Aanvullingen Philips handboeken

Måart/April 1973

Halfgeleiders

Bouweenheden

Geïntegreerde schakelingen

Onderdelen

Materialen

Elektronenbuizen

De in deze uitgave opgenomen technische gegevens worden t.z.t. afgedrukt in de Philips handboeken

AANVULLINGEN PHILIPS HANDBOEKEN

Inhoudsopgave uitgave maart/april 1973

Elektronenbuizen

FAST RECOVERY RECTIFIER DIODES

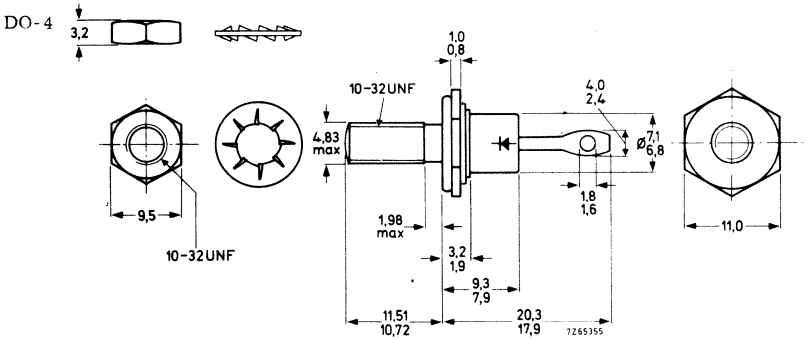
Silicon diodes in a DO-4 metal envelope, intended for use in high frequency power supplies, thyristor inverters and multi-phase power rectifier applications. The series consists of the following types:
Normal polarity (cathode to stud): BYX50-200 and BYX50-300.
Reverse polarity (anode to stud): BYX50-200R and BYX50-300R.

QUICK REFERENCE DATA

			BYX50-200(R)	300(R)	
Crest working reverse voltage	V_{RWM}	max.	200	300	V
Repetitive peak reverse voltage	V_{RRM}	max.	200	300	V
Average forward current up to T_{mb} = 110 °C	$I_{F(AV)}$	max.		6	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.		4	A
Non-repetitive peak forward current t = 10 ms; T_j = 150 °C prior to surge	I_{FSM}	max.		80	A
Junction temperature	T_j	max.		150	°C
Reverse recovery time when switched from I_F = 1 A to V_R = 30 V; −dI/dt = 100 A/µs	t_{rr}	<		100	ns

MECHANICAL DATA

Dimensions in mm



Net weight: 6,5 g.
Diameter of clearance hole: max. 5,2 mm
Accessories supplied on request: 56295
The mark shown applies to the normal polarity types.

Torque on nut: min. 0,8 Nm (8 kg cm)
max. 1,7 Nm (17 kg cm)

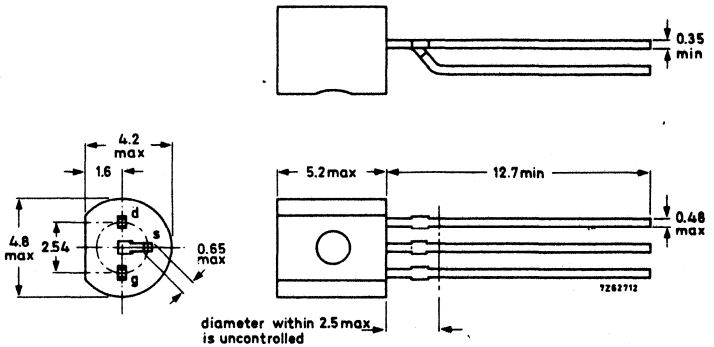
N-CHANNEL SILICON FIELD-EFFECT TRANSISTORS

N-channel silicon epitaxial planar junction field-effect transistors in a plastic TO-92 variant; intended for low input noise stages in tape recorders, hi-fi amplifiers and other audio frequency equipment.

QUICK REFERENCE DATA				
Drain-source voltage	$\pm V_{DS}$	max.	30	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW
Junction temperature	T_j	max.	150	°C
Drain current V_{DS} = 15 V; V_{GS} = 0	I_{DSS}		2 to 12	mA
Transfer admittance (common source) V_{DS} = 15 V; V_{GS} = 0; f = 1 kHz	$\lvert y_{fs} \rvert$	typ.	3,5	mA/V
Noise figure at V_{DS} = 15 V; V_{GS} = 0 f = 1 kHz; R_G = 1 MΩ	F	<	2	dB

MECHANICAL DATA Dimensions in mm

TO-92 variant



SILICON PLANAR EPITAXIAL TRANSISTORS

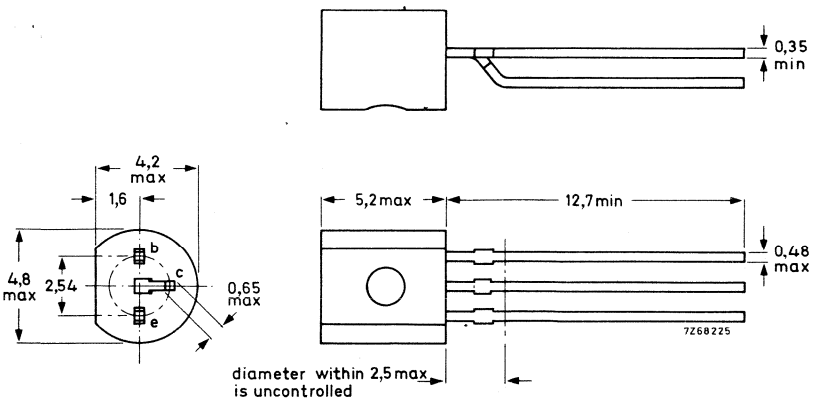
N-P-N transistors in a plastic TO-92 variant primarily intended for use in driver stages of audio amplifiers. P-N-P complements are BC636, BC638 and BC640.

QUICK REFERENCE DATA

			BC635	BC637	BC639	
Collector-emitter voltage (R_{BE} = 1 kΩ)	V_{CER}	max.	45	60	100	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	60	80	V
Collector current (peak value)	I_{CM}	max.		1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1		W
Junction temperature	T_j	max.		150		°C
Transition frequency I_C = 10 mA; V_{CE} = 5 V	f_T	typ.		130		MHz

MECHANICAL DATA Dimensions in mm

TO-92 variant



SILICON PLANAR EPITAXIAL TRANSISTORS

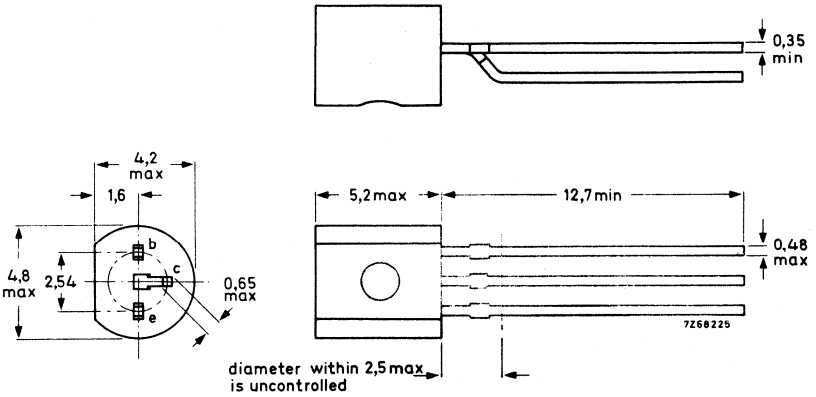
P-N-P transistors in a plastic TO-92 variant primarily intended for use in driver stages of audio amplifiers. N-P-N complements are BC635, BC637, BC639.

QUICK REFERENCE DATA

			BC636	BC638	BC640	
Collector-emitter voltage (R_{BE} = 1 kΩ)	$-V_{CER}$	max.	45	60	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	60	80	V
Collector current (peak value)	$-I_{CM}$	max.		1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.		1		W
Junction temperature	T_j	max.		150		°C
Transition frequency $-I_C$ = 10 mA; $-V_{CE}$ = 5 V	f_T	typ.		50		MHz

MECHANICAL DATA Dimensions in mm

TO-92 variant



SILICON DARLINGTON POWER TRANSISTORS

P-N-P epitaxial base transistors in monolithic Darlington circuit for audio outputs and general amplifier and switching applications; TO-3 envelope. N-P-N complements are BDX67, BDX67A and BDX67B.

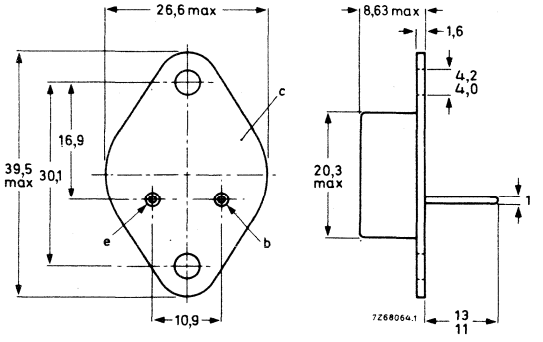
QUICK REFERENCE DATA

			BDX66	BDX66A	BDX66B	
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	60	80	100	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	60	80	100	V
Collector-current (peak value)	$-I_{CM}$	max.		20		A
Total power dissipation up to $T_{mb} = 25\ ^{o}C$	P_{tot}	max.		150		W
Junction temperature	T_j	max.		200		^{o}C
D.C. current gain						
$-I_C = 10$ A; $-V_{CE} = 3$ V	h_{FE}	>		1000		
$-I_C = 15$ A; $-V_{CE} = 3$ V	h_{FE}	typ.		750		
Transition frequency						
$-I_C = 5$ A; $-V_{CE} = 3$ V	f_T	typ.		7		MHz

MECHANICAL DATA Dimensions in mm

Collector connected to envelope

TO-3



Accessories available: 56201e

SILICON DARLINGTON POWER TRANSISTORS

N-P-N epitaxial base transistors in monolithic Darlington circuit for audio outputs and general amplifier and switching applications; TO-3 envelope. P-N-P complements are BDX66, BDX66A and BDX66B.

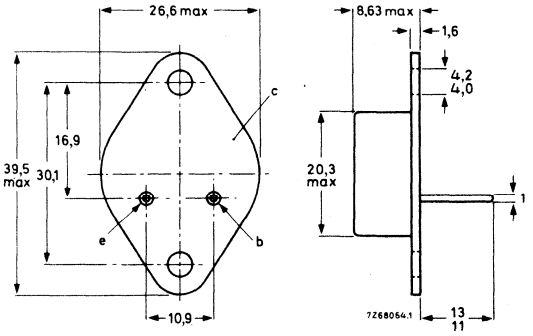
QUICK REFERENCE DATA

			BDX67	BDX67A	BDX67B	
Collector-base voltage (open emitter)	V_{CBO}	max.	80	100	120	V
Collector-emitter voltage (open base)	V_{CEO}	max.	60	80	100	V
Collector-current (peak value)	I_{CM}	max.		20		A
Total power dissipation up to $T_{mb} = 25\ ^{o}C$	P_{tot}	max.		150		W
Junction temperature	T_j	max.		200		^{o}C
D.C. current gain						
I_C = 10 A; V_{CE} = 3 V	h_{FE}	>		1000		
I_C = 15 A; V_{CE} = 3 V	h_{FE}	typ.		750		
Transition frequency						
I_C = 5 A; V_{CE} = 3 V	f_T	typ.		7		MHz

MECHANICAL DATA Dimensions in mm

Collector connected to envelope

TO-3



Accessories available: 56201e

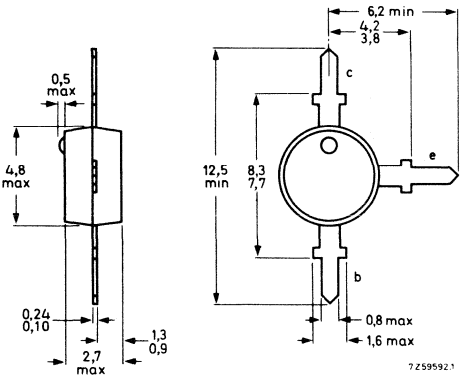
SILICON PLANAR EPITAXIAL TRANSISTOR

N-P-N transistor in a subminiature plastic transfermoulded T-package.
It is primarily intended for use in u.h.f. low power amplifiers such as in pocket phones, paging systems, etc.
The transistor features low current consumption (100 µA - 1 mA); thanks to its high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA				
Collector-base voltage (open emitter)	V_{CBO}	max.	8	V
Collector-emitter voltage (open base)	V_{CEO}	max.	5	V
Collector current (d.c.)	I_C	max.	2,5	mA
Total power dissipation up to T_{amb} = 135 °C	P_{tot}	max.	30	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz				
I_C = 1 mA; V_{CE} = 1 V	f_T	typ.	2,3	GHz
Feedback capacitance at f = 1 MHz				
I_C = 1 mA; V_{CE} = 1 V; T_{amb} = 25 °C	C_{re}	<	0,4	pF
Noise figure at optimum source impedance				
I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	3,8	dB
Max. unilateral power gain (see page 3)				
I_C = 1 mA; V_{CE} = 1 V; f = 500 MHz; T_{amb} = 25 °C	G_{UM}	typ.	17	dB

MECHANICAL DATA

Dimensions in mm



DUAL N-CHANNEL FETs

Dual n-channel silicon planar epitaxial junction field-effect transistors in TO-71 metal envelope, with electrically insulated gates and a common substrate connected to the envelope; intended for high performance low level differential amplifiers.

