 : 3 x 3 shocks 100 g, half-sine, 6 ms		
vibration test (sinewave)	IEC 68-2-6 : 10 Hz to 2000 Hz / 20 g / 3 axes		
package	n° 79 (ceramic with 4 gold-plated j-leads, (tinned pads on request)		
marking	CQE + date code + reference		
ordering information	reference + option code + frequency + pulling range + temperature stability example : QEV 79-AH 30.000 MHz 100HQ20		

TYPE QEV 92-AH

Applications

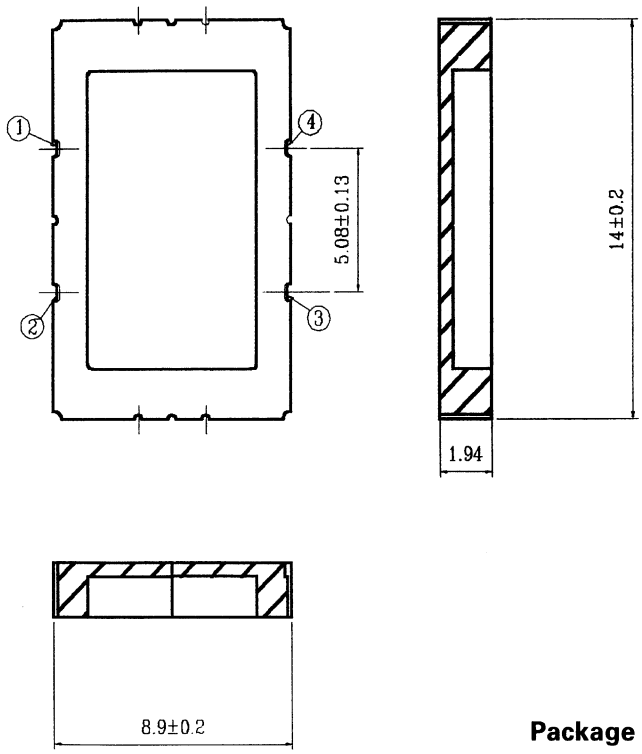
This range of oscillators is intended for civil applications.

This device uses **Phase Locked Loop (PLL)** techniques. It uses a standard fundamental mode crystal to produce output clocks up to 160 MHz.

Features

- Output clock frequencies **up to 160 MHz**
- Compatible with **X 86 and 680 XO CPUs**
- Duty cycle of **47.5 / 52.5 up to 80 MHz**
- Duty cycle of **45 / 50 up to 160 MHz**
- ± **25 mA** drive capability at TTL levels

Package



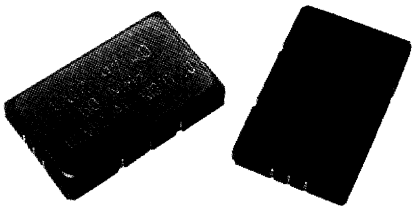
Pad connections

1 : Control voltage

2 : GND

3 : HF output

4 : power supply



Package n° 92

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VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

SMD high frequency VCXO

type	QEV 92-AH	
frequency range	50 MHz to 100 MHz	100 to 160 MHz
pulling range relative to F (+25° C)	≥ ± 75 ≥ ± 100 or ≥ ± 150 ppm	≥ ± 50 ≥ ± 75 or ≥ ± 100 ppm
control voltage	0 V to 5 V, centre value at 2.5 V (Z > 10 kΩ, positive slope)	
calibration tolerance	± 20 ppm (+25° C / ± 2° C)	
frequency stability vs. temperature relative to F (+25° C)	0° C to 70° C ≤ ± 15 ppm -40° C to 85° C ≤ ± 25 ppm other temperature ranges and stabilities available	0 to 70° C ≤ ± 15 ppm
ageing at 25° C	≤ ± 3 ppm / year	
frequency stability vs. other factors	± 6 ppm with 5 V ± 5 % voltage change ± 2 ppm with nominal load change ± 10 %	
supply voltage	5 V ± 5 %	
PPL bandwidth	> 10 kHz	
absolute clock period jitter	deviation from mean < 200 ps typ.	
rise / fall time	≤ 1 ns typical (0.8 to 2 volts)	
output clock duty cycle	47.5 to 52.5 at Vcc = 1.5 V (up to 80 MHz) / 45 to 55 at Vcc = 1.5 V (up to 160 MHz)	
input current without load at +25° C ± 2° C	≤ 45 mA	
output levels	VoH > 2.4 V for IoH = +25 mA	VoL < 0.4 V for IoL = -25 mA (0 to 70° C)
storage temperature	-40° C to +85° C	
shock test	IEC 68-2-27 : 3 x 3 shocks 100 g, half-sine, 6 ms	
vibration test (sinewave)	IEC 68-2-6 : 10 Hz to 2000 Hz / 10 g / 3 axes	
package	n° 92 (ceramic package)	
marking	CQE + date code + reference	
ordering information	reference + option code + frequency +pulling range + temperature stability example : QEV 92-AH 60.000 MHz 100LQ15	

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

VCXO in DIL package / HCMOS output

TEKELEC TEMEX

TYPE QEV 14-KH and QEV 55-KH

Applications

These VCXO's are particularly aimed at civil and military communication market.

They are designed to operate over the temperature range of -40° C to +85° C. The resonator plate has a 3-point mounting system, thereby offering an excellent resistance to shock and vibration.

Associated models

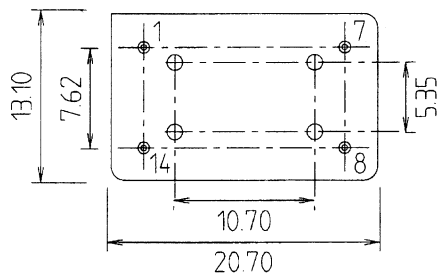
The **QEV 55-AH** has similar data, the main difference being a wider calibration tolerance of **± 20 ppm.**

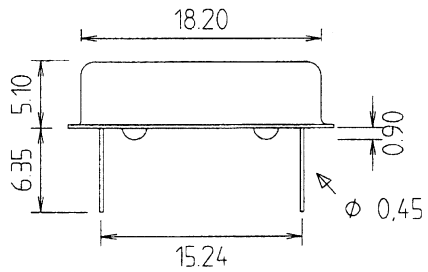
For extended temperature range: **+55° C to +125° C,** please refer to **QEV-49 BH** or **QEV 55-BH.**

Features

- Frequency **up to 35 MHz** (QEV-14 KH: **up to 41 MHz)**
- Temperature range: **-40° C to +85° C**
- **DIL** package
- **HCMOS / TTL**-compatible output
- Pulling range up to **150 ppm**
- Supply voltage: **5 V**

Package





Pad connections

1 : Control voltage

2 : GND

3 : HF output

4 : power supply + 5 V

Package n° 55

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VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

VCXO in DIL package / HCMOS output

type	QEV 14-KH QEV 55-KH			
frequency range	1 MHz to 10 MHz	10 MHz to 20 MHz	20 MHz to 30 MHz	30 MHz to 35 MHz (QEV 14-KH : to 41 MHz)
pulling range	≥± 75 or ≥± 100 or ≥± 150 ppm (QEV 14-KH) ± 75 or ± 100 ppm ± 10 % (QEV 55-KH)		≥± 75 or ≥± 100 ppm (QEV 14-KH) ± 75 or ± 100 ppm ± 10 % (QEV 55-KH)	
control voltage	0.5 V to 4.5 V, centre value at 2.5 V (Z ≥ 10 kΩ, positive slope)			
calibration tolerance	± 10 ppm (+ 25° C ± 2° C, control voltage 2.5 V ± 5 mV, Vcc = 5 V ± 50 mV, nominal load)			
frequency stability vs. temperature relative to F (+25° C)	code LQ ..... 0° C to +70° C ..... ≤ ± 15 or ± 25 or ± 50 ppm code HQ .....-20° C to +70° C ..... ≤ ± 20 or ± 40 ppm code DT .....-40° C to +85° C ..... ≤ ± 25 or ± 50 ppm other temperature ranges and stabilities available			
ageing (storage 0° C to +50° C)	≤ ± 5 ppm 1st year ≤ ± 10 ppm over 10 years			
frequency stability vs. other factors	± 6 ppm with 5 V ± 5 % voltage change ± 2 ppm with nominal load change ± 10 %			
supply voltage	5 V ± 0.5 V			
input current without load at +25° C ± 2° C	≤ 10 mA	≤ 15 mA	≤ 20 mA	≤ 30 mA
output levels	"0" ≤ 0.5 V "1" ≥ 4.5 V			
nominal / max. load	2 TTL-gates or 15 pF / 10 TTL-gates or 50 pF			
rise / fall time	≤ 10 ns on nominal load			
duty cycle	50 / 50 ± 20 % at Vcc / 2 (HCMOS) or 1.4 V (TTL) on nominal load			
start-up time	10 ms typ. at Vcc = 4.75 V			
storage temperature	-55° C to +125° C			
shock test	IEC 68-2-27 : 3 x 3 shocks 100 g, half-sine, 6 ms			
vibration test (sinewave)	IEC 68-2-6 : 10 Hz to 2000 Hz / 20 g / 3 axes			
package	n° 55: hermetically sealed DIL (4 gold plated pins)			
marking	CQE + date code + reference			
ordering information	reference + frequency + pulling range + temperature stability example : QEV 14-KH 30.000 MHz 100HQ20			

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

Linear VCXO in DIL package

TYPE QEV 55-AH

Applications

These VCXO's are particularly aimed at the civil and military communication market.

They are designed to operate over the temperature range of -40° C to +85° C. The resonator plate has a 3-point mounting system, thereby offering an excellent resistance to shock and vibration.

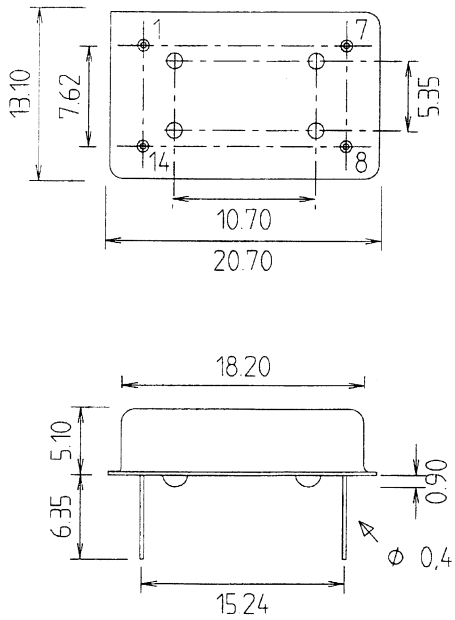
Features

- Frequency: **1 MHz to 41 MHz**
- Temperature range: **-40° C to +85° C**
- Pulling range: **> ±75 ppm up to > ±150 ppm**
- **HCMOS** output
- Linearity better than ± 10 % (option L)
- Supply voltage: **5 V**

Important

Always apply supply voltage ***before*** inputting any signal on pin 1 (**enable/disable**)

Package



Package n° 55

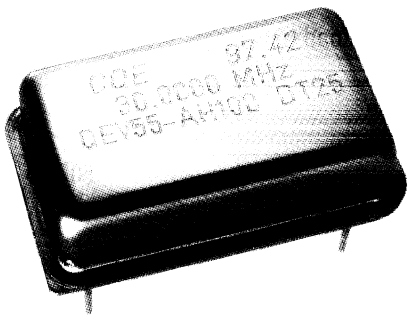
Pad connections

1 : control voltage

7 : GND

8 : output

14 : + 5 V



VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

Linear VCXO in DIL package

type	QEV 55-AH			
frequency range	1 MHz to 10 MHz	10 MHz to 20 MHz	20 MHz to 30 MHz	30 MHz to 41 MHz
pulling range relative to F(+25° C)	≥± 75 or ≥± 100 or ≥± 150 ppm (if no option L) ≥± 75 or ≥± 100 ppm (with option L)		≥± 75 or ≥± 100 ppm (up to 35 MHz only if option L)	
linearity	better than ± 10 %, law of least squares (valid for option L only, and from 1 MHz to 35 MHz)			
control voltage	0.5 V to 4.5 V, centre value at 2.5 V (Z ≥ 10 kΩ, positive slope)			
calibration tolerance	± 20 ppm (+ 25° C ± 2° C), control voltage 2.5 V ± 5 mV, Vcc = 5 V ± 50 mV, nominal load)			
frequency stability vs. temperature relative to F (+25° C)	code LQ ..... 0 ° C to +70 ° C ..... ≤± 15 or ± 25 or ± 50 ppm code HQ .....-20 ° C to +70 ° C ..... ≤± 20 or ± 40 ppm code DT .....-40 ° C to +85 ° C ..... ≤± 25 or ± 50 ppm other temperature ranges and stabilities available			
ageing (storage 0° C to +50° C)	≤ ± 5 ppm 1st year ≤ ± 10 ppm over 10 years			
frequency stability vs. other factors	± 6 ppm with 5 V ± 5 % voltage change ± 2 ppm with nominal load change ± 10 %			
supply voltage	5 V ± 5 %			
input current without load at +25° C ± 2° C	≤ 10 mA	≤ 15 mA	≤ 20 mA	≤ 30 mA
output levels (nom. load)	"0" ≤ 0.5 V "1" ≥ 4.5 V			
nominal load	2 TTL-LS or 15 pF			
maximal load	10 TTL-LS or 50 pF			
rise / fall time	≤ 10 ns on nominal load			
duty cycle	50 / 50 ± 20 % at Vcc/2 (HCMOS) or 1.4 V (TTL)			
start-up time	10 ms typ. at Vcc = 4.75 V			
storage temperature	-55 ° C at +125 ° C			
shock test	IEC 68-2-27: 3 x 3 shocks 100 g, half-sine, 6 ms			
vibration test (sinewave)	IEC 68-2-6: 10 Hz to 2000 Hz / 20 g / 3 axes			
option	code L: pulling linearity better than ± 10 % (pulling range ≤ ± 100 ppm and F ≤ 35 MHz)			
package	n° 55: hermetically sealed DIL (4 gold plated pins)			
marking	CQE + date code + reference			
ordering information	reference + option code + frequency + pulling range + temperature stability example : QEV 55-AHL 30.000 MHz 100HQ20			

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

VCXO in DIL package for military applications

TYPE QEV 49-BH and QEV 55-BH

Applications

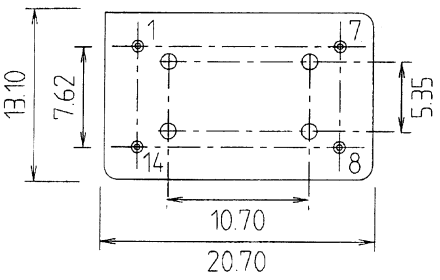
This oscillators **QEV 49-BH** and **QEV 55-BH** are in intended for military airborne and space applications.

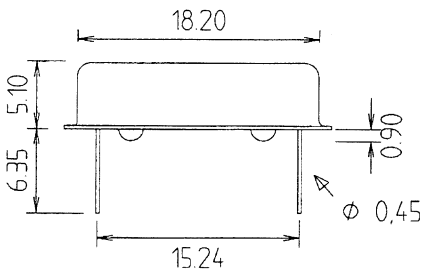
They are designed to operate at operating temperatures up to -55° C to +125° C and withstand tough mecanical environment.

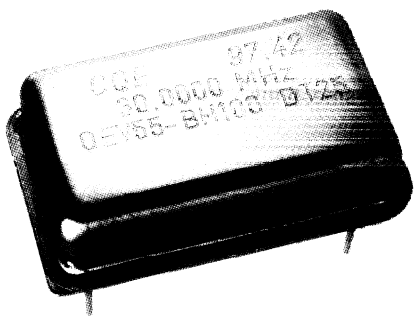
Features

- Frequency: **14 MHz to 36 MHz**
- Temperature range: **-55° C to +125° C**
- Pulling range: ≥ **± 75 ppm up to** ≥ **± 100 ppm**
- HCMOS output
- Supply voltage: **5 V**

Package



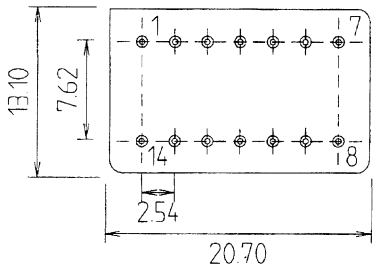


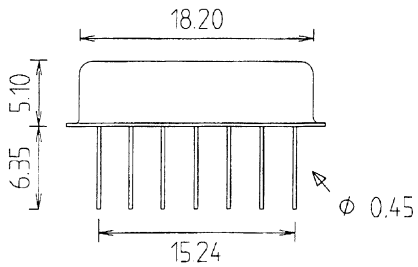


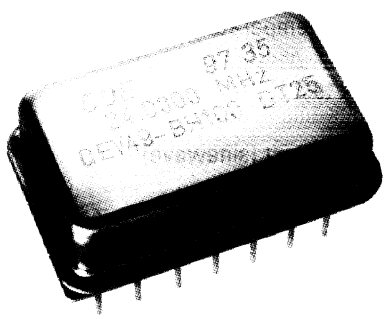
Package n° 55

Pad connections

1	= Control voltage
2 to 6	= N.C.
9 to 13	= N.C.
7	= GND
8	= Output
14	= + 5 V







Package n° 49

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VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

VCXO in DIL package for military applications

type	QEV 49-BH (14 pins) and QEV 55-BH (4 pins)
frequency range	14 MHz to 36 MHz
pulling range relative to F (+25° C)	≥ ± 75 ppm or ≥ ± 100 ppm / > ± 75 ppm (temperature range from -55° C to +125 ° C)
control voltage	0.5 V to 4.5 V, centre value at 2.5 V (Z > 10 kΩ, positive slope)
calibration tolerance	± 20 ppm (+25° C / ± 2° C), control voltage at 2.5 V / ± 5 mV Vcc = 5 V ± 50 mV, nominal load
frequency stability vs. temperature relative to F (+25° C) other temperature ranges and stabilities available	code LQ... 0° C to + 70° C... ≤ ± 15 ppm or ≤ ± 25 or ≤ ± 50 ppm code HQ... -20° C to + 70° C... ≤ ± 25 or ≤ 50 ppm code DT... -40° C to + 85° C... ≤ ± 25 or ≤ 50 ppm code AY... -55° C to +125° C... ≤ ± 50 ppm or ≤ ± 100 ppm
ageing at 25° C	≤ ± 3 ppm / year
frequency stability vs. other factors	± 6 ppm with 5 V ± 5 % voltage change ± 2 ppm with nominal load change ± 10 %
supply voltage	5 V ± 5 %
input current without load at +25° C ± 2° C	≤ 30 mA / ≤ 40 mA (temperature range -55° C to +125° C)
output levels	"0" < 0.5 V / "1" > 4.5 V
nominal / max. load	2 TTL-gates or 15 pF / 10 TTL-gates or 50 pF
rise / fall time	≤ 10 ns on nominal load
duty cycle	50 / 50 ± 20 % at Vcc / 2 V (HCMOS)
start-up time	10 ms typ. at Vcc = 4.75 V
storage temperature	-65° C to +85° C
shock test	IEC 68-2-27 : 3 x 3 shocks 100 g, half-sine, 6 ms
vibration test (sinewave)	IEC 68-2-6 : 10 Hz to 2000 Hz / 10 g / 3 axes
package	n° 55: DIL package (4 pins) n° 49 / DIL package (14 pins)
marking	CQE + date code + reference
ordering information	reference+ option code + frequency + pulling range + temperature stability example : QEV 49-BH 25.000 MHz 100LQ15

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

High frequency VCXO in DIL package

TEKELEC TEMEX

TYPE QEV 55-AT

Applications

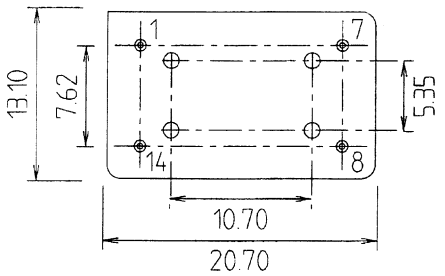
This range of oscillators is intended for civil applications.

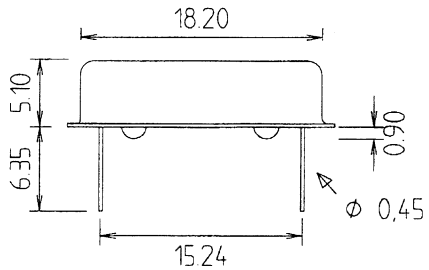
This device uses **Phase Locked Loop (PLL)** techniques. It uses a standard fundamental mode crystal to produce output clocks up to 160 MHz.

Features

- Output clock frequencies **up to 160 MHz**
- Compatible with **X 86 and 680 XO CPUs**
- Duty cycle of **47.5 / 52.5 up to 80 MHz**
- Duty cycle of **45 / 50 up to 160 MHz**
- **25 mA** drive capability at TTL levels

Package





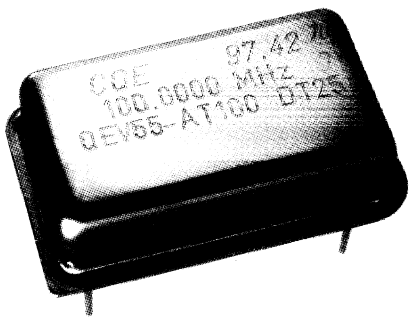
Pad connections

1 : Voltage control

2 : GND

3 : HF output

4 : + 5 V



Package n° 55

SALES OFFICES WEB SITE: http://www.tekelec-temex.com

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VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

High frequency VCXO in DIL package

type	QEV 55-AT	
frequency range	50 MHz to 100 MHz	100 MHz to 160 MHz
pulling range relative to F (+25° C)	≥ ± 75 ppm ; ≥ ± 100 ppm or ≥ ± 150 ppm	≥ ± 50 ppm ; ≥ ± 75 ppm or ≥ ± 100 ppm
control voltage	0 V to 5 V, centre value at 2.5 V (Z > 10 kΩ, positive slope)	
calibration tolerance	± 20 ppm (+25° C / ± 2° C)	
frequency stability vs. temperature relative to F (+25° C)	0° C to +70° C... ≤ ± 15 ppm -40° C to +85° C ... ≤ ± 25 ppm other temperature ranges and stabilities available	0° C to +70° C... ≤ ± 15 ppm
ageing at 25° C ± 2° C	< ± 3 ppm / year	
frequency stability vs. other factors	± 6 ppm with 5 V ± 5 % voltage change ± 2 ppm with nominal load change ± 10 %	
supply voltage	5 V ± 5 %	
PPL bandwidth	> 10 kHz	
absolute clock period jitter	deviation from mean < 200 ps typ.	
rise / fall time	≤ 1 ns typical	
output clock duty cycle	47.5 to 52.5 at Vcc = 1.5 V (up to 80 MHz) / 45 to 55 at Vcc = 1.5 V (up to 160 MHz)	
input current without load at +25° C ± 2° C	≤ 45 mA	
output levels	VoH > 2.4 V for IoH = + 25 mA VoL < 0.4 V for IoL = -25 mA (± 12 mA for -40° C to +85° C)	
storage temperature	-40° C to +85° C	
shock test	IEC 68-2-27 : 3 x 3 shocks 100 g, half-sine, 6 ms	
vibration test (sinewave)	IEC 68-2-6 : 10 Hz to 2000 Hz / 10 g / 3 axes	
package	n° 55 (hermetically seal DIL)	
marking	CQE + date code + reference	
ordering information	reference + frequency + pulling range + temperature stability example : QEV 55-AT 60.000 MHz 100LQ15	

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

ACMOS high frequency VCXO

TYPE QEV 51-KH

Applications

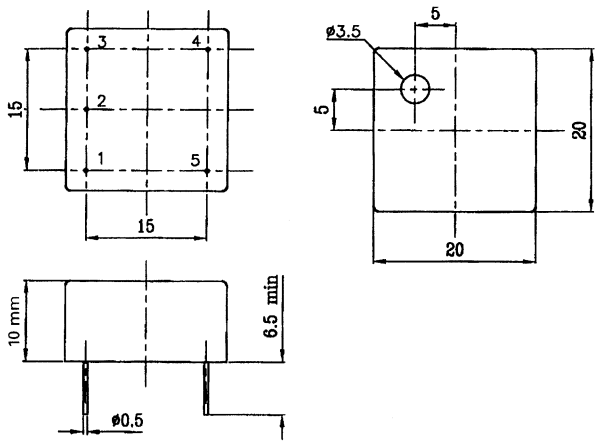
These VCXO's are particularly aimed at the civil and military communication market.

They are designed to operate over the temperature range of -40° C to +85° C.

Features

- Frequency: **14 MHz to 120 MHz**
- Temperature range: **-40° C to +85° C**
- Pulling range **up to 100 ppm**
- **ACMOS** output
- Output current: **±24 mA**

Package



Package n° 51

Pad connections

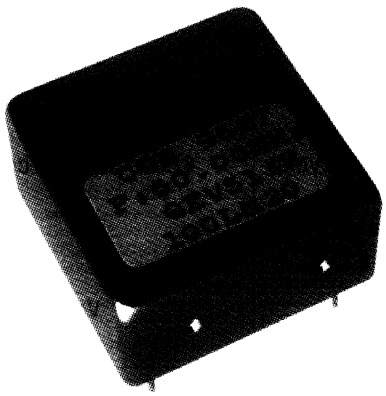
1 : + 5 V

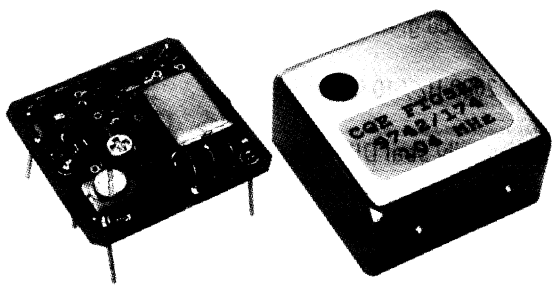
2 : HF output

3 : GND

4 : GND

5 : Voltage control





VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

ACMOS high frequency VCXO

type	QEV 51-KH	
frequency range	14 MHz to 70 MHz	70 MHz to 120 MHz
pulling range relative to F (+25° C)	≥ ± 50 ppm or ≥ ± 75 ppm or ≤ ± 100 ppm	
control voltage	0 V to 5 V, centre value at 2.5 V (Z ≥ 10 kΩ, positive slope)	
calibration tolerance	± 10 ppm (+ 25° C ± 2° C), control voltage 2.5 V ± 5 mV, Vcc = 5 V ± 50 mV, nominal load)	
frequency stability vs. temperature relative to F (+25° C)	code LQ... 0°C to +70°C ≤ ±15 or ±20 ppm code HQ...-20°C to +70°C ≤ ±15 or ±25 or ±40 ppm code DT...-40°C to +85°C ≤ ±25 or ±40 or ±50 ppm	code LQ... 0°C to +70°C ≤ ±15 or ±20 ppm
	other temperature ranges and stabilities available	
ageing (storage 0° C to +50° C)	≤ ± 3 ppm / year	
frequency stability vs. other factors	± 3 ppm with 5 V ± 5 % voltage change ± 2 ppm with nominal load change ± 10 %	
supply voltage	5 V ± 0.5 %	
input current without load at +25° C ± 2° C	≤ 35 mA	≤ 50 mA
output levels (nom. load)	"0" ≤ 0.5 V "1" ≥ 4.5 V	
sub-harmonic	-25 dBc	
nominal output current	± 16 mA	
maximal output current	± 24 mA	
rise / fall time	≤ 5 ns on nominal load	
duty cycle	50 / 50 ± 20 % at Vcc / 2 (HCMOS)	
storage temperature	-55° C to +105° C	
shock test	IEC 68-2-27 : 3 x 3 shocks 100 g, half-sine, 6 ms	
vibration test (sinewave)	IEC 68-2-6 : 10 Hz to 2000 Hz / 20 g / 3 axes	
package	n° 51: (20 x 20 mm)	
marking	CQE + date code + reference	
ordering information	reference + frequency + pulling range + temperature stability example : QEV 51-KH 30.000 MHz 100HQ20	

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

Sine high frequency VCXO

TYPE QEV 51-KO

Applications

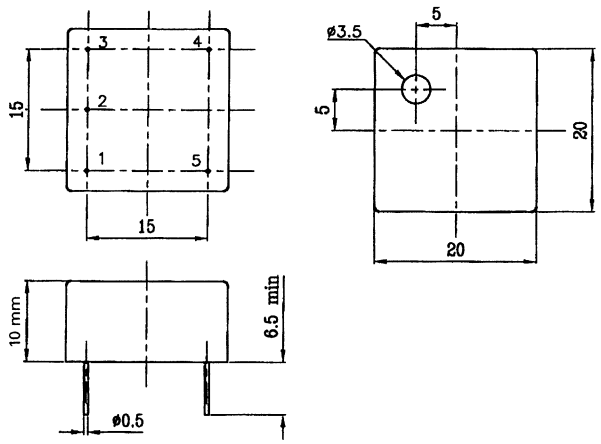
These VCXO's are particularly aimed at civil and military communication market.

They are designed to operate over the temperature range of -40° C to +85° C.

Features

- Frequency: **14 MHz to 200 MHz**
- Temperature range: **-40° C to +85° C**
- Pulling range: **100 ppm up to 150 MHz**
  75 ppm above
- **Sine** output
- Output levels: **> 0 dBm / 50 Ω**
- Supply voltage: **5 V**

Package



Package n° 51

Pad connections

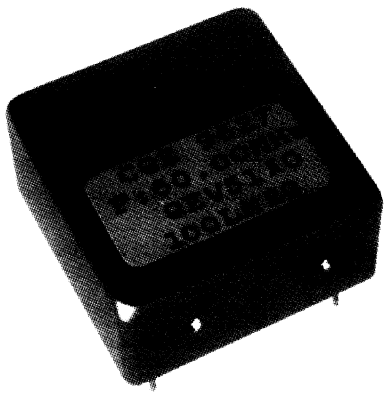
1 : + 5 V

2 : HF output

3 : GND

4 : GND

5 : Voltage control



VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

Sine high frequency VCXO

type	QEV 51-K0	
frequency range	14 MHz to 150 MHz	150 MHz to 200 MHz
pulling range relative to F (+25° C)	≥ ± 50 ppm or ≥ ± 75 ppm or ≥ ± 100 ppm	≥± 50 ppm or ≥ ± 75 ppm
control voltage	0 V to 5 V, centre value at 2.5 V (Z > 10 kΩ, positive slope)	
calibration tolerance	± 10 ppm (+ 25° C ± 2° C), control voltage 2.5 V ± 5 mV, Vcc = 5 V ± 50 mV, nominal load)	
frequency stability vs. temperature relative to F (+25° C)	code LQ... 0°C to +70°C ≤ ±15 or ±20 ppm code HQ...-20°C to +70°C ≤ ±15 or ±25 or ±40 ppm code DT...-40°C to +85°C ≤ ±25 or ±40 or ±50 ppm	code LQ... 0°C to +70°C ≤ ±15 or ±20 ppm
	other temperature ranges and stabilities available	
ageing (storage 0° C to +50° C)	≤ ± 3 ppm / year	
frequency stability vs. other factors	± 5 ppm with 5 V ± 5 % voltage change ± 0.5 ppm with nominal load change 50 Ω 10 %	
supply voltage	5 V ± 0.5 V	
input current without load at +25° C ± 2° C	≤ 35 mA	≤ 45 mA
output levels (nom. load)	≥ 0dBm / 50 Ω	
harmonic sub-harmonic	25 dBc	
spurious	85 dBc	
storage temperature	-55° C to +105° C	
shock test	IEC 68-2-27 : 3 x 3 shocks 100 g, half-sine, 6 ms	
vibration test (sinewave)	IEC 68-2-6 : 10 Hz to 2000 Hz / 20 g / 3 axes	
package	n° 51: (20 x 20 mm)	
marking	CQE + date code + reference	
ordering information	reference + frequency + pulling range + temperature stability example : QEV 51-K0 30.000 MHz 100HQ20	

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

Sine high frequency VCXO

TYPE QEV 67-AO

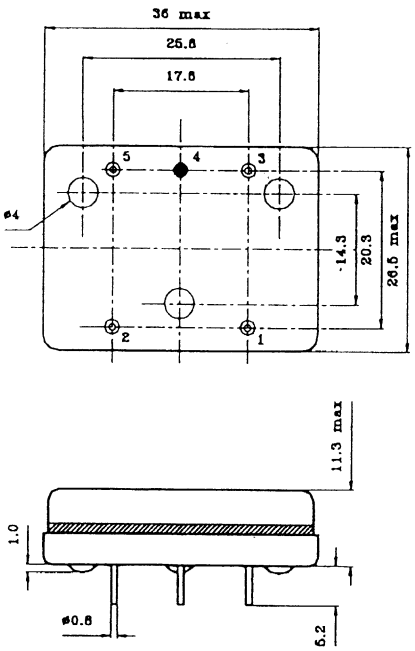
Applications

These VCXO's are particularly aimed at the civil communication market.

Features

- Frequency: **10 MHz to 200 MHz**
- Temperature range: **0° C to +70° C**
- Pulling range: **± 40 ppm**
- Bandwidth at ±3 dB: **> 30 kHz**
- **Sine** output
- Supply voltage: **5 V**

Package



Package n° 67

Pad connections

1 : Voltage control

2 : HF output

3 : Power supply

4 : GND

5 : N.C.

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VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

Sine high frequency VCXO

reference	QEV 67-AO		
frequency range	10 MHz to 30 MHz	30 MHz to 90 MHz	90 MHz to 200 MHz
pulling range relative to F (+25° C)	≥ ± 40 ppm		
control voltage	0 V to 5 V, centre value at 2.5 V (Z > 10 kΩ, positive slope)		
calibration tolerance	± 10 ppm (+25° C ± 2° C) control voltage 2.5 V ± 5 mV, Vcc = 5 V ± 50 mV, nominal load		
frequency stability vs. temperature relative to F (+25° C)	code LQ...0° C to +70° C... ≤ ± 15 or ± 25 ppm other temperature ranges and stabilities available		
bandwidth ± 3 dB	≥ 30 kHz		
phase noise at 1 kHz	≤ 145 dBc/Hz	≤ -135 dBc/Hz	≤ -125 dBc/Hz
ageing storage 0° C to +50° C)	≤ ± 1 ppm / year		
frequency stability vs. other factors	± 1 ppm with 5 V ± 5 % voltage change ± 2 ppm with nominal load change 50 Ω ± 10 %		
supply voltage	5 V ± 5 %		
input current without load at +25° C ± 2 %	≤ 30 ppm at V = 5.25 V	≤ 40 ppm at V = 5.25 V	
output levels (nom. load)	0.6 V ≤ Vpp ≤ 0.9 V		
harmonic sub-harmonic	≥ -35 dBc		≥ -30 dBc
spurious	≥ -60 dBc		≥ -60 dBc
storage temperature	-40° C at +85° C		
shock test	IEC 68-2-27: 3 x 3 shocks 100 g, half-sine, 6 ms		
vibration test (sinewave)	IEC 68-2-6; 10 Hz to 2000 Hz / 10 g / 3 axes		
package	n° 67 (36 x 26.5 x 11.3 mm)		
marking	CQE + date code + reference		
ordering information	type + frequency + pulling range + temperature stability example: QEV 67-AO 30.000 MHz 100HQ20		

VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

SINE high frequency VCXO

TYPE QEV 63-AO

Applications

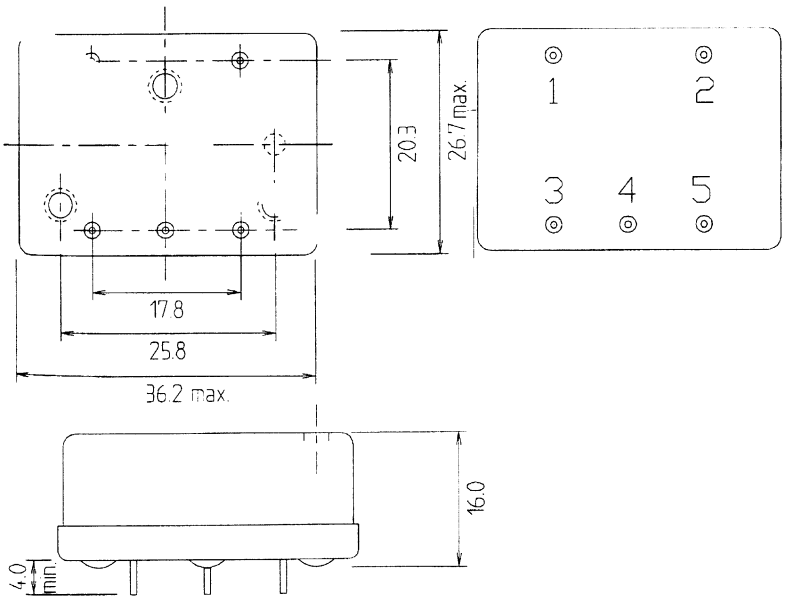
These VCXO's are well suited to civilian telecommunications like ATM technique involving high frequency data transfer up to 155 Mb/s.

For higher data rates, please contact our sales office, since we are developing new products to operate at 622 Mb/s.

Features

- Frequency: **139.264 MHz or 155.520 MHz**
- Pulling range: **> ±42 ppm**
- Frequency control voltage: **-3.5 V to +3.5 V**
- **Sine** output
- Linearity better than **±20 %**
- Frequency stability: **better than 10 ppm**
- Supply voltage: **5 V / 30 mA**

Package



Package n° 63

Pad connections

1 : + 5 V supply

2 : output

3 : GND

4 : Control input

5 : N.C.

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VOLTAGE-CONTROLLED CRYSTAL OSCILLATORS (VCXO)

SINE high frequency VCXO

type	QEV 63-AO
nominal frequency	139.264 MHz or 155.520 MHz (other values on request)
frequency pulling	≥ ± 42 ppm
frequency control voltage	-3.5 V to + 3.5 V
control signal input bandwidth	50 kHz min. at -3 dB
linearity	better than ± 20 % (law of least squares)
frequency adjustment	adjustment range: ≥ 10 ppm resolution better than 1 ppm by externally accessible internal potentiometer
frequency stability	better than ± 10 ppm from 0° C to +70° C (code LQ10) inclusive of power supply variation ± 5 % other values on request
ageing	≤ ± 10.10^{-6} over 10 years
supply voltage (current)	+5 V (30 mA max.)
output signal	sinewave, 0.9 V ≤ amplitude ≤ 1.5 V p-p on 75 Ω ± 10%
shock test	IEC 68-2-27: 100 g / 6 ms / half-sine
vibration test (sinewave)	IEC 68-2-6: test FC / 10 Hz to 55 Hz / 0.75 mm p-p or 10 g
storage temperature	-40° C to +70° C
package	N° 63
marking	CQE + reference + frequency + date code
ordering information	frequency + pulling range + frequency stability example: QEV 63-AO 139.264 MHz 42LQ10

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS (TCXO)

Selection Guide

	Package	Temperature range up to	Frequency range	Output	Type	*PAGE*
T.C.X.O.	**SMD** ceramic package	-40°C to +85° C	9.6 MHz to 21 MHz	Sine output	**QEA 85-AO**	7-58
	SMD ceramic package	-40°C to +85° C	10 MHz to 25 MHz	Sine output Ultra low profile	**QEA 87-AO**	7-60
	Small package 20 x 20 mm	-40°C to +85° C	1 MHz to 110 MHz	Sine output	**QEA 51-AO**	7-62
	36 x 27 mm	-55°C to +105° C	1 MHz to 70 MHz	HCMOS output Supply voltage 5 V up to 15 V	**QEA 45-AH** **QEA 67-AH**	7-64
	51 x 27 mm	-55°C to +105° C	70 MHz to 150 MHz	Sine output Supply voltage 12 V	**QEA 80-AO**	7-68
	36 x 27 mm	-40°C to +85° C	1 MHz to 189 MHz	Sine output	**QEA 45-BO** **QEA 67-BO**	7-70
	36 x 27 mm	-40°C to +85° C	1 MHz to 150 MHz	HCMOS output	**QEA 45-CH** **QEA 67-CH**	7-72
	36 x 27 mm	-40°C to +85° C	4 Hz to 8 Hz	HCMOS output Low power	**QEA 45-BH**	7-74
D.T.C.X.O.	**36 x 27 mm**	-55°C to +105° C	100 kHz to 60 M Hz	HCMOS output High stability	**QED 45-AH** **QED 67-AH**	7-78
	36 x 27 mm	-55°C to +105° C	4 MHz to 60 MHz	Sine output low phase noise High stability	**QEA 45-AO** **QEA 67-AO**	7-76
M.C.X.O.	**41 x 41 mm**	-55°C to +105° C	10, 5 or 1 MHz	HCMOS output Low consumption	**QEM 77-AH**	7-80

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Family Selection guide

FREQUENCY RANGE	OUTPUT	HOLDER	MODEL	PAGE	CIVIL	INDUS-TRIAL	STD MILITARY	AIRBORNE MILITARY	SPATIAL
T.C.X.O. or V.T.C.X.O.									
9.6 MHz to 21 MHz	SINE	SMD	QEA 85-AO	7-58	X	X			
10 MHz to 25 MHz	SINE	SMD	QEA 87-AO	7-60	X	X			
1 MHz to 110 MHz	SINE	20 x 20 mm	QEA 51-AO	7-64	X	X	X		
1 MHz to 30 MHz	HCMOS/TTL	36 x 27 mm	QEA 45-AH	7-64	X	X			
1 MHz to 30 MHz	HCMOS/TTL	36 x 27 mm	QEA 67-AH	7-64	X	X			
4 MHz to 70 MHz	SINE	36 x 27 mm	QEA 45-AO	7-66	X	X			
4 MHz to 70 MHz	SINE	36 x 27 mm	QEA 67-AO	7-66	X	X			
70 MHz to 150 MHz	SINE	51 x 27 mm	QEA 80-AO	7-68	X	X	X		
1 MHz to 189 MHz	SINE	36 x 27 mm	QEA 45-BO	7-70	X	X	X	X	
1 MHz to 189 MHz	SINE	36 x 27 mm	QEA 67-BO	7-70	X	X	X	X	
1 MHz to 150 MHz	HCMOS/TTL	36 x 27 mm	QEA 45-CH	7-72	X	X	X	X	
1 MHz to 150 MHz	HCMOS/TTL	36 x 27 mm	QEA 67-CH	7-72	X	X	X	X	
4 Hz to 8 Hz	HCMOS/TTL	36 x 27 mm	QEA 45-BH	7-74	X	X	X	X	
D.T.C.X.O.									
4 MHz to 60 MHz	SINE	36 x 27 mm	QED 45-AO	7-76	X	X	X		
4 MHz to 60 MHz	SINE	36 x 27 mm	QED 67-AO	7-76	X	X	X		
100 MHz to 60 MHz	HCMOS/TTL	36 x 27 mm	QED 45-AH	7-78	X	X	X		
100 MHz to 60 MHz	HCMOS/TTL	36 x 27 mm	QED 67-AH	7-78	X	X	X		
M.C.X.O.									
10 MHz / 5 MHz / 1 MHz	LS TTL	41 x 41 mm	QEM 77-AH	7-80			X	X	X
To be advised	All	All	On specification		X	X	X	X	

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

SMD packaged TCXO or VCTCXO

TYPE QEA 85-AO

Applications

These oscillators featuring analogue temperature compensation offer an outstanding combination of good stability over a wide temperature range, low power consumption, very short start-up time and low phase noise. They are well suited to portable communication equipment, airborne telecommunication and navigation devices, synthetisers, etc.

ATTENTION

These oscillators are engineered to withstand without damage the mechanical environment according to the detailed specifications overleaf. However, extreme care should be taken in handling to prevent damage due to excessive shocks. This package cannot withstand IR reflow process and must be iron soldered. Immersion in a washing solution is forbidden.

Features

- Frequency: **9.6 MHz to 21 MHz**
- Temperature range up to **-40° C to +85° C**
- Frequency stability: ≤ **± 2 ppm**
- **Sine** output
- Max. input current: ≤ **± 1.5 mA**
- Supply voltage: **4 V or 5 V**
- **Low phase noise**
- **Frequency adjustment** by internal manual trimmer
- Voltage Control Range: **+0.5 Vdc to +4.5 Vdc in option**

Pad connections

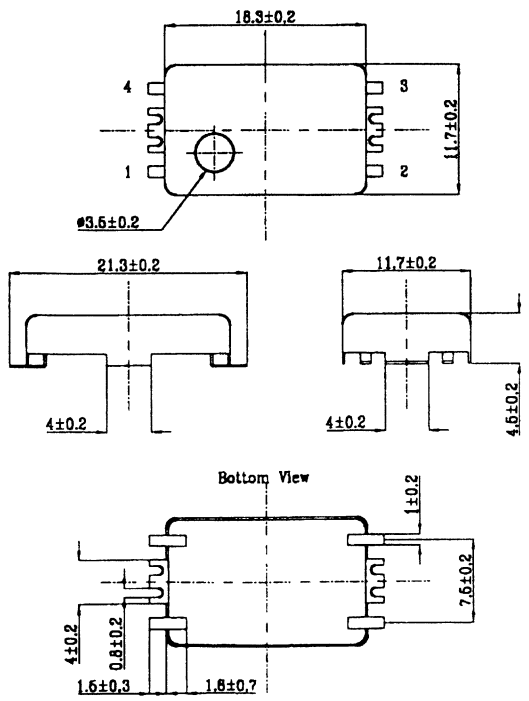
1 : N.C.or Vcont (Control voltage)

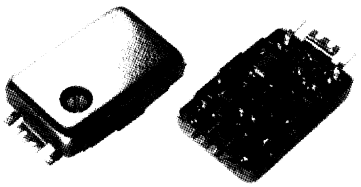
2 : GND

3 : HF output

4 : power supply +4 V or +5 V

Package





Package n° 85

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TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

SMD packaged TCXO or VCTCXO

reference	QEA 85-AO
frequency range	9.6 MHz to 21 MHz
frequency stability vs. temperature	code LM57..... $\leq \pm 5 \times 10^{-7}$ from 0° C to +50° C code FR16..... $\leq \pm 1 \times 10^{-6}$ from -30° C to +75° C code DT26 ..... $\leq \pm 2 \times 10^{-6}$ from -40° C to +85° C tightest tolerances avaialble on each temperature range
static temperature hysteresis	$\leq \pm 3 \times 10^{-7}$
long term stability	$\leq \pm 1 \times 10^{-6}$
short term stability	$\leq 1 \times 10^{-9}$ Allan variance for 1 second Tau
frequency stability vs. supply voltage change	$\leq \pm 2 \times 10^{-7}$ with voltage change ± 5 %
frequency stability vs. load change	$\leq \pm 2 \times 10^{-7}$ for 20 kΩ // 5 pF ± 10 %
supply voltage	**Option A**: 5 V ± 5 % **Option B**: 4 V ± 5 % **Option C**: 3.3 V ≤ 5 % **Option D**: 3 V ≤ 5 %
input current	≤ 1.5 mA
external load	20 kΩ // 5 pF (dc-cut)
output voltage	1.0 V p-p clipped sine
harmonics	-5 dBc max.
phase noise	1 Hz : -60 dBc/Hz 10 Hz : -90 dBc/Hz 100 Hz : -120 dBc/Hz 1 kHz : -135 dBc/Hz 10 kHz : -140 dBciHz 100 kHz : -140 dBc/Hz
frequency adjustment	≥ ± 3 ppm by internal manual trimmer
frequency control deviation sensitivity nom. control voltage control voltage range	**option: V** ± 3 to ± 15 ppm (function of temerature range and stability) 2.5 Vdc +0.5 Vdc to + 4.5 Vdc (port input impedance 100 kΩ min.)
storage temperature	-40° C to +85° C
humidity	90-95% r.h. / 40° C / 48 hrs
shock test	50 g / 10 ms / 3 axes / half-sine
vibrations (sinewave)	30 Hz to 1500 Hz / 10 g / 6 hours
thermal cycling	-40° C for 30 min. then 85° C for 30 min. / 120 cycles (temperature change rate 2° C / min)
holder	n° 85 (18 x 12 x 4.5 mm)
marking	CQE + date code + reference
ordering information	reference + option + frequency + stability code + frequency control range example: QEA85-AOV 9.6 MHz LM57, control range 5 ppm

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

SMD packaged TCXO or VCTCXO

TYPE QEA 87-AO

Applications

These oscillators use SMD package able to withstand IR reflow process. They offer an **ultra low profile** ideal for PCMCIA applications, with low hysteresis, low power consumption.

These oscillators are supplied on tape and reel.

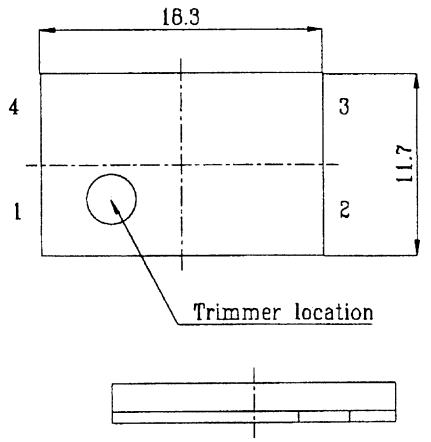
ATTENTION

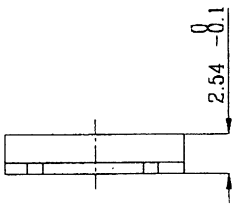
These oscillators are engineered to withstand without damage the mechanical environment according to the detailed specifications overleaf. However, extreme care should be taken in handling to prevent damage due to excessive shocks. Immersion in a washing solution is forbidden.

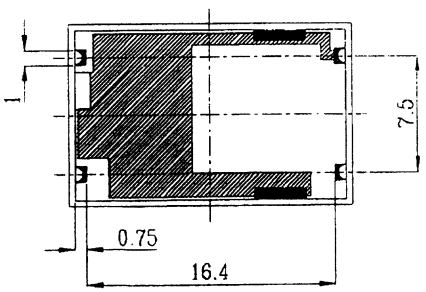
Features

- Frequency: **10 MHz to 25 MHz**
- Temperature range up to **-40° C to +85° C**
- Frequency stability: ≤ **± 1 ppm**
- **Sine** output
- Max. input current: ≤ **± 1.5 mA**
- Supply voltage: **5 V**
- **Low phase noise**
- **Frequency adjustment** by internal manual trimmer
- Voltage Control Range: **+0.5 Vdc to +4.5 Vdc in option**

Package







Ground Plane

Pad Area

Pad connections

1 : N.C.or Vcont (Control voltage)

2 : GND

3 : HF output

4 : power supply +5 V

Package n° 87

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TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

SMD packaged TCXO or VCTCXO

reference	QEA 87-AO
frequency range	10 MHz to 25 MHz
frequency stability vs. temperature relative to F (+25° C)	code FR16 . . . . . ≤ ± 1 x 10^{-6} from -30° C to +75° C code DT157 . . . . ≤ ± 1.5 x 10^{-6} from -40° C to +85° C (tightest tolerances available on each temperature range)
static temperature hysteresis	≤ ± 3 x 10^{-7}
long term stability	≤ ± 1 x 10^{-6}
short term stability	≤ ± 1 x 10^{-9} Allan variance for 1 second Tau
frequency stability vs. supply voltage change	≤ ± 1 x 10^{-7} with voltage change 5 %
frequency stability vs. load change	≤ ± 2 x 10^{-7} for 20 kΩ // 5 pF ±10 %
supply voltage	**Option A:** 5 V ± 5 % **Option B:** 3 V ± 5 % **Option C:** 3.3 V ≤ 5 % **OptionD:** 3 V ≤ 5 %
input current	≤ 1.5 mA
external load	20 kΩ // 5 pF (dc-cut)
output voltage	1.0 V p-p clipped sine min.
harmonics	-5 dBc max.
phase noise	1 Hz : -60 dBc 10 Hz : -90 dBc 100 Hz : -120 dBc 1 kHz : -135 dBc 10 kHz : -140 dBc 100 kHz : -140 dBc
frequency adjustment	≥ ± 3 ppm by internal manual trimmer
frequency control deviation sensitivity nom. control voltage control voltage range	**option: V** ± 3 to ± 15 ppm (function of temperature range and stability) 2.5 Vdc +0.5 Vdc to + 4.5 Vdc (port input impedance 100 kΩ min.)
storage temperature	-40° C to +85° C
humidity	90-95% r.h. / 40° C / 48 hrs
shocks test	50 g / 10 ms / 3 axes / half-sine
vibrations (sinewave)	30 Hz to 1500 Hz / 10 g / 6 hours
thermal cycling	-40° C for 30 min. then 85° C for 30 min. / 120 cycles (temperature change rate 2° C / min)
package	n° 87: (18 x 12 x 2.5 mm)
marking	CQE + date code + reference
ordering information	reference+ option + frequency.+ stability code, + frequency control range example: QEA 87-AOV 10 MHz FR16, control range ± 5 ppm

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Very high frequency TCXO or VCTCXO

TEKELEC TEMEX

TYPE QEA 51-AO

Applications

These oscillators featuring analogue temperature compensation offer an outstanding combination very high frequency, good stability over a wide temperature range, low power consumption short start-up time and low phase noise.

They are well suited to portable communication equipments, airborne telecommunications and navigation devices, synthetisers...

Features

- Frequency: **1 MHz to 110 MHz**
- Temperature range up to: **-40° C to +85° C**
- Long term stability: ≤ ± **1 ppm**
- Supply voltage: **5 V**
- Floor phase noise: **-140 dBc / Hz**
- **Sine** output
- **Small** footprint
- Voltage Control Range: **+0.5 Vdc to +4.5 Vdc in option**

Associated models

The type **QEA 45-BO** gives comparable results on a higher frequency range between **1 MHz to 189 MHz.**

Pad connections

1 : Power supply + 5 V

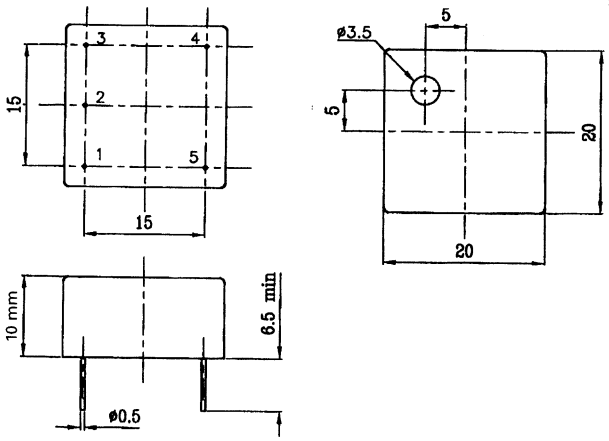
2 : HF output

3 : GND

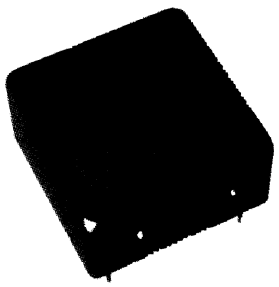
4 : GND

5 : N.C. or voltage control

Package



: n° 51



TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Very high frequency TCXO or VCTCXO

reference	QEA 51-AO	
frequency range	1 MHz to 21 MHz	21 MHz to 110 MHz
frequency stability vs. temperature	code LM57..... $\leq \pm 5 \times 10^{-7}$ from 0° C to +50° C code FR16..... $\leq \pm 1 \times 10^{-6}$ from -30° C to +75° C code DT26..... $\leq \pm 2 \times 10^{-6}$ from -40° C to +85° C other temperature ranges and stabilities available	
static temperature hysteresis	$\leq \pm 3 \times 10^{-7}$	
long term stability	$\leq \pm 1 \times 10^{-6}$	
short term stability	$\leq 1 \times 10^{-9}$ Allan variance for 1 second Tau	
frequency stability vs. supply voltage change	$\leq \pm 2 \times 10^{-7}$ with voltage change ± 10 %	
supply voltage	5 V ± 5 %	
input current	≤ 30 mA	
external load	50 Ω	
output voltage	0 dBm / 50 Ω	
harmonics	-25 dBc max.	
phase noise	10 Hz : -90 dBc/Hz 100 Hz : -120 dBc/Hz 10 kHz : -140 dBc/Hz	10 Hz : -76 dBc/Hz 100 Hz : -106 dBciHz 10 kHz : -126 dBc/Hz
frequency adjustment	≥ ± 3 ppm by internal manual trimmer	
frequency control deviation sensitivity nom. control voltage control voltage range	**option: V** ± 3 to ± 15 ppm (function of temperature range and stability) 2.5 Vdc +0.5 Vdc to + 4.5 Vdc (port input impedance 100 kΩ min.)	
storage temperature	-55° C to +105° C	
humidity	90 - 95 % r.h. / 40° C / 48 hrs	
shock test	50 g / 6 ms / 3 axes / half-sine	
vibrations (sinewave)	30 Hz to 1500 Hz / 10 g / 6 hours	
thermal cycling	-40° C for 30 min. then 85° C for 30 min. / 120 cycles (temperature change rate 2° C / min)	
package	n° 51: (20 x 20 mm)	
marking	CQE + date code + reference	
ordering information	reference + option + frequency + stability code + frequency control range example: QEA51-AOV 60.0000 MHz LM57,control range ± 5 ppm	

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

TCXO or VCTCXO with HCMOS output

TYPES QEA 45-AH and QEA 67-AH

Applications

These oscillators featuring analogue temperature compensation offer an outstanding combination of good stability over a wide temperature range, low power consumption, very short start-up time and low phase noise.
They are well suited to portable communication equipment, airborne telecommunication and navigation devices, synthetisers, etc...

Features

- Frequency range: **1 MHz to 70 MHz**
- Temperature range up to **-55° C to +105° C**
- Ageing: ≤ **±1 ppm / year**
- Supply voltage: **5 V to 15 V**
- **HCMOS** compatible output

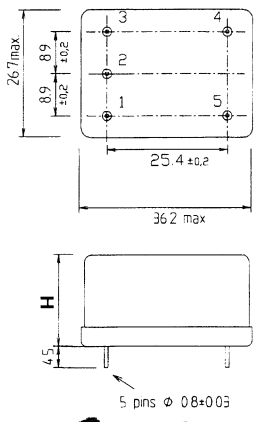
Associated models

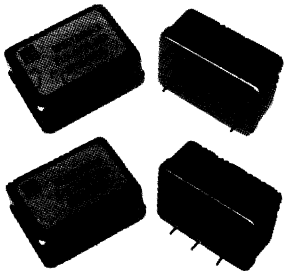
The types **QEA 45-AO and QEA 67-AO** give comparable results on a higher frequency **up to 70 MHz.**
The type **QEA 80-AO** gives comparable results but on a higher frequency range between **to 70 MHz and 150 MHz.**
From **4 Hz to 8 Hz**,the type **QEA 45-BH** gives very similar results but with a unique low power requirement (typically 1.75 mW at 3.3 V).

Package

Package n° 45 / option P

1 - Adjustement potentiometer (wiper)
2 - Adjustement potentiometer (track)
3 - Power supply
4 - HF output
5 - Mechanical & electrical GND Adjustement potentiometer (track)





Package n° 45

Pad connections

(option O)

1 - Adjustement resistor
2 - Adjustement resistor
3 - Power supply
4 - HF output
5 - mechanical & electrical GND

Package n° 67 / option V

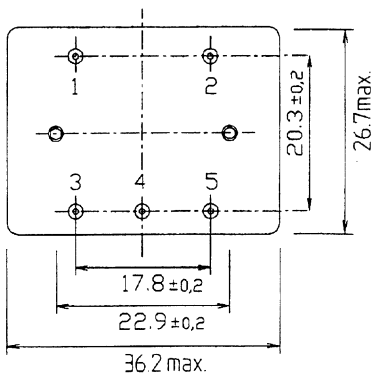
1 - Mechanical & electrical GND
2 - Power supply
3 - HF output
4 - Control output
5 - N.C.

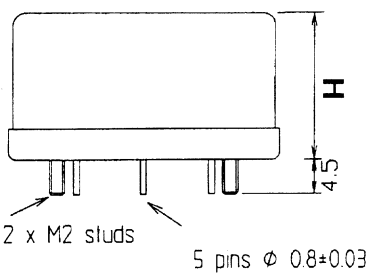
Package n° 45 / option V

1 - Pulling voltage
2 - N.C.
3 - Power supply
4 - HF output
5 - Mechanical & electrical GND

Package n° 67 / option P

1 - Mechanical & electrical GND Adjustement potentiometer (track)
2 - Power supply
3 - HF output
4 - Adjustement potentiometer (wiper)
5 - Potentiometer track (reference voltage)





Package n° 67

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TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

TCXO or VCTCXO with HCMOS output

reference	QEA 45-AH / QEA 67-AH	
frequency range	1 MHz to 30 MHz	30 MHz to 70 MHz
frequency stability vs. temperature (other temperature range and stabilities on request)	code LM57 ..... $\leq \pm 5 \times 10^{-7}$ from 0° C to +50° C code HQ16 ..... $\leq \pm 1 \times 10^{-6}$ from -20° C to +70° C code DT26 ..... $\leq \pm 2 \times 10^{-6}$ from -40° C to +85° C code AX56 ..... $\leq \pm 5 \times 10^{-6}$ from -55° C to +105° C	
long term stability	$\leq \pm 1 \times 10^{-8}$ /day $\leq \pm 2 \times 10^{-7}$ / month $\leq \pm 1 \times 10^{-6}$ / year	
frequency stability vs. supply voltage change	$\leq \pm 1 \times 10^{-7}$ with voltage change ± 5%	
frequency stability vs. load change	$\leq \pm 1 \times 10^{-7}$ from 1 to 2 TTL-gates or 10 to 20 pF (HCMOS)	
supply voltage	**option A**: 5 V ± 5% **option B**: 9 V ± 5%	**option C**: 12 V ± 5% **option D**: 15 V ± 5%
phase noise density	-85 dBc/Hz at 10 Hz -110 dBc/Hz at 100 Hz -135 dBc/Hz at 1 kHz	
input current	≤ 20 mA	≤ 40 mA
output levels	"0" ≤ 0.5V "1 " ≥ 4.5V	
maximal load	5 TTL-gates or 20 pF (HCMOS)	
duty cycle	F < 10MHz: 50/50 ± 10% F ≥ 10 MHz: 50 / 50 ± 20%	
rise / fall time	≤ 10 ns	
start-up time	10 ms typ.	
frequency adjustment	amplitude ≥ ± 5 ppm **option O**: external resistor 0 - 5 kΩ **option P**: external potentiometer or resistor 5 kΩ **option V**: external control voltage 0.5 V to 4.5 V	
storage temperature	-55° C to +105° C	
humidity	93% r.h. / 85° C / 56 days	
shock test	50 g / 11 ms / 3 axes / half-sine	
vibrations (sinewave)	30 Hz to 1500 Hz / 10 g / 6 hours	
package	n° 45 and n° 67, height ≤ 10.5 mm	n° 45 and n° 67, height ≤ 16 mm
marking	CQE + date code + reference	
ordering information	reference + option codes (power supply and frequency adjustment) + frequency + stability code example: QEA 45/67-AHBP 5.0000 MHz DT26	

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TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

TCXO or VTCXO with Sine output

TEKELEC TEMEX

TYPES QEA 45-AO and QEA 67-AO

Applications

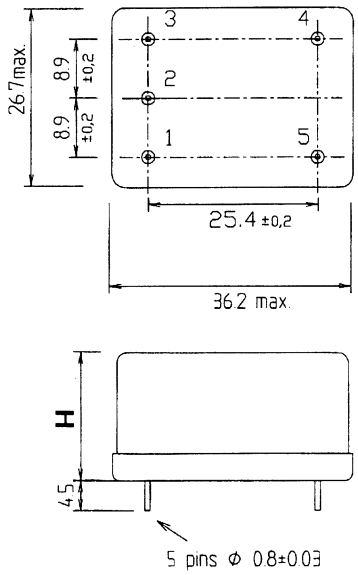
These oscillators featuring analogue temperature compensation offer an outstanding combination of good stability over a wide temperature range, low power consumption, very short start-up time and low phase noise.

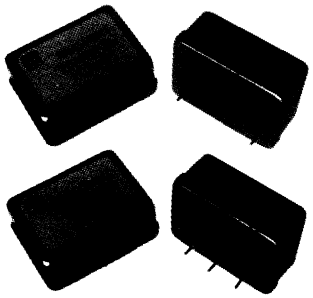
They are well suited to portable communication equipment, airborne telecommunication and navigation devices, synthetisers, etc...

Package

Package n° 45 / option P

1 - Adjustement potentiometer (wiper)
2 - Adjustement potentiometer (track)
3 - Power supply
4 - HF output
5 - Mechanical & electrical GND
Adjustement potentiometer (track)





Package n° 45

Associated models

The types **QEA 45-AH and QEA 67-AH** give comparable results on a lower frequency range **up to 30 MHz.**

The type **QEA 80-AO** gives comparable results on a higher frequency range between **70 MHz and 150 MHz.**
From **4 Hz to 8 Hz**, the type **QEA 45-BH** gives very similar results but with an unique low power requirement (typically 1.75 mW at 3.3 V).

Features

- Frequency range: **4 MHz to 70 MHz**
- Temperature range up to **-55° C to +105° C**
- Ageing: ≤ **±1 ppm / year**
- Supply voltage: from **5 V to 15 V**
- **Low phase noise**
- **Sine** output

Pad connections

(option O)

1 - Adjustement resistor
2 - Adjustement resistor
3 - Power supply
4 - HF output
5 - mechanical & electrical GND

Package n° 67 / option V

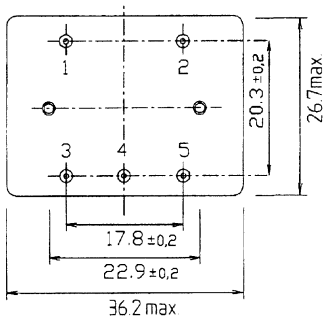
1 - Mechanical & electrical GND
2 - Power supply
3 - HF output
4 - Control output
5 - N.C.

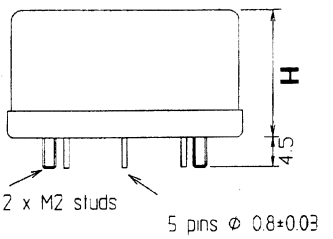
Package n° 45 / option V

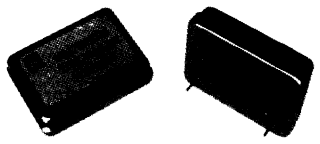
1 - Pulling voltage
2 - N.C.
3 - Power supply
4 - HF output
5 - Mechanical & electrical GND

Package n° 67 / option P

1 - Mechanical & electrical GND
Adjustement potentiometer (track)
2 - Power supply
3 - HF output
4 - Adjustement potentiometer (wiper)
5 - Potentiometer track
(reference voltage)







Package n° 67

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

TCXO or VTCXO with Sine output

reference	QEA 67-AO / QEA 45-AO	
frequency range	4 MHz to 30 MHz	30 MHz to 70 MHz
frequency stability vs. temperature (other temperature ranges and stabilities available)	code LM57 ..... ≤ ± 5 x 10^{-7} from 0° C to +50° C code HQ16 ..... ≤ ± 1 x 10^{-6} from -20° C to +70° C code DT26 ..... ≤ ± 2 x 10^{-6} from -40° C to +85° C code AX56 ..... ≤ ± 5 x 10^{-6} from -55° C to +105° C	
long term stability	≤ ± 1 x 10^{-8} / day ≤ ± 2 x 10^{-7} / month ≤ ± 1 x 10^{-6} 1st year	
frequency stability vs. supply voltage change	≤ ± 1 x 10^{-7} with voltage change ±5 %	
frequency stability vs. load change	≤ ± 1 x 10^{-7} for 50 Ω ± 10 %	
supply voltage	**option A**: 5 V ± 5% **option B**: 9 V ± 5% **option C**: 12 V ± 5% **option D**: 15 V ± 5%	
phase noise density	-85 dBc/Hz at 10 Hz -110 dBc/Hz at 100 Hz -135 dBc/Hz at 1 kHz	
input current	≤ 20 mA	
output levels	≥ 0 dBm / 50 Ω	
start-up time	10 ms typ.	
	amplitude ≥ ± 5 ppm	
frequency adjustment	**option O**: external resistor 0 - 5 kΩ **option P**: external potentiometer 5 kΩ **option V**: external control voltage 0.5 V to 4.5 V	
storage temperature	-55° C to + 105° C	
humidity	93 % r.h. / 85° C / 56 days	
shock test	50 g / 11 ms / 3 axes / half-sine	
vibrations (sinewave)	30 Hz to 1500 Hz / 10 g / 6 hours	
holder	n° 45 & 67, height ≤ 10.5 mm	n° 45& 67, height ≤ 16 mm
marking	CQE + date code + reference	
ordering information	reference + option codes (power supply and frequency adjustment) + frequency + stability code example: QEA 45/67-AOBP 45.0000 MHz DT26	

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TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

High frequency TCXO

TYPE QEA 80-AO

Applications

These oscillators use an analogue temperature compensation and offer an outstanding combination of good temperature stability over a wide temperature range, low power consumption and short start-up time.
They have a frequency range of 70 MHz to 150 MHz.
Furthermore, it is even possible to obtain special versions with frequencies up to 180 MHz.

Associated models

For frequencies lower than **60 MHz**, please refer to our **QEA 67-AH/AO**.
From **4 Hz to 8 Hz**, the type **QEA 45-BH** gives very similar results but with an unique low power requirement (typically 1.75 mW at 3.3 V).

Package

Pad connections

1 : GND

2 : power supply (+)

3 : HF output

4 : frequency adjustment

5 : frequency adjustment

Pad connections (Option O)

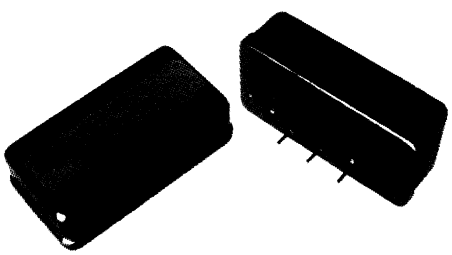
1 : GND / 0 V

2 : power supply (+)

3 : HF output

4 : frequency resistor

5 : adjustment resistor



Features

- Frequency range: **70 MHz to 150 MHz**
- Temperature range up to **-55° C to +105° C**
- Ageing: ≤ **± 1 ppm / year**
- Supply voltage: **12V**
- **Low phase noise**
- **Sine output**

Pad connections (Option P)

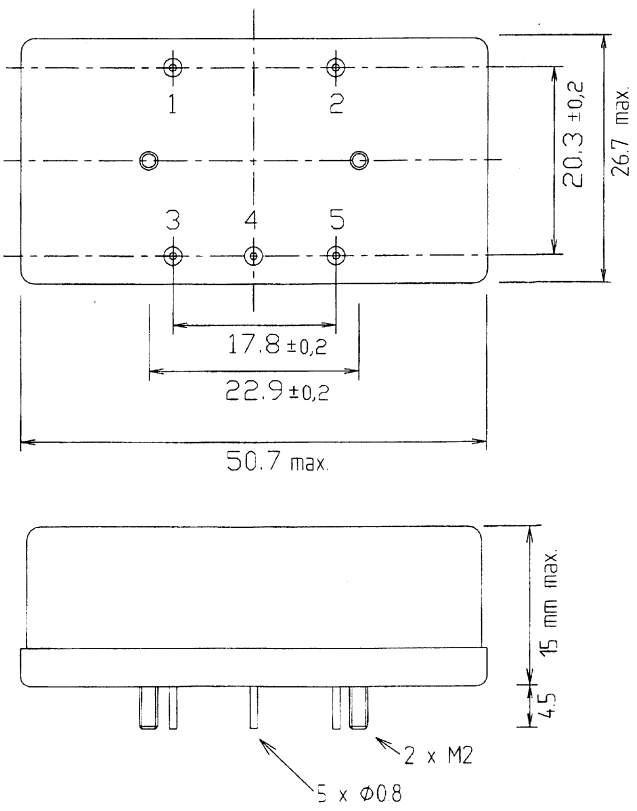
1 : GND / 0 V

2 : power supply (+)

3 : HF output

4 : adjustment potentiometer (wiper)

5 : potentiometer track (reference voltage)



Package n° 80

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

High frequencyTCXO

reference	QEA 80-AO
frequency range	70 MHz to 150 MHz
frequency stability (other stabilities on request)	code LM57 ..... $\leq \pm 5 \times 10^{-7}$ from 0° C to +50° C code HQ16 ..... $\leq \pm 1 \times 10^{-6}$ from -20° C to +70° C code DT26 ..... $\leq \pm 2 \times 10^{-6}$ from -40° C to +85° C code AX56 ..... $\leq \pm 5 \times 10^{-6}$ from -55° C to +105° C
long term stability	$\leq \pm 1 \times 10^{-8}$ / day $\leq \pm 2 \times 10^{-7}$ / month $\leq \pm 1 \times 10^{-6}$ / year
frequency stability vs. supply voltage change	$\leq \pm 1 \times 10^{-7}$ with voltage change 12 V ± 5 %
frequency stability vs. load change	$\leq \pm 1 \times 10^{-7}$ for 50 Ω ± 10 %
supply voltage	12 V ± 5 %
phase noise density at 100 MHz	-85 dBc/Hz at 10 Hz -110 dBc/Hz at 100 Hz -135 dBc/Hz at 1 kHz
input current	≤ 20 mA
output level	0 dBm / 50 Ω
load	50 Ω ± 10 %
start-up time	100 ms typ.
frequency adjustment	≥ ± 5 ppm **option O**: external resistor 5 kΩ **option P**: external potentiometer 5 kΩ **option V**: external control voltage
storage temperature	-55° C to + 105° C
humidity	93 % r.h. / 85° C / 56 days
shocks	50 g / 11 ms / 3 axes / half-sine
vibrations (si newave)	10 Hz to 500 Hz / 20 g / 2 hours
package	n° 80
ordering information	reference + frequency adjustment option + frequency + stability code example: QEA80-AO 92,000000 MHz DT26

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Very high frequency TCXO with Sine output

TEKELEC TEMEX

TYPE QEA 45-BO and QEA 67-BO

Applications

These oscillators featuring analogue temperature compensation offer an outstanding combination very high frequency, good stability over a wide temperature range, low power consumption, short start-up time and low phase noise.
They are well suited to portable communication equipment, airborne telecommunication and navigation devices, synthetisers...

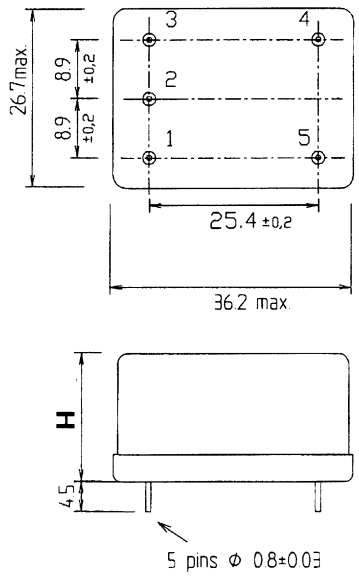
Features

- Frequency range: **1 MHz to 189 MHz**
- Temperature range: **-40° C to +85° C**
- Long tem stability: ≤ **± 1.10^{-6}**
- Supply voltage: **5 V**
- Low phase noise: **-135 dBc / Hz at 1 kHz**
- **Sine** output
- Voltage Control Range (in option) **+0.5 Vdc to 4.5 Vdc**

Package

Package n° 45 / option V

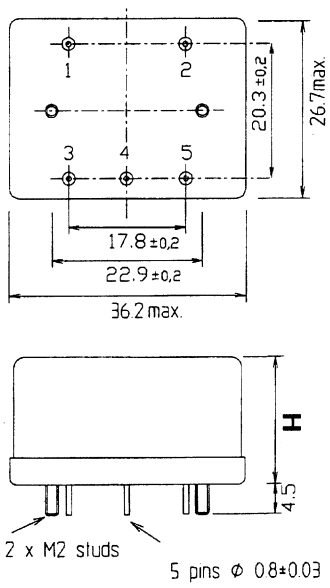
1 - Pulling voltage
2 - N.C.
3 - Power supply
4 - HF output
5 - Mechanical & electrical GND



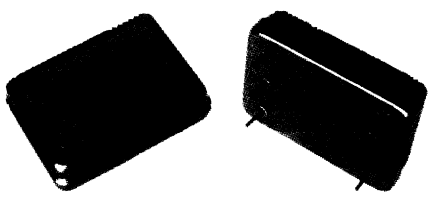
Package n° 45

Package n° 67 / option V

1 - Mechanical & electrical GND
2 - Power supply
3 - HF output
4 - Control output
5 - N.C.



Package n° 67



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TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Very high frequencyTCXO with Sine Output

type	QEA 45-BO and QEA 67-BO		
frequency range	1 MHz to 21 MHz	21 MHz to 110 MHz	110 MHz to 189 MHz
frequency stability vs. temperature (other temperature range and stabilities on request)	code LM57 ..... ≤ ± 5.10^{-7} from 0° C to +50° C code FR16 ..... ≤ ± 1.10^{-6} from -30° C to +75° C code DT26 ..... ≤ ± 2.10^{-6} from -40° C to +85° C		
static temperature hysterisys	≤ ± 3.10^{-7}		
long term stability	≤ ± 1.10^{-6}		
short term stability	≤ ± 1.10^{-9} Allan variance for 1 second Tau		
frequency stability vs. supply voltage change	≤ ±2.10^{-7} with voltage change ±10%		
frequency stability vs. load change	± 5.10^{-7} (Iout ± 10 %)		
supply voltage	5 V ± 5 %		
input current	≤ 10 mA	≤ 30 mA	≤ 40 mA
output voltage	≥ 0 dBm on 50 Ω		
phase noise density	10 Hz: -90 dBc / Hz: 100 Hz: -120 dBc / Hz 1 kHz: -135 dBc / Hz	10 Hz: -76 dBc / Hz 100 Hz: -106 dBc / Hz 1 kHz: -121 dBc / Hz	10 Hz: -71 dBc / Hz 100 Hz: -101 dBc / Hz 1 kHz: -116 dBc / Hz
harmonics	-20 dB max		
frequency adjustment	≥ ± 3.10^{-6}		
frequency control deviation sensitivity nom. control voltage control voltage range	**option: V** ± 3 to ± 15 ppm (function of temperature range and stability) 2.5 Vdc +0.5 Vdc to + 4.5 Vdc (port input impedance 100 kΩ min.)		
humidity	90 - 95 % r.h. / 40° C / 48 hrs		
storage temperature	-55° C to +105° C		
shock test	50 g - 6 ms - 3 axes - half-sine		
vibrations (sinewave)	30 Hz to 1500 Hz / 10 g / 6 hours		
marking	CQE + type + frequency + date code + serial no.		
package	n° 45 and n° 67: (36 x 27 x 11.3)		
marking	CQE + date code + reference		
ordering information	type+ option + frequency + stability code, + frequency control range example: QEA 45-BOV 45.0000 MHz LM57, control range ± 5ppm		

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Very high frequency TCXO with ACMOS output

TYPE QEA 45-CH and QEA 67-CH

Applications

These oscillators featuring analogue temperature compensation offer an outstanding combination very high frequency, good stability over a wide temperature range, low power consumption, short start-up time and low phase noise.
They are well suited to portable communication equipment, airborne telecommunication and navigation devices, synthetisers...

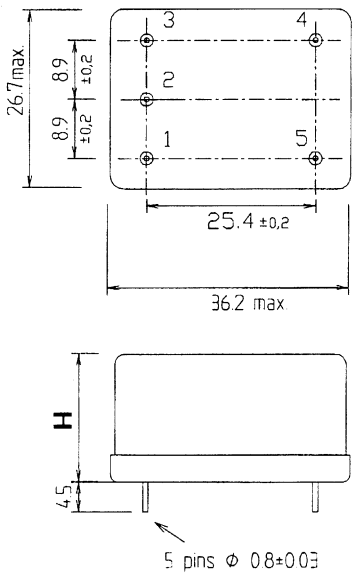
Features

- Frequency range: **1 MHz to 189 MHz**
- Temperature range: **-40° C to +85° C**
- Long tem stability: ≤ **± 1.10^{-6}**
- Supply voltage: **5 V**
- Low phase noise: **-135 dBc / Hz at 1 kHz**
- **HCMOS** output
- Voltage Control Range (in option) **+0.5 Vdc to 4.5 Vdc**

Package

Package n° 45 / option V

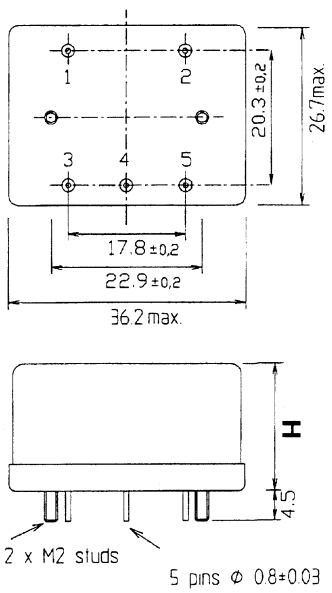
1 - Pulling voltage
2 - N.C.
3 - Power supply
4 - HF output
5 - Mechanical & electrical GND



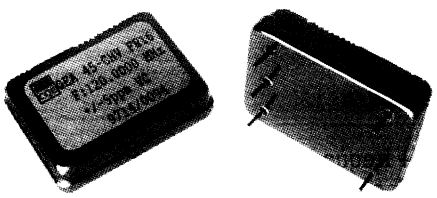
Package n° 45

Package n° 67 / option V

1 - Mechanical & electrical GND
2 - Power supply
3 - HF output
4 - Control output
5 - N.C.



Package n° 67



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TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Very high frequency TCXO with ACMOS output

type	QEA 45-CH and QEA 67-CH		
frequency range	1 MHz to 21 MHz	21 MHz to 110 MHz	110 MHz to 150 MHz
frequency stability vs. temperature (other temperature range and stabilities on request)	code LM57 ..... $\leq \pm 5.10^{-7}$ from 0° C to +50° C code FR16 ..... $\leq \pm 1.10^{-6}$ from -30° C to +75° C code DT26 ..... $\leq \pm 2.10^{-6}$ from -40° C to +85° C		
static temperature hysterisys	$\leq \pm 3.10^{-7}$		
long term stability	$\leq \pm 1.10^{-6}$		
short term stability	$\leq \pm 1.10^{-9}$ Allan variance for 1 second Tau		
frequency stability vs. supply voltage change	$\leq \pm 2.10^{-7}$ with voltage change ± 10%		
frequency stability vs. load change	$\pm 5.10^{-7}$ (Iout ± 10 %)		
supply voltage	5 V ± 5 %		
input current	≤ 10 mA	≤ 50 mA	≤ 60 mA
output levels load	0.5 V / 4.5 V 100 Ω typ.		
nominal output current	± 20 mA		
phase noise density	10 Hz: -90 dBc / Hz: 100 Hz: -120 dBc / Hz 1 kHz: -135 dBc / Hz	10 Hz: -76 dBc / Hz: 100 Hz: -106 dBc / Hz 1 kHz: -121 dBc / Hz	10 Hz: -71 dBc / Hz: 100 Hz: -101 dBc / Hz 1 kHz: -116 dBc / Hz
sub-harmonics	-20 dB max		
frequency adjustment	$\geq \pm 3.10^{-6}$ by internal manual trimmer		
frequency control deviation sensitivity nom. control voltage control voltage range	**option: V** ± 3 ppm to ± 15 ppm (function of temperature range and stability) 2.5 Vdc +0.5 Vdc to + 4.5 Vdc (port input impedance 100 kΩ min.)		
humidity	90 - 95 % r.h. / 40° C / 48 hrs		
storage temperature	-55° C to +105° C		
shock test	50 g - 6 ms - 3 axes - half-sine		
vibrations (sinewave)	30 Hz to 1500 Hz / 10 g / 6 hours		
marking	CQE + type + frequency + date code + serial no.		
package	n° 45 and n° 67: (36 x 27 x 11.3)		
marking	CQE + date code + reference		

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Low power Real Time clock (TCXO)

TYPE QEA 45-BH

Applications

This oscillator has been designed as a real-time clock for use in tactival radio systems operating in hostile environments.

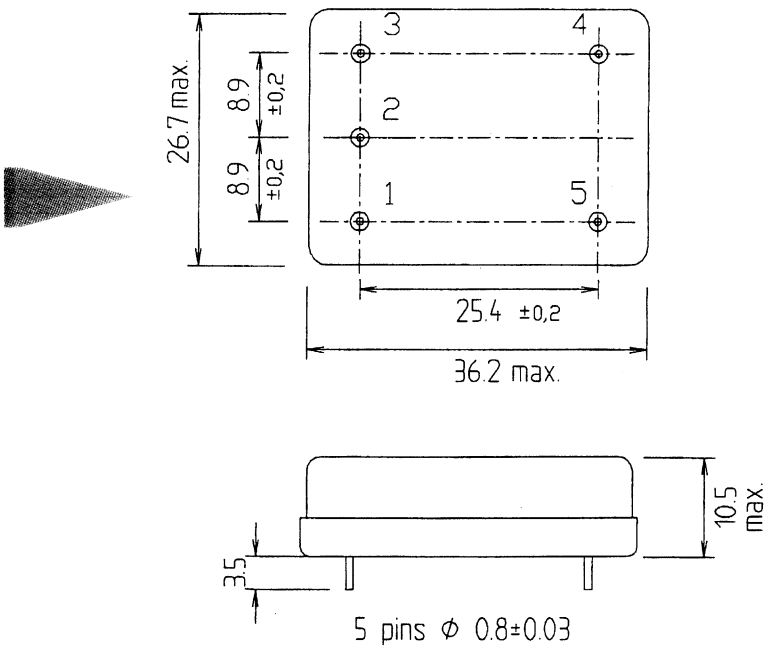
The overall frequency stability including changes of load and supply voltage, first year ageing and frequency/temperature drift over -40° C to +85° C is better than $+2.10^{-6}$.

Features

- Frequency range: **4 Hz to 8 Hz**
- Temperature range up to **-40° C to +85° C**
- Ageing: **± 2 ppm**
- Supply voltage: 2.8 to **5.2 V**
- Input current: ≤ 500 µA @ 3 V
- **Open** collector, **HCMOS** compatible

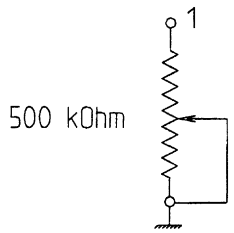
The main feature of the TCXO type QEA 45-BH is the exceptionally low power requirement **less than 1.75 mW** with a supply voltage between 2.8 and 5.2 V.

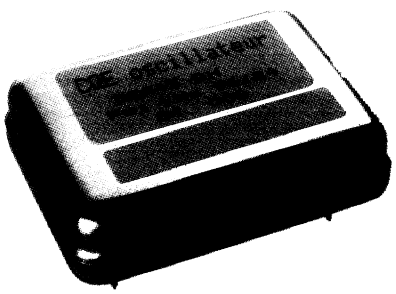
Package

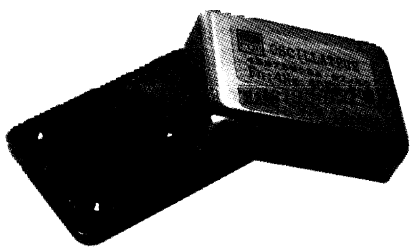


Package n° 45

1 - Frequency adjustment
500 kΩ variable resistor to GND
2 - N.C.
3 - Power supply
4 - HF output
5 - GND







Package n° 45

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Low power Real Time clock (TCXO)

reference	QEA 45-BH
frequency range	4 Hz to 8 Hz
frequency stability	$\leq \pm 2.10^{-6}$ from -40° C to +85° C inclusive of V_{CC} change from +2.8 V to +5.2 V, load and 1st year ageing
supply voltage V_{CC}	2.8 V to 5.2 V
input current	≤ 500 µA @ 3 V
output level	open collector, HCMOS compatible "0" = 0.2 x Vcc "1" = 0.8 x Vcc load = 220 kΩ // 50 pF
duty cycle	50 / 50 ± 10 % at Vcc/2
frequency adjustment	external potentiometer 500 kΩ, range ≥ ± 5 ppm
storage temperature	-55° C to +105° C
shock test	IEC 68-2-27: 100 g / 6 ms / 3 axes / half-sine
vibration test (sinewave)	IEC 68-2-6: 10 Hz to 55 Hz / 1.5 mm p-p / 2 hours
humidity	93 % r.h. / 40° C / 56 days
package	n° 45, max. height 10.5 mm
ordering information	reference + frequency example: QEA45-BH, frequency = 4 Hz

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Digitally Compensated Crystal Oscillators (DTCXO)

TYPES QED 45-AO and QED 67-AO

Applications

These oscillators exhibit a tenfold temperature stability over their analogous compensated counterparts. The phase noise figure is somewhat higher but this shows up only in some applications. Furthermore, it is even possible to obtain a special version where the compensation process can be momentarily disabled.

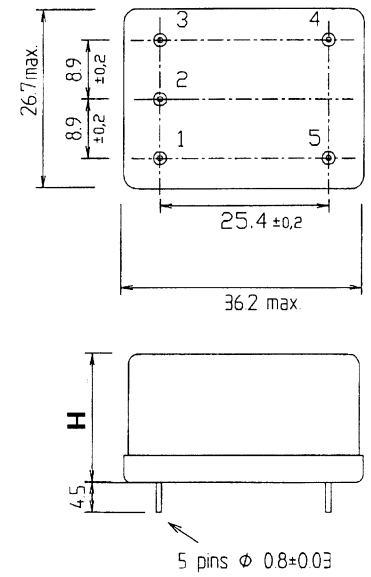
Features

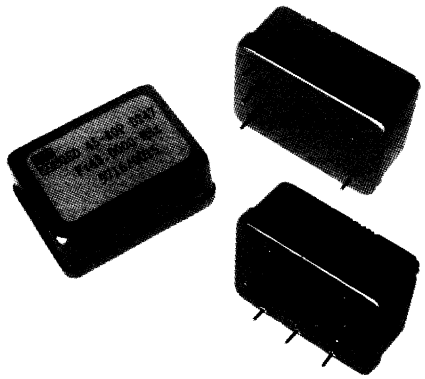
- Frequency range: **4 MHz to 60 MHz**
- Temperature range up to **-55° C to +105° C**
- Ageing: **± 5.10^{-7} / year**
- Supply voltage: **5 V**
- **High frequency stability versus temperature**
- **Sine output**

Associated models

We propose under **QED 45-AH** and **QED 67-AH** the very same oscillator which gives comparable results on a frequency **from 100 kHz to 60 MHz.**

Package





Package n° 45

Package n° 67 / option V

1 - Mechanical & electrical GND
2 - Power supply (+)
3 - HF output
4 - Control output
5 - N.C.

Package n° 45 / option V

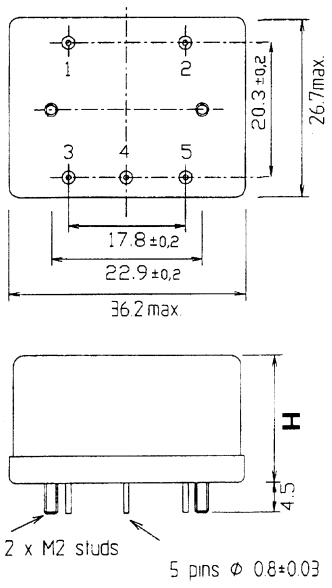
1 - Pulling voltage
2 - N.C.
3 - Power supply (+)
4 - HF output
5 - Mechanical & electrical GND

Package n° 45 / option P

1 - Adjustement potentiometer (wiper)
2 - Adjustement potentiometer (track)
3 - Power supply (+)
4 - HF output
5 - Mechanical & electrical GND Adjustement potentiometer (track)

Package n° 67 / option P

1 - Mechanical & electrical GND Adjustement potentiometer (track)
2 - Power supply (+)
3 - HF output
4 - Adjustement potentiometer (wiper)
5 - Potentiometer track (reference voltage)



Package n° 67

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TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Digitally Compensated Crystal Oscillators (DTCXO)

reference	QED 45-AO and QED 67-AO
frequency range	4 MHz to 60 MHz
frequency stability vs. temperature other stabilities available	code LM17 ..... $\leq \pm 1.10^{-7}$ from 0° C to +50° C code HQ27 ..... $\leq \pm 2.10^{-7}$ from -20° C to +70° C code DT47 ..... $\leq \pm 4.10^{-7}$ from -40° C to +85° C code AX16 ..... $\leq \pm 1.10^{-6}$ from -55° C to +105° C
long term stability	$\leq \pm 5.10^{-9}$ / day $\leq \pm 5.10^{-8}$ / month $\leq \pm 5.10^{-7}$ / year
frequency stability vs. supply voltage change	$\leq \pm 1.10^{-7}$ between 4.5 V and 5.5 V
frequency stability vs. load change	$\leq \pm 5.10^{-8}$ for 50 Ω ± 10 %
supply voltage	5 V ± 5 %
phase noise density	100 Hz: - 80 dBc/Hz 1 kHz: -110 dBc/Hz at floor: -140 dBc/Hz
harmonics and subharmonics levels	≤ 30 dB
input current	10 mA to 50 mA depending on frequency
output levels	≥ 0 dBm / 50 Ω ± 10 %
start-up time	≤ 10 ns
frequency adjustment	amplitude ≥ ± 5 ppm **option P**: external potentiometer or resistor 20 kΩ **option V**: external control voltage 0.5 V to 4.5 V
shock test	IEC 68-2-27: test EA / 50 g - 11 ms
vibrations (sinewave)	IEC 68-2-06: test Fc 10 Hz - 500 Hz / 10 g
package	n° 45 & n° 67: height ≤ 12 mm up to 30 MHz n° 45 & n° 67: height ≤ 16 mm form 30 to 60 MHz
marking	CQE + date code + reference
ordering information (reference)	reference + **option code** (frequency adjustment) + frequency + stability code example: QEB45/47-AOP 45.0000 MHz DT47

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Digitally Compensated Crystal Oscillators (DTCXO)

TEKELEC TEMEX

TYPES QED 45-AH and QED 67-AH

Applications

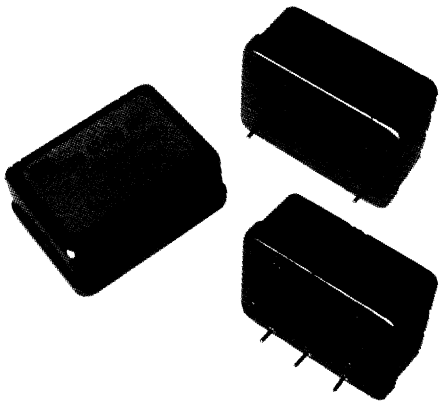
These oscillators exhibit a tenfold temperature stability over their analogous compensated counterparts. The phase noise figure is somewhat higher but this shows up only in some applications. Furthermore, it is even possible to obtain a special version where the compensation process can be momentarily disabled.

Associated models

We propose under **QED 45-AO** and **QED 67-AO** the very same oscillator which gives comparable results on a frequency **from 4 MHz to 60 MHz.**

Features

- Frequency range: **100 kHz to 60 MHz**
- Temperature range: **-55° C to +105° C**
- Ageing: ≤ **± 5.10^{-7}** / year
- Supply voltage: **5 V**
- **High frequency stability versus temperature**
- **HCMOS** compatible output



Package

Package n° 45 / option P

1 - Adjustement potentiometer (wiper)
2 - Adjustement potentiometer (track)
3 - Power supply (+)
4 - HF output
5 - Mechanical & electrical GND Adjustement potentiometer (track)

Package n° 67 / option V

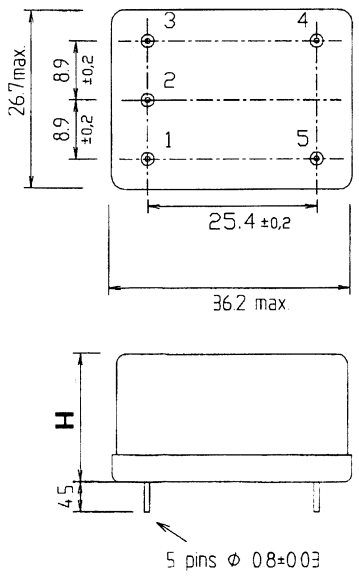
1 - Mechanical & electrical GND
2 - Power supply (+)
3 - HF output
4 - Control output
5 - N.C.

Package n° 67 / option P

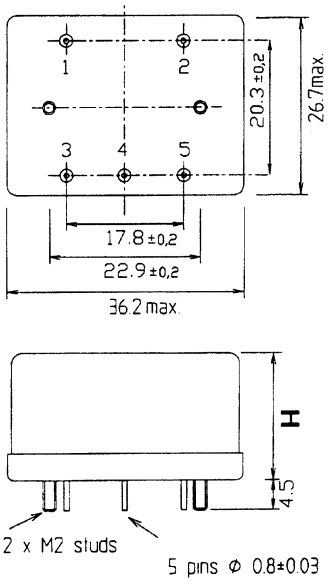
1 - Mechanical & electrical GND Adjustement potentiometer (track)
2 - Power supply (+)
3 - HF output
4 - Adjustement potentiometer (wiper)
5 - Potentiometer track (reference voltage)

Package n° 45 / option V

1 - Pulling voltage
2 - N.C.
3 - Power supply (+)
4 - HF output
5 - Mechanical & electrical GND



Package n° 45



Package n° 67

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Digitally Compensated Crystal Oscillators (DTCXO)

type	QED 67-AH and QED 45-AH
frequency range	100 kHz to 60 MHz
frequency stability vs.temperature other stabilities available	code LM17 ..... ≤ ± 5.10^{-7} from 0° C to + 50° C code HQ27 ..... ≤ ± 2.10^{-7} from -20° C to + 70° C code DT47 ..... ≤ ± 4.10^{-7} from -40° C to + 85° C code AX16 ..... ≤ ± 1.10^{-6} from -55° C to +105° C
long term stability	≤ ± 2.10^{-9} / day ≤ ± 5.10^{-8} / month ≤ ± 5.10^{-7} / year
frequency stability vs. supply voltage change	≤ ±1 x 10^{-7} between 4.5 V and 5.5 V
frequency stability vs. load change	≤ ± 5 .10^{-8} between 1 an 3 TTL-gates
supply voltage	5 V + 5 %
phase noise density	at 100 Hz -80 dBc at 1 kHz -110 dBc at floor -140 dBc
input current	10 mA to 50 mA depending on frequency
output levels	"0" ≤ 0.5 V "1" ≤ 4.5 V
duty cycle	50 / 50 ±10 %
rise / fall time	≤ 10 ns.
start-up time	≤ 10 s
frequency adjustment	amplitude ≥ ± 5 ppm **option P**: external potentiometer or resistor 20 kΩ **option V**: external control voltage 0.5 V to 4.5 V
shock test	IEC 68-2-27: test EA / 50 g - 11 ms
vibrations (sinewave)	IEC 68-2-06: test Fc / 10 Hz - 500 Hz / 10 g
package	n° 45 & n° 67: height ≤ 12 mm up to 30 MHz n° 45 & n° 67: height ≤ 16 mm from 30 to 60 MHz
marking	CQE + date code + reference
ordering information	reference + option code (frequency adjustment) + frequency + stability code example: QED 45/67-AHP 45.0000 MHz HQ27

QEM 77-AH

Description

The MCXO offers the parameters of OCXO's and TCXO's, delivering practically the frequency precision of an ovenized oscillator with the power consumption associated with temperature compensated oscillators over the entire military temperature range of -55° C to +125° C.

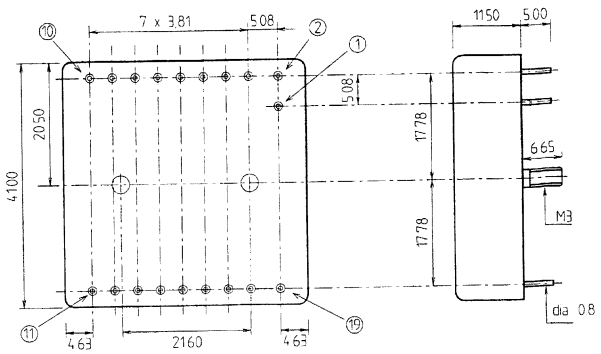
Using digital techniques, it is possible to operate a stand-by mode with low power consumption and to synchronise the 1 Hz signal with an external source. In addition, a choice of output frequencies is available.

Control of secundary functions

The secundary functions of the MCXO are obtained by two methods: application of logic levels on the pin-out as indicated or inputting bytes on the RS232 port.

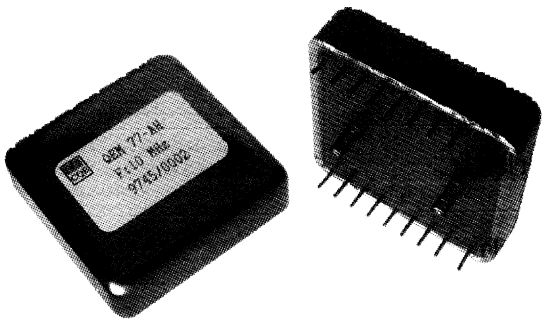
The details of the logic controls are shown on the following pages.

Package

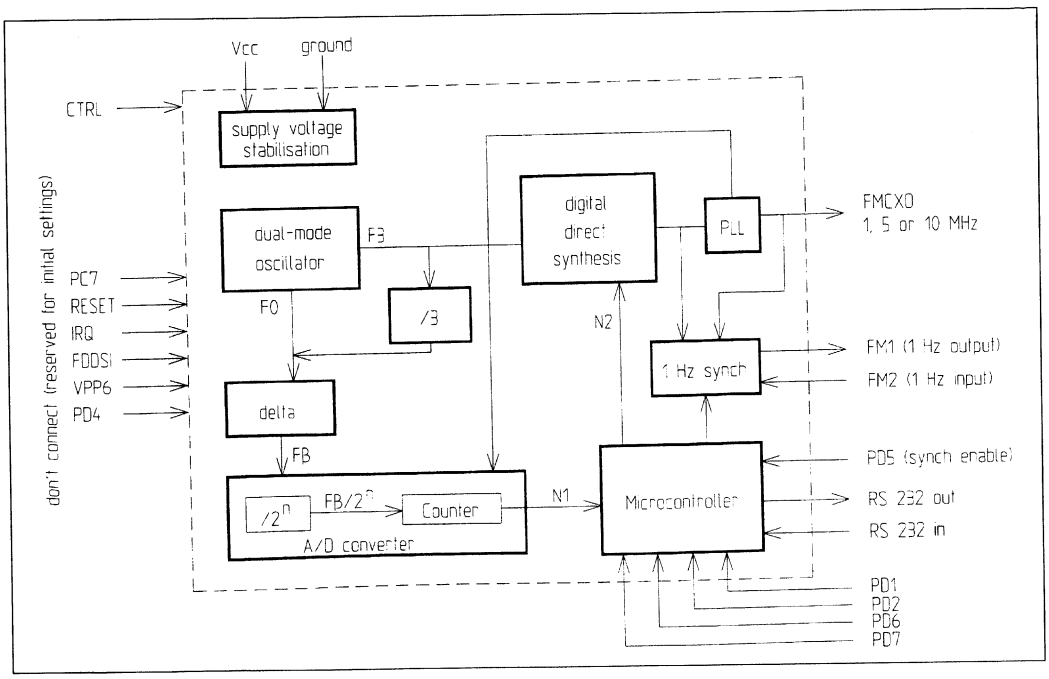


Package n° 77

Pad connections: see p. 7-80



Block-diagram



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TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Microprocessor-Compensated Crystal Oscillators (MCXO)

type	QEM 77-AH
output frequencies	FMCXO output: 10 MHz, 5 MHz,1 MHz user-selectable by external digital control FM1 output: 1 Hz
frequency variations vs. temperature changes	$\leq \pm 2 \times 10^{-8}$ from -30° C to +85° C $\leq \pm 1 \times 10^{-7}$ from -55° C to +125° C
calibration precision	nominal frequency settability (see below) at +25° C attained for 1.4 V 1 % on pin 18
short-term stability	2×10^{-8} / 1 s. 2×10^{-8} / 10 s
long-term stability	1×10^{-9} / day 1×10^{-8} / month
input voltage	3.25 V ≤ Vcc ≤ 6 V
input current	normal operation mode: ≤ 7 mA stand-by mode: ≤ 5 mA
output levels	"0" ≤ 0.4 V "1" ≥ 2.4 V
output current FMCXO	≤ ± 0.5 mA
rise / fall time	≤ 20 ns between 20 % and 80 % of the actual output level, at +25° C ± 2° C
duty cycle	50 / 50 ± 5 % at Vcc/2
frequency adjustment	≥ ± 1 x 10^{-6} (settability to 5×10^{-9}) potentiometer 47 kΩ between pin 18 and GND or control voltage 0 to 2.8 V on pin 18 (slope 1 x 10^{-6} / V) delay between adjustment and corresponding change of FMCXO: ≤ 60 s to 5 x 10^{-9} or ≤ 6 s to 5 x 10^{-8} of FMCXO
secondary functions	see next page
shock test	MIL STD 202F, method 213B, condition I: 3 x 3 shocks 100 g, sawtooth, 6 ms
vibration test (sinewave)	MIL STD 202F, method 204D, condition D: 10 Hz to 2 kHz / 20 g / 3 axes
vibration test (random)	on request
package	n° 77
marking	QEM 77-AH + CQE + date code + serial number

Secundary functions	Logic levels on dedicated inputs	Byte value on pin 13 RS232 port	Action delay	Result
Output frequency selection (FMCXO)	PD1="0" and PD2="0"	$EF	300 ms	FMCXO = 10 MHz
	PD1="1" and PD2="0"	$FE		FMCXO = 5 MHz
	PD1="0" and PD2="1"	$FD		FMCXO = 1 MHz
	PD1="1" and PD2="1"			
Synchronisation of FM1 on FM2	PD5="1"	$FC		synch enable
	PD5="0"	$CF		synch disable
Switching between normal and stand-by modes	PD6="0"	$CA	1s	normal power drain
	PD6="1"	$AC	300 ms	stand-by enable
Phase measurement $\Delta\phi$(FM1, FM2)	PD7="0"	n.a.	1 s	disable
	PD7="1"	n .a.	4 s	enable
Digital frequency adjustment	through RS232 port (see next page)	$BF		increases FMCXO by 1 ppm
		$FB		decreases FMCXO by 1 ppm
		$AB + 3 bytes	300 ms acquisition time + ca. 60" DDS delay to obtain full resolution	increases FMCXO proportionally to the 3 bytes following $AB
		$BA + 3 bytes		decreases FMCXO proportionally to the 3 bytes following $BA
		$BC + 3 bytes		adds a positive frequency offset to FMCXO, proportional to the 3 bytes following $BC
		$CB + 3 bytes		adds a negative frequency offset to FMCXO, proportional to the 3 bytes following $BC
		$BD		cancels every software change, except those performed by $BC or $CB
		$BB		returns FMCXO to factory setting

Important notice: any action initiated through a dedicated input can only be modified or cancelled by an other action on a dedicated input. The same is true for commands issued on the RS232 port.

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Synchronisation of FM1

The 1 Hz frequency output on FM1 is derived by division of the 10 MHz FMCXO, it has therefore the same relative stability.

In order to provide the function of a 1 pps generator in time keeping applications, the FM1 output can be synchronised with an external 1 Hz source. In this case, the synchronisation is effected between two positive-going edges of the compared signals after applying the synchronisation validation signal. The maximum error between the two signals is ± 1 µs.
(**Warning** ! Synchronisation is not possible when the oscillator is in stand-by mode).

After synchronisation and switching to stand-by mode, an additional error inferior to ±50 µs is introduced.

Phase measurement

This function provides the means to measure the difference between rising fronts at 1 Hz on FM1 and FM2 with a precision of ±1 % or ±1 µs (whichever is the greater). During phase measurement, temperature compensation of the frequency cannot be effected. It is therefore important that the temperature remains constant.

The result of this measurement is given by the RS232 link in the form of 3 bytes, the first of which is the most significant. The phase-offset value is given by

φ offset (ms)= decimal value of the 3 bytes/10

Stand-by mode (Reduced power consumption)

In stand-by mode, the temperature compensation intervals are increased. This means the frequency precision is attained after a longer stabilisation time. In this mode, only the 1 Hz-output is available. The dividing stages and certain other functions are switched-off, thereby reducing the consumption to 5 mA.

RS232 Port Communication parameters

Format: NRZ
Speed: 2400 bits /s.
1 start bit / 1 stop bit / 8 data bits
no parity
logic levels: HCMOS 3 V

N.B.: the pin-outs 1, 3, 8, 16 to 19 are used for initial setting during manufacture. They must not be connected, any connection can either cause malfunctioning or cause permanent damage.

Digital frequency adjustment

Adjustments effected by means of the RS 232 port differ in their hierarchy: $BF, $FB, $AB, $BA, change temporarily the FMCXO and can be cancelled by $BD o by $BB. factory setting while $BB returns FMCXO to its original value.

Inputting $BC or $CB superimposes an additional frequency offset that can only be cancelled by $BB.

Amplitude of the frequency adjustment is limited to ± 100 Hz

Computing the 3 correcting bytes (low, medium, high):

value in Hex = Hex(Int(26.948 x ΔF(Hz)))

example: ΔF = 35 Hz gives $AF $03 $00

Pin function	Pin #	Symbol	Typical signal	Maximum absolute rating
reserved for initial setting, **don't connect**	1	FDDSI	n.a.	n.a.
1 Hz output	2	FM1	LS-TTL-compatible "0" ≤ 0.4 V "1" ≥ 2.4 V	sink / source 0.5 mA / 10 pF "0" ≤ -0.5 V "1" ≥ 0.2 V
reserved for initial setting, **don't connect**	3	VPP6	n.a.	n.a.
1 MHz, 5 MHz or 10 MHz frequency output	4	FMCXO	LS-TTL-compatible "0" ≤ 0.4 V "1" ≥ 2.4 V	sink/ source 0.5 mA/ 10 pF "0" ≤ -0.5 V "1" ≥ 3.2 V
1 Hz reference signal input	5	FM2		
output frequency programming inputs	6	PD1	HCMOS 3 V	-0.5 V < V_{in} < 6 V
	7	PD2		
reserved for initial setting, **don't connect**	8	PD4	n.a.	n.a.
1 Hz synch enable / disable	9	PD5		
stand-by / normal mode	10	PD6	HCMOS 3 V	-0.5 V ≤ V_{in} ≤ 6 V
ϕ-measurement enable / disable	11	PD7		
power supply	12	VP		+3.2 V ≤ V_{in} ≤ +6 V
RS 232 input	13	RDI	HCMOS 3 V	-0.5 V ≤ V_{jn} ≤ +6 V
RS 232 output	14	TDO		-0.5 V ≤ V_{out} ≤ +3 V
GND	15	GND	0 V	n.a.
reserved for initial setting, **don't connect**	16	RESET	n.a.	n.a.
	17	PC7		
frequency adjustment (analogue)	18	CTRL	-0.5 V ≤ V_{CTRL} ≤ 2.8 V	0 V ≤ V_{CTRL} ≤ 3.5 V
reserved for initial setting, **don't connect**	19	IRQ	n.a.	n.a.

