

RF, MICROWAVE AND MILLIMETRE WAVE  
Assemblies, Equipment, Components



# M/A-COM's expertise spans the spectrum...

## from dc to millimetre wave

At M/A-COM, core technologies include material fabrication and processing, circuit design and high volume production.

Materials expertise includes silicon and gallium arsenide. Circuit design capability encompasses passive transmission line circuits to complex integrated circuits and equipment in conventional, monolithic and hybrid technologies. The latest high volume production techniques are applied to wafers, chips and integrated circuits. This combined with our extensive packaging experience in ceramics and plastics, provides dramatic cost efficiencies.

You'll find our products in commercial applications like cellular telephones, wireless LANs, advanced automotive electronics, and satellite and navigation systems. You'll also find us in defence applications such as radars, missile systems, EW and surveillance. You'll find M/A-COM wherever RF, microwave or millimetre wave expertise and quality manufacturing is critical.

### Subsystems/Equipment

- Up/Down Converters
- Low Noise, Front Ends
- Transceivers
- Pulsed RF Heads
- Coded Transponders
- Lightweight Transponders
- Video Links

### Sources

- Synthesisers
- Dielectric Resonator
- VCO
- Gunn
- Phase Locked
- Transceivers
- Transistor
- YIG Tuned
- Crystal

### Amplifiers

- Low Noise
- Small Signal
- Linearised/Power
- Gain Blocks
- Assemblies

### Receiver Protectors

- High Power
- Switched
- Non Reflective
- Filter Protected

### Control Components

- PIN Diode/GaAs FET
- Switches
- Attenuators
- Phase Shifters
- Limiters
- E/M Switches

### Receiver Components

- Mixers
- LNA's
- Log IF Amps
- Discriminators
- Detectors
- DLVA's

### Antennas

- Horns
- Slot
- GPS
- CNI
- Feeds
- Spirals
- ECM
- Wireless

### Passive Components

- Isolators
- Circulators
- Filters
- Waveguide Ferrite
- Couplers
- Dividers
- Transformers
- Attenuators
- Terminations
- Rotary Joint

### Cable Assemblies

- High Performance
- CNI
- EW
- Delay Lines
- Test/Instrument
- Fiber Optic

### Connectors

- Standard
- Miniature
- Microminiature
- Blind Mate
- Surface Mount
- Millimeter Wave
- Fiber Optic

### Semiconductors

- Diodes
- Silicon & GaAs Wafers
- Transistors
- MMIC/HMIC™GMIC™

### GaAs Materials

- Substrates
- Wafers
- Bulks

### Space Qualified Parts

- Semiconductors
- Attenuators
- Isolators/Circulators
- Control Devices
- Mixers
- Amplifiers
- Assemblies
- Passive Components
- Connectors



## How to Order

Specify by M/A-COM LTD part number, if special features are required please provide full details. In Europe call (44) 1344 869595, in North America call toll free 800 366 2266, in Asia/Pacific call (81) 3 3226 1671. A full list of local M/A-COM representatives appears at the end of this catalogue.

## Terms

Ex Works Net 30 days if credit has been extended; otherwise shipments will be made on a prepaid or C.O.D. basis at M/A-COM LTD's discretion.

## Warranty

Prices are subject to change without notice.

M/A-COM LTD warrants the Products listed in this publication to be free from defects in materials and workmanship under conditions of normal use. If within 12 months after delivery to the original owner and after prepaid return by the original owner any M/A-COM LTD Product listed in the publication is found to be defective, M/A-COM LTD shall, at its option, repair or replace said defective Product. This warranty does not apply to Products which have been disassembled, modified, or subjected to conditions exceeding the application specifications or ratings.

Returned Products or parts must be accompanied by an advice note stating the original invoice number in respect of the Products and the nature of any claimed defect, together with such further information as M/A-COM LTD may at the time of supply have stipulated.

M/A-COM LTD reserves the right to make design changes without notice on any of its Products without obligations to make some or similar changes to Products previously purchased. In no event does M/A-COM LTD assume liability for installation labour or for consequential damages.

This warranty shall be in lieu of any warranty or condition implied by law as to the quality or fitness for any particular purpose of the Products except any implied by law which by law cannot be excluded.

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## Quality Assurance

M/A-COM LTD operates across a broad range of activities within the area of microwave technology and is characterised by a high level of vertical integration providing optimum control of quality, delivery and cost.

The company develops and manufactures products for use within Civil, Professional, Commercial and Military sectors and has supplied many items from its product range for space qualified applications.

It is the declared policy of M/A-COM LTD that the quality of the services and products supplied shall in all respects satisfy the requirements of its customers, and that the objective of all personnel shall be to "do it right first time, every time".

Implementation of this policy is through an organised and defined management and control system in order to secure the principal objective, i.e. to maintain and enhance the reputation of the Company as a supplier of high quality services and products essential to the continuing prosperity of the Company and its employees.

The Quality System represented in the Company Quality Manual, established to meet the requirements of BS EN ISO 9001 embraces the full range of M/A-COM LTD's activities which include:-

Design, development, manufacture repair and packaging of

***Microwave Systems  
Assemblies  
Oscillators  
Amplifiers  
Active and Passive Components  
Semiconductor Devices***

M/A-COM LTD is approved to BS EN ISO 9001, BS 9300, BS 9062, BS 9210, BS CECC 50 000, BS CECC 22 000 and ESA/SCC 5010.

On site environmental and reliability test facilities required for real time analysis of critical product and process characteristics include:

- ***Cold***
- ***Dry Heat***
- ***Damp Heat, Steady State***
- ***Accelerated Damp Heat***
- ***Damp Heat, Cyclic***
- ***Drop and Topple***
- ***Free Fall***
- ***Vibration (Sinusoidal)***
- ***Random Vibration***
- ***Acceleration, Steady State***
- ***Salt Mist***
- ***Low Air Pressure***
- ***Robustness of Terminations***
- ***Immersion in Cleaning Solvents***
- ***Composite Temperature - Humidity Cyclic Test***
- ***Climatic Sequence***
- ***Combined Dry Heat/Low Air Pressure Tests***
- ***Particle Impact Noise Detection***
- ***Shock***
- ***Rapid Change of Temperature***
- ***Sealing***
- ***Resistance to Fluids***
- ***Soldering***

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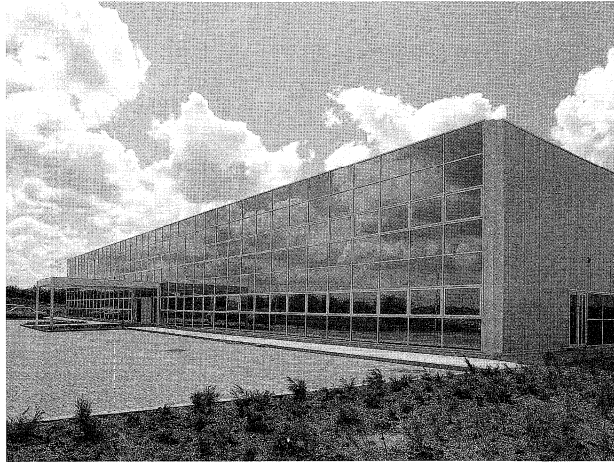
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## **Introduction**



M/A-COM LTD is the U.K. arm of M/A-COM engaged in the design, development and manufacture of microwave products for radar, telecommunications, avionics and satellite applications. Now in its fourth decade of operations the company occupies over 7000 square metres in two factories, 40 miles north of London, manufacturing microwave components, assemblies and sub-systems for customers in Europe, Asia, the U.S.A. and many other parts of the world. More than 40% of production is exported.