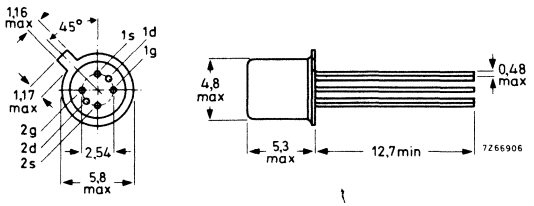
QUICK REFERENCE DATA

Characteristics measured at T_{amb} = 25 °C; I_D = 200 μA; V_{DG} = 15 V

			BFQ10	11	12	13	14	15	16	
Difference in gate current	$\lvert\Delta I_G\rvert$	<	10	10	10	10	10	10	10	pA
Gate-source voltage difference	$\lvert\Delta V_{GS}\rvert$	<	5	10	10	10	15	20	50	mV
Thermal drift of gate-source voltage difference	$\lvert\frac{d\,\Delta V_{GS}}{dT}\rvert$	<	5	5	10	20	20	40	50	μV/°C
Transfer conductance ratio	$\frac{g_{1fs}}{g_{2fs}}$	>	0,98	0,98	0,98	0,98	0,98	0,95	0,95	
		<	1,02	1,02	1,02	1,02	1,02	1,05	1,05	
Difference in transfer impedance	$\lvert\Delta\frac{1}{g_{fs}}\rvert$	<	6	6	12	12	12	20	30	Ω
Difference in penetration factor	$\lvert\Delta\frac{g_{os}}{g_{fs}}\rvert$	<	10	30	30	30	30	30	100	μV/V
Common mode rejection ratio	CMRR	>	100	90	90	90	90	90	80	dB

MECHANICAL DATA Dimensions in mm

TO-71
All leads insulated
from the case



SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors in a micro miniature plastic envelope intended for application in thick- and thin-film circuits. These transistors are intended for general purposes as well as saturated switching and driver applications for industrial service.
The BCX17 and BCX18 are complementary to the BCX19 and BCX20 respectivily.

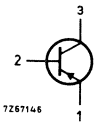
QUICK REFERENCE DATA

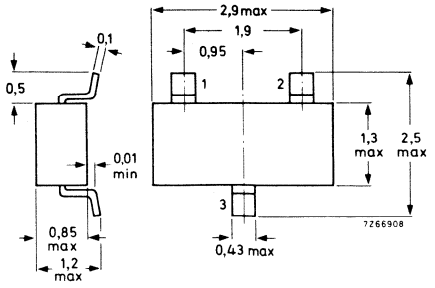
			BCX17	BCX18	
Collector-emitter voltage (V_{BE} = 0)	$-V_{CES}$	max.	50	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	45	25	V
Collector current (peak value)	$-I_{CM}$	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	310		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain $-I_C$ = 100 mA; $-V_{CE}$ = 1 V	h_{FE}		100 to 600		
Transition frequency $-I_C$ = 10 mA; $-V_{CE}$ = 5 V; f = 35 MHz	f_T	typ.	100		MHz

MECHANICAL DATA Dimensions in mm

SOT-23

Code:
BCX17 T1
BCX18 T2





SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a micro miniature plastic envelope intended for application in thick- and thin-film circuits. These transistors are intended for general purposes as well as saturated switching and driver applications for industrial service.
The BCX19 and BCX20 are complementary to the BCX17 and BCX18 respectivily.

QUICK REFERENCE DATA

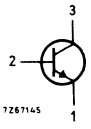
			BCX19	BCX20	
Collector-emitter voltage (V_{BE} = 0)	V_{CES}	max.	50	30	V
Collector-emitter voltage (open base)	V_{CEO}	max.	45	25	V
Collector current (peak value)	I_{CM}	max.	1000		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	310		mW
Junction temperature	T_j	max.	150		°C
D.C. current gain I_C = 100 mA; V_{CE} = 1 V	h_{FE}		100 to 600		
Transition frequency I_C = 10 mA; V_{CE} = 5 V; f = 35 MHz	f_T	typ.	200		MHz

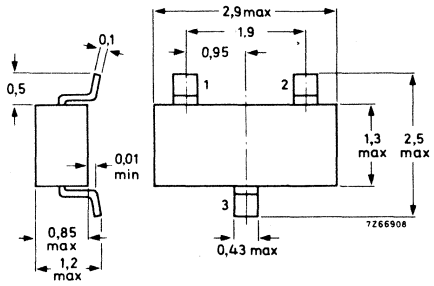
MECHANICAL DATA

Dimensions in mm

SOT-23

Code:
BCX19 U1
BCX20 U2





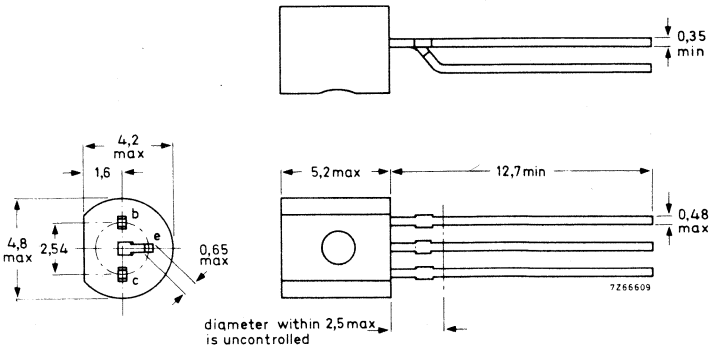
H.F. SILICON PLANAR EPITAXIAL TRANSISTORS

N-P-N transistors in a plastic envelope, recommended for a.m. mixers and i.f. amplifiers in a.m./f.m. receivers.

QUICK REFERENCE DATA					
Collector-base voltage (open emitter)	V_{CBO}	max.	40		V
Collector-emitter voltage (open base)	V_{CEO}	max.	40		V
Collector current (d.c.)	I_C	max.	25		mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250		mW
Junction temperature	T_j	max.	125		°C
			BF240	BF241	
Base current I_C = 1 mA; V_{CE} = 10 V	I_B		4,5-15	8-28	μA
Transition frequency I_C = 1 mA; V_{CE} = 10 V	f_T	typ.	380	350	MHz
Feedback capacitance at f = 1 MHz I_C = 1 mA; V_{CE} = 10 V	$-C_{re}$	<	0,34		pF
Noise figure I_C = 1 mA; V_{CE} = 10 V R_S = 200 Ω; f = 0,2 MHz	F	<	3,5		dB

MECHANICAL DATA Dimensions in mm

TO-92 variant



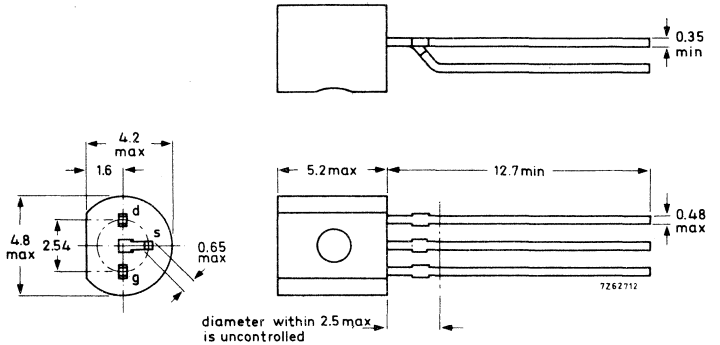
N-CHANNEL SILICON FIELD-EFFECT TRANSISTORS

Symmetrical N-channel planar epitaxial junction field-effect transistors in a plastic TO-92 variant; intended for v.h.f. and u.h.f. applications.

QUICK REFERENCE DATA					
Drain-source voltage	$\pm V_{DS}$	max.	30		V
Gate-source voltage (open drain)	$-V_{GSO}$	max.	30		V
Total power dissipation up to T_{amb} = 75 °C	P_{tot}	max.	300		mW
		BF256A	B	C	
Drain current		>	3	6	11	mA
V_{DS} = 15 V; V_{GS} = 0	I_{DSS}	<	7	13	18	mA
Feedback capacitance at f = 1 MHz					
V_{DS} = 20 V; $-V_{GS}$ = 1 V; T_{amb} = 25 °C	C_{rs}	typ.	0,7		pF
Transfer admittance (common source)					
V_{DS} = 15 V; V_{GS} = 0; f = 1 kHz; T_{amb} = 25 °C	$\lvert y_{fs} \rvert$	>	4,5		mA/V
Power gain at f = 800 MHz					
V_{DS} = 15 V; R_S = 47 Ω	G_p	typ.	11		dB

MECHANICAL DATA Dimensions in mm

TO-92 variant



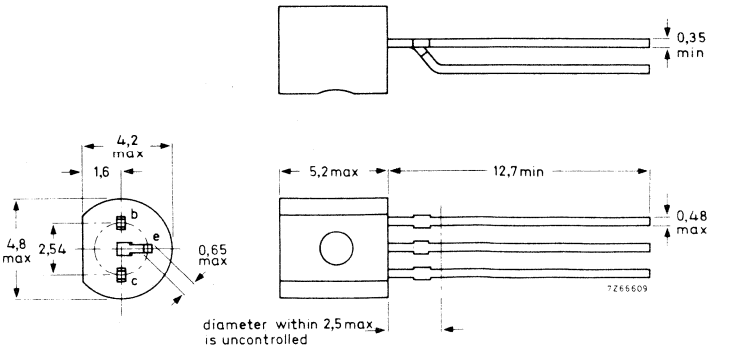
H.F. SILICON PLANAR EPITAXIAL TRANSISTOR

P-N-P transistor in a plastic envelope especially intended for r.f. stages in f.m. front-ends in common base configuration.

QUICK REFERENCE DATA				
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	30	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	30	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 45 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Base current $-I_C$ = 4 mA; $-V_{CE}$ = 10 V	$-I_B$	typ. <	80 160	µA µA
Transition frequency $-I_C$ = 4 mA; $-V_{CE}$ = 10 V	f_T	typ.	550	MHz
Noise figure at f = 100 MHz $-I_C$ = 2 mA; $-V_{CE}$ = 10 V; G_S = 16,7 mA/V	F	typ.	3	dB
Feedback capacitance at f = 1 MHz V_{EB} = 0; $-V_{CB}$ = 10 V	$-C_{rb}$	typ.	0,1	pF

MECHANICAL DATA Dimensions in mm

TO-92 variant



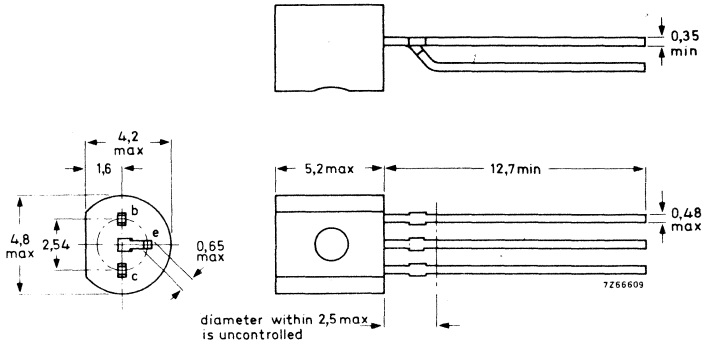
H.F. SILICON PLANAR EPITAXIAL TRANSISTORS

P-N-P transistors in a plastic envelope intended for h.f. and i.f. applications in radio receivers, especially for mixer stages in a.m. receivers and i.f. stages in a.m./f.m. receivers wit negative earth.

QUICK REFERENCE DATA				
Collector-base voltage (open emitter)	$-V_{CBO}$	max.	40	V
Collector-emitter voltage (open base)	$-V_{CEO}$	max.	40	V
Collector current (d.c.)	$-I_C$	max.	25	mA
Total power dissipation up to T_{amb} = 45 °C	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	°C
Base current $-I_C$ = 1 mA; $-V_{CE}$ = 10 V BF450: BF451:	$-I_B$ $-I_B$	< <	16,5 33	µA µA
Transition frequency $-I_C$ = 1 mA; $-V_{CE}$ = 10 V	f_T	typ.	325	MHz
Noise figure at f = 100 kHz $-I_C$ = 1 mA; $-V_{CE}$ = 10 V; R_S = 300 Ω	F	typ.	2	dB

MECHANICAL DATA Dimensions in mm

TO-92 variant



SILICON PLANAR EPITAXIAL TRANSISTOR

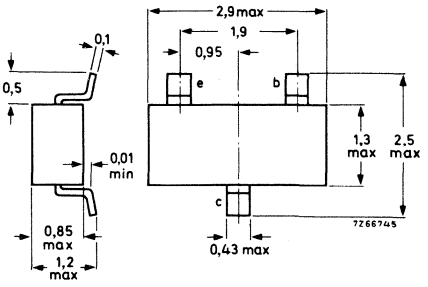
N-P-N transistor in a micro miniature plastic envelope. It is primarily intended for use in u.h.f. and microwave amplifiers in thick-and thin-film circuits, such as in aerial amplifiers, radar systems, oscilloscopes, spectrum analysers etc.
The transistor features very low intermodulation distortion and high power gain: thanks to its very high transition frequency, it also has excellent wideband properties and low noise up to high frequencies.

QUICK REFERENCE DATA				
Collector-base voltage (open emitter)	V_{CBO}	max.	15	V
Collector-emitter voltage (open base)	V_{CEO}	max.	12	V
Collector current (d.c.)	I_C	max.	35	mA
Total power dissipation up to T_{amb} = 60 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	150	°C
Transition frequency at f = 500 MHz I_C = 30 mA; V_{CE} = 5 V	f_T	typ.	5	GHz
Feedback capacitance at f = 1 MHz I_C = 2 mA; V_{CE} = 5 V; T_{amb} = 25 °C	C_{re}	typ.	0,8	pF
Noise figure at optimum source impedance I_C = 2 mA; V_{CE} = 5 V; f = 500 MHz; T_{amb} = 25 °C	F	typ.	1,9	dB
Max. unilateralized transducer gain at T_{amb} = 25 °C I_C = 30 mA; V_{CE} = 5 V; f = 500 MHz	$G_{tr(um)}$	typ.	16,5	dB
Intermodulation distortion at T_{amb} = 25 °C I_C = 30 mA; V_{CE} = 5 V; R_L = 75 Ω; V_o = 300 mV f(p + q − r) = 493,25 MHz (see also page 4)	d_{im}	typ.	−60	dB

MECHANICAL DATA

Dimensions in mm

Code: R1



DUAL OPERATIONAL AMPLIFIER

The TCA490A to C is a monolithic integrated circuit, consisting of two identical amplifiers. Primarily intended as a (stereo) audio amplifier it can also be used for general industrial purposes.
Special features are:

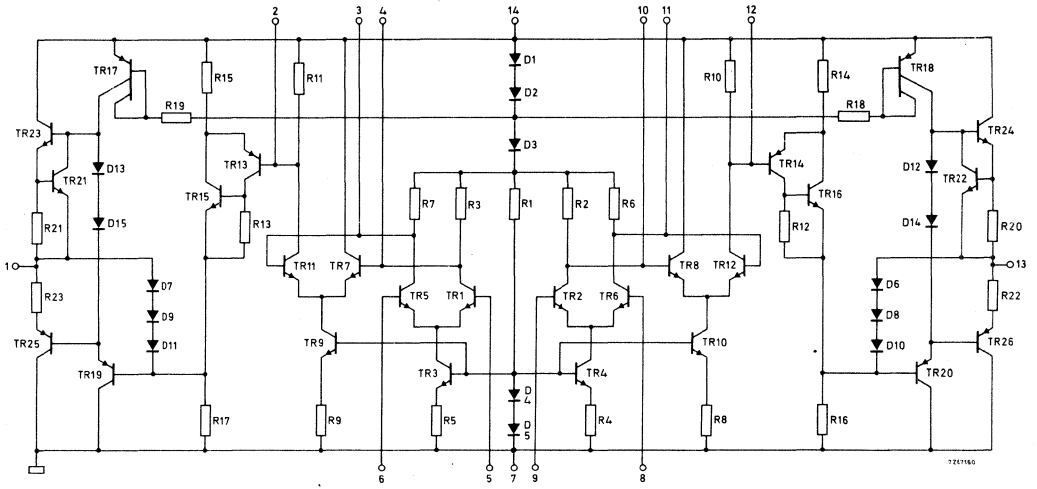
- very low noise figure
- low distortion
- short circuit protection
- no latch up
- large output voltage swing
- usable as unity gain amplifier.