Important: the pins reserved for initial settings should **not be connected**. Any connection could cause malfunctioning or even permanent damage.

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OVEN CONTROLLED CRYSTAL OSCILLATORS (OCXO) With SC-cut or AT-cut

Selection Guide

Package	Temperature range up to	Frequency range	Output	Type	*PAGE*
DIL package	-20° C to +70° C **± 3.10^{-7}**	1 MHz to 35 MHz **± 7.10^{-7}**	HCMOS output supply voltage 5 V or 12 V	**QEO 93-AH**	7-87
Small package (36x27x20 mm) or (38x38x13 mm)	-40° C to +70° C **± 5.10^{-8}**	100 kHz to 50 MHz **± 5.10^{-8}**	Sine output SC-cut	**QEO 67-CO** **QEO 63-CO** **QEO 45-CO**	7-93
				QEO 19-CO	7-89
Small p (3 o (38		to 50 MHz 10^{-8}	Square form output SC-cut	**QEO 67-CH** **QEO 63-CH** **QEO 45-CH**	7-93
				QEO 19-CH	7-89
Smal (36 x2 or (38 x38 x13 mm)		MH		**QEO 67-BO** **QEO 63-BO** **QEO 45-BO**	7-101
				QEO 19-BO	7-97
Small package (36 x27 x20 mm) or (38 x38 x13 mm)	-40° C to +70° C **± 2.10^{-7}**	100 kHz to 50 MHz **± 3.10^{-7}**	re output AT-cut	**QEO 67-BH** **QEO 63-BH** **QEO 45-BHO**	7-101
				QEO 19-BH	7-97
N° 75 (50 x50 x25 mm) **N° 78** (40 x30 x21 mm)	-40° C to +70° C **± 1.10^{-8}**	5 MHz to 30 MHz **± 3.10^{-8}**	Square form output SC-cut	**QEO 75-AH** **QEO 78-AH**	7-105
N° 69 (67 x60 x40 mm)	-40° C to +70° C ≤ **1.10^{-8}**	5 MHz to 10 MHz **± 1.10^{-8}**	Sine output SC-cut	**MOT**	7-107
N° 75 (50 x80 x38 mm)	-20° C to +70° C ≤ **5.10^{-10}**	5 MHz to 10 MHz **± 1.10^{-8}**	Sine output SC-cut	**MOT (C)**	7-110
N° 67 (36 x27 x25 mm)	-20° C to +70° C ≤ **2.10^{-8}**	50 MHz to 120 MHz **1.10^{-7}**	Sine output SC-cut	**QEO 67-DO**	7-113

Family selection guide - O.C.X.O.

FREQUENCY RANGE	OUTPUT	HOLDER	MODEL	PAGE	CIVIL	INDUS.	STD MILITARY	AIRBORNE MILITARY	SPATIAL
1 MHz to 35 MHz	HCMOS/TTL	DIL (4 pins)	QEO 93-AH	7-87	X	X			
100 kHz to 50 MHz	SINE	36 x 27 mm	QEO 45-CO	7-93	X	X	X		
100 kHz to 50 MHz	SINE	36 x 27 mm	QEO 63-CO	7-93	X	X	X		
100 kHz to 50 MHz	SINE	36 x 27 mm	QEO 67-CO	7-93	X	X	X		
100 kHz to 50 MHz	HCMOS/TTL	36 x 27 mm	QEO 45-CH	7-93	X	X	X		
100 kHz to 50 MHz	HCMOS/TTL	36 x 27 mm	QEO 63-CH	7-93	X	X	X		
100 kHz to 50 MHz	HCMOS/TTL	36 x 27 mm	QEO 67-CH	7-93	X	X	X		
100 kHz to 50 MHz	SINE	36 x 27 mm	QEO 45-BO	7-101	X	X	X		
100 kHz to 50 MHz	SINE	36 x 27 mm	QEO 63-BO	7-101	X	X	X		
100 kHz to 50 MHz	SINE	36 x 27 mm	QEO 67-BO	7-101	X	X	X		
100 kHz to 50 MHz	HCMOS/TTL	36 x 27 mm	QEO 45-BH	7-101	X	X	X		
100 kHz to 50 MHz	HCMOS/TTL	36 x 27 mm	QEO 63-BH	7-101	X	X	X		
100 kHz to 50 MHz	HCMOS/TTL	36 x 27 mm	QEO 67-BH	7-101	X	X	X		
5 MHz to 30 MHz	HCMOS/TTL	40 x 30 mm	QEO 78-AH	7-105	X	X	X		
5 MHz to 30 MHz	HCMOS/TTL	50 x 50 mm	QEO 75-AH	7-105	X	X	X		
5 MHz to 10 MHz	SINE	67 x 60 mm	MOT	7-107	X	X	X		
5 MHz to 10 MHz	SINE	67 x 60 mm	MOT (C)	7-110	X	X	X		
50 MHz to 120 MHz	SINE	36 x 27 mm	QEO 67-DO	7-113	X	X			
100 kHz to 50 MHz	SINE	38 x 38	QEO19-CO	7-89	X	X	X		
100 kHz to 50 MHz	HCMOS/TTL	38 x 38	QEO19-CH	7-89	X	X	X		
100 kHz to 50 MHz	SINE	38 x 38	QEO19-BO	7-97	X	X	X		
100 kHz to 50 MHz	HCMOS/TTL	38 x 38	QEO19-BH	7-97	X	X	X		
To be advised	All	All	On specification		X	X	X	X	

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OVEN CONTROLLED CRYSTAL OSCILLATORS (OCXO)

in DIL package using SC-cut

TYPE QEO 93-AH

Applications

These oven-controlled crystal oscillators feature an innovative design providing high thermal stability inspite of the small volume.

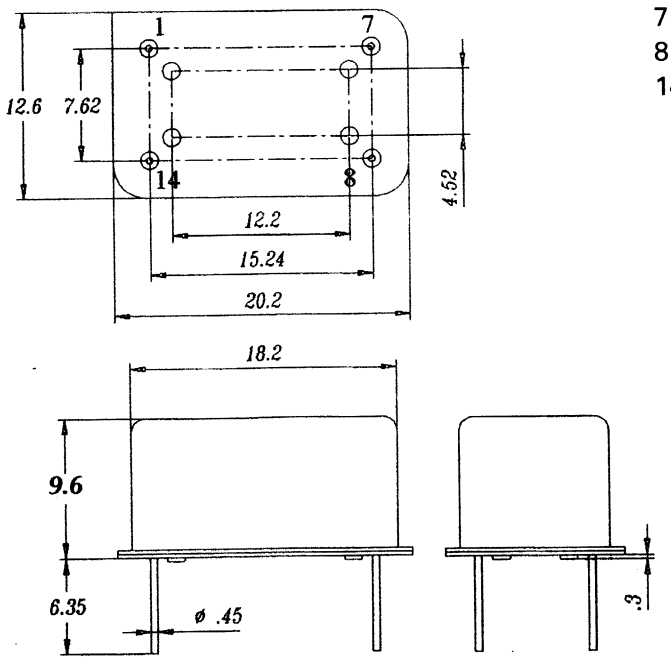
They are well suited to GSM base-stations or mobile equipment like ground or airborne terminals for satellite messaging systems.

They offer a very interesting mix of high stability and small footpring.

Features

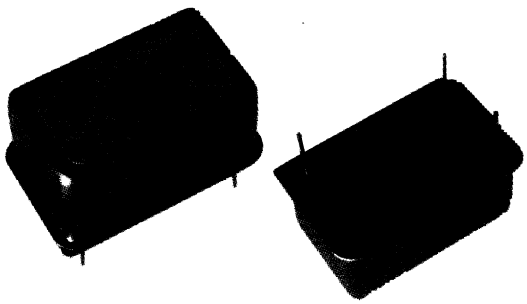
- Frequency range: **1 MHz to 35 MHz**
- Temperature range: **-20° C to +70° C**
- Ageing: ≤ **± 7.10^{-7}** / year
- Supply voltage: **5 V or 12 V**
- **HCMOS** output compatible
- Fast warm-up time: ≤ 60 s at 0° C
- SC-cut resonator

Package



Pad connections

1 - Ext. adjustment
7 - GND
8 - Output
14 - Vcc



Package n° 93

OVEN CONTROLLED CRYSTAL OSCILLATORS

in DIL 14 with SC-cut resonator

reference	QEO 93-AH	
frequency range	1 MHz to 35 MHz	
operating temperature	-20° C to +70° C	
frequency versus temperature change	$\leq \pm 3.10^{-7}$	
long term stability at operating temperature after 1 month	$\leq \pm 7.10^{-7}$ / 1st year $\leq \pm 4.10^{-6}$ / 10 year	
frequency vs supply voltage ± 5 %	$\leq \pm 3.10^{-8}$	
frequency stability vs. load charge ± 1LS	$\leq \pm 5.10^{-8}$	
supply voltage	**option A** Vcc = 5 V ± 5 %	**option B** Vcc = 12 V ± 5 %
input current	**option A** ≤ 200 mA at 25° C / Vcc = 5 V ≤ 350 mA at -20° C / Vcc = 5 V	**option B** ≤ 85 mA at 25° C / Vcc = 12 V ≤ 150 mA at - 20° C / Vcc = 12 V
control voltage	0 to 5 V	
frequency deviation	$\geq \pm 4.10^{-6}$	
frequency calibration at 25° C	$\pm 2.10^{-6}$	
slope	positive	
phase noise density	10 Hz :-100 dBc / Hz 100 Hz :-110 dBc / Hz 1 kHz :-125 dBc / Hz	
output signal	HCMOS compatible	
duty cycle	40 / 60 at Vcc / 2	
rise / fall time	≤ 7 ns	
level	0.5 V / 4.5 V at Vcc = 5 V	
fan out (load)	8 LS	
warm-up (dF/F)	within spec. after 60 s at 0° C	
warm-up (current)	**option A** ≤ 600 mA / Vcc = 5 V	**option B** ≤ 250 mA / Vcc = 12 V
storage temperature	-55° C to + 125° C	
shock test	1500 g, 0 - 2 ms - 3 axes - half-sine	
vibrations (sinewave)	20 Hz to 2000 Hz / 20 g / 3 axes	
package	DIL 14, height = 9.6 mm, 4 pins, GND to case	
marking	CQE + date code + reference	
ordering information	reference + option + frequency example: QEO 93-AHA 20.0000 MHz	

TYPES QEO 19-CO (sinus output) / QEO 19-CH (square output)

Applications

These oven-controlled crystal oscillators feature an innovative design providing high thermal stability inspite of the small volume.

They are well suited to applications where higher stability is a prerequisite and space at a premium: ERMES messaging system (base stations) or VSAT links.

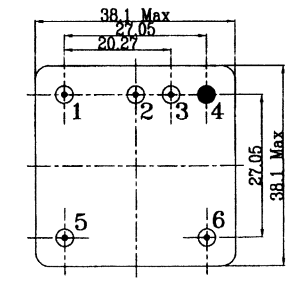
Features

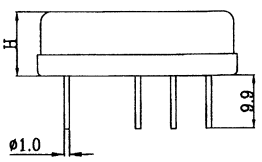
- Frequency: 100 kHz to 50 MHz
- Temperature range up to **-40° C to +70° C**
- Ageing: ≤ **± 5.10^{-8} / year**
- Supply voltage: **12 V**
- Floor phase noise: **-150 dBc / Hz**
- **Square** form output **(types CH)** and **Sine** output **(type CO)**
- **SC-cut** resonator

Associated models

The types **QEO xx-BO** and **QEO xx-BH** use a more economical crystal. If You are looking for the ultimate performance, please consider our **MOT** range, albeit in a bigger housing.

Package

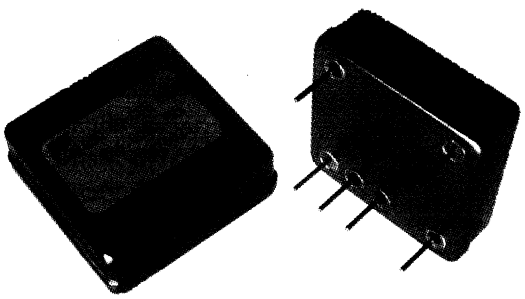




Package n° 19
h = 13 mm

Pad connection

1 - control voltage
2 - regulated output
3 - HF output
4 - GND
5 - GND
6 - 12 V input voltage



OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO with SC-Cut resonator

type	QEO 19-CO...LM59	QE019-CO...HQ28	QE019-CO...DQ58
frequency range	100 kHz to 50 MHz		
operating temperature	0° C to +50° C	-20° C to +70° C	-40° C to +70° C
frequency change vs. temp. change (p-p)	$\leq 5 \times 10^{-9}$	$\leq 2 \times 10^{-8}$	$\leq 5 \times 10^{-8}$
long term stability at +25° C +2° C after 1 month		**option A**	**option B**
/ day		$\leq \pm 1 \times 10^{-9}$	$\leq \pm 5 \times 10^{-10}$
/ month		$\leq \pm 3 \times 10^{-8}$	$\leq \pm 1 \times 10^{-8}$
/ year		$\leq \pm 1 \times 10^{-7}$	$\leq \pm 5 \times 10^{-8}$
frequency change vs. supply voltage 12V+5%	$\leq \pm 5 \times 10^{-9}$		
input current (supply voltage12V±5%)	≤ 500 mA at warm-up ≤ 80 mA at +25° C	≤ 500 mA at warm-up ≤ 100 mA at +25° C	≤ 500 mA at warm-up ≤ 100 mA at +25° C
retrace after 24 hrs		**option A**	**option B**
after 10'		$\leq \pm 5 \times 10^{-8}$	$\leq \pm 3 \times 10^{-8}$
after 30'		$\leq \pm 2 \times 10^{-8}$	$\leq \pm 1 \times 10^{-8}$
frequency stability vs. load change 50Ω ± 10 %	$\leq \pm 5 \times 10^{-9}$		
frequency adjustment over 10 years		**option A**	**option B**
		$\geq \pm 1.5 \times 10^{-6}$	$\geq \pm 7 \times 10^{-7}$
		100 kHz at 17 MHz	**17 MHz at 50 MHz**
phase noise at 10 Hz		-120 dBc/Hz	-110 dBc/Hz
at 100 Hz		-140 dBc/Hz	-130 dBc/Hz
at 1 kHz		-145 dBc/Hz	-135 dBc/Hz
at 10 kHz		-150 dBc/Hz	-140 dBc/Hz
noise floor (typ. at 10 MHz)		-150 dBc/Hz	-140 dBc/Hz
harmonics	-20 dBc		
output signal	≥ 0 dBm / 50 Ω		
subharmonics (F ≥ 17 MHz)	-40 dBc		

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OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO with SC-Cut resonator

type	QEO 19-CH.....LM59	QEO 19-CH.....HQ28	QEO 19-CH.....DQ58
frequency range	100 kHz to 50 MHz		
operating temperature	0° C to +50° C	-20° C to +70° C	-40° C to +70° C
frequency change vs. temp. change (p-p)	$\leq 5 \times 10^{-9}$	$\leq 2 \times 10^{-8}$	$\leq 5 \times 10^{-8}$
long term stability at +25° C +2° C after 1 month	**option A**	**option B**	
/ day	$\leq \pm 1 \times 10^{-9}$	$\leq \pm 5 \times 10^{-10}$	
/ month	$\leq \pm 3 \times 10^{-8}$	$\leq \pm 1 \times 10^{-8}$	
/ year	$\leq \pm 1 \times 10^{-7}$	$\leq \pm 5 \times 10^{-8}$	
frequency change vs. supply voltage 12 V±5 %	$\leq \pm 5 \times 10^{-9}$		
Input current (supply voltage12 V±5 %)	≤ 500 mA at warm-up ≤ 80 mA at +25° C	≤ 500 mA at warm-up ≤ 100 mA at +25° C	≤ 500 mA at warm-up ≤ 100 mA at +25° C
retrace after 24 hrs	**option A**	**option B**	
after 10'	$\leq \pm 5 \times 10^{-8}$	$\leq \pm 3 \times 10^{-8}$	
after 30'	$\leq \pm 2 \times 10^{-8}$	$\leq \pm 1 \times 10^{-8}$	
frequency stability vs. load change ± 10 %	$\leq \pm 5 \times 10^{-9}$		
frequency adjustment over 10 years	**option A**	**option B**	
	$\geq 1.5 \times 10^{-6}$	$\geq 7 \times 10^{-7}$	
	100 kHz at 17 MHz	**17 MHz at 50 MHz**	
phase noise at 10 Hz	-120 dBc/Hz	-110 dBc/Hz	
at 100 Hz	-140 dBc/Hz	-130 dBc/Hz	
at 1 kHz	-145 dBc/Hz	-135 dBc/Hz	
at 10 kHz	-150 dBc/Hz	-140 dBc/Hz	
noise floor (typ. at 10 MHz)	-150 dBc/Hz	-140 dBc/Hz	
output signal	3 TTL-gates / 15 pF "0" ≤ 0.5V / "1" ≥ 4.5 V		
rise / fall time	≤ 10 ns		
duty cycle	50 / 50 ± 20 %		
subharmonics (F ≥ 17 MHz)	≥ - 40 dBc		

OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO with SC-Cut resonator

type	QEO 19-CO	QEO 19-CH
storage temperature range	-55° C to +90° C	
shock test	IEC 68-2-27 : test Ea / 50 g - 1 1 ms	
vibration test (sinewave)	IEC 68-2-06 : test Fc / 10 Hz - 500 Hz / 10 g	
packages	n° 19	
ordering information	type + stability option code + frequency + temperature code + stability code example : QEO 19-COB 5.000 MHz HQ28	

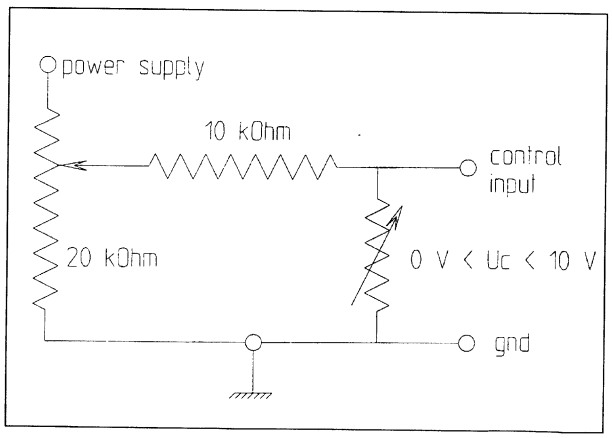
Frequency adjustment and slaving to another frequency standard

These oscillators can be tuned to nominal frequency by various means, each giving a specific result :

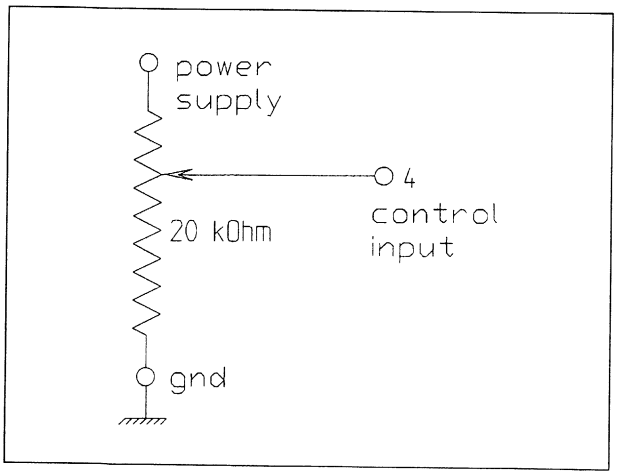
- adjustment resolution ≥ 1.10^{-7} or ≥ 1.10^{-9}
- slaving to an external frequency source

Please refer to the sketches below for the recommended circuits

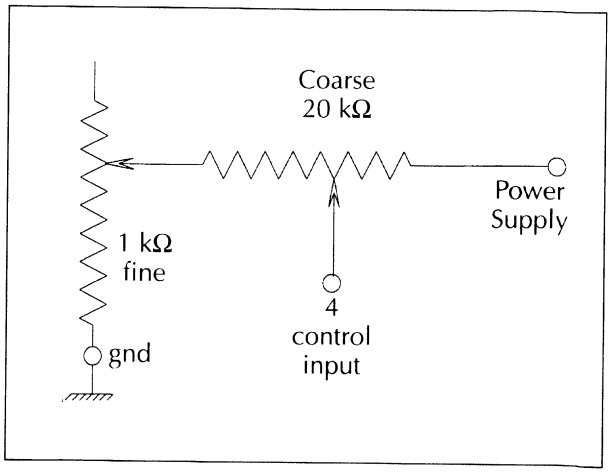
Tuning by an external voltage



Adjustement accuracy 1 x 10^{-7}



Adjustement accuracy 1 x 10^{-9}



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OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO with SC-Cut resonator

TYPES QEO 67-CO (CH) / QEO 63-CO (CH) / QEO 45-CO (CH)

Applications

These oven-controlled crystal oscillators feature an innovative design providing high thermal stability inspite of the small volume.

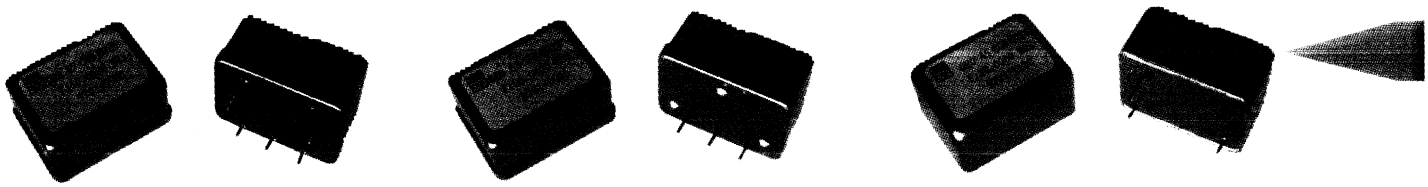
They are well suited to applications where higher stability is a prerequisite and space at a premium: ERMES messaging system (base stations) or VSAT links.

Associated models

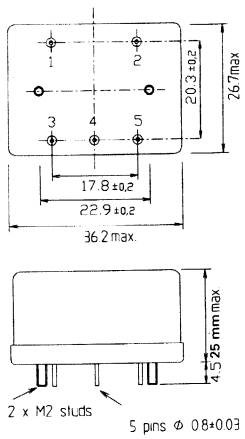
The types **QEO xx-BO** and **QEO xx-BH** use a more economical crystal. If You are looking for the ultimate performance, please consider our **MOT** range, albeit in a bigger housing.

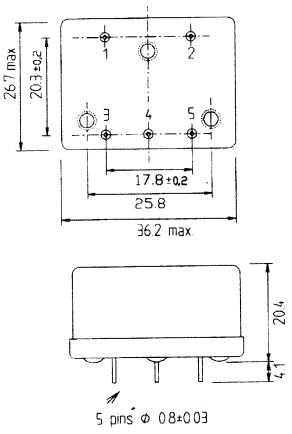
Features

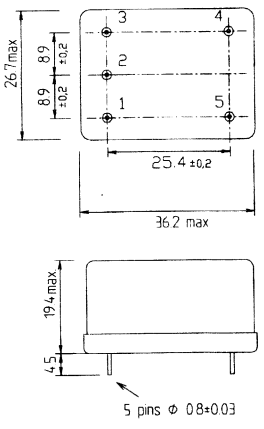
- Frequency: 100 kHz to 50 MHz
- Temperature range up to **-40° C to +70° C**
- Ageing: ≤ **± 5.10^{-8} / year (option B)**
- Supply voltage: **12 V**
- Floor phase noise: **-150 dBc / Hz**
- **Square** form output **(types CH)** and **Sine** output **(type CO)**
- **SC-cut** resonator
- Option : temperature range up to +75° C



Packages







Package n° 67

1 - GND
2 - power supply + 12 V
3 - HF output
4 - control input
5 - reference voltage output

Package n° 63

1 - GND
2 - power supply + 12 V
3 - HF output
4 - control input
5 - reference voltage output

Package n° 45

1 - control input
2 - reference voltage output
3 - power supply + 12 V
4 - HF output
5 - GND

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OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO with SC-Cut resonator

TEKELEC TEMEX

type	QEO 67-CO.....LM59 QEO 63-CO.....LM59 QEO 45-CO.....LM59	QEO 67-CO.....HQ28 QEO 63-CO.....HQ28 QEO 45-CO.....HQ28	QEO 67-CO.....DQ58 QEO 63-CO.....DQ58 QEO 45-CO.....DQ58
frequency range	100 kHz to 50 MHz		
operating temperature	0° C to +50° C	-20° C to +70° C	-40° C to +70° C
frequency change vs. temp. change (p-p)	$\leq 5 \times 10^{-9}$	$\leq 2 \times 10^{-8}$	$\leq 5 \times 10^{-8}$
long term stability at +25° C +2° C after 1 month		**option A**	**option B**
/ day		$\leq \pm 1 \times 10^{-9}$	$\leq \pm 5 \times 10^{-10}$
/ month		$\leq \pm 3 \times 10^{-8}$	$\leq \pm 1 \times 10^{-8}$
/ year		$\leq \pm 1 \times 10^{-7}$	$\leq \pm 5 \times 10^{-8}$
frequency change vs. supply voltage 12V+5%	$\leq \pm 5 \times 10^{-9}$		
input current (supply voltage12V±5%)	≤ 500 mA at warm-up ≤ 80 mA at +25° C	≤ 500 mA at warm-up ≤ 100 mA at +25° C	≤ 500 mA at warm-up ≤ 100 mA at +25° C
retrace after 24 hrs		**option A**	**option B**
after 10'		$\leq \pm 5 \times 10^{-8}$	$\leq \pm 3 \times 10^{-8}$
after 30'		$\leq \pm 2 \times 10^{-8}$	$\leq \pm 1 \times 10^{-8}$
frequency stability vs. load change 50Ω ± 10 %	$\leq \pm 5 \times 10^{-9}$		
frequency adjustment over 10 years		**option A**	**option B**
		$\geq 1.5 \times 10^{-6}$	$\geq 7 \times 10^{-7}$
		100 kHz at 17 MHz	**17 MHz at 50 MHz**
phase noise at 10 Hz		-120 dBc/Hz	-110 dBc/Hz
at 100 Hz		-140 dBc/Hz	-130 dBc/Hz
at 1 kHz		-145 dBc/Hz	-135 dBc/Hz
at 10 kHz		-150 dBc/Hz	-140 dBc/Hz
noise floor (typ. at 10 MHz)		-150 dBc/Hz	-140 dBc/Hz
harmonics	≥ -20 dBc		
subharmonics (F ≥ 17 MHz)	≥ -40 dBc		
output signal	≥ 0 dBm / 50 Ω		

OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO with SC-Cut resonator

type	QEO 67-CH.....LM59 QEO 63-CH.....LM59 QEO 45-CH.....LM59	QEO 67-CH.....HQ28 QEO 63-CH.....HQ28 QEO 45-CH.....HQ28	QEO 67-CH.....DQ58 QEO 63-CH.....DQ58 QEO 45-CH.....DQ58
frequency range	100 kHz to 50 MHz		
operating temperature	0° C to +50° C	-20° C to +70° C	-40° C to +70° C
frequency change vs. temp. change (p-p)	$\leq 5 \times 10^{-9}$	$\leq 2 \times 10^{-8}$	$\leq 5 \times 10^{-8}$
long term stability at +25° C +2° C after 1 month		**option A**	**option B**
/ day		$\leq \pm 1 \times 10^{-9}$	$\leq \pm 5 \times 10^{-10}$
/ month		$\leq \pm 3 \times 10^{-8}$	$\leq \pm 1 \times 10^{-8}$
/ year		$\leq \pm 1 \times 10^{-7}$	$\leq \pm 5 \times 10^{-8}$
frequency change vs. supply voltage 12 V±5 %	$\leq \pm 5 \times 10^{-9}$		
Input current (supply voltage12 V±5 %)	≤ 500 mA at warm-up ≤ 80 mA at +25° C	≤ 500 mA at warm-up ≤ 100 mA at +25° C	≤ 500 mA at warm-up ≤ 100 mA at +25° C
retrace after 24 hrs		**option A**	**option B**
after 10'		$\leq \pm 5 \times 10^{-8}$	$\leq \pm 3 \times 10^{-8}$
after 30'		$\leq \pm 2 \times 10^{-8}$	$\leq \pm 1 \times 10^{-8}$
frequency stability vs. load change ± 10 %	$\leq \pm 5 \times 10^{-9}$		
frequency adjustment over 10 years		**option A** $\geq 1.5 \times 10^{-6}$	**option B** $\geq 7 \times 10^{-7}$
		100 kHz at 17 MHz	**17 MHz at 50 MHz**
phase noise at 10 Hz		-120 dBc/Hz	-110 dBc/Hz
at 100 Hz		-140 dBc/Hz	-130 dBc/Hz
at 1 kHz		-145 dBc/Hz	-135 dBc/Hz
at 10 kHz		-150 dBc/Hz	-140 dBc/Hz
noise floor (typ. at 10 MHz)		-150 dBc/Hz	-140 dBc/Hz
subharmonics (F ≥ 17 MHz)	≥ -40 dBc		
output signal	3 TTL-gates / 15 pF "0" ≤ 0.5V / "1" ≥ 4.5 V		
rise / fall time	≤ 10 ns		
duty cycle	50 / 50 ± 20 %		

OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO with SC-Cut resonator

type	QEO 67-CO QEO 63-CO QEO 45-CO	QEO 67-CH QEO 63-CH QEO 45-CH
storage temperature range	-55° C to +90° C	
shock test	IEC 68-2-27 : test Ea / 50 g - 1 1 ms	
vibration test (sinewave)	IEC 68-2-06 : test Fc / 10 Hz - 500 Hz / 10 g	
packages	n° 67 (with 2 M2 fastening studs) n° 63 (without fastening studs) n° 45 (without fastening studs)	
ordering information	type + stability option code + frequency + temperature code + stability code example : QEO 67-COB 5.000 MHz HQ28	

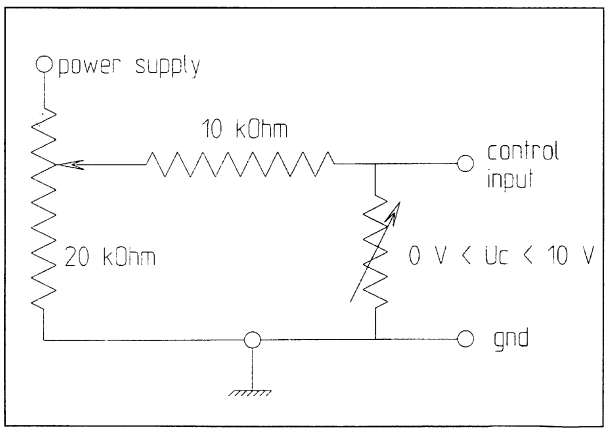
Frequency adjustment and slaving to another frequency standard

These oscillators can be tuned to nominal frequency by various means, each giving a specific result :

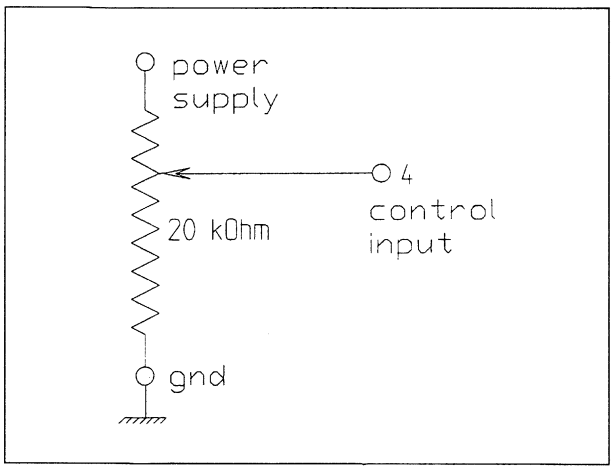
- adjustment resolution ≥ 1.10^{-7} or ≥ 1.10^{-9}
- slaving to an external frequency source

Please refer to the sketches below for the recommended circuits

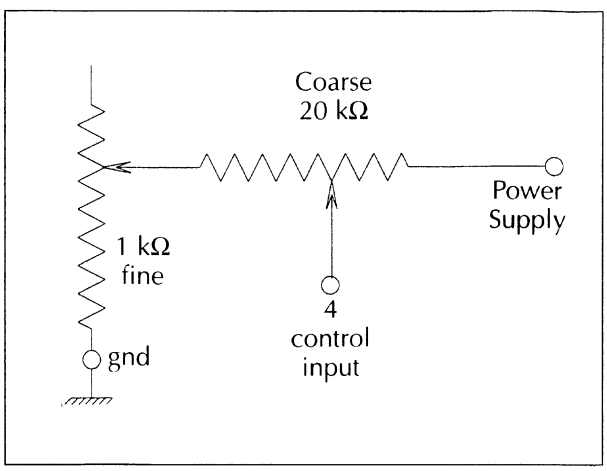
Tuning by an external voltage



Adjustement accuracy 1 x 10^{-7}



Adjustement accuracy 1 x 10^{-9}



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TYPES QEO 19-BO (sinus output) / QEO 19-BH (square output)

Applications

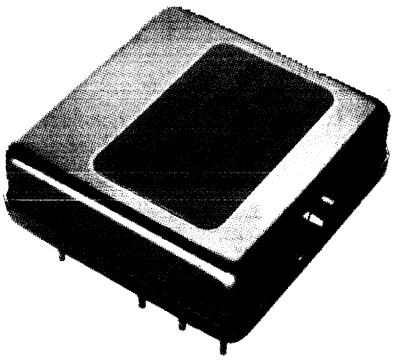
These oven-controlled crystal oscillators feature an innovative design providing high thermal stability inspite of the small volume.
They are well suited to applications where high stability is a prerequisite and space at a premium: mostly mobile equipment like ground terminals for satellite messaging systems (Automatic Vehicle Location).

Features

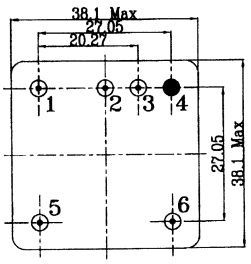
- Frequency: **100 kHz to 50 MHz**
- Temperature range up to **-40° C to +75° C**
- Ageing: ≤ **± 3.10^{-7} / year**
- Supply voltage: **12 V**
- Floor phase noise: **-150 dBc / Hz**
- **Square** form output **(types BH)** and **Sinus** output **(type BO)**
- **AT-cut** resonator

Associated models

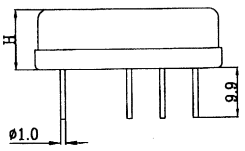
The types **QEO xx-CO** and **QEO xx-CH** use an inherently more stable crystal that provide for a ten fold better stability and phase noise figures. If you are looking for the ultimate performance, please consider our **MOT** range, albeit in a bigger housing.



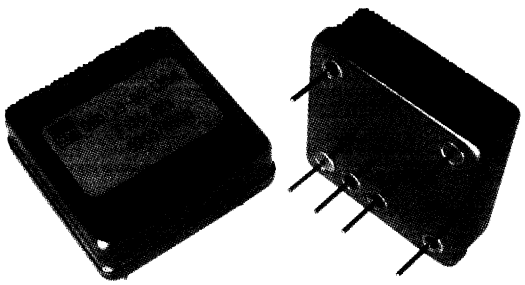
Package



1 - control voltage
2 - regulated output
3 - HF output
4 - GND
5 - GND
6 - 12 V input voltage



Package n° 19
h = 13 mm



OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO with AT-Cut resonator

type	QEO 19-BO.....LM58	QEO 19-BO.....HQ17	QEO 19-BO.....DQ27
frequency range		100 kHz to 50 MHz	
operating temperature	0° C to +50° C	-20° C to +70° C	-40° C to +70° C
frequency change vs. temp. change (p-p)	$\leq 5 \times 10^{-8}$	$\leq 1 \times 10^{-7}$	$\leq 2 \times 10^{-7}$
long term stability at +25° C ± 2° C after 1 month		$\leq \pm 3 \times 10^{-9}$ / day $\leq \pm 5 \times 10^{-8}$ / month $\leq \pm 3 \times 10^{-7}$ / year	
frequency change vs. supply voltage 12 V ± 5 %		$\leq \pm 5 \times 10^{-9}$	
input current (supply voltage 12 V ± 5 %)	≤ 500 mA at warm-up ≤ 80 mA at + 25° C	≤ 500 mA at warm-up ≤ 100 mA at + 25° C	≤ 500 mA at warm-up ≤ 100 mA at + 25° C
retrace after 24 hrs after 10' after 30'		$\leq \pm 3 \times 10^{-7}$ $\leq \pm 1 \times 10^{-7}$	
frequency stability vs. load change 50 Ω 10 %		$\leq \pm 5 \times 10^{-9}$	
frequency adjustment over 10 years		$\geq 5 \times 10^{-6}$	
		100 kHz at 17 MHz	**17 MHz at 50 MHz**
phase noise at 10 Hz		-100 dBc/Hz	-90 dBc/Hz
at 100 Hz		-130 dBc/Hz	-120 dBc/Hz
at 1 kHz		-145 dBc/Hz	-135 dBc/Hz
at 10 kHz		-150 dBc/Hz	-140 dBc/Hz
noise floor (typ. at 10 MHz)		-150 dBc/Hz	-140 dBc/Hz
harmonics		-20 dB	
subharmonics (F ≥ 17 MHz)		≥ -40 dBc	
output signal		≥ 0 dBm / 50 Ω	

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OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO with AT-Cut resonator

type	QEO 19-BH.....LM58	QEO 19-BH.....HQ17	QEO 19-BH.....DQ27
frequency range	100 kHz to 50 MHz		
operating temperature	0° C to +50° C	-20° C to +70° C	-40° C to +70° C
frequency change vs. temp. change (p-p)	$\leq 5 \times 10^{-8}$	$\leq 1 \times 10^{-7}$	$\leq 2 \times 10^{-7}$
long term stability at +25° C ± 2° C after 1 month	$\leq \pm 3 \times 10^{-9}$ / day $\leq \pm 5 \times 10^{-8}$ / month $\leq \pm 3 \times 10^{-7}$ / year		
frequency change vs. supply voltage 12 V ± 5 %	$\leq \pm 5 \times 10^{-9}$		
input current (supply voltage 12 V ± 5 %)	≤ 500 mA at warm-up ≤ 80 mA at +25° C	≤ 500 mA at warm-up ≤ 100 mA at +25° C	≤ 500 mA at warm-up ≤ 100 mA at +25° C
retrace after 24 hrs after 10' after 30'	 $\leq \pm 3 \times 10^{-7}$ $\leq \pm 1 \times 10^{-7}$		
frequency stability vs. load change + 10%	$\leq \pm 5 \times 10^{-9}$		
frequency adjustment over 10 years	$\geq 5\ 10^{-6}$		
	100 kHz at 17 MHz	**17 MHz at 50 MHz**	
phase noise at 10 Hz	-100 dBc/Hz	-90 dBc/Hz	
at 100 Hz	-130 dBc/Hz	-120 dBc/Hz	
at 1 kHz	-145 dBc/Hz	-135 dBc/Hz	
at 10 kHz	-150 dBc/Hz	-140 dBc/Hz	
noise floor (typ. at 10 MHz)	-150 dBc/Hz	-140 dBc/Hz	
subharmonics (F ≥ 17 MHz)	≥ -40 dBc		
output signal	3 TTL-gates / 15 pF "0" ≤ 0.5 V / "1" ≥ 4.5 V		
rise / fall time	≤ 10 ns		
duty cycle	50 / 50 ± 20 %		

OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO

type	QEO 19-BO	QEO 19-BH
storage temperature range	-55° C to +90° C	
shock test	IEC 68-2-27 : test Ea / 50 g - 11 ms	
vibration test (sinewave)	IEC 68-2-06 : test Fc / 10 Hz - 500 Hz / 10 g	
package	n° 19	
ordering information	type + frequency + temperature code + stability code example : QEO 19-BO 5.000 MHz HQ17	

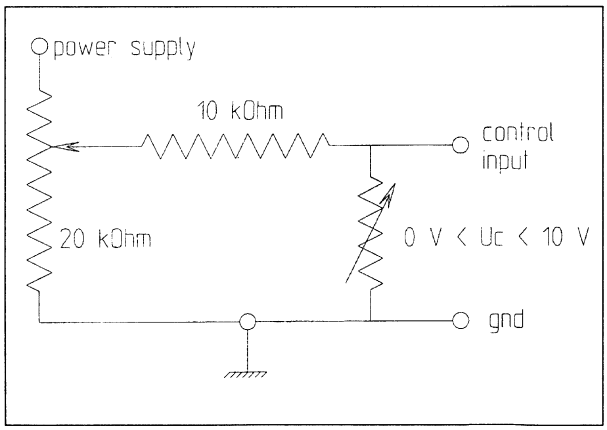
Frequency adjustment and slaving to another frequency standard

These oscillators can be tuned to nominal frequency by various means, each giving a specific result :

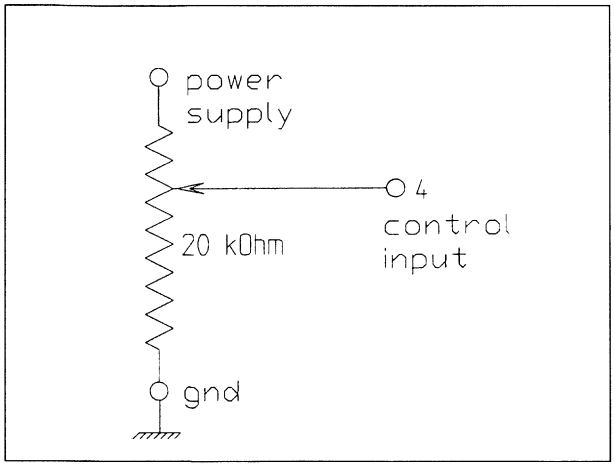
- adjustment resolution ≥ 1.10^{-7} or ≥ $1 .10^{-9}$
- slaving to an external frequency source

Please refer to the sketches below for the recommended circuits

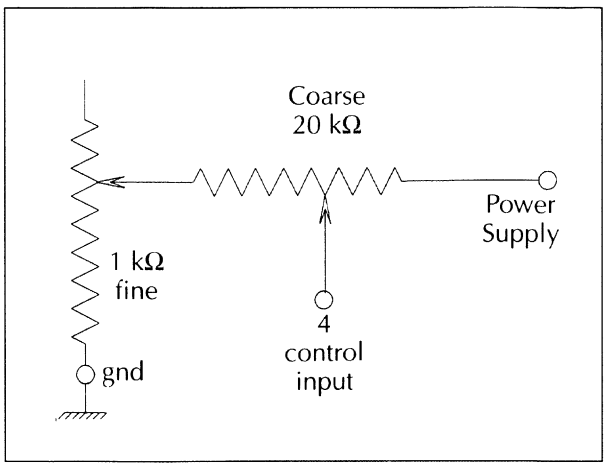
Tuning by an external voltage



Adjustement accuracy 1 x 10^{-7}



Adjustement accuracy 1 x 10^{-9}



TYPES QEO 67-BO (BH) / QEO 63-BO (BH) / QEO 45-BO (BH)

Applications

These oven-controlled crystal oscillators feature an innovative design providing high thermal stability inspite of the small volume.
They are well suited to applications where high stability is a prerequisite and space at a premium: mostly mobile equipment like ground terminals for satellite messaging systems (Automatic Vehicle Location).

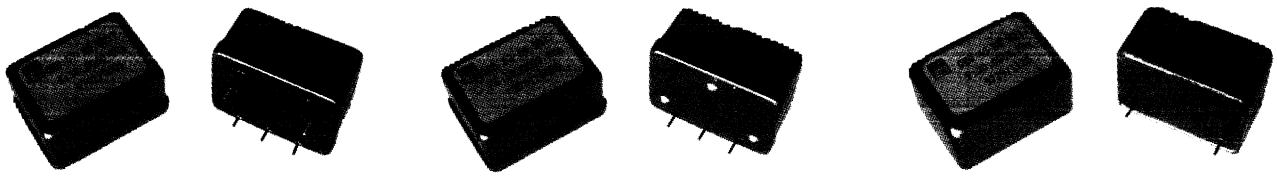
Associated models

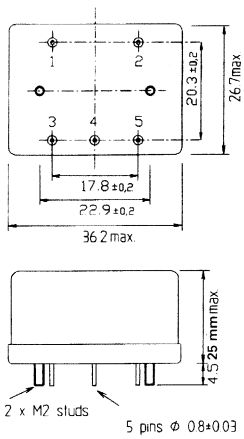
The types **QEO xx-CO** and **QEO xx-CH** use an inherently more stable crystal thatprovide for a ten fold better stability and phase noise figures. If you are looking for the ultimate performance, please consider our **MOT** range, albeit in a bigger housing.

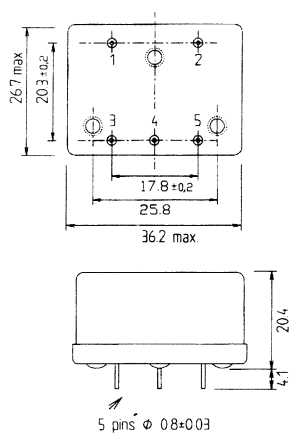
Features

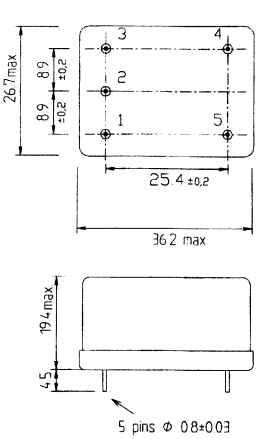
- Frequency: **100 kHz to 50 MHz**
- Temperature range up to **-40° C to +70° C**
- Ageing: ≤ **± 3.10^{-7} / year**
- Supply voltage: **12 V**
- Floor phase noise: **-150 dBc / Hz**
- **Square** form output **(types BH)** and **Sinus** output **(type BO)**
- **AT-cut** resonator
- Option : temperature range up to +75° C

Packages









Package n° 67

1 - GND
2 - power supply + 12 V
3 - HF output
4 - control input
5 - reference voltage output

Package n° 63

1 - GND
2 - power supply + 12 V
3 - HF output
4 - control input
5 - reference voltage output

Package n° 45

1 - control input
2 - reference voltage output
3 - power supply + 12 V
4 - HF output
5 - GND

OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO with AT-Cut resonator

TEKELEC TEMEX

type	QEO 67-BO.....LM58 QEO 63-BO.....LM58 QEO 45-BO.....LM58	QEO 67-BO.....HQ17 QEO 63-BO.....HQ17 QEO 45-BO.....HQ17	QEO 67-BO.....DQ27 QEO 63-BO.....DQ27 QEO 45-BO.....DQ27
frequency range	100 kHz to 50 MHz		
operating temperature	0° C to +50° C	-20° C to +70° C	-40° C to +70° C
frequency change vs. temp. change (p-p)	$\leq 5 \times 10^{-8}$	$\leq 1 \times 10^{-7}$	$\leq 2 \times 10^{-7}$
long term stability at +25° C ± 2° C after 1 month	$\leq \pm 3 \times 10^{-9}$ / day $\leq \pm 5 \times 10^{-8}$ / month $\leq \pm 3 \times 10^{-7}$ / year		
frequency change vs. supply voltage 12 V ± 5 %	$\leq \pm 5 \times 10^{-9}$		
input current (supply voltage 12 V ± 5 %)	≤ 500 mA at warm-up ≤ 80 mA at + 25° C	≤ 500 mA at warm-up ≤ 100 mA at + 25° C	≤ 500 mA at warm-up ≤ 100 mA at + 25° C
retrace after 24 hrs after 10' after 30'	$\leq \pm 3 \times 10^{-7}$ $\leq \pm 1 \times 10^{-7}$		
frequency stability vs. load change 50 Ω ± 10 %	$\leq \pm 5 \times 10^{-9}$		
frequency adjustment over 10 years	$\geq 5 \times 10^{-6}$		
phase noise at 10 Hz at 100 Hz at 1 kHz at 10 kHz noise floor (typ. at 10 MHz)	**100 kHz at 17 MHz** -100 dBc/Hz -130 dBc/Hz -145 dBc/Hz -150 dBc/Hz -150 dBc/Hz	**17 MHz at 50 MHz** -90 dBc/Hz -120 dBc/Hz -135 dBc/Hz -140 dBc/Hz -140 dBc/Hz	
harmonics	≥ -20 dBc		
Subharmonics (F ≥ 17 MHz)	≥ -40 dBc		
output signal	≥ 0 dBm / 50 Ω		

OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO with AT-Cut resonator

type	QEO 67-BH.....LM58 QEO 63-BH.....LM58 QEO 45-BH.....LM58	QEO 67-BH.....HQ17 QEO 63-BH.....HQ17 QEO 45-BH.....HQ17	QEO 67-BH.....DQ27 QEO 63-BH.....DQ27 QEO 45-BH.....DQ27
frequency range	100 kHz to 50 MHz		
operating temperature	0° C to +50° C	-20° C to +70° C	-40° C to +70° C
frequency change vs. temp. change (p-p)	$\leq 5 \times 10^{-8}$	$\leq 1 \times 10^{-7}$	$\leq 2 \times 10^{-7}$
long term stability at +25° C ± 2° C after 1 month	$\leq \pm 3 \times 10^{-9}$ / day $\leq \pm 5 \times 10^{-8}$ / month $\leq \pm 3 \times 10^{-7}$ / year		
frequency change vs. supply voltage 12 V ± 5 %	$\leq \pm 5 \times 10^{-9}$		
input current (supply voltage 12 V ± 5 %)	≤ 500 mA at warm-up ≤ 80 mA at +25° C	≤ 500 mA at warm-up ≤ 100 mA at +25° C	≤ 500 mA at warm-up ≤ 100 mA at +25° C
retrace after 24 hrs after 10' after 30'	$\leq \pm 3 \times 10^{-7}$ $\leq \pm 1 \times 10^{-7}$		
frequency stability vs. load change ±10%	$\leq \pm 5 \times 10^{-9}$		
frequency adjustment over 10 years	$\geq 5\ 10^{-6}$		
	100 kHz at 17 MHz	**17 MHz at 50 MHz**	
phase noise at 10 Hz	-100 dBc/Hz	-90 dBc/Hz	
at 100 Hz	-130 dBc/Hz	-120 dBc/Hz	
at 1 kHz	-145 dBc/Hz	-135 dBc/Hz	
at 10 kHz	-150 dBc/Hz	-140 dBc/Hz	
noise floor (typ. at 10 MHz)	-150 dBc/Hz	-140 dBc/Hz	
subharmonics (F ≥ 17 MHz)	≥ -40 dBc		
output signal	3 TTL-gates / 15 pF "0" ≤ 0.5 V / "1" ≥ 4.5 V		
rise / fall time	≤ 10 ns		
duty cycle	50 / 50 ± 20 %		

OVEN CONTROLLED CRYSTAL OSCILLATORS

Miniature OCXO

type	QEO 67-BO QEO 63-BO QEO 45-BO	QEO 67-BH QEO 63-BH QEO 45-BH
storage temperature range	-55° C to +90° C	
shock test	IEC 68-2-27 : test Ea / 50 g - 11 ms	
vibration test (sinewave)	IEC 68-2-06 : test Fc / 10 Hz - 500 Hz / 10 g	
packages	n° 67 (with 2 M2 fastening studs) n° 63 (without fastening studs) n° 45 (without fastening studs)	
ordering information	type + frequency + temperature code + stability code example : QEO 67-BO 5.000 MHz HQ58	

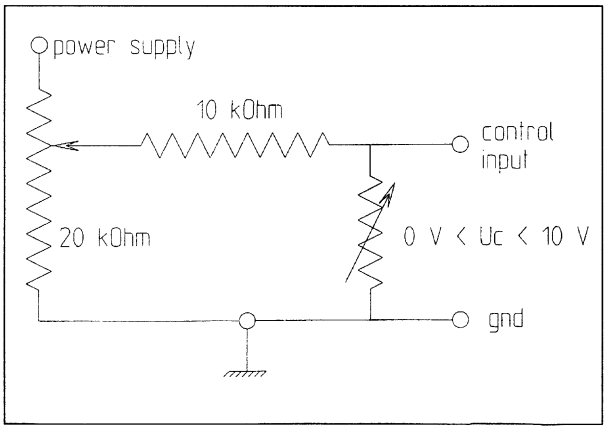
FRequency adjustment and slaving to another frequency standard

These oscillators can be tuned to nominal frequency by various means, each giving a specific result :

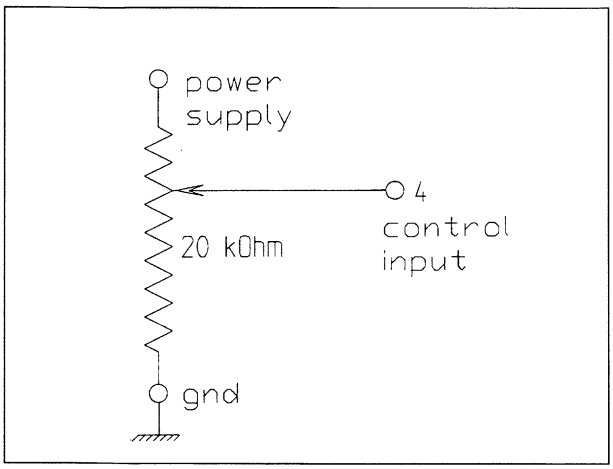
- adjustment resolution ≥ 1.10^{-7} or ≥ 1.10^{-9}
- slaving to an external frequency source

Please refer to the sketches below for the recommended circuits

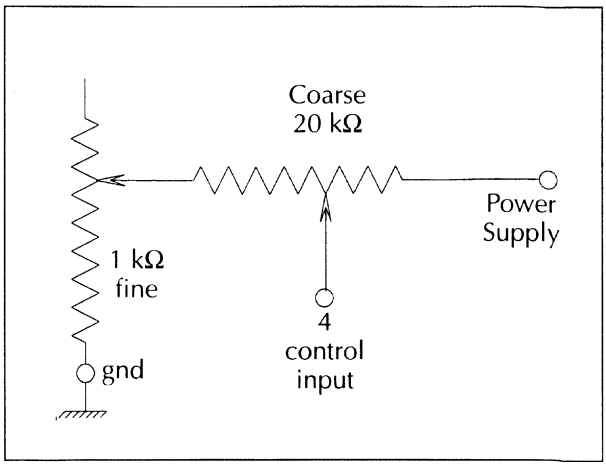
Tuning by an external voltage



Adjustement accuracy 1 x 10^{-7}



Adjustement accuracy 1 x 10^{-9}



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TYPES QEO 75-AH & QEO 78-AH

Applications

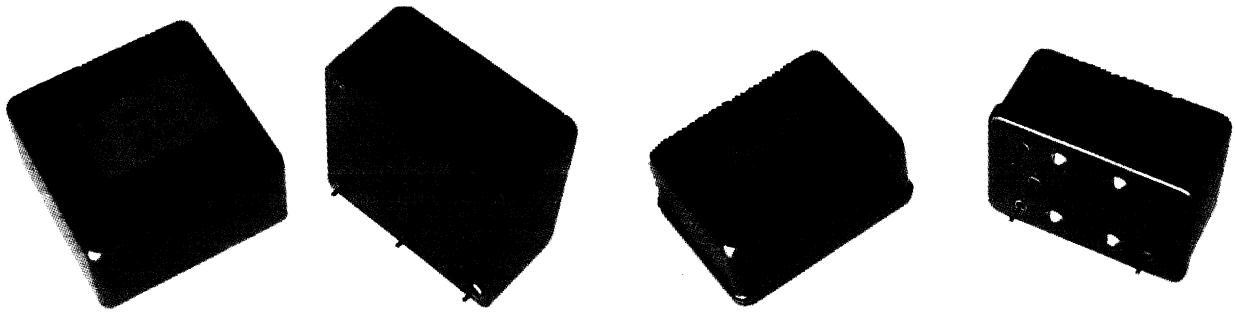
These oscillators are well suited to GSM base-stations. However, they offer a very interesting mix of high stability and small footprint.

Associated models

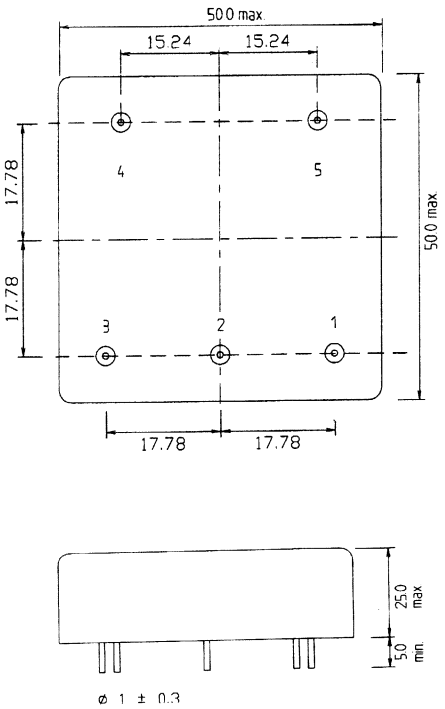
For oscillators with very high stability, please refer to our **MOT** range described page 7-107.

Features

- Frequency: **5 MHz to 30 MHz**
- Temperature range up to **-40° C to +70° C**
- Ageing: ≤ **± 3.10^{-8} / year**
- Supply voltage: **12 V**
- Floor phase noise: **-145 dBc / Hz**
- **Square** form output
- **SC-cut / Glass holder**



Packages



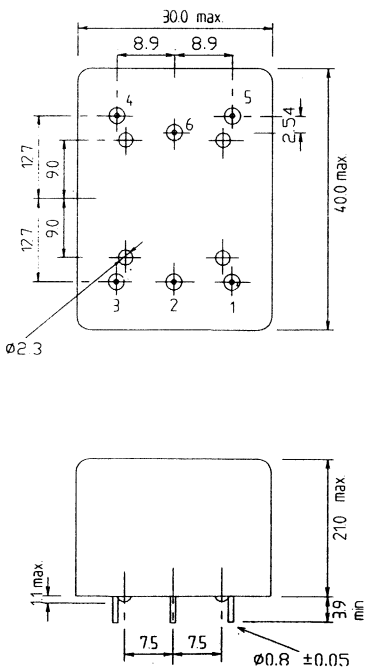
Package n° 75

Pad connections

1 - Frequency adjustment
2 - Reference voltage output
3 - HF output
4 - 0 V and GND
5 - Power supply

Pad connections

1 - Control voltage input
2 - Reference voltage output
3 - Power supply
4 - HF output
5 - 0 V and GND
6 - Oven alarm



Package n° 78

OVEN CONTROLLED CRYSTAL OSCILLATORS

OCXO for GSM base station

reference	QEO 75-AH	QEO 78-AH
frequency range	5 MHz to 30 MHz	
temperature ranges: operating operable storage	 -10° C to +70° C -20° C to +70° C -40° C to +70° C	
warm-up time	≤ 10' to reach FO ± 5.10^{-8}	
frequency stability	± 5.10^{-8} min includes temperature changes (operating range), supply voltage ± 10 % and 1 year ageing	
supply voltage	12 V ± 10 %	
input current	start-up: 400 mA steady state at 25° C: 130 mA steady state over temperature range +10° C to +70° C: 325 mA	
frequency adjustment by external voltage	≥ ± 5.10^{-7} +0.15 ppm / V < slope +0.5 ppm / V (linearity ± 10 %) control input impedance on pin 1: > 200 kΩ reference voltage on pin 2: +4 V to +7 V (1 mA max.)	
phase noise at 20 MHz	10 Hz :-110 dBc / Hz 100 Hz :-130 dBc / Hz 1 kHz :-140 dBc / Hz Noise floor :-145 dBc / Hz	
output signal	«0» < 0.5 V «1» > 4.5 V	
nominal load	10 pF	
duty cycle	50 / 50 ± 20 %	
oven alarm (pin 6)	> 4.5 V when oven circuit closed < 0.5 V when oven circuit open	
shock test	IEC 68-2-27: test Ea / 50 g - 11 ms	
vibrations (sinewave)	IEC 68-2-06: test Fc / 10 Hz - 500 Hz / 10 g	
marking	CQE + type + frequency + date code + serial number	
package	n° 75: 50 x 50 x 25 mm	n° 78: 40 x 30 x 22 mm
ordering information (reference)	type + frequency example: QEO 75-AH, frequency = 26.000 MHz	

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OVEN CONTROLLED CRYSTAL OSCILLATORS

High stability OCXO with SC-cut resonator

TYPE MOT

Applications

This range of master clock oscillators deliver a signal featuring high frequency accuracy, low ageing and high spectral purity. They can be slaved to a **primary frequency standard** (atomic clock).

The main applications are communication network synchronisation and frequency standards. The various types described in this data sheet differ mainly by the long term stability and the phase noise they offer.

The frequency range of these oscillators covers 4 MHz to 10 MHz with standard frequencies of 5 MHz and 10 MHz. Should you need frequencies or parameters differing from the standard ones, please contact our sales desk.

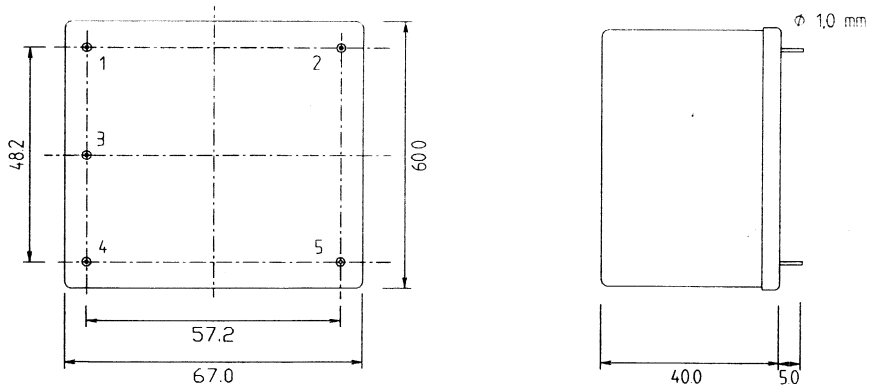
Features

- **Clock frequency**
- Frequency: **5 MHz to 10 MHz**
- Temperature range: **-40° C to +70° C**
- Ageing: ≤ **± 1.10^{-8} / year**
- Supply voltage: **12 V**
- Floor phase noise: **-155 dBc / Hz**
- **Sine** output
- **SC-cut / Glass holder**

Associated models

The oscillators in our **MOT** series are mainly aimed at ground fixed equipment. We manufacture other types, each designed to match specific needs: small size, harsh environmental constraints, low cost, etc... Please contact our sales desk for further information.

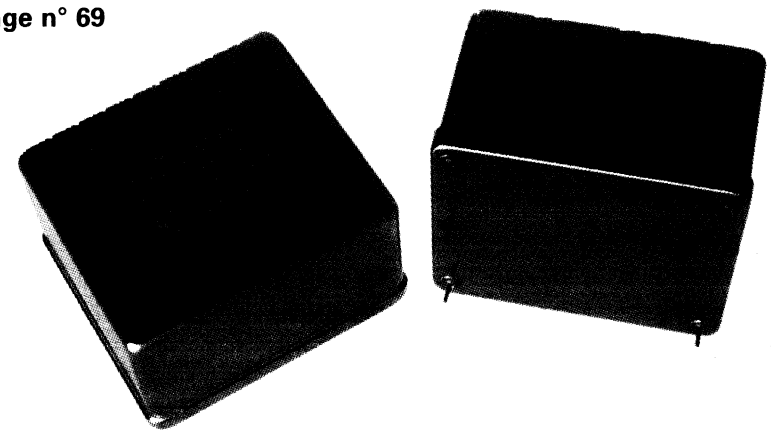
Package



Pad connections

1 - frequency output
2 - frequency adjustment regulated output
3 - GND
4 - frequency adjustment input
5 - power supply + 12 V

Package n° 69



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OVEN CONTROLLED CRYSTAL OSCILLATORS

High stability OCXO

type	MOTE 109	MOTE 510	MOTE 510S	MOTE 110	MOTE 110S	MOTA 511
frequency range	5 MHz to 10 MHz (5 MHz and 10 MHz standard frequencies)					
operating temperature	-40° C to +70° C					-40° C to +50° C
frequency change vs. temp. change (p-p)	$\leq 1 \times 10^{-8}$			$\leq 5 \times 10^{-9}$		
long term stability at +25° C ±2° C after 1 month /day	$\leq \pm 1 \times 10^{-9}$	$\leq \pm 5 \times 10^{-10}$		$\leq \pm 1 \times 10^{-10}$		$\leq \pm 5 \times 10^{-11}$
/month	$\leq \pm 3 \times 10^{-8}$	$\leq \pm 1 \times 10^{-8}$		$\leq \pm 2 \times 10^{-9}$		$\leq \pm 1 \times 10^{-9}$
/year	$\leq \pm 1 \times 10^{-7}$	$\leq \pm 5 \times 10^{-8}$		$\leq \pm 2 \times 10^{-8}$		$\leq \pm 1 \times 10^{-8}$
frequency stability vs. supply voltage 12 V ± 5 %	$\leq \pm 5 \times 10^{-10}$	$\leq \pm 1 \times 10^{-10}$				
input current (supply voltage 12 V ± 5%)	start-up ≤ 700 mA steady state at -40° C ≤ 400 mA steady state at +25° C ≤ 200 mA					
retrace after 24 hrs						
after 10'				$\leq \pm 1 \times 10^{-7}$		
after 15'	$\leq \pm 1 \times 10^{-7}$			$\leq \pm 5 \times 10^{-8}$		$\leq \pm 5 \times 10^{-8}$
after 60'	$\leq \pm 5 \times 10^{-9}$			$\leq \pm 5 \times 10^{-9}$		$\leq \pm 5 \times 10^{-9}$
frequency change vs. load change 50 Ω ± 10 %	$\leq \pm 5.10^{-10}$					
frequency adjustment over 10 years						
ext. voltage 0 V to 8 V	$\geq \pm 1 \times 10^{-6}$	$\geq \pm 5 \times 10^{-7}$	$\geq \pm 5 \times 10^{-7}$	$\geq \pm 2 \times 10^{-7}$	$\geq \pm 2 \times 10^{-7}$	$\geq \pm 2 \times 10^{-7}$
linearity	n.a.	n.a.	± 20 %	n.a.	± 20 %	n.a.
potentiometer 20 kΩ	$\geq \pm 1 \times 10^{-6}$	$\geq \pm 5 \times 10^{-7}$	$\geq \pm 5 \times 10^{-7}$	$\geq \pm 2 \times 10^{-7}$	$\geq \pm 2 \times 10^{-7}$	$\geq \pm 2 \times 10^{-7}$
mechanical	n.a.	n.a.	optional	n.a.	n.a.	n.a.
short-term stability						
100 ms	$\leq 1 \times 10^{-10}$	$\leq 1 \times 10^{-10}$	$\leq 5 \times 10^{-11}$		$\leq 5 \times 10^{-11}$	$\leq 1 \times 10^{-11}$
1 s	$\leq 1 \times 10^{-10}$	$\leq 5 \times 10^{-11}$	$\leq 2 \times 10^{-11}$		$\leq 2 \times 10^{-11}$	$\leq 5 \times 10^{-12}$
5 s	$\leq 1 \times 10^{-10}$	$\leq 5 \times 10^{-11}$	$\leq 2 \times 10^{-11}$		$\leq 1 \times 10^{-11}$	$\leq 5 \times 10^{-12}$
10 s	$\leq 1 \times 10^{-10}$	$\leq 5 \times 10^{-11}$	$\leq 2 \times 10^{-11}$		$\leq 1 \times 10^{-11}$	$\leq 5 \times 10^{-12}$
phase noise at 10 Hz			≤ -120 dBc/Hz		≤ -120 dBc/Hz	
at 1 kHz			*≤ -150 dBc/Hz*		*≤ -140 dBc/Hz*	
noise floor						
F0 = 5 MHz	≤ -140 dBc/Hz	≤ -140 dBc/Hz	*≤ -155 dBc/Hz*	≤ -140 dBc/Hz	*≤ -150 dBc/Hz*	*≤ -140 dBc/Hz*
F0 = 10 MHz		*≤ -150dBc/Hz*				
(typical values in italic)						
g-sensitivity at 1 g	$\leq 5 \times 10^{-9}$		*≤ 2 x 10^{-9}*	$\leq 5 \times 10^{-9}$	*≤ 2 x 10^{-9}*	*≤ 5 x 10^{-9}*

type	MOTE 109	MOTE 510	MOTE 510S	MOTE 110	MOTE 110S	MOTA 511
output signal	sinewave, 0 dbm into 50 Ω harmonic distortion ≤ 40 dB spurious level ≤ 60 dB					
shock test	IEC 68-2-27: test Ea / 50 g - 11 ms					
vibration test (sinewave)	IEC 68-2-06 : test Fc / 10 Hz - 500 Hz / 10 g					
package	dimensions : 60 x 67 x 40 mm, mass ≅ 200 g					
ordering information	type + frequency example : MOTA 511, F = 5,000 MHz					

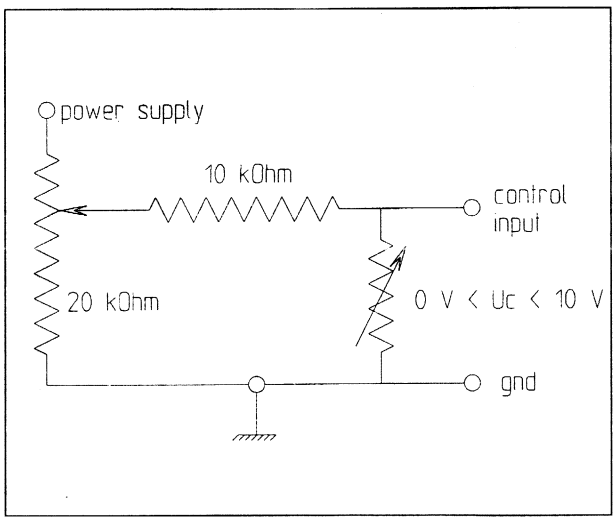
Frequency adjustment and slaving to another frequency standard

The MOT series can be tuned to nominal frequency by various means, each giving a specific result :

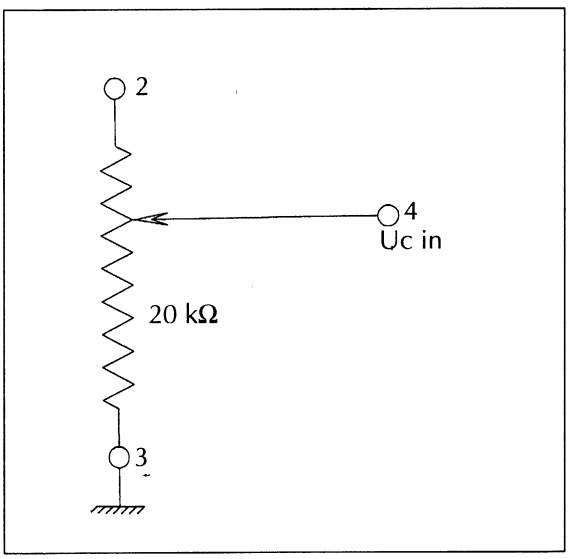
- adjustment resolution $\geq 1.10^{-8}$ or $\geq 1.10^{-10}$
- slaving to an external frequency source

Please refer to the sketches below for the recommended circuits

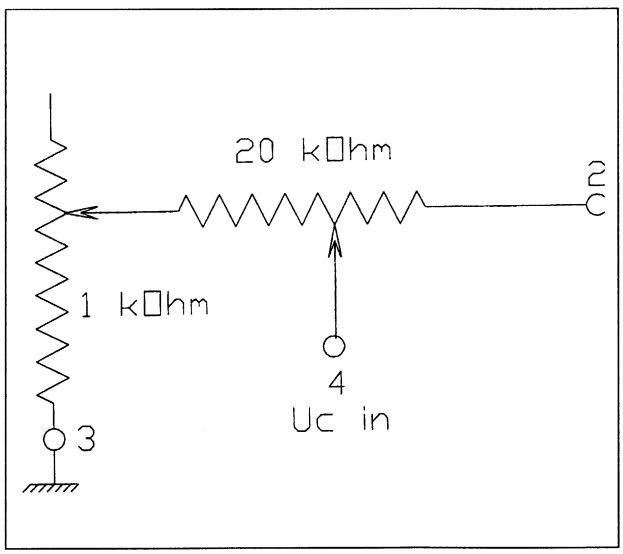
Tuning by an external voltage



Adjustement accuracy 1 x 10^{-8}



Adjustement accuracy 1 x 10^{-10}



OVEN CONTROLLED CRYSTAL OSCILLATORS

Double oven OCXO with SC-cut resonator

TYPE MOT (C)

Frequency stability:
$\pm 1.10^{-10}$ over temperature range

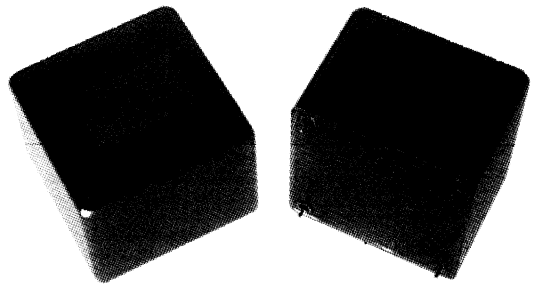
Applications

This range of master clock oscillators deliver a signal featuring high frequency accuracy, low ageing and high spectral purity. They can be slaved to a **primary frequency standard** (atomic clock).

The main applications are communication network synchronisation and frequency standards, GPS, CDMA applications.

Features

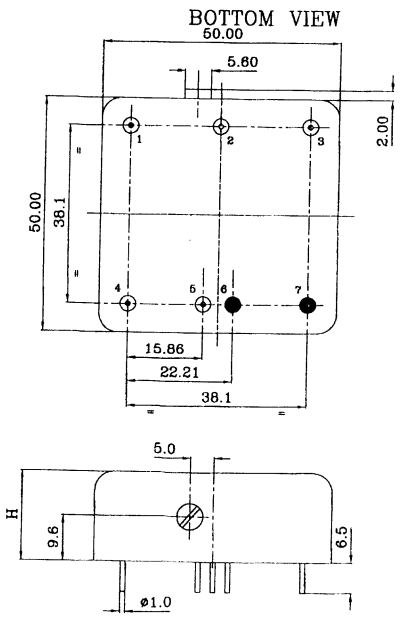
- Frequency: 5 MHz to 20 MHz
- Temperature range: -20° C to +75° C
- Ageing: $\leq \pm 1.10^{-8}$ / year
- Supply voltage: 12 V
- Floor phase noise: -155 dBc / Hz
- **Sinewave** output
- **SC-cut / Glass holder**



Associated models

The oscillators in our **MOT (C)** series are mainly aimed at ground fixed equipment. We manufacture other types in series MOT in temperature range of -40° C to +70° C.
We manufacture also other types, each design to match specific contraints, low cost etc...
Please contact our sales desk for further information.

Package



Package n° 75-1
H = 38 mm

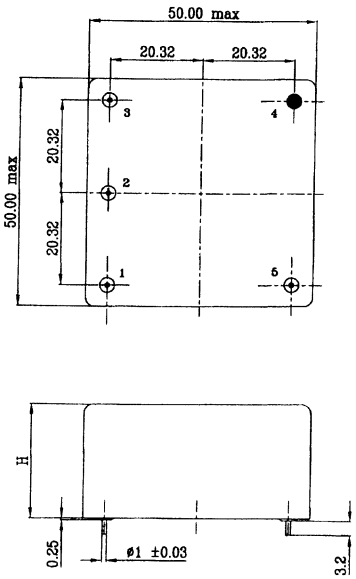
Pad connections

Package 75-1

1 - EFC input
2 - Ref. voltage output
3 - RF output
4 - OV-GND / Case
5 - Power supply +12 V

Package 75-2

1 - Oven return
2 - Osc. supply (+12 V)
3 - Freq. control
4 - Oven supply (+12 V)
5 - RF output
6 - RF-GND ans Osc. return
7 - Case / GND



Package n° 75-2
H = 38 mm

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OVEN CONTROLLED CRYSTAL OSCILLATORS

Double oven OCXO with SC-cut resonator

type	MOTEC 510	MOTEC 510S	MOTEC 110	MOTEC 110S	MOTAC 511
frequency range	5 MHz to 20 MHz (5 MHz and 10 MHz standard frequencies)				
operating temperature	-20° C to +75° C Other temperature ranges available				-20° C to +75° C
frequency change vs. temp. change (p-p)	$\leq 5 \times 10^{-10}$				$\leq 1 \times 10^{-10}$
long term stability at +25° C ±2° C					
after 1 month /day	$\leq \pm 5.10^{-10}$		$\leq \pm 1.10^{-10}$		$\leq \pm 5.10^{-11}$
/month	$\leq \pm 1.10^{-8}$		$\leq \pm 2.10^{-9}$		$\leq \pm 1.10^{-9}$
/year	$\leq \pm 5.10^{-8}$		$\leq \pm 2.10^{-8}$		$\leq \pm 1.10^{-8}$
frequency vs. supply voltage 12 V ± 5 %	$\leq \pm 1.10^{-10}$				
input current (supply voltage 12 V ± 5%)	start-up < 700 mA steady state at -20° C < 400 mA steady state at +25° C < 250 mA				
retrace after 24 hrs					
after 10'	$\leq \pm 1.10^{-7}$				
after 15'	$\leq \pm 5.10^{-8}$				
after 60'	$\leq \pm 5.10^{-9}$				
frequency vs. load change 50 Ω ± 10 %	$\leq \pm 5.10^{-10}$				
frequency adjustment over 10 years					
ext. voltage 0 V to 8 V	$\geq \pm 5.10^{-7}$	$\geq \pm 5.10^{-7}$	$\geq \pm 2.10^{-7}$	$\geq \pm 2.10^{-7}$	$\geq \pm 2.10^{-7}$
linearity	n.a.	20 %	n.a.	20 %	n.a.
potentiometer 20 kΩ	$\geq \pm 5.10^{-7}$	$\geq \pm 5.10^{-7}$	$\geq \pm 2.10^{-7}$	$\geq \pm 2.10^{-7}$	$\geq \pm 2.10^{-7}$
mechanical	n.a.	optional	n.a.	20%	n.a.
short-term stability					
100 ms	$\leq 1.10^{-10}$	$\leq 5.10^{-11}$		$\leq 5.10^{-11}$	$\leq 1.10^{-11}$
1 s	$\leq 5.10^{-11}$	$\leq 2.10^{-11}$		$\leq 2.10^{-11}$	$\leq 5.10^{-12}$
5 s	$\leq 5.10^{-11}$	$\leq 2.10^{-11}$		$\leq 1.10^{-11}$	$\leq 5.10^{-12}$
10 s	$\leq 5.10^{-11}$	$\leq 2.10^{-11}$		$\leq 1.10^{-11}$	$\leq 5.10^{-12}$
phase noise at 10 Hz		≤ -120 dBc/Hz		≤ -120 dBc/Hz	
at 1 kHz		*≤ -150 dBc/Hz*		*≤ -140 dBc/Hz*	
noise floor at					
F0 = 5 MHz	≤-140 dBc/Hz	*≤-140 dBc/Hz*	*≤-155 dBc/Hz*	*≤ -40 dBc/Hz*	*≤ -150 dBc/Hz*
F0 = 10 MHz	*≤ -150dBc/Hz*				
(typical values in italic)					

OVEN CONTROLLED CRYSTAL OSCILLATORS

Double oven OCXO with SC-cut resonator

type	MOTEC 510	MOTEC 510S	MOTEC 110	MOTEC 110S	MOTAC 511
g-sensivity	$\leq \pm 5.10^{-9}$	$\leq \pm 2.10^{-9}$	$\leq \pm 5.10^{-9}$	$\leq \pm 2.10^{-9}$	$\leq \pm 5.10^{-9}$
output signal	sinewave, 0 dBm into 50 Ω harmonic distortion < 40 dB spurious level < 60 dB				
shock test	IEC 68-2-27: test EA / 50 g - 11 ms				
vibration test (sinewave)	EIC 68-2-6: test Fc / 10 Hz to 500 Hz / 10 g				
package	dimensions: 60 x 67 x 40, mas 250 g				
marking	CQE + date code + reference				
ordering information (reference	type + frequency example: MOTAC 511, F = 5.000 MHz				

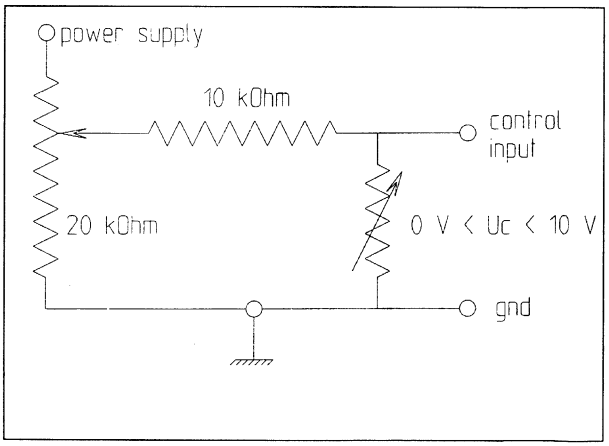
Frequency adjustment and slaving to another frequency standard

The MOT (C) series can be tuned to nominal frequency by various means, each giving a specific result :

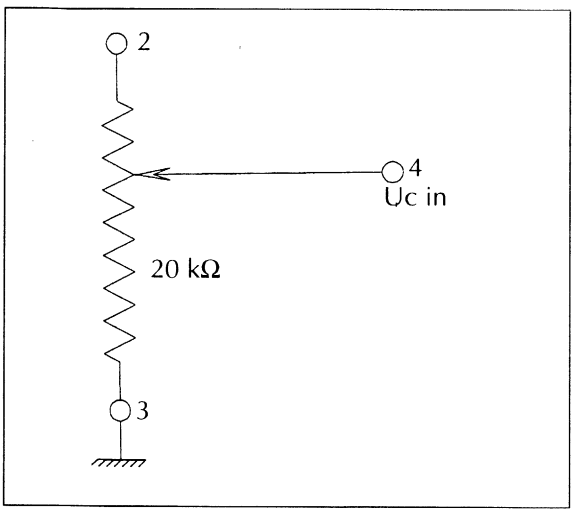
- adjustment resolution $\geq 1.10^{-8}$ or $\geq 1.10^{-10}$
- slaving to an external frequency source

Please refer to the sketches below for the recommended circuits

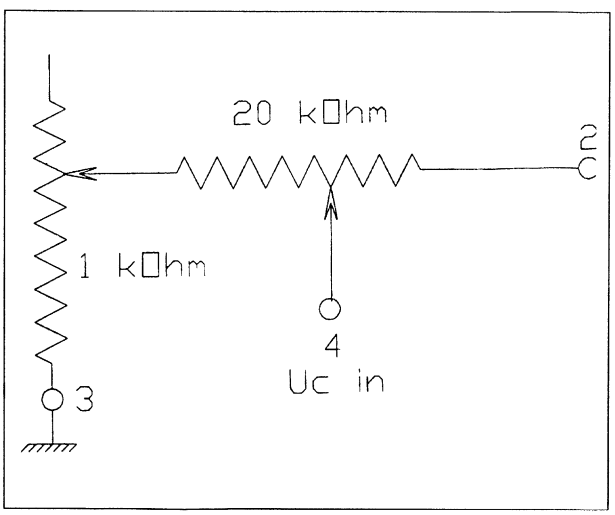
Tuning by an external voltage



Adjustement accuracy 1 x 10^{-8}



Adjustement accuracy 1 x 10^{-10}



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OVEN CONTROLLED CRYSTAL OSCILLATORS

Very high stability OCXO with SC-cut resonator

TYPE QEO 67-DO

Applications

These oscillators deliver a signal featuring high frequency accuracy, low ageing and high spectral purity.

They are manufactured with SC-cut resonator which provide a very good ageing.

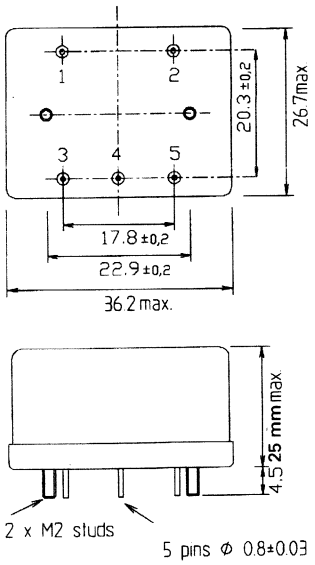
The main applications are communication network synchronisation and all applications where higher stability is a prerequesite.

(TV broadcast network).

Features

- Frequency range: **50 MHz to 120 MHz**
- Temperature range: **-20° C to +70° C**
- Ageing: ≤ **± 1.10^{-7}** / year
- Supply voltage: **12 V**
- **Phase Lock Loop inside** with **VCXO**
- Low phase noise: -150 dBc / Hz at 10 kHz
- **Sinus** output
- **SC-cut / Glass holder**

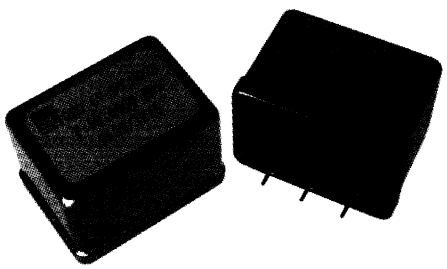
Package



Package n° 67

Pad connections

1 - GND
2 - Power supply
3 - HF output
4 - Control input
5 - Reference voltage output



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OVEN CONTROLLED CRYSTAL OSCILLATORS

High frequency OCXO with SC-cut

reference	QEO 67-DO...LM 59	QEO 67-DO...HQ28
frequency range	50 MHz to 120 MHz	
operating temperature	0° C to +50° C	-20° C to +70° C
frequency vs temperature change (p-p)	$\leq 1.10^{-8}$	$\leq 2.10^{-8}$
long tern stability at +25° C after 1 month	**option A** $< \pm 5.10^{-9}$ / day $< \pm 1.10^{-7}$ / month $< \pm 5.10^{-7}$ / year	**option B** $< \pm 1.10^{-9}$ / day $< \pm 3.10^{-8}$ / month $< \pm 1.10^{-7}$ / year
frequency vs. supply 12 V ± 5 %	$\leq \pm 1.10^{-8}$	
input current	≤ 500 mA at warm-up ≤ 120 mA at 25° C	≤ 500 mA at warm-up ≤ 150 mA at 25° C
retrace after 24 hrs after 15' after 30'	**option A** $\leq \pm 1.10^{-7}$ $\leq \pm 5.10^{-8}$	**option B** $\leq \pm 5.10^{-8}$ $\leq \pm 2.10^{-8}$
frequency vs. load charge 50 Ω ± 10 %	$\leq \pm 2.10^{-8}$	
frequency adjustment over 10 years	on request	
phase noise (typ.) at 10 Hz at 100 Hz at 1 kHz at 10 kHz	 -90 dBc / Hz -110 dBc / Hz -140 dBc / Hz -150 dBc / Hz	
harmonics subharmonics	≥ -30 dBc ≥ -50 dBc	
output signal	> 6 dBm / 50 Ω	
storage temperature	-30° C to +80° C	
shock test	IEC 68-2-27: test EA / 50 g - 6 ms	
vibration test (sinewave)	IEC 68-2-6; test Fc / 10 Hz to 500 Hz / 10 g	
package	n° 67 (36.2 x 26.5 x 25 mm)	
marking	CQE + date code + reference	
ordering information	reference + stability option code + frequency + stability code example: QEo 67-DOB 60.000 MHz LM59	

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CRYSTAL FILTERS

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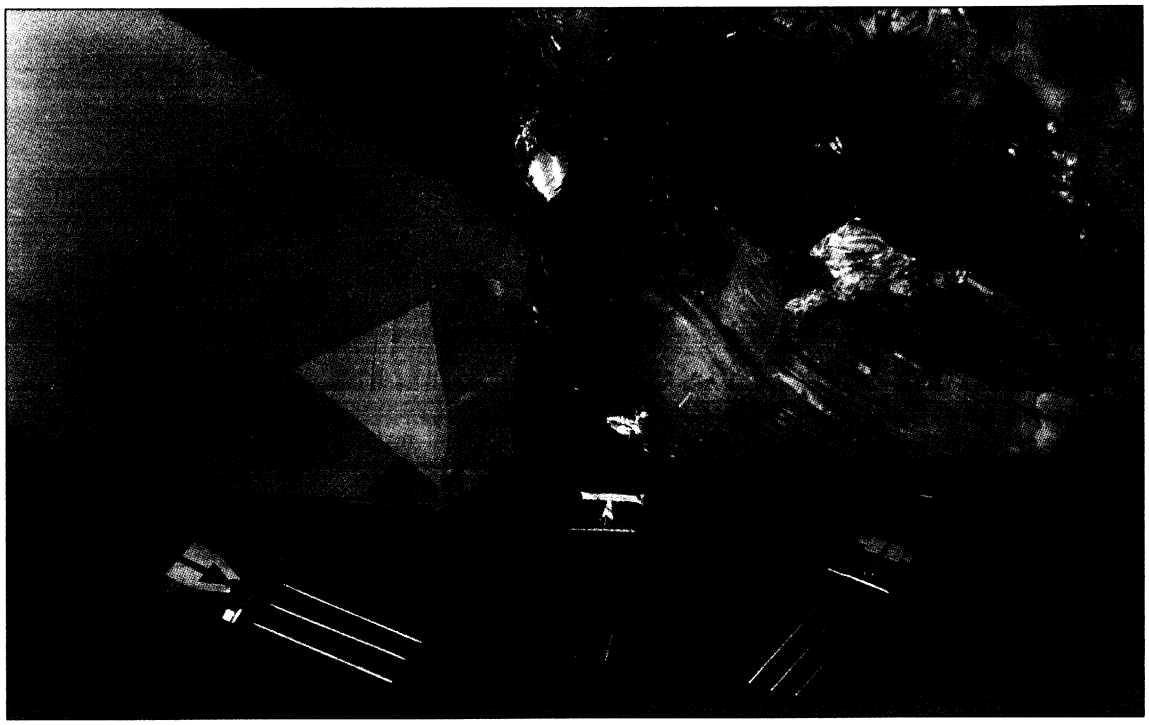

SEE SECTION 2

CATALOGUE N° 4

PAGES 4-4 & 4-14 OF THIS DATA BOOK

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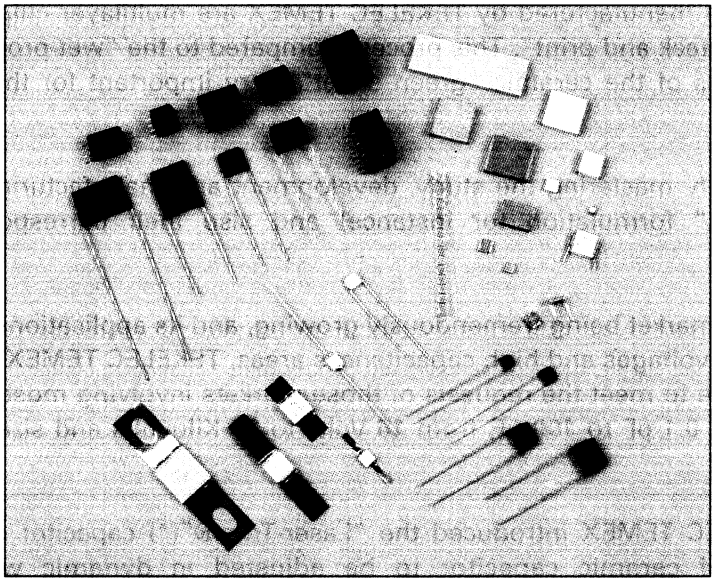
MULTILAYER CERAMIC CAPACITORS

CONTENTS



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GENERAL INFORMATION

TECHNOLOGY & QUALITY

The ceramic capacitors manufactured by TEKELEC TEMEX are multilayer chips obtained from "Dry process" also called "stack and print". This process compared to the "wet process", allows a perfect control of the thickness of the ceramic "green sheet", very important for the homogeneity of the capacitors.

TEKELEC TEMEX is fully mastering the study, development and manufacturing of special dielectric compositions (High"Q" formulation for instance) and also their corresponding electrode and terminations inks.

The ceramic capacitor market being tremendously growing, and its applications being now covering high frequencies, high voltages and high capacitances areas, TEKELEC TEMEX has developed a wide range of products liable to meet the requests of those markets involving most of the time the ability of manufacturing from 0.1 pF to 100 µF, from 16 Volts to 25 Kilovolts and size 0603 to size 7565 for instance...

More recently, TEKELEC TEMEX introduced the "Laser-Trim®"(*) capacitor on the market, a very innovative concept of ceramic capacitor to be adjusted in dynamic with a YAG laser for radiocommunication purposes.

TEKELEC TEMEX: Ceramic capacitors
"The mastering of a technology in the service of (almost) all applications !"

Most of ceramic capacitors made by TEKELEC TEMEX are manufactured and qualified against the CECC 32101 specifications:

- **CECC 32101-007 : CEA 1 & CEA 2 High "Q" ceramic capacitors (Class 1BAG)**

In a factory holding the Quality system certificates:

- **ISO 9001/ EN9001 : N° 1992/47a**
- **CECC 00114/NF-EN 29001 : N° 029-92**

(*) Note : "Laser-trim"® is a trade mark J.D.I. (Johanson Dielectrics Inc.)

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CERAMIC CAPACITORS RANGE
SUMMARY - DESCRIPTION

In order to ease the choice of the designer, the TEKELEC TEMEX range of capacitors is presented hereafter into two parts:
Type 1: Defined temperature coefficient dielectrics (very stable capacitors for filtering and R.F. applications)
Type 2: Non defined temperature coefficient dielectrics (for decoupling and general purposes applications)

Defined temperature coefficient dielectrics

	Temperature coefficient	Description	Chip	Wires	Ribbons	Note	Section
Type 1	NPO	Standard voltage 50 / 63 - 100 V Standard S.M.T.	0504 0603 ...to... 2220			¤ ¤ ¤	1
		"L" Series Microwave applications 100 / 200 / 500 V Standard S.M.T	0504 0603 0805 1206 1210			¤ ¤ ¤	3
		UHF-VHF Single layer MOS	0.4 x 0.4 ...to... 1.0 x1.0			¤ ¤ ¤	1-4-5
		UHF-VHF Single layer Ceramic NPO & Negative T.C	0.25 x 0.25 ...to... 2.5 x 2.5			¤ ¤	3
		"Laser-Trim"® Trimmer capacitor	0805 1206 1210			¤	2
		High"Q" Porcelain R.F High power 500 / 1 KV / 2.5 KV / 3.6 KV	CLC CLE CLF	axial & radial	axial	¤ ¤ ¤	3
		Medium voltage 200/500/1KV/2 KV	1210 1812 2220	radial		¤ ¤ ¤	4
		H1515.....7565 High D.C Voltage 1 KV to 10 KV	1515 ...to... 7565	radial		¤ ¤ ¤	4
	P100	High"Q" Porcelain Microwave CHA-CHB-CFB 500 to 1500 V	CHA CHB CFB	axial & radial	axial & radial	¤ ¤ ¤	3
		High"Q" Porcelain R.F. High power 500 / 1 KV / 2.5 / 3.6 KV	CPC CPE CPF	axial & radial	axial	¤ ¤ ¤	3

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Non-defined temperature coefficient

	Temperature cœfficient	Description	Chip	Wires	Ribbons	Note	Section
Type 2	**BX**	Standard voltage 50 / 63 - 100 V Standard S.M.T.	0504 0603 ...to... 2220			¤ ¤ ¤	1
		Standard voltage 50 / 63 V Standard S.M.T.	0504 0603 ...to... 2220			¤ ¤ ¤	1
	X7R	Medium voltage 200 / 500 / 1 KV / 2 KV	1210 1812 2220	radial		¤ ¤ ¤	4
		H1515.....7565 High voltage 1 KV.....10 KV	H1515 ...to... H7565	radial		¤ ¤ ¤	4
		R2225.....R8060 High capacitance values 0.1.....100 µF	R2225 ...to... R8060	Chips and 2 radial leads		¤ ¤ ¤	5
		SC, SV, TB Assemblies High capacitance values 0.1.....100 µF	SC01/SC07 SV01/SV07 TB	2 radial wires: S.V. 4 radial wires: SC, TB	Ribbons and D.I.L.: SC...	¤ ¤ ¤	5
	Z5U / Y5U	Standard voltage 25 - 50 / 63 V Standard S.M.T	0504 0603 ...to... 1210			¤ ¤ ¤	1
		High capacitance values	1210 1812 2220	radial		¤ ¤ ¤	5

Note:

¤ : Made by TEKELEC TEMEX under J.D.I. License

¤ ¤ : Made for TEKELEC TEMEX by J.D.I.

¤ ¤ ¤ : Made by TEKELEC TEMEX

SUMMARY by SECTION:

SECTION	
1	Standard S.M.T: NPO, BX, X7R, Z5U, Y5U (Silver palladium & nickel barrier)
2	Laser-trim ®: a solid -state ceramic trimmer capacitor
3	R.F & microwave capacitors: "L" series, HQ, R.F. power types
4	Medium and high voltage capacitors
5	High capacitance capacitors

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GENERAL RECOMMENDATIONS FOR THE USE OF OUR CAPACITORS

CERAMIC CHIPS

Documents of reference:

CECC32101-801 : Fixed multilayer ceramic chip capacitors. Sub-Classes: 1BCG-2R1-2C1
CECC32101-007 : Fixed multilayer ceramic chip capacitors. Sub-Class: 1BAG
CECC00802 : Standard method for the specification of SMD's of assessed quality
Draft IEC1760 : Guidance document - Standard methods for the specification for SMD's of assessed quality.

Recommendation:

I/ "Chips" or "SMD":

a) General:

In accordance with the introduction of the IEC 1760 (Draft), we can say that "...traditionnally, specifications for electronic components have been developed within each component family, with environmental tests being selected from either IEC 68 or CECC 30000 in an acknowledgement that all components, once in the equipment, must satisfy certain criteria.
The introduction and increasing use of Surface mounting techniques make it necessary to extend the traditional requirements with those arising from the assembly processing".
This is why you will find hereafter some recommendation linked to the technology of the component and the assembling method which is chosen, allowing to use it with the safest conditions for a reliable application.
Hereafter are the recommended soldering processes, temperature-time limits as per CECC and IEC above listed documents.
Proper pre-heating is essential to prevent thermal shock craking of the capacitor. The circuit assembly should be pre-heated as shown in the recommended profiles at a rate of 1 to 2K/s to whithin 65° C to 100° C of the maximum soldering temperature.
Solders typically utilized in SMT have melting points between 179° C and 188° C ; Activation of rosin fluxes occurs at about 200° C. Based on these facts, a minimum peak reflow temperature of 205° C to 210° C should be established. A maximum peak reflow temperature of 225° C should be adequate in most applications. Many reflow process profiles have peaks ranging from 240° C to 260° C and while multilayer ceramic capacitors can withstand soldering temperatures in this range for short durations, they should be minimized or avoided whenever possible.
It is also recommended not to submit case sizes 1812 and above to double wave soldering in order to avoid thermal and mechanical stress which could generate microcracks inside the capacitors ; Reflow soldering is recommended.

b) Soldering methods:

Vapour phase : see figures 1 page 9-8
Reflow infrared : see figure 2 page 9-8
Double wave : see figure 3 page 9-8

Soldering Iron:
Multilayer ceramic capacitor attachment with a soldering iron is discouraged due to the process control limitations.
In the event that a soldering iron must be used, the following precautions should be observed:

- Pre-heat circuit to 150° C
- Do not contact ceramic with the iron tip
- 30 Watts iron output
- 280° C maximum tip temperature
- 3 mm maximum tip diameter
- Soldering time limit: 5 seconds

II/ High "Q" capacitors:

Depending upon size and termination types to be used, some precautions have to be taken to insure a good reliability and a good behavior of the capacitor during its working life.

It is very important to consider two factors:

1) Type of terminations
2) Size of the capacitor.

1) Type of termination:

Whatever the size of the capacitor is, the following rules apply to the considered termination type:
Depending upon the application, the user can be brought to use non-magnetic terminations such as silver/palladium/platinum: in this case, if those terminations are heated up (dipped for instance in a solder bath Sn/Pb/Ag) above: 235 ° C for a time exceeding 10 seconds: there is a risk of "leaching".
Consequently, we recommend to solder our "P" terminations within the couple 235° C x 10 seconds (Conditions under which they are tested in production).
For terminations such as Gold ("G") or tin ("V") over nickel barrier the time can be extended to 120 seconds without any risk of leaching.

For ribbon terminations we recommend not to use soldering temperature over 280 ° C in order to avoid melting of the original solder used for connecting chip to ribbon.
The ribbons are generally used in order to prevent chips from thermal and mechanical stress which could result from soldering directly a chip to a substrate.

2) Capacitor size:

If above conditions are met with regard to the type of terminations, following procedures are recommended in order to prevent thermal and mechanical shock cracking of the capacitors.

- CHA and CHB sizes:

Resistance to soldering operation is generally tested in dipping the capacitors into a solder bath at 260° C for 10 to 120 seconds (depending upon termination type) without any pre-heating.
However, most of the soldering methods used in production today (Vapor phase reflow, infra-red reflow, soldering wave...) are featuring pre-heating phases from 1.0 to 2.0° C per second from 65 to 100° C which are fully acceptable for our High "Q" capacitors.

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In the event that a soldering iron must be used and specially for "P" terminations, the soldering precautions should be taken:

- Pre-heat circuit to 150° C
- Do not contact the ceramic with the iron tip
- 30 Watt iron output (max)
- 280° C tip temperature (max)
- 3 mm tip diameter (max)
- Max soldering time 5 seconds

- CPC - CPE - CPF - CLC - CLE - CLF types:

Do not submit those capacitors to soldering operation without pre-heating sequence as recommended hereafter; Otherwise some damage may affect the reliable life of the capacitor:

a) Bare chips:

Use three heating plates as follows:
- 120° C 5 to 10 minutes
- 170° C 5 to 10 minutes
- 240° C 5 to 10 minutes

When reflow soldering process cannot be implemented, precautions for iron soldering as described in § II-1 should be taken with additional pre-heating sequences described.

b) Chips with ribbons:

Pre-heating of the chip with its ribbons on a heating plate prior to any soldering operation is necessary: the sequence described for standard chips (§2a) is recommended. Do not heat the ribbons above 280° C for more than 10 seconds.

III/ HIGH VOLTAGE AND HIGH CAPACITANCE CAPACITORS:

All above precautions given for S.M.D. and CP/CL types are applicable for the implementation of large bare chips (1515 to 7565): a pre-heating sequence similar to § II will be applied in order to avoid thermal shocks. But, in general, large chips above 2225 size are not recommended to be mounted on epoxy printed board, due to thermal expansion coefficient mismatch between ceramic capacitor body and epoxy.

This is the reason why chips equipped with wires and ribbons will be preferred for reliable applications.

Depending upon the type and the size of connections used (axial or radial leads, "J" or "L" D.I.L and ribbons) and the soldering method which will be used (reflow or iron) the recommendation given in the previous chapter will remain applicable.

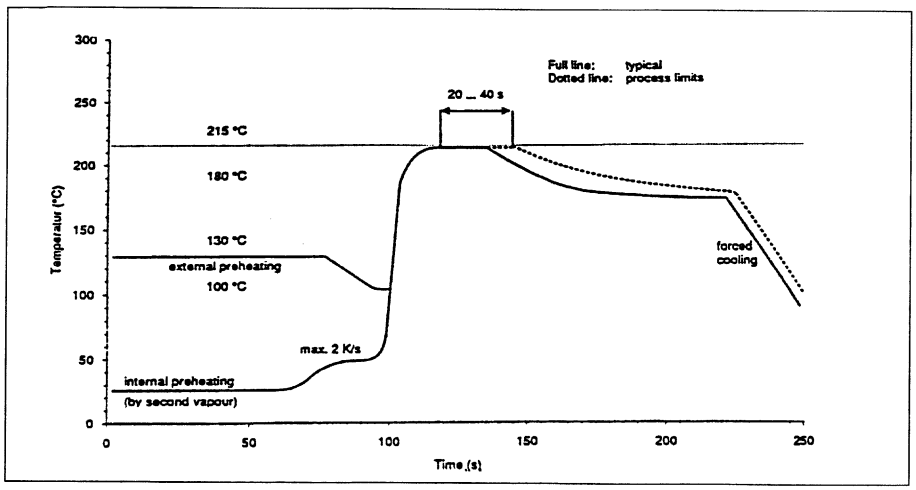


Figure 1: Vapour Phase Soldering, Batch System with Preheating Temperature / Time - Profile (Lead-Temperature)

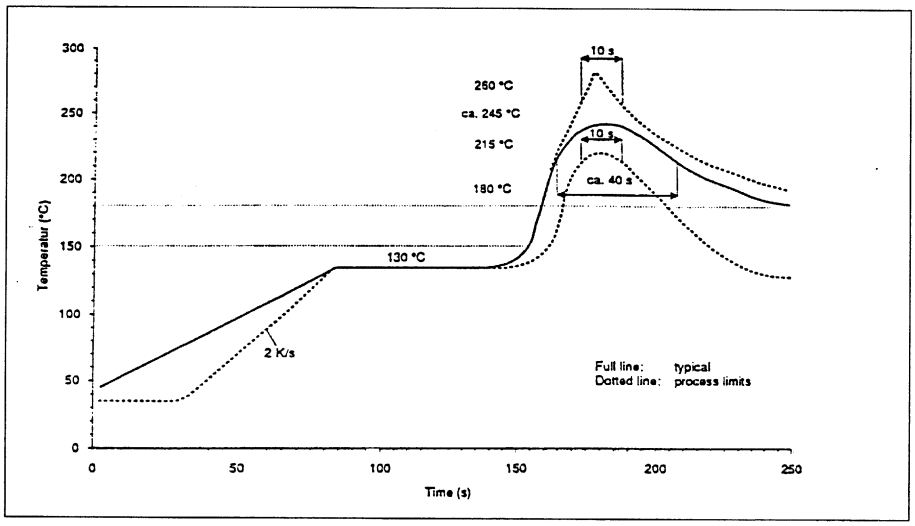


Figure 2: Infrared-Soldering, Temperature / Time - Profile (Lead-Temperature)

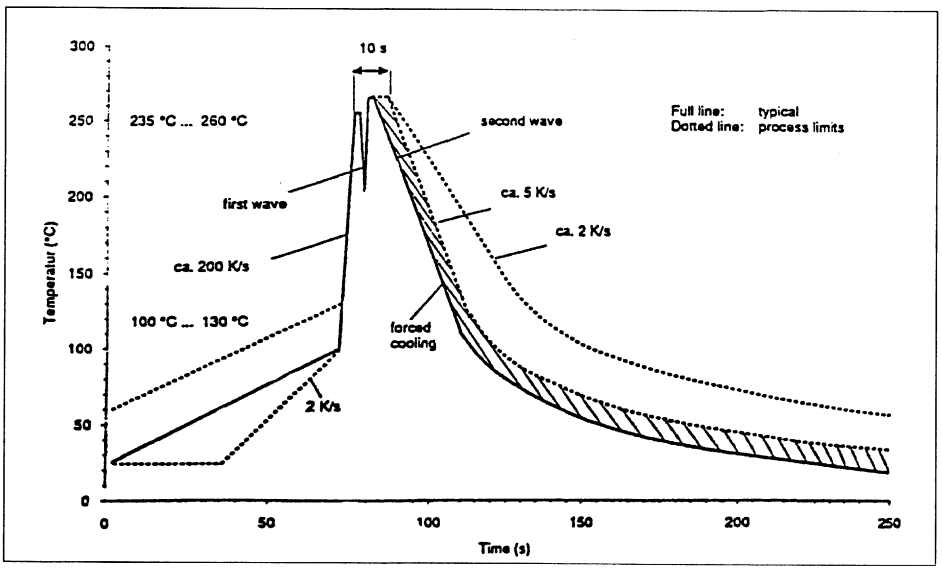


Figure 3: Double-Wave-Soldering, Temperature / Time - Profile (Lead-Temperature)

TERMINATIONS

- Type of terminations used for ceramic chip capacitors:

Termination	Suffix	Metallization	Capacitors	Section
With nickel-barrier	V	Electroplated tinning over nickel barrier	Standard SMT, "L"series, HQ	1,2,3
	W	Dipped tinning over "V" termination	under customer request	3
	G	Electroplated gold over nickel barrier	HQ	2,3
Without nickel-barrier (non magnetic applications)	P	Silver -Palladium	Standard SMT, "L"series, HQ, High voltage, High capacitance	1,3,4,5
	A	Silver-Palladium (High leach resistant) (consult us)	Standard SMT, "L"series HQ,	1,3
	T	Dipped tinning over "P"or "A" termination	under customer request	1,3

SOLDERABILITY & RESISTANCE TO DISSOLUTION OF METALLIZATION:

Termination type	"P"-"T"	"A"	"V"-"W"	"G"
Resistance to dissolution of metallization (leaching)	260° C 5 s	260° C 30 s	260° C 120 s	260° C 120 s

RESISTANCE TO SOLDERING HEAT:

See methods and conditions in "General recommendation for the use of our capacitors" chapter.