M/A-COM LTD is the lead house within the Corporation for:

- ◆ Microwave Synthesisers, specialising in ultra low noise, fast switching designs for both commercial and military applications.
- ◆ High power solid state receiver protectors
- ◆ Hybrid microwave amplifiers and oscillators
- ◆ Crystal and YIG oscillators

The company covers almost all microwave technologies with products ranging from semiconductors through to equipment. This high degree of vertical product integration provides close control of quality, cost, size and delivery, the benefits of which translate into reduced cost of ownership.

M/A-COM LTD is the only qualified supplier of semiconductors to ESA/SCC 5010 for space applications and has a strong presence in the space industry having supplied a range of products over the years for more than twenty satellite payloads. The company is approved to ISO 9001 and BS/CECC 20000.

Research and Development is devoted to extending the performance of existing designs and to developing new designs to meet the need for improved performance, lower weight and power consumption with increased reliability. In addition, substantial investment is made in developing technologies and techniques to minimise manufacturing costs.

To complement its U.K. facilities M/A-COM LTD has total access to technologies within the Corporation as a whole allowing the company to offer the most cost and time effective service to its customers.

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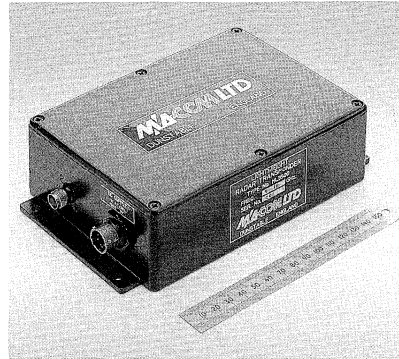


## Products

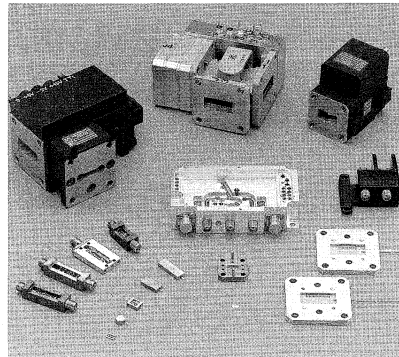
M/A-COM LTD produces a wide range of products in the following categories:

- ◆ Equipment
- ◆ Surveillance Links
- ◆ Transponders
- ◆ Multi-Function Assemblies
- ◆ Synthesisers
- ◆ Oscillators
- ◆ Amplifiers
- ◆ Mixers and Detectors
- ◆ Control Devices
- ◆ Filters
- ◆ Isolators and Circulators
- ◆ Microwave semiconductors

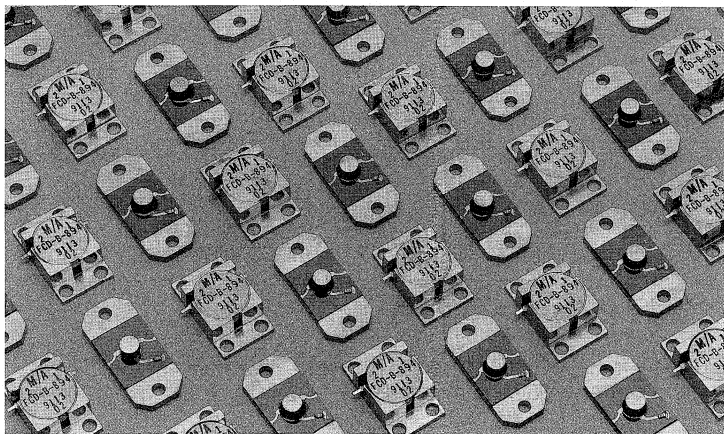
This list gives an overview of the company's products but does not describe overall capability since the majority of products and services provided by M/A-COM LTD are designed to meet specific rather than general customer needs. Some examples of applications served by the company are shown in the following pages.



*Lightweight I Band Transponder*



*High Power Receiver Protectors*



*Drop-in Ferrite Isolators*

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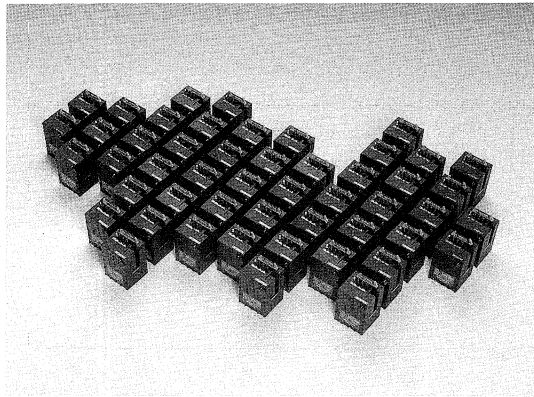
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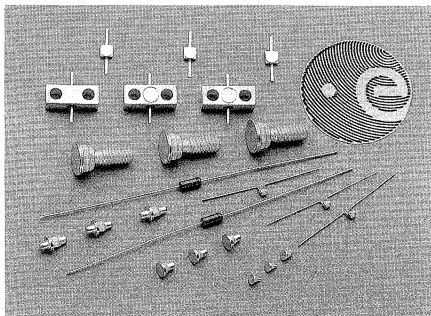


## **Telecommunications**

In addition to its broad range of commercial active and passive components M/A-COM LTD specialises in the design and volume manufacture of ultra low noise, low phase jitter synthesisers, phase locked oscillators and assemblies for use in modern fixed and mobile telecommunications systems. Examples range from ultra miniature dual channel synthesisers for man portable ground stations to complete synthesised up/down converter sub-systems.



*Communications Synthesizers*



*Space Qualified Semiconductors*

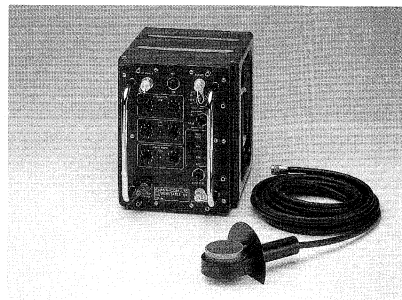
## **Test Equipment**

M/A-COM LTD designs and manufactures specialised test equipment for radar systems. Examples include the Ruggedised Noise Measuring Equipment (RNME), Modulation Analyser and ECM test sets which are used for factory production checks and in-service testing of airborne radars; and Transponder verifier, a hand held test set which allows remote confidence checks on airborne and marine transponders without need of any connection to the equipment under test. M/A-COM also manufactures most critical microwave components for test equipment use.