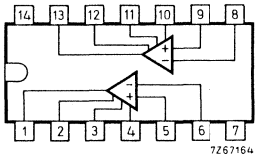
QUICK REFERENCE DATA

Voltage gain	G_v	typ.	15000		
Slew rate (gain = 10)		typ.	5		V/μs
		TCA490A	-B	-C	
Broadband noise figure	F	< 6	3	1,5	dB
Output noise voltage (r.m.s. value) (R.I.A.A.)	$V_{o(rms)}$	< 0,4	0,25	0,125	mV

PACKAGE OUTLINE 14 lead plastic dual in-line (type A)

CIRCUIT DIAGRAM

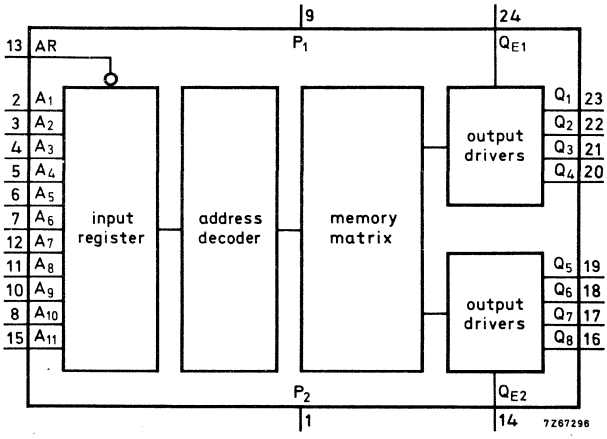


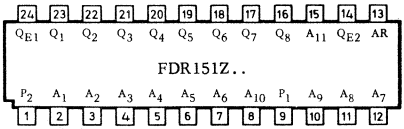


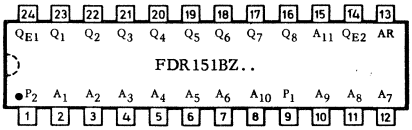
1. Output A
2. Lag output A
3. Lag input A
4. Lag input A
5. Non-inverting input A
6. Inverting input A
7. Negative supply (V_N)
8. Inverting input B
9. Non-inverting B
10. Lag input B
11. Lag input B
12. Lag output B
13. Output B
14. Positive supply (V_P)

The FD family is a series of complex monolithic integrated circuits utilizing MOS P-channel enhancement mode technology.

STATIC READ ONLY MEMORY, 2048 WORDS, 8 BITS PER WORD







P_2 and metal lid on bottom of the package are connected

QUICK REFERENCE DATA			
Read access time	t_{ac}	< 1,2	µs
Supply voltages	V_{P1}	−11,4 to −12,6	V
	V_{P2}	+4,75 to +5,25	V
Power dissipation per bit at V_{P1} = −12 V	P_{tot}	typ. 32	µW
Ambient temperature	T_{amb}	0 to +70	°C

PACKAGE OUTLINE

FDR151Z.. : 24 lead metal ceramic dual in-line
FDR151BZ.. : 24 lead plastic dual in line

GENERAL DESCRIPTION

The FDR151(B)Z is a monolithic 16 384-bit, static operated, READ-only memory utilizing low voltage MOS enhancement mode P-channel technology.
When the address is read into the ROM, all outputs appear and remain in a steady state until a new address is read. Full address decoding is performed on chip. The 16 384 bits are organized as 2048 addresses with 8 output lines; its size enhances usage in any high density, fixed memory application such as logic function generation or micro-programming. The organization can also be considered as 128 8x16 matrices, particularly suitable for high resolution character generation. Programming of the device is accomplished via the use of one custom mask during fabrication.
Internal resistors at the input provide pull-up for direct TTL compatibility.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages on all data inputs, clock inputs and supply terminals		+0,25 to −18	V
Power dissipation at T_{amb} = 25 °C	P_{tot}	max. 1,25	W
Operating ambient temperature	T_{amb}	0 to +70	°C
Junction temperature	T_j	max. 150	°C
Storage temperature	T_{stg}	−65 to +150	°C

THERMAL RESISTANCE

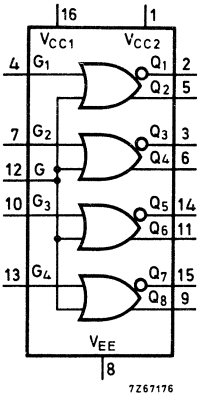
From junction to ambient	$R_{th\ j-a}$	=	100	°C/W

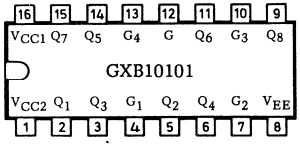
The GX family of CML silicon monolithic integrated circuits is designed for high speed central processors and digital communication systems.
With 2,0 ns typical propagation delay and only 25 mW power dissipation per gate, this family offers an excellent speed-power product and so is recommended for high speed large system design.

The GXB10101 is a quadruple 2-input OR/NOR gate with one input from each gate common to pin 12.

Input pull-down resistors (50 kΩ) allow unused inputs to be left open.
The GX family corresponds to the ECL10000 series.

QUADRUPLE OR/NOR GATE





$V_{CC1} = V_{CC2} = 0$ V (ground)
$V_{EE} = -5,2$ V

QUICK REFERENCE DATA				
Supply voltage	V_{EE}		−5,2 ± 10%	V
Operating ambient temperature range	T_{amb}		0 to +75	°C
Average propagation delay	t_{pd}	typ.	2,0	ns
Output voltage HIGH state	V_{OH}	nom.	−880	mV
LOW state	V_{OL}	nom.	−1720	mV
Power consumption per package	P_{av}	typ.	100	mW

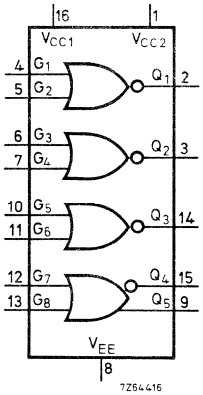
PACKAGE OUTLINE 16 lead ceramic dual in-line

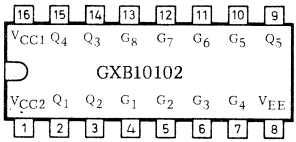
The GX family of CML silicon monolithic integrated circuits is designed for high speed central processors and digital communication systems.
With 2,0 ns typical propagation delay and only 25 mW power dissipation per gate, this family offers an excellent speed-power product and so is recommended for high speed large system design.

The GXB10102 is a quadruple 2-input NOR gate.

Input pull-down resistors (50 kΩ) allow unused inputs to be left open.
The GX family corresponds to the ECL10 000series.

QUADRUPLE NOR GATE





$V_{CC1} = V_{CC2} = 0$ V (ground)
$V_{EE} = -5,2$ V

QUICK REFERENCE DATA				
Supply voltage	V_{EE}		$-5,2 \pm 10\%$	V
Operating ambient temperature range	T_{amb}		0 to +75	°C
Average propagation delay	t_{pd}	typ.	2,0	ns
Output voltage HIGH state	V_{OH}	nom.	−880	mV
LOW state	V_{OL}	nom.	−1720	mV
Power consumption per package	P_{av}	typ.	100	mW

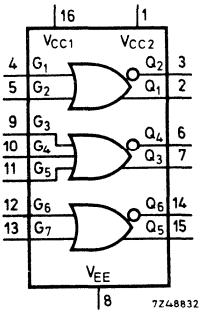
PACKAGE OUTLINE 16 lead ceramic dual in-line

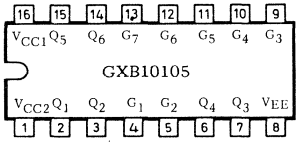
The GX family of CML silicon monolithic integrated circuits is designed for high speed central processors and digital communication systems.
With 2,0 ns typical propagation delay and only 25 mW power dissipation per gate, this family offers an excellent speed-power product and so is recommended for high speed large system design.

The GXB10105 is a triple 2-3-2 input OR/NOR gate.

Input pull-down resistors (50 kΩ) allow unused inputs to be left open.
The GX family corresponds to the ECL10 000series.

TRIPLE OR/NOR GATE





$V_{CC1} = V_{CC2} = 0$ V (ground)
$V_{EE} = -5,2$ V

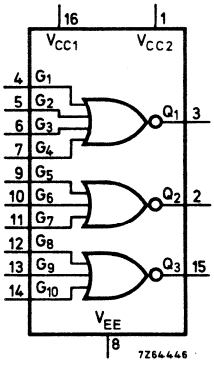
QUICK REFERENCE DATA				
Supply voltage	V_{EE}		−5,2 ± 10%	V
Operating ambient temperature range	T_{amb}		0 to +75	°C
Average propagation delay	t_{pd}	typ.	2,0	ns
Output voltage HIGH state	V_{OH}	nom.	−880	mV
LOW state	V_{OL}	nom.	−1720	mV
Power consumption per package	P_{av}	typ.	75	mW

PACKAGE OUTLINE 16 lead ceramic dual in-line

The GX family of CML silicon monolithic integrated circuits is designed for high speed central processors and digital communication systems.
With 0,2 ns typical propagation delay and only 25 mW power dissipation per gate, this family offers an excellent speed-power product and so is recommended for high speed large system design.
The GXB10106 is a triple 4-3-3 input NOR gate.

Input pull-down resistors (50 kΩ) allow unused inputs to be left open.
The GX family corresponds to the ECL10000 series.

TRIPLE NOR GATE



$V_{CC1} = V_{CC2} = 0$ V (ground)
$V_{EE} = -5,2$ V

QUICK REFERENCE DATA				
Supply voltage	V_{EE}		−5,2 ± 10%	V
Operating ambient temperature range	T_{amb}		0 to +75	°C
Average propagation delay	t_{pd}	typ.	2,0	ns
Output voltage HIGH state	V_{OH}	nom.	−880	mV
LOW state	V_{OL}	nom.	−1720	mV
Power consumption per package	P_{av}	typ.	75	mW

PACKAGE OUTLINE 16 lead ceramic dual in-line

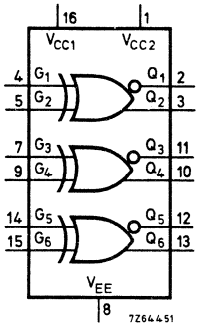
The GX family of CML silicon monolithic integrated circuits is designed for high speed central processors and digital communication systems.
With 2,0 ns typical propagation delay and only 25 mW power dissipation per gate, this family offers an excellent speed-power product and so is recommended for high speed large system design.

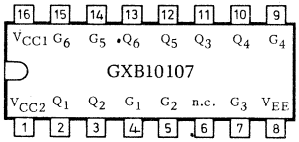
The GXB10107 is a three gate array designed to provide the positive EXCLUSIVE OR and NOR functions.

Input pull-down resistors (50 kΩ) allow unused inputs to be left open.

The GX family corresponds to the ECL10 000series.

TRIPLE EXCLUSIVE OR/EXCLUSIVE NOR GATE





$V_{CC1} = V_{CC2} = 0$ V (ground)
$V_{EE} = -5,2$ V

QUICK REFERENCE DATA				
Supply voltage	V_{EE}		−5,2 ± 10%	V
Operating ambient temperature	T_{amb}		0 to +75	°C
Average propagation delay	t_{pd}	typ.	2,4	ns
Output voltage HIGH state	V_{OH}	nom.	−880	mV
LOW state	V_{OL}	nom.	−1720	mV
Power consumption per package	P_{av}	typ.	115	mW

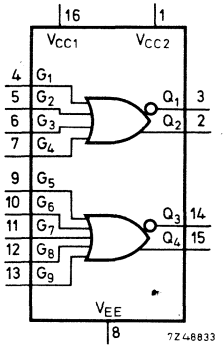
PACKAGE OUTLINE 16 lead ceramic dual in-line

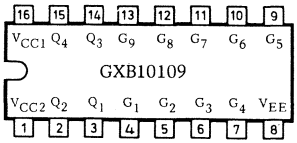
The GX family of CML silicon monolithic integrated circuits is designed for high speed central processors and digital communication systems.
With 2,0 ns typical propagation delay and only 25 mW power dissipation per gate, this family offers an excellent speed-power product and so is recommended for high speed large system design.

The GXB10109 is a dual 4-5 input OR/NOR gate.

Input pull-down resistors (50 kΩ) allow unused inputs to be left open.
The GX family corresponds to the ECL10 000series.

DUAL OR/NOR GATE





$V_{CC1} = V_{CC2} = 0$ V (ground)
$V_{EE} = -5,2$ V

QUICK REFERENCE DATA				
Supply voltage	V_{EE}		$-5,2 \pm 10\%$	V
Operating ambient temperature range	T_{amb}		0 to +75	°C
Average propagation delay	t_{pd}	typ.	2,0	ns
Output voltage HIGH state	V_{OH}	nom.	−880	mV
LOW state	V_{OL}	nom.	−1720	mV
Power consumption per package	P_{av}	typ.	50	mW

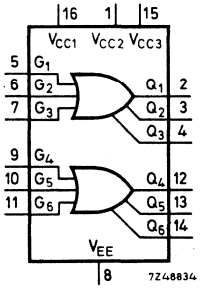
PACKAGE OUTLINE 16 lead ceramic dual in-line

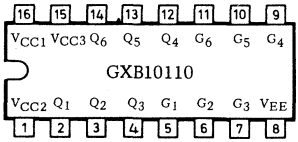
The GX family of CML silicon monolithic integrated circuits is designed for high speed central processors and digital communication systems.
With 2,0 ns typical propagation delay and only 25 mW power dissipation per gate, this family offers an excellent speed-power product and so is recommended for high speed large system design.