DIMENSIONS & TAPING

IEC-CECC	Case size	0402	0504	0505	0603	0805	1111	1206	1210	1808	1812	1825	2220	2225
TEKELEC	Size code	R07	R11	CHA	R14	R15	CHB CFB	R18	S41	R29	S43	S49	S47	S48
Length (US)	L1	1.02 ±0.1	1.27 ±0.25	N.A	1.50 ±0.25	2.03 ±0.25	N.A	3.18 ±0.25	3.18 ±0.25	4.57 ±0.25	4.45 ±0.25	4.57 ±0.25	N.A	5.72 ±0.25
Length (CECC)		N.A	1.25 ±0.20	1.40 ±0.25	1.60 ±0.30	2.00 ±0.30	2.80 ±0.40	3.20 ±0.30	3.20 ±0.30	4.50 ±0.30(*)	4.50 ±0.30(*)	N.A	5.70 ±0.40(*)	5.70 ±0.40(*)
Width: (U.S)	W	0.51 ±0.1	1.02 ±0.25	N.A	0.75 ±0.25	1.27 ±0.25	N.A	1.58 ±0.25	2.41 ±0.25	2.03 ±0.25	3.18 ±0.25	6.35 ±0.25	N.A	6.35 ±0.25
Width: (CECC)		N.A	1.00 ±0.20	1.40 ±0.25	0.80 ±0.20	1.25 ±0.30	2.80 ±0.40	1.60 ±0.30	2.50 ±0.30	2.00 ±0.30	3.20 +/0.30	N.A	5.00 ±0.40	6.30 ±0.40
Thickness: (U.S)	T	0.63 max	1.02 max	N.A	0.90 max	1.27 max	N.A	1.27 max	1.65 max	1.65 max	1.65 max	1.65 max	N.A	1.65 max
Thickness: (CECC)		N.A	1.00 max	1.40 max	0.80 max (0.95)*	1.30 max	2.60 max	1.60 max	1.80 max	1.80 max	1.80 max	N.A	1.80 max	1.80 max (2.00)*
Distance between end-band	L4	N.A	0.40 min	0.40 min	0.40 min	0.50 min	0.40 min	1.40 min	1.40 min	2.20 min	2.20 min	N.A	2.90 min	2.90 min
End-band: (U.S)	L2-L3	0.20 ±0.1	0.38 ±0.13	N.A	0.25 ±0.13	0.38 ±0.25	N.A	0.508 ±0.25	0.508 ±0.25	0.508 ±0.25	0.508 ±0.25	0.508 ±0.25	N.A	0.508 ±0.25
End-band: (CECC)		N.A	0.10 min 0.40 max	0.10 min 0.40 max	0.10 min 0.40 max	0.13 min 0.75 max	0.20 min 0.60 max	0.25 min 0.75 max	0.25 min 0.75 max	0.25 min 1.00 max	0.25 min 1.00 max	N.A	0.25 min 1.00 max	0.25 min 1.00 max

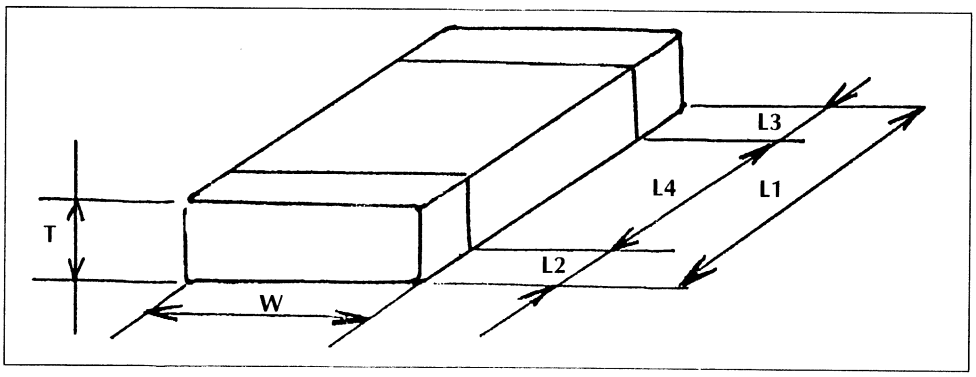
The dimensions referenced as "U.S" are applicable to SMT and Medium & High voltages with silver-nickel-tin terminations made for TEKELEC TEMEX.

The dimensions referenced as "CECC" are applicable to the chips made in Pessac in accordance with CECC32101-801 & CECC 32101-007 specifications.

When specification is not existing: N.A: non applicable.

When solder dipping (Versions "W" or "T" are employed, the positive tolerance on Length, width and thickness shall be increased by 0.3 mm).

(*) Tekelec Temex deviation: Length: ± 0.5 mm for the tolerance / maximum thickness



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PACKAGING:

1/ Chips Taping:

TEKELEC TEMEX chips capacitors are available taped per IEC 286-3 and EIA 481 standards. Tape options include 7" (180 mm) and 13" (330 mm) reels. Tapes will be either high quality dust free punch 8 mm paper (delamination and moisture absorption resistent) or embossed plastic 8 & 12 mm.
Quantity per reel ranges are listed in the tables below and depends on chip thickness and varies in increment of 500 pieces.
Consult us for special conditionings (U.R: under request).

Standard S.M.D chips:

IEC-CECC	case size	0402	0504	0505	0603	0805	1111	1206	1210	1808	1812	1825	2220	2225
Tekelec Temex		R07	R11	CHA	R14	R15	CHB-CFB	R18	S41	R29	S43	S49	S47	S48
Tape width		8 mm	8 mm	8 mm	8 mm	8 mm	8 mm	8 mm	8 mm	12 mm	12 mm	12 mm	12 mm	12 mm
Quantity per reel	7"Ø (180 mm)	5 K	3 K	3 K	4 K	3-5 K	1 K	3-5 K	2-4.5 K	2-4.5 K	2-3 K	1 K	0.5-1 K	0.5-1 K
	13"Ø (330 mm)	15 K	10 K	U.R	15 K	10-15 K	U.R	10-15K	10-15 K	10-15 K	10 K	5 K	5 K	5 K

High voltage chips:

IEC-CECC	case size	1515	2020	2520
Tekelec Temex		H1515	H2020	H2520
Tape width:		12 mm	12 mm	12 mm
Quantity /reel	7"Ø (180mm)	0.5 K	0.5 K	0.5 K
	13"Ø (330mm)	U.R	U.R	U.R

2/ Leaded devices:

Some leaded devices (2 radial wires) may also be required to be delivered on tape (as per IEC 286-2): please consult us.

ELECTRICAL CHARACTERISTICS

Ceramic dielectric designation				Dielectrics			
CECC	1B CG	1B AG	2C1	2R1	-	2F1	2F4
EIA	COG (NPO)	P100	BX	X7R	Z5U	X7V	Y5U
TEKELEC TEMEX	N or L	High"Q"	W or X	W or X	Z	V	Y
Applicable section	1,2,3	3	1,4,5	1,4,5	1,5	1,5	1,5
Temperature range:	-55° C to +125° C	-55° C to +125° C (+175° C CFB)	-55° C to + 125° C	-55° C to +125° C	+10° C to +85° C	-55° C to +125° C	-30° C to +85° C
Temperature coefficient of capacitance	0 ± 30ppm/° C	100 ± 30ppm/° C	N.A	N.A	N.A	N.A	N.A
Maximum variation (ΔC/C) of capacitance over temperature range:							
- without voltage applied			BX: ±15 %	X7R: ±15 %	Z5U: +22/-56 %	X7V:+22/-82 %	Y5U:+22/-56 %
			CECC ±20 %	CECC: ±15 %	N.A	CECC+30/-80 %	CECC+30/-80 %
- under Ur or Uc			BX: +15/-25 %	N.A	N.A	X7V: N.A&	N.A
			CECC +20/-30 %	N.A	N.A	CECC+30/-90 %	CECC+30/-90 %
Capacitance range:	see section: 1,2,3	see section: 3	see section: 1,4,5	see section: 1,4,5	see section: 1,5	see section: 1,5	see section: 1,5
Tolerance on capacitance:	C < 10 pF:	C < 10 pF:					
	(A: ±0.05 pF)	(A: ±0.05 pF)					
	B: ±0.10 pF	B: ±0.10 pF					
	C: ±0.25 pF	C: ±0.25 pF					
Note: for tolerance between	D: ±0.5 pF	D: ±0.5 pF					
brackets.please consult us	C≥10 pF	C≥10 pF					
	F: ±1 %	F: ±1 %	(J: ±5 %)	(J: ±5 %)	M: ±20 %	M: ±20 %	M: ±20 %
	G: ±2 %	G: ±2 %	K: ±10 %	K: ±10 %	Z: -20/+80 %	Z: -20/+80 %	Z: -20/+80 %
	J: ±5 %	J: ±5 %	M: ±20 %	M: ±20 %	(P: 0/+100 %)	(P: 0/+100 %)	(P: 0/+100 %)
	K: ±10 %	K: ±10 %					
Voltage range:	50 to 10 KV see relevant sections	50 to 3600 V see relevant section	50-100 V	50 to 10 KV see relevant section	16 to 50 V	25 to 200 V	25 to 200 V
Maximum variation of capacitance versus voltage:	N.A	N.A	see above chapter ΔC/C	see chart in relevant section	see above chapter ΔC/C	see above chapter ΔC/C	see above chapter ΔC/C
Voltage proof: (50 mA -5 s)							
- Standard SMD:	2.5 x Ur		2.5 x Ur	2.5 x Ur	2.5 x Ur	2.5 x Ur (2 x Ur for 200 V)	2.5 x Ur (2 x Ur for 200 V)
- Medium & High Voltages:							
Ur ≤ 500 V	2.0 x Ur			1.5 x Ur			
Ur ≥ 1000 V	1.2 x Ur			1.2 x Ur			
- R.F (HF & VHF) ∀ Ur	2.5 x Ur	2.5 x Ur					

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ELECTRICAL CHARACTERISTICS

Ceramic dielectric designation	Dielectrics						
CECC	1B CG	1B AG	2C1	2R1	-	2F1	2F4
EIA	COG (NPO)	P100	BX	X7R	Z5U	X7V	Y5U
TEKELEC TEMEX	N or L	High"Q"	W or X	W or X	Z	V	Y
Capacitance ageing	N.A	N.A	≤ 2.5 %/decade time	≤ 2.5 % decade time	≤ 5 % decade time	≤ 5 % decade time	≤ 5 % decade time
Measuring conditions for capacitance and tan δ:							
- Voltage:	<5 Vrms	<5 Vrms	1 ± 0.2 Vrms	0.3 ± 0.2 Vrms	0.1 ± 0.2 Vrms	0.1 ± 0.2 Vrms	0.1 ± 0.2 Vrms
- Frequency (± 20 %):							
C ≤ 1 nF	1 MHz	1 MHz					
C > 1 nF	1 KHz	1 KHz	1 KHz	1 KHz	1 KHz	1 KHz	1 KHz
Insulation resistance:							
Under Ur for U ≤ 1000 V							
Under 1000 V for Ur >1000 V							
@ 25° C	100 GΩ or 1000 s	C ≤ 470 pF 1000 GΩ C ≥ 510 pF 100 GΩ	100 GΩ or 1000 s	100 GΩ or 1000 s	10 GΩ or 100 s	10 GΩ or 100 s	10 GΩ or 100 s
@ 125° C: 0.1 x R_i @ 25° C							
Tangent of the loss angle(*): tan δ ≤	15 x 10^{-4}	15 x 10^{-4}	35 x 10^{-3}	35 x 10^{-3}	35 x 10^{-3}	35 x 10^{-3}	35 x 10^{-3}

Note: The above parameters and test conditions are applicable unless otherwise prescribed in the relevant section and product data sheet.

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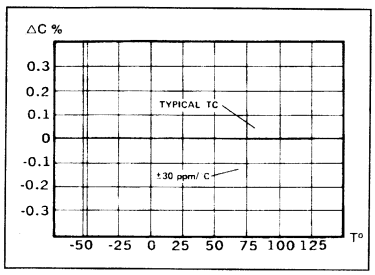
(*) Standard limit are shown in accordance with CECC specification

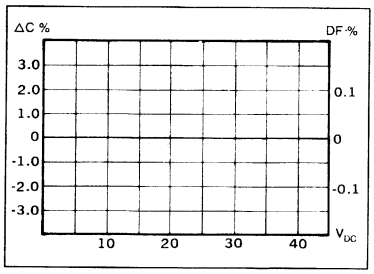
TYPICAL CHARACTERISTICS

TYPE I NPO

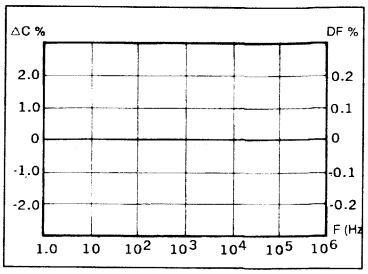
LOW K - ULTRA STABLE DIELECTRIC



TEMPERATURE COEFFICIENT



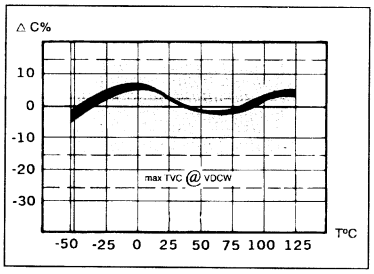
AC TEST VOLTAGE (VRMS)



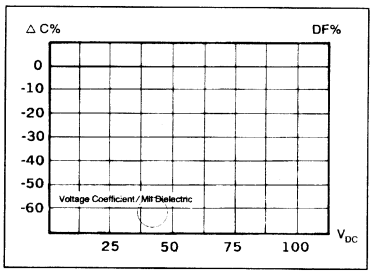
FREQUENCY

TYPE II BX

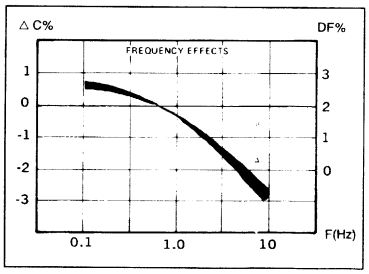
MEDIUM K - TEMPERATURE VOLTAGE CONTROLED DIELECTRIC



TEMPERATURE ° C



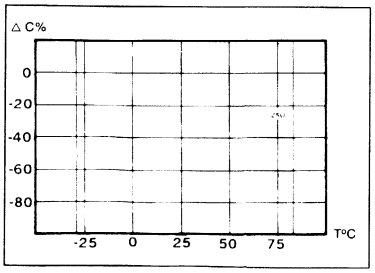
BIAS - VOLT DC/MIL DIELECTRIC



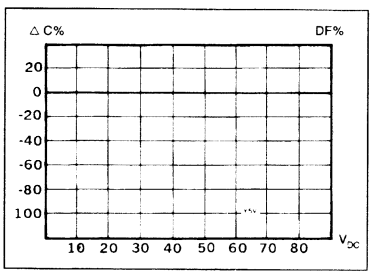
FREQUENCY - KHz

TYPE II Z5U

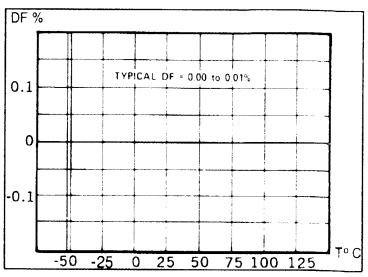
HIGH K - DIELECTRIC



TEMPERATURE ° C



BIAS VDC/MIL DIELECTRIC @ 25° C



FREQUENCY - KHz

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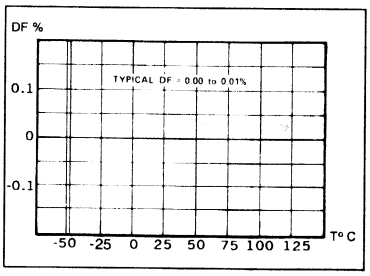
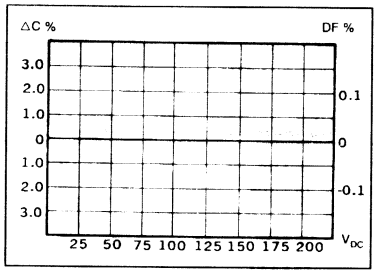
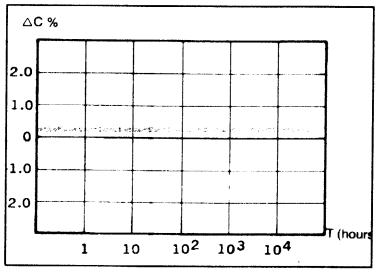


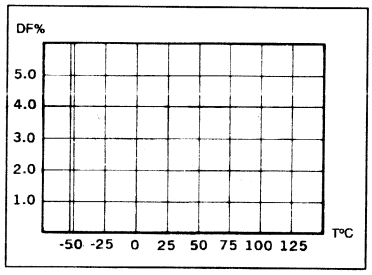
TEMPERATURE



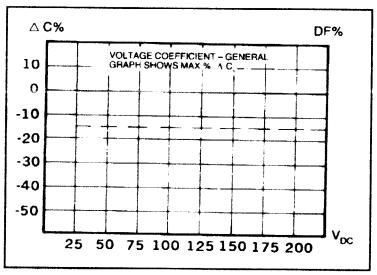
BIAS - VOLTS DC



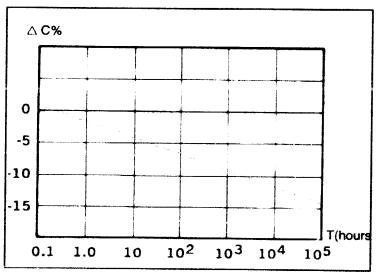
AGEING



TEMPERATURE



BIAS - VOLTS DC



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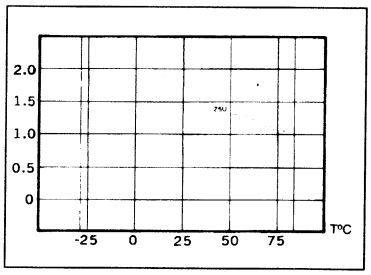
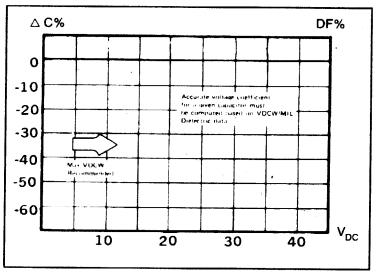
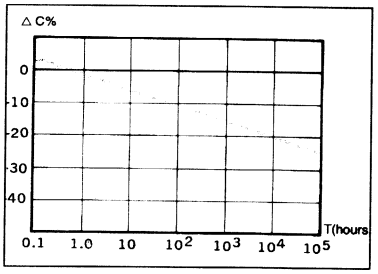


TEMPERATURE



BIAS - VOLTS DCW @ 25° C



AGEING

TYPE 1 - NPO - DEFINED TEMPERATURE CŒFFICIENT

Those parts are generally used when very stable parameters (capacitance, dissipation factor, high insulation resistance) are sought in many applications (filters, coupling, temperature compensation...).
They can be delivered with silver-palladium (P), enhanced silver-palladium (A = consult us for this version) terminations (see table 1) or with nickel-tinned (V) terminations (see table 2).

CAPACITANCE-VOLTAGE RANGE (per case size): ***Table 1: Silver-Palladium (P) Terminations***

Tekelec Temex case reference / CECC case reference		R11 0504	R14 0603	R15 0805	R18 1206	S41 1210	S43 1812	S47 2220
Capacitance (pF)	Code							
1.0	1R0							
1.2	1R2							
1.5	1R5							
1.8	1R8							
2.2	2R2							
2.7	2R7							
3.3	3R3							
3.9	3R9	• See «L» and «Medium voltage» series						
4.7	4R7							
5.6	5R6							
6.8	6R8							
8.2	8R2							
10	100							
12	120							
15	150							
18	180							
22	220							
27	270							
33	330							
39	390							
47	470							
56	560							
68	680							
82	820							
100	101							
120	121							
150	151							
180	181							
220	221							
270	271							
330	331							
390	391							
470	471							
560	561							
680	681							
820	821							
1000	102							
1200	122							
1500	152							
1800	182							
2200	222							
2700	272							
3300	332							
3900	392							
4700	472			100 V				
5600	562							
6800	682			50/63 V				
8200	822							
10000	103							
12000	123							
15000	153							
18000	183							
22000	223							
27000	273							
33000	333							

Note: for capacitance value below 1 pF please consult us.

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Table 2: Tinned nickel barrier (V) terminations

Cr (pF)	Code	R07 0402	R14 0603	R15 0805	R18 1206	S41 1210	S43 1812
0.5	0R5						
1.0	1R0						
1.2	1R2						
1.5	1R5						
1.8	1R8						
2.2	2R2						
2.7	2R7						
3.3	3R3						
3.9	3R9						
4.7	4R7						
5.6	5R6						
6.8	6R8						
8.2	8R2						
10	100						
12	120						
15	150						
18	180						
22	220						
27	270						
33	330						
39	390						
47	470						
56	560						
68	680						
82	820						
100	101						
120	121						
150	151						
180	181						
220	221						
270	271						
330	331						
390	391						
470	471						
560	561						
680	681						
820	821						
1000	102						
1200	122						
1500	152						
1800	182						
2200	222						
2700	272						
3300	332						
3900	392						
4700	472						
5600	562						
6800	682						
8200	822						
10000	103						
12000	123						
15000	153						
18000	183						
22000	223						

100 V
50 V
25 V

STANDARD CERAMIC CHIP CAPACITORS

Type 1 - NPO - Defined temperature cœfficient

ELECTRICAL CHARACTERISTICS:

See general description pages 9-12 & 9-13.

DIMENSIONS:

See page 9-10.

HOW TO ORDER:

101	R15	N	151	J	V	E
Voltage code: 101 = 100 V 630 = 63 V 500 = 50 V 250 = 25 V 160 = 16 V	Case size: 0402 = R07 0504 = R11 0603 = R14 0805 = R15 1206 = R18 1210 = S41 1812 = S43 2220 = S47	Dielectric code: N = NPO	Capacitance value code: The first two digits are significant of C; the last one is the number of "0" to read the capacitance in "pF": 1R5 = 1.5 pF 150 = 15 pF 151 = 150 pF	Tolerance code: For Cr ≤ 10 pF B = ±0.1 pF C = ±0.25 pF D = ±0.5 pF For Cr ≥ 10pF F = ±1 % G = ±2 % J = ±5 % K = ±10 %	Termination code: V = Tin over nickel barrier P = Silver-Palladium A = enhanced silver-palladium (consult us)	When pieces are required taped: "E" for embossed plastic tape ; "T" for punched paper tape ; Consult us. (Standard: 3 to 5 K/7" reel) See general characteristics

TYPE 2 - BX/X7R - NON-DEFINED TEMPERATURE CŒFFICIENT

Those parts are generally used in general purposes applications which do not require high stability but a good C x V product for filtering, by-passing or decoupling over a wide temperature range (-55° C to +125° C).
They can be delivered with silver-palladium (P) ,enhanced silver-palladium (A= consult us for this version) terminations (see tables 1& 2) or with nickel-tinned (V) terminations (see table 3).

CAPACITANCE-VOLTAGE RANGE (per case size):

Table 1:

SUB-CLASS 2C1: BX

Tekelec Temex case reference CECC case reference		R11 0504	R14 0603	R15 0805	R18 1206	S41 1210	S43 1812	S47 2220
Capacitance	Code							
100 pF	101							
150 pF	151							
220 pF	221							
330 pF	331							
470 pF	471							
680 pF	681							
1000 pF	102							
1500 pF	152							
2200 pF	222							
3300 pF	332							
4700 pF	472							
6800 pF	682							
10 nF	103							
15 nF	153							
22 nF	223							
33 nF	333							
47 nF	473							
68 nF	683			100 V				
100 nF	104							
150 nF	154			50/63 V				
220 nF	224							
330 nF	334							

Table 2: SUB-CLASS 2R1: X7R - SILVER PALLADIUM (P) TERMINATIONS

Tekelec Temex case reference CECC case reference		R11 0504	R14 0603	R15 0805	R18 1206	S41 1210	S43 1812	S47 2220
Capacitance	Code							
1000 pF	102							
1500 pF	152	**SEE "BX" RANGE**						
2200 pF	222							
3300 pF	332							
4700 pF	472							
6800 pF	682							
10 nF	103							
15 nF	153							
22 nF	223							
33 nF	333							
47 nF	473							
68 nF	683							
100 nF	104							
150 nF	154							
220 nF	224			50/63V				
330 nF	334							
470 nF	474							
680 nF	684							
1 µF	105							

Table 3: Sub class 2R1: X7R: Tinned nickel-barrier (V) terminations

TekelecTemex case reference		R07	R14	R15	R18	S41	S43
Cr	Code	0402	0603	0805	1206	1210	1812
100 pF	101						
150 pF	151						100 V
220 pF	221						
330 pF	331						50 V
470 pF	471						
680 pF	681						25 V
1000 pF	102						
1500 pF	152						
2200 pF	222						
3300 pF	332						
4700 pF	472						
6800 pF	682						
10 nF	103						
15 nF	153						
22 nF	223						
33 nF	333						
47 nF	473						
68 nF	683						
100 nF	104						
150 nF	154						
220 nF	224						
330 nF	334						
470 nF	474						

ELECTRICAL CHARACTERISTICS:

See general description pages 9-12 & 9-13.

DIMENSIONS:

See page 9-10.

HOW TO ORDER:

101	R18	X	104	K	V	E
Voltage code: 101 = 100 V 630 = 63 V 500 = 50 V 250 = 25 V 160 = 16 V	Case size: 0402 = R07 0504 = R11 0603 = R14 0805 = R15 1206 = R18 1210 = S41 1812 = S43 2220 = S47	Dielectric code: W = BX X = X7R	Capacitance value code: The first two digits are significant of C; the last one is the number of "0"to read the capacitance in "pF": 102 = 1000 pF 103 = 10000 pF 104 = 100 nF	Tolerance code: K = ±10 % M = ±20 % under request (J = ±5 %)	Termination code: V = Tin over nickel barrier P = Silver-Palladium A = enhanced silver-palladium (consult us)	When pieces are required taped: "E" for embossed plastic tape ; "T" for punched paper tape ; Consult us. (Standard: 3 to 5 K/7" reel) See general characteristics

TYPE 2 - Z5U / Y5U - NON-DEFINED TEMPERATURE COEFFICIENT

Those parts are generally used in general purposes applications which do not require high stability, because of their high dielectric constant, high capacitance values are achieved, insuring a high C x V product for filtering, by-passing or decoupling over a restricted temperature range (-30° C to +85° C for Y5U and +10° C to +85° C for Z5U).
They can be delivered with silver-palladium (P), enhanced silver-palladium (A= consult us for this version) terminations (see table 1) or with nickel-tinned (V) terminations (see table 2).

CAPACITANCE-VOLTAGE RANGE (per case size):

TABLE 1:
SUB-CLASS 2F4: Y5U: SILVER PALLADIUM (P) TERMINATIONS

Tekelec Temex case reference CECC case reference		R11 0504	R14 0603	R15 0805	R18 1206	S41 1210	S43 1812 (*)	S47 2220 (*)
Capacitance	Code							
4.7 nF	472							
6.8 nF	682							
10 nF	103							
15 nF	153							
22 nF	223							
33 nF	333							
47 nF	473							
68 nF	683							
100 nF	104							
150 nF	154							
220 nF	224							
330 nF	334							
470 nF	474							
680 nF	684							
1 µF	105							
1.5 µF	155		50/63 V					
2.2 µF	225							
3.3 µF	335		25 V					
4.7 µF	475							
6.8 µF	685							
8.2 µF	825							

(*) under final evaluation: please consult us for availability prior to any industrial implementation

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Table 2: Z5U: Tinned nickel barrier (V) terminations

Cr	Code	R07 402	R14 0603	R15 0805	R18 1206	S41 1210	S43 1812
1000 pF	102						
1500 pF	152						
2200 pF	222						
3300 pF	332						
4700 pF	472						
6800 pF	682						
10 nF	103						
15 nF	153						
22 nF	223						
33 nF	333						
47 nF	473						
68 nF	683						
100 nF	104						
150 nF	154						
220 nF	224						
330 nF	334						
470 nF	474						
680 nF	684						
1 µF	105						
1.5 µF	155						
2.2 µF	225						
3.3 µF	335						
4.7 µF	475						

ELECTRICAL CHARACTERISTICS:

See general description pages 9-12 & 9-13.

DIMENSIONS:

See page 9-10

HOW TO ORDER:

250	R18	Z	224	Z	V	E
Voltage code: 101 = 100 V 630 = 63 V 500 = 50 V 250 = 25 V 160 = 16 V	Case size: 0402 = R07 0504 = R11 0603 = R14 0805 = R15 1206 = R18 1210 = S41 1812 = S43 2220 = S47	Dielectric code: Z = Z5U Y = Y5U	Capacitance value code: The first two digits are significant of C; the last one is the number of "0" to read the capacitance in "pF": 102 = 1000 pF 103 = 10000 pF 104 = 100 pF	Tolerance code: M = ±20 % Z = -20/+80 % P= 0/100 % under request (K = ±10 %)	Termination code: V = Tin over nickel barrier P = Silver-Palladium A = enhanced silver-palladium (consult us)	When pieces are required taped: "E" for embossed plastic tape ; "T" for punched paper tape ; Consult us. (Standard: 3 to 5 K/7" reel) See general characteristics

LASER TRIM® CERAMIC CHIP CAPACITORS (Section 2)

APPLICATIONS

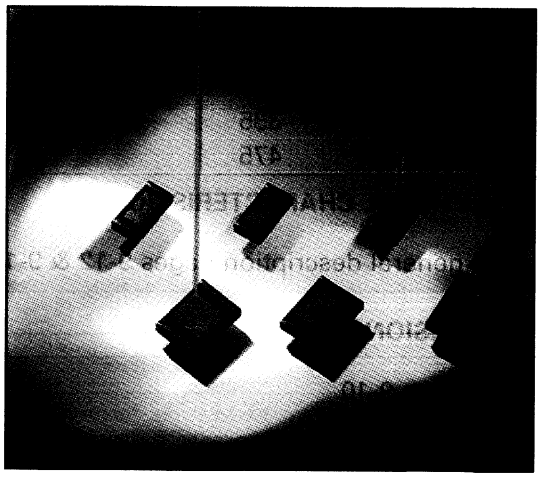
Laser-Trim®, tuning capacitors are laser adjustable monolithic ceramic surface mount devices for precise functional tuning of R.F. circuits.

Laser-Trim® have the high reliability expected of conventional multi-layer chip capacitors and do not experience capacitance drift, flux entrapment and other reliability concerns associated with conventional trimmers.

These capacitors exhibit excellent post-trim "Q" and "ESR" performance at frequencies of 100 - 2000 MHz. Offered in standard sizes 0805, 1206 and 1210 with nickel-barrier terminations and tape and reel packaging, Laser-Trim® are compatible with high volume S.M.T auto-placement and reflow techniques.

They are ideally suited for functional tuning applications in oscillator, filter and antenna circuits in a variety of products mostly dealing with wireless R.F such as:

- Pagers
- Transceivers
- Remote control
- Cellular communications
- R.F Modems
- Digital RF products
- etc...



MAJOR ADVANTAGES

- Ease of functional tuning process automation
- High resolution, high accuracy tuning capability
- High stability and reliability after adjustment
- Reduced component placement & tuning cost
- Standard & small component size
- Non-interactive tuning process, no trim tool to affect the performance of the R.F circuits
- Capability to trim inside electro-magnetic shields through very small access holes.

ELECTRICAL CHARACTERISTICS:

Temperature coefficient	:	0 ± 30 ppm
Quality factor	:	See enclosed curves
Insulation resistance	:	100 seconds or 10 GΩ @ 50 V, 25° C
Rated voltage	:	50 V dc
Voltage proof	:	2.5 x Ur (50 mA max. -5 ± 1 sec)
Test parameters	:	1 MHz (± 5 %) -1 ± 0.2 Vrms

Laser-Trim® is a trade-mark Johanson Dielectrics Inc.

LASER-TRIM® RANGE:

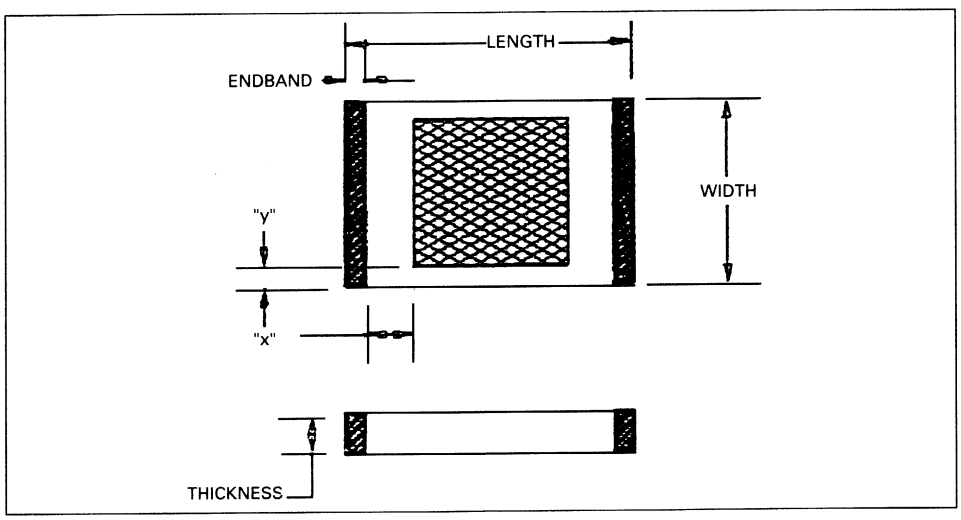
Part number	Size	Pre-trim minimum capacitance	Tuning range	Pre-trim "Q" @ 200 MHz (minimum)	Pre-trim "Q" @ 900 MHz (minimum)
500L15N100XG4	0805	10 pF	10 - 1 pF	50	
500L18C2R0XG4	1206	2.0 pF	2.0 - 0.5 pF	600	100
500L18L4R0XG4	1206	4.0 pF	4.0 - 0.8 pF	350	50
500L18L6R5XG4	1206	6.5 pF	6.5 - 1.2 pF	300	40
500L41C2R5XG4	1210	2.5 pF	2.5 - 0.5 pF	600	125
500L41C4R5XG4	1210	4.5 pF	4.5 - 1.0 pF	400	75
500L41L120XG4	1210	12 pF	12.0 - 2.5 pF	200	25
500L41N210XG4	1210	21 pF	21.0 - 3.0 pF	90	....

Notes: 1 - The temperature coefficient is 0 ± 30 ppm for all types.
2 - Pre-trim minimum capacitance has a standard tolerance of: + 25 % / - 0 %.

DIMENSIONS:

Size	0805 (L15) mm	0805 (L15) inch	1206 (L18) mm	1206 (L18) inch	1210 (L41) mm	1210 (L41) inch
Length	2.0 ± 0.2	0.08 ± 0.008	3.09 ± 0.2	0.122 ± 0.008	3.30 ± 0.2	0.130 ± 0.008
Width	1.27 ± 0.2	0.05 ± 0.008	1.52 ± 0.2	0.060 ± 0.008	2.54 ± 0.2	0.100 ± 0.008
Thickness	0.63 ± 0.13	0.025 ± 0.005	0.63 ± 0.13	0.025 ± 0.005	0.63 ± 0.13	0.025 ± 0.005
Endband	0.13 min	0.005 min	0.13 min	0.005 min	0.13 min	0.005 min
Space "x"&"y"	0.1 min	0.004 min	0.10 min	0.004 min	0.10 min	0.004 min

LASER-TRIM® Adjustable Ceramic chip capacitor



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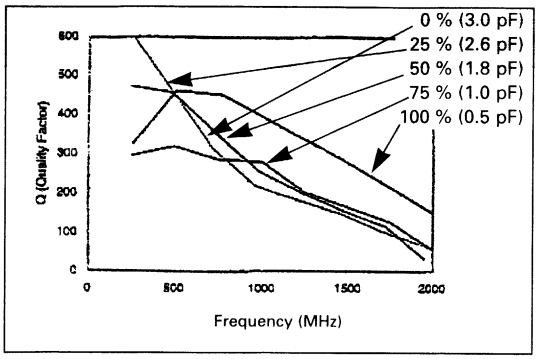
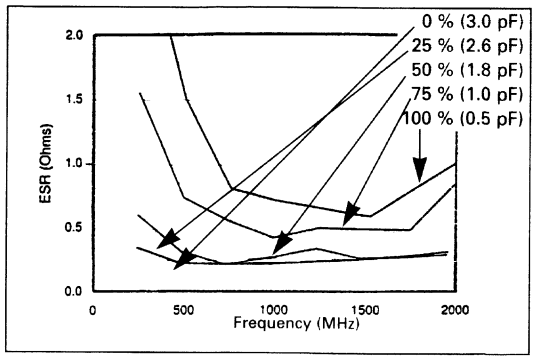
TYPICAL RF CHARACTERISTICS

Q vs Frequency for L41C2R5

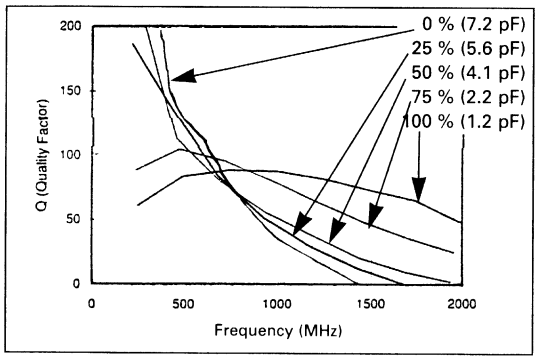


ESR vs Frequency for L41C2R5

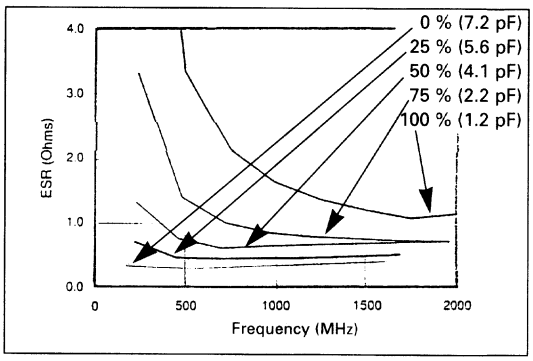


Data obtained using a Boonton 34A Laser parameters: Speed = 50 mm/sec. Q rate = 2.5 KHz, Scan increment = 12.5 µm ; Power = 2.2 watts.

Q vs Frequency for L18L6R5

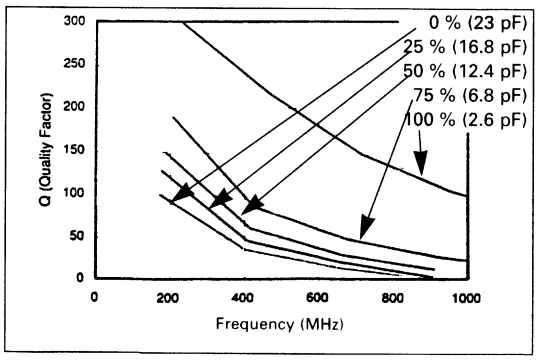


ESR vs Frequency for L18L6R5

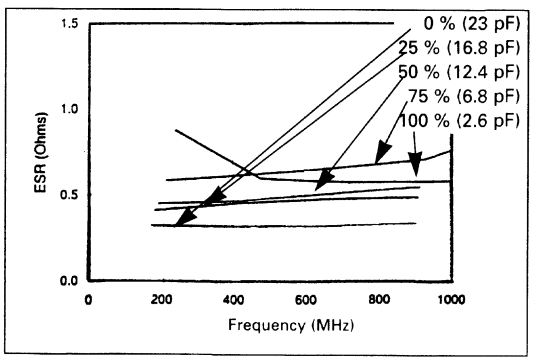


Data obtained using a Boonton 34A Laser parameters: Speed = 50 mm/sec. Q rate = 2.5 KHz, Scan increment = 12.5 µm ; Power = 2.2 watts.

Q vs Frequency for L41N210



ESR vs Frequency for L41N210



Data obtained using a Boonton 34A Laser parameters: Speed = 50 mm/sec. Q rate = 2.5 KHz, Scan increment = 12.5 µm ; Power = 2.2 watts.

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How to order

500	L41	N	210	X	G	*

500	L41	N	210	X	G	*
Standard voltage: 500 = 50 V	Case Size: L41 = 1210 L18 = 1206 L15 = 0805	Dielectric constant N.L = NPO C = HighQ/NPO	Pre-trim capacitance: 1st two digits are significant third digit denotes number of zeros ; R is decimal point ex: 2R0 = 2.0 pF 210 = 21 pF	Initial capacitance tolerance is: +25 % -0 %	Termination (Gold over nickel barrier)	Tape code / Tape type / Reel size E embossed 7" U embossed 13" T paper 7" R paper 13"

HF & MICROWAVE CERAMIC CHIP CAPACITORS (Section 3)

Selection Guide

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"L" SERIES

Ultra stable dielectric - Low K - Low E.S.R

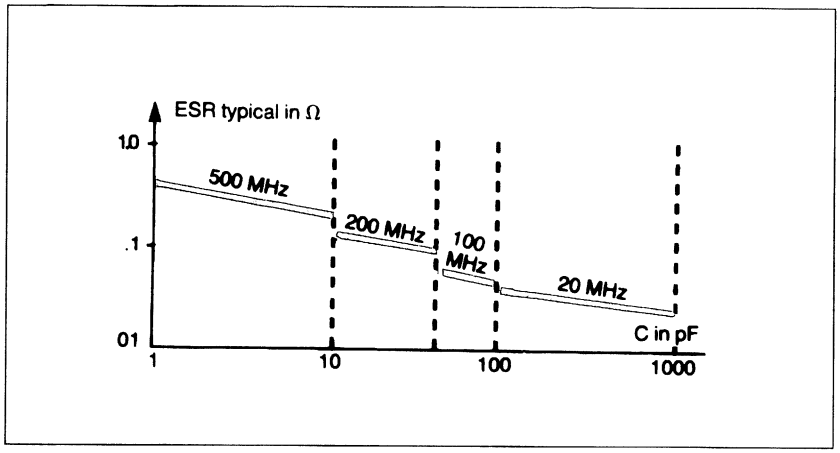
Between High"Q" porcelain chips and standard NPO types, there is an increasing need for a product which offers to the design engineer a guarantee of maximum E.S.R for circuit performances in the frequency range of 20 to 800 MHz (sometimes higher) and also the insurance that the performances will be kept from one lot to an other lot.
The "L" Series uses a special design and a low dielectric constant NPO and is the TEKELEC TEMEX solution to the problem.

CAPACITANCE & VOLTAGE RANGE (per case size):

Tekelec Temex case reference CECC case reference (Previous NFC reference)		R11 0504 -	R14 0603 -	R15 0805 CEC37	R18 1206 CEC38	S41 1210 CEC39
Capacitance (pF)	Code					
1.0	1R0	100V		500V	500V	500V
1.2	1R2	100V		500V	500V	500V
1.5	1R5	100V		500V	500V	500V
1.8	1R8	100V		500V	500V	500V
2.2	2R2	100V		500V	500V	500V
2.7	2R7	100V		500V	500V	500V
3.3	3R3	100V		500V	500V	500V
3.9	3R9	100V	200V	500V	500V	500V
4.7	4R7	100V	200V	500V	500V	500V
5.6	5R6	100V	200V	500V	500V	500V
6.8	6R8	100V	200V	500V	500V	500V
8.2	8R2	100V	200V	500V	500V	500V
10	100	100V	200V	200V	500V	500V
12	120	100V	200V	200V	500V	500V
15	150	100V	200V	200V	500V	500V
18	180	100V	200V	200V	500V	500V
22	220	100V	500V	200V	500V	500V
27	270	100V	500V	200V	500V	500V
33	330	100V	500V	200V	500V	500V
39	390	100V	500V	200V	500V	500V
47	470	100V	500V	200V	500V	500V
56	560			200V	500V	500V
68	680			200V	500V	500V
82	820			200V	500V	500V
100	101			500V	200V	500V
120	121			200V	200V	500V
150	151			200V	200V	500V
180	181			200V	200V	500V
220	221			200V	200V	500V
270	271			200V	200V	500V
330	331			200V	200V	500V
390	391			200V	200V	500V
470	471			200V	200V	500V
560	561			200V	200V	500V
680	681			200V	200V	500V
820	821			200V	200V	500V
1000	102			200V	200V	500V

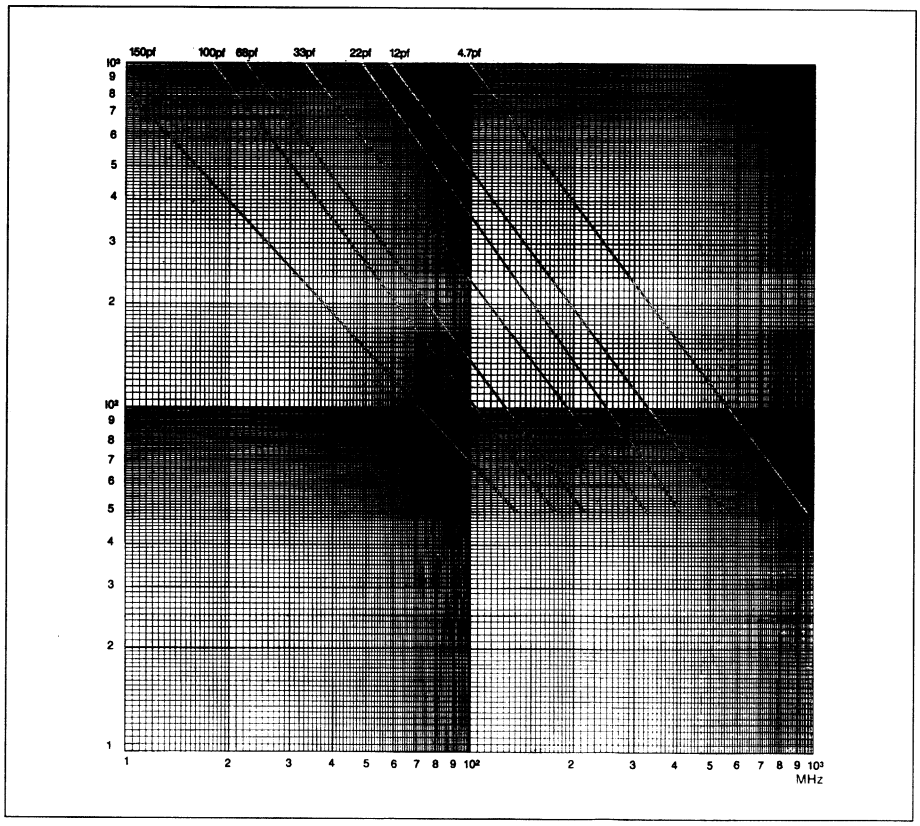
500V
100V
200V

Note: for capacitance below 1.0 pF please consult us



Curve 1: ESR versus frequency and capacitance

TYPICAL CHARACTERISTIC CURVE (QUALITY FACTOR VS FREQUENCY)



Curve 2: Quality factor versus frequency and capacitance (typ.)

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ELECTRICAL CHARACTERISTICS:

See general description pages 9-12 & 9-13.

DIMENSIONS:

See page 9-10.

FREQUENCY PARAMETERS:

E.S.R. versus frequency and capacitance value: see curve 1.

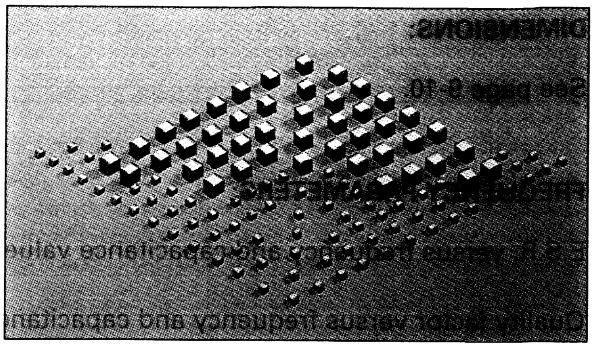
Quality factor versus frequency and capacitance value: see curve 2.

HOW TO ORDER:

201	R15	L	150	J	V	E
Voltage code: 201 = 200 V 101 = 100 V 501 = 500 V	Case size: R11 = 0504 R14 = 0603 R15 = 0805 R18 = 1206 S41 = 1210	Dielectric code: "L"	Capacitance value code: The first two digits are significant of C; the last one is the number of "0"to read the capacitance in "pF": 150 = 15 pF 151 = 150 pF	Tolerance code: For Cr < 10pF B = ±0.1pF C = ±0.25pF D= ±0.5pF For Cr > 10pF F = ± 1 % G = ± 2 % J = ± 5 % K = ± 10 %	Termination code: V = Tin over nickel barrier P = Silver-Palladium A = enhanced silver-palladium (consult us)	When pieces are required taped, please specify "E" for embossed plastic tape (Standard: 3 to 5 K/7" reel)

CHA-CHB-CFB SERIES

Ceramic chips for microwave applications
ultra HIGH "Q" low ESR



DESCRIPTION

The high-Q characteristics of these monolithic chip capacitors make them ideally suited for applications at microwave frequencies. Featuring a very low equivalent series resistance, they are capable of handing high current levels and therefore offer greater efficiency in DC to RF conversion.

Constructed of an exceptionnally stable ceramic body, they exhibit no ageing effects, very low drift, and maintain their characteristics over an extreme range of temperature, frequency and voltage variations.

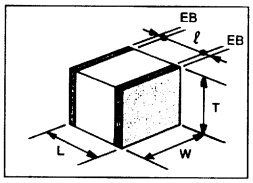
They have been designed and are manufactured to meet or exceed the requirements of the CECC 32101-007 (CEA 1- CEA 2).

They comply with the widely used specifications MIL-C 55681 (equivalent sizes CRR 11/12, CDR 13/14).

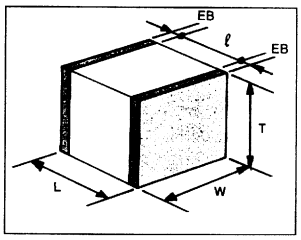
Also called "Porcelain capacitors" for the high purity of their basic ceramic material used in their construction, they provide the user with a full range of sizes, capacitances, voltages and electrical performances which cover all the most stringent requirements of the VHF-UHF applications.

Dimensions (mm)

SIZE A



SIZE B



	A	B
L	1.4 ±0.25	2.8 ±0.4
W	"	"
T max	1.4	2.6
I min	0.4	0.4
EB	0.1 0.4	0.2 0.6

Remark:
For tinned versions T and W, increase H, W and T dimensions by 0.5 mm

Series		CH		CF
FEATURES	Size	A	B	B
	CECC Ref.	CEA 1	CEA 2	exceeds CEA 2
	Capacitance range	0.1 to 100 pF	0.1 to 1000 pF	0.1 to 100pF
	Voltage range	50 V	500 V to 50 V	500 V to 100 V
	Extended voltage on request	200 V	1000 V to 300 V	1500 V to 500 V
	Temperature range	-55° C to +125° C		-55° C to +175° C

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Table 1: **CH Series** (Size A)

Capacitance code	Capacitance (pF)	Rated voltage	Extended rated voltage	Tolerance on capacitance (coded)
0R1	0.1	50 V	200 V	B (*)
0R2	0.2			
0R3	0.3			B, C
0R4	0.4			
0R5	0.5			B, C, D
0R6	0.6			
0R7	0.7			
0R8	0.8			
0R9	0.9			
1R0	1.0			
1R1	1.1			
1R2	1.2			
1R3	1.3			
1R4	1.4			
1R5	1.5			
1R6	1.6			
1R7	1.7			
1R8	1.8			
1R9	1.9			
2R0	2.0			
2R1	2.1			
2R2	2.2			
2R4	2.4			
2R7	2.7			
3R0	3.0			
3R3	3.3			
3R6	3.6			
3R9	3.9			
4R3	4.3			
4R7	4.7			
5R1	5.1			
5R6	5.6			
6R2	6.2			
6R8	6.8			B, C, D
7R5	7.5			J
8R2	8.2			
9R1	9.1			
100	10			F, G, J
110	11			K, M
120	12			
130	13			
150	15			
160	16			
180	18			
200	20			
220	22			
240	24			
270	27			
300	30			
330	33			
360	36			
390	39			
430	43			
470	47			
510	51			
560	56			
620	62			
680	68			
750	75			
820	82			
910	91			
101	100			

Table 2: **CH Series** (Size B)

Capacitance code	Capacitance (pF)	Rated voltage	Extended rated voltage	Tolerance on capacitance (coded)
0R1	0.1	500 V	1000 V	B (*)
0R2	0.2			
0R3	0.3			B, C
0R4	0.4			
0R5	0.5			B, C, D
0R6	0.6			
0R7	0.7			
0R8	0.8			
0R9	0.9			
1R0	1.0			
1R1	1.1			
1R2	1.2			
1R3	1.3			
1R4	1.4			
1R5	1.5			
1R6	1.6			
1R7	1.7			
1R8	1.8			
1R9	1.9			
2R0	2.0			
2R1	2.1			
2R2	2.2			
2R4	2.4			
2R7	2.7			
3R0	3.0			
3R3	3.3			
3R6	3.6			
3R9	3.9			
4R3	4.3			
4R7	4.7			
5R1	5.1			
5R6	5.6			
6R2	6.2			
6R8	6.8			B, C, D
7R5	7.5			J
8R2	8.2			
9R1	9.1			
100	10			F, G, J
110	11			K, M
120	12			
130	13			
150	15			
160	16			
180	18			
200	20			
220	22			
240	24			
270	27			
300	30			
330	33			
360	36			
390	39			
430	43			
470	47			
510	51			
560	56			
620	62			
680	68			
750	75			
820	82			
910	91			
101	100			
111	110	300 V		
121	120			
131	130			
151	150			
161	160			
181	180			
201	200			
221	220			
241	240	200 V	600 V	
271	270			
301	300			
331	330			
361	360			
391	390			
431	430			
471	470			
511	510	100 V	300 V	
561	560			
621	620			
681	680	50 V		
751	750			
821	820			
911	910			
102	1000			

Table 3: **CF Series** (Size B)

Capacitance code	Capacitance (pF)	Rated voltage	Extended rated voltage	Tolerance on capacitance (coded)
0R1	0.1	500 V	1500 V	B (*)
0R2	0.2			
0R3	0.3			B, C
0R4	0.4			
0R5	0.5			B, C, D
0R6	0.6			
0R7	0.7			
0R8	0.8			
0R9	0.9			
1R0	1.0			
1R1	1.1			
1R2	1.2			
1R3	1.3			
1R4	1.4			
1R5	1.5			
1R6	1.6			
1R7	1.7			
1R8	1.8			
1R9	1.9			
2R0	2.0			
2R1	2.1			
2R2	2.2			
2R4	2.4			
2R7	2.7			
3R0	3.0			
3R3	3.3			
3R6	3.6			
3R9	3.9			
4R3	4.3			
4R7	4.7			
5R1	5.1			
5R6	5.6			
6R2	6.2			
6R8	6.8			B, C, D
7R5	7.5			J
8R2	8.2			
9R1	9.1			
100	10			F, G, J
110	11			K, M
120	12			
130	13			
150	15			
160	16		1000 V	
180	18			
200	20			
220	22			
240	24			
270	27			
300	30			
330	33			
360	36			
390	39			
430	43			
470	47	300 V	500 V	
510	51			
560	56			
620	62			
680	68	100 V		
750	75			
820	82			
910	91			
101	100			

CHA and CHB type are qualified in accordance with CECC 32101.007 (CEA1 and CEA2)

(*) Tightened tolerance (A: ± 0.05 pF) can be achieved on request.

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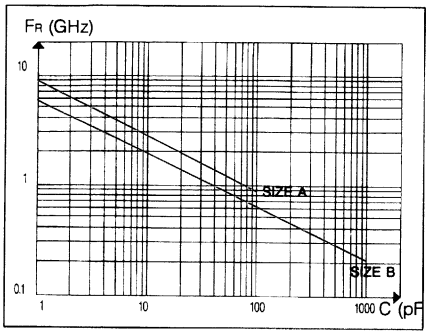
HF & MICROWAVE CERAMIC CHIP CAPACITORS

CHA-CHB-CFB Series

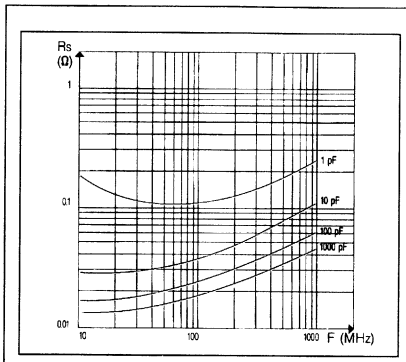
GENERAL CHARACTERISTICS

SERIES	CH		CF
Size	A	B	B
Capacitance range (CR)	0.1 to 100 pF	0.1 to 1000 pF	0.1 to 100 pF
Rated voltage (UR)	see table 1	see table 2	see table 3
Standard	50V	500 to 50 V	500 to 100 V
On request (specify TK55)	200V	1000 to 300 V	1500 to 500 V
Voltage proof	2.5 x UR for 5 seconds		
Tolerance on Capacitance	CR < pF ± 0.1 pF (B) ± 0.25 pF (C) ± 5 % (J) ± 0.5 pF (D) C ≥ 10 pF ± 1 % (F) ± 5 % (J) ± 20 % (M) ± 2 % (G) ± 10 % (K)		
Temperature cœfficient	100 (± 30) ppm/° C		
Temperature range	-55° C to +125° C		-55° C to +175° C
Q Factor	f = 1 MHz: Q ≥ 10 000 f = 100 MHz: Q x C (pF) ≥ 20 000		
E.S.R. vs (Frequency)	See curves		
Insulation resistance (Ri) at 25° C CR ≤ 470 pF	≥ 10^6 MΩ	≥ 10^6 MΩ	≥ 10^6 MΩ
CR ≥ 510 pF		10^5 MΩ	
at 125° C CR ≤ 470 pF	≥ 10^5 MΩ	≥ 10^5 MΩ	
CR ≥ 510 pF		10^4 MΩ	
at 175° C			10^5 MΩ
Life Test	2000h 1.5 UR 125° C		2000h 1.5 UR 175° C
Maximum Capacitance Drift (at 25° C)	±0.02 % or ± 0.020 pF whichever is the greater		

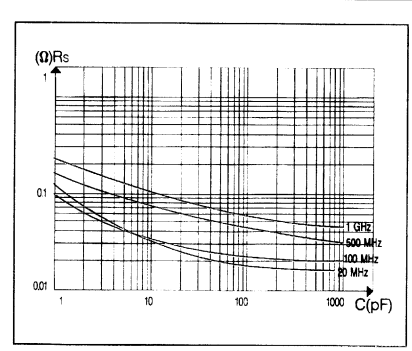
PERFORMANCES CURVES



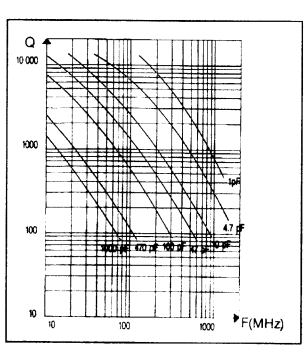
Resonant frequency versus capacitance



ESR versus frequency



ESR versus capacitance



Quality factor versus frequency

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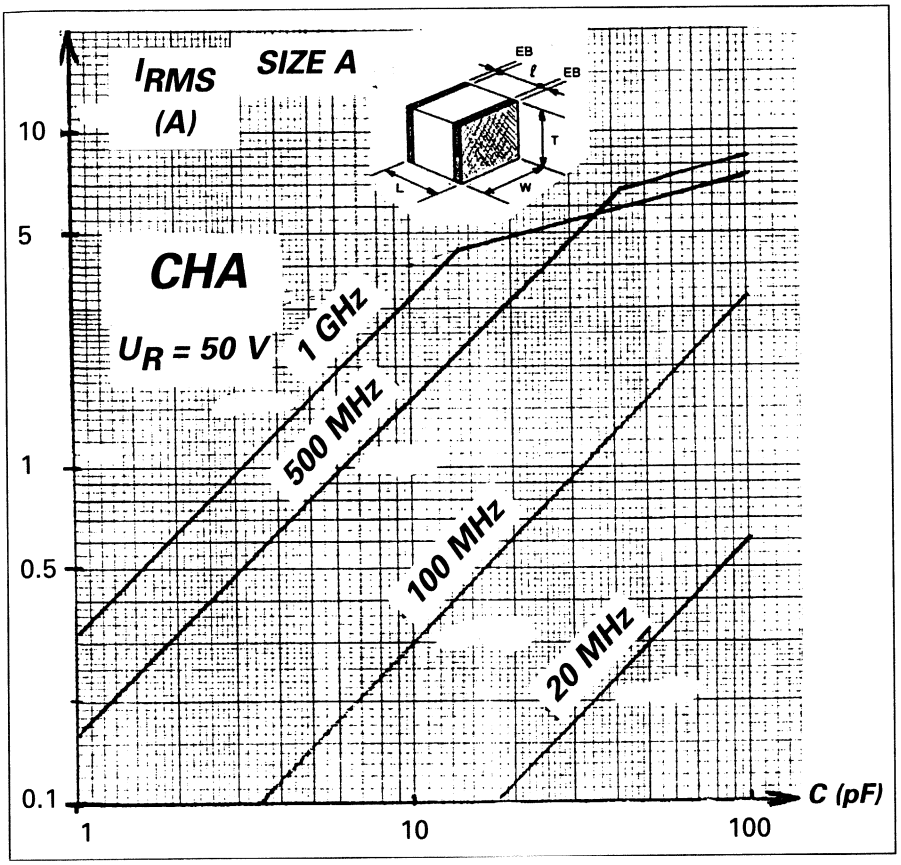
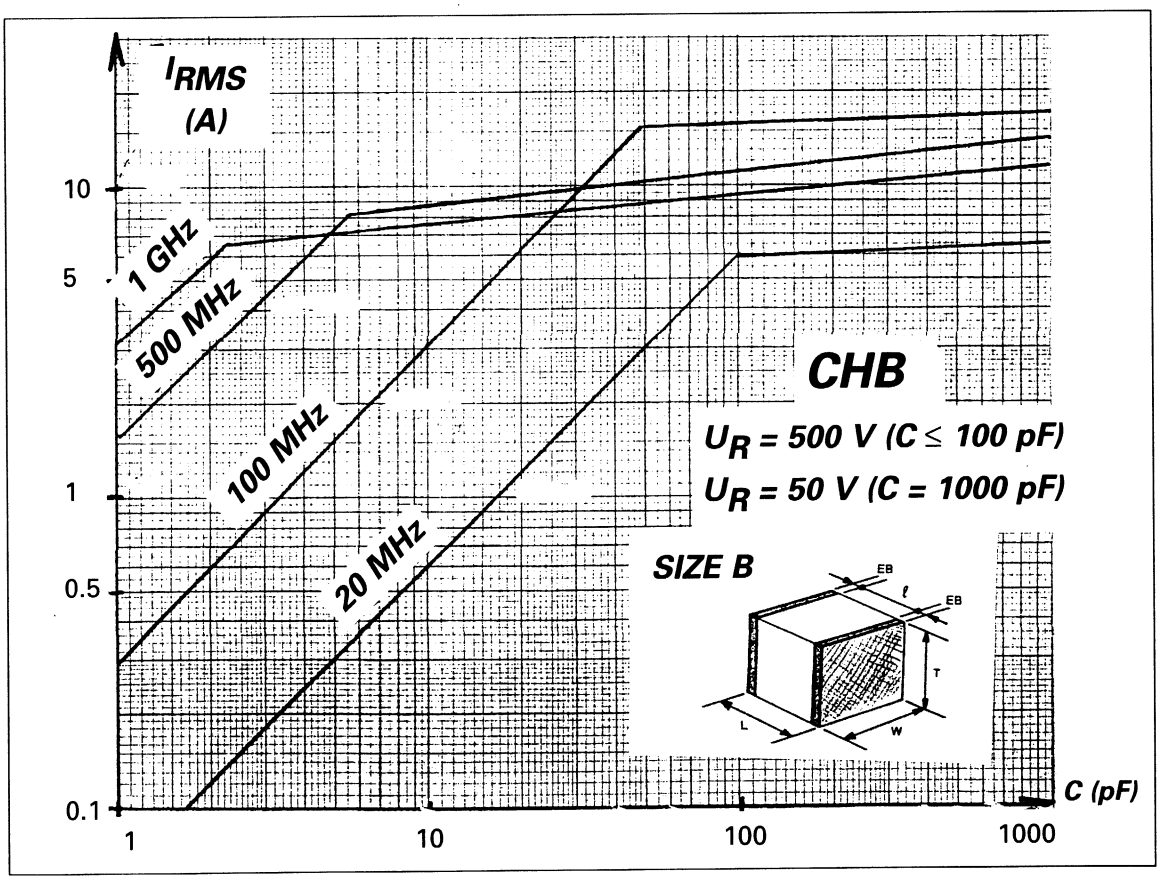

I_{RMS} (A)
SIZE A
EB
ℓ
EB
T
L
W
CHA
U_R = 50 V
1 GHz
500 MHz
100 MHz
20 MHz
10
5
1
0.5
0.1
1
10
100
C (pF)

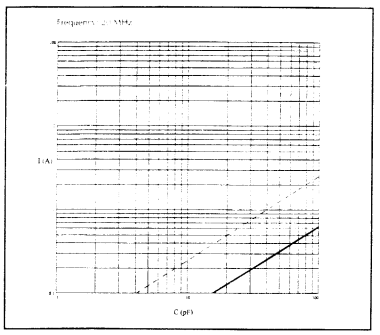

I_{RMS} (A)
10
5
1
0.5
0.1
1 GHz
500 MHz
100 MHz
20 MHz
CHB
U_R = 500 V (C ≤ 100 pF)
U_R = 50 V (C = 1000 pF)
SIZE B
EB
ℓ
EB
T
L
W
1
10
100
1000
C (pF)

MAXIMUM ADMISSIBLE RIPPLE CURRENT VERSUS FREQUENCY AND CAPACITANCE

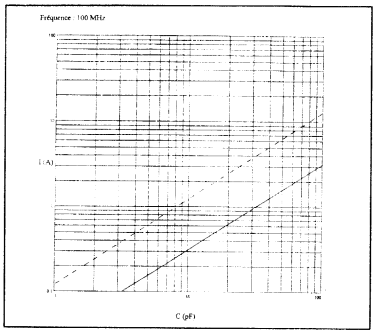
Full line = rated voltage

cashed line = upgraded voltage (TK55)

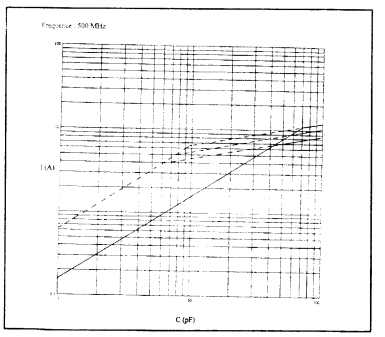
CHA TYPE



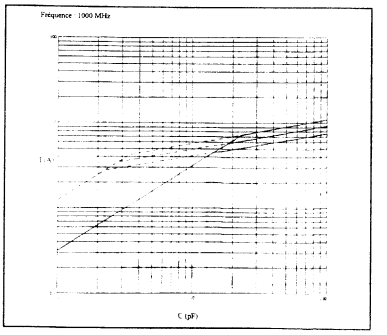
Frequency:
20 MHz



Frequency:
100 MHz

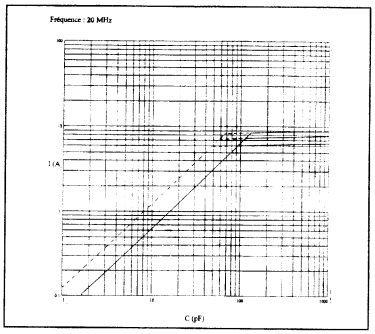


Frequency:
500 MHz

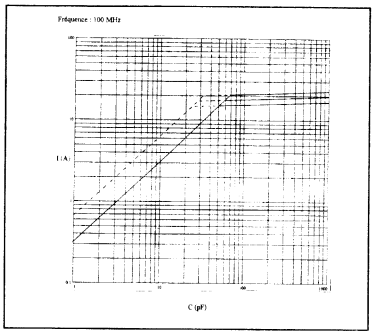


Frequency:
1000 MHz

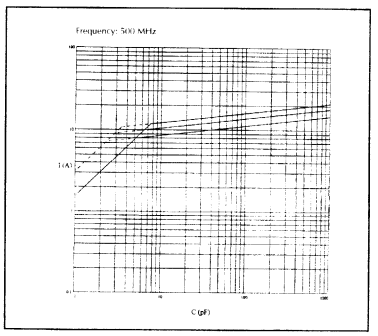
CHB TYPE



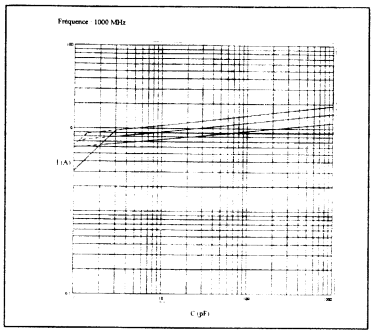
Frequency:
20 MHz



Frequency:
100 MHz



Frequency:
500 MHz



Frequency:
1000 MHz

TERMINATIONS

- ***Standard terminations***

– Silver-Palladium (stock): ..... Termination code P

– Tinned over Silver-Palladium (62/36/2 dipping): ..... Termination code T

– Gold over nickel (stock): ..... Termination code G

– Tinned over nickel (62/36/2 dipping): ..... Termination code W

– Tinned over nickel (90/10 electrolytic): ..... Termination code V

– For enhanced silver-Palladium terminations (A): ..... Please consult us

- ***Ribbons and wires terminations*** *(size B only)*

Items not kept in stock. Please consult us.

TERMINATION		PHYSICAL OUTLINES	BODY DIMENSIONS			LEAD AND TERMINATION DIMENSIONS			TERMINATION CODE
STYLE	TYPE		LENGTH (L)	WIDTH (W)	THICKNESS (T)	LENGTH (L)	WIDTH (W)	THICKNESS (T)	
	Micro -strip		min. 2.92 to max. 3.81	2.79 ± .381	T + .381 max.	min. 6.35	2.36 ± .13	.102 ± .025	1
	Axial Ribbon								2
	Radial Ribbon								3
	Narrow Axial Ribbon		min. 2.92 to max. 3.94			min. 6.35	1.27 ± .13	.153 ± .076	4
	Narrow Micro-strip								5
	Radial Wire		min. 2.92 to max. 4.19			min. 12.7	wire diameter 0.6 ± 10 %		6
	Axial Wire								7

MARKING

On request (Add "L" to the reference - see "how to order") a lasermarking will be achieved, indicating capacitance value (coded) tolerance on capacitance (coded) and Tekelec Temex logo (TA)
CHA and CHB series will be marked : TA
CF series will be marked : TA:

PACKAGING

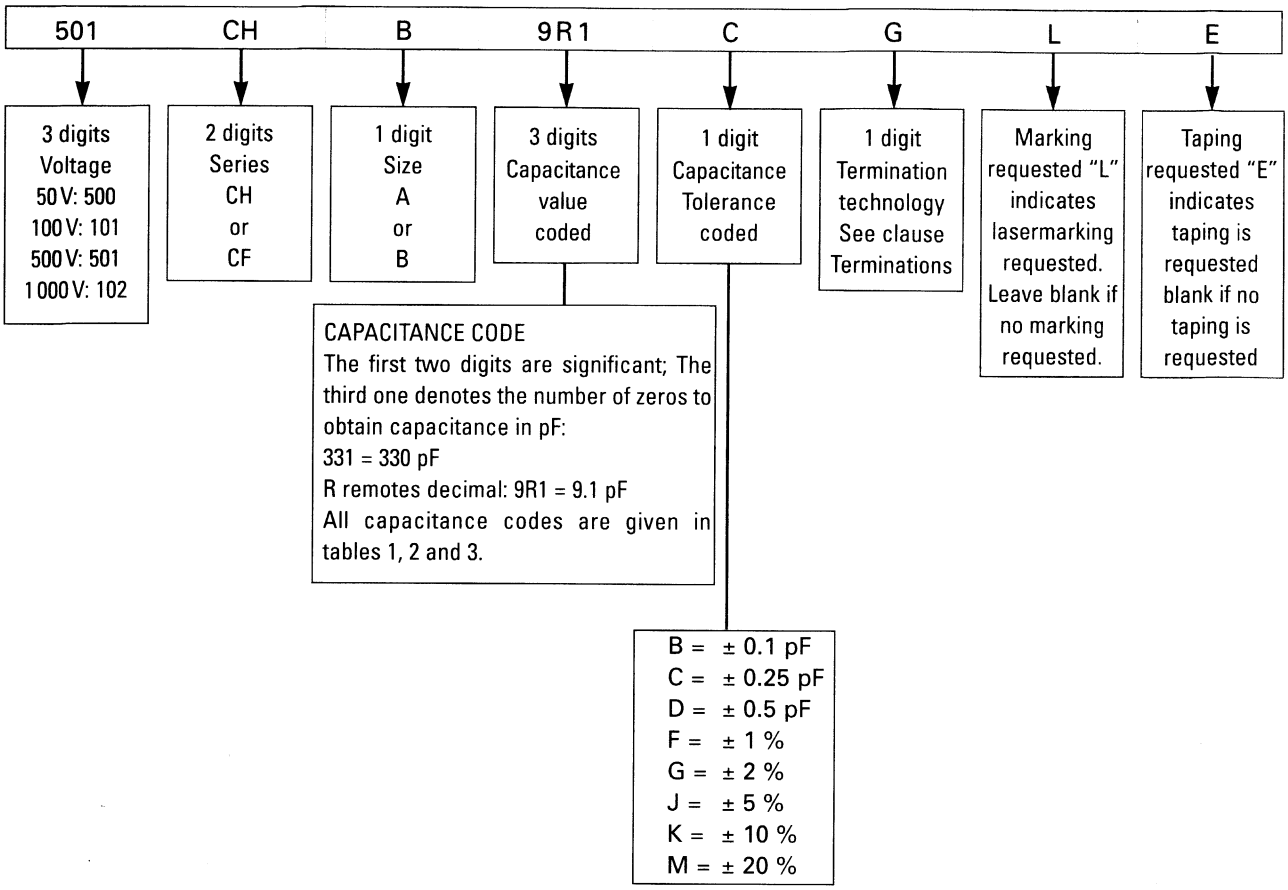
Unless otherwise specified, pieces will be delivered in plastic boxes with special product keeping chips out from humidity.

Pieces may be delivered on tape (3000 pieces per reel size A, 1000 pieces per reel size B) 8 mm tape width/180 mm diameter reel as per IEC 286.3.

HF & MICROWAVE CERAMIC CHIP CAPACITORS

CHA-CHB-CFB Series

HOW TO ORDER



Note: When extended rated voltage is needed
(i.e: CH: 1 000 V instead of 500 V Volts.
reference becomes 102 CH B 9 R 1 C G L: add: TK55

High "Q"-"DEMO-KIT"

The CHA and CHB Demo-Kit contain 10 pieces of the following values:

CHA	pF	0.1	0.3	0.5	0.7	1.0	1.5	2.0	2.7	3.6	4.7	6.8	10.0
	Tol	B	B	B	B	C	C	C	C	C	C	C	J
CHB	pF	0.3	0.9	1.5	2.2	3.6	5.6	8.2	10.0	18.0	33.0	56.0	100.0
	Tol	B	C	C	C	C	C	C	J	J	J	J	K

B = ± 0.1 pF C = ± 0.25 pF J = ± 5 % K = ± 10 %

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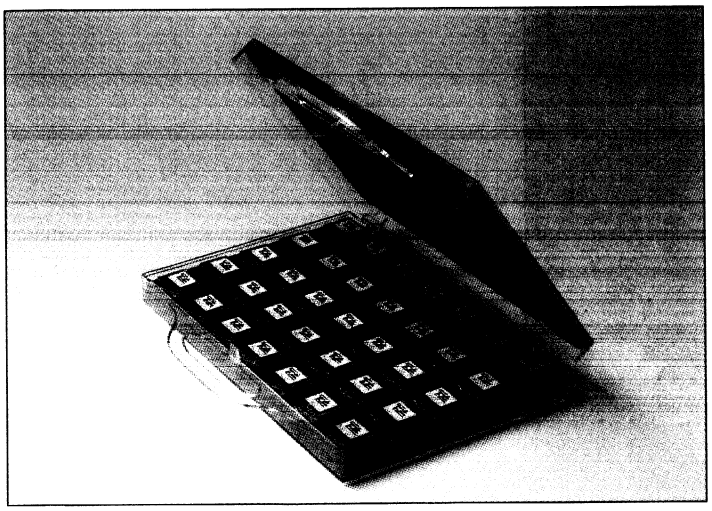
HIGH "Q" - LABORATORY KITS



For both engineers and technicians, choosing the correct value of capacitor is vital to ensure as near perfectmatching as possible for a given application. This is all the more true when working in the VHF/UHF field when as little as 0.1 pF can make all the difference.

However the choice is difficult and severely limited if the necessary value is not immediately available.

- In order to assist designers in their plight, TEKELEC TEMEX has introduced two laboratory kits for HIGH "Q" chips, based on CHA and CHB series.

CHA KIT: 33 values in CHA size ranging from 0.3 pF to 100 pF + 2 values in CHB size 100 and 220 pF (20 pieces per value)
CHB KIT: 35 values in CHB size ranging from 0.3 to 560 pF (10 pieces per value).

- All the capacitors will be supplied with standard gold determinations (G) over nickel-barrier making them ideally suited to repeated soldering and de-soldering operations.

Each capacitor will be laser marked with capacitance value and tolerance.

Detailed values and associated tolerances are indicated below.

KIT-CHA: 35 values CHA CHB
(20 pieces/value) 700 pieces

CR (pF)	Tol.	UR	CR(pF)	Tol.	UR	CR (pF)	Tol.	UR
0.3	B	50 V	3.3	C	50 V	39	J	50 V
0.4	"	"	3.9	"	"	47	"	"
0.5	"	"	4.7	"	"	56	"	"
0.6	"	"	5.6	"	"	68	K	"
0.7	"	"	6.8	J	"	82	K	"
0.8	"	"	8.2	"	"	91	K	"
0.9	"	"	10	"	"	100	K	"
1.	"	"	12	"	"			
1.3	"	"	15	"	"	CHB		
1.6	"	"	18	"	"	100	K	500 V
1.9	"	"	22	"	"	220	K	200 V
2.1	B	"	27	"	"			
2.7	C	"	33	"	"			

KIT-CHB: 35 values CHB
(10 pieces/value) 350 pieces

CR (pF)	Tol.	UR	CR (pF)	Tol.	UR	CR (pF)	Tol.	UR
0.3	B	500 V	10	J	500 V	120	K	300 V
0.6	"	"	12	"	"	150	"	"
0.9	"	"	15	"	"	180	"	"
1.2	"	"	18	"	"	220	"	200 V
1.5	C	"	22	"	"	270	M	"
1.8	"	"	27	"	"	330	"	"
2.2	"	"	33	"	"	390	"	"
2.7	"	"	39	"	"	470	"	"
3.6	"	"	47	"	"	560	"	100 V
4.7	"	"	56	"	"			
5.6	"	"	68	"	"			
6.8	"	"	82	K	"			
8.2	"	"	100	"	"			

HOW TO ORDER: "LABO KIT" or "DEMO KIT" CHA
"LABO KIT" or "DEMO KIT" CHB

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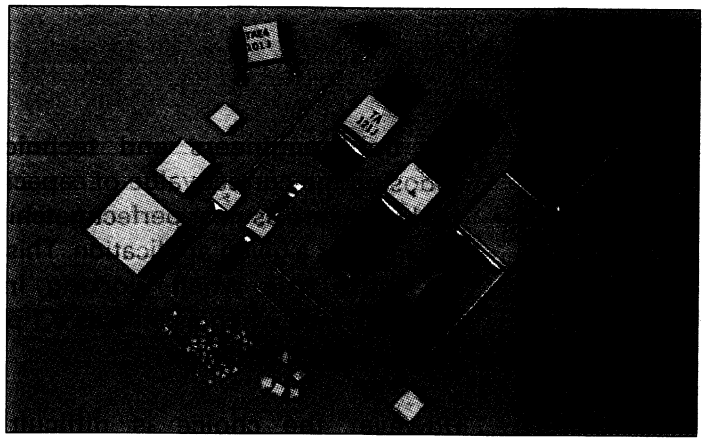
HIGH VOLTAGE R.F. CAPACITORS



DESCRIPTION:

The CP and CL series have been developed for communication, transmission and high technical applications (military, civil, medical...) in which low loss, high current, high voltage capabilities are required in H.F and V.H.F. frequencies range.

Their pure high grade dielectric material (Type 1) and special electrode construction make them ideally suited for tuning and impedance matching applications where temperature rise under R.F. current flowing has to be minimized to insure perfect reliability.

The non-porous ceramic which is used make them totally impervious to most of external contaminating agents.

They are offered as bare chips with several types of terminations as required by the design:

- Silver-Palladium (A&P: for non-magnetic applications)
- Gold (G) or Tin (V) over nickel for general purposes

They are most of the time used with radial or axial wires and also with strip leads (ribbons).

APPLICATIONS (GENERALLY BETWEEN 10 TO 100 MHz):

- Transmission HF-VHF
- Antenna tuning
- Probe antenna
- Impedance matching
- Induction heating
- Filters

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The range of capacitors is based on:

- **Two dielectrics (Type 1):**
  a NPO : 0 ± 30 ppm /° C referenced as "L"
  a P100 : 100 ± 30 ppm /° C referenced as "P"

- **Three chip sizes (L x W / mm):**

Size	NPO	P100
tolerance	(± 1.0 mm)	(± 0.5 mm)
"C"	6.5 x 6.0	6.5 x 5.0
"E"	10.5 x 9.5	10.5 x 9.0
"F"	18 x 16	18 x 15.5

providing the following combinations/references:

Temperature coeff.	Size C	Size E	Size F
NPO	(CLC)	CLE	CLF
P100	CPC	CPE	(CPF)

( ) under development.

I- TERMINATIONS & MARKING:

1) Terminations:

a) chip version

They are made of either:

- Silver-Palladium (for non-magnetic applications) : Ref : P
- Silver-Platinum-Palladium (for non-magnetic applications) : Ref : A
- Dipped tinned (Sn/Pb/Ag: 62/36/2) over "P" or "A" : Ref : T
- Gold (electrolytic) over nickel : Ref : G
- Tin (electrolytic) over nickel : Ref : V
- Dipped tinned (Sn/Pb/Ag:62/36/2) over nickel barrier : Ref : W

b) Ribbons and leads versions:

In many applications, ribbons and/or leads are necessary: consult Table 2 to choose the adequate version.
Ribbons are made of silver.
Leads are made of tinned copper.
Recommendation: See general recommendation for the use of our capacitors (soldering conditions).

2) Marking:

The capacitors (chips & leaded) will be marked (Laser or print) when requested:
(Suffix L in the ordering instruction) with the following information:

- TEKELEC TEMEX logo : TA
  Capacitance value : 3 digits code
  Tolerance on capacitance : 1 digit code
  Voltage : 3 digit code (on special request)
  Manufacturing date : 2 digits code (year/month) (on special request)

3) Coating:

On request, pieces will be coated with an insulating varnish.

II - GENERAL CHARACTERISTICS:

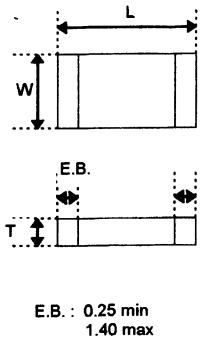
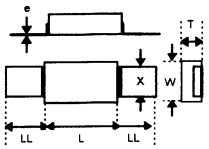
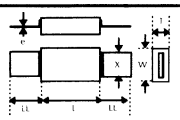
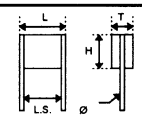
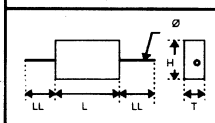
The characteristics herebelow mentioned apply for both NPO and P100 characteristics unless otherwise stated.

Parameter	Size C	Size E	Size F
Capacitance range: (see table1)	1 pF to 1200 pF	1 pF to 2200 pF	1000 pF to 10000 pF
Tolerance on capacitance:	C < 10 pF: B: ± 0.1 pF C: ± 0.25 pF D: ± 0.5 pF C ≥ 10 pF F: ± 1 % G: ± 2 % J: ± 5 % K: ± 10 % M: ± 20 %	idem Size C	idem Size C
Voltage range (Vdc): (see table 1)	2500 to 1250 V	3600 to 1000V	1000V to 500V
Reactive power:	see table	see table	see table
Temperature coefficient of capacitance: NPO: P100:	CLC: 0 ± 30 ppm/° C CPC: 100 ± 30 ppm/° C	CLE: 0 ± 30 ppm/° C CPE: 100 ± 30 ppm/° C	CLF: 0 ± 30 ppm/° C CPF:100 ± 30 ppm/° C
Q factor @ 1MHz (For other frequency see curve)	>10000	>10000	>10000
E.S.R. @ Frequency	see curve	see curve	see curve
resonance frequency	see curve	see curve	see curve
Maximum admissible R.F current versus Cr and frequency:	see curve	see curve	see curve
Insulation resistance: @ 25° C @ 125° C see condition p. 9-13	 Ri > 10^5 MΩ Ri > 10^4 MΩ	 Ri > 10^5 MΩ Ri > 10^4 MΩ	 Ri > 10^5 MΩ Ri > 10^4 MΩ
Voltage proof (dc):	P100: 2 x Ur NPO: 1.5 xUr	P100: 2 x Ur NPO: 1.5 xUr	P100: 2 x Ur NPO: 1.5 xUr
Endurance: 2000 Hours -125° C	1.5 xUr	Ur	Ur

Table 1: Capacitance and voltage ranges (per case size):

		Size C			Size E			Size F		
Cr (pF)	Cr code	Ud.c (V)	Ur.m.s (V)	Q (KVar)	Ud.c (V)	Ur.m.s (V)	Q (KVar)	Ud.c (V)	Ur.m.s (V)	Q (KVar)
1	1R0		2000	6		2500	12			
1.2	1R2									
1.5	1R5									
1.8	1R8									
2.2	2R2									
2.7	2R7									
3.3	3R3									
3.9	3R9									
4.7	4R7									
5.6	5R6									
6.8	6R8									
8.2	8R2									
10	100									
12	120									
15	150									
18	180									
22	220									
27	270									
33	330									
39	390									
47	470									
56	560									
68	680									
82	820									
100	101									
120	121									
150	151									
180	181									
220	221									
270	271									
330	331	**1250**	1000	6						
390	391									
470	471					1800	12			
560	561									
680	681									
820	821				**1600**	1100	6			
1000	102							**1000**	700	3
1200	122				**1000**	700	6			
1500	152									
1800	182									
2200	222									
2700	272									
3300	332									
3900	392									
4700	472									
5600	562									
6800	682									
8200	822							**500**	350	3
10000	103									

Table 2: Dimensions and Termination types

TERMINATION TYPE	Suffix	Dielectric	Size	Bare chip L	Bare chip W	Bare chip T (max)	Chip with connection L	W	LL(min)	X±0.2	T or H (max)	L.S.±0.8	e or Ø
 E.B. : 0.25 min 1.40 max	A, P G, V	P100 (P)	C	6.5 ± 0.5	5 ± 0.5	3.0							
			E	10.5 ± 0.5	9 ± 0.5	4.5							
			F	18 ± 0.5	15.5 ± 0.5	4.0							
	T, W		C	7.5 ± 0.5	6 ± 0.5	4.0							
			E	11.5 ± 0.5	10 ± 0.5	5.5							
			F	19 ± 0.5	16.5 ± 0.5	5.0							
	A, P G, V	NP0 (N)	C	6.5 ± 1	5 ± 1	3.0							
			E	10.5 ± 1	9 ± 1	4.5							
			F	18 ± 1	15.5 ± 1	4.0							
	T, W		C	7.5 ± 1	6 ± 1	4.0							
			E	11.5 ± 1	10 ± 1	5.5							
			F	19 ± 1	16.5 ± 1	5.0							
	1	N, P	C				6.5+1.5/-0.5	5±0.5	8	2.4±0.2	4		0.1+0.2/-0.02
		N	E				11.5+1.5/-0.5	10.5±0.5	16	8.9±0.2	5.5		0.3+0.6/-0.03
		P	E				9.5+1.5/-0.5	9±0.5	16	8.9±0.2	5.5		0.3+0.6/-0.03
		P	F				18±1.5	15.5±1.5	2.5	15±0.5	5.0		0.6±0.06
	1S	N	E				11.5+1.5/-0.5	10.5±0.5	9	8.9±0.2	5.5		0.3+0.6/-0.03
		P	E				9.5+1.5/-0.5	9±0.5	9	8.9±0.2	5.5		0.3+0.6/-0.03
	2	N	E				11.5+1.5/-0.5	10.5±0.5	16	8.9±0.2	5.5		0.3+0.6/-0.03
		P	E				9.5+1.5/-0.5	9±0.5	16	8.9±0.2	5.5		0.3+0.6/-0.03
	6	P	C				6.5+2/-0.5	5±0.5	30		3	7.62	0.6±0.06
		N	E				11.5+2.5/-0.5	10.5±0.5	30		4.5	12.7	0.9±0.09
		P	E				9.5+2.5/-0.5	9±0.5	30		4.5	12.7	0.9±0.09
		P	F				18±1	16±1	30		4.0	15.24	0.9±0.09
	7	P	C				6.5+2/0.5	5±0.5	30		3		0.6±0.06
		N	E				11.5+1.5/-0.5	10.5±0.5	30		4.5		0.9±0.09
		P	E				9.5+2.5/-0.5	9±0.5	30		4.5		0.9±0.09

III - HOW TO ORDER

Only capacitance/voltage values shown in Table 1 page 9-45 are liable to be coded.
If capacitance values outside E12 range (see table 1) are sought, please consult us.

252	C	*	*	470	J	P
Voltage code: Ur (d.c) 362=3600 V 252 = 2500 V 162 = 1600 V 122 = 1250 V 102 = 1000 V 501 = 500 V	Capacitor series	Dielectric code: L = NPO P = P100	Case code: C E F see dimensions and capacitance range in table 1	Capacitance value code: the first two digits are significant of C ; the last one is the number of "0" to read the capacitance in "pF": 150 = 15 pF 151 = 150 pF	Tolerance code: for Cr < 10 pF B = ±0.1 pF C = ±02.5 pF D = ±0.5 pF For Cr ≥ 10 pF F = ±1 % G = ±2 % J = ±5 % K = ±10 %	Termination code: A = Silver-palladium-platinum P = Silver-palladium V = tinned nickel-barrier... See table 2 for ribbons and wires variants

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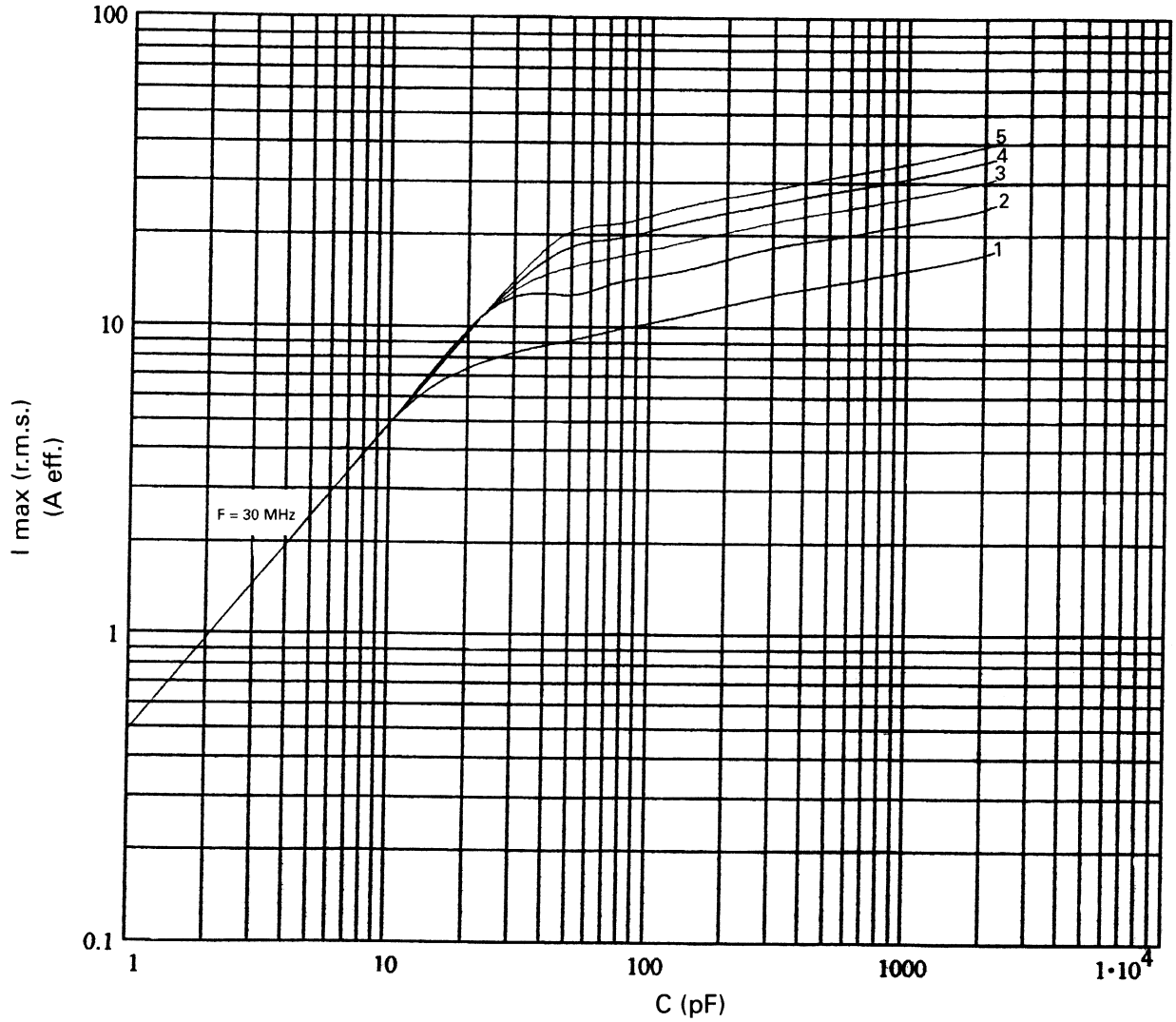
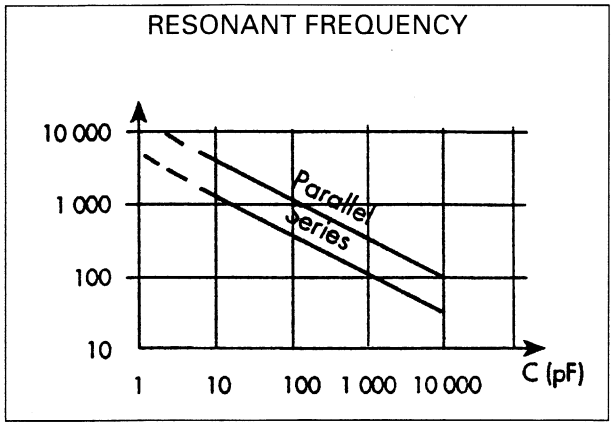
CPE - CLE types

Irms = f(C, f)

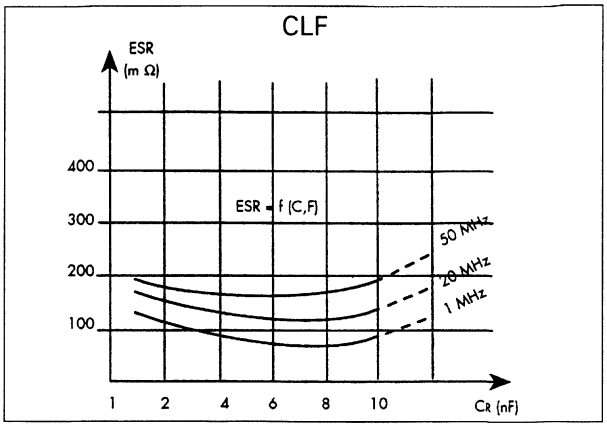


5 - Delta T = 100° C Case rise
4 - Delta T = 80° C
3 - Delta T = 60° C
2 - Delta T = 40° C
1 - Delta T = 20° C

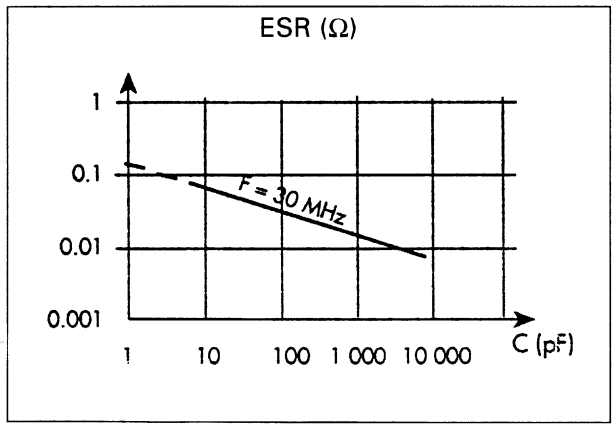
Performances curves



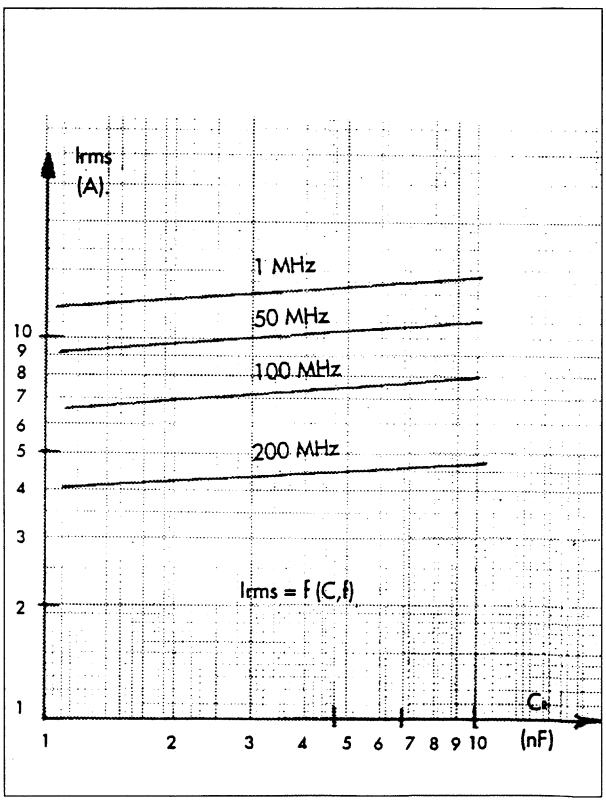
CPE-CLE: Resonant Frequency versus C_R



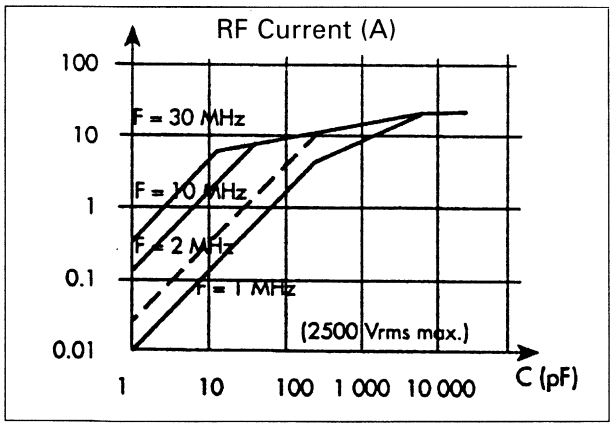
CLF: ESR versus C_R



CPE-CLE: ESR versus C_R



CLF: Irms versus C_R



SINGLE LAYER CAPACITORS - U SERIES

MICROWAVE (UHF/SHF) CERAMIC CHIP CAPACITORS SINGLE LAYER CONSTRUCTION

DESCRIPTION

Single layer capacitors are designed for applications ranging from D.C. to microwave frequencies.

They offer the design engineer extreme flexibility in hybrid circuit layouts.

Low profiles suit them for microwave stripline applications up to 50 GHz.

Single layer ceramic capacitor chips are by nature a semi-custom product.

When used in circuits operating at microwave frequencies, the physical dimensions of the chip can be as important to the circuit performance as the dielectric materials which are used to fabricate them.

The five ceramic material shown cover the capacitance range of 0.1 pF to 2400 pF, with voltage ratings of up to 15 kV.

The glass-free noble metal (Pt-Au-Pd alloy) electrode system supplies superior bond strength to the ceramic and is easily attached to by conventional wire bonding, soldering or conductive epoxy bonding techniques.

Alternate ceramic materials are available with positive or negative temperature characteristics and varying dielectric constants to build the particular chip most suited to your application.

APPLICATION

- Hyrid circuit (low and high voltage)
- Microwave strip line
- Coupling, By-Pass, Dc blocking in microwave circuits
- For use up to 50 GHz
- Fine grain, high fire dielectrics
- Low loss ruggedized cap
- Universal terminations
- Impervious to static charges
- No special care in circuit assembly
- Large bonding areas (top and bottom surfaces are solderable, using all types of standard solders
- Capacitance value as low as 0.1 pF
- Low insertion Loss
- Low self inductance
- Low series resistance
- High "Q" factor

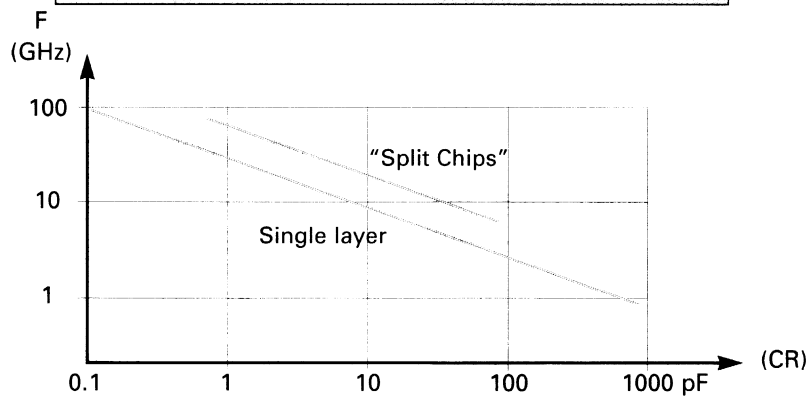
ELECTRICAL AND MECHANICAL CHARACTERISTICS

Electrical characteristics (25° C unless otherwise specified)		
Operating frequency	:	Up to 50 GHz (75 GHz for dual-chips)
Resonant frequency	:	See performance curve
Capacitance range	:	0.1 to 2400 pF (Std)
Capacitance tolerance	:	±0.01 pF to -20 % / +80 % see table
Quality factor	:	1 MHz ≥ 10000 (dielect. Q) ≥ 2000 (dielect K, N) ≥ 1000 (U, V, R, L)
Dissipation factor	:	1 kHz ≤ 2 % (dielect. D) ≤ 2.5 % (dielect. B, W, X, T, Z) ≤ 3 % (dielect. Y)
Rated voltage (UR)	:	100 V Extended range up to 15 KV (U_R)
Voltage proof	:	2.5 U_R for 5 seconds.
Insulation resistance	:	Ri ≥ 10^5 MΩ (All dielectics) Ri ≥ 10^4 MΩ (dielectics Z, Y)

Mechanical characteristics

- Bond strength (exceeds MIL-Std 883 method 2011)
- Shear strength exceeds MIL-Std 883 method 2019)
- Attachment
  Eutectics
  Conductive epoxy
  Solder (Sn 62)

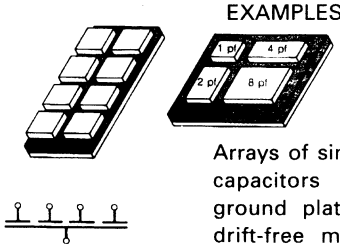
Typical Series Resonant Frequency



Dual and multiple capacitor arrays

MULTIPLE CAPACITOR ARRAYS

EXAMPLES

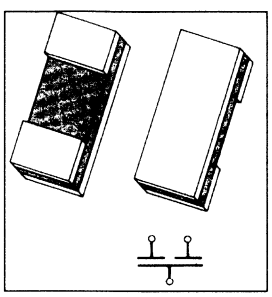


BINARY ARRAY

Arrays of single or multiple valued capacitors sharing a common ground plate, offer a convenient drift-free method of fine tuning circuits, while minimizing the amount of assembly effort involved.

SPLIT-CHIPS ®

EXAMPLES



The primary application for split-chip capacitors is in microwave strip-line circuitry. Low silhouettes and width dimensions that match strip-line widths, tend to minimize disturbances in wave propagation through the line

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HF & MICROWAVE CERAMIC CHIP CAPACITORS

Single layer capacitors - U Series

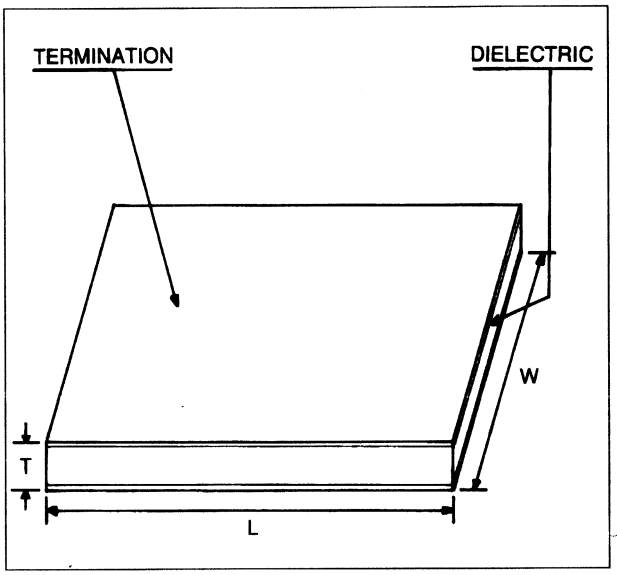
CHOICE OF THE DIELECTRIC

Class 1			Class 2		
Dielectric designation	Dielectric constant	T.C. (*) ppm / ° C	Dielectric designation	Dielectric constant	$\frac{\Delta C}{C}$ (*)
Q	21	90 (±30)	D	600	±10%
K	37	0 (±30)	B	1200	±15%
N	80	0 (±30)	W	2000	±15%
U	130	-750 (±30)	X	3000	±15%
V	200	-1500 (±300)	T	4200	±15%
R	300	-2200 (±500)	Z	7500	+22/-56%
L	400	-3300 (±500)	Y	12000	+22/-82%

(*) over the temperature range -55° C / +125° C excepted Z, Y: -30 / +85° C

CHOICE OF THE TERMINATIONS

Terminations designation	Nature of termination
9	Platinum/Gold/Palladium alloy Compatible with all bonding techniques
G	Electroplated Gold over Pt/Au/Pd (0.0001/2.5 µm) for thermal compression, ultra son and thermosonic bonding



CHOICE OF THE CASE SIZE

Case sign designation	W or L		T (*)	
	inches	mm	inches	mm
BB	0.01 ± 0.003	0.25 ± 0.08		
CC	0.015 "	0.38 "		
DD	0.02 "	0.51 "		
EE	0.025 ± 0.05	0.64 ± 0.13		
FF	0.030 "	0.76 "		
GG	0.035 "	0.89 "		
HH	0.040 ± 0.010	1.02 ± 0.25	0.003	0.08
II	0.045 "	1.14 "		
JJ	0.050 "	1.27 "	to	to
KK	0.055 "	1.40 "		
LL	0.060 "	1.52 "	0.010	0.25
MM	0.065 "	1.65 "		
NN	0.070 "	1.78 "		
OO	0.075 "	1.91 "		
PP	0.080 "	2.03 "		
QQ	0.085 "	2.16 "		
RR	0.090 "	2.30 "		

(*) depending on capacitance value

CHOICE OF CAPACITANCE TOLERANCE

A	B	C	D	F	G	J	K	M	Z
± 0.05pF	± 0.1	± 0.25pF	± 0.5pF	± 1%	± 2%	± 5%	± 10%	± 20%	-20 +80%
C ≤ 10 pF				C > 10 pF					

Note: for rectangular size (L shall not exceed 2 x W for mechanical reliability) and more generally for any specific size please consult us.

HF & MICROWAVE CERAMIC CHIP CAPACITORS

Single layer capacitors - U Series

CHOICE OF THE CAPACITANCE VALUE VERSUS THE DIELECTRIC AND THE CASE SIZE (pF, Cmin / Cmax)

Electric designation	Q	K	N	U	V	R	L	D	B	W	X	T	Z	Y
Dielectric constant (K)	21	37	80	130	200	300	400	600	1200	2000	3000	4200	7500	12000
BB	0.1	0.1	0.2	0.2	0.48	0.7	1.	1.5	3.	5.	7.5	10.	18.	29.
	0.15	0.3	0.6	1.	1.2	2.2	3.	4.5	9.	15.	20.	30.	36.	90.
CC	0.12	0.22	0.45	0.75	1.2	1.7	2.3	3.4	6.8	11.5	17.	24.	43.	68.
	0.35	0.65	1.4	2.2	3.4	5.	6.8	10.5	21.	34.	51.	71.	127.	202.
DD	0.22	0.37	0.8	1.3	2.	3.	4.	6.	12.	20.	30.	42.	75.	120.
	0.68	1.2	2.4	3.9	6.	9.	12.	18.	36.	60.	90.	125.	225.	360.
EE	0.30	0.6	1.2	1.8	2.8	4.2	5.6	8.6	17.	28.	42.	53.	105.	170.
	0.5	0.9	1.9	3.1	4.7	7.	9.4	14.	28.	47.	71.	99.	176.	281.
FF	0.45	1.75	1.7	2.7	4.1	6.1	8.1	12.2	25.	41.	61.	85.	152.	243.
	0.7	1.25	2.7	4.4	6.8	10.5	13.5	21.	41.	68.	100.	140.	250.	400.
GG	0.58	1.1	2.2	3.6	5.6	8.4	11.	16.8	33.	55.	83.	116.	208.	335.
	1.	1.6	3.6	6.	9.	13.	18.	27.	55.	90.	136.	192.	340.	550.
HH	0.8	1.4	2.9	4.7	7.2	11.	14.5	22.	43.5	72.	108.	151.	270.	432.
	1.2	2.2	4.7	7.7	11.	17.	24.	35.	71.	120.	180.	250.	449.	718.
II	1.	1.7	3.7	6.	9.2	14.	19.	28.	55.	91.	137.	192.	342.	550.
	1.6	2.8	6.	10.	15.	22.	30.	45.	90.	150.	220.	300.	560.	900.
JJ	1.2	2.1	4.5	7.3	11.5	17.	23.	34.	68.	113.	169.	240.	430.	680.
	2.	3.4	7.4	12.	18.	28.	37.	56.	110.	180.	280.	390.	700.	1100.
KK	1.5	4.6	5.5	8.9	14.	21.	27.	41.	82.	136.	205.	290.	510.	820.
	2.4	4.	9.	14.	22.	33.	45.	68.	135.	226.	340.	470.	850.	1360.
LL	1.7	3.	6.6	11.	16.5	24.	33.	50.	100.	160.	250.	340.	610.	980.
	2.8	5.	10.	17.	27.	40.	54.	80.	160.	270.	400.	560.	1000.	1600.
MM	2.	3.6	7.6	13.	19.	29.	38.	57.	114.	190.	285.	400.	720.	1200.
	2.2	3.9	8.4	14.	21.	32.	42.	63.	130.	210.	310.	440.	790.	1300.
NN	2.3	4.	9.	14.	21.	33.	45.	63.	135.	216.	324.	460.	820.	1350.
	2.6	4.5	10.	16.	24.	37.	50.	70.	150.	240.	360.	510.	920.	1500.
OO	2.7	4.5	10.	16.	25.	38.	50.	75.	150.	250.	370.	540.	940.	1600.
	3.	5.	11.	18.	28.	42.	56.	84.	168.	280.	420.	600.	1050.	1700.
PP	3.1	5.4	12.	19.	29.	43.	57.	86.	170.	290.	430.	610.	1080.	1800.
	3.5	6.	13.	21.	32.	48.	54.	96.	190.	320.	480.	680.	1200.	2000.
QQ	3.4	6.1	13.	21.	32.	49.	65.	100.	200.	320.	500.	680.	1300.	2000.
	3.8	6.8	15.	23.	36.	54.	72.	110.	220.	360.	560.	760.	1400.	2200
RR	3.8	6.7	14.5	23.5	36.5	55.	73.	109.	218.	365.	546.	764.	1365.	2184
	4.2	7.4	16.	26.	40.	61.	81.	120.	240.	400.	600.	840.	1500.	2400

– Values indicated above have been obtained by calculation by taking the optimal thickness for a good mechanical reliability. Higher capacitance values may be achieved by using special thickness, please consult us.