## **Space Qualification**

The company has been actively involved in providing Space Qualified parts for a number of European payloads manufactured since 1974. Over 60 qualification programmes have been completed for various parts to date and M/A-COM LTD now has a virtually complete family of microwave semiconductors on the ESA Qualified Parts List.

We are able to perform full qualification on all our products and also provide an up-screening service to payload manufacturers for parts from off-shore suppliers and others who are unable to undertake qualification to European Space standards.



*E.C.M. Test Equipment*

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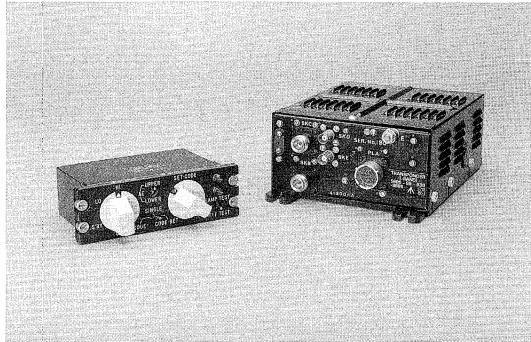
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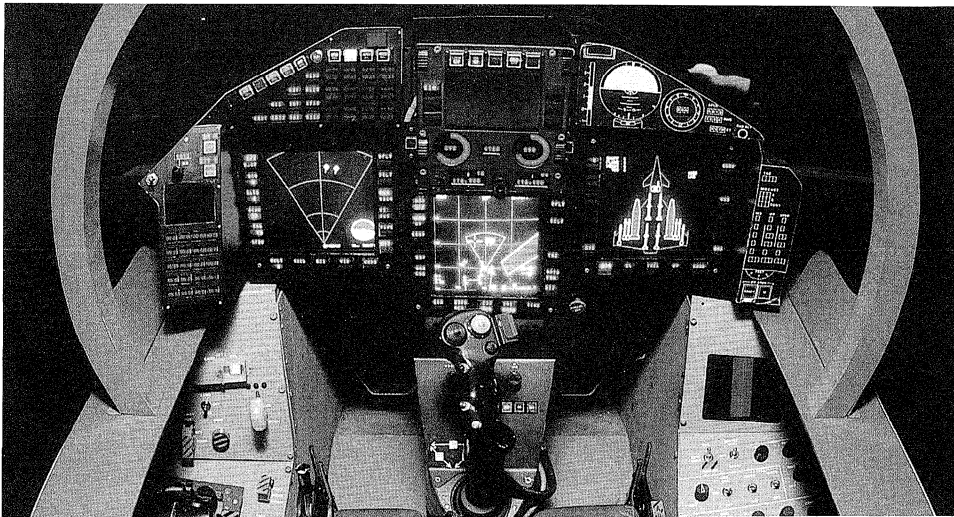
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## Navigation Systems

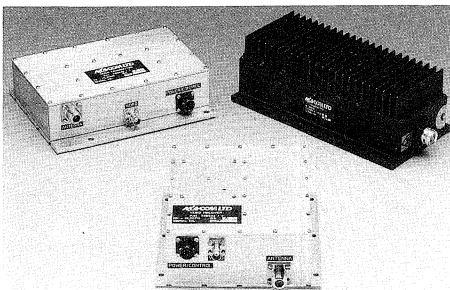
In the avionics field M/A-COM LTD is involved in many programmes from the project definition stage to the development and manufacture of systems and sub-systems including frequency synthesisers, altimeters, transponders and G.P.S. front ends. We have also provided complex components such as solid state TWTA replacements for mature systems. We are a significant supplier into platforms including Tornado, AMX, EFA, Harrier, Lynx and Merlin and have provided components for many other airborne systems.



*I Band Airborne Transponder*



Courtesy British Aerospace



*Mobile Video Links*

## Surveillance/Training

Portable Video/Data microwave transmission systems designed and manufactured by M/A-COM LTD are in use by many law enforcement agencies for covert surveillance. They also find application as part of training systems where video monitoring of pupil response is needed. These systems meet CCIR standards and are designed for operation over obscured and non line-of-sight paths.

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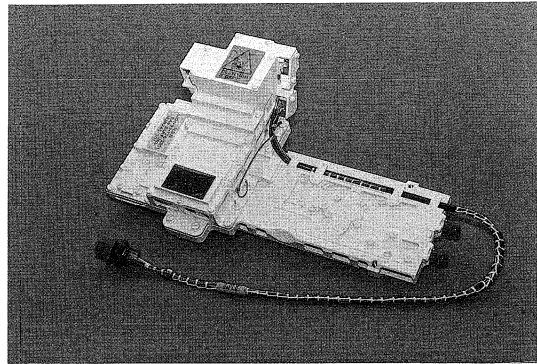
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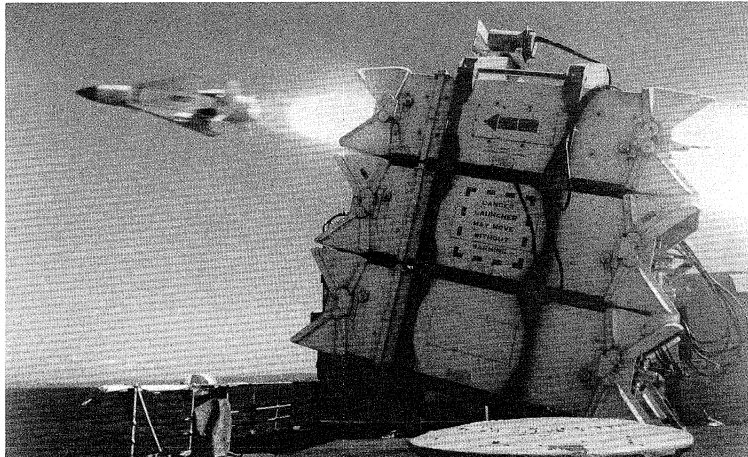
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## ***Guided Weapons***

M/A-COM LTD has been supplying guided weapon components and assemblies for systems such as Sky Flash, Sea Skua, Stiletto, Sea Eagle and Rapier for many years including a new design for the Sea Wolf missile beacon which successfully completed initial flight trials within 6 months of contract award. In addition we have developed complex signal generation sub-systems and components for both the surveillance and Blindfire radar systems for Rapier 2000.