The GXB10110 is a dual 3-input/3-output OR gate intended to drive up to three transmission lines simultaneously. This feature makes the device particularly useful in clock distribution applications.

The GX family corresponds to the ECL10 000series.

DUAL 3-INPUT/3-OUTPUT OR LINE DRIVER





$V_{CC1} = V_{CC2} = V_{CC3} = 0$ V (ground)
$V_{EE} = -5,2$ V

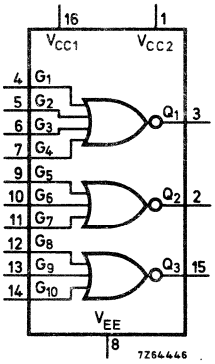
QUICK REFERENCE DATA				
Supply voltage	V_{EE}		−5,2 ± 10%	V
Operating ambient temperature range	T_{amb}		0 to +75	°C
Average propagation delay	t_{pd}	typ.	2,4	ns
Output voltage HIGH state	V_{OH}	nom.	−880	mV
LOW state	V_{OL}	nom.	−1720	mV
Power consumption per package	P_{av}	typ.	150	mW

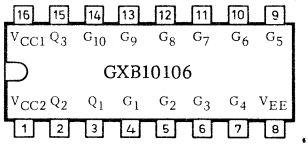
PACKAGE OUTLINE 16 lead ceramic dual in-line (See page 6).

The GX family of CML silicon monolithic integrated circuits is designed for high speed central processors and digital communication systems.
With 0,2 ns typical propagation delay and only 25 mW power dissipation per gate, this family offers an excellent speed-power product and so is recommended for high speed large system design.
The GXB10106 is a triple 4-3-3 input NOR gate.

Input pull-down resistors (50 kΩ) allow unused inputs to be left open.
The GX family corresponds to the ECL10000 series.

TRIPLE NOR GATE





$V_{CC1} = V_{CC2} = 0$ V (ground)
$V_{EE} = -5,2$ V

QUICK REFERENCE DATA				
Supply voltage	V_{EE}		−5,2 ± 10%	V
Operating ambient temperature range	T_{amb}		0 to +75	°C
Average propagation delay	t_{pd}	typ.	2,0	ns
Output voltage HIGH state	V_{OH}	nom.	−880	mV
LOW state	V_{OL}	nom.	−1720	mV
Power consumption per package	P_{av}	typ.	75	mW

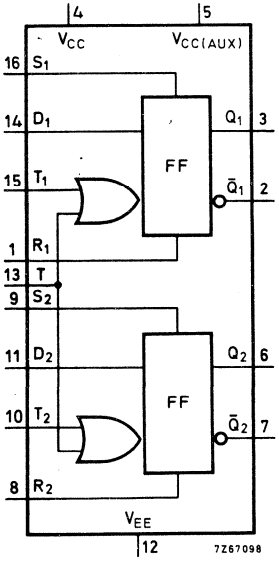
PACKAGE OUTLINE 16 lead ceramic dual in-line

The GH family of CML silicon monolithic integrated circuits is designed for high speed instrumentation, digital communication systems, central processors and computer terminals. All GH family elements incorporate a unique temperature compensation network which insures that significant parameters such as logic levels, noise margin and speed remain relatively constant over a wide temperature range.

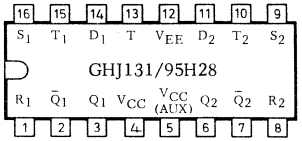
The GHJ131/95H28 is a very high speed dual D-type flip-flop allowing easy implementation of high speed counters, registers and control circuits.

Internal pull-down resistors (2 kΩ) eliminate the necessity for external termination of lines up to 15 cm and unused logic inputs. Package pin locations are chosen to reduce internal noise generation and crosstalk.

The GH family corresponds to the ECL9500series.



VERY HIGH SPEED DUAL D-TYPE FLIP-FLOP



Note

V_{CC} = ground (pins 4 and 5)
$-V_{EE}$ = 5,2 V (pin 12)

PACKAGE OUTLINE

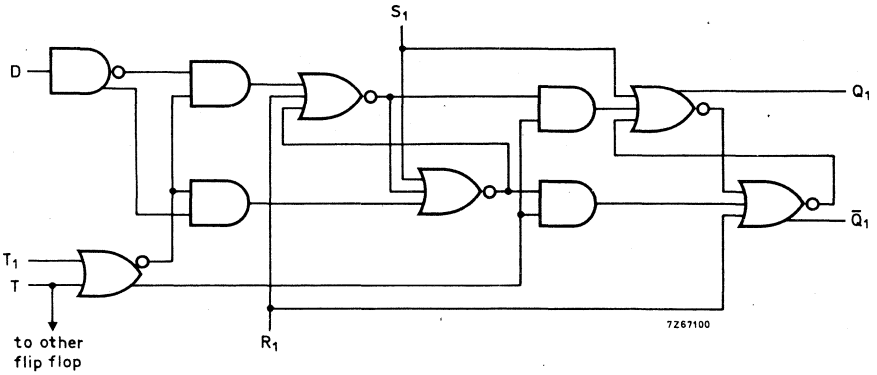
16 lead ceramic dual in-line

QUICK REFERENCE DATA				
Supply voltage	$-V_{EE}$		5,2	V
Operating ambient temperature	T_{amb}		0 to +75	°C
Toggle rate	f	typ.	250	MHz
Output voltage HIGH state	$-V_{OH}$	nom.	910	mV
LOW state	$-V_{OL}$	nom.	1740	mV
Power consumption per package	P_{av}	typ.	330	mW

FUNCTIONAL DESCRIPTION

Each D-type flip-flop consists of both a master and a slave. While the clock is LOW, the slave is held steady, but the information on the D-input is permitted to enter the master. The next clock transition from LOW to HIGH locks the master in its present state making it insensitive to the D-input and connects the slave to the master causing the new information to be reflected on the outputs. The internal clock is the OR of two clock inputs, one common to both flip-flops.
The ORed clock permits the use of one input as a clock pulse input and the other as an active LOW enable.

LOGIC DIAGRAM



PIN NAMES

D = data input to master
T_1 = clock input
T = common clock input
Q = slave output
Q = slave complement output
S = set direct input
R = reset direct input

FUNCTION TABLES

Synchronous operation

D-input	
D_n	$Q_n + 1^{*)}$
L	L
H	H

*) S · R = LOW

Asynchronous operation

S · R			
R	S	Q	$\bar{Q}$
L	L	**)	**)
L	H	H	L
H	L	L	H
H	H	not allowed	

**) See D-input table

32 kHz CLOCK CIRCUIT

The SAJ250A is a monolithic integrated circuit which contains the complete electronics needed for a battery operated 32 kHz quartz crystal controlled clock. It consists of an oscillator, a 15-stage frequency divider, a driver for a stepping motor and a supply current regulator.
The output pulse frequency is 1 Hz with 31, 25 ms duration and a current drive capability of 15 mA.
The circuit works with a supply voltage between 0, 9 V and 3 V; at 1, 3 V, the current requirement is 20 μA.

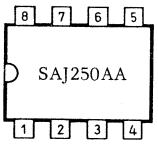
The SAJ250B is the same circuit but with the output voltage regulated at 1, 2 V for a supply voltage between 1, 3 V and 1, 8 V.

QUICK REFERENCE DATA			
Frequency division		$2^{15} = 32768$	
Supply voltage range	V_P	0, 9 to 3	V
Supply current	I_P	typ. 20	μA
Output current	I_O	15	mA

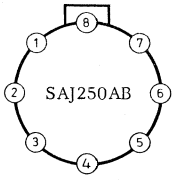
PACKAGE OUTLINES See page 2

CONNECTION DIAGRAM AND PINNING

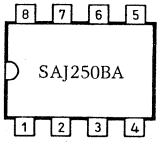
Designation code: The first letter following the type number SAJ250 designates the electrical version of the circuit, the second letter the encapsulation.



1. interrupt input
2. output
3. ground
4. positive supply (Vp)
5. internally connected
6. internally connected
7. quartz crystal connection
8. quartz crystal connection



1. quartz crystal connection
2. interrupt input
3. output
4. ground
5. positive supply (Vp)
6. internally connected
7. internally connected
8. quartz crystal

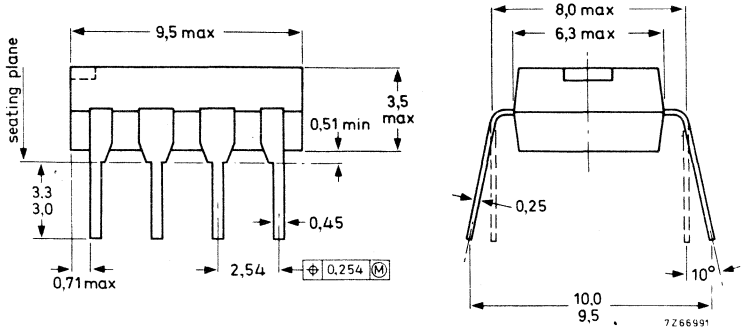


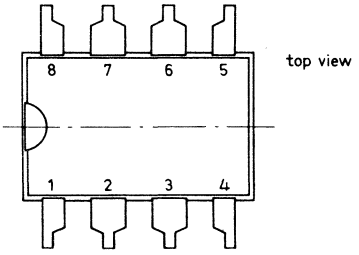
1. not connected
2. output
3. ground
4. positive supply (Vp)
5. internally connected
6. internally connected
7. quartz crystal connection
8. quartz crystal connection

PACKAGE OUTLINES

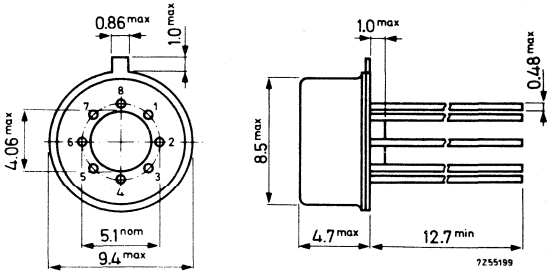
Dimensions in mm

8 lead plastic dual in-line (second additional letter to type number : A)

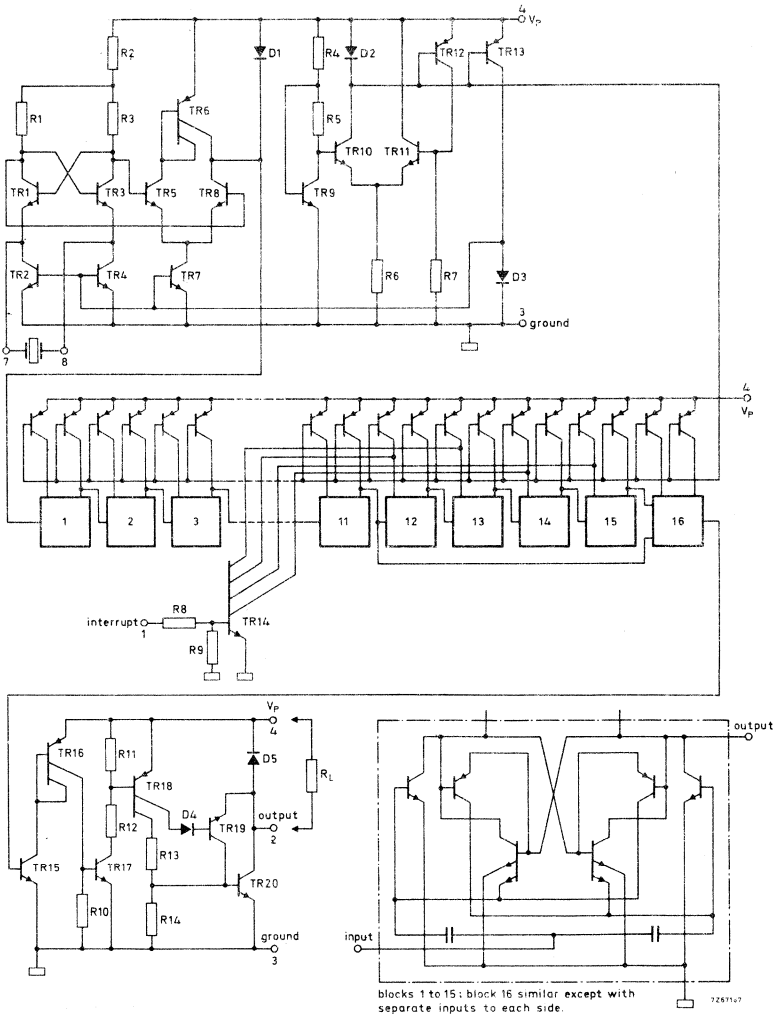




TO-99 metal envelope (second additional letter to type number: B)



CIRCUIT DIAGRAM

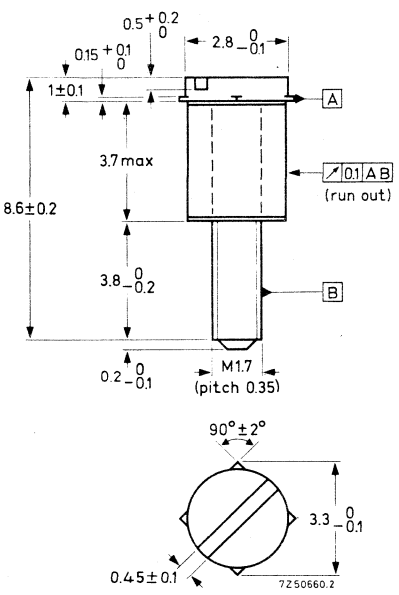


Note

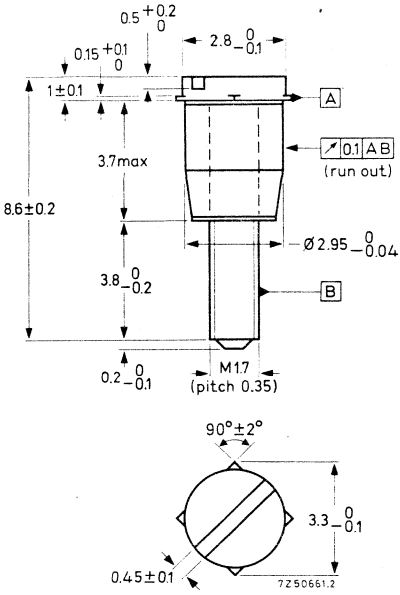
The SAJ250A has the same circuit diagram, but without diode D4 and transistor TR19.