HOW TO ORDER

101	U	QQ	W	470	J	P
Voltage code: Std ; 101 = 100 V 1st two digits are significant, 3rd digit denotes number of zero.	U - Single layer chips series	• Case size • Letters may be different for rectangular size. Ex.: HQ	Dielectric designation	Capacitance code (pF) the first two digits are significant, third denotes number of zero 331 = 330 pF	Tolerance code: See above table	Termination designation

MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS (Section 4)

Selection Guide

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MEDIUM VOLTAGE (200 - 2000 V)

DESCRIPTION

TEKELEC TEMEX is offering this range of 200V to 2000V capacitors (chips and leaded components) in order to assist the designers in their search of components for protection when environmental conditions (transient, electric electrostatic and/or electromagnetic origins) may disrupt electronic circuits.

Those capacitors are of course very well fitted to all applications requiring high voltage and /or filtering functions such as voltage multipliers, circuit protection, noise suppression, etc...

They are basically offered in:

- 3 popular IEC chip sizes 1210-1812-2220 compatible with voltages with silver-palladium terminations and radial leaded versions for standard insertion ; both configurations in NPO and X7R dielectrics (see tables 1 & 3).

- 6 IEC chip sizes (1206,1210,1808,1812,1825,2225) with tinned nickel barrier for S.M.T applications (see tables 2 & 4).

For other sizes and capacitance-voltage combination, please consult us.

RECOMMENDATIONS

It is generally recommended in the industry to use reflow soldering techniques for such sizes of capacitors in order to prevent thermal shock which could crack the capacitor: this is the reason why the preferred type of terminations of the chips is an enhanced Silver-Palladium-version (A) insuring a 260° C 30 seconds soldering time free of leaching effect. Please consult us for this application.

Unless otherwise prescribed, the temperature profiles of CECC 00 802 are recommended.

Depending on the rated voltage, proof test is equal to 1.2 or twice this rated voltage. Circuit applications in excess of 1000V may require adequate precaution (cleaning, surface coating, short metallized pads, slot in the P.C board...) to prevent external arcing.

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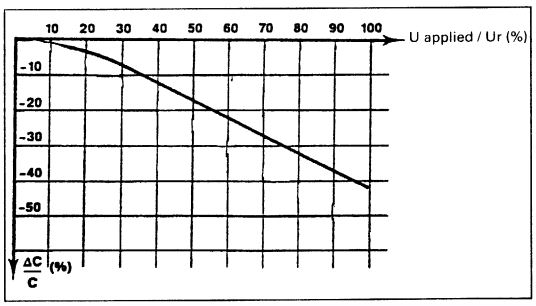
CHARACTERISTICS

(Unless otherwise prescribed hereafter, the conditions of tests and measurements will be in accordance with the CECCC 32101-801)

PARAMETER	NPO Dielectric	X7R Dielectric
Tekelec Temex dielectric code	"N"	"X"
CECC Equivalence	Type 1 - 1B CG	Type 2- 2R1
Capacitance range	See tables 1 & 2	See tables 3 & 4
Voltage range (D.C)	200-500-1000-2000 V	200-500-1000-2000 V
Tolerance on capacitance	Standard: 10 % (code K) On request: 2 % (G) -5% (J)	Standard: 20% (code M) On request: 10% (K)
Temperature range	-55° C to +125° C	-55° C to +125° C
Temperature coefficient	0 ± 30 ppm /° C	Not applicable
Maximum variation of capacitance over temperature range	not applicable	± 15 % with no voltage applied
Maximum variation of capacitance with applied voltage	not applicable	See curve of variation versus U applied / U rated
Ageing:	not applicable	2.5 % /decade hour
Tangent of the loss angle (or Dissipation Factor: D.F.)	≤ 15 x 10^{-4}	≤ 25 x 10^{-3}
Insulation resistance:	@ 25° C: $R_I \geq 20$ GΩ	@ 25° C
under Ur for Ur = 200 to 1000 V	@ 125° C: ≥ 10 GΩ or 100 ΩF	$R_I \geq 20$ GΩ for C ≤ 22 nF
under 1000 V for Ur > 1000 V	whichever is the less	$R_{I.C} \geq 500$ ΩF for C > 22 nF
Voltage proof	2 x Ur for Ur ≤ 500 V 1.2 x Ur for Ur ≥ 1000 V	1.5 x Ur for Ur ≤ 500 V 1.2 x Ur for Ur ≥ 1000 V
Test conditions for "C" and " D.F"		
Frequency	C ≤ 1000 pF 1 MHz C > 1000 pF 1 kHz	1 kHz
Voltage	< 5 Vrms	1 ± 0.2 Vrms

Note: For X7R dielectric the following curve of capacitance value versus applied voltage will apply:

Capacitance versus applied voltage (X7R dielectric) maximum deviation



MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

Medium voltage (200 - 2000 V)

Table 1: NPO (Silver-Palladium terminations) - Capacitance / voltage range per case size:

Cr	Cr	1210 (S41)				1812 (S43)				2220 (S47)			
pF/nF	code	200V	500V	1000V	2000V	200V	500V	1000V	2000V	200V	500V	1000V	2000V
15	150												
18	180												
22	220												
27	270												
33	330												
39	390												
47	470												
56	560												
68	680												
82	820												
100	101												
120	121												
150	151												
180	181												
220	221												
270	271												
330	331												
390	391												
470	471												
560	561												
680	681												
820	821												
1000	102												
1200	122												
1500	152												
1800	182												
2200	222												
2700	272												
3300	332												
3900	392												
4700	472												
5600	562												
6800	682												
8200	822												
10	103												
12	123												
15	153												

(¤) 2.5 mm thickness instead of 1.7 mm standard

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Table 2: NPO (Tinned nickel barrier terminations) - Capacitance / Voltage range per case size:

Cr	Cr	1206 (R18)				1210 (S41)				1808 (R29)				1812 (S43)				1825 (S49)				2225 (S48)			
pF/nF	code	200V	500V	1kV	2kV	200V	500V	1kV	2kV	200V	500V	1kV	2kV	200V	500V	1kV	2kV	200V	500V	1kV	2kV	200V	500V	1kV	2kV
10	100																								
12	120																								
15	150																								
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8200	822																								
10	103																								
12	123																								
15	153																								
18	183																								
22	223																								

For higher voltages, please consult us.

MEDIUM & HIGH VOLTAGE CERAMIC CAPACITORS

Medium voltage (200 - 2000 V)

Table 3: X7R (Silver-palladium terminations) Capacitance / Voltage range per case size:

Cr	Cr	1210 (S41)				1812 (S43)				2220 (S47)			
pF/nF	code	200V	500V	1000V	2000V	200V	500V	1000V	2000V	200V	500V	1000V	2000V
220	221												
270	271												
330	331												
390	391												
470	471												
560	561												
680	681												
820	821												
1000	102												
1200	122								¤				
1500	152												
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3900	392												
4700	472												
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6800	682												
8200	822												
10	103							¤					
12	123												
15	153												
18	183												
22	223		¤										
33	333												
39	393												
47	473						¤						
56	563												
68	683												
82	823												
100	104										¤		
120	124												
150	154												
220	224												

(¤) 2.5 mm thickness instead of 1.7 mm standard

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Table 4: X7R (Tinned nickel barrier terminations) Capacitance / Voltage range per case size:

Cr	1206 (R18)				1210 (S41)				1808 (R29)				1812 (S43)				1825 (S49)				2225 (S48)			
code	200V	500V	1Kv	2kV	200V	500V	1Kv	2kV	200V	500V	1kV	2kV	200V	500V	1kV	2Kv	200V	500V	1kV	2kV	200V	500V	1kV	2kV
221																								
271																								
331																								
391																								
471																								
561																								
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154																								
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274																								
334																								
394																								

For higher voltages, please consult us.

DIMENSIONS

(All dimensions are given in mm)

1) CHIPS

Applicable for chips described in tables 1 & 3

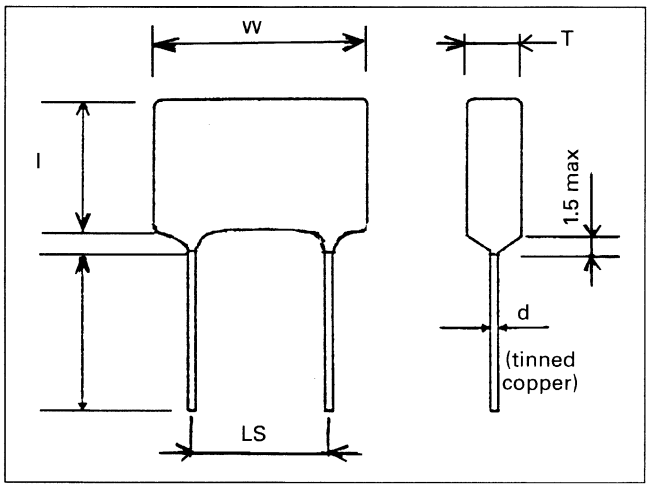
Case size (IEC)	Case size (TEKELEC TEMEX)	Length "L"	Width "W"	End band min/max	Thickness (*)
1210	S41	3.2 ± 0.4	2.5 ± 0.3	0.25 / 0.75	1.8
1812	S43	4.5 ± 0.5	3.2 ± 0.4	0.25 / 1	1.8
2220	S47	5.7 ± 0.5	5.0 ± 0.5	0.25 / 1	1.8

(*) top of the range value: 2.5 mm

For chips described in tables 2 & 4, please refer to general U.S. dimension table, page 9-10.

2) LEADED VERSION

Only 1812 and 2220 of the tables 1 & 3 are offered with radial wire terminations.
Those parts are epoxy coated (dark blue) and marked with: TA logo, capacitance value (coded), tolerance (coded) and voltage (coded).



SIZE	Thickness T max (*)	Width W max	Height H max	Lead spacing L.S. ± 0.5	Wire diameter d ± 10%
1812 (S43)	3.2	7.1	6.6	5.08	0.6
2220 (S47)	3.2	8.3	8.5	5.08	0.6

(*) 3.7 mm for last value of each voltage (top of the range)

HOW TO ORDER:

(CODIFICATION OF THE PARTS)

The values indicated in tables 1 to 4 are standard values ; they can be codified as follows:

202	S43	N	101	K	V	E
Voltage code: 201 = 200 V 501 = 500 V 102 = 1 kV 202 = 2 kV	Case size: R18 = 1206 S41 = 1210 R29 = 1808 S43 = 1812 S49 = 1825 S47 = 2220 S48 = 2225	Dielectric code: N = NPO X = X7R	Capacitance value code: the first two digits are significant of C ; the last one is the number of "0" to read the capacitance in "pF": 150 = 15 pF 151 = 150 pF 103 = 10000 pF	Tolerance code: J = ±5 % K = ±10 % M = ±20 %	Termination code: V = Tin over nickel barrier P = Silver-Palladium A = enhanced silver-palladium (consult us) R = Radial leads (for S43 and S47 shown on tables 1 & 3 page 9-56 & 9-58)	When pieces are required taped, please specified "E" for embossed plastic tape ; (Quantity per reel is depending upon chip size) See general packaging chapter

Note:

The standard chip version (Tables 1 & 3) is delivered with Silver-Palladium (P) terminations.
For enhanced silver-palladium termination (A), please consult us.
Chips capacitors described in tables 2 & 4 will be delivered with nickel-barrier ("V") terminations unless otherwise required.
The last digit (E) apply only for chip version (P or V) when parts are requested to be delivered on tape.

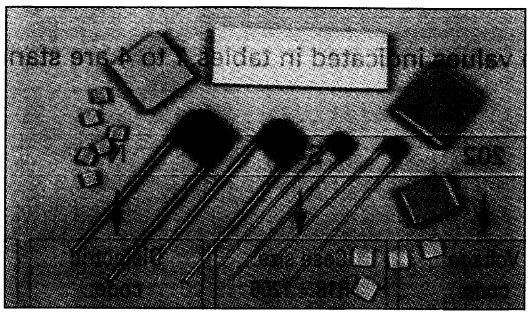
For leaded devices:

Taping may also be achieved for some sizes, please consult us.

HIGH VOLTAGE

DESCRIPTION

- 1 kV to 10 kV_{DC}
- NPO range 100 pF to 33 nF
- X7R range 100 pF to 470 nF

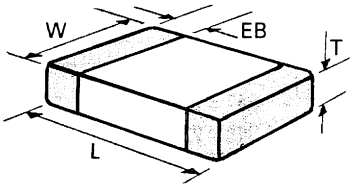


The high voltage series is intended for such typical applications as high voltage power supplies and voltage multipliers circuits.

Available as bare chips, they can be used in surface mounting or hybrid circuits applications.

Their multilayer construction offers a significant size and space saving advantage.

Combination of standard case sizes may be obtained for special applications. They are suited for use in commercial industrial or high Rel military circuits.



EB: min. / max. (mm) :
0.3 / 1.2 for size 1515
0.3 / 1.4 for sizes 2020 and 2520
0.5 / 2.0 for all other sizes

DIMENSIONS (in mm):

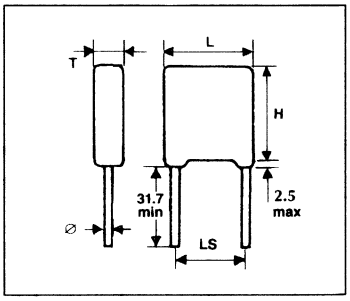
CHIPS:

					Maximum thickness (T max) per case size/voltage									
Size (mm)	L	Tol.	W	Tol.	Voltage (kV)									
		(±)		(±)	1	2	3	4	5	6	7	8	9	10
1515	3.8	0.38	3.8	0.38	3.9	3.9	3.9	3.9						
2020	5.1	0.51	5.1	0.51	3.9	3.9	3.9	3.9						
2520	6.4	0.64	5.1	0.51	3.9	3.9	4.5	4.5	4.5					
3333	8.4	0.84	8.4	0.84	4.5	4.5	4.5	4.5	5.9	5.9				
3530	8.9	0.89	7.6	0.76	3.9	4.5	4.5	4.5	5.1	5.1				
4020	10.2	1.0	5.1	0.51	3.9	3.9	4.5	4.5	4.5	4.5	5.1	5.1	5.1	5.1
4040	10.2	1.0	10.2	1.0	3.9	4.5	5.1	5.1	5.1	5.1				
4540	11.4	1.1	10.2	1.0	3.9	4.5	5.1	5.1	5.1	5.1	5.1			
5040	12.7	1.3	10.2	1.0	3.9	3.9	3.9	4.5	4.5	4.5	5.1	5.1	5.1	5.1
5440	13.7	1.4	10.2	1.0	4.5	5.1	5.1	5.1	6.4	6.4	6.4	6.4		
5550	14.0	1.4	12.7	1.3	4.5	5.1	6.4	6.4	6.4	6.4	6.4	6.4		
6560	16.5	1.7	15.2	1.5	4.5	5.1	5.1	5.1	6.4	6.4	6.4	6.4		
6666	16.8	1.7	16.8	1.7	3.9	4.5	4.5	5.1	6.4	6.4	6.4	6.4	6.4	6.4
7565	19.0	1.9	16.5	1.7	4.5	5.1	5.1	5.1	6.4	6.4	6.4	6.4		

☐ Preferred case size

DESCRIPTION

- 1 kV to 10 kV_{DC}
- NPO range 100 pF to 33 nF
- X7R range 100 pF to 470 nF



The high voltage series is intended for such typical applications as high voltage power supplies and voltage multipliers circuits.

Available as encapsulated leaded devices, they can be used in conventional circuits.

Their multilayer construction offers a significant size and space saving advantage over equivalent disc type capacitors.

They are suited for use in commercial industrial or high Rel military circuits.

DIMENSIONS (in mm):

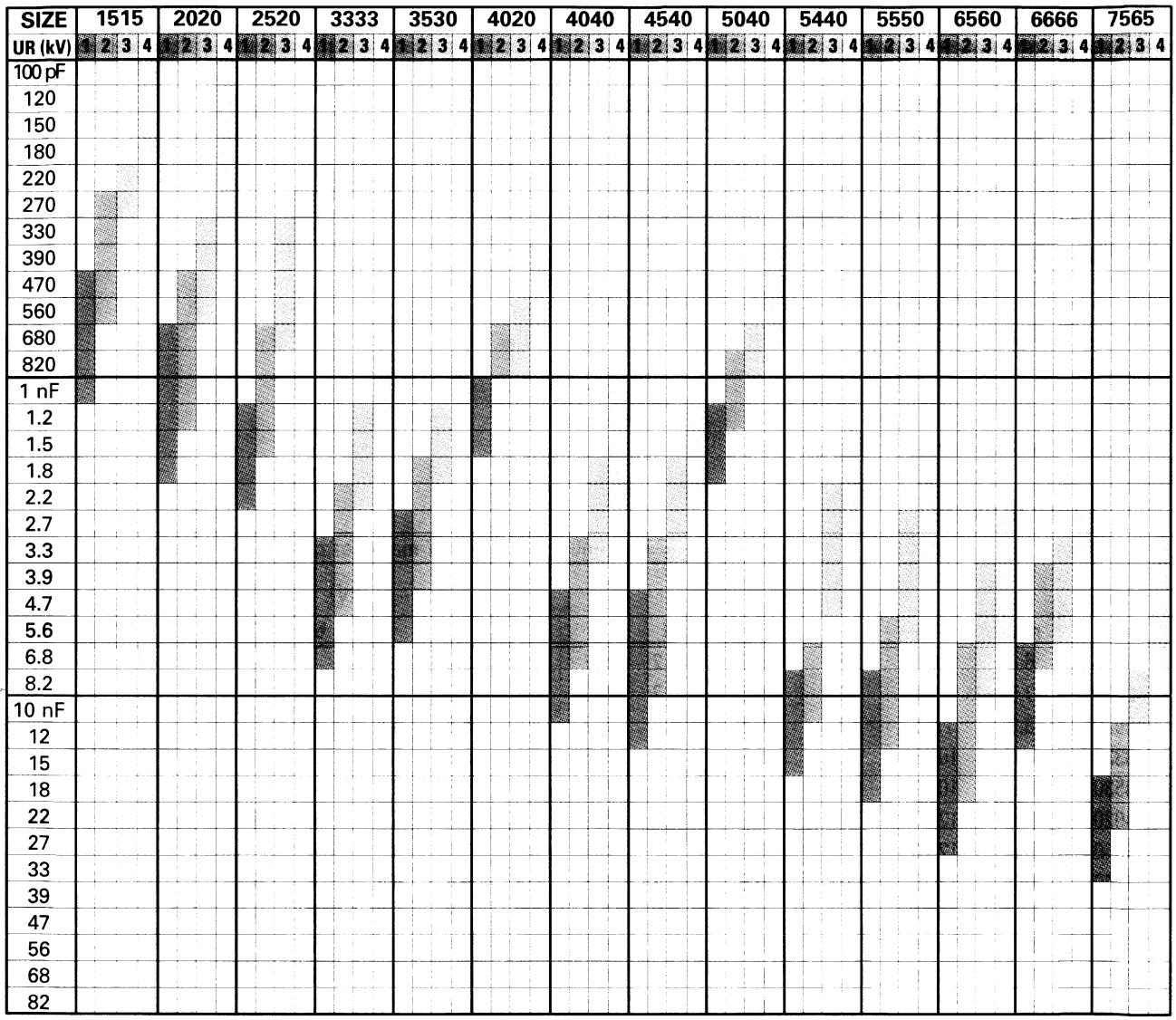
LEADED DEVICES:

					Maximum thickness (T max) per case size/voltage									
Size	L	L.S.	H	Ø	Voltage (kV)									
	max	±0.5	max	±10%	1	2	3	4	5	6	7	8	9	10
1515	6.3	5.08	5.8	0.6	5.2	5.2	5.2	5.2						
2020	7.6	5.08	7.1	0.6	5.2	5.2	5.2	5.2						
2520	8.9	7.62	7.1	0.6	5.2	5.2	5.8	5.8	5.8					
3333	11.4	10.16	10.4	0.9	5.8	5.8	5.8	5.8	7.2	7.2				
3530	11.9	10.16	9.6	0.9	5.2	5.8	5.8	5.8	6.4	6.4				
4020	13.2	12.70	7.1	0.9	5.2	5.2	5.8	5.8	5.8	5.8	6.4	6.4	6.4	6.4
4040	13.2	12.70	12.2	0.9	5.2	5.8	6.4	6.4	6.4	6.4				
4540	14.4	12.70	12.2	0.9	5.2	5.8	6.4	6.4	6.4	6.4	6.4			
5040	15.7	15.24	12.2	0.9	5.2	5.2	5.2	5.8	5.8	5.8	6.4	6.4	6.4	6.4
5440	16.7	15.24	12.2	0.9	5.8	6.4	6.4	6.4	7.7	7.7	7.7	7.7		
5550	17.0	15.24	14.7	0.9	5.8	6.4	7.7	7.7	7.7	7.7	7.7	7.7		
6560	19.5	17.78	17.2	0.9	5.8	6.4	6.4	6.4	7.7	7.7	7.7	7.7		
6666	19.8	17.78	18.8	0.9	5.2	5.8	5.8	6.4	7.7	7.7	7.7	7.7	7.7	7.7
7565	22.0	20.32	18.5	0.9	5.8	6.4	6.4	6.4	7.7	7.7	7.7	7.7		

Preferred case size

NPO

High voltage 1 kV to 4 kV Type: 1 (NPO)



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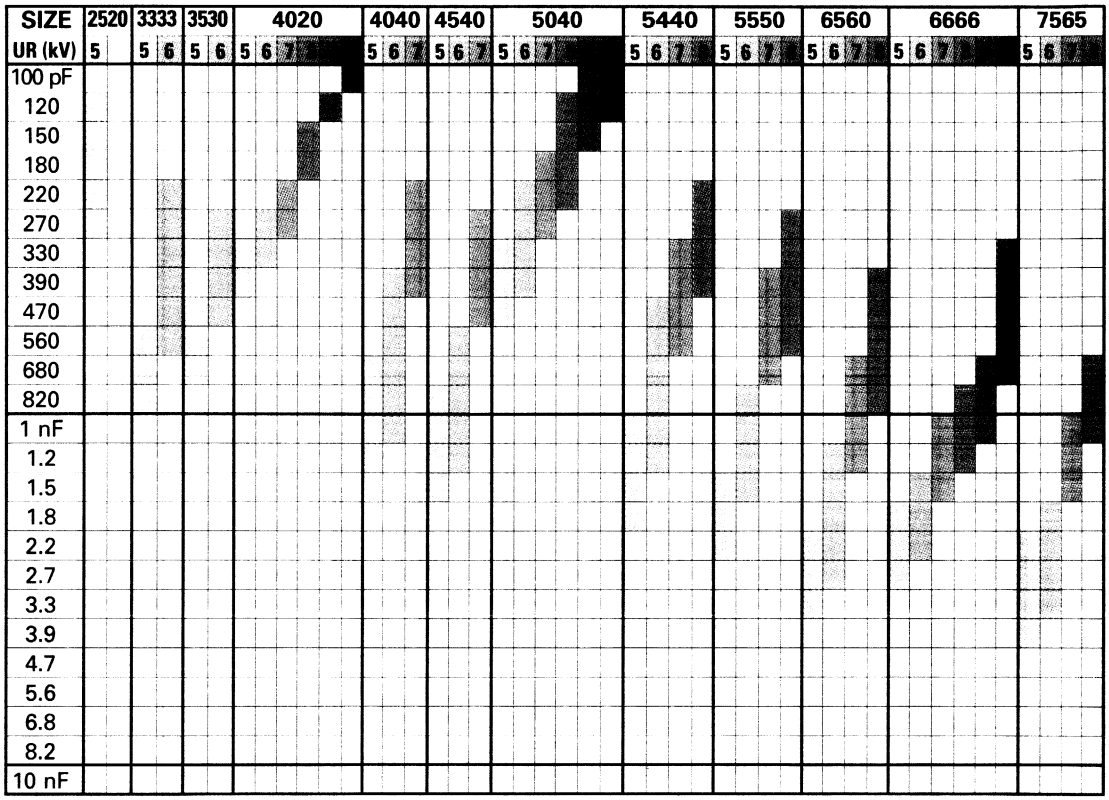
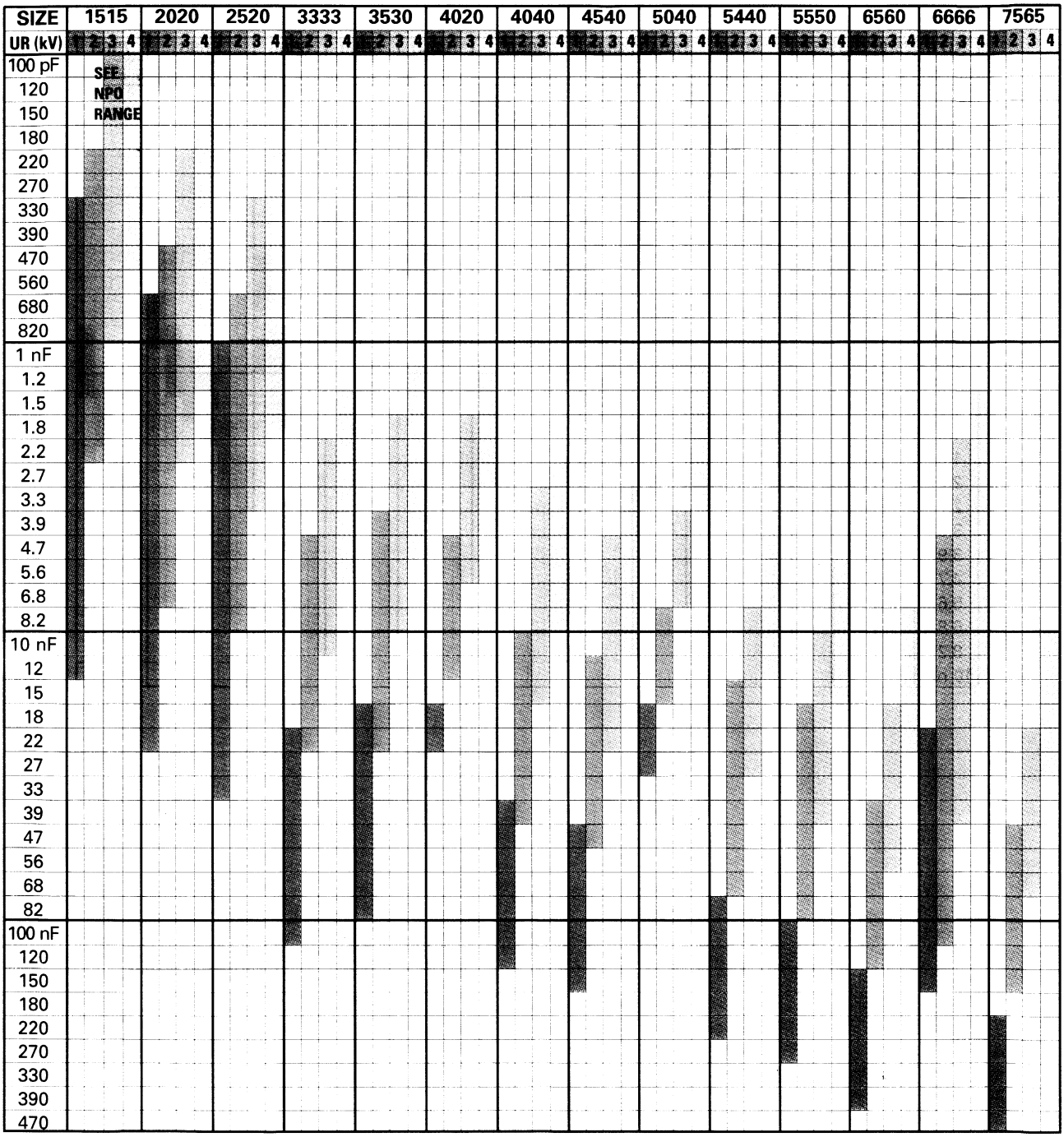
NPO

High voltage 5 kV to 10 kV Type: 1 (NPO)



X7R

High voltage 1 kV to 4 kV Type: 2 (X7R)



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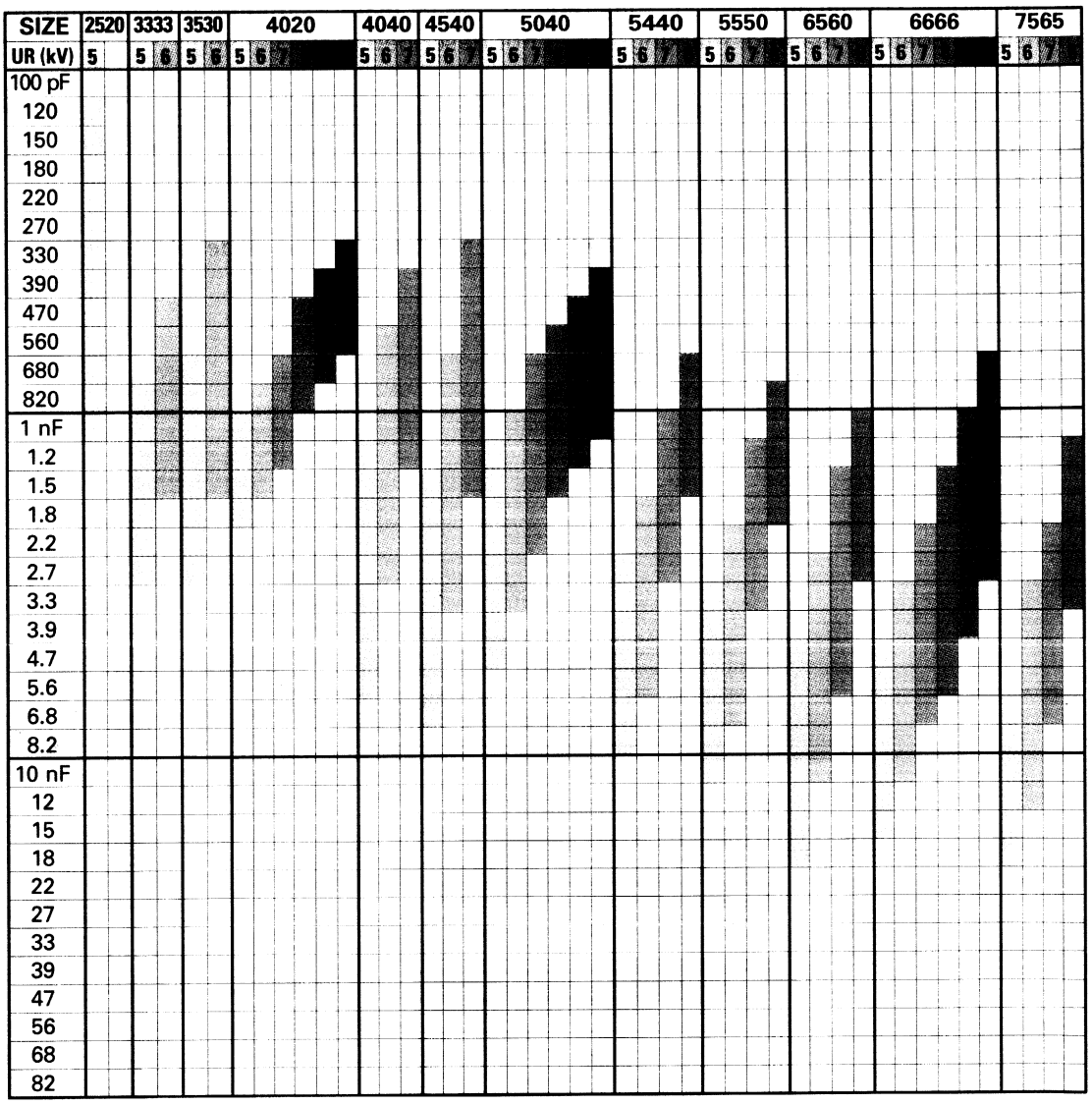
X7R

High voltage 5 kV to 10 kV Type: 2 (X7R)



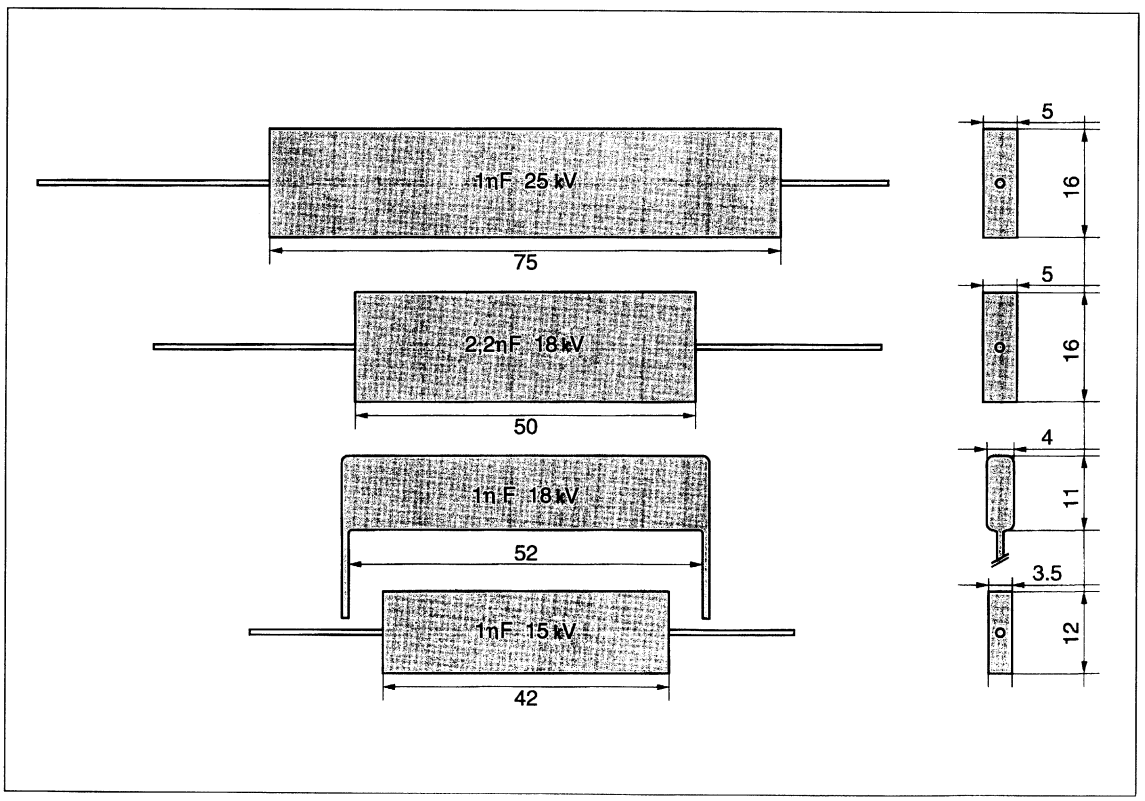
SPECIAL TYPES

- You have found in the preceding pages our standard range of chips and leaded devices (epoxy coated).

- However, some special applications may require special features (higher voltage, burn-in, dimensions, coating, leading, marking, etc...) not described in the catalog.

- Based on the "state of the Art" and on their knowledge of the technology our Engineers may study, at your request, a product stemming from standard production but "Customized" to your application.

- Hereafter are some illustrations of the TEKELEC TEMEX special range developed with our customers.



- Please consult us for detailed information

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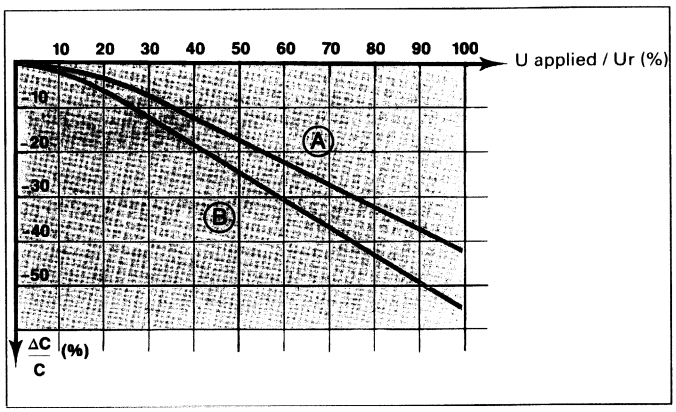
GENERAL CHARACTERISTICS

	Dielectric	
	type1 (NPO)	type 2 (X7R)
Capacitance range	100 pF - 33 nF	100 pF - 470 nF
Tolerance on capacitance	±5 - ±10 - ±20 -20 / + 80 % 0 / + 100 %	±5 - ±10 - ±20 -20 / + 80 % 0 / + 100 %
Voltage (U_R)	see table	see table
Voltage proof: (50 mA - 5 seconds)	1.2 x U_R	1.2 x U_R
Temperature range	-55° C / +125° C	-55° C / +125° C
Temperature cœfficient or/ characteristics	0 ± 30 ppm/ ° C	± 15 %
Voltage cœfficient	no effect	see curve
Ageing	no effect	2.5 % /decade hour
Dissipation factor (at 1 kHz. 25° C)	typ.: ≤ 0.04 % max: 0.1 %	typ.: ≤ 1.5 % max: 2.5 %
Insulation resistance 1000 V, 25° C 1000 V, 125° C	100 GΩ or 1 000 MΩ.µF 10 GΩ or 100 MΩ.µF (whichever is the less)	
Test conditions	1 kHz, 1 V_{RMS} ± 0.2 V 20° C no bias	
Terminations	Chip : Silver palladium (P code) Leaded version: Tinned copper	
Marking: (leaded version only)	TA logo C_R (coded) U_R Tolerance (coded)	

Capacitance versus applied voltage (X7R dielectric) maximum deviation



— All case sizes excepted 4020
5040
6666

Curve A: 1 to 3 kV
Curve B: 4 to 7 kV

— Case size 4020, 5040, 6666
Curve A: 1 to 7 kV
Curve B: 8 to 10 kV

HOW TO ORDER:

102	H4040	X	124	K	P	—
Voltage code: 102 = 1 000 V 202 = 2 000 V 302 = 3 000 V 502 = 5 000 V 103 = 10 000 V	High volt. case series size	Dielectric code: N = NPO X = X7R	Capacitance code: the first two digits are significant, third is the number of "0": ex: 124 120 000 pF	Tolerance code: J = ± 5 % K = ± 10 % M = ± 20 % Z = - 20 + 80 % P = + 0 + 100%	Termination • Radial leads : R • Silver Palladium (chip) : P	Special code for special requirement if any

HIGH CAPACITANCE CERAMIC CAPACITORS

Selection Guide

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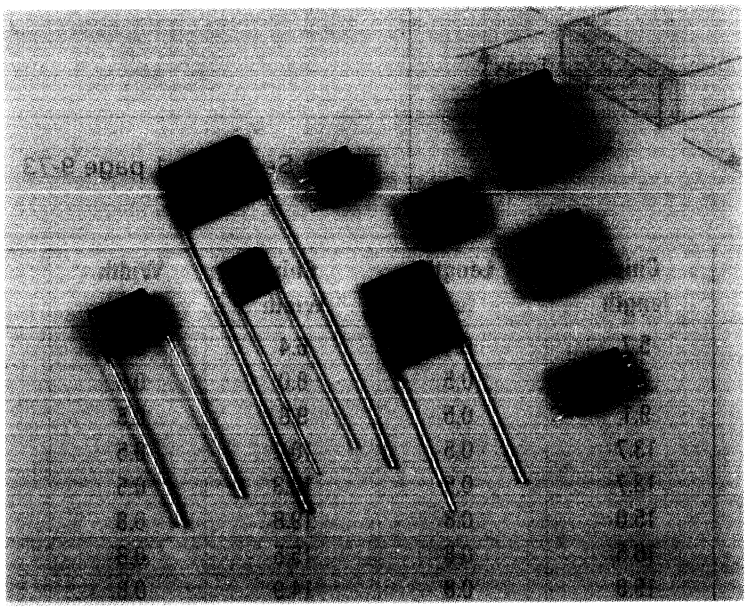
HIGH CAPACITANCE CERAMIC CAPACITORS

	Basic chip	Radial leads Vertical mounting Conformal epoxy coating.	Horizontal assemblies "SC" made of 1 to "n" basic chips Varnish coated.	Horizontal assembly "TB" made of 1 to "n" basic chips. Molded case.	Vertical assemblies "SV" made of 1 to "n" basic chips. Varnish coated.
Mounting	Though they can be considered as SMT devices those chips, if mounted on Alumina substrate have to be submitted to preheating. Their direct use onto an epoxy printed board is not recommended, unless special method is agreed	2 radial leads standard mounting on printed circuits boards. Lead spacing from 5.08 to 20.32 mm.	4 terminals and straight D.I.L. pins configuration are intended for standard use on printed circuit boards. D.I.L., "J" and "L" configurations are intended for S.M.T. reflow soldering process. Upon special request, "J" and "L" ribons configurations can be achieved. Same pattern for a given size.	Standard 4 terminals configuration. Same pattern for the whole capacitance / voltage range (only the height is growing with the CV product)	Constant height for a given case size. The thickness only is growing with the C.V. product for a given case size.
Basic sizes & Assemblies	R2225.....P	R2225...R (CC08)			
	R3033.....P	R3033...R (CC10)	SC01		SV01
	R3740.....P	R3740...R (CC13)	SC02		SV02
	R5440.....P	R5440...R (CC16)	SC03		SV03
	R5550.....P	R5550...R (CC17)	SC04		SV04
	R6080.....P	R6080...R (CC18)	SC06		SV06
	R6560.....P	R6560...R (CC20)	SC05	TB	SV05
	R8060.....P	R8060...R (CC23)	SC07		SV07



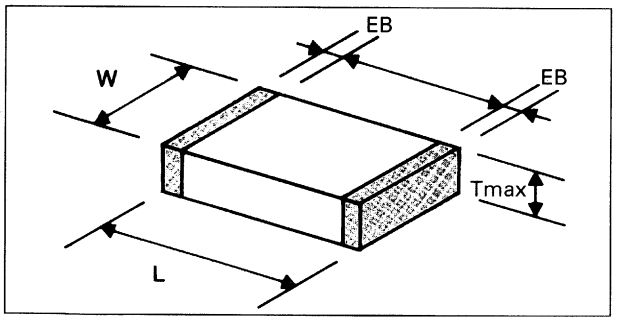
CHIPS X7R

DESCRIPTION

- 0.1 µF to 18 µF
- 50 V to 500 V_{DC}

These capacitors have been developed in response to demand from switched mode power supply (S.M.P.S.) and DC-DC converter manufacturers.
They are particularly suitable for filtering, smoothing and decoupling purpose in Hi-Rel equipments.
The capacitors utilise advance ceramic technology to achieve Hi-Rel long operating life and small size. They are designed for hybrid assembly and low profile printed circuit applications.
Customized assemblies may be achieved with standard chip sizes mentioned herebelow.
(see SC and SV series)

DIMENSIONS (mm)



Tmax: See table 1 page 9-73

Chip case size	Chip length	Length tol.	Chip width	Width tol.	End-band (min/max)
2225	5.7	0.4	6.4	0.4	0.3/1.4
3033	7.4	0.5	8.0	0.5	0.5/2.0
3740	9.1	0.5	9.8	0.5	0.5/2.0
5440	13.7	0.5	10.2	0.5	0.5/2.0
5550	13.7	0.5	12.3	0.5	0.5/2.0
6080	15.0	0.8	19.8	0.8	0.5/2.0
6560	16.5	0.8	15.5	0.8	0.5/2.0
8060	19.8	0.8	14.9	0.8	0.5/2.0

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Chips

CHIPS (X7R)	Maximum thickness (Tmax in mm) is indicated per case size and capacitance/voltage value																							
Cr	2225				3033				3740				5440				5550				6560				6080 / 8060			
(µF)	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V
0.10			1.8	3.0				2.5																				
0.12			1.8					2.5																				
0.15			2.0					2.5																				
0.18			2.0					3.2																				
0.22			2.5					3.2				3.0																
0.27			2.5				2.0					3.0				3.0												
0.33		1.8					2.0				2.0	3.3				3.5				2.5								
0.39		1.8					2.0				2.0	3.5				3.5				2.5								
0.47		1.8					2.0				2.0					3.5				3.0								
0.56		2.0					2.5				2.0					3.8				3.0								
0.68		2.0				2.0					2.5				2.5	4.0				3.0				2.5				3.0
0.82	2.0					2.0					2.5				3.0				3.0				2.0	3.0				3.0
1.0	2.2					2.5				2.0	3.0				3.0				3.0			2.0	2.0	3.0				3.0
1.2	2.5					2.5				2.0	3.0				3.5				3.0			2.0	2.0	3.5				3.5
1.5	2.5				2.8	3.0				2.0					3.5				3.0			2.0	2.5	4.0			3.0	4.0
1.8					2.8	3.0				2.5				2.0	4.0			2.5	3.0			2.0	2.5				3.0	
2.2					2.8	3.0			2.5	2.5			2.5	2.5	4.0			2.5				2.0	2.5				3.0	
2.7					3.3				2.8	2.8			2.5	2.5				2.5				2.0	3.0				3.0	
3.3					3.8				2.8	2.8			3.0	3.0				2.5			2.0	2.0	3.0				3.0	
3.9									3.3				3.0	3.0				2.5			2.0	2.0	3.5			3.0		
4.7									3.5				3.0	3.0			3.0	3.0			2.0	2.0				3.0		
5.6													3.5				3.0	3.0			2.5	2.5				3.0		
6.8													3.5				3.0	3.0			2.5	2.5				3.0		
8.2																	3.5				3.0	3.0				3.0		
10																	3.8				3.0	3.0				3.5		
12																					3.5				3.0	3.5		
15																					4.0				3.0			
18																					4.0				3.5			

HOW TO ORDER:

101	R3033	X	105	K	P
Voltage code: 500: 50 V 101: 100 V 201: 200 V 501: 500 V	Size code See tables 1	Dielectric code: X = X7R	Capacitance code: (picofarads) 1st two digits are significant 3rd digit = number zero ex: 105: 1000000 pF = 1 µF	Tolerance code: J = ± 5 % K = ± 10 % M = ± 20 %	Termination code P = Silver Palladium (chip)

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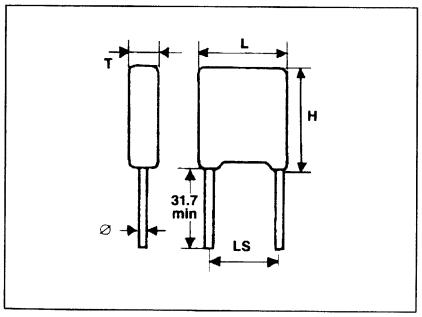
RADIAL LEADED (X7R)

DESCRIPTION

- 0.1 µF to 18 µF
- 50 V to 500 V_{DC}

This range is intended for used in switched mode power supplies & DC-DC converters. They are particularly suitable for filtering, smoothing, coupling & de-coupling purposes in Hi-Rel equipments. The capacitors utilise advanced ceramic technology to achieve high reliability, long operating life & small size. They are designed for low profile printed circuit applications.

DIMENSIONS (mm)



MARKING

- TA Logo (can be omitted on small sizes)
- Capacitance (coded)
- Tolerance (coded)
- Rated voltage

Leaded case size	Basic chip	L max	H max	L.S. ± 0.5	Wire diam. ± 10 %
CC08	2225	7.6	8.8	5.08	0.5
CC10	3033	10.2	10.5	5.08	0.5
CC13	3740	12.7	12.3	10.2	0.6
CC16	5440	17.2	12.7	15.2	0.9
CC17	5550	17.2	14.8	15.2	0.9
CC18	6080	18.8	22.6	15.2	0.9
CC20	6560	20.3	18.3	17.8	0.9
CC23	8060	23.6	17.7	20.3	0.9

Radial leaded devices

Maximum thickness (Tmax in mm) is indicated per case size and capacitance/voltage value																												
Cr	2225-CC08				3033-CC10				3740-CC13				5440-CC16				5550-CC17				6560-CC20				6080-CC18 8060-CC23			
(µF)	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V	50V	100V	200V	500V
0.10			3.1	4.3				3.8																				
0.12			3.1					3.8																				
0.15			3.3					3.8																				
0.18			3.3					4.5																				
0.22			3.8					4.5				4.3																
0.27			3.8				3.3					4.3				4.3												
0.33		3.1					3.3				3.3	4.6				4.8				3.8								
0.39		3.1					3.3				3.3	4.8				4.8				3.8								
0.47		3.1					3.3				3.3					4.8				4.3								
0.56		3.3					3.8				3.3					5.1				4.3								
0.68		3.3				3.3					3.8				3.8	5.3				4.3				3.8				4.3
0.82	3.3					3.3					3.8				4.3				4.3				3.3	4.3				4.3
1.0	3.5					3.8				3.3	4.3				4.3				4.3			3.3	3.3	4.3				4.3
1.2	3.8					3.8				3.3	4.3				4.8				4.3			3.3	3.3	4.8				4.8
1.5	3.8				4.1	4.3				3.3					4.8				4.3			3.3	3.8	5.3			4.3	5.3
1.8					4.1	4.3				3.8				3.3	5.3			3.8	4.3			3.3	3.8				4.3	
2.2					4.1	4.3			3.8	3.8			3.8	3.8	5.3			3.8				3.3	3.8				4.3	
2.7					4.6				4.1	4.1			3.8	3.8				3.8				3.3	4.3				4.3	
3.3					5.1				4.1	4.1			4.3	4.3				3.8			3.3	3.3	4.3				4.3	
3.9					6.5				4.6				4.3	4.3				3.8			3.3	3.3	4.8			4.3		
4.7					6.5				4.8				4.3	4.3			4.3	4.3			3.3	3.3				4.3		
5.6					8.0				7.5				4.8				4.3	4.3			3.8	3.8				4.3		
6.8					8.5				8.0				4.8				4.3	4.3			3.8	3.8				4.3		
8.2					10.5				8.0				7.5				4.8				4.3	4.3				4.3		
10					12.0				8.5				7.5				5.1				4.3	4.3				4.8		
12																					4.8				4.3	4.8		
15																					5.3				4.3			
18																					5.3				4.8			

For maintenance only - For new design, please use «SV» series

HOW TO ORDER:

101	CC 10	X	105	K	R
Voltage code: 500: 50 V 101: 100 V 201: 200 V 501: 500 V	Size code See tables 1 CC08 CC10 ... ... CC23	Dielectric code: X = X7R	Capacitance code: (picofarads) 1st two digits are significant 3rd digit = number zero ex: 105: 1000000 pF = 1 µF	Tolerance code: J = ± 5 % K = ± 10 % M = ± 20 %	Radial termination

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CNC5440
CNC6560 (X7R)

DESCRIPTION

- 0.33 to 18 µF
- 63 to 400 V_{DC}

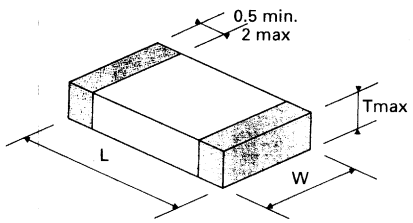
These capacitors have been developed in response to demand from S.M.P.S. (Switch Mode Power Supply) and DC-DC converters.

They are derived from the standard series R5440X and R6560X described in this catalog.

DIMENSIONS (mm)

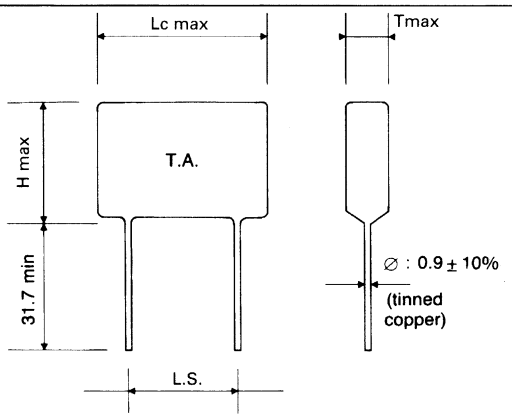
See table page 9-78

Chip



Tmax: see table 1 page 9-77

Leaded radial



Tmax: see table 2 page 9-77

MARKING

- TA Logo (can be omitted on small sizes)
- Capacitance (coded)
- Tolerance (coded)
- Rated voltage

Table 1: CHIPS

Maximum thickness (Tmax in mm) per size and capacitance / voltage value:								
	CNC5440				CNC6560			
CR (µF)	63 V	100 V	250 V	400 V	63 V	100 V	250 V	400 V
0.10								
0.12								
0.15								
0.18								
0.22								
0.27				2.5				2.0
0.33				2.5				2.0
0.39				3.0				2.0
0.47				3.0				2.0
0.56				3.0			2.0	2.0
0.68			3.0	3.5			2.0	2.5
0.82			3.0	4.0			2.0	3.0
1.0			3.0	4.4		2.0	2.0	3.0
1.2			3.0			2.0	2.0	3.5
1.5			3.5			2.0	2.5	4.0
1.8		2.5	4.0			2.0	2.5	5.0
2.2		2.5	4.0			2.0	2.5	
2.7	3.0	3.0			2.0	2.0	3.0	
3.3	3.0	3.0			2.0	2.0	3.0	
3.9	3.0	3.0			2.0	2.0	3.5	
4.7	3.0	3.0			2.0	2.0		
5.6	3.0				2.5	2.5		
6.8	3.0				2.5	2.5		
8.2					3.0	3.0		
10					3.0	3.0		
12					3.5			
15					4.0			
18					4.0			

Table 2: LEADED DEVICES

Maximum thickness (Tmax in mm) per size and capacitance / voltage value:								
	CNC5440				CNC6560			
CR (µF)	63 V	100 V	250 V	400 V	63 V	100 V	250 V	400 V
0.10								
0.12								
0.15								
0.18								
0.22								
0.27				3.8				3.3
0.33				3.8				3.3
0.39				4.3				3.3
0.47				4.3				3.3
0.56				4.3			3.3	3.3
0.68			4.3	4.8			3.3	3.8
0.82			4.3	5.3			3.3	4.3
1.0			4.3	5.7		3.3	3.3	4.3
1.2			4.3			3.3	3.3	4.8
1.5			4.8			3.3	3.8	5.3
1.8		3.8	5.3			3.3	3.8	6.3
2.2		3.8	5.3			3.3	3.8	
2.7	4.3	4.3			3.3	3.3	4.3	
3.3	4.3	4.3			3.3	3.3	4.3	
3.9	4.3	4.3			3.3	3.3	4.8	
4.7	4.3	4.3			3.3	3.3		
5.6	4.3				3.8	3.8		
6.8	4.3				3.8	3.8		
8.2					4.3	4.3		
10					4.3	4.3		
12					4.8			
15					5.3			
18					5.3			

CNC5440 / CNC6560

Dimensions:

Chip		**CNC 5440**	**CNC 6560**
Length	Lmax	13.7 (± 0.5)	16.5 (± 0.8)
Width	Wmax	10.2 (± 0.5)	15.5 (± 0.8)
Thickness	Tmax	See table	See table
End band	E.B	0.5 min / 2.0 max	0.5 min / 2.0 max
Leaded version			
Length	Lc max	17.2	20.3
Heigth	Hmax	12.7	18.3
Thickness	Tmax	Chip +1.3 mm	Chip + 1.3 mm
Lead spacing	L.S	15.24 (± 0.5)	17.8 (± 0.5)

HOW TO ORDER:

630	CNC 6560	X	105	K	•
Voltage code: 630: 63 V 101: 100 V 251: 250 V 401: 400 V	Case code 5440 6560 See tables 1-2	Dielectric code: X = X7R	Capacitance code: (picofarads) 1st two digits are significant 3rd digit = number zero ex: 105: 1000000 pF = 1 µF	Tolerance code: J = ± 5 % K = ± 10 % M = ± 20 %	Termination code • Radial leads: R • Silver Palladium: P (chip)

"SV" ASSEMBLIES

DESCRIPTION

- 0.1 to 100 µF (X7R)
- 50 to 500 V_{DC}

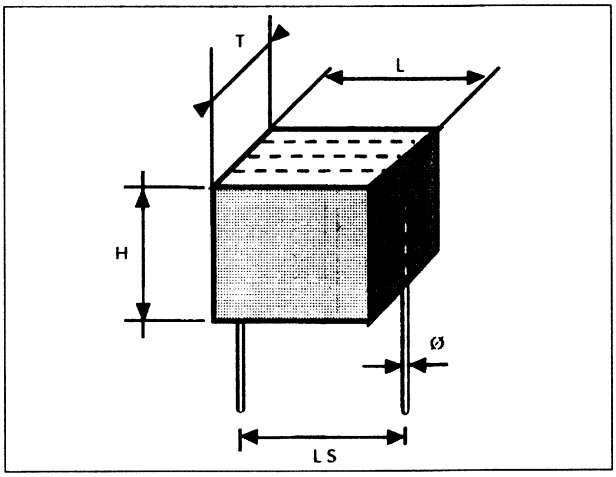
This range of capacitors is intended for use in switch mode power supplies (SMPS) and DC-DC converters where low ESR, low ESL and high currents are required in military and professional applications.
They are particularly suitable for filtering, smoothing, coupling and decoupling purposes in "High-Rel" equipments.
Their performances in ESR and frequency make them suitable to replace a 10 times higher capacitance value in an Electrolytic technology (Aluminium or Tantalum).
They are offered with two leads terminations making them perfectly suitable to any design capable to withstand severe environmental conditions (shocks, bumps, vibrations...).

DIMENSIONS

- See figure 1

Table 1

Case	L	H	L.S	Ø	T
SV01	10.20	9.6	10.16	0.6	See tables 2 & 3
SV02	11.90	11.4	10.16	0.6	
SV03	17.0	12.0	15.24	0.9	
SV04	16.5	14.0	15.24	0.9	
SV05	20.0	16.6	17.8	0.9	
SV06	17.8	21.6	15.24	0.9	
SV07	22.7	16.6	20.32	0.9	



GENERAL CHARACTERISTICS

Test parameters (1 KHz - 1 ± 0.2 Vrms, 20° C unless otherwise stated).

C_r range	0.1 to 100 µF - See tables 2 & 3	
U_r rated voltage	50 to 500 V_{DC} 63 to 400 V_{DC}	
Tolerance on capacitance	± 10 % (K) ± 20 % (M)	NPO Consult us ± 5 % (J)
Voltage proof (50 mA. 5 sec.)	50.63 V →125 V 100 V →250 V 200.250 V→500 V	400 V → 800 V 500 V →1 000 V
Insulation resistance (U_r -20° C)	≥ 1 000 MΩ x µF	
Maximum change of capacitance over temperature range (X7R only) $\left(\frac{\Delta C}{C} \max\right)$	without applied voltage: ± 20%	with rated voltage applied: 50, 100, 200 V: +20 % -30 %; 63,250,400,500V: +20 % -45 %
Temperature range	-55° C to +125° C	
Dissipation factor	≤ 25. 10^{-3}	
Ageing rate	≤ 2 % / decade hour	
E.S.R./Ripple current	Consult application notes	
Marking	• TA logo (can be omitted on small sizes) • Capacitance (coded) • Tolerance (coded) • Rated voltage	

"SV" ASSEMBLIES

Capacitance & voltage ranges

Table 2: 50 / 100 / 200 / 500 V

	SV01 (3033)				SV02 (3740)				SV04 (5550)				SV06 (6080) SV07 (8060)			
Cr (µF)	**50V**	**100V**	**200V**	**500V**	**50V**	**100V**	**200V**	**500V**	**50V**	**100V**	**200V**	**500V**	**50V**	**100V**	**200V**	**500V**
0.12																
0.15				2.7												
0.18				3.4												
0.22				3.4				3.2								
0.27				5.4				3.2								
0.33			2.2	6.1				3.5				2.7				
0.39			2.2	6.1				3.7				2.7				
0.47			2.2	6.9				6.4				3.2				
0.56			2.7	10.5				6.7				3.2				
0.68			4.4	10.5			2.7	7.0				3.2				3.2
0.82			4.4	13.9			2.7	9.9				5.9				3.2
1.0		2.7	4.4			2.2	3.2	10.3				6.4				3.2
1.2		2.7	5.4			2.2	3.2	14.0			3.2	6.4				3.7
1.5		2.7	6.6			2.2	5.4				3.2	9.6				5.0
1.8		3.2	8.8			2.7	5.9				3.2	9.6				6.4
2.2	3.0	3.2	10.8		2.7	2.7	6.4				5.9	9.6			3.2	6.9
2.7	3.5	5.4			3.0	3.0	6.4				6.4	12.8			3.2	9.6
3.3	4.0	5.9			3.0	3.0	9.6			2.7	6.4				3.2	10.1
3.9	6.0	5.9			3.5	4.9	9.6			2.7	6.4				6.4	12.8
4.7	6.0	6.4			3.7	5.4	12.8		3.2	3.2	9.6				6.4	14.8
5.6	7.0	9.6			6.0	6.0			3.2	3.2	9.6				6.4	
6.8	8.0	9.6			6.0	6.0			3.2	3.2	12.8			3.2	6.4	
8.2	11.0	12.5			7.2	9.0			3.7	5.4				3.2	9.6	
10	12.0				7.4	9.0			4.0	5.4			3.2	3.7	9.6	
12	14.0				10.5	12.0			6.4	6.4			3.2	3.7	12.8	
15					11.1				7.2	8.1			3.2	6.4		
18					14.8				7.7	10.8			3.7	6.9		
22									8.0	12.8			6.4	7.4		
27									11.7	12.8			6.4	10.6		
33									12.0				7.1	11.1		
39									16.0				9.6	14.8		
47													9.6	14.8		
56													11.6			
68													14.8			
82																
100																

Note: Tmax dimension is indicated in the above table 2 for each capacitance/voltage value.

Capacitance & voltage ranges

Table 3: 63 / 100 / 250 / 400 V

	SV03 (5440)				SV05 (6560)			
Cr (µF)	**63V**	**100V**	**250V**	**400V**	**63V**	**100V**	**250V**	**400V**
0.12								
0.15								
0.18								
0.22				2.5				
0.27				2.5				
0.33			3.0	3.0				
0.39			3.0	3.0				
0.47			3.0	3.0				
0.56		2.5	3.0	3.0				
0.68		2.5	3.0	3.0				
0.82		2.5	3.0	6.4				
1.0		2.5	3.0	6.4		2.2	2.2	3.2
1.2		2.5	6.4	6.4		2.2	2.2	3.7
1.5	3.0	3.5	6.4	10.0		2.2	2.7	4.2
1.8	3.0	3.0	10.0	10.0		2.2	2.7	6.4
2.2	3.0	3.0	10.0	10.0		2.2	2.7	6.9
2.7	3.0	3.0	10.0	12.8		2.2	3.2	7.9
3.3	3.2	3.2	10.0	14.8	2.2	2.2	3.2	8.4
3.9	3.2	3.2	12.8		2.2	2.2	5.4	11.1
4.7	3.2	3.2	14.8		2.2	2.2	5.4	12.6
5.6	3.7	5.4			2.7	2.7	5.9	15.8
6.8	3.7	5.4			2.7	2.7	6.4	
8.2	6.4	5.9			3.2	3.2	9.1	
10	6.4	6.4			3.2	3.2	9.6	
12	7.4	9.6			3.7	5.4	12.8	
15	10.1	9.6			4.2	6.4		
18	12.8				4.2	6.4		
22	14.8				6.4	6.4		
27					7.9	9.1		
33					8.4	9.6		
39					8.4	12.8		
47					12.6			
56					16.8			
68					16.8			
82					21.0			
100					25.2			

Note: Tmax dimension is indicated in the above table 3 for each capacitance/voltage value.

"SV" ASSEMBLIES

HOW TO ORDER:

- Each assembly referred to as "SV xx" is made of 1 to "n" basic chips stacked to give the appropriate capacitance / voltage requirements. They will be referenced as: SV01 to SV07 ; each assembly being build from the corresponding chip size:

SV01 - 3033
SV02 - 3740
SV03 - 5440
SV04 - 5550
SV05 - 6560
SV06 - 6080
SV07 - 8060

- How to build the reference to be ordered

xxx	SV xx	X	xxx	x	W 2	C
3 digits for the rated voltage 50 V: 500 63 V: 630 100 V: 101 200 V: 201 250 V: 251 400 V: 401 500 V: 501	Basic Assembly size SV01 SV02 SV03 SV04 SV05 SV06 SV07	Dielectric code: X = X7R N=NPO (on study) Z = Z5U (on study)	Capacitance code: 0.1 µF = 104 1 µF = 105 10 µF = 106 100 µF = 107	Tolerance code: J = ± 5 % (NPO only) K = ± 10 % M = ± 20 % Z = - 20 % / + 80 %	Termination code 2 wires	Varnish coating: C

For special capacitance, values, voltage, tolerance, mechanical variant, please consult us.

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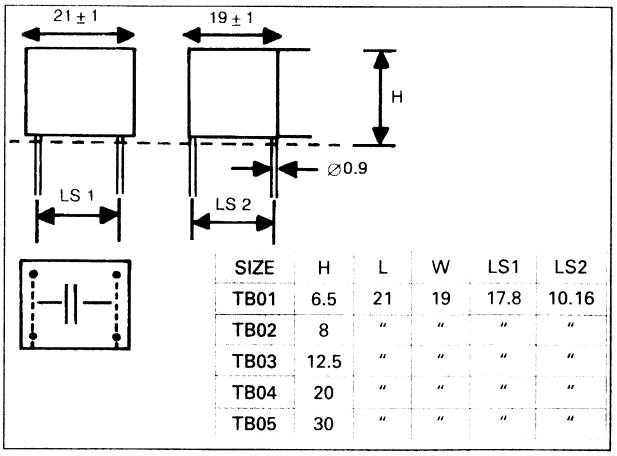
"TB" SERIES

DESCRIPTION

- 0.68 µF to 100 µF
- 50 / 63 to 400 V_{DC}

This series features same electrical parameters as the "SC" series with only 4 wires variant, the capacitor being molded in a plastic housing making it perfectly impervious to all external agents.
Low ESR, low ESL, high ripple current for switch mode power supplies (SMPS).

DIMENSIONS (mm)



SIZE	H	L	W	LS1	LS2
TB01	6.5	21	19	17.8	10.16
TB02	8	"	"	"	"
TB03	12.5	"	"	"	"
TB04	20	"	"	"	"
TB05	30	"	"	"	"

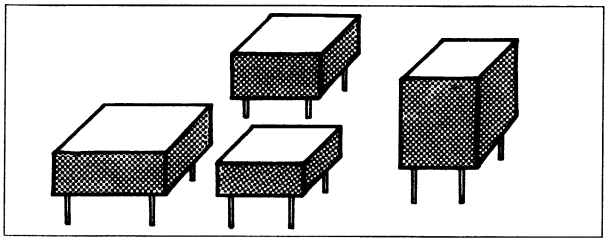
GENERAL CHARACTERISTICS

C_r range	See table
U_r rated voltage	See table
Tolerance on capacitance	± 10 % (K), ± 20 % (M)
Voltage proof (50 mA. 5 sec.)	2 x U_R
Insulation resistance (U_r 20° C)	≥ 1 000 MΩ x µF
Maximum change of capacitance over temperature range (X7R only) $\left(\frac{\Delta C}{C}\text{ max}\right)$	without applied voltage: ± 20 %; with rated voltage applied: < 400 V: + 20 % / -30 %; 400 V: + 20% / -45 %
Operating Temperature range	-55° C to +125° C
Climatic category	55 /125 /56
Dissipation factor (1 kHz. 20° C)	≤ 25. 10^{-3}
Ageing rate	≤ 2 % / decade hour
E.S.R./Ripple current	Consult application notes
Marking	• TA logo • Capacitance (coded) • Tolerance (coded) • Rated voltage

Capacitance / voltage range

Cr (µF)	TB series			
	63 V	100 V	250 V	400 V
1.0			1	1
1.2			1	1
1.5			1	2
1.8			1	2
2.2		1	1	3
2.7		1	1	3
3.3		1	1	3
3.9		1	2	4
4.7		1	2	4
5.6	1	1	3	4
6.8	1	1	3	5
8.2	1	1	3	
10	1	1	3	
12	1	2	4	
15	1	3		
18	2	4		
22	2	4		
27	3	4		
33	3	4		
39	3	5		
47	4			
56	4			
68	4			
82	5			
100	5			

1 = TB01 2 = TB02
3 = TB03 4 = TB04 5 = TB05



HOW TO ORDER

xxx	TBxx	X	xxx	x	W4
3 digts for the rated voltage	Code size TB01 to TB05 see table 1	Dielectric code X = X7R	Capacitance code 1µF = 105 10 µF = 106 100 µF = 107	Tolerance code K = ± 10 % M = ± 20 %	Termination code 4 wire

"SC" ASSEMBLIES

DESCRIPTION

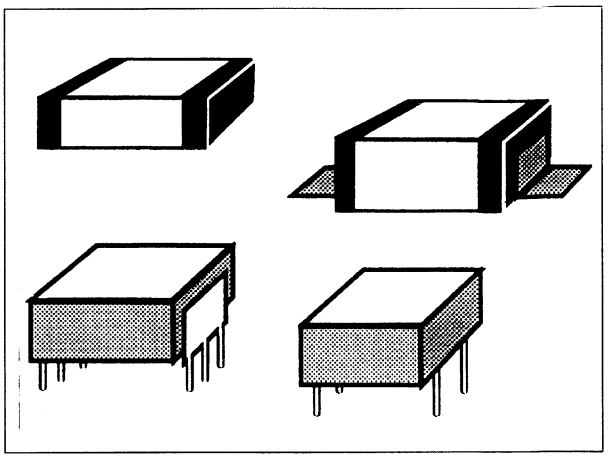
- 0.1 µF to 100 µF (X7R)
- 50 to 500 V_{DC}

This range of capacitors is intended for use in switch mode power supplies (SMPS) and DC-DC converters where low ESL and high currents are required in military and professionnal applications.
They are particularly suitable for filtering, smoothing, coupling and decoupling purposes in "High-Rel" equipments.
Their performances in ESR and frequency make them suitable to replace a 10 times higher capacitance value in an Electolytic technology (Aluminium or Tantalum).
They are also offered with several termination variants making them perfectly suitable to any design (ceramic substrate, epoxy board...) capable to withstand severe environmental conditions (shocks, bumps, vibrations...).

DIMENSIONS MECHANICAL VARIANTS

- See figures 1 to 3
- See tables 1 to 5

DIMENSIONS (mm)



GENERAL CHARACTERISTICS

Test parameters (1 KHz - 1 ± 0.2 Vrms, 20° C unless otherwise stated).

C_r range	See tables 1 & 2		
U_r rated voltage	50 to 500 V_{DC} 63 to 400 K_{DC}		
Tolerance on capacitance	± 10 % (K), ± 20 % (M)	NPO consult us ± 5 % (J)	
Voltage proof (50 mA. 5 sec.)	50.63 V → 125 V 100 V → 250 V 200.250 V → 500 V	400 V → 800 V 500 V → 1000 V	
Insulation resistance (U_r 20° C)	≥ 1000 MΩ x µF		
Maximum change of capacitance over temperature range (X7R only) $\left(\frac{\Delta C}{C} \max\right)$	without applied voltage	with rated voltage applied 50, 100, 200 V	63,250,400,500 V
	± 20 %	+ 20 % -30 %	+ 20 % -45 %
Working temperature range	-55° C to +125° C		
Dissipation factor	≤ 25. 10^{-3}		
Ageing rate	≤ -2% / decade hour		
E.S.R./Ripple current	Consult application notes		
Marking	• TA logo (can be omitted on small size) • Capacitance (coded) • Tolerance (coded) • Rated voltage		

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"SC" ASSEMBLIES

Capacitance & voltage ranges

Table 1: 50 / 100 / 200 / 500 V

	SC01 (3033)				SC02 (3740)				SC04 (5550)				SC06 (6080) SC07 (8060)			
Cr (µF)	**50V**	**100V**	**200V**	**500V**	**50V**	**100V**	**200V**	**500V**	**50V**	**100V**	**200V**	**500V**	**50V**	**100V**	**200V**	**500V**
0.12																
0.15				2.7												
0.18				3.4												
0.22				3.4				3.2								
0.27				5.4				3.2								
0.33			2.2	6.1				3.5				2.7				
0.39			2.2	6.1				3.7				2.7				
0.47			2.2	6.9				6.4				3.2				
0.56			2.7	10.5				6.7				3.2				
0.68			4.4	10.5			2.7	7.0				3.2				3.2
0.82			4.4	13.9			2.7	9.9				5.9				3.2
1.0		2.7	4.4			2.2	3.2	10.3				6.4				3.2
1.2		2.7	5.4			2.2	3.2	14.0			3.2	6.4				3.7
1.5		2.7	6.6			2.2	5.4				3.2	9.6				5.0
1.8		3.2	8.8			2.7	5.9				3.2	9.6				6.4
2.2	3.0	3.2	10.8		2.7	2.7	6.4				5.9	9.6			3.2	6.9
2.7	3.5	5.4			3.0	3.0	6.4				6.4	12.8			3.2	9.6
3.3	4.0	5.9			3.0	3.0	9.6			2.7	6.4				3.2	10.1
3.9	6.0	5.9			3.5	4.9	9.6			2.7	6.4				6.4	12.8
4.7	6.0	6.4			3.7	5.4	12.8		3.2	3.2	9.6				6.4	14.8
5.6	7.0	9.6			6.0	6.0			3.2	3.2	9.6				6.4	
6.8	8.0	9.6			6.0	6.0			3.2	3.2	12.8			3.2	6.4	
8.2	11.0	12.5			7.2	9.0			3.7	5.4				3.2	9.6	
10	12.0				7.4	9.0			4.0	5.4			3.2	3.7	9.6	
12	14.0				10.5	12.0			6.4	6.4			3.2	3.7	12.8	
15					11.1				7.2	8.1			3.2	6.4		
18					14.8				7.7	10.8			3.7	6.9		
22									8.0	12.8			6.4	7.4		
27									11.7	12.8			6.4	10.6		
33									12.0				7.1	11.1		
39									16.0				9.6	14.8		
47													9.6	14.8		
56													11.6			
68													14.8			
82																
100																

Note: Hmax dimension applicable for each mechanical variant (see tables 3 to 5) is indicated in the above table 1 for each capacitance/voltage value.

"SC" ASSEMBLIES

Capacitance & voltage ranges

Table 2: 63 / 100 / 250 / 400 V

	SC03(5440)				SC05(6560)			
Cr (µF)	**63V**	**100V**	**250V**	**400V**	**63V**	**100V**	**250V**	**400V**
0.12								
0.15								
0.18								
0.22				2.5				
0.27				2.5				
0.33			3.0	3.0				
0.39			3.0	3.0				
0.47			3.0	3.0				
0.56		2.5	3.0	3.0				
0.68		2.5	3.0	3.0				
0.82		2.5	3.0	6.4				
1.0		2.5	3.0	6.4		2.2	2.2	3.2
1.2		2.5	6.4	6.4		2.2	2.2	3.7
1.5	3.0	3.5	6.4	10.0		2.2	2.7	4.2
1.8	3.0	3.0	10.0	10.0		2.2	2.7	6.4
2.2	3.0	3.0	10.0	10.0		2.2	2.7	6.9
2.7	3.0	3.0	10.0	12.8		2.2	3.2	7.9
3.3	3.2	3.2	10.0	14.8	2.2	2.2	3.2	8.4
3.9	3.2	3.2	12.8		2.2	2.2	5.4	11.1
4.7	3.2	3.2	14.8		2.2	2.2	5.4	12.6
5.6	3.7	5.4			2.7	2.7	5.9	15.8
6.8	3.7	5.4			2.7	2.7	6.4	
8.2	6.4	5.9			3.2	3.2	9.1	
10	6.4	6.4			3.2	3.2	9.6	
12	7.4	9.6			3.7	5.4	12.8	
15	10.1	9.6			4.2	6.4		
18	12.8				4.2	6.4		
22	14.8				6.4	6.4		
27					7.9	9.1		
33					8.4	9.6		
39					8.4	12.8		
47					12.6			
56					16.8			
68					16.8			
82					21.0			
100					25.2			

Note: Hmax dimension applicable for each mechanical variant (see tables 3 to 5) is indicated in the above table 2 for each capacitance/voltage value.

"SC" ASSEMBLIES

Termination variants and dimensions

Table 3: 4 WIRE TERMINATIONS

SIZE	L	W	Z	E	D	H
SC02	11.9	11.4	10.20	7.62	0.6	See tables 1, 2
SC03	17.0	12.0	15.24	10.16	0.9	
SC04	16.5	14.0	15.24	10.16	0.9	
SC05	20.0	16.6	17.80	10.16	0.9	
SC06	17.8	21.6	15.24	10.16	0.9	
SC07	22.7	16.6	20.32	10.16	0.9	

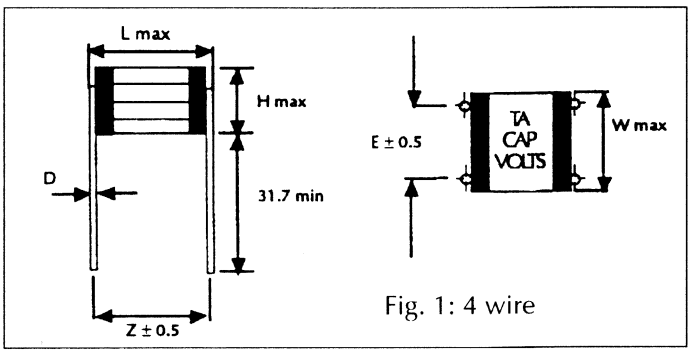

Fig. 1: 4 wire

Table 4: D.I.L. TERMINATIONS ("J", "L" or "N" variant)
(prefered)

SIZE	L	W	Z**	H	*
SC01	10.2	9.6	7.62	See tables 1. 2	3
SC02	11.9	11.4	10.16		4
SC03	15.5	11.5	14.00		4
SC04	16.5	14.0	13.70		5
SC05	18.5	17.0	17.78		6
SC06	17.8	21.6	15.24		7
SC07	22.7	16.6	20.32		6

(*) Number of pins on each side of the chip
(**) ± 0.5 except SC07: ± 0.8

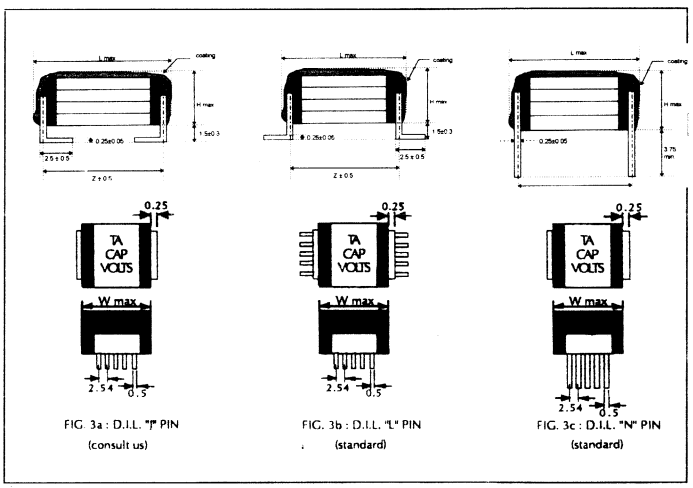

FIG. 3a : D.I.L. "J" PIN (consult us)
FIG. 3b : D.I.L. "L" PIN (standard)
FIG. 3c : D.I.L. "N" PIN (standard)

Table 5: RIBBON TERMINATION ("J" or "L" variant)
(Upon special request)

SIZE	L	W	A*	H
SC01	10.2	9.6	8.0	See tables 1, 2
SC02	11.9	11.4	8.0	
SC03	15.5	11.5	8.0	
SC04	16.5	14.0	8.0	
SC05	18.5	17.0	15.0	
SC06	17.8	21.6	15.0	
SC07	22.7	16.6	15.0	

(*) ± 0.2 mm

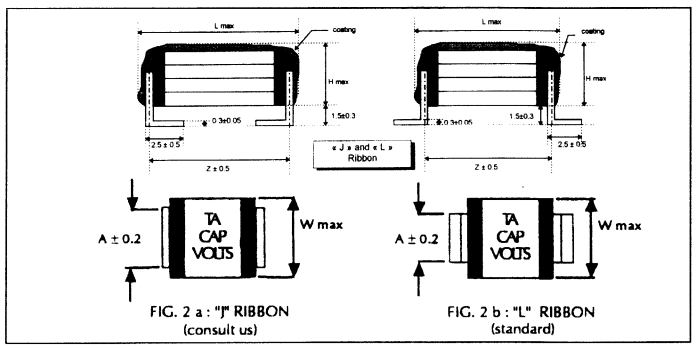

FIG. 2 a : "J" RIBBON (consult us)
FIG. 2 b : "L" RIBBON (standard)

Unless otherwise prescribed all dimensions are maximum dimensions.

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"SC" ASSEMBLIES

How to order:

- Each assembly referred to as "SC xx" is made of 1 to "n" basic chips stacked to give the appropriate capacitance / voltage requirements. They will be referenced as: SC01 to SC07: each assembly being build from the corresponding chip size:

  SC01 - 3033
  SC02 - 3740
  SC03 - 5440
  SC04 - 5550
  SC05 - 6560
  SC06 - 6080
  SC07 - 8060

- Once the capacitance / voltage has been choosen, (tables 1, 2) then the type of termination has to be defined:
  - wire terminations (4 wires) see table 3
  - D.I.L. terminations ("J", "L" or "N" variant) - see table 4
  - Ribbon terminations ("J" or "L" variant) see table 5

  For each variant the H dimension will be found in either table 1 or 2 since it is directly related to the number of chips which have been stacked together to obtain the desired capacitance value.

- How to build the reference to be ordered

xxx	SC xx	X	xxx	x	x x	•
3 digits for the rated voltage 50 V: 500 63 V: 630 100 V: 101 200 V: 201 250 V: 251 400 V: 401 500 V: 501	Basic Assembly size SC01 SC02 SC03 SC04 SC05 SC06 SC07	Dielectric code X = X7R N = NPO (on study) Z = Z5U (on study)	Capacitance code 0.1 µF = 104 1 µF = 105 10 µF = 106 100 µF = 107	Tolerance code J = ± 5 % (NPO only) K = ± 10 % M = ± 20 % Z = -20 % / +80 %	Termination code Wire: 4 Wires: W4 D.I.L.: J shape: DJ (consult us) L shape: DL (standard) N shape: DN (standard) Ribbon: J shape: RJ (on special L shape: RL request)	Varnish coating: C

For special capacitance, values, voltage, tolerance, mechanical variant, please consult us.

GENERAL CHARACTERISTICS

Capacitance range (C_r):	0.1 to 100 µF
Rated voltage (U_r):	50 to 500 V
Tolerance on capacitance:	± 10 % (K) ± 20 % (M)
Voltage proof (50 mA max. 5 sec)	2.5 x U_r
Overvoltage pulse capability (50 / 63 V rated)	80 V for 100 ms 10000 cycles F = 1 Hz @ 100° C
Maximum capacitance change over temperature range: $\left(\frac{\Delta C}{C}\ \%\right)$ without applied voltage	± 15 % (X7R dielectric)
Temperature range	-55° C to +125° C
Dissipation factor (DF): (1 kHz - 20° C)	≤ 25 x 10^{-3}
Insulation resistance: (U_r - 20° C)	R_i x C ≥ 1 000 MΩ x µF (sec)
Ageing rate	≤ 2.5 % / decade hour
E.S.R. versus frequency (500 kHz - 20° C)	≤ 10 mΩ ± 5 mΩ see curves for detail
E.S.L.	≤ 10 nH

Ripple current (Irms)

Tamb	20° C	50° C	75° C	100° C
correct. factor	application notes	x 0.85	x 0.7	x 0.5

Thermal Resistance

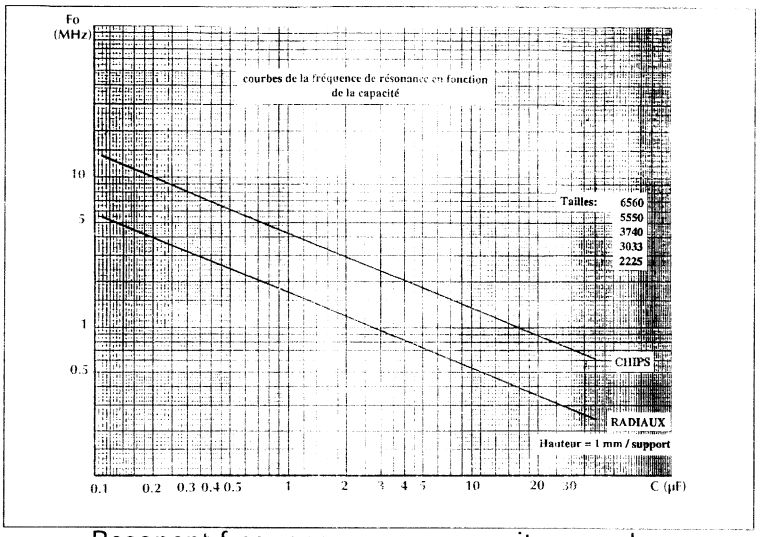
Capacitors mounted on an infinite heat sink in still air (Ta = 20 to 100° C)

Thermal resistance is expressed in ° C / W - Leaded devices: 2 mm lead length

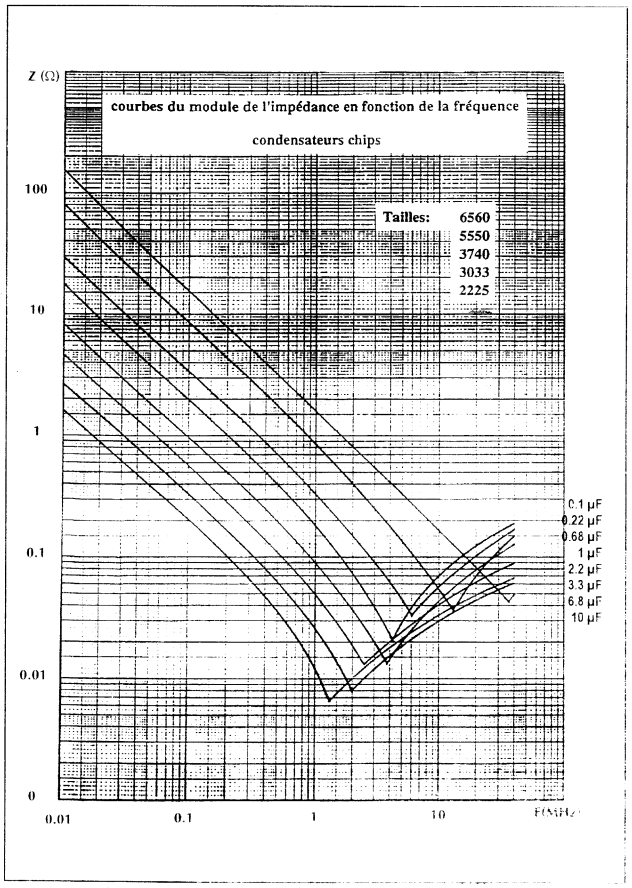
Chips	2225	3033	3740	5550	6560	6080/8060
	28	20	20	20	20	20
Leaded devices	CC 08	CC 10	CC 13	CC 17	CC 20	CC 18/CC 23
	40	40	34	28	26	26

HIGH CAPACITANCE CERAMIC CAPACITORS

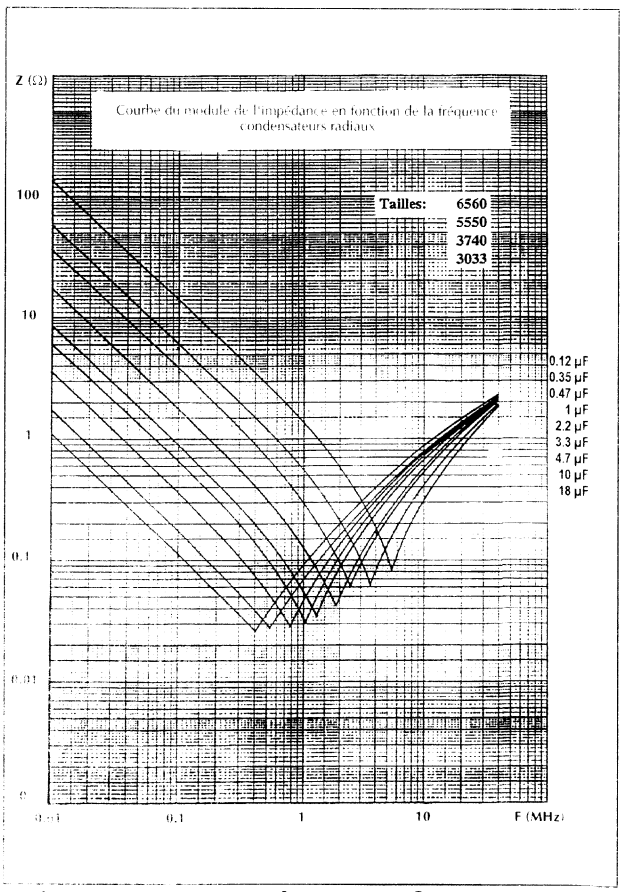
"SC" assemblies



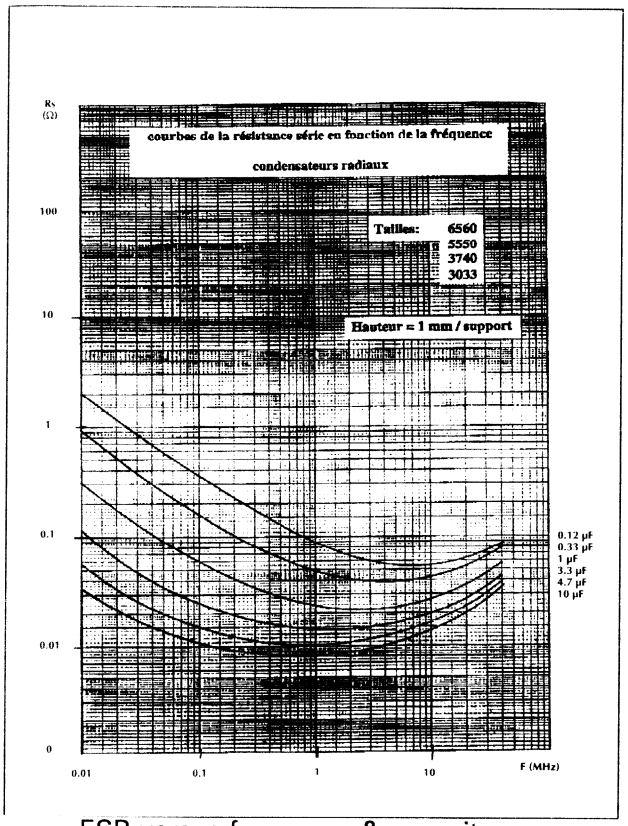
Resonant frequency versus capacitance value
(Chip & radial lead versions)



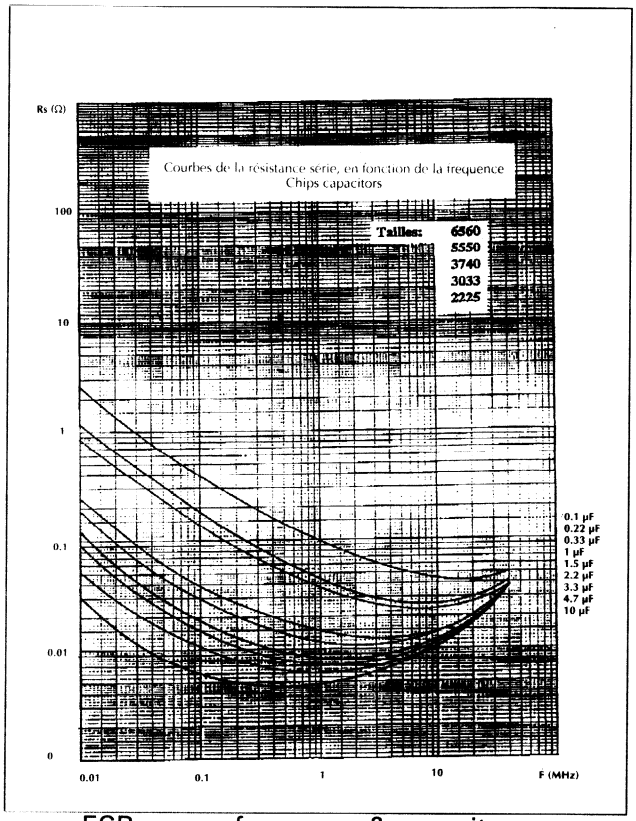
ESR versus frequency & capacitance
(Chips)



Impedance versus frequency & capacitance
(Radial leaded capacitors)



ESR versus frequency & capacitance
(Radial leaded capacitors)



ESR versus frequency & capacitance
(Chips)

HIGH CAPACITANCE CERAMIC CAPACITORS X7V & Y5U

WARNING NOTE: This series being under final evaluation, you are kindly invited to contact us prior to any industrial implementation. The ranges and characteristics may be subject to changes without notice.

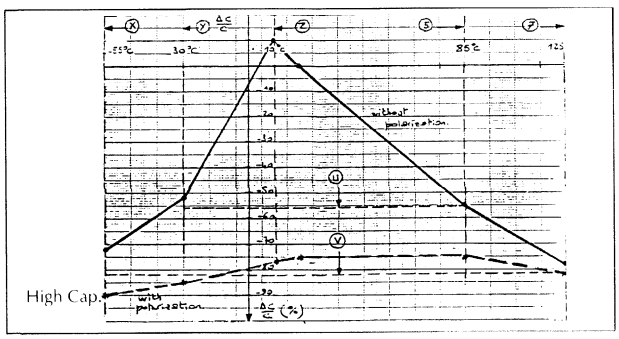
DESCRIPTION:

TEKELEC TEMEX has developed this range of 25 V to 200 V capacitors (chips and leaded components) in order to provide the designers with a high capacitance value - low E.S.R. for filtering and decoupling applications.
Their high C.V. product, their high resonant frequency and the fact that they are not polarized make them ideally suited for filtering applications in replacement of larger capacitance achieved in electrolytic technology.
They will be used in D.C. power supply smoothing filters, high frequency switch mode power supplies and most of decoupling applications.
They are described as X7V AND Y5U capacitors for the following reasons:
• Most of the time, the High "K" constant are deemed unstable over a given temperature range and to keep the variation of capacitance within acceptable limits imposes to restrict this temperature range over which this variation has to be controlled.
Depending upon the considered "window" the capacitor may be defined (in accordance with EIA limits) as a X7V, Y5V, Y5U or Z5U ; however, its electrical characteristics have to be defined at its maximum limits so that the user may calculate the worst case in his equipment.
It is also worthy of mentioning that the highest the ratio Uapplied /Urated is, the smallest the capacitance excursion within the temperature range will be: of course, the actual capacitance is smaller than the rated capacitance, but the voltage stress is overridding the temperature (see curves...).
Both parameters have to be considered in accordance with derating design rules.

EIA/CECC TEMPERATURE DESCRIPTION (For information):

EIA Dielectric code	Minimum category temperature	Maximum category temperature	Maximum variation of capacitance over the range +22 % / -82 %	CECC reference
X7V	-55° C	+125° C	+22 % / -82 %	2F1
Y5V	-30° C	+85° C	+22 % / -56 %	
Y5U	-30° C	+85° C	+22 % / -56 %	2F4
Z5U	+10° C	+85° C		

It is obvious that the fact to deliver a X7V satisfy Y5V and that delivering Y5U also satisfy Z5U.



Curve 1

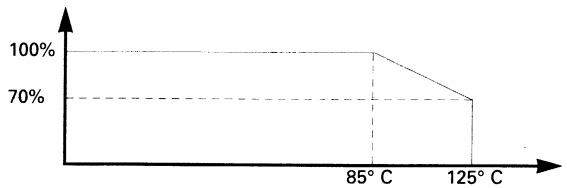
CHARACTERISTICS

(Unless otherwise prescribed hereafter, the conditions of tests and measurements will be in accordance with the CECC 30701-802)

PARAMETER:	X7V	Y5U
Climatic category	-55° C / +125° C / 56 days	-30° C / +85° C / 56days
TEKELEC TEMEX dielectric code	V	Y
CECC equivalence	2F1	2F4
Capacitance range	See table 1	See table 1
Voltage range (D.C.)	See table 1 for 100 and 200 V the applied voltage will be derated in accordance with the curve 1 from 85° C to 125° C	See table 1
Tolerance on capacitance	Standard:-20 / +80 % (Z) On request: ± 20 % (M)	Standard:-20 / +80 % (Z) On request: ± 20 % (M)
Temperature range	-55° C to +125° C Rated temperature: + 125° C Category voltage: +85° C (for 100 and 200 V)	-30° C to + 85 ° C
Maximum variation of capacitance over temperature range	+22 %/-82 % without DC voltage applied	+22 %/-56 % without DC voltage applied
Maximum variation of capacitance with applied voltage:	see curve 1	see curve 1
Ageing:	≤ 5 % / decade hour	≤5 % / decade hour
Tangent of the loss angle (or Dissipation Factor: D.F.)	≤ 35 x 10^{-3}	≤ 35 x 10^{-3}
E.S.R @ frequency	see curves(*)	see curves(*)
Maximum ripple current @ capacitance value & frequency	see curves(*)	see curves(*)
Insulation resistance: **under Ur for U_r = 200 to 1000 V** **under 1000 V for U_r > 1000 V**	Cr >25 nF R_i x Cr >100 seconds (> 10 sec @ 125° C)	Cr >25 nF R_i x Cr >100 seconds (>10 sec @ 85° C)
Voltage proof (50 mA - 5 sec)	Ur ≤ 100V 2.5 x Ur Ur ≤ 100V 2.5 x Ur	Ur ≤ 100 V 2.5 x Ur Ur >100 V 1.5 Ur+ 100 V
Test conditions for "C" and " D.F"		
Frequency	1 KHz ± 20 %	1 KHz ± 20 %
Voltage	0.1 ± 0.2 V	0.1 ± 0.2 V

(*) in process (to be added)

Curve 1: Derating of applied voltage & ripple current versus ambient temperature:



HIGH CAPACITANCE CERAMIC CAPACITORS

High capacitance ceramic capacitors X7V & Y5U

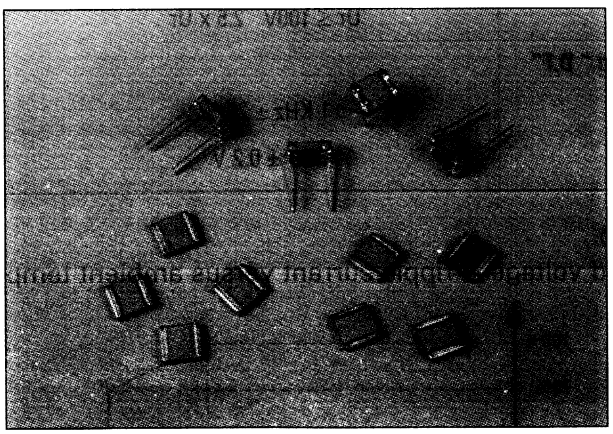
Table 1: Chip size-Capacitance/voltage range:

Cr	Cr	1210 (S41)				1812 (S43)				2220 (S47)			
µF	code	25 V	50 V	100 V	200 V	25 V	50 V	100 V	200 V	25 V	50 V	100 V	200 V
0.10	104												
0.12	124				¤								
0.15	154												
0.18	184												
0.22	224								¤				
0.27	274												
0.33	334												
0.39	394			¤									
0.47	474												¤
0.56	564												
0.68	684												
0.82	824							¤					
1.00	105												
1.20	125												
1.50	155		¤										
1.80	185											¤	
2.20	225	¤											
2.70	275												
3.30	335						¤						
3.90	395					¤							
4.70	475												
5.60	565												
6.80	685										¤		
8.20	825									¤			
10.00	106												

(¤) top of each range value:

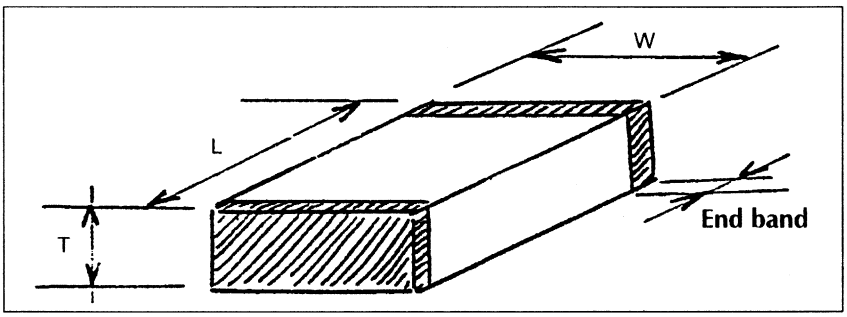
Chip thickness: 2.2 mm

Coated capacitor thickness: 3.7 mm



DIMENSIONS:
(All dimensions are given in mm)

CHIPS:

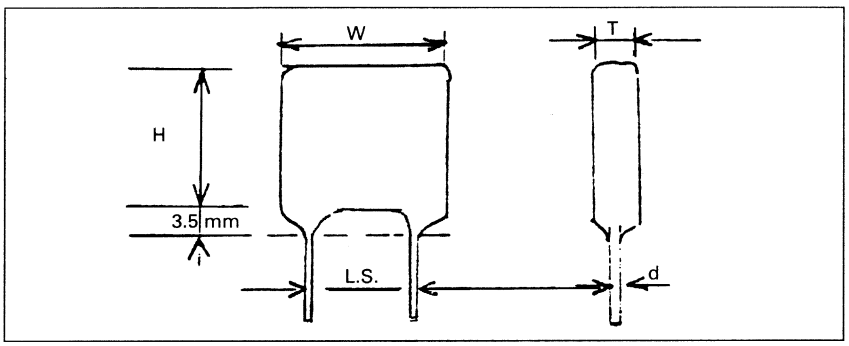


Case size (IEC)	Case size (TEKELEC TEMEX)	Length	Width	End band min/max	Thickness (*)
1210	S41	3.2 ± 0.4	2.5 ± 0.3	0.25/0.75	1.8
1812	S43	4.5 ± 0.5	3.2 ± 0.4	0.25/1.00	1.8
2220	S47	5.7 ± 0.5	5.0 ± 0.5	0.25/1.00	1.8

(*) unless otherwise indicated in table 1, top of the range value: 2.2 mm

LEADED VERSION:

Those parts are epoxy coated (dark blue) and marked with: TA logo, capacitance value (coded), tolerance (coded) and voltage (coded) within the permitted dimensions.



Size	Thickness: Tmax (*)	Width: W (max)	Height: H (max)	Lead spacing: L.S. ± 0.5	Wire diameter: d ± 10 %
1812(S43)	3.2	7.1	6.6	5.08	0.6
2220(S47)	3.2	8.3	8.5	5.08	0.6

(*) 3.7 mm for last value of each voltage (top of the range)

HIGH CAPACITANCE CERAMIC CAPACITORS

High capacitance ceramic capacitors X7V & Y5U

HOW TO ORDER

The values indicated in tables 1 (shaded areas) are standard values ; they can be codified:
The TEKELEC TEMEX part number structure is defined hereafter:

250	S43	V	335	Z	P	(E)
XXX	XXX	XXX	XXX	X	X	X
Voltage: (coded) 250 = 25 V 500 = 50 V 101 = 100 V 201 = 200 V	Case size: S41 = 1210 S43 = 1812 S47 = 2220	Dielectric type V = X7V Y = Y5U	Cap value 3 digits: 2 significants 1 multiplier 104 = 100 nF 105 = 8.2 µF etc...	Tolerance Z = -20 % +80 % M = ± 20 %	Termination P = chip version R = leaded version (See note)	Taping

Note: The standard chip version is delivered with Silver-Palladium terminations.
For Nickel-tinned terminations ("V" code) please consult us.

The last digit (E) apply only for chip version (P) when parts are requested to be delivered on tape.

TAPING

For chip version only:
Taping conditions are in accordance with IEC 286
Parts will be delivered as follows:

Case size	7" reel (diameter) = 180 mm	Tape width
1210 (S41)	3000 (thickness < 1.3) or 2000	8 mm
1812 (S43)	1000 " or 500	12 mm
2220 (S47)	1000 (thickness < 1.8) or 500	12 mm

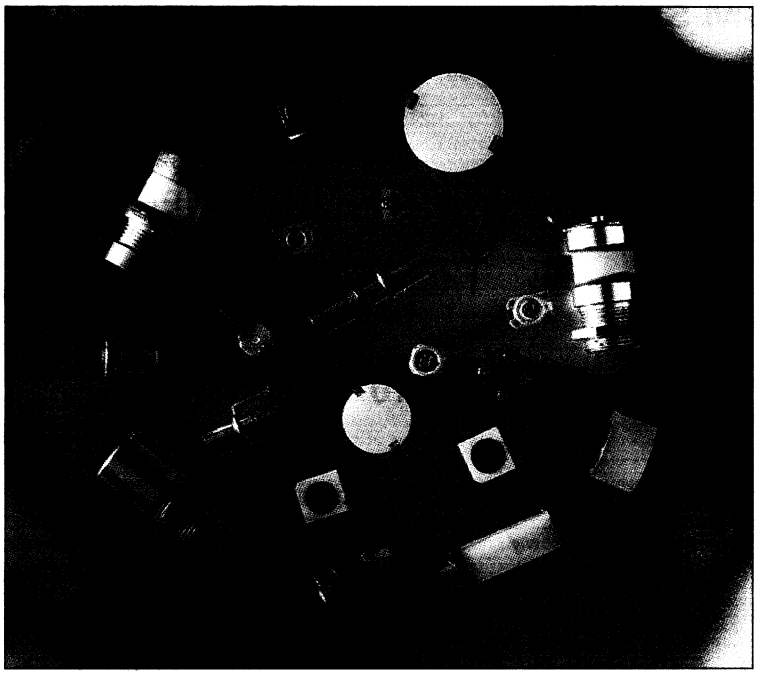
For leaded devices:
Part may also be delivered on tape, please consult us.

RECOMMENDATION

It is generally recommended in the industry to use reflow soldering techniques for such sizes of capacitors in order to prevent thermal shock which could create internal cracks in the capacitor: this is the reason why the preferred type of terminations of the chips is the Silver-Palladium-Platinum version (P) insuring a 260° C 30 seconds soldering time free of leaching effect.
(Nickel-tinned terminations are also available ; please consult us).
Unless otherwise prescribed, the temperature profiles of CECC 00 802 are recommended.

TRIMMER CAPACITORS & RF/MICROWAVE TUNING DEVICES

CONTENTS



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SURFACE MOUNT TRIMMER CAPACITORS

Selection guide

TRIMMER CAPACITORS

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NEW !

VT & SM SERIES
SURFACE MOUNT SAPPHIRE TRIMMER CAPACITORS

Description

As a new mounting style, **Gigahertz trimmers VT and SM SERIES** are multiturn sapphire dielectric trimmer capacitors in surface mount packages, available on tape and reel , specially designed for reflow soldering process and volume RF applications like cellular base stations.

Sapphire was selected as the dielectric offering the best performance trade-offs at such frequencies.

VT and SM series incorporate the self locking constant torque drive mechanism. The VT series offer a vertical tuning axis with a good mechanical stability on the circuit board ; VT series include a permanent sealing cap which allows easy access to the tuning rotor. The SM series offer a rectangular outline with horizontal tuning axis ; any faxe of SM series can be soldered directly onto a surface mount PCB. External outlines of VT series and SM series are suitable for tape and reel packing and facilitate their use with automatic pick an place machines.