*Missile Beacon*

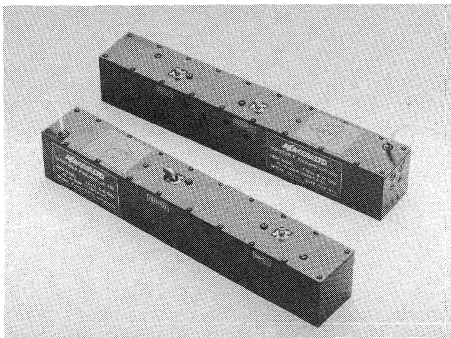


*Sea Wolf Missile*

Courtesy British Aerospace

## ***Electronic Warfare***

We have provided components and assemblies to equipment contractors for most U.K. EW programmes and many in Continental Europe. Examples of products supplied by M/A-COM LTD include multi-octave up and down converters, high power solid state TWTA replacement amplifiers, multi-channel BITE sources stabilised by crystals or by dielectric resonators, standard wideband hybrid amplifiers covering the 2-18 GHz range, broadband ferrites and diode control devices with instantaneous bandwidth from DC to 20 GHz.



*Solid State TWT Replacement Amplifier*

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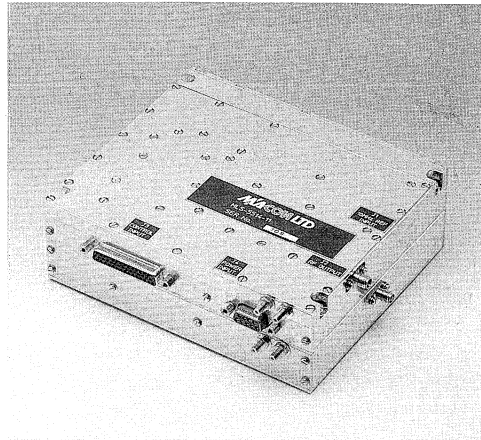
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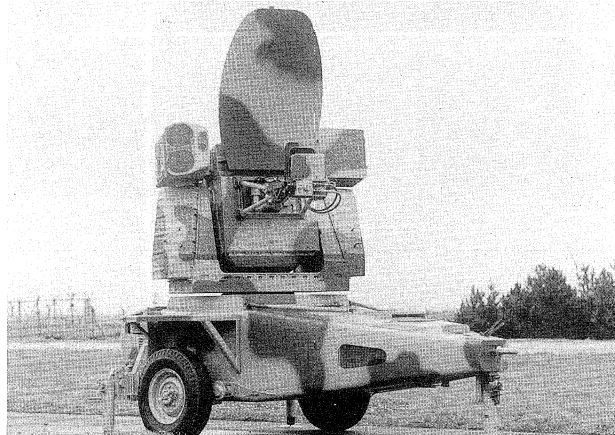


## **Radar**

Key Radar products designed and manufactured by M/A-COM LTD include high power solid-state receiver protectors in all radar bands with or without B.I.T. and linearised S.T.C., and fast switching single and dual channel synthesisers for end use in ground, naval and airborne systems. In addition M/A-COM's broad range of microwave components, integration techniques and systems understanding has resulted in the development of a number of complex assemblies from converter sub-systems to complete R.F. front ends.

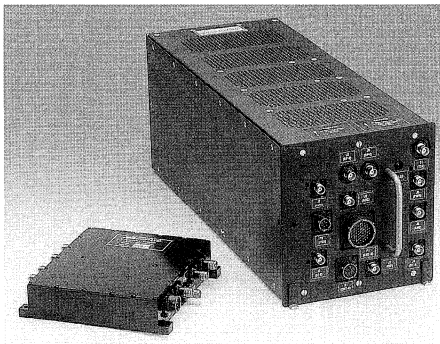


*Fast Switching Radar Synthesiser*



*Rapier Blindfire Radar*

Courtesy British Aerospace



*Anti Collision SSR Interrogator*

## **Conclusion**

The following sections provide more detailed product information and demonstrate the company's overall capability. Since a high proportion of M/A-COM LTD products are application specific, developed in close co-operation with its customers, this catalogue is not exhaustive and if you have specific requirements not shown then engineering and management staff are always available to discuss broader aspects of our ability to meet your needs.

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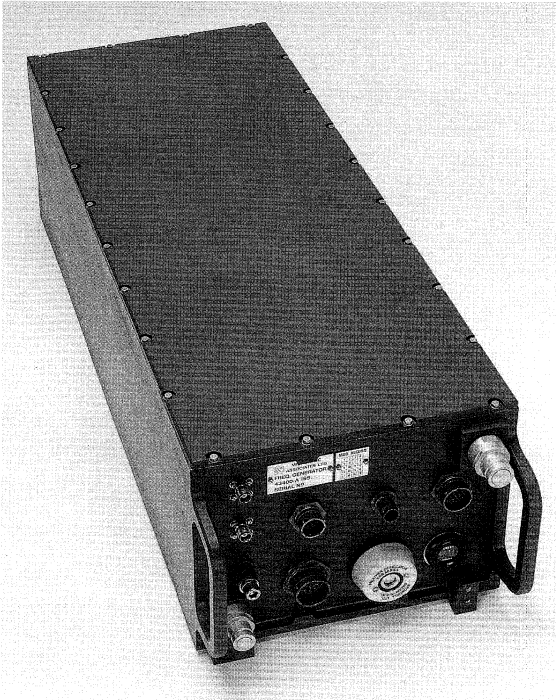
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# SYSTEMS AND EQUIPMENT

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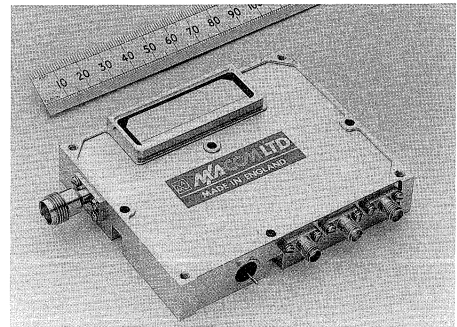
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## HYBRID UP CONVERTER

### 4 TO 8 GHz

### FEATURES

- ◆ **Lightweight/Compact**
- ◆ **Low Cost**
- ◆ **Hybrid M.I.C. Technology**
- ◆ **Variable Output Power**



### DESCRIPTION

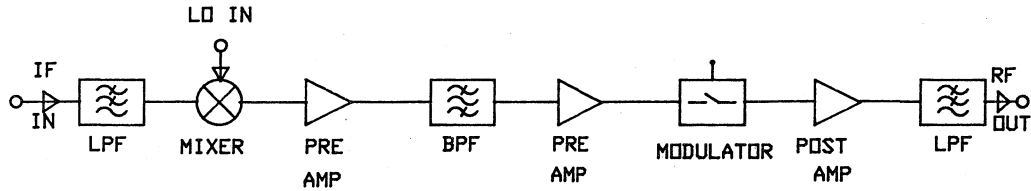
Designed and manufactured in the U.K., MLUC-1100 Series Up-Converters are intended for military and civil applications where size and weight are critical. These units feature variable output power for ECCM considerations (silent radar applications). The unit also features full temperature compensation.

### SPECIFICATION

R.F. Frequency	: 4 to 8 GHz	I.F. Frequency	: 600 MHz
R.F. Output Power	: -4 to +26dBm	I.F. Bandwidth	: ±100 MHz
Conversion Gain	: 30dB min.	I.F. Input Power	: -5dBm ±1dB
Noise Figure	: 10dB max.	D.C. Voltage	: +12V ±0.25V
L.O. Frequency	: 3.4 - 7.4 GHz	D.C. Current	: 600mA max.