INDUCTANCE ADJUSTORS

ADJUSTORS



Version A, tube dia 2,5 −0,04 mm
Version B, tube dia 2,7 −0,04 mm
Version C, tube dia 2,77 −0,04 mm



Version D

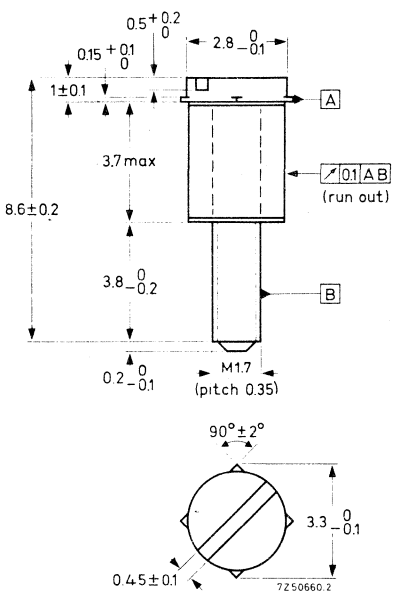
The tolerances on inductance of the pre-adjusted cores (without adjustor) are given below "Pre-adjusted Cores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy <0.03 % by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil (see following pages).

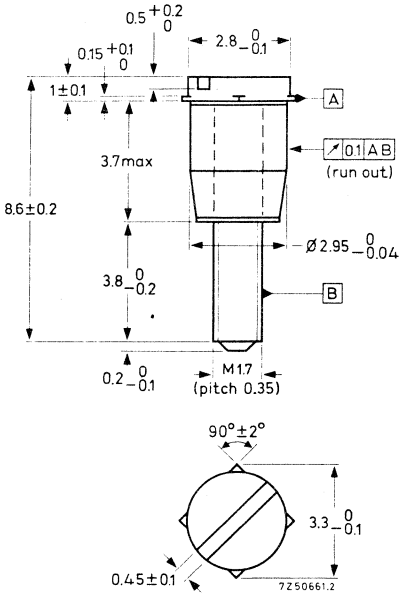
The adjustor is screwed through the centre hole of the core into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower A_L value.

The influence of the adjustor on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.

INDUCTANCE ADJUSTORS

ADJUSTORS





Version A, tube dia 2,5 − 0,04 mm
Version B, tube dia 2,7 − 0,04 mm
Version C, tube dia 2,77 − 0,04 mm

Version D

The tolerances on inductance of the pre-adjusted cores (without adjustor) are given below "Pre-adjusted Cores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy <0.03 % by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil (see following pages).
The adjustor is screwed through the centre hole of the core into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower A_L value.
The influence of the adjustor on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.

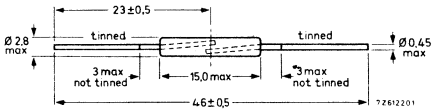
DRY REED SWITCH

Micro dry reed switch hermetically sealed in a gas-filled glass capsule. Single-pole, single-throw type, having normally open contacts, and containing two magnetically actuated reeds. The switch is of the double-ended type and may be actuated by means of either an electromagnet or a permanent magnet or combinations of both. The switch is intended for use in push buttons or similar devices, in conjunction with semiconductor circuits.

QUICK REFERENCE DATA		
Contact	S.P.S.T. normally open	
Switched power	10	W
Switched voltage	100	V
Switched current	500	mA
Contact resistance (initial)	160	mΩ

MECHANICAL DATA Dimensions in mm

Contact arrangement	normally open
Terminal finish	tinned
Resonant frequency of single reed	approx. 2900 Hz
Net weight	approx. 0,16 g
Mounting position	any



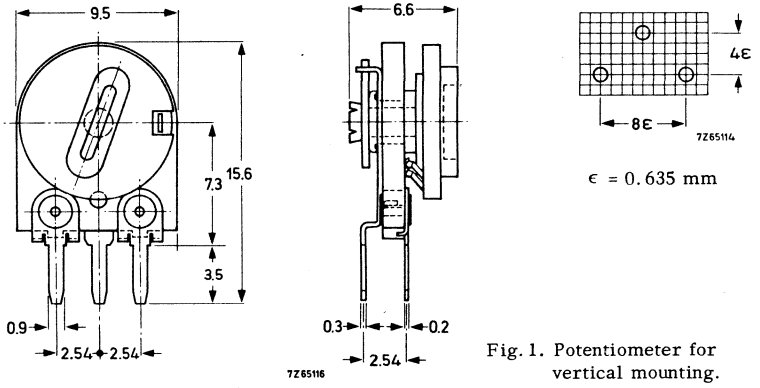
METAL GLAZE TRIMMING POTENTIOMETERS

QUICK REFERENCE DATA	
Resistance range, linear law	100Ω - 1 MΩ (E3 series)
Maximum dissipation at 70 °C	0.5 W

DESCRIPTION

These potentiometers comprise a resistance element of thin glass film, with particles of conductive metal dispersed in it.
The element is supported by a non-conductive temperature-resistant ceramic base.
The potentiometers are available in two versions: one for vertical and one for horizontal mounting on printed-wiring boards.

Dimensions in mm



ε = 0.635 mm

Fig. 1. Potentiometer for vertical mounting.

HIGH VOLTAGE RESISTOR

QUICK REFERENCE DATA		
Resistance range	VR37 : 1MΩ to 33 MΩ, E 24 series VR68 : 1MΩ to 68 MΩ, E 24 series	
Resistance tolerance	± 5%	
Max. body temperature (hot spot)	155 °C	
Temperature coefficient	± 200 ppm/degC	
Rated dissipation at T_{amb} = 70 °C	VR37 : 0,5 W VR68 : 1,0 W	
Limiting voltage	VR37 : 2500 V r.m.s. VR68 : 10000 V d.c. or 7000 V r.m.s.	
Dielectric withstanding voltage of the insulation for 1 minute	min 700 V r.m.s.	
Basic specification	IEC115, type 1B	
Climatic category (IEC68)	55/155/56	
Stability after:	typical value VR37	 VR68
1000 h max. load	ΔR 0,5%	ΔR 1%
accellerated damp heat test (6 days)	ΔR 0,5%	ΔR 1%
long term damp heat test (56 days)	ΔR 0,5%	ΔR 1%
Noise	0,5 μV/V	0,5 μV/V

APPLICATION

These resistors have been developed for applications in which high resistance values, high stability and reliability are required at high voltages.

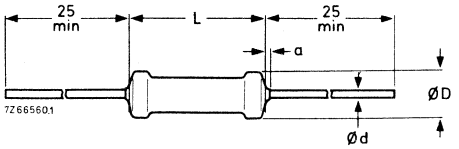
DESCRIPTION

A metal-glaze film is deposited on a high grade ceramic body. Contact caps of special alloy are then pressed onto the ends of the resistor body, and next the tinned electrolytic copper connecting wires are welded to the caps.
The resistors are coated with a light blue insulating lacquer which also provides protection against environmental effects.

MECHANICAL DATA

Dimensions (mm)

Fig.1



style	L_{max}	D_{max}	d_{max}	a_{max}
VR37	10	3,7	0,7	1,0
VR68	18	6,8	0,8	1;2

The length of the body is measured by inserting the leads into the holes of two identical gauge plates and by moving these plates parallel to each other until the resistor body is clamped without deformation. (see IEC publication "Measurement of the dimensions of a cylindrical component having two axial terminations").

Width of hole in gauge plate 1,0 mm

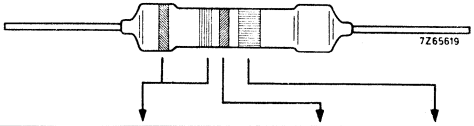
Weight (100 pcs) VR37 : 42 g
VR68 : 130 g

Mounting

The resistors must be mounted stress free so as to allow thermal expansion over the wide permissible temperature range.

Marking

The nominal resistance value and the tolerance are marked on these resistors by means of four coloured bands according to IEC publication 62 "Colour code for fixed resistors".

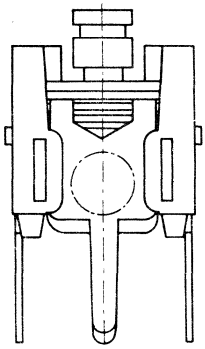


colour	significant figures	multiplier	tolerance
black	0	–	
brown	1	–	
red	2	–	
orange	3	–	
yellow	4	–	± 5%
green	5	100 000 x	
blue	6	1 000 000 x	
violet	7	–	
grey	8	–	
white	9	–	

FILM DIELECTRIC TRIMMERS

high temperature type

QUICK REFERENCE DATA	
Max. C_{min}/min. C_{max}	1, 4/5, 5 pF 2 / 9 pF 2 /18 pF
Overall dimensions	8 x 9 x 10 mm
Rated voltage	300 V d.c.
Temperature range	−40 to +125 °C



APPLICATION

For use in measuring and telecommunication equipment, specially where high temperatures occur and a low temperature coefficient is important, e.g. for fine adjustment of h.f. tuned circuits.

DESCRIPTION

The trimmers consist of a polysulphone housing, brass rotor and silver-plated brass stator with a P.T.F.E. film as the dielectric. The stator plates with their tag are heat sealed to the housing. The rotor contact is made by a silver-plated spring against gold plated surfaces to ensure a long life and a stable contact even under severe climatic conditions.
The capacitors can be adjusted from both sides by means of a screwdriver.

TUBULAR CERAMIC CAPACITORS

SAFETY

QUICK REFERENCE DATA	
Capacitance range	
in class 1 B	22 to 390 pF (E12 series)
in class 2	390 to 4700 pF (E12 series)
Rated voltage	400 V a.c.
Tolerance on capacitance	± 20%
Temperature dependence	class 1 B, class 2
Climatic category (IEC 68)	25/085/21
Basic specification	IEC65 SEV 1016, 1959 VDE 0560, part 2/5.70 SEMKO 101 amendment 2 DEMKO (permission for application)

APPLICATION

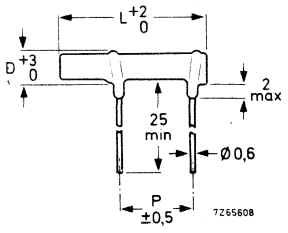
Safety capacitors are coupling capacitors designed to withstand considerable voltages so that they can be employed in circuits where "live" components should be isolated from conductive parts which might be touched. Such is the case with aerial terminals in radio and television sets, but also mains transformers or picture-tube rimbands can be earthed via a safety capacitor.

DESCRIPTION

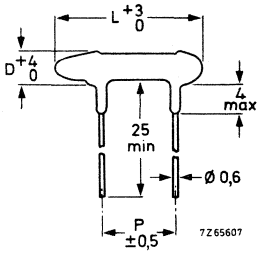
The capacitors consist of a ceramic tube, fully metallised internally, and partly outside, with two tangential leads.
An insulated and a non-insulated version are available.
The class 1B capacitors are grey, the class 2 capacitors tan coloured.

MECHANICAL DATA

Dimensions (mm)



non-insulated type



insulated type

For dimensions L, D and P, see Table 1

Marking

The body of the class 1 B capacitors is grey and of the class 2 capacitors is tan coloured. On the body is indicated in red script for the insulated types and in black script for non-insulated types: the capacitance value, a letter indicating the tolerance (see Table 1) the rated a.c. voltage, the basic part of the catalogue number 619 and the following symbols:

manufacturers trade mark

VDE mark (Germany)

SEMKO mark (Sweden)

SEV mark (Switserland)

Approvals: type 1 B insulated : VDE, SEMKO, DEMKO, SEV
type 1 B non-insulated: VDE, SEMKO, DEMKO
type 2 insulated : SEMKO, DEMKO, SEV
type 2 non-insulated: VDE, SEMKO, SEMKO

Mounting

The non-insulated version must be so mounted that it is properly insulated from earth (chassis) and cannot be touched by accident.

Soldering conditions max. 270 °C, max. 5 s

CERAMIC DISC CAPACITORS
CLASS 2
high voltage "corona free"

QUICK REFERENCE DATA	
Capacitance range	33 to 560 pF (E 12 series)
Rated voltage	2 kV d.c. and 2 kVp (16 kHz)
Tolerance on capacitance	±10%, ±20%
Basic specification	IEC 187
Category (IEC 68)	40/085/21

APPLICATION

These capacitors can be used in television and other circuitry where high d.c. or high pulse voltages (16 kHz) are applied. (e.g. line deflection).

DESCRIPTION

The capacitors consist of a ceramic disc, both sides being metallised and provided with connecting leads. They are insulated by a coating that ensures excellent behaviour under humid conditions.
The capacitors are insulated with a tan coloured lacquer.
This lacquer has an excellent resistance against organic cleaning solvents and is uninflammable. (acc. MIL 202 D test 215 and MIL 202 C test 111).

CERAMIC DISC CAPACITORS
CLASS 2
interference suppression

QUICK REFERENCE DATA	
Capacitance range	220 to 2200 pF
Rated voltage	250 V a.c.
Tolerance on capacitance	±20%
Basic specification	IEC 161 VDE 0560 part 7/11.67 *)
Category (IEC 68)	40/085/21

APPLICATION

These capacitors are in accordance with the VDE 0560 part 7/11.67. Therefore they can be used as interference suppression for e.g. home appliances as "X-and Y-capacitor".

DESCRIPTION

The capacitors consist of a ceramic disc, both sides being metallised and provided with connecting leads. They are insulated by a coating that ensures excellent behaviour under humid conditions.
The capacitors are insulated with a tan coloured lacquer.
This lacquer has an excellent resistance against organic cleaning solvents and is uninflammable. (acc. MIL 202 D test 215 and MIL 202 C test 111).

*) VDE approval under considerations.

CERAMIC DISC CAPACITORS
CLASS 2
SAFETY

QUICK REFERENCE DATA	
Capacitance range	33 to 1000 pF (E12 series)
Rated voltage	400 V a.c.
Tolerance on capacitance	±10%, ±20%, +50 to −20%
Basic specification	IEC 65
Category (IEC 68)	40/085/21

APPLICATION

These capacitors are in accordance with the VDE *) 0560 part 2/5.70, S.E.V. *) and SEMKO (Sweden). Therefore they can be used for the galvanic separation of mains and conductive parts which might be touched e.g. antenna inputs in radio and television sets.