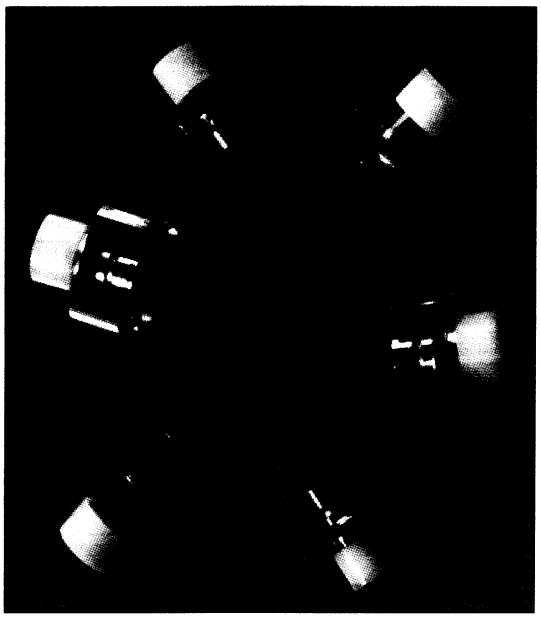
Features

- High Q and high resonant frequency
- Excellent tuning stability and low dynamic noise
- Low temperature coefficient
- Very fine tuning resolution
- Resistant to soldering heat
- Meets MIL-C-14 409 and ESA/SCC 3010

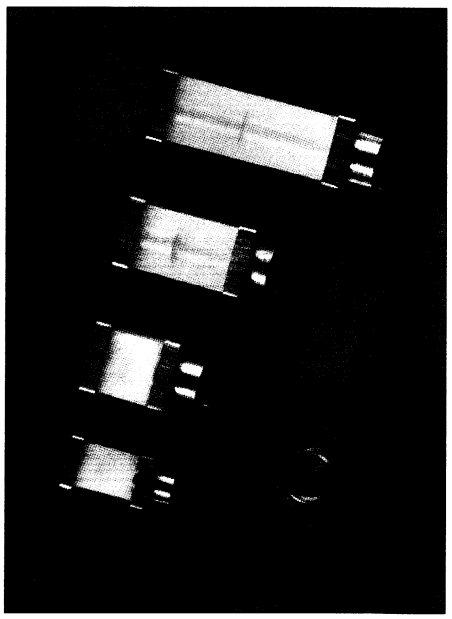
Applications

- Base station amplifier
- Filter tuning
- Crystal trimming
- Impedance matching

VT SERIES



SM SERIES



SURFACE MOUNT SAPHIRE TRIMMER CAPACITORS

VT & SM Series

Characteristics

Range	See table	See curve
Δ Cvs Rotation		Linear over wide range
Voltage	Rated 500 VDC Test 1000 VDC	Typical Breakdown @ sea level > 1500 VDC
Min. Q @ 250 MHz	> 3500 See table	Measured at max. capacitance
Operating temperature	-55° C to +125° C	Stable over full range
Thermal shock	-55° C to +125° C	
Temperature coefficient	See table	Measured at 75% Max. capacitance

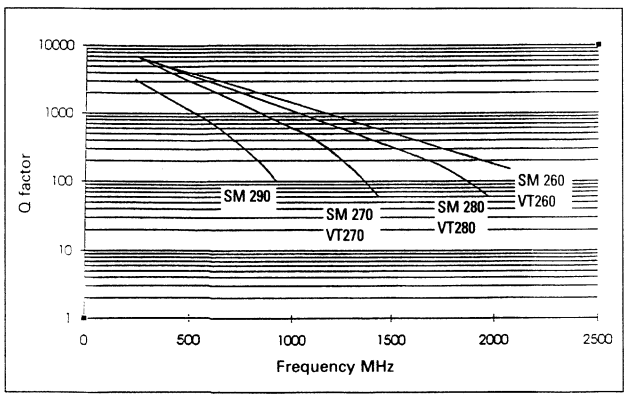
Torque **SM260 & VT260** **All others**	 7 to 70 cN.cm 14 to 130 cN.cm	Average 30 cN.cm 60 cN.cm
Rotational life	> 800 revolutions	Meets MIL-C-14490D
Insulation resistance	$>10^4$ MΩ @ 500 VDC	Measured at 25°C and 50% RH
Contact resistance	< 0.01 Ω	Low dynamic noise
Self resonant frequency	See curve	Operates B to C band
Vibration	60 g 10 - 2000 Hz	MIL-STD-202 E Method 204 C
Shock	100 g 6 ms	MIL-STD-202 E Method 213 B

Technical data

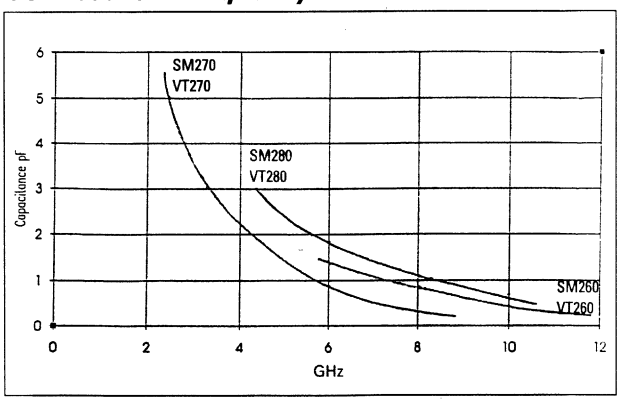
Tekelec part number (pF)		Capacitance range	Temperature coefficient (ppM/°C)	Q factor at 250 MHz
VT260	SM260	0.3 - 1.2	0 ± 50	> 3500
VT270	SM270	0.6 - 4.5	0 ± 50	> 2000
VT280	SM280	0.4 - 2.5	0 ± 50	> 2500
	SM290	0.8 - 8.0	0 ± 75	> 2000 *

* 100 MHz

Q factor



Self-resonant frequency



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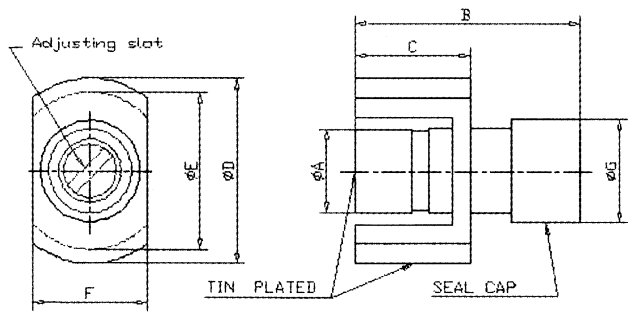
Outline drawings

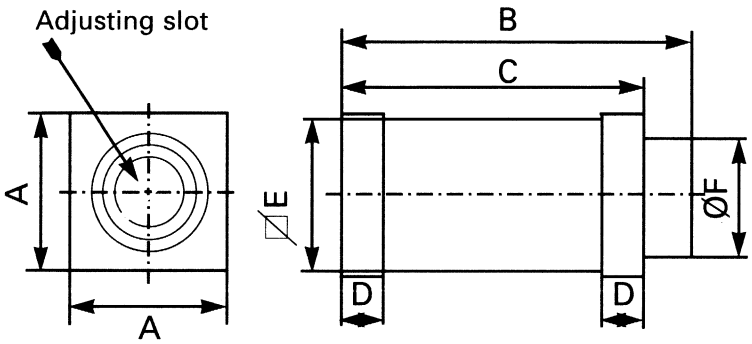
VT SERIES



	VT 260	VT 270	VT 280
A ± 0.1	1.9	3.0	3.0
B ± 0.4	5.9	8.1	5.9
C ± 0.1	3.1	4.1	3.1
D ± 0.1	5.6	6.6	6.6
E ± 0.1	4.6	5.6	5.6
F ± 0.1	3.1	4.1	4.1
G ± 0.1	2.6	3.7	3.7
Adjusting slot	1.1 typ x 0.25 w x 0.4 deep	1.9 typ x 0.4 w x 0.4 deep	

Dimensions in mm
External electrodes are tin plated under nickel

SM SERIES



	SM260	SM270	SM280	SM290
A ± 0.05	3.0	4.0	4.0	4.0
B ± 0.3	6.4	8.8	6.6	13.1
C ± 0.3	5.1	7.6	5.1	11.4
D ± 0.05	0.8	1.0	1.0	1.0
E ± 0.1	2.8	3.8	3.8	3.8
F ± 0.05	1.9	3.0	3.0	3.0
Adjusting slot	1.1 typ x 0.5 w x 0.4 deep	1.9 typ x 0.4 w x 0.4 deep		

Dimensions in mm
External electrodes are gold plated under nickel

Packaging

Tape & reel: TEKEMEC TEMEX tape and reel packaging is in accordance with EIA-481 specification

VT series	SM series
Tape width: VT260: 16 mm VT270 and VT280: 24 mm Quantity per reel : 13 inch diameter : 500	Tape width : SM260 and SM280 : 12 mm SM 270 : 16 mm SM 290 : 24 mm Quantity per reel : 7 inch diameter : 500 13 inch diameter : 2000

Bulk: TEKELEC TEMEX standard bulk packaging

SMD HERMETIC CERAMIC TRIMMERS CAPACITORS

Description

SMD hermetic ceramic trimmer is a high performance surface mount trimmer capacitor. Designed specifically to withstand harsh environments, SMD hermetic ceramic trimmer delivers exceptional performance through microwave frequencies at operating temperatures of -55° C to +125° C.

- **SMD hermetic ceramic trimmer** rugged construction renders it resistant to penetration of solder fluxes and cleaning solvents.
- **SMD hermetic ceramic trimmer** square drive tuning mechanism provides and assures complete compatibility with automated tuning devices for positive non-slip tamper-proof adjustments.
- **SMD hermetic ceramic trimmer** design makes it possible to utilize tape and reel or cartridge placement. The alumina housing provides mechanical strength with outstanding electrical and heat resistant properties.

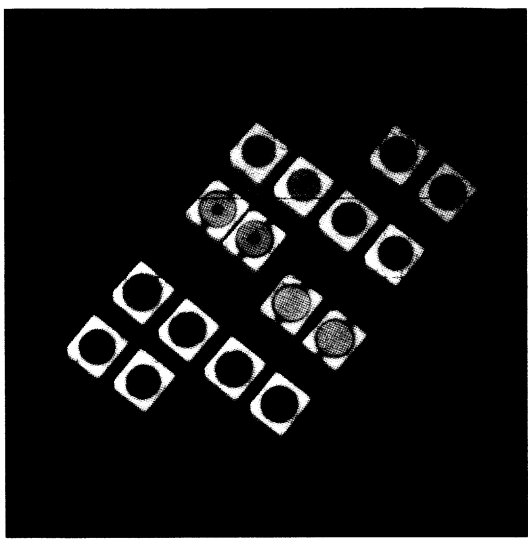
Recommended handling instructions outlining soldering procedures are available upon request.

Features

- Working voltage 250 VDC, test 500 VDC
- Resistance to soldering heat and flux, 235° C for 30 s
- Can withstand up to 5 minutes total immersion in typical cleaning solvents at room temperature
- Solderability and moisture resistance meet MIL-STD-202
- Conform with specification MIL-C-81

Applications

- VCOS - Microprocessors
- Filter networks - Crystal trimming
- Avionics equipments - Disc drives
- Impedance matching - Telemetry

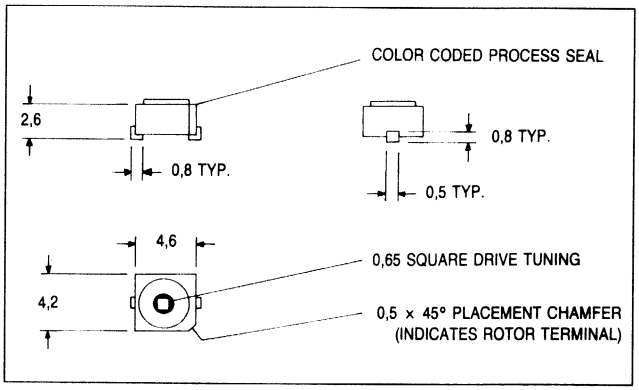


SURFACE MOUNT TRIMMER CAPACITORS

SMD hermetic ceramic trimmers

Characteristics

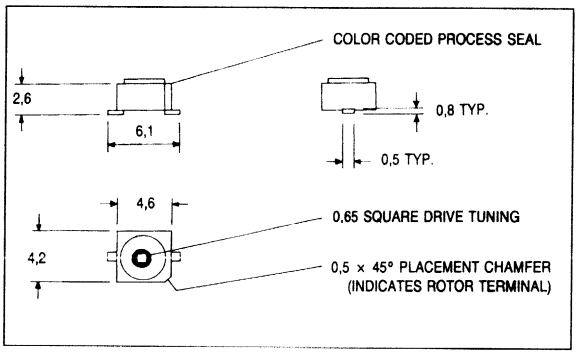
Capacitance range	See table
Voltage	Rated 250 VDC Test 500 VDC
Q at 100 MHz	See table
Operating temp.	-55° C to +125° C
Temp. coeff.	See table
Torque	See table
Insulation resistance	> 10^4 MΩ at 500 VDC
Vibration	15 g 10-2000 Hz
Shock	100 g 6 ms



Technical data

Tekelec Part N°	Capacitance range (pF)	Temperature coefficient (ppM/°C)	Min Q at 100 MHz	Torque g.cm	Color Code
AT2320-0	0.6 - 2.5	100 ± 200	3000	4 - 70	Red
AT2320-1	1 - 5	100 ± 200	1000	4 - 70	Black
AT2320-2	2.5 - 10	100 ± 200	1000	4 - 70	Blue
AT2320-3	5 - 18	- 450 ± 300	500	4 - 70	Green
AT2320-4	6.5 - 25	- 1100 ± 300	300	4 - 70	Amber

SL (Strip-Line)

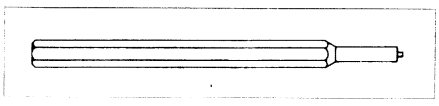


Packaging

- **TAPE AND REEL:** TEKELEC tape and reel packaging is in accordance with EIA-481 specification in 12 mm width carrier tape in quantities of 500 on 18 cm reel & 2500 on 33 cm reel
- **BULK:** TEKELEC standard bulk packaging in quantities of 200 in a sealed antistatic plastic bag with dessicant

How to order

- Standard — ex: AT2320-2
- Strip line add SL after TEKELEC P/ Nb — ex: AT2320-2 SL
- For tape and reel, add code after TEKELEC P/ Nb: — R1 for 18 cm diameter reel, and R2 for 33 cm diameter reel



TEKELEC Tuning Tool :AT4192

SMD THIN & SEALED CERAMIC TRIMMER CAPACITORS

Description

- SMD thin trimmer capacitors are an advanced development in miniaturized trimmer capacitors for applications in circuits where size and performance are critical.

- The SMD thin trimmer capacitors embodies a radical reduction in size and weight over standard ceramic capacitors, with a proportional improvement in electrical characteristics. The capacitor consists of a metallic rotor suspended under spring pressure between two metalized dielectric disks. In addition to physically securing the assembly, the springs serve as both the internal electrical connection and the external terminal, simplifying the construction and further reducing size. The incorporation of the square drive tuning mechanism insures captive, non-slip, tamper-proof adjustments which are not subject to blacklash problems associated with screwdriver type adjustment slots.

- SMD thin trimmer capacitors (AT9401 series) feature high Q performance up to 2 GHz and beyond. AT9401 series construction incorporates a butterfly electrode pattern which provides a series parallel capacitor with extremely low ESR and ESL.

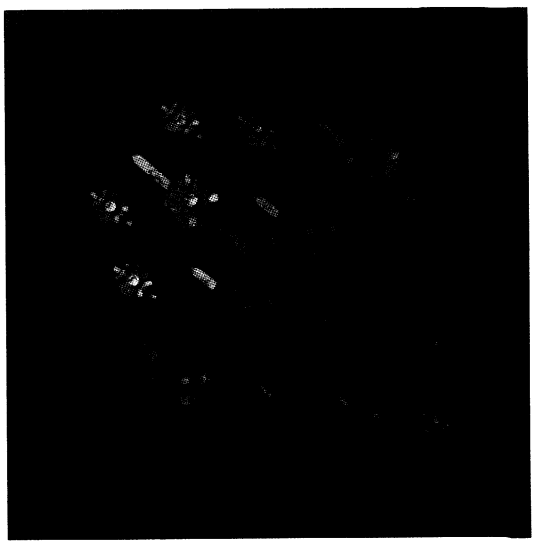
- The Sealed trimmer is a high performance SMD thin ceramic trimmer capacitor encapsulated in a moistureproof housing. This design resists intrusion of dirt, dust, solder flux and cleaning agents during assembly and atmospheric contamination during use. These capacitors offer low drift rates and high Q, making them ideal for higher frequency applications beyond the limits of ordinary ceramic trimmer capacitors

Features

- Working voltage 250 VDC, test 500 VDC
- Resistance to cleaning solvents and soldering heat, moisture resistance, solderability meet MIL-STD-202
- Conform to specification MIL-C-81

Applications

- Microprocessor clock - Interstage coupling
- Filter networks - Impedance matching
- Crystal trimming - Antenna tuning
- Electronic watches -Telemetry
- Avionics equipments
- WLAN



SALES OFFICES **WEB SITE: http://www.tekelec-temex.com**

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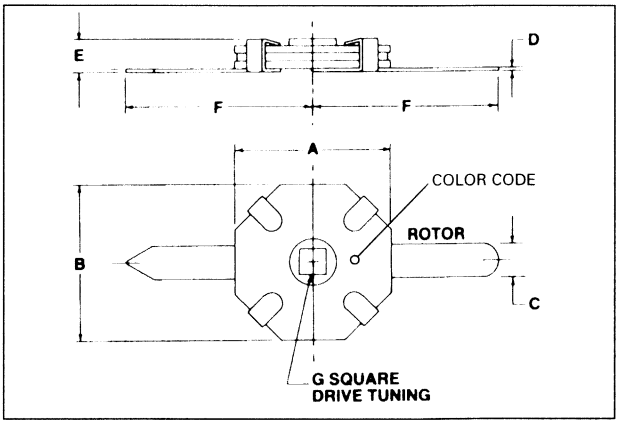
SURFACE MOUNT TRIMMER CAPACITORS

SMD thin trimmers

Characteristics

Range	See table
Voltage	Rated 250 VDC Test 500 VDC
Q at 100 MHz	See table
Operating temp.	-55° C to +125° C
Temp. coeff.	See table
Torque	See table
Insulation resistance	> 10^4 MΩ at 500 VDC
Vibration	15 g 10-2000 Hz
Shock	100 g 6 ms
Capacitance drift	< 1 %



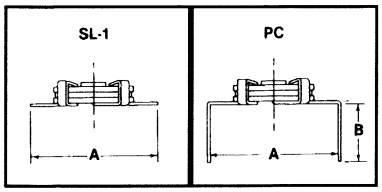
Technical data

Tekelec Part N°	Capacitance range (pF)	Temperature coefficient (ppM/°C)	Min Q at 100 MHz	Torque g.cm
AT9401-0	0.25 - 0.7	50 ± 50	1000	4 - 70
AT9401-1	0.5 - 1.3	NPO ± 100	1000	4 - 70
AT9401-2	0.6 - 2	- 400 ± 200	1000	4 - 70
AT9401-4	1.5 - 4	- 1100 ± 300	500	4 - 70
AT9402-0	0.6 - 2.5	100 ± 100	3000	4 - 70
AT9402-1	1 - 5	100 ± 200	1000	4 - 70
AT9402-2	2.5 - 10	- 50 ± 100	1000	4 - 70
AT9402-4	3 - 12	- 1100 ± 300	500	4 - 70
AT9402-6	6 - 25	- 1100 ± 300	300	4 - 70
AT9402-8	5 - 15	- 300 ± 300	750	4 - 70
AT9402-9	5 - 18	- 450 ± 300	500	4 - 70
AT9410-0	1 - 4.5	50 ± 50	1000	14 - 140
AT9410-1	2.5 - 10	- 100 ± 200	1000	14 - 140
AT9410-2	4 - 18	- 400 ± 200	700	14 - 140
AT9410-3	6 - 35	- 1100 ± 300	200	14 - 140
AT9410-4	7 - 40	- 1100 ± 300	200	14 - 140
AT9410-5	8 - 50	- 1500 ± 500	200	14 - 140
AT9410-25	5 - 25	NPO ± 150	200	14 - 140

Dimensions (mm)

Color Code	A	B	C	D	E	F	G
Red Black Blue Brown	3.6 max	3.2	0.5	0.1	1.0 max	5.0	0.6
Red Black Blue Brown Yellow None Grey	3.2	3.2	0.5	0.1	1.0	5.0	0.6
Red Black Blue Orange Brown Green Yellow	5.1	5.1	1.0	0.1	1.5 max	7.6	0.8

Optional Configuration



	SL	PC	
Tekelec P/Nb	**A**	**A**	**B**
AT9401 Series	5.1	5.1	2.3
AT9402 Series	5.1	5.1	2.3
AT9410 Series	6.4 Max	5.1	5.1

Packaging

- **BULK:** TEKELEC standard bulk packaging in a sealed antistatic plastic bag
- **TAPE AND REEL:** TEKELEC standard tape and reel packaging is available in quantities of 1500 or 6000 pieces per reel on carrier tape 12 mm width for AT9401 SL and AT9402 SL products, and in quantities of 3000 pieces per reel on carrier tape 24 mm width for AT9410 products

HOW TO ORDER

- Standard — ex: AT9402-2
- For optional configuration add code after TEKELEC P/ Nb — ex: AT9402-2 PC

TEKELEC Tuning Tool : AT4192 : For 9401 and 9402 series
AT4193 : For 9410 series

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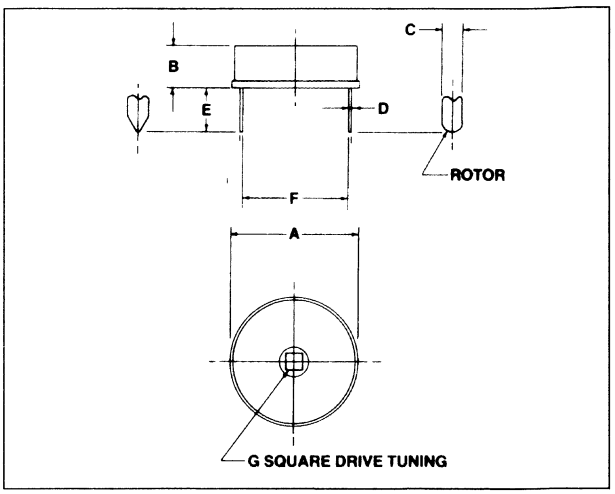
SURFACE MOUNT TRIMMER CAPACITORS

Sealed trimmers

TEKELEC TEMEX

Characteristics

Range	See table
Voltage	Rated 250 VDC - 400 VDC Test 500 VDC - 800 VDC } 9690
Q factor	See table
Operating temp.	-20° C to +85° C
Temp. coeff.	See table
Torque	See table
Insulation resistance	> 10^4 MΩ at test voltage
Vibration	15 g 10-2000 Hz
Shock	100 g 6 ms
Capacitance drift	< 1 %
Moisture resistance	24 H 25° C to 65° C and 80 % to 98% R.H. for 10 days



Technical data

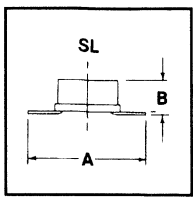
Tekelec Part N°	Capacitance range (pF)	Temperature coefficient (ppM/°C)	Min Q at 100 MHz	Torque g.cm
AT9620	0.6 - 2.5	100 ± 150	1000	4 - 70
AT9621	1 - 5	0 ± 400	1000	4 - 70
AT9622	2.5 - 10	100 ± 600	1000	4 - 70
AT9626	6 - 25	- 1500 ± 900	300	4 - 70
AT9628	5 - 15	- 300± 300	750	4 - 70
AT9629	5 - 18	- 450 ± 300	500	4 - 70
AT9610	1 - 4.5	50 ± 150	1000	14 - 140
AT9611	2.5 - 10	- 100 ± 500	1000	14 - 140
AT9612	4 - 18	- 300 ± 800	700	14 - 140
AT9613	6 - 35	- 1500 ± 900	200	14 - 140
AT9614	7 - 40	- 1500 ± 900	200	14 - 140
AT9615	5 - 25	- 400± 500	200	14 - 140
AT9616	8 - 50	- 1500 ± 900	200	14 - 140
AT9694	7.5 - 50	- 1500 ± 900	1000*	14 - 140
AT9697	20 - 100	- 1500 ± 900	1000*	14 - 140

* Min Q at 1 MHz

Dimensions (mm)

A	B	C	D	E	F	G
4.6	2.2	0.5	0.1	2.2	3.6	0.6
6.9	2.5	1.0	0.13	3.8	5.6	0.8
9.9	3.2	1.6	0.15	3.8	8.4	1.3

Optional configuration

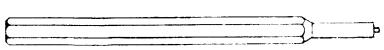


Tekelec P/Nb	A	B
AT9620 Series	8.1	2.3
AT9610 Series	13.2	2.8

How to order

- Standard — ex: AT9622
- For optional configuration add code after TEKELEC P/ Nb — ex: AT9622-SL

TEKELEC Tuning Tool : AT4192 : For 9620 series
AT4193 : For 9610 series
AT2190 : For 9690 series



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AT0300 & AT1300 SERIES - AT0200 SERIES SURFACE MOUNT TRIMMER CAPACITORS

Description

AT0300 and AT1300 series are surface mount ceramic dielectric chip size trimmer capacitors. They are specially designed for reflow soldering process and commercial applications like handy radiocommunication equipments, wireless LAN or crystal oscillators. Dust proof and preserved from solvent and washable, they are available on tape and reel. Full ring around the rotor facilitates its use with automatic pick and place machine.

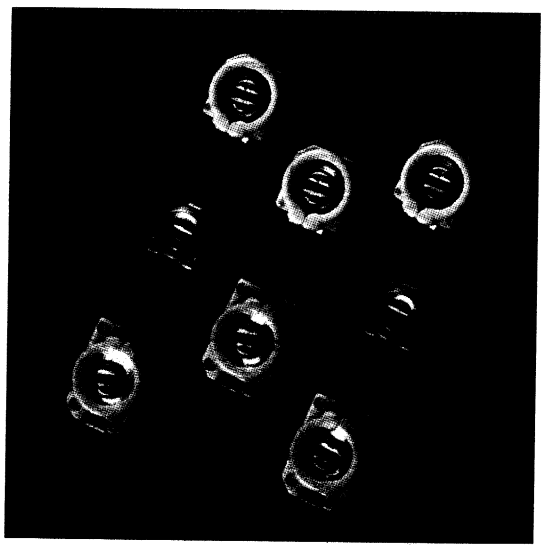
The new AT0200 series are the smallest trimmer capacitors of the market for reflow soldering process and are available on tape and reel.

Features

- Very good Q and high resonant frequency
- Low capacitance drift
- Very stable over time
- Low temperature coefficient

Applications

- Crystal and resonator trimming
- Paging system
- WLAN
- CATV amplifiers
- All varieties of communication and test equipments



SURFACE MOUNT TRIMMER CAPACITORS

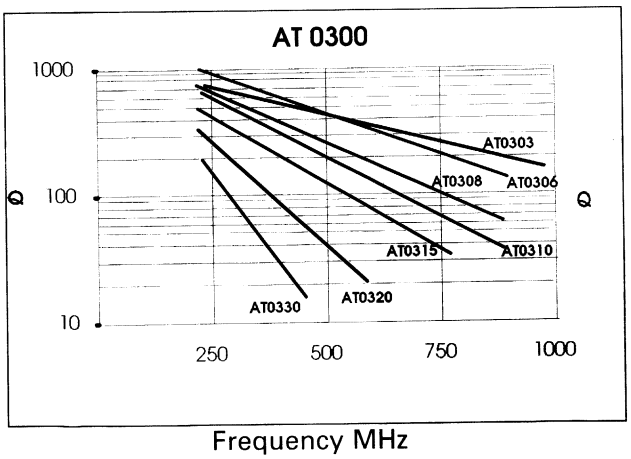
AT0300 & AT1300 Series
AT0200 Series

TEKELEC TEMEX

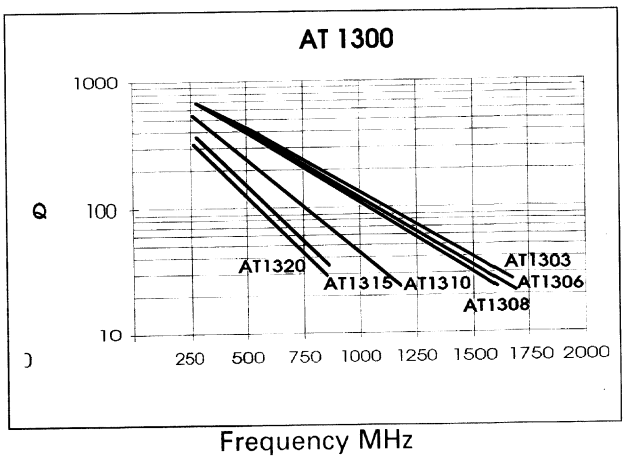
Characteristics

	AT0303 AT1303	AT0306 AT1306	AT0308 AT1308	AT0310 AT1310	AT0315 AT1315	AT0320 AT1320	AT0330 AT1330	AT034 AT134
Mamimum capacitance pF & tolerance	+ 50 % 3.0 - 0 %	+ 50 % 6.0 - 0 %	+ 50 % 8.0 - 0 %	+ 100 % 10.0 - 0 %	+ 100 % 15.0 - 0 %	+ 100 % 20.0 - 0 %	+ 100 % 30.0 - 0 %	+ 10 40.0 -
Minimum capacitance pF	1.5 max	2 max	3 max	2 max	3 max	4.5 max	5.5 max	8.0 ma
Rated voltage VDC	100	100	100	50	50	50	50	50
Voltage proof VDC	220	220	a220	110	110	110	110	110
Working temperature range	- 40° C to 85° C							
Temperature coefficient ppm/°C	0 ± 200	0 ± 300	-750 ± 500	0 ± 300	0 ± 300	0 ± 500	-750 ± 500	-750 ± !
Capacitance drift pF	0.1 max		0.2 max	0.3 max	0.4 max	0.5 max	1.0 max	1.2 ma
Setting drift	< 1 %							
Typical self resonant frequency at max. rated cap GHz (*AT1300 series)	2 2.3*	1.4 1.6*	1.2 1.4*	1.1 1.2*	0.9 1.0*	0.8 0.9*	0.6 0.7*	0.4 0.5*
Insulation resistance MΩ	10 000 min							
Color code	Black	Blue	Violet	White	Pink	Red	Orange	Yello
Tensile strength of terminal	250 g min							
Torque	10 to 70 g. cm							
Resistance to axial loading	500 g min							
Packaging	All parts delivered on 12 mm tape and reel (1000 pieces per reel)							

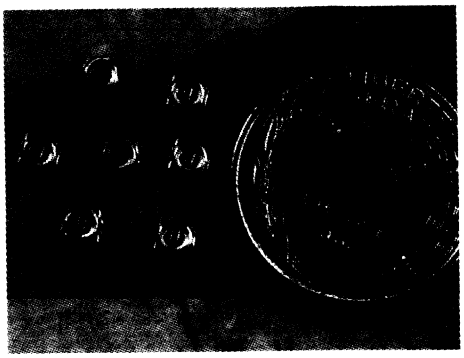
Quality factor



Frequency MHz



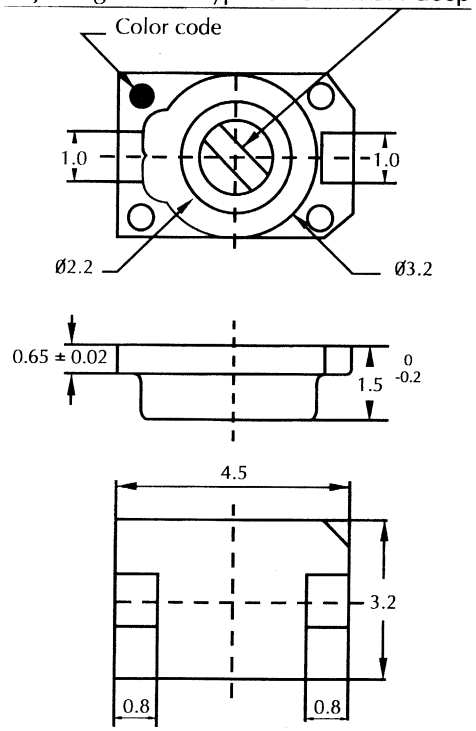
Frequency MHz



Outline drawings

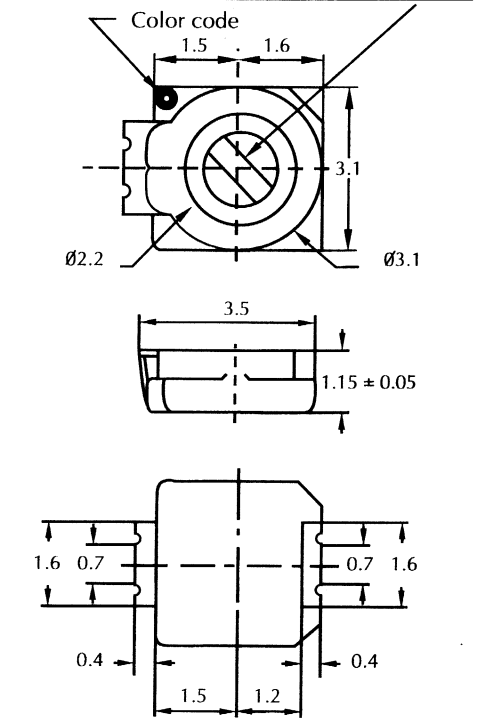
AT 0300

Adjusting slot 1.4 typ x 0.45 w x 0.4 deep



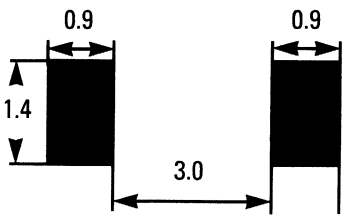
AT 1300

Adjusting slot 1.4 typ x 0.45 w x 0.4 deep

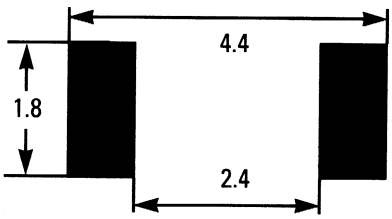


Typical solder Pad layout

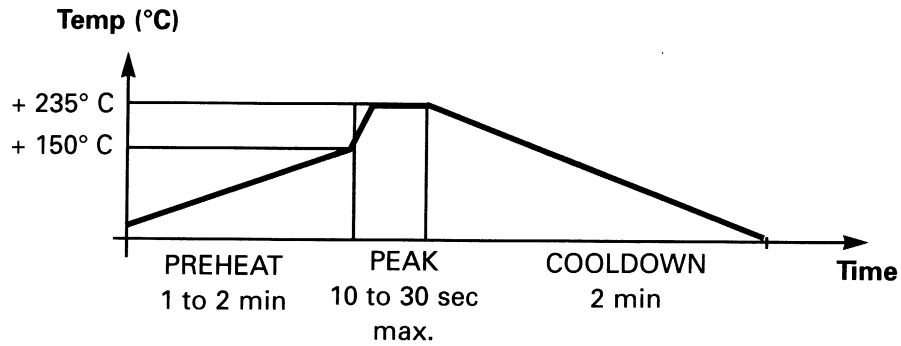
AT0300
Tolerance ± 0.2 mm



AT1300
Tolerance ± 0.1 mm



Recommended reflow solder temperature profile



SURFACE MOUNT TRIMMER CAPACITORS

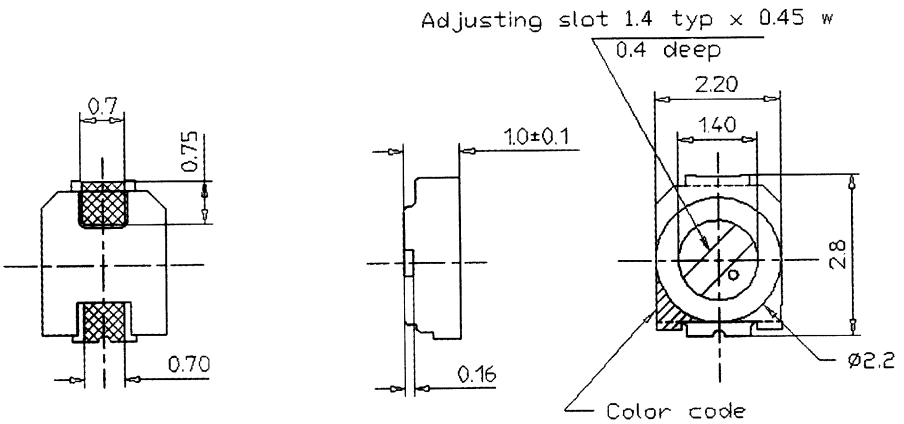
AT0300 & AT1300 Series
AT0200 Series

TEKELEC TEMEX

Characteristics

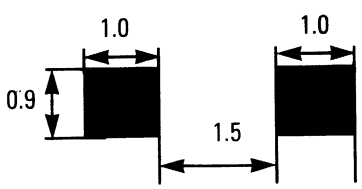
	AT 0210	AT 0220
Maximum capacitance pF & tolerance	+100% 10.0 -0%	+ 100% 20.0 0%
Minimum capacitance pF	3.0 max	4.5 max
Rated voltage VDC	25	
Voltage proof VDC	55	
Working temperature range	-25°C to +85°C	
Temp. coefficient ppm/°C	0 ± 500	0 ± 500
Capacitance drift pF	0.5 max	0.5 max
Setting drift	< 1%	
Q factor @ 1 MHz	> 500	
Insulation resistance MW	10^4 min	
Color code	White	Red
Tensile strength of terminal	250 g	
Torque	40 g.cm max	
Resistance to axial loading	500 g	
Packaging	Parts delivered on 8 mm tape and reel per quantity of 2000	

Outline drawing



Typical solder Pad layout

AT0200
Tolerance ± 0.1 mm



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GIGAHERTZ TRIMMER CAPACITORS

Description

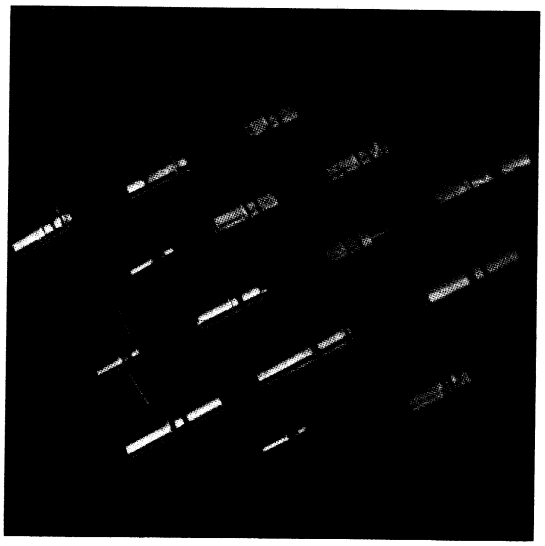
- **Gigahertz trimmers** are tiny trimmer capacitors which provide a straight-forward technique for fine tuning RF and microwave circuits by eliminating time consuming methods of abrasive trimming, cut and try adjustment techniques, and inter-change of fixed capacitors.
- The design involved the need from a virtually indestructible miniature trimmer with superior electrical characteristics.
- Gigahertz trimmers whistand the rigors of soldering heat, excessive tuning and rough handling. As a result of the excellent dielectric and insulation properties of the sapphire housing, high breakdown voltage is achieved. Incorporating the self-locking constant torque drive mechanism which eliminates the need for external bushing slots, the new Gigahertz trimmers offer many improvements: a fixed length, increased Q, essentially zero tuning noise and reduced susceptibility to solder flux intrusion during installation.
- A variety of mounting styles is available for vertical, printed circuit, panel, cavity and strip-line applications.
- Gigahertz trimmers can be delivered with permanent sealing cap which resists intrusion of solder flux and cleaning agents and allows easy access to the tuning rotor.

Features

- Very high Q
- Excellent tuning stability and low dynamic noise
- Two temperature coefficients available
- Working voltage 500 VDC, test 1000 VDC
- High ratio capacitance / volume
- Removable or permanent sealing caps
- Meets MIL-C-14 409
- Meets ESA/SCC 3010
- French military QPL
- Non-magnetic version

Applications

- Impedance matching
- Crystal and resonator trimming
- Interstage coupling
- Gap trimming in microstrip
- Filter tuning
- Cavity tweaking
- Amplifier adjustment



TRIMMER CAPACITORS

Gigahertz trimmers

TEKELEC TEMEX

Characteristics

Range	See table	See curve
Δ Cvs Rotation	See curve	Linear over wide range
Voltage	Rated 500 VDC Test 1000 VDC	Typical breakdown @ sea level > 1500 VDC
Min. Q @ 250 MHz	> 5000 See table	Measured at max. capacitance
Operating temperature	-55° C to +125° C	Stable over full range
Thermal shock	-55° C to +125° C	
Temperature coefficient	See table	Measured at 75% Max. capacitance

Torque **AT(X) 7260** **All others**	 7 to 70 cN.cm 14 to 130 cN.cm	1 cN.cm ≥ 1 g.cm Average 30 cN.cm Average 60 cN.cm
Rotational life	> 800 revolutions	Meets MIL-C-14490D
Insulation resistance	$>10^4$ MΩ @ 500 VDC	Measured at 25° C and 50% RH
Contact resistance	< 0.01 Ω	Low dynamic noise
Self resonant frequency	To > 12 GHz See curve	Operates B to C band
Vibration	60 g 10 - 2000 Hz	MIL-STD-202 E Method 204 C
Shock	100 g 6 ms	MIL-STD-202 E Method 213 B

Technical data

Series Lead (see syles drawings)	Q factor at 250 MHz	Capacitance range (pF)	Temp. coef. Standard option (x) = 3	(x) = 2
AT(x) 726 serie	> 5000	0.3 - 1.2	350 ± 75	0 ± 50
AT(x) 727 serie	> 3000	0.6 - 4.5	350 ± 75	0 ± 50
AT(x) 728 serie	> 4000	0.4 - 2.5	350 ± 75	0 ± 50
AT(x) 729 serie	> 3000*	0.8 - 8.0	350 ± 75	0 ± 75

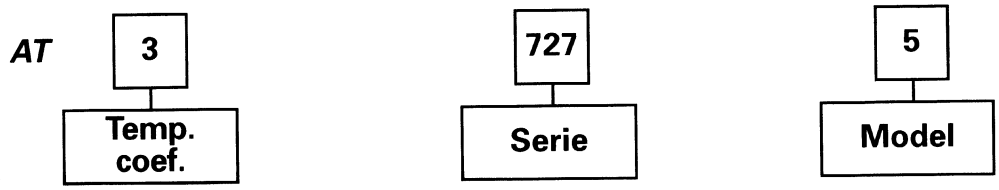
* 100 MHz

Dimensions (mm)

A ± 0.3	B ± 0.1	C ± 0.1	D ± 0.1	E ± 0.1	F ± 0.2	G ± 0.1	H ± 0.1
5.8	1.9	2.0	2.0	1.9	3.0	4.0	5.7
8.0	3.0	3.2	4.0	2.8	4.2	2.5	5.9
5.8	3.0	2.0	2.3	2.8	4.2	3.6	5.9
12.3	3.0	6.4	6.4	2.8	4.2	3.1	5.9

How to order

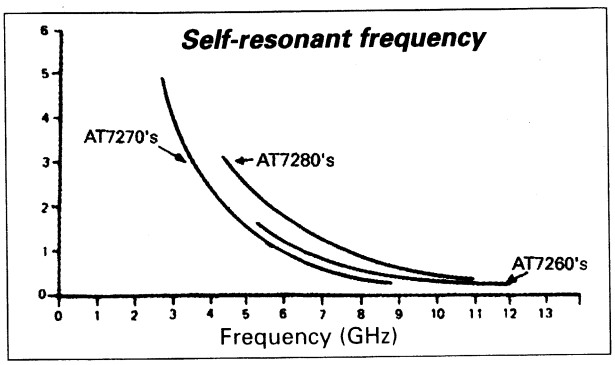
Ex: AT37275

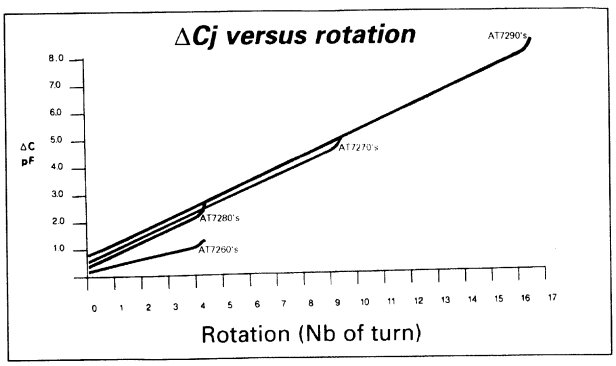


350 ± 75 ***0.6 to 4.5 p*** ***Model 5***

For strip line mounting (Model 1 only), add SL to reference No ex.: AT37271 SL

For Gigahertz including permanent sealing cap, add S to the reference number ex. : AT27273 S





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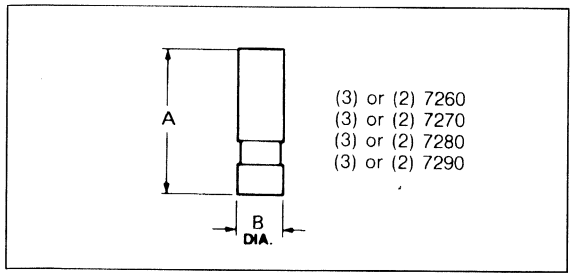
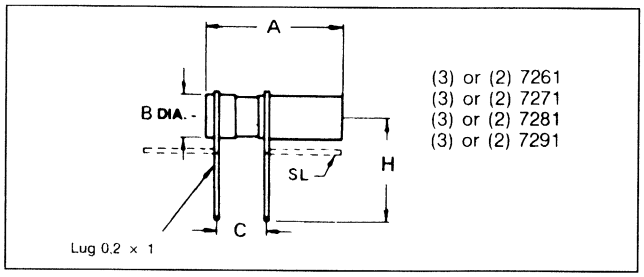
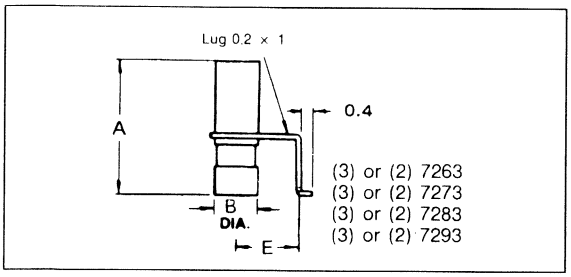
Model 0



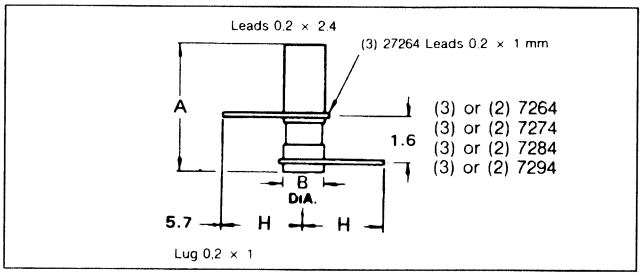
Model 1



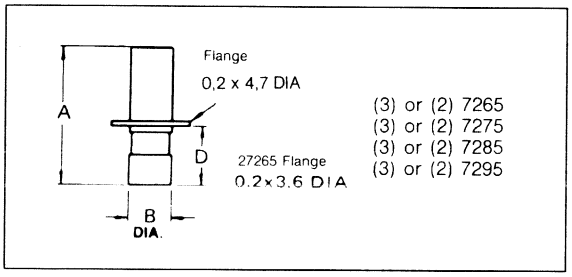
Model 3



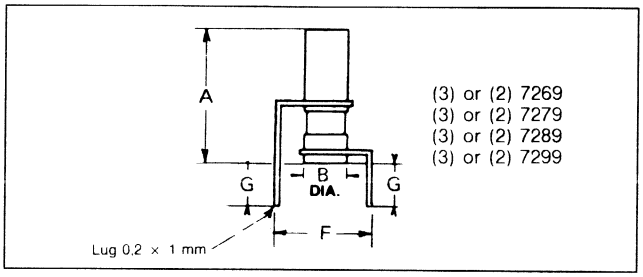
Model 4



Model 5



Model 9



Note 1: ATX726 series can be delivered with permanent sealing cap AT69600
ATX727, ATX728 and ATX729 can be delivered with permanent sealing cap AT69700
Total length A is increased by 0.1 mm with permanent sealing cap

Note 2: ATX727, ATX728 and ATX729 series can be supplied with removable sealing cap AT69800

Note 3: For fixing hole layout dimensions and tolerances, consult page 10-40

Note 4: For special and custom design models, consult page 10-35

Non-magnetic Gigahertz trimmer capacitors

For nuclear magnetic resonance, medical electronics and other very low magnetic signature applications, TEKELEC TEMEX produces a non-magnetic trimmer capacitors (model AT57290) ; this model has a capacity range from 0.8 to 8.0 pF.

Packaging

- Bulk: TEKELEC TEMEX standard bulk packaging
- Tape & reel: ATX7263, ATX7273 and ATX7283 are available on TEKELEC TEMEX standard tape and reel packaging in quantities of 500 pieces per reel on carrier tape 16 mm width. Units include permanent sealing cap.

TEKELEC TEMEX tuning tools

AT8762 for ATX726 SERIES AT8777 for ATX727, ATX728 andX729.

AIR DIELECTRIC TRIMMER CAPACITORS

Description

• **Standard** trimmer air capacitors are designed specifically for RF applications, VHF through microwave, and have become the industry standard of excellence. High Q and temperature stability are a result of proper attention to geometry and choice of optimum materials. The heart of this trimmer is the one piece self-locking constant torque drive mechanism. This mechanism utilizes transverse slots to create a spring effect between two threaded sections resulting in substantial contact areas which insure uniform torque, high Q and low dynamic tuning noise.

• **Miniature** trimmer air capacitors offer an even further size reduction of the standard air capacitors coupled with finer tuning resolution and ultra high Q, making them ideal for use in microwave circuits.

• Both standard and miniature capacitors are available in vertical mounting configurations which save board space and allow top tuning. **Vertical mount** capacitors are available in single dual and low inductance leads with upright or inverted tuning.

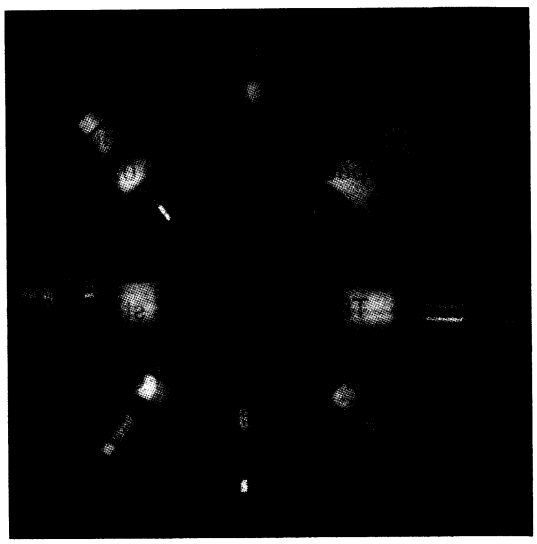
• Where **High voltage** is a requirement, the AT5300 series air capacitors are an exellent replacement for comparable range glass capacitors.

Features

- Q's previously unavailable in trimmer capacitors
- Excellent tuning stability and very low dynamic noise
- Approximately zero temperature coefficient
- Working voltage 250 VDC, test 500 VDC
- 306° C solder used in assembly
- Removable hermetic seal
- Meets MIL-C-14 409D
- French military QPL
- ESA-SCC 3010 qualified and NFC 93.171 approved

Applications

- RF amplifiers and oscillators
- Impedance matching
- Crystal trimming
- Interstage coupling
- Filter tuning



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Characteristics

Range	1 to 10 pF	
Δ Cvs Rotation		Linear over wide range
Voltage	Rated 500 VDC Test 1000 VDC	Typical breakdown @ sea level > 1200 VDC
Min. Q @ 100 MHz	> 2000	Measured at max. capacitance
Operating temperature	-55° C to +125° C	Stable over full range
Thermal shock	-55° C to +125° C	MIL-C-14409D
Temperature coefficient	0 ± 20 ppM/° C	Measured at 75% max. capacitance

Torque	70 to 420 cN.cm	
Rotational life	> 800 revolutions	Equivalent to MIL-C-14409D
Insulation resistance	$>10^6$ MΩ @ 500 VDC	Measured at 25° C and 50% RH
Contact resistance	< 0.01 Ω	Low noise while tuning
Vibration	60 g 10 - 2000 Hz	MIL-STD-202 E Method 204 C
Shock	1500 g 0.5 ms	MIL-STD-202 E Method 213 B

Technical data

Tekelec Part N°	Q factor at 100 MHz	Capacitance range (pF)	Temperature coefficient (ppM/°C)
AT5300	> 2000	1 - 10	0 ± 20
AT5301	> 2000	1 - 10	0 ± 20
AT5302	> 2000	1 - 10	0 ± 20

Dimensions (mm)

Fig.	A	B	C	Thread
1	10.7	7.8	9.8	5/16-64
2	11.1	8.3	9.8	5/16-64
3	10.7	7.8	9.8	5/16-64

Figure 1

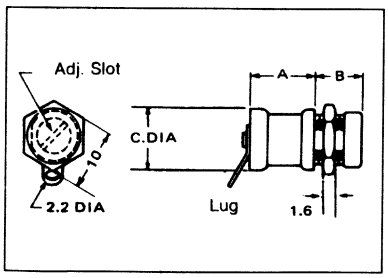


Figure 2

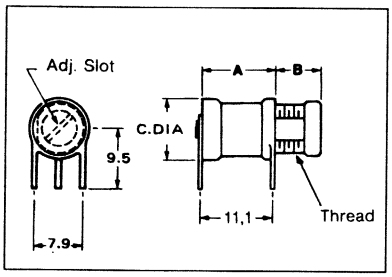
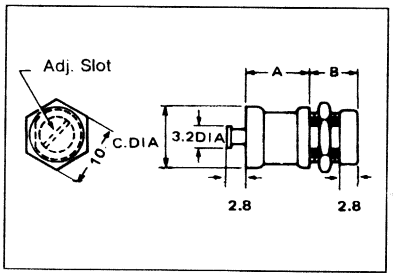
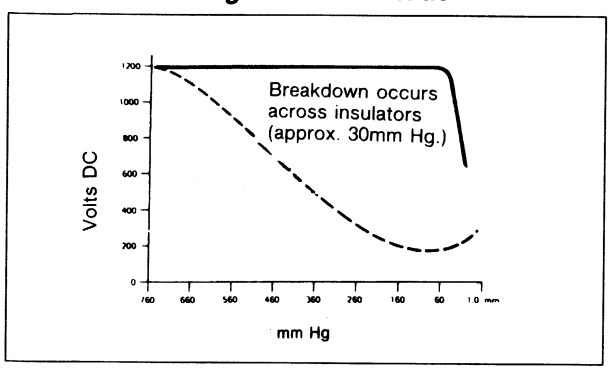


Figure 3

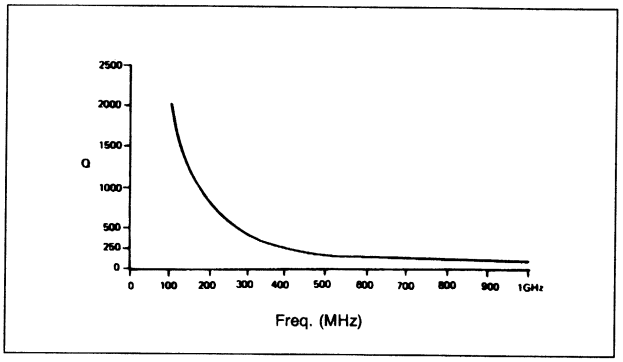


Note 1 : For fixing hole layout tolerances and dimensions, consult page 10-40
Note 2 : For Tap sizes and ref. numbers, see 10-36
Note 3 : For special and custom design models, consult page 10-35
Note 4 : For panel mounting version (with nut) minimum circuit thickness: 0.8 mm

Breakdown voltage versus altitude



Q factor versus frequency



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STANDARD TRIMMER

Air capacitors

TEKELEC TEMEX

Characteristics

Range	See table	See graph
Δ Cvs Rotation	See graph	Linear over wide range
Voltage	Rated 250 VDC Test 500 VDC	Typical breakdown @ sea level > 800 VDC
Min. Q @ 100 MHz	To > 5000 See table	Measured at max. capacitance
Operating temperature	-55° C to +125° C	Stable over full range
Thermal shock	-55° C to +125° C	MIL-C-14409D
Temperature coefficient	See table	Measured at 75% max. capacitance

Torque	70 to 360 cN.cm	Average 150 cN.cm
Rotational life	> 800 revolutions	Equivalent to MIL-C-14409D
Insulation resistance	$>10^6$ MΩ @ 500 VDC	Measured at 25° C and 50% RH
Contact resistance	< 0.01 Ω	Low dynamic noise
Self resonant frequency	to > 5 GHz See graph	Suitable to «C» band applications
Vibration	60 g 10 - 2000 Hz	MIL-STD-202 E Method 204 C
Shock	1500 g 0.5 ms	MIL-STD-202 E Method 213 B

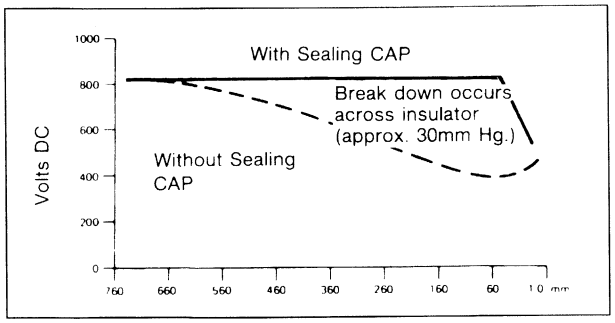
Technical data

Tekelec Part N°	Q factor at 100 MHz	Capacitance range (pF)	Temperature coefficient (ppM/°C)
AT5200 AT5201 AT5202 AT5205	> 5000	0.8 - 10	0 ± 15
AT5400 AT5401 AT5402 AT5405	> 3000	1 - 14	0 ± 25
AT5450 AT5451 AT5452 AT5455	> 3000	1 - 16	0 ± 50
AT5500 AT5501 AT5502	> 1500	1 - 20	0 ± 30
AT5550 AT5551 AT5552	> 1000	1.5 - 25	0 ± 50
AT5600 AT5601 AT5602	> 800	1 - 30	0 ± 30

Dimensions (mm)

Fig.	A	B	C	D	E	Thread
1	7.7	5.8		7.6		15/64-64
2b	8.0	5.4	7.2	7.6	7.9	15/64-64
3	7.2	5.8		7.6		15/64-64
4	8.0	5.4	7.2	7.6	3.9	15/64-64
1	7.7	5.8		7.6		15/64-64
2b	8.0	5.4	7.2	7.6	12.0	15/64-64
3	7.2	5.8		7.6		15/64-64
4	8.0	5.4	7.2	7.6	3.9	15/64-64
1	7.7	5.8		7.6		15/64-64
2b	8.0	5.4	7.2	7.6	12.0	15/64-64
3	7.2	5.8		7.6		15/64-64
4	8.0	5.4	7.2	7.6	3.9	15/64-64
1	12.5	6.7		8.0		15/64-64
2b	14.7	4.3	14.2	8.0	12.0	15/64-64
3	12.4	6.7		8.0		15/64-64
1	12.5	6.7		8.0		15/64-64
2b	14.7	4.3	14.2	8.0	12.0	15/64-64
3	12.4	6.7		8.0		15/64-64
1	17.3	6.6		8.0		15/64-64
2a	19.4	4.4	18.8	8.0	12.0	15/64-64
3	17.3	6.6		8.0		15/64-64

Breakdown voltage versus altitude



Δ VS rotation

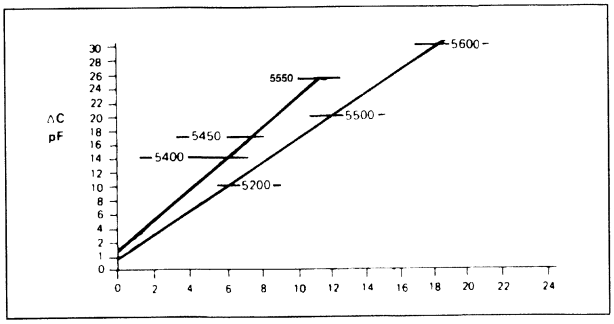


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Figure 1

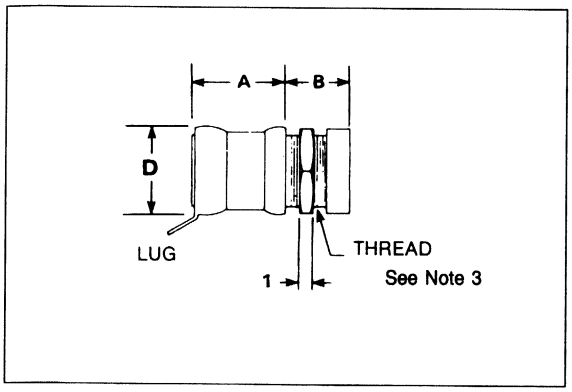


Figure 2

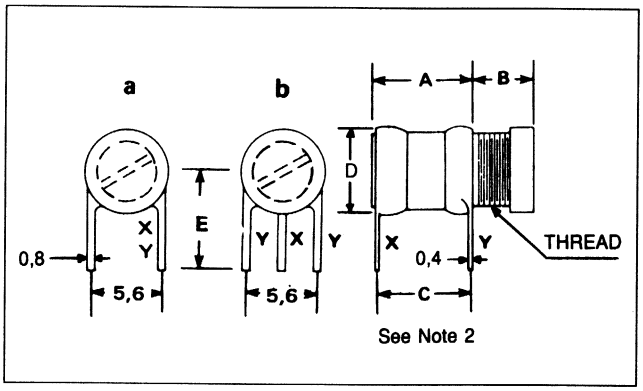


Figure 3

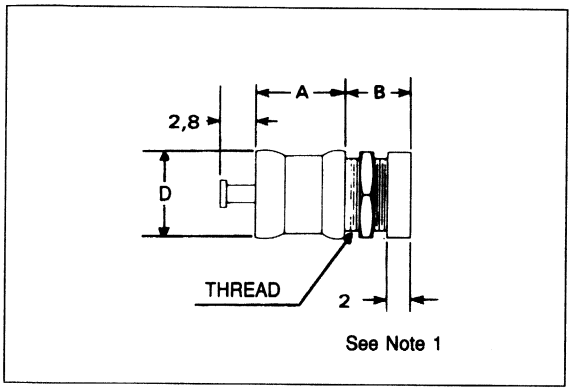
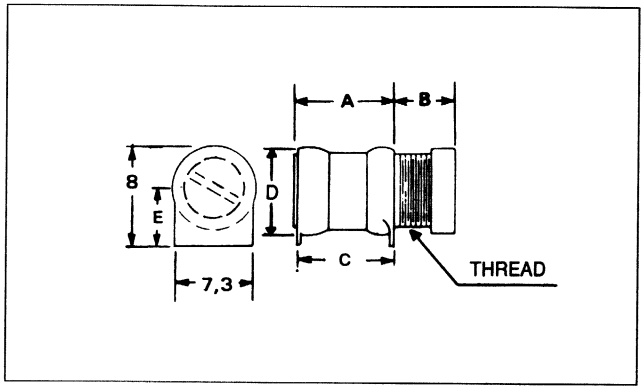


Figure 4

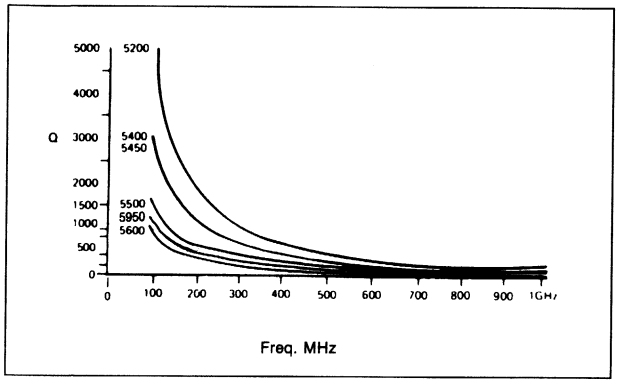


Note 1: B. Dimension is increased by 0.8 mm with slotted seal cap.
Note 2: For fixing hole layout tolerances and dimensions consult page 10-40
Note 3: For Tap sizes and reference numbers see page 10-36
Note 4: For special and custom design models consult page 10-35
Note 5: For panel mounting version (with nut) minimum circuit thickness: 0.8 mm

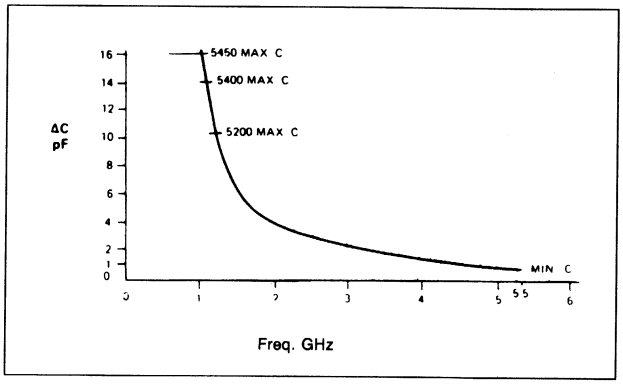
How to order

- With standard seal cap ex: AT5202
- With slotted seal cap add suffix S ex: AT5202 S

Q versus frequency



Δ C versus self-resonant frequency



MINIATURE TRIMMER

Air capacitors

TEKELEC TEMEX

Characteristics

Range	See table	See graph
Δ Cvs Rotation	See graph	Linear over wide range
Voltage	Rated 250 VDC Test 500 VDC	Typical breakdown @ sea level > 800 VDC
Min. Q @ 100 MHz	To > 10000 See table	Measured at max. capacitance
Operating temperature	-55° C to +125° C	Stable over full range
Thermal shock	-55° C to +125° C	MIL-C-14409D
Temperature coefficient	See table	Measured at 75% max. capacitance

Torque AT5700's AT5800's	30 to 290 cN.cm 22 to 220 cN.cm	
Rotational life	> 800 revolutions	Equivalent to MIL-C-14409D
Insulation resistance	$>10^6$ MΩ @ 500 VDC	Measured at 25° C and 50% RH
Contact resistance	< 0.01 Ω	Low dynamic noise
Self resonant frequency	to > 6 GHz See graph	Suitable to «C» band applications
Vibration	60 g 10 - 2000 Hz	MIL-STD-202 E Method 204 C
Shock	1500 g 0.5 ms	MIL-STD-202 E Method 213 B

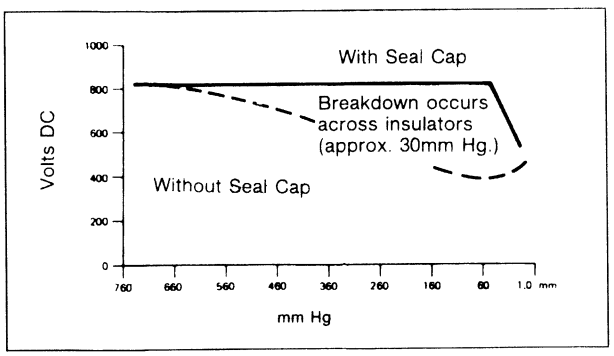
Technical data

Tekelec Part N°	Q factor at 100 MHz	Capacitance range (pF)	Temperature coefficient (ppM/°C)
AT5700 AT5701 AT5702 AT5705	> 10000	0.8 - 6	0 ± 15
AT5750 AT5751 AT5752 AT5755	> 7500	0.8 - 10	0 ± 50
AT5800 AT5801 AT5802 AT5805	> 10000	0.35 - 3.5	0 ± 50
AT5850 AT5851 AT5852 AT5855	> 7500	0.5 - 5	0 ± 50

Dimensions (mm)

Fig.	A	B	C	D	E	F	G	Thread
1	7.0	5.6		6.2				10-64
2b	7.3	5.1	6.7	6.2	6.3		0.4	10-64
3	6.9	5.6		6.2				10-64
5	7.3	5.1	6.7	6.2	6.4	5.6	0.4	10-64
1	7.0	6.3		6.2				10-64
2b	7.3	5.8	6.7	6.2	6.3		0.4	10-64
3	6.9	6.3		6.2				10-64
5	7.3	5.8	6.7	6.2	6.4	5.6	0.4	10-64
4	6.7	5.9		4.6				.120-80
2a	7.0	5.7	6.5	4.6	5.4		0.25	.120-80
3	6.7	5.9		4.6				.120-80
5	7.2	5.5	6.7	4.6	4.6	3.8	0.4	.120-80
4	6.7	6.8		4.6				.120-80
2a	7.0	6.6	6.5	4.6	5.4		0.25	.120-80
3	6.7	6.8		4.6				.120-80
5	7.2	6.4	6.7	4.6	4.6	3.8	0.4	.120-80

Breakdown voltage versus altitude



Δ VS rotation

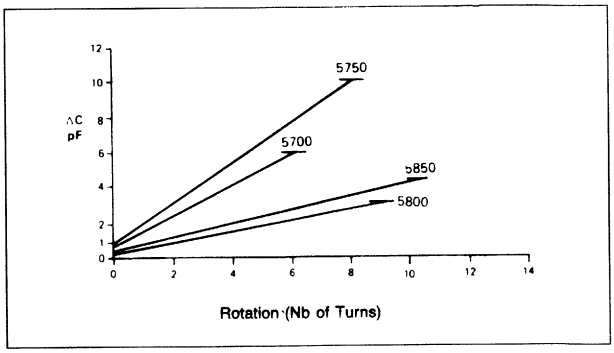


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Figure 1

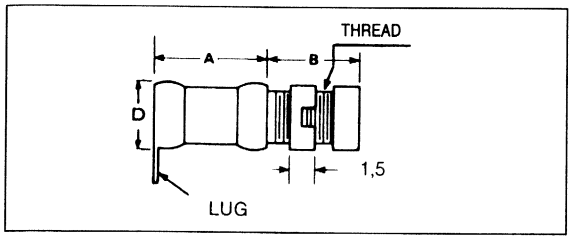


Figure 2

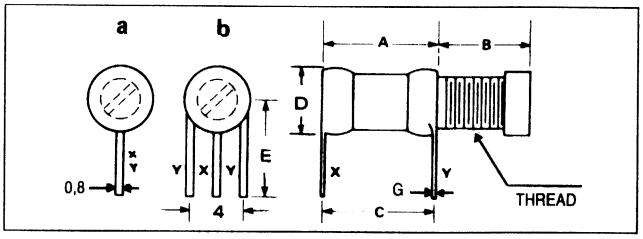


Figure 3

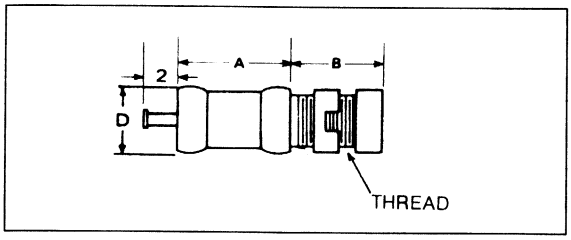


Figure 4

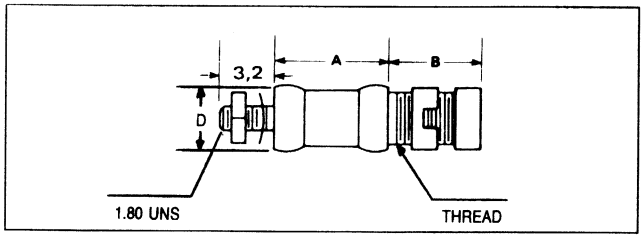
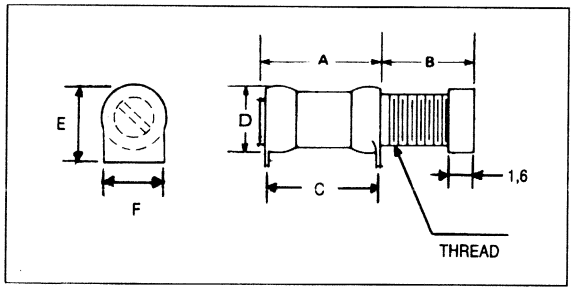


Figure 5



Note 1: B. Dimension is increased by 0.8 mm with slotted seal cap.

Note 2: For fixing hole layout tolerances and dimensions consult page 10-40

Note 3: For Tap sizes and reference numbers see page 10-36

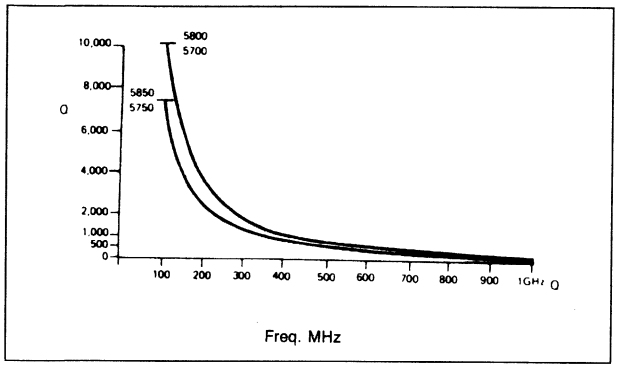
Note 4: For special and custom design models consult page 10-35

Note 5: For panel mounting version (with nut) minimum circuit thickness: 0.8 mm

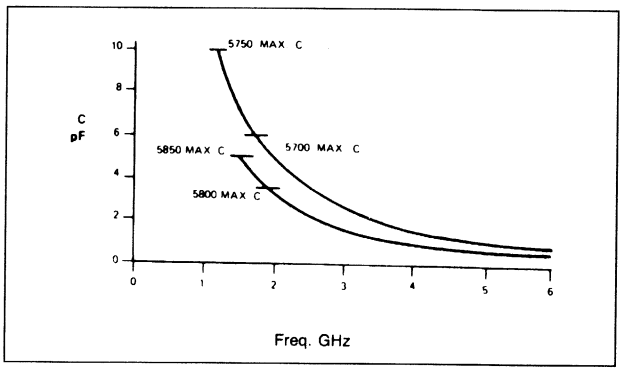
How to order

- With standard seal cap ex: AT5701
- With slotted seal cap add suffix S ex: AT5701 S

Q factor versus frequency



Self-resonant frequency



VERTICAL MOUNT TRIMMER

Air capacitors

TEKELEC TEMEX

Characteristics

Range	See table	
Δ Cvs Rotation	See graph page 21 - 23	
Voltage	Rated 250 VDC Test 500 VDC	Typical breakdown @ sea level > 800 VDC
Min. Q @ 100 MHz	To > 10000, see graph p. 10/21-23	Measured at max. capacitance
Operating temperature	-55° C to +125° C	Stable over full range
Thermal shock	-55° C to +125° C	MIL-C-14409D
Temperature coefficient	See table	Measured at 75% max. capacitance

Torque	T_1 70 to 360 cN.cm T_2 22 to 220 cN.cm T_2 30 to 290 cN.cm	
Rotational life	> 800 revolutions	Equivalent to MIL-C-14409D
Insulation resistance	$>10^6$ MΩ @ 500 VDC	Measured at 25° C and 50% RH
Contact resistance	< 0.01 Ω	Low dynamic noise
Self-resonant frequency	To > 5 GHz See graph p. 10-21	Suitable to «S» band applications
Vibration	60 g 10 - 2000 Hz	MIL-STD-202 E Method 204 C
Shock	1500 g 0.5 ms	MIL-STD-202 E Method 213 B

Figure 1

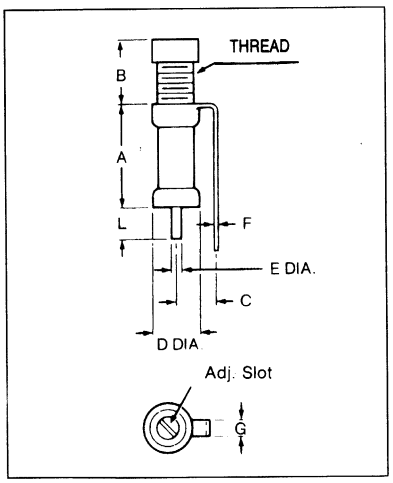


Figure 2

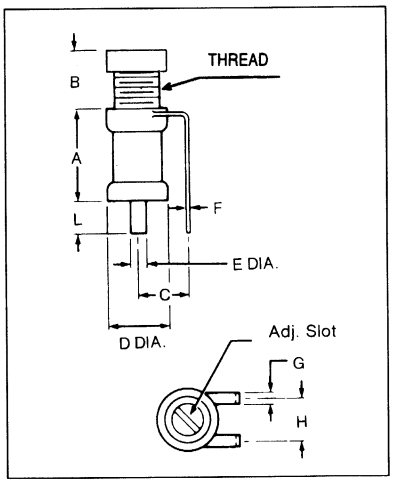


Figure 3

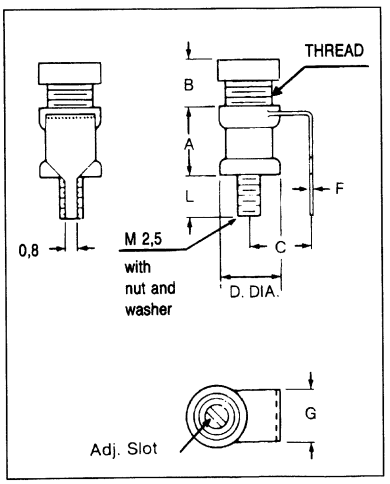


Figure 4

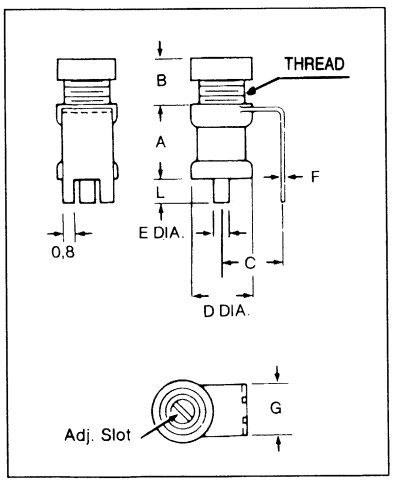


Figure 5

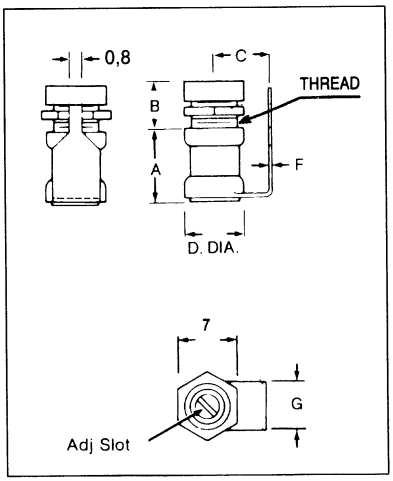
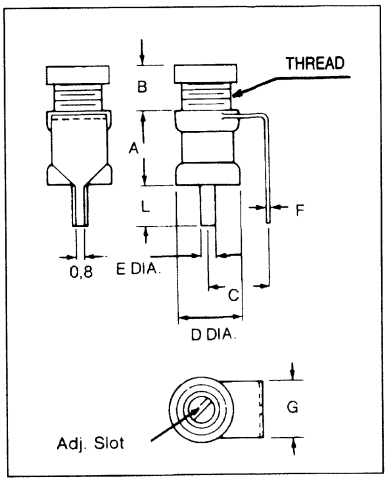


Figure 6



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Vertical mount, Standard & extended range

Tekelec Part N°	Q factor at 100 MHz	Capacitance range (pF)	Temperature coefficient (ppM/°C)	Torque
AT8052	> 5000	1.5 - 10	0 ± 15	T_1
AT5276	> 5000	1.5 - 10	0 ± 15	T_1
AT8053	> 3000	1.5 - 14	0 ± 25	T_1
AT5476	> 3000	1.5 - 14	0 ± 30	T_1
AT5453	> 3000	1.5 - 16	0 ± 50	T_1
AT8054	> 1500	1.5 - 20	0 ± 30	T_1
AT5553	> 1000	1.5 - 25	0 ± 50	T_1

Dimensions (mm)

Fig.	A	B	C	D	E	F	G	H	L	Thread
1	7.5	5.6	5.2	7.6	1.6	0.4	1		2.8	15/64-4
2	7.5	5.6	5.2	7.6	1.6	0.4	1	5.6	2.8	15/64-4
1	7.5	5.6	5.2	7.6	1.6	0.4	1		2.8	15/64-4
2	7.5	5.6	5.2	7.6	1.6	0.4	1	5.6	2.8	15/64-4
2	7.5	5.6	5.2	7.6	1.6	0.4	1	5.6	2.8	15/64-4
1	14.7	4.4	5.2	8.0	1.6	0.4	1		2.8	15/64-4
1	14.7	4.4	5.2	8.0	1.6	0.4	1		2.8	15/64-4

Vertical mount, Miniature

Tekelec Part N°	Q factor at 100 MHz	Capacitance range (pF)	Temperature coefficient (ppM/°C)	Torque
AT8051	> 10000	0.6 - 3.5	0 ± 50	T_2
AT5853	> 7500	0.7 - 5	0 ± 50	T_2
AT8050	> 10000	0.8 - 6	0 ± 15	T_3
AT5753	> 7500	1.2 - 10	0 ± 50	T_3

Dimensions (mm)

Fig.	A	B	C	D	E	F	G	H	L	Thread
1	7.0	5.6	3.2	4.6	0.8	0.25	0.5		2.8	.120 - 80
1	7.0	6.6	3.2	4.6	0.8	0.25	0.5		2.8	.120 - 80
1	7.3	5.1	4	6.2	1.1	0.4	0.8		3	10-64
2	7.3	5.8	4	6.2	1.1	0.4	0.8	4	3	10-64

Vertical mount, Low inductance

Tekelec Part N°	Q factor at 100 MHz	Capacitance range (pF)	Temperature coefficient (ppM/°C)	Torque
AT8090	> 2000	1.5 - 10	0 ± 20	T_1
AT8091	> 2000	1.5 - 14	0 ± 25	T_1
AT8092	> 2000	1.5 - 14	0 ± 25	T_1
AT8093	> 2000	1.5 - 14	0 ±30	T_1

Dimensions (mm)

Fig.	A	B	C	D	E	F	G	H	L	Thread
3	7.5	5.6	7.2	7.6		0.4	6.4		4.8	15/64-64
5	7.7	4.7	7.2	7.6		0.4	6.4			15/64-64
4	7.5	5.6	7.2	7.6	1.6	0.4	6.4	5.5	2.8	15/64-64
6	7.5	5.6	7.2	7.6	1.6	0.4	6.4		2.8	15/64-64

Note 1 : All models supplied with sealing cap.
Note 2 : B. Dimension is increased by 0.8 mm with slotted seal cap.
Note 3 : For Tap sizes and ref. numbers, consult page 10-36
Note 4 : For special and custom design models, consult page 10-35
Note 5 : For fixing hole layout tolerances and dimensions, consult page 10-40

How to order

- With standard seal cap — Ex. : AT5853
- With slotted seal cap add suffix S — Ex. : AT5853 S

M SERIES TRIMMER CAPACITORS

Description

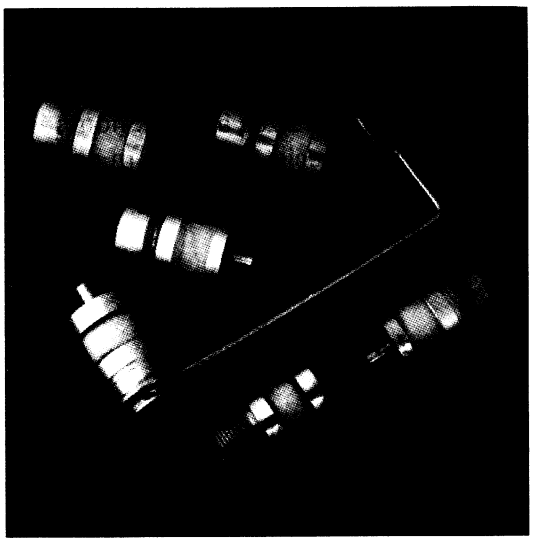
- **M Series** air trimmer capacitors are new generation trimmers specially designed and developed by TEKELEC TEMEX to answer commercial and high volume applications needs.
- **M Series** incorporate the self locking constant torque drive mechanism which insures uniform torque, high Q and low dynamic tuning noise.
- The AT M120 series design results in the rotor and stator is of one part construction. With a resolution of 1 pF per turn, this series is designed for HF applications and offers a significant advantage for accurate adjustment in circuit tuning.
- Using the same assembly process, and completing the serie AT M220, AT M320 and AT M420 series with press fitted tubes were designed.

Features

- High Q factor
- Excellent tuning stability and low tuning noise
- Low temperature coefficient
- Working voltage 200 VDC, test 400 VDC
- Fine tuning resolution

Applications

- Commercial applications
- CATV
- Radiotelephone



SALES OFFICES WEB SITE: http://www.tekelec-temex.com

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FRANCE: +33 (0) 1 49884900 ITALY: +39 (0) 2 58 01 91 06 SPAIN: +34 (0) 1 3204160 UK: +44 (0) 1256 883340

Characteristics

Range	See table	See curve
Δ Cvs Rotation	See curve	Linear over wide range
Voltage	Rated 200 VDC Test 400 VDC	Typical breakdown @ sea level > 800 VDC
Min. Q @ 100 MHz	See table	Measured at max. capacitance
Operating temperature	-40° C to +85° C	Stable over full range
Thermal shock	-40° C to +85° C	
Temperature coefficient	See table	Measured at 75% max. capacitance

Torque	70 to 360 cN.cm	
Rotational life	> 600 revolutions	
Insulation resistance	>10⁴ MΩ @ 400 VDC	Measured at 25° C and 50% RH
Contact resistance	< 0.01 Ω	Low dynamic noise
Self-resonant frequency	See curve	> 2 GHz
Vibration	60 g 10 - 2000 Hz	MIL-STD-202 E Method 204 C
Shock	1500 g 0.5 ms	MIL-STD-202 E Method 213 B

Technical data

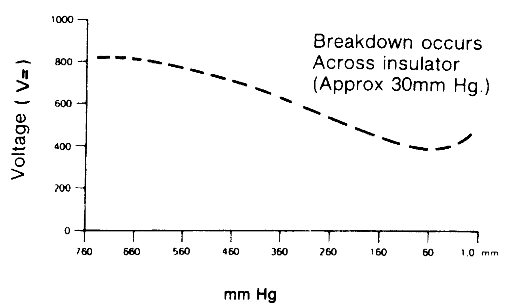
Tekelec Part N°	Color Code	Q factor at 100 MHz	Capacitance range (pF)	Temperature coefficient (ppM/°C)
AT M120	White	> 2000	1.2 - 7	50 ± 50
AT M121	White	> 2000	1.2 - 7	50 ± 50
AT M122	White	> 2000	1.2 - 7	50 ± 50
AT M123	White	> 2000	1.2 - 7	50 ± 50
AT M220	Green	> 2000	0.9 - 7.5	0 ± 50
AT M221	Green	> 2000	0.9 - 7.5	0 ± 50
AT M222	Green	> 2000	0.9 - 7.5	0 ± 50
AT M223	Green	> 2000	1.5 - 7.5	0 ± 50
AT M320	Red	> 2500	1 - 10	0 ± 50
AT M321	Red	> 2500	1 - 10	0 ± 50
AT M322	Red	> 2500	1 - 10	0 ± 50
AT M323	Red	> 2500	1 - 10	0 ± 50
AT M420	Blue	> 1500	1.4 - 14	0 ± 50
AT M421	Blue	> 1500	1.4 - 14	0 ± 50
AT M422	Blue	> 1500	1.4 - 14	0 ± 50
AT M423	Blue	> 1500	1.4 - 14	0 ± 50

Dimensions (mm)

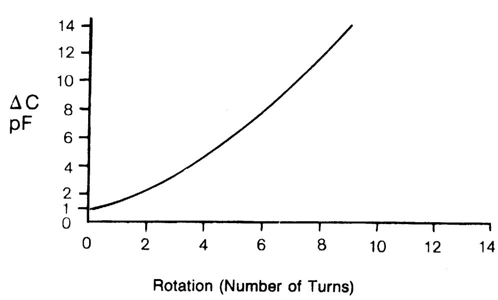
Fig.	A	B	C	D	E	F	G
1	7.8	4.6		7		Ø 6x0.5	5.8
2	8.2	4.2	7.6	7	7.9		5.8
3	7.2	4.6	2.8	7		Ø 6x0.5	5.8
4	7.6	4.2	5.2	7	2.8		5.8
1	8.1	4.6		7		Ø 6x0.5	5.8
2	8.5	4.2	7.9	7	7.9		5.8
3	7.8	4.6	2.8	7		Ø 6x0.5	5.8
4	8.2	4.2	5.2	7	2.8		5.8
1	8.1	4.6		7		Ø 6x0.5	5.8
2	8.5	4.2	7.9	7	7.9		5.8
3	7.8	4.6	2.8	7		Ø 6x0.5	5.8
4	8.2	4.2	5.2	7	2.8		5.8
1	8.1	4.6		7		Ø 6x0.5	5.8
2	8.5	4.2	7.9	7	7.9		5.8
3	7.8	4.6	2.8	7		Ø 6x0.5	5.8
4	8.2	4.2	5.2	7	2.8		5.8

M series trimmers, models N° AT MX20 and AT MX22, are available with 15/64-64 threaded bushing with 7 mm hex nut 1 mm thick.

Breakdown voltage versus altitude



ΔC versus rotation



M SERIES TRIMMER

Air capacitors

Figure 1

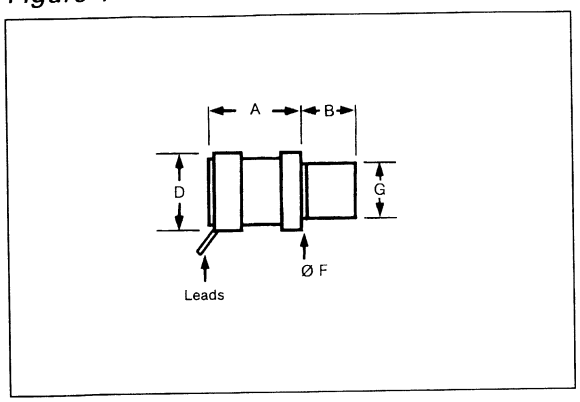


Figure 2

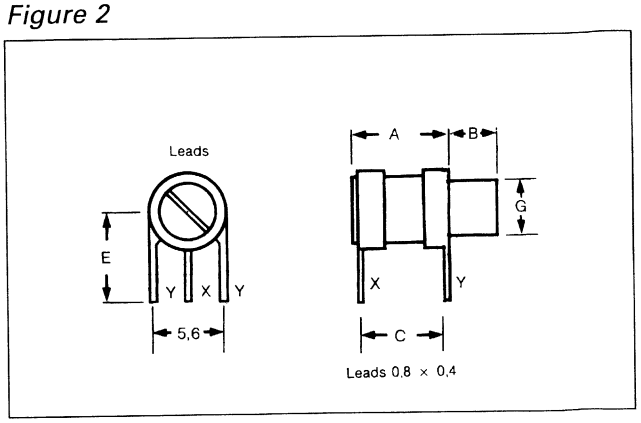


Figure 3

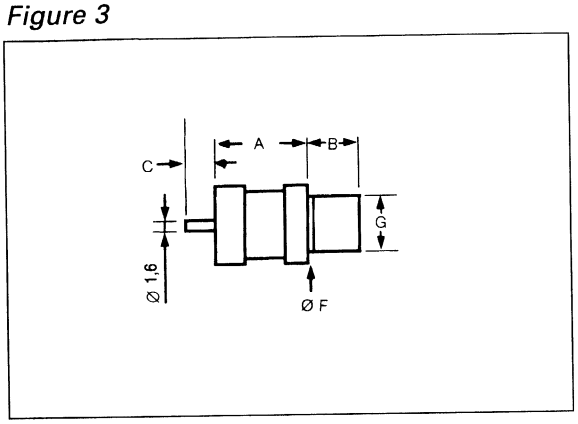
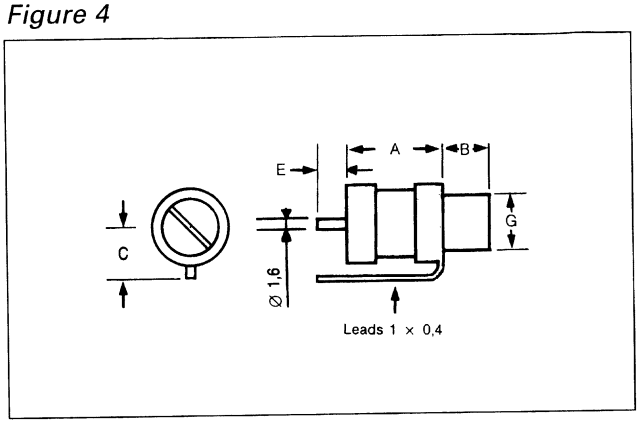


Figure 4

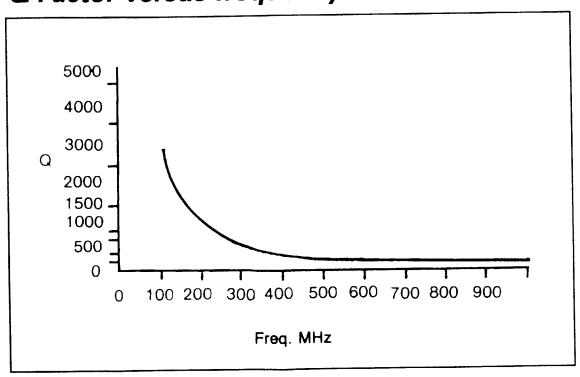


Note 1 : For fixing hole layout tolerances and dimensions, consult page 10-40
Note 2 : For Tap sizes and ref. numbers, see page 10-36
Note 3 : For special and custom design models, consult 10-35
Note 4 : For panel mounting version (with nut) minimum circuit thickness: 0.8 mm

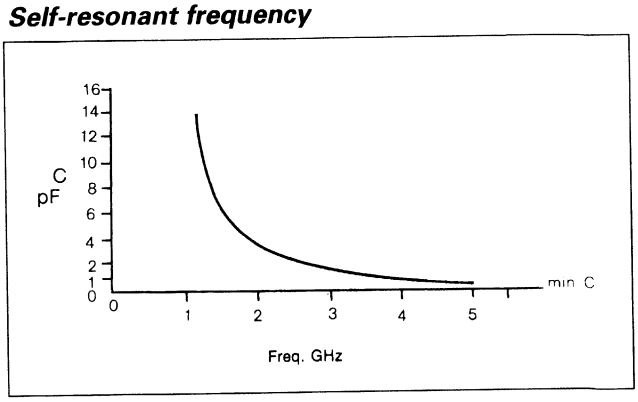
How to order

- Standard M series trimmer — ex: AT M122
- M series with threaded bushing and nut — ex: AT M122 THR

Q Factor versus frequency



Self-resonant frequency



MICROWAVE TUNING ELEMENTS

Selection guide

GENERAL MATTERS

Description

Microwave tuning elements are an economical means of introducing variable reactance to waveguides, cavities and other microwave structures. They are excellent for applications requiring precision, low loss high resolution tuning. The self-locking, constant torque drive mechanism eliminates the need for locking nuts and assures stable, noise free adjustment in application from DC to W band.

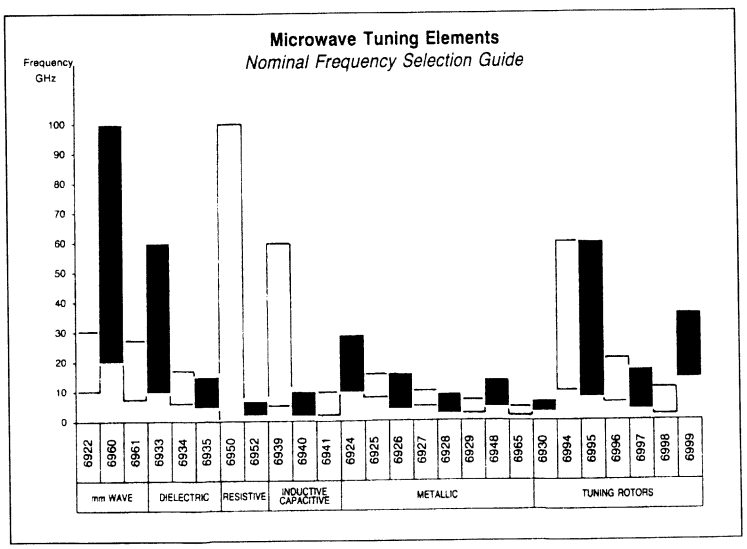
A microwave tuning element consists of a mounting bushing with an integral tuning rotor.

Features

- High tuning resolution
- Excellent tuning stability and very low dynamic noise
- Frequency range from 0 to 100 GHz and more
- Easy to use, one hand tuning
- Gold and chromate finish (other plating upon request)
- Metallic, dielectric and resistive types available
- All tuning rotors available separatly
- High reliability versions available upon request

Applications

- Combline filters - Interdigital filters
- Impedance transformers - Attenuators
- Impatt and Gunn oscillators
- Microstrip and strip-line circuits
- Coaxial structures - Waveguide circuitry



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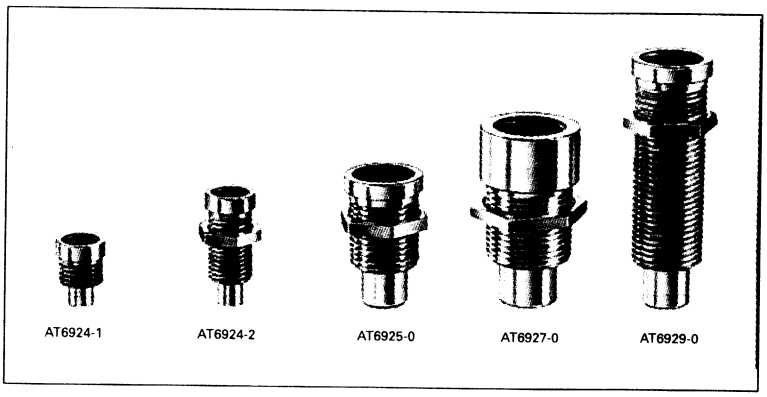
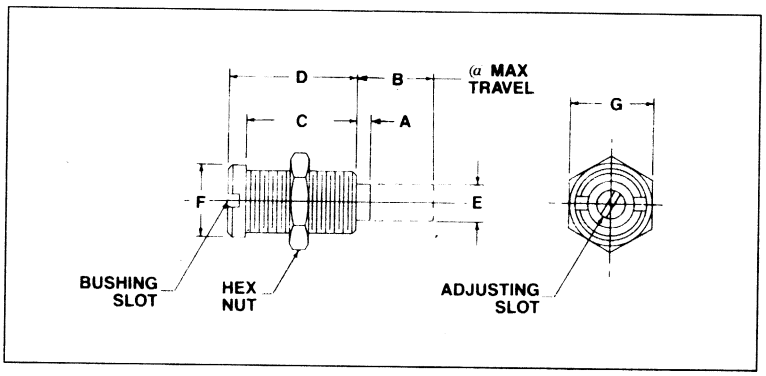
A - BUSHING WITH METALLIC ROTOR

Tuning elements with metallic posts are simple and straight-forward in design. Each tuning unit consits of two parts, a threaded mounting bushing and a self-locking rotor screw that won't vibrate loose. Noise free, low resistance contacting is maintained between both parts by the «spring loaded» webbing which forces the threads together. High Q tuning is possible from the smooth, short, non threaded slug with less exposed surface area than with standard screws.





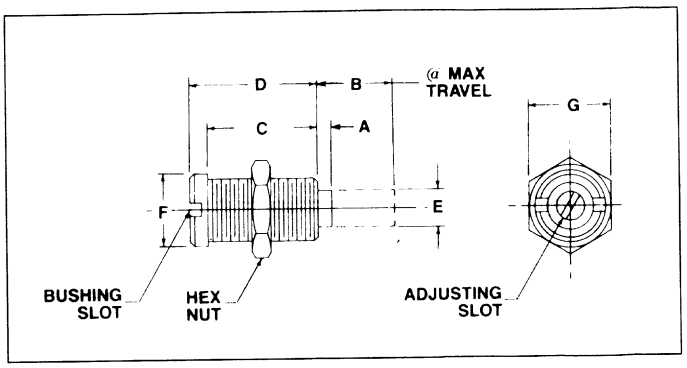
Technical data

Dimensions (mm)

Tekelec Part N°	Nominal frequency band	Bushing thread	Tap reference	Typ. tap drill	Mounting torque g. cm	A	B	C	D	E	F	G
AT6924-0 SL	X and K	.120 - 80	7060	2.75	700	0	3.8	5.1	6.0	1.8	3.4	4.0
AT6924-1 SL	X and K	.120 - 80	7060	2.75	700	1.2	1.9	2.2	3.1	1.8	3.4	4.0
AT6924-2 SL	X and K	.120 - 80	7060	2.75	700	0	1.9	5.1	6.0	1.8	3.4	4.0
AT6924-3 SL	X and K	.120 - 80	7060	2.75	700	0	0.8	2.2	3.1	1.8	3.4	4.0
AT6925-0 SL	C and X	10 - 64	7061	4.45	2100	0	3.8	5.4	6.4	3.2	5.3	5.6
AT6925-1 SL	C and X	10 - 64	7061	4.45	2100	0	0.6	2.2	3.2	3.2	5.3	5.6
AT6925-2 SL	C and X	10 - 64	7061	4.45	2100	0	3.2	5.4	6.4	1.6	5.3	5.6
AT6925-3 SL	C and X	10 - 64	7061	4.45	2100	3.3	7.1	5.4	6.4	3.2	5.3	5.6
AT6925-7 SL	C and X	10 - 64	7061	4.45	2100	1.1	4.9	5.4	6.4	3.2	5.3	5.6
AT6925-8 SL	C and X	10 - 64	7061	4.45	2100	0.2	2.0	3.2	4.2	3.2	5.3	5.6
AT6925-9 SL	C and X	10 - 64	7061	4.45	2100	0	2.3	6.6	7.6	3.2	5.3	5.6
AT6926-0 SL	C and X	15/64 - 64	7062	5.55	3500	0	2.7	4.6	5.4	4.1	6.8	7.0
AT6926-1 SL	C and X	15/64 - 64	7062	5.55	3500	0	0.7	2.4	3.2	4.1	6.8	7.0
AT6926-4 SL	C and X	15/64 - 64	7062	5.55	3500	2.3	8.8	5.5	9.1	4.1	6.8	7.0
AT6926-5 SL	C and X	15/64 - 64	7062	5.55	3500	0.6	2.7	4.0	4.8	4.1	6.8	7.0
AT6926-6 SL	C and X	15/64 - 64	7062	5.55	3500	2.6	11.5	5.4	11.5	4.1	6.8	7.0
AT6926-7 SL	C and X	15/64 - 64	7062	5.55	3500	1.9	4.6	4.6	5.4	4.1	6.8	7.0
AT6926-8 SL	C and X	15/64 - 64	7062	5.55	3500	0.5	2.7	4.0	4.8	4.1	6.8	7.0
AT6926-9 SL	C and X	15/64 - 64	7062	5.55	3500	0	2.7	5.5	9.1	4.1	6.8	7.0
AT6926-10 SL	C and X	15/64 - 64	7062	5.55	3500	0	4.6	5.5	9.1	4.1	6.8	7.0
AT6927-0 SL	C and X	15/64 - 64	7062	5.55	3500	0	6.5	5.5	9.1	4.1	6.8	7.0
AT6928-0 SL	C	15/64 - 64	7062	5.55	3500	0	8.8	5.4	11.5	4.1	6.8	7.0
AT6928-2 SL	C	15/64 - 64	7062	5.55	3500	6.1	8.8	4.6	5.4	4.1	6.8	7.0
AT6929-0 SL	C	10 - 64	7061	4.45	2100	0	11.4	13.0	14.0	3.2	5.3	5.6
AT6948-0 SL	C and X	.312 - 64		7.55	8400	0	5.9	8.2	9.2	5.3	9.5	10
AT6965-0 SL	L and S	.469 - 32		11.10	16800	0	12.7	17.3	18.3	8.8	13.5	14.2

B - BUSHING WITH POWER ABSORBENT ROTOR

The AT6950 series tuning elements are unique in that they absorb varying amounts of microwave power. The amount of power absorbed depends on the insertion of the slug into the waveguide or cavity. When properly mounted in the input or the output ports of microwave amplifiers, oscillators, etc., they may provide the test engineer a convenient means to trim the microwave power. The slug material is a magnetically loaded epoxide rod, chosen for its broadband lossy properties.



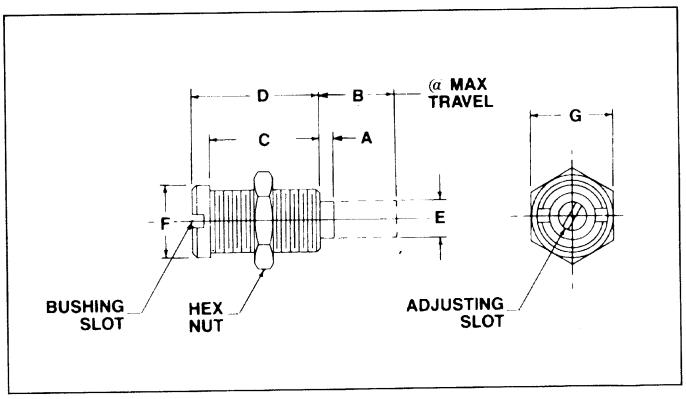
Technical data

Dimensions (mm)

Tekelec Part N°	Nominal frequency band	Bushing thread	Tap reference	Typ. tap drill	Mounting torque g. cm	A	B	C	D	E	F	G
AT6950-0 SL	Broad Band	.120 - 80	7060	2.75	700	0.6	4.3	5.1	6.0	1.6	3.4	4.0
AT6950-1 SL		.120 - 80	7060	2.75	700	0	3.3	5.1	6.0	2.0	3.4	4.0
AT6952-0 SL		15/64 - 64	7062	5.55	3500	0	6.4	5.5	9.1	3.9	6.8	7.0

C - BUSHING WITH DIELECTRIC ROTOR

Dielectric tuning elements are used whenever the ultimate is required in high frequency low loss tuning. When a dielectric rod is introduced into a microwave cavity, the cavity «appears» electrically larger and the resonant frequency is lowered. This change in resonant frequency is dependent on the depth of dielectric rod insertion, the dissipation factor (DF) which must be kept low to minimize circuit loss, the dielectric constant (K) of the material for tuning resolution, the diameter of the rod and its placement in the circuit. Ideal applications are Gunn diode and impatt oscillators.



Technical data

Dimensions (mm)

Tekelec Part N°	Rod mat.	Nominal frequency band	Bushing thread	Tap reference	Typ. tap drill	Mounting torque g. cm	A	B	C	D	E	F	G
AT6933-0 SL	S	X and K	.120 - 80	7060	2.75	700	0.8	4.3	5.1	6.0	1.6	3.4	4.0
AT6933-1 SL	S	X and K	.120 - 80	7060	2.75	700	0.8	3.3	5.1	6.0	0.9	3.4	4.0
AT6933-2 SL	Q	K	.120 - 80	7060	2.75	700	0.6	4.3	5.1	6.0	1.6	3.4	4.0
AT6934-0 SL	S	C,X and K	15/64 - 64	7062	5.55	3500	0.8	3.0	4.6	5.4	3.9	6.8	7.0
AT6935-0 SL	S	X and K	15/64 - 64	7062	5.55	3500	0.8	6.8	5.5	9.1	3.9	6.8	7.0

	Rod material	Approximate K @ 10 GHz	Approximate DF @ 10 GHz
S	SAPPHIRE	9.9	0.0001
Q	QUARTZ	3.8	0.0001
A	ALUMINA	9.7	0.0002

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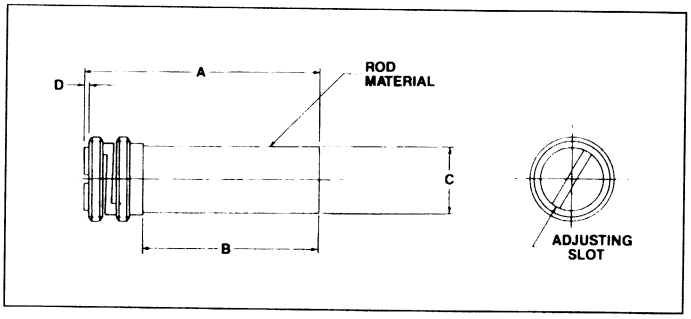
D - TUNING ROTOR

Extended range high Q dielectric and metallic rotors are used where direct insertion of the tuning element is desired.
Taps designed specifically to insure proper fit are available from the factory and are listed below.

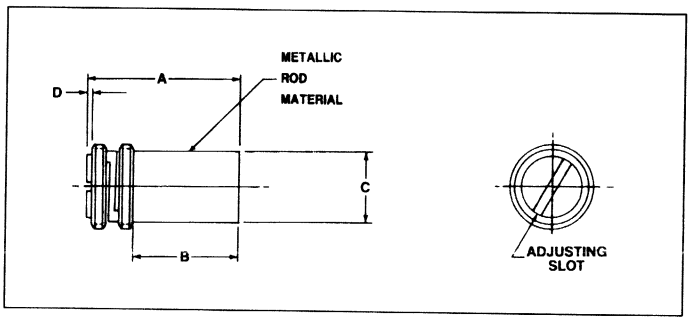


Dielectric rotors

Technical data *Dimensions (mm)*

Tekelec Part N°	Rod material	Thread UNS-2A	Tap reference	Typ. tap drill	A	B	C	D	Slot W x L
AT6930-3	Alumina	10 - 64	7061	4.45	12.1	8.8	3.9	0.3	0.5 x 3.7
AT6930-4	Sapphire	3/32 - 80	7064	2.05	5.8	2.5	0.9	0.5	0.4 x 1.5
AT6930-8	Sapphire	3/32 - 80	7064	2.05	6.6	3.5	1.6	0.5	0.4 x 1.5

Other dielectric materials available upon request



Metallic Rotors

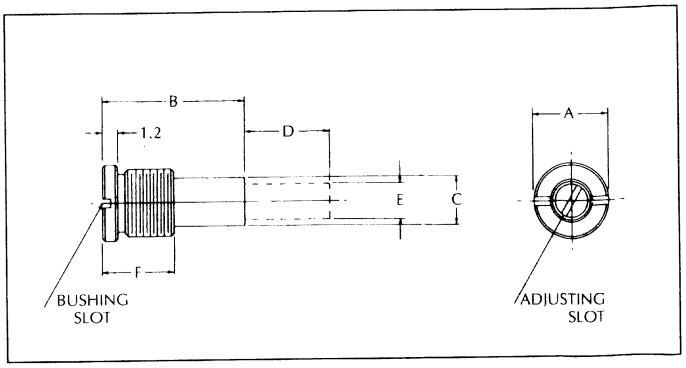
Technical data *Dimensions (mm)*

Tekelec Part N°	Rod material	Thread	Tap reference	Typ. tap drill	A	B	C	D	Slot W x L
AT6501-3	Brass	M 1.5 x 0.25	AT7071	1.25	4.4	2.3	1.1	0.4	0.25 x 1.10
AT6501-0	Brass	M 2.5 x 0.25	AT7070	2.25	5.4	3.3	2.1	0.4	0.4 x 1.90
AT6501-1	Brass	M 2.5 x 0.25	AT7070	2.25	4.4	2.3	2.1	0.4	0.4 x 1.90
AT6501-2	Brass	M 2.5 x 0.25	AT7070	2.25	7.7	5.6	2.1	0.4	0.4 x 1.90
AT6995-0	Brass	3/32 -80	AT7064	2.05	3.1	0.8	1.8	0.5	0.4 x 150
AT6995-1	Brass	3/32 -80	AT7064	2.05	4.2	1.9	1.8	0.5	0.4 x 150
AT6995-2	Brass	3/32 -80	AT7064	2.05	6.1	3.8	1.8	0.5	0.4 x 150
AT6996-0	Brass	5/32 - 64	AT7059	3.55	5.8	3.2	1.6	0.25	0.50 x 3.0
AT6996-1	Brass	5/32 - 64	AT7059	3.55	6.4	3.8	3.2	0.25	0.50 x 3.0
AT6996-2	Brass	5/32 - 64	AT7059	3.55	9.7	7.1	3.2	0.25	0.50 x 3.0
AT6996-3	Brass	5/32 - 64	AT7059	3.55	14.0	11.4	3.2	0.25	0.50 x 3.0
AT6996-4	Brass	5/32 - 64	AT7059	3.55	3.2	0.6	3.2	0.25	0.50 x 3.0
AT6996-5	Brass	5/32 - 64	AT7059	3.55	7.5	4.9	3.2	0.25	0.50 x 3.0
AT6996-6	Brass	5/32 - 64	AT7059	3.55	4.6	2.0	3.2	0.25	0.50 x 3.0
AT6996-8	Brass	5/32 - 64	AT7059	3.55	4.9	2.3	3.2	0.25	0.50 x 3.0
AT6997-0	Brass	10 - 64	AT7061	4.45	14.1	11.5	4.1	0.3	0.50 x 3.70
AT6997-1	Brass	10 - 64	AT7061	4.45	5.3	2.7	4.1	0.3	0.50 x 3.70
AT6997-2	Brass	10 - 64	AT7061	4.45	9.1	6.5	4.1	0.3	0.50 x 3.70
AT6997-3	Brass	10 - 64	AT7061	4.45	11.4	8.8	4.1	0.3	0.50 x 3.70
AT6997-4	Brass	10 - 64	AT7061	4.45	3.3	0.7	4.1	0.3	0.50 x 3.70
AT6997-5	Brass	10 - 64	AT7061	4.45	7.2	4.6	4.1	0.3	0.50 x 3.70

Other materials available upon request

E - HIGH Q WIDE BAND LC TUNING ELEMENTS

A variation of the metallic element for high Q wide band tuning applications is the LC post configuration. This design is the same as the standard metallic units with the tuning post extended and is available in the standard lenghts listed. A typical application is a direct-coupled TEM mode coaxial configuration. A post length is selected to cover the desired range... A circuit is then designed around the tunable post so that each section approximates 76 Ω for optimum resonator Q and best selectivity.