Alternative frequency ranges, stable local oscillators and BITE outputs are available as options.

## BLOCK DIAGRAM



## MECHANICAL CHARACTERISTICS

R.F. Connectors	:	TNC or SMA
Control & D.C. Connectors	:	Solder Pins
Size	:	100 x 80 x 15mm (Excluding Connectors)
Weight	:	300g

## ENVIRONMENTAL CONDITIONS

Operating Temperature Range	:	-40°C to +90°C
Storage Temperature Range	:	-54°C to +100°C

Designed to meet the environmental test requirements of MIL-STD-810C or similar standards related to military and airborne applications.

All specifications are typical and subject to change without notice

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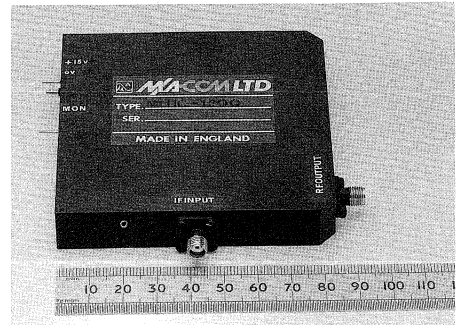


**HIGH STABILITY UP-CONVERTER ASSEMBLY**

**6 TO 18 GHz OUTPUT**

**FEATURES**

- ◆ **Low Noise**
- ◆ **Compact/Low Weight**
- ◆ **Low Spurious/Intermod**
- ◆ **Crystal Stabilised**
- ◆ **Phase Locked Local Oscillator**



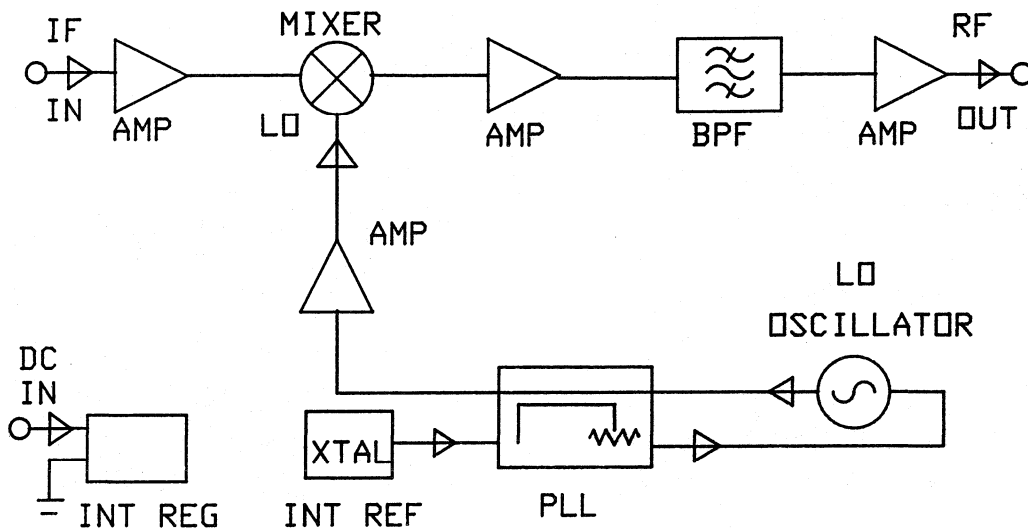
**DESCRIPTION**

ML UC-1200 Series up-converters, designed for ECM and ECCM applications, accept inputs from 2 GHz to 7 GHz providing outputs from 6 GHz to 18 GHz. The stable local oscillator frequency is derived from an internal crystal reference. All units have built-in power conditioning and operate over octave bandwidths.

**SPECIFICATION**

IF Input Frequency Range	: 2 to 7 GHz	Output Frequency Range	: 6 to 18 GHz
Input Power	: -6dBm	LO Frequency Options	: 4 to 11 GHz
Survival Input Power	: +15dBm	Output Power	: +6dBm
Input V.S.W.R.	: 2:1	Output Power Variation	: ±1.0dB
Conversion Gain	: 10dB	Frequency Stability	: 25 ppm
Noise Figure	: 10dB	L.O. Leakage	: -10dBm
AM Noise 1KHz - 1MHz	: -100dBc/Hz	Output V.S.W.R.	: 2:1
FM Noise 10MHz	: -70dBc/Hz	Supply Voltage	: +15V at 400mA
Spurious Outputs	: -25dBc		

Provision for external reference input and local oscillator monitor are available as options.

**BLOCK DIAGRAM****MECHANICAL CHARACTERISTICS**

R.F. Connectors	:	SMA Female
D.C. Connectors	:	Solder Pins
Size	:	85 x 85 x 16mm (excluding connectors and fixings)
Weight	:	200g

**ENVIRONMENTAL CHARACTERISTICS**

Operating Temperature Range	:	-40°C to +80°C
Storage Temperature Range	:	-50°C to +100°C

Designed to meet the environmental test requirements of MIL-STD-810C or similar standards related to military and airborne applications.

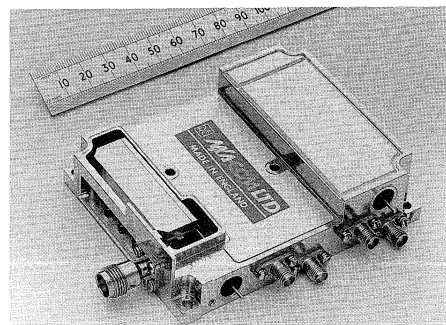
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**HYBRID DOWN CONVERTER**

**4 TO 8 GHz**

**FEATURES**

- ◆ **Lightweight/Compact**
- ◆ **Low Cost**
- ◆ **Low Noise Figure**
- ◆ **Wide I.F. Bandwidth**
- ◆ **Hybrid M.I.C. Technology**



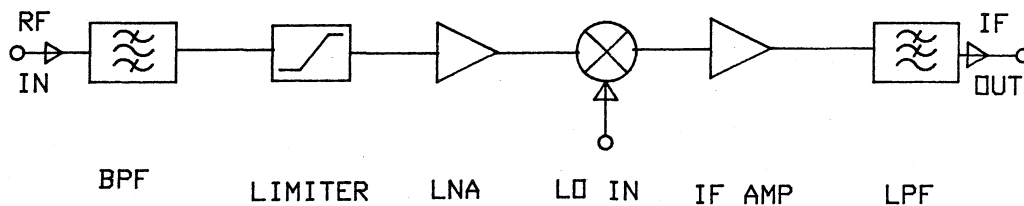
**DESCRIPTION**

Designed and manufactured in the U.K., MLDC-1100 Series Down Converters are intended for military and civil applications where size and weight are critical. Limiter protection is provided for use in hostile R.F. environments.