DESCRIPTION

The capacitors consist of a ceramic disc, both sides being metallised and provided with connecting leads. They are insulated by a coating that ensures excellent behaviour under humid conditions.
The capacitors are insulated with a tan coloured lacquer.
This lacquer has an excellent resistance against organic cleaning solvents and is uninflammable. (acc. MIL 202 D test 215 and MIL 202 C test 111).

*) VDE and S.E.V. approval under consideration

WET ALUMINIUM ELECTROLYTIC CAPACITORS

large type for general applications

QUICK REFERENCE DATA	
Nominal capacitance range (E 6 series)	680 to 68 000 µF
Tolerance on nominal capacitance	−10 to +50 %
Rated voltage range (U_R) (R5 series)	6,3 to 63 V
Category temperature range	−25 to +70 °C
Typical life time	32000 hours at 40 °C
Basic specification	IEC 103, type 2
Category, IEC 68	25/070/56

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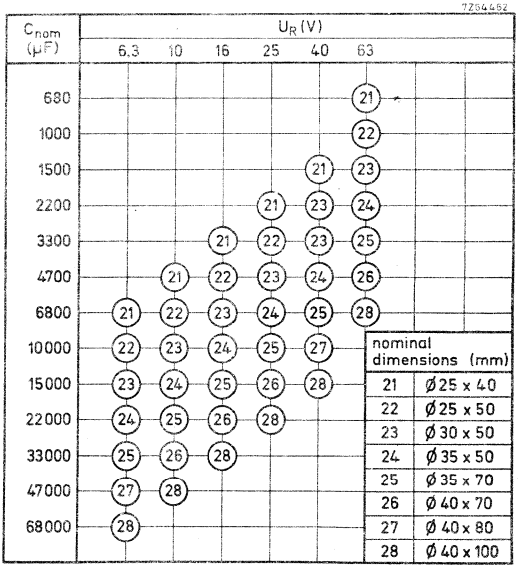


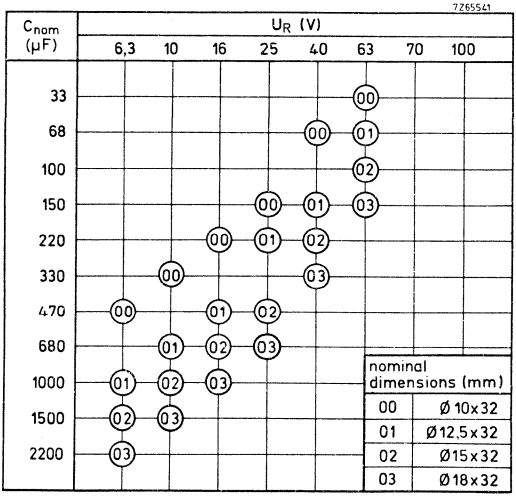
APPLICATION

These high capacitance large electrolytic capacitors have been developed principaly for smoothing, coupling and decoupling purposes in radio, television and audio circuits. They are also very suitable for use in measuring and regulating circuits where an IEC type 1 capacitor is not required.

WET ALUMINIUM ELECTROLYTIC CAPACITORS

small type for industrial and long life applications

QUICK REFERENCE DATA	
Nominal capacitance range (E6 series)	33 to 2200 µF
Tolerance on nominal capacitance	−10 to +50 %
Rated voltage range (U_R) (R5 series)	6,3 to 63 V
Category temperature range	−40 to +85 °C
Typical life time	> 10 000 hours at +85 °C
Basic specification	IEC 103 (type 1) DIN 41 240 (IA) DEF 5134-1 GPO D2186
Category IEC 68 DIN 40040	40/085/56 GPF (56 days)
Approvals	GPO D2186 Min. of Defence (Navy) DEF 5134-1



APPLICATION

These small type capacitors are designed for industrial and long life applications.

DESCRIPTION

The capacitor has etched aluminium foil electrodes rolled up with a porous paperspacer which separates the anode and the cathode. The spacer is impregnated with an electrolyte which retains its good characteristics both at low and high temperatures. The capacitor is housed in an aluminium case with axial leads and is insulated with a blue transparent synthetic sleeve.

MECHANICAL DATA

Dimensions in mm

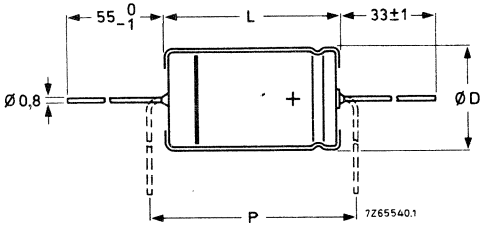


Table 1

case size	dimensions			approx. weight (g)
	D + 0,5	L + 0,5	P_{min} *)	
00	10,0	32,0	35 (14e)	4,3
01	12,5	32,0	35 (14e)	6,6
02	15,0	32,0	35 (14e)	8,5
03	18,0	32,0	35 (14e)	11,2

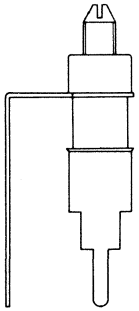
Marking

Stamped on the case are: nominal capacitance, rated voltage, tolerance on capacitance, group number 108, maximum temperature, date code (year and month), a band to identify the negative terminal and "+" signs for the positive terminal.

*) e = 2,50 + 0,04 mm

TUBULAR CERAMIC TRIMMERS

QUICK REFERENCE DATA	
Max. C_{min}/min. C_{max}	0, 8/6 and 2/10 pF
Overall dimensions	17, 5 x 6 x 11 mm
Rated voltage	500 V d.c.
Tan δ at 1 MHz	max. $12,5.10^{-4}$ and 25.10^{-4} resp.
Climatic category (IEC 68)	50/100/21



APPLICATION

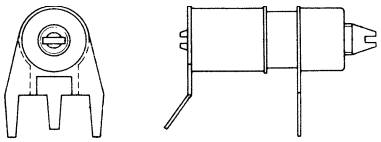
These trimmers are particularly suitable for u.h.f. tuners and other electronic circuits operating in the higher frequency ranges.

DESCRIPTION

The basic trimmer design consists of an internally ground ceramic tube, accurately matched to a threaded brass rotor spindle, which is slotted for screwdriver adjustment of capacitance. The stator is a silver-plated brass tube, tightly fitted on the lower end of the ceramic tube. Two terminal pins extending from the stator, and one from the upper metal cap (rotor), are spaced for direct insertion into printed-wiring boards having a 2,54 mm (0, 1 in) grid.

TUBULAR CERAMIC TRIMMERS

QUICK REFERENCE DATA	
Max. C_{min}/min. C_{max}	0,3/1,5, 0,5/3,5 and 1/6 pF
Overall dimensions	9 x 6 x 6 mm
Rated voltage	400 V d.c.
Tan δ at 1 MHz	max. 20.10^{-4}
Climatic category (IEC 68)	50/100/21



APPLICATION

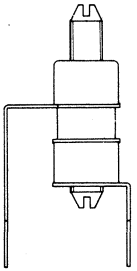
These trimmers are particularly suitable for u.h.f. tuners and other electronic circuits operating in the higher frequency ranges.

DESCRIPTION

The basic trimmer design consists of an internally ground ceramic tube, accurately matched to a threaded invar rotor spindle, which is slotted for screwdriver adjustment of capacitance. The stator is a silver-plated brass tube, tightly fitted on the ceramic tube. One terminal pin extending from the stator, and two from the rotor cap, are spaced for direct insertion into printed-wiring boards having a 2,54 mm (0,1 in) grid.

TUBULAR CERAMIC TRIMMERS

QUICK REFERENCE DATA	
Max. C_{min}/min. C_{max}	0,5/3 and 1/5,5 pF
Overall dimensions	12 x 4 x 8 mm
Rated voltage	400 V d.c.
Tan δ at 1 MHz	max. 20.10^{-4}
Climatic category (IEC 68)	50/100/21



APPLICATION

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DESCRIPTION

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TRIODE-PENTODE

Triode-pentode intended for use in television receivers; triode section as limiter, noise detector, A.G.C. amplifier, sync. separator and pulse-amplifier; pentode section as sound I.F. amplifier and video I.F. amplifier.

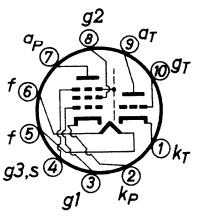
QUICK REFERENCE DATA			
Pentode section			
Anode current	I_a	13	mA
Transconductance	S	14	mA/V
Amplification factor	$\mu_{g_2g_1}$	53	-
Triode section			
Anode current	I_a	8.5	mA
Transconductance	S	5.2	mA/V
Amplification factor	μ	57	-

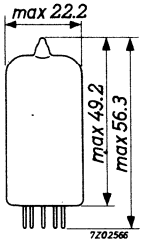
HEATING: Indirect by A.C. or D.C.; series supply

Heater current	I_f	300	mA
Heater voltage	V_f	8	V

DIMENSIONS AND CONNECTIONS Dimensions in mm

Base: Decal





TRIODE-PENTODE

Triode pentode intended for use in T.V. receivers; triode section as line-blocking oscillator, part of a multivibrator, sync separator, pulse amplifier or A.G.C. delay diode; pentode section with remote cut-off as video I.F. amplifier.

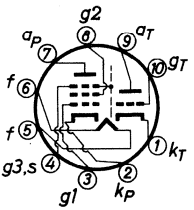
QUICK REFERENCE DATA			
Pentode section			
Anode current	I_a	13	mA
Transconductance	S	12.6	mA/V
Amplification factor	$\mu_{g_2g_1}$	45	-
Triode section			
Anode current	I_a	14	mA
Transconductance	S	4.8	mA/V
Amplification factor	μ	17.5	-
Cathode peak current	I_{k_p}	max. 50	mA

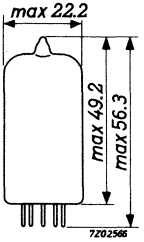
HEATING: Indirect by A.C. or D.C.; series supply

Heater current	I_f	300	mA
Heater voltage	V_f	8	V

DIMENSIONS AND CONNECTIONS Dimensions in mm

Base: Decal





MONITOR TUBE

The M24-101W is a 24 cm-diagonal rectangular television tube with integral protection primarily intended for use as a monitor or display tube.

QUICK REFERENCE DATA			
Deflection angle		90 °	
Focusing		electrostatic	
Resolution		900	lines
Overall length	max.	260	mm

SCREEN

Metal backed phosphor			
Luminescence		white	
Light transmission of face glass		52	%
Useful diagonal	min.	225	mm
Useful width	min.	190	mm
Useful height	min.	140	mm

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage	V_f	6,3	V
Heater current	I_f	300	mA

FOCUSING

electrostatic

For focusing voltage providing optimum focus at a beam current of 100 μA see under "Typical operating conditions".

DEFLECTION

magnetic

Diagonal deflection angle	90 °
Horizontal deflection angle	80 °
Vertical deflection angle	65 °

Deflection coil AT1071/01 is recommended.

MONITOR TUBE

The M31-130W is a 31 cm-diagonal rectangular television tube with metal backed screen primarily intended for use as a monitor or display tube.

QUICK REFERENCE DATA			
Deflection angle		90 °	
Focusing		electrostatic	
Resolution		900	lines
Overall length	max.	310	mm

SCREEN

Metal backed phosphor

Luminescence		white	
Light transmission or face glass	approx.	50	%
Useful diagonal	min.	295	mm
Useful width	min.	257	mm
Useful height	min.	195	mm

HEATING

Indirect by a.c. or d.c.; parallel supply

Heater voltage	V_f	6,3	V
Heater current	I_f	300	mA

FOCUSING electrostatic

For focusing voltage providing optimum focus at a beam current of 100 μA see under "Typical operating conditions".

DEFLECTION magnetic

Diagonal deflection angle 90 °

For a deflection coil please contact the local tube supplier

Data based on pre-production tubes.

CAMERA TUBE

Plumbicon * television camera tube with high resolution lead-oxide photoconductive target with extended red response, low heater power, separate mesh construction, magnetic deflection and 25,4 mm (1 in) diameter.
The tubes of the XQ1073 and the XQ1073/01 series respectively are mechanically interchangeable with 1 in diameter vidicons with separate mesh and have the same pin connections. The XQ1073 and XQ1073/01 are intended for use in black and white cameras, the XQ1073R and XQ1073/01R for use in the red chrominance channel of colour cameras in broadcast, educational and high-quality industrial applications.

QUICK REFERENCE DATA	
Separate mesh	
Focusing	magnetic
Deflection	magnetic
Diameter	25,4 mm (1 in)
Length, excluding 5 mm anti-halation glass disc	158 mm (6,25 in)
Provided with anti-halation glass disc	XQ1073, XQ1073R
Without anti-halation glass disc	XQ1073/01, XQ1073/01R
Cut-off of spectral response	850 to 950 nm
Heater	6,3 V, 95 mA
Resolution	≥ 750 TV lines

OPTICAL DATA

Quality rectangle on photoconductive target (aspect ratio 3:4) — 9,6 x 12,8 mm^2 [1])

Orientation of image on photoconductive target

For correct orientation of the image on the target the vertical scan should be essentially parallel to the plane passing through the tube axis and the marker line on the metal sleeve on the base end of the tube.

Faceplate

Refractive index	n 1,49
Refractive index of anti-halation glass disc	n 1,52

* Registered Trade Mark for television camera tube.

CAMERA TUBE

Plumbicon*, sensitive pick-up tube with lead oxide photoconductive target with extended red response, high resolution, low heater power, separate mesh construction, magnetic focusing, magnetic deflection and 25,4 mm (1 in) diameter.

The tubes of this series are mechanically and electrically identical to the tubes of the XQ1073 and XQ1073/01 series, the only difference being the degree of freedom from blemishes of the photoconductive target.

The tubes are intended for industrial and educational black and white and colour cameras. The series comprises the following versions:

XQ1074, with anti-halation glass disc XQ1074/01, without anti-halation glass disc	for use in black and white cameras
XQ1074R, with anti-halation glass disc XQ1074/01R, without anti-halation glass disc	for use in the red channel in colour cameras

For all further information see data of XQ1073, XQ1073/01 series.

* Registered Trade Mark for television camera tube.

CAMERA TUBE

Plumbicon*, sensitive pick-up tube with lead-oxide photoconductive target with extended red response, high resolution, low heater power separate mesh construction, magnetic focusing, magnetic deflection and 25,4 mm (1 in) diameter.