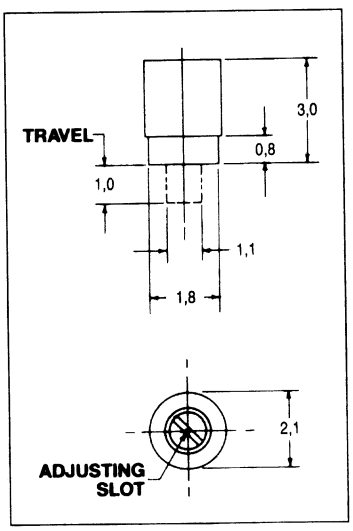
Technical data

Dimensions (mm)

Tekelec Part N°	Nominal frequency GHz	External thread	Tap reference	Typ. tap drill	Mounting torque g.cm	A	B	C	D	E	F
AT6939-0	6 - 10	5/32 - 64	7059	3.55	1400	4.7	9.0	3.0	3.7	1.8	5.9
AT6939-2	6 - 10	5/32 - 64	7059	3.55	1400	4.7	12.2	3.0	3.7	1.8	5.9
AT6939-9	5 - 6.5	5/32 - 64	7059	3.55	1400	4.7	15.3	3.0	3.7	1.8	3.9
AT6940-1	4 - 7	15/64 - 64	7062	5.55	3500	6.7	14.1	4.3	11.4	3.2	5.9
AT6941-1	2 - 3	1/4 - 64	7063	5.95	6300	7.1	31.3	5.3	8.8	4.1	5.9
AT6941-2	1.5 - 2	1/4 - 64	7063	5.95	6300	7.1	40.2	5.3	8.8	4.1	5.9

F - MICROWAVE TUNING ELEMENTS

The millimeter wave tuning elements are higher frequency versions of both the metallic and dielectric tuning elements described in this catalog. Please contact TEKELEC TEMEX for furter information.



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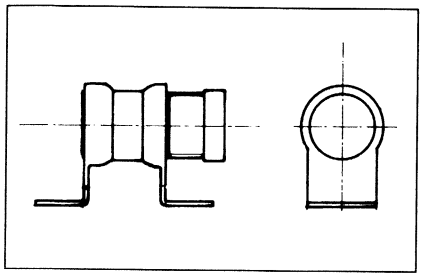
CUSTOM DESIGNS

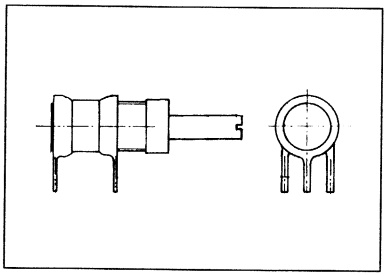
- TEKELEC TEMEX can manufacture custom design Frequency Tuning Components when standard types do not meet exact customer needs.

- Special models have been designed to make mounting or tuning easier, to increase capacitance range, etc... to answer customers individual requirements. Don't hesitate to consult us about the required specifications for your particular application. Some special models are shown hereunder.

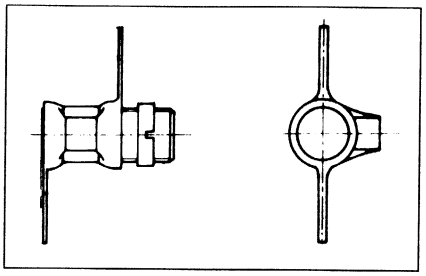
Air trimmer capacitors



TL 133 Strip-line

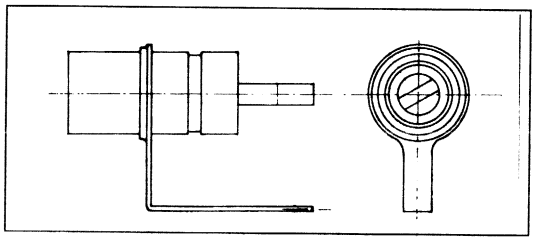


Insulating shaft TL 160

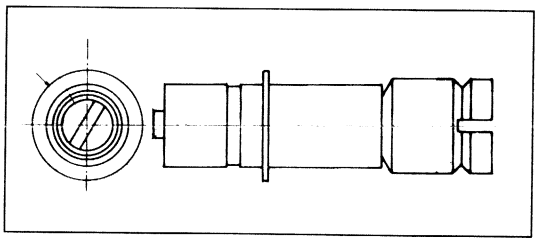


Extended range with HQ chips TL 172

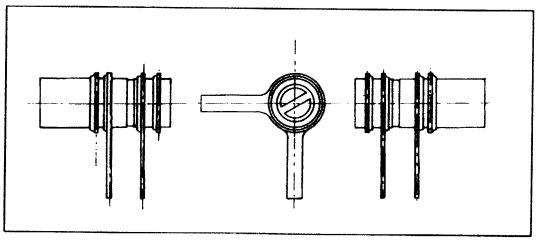
Sapphire trimmer capacitors



Vertical mounting TG 009

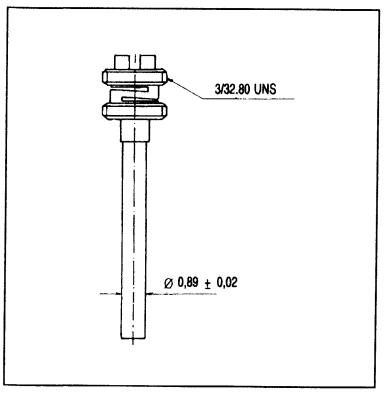


Special design with sealing cap TG 030

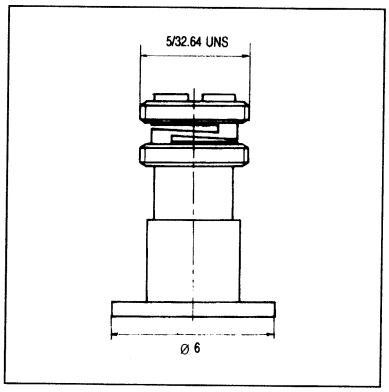


Special 4 leads TG 038

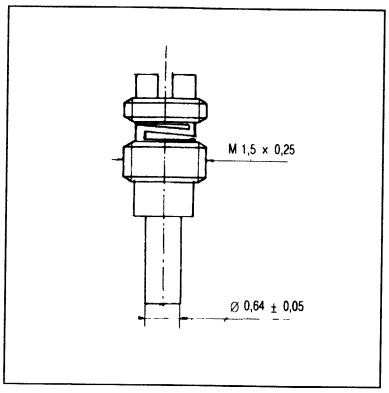
Microwave tunning elements



Miniature sapphire rod TU 047



Metallic disk TU 071

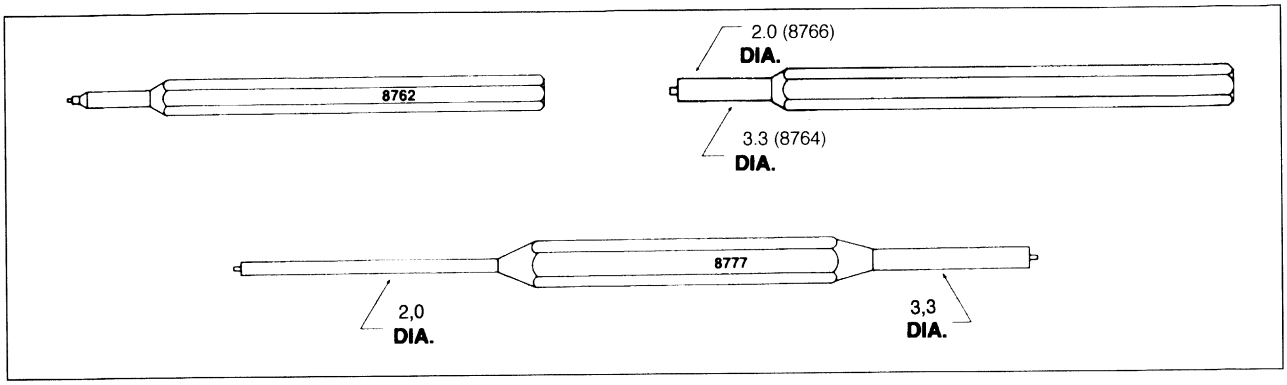


Miniature metallic screw TU 101

TUNING TOOLS, TAPS

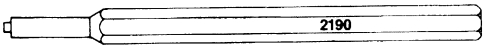
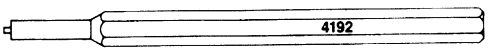
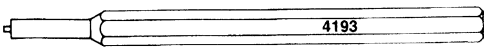
TUNING TOOLS

- **Slot tuning tools**



Tekelec Part N°	APPLICATION	
AT8762	AT(x) 7260 Gigahertz trimmers Series AT6922 Tuning elements	
AT8764	3.3 DIA Standard Air Series AT5700 Miniature Series	
AT8766	2.0 DIA AT(x) 7270, 80 90 Gigahertz trimmers Series AT5800 Miniature Air Series	
AT8777	3.3 DIA Standard Air Series AT5700 Miniature Series	2.0 DIA AT(x) 7270, 80 90 Gigahertz trimmers Series AT5800 Miniature Air Series

- **Square drive tuning tools**

Tekelec Part N°	APPLICATION	
AT2190	AT9690 Sealed trimmers Series	
AT4192	AT9401, AT9402 } Thin trimmers Series AT9620, AT9630 } Sealed trimmers Series AT2320 Ceramic trimmers	
AT4193	AT9410 Thin trimmers Series AT9610 Sealed trimmers Series	

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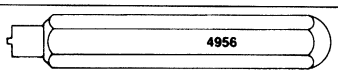
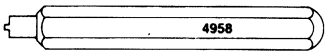
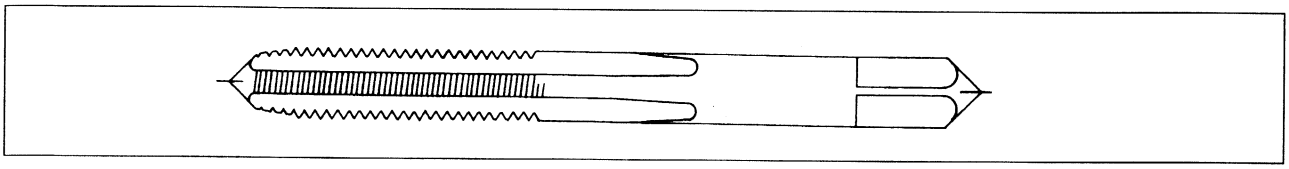
- **Round nut wrenches**

Tekelec Part N°	APPLICATION	
AT4958	5800 Miniature Air Series	
AT4956	5700 Miniature Air Series	

Taps



Tekelec Part N°	THREAD SIZE UNS-2	RECOMMENDED TAP DRILL
AT7057	.200 - 80	4.75
AT7059	5/32 - 64	3.55
AT7060	.120 - 80	2.75
AT7061	10 - 64	4.45
AT7062	15/64 - 64	5.55
AT7063	1/4 - 64	5.95
AT7064	3/32 - 80	2.05
AT7070	M 2.5 x 0.25	2.25
AT7071	M 1.5 x 0.25	1.25

HARDWARE

		TEKELEC TEMEX PART NUMBER		
		MOUNTING THREAD UNS-2		
		15/64 - 64	10 - 64	.120 - 80
	Insulated Adapters	AT6515	AT6516	AT6517
	Insulated Bushings	AT8705	AT8702	AT8701
	Slotted Seal Cap	AT4613	AT6486	AT6487
	Lock Washer	AT1999	AT1994	AT1993
	Round Nut	AT6546	AT4825	AT4680
	Hex Nut	AT3469	AT4537	AT6389

	Removable sealing cap	AT69800	For Gigahertz trimmers AT727, AT728 and AT729 series
	Permanent sealing cap	AT69600	For Gigahertz trimmers ATX726 series
	Permanent sealing cap	AT69700	For Gigahertz trimmers ATX727, ATX728 and ATX729 series

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PRECAUTION OF USE

General

TEKELEC TEMEX variable capacitors and microwave tuning elements are precision components and may require specific handling during installation and adjustments. If these simple procedures are followed, your TEKELEC TEMEX component can be expected to provide you with trouble free service.

Mounting

- Use apropriate tuning tool
- Rotor should not be disassembled from stator
- Handle components with dry hands or finger stalls
- Capacitors should not be heated at temperature higher than:
  - Air trimmers : 235° C
  - Gigahertz trimmmers : 185° C

Maximum torques

The torques indicated in the following chart should not be exceeded on:

- Rotor stops (max. capac. position): (Rot Stop)
- Mounting nuts (Mnt Nut)
- Sealing caps (Seal)
- Note: 1 cN.cm ≠ 1 g.cm

AIR TRIMMERS Series	Rot Stop cN.cm	Mnt Nut cN.cm	Seal cN.cm
AT5200-5400-5450	500	5000	800
AT5500-5550-5600	500	5000	800
AT5300	600	7000	1000
AT5700-5750	400	3000	600
AT5800-5850	300	1000	300

GIGAHERTZ TRIMMER Series	Rot Stop cN.cm	Tuning Elements	Mnt Nut cN.cm
AT7260	80	AT6924-6933-6950 AT6925-6969	1000
AT7280	120	AT6926-6927-6928	3000
AT7270/90	150	AT6934-6935-6940-6952 AT6948	5000 7000

Cleaning

Air and Gigahertz trimmer capacitors without seal caps should be protected from intrusion of cleaning solvents on the internal bushing thread. It is recommended these units be installed after circuit boards have been cleaned. Units with seal caps may be immersed in liquid, vapor, and ultrasonic cleaning systems.

SMD thin trimmer capacitors should be cleaned in contamination free solvent. If rough torque occurs after cleaning, reclean in fresh solvent.

Sealed trimmer capacitors can withstand total immersion solvent cleaning in contamination free solvent. Excellent results have been obtained using water soluble flux and cleaning in an automatic dishwasher.

Soldering

Always use a low temperature solder (e.g. SN 63). When hand soldering, use a temperature controlled soldering iron set at 260° C maximum and make solder joints in 3 seconds or less; a 40 watts iron will be sufficient for most applications. Do not solder directly to the bushing or stator of an air capacitor. Protect all unsealed Air and Gigahertz trimmer capacitors from flux intrusion on the internal bushing thread.

Do not allow molten solder or hot soldering iron to contact the Sealed trimmer(s) capacitor housing. Do not remove the protective teflon washer from the base of these units.

Adjusting

Always use the recommended tuning tool. TEKELEC TEMEX tuning tools are designed specifically for tuning TEKELEC TEMEX products; use of other tools may damage the internal bushing thread causing the rotor to bind.

MOUNTING HOLES LAYOUT

Trimmer air capacitors

	Fig.	Ø1	Ø2	L	M
AT5200-5400-5450	A	6.2	-	-	-
AT5201-5401-5451	B	1.3	-	5.6	7.2
AT5202-5402-5452	A	6.2	-	-	-
AT5276-5476-5453	C	1.3	1.7	5.6	5.2
AT5300-5302	A	8.1	-	-	-
AT5301	B	1.3	-	7.9	11.1
AT5500-5550	A	6.2	-	-	-
AT5501-5551	B	1.3	-	5.6	14.2
AT5502-5552	A	6.2	-	-	-
AT5600-5602	A	6.2	-	-	-
AT5601	D	1.3	-	5.6	18.8
AT5700-5750	A	4.9	-	-	-
AT5701-5751	B	1.3	-	4.0	6.7
AT5702-5752	A	4.9	-	-	-
AT5753	B	1.3	-	4.0	4.0
AT5800-5850	A	3.2	-	-	-
AT5801-5851	E	1.3	1.3	-	6.5
AT5802-5852	A	3.2	-	-	-
AT5853	E	0.7*	1.0	-	3.2
AT8050	E	1.3	1.3	-	4.0
AT8051	E	0.7*	1.0	-	3.2
AT8052-8053-8054	E	1.3	1.7	-	5.2
AT8090	E	1.3	2.9	-	7.2
AT8091	C	1.3	6.2	-	7.2
AT8092	E	1.3	1.7	5.6	7.2
AT8093	A	1.3	1.7	-	7.2

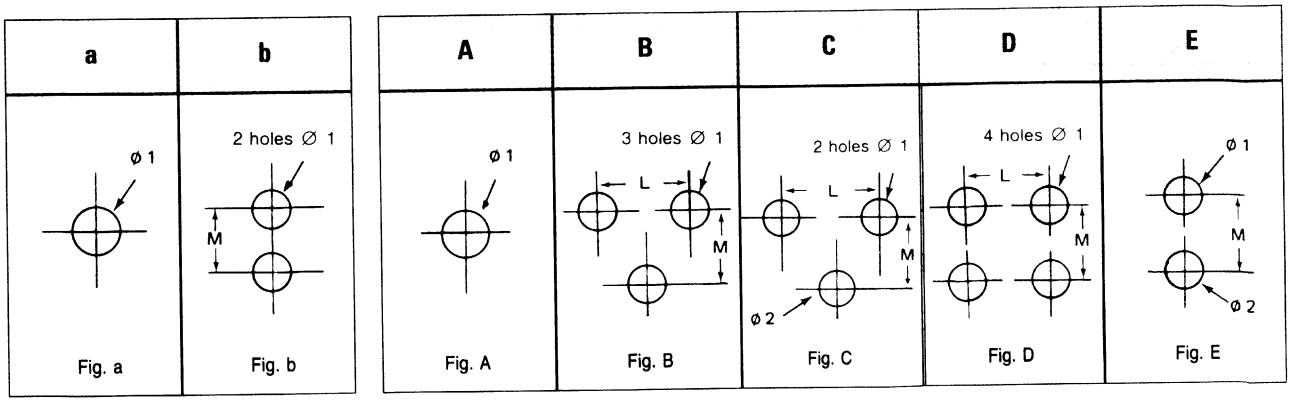
M Series capacitors

	Fig.	Ø1	Ø2	L	M
AT M120-220-320-420	A	6.2	-	-	-
AT M121	B	1.3	-	5.6	7.6
AT M122-222-322-422	A	6.2	-	-	-
AT M123-223-323-423	E	1.3	1.7	5.2	-
AT M221-321-421	B	1.3	-	5.6	7.9

Gigahertz trimmers

	Fig.	Ø	M
AT(x) 7261	b	1.2	2.0
AT(x) 7265	a	2.1	-
AT(x) 7269	b	1.2	3.0
AT(x) 7271	b	1.2	3.2
AT(x) 7275-85-95	a	3.2	-
AT(x) 7279-89-99	b	1.2	4.2
AT(x) 7281	b	1.2	2.0
AT(x) 7291	b	1.2	6.4

Dimensions are given in mm.
Tolerance ± 0.1 mm except if (*) ± 0.05 mm.



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PROTOTYPING KITS

• *SMD hermetic ceramic trimmer capacitor Kit KTT-023*

Quantity	Part Number	Capacity pF
4	AT2320-0	0.6 - 2.5
4	AT2320-1	1 - 5
4	AT2320-2	2.5 - 10
4	AT2320-3	5 - 18
4	AT2320-4	6.5 - 25
1	AT4192	Tuning tool

• *SMD thin trimmer capacitor Kit KTT-941 (3 mm)*

Quantity	Part Number	Capacity pF
5	AT9401-0	0.25 - 0.7
5	AT9401-1	0.5 - 1.3
5	AT9401-2	0.6 - 2
5	AT9401-4	1.5 - 4
1	AT4192	Tuning tool

• *SMD thin trimmer capacitor Kit KTT-942 (3 mm)*

Quantity	Part Number	Capacity pF
4	AT9402-0	0.25 - 2.5
4	AT9402-1	1 - 5
4	AT9402-2	2.5 - 10
4	AT9402-8	3 - 12
4	AT9402-6	6 - 25
4	AT9402-9	5 - 18
1	AT4192	Tuning tool

• *SMD thin trimmer capacitor Kit KTT-940 (5 mm)*

Quantity	Part Number	Capacity pF
5	AT9410-0	1 - 4.5
5	AT9410-1	2.5 - 10
5	AT9410-2	4 - 18
5	AT9410-3	6 - 35
1	AT4193	Tuning tool

• *Chip trimmer capacitor Kit KTT-0300*

Quantity	Part Number	Capacity pF
5	AT0303	1.5 - 3
5	AT0306	2 - 6
5	AT0308	3 - 8
5	AT0310	2 - 10
5	AT0315	3 - 15
5	AT0320	4.5 - 20
5	AT0330	5.5 - 30

• *Chip trimmer capacitor Kit KTT-1300*

Quantity	Part Number	Capacity pF
5	AT1303	1.5 - 3
5	AT1306	2 - 6
5	AT1308	3 - 8
5	AT1310	2 - 10
5	AT1315	3 - 15
5	AT1320	4.5 - 20

• *Gigahertz trimmer capacitor Kit KTT-272*

Quantity	Part Number	Capacity pF
3	AT27261	0.3 - 1.2
3	AT27263	0.3 - 1.2
3	AT27271	0.6 - 4.5
3	AT27284	0.4 - 2.5
3	AT27285	0.4 - 2.5
3	AT27291	0.8 - 8.0
1	AT8762	Tuning tool
1	AT8777	Tuning tool

• *Gigahertz trimmer capacitor Kit KTT-372*

Quantity	Part Number	Capacity pF
3	AT37261	0.3 - 1.2
3	AT37263	0.3 - 1.2
3	AT37271	0.6 - 4.5
3	AT37284	0.4 - 2.5
3	AT37285	0.4 - 2.5
3	AT37291	0.8 - 8.0
1	AT8762	Tuning tool
1	AT8777	Tuning tool

• *Air dielectric capacitor Kit KTT-500*

Quantity	Part Number	Capacity pF
3	AT5201	0.8 - 10
3	AT5202	0.8 - 10
3	AT5701	0.6 - 6
3	AT5702	0.6 - 6
3	AT5801	0.35 - 3.5
3	AT5802	0.35 - 3.5
1	AT8777	Tuning tool

• *Microwave tuning elements Kit KTT-690*

Quantity	Part Number	Max. Travel	Rod Diameter
5	AT6924-0	3.8	1.8
5	AT6925-0	3.8	3.2
5	AT6926-0	2.7	4.1
5	AT6927-0	6.5	4.1
3	AT6928-0	8.8	4.1
3	AT6933-0	4.3	1.6
1	AT7060	.120-80 Tap	
1	AT7061	10-64 Tap	
1	AT7062	15/64 - 64 Tap	

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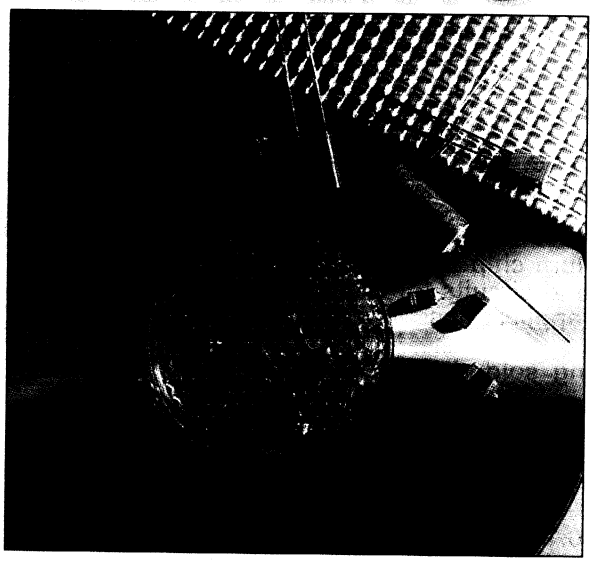
SOLID TANTALUM CAPACITORS

CONTENTS



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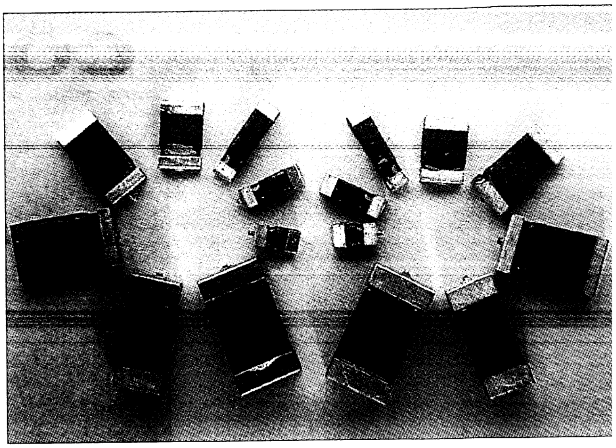
CHIP CAPACITORS
CTC1 (HTC)

CECC Type number	TEKELEC TEMEX Type number	CECC Specification
CTC1	HTC	30801-001

CTC1 is ESA approved (ESA/SCC 3011)



General information

HTC solid electrolyte tantalum chip capacitors are intended to be used in hybrid circuits for medical, military, aircraft and space applications.

It can withstand all existing soldering processes including wave soldering.

Standard ratings

- Capacitance range : 0.1 µF to 100 µF
- Capacitance tolerance : ± 20 % (standard)
  ± 10 % (upon request)
  ± 5 % (upon request)
- Voltage range : 4 to 50 V
- Rated voltage (Ur) : See table on next page
- Category voltage (Uc) : 0.66 Ur
- Climatic category : 55 / 125 / 56
- Rated temperature : 85° C
- Category temperature : 125° C

Electrical characteristics

- Dissipation factor : tgδ @ 20 ± 5° C, 100 Hz

  Ur < 10 V: $tg\delta \leq 8.10^{-2}$
  Ur ≥ 10 V: $tg\delta \leq 6.10^{-2}$

- Leakage current (I_L @ 20 ± 5° C):

  $I_L \leq 0.01$ Cr.Ur or 1 µA (whichever is greater)

❑ **Electrical characteristics change versus temperature**

Temperature (°C)	| Δ C/C | (%)	tgδ (max.) Ur < 10 V	tgδ (max.) Ur ≥ 10 V	Max. Leakage Current (µA)
20 ± 5	REFERENCE	8.10^{-2}	6.10^{-2}	See above
-55 ± 5	-12	15.10^{-2}	12.10^{-2}	Not applicable
85 ± 2	+10	15.10^{-2}	12.10^{-2}	0.1 Cr.Ur (*)
125 ± 2	+15	15.10^{-2}	15.10^{-2}	0.1 Cr.Ur (*) measured with Uc = 0.66 Ur

(*) or 1 µA whichever is greater

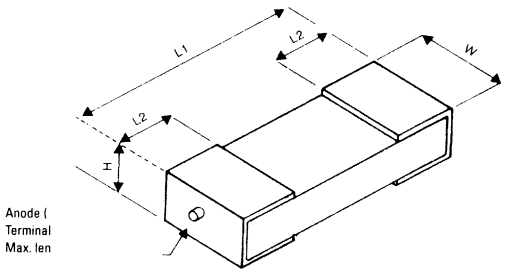
Packing

- Standard : Bulk
- Optional : Tape & Reel - see page 11-24
  When ordering add the suffix «R» just after the termination code.
  Ex.: CTC1 D 1 µF 40 V 20 % G R

Dimensions (mm)

Case Size	IEC L1 x W	L1 ± 0.4	W ± 0.4	H + 0.1 - 0.4	L2 ± 0.15
A	10.05	2.54	1.27	1.27	0.76
B	15.05	3.81	1.27	1.27	0.76
C	20.05	5.08	1.27	1.27	0.76
D	15.10	3.81	2.54	1.27	0.76
E	20.10	5.08	2.54	1.27	0.76
F	22.13	5.59	3.43	1.78	0.76
G	26.11	6.73	2.79	2.79	1.27
H	28.15	7.24	3.81	2.79	1.27

For hot solder dipped termination, add 0.4 mm to all dimensions.



Polarity indication is given by anode tantalum wire protruding in the center of the positive end cap.

Capacitance / Voltage range

Ur (V) / Cr (µF)	Rated Voltage Ur (V) @ 85° C							
	4	6.3	10	16	20	25	40	50
0.1								A
0.15								A
0.22							A	B
0.33						A		B
0.47					A		B	C
0.68				A		B	C	D
1			A		B	C	D	E
1.5		A		B	C	D	E	F
2.2	A		B	C	D	E		F
3.3		B	C	D	E		F	G
4.7	B	C	D	E		F	G	H
6.8	C	D	E		F	G	H	
10	D	E		F		G	H	
15	E		F		G	H		
22		F		G	H			
33	F		G	H				
47		G	H					
68	G	H						
100	H							

Terminations

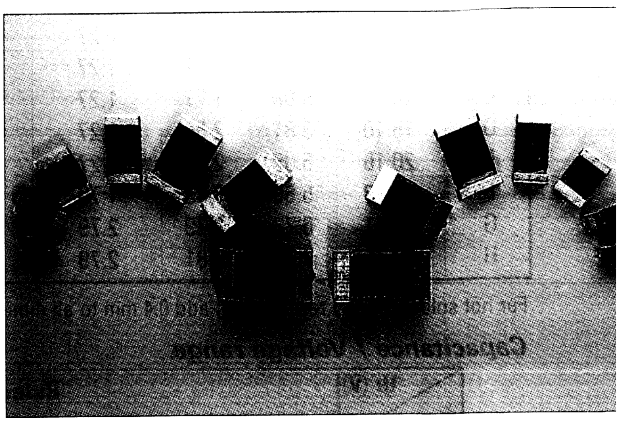
- Terminations are made of Nickel (Ni), nickel plated, on which four plating finishes may be achieved:
  - *Standard termination:*
    gold plating for standard epoxy bonding and soldering paste
  - *Upon request:*
    1- additional gold plating for ball-bonding or ultrasonic bonding
    2- tinning electrolytic (90 Sn - 10 Pb)
    3- hot solder dipped
- Solderability: IEC 384.3 § 4.7 Method 1
- Solderability recommendations: see page 11-23

How to order

CTC1	D	1 µF	40 V	20 %	G	R
Type Number	Case Size	Capacitance (µF)	Voltage (V)	Capacitance tolerance	Termination G: Gold G+: additional gold plated T: Tinned S: Hot solder dipped	R: Tape & Reel Blank: Bulk

TCR - LOW ESR

CECC Type number	TEKELEC TEMEX Type number	CECC Specification
-	**TCR**	-



General Information

Designed in order to provide an alternative to standard capacitors with better electrical parameters, TCR combines improvments in manufacturing process as well as in the use of tantalum powder of new generation. TCR is from then on particularly useful in power supplies, being capable of higher ripple currents than standard products.
This product is 100% compatible with MIL STYLE CWR06

Standard ratings

- Capacitance range : 0.1 µF to 100 µF
- Capacitance tolerance : ± 20 % (standard)
  ± 10 % (upon request)
- Voltage range : 4 to 50 V
- Rated voltage (Ur) : See table on next page
- Category voltage (Uc) : 0.66 Ur
- Climatic category : 55 / 125 / 56
- Rated temperature : 85° C
- Category temperature : 125° C

Electrical characteristics

- Dissipation factor: tgδ @ 20 ± 5° C, 100 Hz:

  Ur < 10 V : $tg\delta \leq 8.10^{-2}$

  Ur ≥ 10 V : $tg\delta \leq 6.10^{-2}$

- Leakage current (I_L @ 20° ± 5° C):

  $I_L \leq 0.01$ Cr.Ur or 1 µA (whichever is greater)

- Equivalent series resistance: see table next page

❑ **Electrical characteristics change versus temperature**

Temperature (°C)	| Δ C/C | (%)	tgδ (max.)		Max. Leakage Current (µA)
		Ur < 10 V	Ur ≥ 10 V	
20 ± 5	REFERENCE	8.10^{-2}	6.10^{-2}	See above
-55 ± 5	12	15.10^{-2}	12.10^{-2}	Not applicable
85 ± 2	10	15.10^{-2}	12.10^{-2}	0.1 Cr.Ur (*)
125 ± 2	15	15.10^{-2}	15.10^{-2}	0.1 Cr.Ur (*) measured with Uc = 0.66 Ur

(*) or 1 µA whichever is greater

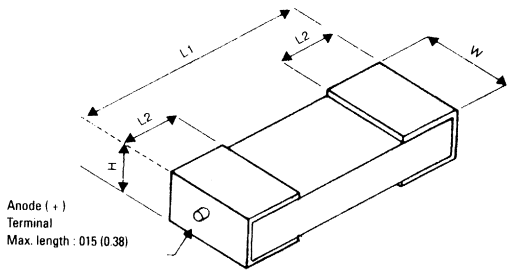
Packing

- Standard : Bulk
- Optional : Tape & Reel - see page 11-24

Dimensions (mm)

Case Size	IEC L1 x W	L1 ± 0.4	W ± 0.4	H + 0.1 - 0.4	L2 ± 0.15
A	10.05	2.54	1.27	1.27	0.76
B	15.05	3.81	1.27	1.27	0.76
D	15.10	3.81	2.54	1.27	0.76
E	20.10	5.59	2.54	1.27	0.76
F	22.13	5.6	3.43	1.78	0.76
G	26.11	6.73	2.79	2.79	1.27
H	28.15	7.24	3.81	2.79	1.27

For hot solder dipped termination, add 0.4 mm to all dimensions.



Polarity indication is given by anode tantalum wire protruding in the center of the positive end cap.

Capacitance / Voltage range & Maximum ESR (Ω) @ 100 kHz and 25° C (see figures between brackets)

Ur (V) / Cr (µF)	Rated Voltage Ur (V) @ 85° C							
	4	6.3	10	16	20	25	40	50
0.1								A (25.0)
0.15								A (22.0)
0.22							A (15.0)	B (19.0)
0.33						A (15.0)		B (11.0)
0.47					A (14.0)		B (11.0)	D (8.0)
0.68				A (12.0)		B (12.0)		D (5.5)
1			A (11.0)		B (10.0)		D (5.0)	E (3.5)
1.5		A (7.0)		B (6.0)		D (2.5)	E (2.5)	F (2.5)
2.2	A (7.0)		B (6.0)		D (5.0)	E (2.1)		F (1.2)
3.3		B (5.0)		D (2.5)	E (2.1)		F (1.2)	G (1.0)
4.7	B (5.0)		D (2.5)	E (2.1)		F (1.2)	G (0.8)	H (0.7)
6.8		D (2.0)	E (2.1)		F (1.2)		H (0.6)	
10	D (2.0)	E (1.5)		F (1.2)		G (0.6)	H (0.4)	
15	E (1.5)		F (1.2)		G (0.6)	H (0.4)		
22		F (1.2)		G (0.6)	H (0.4)			
33	F (1.2)		G (0.6)	H (0.4)				
47		G (0.6)	H (0.4)					
68	G (0.6)	H (0.4)						
100	H (0.4)							

Terminations

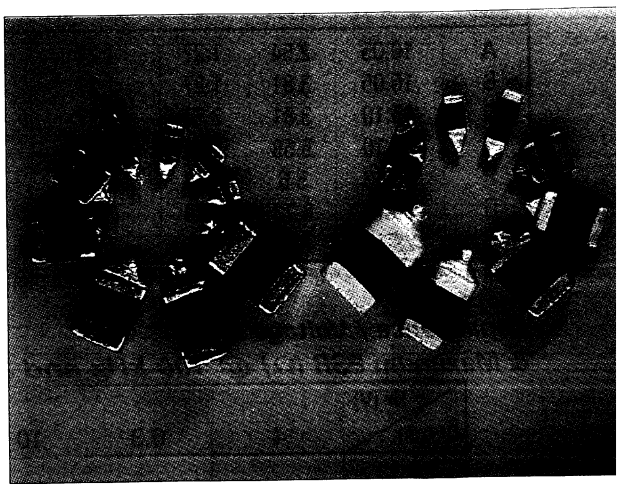
- Terminations are made of Nickel (Ni), nickel plated, on which four plating finishes may be achieved:
  - *Standard termination:* gold plating for standard epoxy bonding and soldering paste
  - *Upon request:*
    1- additional gold plating for ball-bonding or ultrasonic bonding
    2- tinning electrolytic (90 Sn - 10 Pb)
    3- hot solder dipped
- Solderability: IEC 384.3 § 4.7 Method 1
- Solderability recommendations: see page 11.23

How to order

TCR	D	1 µF	40 V	20 %	G	R
Type Number	Case Size	Capacitance (µF)	Voltage (V)	Capacitance tolerance	Termination G: Gold G+: additional gold plated T: Tinned S: Hot solder dipped	R: Tape & Reel Blank: Bulk

CTC2 (CTT) - CHIP CAPACITORS

CECC Type number	TEKELEC TEMEX Type number	CECC Specification
CTC2	CTT	30801-006



General Information

The TEKELEC TEMEX CTT tantalum chip technology provides a simple and rugged construction for chip encapsulation.
It consists of a body protected by a strong epoxy resin coating with a termination base of conductive epoxy overlayed via a nickel barrier.
The manufacturing process engineered by TEKELEC TEMEX ensures a perfect conformal coating, guaranteeing a rectangular body for ease and accuracy of placement.
The result is a high performance tantalum chip capacitor which meets the requirements of pick-and-place applications and withstands all existing soldering processes.

Standard ratings

- Capacitance range : 0.1 µF to 100 µF
- Capacitance tolerance : ± 20 % (standard)
  ± 10 %; ± 5 % (upon request)
- Voltage range : 4 to 50 V
- Rated voltage (Ur) : See table on next page
- Category voltage (Uc) : 0.66 Ur
- Climatic category : 55 / 125 / 56
- Rated temperature : 85° C
- Category temperature : 125° C

Electrical characteristics

- Dissipation factor: tgδ @ 20 ± 5° C, 100 Hz:

  Ur < 10 V : $tg\delta \leq 8.10^{-2}$

  Ur ≥ 10 V : $tg\delta \leq 6.10^{-2}$

- Leakage current (I_L @ 20° ± 5° C):

  $I_L \leq 0.01$ Cr.Ur or 1 µA (whichever is greater)

❑ **Electrical characteristics change versus temperature**

Temperature (°C)	| Δ C/C | (%)	tgδ (max.) Ur < 10 V	tgδ (max.) Ur ≥ 10 V	Max. leakage current (µA)
20 ± 5	REFERENCE	8.10^{-2}	6.10^{-2}	See above
-55 ± 5	-12	15.10^{-2}	12.10^{-2}	Not applicable
85 ± 2	+10	15.10^{-2}	12.10^{-2}	0.1 Cr.Ur (*)
125 ± 2	+15	15.10^{-2}	15.10^{-2}	0.1 Cr.Ur (*) measured with Uc = 0.66 Ur

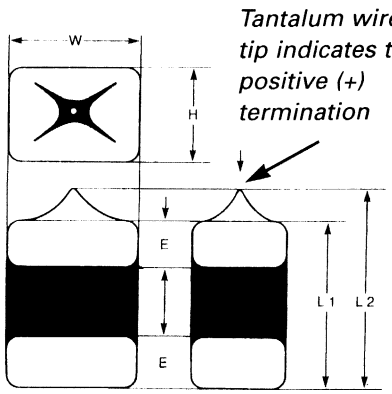
Packing

- Standard : Bulk
- Optional : Tape & Reel - see page 11-24
  When ordering add the suffix «R» just after the termination code.
  Ex.: CTC2 D 1 µF 40 V 20 % G R

Dimensions (mm)

Case Size	L2 ± 0.25	W max.	H max.	E max.	E min.	L1 max. (*)
AM	2.5	1.55	1.2	0.5	0.2	1.8
A	3.0	1.8	1.4	0.8	0.3	2.4
B	4.2	1.8	1.4	1.0	0.3	2.9
C	5.0	1.8	1.4	1.1	0.3	4.2
D	4.2	2.6	1.4	1.1	0.3	3.1
E	5.5	2.6	1.4	1.4	0.4	4.5
F	6.0	4.0	2.0	1.5	0.4	4.9
G	7.0	3.4	2.8	1.5	0.4	5.5
H	7.8	4.2	3.0	1.5	0.4	6.2

(*) For information only



Tantalum wire tip indicates the positive (+) termination

Capacitance / voltage range

Ur (V) / Cr (µF)	Rated Voltage Ur (V) @ 85° C							
	4	6.3	10	16	20 (*)	25	40	50
0.1								A/AM
0.15								A/AM
0.22							A/AM	B
0.33						A/AM		B
0.47				A/AM	A/AM		B	(C) D
0.68				A/AM		B	(C)	D
1			A/AM	B	B	(C)	D	E
1.5		A/AM		B	(C)	D	E	F
2.2	A/AM		B	(C) D	D	E		F
3.3		B	(C)	D	E		F	G
4.7	B	(C)	D	E		F	G	H
6.8	(C)	D	E	F	F	G	H	
10	D	E		F		G	H (*)	
15	E		F	G	G	H		
22		F		G	H			
33	F		G	H				
47		G	H					
68	G	H						
100	H							

(*)on special request (C) for maintenance only

Terminations

- Terminations are made of conductive silver paste and nickel plated, on which two plating finishes may be achieved:

  1- gold plating
  2- tinning electrolytic (Sn 90 - Pb 10)

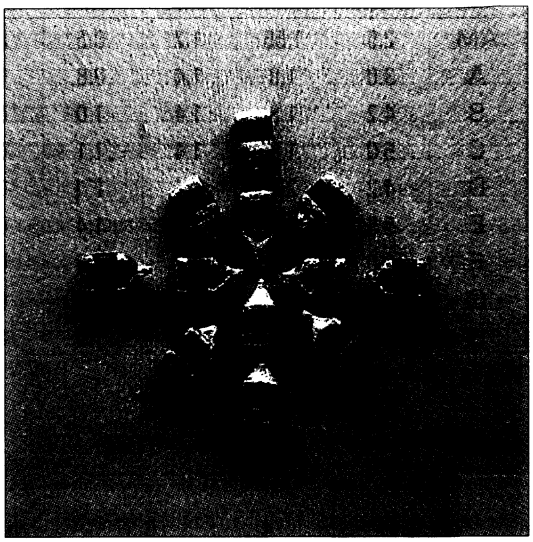
- Solderability: IEC 384.3 § 4.7 Method 1
- Solderability recommendations: see page 11.23

How to order

CTC2	D	1 µF	40 V	20 %	G	R
Type Number	Case Size	Capacitance (µF)	Voltage (V)	Capacitance tolerance	Termination G : Gold T : Tinned	R : Tape & Reel Blank : Bulk

TCA

CECC Type number	TEKELEC TEMEX Type number	CECC Specification
-	TCA	-



General Information

Specially developed for equipments where a very small size of components is required such as hearing aids, the TEKELEC TEMEX TCA tantalum chip technology provides a simple and rugged construction for chip encapsulation. It exists in one single size.
It consists of a rectangular body, protected by a strong epoxy resin coating with a termination base of conductive epoxy overlayed via a nickel barrier. The design offers one of the highest C.V per volume unit for a chip construction.
The result is a high performance chip which meets the requirements of pick and place applications, and withstands all soldering processes like infrared reflow, vapour phase, solder wave.

Standard ratings

- Capacitance range : See table on next page
- Capacitance tolerance : ± 20 % & ± 10 %
  C/56
- Rated voltage (Ur) : See table on next page
- Maximum peak over voltage: 1.3 Ur @ 85° C
- Climatic category : 434
  -55° C +125° C
  days damp heat
- Rated temperature : 85° C
- Category temperature : 125° C

❑ Electrical characteristics

Ur @ 85°C (V)	C (µF)	STANDARD RATINGS - MAXIMUM LIMITS OF ELECTRICAL PARAMETERS									
		| Δ C / C | (%)			tg ∂ (%)				I_L (µA)		
		-55°	+85°	+125°	-55°	+20°	+85°	+125°	+20°	+85°	+125°
2	10	10	10	12	9	6	9	12	0.5	5.0	6.3
4	4.7	10	10	12	9	6	9	12	0.5	5.0	6.3
4	6.8	10	10	12	9	6	9	12	0.5	5.0	6.3
6.3	3.3	10	10	12	9	6	9	12	0.5	5.0	6.3
10	2.2	10	10	12	9	6	9	12	0.5	5.0	6.3
16	1.5	10	10	12	9	6	9	12	0.5	5.0	6.3
20	1.0	10	10	12	9	6	9	12	0.5	5.0	6.3
20	0.68	10	10	12	9	6	9	12	0.5	5.0	6.3
25	0.47	10	10	12	9	6	9	12	0.5	5.0	6.3

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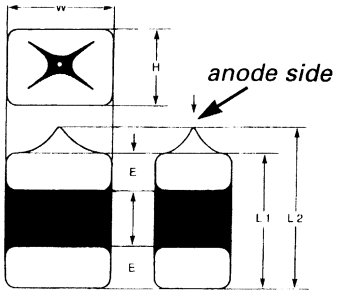
Dimensions (mm)

$L_2 \pm 0.2$	W ± 0.3	H ± 0.3 max.	E max.	E min.	L_1 (*)
2.0	1.2	1.2	0.5	0.3	1.3

(*) For information only



Capacitance/voltage range

Ur (V) / C (µF)	Rated Voltage Ur (V) @ 85° C / Category Voltage (V) @ 125° C					
	4 V / 2.5 V	6.3 V / 4 V	10 V / 6.3 V	16 V / 10 V	20 V / 13 V	25 V / 16 V
0.47						
0.68						
1.0						
1.5						
2.2						
3.3						
4.7						
6.8						
10	2 V					

Other information

- ***Applicable documents:***

  Generic specification CECC 30 000 (Ed. 3)
  Intermediate specification CECC 30 800 (Ed. 2)

- ***Solderability recommendations:*** see page 11-23

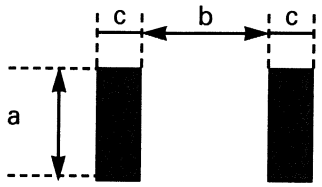
- ***Marking:***

  The small area of the body doesn't allow any marking on the capacitor. All required data are present on the package in which the capacitors are shipped. Please note that these data are necessary for further information.

- ***Terminations***

  Terminations are made of conductive silver paste and nickel plated, on which two plating finishes may be achieved:
  1- gold plating
  2- tinning electrolytic (Sn 90 - Pb 10)

- ***Recommanded Lay-out (mm):***



a	b	c
1.5	0.7	0.6

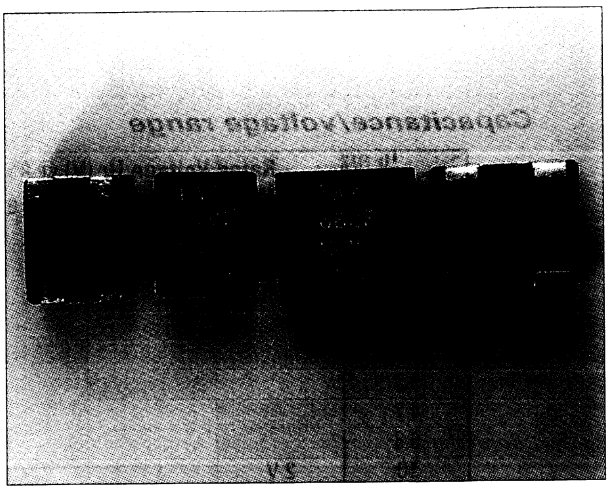
How to order

TCA	1.5 µF	16 V	20 %	T
Type Number	Capacitance (µF)	Voltage (V)	Capacitance tolerance	Termination T: Electrolytic tinned (90-10) G: Gold

CTC21 - SMD, LOW ESR

CECC Type number	TEKELEC TEMEX Type number	CECC Specification
CTC21	CTC21	30801-013

(CECC approval not granted)



General Information

The CTC21 capacitor is the SMD version of CTS21. It is specially designed to be used in energy conversin systems, particularly in switching power supplies.
Its low equivalent series resistance permits it to endure high ripple currents up to 1.3 amperes and its low series inductance enables its use at higher frequencies than the CTS21. Manufactured with a low series resistance anode moulded in a resin with a very good thermal conductivity, it is designed in two different cas sizes and has the same capacitance and voltage range than CTS21.

Standard ratings

- Capacitance range : 5.6 µF to 300 µF
- Capacitance tolerance : E6 values ± 20%, ± 10%
  E12 values ± 10%
  (upon request)
- Voltage range : 6.3 to 63 V
- Rated voltage (Ur) : See table on next page
- Climatic category : 434 (-55 / 125 / 56)
- Rated temperature : 85° C
- Category temperature : 125° C

Capacitance / voltage range

Ur (V) / Cr (µF)	Rated voltage Ur (V) @ 85° C / Category voltage Uc (V) @ 125° C							
	6.3/4	10/6.3	16/10	20/13	25/16	40/25	50/32	63/40
(5.6)								C
6.8								C
(8.2)								C
10								C
12								
15							C	
(18)							C	D
22						C	D	D
(27)					C			
33					C	D		
(39)				C				
47				C				
(56)			C		D			
68			C		D			
(82)		C		D				
100		C		D				
(120)	C		D					
150	C		D					
(180)		D						
220		D						
(270)	D							
330	D							

Values given between brackets (E12 values) are non preferred ratings, and can be submitted to minimum quantities.

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❑ Electrical characteristics

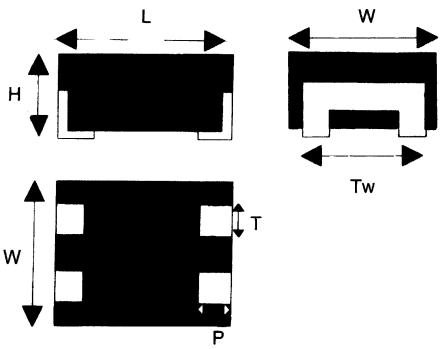
Ur (+85°C) / Uc (+125°C) Rated voltage & Category voltage (V)	Rated capacitance at 1 KHz (µF)	Cases	D_F 1 KHz 20°C (%)	ESR 500 KHz 20°C (mΩ)	Leakage current (µA)			Ripple current 100 KHz (A)	Ripple current 1 KHz (A)
					+20°C	+85°C	+125°C		
6.3 / 4	120	C	8	40	7.6	76	95	3.2	2.5
	150	C	10	35	9.4	94	117	3.3	2
	270	D	10	30	17	170	212	4.1	3.4
	330	D	12	25	20.8	208	260	4.3	3.8
10 / 6.3	82	C	8	45	8.2	82	102	2.9	1.8
	100	C	8	40	10	100	125	3	2.2
	180	D	8	35	18	180	225	3.7	3.4
	220	D	10	30	22	220	275	3.9	3.4
16 / 10	56	C	6	55	8.9	89	111	2.6	1.8
	68	C	6	50	108	108	135	2.7	2.2
	120	D	8	40	19.2	192	240	3.5	2.8
	150	D	8	35	24	240	300	3.6	3.1
20 / 13	39	C	5	65	7.8	78	97	2.4	1.7
	47	C	6	60	9.4	94	117	2.5	1.8
	82	D	6	45	16.4	164	205	3.1	2.5
	100	D	8	40	20	200	250	3.3	2.5
25 / 16	27	C	5	75	6.7	67	83	2.2	1.2
	33	C	5	70	8.2	82	102	2.3	1.4
	56	D	6	55	14	140	175	2.9	2.2
	68	D	6	50	17	170	212	3	2.4
40 / 25	22	C	4	85	8.8	88	110	2.1	1.5
	33	C	5	70	13.2	132	165	2.5	1.9
	47	D	5	60	18.8	188	235	2.7	2.2
50 / 32	15	C	3	100	7.5	75	93	1.9	1.4
	18	C	4	90	9	9.	112	2	1.4
	22	D	4	85	11	110	137	2.3	1.7
63 / 40	5.6	C	3	155	3.5	35	44	1.5	0.6
	6.8	C	3	140	4.2	42	53	1.6	0.9
	8.2	C	3	130	5.1	51	64	1.6	0.9
	10	C	3	120	6.3	63	78	1.7	1.1
	18	D	4	90	11.3	113	141	2.1	1.5
	22	C	4	85	13.8	138	173	2.3	1.7

Notes: Permissible ripple current limits given for 1 KHz apply for lower frequencies,
Permissible ripple current limits given for 100 KHz apply for higher frequencies
Between these two frequencies, maximum current can be considered as a linear function of frequency

Maximum change of capacitance with temperature compared to the value at 20° C:	*Dissipation factor (D_F) at lower and upper temperatures measured at 1 kHz:*
-55° C = ± 10 %	-55° C = (limit at 20° C) x 2
+ 85° C = ± 8 % + 125° C = ± 12 %	+ 85° and + 125° C = (limit at 20° C) x 1.5

Dimensions (mm)

Case Size	L -0.1+ 0.5	W -0.1+0.5	H -0.1+0.5	Tw ± 0.3	P ± 0.3	T ± 0.3	Weight (g)
C	11	9	4,5	7	1.5	2	1.5 to 1.7
D	11	12.5	5.5	10.5	1.5	3	2.7 to 3.0

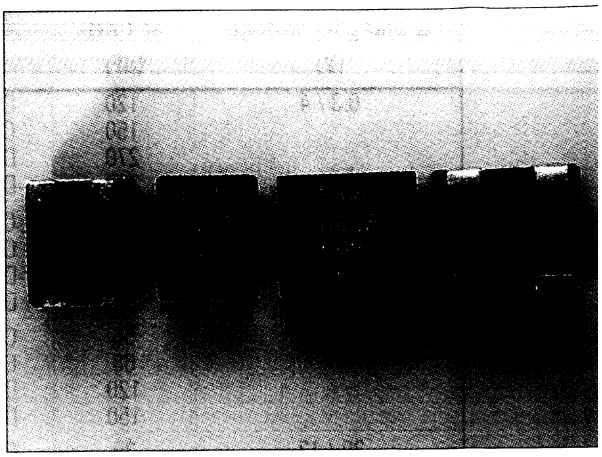


How to order

CTC21	C	22 µF	40 V	10 %
CECC Type	Case Size	Capacitance (µF)	Voltage (V)	Capacitance tolerance

CTC23 - SMD - HIGH CAPACITANCE / VOLTAGE

CECC Type number	TEKELEC TEMEX Type number	CECC Specification
CTC23	CTC23	30801-013



General information

The CTC23 is the moulded SMD version of the CTS23. It is suited for applications where a high capacitance /voltage together with a high level of ripple currents is required. It's low inductance due to the construction provides an excellent frequency response.

Standard ratings

- Capacitance range : 8.2 µF to 1000 µF
- Capacitance tolerance : ± 10%, ± 20%
- Voltage range (Ur) : 6.3 to 63 V
- Surge current : one million cycles
- Climatic category : 55 / 125 / 56
- Category temperature : 125° C

Electrical characteristics

Rated voltage / Category voltage Ur (+85°C)/Uc (+125°C)	Rated capacitance at 1 KHz	Case size	DF 1 KHz 20° C	Leakage current (µA)		
(V)	(µF)		(%)	+20°C	+85°C	+125°C
6.3 / 4	220	B	6	14	139	173
	270	B	6	17	170	213
	330	C	8	21	208	260
	290	C	8	25	246	307
	470	C	8	30	296	370
	680	D	8	43	428	536
	820	D	8	52	77	646
	1000	D	8	63	630	788
10 / 6.3	150	B	6	15	150	188
	180	B	6	18	180	225
	220	C	8	22	220	275
	270	C	8	27	270	338
	390	D	8	39	390	488
	470	D	8	47	470	588
	560	D	8	56	560	700
16 / 10	100	B	6	16	160	200
	120	B	8	19	192	240
	150	C	8	24	240	300
	180	C	8	29	288	360
	270	D	8	43	432	540
	330	D	8	53	528	660

CTC23 (SMD - HIGH CAPACITANCE ; HIGH VOLTAGE)

Rated voltage / Category voltage (V)	Rated capacitance at 1 KHz (µF)	Case size	DF 1 KHz 20° C (%)	Leakage current (µA) +20°C	+85°C	+125°C
20 / 13	68	B	6	14	136	170
	82	B	6	16	164	205
	100	C	8	20	200	250
	120	C	8	24	240	300
	150	C	8	30	300	375
	180	D	8	36	360	450
	220	D	8	44	440	550
	270	D	8	54	540	675
25 / 16	33	B	6	8	83	103
	47	B	6	12	118	147
	68	C	6	17	170	213
	82	C	8	21	205	256
	100	D	8	25	250	313
	120	D	8	30	300	375
	150	D	8	38	375	469
40 / 25	15	B	6	6	60	75
	22	B	6	9	88	110
	33	C	6	13	132	165
	39	C	6	16	156	195
	47	C	6	19	188	235
	68	D	8	27	272	340
	82	D	8	33	328	410
	100	D	8	40	400	500
50 / 32	8.2	B	4	4	41	51
	10	B	4	5	50	63
	22	C	6	11	110	138
	27	C	6	14	135	169
	47	D	8	24	235	294
	56	D	8	28	280	350
63 / 40	8.2	B	4	3	33	41
	15	C	6	6	60	75
	18	C	6	7	62	90
	33	D	6	13	132	165
	39	D	6	16	156	195

	-55°C	+85°C	+125°C
Capacitance drift (%) (Ref C value @20°C)	<-0.1	<±8%	<±12°C
Dissipation factor drift (Ref.DF @20°C @1KHz)	x 2	x 1.5	x 1.5

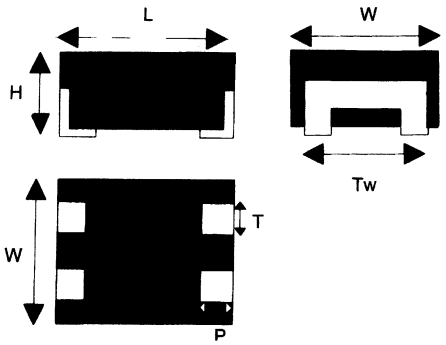
Dimensions (mm)

Case size	L -0.1+0.5	W 0.1+0.5	H 0.1+0.5	TW ±0.3	P ±0.3	T ±0.3
B	9.0	6.6	3.8	4.6	1.5	1.5
C	11.0	9.0	4.5	7.0	1.5	2.0
D	11.0	12.5	5.5	10.5	1.5	3.0

Anode indicated by a «+» signal on the component
Case size «B» available

How to order

CTC23	C	100 µF	20 V	10 %
Type number	Case size	Capacitance (µF)	Voltage Ur (V)	Tolerance



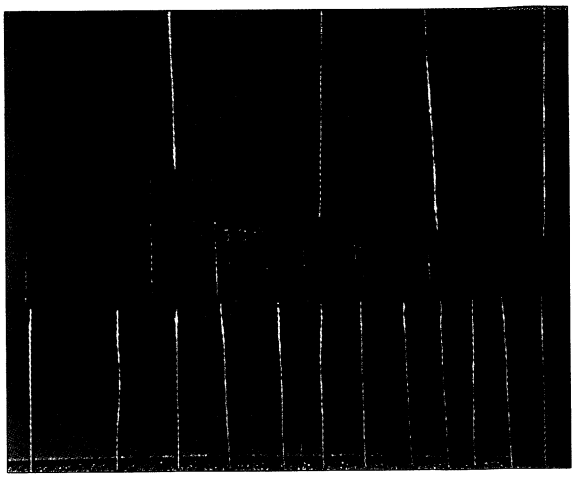
NEW !

TEKELEC TEMEX

MINIATURE EXPOXY SEAL
TAH FOR 125° C

CECC Type number	TEKELEC TEMEX Type number	CECC Specification
30201-048	THR	TAH

The product is currently waiting CECC release



General information

The TAH is a polar tantalum capacitor for high reliability applications. The 125° C category temperature makes it specifically adapted to military requirements. Available as axial and radial.

Standard ratings

- Capacitance range : 0.1 µF to 150 µF
- Capacitance tolerance : ± 5, ± 10%, ± 20%
- Voltage range (Ur) : 6.3 to 35 V
- Surge current : 1.3 Ur or 1.3 Uc
- Climatic category : 55 / 125 / 21
- Category temperature : 125° C

Electrical characteristics

Rated voltage / Category voltage Ur (+85°C)/Uc (+125°C)	Rated capacitance at 1 KHz	Case size	Leakage current max. (µA) (1)			Max. dissipation factor @ 120 Hz (%)				Z @ 20° C (Ω)
(V)	(µF)		+20°C	+85°C	+125°C	+55°C	+20° C	+85°C	+125°C	
6.3 / 4	3.3	G	0.5	5.0	6.25	10	6	8	10	15
	10	H	1.0	10	12.5	10	6	8	10	10
	33	J	3.0	30	37.5	10	6	8	10	5
	47	K	3.0	30	37.5	10	6	8	10	5
	150	L	9.0	90	112.5	13	10	12	13	2
10 / 6.3	2.2	G	0.5	5.0	6.25	10	6	8	10	15
	6.8	H	1.0	10	12.5	10	6	8	10	10
	22	J	3.0	3.0	37.5	10	6	8	10	5
	33	K	3.0	3.0	37.5	10	6	8	10	5
	100	L	9.0	90	112.5	11	8	10	11	2
16 / 10	1.5	G	0.5	5.0	6.25	10	6	8	10	15
	4.7	H	1.0	10	12.5	10	6	8	10	10
	15	J	3.0	30	37.5	10	6	8	10	5
	22	K	3.0	30	37.5	10	6	8	10	5
	68	L	9.0	90	112.5	11	8	10	11	2
20 / 13	1.0	G	0.5	5.0	6.25	10	6	8	10	15
	3.3	H	1.0	10	12.5	10	6	8	10	10
	10	J	3.0	30	37.5	10	6	8	10	5
	15	K	3.0	30	37.5	10	6	8	10	5
	47	L	9.0	90	112.5	10	6	8	10	2
25 / 16	0.68	G	0.5	5.0	6.25	10	6	8	10	15
	2.2	H	1.0	10	12.5	10	6	8	10	10
	6.8	J	3.0	30	37.5	10	6	8	10	5
	10	K	3.0	30	37.5	10	6	8	10	5
	33	L	9.0	90	112.5	10	6	8	10	2

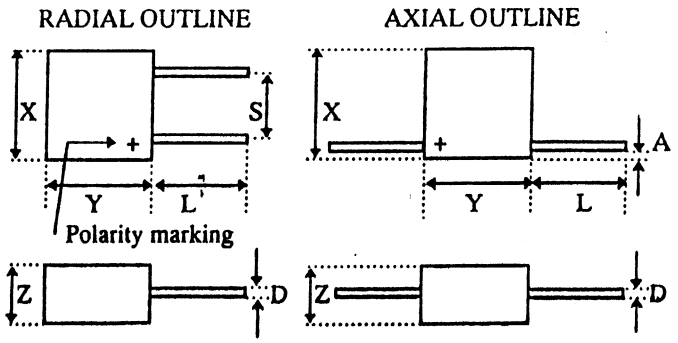
Rated voltage / Category voltage Ur (+85°C)/Uc (+125°C) (V)	Rated capacitance at 1 KHz (µF)	Case size	Leakage current max. (µA) (1) +20°C	+85°C	+125°C	Max. dissipation factor @ 120 Hz (%) +55°C	+20° C	+85°C	+125°C	Z @ 20° C (Ω)
35 / 23	0.10	G	0.5	5	6.25	10	6	8	10	n/a
	0.15	G	0.5	5	6.25	10	6	8	10	n/a
	0.22	G	0.5	5	6.25	10	6	8	10	n/a
	0.33	G	0.5	5	6.25	10	6	8	10	n/a
	0.47	G	0.5	5	6.25	10	6	8	10	n/a
	0.68	H	1.0	10	12.5	10	6	8	10	10
	1.0	H	1.0	10	12.5	10	6	8	10	10
	1.5	H	1.0	10	12.5	10	6	8	10	10
	2.2	J	3.0	30	37.5	10	6	8	10	5
	3.3	J	3.0	30	37.5	10	6	8	10	5
	4.7	J	3.0	30	37.5	10	6	8	10	5
	6.8	K	3.0	30	37.5	10	6	8	10	5
	10	L	9.0	90	112.5	10	6	8	10	2
	15	L	9.0	90	112.5	10	6	8	10	2
	22	L	9.0	90	112.5	10	6	8	10	2

(1) Leakage current at 125° C is measured with Uc

Electrical characteristics (cont)

	-55°C	+85°C	+125°C
Capacitance drift (%) (Ref C value @20°C)	≥-12 %	≤+12 %	≤+15 %

Endurance test: 2000 h @ 85° C under Ur



Dimensions (mm)

Case Size	Y max.	X max.	Z max.	D +0.3-0.05	Radial S	Radial L (min.)	Axial A (max.)	Axial L (min.)
G	4.2	3.2	1.9	0.25	2.5 ± 0.5	4.0	1.0	25
H	5.8	4.8	2.0	0.25	3.8 ± 0.5	4.0	1.0	25
J	7.4	5.7	2.9	0.40	4.6 ± 0.65	4.0	1.5	25
K	7.9	5.9	3.4	0.40	5.0 ± 0.65	4.0	1.5	25
L	12.1	9.6	3.9	0.40	7.6 ± 0.65	4.0	2.0	25

How to order

TAH	L	R	100 µF	10 V	10 %
Type number	Case size	Outline A-axial R-radial	Capacitance (µF)	Voltage Ur (V)	Tolerance

MINIATURE EPOXY SEAL

CECC Type number (*)	TEKELEC TEMEX Type number	CECC Specification
CTS4	MT R	30201-003
CTS44	MT A	30201-003
CTS5	MTN R	30201-004
-	MTN A	-
-	CD R	-
-	CD A	-
-	CDN R	-
-	CDN A	-

(*) When applicable

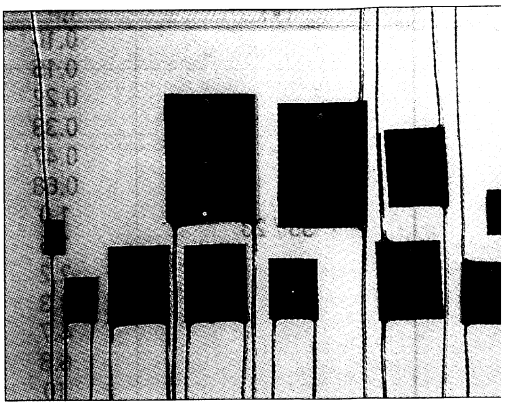


Photo: Polar rectangular.

General information

The MT (rectangular) and CD (cylindrical) types are subminiature, solid electrolyte, polar tantalum capacitors designed for high-density applications such as hybrid and modular circuits. The MTN (rectangular) and CDN (cylindrical) are non-polar types, made up of two sections mounted back-to-back by their cathodes and enclosed in the same package. All types (MT, CD, MTN and CDN) can be offered in either Radial (R) or Axial (A) lead configuration.

Standard ratings

- Capacitance range : *(E6 series)*
  MT: 0.1 µF to 330 µF
  CD: 0.1 µF to 68 µF
  MTN: 0.1 µF to 68 µF
  CDN: 0.1 µF to 15 µF
- Capacitance tolerance:
  Standard: MT0 / CD0: - 20 %, + 40 %
  Others: ± 20 %
  Upon request: ± 10 %, ± 5 %
  ± 20 % (only for MT0 / CD0)
- Voltage range : 4 to 50 V (all types)
- Rated voltage (Ur) : See table on next page
- Climatic category : 55/85/ 21
  55/125/21 (upon request*)
- Rated temperature : 85° C
- Category temperature : 125° C (upon request*)

(*) High reliability applications

Electrical characteristics

- Dissipation factor : tgδ @ 20 ± 5° C, 100 Hz
  Cr.Ur ≤ 1900 µC: $tg\delta \leq 6.10^{-2}$
  Cr.Ur > 1900 µC: $tg\delta \leq 8.10^{-2}$
- Leakage current (I_L @ 20 ± 5° C):
  - For polar types and CTS 5 model:
  $I_L \leq 0.01$ Cr.Ur or 1 µA (whichever is greater)
  - For non-polar types except CTS 5 model:
  $I_L \leq 0.02$ Cr.Ur or 2 µA (whichever is greater)
- Impedance @ 100 KHz, 20 ± 5°C (*):

Cr.Ur (µC)	< 60	≥ 60 < 250	≥ 250 < 1100	≥ 1100
Z (*) (Ω)	10	5	2	1

(*) Not applicable for values below 0.33 µF and CD types

- Endurance test: 2000 h @ 85° C under Ur

❑ **Electrical characteristics change versus temperature (for CTS types only)**

Temperature (°C)	| Δ C/C | (%)	tgδ (max.)		Max. Leakage Current (µA)
		Cr.Ur ≤ 1900 µC	Cr.Ur > 1900 µC	
20 ± 5	REFERENCE	6.10^{-2}	8.10^{-2}	See above
-55 ± 3	10	9.10^{-2}	11.10^{-2}	Not applicable
85 ± 2	12	9.10^{-2}	11.10^{-2}	0.1 Cr.Ur (*)

(*) or 1 µA whichever is greater

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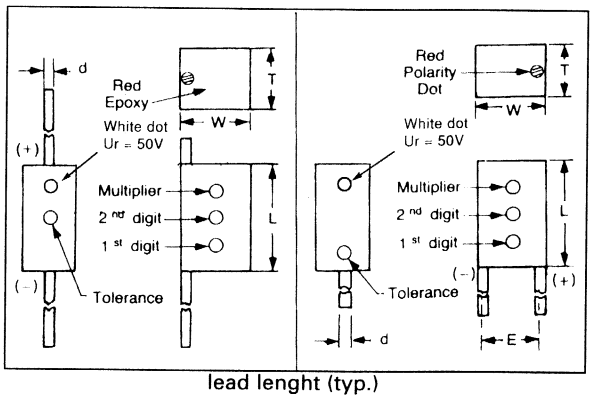
POLAR RECTANGULAR

Dimensions (mm)

Type Radial	Type Axial	$L_{max.}$	$W_{max.}$	$T_{max.}$	E (*) ± 0.3	d +10% - 0.05
CTS4A (MT0R)	CTS44A (MT0A)	3.4	2.1	1.3	1.27	0.3
CTS4B (MT1R)	CTS44B (MT1A)	4.4	3.3	2.1	2.54	0.3
CTS4C (MT2R)	CTS44 (MT2A)	C5.9	4.9	2.1	3.81	0.3
CTS4D (MT3R)	CTS44D (MT3A)	7.6	6.0	3.0	5.08	0.4
CTS4E (MT4R)	CTS44E (MT4A)	8.1	6.1	3.5	5.08	0.4
CTS4F (MT5R)	CTS44F (MT5A)	12.3	9.8	4.1	7.62	0.4
- (MT5DR)	(MT5DA) -	(13.70) (12.30)	(12.07) (12.07)	(9.53) (9.53)	(7.62) (7.62)	(0.4) (0.4)

Dimensions indicated in this table comply with CECC 30201-003.
Dimensions given between brackets are those typically achieved for MT5D.
(*) CTS4 only.

Axial **Radial**



lead lenght (typ.)
Anode: 38.1
Cathode: 31.8
A marking in clear (capacitance, voltage) is also available on sizes C to F.

Capacitance / Voltage range

Ur (V) / Cr (µF)	Rated Voltage Ur (V) @ 85° C								
	4	6.3	10	16	20	25	32 / 35	40	45
0.1					MT0			MT1	MT1
0.15					MT0			MT1	MT1
0.22				MT0				MT1	MT1
0.33			MT0					MT1	MT2
0.47		MT0					MT1	MT2	MT2
0.68	MT0					MT1		MT2	MT2
1					MT1			MT2	MT2
1.5				MT1			MT2	MT3	MT3
2.2			MT1			MT2		MT3	MT3
3.3		MT1			MT2			MT3	MT4
4.7	MT1				MT2		MT3	MT4	MT4
6.8			MT2		MT3		MT4	MT5	MT5
10		MT2			MT3	MT4		MT5	MT5
15				MT3	MT4			MT5	MT5D
22			MT3	MT4			MT5		MT5D
33		MT3	MT4			MT5		MT5D	
47	MT3	MT4			MT5		MT5D		
68	MT4			MT5		MT5D			
100			MT5		MT5D				
150		MT5		MT5D					
220			MT5D						
330		MT5D							

How to order

a) Under TEKELEC TEMEX reference

MT	5	R	100 µF	10 V	20 %
Tekelec Type Number	Case Size	R = radial leads A = axial leads	Capacitance (µF)	Voltage (V)	Capacitance tolerance

b) Under CECC/UTE reference

CTS4	F	100 µF	10 V	20 %
CECC/UTE Type Number CTS4: Radial leads CTS44: Axial leads	Case Size	Capacitance (µF)	Voltage (V)	Capacitance tolerance

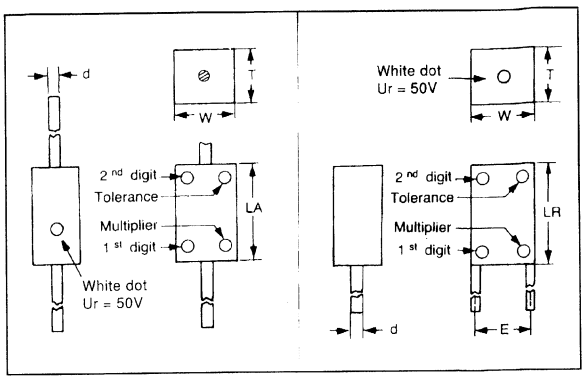
NON POLAR RECTANGULAR

Dimensions (mm)

Type		$L_{Amax.}$	$L_{Rmax.}$	$W_{max.}$	$T_{max.}$	E (*) ± 0.3	d +10% - 0.05
Radial	*Axial*						
CTS5A (MTN1R)	- (MTN1A)	- (5.59)	5.2 (4.6)	3.4 (3.18)	3.4 (3.18)	2.54	0.3
CTS5B (MTN2R)	- (MTN2A)	- (7.11)	6.3 (6.1)	3.8 (3.56)	4.8 (4.57)	2.54	0.3
CTS5C (MTN3R)	- (MTN3A)	- (9.40)	8.3 (8.0)	4.9 (4.57)	6.0 (5.59)	3.81	0.4
CTS5D (MTN4R)	- (MTN4A)	- (9.91)	8.8 (8.5)	6.1 (5.84)	6.1 (5.84)	5.08	0.4
- MTN5R)	- (MTN5A)	- (13.7)	- (12.1)	- (9.53)	- (7.62)	7.62	(0.4)

Dimensions indicated in this table comply, when applicable, with CECC 30201-004.
Dimensions given between brackets are those typically achieved for MTN A.
(*) CTS5 only.

Axial **Radial**



lead lenght (typ.) 38.1

Capacitance / Voltage range

Ur (V) / Cr (µF)	Rated Voltage Ur (V) @ 85° C								
	4	6.3	10	16	20	25	32/35	40	50
0.1								MTN1	MTN1
0.15								MTN1	MTN2
0.22								MTN1	MTN2
0.33						MTN1		MTN2	MTN2
0.47				MTN1				MTN2	MTN2
0.8			MTN1			MTN2		MTN3	MTN3
1		MTN1				MTN2		MTN3	MTN3
1.5		MTN1			MTN2			MTN3	MTN4
2.2					MTN2		MTN3	MTN4	MTN4
3.3			MTN2		MTN3		MTN4	MTN5	MTN5
4.7		MTN2			MTN3	MTN4		MTN5	MTN5
6.8				MTN3	MTN4			MTN5	MTN5
10			MTN3	MTN4			MTN5		
15		MTN3	MTN4			MTN5			
22	MTN3	MTN4			MTN5				
33	MTN4			MTN5					
47			MTN5						
68		MTN5							

How to order

a) Under TEKELEC TEMEX reference

MTN	4	R	6.8 µF	20 V	20 %
Tekelec Type Number	Case Size	R = radial leads A = axial leads	Capacitance (µF)	Voltage (V)	Capacitance tolerance

b) Under CECC/UTE reference

CTS5	D	6.8 µF	20 V	20 %
CECC/UTE Type Number CTS5: Radial leads	Case Size	Capacitance (µF)	Voltage (V)	Capacitance tolerance

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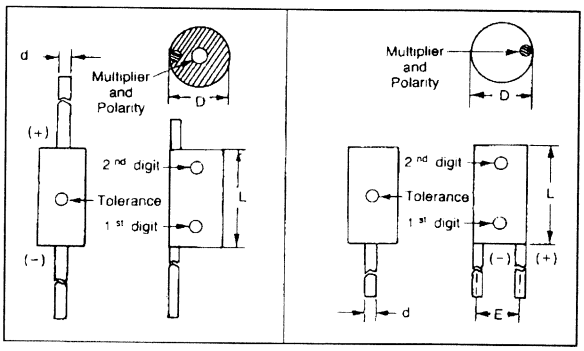
POLAR CYLINDRICAL

Dimensions (mm)

Case Size	$L_{max.}$	$D_{max.}$	E	d + 10 % - 0.03
CD0	3.18	1.78	1.27 ± 0.38	0.3
CD1	4.06	1.78	1.27 ± 0.38	0.3
CD2	5.08	2.03	1.27 ± 0.38	0.3
CD3	5.72	2.54	1.78 ± 0.51	0.3
CD4	6.35	3.81	3.05 ± 0.64	0.4
CD5	6.60	6.60	5.50 ± 0.64	0.4

Axial **Radial**



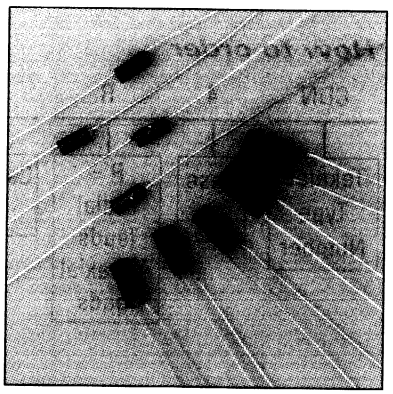
lead lenght (typ.)
Anode: 38.1
Cathode: 31.8

Capacitance / Voltage range

Ur (V) / Cr (µF)	Rated Voltage Ur (V) @ 85° C						
	4	6	10	15	20	35	50
0.1					CD0	CD1	CD1
0.15					CD0	CD1	
0.22					CD0	CD1	
0.33				CD0	CD1	CD2	
0.47			CD0		CD1	CD2	
0.8		CD0		CD1	CD2	CD3	
1	CD0		CD1		CD2	CD3	
1.5		CD1		CD2	CD3	CD4	
2.2	CD1		CD2		CD3	CD4	
3.3		CD2		CD3	CD4	CD4	
4.7	CD2		CD3		CD4	CD5	
6.8		CD3			CD4	CD5	
10	CD3			CD4	CD5	CD5	
15			CD4		CD5		
22		CD4			CD5		
33	CD4			CD5			
47			CD5				
68		CD5					

How to order

CD	5	A	10 µF	35 V	10 %
Tekelec Type Number	Case Size	R = radial leads A = axial leads	Capacitance (µF)	Voltage (V)	Capacitance tolerance

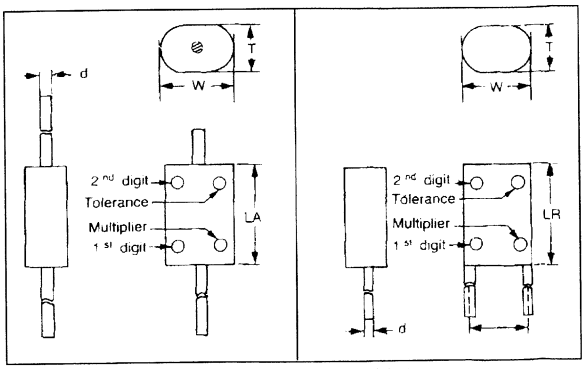


NON POLAR CYLINDRICAL

Dimensions (mm)

Case Size	$L_{Amax.}$	$L_{Rmax.}$	$W_{max.}$	$T_{max.}$	E	d + 10 % - 0.03
CDN0	4.45	3.43	3.05	1.78	2.54 ± 0.51	0.3
CDN1	5.33	4.06	3.05	1.78	2.54 ± 0.51	0.3
CDN2	6.10	5.08	3.56	2.03	2.54 ± 0.51	0.3
CDN3	6.99	5.97	4.83	2.67	3.18 ± 0.51	0.3
CDN4	7.87	6.86	7.37	3.94	5.08 ± 0.64	0.4

Axial **Radial**



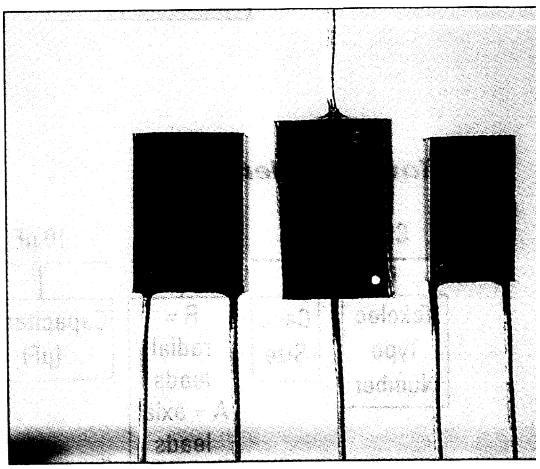
lead lenght (typ.) 38.1

Capacitance / Voltage range

Ur (V) / Cr (µF)	Rated Voltage Ur (V) @ 85° C						
	4	6	10	15	20	35	50
0.1					CDN0	CDN1	CDN1
0.15				CDN0	CDN1	CDN2	
0.22			CDN0	CDN0	CDN1	CDN2	
0.33		CDN0		CDN1	CDN2	CDN3	
0.47	CDN0		CDN1		CDN2	CDN3	
0.68		CDN1		CDN2	CDN3	CDN4	
1	CDN1		CDN2		CDN3	CDN4	
1.5		CDN2		CDN3		CDN4	
2.2	CDN2		CDN3		CDN4		
3.3		CDN3			CDN4		
4.7	CDN3			CDN4			
6.8			CDN4				
10		CDN4					
15	CDN4						

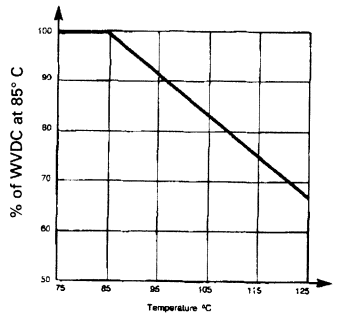
How to order

CDN	4	R	1.5	35	10 %
Tekelec Type Number	Case Size	R = radial leads A = axial leads	Capacitance (µF)	Voltage (V)	Capacitance tolerance

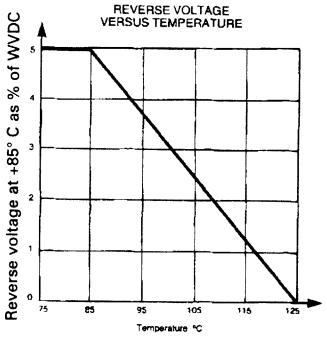


TYPICAL - PERFORMANCE CURVES

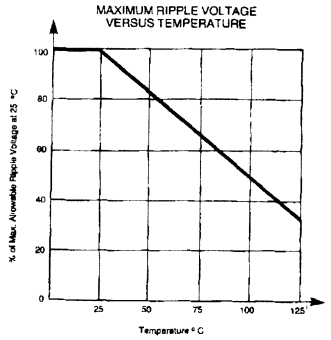
WVDC VERSUS TEMPERATURE



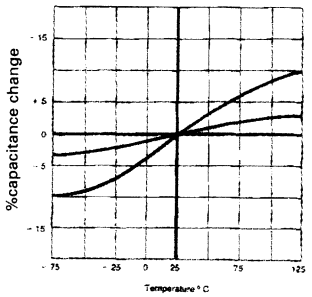
REVERSE VOLTAGE VERSUS TEMPERATURE



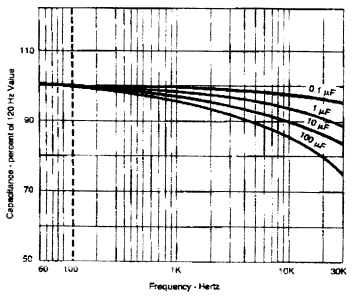
MAXIMUM RIPPLE VOLTAGE VERSUS TEMPERATURE



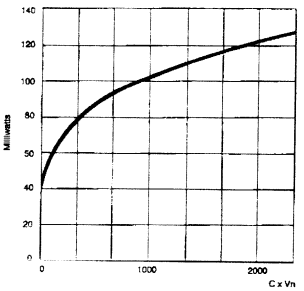
TYPICAL CAPACITANCE CHANGE VERSUS TEMPERATURE



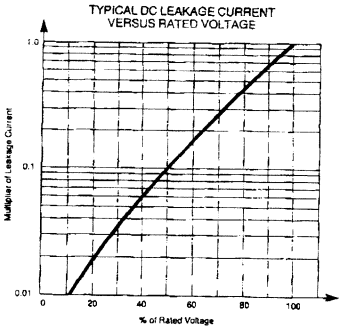
TYPICAL CAPACITANCE CHANGE VERSUS FREQUENCY



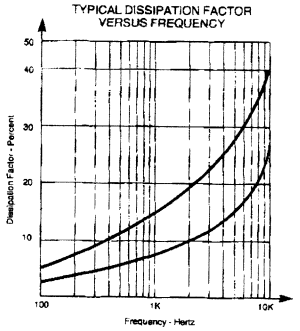
MAXIMUM POWER DISSIPATION



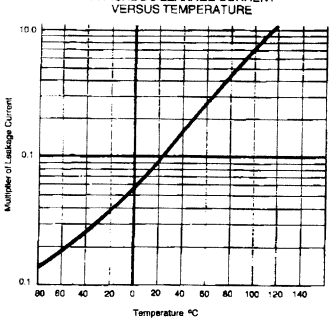
TYPICAL DC LEAKAGE CURRENT VERSUS RATED VOLTAGE



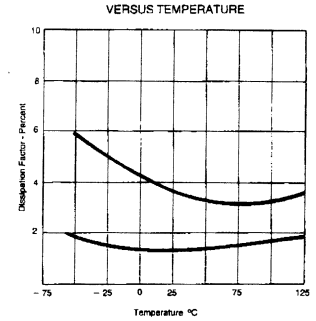
TYPICAL DISSIPATION FACTOR VERSUS FREQUENCY



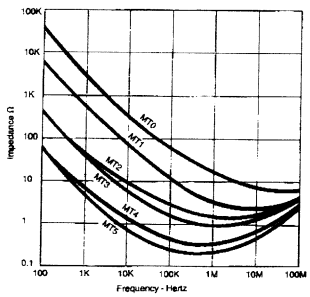
TYPICAL DC LEAKAGE CURRENT VERSUS TEMPERATURE



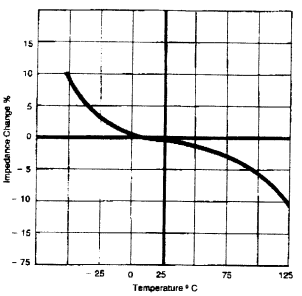
VERSUS TEMPERATURE



TYPICAL IMPEDANCE VERSUS FREQUENCY



TYPICAL IMPEDANCE VERSUS TEMPERATURE



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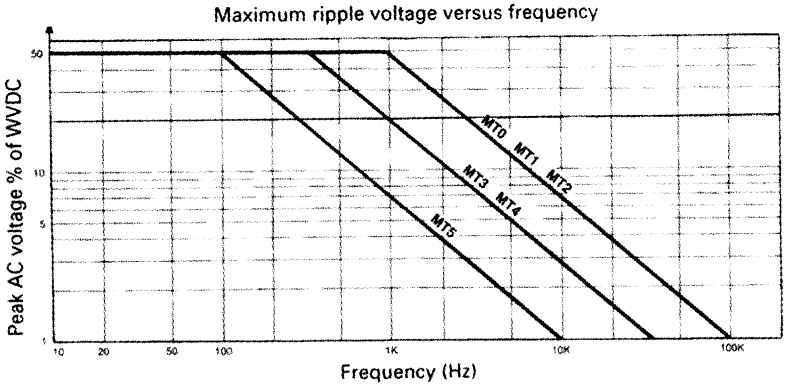
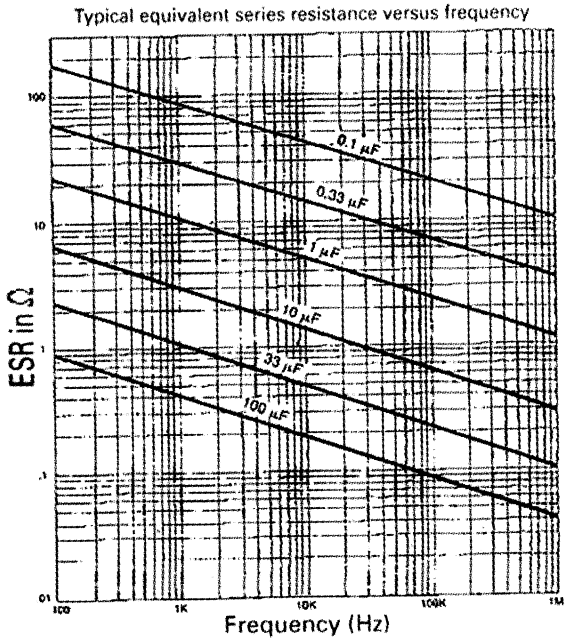
Maximum ripple voltage versus frequency



Typical equivalent series resistance versus frequency



Colour code

Capacitance	
Colour	**Digit**
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9

Capacitance	
Colour	**Tolerance**
No dot	± 20% (*)
Silver	± 10%
Gold	± 5%

(*) Except:
MT0, CD0
No dot: -20% +40%

Notes:

- No dot = black
- Example:

Red	Red	Green
2	2	5

2200000 pF = 2.2 µF

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RECOMMENDED DATA

Soldering recommendations

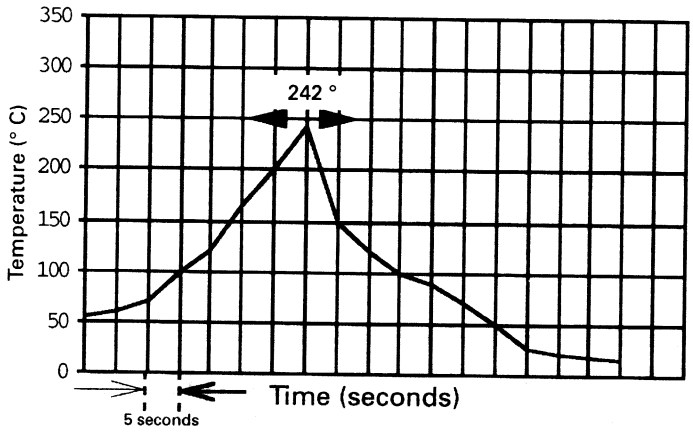
HTC (CTC1) ; TCR ; CTT (CTC2) and TCA

Chips capacitors can be attached using all current soldering techniques such as wave and reflow soldering, vapour phase and hot plate methods.

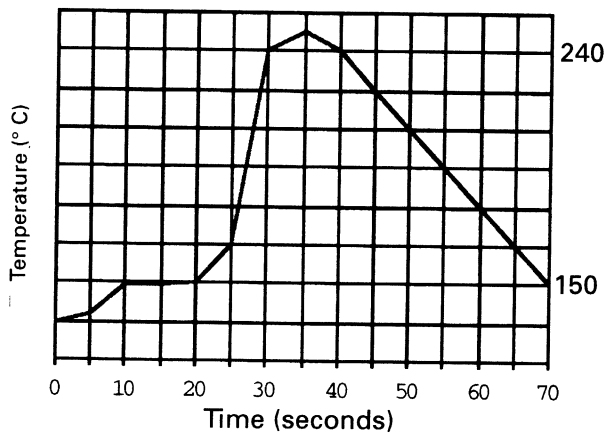
Temperature should not exceed 260° C and recommended time is 10 seconds between 240° C and 260° C.

See curves 1 and 2 for the recommended profiles for a tunnel oven and infrared melting.

Curve 1
TUNNEL OVEN CONDITION

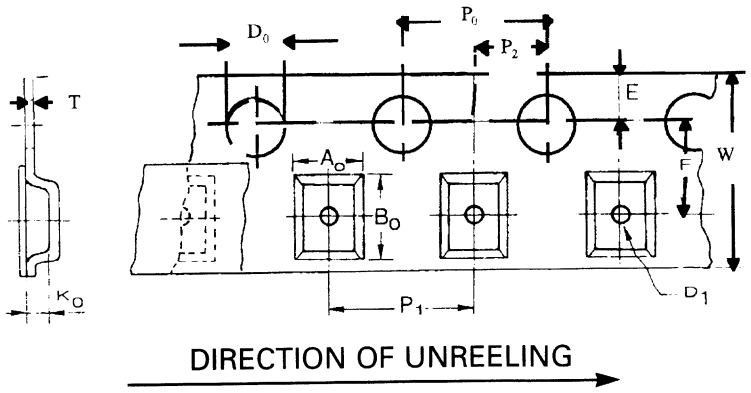


Curve 2
INFARED CONDITION



CHIP CAPACITORS - TAPE & REEL

Tape and reel packaging
(per IEC 286-3)



Tape dimensions (mm)

W ± 0.3	E ± 0.1	F ± 0.05	P_0 ± 0.1	D_0 + 0.1 - 0	D_1 ± 0.1	D_1 max.	P_1 ± 0.1	P_2 ± 0.05
8.0	1.75	3.5	4.0	1.5	1.0	0.3	4/8.0	2.0
12.0	1.75	5.5	4.0	1.5	1.5	0.3	4/8.0	2.0
16.0	1.75	7.5	4.0	1.5	2.0	0.3	8.0	2.0

Note:
1. Ao Bo Ko are defined by the component size
2. Reel diameter: 180.0 mm (nominal)
   Diameter of centre hole: 12.75 + 0.15 mm - 0

Tape width, maximum quantity per reel, components position and pitch (P_1)

CHIP TYPE	CTT - CTC 2				HTC - CTC 1 - TCR			
Case size	Tape Width (mm)	Qty. per Reel	Component Pos.	Component P_1 (mm)	Tape Width (mm)	Qty. per Reel	Component Pos.	Component P_1 (mm)
AM	8.0	2800	T	4.0	—	—	—	—
A	8.0	2800	T	4.0	8.0	2800	T	4.0
B	8.0	1400	L	8.0	8.0	1400	L	8.0
C	8.0	1400	L	8.0	8.0	1400	L	8.0
D	8.0	1400	L	8.0	8.0	1400	L	8.0
E	8.0	1400	L	8.0	8.0	1400	L	8.0
F	8.0	800	L	8.0	12.0	1000	T	8.0
G	12.0	1000	T	4.0	16.0	600	T	8.0
H	16.0	600	T	8.0	16.0	600	T	8.0

Note: The minimum quantity per reel is 50 % of the above mentioned one

Component position

T = Transversal (loading across the tape)
Positive termination away from the sprocket hole

L = Longitudinal
Positive termination in the direction of unreeling

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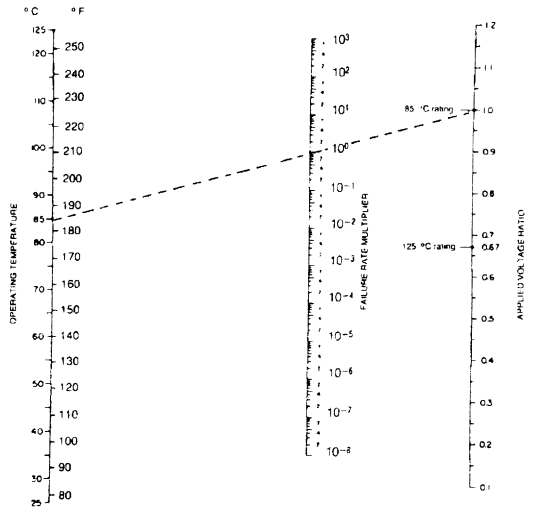
HIGH RELIABILITY - PROGRAMS

The reliability of the solid tantalum capacitors is dependent upon the operating conditions and working environment of the equipment in which they are used. Essentially three factors affect the basic failure rate (FR): APPLIED VOLTAGE (V), OPERATING TEMPERATURE (T) and SERIES CIRCUIT RESISTANCE.

EFFECT OF APPLIED VOLTAGE AND OPERATING TEMPERATURE



T FR multiplier Vapp/Unom

EFFECT OF SERIES CIRCUIT RESISTANCE

Circuit impedance (ohms/volts)	Failure rate multiplying factor
0.1	1.0
0.2	0.8
0.4	0.6
0.6	0.4
0.8	0.3
1.0	0.2
2.0	0.1
3 or greater	0.07

Examples of Selection programs (for HIGH RELIABILITY) in relationship with customers

Some of these programs have been established to verify the intrinsic reliability of a batch, to eliminate early failures in the field and to reduce the potential for failure when subject to adverse environments, such as: vibration, thermal stress, rapid temperature cycling, X-rays, etc... Detailed specifications are available on request.

PROGRAMME	FEATURES	TYPICAL APPLICATIONS
TTF 50	• Very high reliability (operating & storage) • Use with 0.1Ω source impedance with current transients • Parts serialised	• Space • Emergency equipment • Very high security circuits
TTF 33	• High reliability (operating & storage) • Use with 0.1Ω source impedance with current transients	• Aircraft • Emergency equipment • Medical • Military applications • High security circuits
TTF 36	• High reliability • Use with 0.5 Ω source impedance	• Military applications • Professional applications
TTF 31	• Specially developed for MT & MTN • Identical to TTF 36 except test at 125° C instead of 85° C	• High temperature military and professional application

CROSS REFERENCE LIST

Solid LEADED tantalum capacitors

TEKELEC TEMEX	CECC Ref.	SPRAGUE	KEMET	AVX	FIRADEC	TANSITOR	ROEDERSTEIN	SIEMENS MATSUSHITA
ATR	CTS1	CTS1	T110	TAA	SI125			B45170
ATM	CTS13	CTS13	T110	TAA	SI85			
ATP	CTS32	CTS32	T110	TAA	IS125			
ATB	CTS27	CTS27	T340		CIP125		ETR	B45181
MTR	CTS4			TMM	SBMR	TC-C-R		
MTA	CTS44			TMM	SBMA	TC-C-A		
THR	TAH			TAH	--	--		
MTNR	CTS5				NSBMR	TC-N-R		
MTNA	--				NSBMA	TC-N-A		
CDR	--				SCMR	HA-C-R		
CDA	--				SCMA	HA-C-A		
CDNR	--				NSCMR	HA-N-R		
CDNA	--				NSCMA	HA-N-A		
ATRN	CTS20							

Solid CHIP tantalum capacitors

TEKELEC TEMEX	CECC Ref.	SPRAGUE	KEMET	AVX	FIRADEC	TANSITOR	MIL Std	ROEDERSTEIN
HTC	CTC1	194D	--	TAZ (*)	--	GC / CWR06	--	--
TCR	CTC1	194D	--	--	--	--	CWR06 (**)	--
CTT	CTC2	195D	--	--	--	--	CWR10	ETD
TCA (***)	CTC95	595D	--	--	--	--	--	--
CTC21	CTC21		--	--	CTC21	--	--	--
CTC23	CTC23		--	--	CTC23	--	--	--

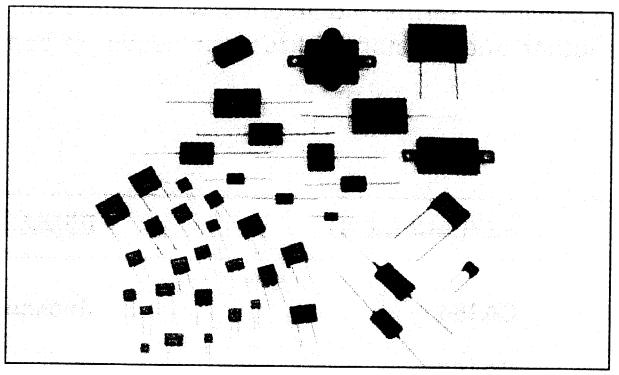
(*) TAZ is a molded product in the same range as the CTC1

(**) CWR09 is also equivalent

(***) TCA is equivalent to case size S of 595D series from Vishay - Sprague

SILVERED MICA CAPACITORS

CONTENTS



This catalog doesn't contain all products manufactured by TEKELEC TEMEX.
Don't hesitate to consult us for special requirements.

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Replacement suggestion

In order to give you the best service in terms of deliveries, we suggest you, every time it's possible to replace a component by another one, to standardize your needs on some preferential types listed hereafter:

TYPE	REPLACEMENT	REMARKS
CA160/161	CA154	thickness
S5	CA152	thickness
S13	CA155	C max: 3000 pF
S15	CA155	
S20	CA172/173	
CA113/114	S10 or CA154	Ur
CA115 dipped	CA115 transfer molded	
CA116/117	CA172/173	Ur
CA71	CA20	Ur from 1000 to 2200 pF
CA72	CA40	Ur from 8200 to 10000 pF leads diameter
CA73C	CA19	thickness

HOW TO ORDER

Ordering codes are easily created. You just have to indicate the type, the rated voltage, the capacitance value and the tolerance. Hereafter are some examples:

- CA154 250V 47 pF 5 %
- CA163 250V 8250 pF 2 %
- CA15 300V 523 pF 1 %

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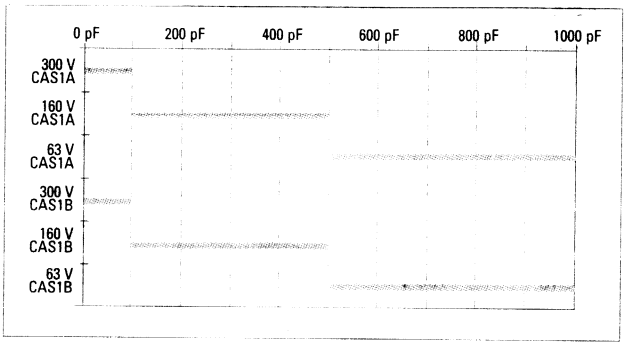
SMD Series - CAS1A & CAS1B

GENERAL CHARACTERISTICS

Chip style capacitors - Transfer molding
Marking: capacitance, tolerance

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
CAS1A	300 V	4.7	100
CAS1A	160 V	100	510
CAS1A	63 V	510	1000
CAS1B	300 V	4.7	100
CAS1B	160 V	100	510
CAS1B	63 V	510	1000



TOLERANCE ON CAPACITANCE

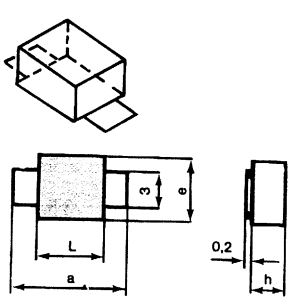
see table page 12-19 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

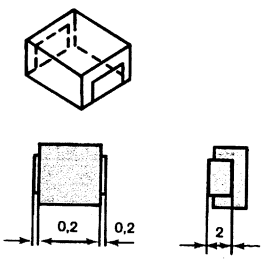
a (*)	L	e	H
9.4 ± 0.2	5.2 ± 0.4	4.7 ± 0.4	3.6 ± 0.4

(*) : for CAS1A only

CAS1A



CAS1B



ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1 mn): 2.5 Ur @ 20° C
- Insulation resistance: ≥ 100000 MΩ @ 20° C

Radial Types

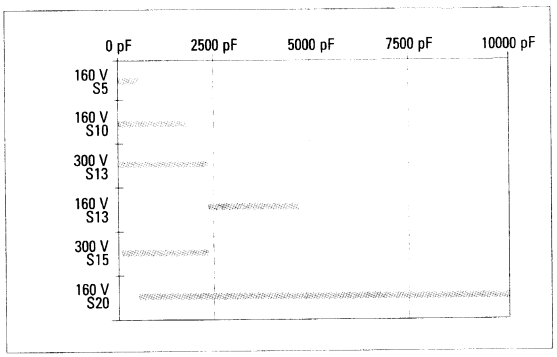
S 5 TO S 20

GENERAL CHARACTERISTICS

Box shaped capacitors with radial lead for printed circuit boards - Transfer molding
Marking: type, capacitance, tolerance and manufacturer's trade mark.

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
S5	160 V	4.7	512
S10	160 V	4.7	1800
S13	300 V	4.7	2200
S13	160 V	4.7	2200
S15	160 V	2200	4700
S20	160 V	560	10000

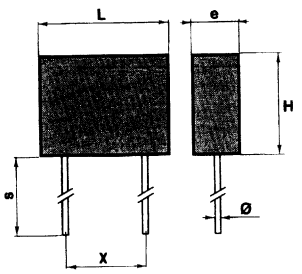


TOLERANCE ON CAPACITANCE

see table page 12-19 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

Type	L	H	e ± 0.5	x
S5	6 ± 0.5	5.5 ± 0.5	3	2.5 ± 0.2
S10	9 ± 1	6 ± 1	3	5.1 ± 0.2
S13	11.2 ± 1	8.5 ± 1.5	4.4	7.6 ± 0.3
S15	12 ± 0.5	8 ± 0.5	3.5	7.6 ± 0.3
S20	18 ± 0.5	12 ± 0.5	4	10.2 ± 0.3

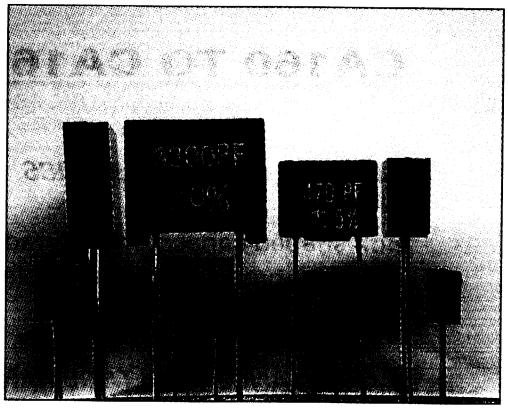


Leads diameter: 0.5 mm for S5 - 0.6 mm for S10, S13 & S15 - 0.8 mm for S20

ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C
- Insulation resistance: ≥ 100 000 MΩ @ 20° C

CA152 TO CA156

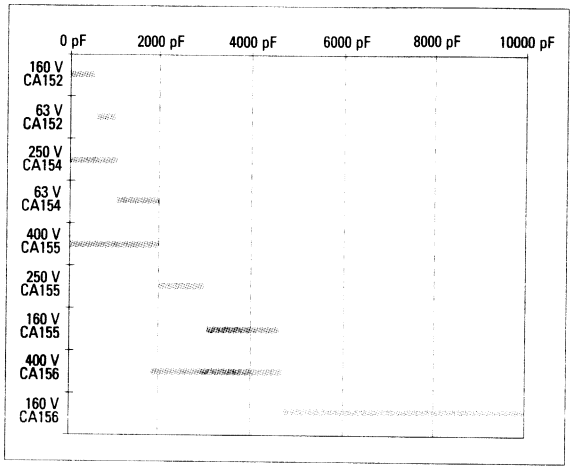


GENERAL CHARACTERISTICS

Box shaped capacitors with radial leads for printed circuit boards
Transfer molding
Marking: type, capacitance, tolerance and manufacturer's trade mark.

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA152	160 V	4.7	510
CA152	63 V	510	1000
CA154	250 V	4.7	1000
CA154	63 V	1000	2000
CA155	400 V	4.7	2000
CA155	250 V	2000	3000
CA155	160 V	3000	4700
CA156	400 V	1800	4700
CA156	160 V	4700	10000



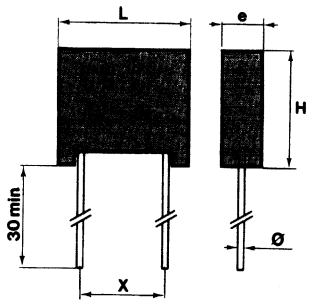
TOLERANCE ON CAPACITANCE

see table page 12-19 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

Type	L	H (*)	e	x
CA152	5.5 ± 0.5	6 ± 0.5	3 ± 0.5	2.5 ± 0.2
CA154	8.5 ± 1	7.7 ± 0.5	4.5 ± 0.5	5.1 ± 0.2
CA155	12 ± 1	10.5 ± 1.5	4.5 ± 0.5	7.6 ± 0.3
CA156	15.7 ± 1.5	14 ± 1.5	5 ± 0.5	10.2 ± 0.3

(*): including height of supports.
Leads diameter: 0.5 mm for CA152 & CA154, 0.6 mm for CA155, 0.8 mm for CA156.



For CA152, leads length is 15 mm min.

ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C
- Insulation resistance: ≥ 100000 MΩ @ 20° C

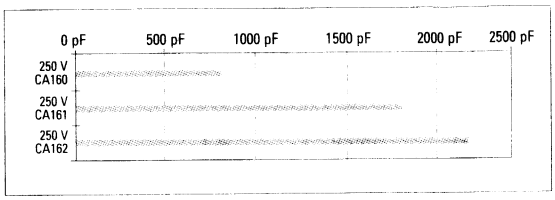
CA160 TO CA165

GENERAL CHARACTERISTICS

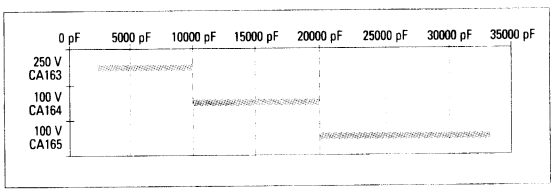
Box shaped capacitors with radial leads for printed circuit boards - Transfer molding
Marking: type, capacitance, tolerance and manufacturer's trade mark.

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA160	250 V	4.7	820
CA161	250 V	10	1800
CA162	250 V	4.7	2200



Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA163	250 V	2 210	10000
CA164	125 V	10000	20000
CA165	125 V	20000	33000

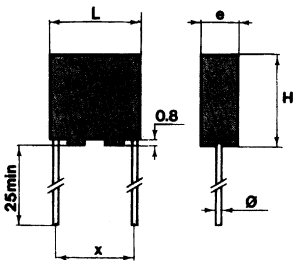


TOLERANCE ON CAPACITANCE

see table page 12-19 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

Type	L	H (*)	e max	x ± 0.3
CA160	9 ± 0.5	8.5 ± 0.5	2.5	5.1
CA161	9 ± 0.5	10 ± 0.5	2.5	5.1
CA162	11.7 ± 1	11.7 ± 1	3.4	10.2
CA163	11.7 ± 1	11.7 ± 1	5	10.2
CA164	11.7 ± 1	11.7 ± 1	7.5	10.2
CA165	11.7 ± 1	11.7 ± 1	10.5	10.2



(*): including height of supports.
Leads diameter: 0.6 mm for CA160, CA161 & CA162
0.8 mm for CA163, CA164 & CA165

ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C
- Insulation resistance: ≥ 100000 MΩ @ 20° C

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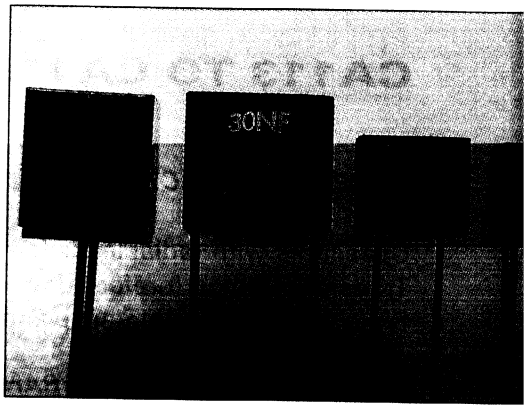
CA172 TO CA175

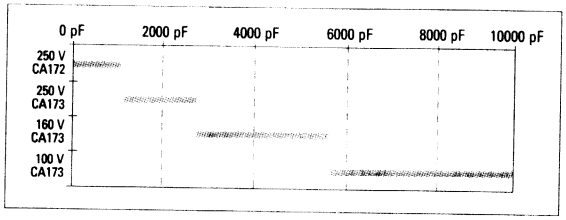


GENERAL CHARACTERISTICS

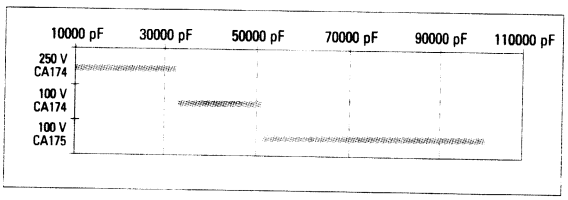
Box shaped capacitors with radial leads for printed circuit boards
Transfer molding
Marking: type, capacitance, tolerance and manufacturer's trade mark.