**SPECIFICATION**

R.F. Frequency	: 4 to 8 GHz	I.F. Frequency	: 600 MHz
R.F. Bandwidth	: 5%	I.F. Bandwidth	: $\pm 100$ MHz
R.F. Input Power	: $-30$ dBm max.	Image Rejection	: 15dB min.
Conversion Gain	: 22dB $\pm 2$ dB	D.C. Voltage	: $+12V \pm 0.25V$
Noise Figure	: 4.5dB max.	D.C. Current	: 200mA max.
L.O. Frequency	: 3.4 - 7.4 GHz		

Alternative frequency ranges, stable local oscillators and BITE outputs are available as options.

**BLOCK DIAGRAM****MECHANICAL CHARACTERISTICS**

R.F. Connectors	:	TNC or SMA
Control & D.C. Connectors	:	Solder Pins
Size	:	100 x 80 x 25 mm (Excluding connectors)
Weight	:	300 g

**ENVIRONMENTAL CONDITIONS**

Operating Temperature	:	-40°C to +90°C
Storage Temperature	:	-54°C to +100°C

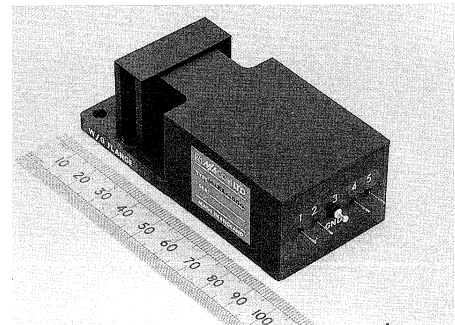
Designed to meet the environmental test requirements of MIL-STD-810C or similar standards related to military and standard applications.

All specifications are typical and subject to change without notice



**LOW NOISE RF FRONT END**
**8 TO 12 GHz**
**FEATURES**

- ◆ **Compact/Low Weight**
- ◆ **Low Cost**
- ◆ **Tunable Local Oscillator**
- ◆ **Low Noise Figure**
- ◆ **High Image Rejection**

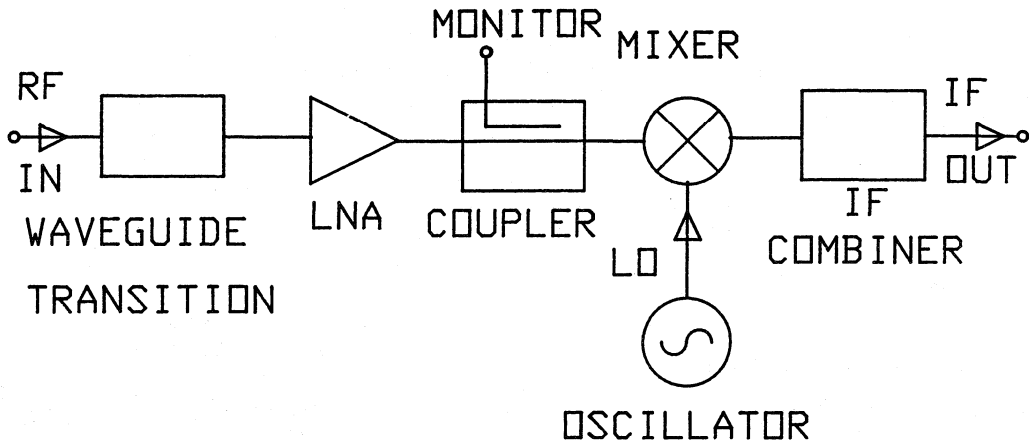

**DESCRIPTION**

ML RX-1000 Series general purpose front ends feature waveguide RF input, varactor tunable L.O., BITE monitor and built-in IF combiner. Designed and manufactured in the U.K. these units are intended for airborne and ground radar and telecommunications applications.

**SPECIFICATION**

R.F. Frequency	: 8 to 12 GHz	R.F. Input Power	: 100 mW max.
R.F. Bandwidth	: 5%	*L.O. Frequency Range	: 8 to 12 GHz
Noise Figure	: 4.8dB typical 5.8dB max.	L.O. Bandwidth	: 5%
Conversion Gain	: -1dB to +4dB	L.O. Tuning Voltage	: +5 to +35V
Output Power (1dB compression)	: -6dBm max.	D.C. Voltage	: +11.5 to +12.5V
I.F. Frequency	: L.O. - R.F.	D.C. Current	: 200mA max.
I.F. Bandwidth	: 60 MHz min.	*Note: L.O. frequency is always higher than R.F.	

Limiter protected versions and alternative frequency ranges are available as options.

**BLOCK DIAGRAM****MECHANICAL CHARACTERISTICS**

R.F. Input	:	WG16 (R100)
IF Output	:	Solder Pin
Control, Monitor, D.C. Supplies	:	Solder Pins
Size	:	100 x 42 x 31mm (Excluding Connectors)
Weight	:	250 g

**ENVIRONMENTAL CHARACTERISTICS**

Operating Temperature Range	:	+5°C to +55°C
Storage Temperature Range	:	-54°C to +100°C

Designed to meet the environmental test requirements of MIL-STD-810C or similar standards related to military and airborne application.

All specifications are subject to change without notice

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Europe: (44) 1344 869595

North America: 800 366 2266

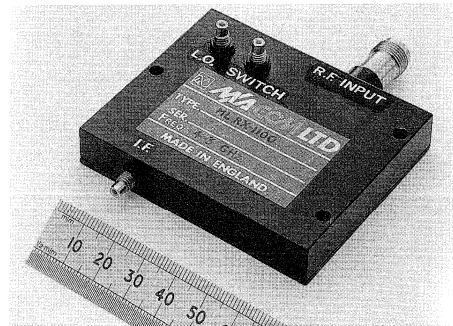
Asia Pacific: (81) 3 3226 1671

## DOWN CONVERTER ASSEMBLY

4.3 GHz

### FEATURES

- ◆ **Compact/Low Weight**
- ◆ **Hermetic Sealing**
- ◆ **BITE Facility**



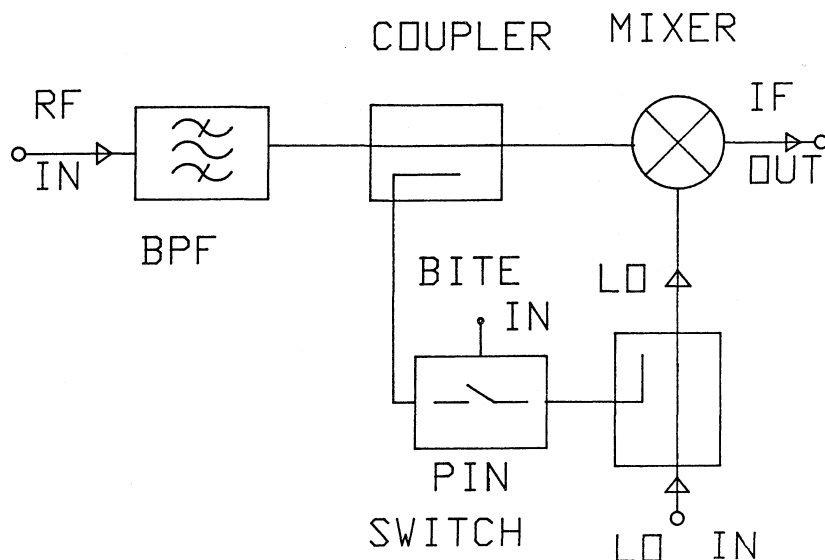
### DESCRIPTION

Designed for U.A.V. aircraft and missile altimeter applications the MLRX-1100 meets full military specifications embodying filter, couplers, mixer and BITE modulator in a compact hermetic package.