The tubes of the XQ1075 series are identical to the tubes of the XQ1073 series but incorporate an infra-red reflecting filter on the anti-halation glass disc.

QUICK REFERENCE DATA	
Separate mesh	
Focusing	magnetic
Deflection	magnetic
Diameter	25,4 mm (1 in)
Length, excluding 5 mm of anti-halation glass disc	158 mm (6,25 in)
Cut-off of spectral response	750 nm
Heater	6,3 V , 95 mA
Provided with anti-halation glass disc with infra-red reflecting filter.	

The infra-red reflecting filter eliminates the need for additional filters in the optical systems when the XQ1075 and XQ1075R are applied in black and white and colour cameras originally designed for tubes of the XQ1070 series.

The spread in spectral responses in the long wavelength region as published for the XQ1073 and XQ1073R tubes is greatly reduced, warranting minimum differences in colour rendition between cameras of identical manufacture.

The XQ1075 will provide black and white pictures with true tonal rendition of colours, the spectral response approaching very nearly the relative spectral sensitivity of the human eye.

The XQ1075R is intended for use in the red chrominance channel of colour cameras in broadcast, educational and high-quality industrial applications.

* Registered Trade Mark for television camera tube.

CAMERA TUBE

Plumbicon *, sensitive pick-up tube with lead oxide photoconductive target with extended red response, high resolution, low heater power, separate mesh construction, magnetic focusing, magnetic deflection and 25,4 mm (1 in) diameter. Provided with anti-halation disc with I.R. filter.

The tubes of this series are mechanically and electrically identical to the tubes of the XQ1075 series, the only difference being found in the degree of freedom from blemishes of the photoconductive target.

The tubes are intended for industrial and educational black and white and colour cameras. The series comprises the following versions:

XQ1076	for use in black and white cameras
XQ1076R	for use in the red channel of colour cameras

For all further information see data of XQ1075 and XQ1073 series.

* Registered Trade Mark for television camera tubes.

CAMERA TUBE

Plumbicon*, television camera tube with high resolution lead-oxide photoconductive target, low heater power, separate mesh construction, magnetic focusing, magnetic deflection and 25,4 mm (1 in) diameter.

The tubes of the XQ1081 series are provided with an A.C.T. electron gun and a light-pipe and are electrically and mechanically identical to the tubes of the XQ1080 series, the only difference being the degree of freedom from blemishes of the photoconductive target.

The tubes are intended for industrial and educational black-and-white and colour cameras.

The series comprises the following versions:

XQ1081	for bl/wh cameras
XQ1081R	for use in the chrominance channels of colour cameras
XQ1081G	
XQ1081B	

For all further information see data of the XQ1080 series.

* Registered Trade Mark for television camera tube.

CAMERA TUBE

Plumbicon* , television camera tube with high resolution lead-oxide photoconductive target, low heater power, separate mesh construction, magnetic focusing, magnetic deflection and 25,4 mm (1 in) diameter.

The tubes of the XQ1090, XQ1091 series and of the XQ1100, XQ1101 series are provided with an A.C.T. electron gun and a lightpipe like the tubes of the XQ1080, XQ1081 series but are front loading types and hence without ceramic centring ring.

The tubes of the XQ1100, XQ1101 series are moreover not provided with an anti-halation glass disc.

The series comprise the following versions:

	with anti-halation glass disc	without anti-halation glass disc
For use in bl/wh and colour cameras in broadcast applications	XQ1090 L R G B	XQ1100 L R G B
For use in bl/wh and colour cameras in industrial applications	XQ1091 R G B	XQ1101 R G B

The electrical and mechanical data of the tubes are identical to those of the XQ1080 or XQ1081 respectively, with the following exceptions:

ELECTRICAL DATA

Capacitance

Signal electrode to all	C_{as} 3 to 5 pF

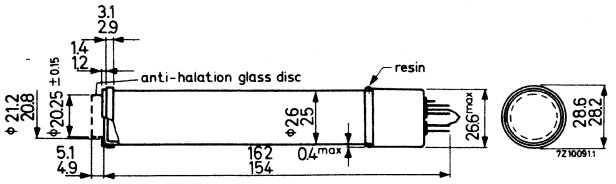
ACCESSORIES

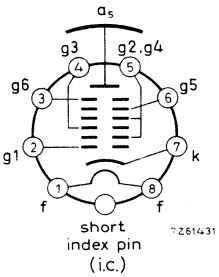
Deflection and focusing coil unit	for colour and bl/wh cameras AT1103, AT1116 or equivalent

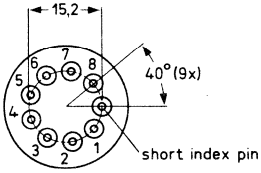
* Registered Trade Mark for camera tube.

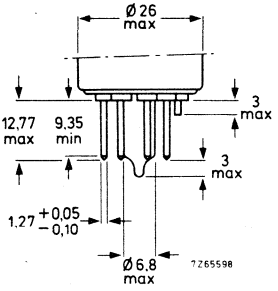
MECHANICAL DATA

Dimensions in mm









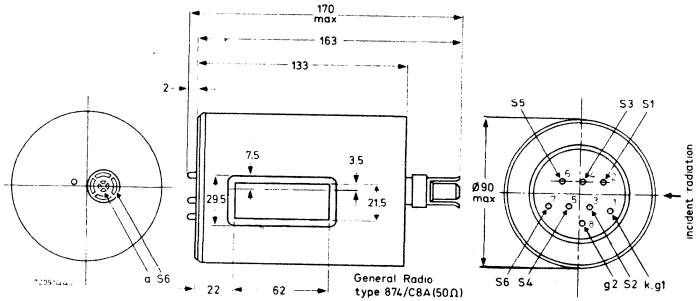
6 STAGE PHOTOMULTIPLIER TUBE

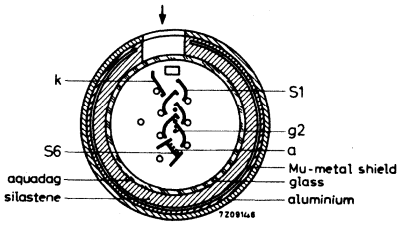
Photomultiplier tube intended for measuring very short light pulses having a very high luminous flux.

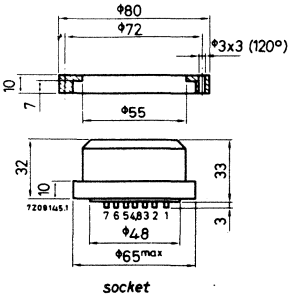
QUICK REFERENCE DATA		
Spectral response	type S4	
Useful area of the photocathode	280	mm^2
Gain (at 3500 V)	10^4	
Anode pulse rise time	1	ns
Coaxial outlet	50	Ω
Linearity	up to 5	A

DIMENSIONS AND CONNECTIONS

Dimensions in mm







socket

ACCESSORIES

Coaxial cable connector
Socket (see drawing above)

"General Radio" type 874/C8A delivered with the tube

10-STAGE VENETIAN BLIND PHOTOMULTIPLIER TUBE

The XP2000 is a 10-stage venetian blind photomultiplier tube with a bialkali type photocathode. The input optics design provides a uniform collection efficiency and combined with the high sensitivity of the photocathode offers a typical pulse height resolution for ^{137}Cs of 7,5%. This tube is intended for use in nuclear applications requiring detection and measurement of radiation with scintillation counters.

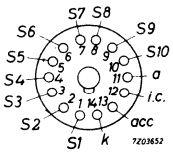
QUICK REFERENCE DATA		
Spectral response	type D	
Useful diameter of the photocathode	44	mm
Gain (at 1500 V)	$2,5 \times 10^5$	
Quantum efficiency	28,4	%
Radiant sensitivity of the photocathode	100	mA/W
Pulse height resolution for ^{137}Cs	7,5	%

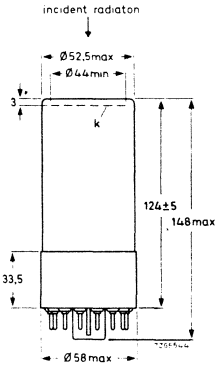
To be read in conjunction with "General Operational Recommendations Photomultiplier tubes"

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: 14-pin (Jedec B14-38)





Data based on pre-production tubes.

10–STAGE VENETIAN BLIND PHOTOMULTIPLIER TUBE

The XP2030 is a 10-stage venetian blind photomultiplier tube with a bialkali type photocathode. The input optics design provides a uniform collection efficiency and combined with the high sensitivity of the photocathode offers a typical pulse height resolution for ^{137}Cs of 7,5%. This tube is intended for use in nuclear applications requiring detection and measurement of radiation with scintillation counters.

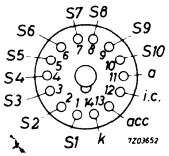
QUICK REFERENCE DATA		
Spectral response	type D	
Useful diameter of the photocathode	69	mm
Gain (at 1500 V)	$2,5 \times 10^5$	
Quantum efficiency	32,6	%
Radiant efficiency of the photocathode	115	mA/W
Pulse height resolution for ^{137}Cs	7,5	%

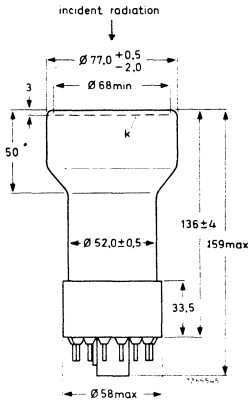
To be read in conjunction with "General Operational Recommendations Photomultiplier tubes"

DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: 14-pin (Jedec B14-38)





Data based on pre-production tubes

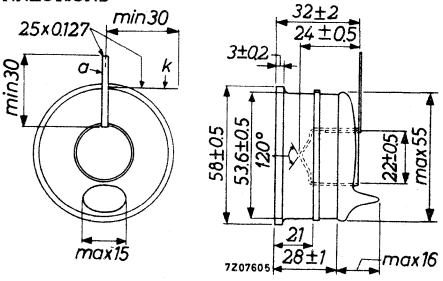
BETA RADIATION COUNTER TUBE

End window halogen quenched β radiation counter tube.

QUICK REFERENCE DATA		
Window thickness	3,5 to 4	mg/cm^2
Window diameter	51	mm
Operating voltage	700 to 1100	V

DIMENSIONS AND CONNECTIONS

Dimensions in mm



WINDOW

Thickness	3,5 to 4	mg/cm^2
Effective diameter	51	mm
Material	mica	

CATHODE

Thickness	1,25	mm
Effective length	25	mm
Material	28 % Cr, 72 % Fe	

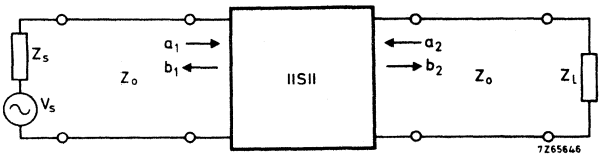
FILLING Ne, A, halogen

CAPACITANCE

Anode to cathode	C_{ak} 5	pF

SCATTERING PARAMETERS

In distinction to the conventional h, y and z parameters, s-parameters relate to travelling wave conditions. The figure below shows a two-port network with the incident and reflected travelling wave quantities a_1, b_1, a_2 and b_2, which are square roots of power.



a_1^2 = the power incident at the input $\left(= \frac{V_{i1}^2}{Z_o} \right)$

a_2^2 = the power incident at the output $\left(= \frac{V_{i2}^2}{Z_o} \right)$

b_1^2 = the power reflected from (or generated at) the input $\left(= \frac{V_{r1}^2}{Z_o} \right)$

b_2^2 = the power reflected from (or generated at) the output $\left(= \frac{V_{r2}^2}{Z_o} \right)$

Z_o = the characteristic impedance of the transmission line in which the two-port is connected

V_i = incident voltage

V_r = reflected (generated) voltage

The four-pole equations for s-parameters are:

$$b_1 = s_{11}a_1 + s_{12}a_2$$

$$b_2 = s_{21}a_1 + s_{22}a_2$$

Using the subscripts i for 11, o for 22, f for 21 and r for 12, it follows that

$$s_i = s_{11} = \frac{b_1}{a_1}\Big|_{a_2 = 0}$$

$$s_f = s_{21} = \frac{b_2}{a_1}\Big|_{a_2 = 0}$$

$$s_o = s_{22} = \frac{b_2}{a_2}\Big|_{a_1 = 0}$$

$$s_r = s_{12} = \frac{b_1}{a_2}\Big|_{a_1 = 0}$$

a_1 can be made zero by terminating the input side with $Z_S = Z_O$ (no input power and no reflection from the source).

a_2 can be made zero by terminating the output side with $Z_l = Z_O$ (no reflection from the load).

Because $\frac{b_1}{a_1} = \frac{V_{r1}}{V_{i1}}$ it can be seen that s_i is the input reflection coefficient; in the same way s_o is the output reflection coefficient.

The s-parameters can be named and expressed as follows:

$s_i = s_{11}$ = Input reflection coefficient (for the given characteristic impedance) - Ratio between the square root of the power reflected from the input and the square root of the power incident at the input, output terminated with the characteristic impedance.

$s_f = s_{21}$ = Forward transmission coefficient (for the given characteristic impedance) - Ratio between the square root of the power generated at the output and the square root of the power incident at the input, output terminated with the characteristic impedance.

$s_o = s_{22}$ = Output reflection coefficient (for the given characteristic impedance) - Ratio between the square root of the power reflected from the output and the square root of the power incident at the output, input terminated with the characteristic impedance.

$s_r = s_{12}$ = Reverse transmission coefficient (for the given characteristic impedance) - Ratio between the square root of the power generated at the input and the square root of the power incident at the output, input terminated with the characteristic impedance.

TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR

QUICK REFERENCE DATA	
Frequency range	4,5 - 15 MHz *)
Frequency tolerance	$\pm 2 \times 10^{-6}$
Temperature range	-20 to + 70 °C
Ageing	$\pm 1 \times 10^{-6}$ per year
Frequency is adjustable with external trimmer	

APPLICATION

Temperature compensated crystal oscillators (TCXO's) are used in mobilophones, electronic timing devices, measuring equipment, synthesizers, etc.

DESCRIPTION

A TCXO module comprises a quartz crystal oscillator, and a thermally controlled circuit that compensates for frequency changes over the whole temperature range. The metal housing is filled with dry nitrogen and hermetically sealed.
The unit is provided with 5 connecting pins which are arranged to fit printed-wiring boards with a grid pitch of 2,54 mm (see Fig. 1).