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA172	250 V	4.7	1200
CA173	250 V	1200	2700
CA173	160 V	2700	5600
CA173	100 V	5600	10000



Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA174	250 V	10000	33000
CA174	100 V	33000	51000
CA175	100 V	51000	100000



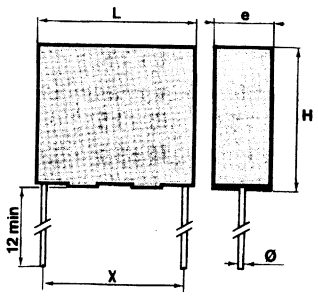
TOLERANCE ON CAPACITANCE

see table page 12-19 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

Type	L ± 0.2	H ± 0.2 (*)	e ± 0.2	x ± 0.3
CA172	13.1	8.3	2.3	10.2
CA173	13.1	8.3	4.8	10.2
CA174	20	18.3	4.8	17.8
CA175	20	18.3	7.4	17.8

(*): including the height of the supports.
Leads diameter: 0.6 mm for CA172 & CA173, 0.8 mm for CA174 & CA175.



ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C
- Insulation resistance: ≥ 100000 MΩ @ 20° C for C < 10000 pF
  > 1000 s @ 20° C for C ≥ 10000 pF

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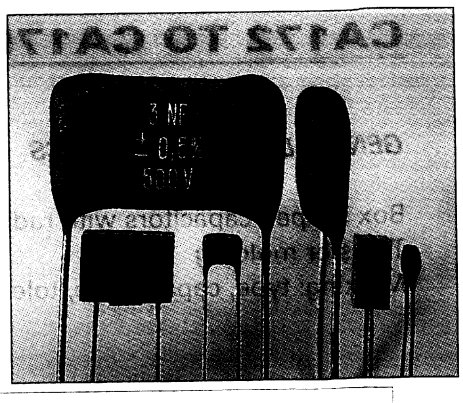
CA113 TO CA118

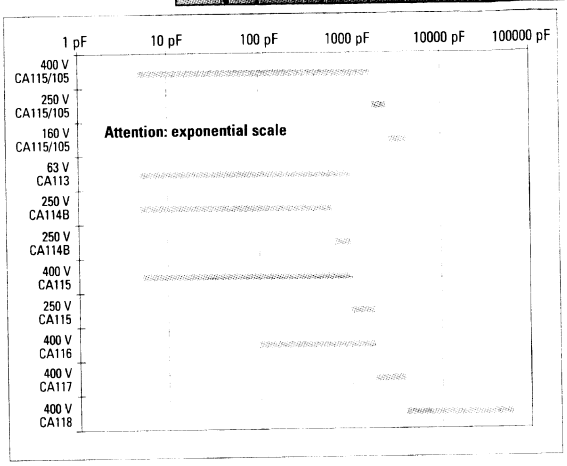


GENERAL CHARACTERISTICS

Capacitors with radial leads for printed circuit boards
Transfer molding (preferred) or dipped Marking:
type, capacitance, tolerance and manufacturer's trade mark.

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA115/105	400 V	4.7	2000
CA115/15	250 V	2000	3000
CA115/105	160 V	3000	4700
CA113	63 V	4.7	1000
CA114A	250 V	4.7	510
CA114B	250 V	510	1000
CA115	400 V	4.7	1000
CA115	250 V	1000	2200
CA116	400 V	100	2200
CA117	400 V	2200	4700
CA118	400 V	4700	56000



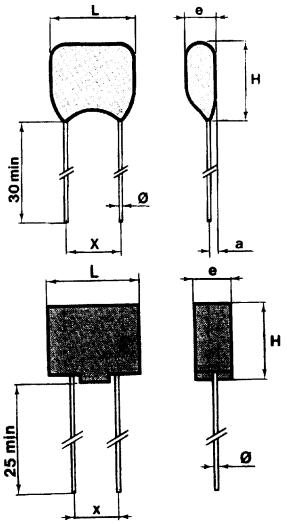
TOLERANCE ON CAPACITANCE

see table page 12-19 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

Type	L	H (*)	e max	x	a ± 0.3
CA115/105	11.2 ± 1	8.5 ± 1.5	4.5	7.6 ± 0.2	NA
CA113	6.5 ± 0.5	6 ± 0.5	3.5	5.1 ± 0.3	1
CA114A	8 ± 0.5	6 ± 1.5	4.5	5.1 ± 0.3	1
CA114B	8.5 ± 0.5	6 ± 1.5	5	5.1 ± 0.3	1
CA115	10.5 ± 1.5	10 ± 1.5	4.9	7.6 ± 0.3	1.2
CA116	16 ± 1	14 ± 1.5	7.5	10.2 ± 0.3	1.8
CA117	20.5 ± 1	15 ± 1	7.5	10.2 ± 0.3	1.8
CA118	32 ± 2	24 ± 2	12	25.4 ± 0.3	2.5

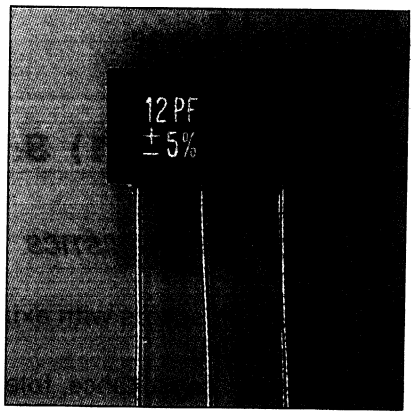
(*): including the height of supports for molded types
Leads diameter: 0.6 mm for CA115/105 & CA115, 0.8 mm for CA116 & CA117, 1 mm for CA118.



ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +85° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C
- Insulation resistance: ≥ 100000 MΩ @ 20° C for C < 10000 pF
  > 1000 s @ 20° C for C ≥ 10000 pF

EX110 / 115 / 120 (DM STYLE)

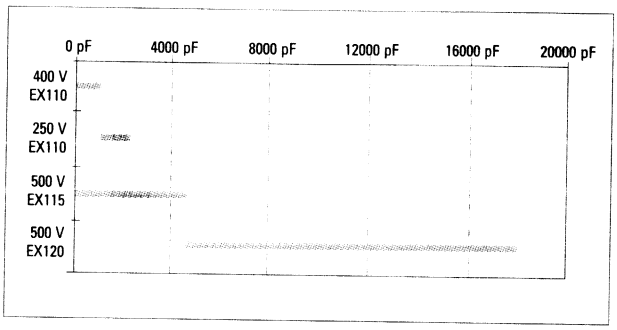


GENERAL CHARACTERISTICS

Capacitors with radial leads for printed circuit boards
Transfer molding (preferred) or dipped
Marking: type, capacitance, tolerance and manufacturer's trade mark.
For available classes according to capacitances and tolerances,
see table page 12-18.

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
EX110	400 V	4.7	1000
EX110	250 V	1000	2200
EX115	500 V	4.7	4700
EX120	500 V	4700	18000



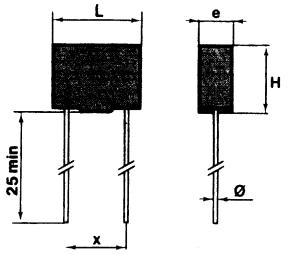
TOLERANCE ON CAPACITANCE

see table page 12-19 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

Type	L	H(*)	e ± 0.5	x ± 0.2
EX110	9 ± 0.5	9 ± 0.5	4.8	3.8
EX115	11.2 ± 0.4	10.5 ± 0.4	4.8	5.7
EX120	17 ± 1	14 ± 1	6.8	8.9

(*): including the height of supports.
Leads diameter: 0.5 mm for EX110 ; 0.6 mm for EX115 ; 0.8 mm for EX120

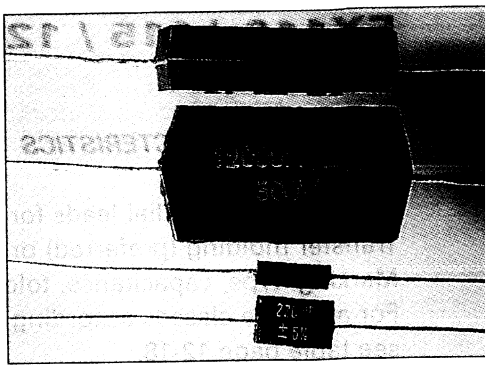


ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C
- Insulation resistance: ≥ 100000 MΩ @ 20° C for C < 10000 pF
  > 1000 s @ 20° C for C ≥ 10000 pF

Axial Types

CA10 (CA131) & CA19

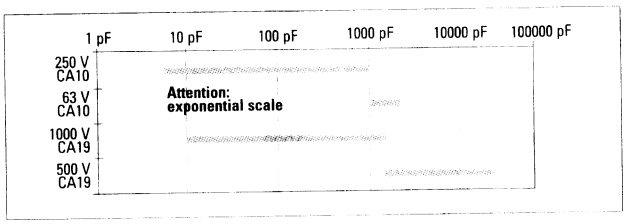


GENERAL CHARACTERISTICS

Box shaped capacitors with axial leads for printed circuit boards
Transfer molding
Marking: type, capacitance, tolerance and manufacturer's trade mark.

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA10	250 V	4.7	1000
CA10	63 V	1000	2200
CA19	1000 V	10	1600
CA19	500 V	1600	24900



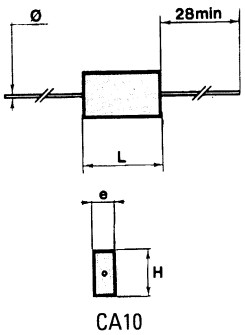
TOLERANCE ON CAPACITANCE

see table page 12-19 showing standardized values according to Renard series E24 to E192

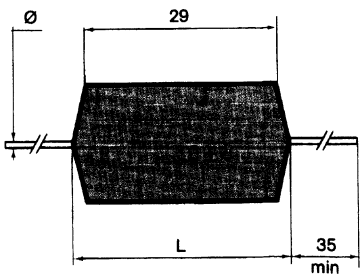
SHAPE AND DIMENSIONS (mm)

Type	L	H	e
CA10	9.5 + 0 -1	5.5 + 0 -1	3 ± 0.3
CA19	33.5 + 0 -2	18 + 0 -2	8.5 + 0.5 -1.5

Leads diameter: 0.5 mm for CA10 ; 1 mm for CA19



CA10



CA19

ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C for Ur < 1000 V
  2 Ur @ 20° C for Ur ≥ 1000 V
- Insulation resistance: ≥ 100000 MΩ @ 20° C for C < 10000 pF
  > 1000 s @ 20° C for C ≥ 10000 pF

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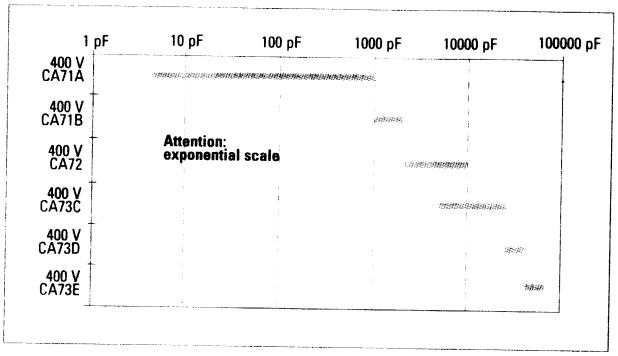
CA71, CA72 & CA73

GENERAL CHARACTERISTICS

Capacitors with axial leads for printed circuit boards - Termosetting resin dipped
Marking: type, capacitance, tolerance and manufacturer's trade mark.

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA71A	400 V	5	1000
CA71B	400 V	1000	2200
CA72	400 V	2200	10000
CA73C	400 V	4700	27000
CA73D	400 V	2700	39000
CA73E	400 V	39000	56000



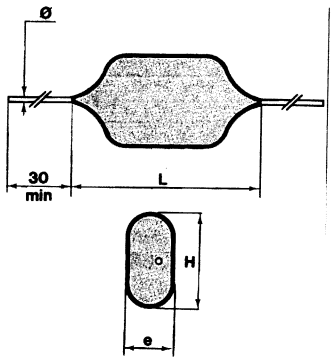
TOLERANCE ON CAPACITANCE

see table page 12-19 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

Type	L	H	e max
CA71A	24 ± 2	11.5 ± 1	6
CA71B	24 ± 2	11.5 ± 1	7.5
CA72	28 ± 2	12.5 ± 1	7.5
CA73C	41 ± 2	20 ± 2	8
CA73D	41 ± 2	20 ± 2	9
CA73E	41 ± 2	20 ± 2	12

Leads diameter: 0.8 mm for CA71 & CA72 - 1 mm for CA73



ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C for Ur < 1000 V
- Insulation resistance: ≥ 100000 MΩ @ 20° C

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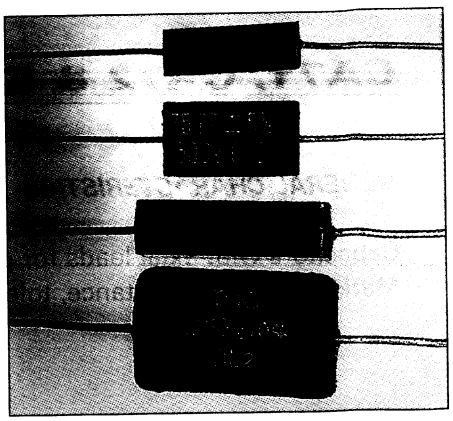
CA15 & CA20 (CM STYLE)

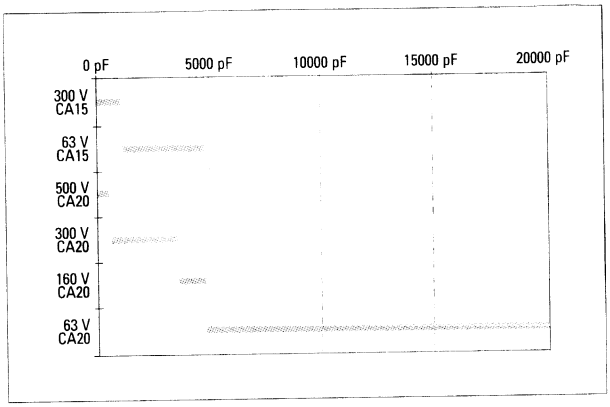


GENERAL CHARACTERISTICS

Box shaped capacitors with axial leads for printed circuit boards
Transfer molding
Marking: type, capacitance, tolerance, class[1] and manufacturer's trade mark.

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA15	300 V	4.7	1000
CA15	63 V	1000	4700
CA20	500 V	4.7	510
CA20	300 V	510	3300
CA20	160 V	3300	4700
CA20	160 V	3300	4700
CA20	63 V	4700	20000



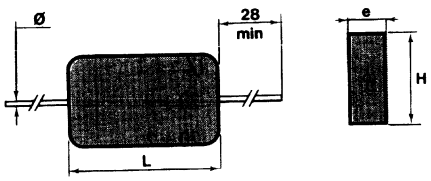
TOLERANCE ON CAPACITANCE

see table page 12-19 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

Type	L	H	e
CA15	13 ± 1	7 ± 1	4.5 ± 1
CA20	18.5 ± 1.5	11.5 ± 1	5 ± 1

Leads diameter: 0.6 mm for CA15 ; 0.8 mm for CA20



ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C
- Insulation resistance: ≥ 100000 MΩ @ 20° C

[1] for informations regarding available classes according to capacitances and tolerances, see table page 18

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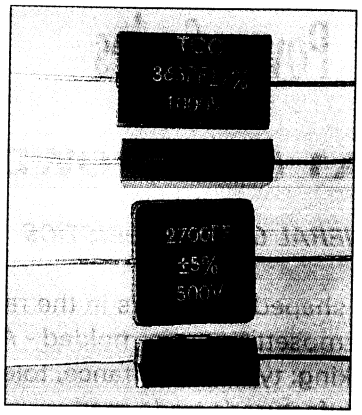
CA30, CA35 & CA40 (CM STYLE)

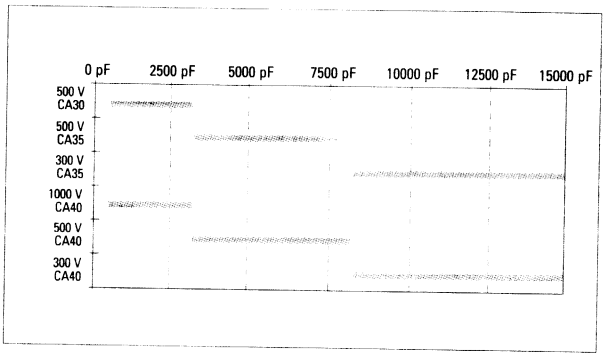


GENERAL CHARACTERISTICS

Box shaped capacitors with axial leads for printed circuit boards
Transfer molding
Marking: type, capacitance, tolerance and manufacturer's trade mark.

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA30	500 V	510	3300
CA35	500 V	3300	8200
CA35	300 V	8200	15000
CA40	1000 V	510	3300
CA40	500 V	3300	8200
CA40	300 V	8200	15000



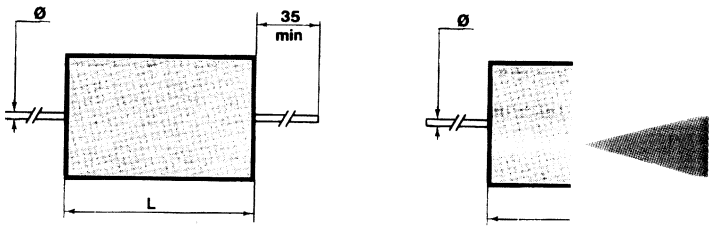
TOLERANCE ON CAPACITANCE

see table page 12-19 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

Type	L	H	e
CA30	20.5 ± 1	20.5 ± 1	6.5 ± 1
CA35	20.5 ± 1	20.5 ± 1	8 ± 1
CA40	25 ± 1	15 ± 1.5	8 ± 1

Leads diameter: 1 mm for the three models.



ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C for Ur < 1000 V
  2 Ur @ 20° C for Ur ≥ 1000 V
- Insulation resistance: ≥ 100000 MΩ @ 20° C for C < 10000 pF
  > 1000 s @ 20° C for C ≥ 10000 pF

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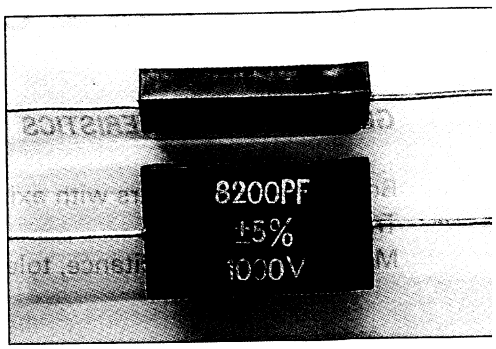
Power Series



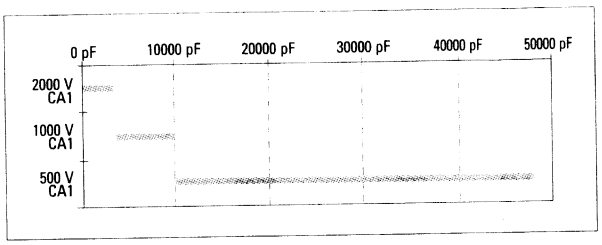
CA1 (LOW POWER SERIES)

GENERAL CHARACTERISTICS

Box shaped capacitors in the range of 500 V to 2000 V
Thermosetting resin molded - Axial leads
Marking: type, capacitance, tolerance, rated voltage, manufacturer's trade mark.

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA1	2000 V	10	3300
CA1	1000 V	3300	10000
CA1	500 V	10000	47000



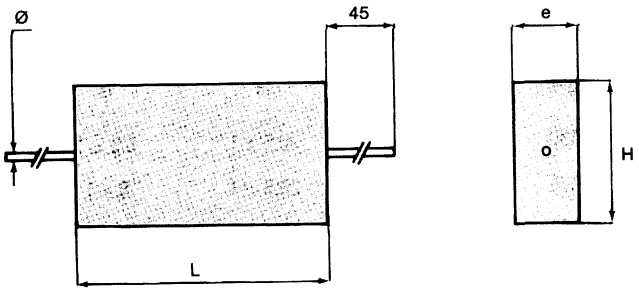
TOLERANCE ON CAPACITANCE

see table page 12-18 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

Type	L	H	e
CA1	38 ± 1.5	22 ± 1.5	9.5 ± 1

Leads diameter: 1.2 mm



ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C for Ur < 1000 V
  2 Ur @ 20° C for Ur ≥ 1000 V
- Insulation resistance: ≥ 100000 MΩ @ 20° C for C < 10000 pF
  > 1000 s @ 20° C for C ≥ 10000 pF
- Admissible current: see curves page 12-17

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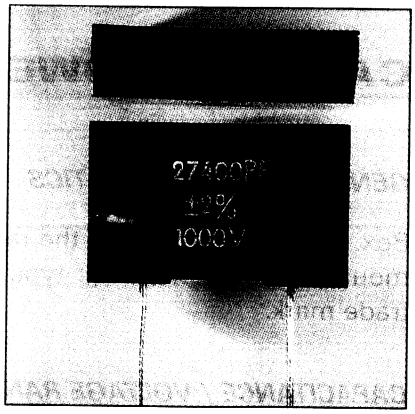
CA3R (HIGH VOLTAGE SERIES)

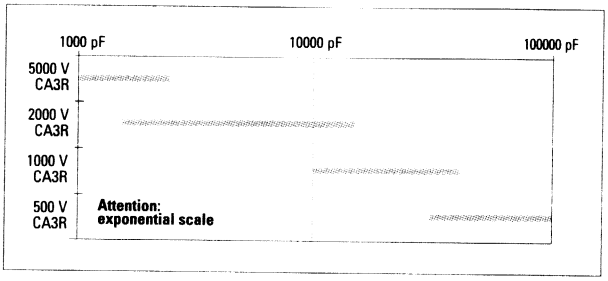


GENERAL CHARACTERISTICS

Box shaped capacitors in the range of 500 V to 5000 V
Termosetting resin molded - Radial leads
Marking: type, capacitance, tolerance, rated voltage, manufacturer's trade mark.

CAPACITANCE / VOLTAGE RANGE

Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA3R	5000 V	1000	2200
CA3R	2000 V	1500	15000
CA3R	1000 V	10000	47000
CA3R	500 V	33000	100000



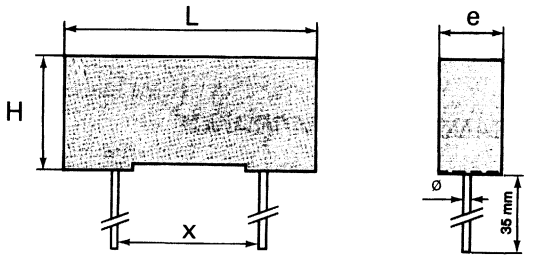
TOLERANCE ON CAPACITANCE

see table page 12-19 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

Type	L	H	e	x
CA3R	48 ± 1	30 ± 1	12 ± 1	28 ± 0.2

Leads diameter: 1.2 mm



ELECTRICAL CHARACTERISTICS

- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C for Ur < 1000 V
  2 Ur @ 20° C for 1000 V ≤ Ur < 5000 V
  1.5 Ur @ 20° C for Ur = 5000 V
- Insulation resistance: ≥ 100000 MΩ @ 20° C for C < 10000 pF
  > 1000 s @ 20° C for C ≥ 10000 pF
- Admissible current: see curves page 12-17

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CA2 (LOW POWER SERIES)

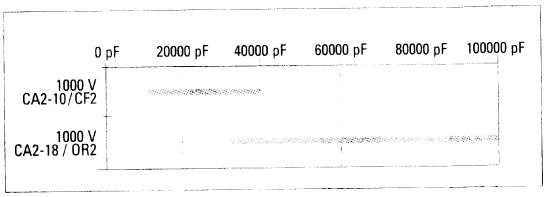
GENERAL CHARACTERISTICS

Box shaped capacitors in the range of 1000 to 5000 V - Thermosetting resin molded - OR2 type with mounting ears - Marking: type (except OR2), capacitance, tolerance, rated voltage, manufacturer's trade mark.

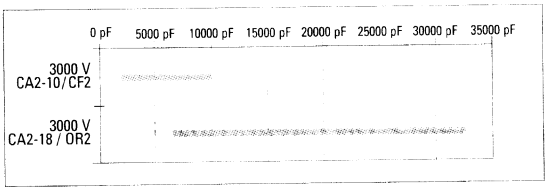
CAPACITANCE / VOLTAGE RANGE

The tables hereafter show the different ranges of capacitance/voltage products given by rated voltages

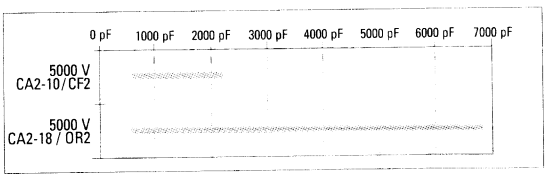
Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA2-10 / CF2	1000 V	10000	40000
CA2-18 / OR2	1000 V	33000	100000



Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA2-10 / CF2	3000 V	2200	1000
CA2-18 / OR2	3000 V	6800	33000



Type	Voltage	Minimum value (pF)	Maximum value (pF)
CA2-10 / CF2	5000 V	510	2200
CA2-18 / OR2	5000 V	510	6800



TOLERANCE ON CAPACITANCE

See table page 12-19 showing standardized values according to Renard series E24 to E192

SHAPE AND DIMENSIONS (mm)

Details on next page

ELECTRICAL CHARACTERISTICS

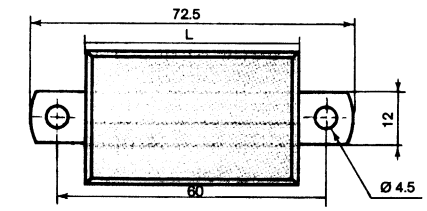
- Operating temperature range: -55° C / +125° C
- Rated voltage: Ur over the operating temperature range
- Voltage proof (test 1mn): 2.5 Ur @ 20° C
- Insulation resistance: ≥ 100000 MΩ @ 20°C for C < 10000 pF
  > 1000 s @ 20° C for C ≥ 10000 pF
- Admissible current: see curves page 12-17

SHAPE AND DIMENSIONS

TYPE	L ± 1	H ± 1	e ± 1
CA2-10	48	30	10
CF2	45.5	30	10
CA2-18	48	30	18
OR2	45	30	16.5

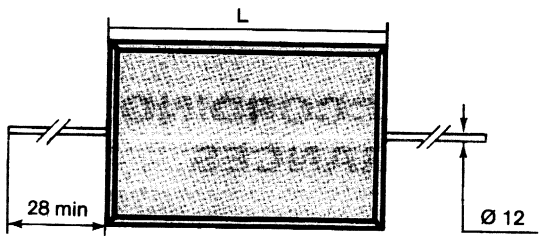
Others dimensions (lugs, mounting ears, leads diameter) are given on the different drawings.

CA2-10, CA2-18

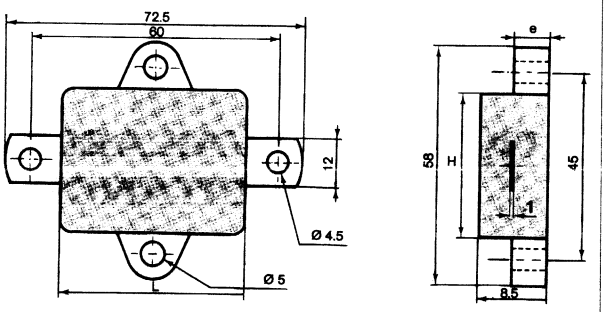


External length: 72.5
Distance between lug's holes: 60 mm

CF2



OR2



RATED CURRENT CURVES (CA1 & CA2)

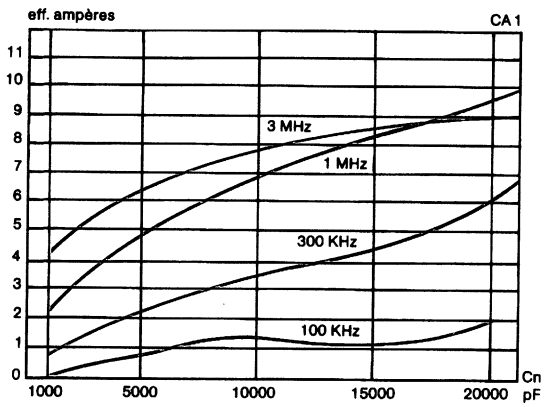


Fig. 1

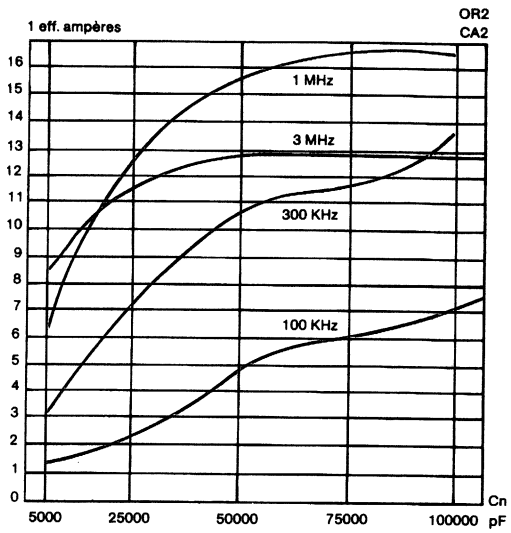


Fig. 2

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APPENDIX

MICA CAPACITORS CLASSES: DEFINITION

Class of mica capacitors is defined by temperature coefficient and capacitance drift after thermal cycle. The measurements are done in accordance with CECC 31300 § 2-5.

Code	Temperature cœfficient (10^{-6} / ° C)	Capacitance drift limit after thermal cycle (pF)
1	-200 +200 -100 +100	± (5.10^{-3} C_r + 0.1) ± 0.3% + 0.1 pF
2	-20 +100 0 + 70	± (1.10^{-3} C_r + 0.1) ± 0.05% + 0.1 pF
3	-20 +50	± (5.10^{-4} C_r + 0.1)
4	-20 +30	± (5.10^{-4} C_r + 0.1)

TABLE OF AVAILABLE CLASSES ACCORDING TO CAPACITANCES AND TOLERANCES

applicable for CA15-20-30-35 (CM Style) and EX110-115-120 (DM Style)

Type	Capacitance (pF)	Voltage (V)	E12 ± 10%	E24 ± 5%	E48 ± 2%	E96 ± 1%
CA15	4.7 ≤ C < 10	300 V	1	-	-	-
	10 ≤ C < 22	300 V	1	1	-	-
	22 ≤ C < 47	300 V	2	2	2	-
	47 ≤ C < 100	300 V	2	2	2	2
	100 ≤ C < 510	300 V	3	3	3	3
	510 ≤ C < 1000	300 V	3 - 4	3 - 4	3 - 4	3 - 4
	1000 ≤ C < 4700	63 V	3 - 4	3 - 4	3 - 4	3 - 4
CA20	4.7 ≤ C < 22	500 V	1	-	-	-
	22 ≤ C < 47	500 V	2	2	-	-
	47 ≤ C < 100	500 V	2	2	2	-
	100 ≤ C < 510	500 V	3	3	3	3
	510 ≤ C < 3300	300 V	3 - 4	3 - 4	3 - 4	3 - 4
	3300 ≤ C < 4700	160 V	3 - 4	3 - 4	3 - 4	3 - 4
	4700 ≤ C < 20000	63 V	4	4	4	4

Type	Capacitance (pF)	Voltage (V)	E12 ± 10%	E24 ± 5%	E48 ± 2%	E96 ± 1%
CA30	510 ≤ C < 3300	500 V	3 - 4	3 - 4	3 - 4	3 - 4
CA35	3300 ≤ C < 8200	500 V	3 - 4	3 - 4	3 - 4	3 - 4
	8200 ≤ C < 15000	300 V	3 - 4	3 - 4	3 - 4	3 - 4
EX110	4.7 ≤ C < 100	400 V	2	2	-	-
	100 ≤ C < 510	400 V	3	3	3	3
	510 ≤ C < 1000	400 V	3	3	3	3
	1000 ≤ C < 2200	250 V	3	3	3	3
EX115	4.7 ≤ C < 100	500 V	2	2	2	-
	100 ≤ C < 510	500 V	3	3	3	3
	510 ≤ C < 2200	500 V	3	3	3	3
	2200 ≤ C < 4700	500 V	3	3	3	3
EX120	4700 ≤ C < 18000	500 V	3	3	3	3

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TABLE OF STANDARDIZED VALUES FOR MICA CAPACITORS ACCORDING TO THE REQUESTED TOLERANCE

E24 ± 5%	E48 ± 2%	E96 ± 1%	E192 ± 0.5%	E24 ± 5%	E48 ± 2%	E96 ± 1%	E192 ± 0.5%	E24 ± 5%	E48 ± 2%	E96 ± 1%	E192 ± 0.5%	E24 ± 5%	E48 ± 2%	E96 ± 1%	E192 ± 0.5%
100	100	100	100		178	178	178		316	316	316	560	562	562	562
			101	180			180				320				569
		102	102			182	182			324	324			576	576
			104				184	330			328				583
	105	105	105		187	187	187		332	332	332		590	590	590
			106				189				336				597
		107	107			191	191			340	340			604	604
			109				193				344				612
110	110	110	110		196	196	196		348	348	348	620	619	619	619
			111				198				352				626
		113	113	200		200	200			357	357			634	634
			114				203	360			361				642
	115	115	115		205	205	205		365	365	365		649	649	649
			117				208				370				657
		118	118			210	210			374	374			665	665
120			120				213				379				673
	121	121	121		215	215	215		383	383	383	680	681	681	681
			123	220			218				388				690
		124	124			221	221	390		392	392			698	698
			126				223				397				706
	127	127	127		226	226	226		402	402	402		715	715	715
			129				229				407				723
130		130	130			232	232			412	412			732	732
			132				234				417				741
	133	133	133		237	237	237		422	422	422	750	750	750	750
			135	240			240				427				759
		137	137			243	243	430		432	432			768	768
			138				246				437				777
	140	140	140		249	249	249		442	442	442		787	787	787
			142				252				448				796
		143	143			255	255			453	453			806	806
			145				258				459	820			816
	147	147	147		261	261	261		464	464	464		825	825	825
			149				264	470			470				835
150		150	150	270		267	267			475	475			845	845
			152				271				481				856
	154	154	154		274	274	274		487	487	487		866	866	866
			156				277				493				876
		158	158			280	280			499	499			887	887
160			160				284				505				898
	162	162	162		287	287	287	510	511	511	511	910	909	909	909
			164				291				517				920
		165	165			294	294			523	523			931	931
			167				298				530				942
	169	169	169	300	301	301	301		536	536	536		953	953	953
			172				305				542				965
		174	174			309	309			549	549			976	976
			176				312				556				966

☞ ***Common tolerances are from 5 % to 1 % (E24 to E96 series). E192 values are available only on special request. Please consult your local sales offices.***

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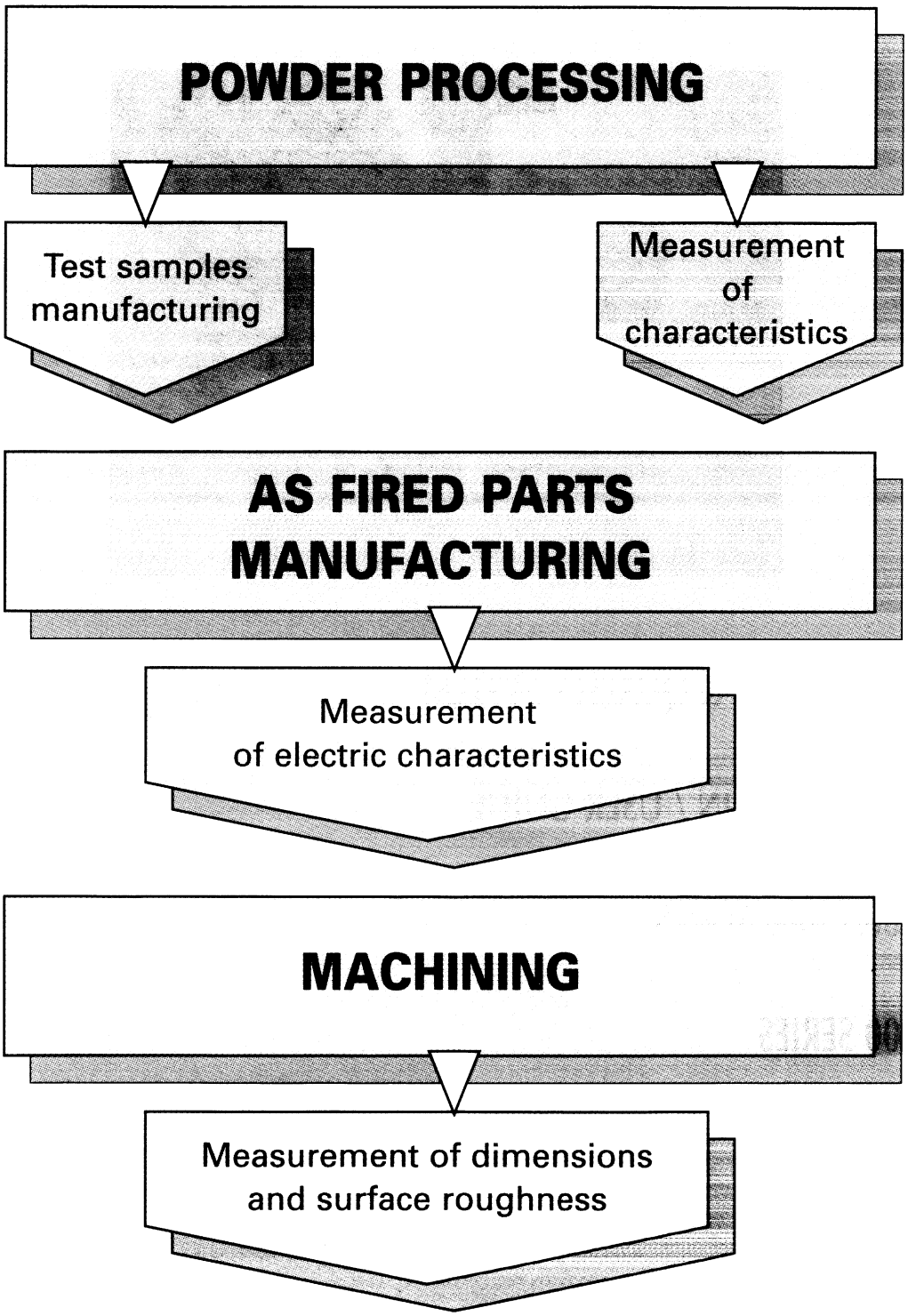
MICROWAVE DIELECTRIC RESONATORS

CONTENTS

Production and Quality System ISO 9001

Dielectric ceramic materials



(*) or 1 µA whichever is greater

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INTRODUCTION

TEKELEC TEMEX is a leading supplier of microwave ceramic materials and has over 30 years experience in designing and manufacturing dielectric resonators for the electronics industry. The facility uses the most effective manufacturing techniques to bring you high quality components on time.

This brochure presents a description of TEKELEC TEMEX's dielectric resonators, specially designed to meet the demand of microwave applications for high-performance and low-cost devices. TEKELEC TEMEX's dielectric resonators are designed to provide the highest quality level at the most cost-effective price.

Our recognized quality level wouldn't be possible without a fully certified quality system. The factory has got the ISO9001 label (#92/474) for many years and quality is a priority for all the departments.

Typical applications include TVRO/DBS, DROs, narrowband microwave filters, microwave oscillators, radar detectors, alarm systems.

If you are looking for a supplier of dielectric resonators which can offer:

- high quality products at competitive prices
- a wide range of products
- a fully certified quality organisation system
- large production capacity
- a staff of engineers available to answer your request

please, contact your local TEKELEC TEMEX agent for more information.

GENERAL INFORMATION

General information on the use of dielectric resonators

Dielectric resonators are mainly designed to replace resonant cavities in microwave circuits (filters, oscillators, etc...). Like resonant cavities, they present the following features:

- resonant modes of frequency determined by the dimensions
- high Q-factors

But they also have the following advantages:

- more compact
- higher temperature stability
- easy to use

The main difference lies in the fact that the wavelength in dielectric materials is divided by the square root of the permittivity. Moreover, unlike resonant cavities, the reactive power stored during resonance is not strictly confined inside the resonator. The leakage fields from the resonator can be used for coupling or adjusting the frequency.

With an isolated resonator, these leakage fields produce a radiation which may be useful (to produce an antenna for example) but which must be eliminated by metal shielding - in most applications - in order to prevent any decay of the quality factor. The design of the shield plays a very important part in final performances such as insertion loss, spectral purity, temperature stability and spurious mode rejection.

The most commonly used mode is reffered to as $TE_{01\delta}$ (fig. 1) which has a rotational symmetry. The encapsulation must respect this symmetry in order to get optimum performances. Other modes not possessing this symmetry can be used for very specific applications. Some are hybrid modes (HE_{111} for example) and the influence of the encapsulation becomes even more important in these cases. Metallized coaxial resonators can also be used in TEM mode for frequencies lower than 2 GHz (please, see part 3-1).

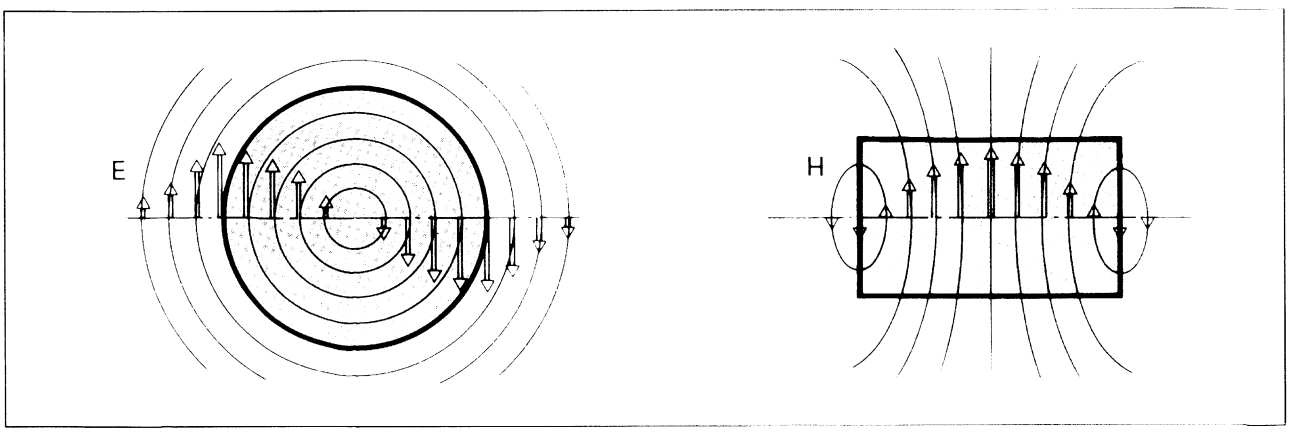
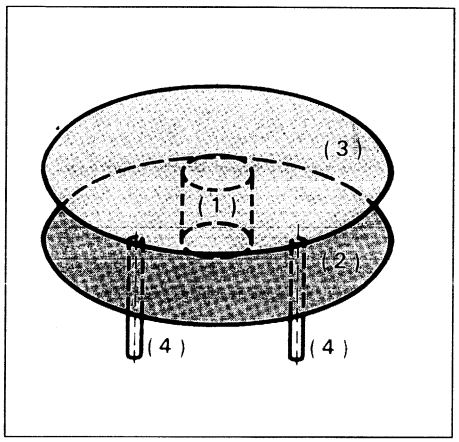


fig. 1 - $TE_{01\delta}$

Characterization

Permittivity measurement

It is important for the user to accurately know the permittivity of the material in order to calculate the dimensions of the resonator which is to operate at a given frequency.
This parameter is measured by the classic Hakki and Coleman method. A cylindrical sample is placed between two metal discs (fig. 2a). When the disks make contact with the cylinder ends, the expression of the fields continuity conditions can be expressed by a transcendental equation relating resonance frequency, permittivity and resonator size.
This method is extremely accurate since the real field configuration conforms to the theoretical configuration. Moreover the selection of mode TE_{011} means that there is no fringing fields or contact problem. This mode can be easily identified. Of all the low fequency modes, this is the only one the frequency of which decreases as the metal disk moves away from the resonator. The measurement accuracy is mainly determined by the accuracy of the dimensions, typically 0.1 %.



1. cylindrical sample
2. lower metal disk
3. mobile metal disk
4. coaxial line terminated by coupling loops
5. metal cylinder
6. low permittivity support

fig. 2a
Permittivity measurement

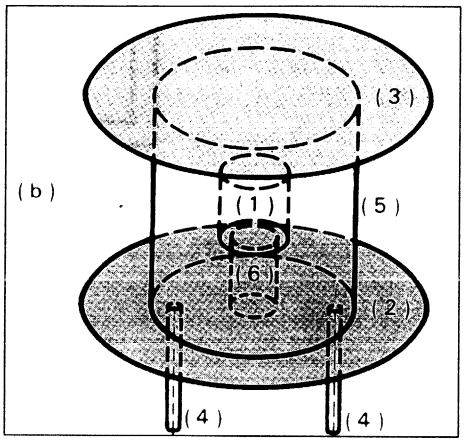


fig. 2b
Dielectric loss measurement

Q-factor measurement

The concepts of Q-factor and dielectric loss tangent can be used interchangeably. The latter is more correct in terms of solid state physics, however the former is more commonly used in microwave circuit design. Three methods can be used to perform this measurement:

- selecting a configuration in which the metallic loss is significant (fig. 2b). The shield must be approximately three times the resonator dimensions and the metal must be a good conductor (copper, silver, ...)

  thus : $\tan \partial \# \Delta f/f$ accuracy better than ± 10 %

- calculating the resonance fields and the currents induced in the metal wall. The metallic loss can be deduced from simple numerical methods or more complex numerical methods

- eliminating the metallic loss by the triple measurement method (permittivity of 2 resonators measured separately and together)

Temperature stability measurement

This typical measurement method is shown in Fig. 2a, using an automatic bench which permanently monitors the resonant frequency by modelling the transfer function of the resonator operating as a single-pole filter (Fig. 4).

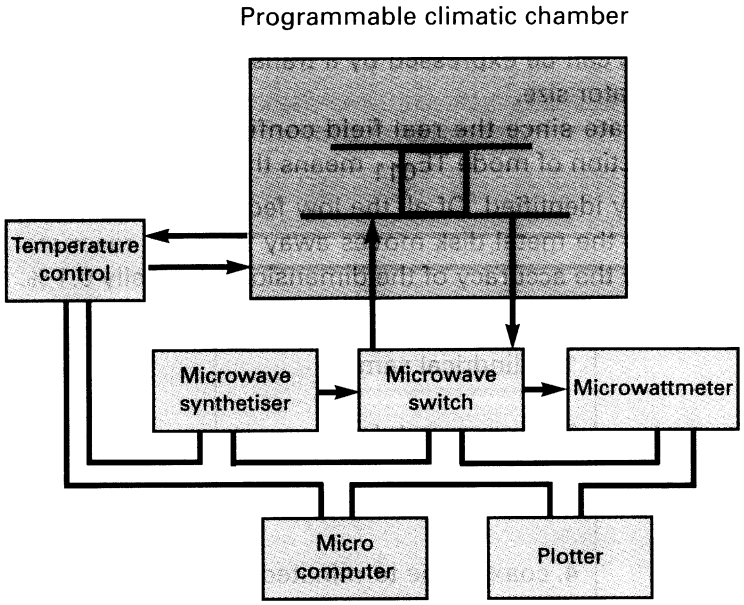


fig. 4
Measuring bench

Materials used to manufacture resonators are normally characterized by the frequency drift τf rather than the permittivity te. The variation of the frequency versus temperature T is never strictly linear, and can be expressed by a polynomial expression:

$$f(T) / f(T_0) = 1+a(T-T_0) + b(T-T_0)^2+...$$

The above formula is the most general. There are different manners to link values of the coefficient τf with a and b:

either : $\tau f = a$ with $T0 = 20°$ C
or $\tau f = (f(T2) - f(T1)) / f(T0).(T2 - T1)$
$\tau f = a + 2b.\Delta T$ if $T2 = T0 + \Delta T$ and $T1 = T0 - \Delta T$

In the last case, the maximum frequency margin between the law of linearity and the model curve is $b.\Delta T^2$

USER GUIDE

Calculating frequency or dimensions

There exist several methods for calculating the resonant frequency of a resonator in a given environment: Eigen modes development, integration by finite elements, finite difference.

In practice, it is easier to use a simple formula:

- First order working equation: $n.f.\phi = 300$ mm.GHz
  $n = \sqrt{\varepsilon'}$, f = resonant frequency (in GHz), ϕ = diameter (in mm)
- Second order equation: $n.f.V^{1/3} = 230$ to 270 mm.GHz
  V = volume (in mm^3)

These formula can be used to give a preliminary determination (within 5 to 10 %) of the size for a given frequency. Using the measurement of this specified resonator, it is possible to determine the value of $n.f.\phi$ or $n.f.V^{1/3}$ in the considered environment and to correct one of the parameters while maintaining the product constant. Using this procedure, the correct result is rapidly obtained.

Dielectric resonators are available in the shape of disks, toroids, and rods in accordance with the dimensions or frequency specified.The size ratio depends on the selected resonance mode and the customer application.

Frequency adjustment

Frequency correlation: as the resonant frequency is closely related to the DRO design, a frequency correlation between the user's test set and the TEKELEC TEMEX's one has to be made according to the former sampling results. Our preferred solution is to get the test fixture of the customer. In case it is not possible, a duplication of the test jig we use can be provided.
The frequency adjustment can be achieved by several mechanical means:

- lapping the resonator, using diamond or silicon carbide tools, abrasive paste or paper,
- perturbing the fringing fields outside the dielectric resonator, via screws for example,
- using the so-called double resonator configuration, where two halves of the dielectric resonator act as one. With this method, a tuning range of up to 20 % can be achieved.

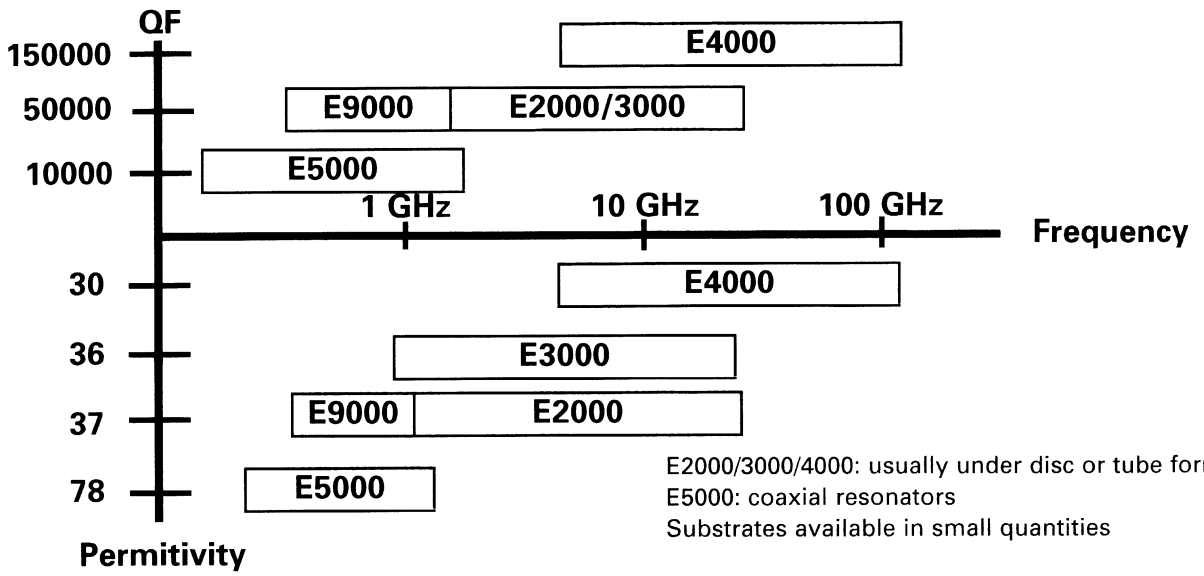
Coupling

In a microstrip circuit, the resonator is coupled by being located near a microstrip line. Basically, this is a magnetic coupling. Its value can be adjusted by varying either the distance between the resonator and the line or the height of the spacer between the resonator and the substrate. Common practice for achieving a higher overall Q factor is to use a spacer, which can be in alumina, silica or low polymer with low dielectric loss.

The resonator can overhang the line in order to provide as sufficient strong coupling. Note, however, that the coupling is cancelled when the resonator is centered on the line.

Loops or antennas can be used to provide the Input/Output couplings.

PRODUCT CHARACTERISTICS: GENERAL OVERVIEW



E2000/3000/4000: usually under disc or tube form
E5000: coaxial resonators
Substrates available in small quantities

Electrical and physical characteristics

	E2000*	E3000	E4000	E5000*	E9000
Dielectric constant	37	34	30	78	37
Typical Q factor	5000 @ 10 GHz	4000 @ 10 GHz	15000 @ 10 GHz	8000 @ 1 GHz	40000 @ 1 GHz
Available tf (ppm/°C)	-2 to 18	0 to 8	0 to 10	0 and 3	0 to 8
Non-linearity coefficient	-25.10^{-9}	4.10^{-9}	$-25,10^{-9}$	$-25,10^{-9}$	$-25,10^{-9}$
Recommended frequency range (GHz)	2 to 20	2 to 20	5 to 60	1 to 7	0.8 to 2
Thermal expansion (ppm/°C) (25°C)	6	5	10	8	6
Insulation resistivity (W.cm) (25°C)	10^{13}	10^{13}	10^{13}	10^{12}	10^{13}
Thermal conductivity (cal/cm.sec.°) (25°C)	0.005	0.004	0.006	0.007	0.005
Water absorbtion (%)	<0.01	<0.01	<0.01	<0.01	<0.01
Density (g/cm^3)	5.2	5.3	7.5	5.6	5.2

Notes
(*): these materials are also used for coaxial resonators (please, consult page 3-1)
The above values are typical values.

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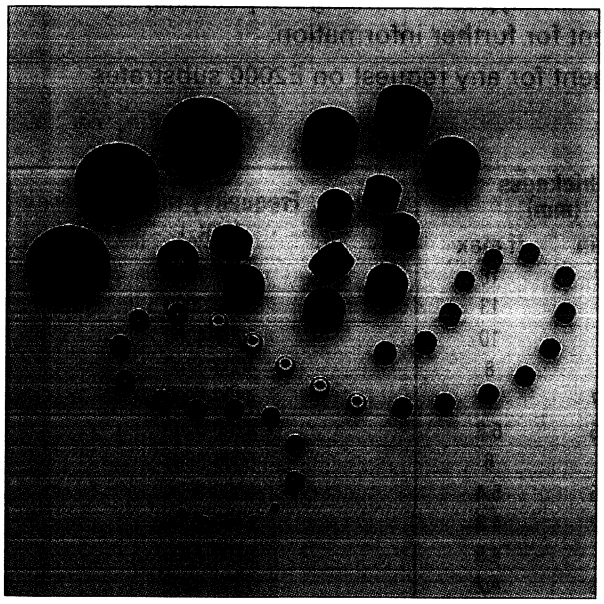
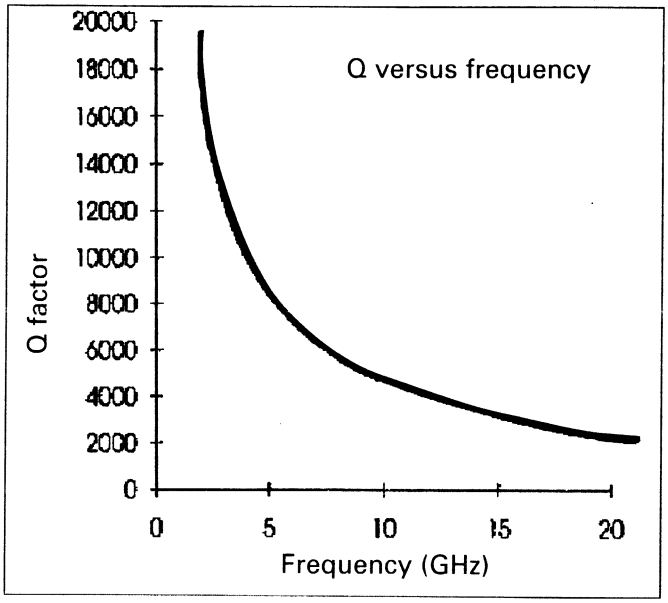
E2000 - E3000 SERIES

Description

TEKELEC TEMEX has designed the E2000 series materials and a manufacturing process for applications which require:

- mass production capacity
- a wide selection of temperature coefficients
- tight frequency tolerances
- high Q factor for high stability DRO design
- high dielectric constant for size reduction
- operating frequencies between 2 GHz and 20 GHz





E2000 typical applications

- Low Noise Blockconverters for D.B.S
- Motion / speed radar detectors
- DRO for communication equipments
- Microwave filters
- Microwave sources

E2000 ceramic characteristics

- density: 5.2
- composition: (Zr, Sn, Ti) O4
- dielectric constant: 36.9 to 37.4
- Typical Q factor: 5000 @ 10 GHz

E3000 series

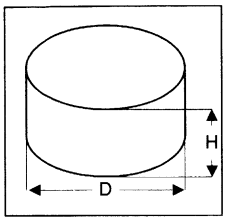
The E3000 material is a very close material from the E2000 and has been specially designed for applications which require extremely high linearity of frequency versus temperature. Only few sizes are available on this material. Please, contact your local sales force support for any request on this material. The differences with the E2000 are as follows:

* Non-linearity: 4.10^{-9}
* Typical Q factor: 4000 @ 10 GHz

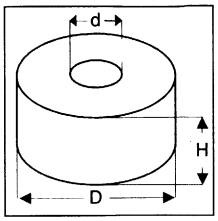
E2000

Standard characteristics

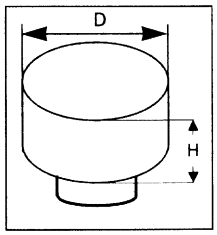
Typical configurations



Disc type



Cylinder type



Disc + support

Notes: supports are available in various materials.
Please, ask your local TEKELEC TEMEX agent for further information.

Marking: optionnal marking is available on request. Several types of marking are possible, in several materials. Please, ask your local TEKELEC TEMEX agent for further information.

Substrates: Please, ask your local TEKELEC TEMEX agent for any request on E2000 substrates

Dimensions and frequency (TABLE 1), User guide

Part number	Standard diameter (mm)		Thickness (mm)		Frequency range (MHz)
Disc type	**D**	**d**	**H min.**	**H max**	
D300	30	-	12	18	1800-2300
D220	22	-	9	13	2300-3000
D160	16	-	6	10	3000-4000
D130	13	-	5	8	4000-4700
D117	11.75	-	4.7	7	4300-5000
D113	11.3	-	4.5	6.8	4500-5200
D100	10	-	4	6	5000-5800
D090	9	-	3.6	5.4	5600-6500
D080	8	-	3.2	4.8	6400-7300
D075	7.5	-	3	4.5	6800-7700
D070	7	-	2.8	4.2	7300-8200
D065	6.5	-	2.6	3.9	7800-8800
D060	6	-	2.4	3.6	8500-9600
D059	5.9	-	2.4	3.5	9000-10000
D057	5.7	-	2.3	3.4	9100-10200
D053	5.3	-	2.1	3.2	9700-10900
D051	5.1	-	2.05	3.05	10000-11300
D049	4.9	-	1.95	2.95	10500-11800
D047	4.7	-	1.90	2.80	10800-12200
D042	4.25	-	1.7	2.55	12100-13500
Cylinder type					
C113 I 43	11.3	4.3	4.5	5	4800-5500
C100 I 20	10	2	4	6	4990-5700
C059 I 20	5.9	2	2.36	3.55	9100-10500
C053 I 20	5.3	2	2.12	3.2	10000-11600

Notes:

- Other sizes are available on request. Rods can be delivered as well
- Diameter tolerance: ± 0.1 mm as standard tolerance (± 0.02 mm for specific production)
- Thickness: typical values, to be adjusted to get the required frequency
- Tape and reel packaging possible if required (several formats available)

Main characteristics (TABLE 2)

Material	τf (ppm/°C)	Q factor (typical) @ 10 GHz	dielectric constant (ε ± 0.5)
E200	0	5000	37
E230	3	5000	37.1
E260	6	5000	37.3
E290	9	5000	37.3
E212	12	5000	37.3
E215	15	5000	37.4
E218	18	5000	37.4

Note: other values are possible on request

Temperature cœfficient (τf) tolerances (TABLE 3)

Tolerance type	Tolerance (ppm/°C)	Process
T	± 2	Mass production
U	± 1.5	Mass production
V	± 1	Mass production
W	± 0.5	Specific production

Frequency tolerance (TABLE 4)

Tolerance type	Frequency tolerance	Mass production AQL
A	± 1 %	1.5 %
B	± 0.5 %	1.5 %

Other frequency tolerance can be achieved according to a specific requirement.
Each lot is controled according to international norm MIL STD 414 (available on request).

How to order (with frequency specification)

Disc type	D	049	E212	U	11300	B (size in mm)
		table 1 D*10	table 2 material	table 3	 frequency (MHz)	table 4

Cylinder type C	113	I 43	E290	V	4950	A (size in mm)
	table 1 D*10	table 1 D*10	table 2 material	table 3	 frequency (MHz)	table 4

How to order (with size specification)

	D	057	L0030	E260	V (size in mm)
		table 1 D*10	table 1 thickness*10	table 2 material	table 3

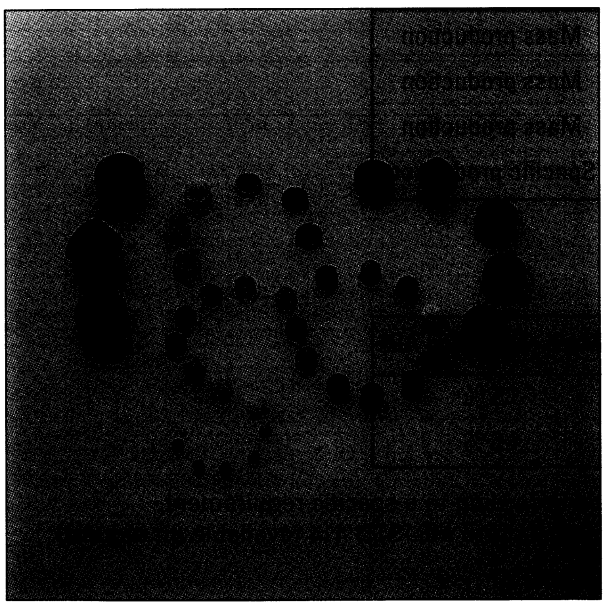
E4000 SERIES

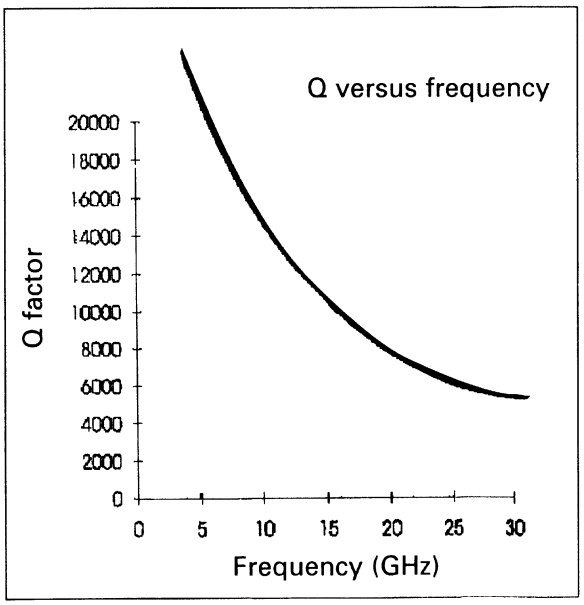
Description

TEKELEC TEMEX has designed a range of very high Q dielectric resonators operating in microwave and millimetric frequency range. This series offers a typical Q factor of 15000 at 10 GHz.

The E4000 series is especially suitable for applications which require:

- low losses @ high-frequencies
- temperature stability
- low phase noise
- tight bandwidth
- operating frequencies: 5 GHz to 60 GHz





Typical applications

- Low Noise Blockconverters for D.B.S
- high stability DROs
- satellite mutliplexing filters devices
- millimetric applications:
  - automotive anti-collision
  - trafic control systems
- millimetre waves short-range radio-links for communications & data transmission
- millimetre waves alarm systems

Ceramic characteristics

- density: 7.5
- chemical composition: BaZnTaOxide
- dielectric constant: 29.5 to 30.5
- Typical Q factor: 15000 @ 10 GHz

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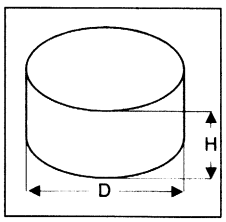
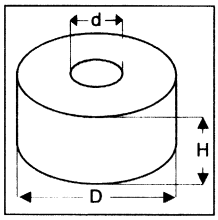
Standard characteristics

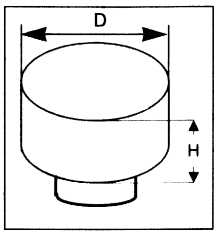
Typical configurations



Disc type



Cylinder type



Disc + support

Notes:
Supports are available in different materials.
Please, ask your local TEKELEC TEMEX agent for further information.

Dimensions and frequency (TABLE 1), User guide

Part number	Standard diameter (mm)		Thickness (mm)		Frequency range (MHz)
Disc type	D	d	H min.	H max	
D130	13	-	5	8	4400-5000
D117	11.75	-	4.7	7	4800-5800
D113	11.3	-	4.5	6.8	5000-5900
D100	10	-	4	6	5600-6500
D090	9	-	3.6	5.4	6300-7200
D080	8	-	3.2	4.8	7000-8000
D075	7.5	-	3	4.5	7500-8600
D070	7	-	2.8	4.2	8100-9200
D065	6.5	-	2.6	3.9	8700-9900
D060	6	-	2.4	3.6	9500-10800
D059	5.9	-	2.4	3.5	9600-10900
D057	5.7	-	2.3	3.4	9900-11300
D053	5.3	-	2.1	3.2	10800-12600
D051	5.1	-	2.05	3.05	11000-13000
D049	4.9	-	1.95	2.95	11600-13000
D047	4.7	-	1.90	2.80	12000-13600
D042	4.25	-	1.7	2.55	13200-15000
D030	3	-	1.2	1.8	18500-21500
D020	2	-	0.8	1.2	28000-32200
Cylinder type					
C113 I 43	11.3	4.3	4.5	5	4800-5500
C100 I 20	10	2	4	6	4990-5700
C059 I 20	5.9	2	2.36	3.55	9100-10500
C053 I 20	5.3	2	2.12	3.2	10000-11600

Notes:
- Other sizes are available on request
- Diameter tolerance: up to ± 0.02 mm
- Thickness: typical values, to be adjusted to get the required frequency

Main characteristics (TABLE 2)

Material	τf (ppm/°C)	Q factor (typical) @ 10 GHz	dielectric constant (ε ± 0.5)
E400	0	15.000	29.5
E420	2	15.000	30
E440	4	15.000	30
E460	6	15.000	30.5
E480	8	15.000	30.5
E4100	10	15.000	30.5

Note: other values are possible on request

Temperature cœfficient (τf) tolerances (TABLE 3)

Tolerance type	Tolerance (ppm/°C)	Process
T	± 2	Mass production
U	± 1.5	Mass production
V	± 1	Mass production
W	± 0.5	Specific production

Note: τf is measured from 0 to 40° C. Specific measurements may be obtained on request

Frequency tolerance (TABLE 4)

Tolerance type	Frequency tolerance	Mass production AQL
A	± 1 %	1.5 %
B	± 0.5 %	1.5 %

Other frequency tolerance can be achieved according to a specific requirement.
Each lot is controled according to international norm MIL STD 414 (available on request).

How to order (with frequency specification)

Disc type	D	049	E440	U	11300	B (size in mm)
		table 1 D*10	table 2 material	table 3	 frequency (MHz)	table 4

Cylinder type C	113	I 43	E460	V	4950	A (size in mm)
	table 1 D*10	table 1 D*10	table 2 material	table 3	 frequency (MHz)	table 4

How to order (with size specification)

	D	057	L0030	E460	V (size in mm)
		table 1 D*10	table 1 thickness*10	table 2 material	table 3

E5000 SERIES

Description

TEKELEC TEMEX has designed a range of dielectric resonators exhibiting a very high dielectric constant, especially designed for lower frequency applications. The material can also be delivered in the form of coaxial resonators (please, see page 3-1).

This material has been especially designed for applications which require:

- reduced dimensions
- lower height
- temperature stability
- operating frequencies from 1 to 7 GHz

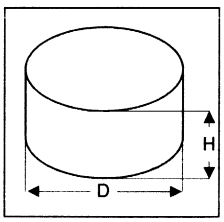
Typical applications

- filters
- duplexers
- cellular base stations

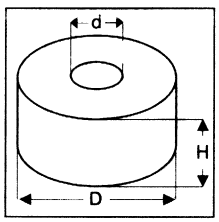
Ceramic characteristics

- density: 5.6
- chemical composition: Ba, Sm, Ti
- dielectric constant: 78 ± 2
- typical Q factor: 8000 @ 1 GHz

Typical configurations



Disc type



Cylinder type

Available dimensions

Diameter (D)	6 to 20 mm
Thickness (T)	4 to 12 mm

Any size within these ranges could be made. Please, contact your local TEKELEC TEMEX agent for further information.

Main characteristics

Material	τf (ppm/°C)	Q factor (typical) @ 10 GHz	dielectric constant (ε ± 0.5)
E500	0	8000	78
E530	3	8000	78

E9000 SERIES

Description

TEKELEC TEMEX has developed a new line of dielectric resonators of high Q quality factor for Base Station Filters used in the cellular communication market.

The E9000 series is particularly suitable for applications which require:

- phase noise reduction
- size reduction
- high-temperature stability
- operating frequencies from 850 MHz to 2 GHz

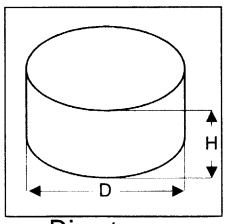
Typical applications

- base stations for DCS 1800
- base stations for GSM

Ceramic characteristics

- density: 5.2
- composition: ZrSnTi
- dielectric constant: 37 ± 1
- Q factor: 40000 @ 1 GHz

Typical configurations



Disc type

Dimensions

Diameter (D)	50 to 70 mm
Thickness (T)	20 to 30 mm

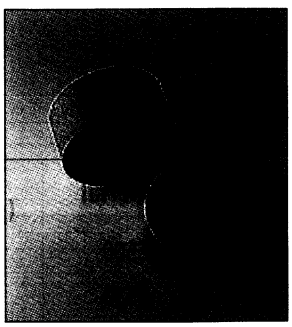
Any size within these ranges could be made. Please, contact your local TEKELEC TEMEX agent for further information.

Main characteristics

Material	τf (ppm/°C)	Q factor (typical) @ 1 GHz	dielectric constant (ε ± 1)
E900	0	40.000	37
E920	2	40.000	37
E940	4	40.000	37
E960	6	40.000	37

Diameter (D)	50 to 70 mm
X	± 2
Y	± 1

Note: τf is measured from 0 to 40° C. Specific measurements can be made on request



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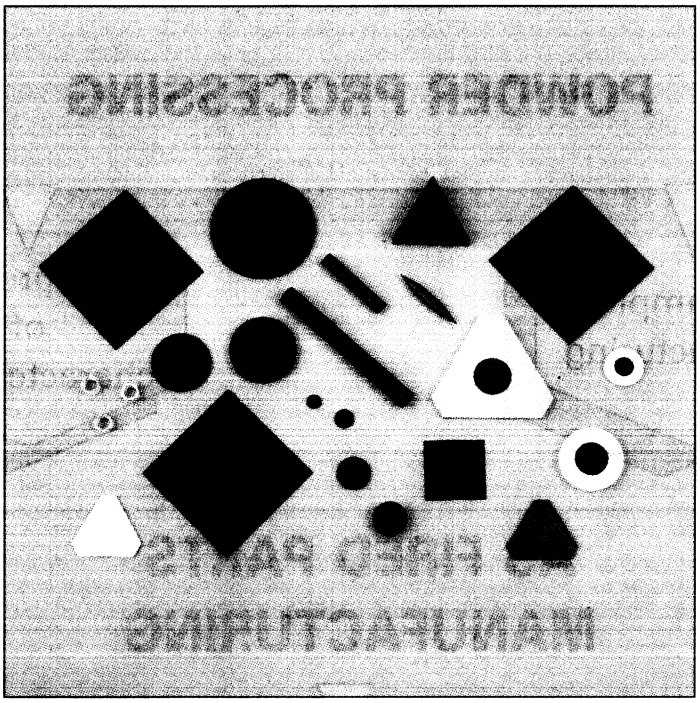
MICROWAVE FERRITE MATERIALS

CONTENTS



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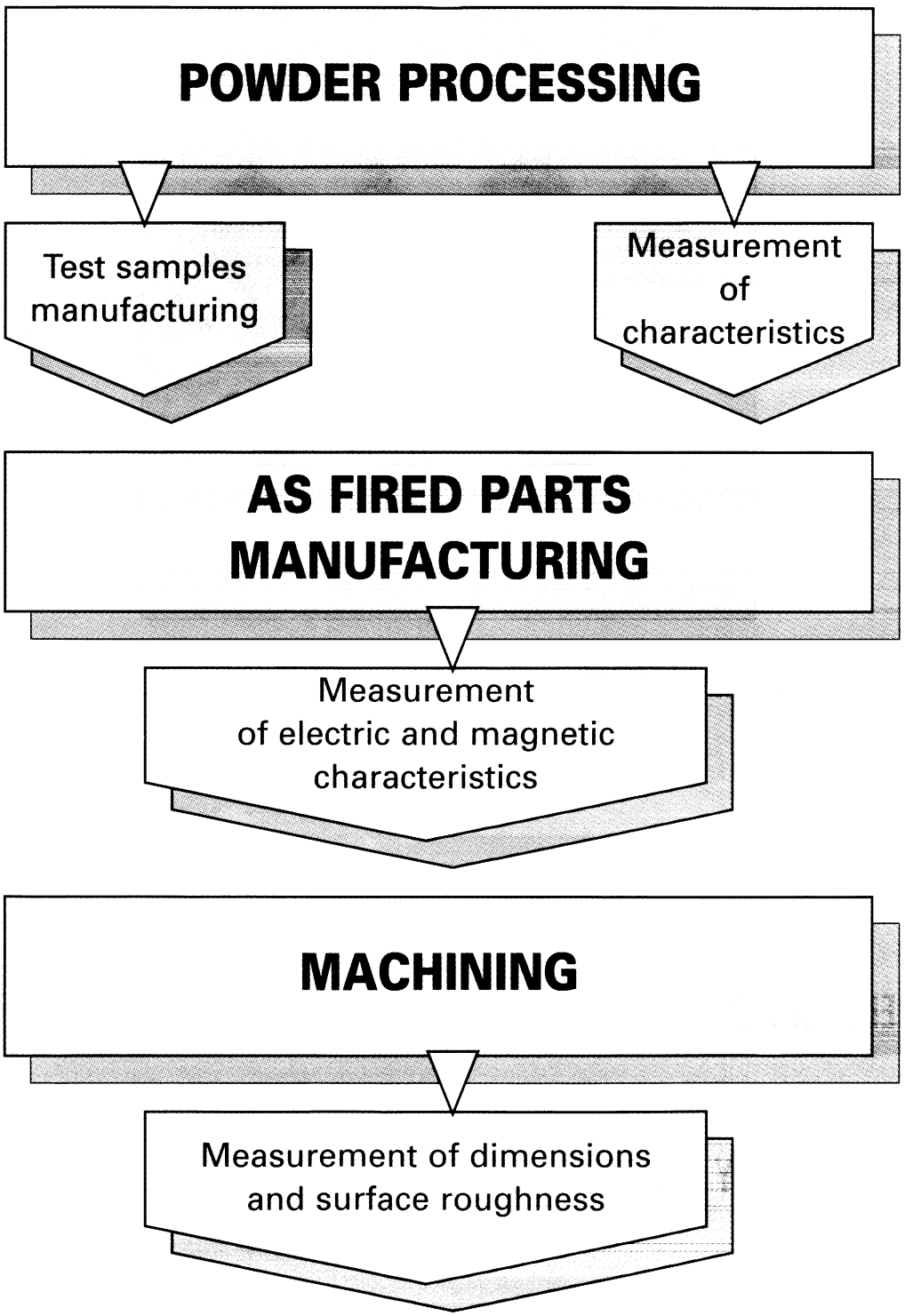
Production and Quality System ISO 9001

Ferrite Materials



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SYMBOLS

$\propto$	magnetization temperature coefficient
B	magnetic induction
B_m	maximum induction at 5 H_c
B_r	remanent induction
B_r / B_m	squareness ratio
ΔH	ferromagnetic resonance line width (@ -3 dB)
ΔH_{eff}	effective line width
ΔH_k	spin wave line width
ϵ'	relative permittivity (real part)
ϵ''	relative permittivity (imaginary part)
tan δ	dielectric loss tangent = ϵ'' / ϵ'
ϵ_r	relative complex permittivity
f	frequency
γ	gyromagnetic ratio
g_{eff}	Landé factor
H	applied magnetic field
H_c	coercive force
h_c	microwave critical field
$4\pi J_s$	saturation magnetization (Gauss units)
χ	diagonal constant of the susceptibility tensor
M_s	saturation magnetization (S.I. units)
μ	diagonal constant of the permeability tensor
Ra	average surface roughness
T	temperature
T_c	Curie temperature

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BASIC PROPERTIES AND MATERIAL CHARACTERIZATION

Selecting a ferrite for a given microwave application is a difficult challenge; the range of devices to be produced is wide, the parameters numerous. In the case of a three-port circulator for example, we can list the following parameters:

- forward and backward insertion loss, midband frequency, bandwidth temperature range, average and peak power, dimensions, weight and cost effective design.

With both reciprocal (phase shifter) and non-reciprocal devices (isolator, circulator), the microwave appliances make use of the permeability of the ferrite which is determined by the phenomenon of magnetic resonance. Thus, the permeability depends on one hand, on the magnetization and the applied static magnetic field and on the other hand, on the frequency and polarization of the electromagnetic wave, with respect to the static field. With a circularly polarized wave propagating parallel to the static field, the permeability will depend on the sign of polarization (positive or negative refers to the direction of rotation of the base vectors with respect to the direction of propagation):

where χ' is the susceptibility
where χ'' represents the loss
In case of saturated materials

$$\mu \pm = 1 + \chi \pm$$

$$\chi = \chi' - j\chi''$$

$$\chi'_{\pm} = M_s \frac{(H_r \mp f/\gamma)}{(H_r \mp f/\gamma)^2 + (\Delta H/2)^2}$$

$$\chi''_{\pm} = M_s \frac{(\Delta H/2)}{(H_r \mp f/\gamma)^2 + (\Delta H/2)^2}$$

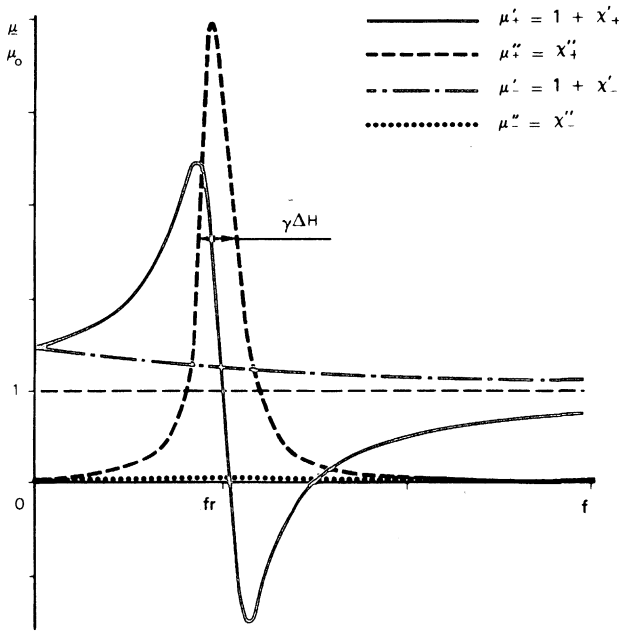


Fig. 1

where f is the operating frequency
H_r is the applied field
γ is the ferromagnetic ratio

$$\gamma = 2\pi . g_{eff} . 001759 \text{ MHz.m/A}$$
$$= 2\pi . g_{eff} . 1.4 \text{ MHz/Oe}$$

M_s is the saturation magnetization
ΔH is the mid point width of the Lorentz curve
$\chi''_+ (f)$ centered around $f_r = \gamma H_r$

Within a given frequency range, it is possible to find values of H such that the permeabilites μ'_+ and μ'_- are substantially different, while μ''_+ and μ''_- have very low values (Fig. 1). This property is used in the construction of non-reciprocal devices. The applied field H can be either lower or higher than the resonant field H_r. The first solution is often preferable, for size reduction, since the magnets required are smaller, and optimization of some characteristics.

Influence of the magnetization of the material

The magnetization is a multiplicative factor in all terms of magnetic susceptibility. The greatest efficiency is linked to the highest degree of magnetization. However, the phenomenon of natural resonance in unsaturated materials must be taken into account, as this leads to "low strength field loss". Consequently, for a given frequency f, the material selected must have a magnetization lower than f/γ, unless it has to be used above the resonant frequency.

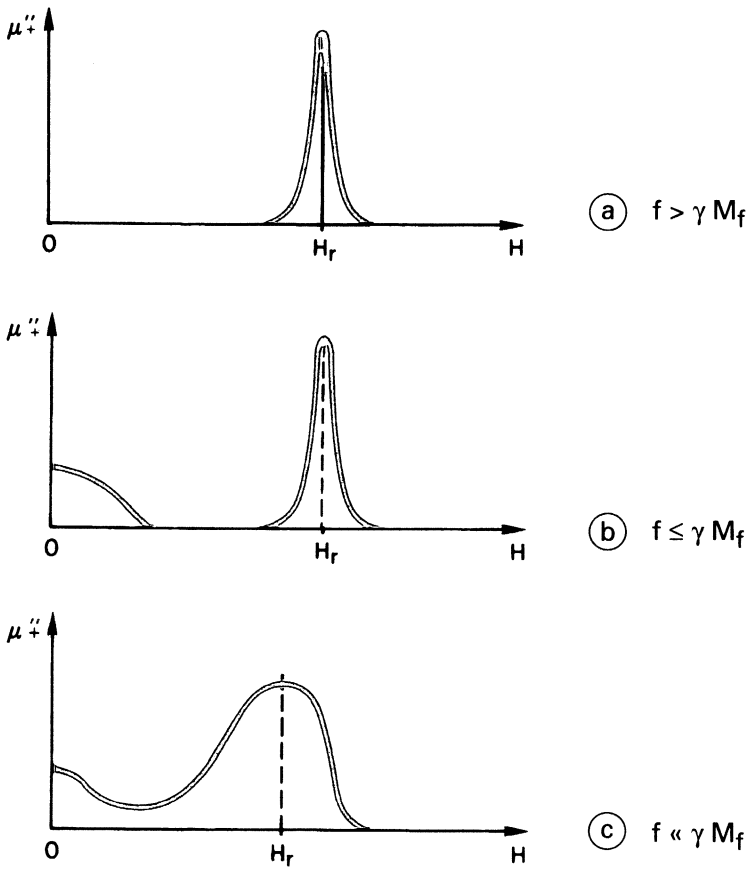


Fig.2 - Permeability μ''_+ versus applied static field H

Influence of loss

One of the main preoccupations in the construction of ferrite components is the problem of reducing forward insertion loss. Loss from ferrite materials has two origins: dielectric and magnetic.
Modern technology produces microwave ferrites which, depending on their composition, have dielectric loss tangents at 10 GHz tg $\delta_\epsilon = \epsilon''/\epsilon'$ between 10^{-4} and 10^{-3}.

Two kinds of magnetic loss can be distinguished: at low and high microwave power level.

- **Low microwave power magnetic loss:**

Experiments show that the curve $\chi''_+(H)$ is a Lorentz curve away from the resonant frequency with an effective line width $\Delta H_{eff} \leq \Delta H$.

On the other hand, near the resonant frequency, the line is broadened by several phenomena: doping ions porosity, magneto-crystalline anisotropy, impurities.

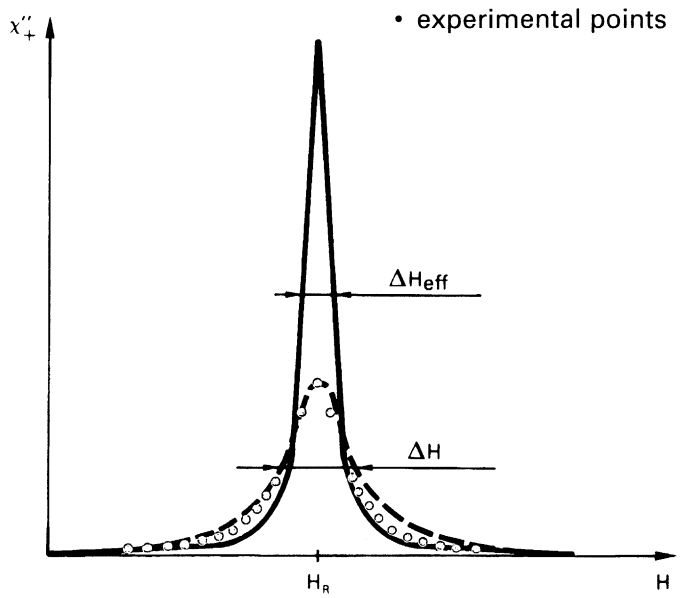


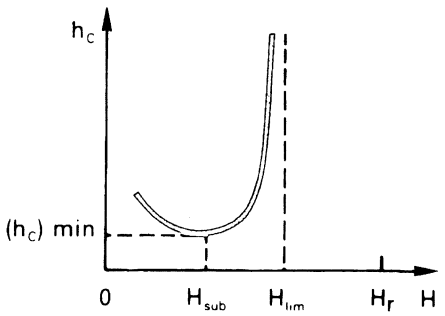
Fig. 3

• **High microwave power magnetic loss:**
Above a certain microwave signal level, non linear phenomena take place resulting in additional magnetic loss which rapidly becomes prohibitive in the devices.

The critical microwave field h_c, from which such effects appear, depends on the applied static field. The non-linear effects are associated with the excitation of the spin waves, the attenuation of which is described by ΔH_k. For "below resonance" devices, non-linearity threshold of electromagnetic field is given by:

$$h_c \text{ min} = \Delta H_k \, 2f/\gamma M_s$$

The higher the value of ΔH_k is, the better the high-power behaviour will be.



h_c 1st order non-linear effect critical field function of static field H.

Fig. 4

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Characterization

MEASUREMENT METHODS

The methods used to measure the properties of ferromagnetic materials for microwave applications comply with the «Instructions for specifications relating to ferrites for use in microwave applications». (Publication 556) established by the International Electronics Commission (I.E.C.) concerning «Ferrite and Magnetic Components». The characteristics of the products published in the present catalogue are expressed in S.I. units. However, to simplify reading of this document, the magnetic characteristics are also given in the classic Gauss system (C.G.S. system) units.

- **Saturation magnetization, ($4\pi J_s$ in C.G.S. and M_s S.I):**

Saturation magnetization ($4\pi J_s$ in Gauss units) is measured at room temperature by the Weiss method. A sample is moved out the air gap of a magnet delivering a magnetic field of 8000 Oe. The flux variation is read on an integrator with an accuracy of ± 1%. The $4\pi J_s$ or M_s curves versus temperature and the Curie point (Tc in °C) are obtained by the vibrating sample method. Detecting the voltage induced by the flux variation gives a magnetization level accuracy of ± 1%.

- **Magnetization temperature coefficient, $\propto$:**

The average temperature coefficient of magnetization in the range –20° C, +60° C, is given by the following expression:

$$\propto = \frac{\Delta J_s}{J_s . \Delta T}$$

where ΔJ_s represents the maximum magnetization level difference in the temperature range ΔT.

- **Ferromagnetic resonance line width, ΔH: Lande factor, geff**

The effective Lande factor (g_{eff}), and the ferromagnetic resonance line width (ΔH) are mesured in a rectangular cavity at 9.3 GHz, at room temperature. The sample is a 1 mm diameter sphere, lapped using grain abrasive wheels. For materials with a low ΔH value, the sphere is polished to optical quality to eliminate disturbances caused by surface unevenness. The g_{eff} measurement accuracy is ± 1%. The accuracy of the ΔH values falls in two categories:

— for $\Delta H > 125$ Oe, accuracy is ± 5% ;
— for $\Delta H < 125$ Oe, accuracy is ± 2% with a limit of ± 0.5 Oe.

- **Effective line width, ΔH_{eff}:**

The effective resonance line width (ΔH_{eff}) is measured at room temperature in a cylindrical cavity at 9 GHz using a 2 mm diameter rod. The values of ΔH_{eff} are given for an applied magnetic field at 500 Oe. For materials with $4\pi J_s$ 2000 Gauss, ΔH_{eff} is measured above the resonant frequency (approximately 5000 Oe). The ΔH_{eff} measurement accuracy is ± 10% with a limit of ± 1 Oe.

- **Spin wave line width, ΔH_k:**

The spin wave line width (ΔH_k) is measured using a 3 mm diameter sphere, in a cylindrical cavity at 9.4 GHz, at room temperature, using parallel pumping with a pulse duration of 2.5 µs. The ΔH_k measurement accuracy is ± 5% with a limit of ± 1 Oe.

- **Complex permittivity, ϵ_r:**

The complex permittivity (ϵ_r) is measured using a 1 mm diameter rod in a rectangular cavity at 8.3 GHz, at room temperature. The dielectric constant (ϵ') measurement accuracy is ± 1%. This gives a dielectric loss tangent (tan δ) accuracy of ± 20% with a maximum of ± 5.10^{-5}.

- **Hysteresis loop:**

A toroidal sample fitted with a double winding is used as a transformer. The primary winding magnetizes the sample through a 0.1 Hz frequency signal. The applied field H is proportional to the primary current; the signal induced in the secondary winding is proportional to the magnetic flux variation and is integrated to obtain the magnetic induction B.

The induction value B_m is obtained for an applied field of 5 H_c. The measurement accuracy is as follows:

H_c ± 2% ; B_r, B_m ± 10% ; B_r/B_m ± 2%.

The temperature coefficients of inductions B_r and B_m and coercive field H_c in the temperature range ΔT (- 60° C, + 100° C), are given by the expressions:

$\alpha B_r = \Delta B_r/(B_r.\Delta T)$ $\alpha B_m = \Delta B_m/(B_m.\Delta T)$ $\alpha H_c = \Delta t_c/(H_c.\Delta T)$

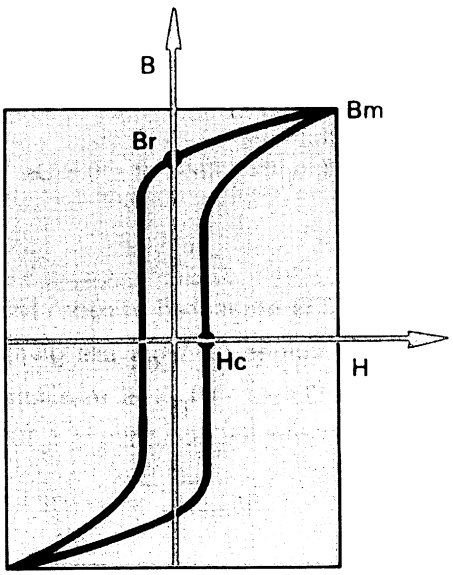

Fig. 5

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USER GUIDE

Materials and applications

The table 1 here below shows how the parameters used in the catalogue meet the most common needs of the users.

Table 1

APPLICATIONS	CUSTOMER REQUIREMENTS	EFFECT ON CHOICE OF MATERIAL
Low level circulator	Low insertion loss High directivity Compactness Widest possible frequency band Wide temperature range	ΔH_{eff} minimum ΔH minimum ϵ' maximum M_S adjusted to frequency α as low as possible
High level circulator	Power behaviour Low insertion loss Temperature stable M_S	ΔH_k high ΔH_{eff} and ΔH as low as possible compatible with ΔH_k
Isolator at resonant frequency	Low insertion loss Narrow frequency band	ΔH_{eff} minimum M_S and ΔM_S function of frequency ΔH according to the required band
Phase shifter	Temperature stable M_S	α as low as possible

The diagrams shown in the catalogue are arranged in the table 2 here below. For each diagram, optimum use of the different parameters is shown.
For details of the possible materials corresponding to a given diagram, refer to the page indicated in the table.

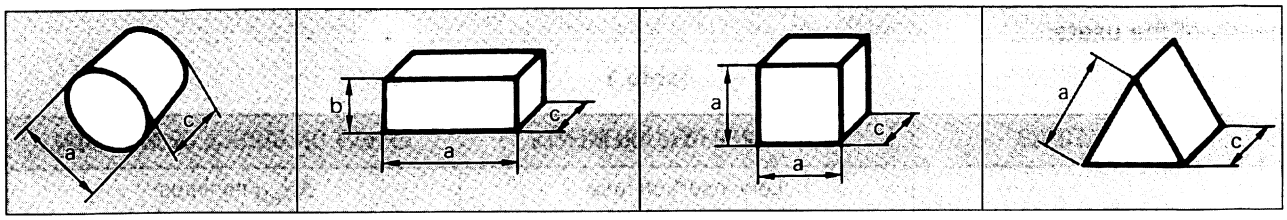
Synoptical table 2

Crystal Structure	Chemical composition	Recommanded band of operating frequencies	Temperature stability	Power behaviour	Magnetic loss out of resonant frequency	Cycle Squareness	Catalogue page n°
garnets	• Y - Gd	S-C-X	**	*	*		14-12
	• Y - Al	L-S-C	*	*	**		14-14
	• Y - Gd - Al	L-S-C	*	**	*		14-16
	• Y - Gd - Al Co-doped	L-S-C-X	**	***	*		14-17
	• Y - Gd - Al Dy-doped	L-S-C-X	**	***	*		14-18
	• CVG	S-C-X	**	*	***		14-13
	temperature stable CVG	S-C	***	**	**		14-15
spinels	• Mn - Mg	S-C-X-Ku-K	*	*	**	**	14-19
	• Ni	S-C-X-Ku-K	***	***	*	*	14-22
	• Li	C-X-Ku-K-Ka	***	*	***	***	14-23

* poor ** fair *** excellent

Dimensioning

As-fired parts are produced from pressed powder fired at high temperatures (sintering).
A wide range of shapes can be produced.



Machined parts

Standard machining tolerances = ± 0.02 mm.
Tighter accuracy can be achieved on request.

A wide range of shapes and dimensions can be made according to the user's specification:

- **Disks** ..... : Diameters = 1 mm up to 55 mm (typical values)
- **Substrates** ..... : Max size = 50.8 x 50.8 mm
  Thickness = 0.5 mm to 3 mm (typical values)
- **Triangles**
- **Rods** ..... : Max diameter = 12 mm (standard)
  Max length = 90 mm (standard)
  Other dimensions can be achieved on request.
- **Composite assemblies** ..... : Ferrite and dielectric materials.
- **Planeity and parallelism specification** : from 0.05 to 0.01, depending on the grinding method.

Surface finishing

As-fired parts can be grinded, lapped and/or polished. The standard average peak-to-valley height (Ra) is specified here below:

Standard surface finishing	Ra micrometer		Ra microinch	
	min	max	min	max
Standard	0.4	0.8	16	32
Lapped	0.2	0.4	8	16
Polished	–	0.15	–	6

Acceptable quality level requirements

TEKELEC TEMEX applies CEI410 (equivalent to MIL-STD-105) attribute sampling plan, General Inspection Level II, for the qualification of outgoing product. The following table provides the AQL criteria for typical product attributes.

Attribute	A.Q.L. Level II
Visual imperfections	2.5
Dimensions	1.5

Outgoing products are qualified according to this A.Q.L., unless other A.Q.L. are specified by the customer before placing an order.

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IRON GARNETS

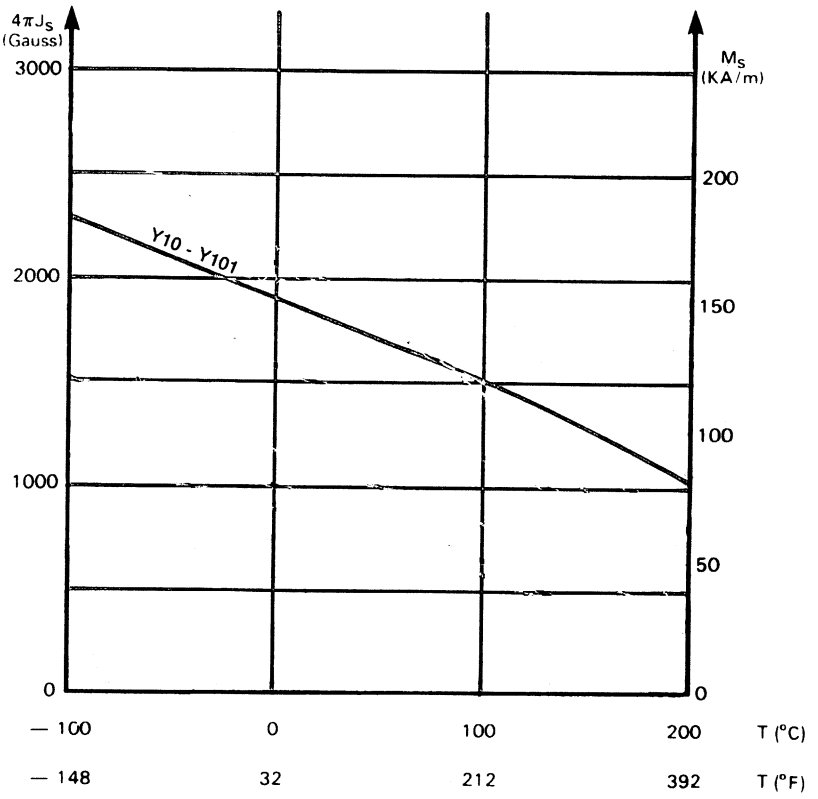
YIG

Yttrium - Iron garnet

TYPES	$4\pi J_s$ (Gauss) ± 5%	T_c (°C) ± 5%	G_{eff} ± 5%	ΔH (Oe) ± 20%	ΔH_{int} (Oe) ± 20%	ΔH_k (Oe) ± 10%	ϵ' ± 5%	10^4 tan δ	$\alpha \cdot 10^4$ * (°C^{-1}) -20, +20°C ± 0.2
				**					
Y10	1780	280	2.00	45	4	2	15.3	< 2	2.2
Y101	1820	280	2.00	20	4	2	15.4	< 2	2.2

$$* \alpha = \frac{\Delta J_S}{J_S . \Delta T}$$

** Measurement taken on optically finished sphere



Y - Gd

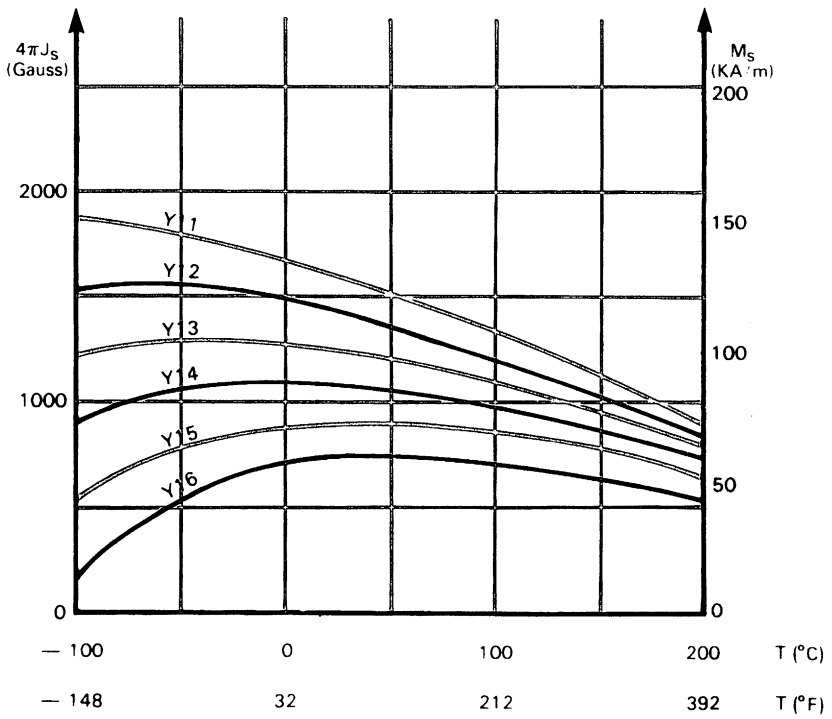
Yttrium - Gadolinium

This Yttrium - Gadolinium garnet family is especially useful in applications where a high degree of temperature stability is required.

These materials can be used with a moderate level of peak power.

TYPES	$4\pi J_s$ (Gauss) ± 5%	T_c (°C) ± 5%	G_{eff} ± 5%	ΔH (Oe) ± 20%	ΔH_{eff} (Oe) ± 20%	ΔH_k (Oe) ± 10%	ϵ' ± 5%	$10^4 \tan\delta$	$\propto .10^3$ * (25°) –20, +60°C ± 0.2
Y11	1600	280	2.00	60	5	3.0	15.3	< 2	1.8
Y12	1420	280	2.01	65	6	6.0	15.3	< 2	1.5
Y13	1250	280	2.01	75	8	8.0	15.3	< 2	1.0
Y14	1100	280	2.02	95	12	9.0	15.4	< 2	0.5
Y15	900	280	2.03	140	18	11.0	15.4	< 2	0.7
Y16	750	280	2.02	200	25	15.0	15.4	< 2	0.9

$$* \propto = \frac{\Delta J_S}{J_S . \Delta T}$$



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CALCIUM VANADIUM GARNETS (CVG)

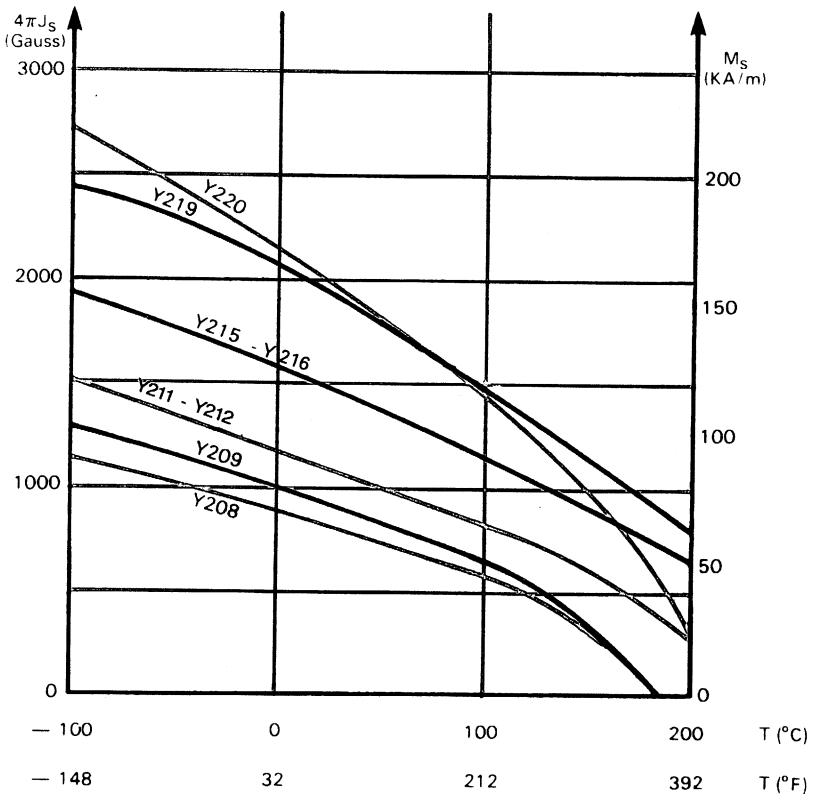
Narrow line width materials

This family of materials have been specially designed and produced for low loss devices. Bandwidth improvements are obtained for beyond resonance applications.

TYPES	$4\pi J_s$ (Gauss) ± 5%	T_c (°C) ± 5%	G_{eff} ± 5%	ΔH (Oe) ± 20%	ΔH_{eff} (Oe) ± 20%	ΔH_k (Oe) ± 10%	ϵ' ± 5%	10^4 tan δ	$\propto .10^4$ * (°C^{-1}) -20, +60°C ± 0.2
				**					
Y220	1950	205	2.01	10	2	1	15.4	< 2	3.1
Y219	1900	240	2.02	25	4	2	15.1	< 2	2.6
Y218	1850	215	2.01	10	–	–	14.8	< 2	2.6
Y216	1600	218	2.01	10	–	–	14.8	< 2	2.6
Y215	1450	215	2.01	10	2	1	14.7	< 2	2.7
Y212	1200	209	2.01	10	2	1	14.5	< 2	2.9
Y211	1100	205	2.01	10	2	1	14.4	< 2	3.0
Y210	1000	200	2.01	10	–	–	14.2	< 2	3.3
Y209	900	180	2.01	10	2	1	14.1	< 2	3.5
Y208	800	177	2.01	10	2	1	14.0	< 2	3.7
Y206	600	150	2.01	15	–	–	13.8	< 2	3.5

$$* \propto = \frac{\Delta J_S}{J_S . \Delta T}$$

** Measurement taken on optically finished sphere



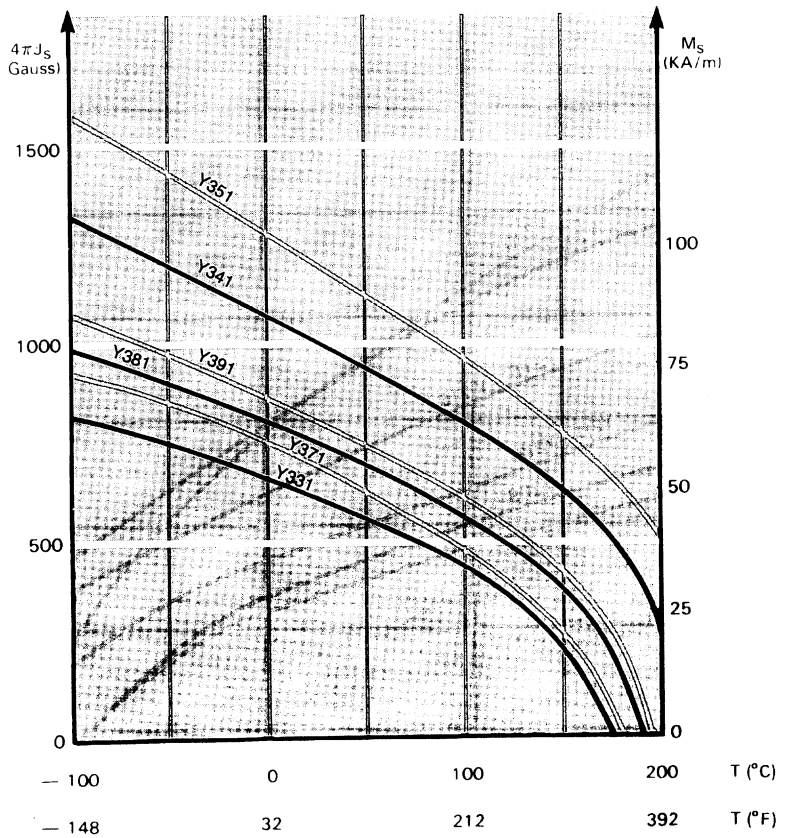
Y - Al

Narrow line width materials - Yttrium Aluminium

These garnets offer a wide choice of saturation magnetization covering most microwave applications for devices operating with very low loss in a wide band.

TYPES	$4\pi J_s$ (Gauss) ± 5%	T_c (°C) ± 5%	G_{eff} ± 5%	ΔH (Oe) ± 20%	ΔH_{eff} (Oe) ± 20%	ΔH_k (Oe) ± 10%	ϵ' ± 5%	10^4 tan δ	$\propto .10^3$ * (°C^{-1}) -20, +60°C ± 0.2
Y35	1200	225	2.01	40	4	2.0	14.9	< 2	2.6
Y351	1200	225	2.01	22	4	2.0	14.9	< 2	2.6
Y34	1000	210	2.01	40	4	2.0	14.8	< 2	2.7
Y341	1000	210	2.01	22	4	2.0	14.8	< 2	2.7
Y39	800	195	2.01	40	4	2.0	14.6	< 2	2.9
Y391	800	195	2.01	22	4	2.0	14.6	< 2	2.9
Y38	760	190	2.01	40	4	2.0	14.5	< 2	2.9
Y381	760	190	2.01	22	4	2.0	14.5	< 2	2.9
Y37	680	180	2.01	40	4	2.0	14.5	< 2	2.9
Y371	680	180	2.01	22	4	2.0	14.5	< 2	2.9
Y33	615	175	2.01	40	4	2.0	14.5	< 2	3.2
Y331	615	175	2.01	22	4	2.0	14.5	< 2	3.3
Y30	565	160	2.01	30	4	2.0	14.4	< 2	3.8
Y32	420	135	2.01	30	4	2.0	14.4	< 2	3.2
Y31	370	125	2.01	30	4	2.0	14.1	< 2	4.1
Y36	290	115	2.01	25	4	2.0	14.0	< 2	4.6
Y302	240	100	2.01	30	4	2.0	13.8	< 2	5.0

$$* \propto = \frac{\Delta J_S}{J_S \cdot \Delta T}$$



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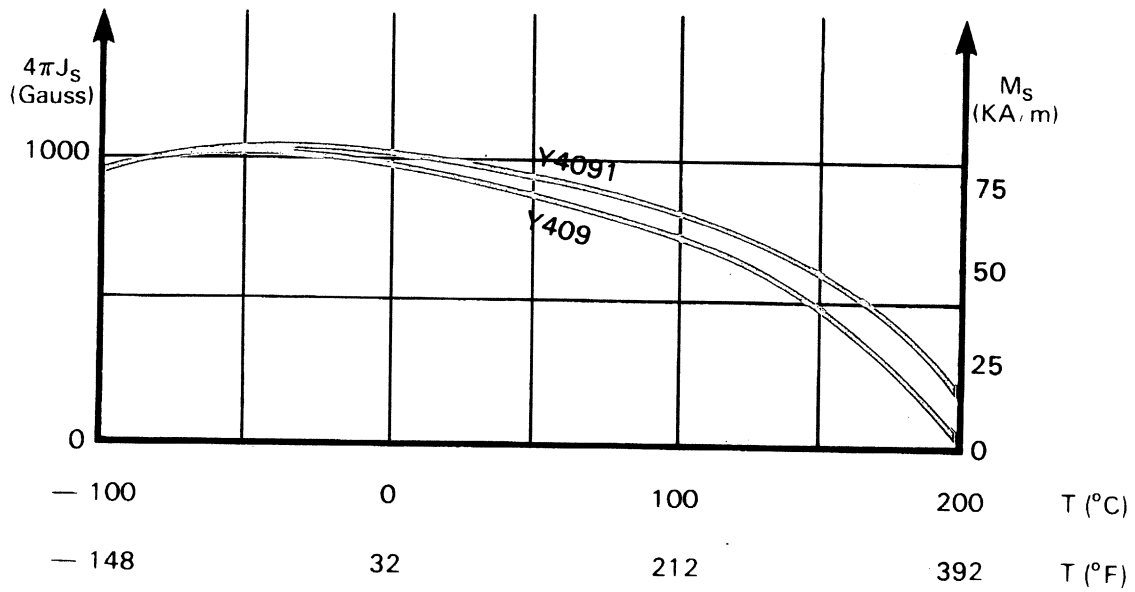
NARROW LINE WIDTH - TEMPERATURE STABLE MATERIALS

This family of materials has been specially designed and produced for low loss and temperature stable devices. It is possible to increase the bandwidth for beyond resonance applications.