### SPECIFICATION

R.F. Frequency	: 4.3 GHz	I.F. Frequency	: DC-15 MHz
Bandwidth	: $\pm 100$ MHz	LO/RF Isolation	: 18dB
Noise Figure	: 10dB (DSB)	Filter Characteristic	: Tchebychef response. Stop Band to 12 GHz
Input VSWR	: 1.7:1		

Alternative frequencies and stable local oscillators are available as options.

**BLOCK DIAGRAM****MECHANICAL CHARACTERISTICS**

R.F. Input	:	TNC
I.F., L.O., BITE	:	SMC
Size	:	65 x 76 x 13mm (Excluding connectors)
Weight	:	300g

**ENVIRONMENTAL CHARACTERISTICS**

Operating Temperature Range	:	-40°C to +70°C
Storage Temperature Range	:	-54°C to +100°C

Designed to meet the environmental test requirements of MIL-STD-810C or similar standards related to military and airborne applications

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## COMBINED DUAL CHANNEL GPS FRONT END

### FEATURES

- ◆ Operates on Combined L1 and L2
- ◆ High Selectivity, High Stability
- ◆ Passive Limiting with Blanking
- ◆ Low Noise, Temperature Compensated Amplification
- ◆ Accurate Amplitude and Group Delay Balance
- ◆ Integral Input Diplexer
- ◆ Fully Hermetic

### DESCRIPTION

Designed and manufactured in the UK, the MLMF-1002 Front End interfaces between a Dual Frequency GPS Antenna and a GPS Receiver. It reduces interfering out of band signals from IFF and other equipment so allowing reception of the weakest GPS satellite signals.

Input signals are fed from the antenna input via an integral diplexer which separates L1 and L2 frequencies into different channels. Each channel is then filtered and amplified to provide the necessary signal strength to drive a GPS receiver. Both channels are balanced in amplitude and group delay, removing the need for recalibration when switching from one channel to the other. Mechanical filters ensure high selectivity without degradation of spread spectrum signals and prevent saturation of the amplifiers by out of band interference or jamming. The passive limiter protects against external high power signal transmitters such as IFF systems. A TTL control input activates the blanking of both channels simultaneously, giving protection from the host vehicle transmitters.

### SPECIFICATION

Frequency	: L1 1575.0 MHz $\pm$ 3 MHz L2 1227.6 MHz $\pm$ 3 MHz	Noise Figure	: 7dB max.
Input 3dB Bandwidth	: 50-70MHz	Rejection	: 35dB min. @ 40 MHz from centre frequency 50dB min. @ 60 MHz 60dB min. @ 100 MHz
Output 3dB Bandwidth	: 25MHz min.	Isolation between channels	: 80dB min.
Channel Gain	: 30dB min.	Balance, amplitude	: 2dB max.
Input VSWR	: 1.6:1 max.	group delay	: $\pm$ 2ns max.
Output VSWR	: 1.7:1 max.	Blanking isolation	: 40dB min.
Input Power, max.	: 4W mean 450W peak (50 $\mu$ s pulsewidth at a duty cycle of 1%)	Power Consumption	: 5W max.
Input Power, 1dB compression	: -30dBm max.	Power Supplies	: +15V, -15V

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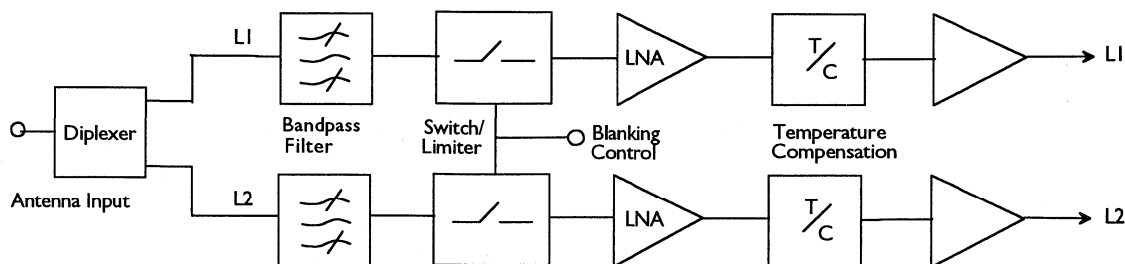
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## BLOCK DIAGRAM



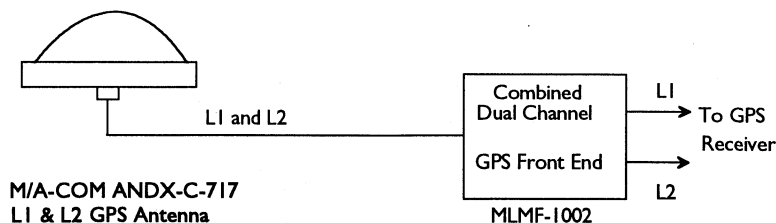
## MECHANICAL CHARACTERISTICS

RF Connectors	:	SMA (F)
Blanking Connector	:	SMA (F)
Size, excluding Connectors & Fixings	:	150 x 82 x 35mm
Weight	:	650g max.

## ENVIRONMENTAL CHARACTERISTICS

Temperature, Operating	:	-55°C to +70°C
Storage	:	-55°C to +100°C
Altitude	:	70,000 ft.