MECHANICAL AND ENVIRONMENTAL DATA

Dimensions (mm) and terminal location

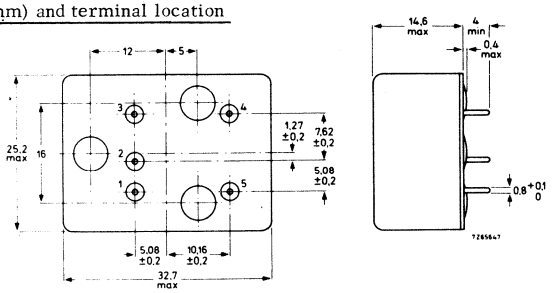


Fig. 1

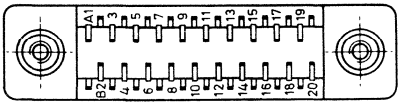
*) A 5 MHz TCXO can be ordered under catalogue number 4322 191 00011,
an 8 MHz TCXO can be ordered under catalogue number 4322 191 00021,
a 10 MHz TCXO can be ordered under catalogue number 4322 191 00001
TCXO's with other frequencies can be ordered under number 4322 191 stating the required frequency.

1,27 mm (0,05 in) PITCH TWO-PART PRINTED-WIRING CONNECTORS

QUICK REFERENCE DATA	
Contact pitch	1,27 mm (0,05 in)
Number of connections	40, 48, 84 and 116
Terminations	solder and/or dipsolder pins
Category (IEC publ. 68)	55/125/56

DESCRIPTION

These connectors consist of a part to be fitted to a printed-wiring board (board part) and another part to be mounted on a chassis or back panel (panel part).
Both parts have a blue glass fibre filled diallylphthalate body.
The contact springs are of phosphor bronze. The contact faces are gold on nickelplating.
No special provisions are required for positioning.
The 40-, 84- and 116-way versions are especially designed in accordance with IEC specifications.



TECHNICAL DATA

Dimensions (in mm)

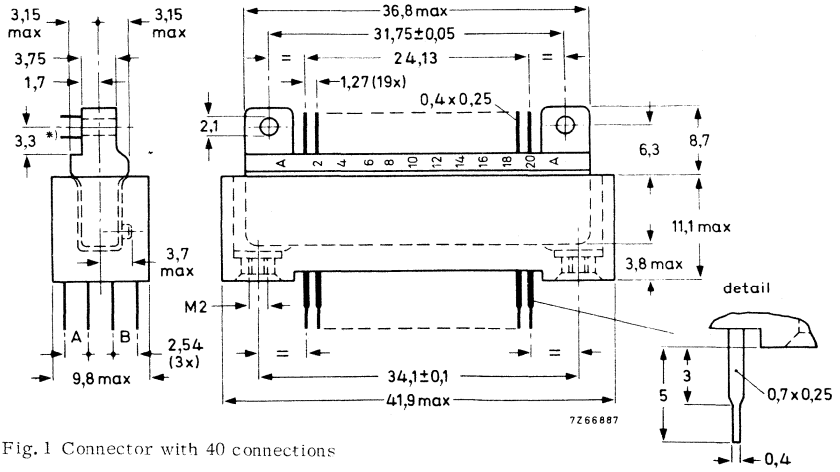


Fig. 1 Connector with 40 connections

DIRECT CURRENT MOTOR

ironless rotor type

QUICK REFERENCE DATA			
Nominal voltage		24	V d.c.
Speed		2800	rev/min
Input power	max.	4,2	W
Torque		100	gcm *)

APPLICATION

This motor has been designed for applications which require high acceleration, high efficiency, smooth running (no magnetic holding-torque).

Examples:
- magnetic tape handling systems (reel and capstan drive)
- recording measuring instruments (chart and pen drive)
- calculating machines (printer drive)
- process control systems (servo motor or tachogenerator)
- professional film cameras.

*) 1 gcm = 10^{-4} Nm

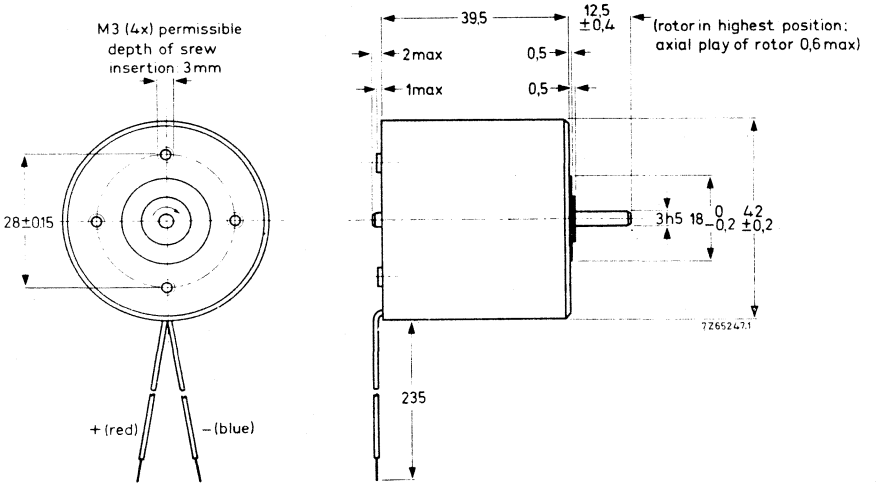
DESCRIPTION

The motor owes its special characteristics to the following design:

- ironless rotor with oblique winding;
  The low moment of inertia (38×10^{-3} gcms^2), and the high starting torque (690 gcm), yield a motor constant of no more than 19 ms;
- a gold-plated commutator with 9 segments and silver-plated brushes of three parts ensure optimal commutation, thus making the motor suitable for accurate electronic control and optimal functioning as a servo motor or tachogenerator;
- the powerful cylindrical steel permanent magnet, around which the rotor rotates, makes for high efficiency;
- the abovementioned commutator/brush construction together with the sintered slide bearings ensures a long life, smooth running and low noise level.

TECHNICAL DATA

Dimensions in mm



The direction of rotation is given in connection with the polarity.

Weight approx. 230 g

DIRECT CURRENT MOTOR

ironless rotor type

QUICK REFERENCE DATA			
Nominal voltage		24	V d.c.
Speed		2800	rev/min
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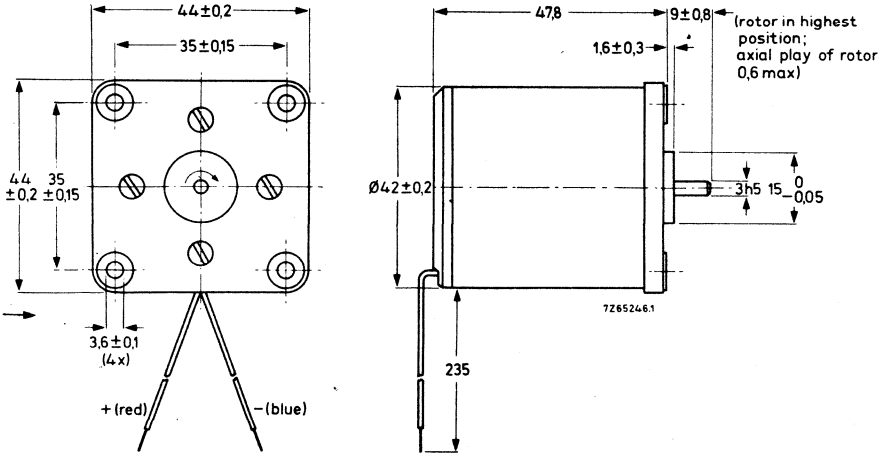
TECHNICAL DATA

Dimensions in mm



The direction of rotation is given in connection with the polarity.

Weight approx. 250 g

A.C. STABILIZER MODULE

QUICK REFERENCE DATA	
Input voltage	195 to 240 V
Stabilized output voltage	0 to 115% of input voltage
Maximum stabilization accuracy	± 0,8 V
Ambient temperature range	−10 to + 40 °C

APPLICATION

This automatic stabilizer module can be used in combination with any number of motor-driven transformers for correction of voltage variations. Its main use will be in those applications where the speed of response is of secondary importance to waveform distortion, and where the price per kVA of controlled power must be kept low. Examples of areas of application are test and research laboratories, service shops, and factories with complex machinery.
The module can also be used as a voltage, light or temperature-sensitive switch to control different power sources.

DESCRIPTION

A complete a.c. stabilizer circuit consists of:
- one or more mains transformers
- a transformer ganging unit
- a motor drive module
- the a.c. stabilizer module
- a control potentiometer

The stabilizer circuit is shown in Fig. 1 in block diagram form. A stabilised power supply provides a d.c. reference voltage (V_{ref}), which is applied to the control potentiometer. This potentiometer reduces the reference voltage by a factor k_1, thus the voltage $k_1 V_{ref}$ is applied to the comparator. The output voltage of the variable mains transformer is applied to the primary of a step-down transformer whose secondary output is rectified. The output of the rectifier, $k_2 V_{out}$, is applied to the other comparator input. The comparator provides an output e to the switching amplifier when the difference between $k_2 V_{out}$ and $k_1 V_{ref}$ exceeds the value set by the accuracy trimming potentiometer on the module. The output of the switching amplifier energizes the appropriate relay for driving the motor in the direction which corrects the voltage variation of the transformer.

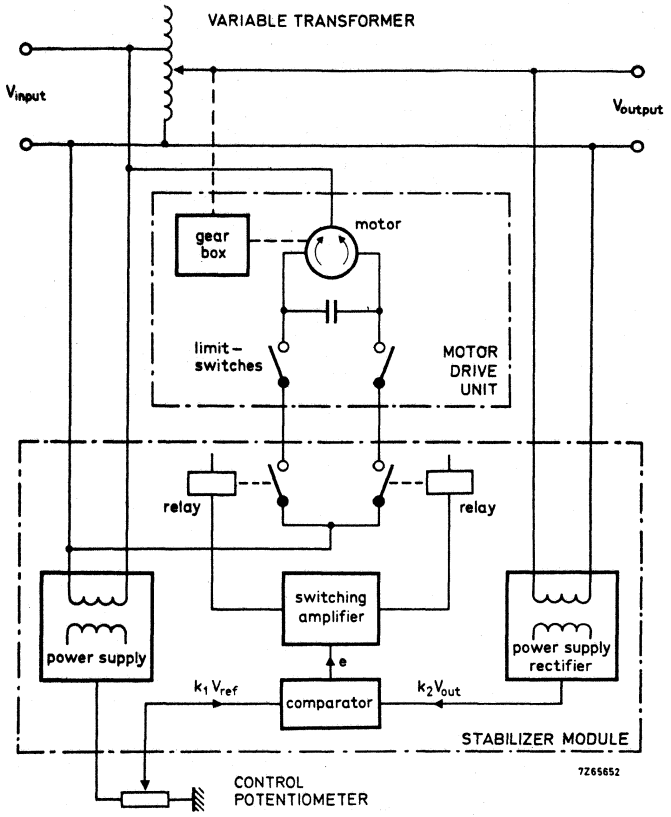


Fig. 1

Fig. 2 shows the circuit diagram of the stabilizer module. A sample of the input to the motor-driven transformer is applied to T1 and rectified by bridge network D_1 to D_4. The output of the diode bridge is smoothed, stabilized and regulated by the circuit of TR_1, TR_2 and TR_5 to provide the reference voltage V_{ref}. External control potentiometer R_X 1) applies the reduction factor k_1. Stabilization accuracy is adjusted by trimming potentiometer R_{20}.

1) Fixed resistors can be used to establish a control programme. A combination of fixed resistors and NTC thermistors or LDR's can be used to control a temperature or illumination level respectively.

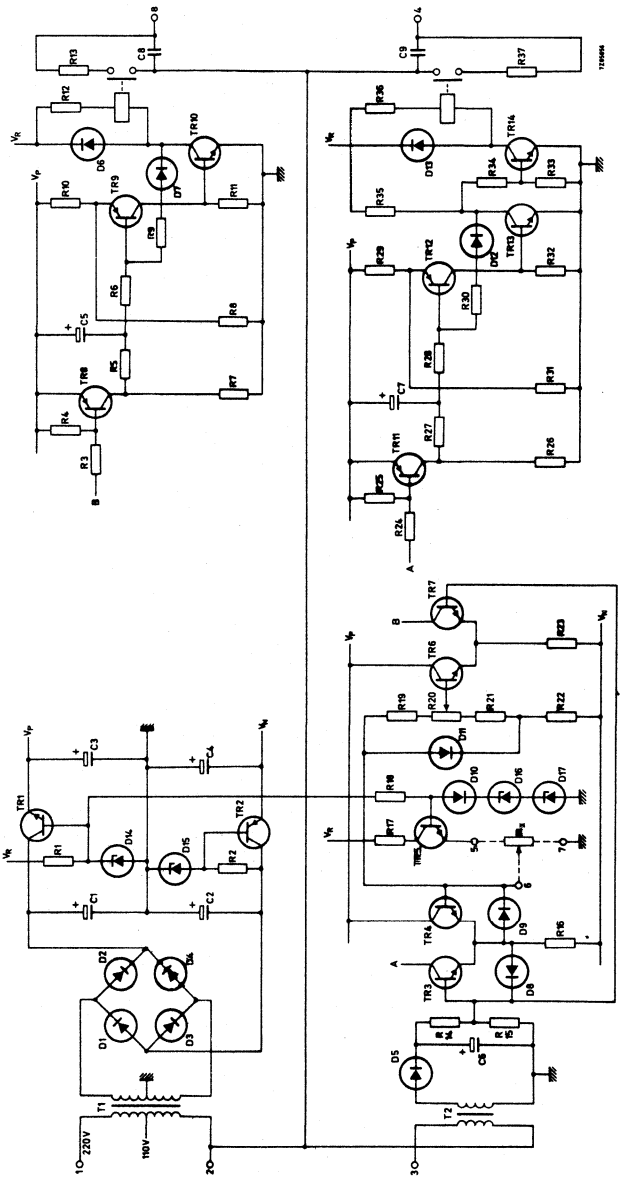

TR1
TR2
TR3
TR4
TR5
TR6
TR7
TR8
TR9
TR10
TR11
TR12
TR13
TR14
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
D16
D17
T1
T2
220V
110V
C1
C2
C3
C4
C5
C6
C7
C8
C9
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
A
B

Fig. 2

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