TYPES	$4\pi J_s$ (Gauss) ± 5%	T_c (°C) ± 5%	G_{eff} ± 5%	ΔH (Oe) ± 20%	ΔH_{eff} (Oe) ± 20%	ΔH_k (Oe) ± 10%	ϵ' ± 5%	10^4 tan δ	$\propto .10^2$ * ($°C^{-1}$) -20, +80°C ± 0.2
Y4091	960	220	2.02	45	12	9.0	15.2	< 2	0.8
Y409	920	205	2.02	50	18	12.0	15.2	< 2	1.4

$$* \propto = \frac{\Delta J_S}{J_S . \Delta T}$$



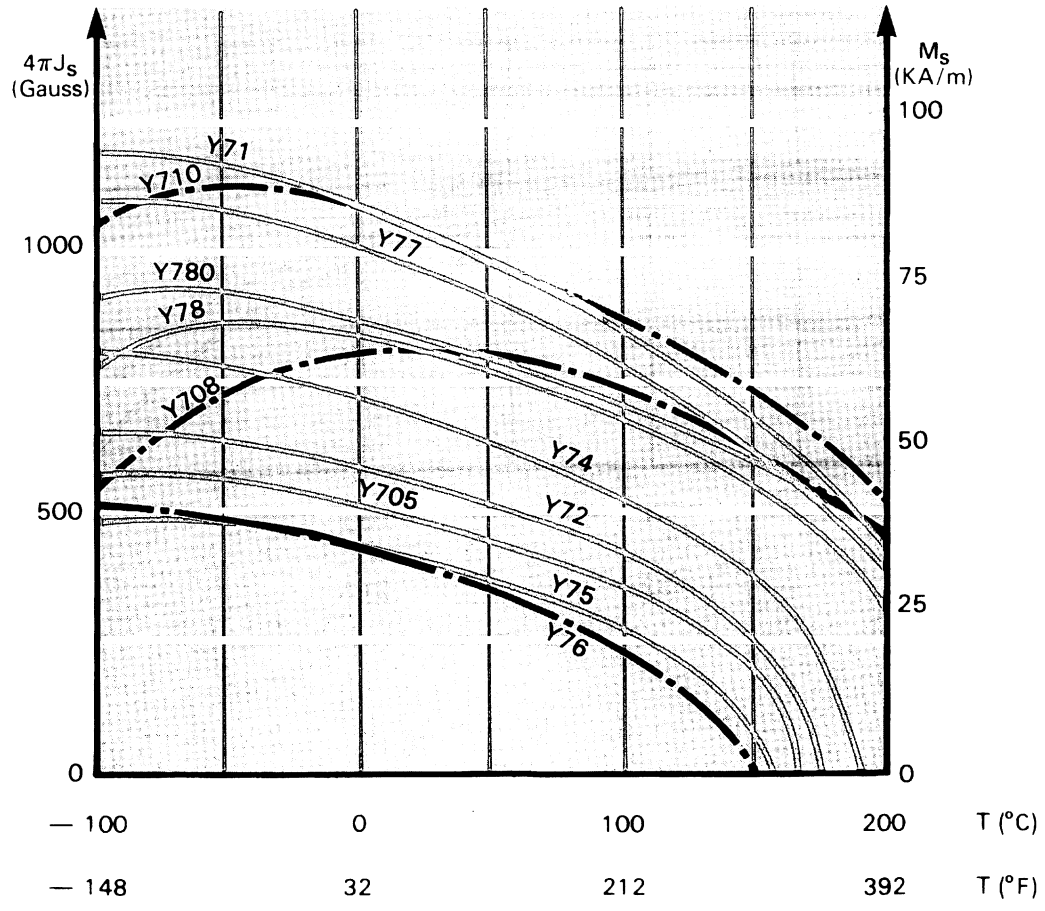
Y - Gd - Al

Yttrium - Gadolinium - Aluminium

The main feature of this family of products is its high temperature stability. These garnets are suitable for use at moderate peak power levels.

TYPES	$4\pi J_s$ (Gauss) ± 5%	T_c (°C) ± 5%	G_{eff} ± 5%	ΔH (Oe) ± 20%	ΔH_{eff} (Oe) ± 20%	ΔH_k (Oe) ± 10%	ϵ' ± 5%	10^4 tan δ	$\propto .10^3$ * ($°C^{-1}$) –20, +60°C ± 0.2
Y71	1020	235	2.01	60	7	5.0	15.0	< 2	2.2
Y710	1020	240	2.02	75	9	7.0	15.0	< 2	1.7
Y77	950	230	2.01	60	6	5.0	14.9	< 2	2.0
Y780	830	235	2.02	60	6	5.5	14.8	< 2	1.6
Y78	800	220	2.00	80	8	8.0	15.0	< 2	1.3
Y708	800	260	2.04	140	15	15.0	15.2	< 2	0.5
Y74	670	190	2.01	60	6	6.0	14.9	< 2	2.3
Y72	540	175	2.01	60	6	6.0	14.6	< 2	2.3
Y705	470	170	2.02	65	6	6.0	14.3	< 2	2.8
Y75	400	160	2.03	65	6	6.0	14.3	< 2	2.7
Y76	390	150	2.02	50	6	6.0	14.2	< 2	3.4

$$* \propto = \frac{\Delta J_S}{J_S . \Delta T}$$



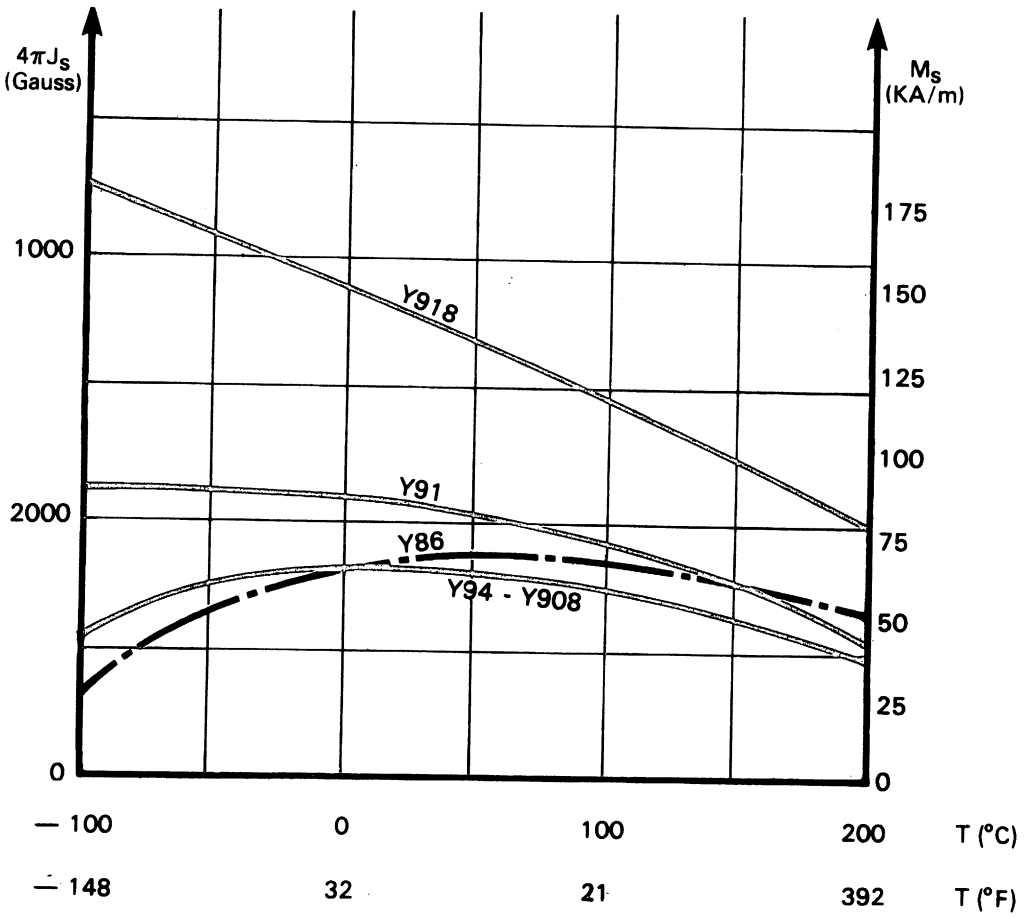
Y - Gd - Al CO-DOPED

Yttrium - Gadolinium - Aluminium Cobalt-doped power materials

These garnets are designed for high peak power level applications. Most of them have good temperature stability, which means that they can be used at high average output levels.

TYPES	$4\pi J_S$ (Gauss) ± 5%	T_c (°C) ± 5%	G_{aff} ± 5%	ΔH (Oe) ± 20%	ΔH_{eff} (Oe) ± 20%	ΔH_k (Oe) ± 10%	ϵ' ± 5%	10^4 tan δ	$\propto .10^4$ * (°C^{-1}) -20, +60°C ± 0.2
Y918	1760	280	2.02	85	12	20	15.0	< 2	2.2
Y91	1020	240	2.02	60	17	14	15.1	< 2	1.3
Y86	830	270	2.03	95	34	25	15.4	< 2	1.2
Y94	780	250	2.02	75	14	23	15.2	< 2	0.3
Y908	780	250	2.02	85	14	29	15.2	< 2	0.3
Y9081	780	250	2.02	120	14	35	15.2	< 2	0.3

$$* \propto = \frac{\Delta J_S}{J_S . \Delta T}$$



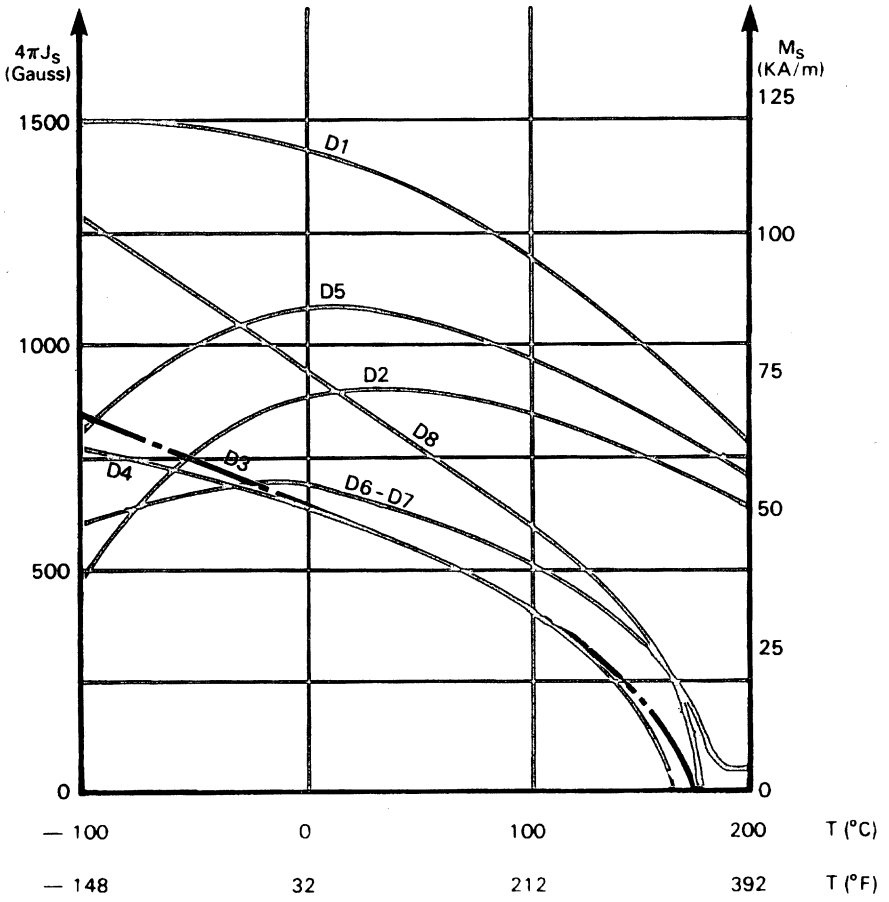
Y - Gd - Al DY-DOPED

Yttrium - Gadolinium - Aluminium Dysprosium-doped power materials

These garnets are designed for high peak power level applications. Most of them have good temperature stability, which means that they can be used at high average output levels.

TYPES	$4\pi J_S$ (Gauss) ± 5%	T_c (°C) ± 5%	G_{eff} ± 5%	ΔH (Oe) ± 20%	ΔH_{eff} (Oe) ± 20%	ΔH_k (Oe) ± 10%	ϵ'_T ± 5%	10^4 tan δ	$\alpha \cdot 10^4$ * ($°C^{-1}$) -20, +80°C ± 0.2
D1	1400	270	2.00	110	34	16	15.5	< 2	1.4
D5	1070	270	2.02	150	36	23	15.5	< 2	0.5
D2	900	270	2.01	185	25	24	15.5	< 2	0.8
D8	870	176	2.00	55	11	10	13.9	< 2	3.9
D7	640	180	2.00	180	140	> 50	14.3	< 5	1.7
D6	640	190	2.00	160	120	> 50	14.0	< 5	1.6
D3	590	175	2.00	85	16	19	14.5	< 2	3.5
D4	580	170	2.00	140	34	33	14.4	< 2	3.0

$$* \alpha = \frac{\Delta J_S}{J_S . \Delta T}$$



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SPINEL FERRITES

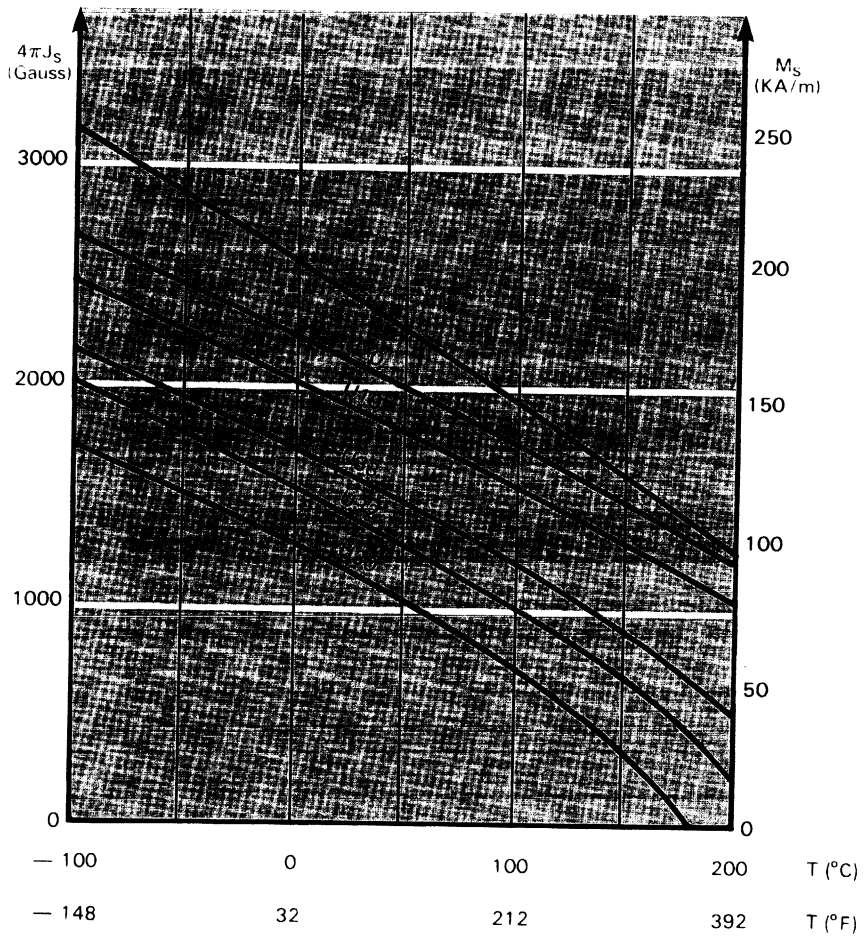
Mn - Mg

Manganese- Magnesium

Manganese - magnesium ferrites are used in devices which must have low magnetic and dielectric losses.

TYPES	$4\pi J_s$ (Gauss) ± 5%	T_c (°C) ± 5%	G_{eff} ± 5%	ΔH (Oe) ± 20%	ΔH_{eff} (Oe) ± 20%	ΔH_k (Oe) ± 10%	ϵ' ± 5%	10^4 tan δ	$\propto .10^4$ * (°C⁻¹) -20, +80°C ± 0.2
U21	2400	275	2.03	290	6.0	4	13.0	< 3	2.7
U20	2100	300	2.01	360	6.0	4	13.0	< 3	2.3
U19	1900	280	2.01	350	6.0	4	13.0	< 3	2.2
U33	1600	230	2.02	290	8.0	4	12.4	< 3	3.3
U32	1400	210	2.01	260	8.0	4	12.1	< 3	3.7
U30	1130	175	2.00	180	9.0	5	12.0	< 3	4.5

$$* \propto = \frac{\Delta J_S}{J_S . \Delta T}$$



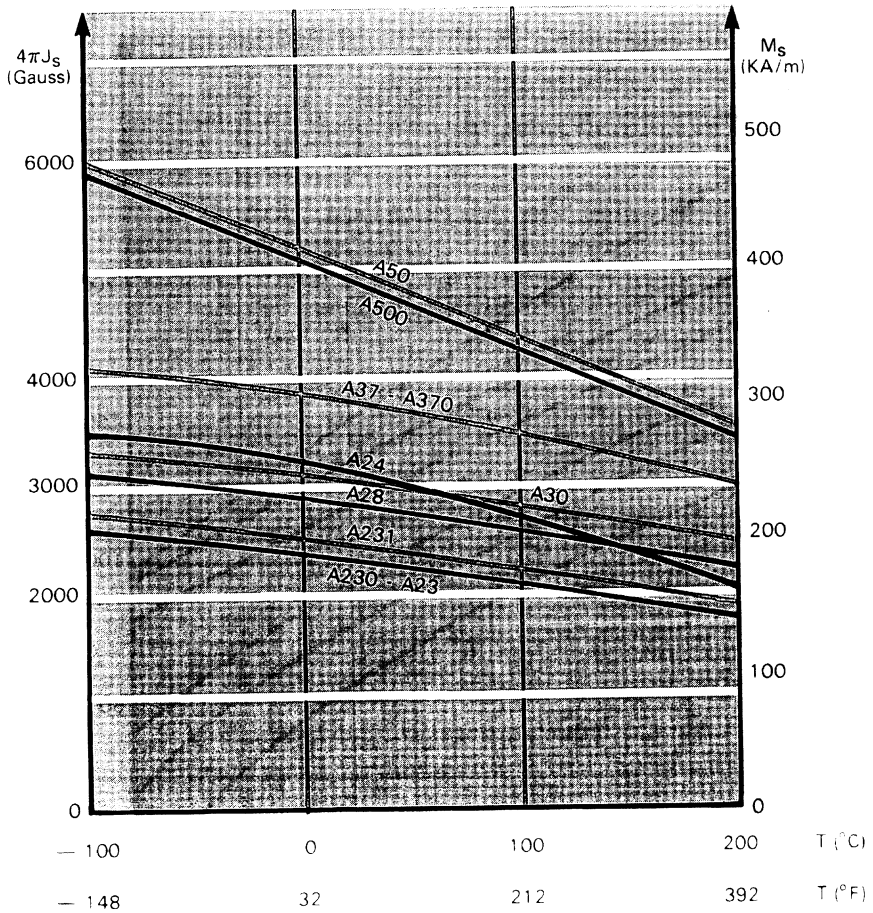
Li

Lithium - Titanium - Zinc

These ferrites are used in the production of temperature stable components operating in and above the X band. A370 an A230 are power materials.

TYPES	$4\pi J_s$ (Gauss) ± 5%	T_c (°C) ± 5%	G_{eff} ± 5%	ΔH (Oe) ± 20%	ΔH_{eff} (Oe) ± 20%	ΔH_k (Oe) ± 10%	ϵ' ± 5%	10^4 tan δ	$\propto .10^3$ * ($°C^{-1}$) –20, +60°C ± 0.2
A50	5000	450	2.06	170	4.0	3	15.3	< 5	1.6
A500	4900	450	2.06	200	9.0	10	15.3	< 5	1.6
A37	3700	565	2.08	400	4.0	3	16.0	< 5	1.0
A370	3700	565	2.07	400	7.0	6	15.9	< 5	1.0
A30	3000	555	2.08	450	4.0	3	16.4	< 5	0.8
A28	2800	540	2.08	450	4.0	3	16.6	< 5	0.9
A24	2450	390	2.08	250	4.0	3	16.8	< 5	–
A231	2400	505	2.08	450	–	40	16.8	< 5	1.2
A23	2300	505	2.08	450	4.0	3	16.8	< 5	1.2
A230	2300	505	2.08	450	9.0	8	16.7	< 5	1.2

$$* \propto = \frac{\Delta J_S}{J_S . \Delta T}$$



Li

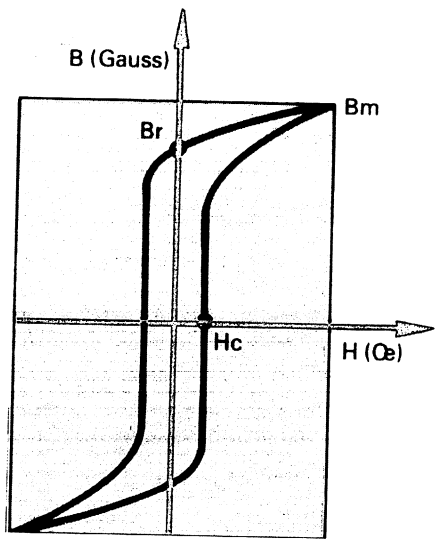
Hysteresis loop

TYPES	B_r / B_m (%)	B_r (Gauss)	$10^3 . \propto B_r$* ($°C^{-1}$) (–60, +100°C)	H_c (Oe)	$10^3 . \propto H_c$** ($°C^{-1}$) (–60, +100°C) ± 0.2
A50	92	2880	0.39	0.5	0.83
A37	96	2560	0.24	2.0	0.61
A30	97	1990	0.23	1.3	0.41
A23	98	1630	0.26	1.0	0.65
A230	97	1655	0.29	1.3	0.61

$\propto B_m = \propto B_r$

* $\propto B_r = \Delta B_r/(B_r.\Delta T)$

** $\propto H_c = \Delta H_c/(H_c.\Delta T)$



Ni

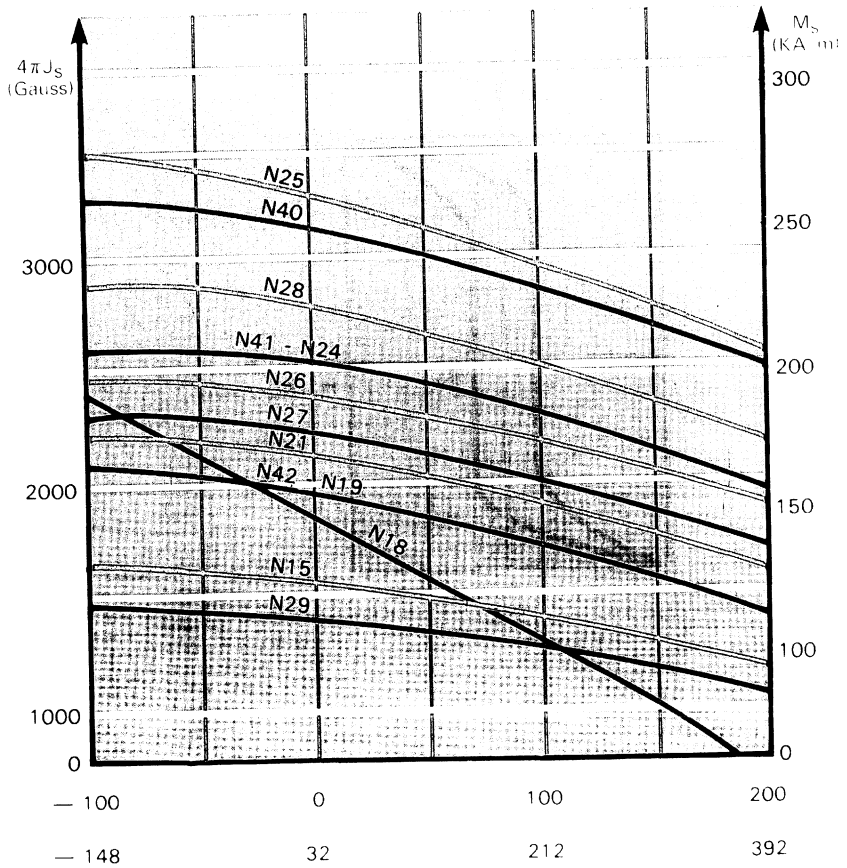
Nickel

These materials are used for high peak and average power applications.

TYPES	$4\pi J_s$ (Gauss) ± 5%	T_c (°C) ± 5%	G_{eff} ± 5%	ΔH (Oe) ± 20%	ΔH_{eff} (Oe) ± 20%	ΔH_k (Oe) ± 10%	ϵ' ± 5%	10^4 tan δ	$\propto 10^2$ * ($°C^{-1}$) -20, +60°C ± 0.2
NZ50	5000	375	2.10	160	–	–	13**	< 15	2.0
NZ40	4000	470	2.20	200	–	–	13**	< 15	2.5
N25	3200	560	2.30	250	100	26	12.7	< 6	1.0
N40	3100	560	2.30	370	130	34	12.5	< 6	0.8
N28	2750	550	2.30	330	100	24	12.4	< 6	0.8
N41	2500	530	2.30	370	130	35	12.3	< 6	0.7
N24	2500	530	2.30	400	15	12	13.0	< 6	0.7
N26	2350	520	2.30	300	100	35	12.2	< 6	0.7
N27	2200	500	2.30	330	100	25	11.8	< 6	0.9
N21	2100	500	2.40	400	15	12	12.6	< 6	1.0
N42	1900	480	2.30	350	130	36	11.4	< 6	1.0
N19	1900	480	2.30	400	15	12	12.4	< 6	1.0
N18	1750	240	2.30	250	–	–	12.5	< 5	3.2
N15	1550	470	2.30	200	–	28	12.5	< 10	0.9
N29	1400	450	2.40	380	100	40	11.2	< 6	0.8

$$* \propto = \frac{\Delta J_S}{J_S . \Delta T}$$

** = ± 10%



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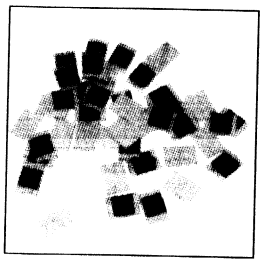
NEW !

INTEGRATED 50 Ω POWER LOAD



TEKELEC TEMEX proposes a new line of power load ranging from 15 to 100 W. The carrier substrate is alumina and the design allows an advantageous alternative against the traditional BeO substrate up to 100 W, without its environmental inconvenience.

BeO FREE

Standard range of loads - Alumina substrate

- Power loads are manufactured using a resistive thick film technology on alumina substrate
- Silver-Palladium metallization for connection pads
- Impedance: 50 Ω ± 5 % (DC)
- Metallization on the bottom face for grounding and better thermal contact

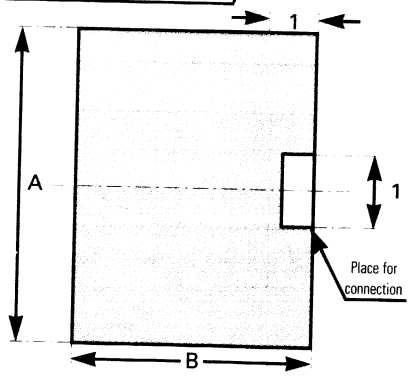
Type	Maximum power handling capability (W) (1)	Maximum operating frequency (MHz) (2) with VSWR ≤ 1.2 : 1	Maximum Dimensions (mm)	
			A	B
L 015 024	15	2.0	3.38	5.64
L 021 025	21	1.9	3.90	6.35
L 032 021	32	2.0	6.77	5.64
L 050 022	50	2.0	7.81	6.77
L 072 023	72	1.3	9.00	7.81
L 100 026	100	1.0	12.70	6.77

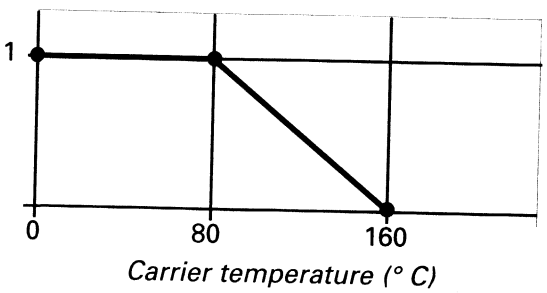
(1) Maximum power handling capability

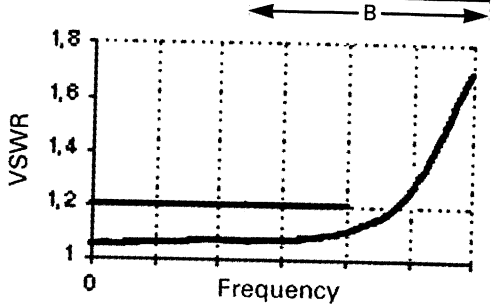
Maximum power is defined for a carrier temperature of 80° C. For different carrier temperatures, please refer to the following curve. Thermal efficiency requires uniform brazing of the complete metallized bottom face of the carrier.

(2) Maximum operating frequency

See the curve VSWR versus frequency.







Our engineering staff is ready to design and produce loads for your specific applications.

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ABSORBING POWDERS

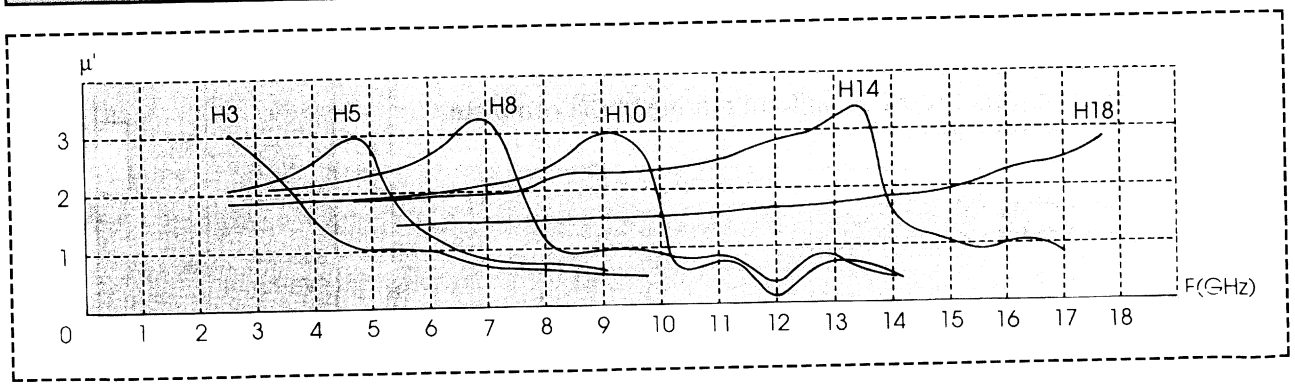
Absorbing powders have been developed to obtain the following effects:

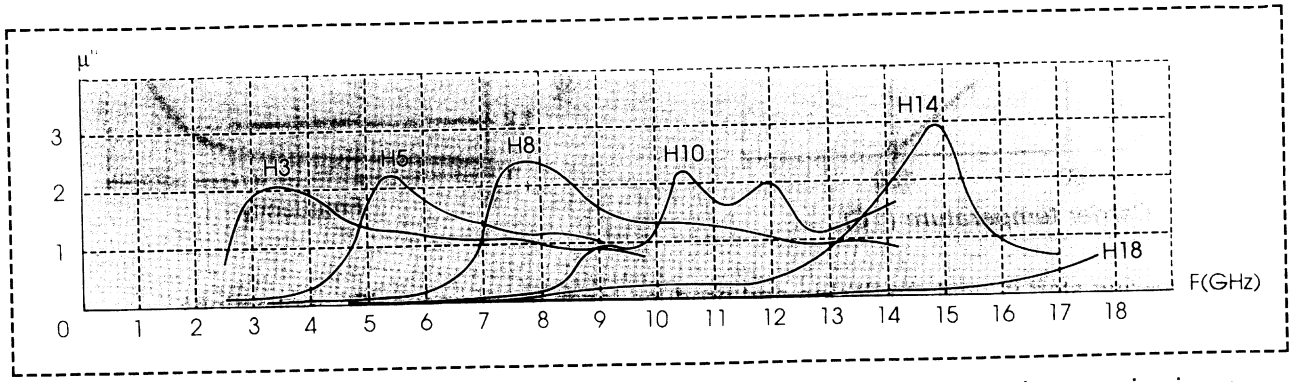
- microwave energy absorption
- parasitic reflexions reduction
- secundary lobes reduction
- clutter reduction
- EMC problems

These materials present ferromagnetic resonance within a frequency range from 2 GHz to 20 GHz and can be used alone or incorporated in painting or in plastic. The main applications are:

- medium bandwidth dummy loads
- anechoic room
- military equipments: stealth aircrafts, ships and vehicles; powders are incorporated in painting or used in ceramic versions.
- painting for building to limit parasitic echos in microwave communication
- microwave ovens for home cookers: prevention of microwave leakage; powders are incorporated in rubbers.

Material referency		H3	H5	H8	H10	H14	H18
Frequency bandwidth GHz		2 - 4	4 - 6	6 - 8	9 - 11	13 - 15	17 - 19
Complex permittivity	ϵ'	18	18	18	18	18	18
	ϵ''	3	3	3	3	3	3

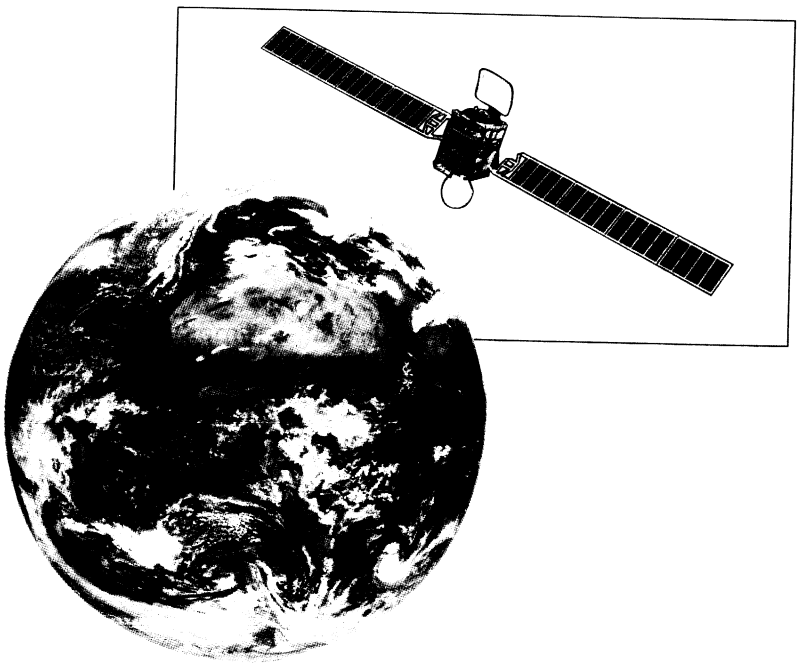




These materials are supplied in form of powder (mean grain size: 50 μm) or in ceramic pieces.

SPACE RANGE

CONTENTS



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GENERAL INFORMATION

From components to subsystems - Space products form an integral and mature part of our product portfolio. Close ties with academia and Space agencies has enabled us to grow this most prestigious area of our business via the introduction of new and more exciting products - the latest being HI-Q ceramic capacitors and PIN diodes.

In order to offer state of the art products, TEKELEC TEMEX has invested in the most up to date machinery and cleans-rooms:

- 10^{-6} Torr vacuum climatic chamber,
- Test benches power amplifier,
- PIND tester,
- Vibration and acceleration test benches.

Our products are dedicated to telecommunications, remote sensing and scientific satellites. Today, more than 60 space programs use products manufactured by TEKELEC TEMEX.

We are proud to have participated in the advancement of space technology and hope to continue into the new millennium and beyond.

In-house facilities

- Climatic chamber,
- Power source,
- Thermal vacuum chamber,
- TWT amplifier,
- Vibration test,
- SEM,
- Pind test,
- Semiconductor life test.

Main programs concerned

STENTOR
SESAT
ERS 1
ERS 2
TELEX
EXS
L-SAT
DFS
X-SAR
ARGOS
IRS 1-2
ADEOS
MAROTS

ARTEMIS
CASSINI
TOPEX POSSEÏDON
TELECOM 1-2
INTELSAT 6-7
SPOT 1-2-3-4
EUTELSAT 2
INSAT 2
TURKSAT
ARABSAT-2
ITALSAT
METEOSAT
ENVISAT-1

TV-SAT
GLOBALSTAR
INMARSAT-3
POLAR PLATFORM
HOT-BIRD
TEMPO
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SILICON MICROWAVE DIODES

STEP RECOVERY DIODES

All the detail specification shall be read in conjunction with ESA/SCC Generic Specification N° 5010, the special requirements are included in the detail specification.

Features

Designed for harmonic generation from 0.2 GHz to 25 GHz of high power levels and / or high multiplication orders, the SRD diodes are ESA qualified. The detail specification ESA/SCC5512/016 is available upon request.

These diodes are available in package and chips.

Main characteristics

Electrical characteristics

Type	ESA/SCC5512/016		Total capacitance (pF)		Output	
	Variant	Package	min	max	Frequency (GHz)	Power (W)
DH252	01	F27D	1.1	2.2	2.0 - 8.0	3.0
DH256	02	F27D	0.7	1.3	5.0 - 12	2.0
DH292	03	F27D	0.4	0.7	8.0 - 16	0.6
DH267	04	F27D	0.4	0.5	10 - 25	0.2

Maximum ratings

Characteristics	Type	Variant	Maximum ratings
DC reverse voltage	DH252	01	40V
	DH256	02	30V
	DH292	03	20V
	DH267	04	15V
DC forward current	DH252 & DH256	01 & 02	200mA
	DH292 & DH267	03 & 04	100mA
RF power dissipation	DH252	01	1.5W
	DH256	02	1.25W
	DH292	03	1.1W
	DH267	04	0.75W
Operating temperature	All	All	- 55 to + 150 ° C
Storage temperature	All	All	- 65 to + 175 ° C
Soldering temperature	All	All	+ 220° C

Other package, specially M208 family can be used.
Other type have been successfully delivered for Space applications: please, don't hesitate to request our space project part list, periodically updated.

ULTRA FAST SWITCHING PIN DIODES

All the detail specification shall be read in conjunction with ESA/SCC Generic Specification N° 5010, the special requirements are included in the detail specification.

Features

These diodes are specially designed for fast switching.They operate at frequencies from few MHz to 25 GHz. The passivated mesa technology, have medium (≤50 µm) and thin layer (≤10 µm). They are manufactured with proprietary technology.
They are being ESA qualified. They are project part list qualified.
The detail specification ESA/SCC5513 is available upon request.

Main characteristics

ULTRA FAST SWITCHING MEDIUM VOLTAGE PIN DIODES

Electrical characteristics ESA/SCC5513/0XX

These diodes are available in M208 family package, see page 1-21 of this data book.

Variant	Type	DC reverse voltage (min)	Junction capacitance (max)	Forward series resistance (max)	Minority carrier lifetime (max value)	ESA/SCC number
01 to 07	DH50033	30 V	0.12 pF	1.8 Ω	40 ns	ESA/SCC5513/032
08 to 14	DH50034	30 V	0.17 pF	1.5 Ω	50 ns	ESA/SCC5513/032
15 to 21	DH50035	30 V	0.23 pF	1.0 Ω	50 ns	ESA/SCC5513/032
22 to 28	DH50036	30 V	0.40 pF	0.9 Ω	60 ns	ESA/SCC5513/032
29 to 37	DH50037	30 V	0.60 pF	0.7 Ω	80 ns	ESA/SCC5513/032
38 to 42	DH50052	50 V	0.08 pF	1.6 Ω	80 ns	ESA/SCC5513/036
43 to 49	DH50053	50 V	0.12 pF	1.4 Ω	60 ns	ESA/SCC5513/036
50 to 56	DH50054	50 V	0.17 pF	1.1 Ω	70 ns	ESA/SCC5513/036
57 to 63	DH50055	50 V	0.23 pF	1.0 Ω	80 ns	ESA/SCC5513/036
64 to 70	DH50056	50 V	0.40 pF	0.9 Ω	100 ns	ESA/SCC5513/036
71 to 77	DH50057	50 V	0.60 pF	0.7 Ω	120 ns	ESA/SCC5513/036
78 to 84	DH50071	70 V	0.06 pF	2.0 Ω	100 ns	ESA/SCC5513/037
85 to 91	DH50072	70 V	0.08 pF	1.7 Ω	100 ns	ESA/SCC5513/037
92 to 98	DH50073	70 V	0.12 pF	1.6 Ω	120 ns	ESA/SCC5513/037
99 to 105	DH50074	70 V	0.17 pF	1.4 Ω	120 ns	ESA/SCC5513/037
106 to 112	DH50075	70 V	0.23 pF	1.0 Ω	200 ns	ESA/SCC5513/037
113 to 119	DH50076	70 V	0.40 pF	0.9 Ω	200 ns	ESA/SCC5513/037
120 to 126	DH50077	70 V	0.60 pF	0.7 Ω	300 ns	ESA/SCC5513/037
127 to 133	DH50101	100 V	0.06 pF	1.9 Ω	300 ns	ESA/SCC5513/038
134 to 140	DH50102	100 V	0.08 pF	1.7 Ω	300 ns	ESA/SCC5513/038
141 to 147	DH50103	100 V	0.12 pF	1.4 Ω	400 ns	ESA/SCC5513/038
148 to 154	DH50104	100 V	0.17 pF	1.2 Ω	500 ns	ESA/SCC5513/038
155 to 161	DH50105	100 V	0.23 pF	1.0 Ω	500 ns	ESA/SCC5513/038
162 to 168	DH50106	100 V	0.40 pF	0.8 Ω	800 ns	ESA/SCC5513/038
169 to 175	DH50107	100 V	0.60 pF	0.6 Ω	1000 ns	ESA/SCC5513/038

FAST SWITCHING SILICON PIN DIODES

Electrical characteristics ESA/SCC 5513/OYY

These diodes are available in M208 family package, see page 1-22 of this data book

Variant	Type	DC reverse voltage (min)	Junction capacitance (max)	Forward series resistance (max)	Minority carrier lifetime (max)	ESA/SCC number
01 to 07	DH50151	150 V	0.06 pF	2.0 Ω	160 ns	ESA/SCC5513/031
08 to 14	DH50152	150 V	0.08 pF	1.7 Ω	185 ns	ESA/SCC5513/031
15 to 21	DH50153	150 V	0.12 pF	1.5 Ω	240 ns	ESA/SCC5513/031
22 to 28	DH50154	150 V	0.17 pF	1.4 Ω	400 ns	ESA/SCC5513/031
29 to 37	DH50155	150 V	0.23 pF	1.0 Ω	440 ns	ESA/SCC5513/031
386 to 42	DH50156	150 V	0.40 pF	0.8 Ω	640 ns	ESA/SCC5513/031
43 to 49	DH50157	150 V	0.60 pF	0.6 Ω	760 ns	ESA/SCC5513/031
50 to 56	DH50201	200 V	0.06 pF	2.3 Ω	240 ns	ESA/SCC5513/033
57 to 63	DH50202	200 V	0.08 pF	2.1 Ω	320 ns	ESA/SCC5513/033
64 to 70	DH50203	200 V	0.12 pF	1.5 Ω	400 ns	ESA/SCC5513/033
71 to 77	DH50204	200 V	0.17 pF	1.3 Ω	520 ns	ESA/SCC5513/033
78 to 84	DH50205	200 V	0.23 pF	1.0 Ω	640 ns	ESA/SCC5513/033
85 to 91	DH50206	200 V	0.40 pF	0.8 Ω	710 ns	ESA/SCC5513/033
92 to 98	DH50207	200 V	0.60 pF	0.7 Ω	840 ns	ESA/SCC5513/033
99 to 105	DH50208	200 V	0.80 pF	0.6 Ω	1000 ns	ESA/SCC5513/033
106 to 112	DH50209	200 V	1.20 pF	0.5 Ω	1200 ns	ESA/SCC5513/033
113 to 119	DH50251	250 V	0.06 pF	2.4 Ω	265 ns	ESA/SCC5513/034
120 to 126	DH50252	250 V	0.08 pF	2.2 Ω	400 ns	ESA/SCC5513/033
127 to 133	DH50253	250 V	0.12 pF	2.0 Ω	600 ns	ESA/SCC5513/033
134 to 140	DH50254	250 V	0.17 pF	1.4 Ω	720 ns	ESA/SCC5513/033
141 to 147	DH50255	250 V	0.23 pF	0.9 Ω	800 ns	ESA/SCC5513/033
148	DH50256	250 V	0.40 pF	0.8 Ω	970 ns	ESA/SCC5513/033
149 to 155	DH50401	400 V	0.06 pF	2.5 Ω	560 ns	ESA/SCC5513/035
156 to 162	DH50402	400 V	0.08 pF	2.3 Ω	640 ns	ESA/SCC5513/035
163 to 169	DH50403	400 V	0.12 pF	2.1 Ω	800 ns	ESA/SCC5513/035
170	DH50404	400 V	0.17 pF	1.8 Ω	1200 ns	ESA/SCC5513/035
171	DH50405	400 V	0.23 pF	1.6 Ω	1600 ns	ESA/SCC5513/035

Maximum ratings

For all variants:

Temperature Tcase	
Operating temperature	- 55 to + 125 ° C
Storage temperature	- 65 to + 150 ° C
Soldering temperature	+ 220° C

Package

For all variants: the detail specification gives the variant with the F27d and M208 family (different possibilities of ribbons). Other hermetic packages can be supplied upon request.

All the detail specification shall be read in conjunction with ESA/SCC Generic Specification N° 5010, the special requirements are included in the detail specification.

TUNING VARACTORS

Features

Designed for tuning in VCO and VCXO, the DH7XXX series offer a large selection of capacitance range and quality factor.

These diodes can be used in other applications such as phase shifters, delay lines...
The wafer technology has a passivated epitaxial mesa.
These diodes are available in packages and chips.

Main characteristics

Electrical characteristics

Type	ESA/SCC551X/xx Variant	Package	Breakdown voltage	Total capacitance 1 MHz	Tuning ratio CTO/CT20	Figure of Merite Q
DH724	XX	F30	25 V	at Vr = 4 **C = 15 pF**	F = 1 MHz **Typ: 10**	F = 50 MHz, Vr **min: 100**
DH735	XY	F27 or M208	20 V	at Vr = 6 **C = 1.8 pF**	F = 1 MHz **Typ: 5**	F = 1 GHz, Vr **min: 150**
DH736	XZ	F27 or M208	20 V	at Vr = 6 **C = 2.7 pF**	F = 1 MHz **Typ: 6**	F = 1 GHz, Vr **min: 100**

Maximum ratings

Characteristics	Type	Variant	Maximum ratings
Operating temperature	All	All	- 55 to + 125 ° C
Storage temperature	All	All	- 65 to + 150 ° C
Soldering temperature	All	All	+ 220° C

Qualification status

This tuning varactor series is PPL qualified. ESA qualification is foreseen for 1998.

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All the detail specification shall be read in conjunction with ESA/SCC Generic Specification N° 5010, the special requirements are included in the detail specification.

BARRIER SCHOTTKY FOR MIXING

Features

These low barrier diodes are specially required for mixing application where the local oscillator (LO) drive level is between -10 dBm and +10 dBm.
From 1 to 18 GHz, wide band, the low value for silicon diode of noise figure, these kind of diodes represent the component that can be used for telecommunication satellite application.

The wafer technology with a passivated planar construction is as reliable as these diodes are used for space application till 1976.

The detail specification ESA/SCC5512/017 is available upon request.
These diodes are available in package and chips.

Electrical characteristics ESA/SCC5512/017

These diodes are available in F51 family package. Please consult page 1-28 of this data book.

Variant	Type	Frequency range (GHz) (typ)	Total junction capacitance (max)	Noise figure (dB) (max)
01 to 06	DH301	1.0 - 6.0	0.48 pF	6.5
07 to 12	DH302	1.0 - 6.0	0.48 pF	6.0
13 to 18	DH303	1.0 - 6.0	0.48 pF	5.5
19 to 24	DH312	6.0 - 12.0	0.30 pF	7.0
25 to 30	DH313	6.0 - 12.0	0.30 pF	6.5
31 to 36	DH314	6.0 - 12.0	0.30 pF	6.0
37 to 42	DH315	6.0 - 12.0	0.30 pF	5.5
43 to 48	DH322	12.0 - 18.0	0.21 pF	7.5
49 to 54	DH323	12.0 - 18.0	0.21 pF	7.0
55 to 60	DH324	12.0 - 18.0	0.21 pF	6.5
61 to 66	DH325	12.0 - 18.0	0.21 pF	6.0

Maximum ratings

Characteristics	Type	Variant	Maximum ratings
DC reverse voltage	All	01 to 66	3 V
DC forward current	All	01 to 66	50 mA
Power dissipation	All	01 to 66	50 mW
Burn-out energy	All	01 to 66	5.0 erg
Operating temperature	All	All	- 55 to + 150 ° C
Storage temperature	All	All	- 65 to + 175 ° C
Soldering temperature	All	All	+ 220° C

SILICON MOS CAPACITORS

All the detail specification shall be read in conjunction with ESA/SCC Generic Specification N° 5010, the special requirements are included in the detail specification.

General Features

MOS (Metal Oxyde Silicon) capacitors chips and array capacitors are suitable for hybrid microwave circuits up to 30 GHz.

Their extreme stability versus temperature make them the best capacitors for all wide temperature range and wide frequency range on the market.

The top metallization are titanium sputtered (700 Å) and gold (6000 Å) which allow: thermocompression, thermosonie and wedge bonding.

The bottom termination of 1.5 µm Au allows high temperature soldering as:
AuSn eutectic at melting point 280° C, or AuGe eutectic at melting point 350° C.

Gluing can be also used for die attach.

SINGLE-PAD CHIPS CAPACITORS (CS SERIES)

Features

They are designed for impedance matching, decoupling, RF by-pass, DC- Block

Typical characteristics

Values are available from: 0.22 pF up to 100 pF. Please, consult page 1-42 of this data book.

MULTI-PADS CAPACITORS ARRAYS (CJ SERIES)

Features

These capacitors arrays are designed for fine and precise tuning in hybrids.

They are suitable for frequency tuning when the frequency band must be tuned after the design of the equipment, by bonding only the right capacitance without a rework on hybrids. The adjustment is kept whatever the mechanical and environmental conditions are.

Typical characteristics

Values are available from: 0.125 pF up to 60 pF, with steps of 2S, 4S, 10S.
(S value of the smallest capacity of the array)

Please, consult page 1-43 of this data book.

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MULTI-PADS BAR CAPACITORS (CB SERIES)

Features

These capacitors bar arrays are designed for by-pass decoupling MMIC's.

They can also be used in hybrid circuits where high performances and stable capacitors are required. They are suitable for frequency tuning when the frequency band must be tuned after the design of the equipment, by bonding only the right capacitance without a rework on hybrids.The adjustment is kept whatever the mechanical and environmental conditions are.

Typical characteristics

Values are available from: 0.125 pF up to 60 pF, with steps of 2S, 4S, 10S.
(S value of the smallest capacity of the array).

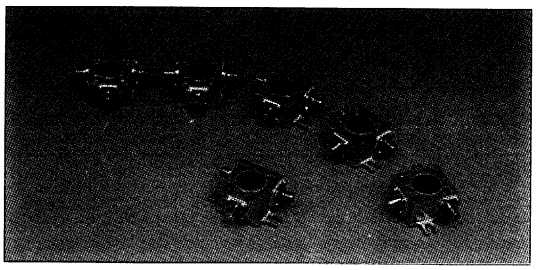
Please, consult page 1-44 of this data book.

FERRITE DEVICES: ISOADAPTATORS, ISOLATORS AND CIRCULATORS

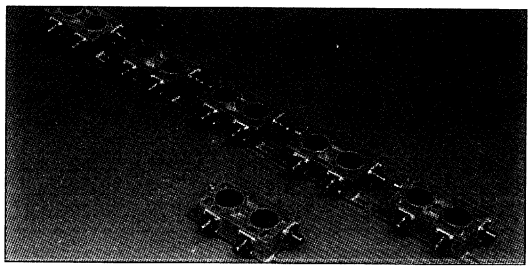
Features

TEKELEC TEMEX is manufacturing and designing ferrite devices for space application since 1970. The coaxial, and waveguide technologies are fully qualified in temperature range of - 40° C / + 85° C. High power devices free of multipactor effects have been designed and delivered in S, C and Ku-Band. Low loss and low weight isolators in both technologies - waveguide and coaxial - are available.

HIGH POWER COAXIAL CIRCULATORS AND ISOLATORS



Isolator 4 GHz Coaxial



Double circ. coax. 4 GHz

Typical main characteristics (over temperature range)		The lightest	Designed for high power
Frequency range	1.2 GHz to 14.5 GHz	12.5 - 12.75 GHz	3.7 - 4.2 GHz
Access	SMA and TNC	SMA	TNC
Mass	20 g to 190 g	20 g	190 g
Power	up to 50 dBm	+30 dBm	+48 dBm
Insertion losses	0.12 to 0.3 dB	0.25 dB	0.12 dB
VSWR	1.1 to 1.2	1.1	1.15
Isolation	20 to 30 dB	20 dB	23 dB
Operating temperature	-40° C, +85° C	-5° C, +75° C	-5° C, +75° C
Based on type		BJ1006	BG1019

Heritage

Telecom 1 & 2, DFS, ATHOS, MARECS, SPOT 1/2/3, GIOTTO, TVSAT/TDF, TELEX, INTELSAT 6/7, ITALSAT, EUTELSAT, POSEIDON, INSAT 2, PPF, TEMPO, HOTBIRD, ARABSAT 2, INMARSAT 3, GLOBALSTAR, ARTEMIS.

Additional information on specific products, performances and programmes can be provided upon request.

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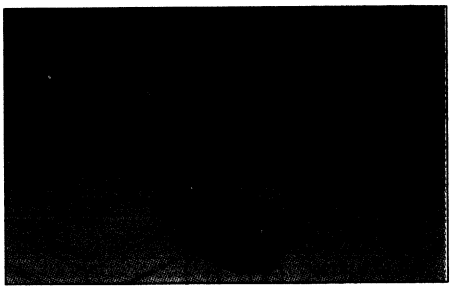
HIGH POWER AND LOW POWER WAVEGUIDE CIRCULATORS AND ISOLATORS



Typical main characteristics (over temperature range)		Example of available device: The lightest	Example of available device: Designed for high power
Frequency range	3.5 GHz to 30 GHz	12.5 - 12.75 GHz	3.7 - 4.2 GHz
Available interface	WR28, WR34, WR42, WR51 WR62, WR75, WR90, WR112, WR137 WR159, WR229	WR28	WR229
Mass	20 g to 990 g	20 g	800 g
Power	up to 50 dBm (100 Watt)	+10 dBm	+50 dBm
Insertion losses	0.1 to 0.35 dB	0.35 dB	0.20 dB
VSWR	1.07 to 1.20	1.1	1.15
Isolation	20 to 30 dB	20 dB	23 dB
Operating temperature	-40° C, +85° C	-20° C, +70° C	-15° C, +60° C
Based on type		FK1001	FF1002

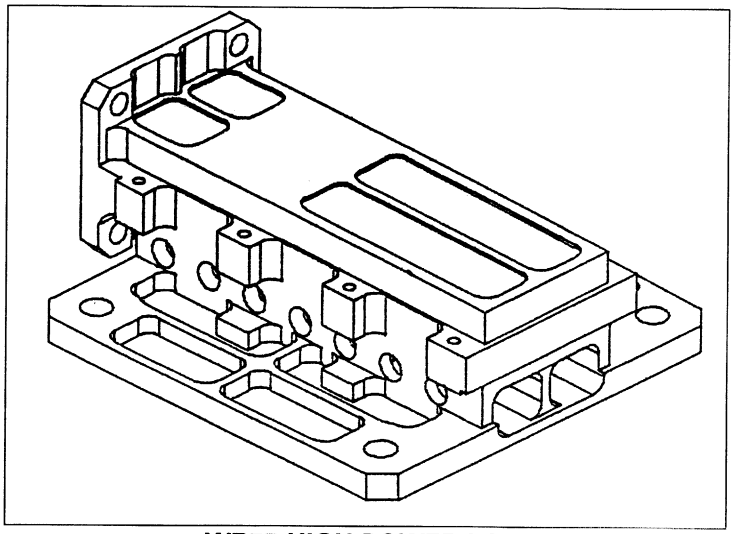
Heritage

Telecom 1 & 2, LSAT, DFS, ATHOS, MARECS, SPOT 4, ERS 1 & 2, ADEOS, AMOS, TVSAT/TDF, TELEX, ITALSAT, EUTELSAT, ARABSAT, ARABSATII, BSS.

Additional information on specific products, performances and programmes can be provided upon request.

Waveguide isolators for space have been designed and qualified up to 30 GHz.

HIGH POWER AND LOW POWER WAVEGUIDE LOADS



WR75 HIGH POWER LOAD

Typical main characteristics (over temperature range)	
Frequency bandwidth	4 GHz to 25 GHz
Available interface	WR34, WR75, WR112 WR229
Mass	5 g to 70 g
Power	up to 50 dBm
VSWR	1.05 to 1.10 Typ
Operating temperature	-40° C, +85° C

Heritage

Telecom 2, SPOT 4, ADEOS, INSAT 2, ARTEMIS, ARABSAT.

Additional information on specific products, performances and programmes can be provided upon request.

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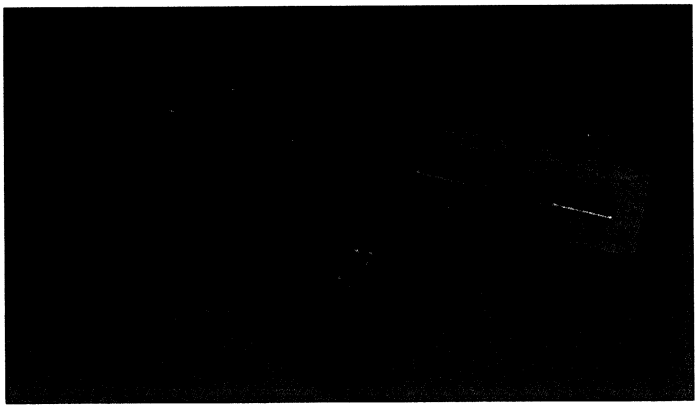
HIGH POWER AND LOW POWER WAVEGUIDE - COAXIAL ADAPTORS



Typical main characteristics (over temperature range)	
Frequency range	7 GHz to 15 GHz
Availalbe interface	WR: 75/SMA 90/SMA 112/SMA
Mass	18 g to 40 g
Power	up to 44 dBm
VSWR	1.105 to 1.15 Typ
Operating temperature	-40° C, +85° C

Heritage

EUTELSAT 2, SPOT 4, AMOS, HOTBIRD.

Additional information on specific products, performances and programmes can be provided upon request.

HYBRID MODULES

CUSTOM DEVICES

TEKELEC TEMEX designs, qualifies and manufactures hybrid devices for Space applications according to the requirement of ESA-PSS 608:

- CIL: Circulator-Isolator-Limiter specially designed for E/R module for active antennas,
- Amplifiers: in S and L Band, surface mount (in SMM2 package) and TO package,
- VCO's: in S and L Band, surface mount (in SMM2 package) and TO package.

Features

These devices can be proposed in accordance with MIL specifications for all Hirel applications.

Components list and material list can be provided upon request.

Assembly are performed in 10000 clean room. Certified people are dedicated to Hirel products.

This film technology has been space qualified for ASAR program (ESA requirements).

Quality Information:

Please refer to pages 3-3 & 3-4 of this data book.

Circulator + Isolator + Limiter

ESA qualification have been sucessfully performed according to ESA-PSS-01-608.
Please refer to pages 3-54 & 3-55 of this data book.

Amplifiers

Please refer to pages 3-19 of this data book.

VCO's

Please refer to pages 3-7 of this data book.

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TRIMMER CAPACITORS

All the detail specification shall be read in conjunction with ESA/SCC Generic Specification N°3010, the special requirements are included in the detail specification.

Detail specification and size

Detail specification	Part number	Variant	Temperature coefficient	Range of capacitance
ESA/SCC3010-004	AT5200	01	± 15 ppm / ° C	1 to 10 pF
ESA/SCC3010-004	AT5202	02	± 15 ppm / ° C	1 to 10 pF
ESA/SCC3010-004	AT5201	03	± 15 ppm / ° C	1 to 10 pF
ESA/SCC3010-004	AT8052	04	± 15 ppm / ° C	1 to 10 pF
ESA/SCC3010-004	AT5276	05	± 15 ppm / ° C	1 to 10 pF
ESA/SCC3010-004	AT5205	06	± 15 ppm / ° C	1 to 10 pF
ESA/SCC3010-006	AT5400	01	± 25 ppm / ° C	1.4 to 14 pF
ESA/SCC3010-006	AT5402	02	± 25 ppm / ° C	1.4 to 14 pF
ESA/SCC3010-006	AT5401	03	± 25 ppm / ° C	1.4 to 14 pF
ESA/SCC3010-006	AT8053	04	± 25 ppm / ° C	1.4 to 14 pF
ESA/SCC3010-006	AT8092	05	± 25 ppm / ° C	1.4 to 14 pF
ESA/SCC3010-006	AT5405	06	± 25 ppm / ° C	1.4 to 14 pF
ESA/SCC3010-008	AT5500	01	± 30 ppm / ° C	1 to 20 pF
ESA/SCC3010-008	AT5502	02	± 30 ppm / ° C	1 to 20 pF
ESA/SCC3010-008	AT5503	03	± 30 ppm / ° C	1 to 20 pF
ESA/SCC3010-010	AT5700	01	± 15 ppm / ° C	0.8 to 6 pF
ESA/SCC3010-010	AT5702	02	± 15 ppm / ° C	0.8 to 6 pF
ESA/SCC3010-010	AT5701	03	± 15 ppm / ° C	0.8 to 6 pF
ESA/SCC3010-010	AT8050	04	± 15 ppm / ° C	0.8 to 6 pF
ESA/SCC3010-011	AT5750	01	± 50 ppm / ° C	1. to 10 pF
ESA/SCC3010-011	AT5752	02	± 50 ppm / ° C	1. to 10 pF
ESA/SCC3010-011	AT5751	03	± 50 ppm / ° C	1. to 10 pF
ESA/SCC3010-011	AT5753	04	± 50 ppm / ° C	1. to 10 pF
ESA/SCC3010-012	AT5800	01	± 50 ppm / ° C	0.6 to 3.5 pF
ESA/SCC3010-012	AT5802	02	± 50 ppm / ° C	0.6 to 3.5 pF
ESA/SCC3010-012	AT5801	03	± 50 ppm / ° C	0.6 to 3.5 pF
ESA/SCC3010-012	AT8051	04	± 50 ppm / ° C	0.6 to 3.5 pF
ESA/SCC3010-012	AT5805	05	± 50 ppm / ° C	0.6 to 3.5 pF
ESA/SCC3010-013	AT5850	01	± 50 ppm / ° C	0.6 to 5. pF
ESA/SCC3010-013	AT5852	02	± 50 ppm / ° C	0.6 to 5. pF
ESA/SCC3010-013	AT5851	03	± 50 ppm / ° C	0.6 to 5. pF
ESA/SCC3010-013	AT5853	04	± 50 ppm / ° C	0.6 to 5. pF
ESA/SCC3010-013	AT5855	05	± 50 ppm / ° C	0.6 to 5. pF

TEKELEC TEMEX can propose custom detail specifications for hirel applications if requested.

Tunning screw are considered as qualified by simiarity with trimmers.

For electrical and mechanical characteristics, please consult catalog n° 10 of this data book.

CHIPS TANTALUM CAPACITORS: CTC1

All the detail specification shall be read in conjunction with ESA/SCC Generic Specification N°3011, the special requirements are included in the detail specification.

Detail specification and size

Detail specification	Size	IEC: L1 x W (mm)	Capacitance range
ESA/SCC3011-001	A	10.05	0.1 to 2.2 µF
ESA/SCC3011-002	B	15.05	0.22 to 4.7 µF
ESA/SCC3011-003	C	20.05	0.47 to 6.8 µF
ESA/SCC3011-004	D	15.10	0.68 to 10 µF
ESA/SCC3011-005	E	20.10	1. to 15. µF
ESA/SCC3011-006	F	22.13	1.5 to 33 µF
ESA/SCC3011-007	G	26.11	3.3 to 68 µF
ESA/SCC3011-008	H	28.15	4.7 to 100 µF

Tinned and gold versions are available in accordance with ESA detail specification.

These products are also CECC qualified: 30801-001.

Light screening for large volume applications is available ; Please ask for TEKELEC TEMEX internal specification for HIREL product (TTF 182). This specification is based on required tests of both ESA and MIL specifications with shorter duration test.

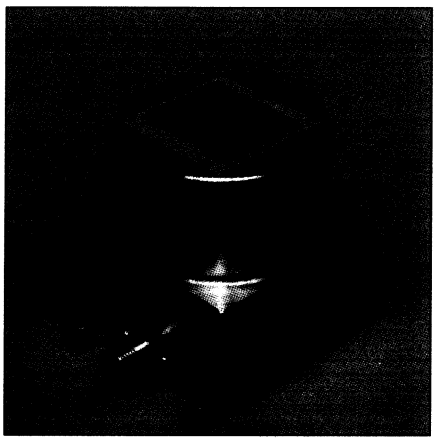
For electrical and mechanical characteristics, please consult the catalog n° 11 of this data book.

SPACE QUALIFIED ULTRA STABLE CRYSTAL OSCILLATOR TYPE MO4D-SC

Product characteristics:

Our space qualified Master Oscillator has the following distinctive features:

- Very small mass and volume
- Low power consumption
- Low temperature sensitivity
- Excellent short and long term stability
- Fast warm-up
- Wide operating temperature
- Pre-adjusted frequency
- Specially designed for working in radiation (tested at 100 Krad, estimated by analysis up to 200 krad)

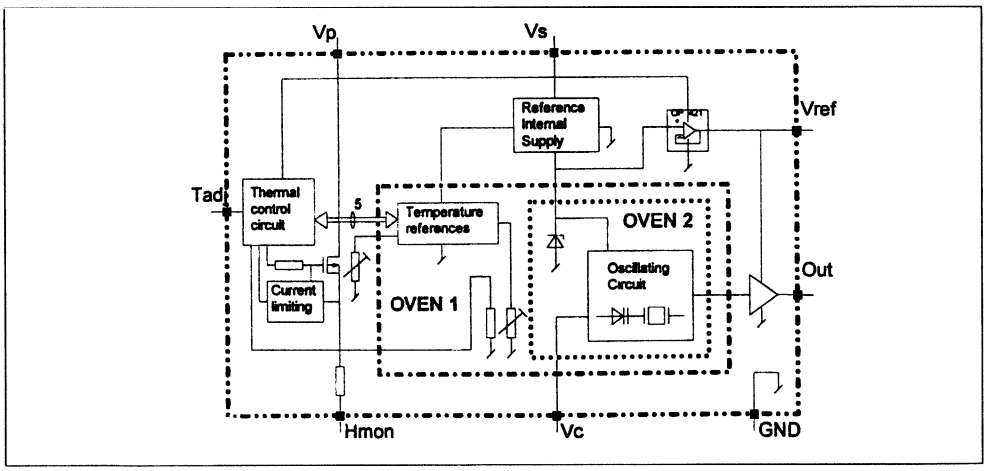


SPACE QUALIFIED ULTRA STABLE CRYSTAL OSCILLATOR

Electrical characteristics

Type		MO4C-SC
Parameter		*Value*
Dimensions		44 x 54 x 57 (44) mm
Output signal frequency		10 MHz
Frequency long term stability, 1st year		< 3 x 10^{-8} per year
Average ageing per day after 1 month		± 1 x 10^{-10} per day
Frequency long term stability, years after		< 1 x 10^{-8} per year
Frequency short term stability		< 2 x 10^{-12} (1-100sec)
Frequency stability over full temp. range		5 x 10^{-10}
Frequency adjustment		≈ 1.5 Hz
SSB phase noise assuming 10 MHz carrier		
	1 Hz	< -100 dBc
	10 Hz	< -130 dBc
	100 Hz	< -140 dBc
	1000 Hz	< -150 dBc
	10000 Hz	< -155 dBc
Output signal level range		5 dBm ± 1 dBm
Output impedance		50 Ω ± 20 %
Harmonics		-30 dBc
Spurious signals		-120 dB
Load impedance		50 Ω
Power consumption during warm-up		5 W
Nominal power consumption		3 W
Maximum power consumption		4.5 W
Mass (Master Oscillator)		200 g
Volume		0.11 dm^3
Power supply		12 - 18 V
Connectors	1) Power / TC	3 x pins
	2) RF Output	SMA
	3) Case ground	2 x M4 stud
Mechanical interface		flat base plate
Max. baseplate operating temperature		60° C
Min. baseplate operating temperature		-15° C
Non operating temperature		-40 to 70° C
First natural resonance		> 800 Hz
Random Vibration	**20 - 80 Hz**	+6 dB/oct
tested, with	**80 - 350 Hz**	0.8 g^2/Hz
axis perpendicular to	**350 - 443 Hz**	-6 dB/oct
the mounting plane.	**443 - 600 Hz**	0.5 g^2 /Hz
	600 - 2000 Hz	-6 dB/oct
During		120 sec/axis
Random Vibration	**20 - 80 Hz**	+6 dB/oct
tested, with	**80 - 350 Hz**	0.32 g^2/Hz
axis parallel to the	**350 - 443 Hz**	-6 dB/oct
mounting plane.	**443 - 950 Hz**	0.2 g^2/Hz
	950 - 2000 Hz	-6 dB/oct
During		120 sec/axis
Sinusoidal vibration	5 - 19 Hz	11 mm 0-peak
	19 - 80 Hz	16 g
	80 - 100 Hz	8 g
Life time		15 years
Pressuresensitivity vacuum to atmosphere		< 5 x 10^{-10}

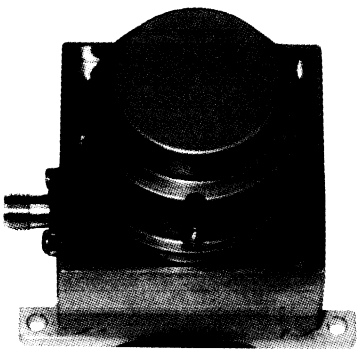
Functional block diagram of the MO Core



Options

Available options on request

Code	Parameter	Value
D5/16	Frequency	5 MHz / 16 MHz
F	Fast warm-up time to 2 x 10^{-8}	5 min
P	Two powers pins (Vs and Vp)	-
T	Special temp. operating range	On request
X5	Frequency long term stability	± 5 x 10^{-11} / day
X3	Frequency long term stability	± 3 x 10^{-11} / day
T2	F stability overfull temp. range	± 5 x 10^{-11} / day



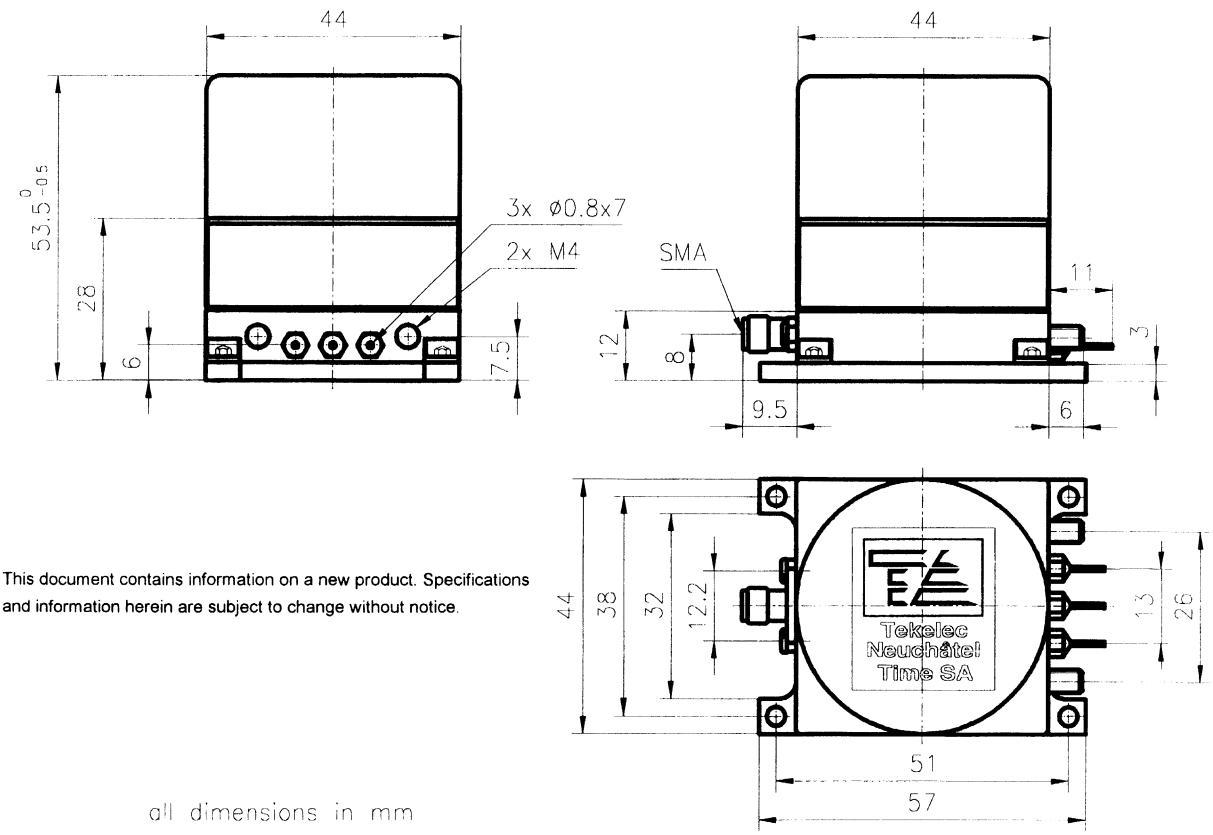
User accessible parameters

The externally accessible parameters are the frequency adjustment control voltage (Vadj) and the reference voltage (Vref)

To adjust the frequency, a control voltage shall be applied on the Vadj pin. The allowed voltage range is GND ≤ Vadj ≤ Vref. This can be performed through the use of a resistor bridge or a 100 kΩ variable resistor, connected between the Vref pin and the power ground.

In the standard version, all the modifiable parameters are factory adjusted by fixed value SMD resistors which are soldered on the user accessible interface PCB. The parameters can also be re-adjusted by the user, if required.

Master Oscillator external dimensions



all dimensions in mm

PERIPHERALS

CONTENTS

TIME GENERATOR VME BOARD / GPS - STANAG 4430

The TSVME 640 is a precise, stable, complete date / time signaling subsystem, configured on a single VMEboard. The TSVME 640 is designed to meet all date / time signaling needs for VME-based computer applications, such as work-stations and data acquisition systems.

This equipment is self contained, grouping the date / time generator and its associated management features. Synchronization is provided by an external reference, with internal backup or by an on-board GPS receiver.

Software-driven remote control is provided via the VMEbus. This makes the TSVME 640 an ideal choice for embedded applications with synchronization requirements.

Main features

• *ACQUISITION OF TIME REFERENCE*

The TSVME 640 can be synchronized to either a STANAG 4430 interface or a simple serial time interface; each is associated with a separate 1 pps signal.

The STANAG 4430 is the new NATO standard for time synchronization and transfer.

The TSVME 640 acts as a STANAG 4430 receiver, using the standard time message and its associated 1 pps, with both available on the same connector.

The Serial Time Interface is designed with a very simple protocol that can easily be handled by commercial computers.

In addition to the time reference inputs, a 5 MHz input is available on the front panel and can be used as a frequency reference for the time core. The TSVME 640 can be synchronized to UTC by an internal on-board GPS receiver, automatically tracking up to 8 satellites.

• *FREQUENCY AND TIME KEEPING*

The TSVME 640 core is a real-time generator with automatic leap second and leap year management. It is slaved to the main time input and updates the internal time and its management with the incoming information.

In case of reference disruption, the time is automatically maintained by the core, driven by the frequency reference (internal or external).

The TSVME 640 is equipped with an internal oscillator. The customer can choose one of the following: XO, TCXO, OCXO. These oscillators provide a reference frequency, accurate up to $2x10^{-8}$. In case of input reference disruption, the time is maintained by the internal oscillator.

• *TIME DISTRIBUTION*

Date / time information is available on the VMEbus with zero latency. A double buffering mechanism avoids any time modification during reading. The time rollover is correlated with the 1 pps signal output.

Further to the basic clock function, the TSVME 640 also features a pulse that can be programmed over the range of 1ms to 65535 ms.

This pulse is available on the front panel and generates a VMEbus interrupt, with the corresponding time latched in registers on the VMEbus. This avoids any real time constraint for the collection of the time on the VMEbus.

All output status and configurations are accessible by the VMEbus through registers, such as pulse rate, interrupt, enable.

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TIME GENERATOR VME BOARD

TSVME 640

Main specifications

ACCURACY - STABILITY (1 PPS OUTPUT)

- initial synchronization: < ± 1 µs
- Jitter:
  Reference available
  - 50 ns: OCXO
  - 500 ns: TCXO
  - 15 µs: XO

  In auto mode:
  - 100 µs/ day: OCXO
  - 10 ms / day: TCXO
  - 1.5 s / day: XO

TIME MANAGEMENT

- Tracking of 1pps signal by comparison with the time source and automatic adjustments
- Leap second management
- Leap year management

OPERATING MODE

- Nominal start-up time:
  < 1 minute (15 minutes with GPS receiver).
- Synchronization and slaving on selected source (STANAG 4430, Serial Time Interface, 1pps, external 5 MHz or GPS)
- Periodic pulse generation
- User interface by LED (status)
- Permanent self-test of main functions, maintenance ensured by error messages and front panel LED display
- VMEbus interface with interrupt capabilities on output events
- Remote status and control by VMEbus.

INPUTS

- Serial Time Interface and 1pps
- STANAG 4430
- 5 MHz external frequency reference
- GPS antenna (option)

OUTPUTS

- Time available on VMEbus
- Monitoring registers, via VMEbus
- 1 pps (TTL)
- TTL pulse at variable rate:
  1 ms to 65535 ms,
  with associated VME interrupt.

VMEbus INTERFACE

- Compatible VMEbus revision C
- Slave A24/D16-D8 (EO)

BUS INTERFACE

- DC supply: +5 V, +12 V, -12 V
- Power consumption: < 12 W

ENVIRONMENT

- Operating temperature: 0° C to + 50° C
- Storage temperature: - 20° C to + 85° C
- Relative humidity:
  90 % without condensation
- Overange on request

PHYSICAL CHARACTERISTICS

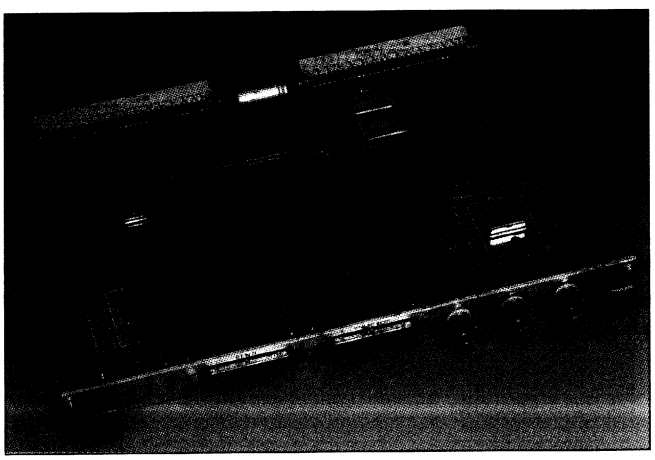
- 6U/4TE; 6U / 8TE with GPS receiver or OCXO
- Size (W x D x H): 233.5 x 20 x 160 mm

ACCESSORIES

- Operating and instruction manual

OPTION

- GPS receiver 8 channels on-board and 24 dB antenna with 5 meters cable



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GPS CLOCK OEM BOARD CAPABILITIES

OEM boards delivering ultra stable time and frequency signals (GPS input) can be tailored to your specifications in order to be integrated directly into your systems. We offer 10 years experience in designing and manufacturing GPS based Time & Frequency equipment. Using their expert knowledge in crystal oscillators, rubidium, digital signal processing and software engineering, our R & D team can provide a low cost solution to your specific requirements.

All inquiries are welcomed.

The unit described below is an example of a custom design product.

For an overview of our full range of capabilities, including our off-the-shelf GPS clocks, please ask for the Epsilon Clock Family brochure

Main features

- ***Acquisition of Time reference***

The TE 672 includes a GPS C/A code receiver tracking up to 8 channels on L1 (1575 MHz). The GPS receiver adds a layer of integrity to the GPS timing solution through the use of a RAIM (Receiver Autonomous Integrity Monitoring) algorithm.

- ***Frequency and Time keeping***

The TE 672 accomodates several options of oscillators, slaved to GPS. In case of reference disruption, the time and frequency are maintained by the internal oscillator under microprocessor control.

- ***Time and Frequency distribution***

  - Time Of Day is accessible by a serial interface (RS 422),
  - 1 pps and 4.096 MHz outputs are delivered on RS 422 interface.

- ***Control and Monitoring***

  - Different functional modes are available. Setup and status are accessible via a serial line interface,
  - The antenna cable delay is programmed by this way,
  - Status are displayed on the front panel thanks to three leds.

The specifications given below correspond to a particular requirement from one of our customers. We offer, on our OEM boards, a range of frequency outputs (2048 kHz, 10 MHz, 26 MHz for instance) with an accuracy of up to 1 x 10^{-12} (GPS locked) and 1 x 10^{-10} in holdover mode.

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Main specifications

ACCURACY

- Frequency output (4.096 MHz)
  GPS with S/A: $< \pm 5 \times 10^{-11}$
  GPS unavailable: $< \pm 10^{-8}$*
- Time output (1 pps)
  GPS, 1 σ: < ± 100 ns
  GPS unavailable: < ± 3 µs**

* One day after last GPS synchronization, at full operating temperature range

** At quasi constant temperature, one hour

OPERATING MODE

Nominal start-up time: < 20 minutes

Synchronisation and slaving on GPS reference

1 pps offset and leap second programmation
GPS or UTC Time delivery

Position hold mode for timing applications

Automatic detection and removal of failed satellites

Quick GPS reacquisition time (45 s typical)

GPS and Time & Frequency monitoring from serial port

User interface by leds (GPS, status, power)

Permanent self-test of main functions, maintenance ensured by error messages and front panel report

INPUT

GPS active antenna (N connector)

OUTPUTS

Time Of Day on serial line interface (RS422)
1 pps (RS422)
4.096 MHz squarewave (RS422)
Alarm Signal (RS422)

POWER SUPPLY

DC supply: 12 V ± 5 %
Power consumption: < 15 W typical at warm up

ENVIRONMENT

Operating and start up temperature:
0 °C to + 60 °C

Operation from -10 ° C to 0° C does not cause any damage

Storage temperature: - 30° C to + 70° C

Relative humidity: 90 % non condensing

European EMC standard

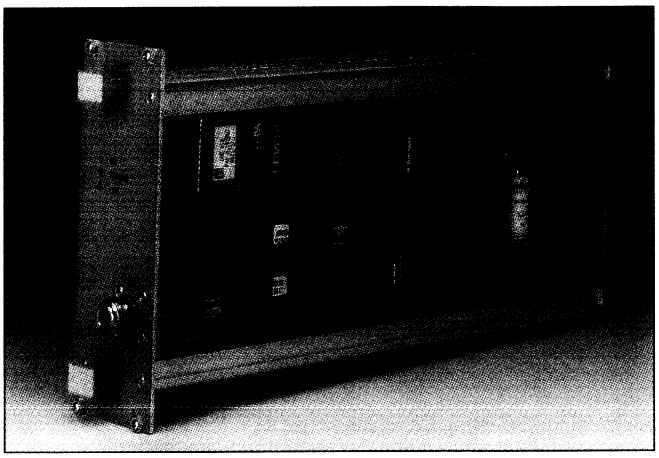
PHYSICAL CHARACTERISTICS

Rackable unit:

- Height:	4 U
- Width:	12 TE
- Depth:	290 mm
- Weight:	< 1 kg

ACCESSORIES

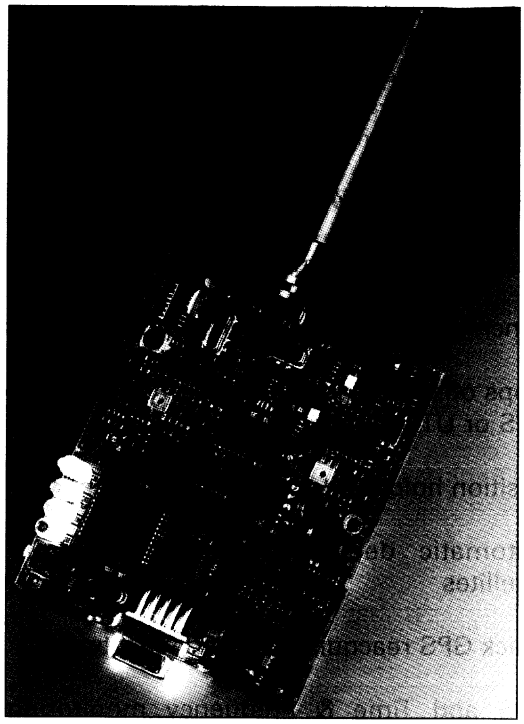
Operating and instruction manual
GPS antenna with 5 meters cable



OEM RADIO MODEM AT 434 MHZ - RM 4

- Plug and play
- Error-free transmissions
- Point to Multipoint
- License free

The RM4 OEM unit provides wireless data transmission in the 433-434 MHz band. It uses a FSK modulation and can transmit up to 19 200 bit/s with error detect. It complies with ETSI standard ETS 300-220 therefore it doesn't require any license.



It can be used in point to point or point to multipoint configurations. With a standard 0 dB omni-directional antenna the range can reach up to 2 km. The unit weights less than 150 grams with the power requirement of 12 V max. The transmit power consumption is 220 mA and the receive consumption is 120 mA.

The RM4 doesn't require any development effort with no special software needed. The RM4 can be configured with FDMA or TDMA protocols at the user request.

The OEM version of the RM4 allows the integrators to add wireless mobility to their products at lower cost. Because of its small size, the RM4 can be integrated into handheld devices for a wide range of mobile or fixed applications in various industries and services such as wharehousing, manufacturing, transportation, medical, processing, etc...

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OEM SPREAD SPECTRUM TRANSCEIVER DSM245 - DSM250

- License free operation
- Reliable communications
- Immune to interference and jamming
- Point to Multipoint protocole

The range of DSM OEM units are especially designed for wireless communications of digital data, voice and video in hostile environment.

They consist of a high performance one piece card transmitting at up to 2 Mbit/s in the 2.4 - 2.487 GHz. They use either a BPSK or a QPSK modulation. Optional daughter card can be provided with specific data transmission protocols such as TDMA, FDMA, CSMA or for voice and video applications.

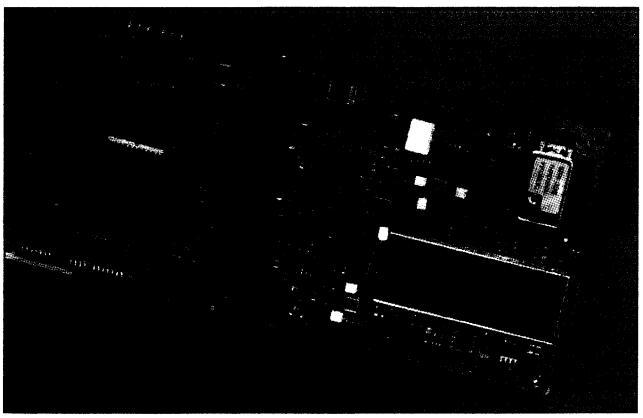
The range DSM is based on direct sequence spread spectrum technology which ensures:

- high immunity to electromagnetic noise, interference, fading and multipath distorsion,
- low probability of intercept,
- error free transmissions,
- multiple access with the use of the same frequency for simultaneous communications.

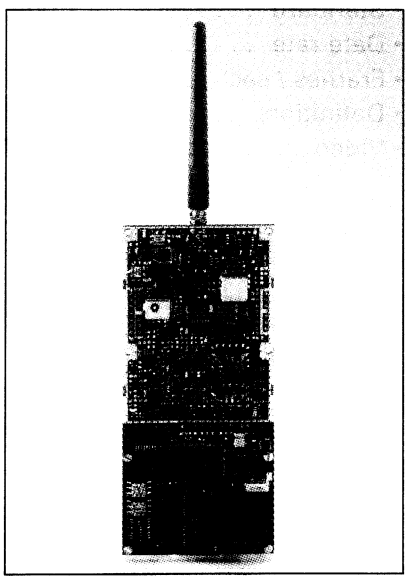
The setup can be in straight forward pass-through mode or be customized with software to change spread spectrum parameters.

The output power does not exceed 100 mW according to ETSI standard 300-328.

The DSM OEM unit allows integration into mobile devices such as barcode scanners, data collection equipment, environment monitoring, point of sales, remote control, security systems, video surveillance, process monitoring, handheld terminals, etc. In doing so, the integrators can expend the range of applications for their products and meet new customer requirements.



DSM245



DSM250

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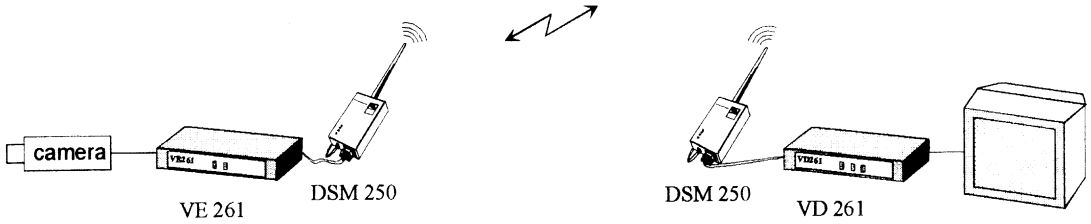
RADIO TRANSMISSIONS OF DIGITAL VIDEO IMAGES VE261 - VD261

ST2E has developed **a video encoder and decoder** which can be interfaced with ST2E's spread spectrum radio modem (DSM250).

The basic system is described below:



The signal transmitted by the video camera (in PAL format ; NTSC in option) is digitized and compressed by the VE261 encoder in accordance with H.261 specifications.

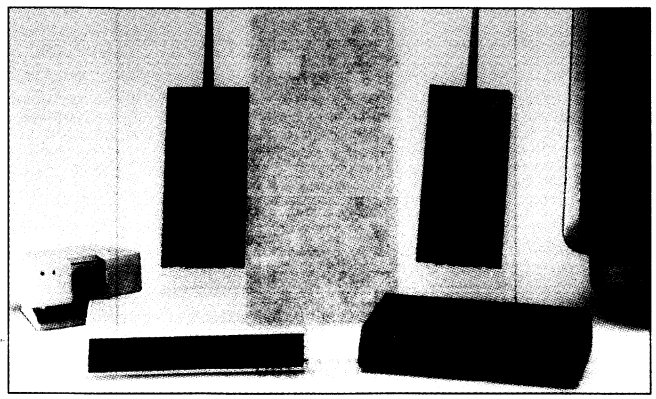
The compression is performed based on the parameters set by the user (trade-off between image resolution and flow ; digital image format ; animation ; throughput of compressed digital data).

The resulting digitized signal is received by the DSM250 radio modem via a RS2422 connector and then transmitted on the ISM 2.4 GHz band. The images transmitted can be fixed, animated, in color or monochrome.

The VD261 performs the decompression of the digital images and send analog signals to the TV monitor.

Specifications

- Standard . . . . . .Coding H.261 (according to ITU regulations)
- Date rate . . . . . .From 64 Kbit/s to 2 Mbit/s
- Frames / sec . . . . . .Up to 25 frames / second
- Definition . . . . . .CIF (288 lines x 352 columns) or QCIF (144 lines x 176 columns)
- Video . . . . . .PAL (NTSC optional)



Mechanical (VE261 or VD261)

- Weight: 0.450 kg
- Dimensions: 205 x 108 x 38 mm

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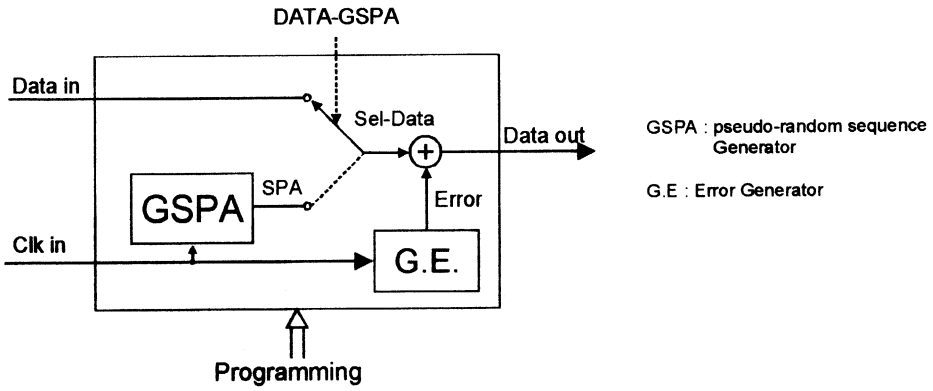
RANDOM ERROR GENERATOR
GEA

The **GEA** is a device that allows introduction of errors in a digital transmission in order to:

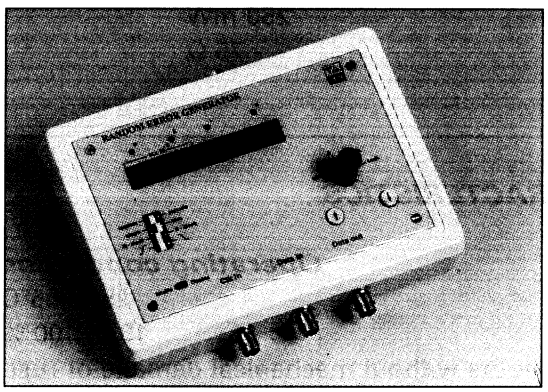
- simulate a transmission channel,
- verify different protocols of communication,
- evaluate performances of error detection / correction protocols.



Depending on the position of "DATA-GSPA", the device can receive digital data "Data in" and their clock "Clk in".

The GEA adds error sequences called "Error" and provides a signal "Data out". It simulates a digital transmission channel.

The device allows also to create different pseudo-random sequences to replace the data "Data in". In this case, the GEA tests data receivers that use error detection / correction protocols. With standard pseudo-random sequences that are recognized by error analysers and with the appropriate error sequence, it is possible to evaluate correction capacity of the error detection / correction protocol.



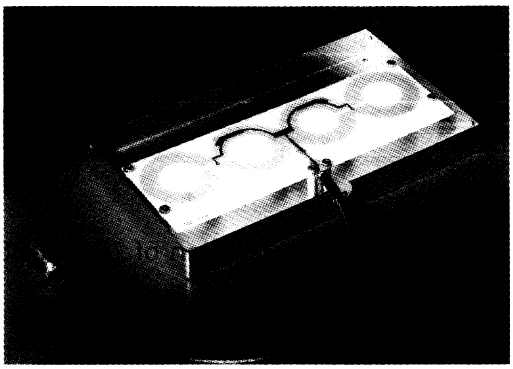
Tekelec Temex offers a range of microstrip and patch antennas for microcellular mobile communications.
These antennas are available for all the principal systems:
GSM, DECT, DCS 1800, PCS 1900.

These antennas are designed either for standalone external mounting or for OEM integration within the micro cell equipment enclosure.

Hereafter are some examples of TEKELEC TEMEX capability:

9 dBi DECT ANTENNA

This 9 dBi DECT antenna is designed using a patented microstrip technology. This OEM version should be mounted with an hermetic equipment enclosure for external use.



Electrical characteristics:

Operating Frequency band	1.88 - 1.93 GHz
Nominal gain	9 dBi ± 1 dBi
3 dB aperture in H plane	40° ± 3°
3 dB aperture in E plane	60° ± 10°
Sidelobes at 110° ± 3° aperture in H plane	-24 dB
Sidelobes at more than 110° aperture in H plane	-24 dB
Sidelobes at 160 ° ±10° aperture in E plane	-17 dB
Sidelobes at more than 160° aperture in E plane	-25 dB
Polarisation	Vertical
VSWR	< 1.5

• Maximum input power:	250 mW
• Nominal impedance:	75 Ω

Specifications

ENVIRONMENTAL CHARACTERISTICS

	Operating conditions
- Temperature:	-25 to 55°C
- Relative humidity:	10 to 100 %
- Salt spray:	96 hours without mechanical damage or rust.

	Storage and transport
- Temperature:	-25°C to +70°C

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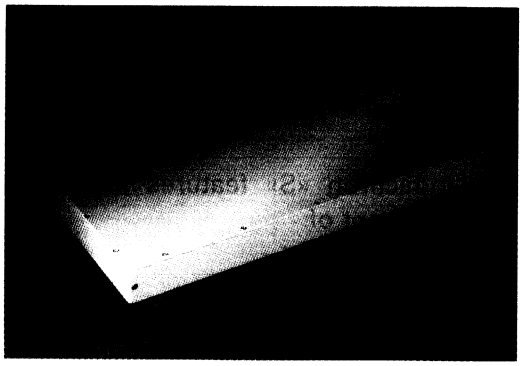
12 dBi DECT ANTENNA

This 12 dBi DECT antenna is designed using a patented microstrip technology. It is fully protected from the environment by an hermetic enclosure and may be mounted externally.



Electrical characteristics:

Operating Frequency band	1.88 - 1.90 GHz
Nominal gain	< 11 dBi ± 1 dBi (11.7 dBi typ.)
3 dB aperture in H plane	> 20°
3 dB aperture in E plane	> 50° ± 10°
Sidelobes at more than 110° aperture in H plane	≤-12 dB
Rear sidelobes in H plane	< -15 dB
Rear sidelobes in E plane	< -13 dB
Polarisation	Vertical
VSWR	< 1.5

• Maximum input power:	250 mW
• Nominal impedance:	75 Ω
• Connector	F male centre pin 1 mm diameter
• L x W x H	370 x 170 x 38 mm

Specifications

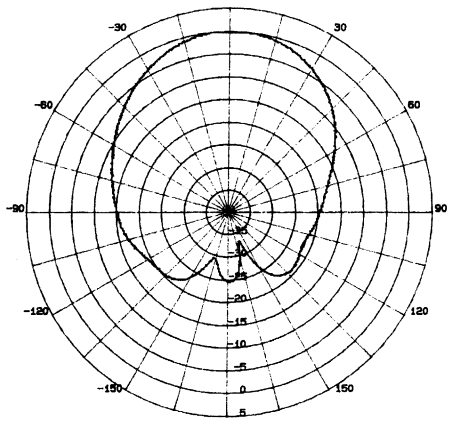
ENVIRONMENTAL CHARACTERISTICS

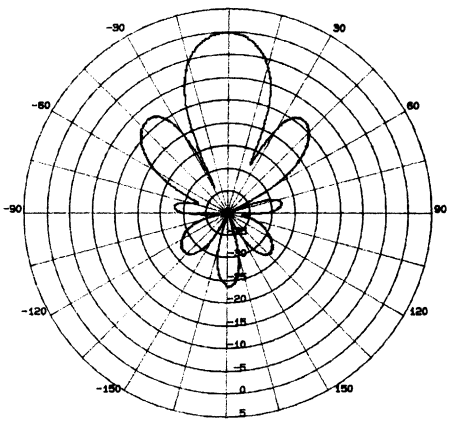
Operating conditions

- Temperature:	-25 to 55°C
- Relative humidity:	10 to 100 %
- Salt spray:	96 hours without mechanical damage or rust.

Storage and transport

- Temperature:	-25°C to +70°C





MINIATURE ELECTROLYTIC COUNTER / METER

Indachron «S»

Functions

The Indachron «S» features a pointer travelling longitudinally along a graduated scale for the measurement of:

- coulombs,
- elapsed times
- pulses

¤ **Use as a coulombmeter,** the capillary features a constant K allowing the scale to be graduated in coulombs: K = 1.447 cb/mm

¤ **Use as an elapsed time indicator:** if the Indachron «S» is fed with a constant current (DC or AC rectified) the travel of the index is proportional to the time during which the current has been applied. For each series, refer to the paragraph «Applications as an elapsed time indicator».

¤ **Use as a pulse counter,** the Indachron «S» will integrate any shaped pulse with a duration ≥ 1 ms. If the phenomenon is a repetitive one, each pulse corresponds to one same quantity -q- of electricity. The ratio k / q gives the number of pulses per mm of scale.

Versions

The Indachron «S» exists in two versions:

• **Without built-in electronics:** types 120 and 720. They can be used in the 3 functions previously described. In this case the electronic adaptation is achieved by the user himself.

• **With built-in electronics:** these models can be used as elapsed time indicator only for the stated scale and voltage: type 420 (DC), type 520 (AC), type 620 (military version).

• Other scales : upon request

Main features

• High sensitivity: any quantity of electricity passing through the Indachron «S» is transformed without loss or mass transfer.

• The Indachron «S» does not require any external power supply to operate: this is a real advantage for airborne systems, far from any power supply source or requiring low consumption elements.

• The Indachron «S» is reversible and can be used without limits. The index can be easily reset to zero after any time of use. Refer to paragraph: «Reset to zero» for each model.

• Measurements with the Indachron «S» only require a very low current. This offers a warranty of good operation in an «explosive» environment and avoids any disturbance of the near-by electronic circuitry.

The table hereunder reviews a certain number of applications in a great number of different fields of industry or research: aeronautics, data processing, instrumentation, industrial testing, military equipments, home appliances, high fidelity, astronomy...

APPLICATION	FUNCTION	FIELD
MTBF Statistics	Elapsed time indicator	- Part and sub-assembly reliability - New or pre-series material MTBF - Operating time of an instrument
	Pulse counter	- Number of typed characters - Passage of cards, vehicles, parts, number of cycles, etc.
WARRANTY in actual hours of use	Elapsed time indicator	- Electric engines, drillers, cameras - Electronic tubes - Home appliances - Magnetic read heads
	Pulse counter	- Print heads on fast printers
MAINTENANCE in actual hours of use	Elapsed time indicator	- Electronic assemblies and sub-assemblies - Electric engines or turbine explosion - Measurement instruments, - Military equipments, - Pick-up stylus - Filters: dust, grease - Read heads
	Pulse counter	- Print heads on fast printers - Equipments: commands by electric pulses
CHARGE AND DISCHARGE MONITORING	Coulombmeter	- Battery chargers - Battery discharge on portable material - Charge by solar cells - Plating - Gauges on electrical vehicles

HOW TO ORDER

Type, Series, Mounting, Voltage (for types 420 and 620), Scale

Example:

120 FSC neutral
420 CP53 24 V 1000 H

MINIATURE ELECTROLYTIC COUNTER / METER

Indachron «S»

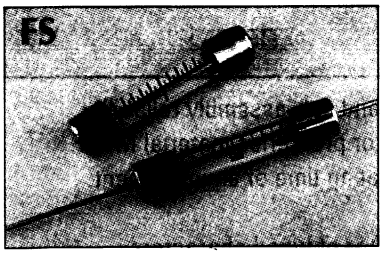
TEKELEC TEMEX

SERIES CONFIGURATION

ELECTRICAL CHARACTERISTICS

MECHANICAL CHARACTERISTICS

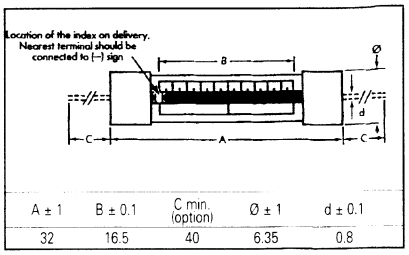
FS



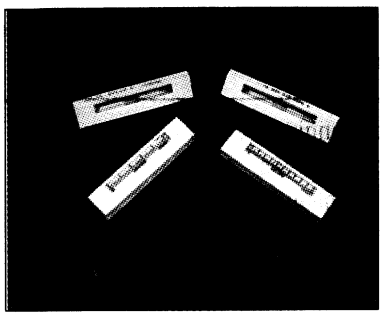
TYPES	VOLTAGE	MOUNTING	SCALES
120	User defined	E: pluggable C: Axial leads	Neutral

Current (µA) for desired time scale:
It = 6.77 * 1000 / T (hour)

* Reset to zero:
apply a current (< 85 µA) to move index to the scale zero.



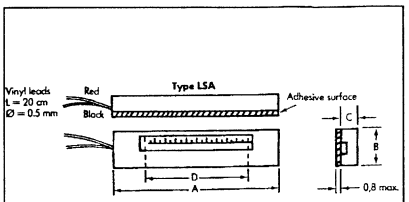
A ± 1	B ± 0.1	C min. (option)	Ø ± 1	d ± 0.1
32	16.5	40	6.35	0.8



TYPES	VOLTAGE	MOUNTING	SCALES
120	User defined	A: Adhesive	1000 h
420	5; 12; 24; 48 VDC	C: PCB horiz. C2: PCB vert.	2000 h 5000 h
520	220 VAC	P: Pluggable	10000 h

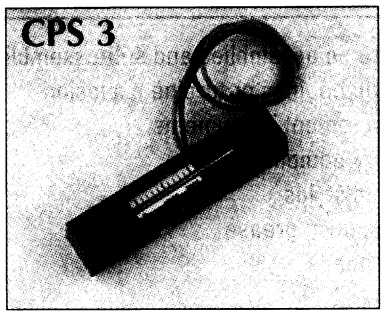
Current (µA) for desired time scale:
It = 10.44*1000 / T (hour)

* Reset to zero:
apply a current (< 85 µA) to move index to the scale zero.



A ± 0.2	B ± 0.1	C ± 0.1	D ± 0.1
41	9	4	25.4

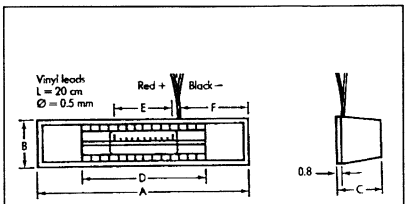
CPS 3



TYPES	VOLTAGE	MOUNTING	SCALES
120	User defined	A: Adhesive	A-B-C-D 0-100%
420	5; 12; 24; 48 VDC		1000 h 2000 h
520	220 VAC		5000 h 10000 h

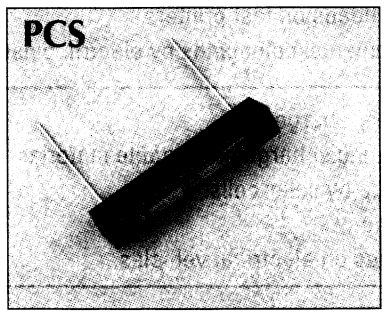
Current (µA) for desired time scale:
It = 5.22*1000 / T (hour)

* Reset to zero:
pull cover, reverse it and push it



A ± 0.2	B ± 0.2	C ± 0.3	D ± 0.1	E ± 0.1	F
48.3	10.2	10.2	28	12.7	18

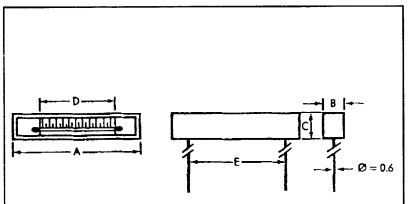
PCS



TYPES	VOLTAGE	MOUNTING	SCALES
120	User defined	Radial leads for PCB	Neutral
720			1000 h 5000 h 10000 h

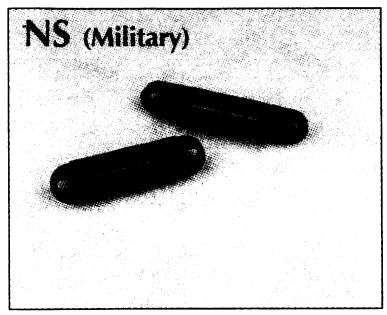
Current (µA) for desired time scale:
It = 6.77*1000 / T (hour)

* Reset to zero:
apply a current (< 85 µA) to move index to the scale zero.



A ± 0.2	B ± 0.2	C ± 0.2	D ± 0.2	E ± 0.3
28.2	4.6	5.7	16.5	22.9

NS (Military)

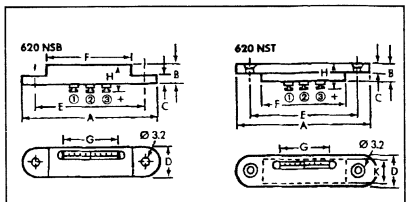


TYPES	VOLTAGE	MOUNTING	SCALES
120	User defined	B: Front panel	1000 h
620	28 VDC 220 VAC	T: Rear panel	5000 h 10000 h

Current (µA) for desired time scale:
It = 6.77*1000 / T (hour)

* Connection: ③ «+» Ve; ① «-» Ve

* Reset to zero:
apply a voltage as: ② «+» Ve; ③ «-» Ve
Current should not exceed 85 µA



	A±0.3	B±0.2	C±0.2	D±0.2	E±0.2	F±0.2	G±0.2	H±0.2	K±0.2
NSB	40.7	5.1	2.6	8	33.5	25.7	16.5	8.3	-
NST	36.8	5.1	2.6	9.4	30.4	25.7	16.5	8.3	8

Common data to all series:

Max. admissible DC current	=	85 µA
Consumption in 1000 h	=	2 mW

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