## TYPICAL APPLICATION



## OPTIONS

- BITE signal injection into output ports
- Single bias via output ports
- Single channel output

All specifications are typical and subject to change without notice

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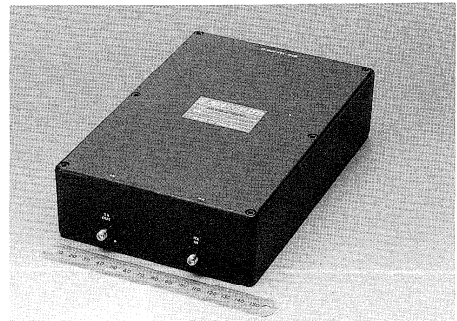
Europe: (44) 1344 869595

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**RF TRANSCEIVER ASSEMBLY**
**5.8 GHz**
**FEATURES**

- ◆ **High Stability**
- ◆ **Low Cost**
- ◆ **ASK Modulation**
- ◆ **Image Rejection Mixer**

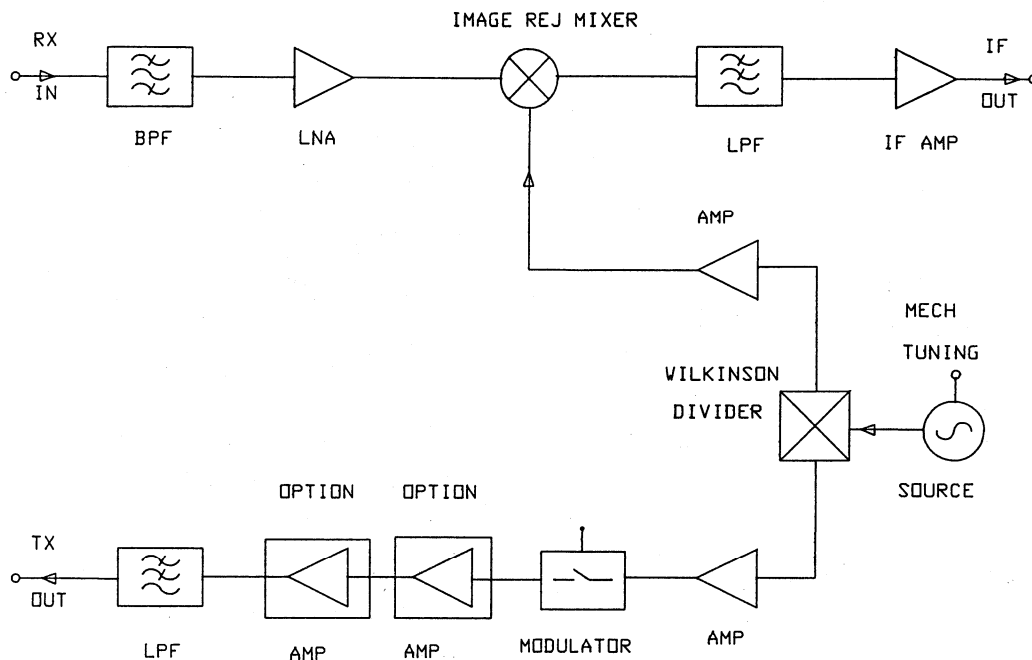

**DESCRIPTION**

MLTR-1000 transceivers are designed for use in Autotoll beacons. Featuring a stable dielectric resonator oscillator, image rejection mixer, transmit modulator plus all necessary amplifiers, and filters which interface directly with the antenna and IF circuitry.

**SPECIFICATION**

<b>TRANSMITTER</b>		<b>RECEIVER</b>	
Frequency Range	: 5.8 GHz	I.F. Output Range	: 10 MHz $\pm$ 2 MHz
Tuning Range	: $\pm$ 15 MHz	Receiver Noise Figure	: 5dB S.S.B.
Frequency Stability	: 20 KHz/ $^{\circ}$ C	Image/L.O. Rejection (Lower Side Band)	: 20dB
Output Power	: 250 mW min.	Conversion Gain	: 20dB
Modulation Rate (Square Wave)	: 1.5 MHz	Rx 1dB Compression	: -6dBm
Modulation Depth	: 20dB min.	Power Supply	: +12V @ 500mA -12V @ 25mA
Modulation Input	: TTL		

Increased output powers, I/Q modulation, single antenna output using ferrite duplexing, and integral antenna are available as options.

**BLOCK DIAGRAM****MECHANICAL CHARACTERISTICS**

<b>R.F. Connectors</b>	:	<b>SMA Female</b>
<b>Other Connectors</b>	:	<b>Cannon 'D' Type</b>
<b>Size</b>	:	<b>150 x 150 x 50mm (Excluding connectors)</b>
<b>Weight</b>	:	<b>800g</b>

**ENVIRONMENTAL CHARACTERISTICS**

<b>Operating Temperature Range</b>	:	<b>-30°C to +70°C</b>
<b>Storage Temperature Range</b>	:	<b>-40°C to +85°C</b>
<b>Designed for external ground use.</b>		

All specifications are typical and subject to change without notice

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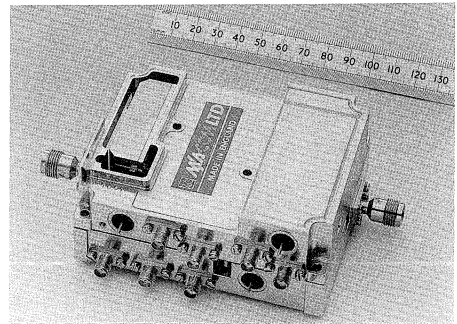
Asia Pacific: (81) 3 3226 1671

**F.M. C.W. RADAR R.F. HEAD ASSEMBLY**

**4 TO 8 GHz**

**FEATURES**

- ◆ **Compact/Low Weight**
- ◆ **Low Cost**
- ◆ **Variable Output Power**
- ◆ **AM/FM Modulation**
- ◆ **Low Noise Figure**



**DESCRIPTION**

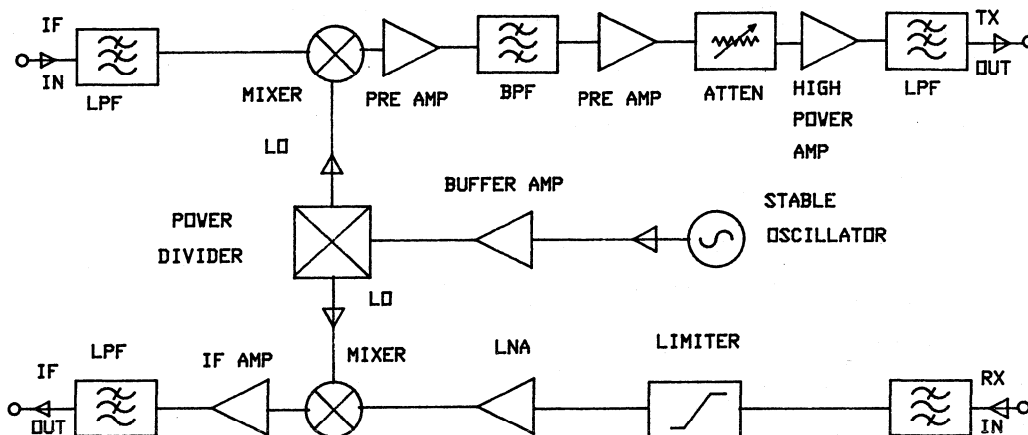
MLTR-1200 front ends are designed for F.M. C.W. radars where size and weight are at a premium and where a very stable operating frequency is required.

**SPECIFICATION**

<b>TRANSMITTER</b>		<b>RECEIVER</b>	
R.F. Frequency	: 4 to 8 GHz	R.F. Input Power	: -30dBm
R.F. Bandwidth	: ±100 MHz	RX Channel Gain	: 22dB ±2dB
R.F. Output Power	: -4 to +26dBm	RX Channel Noise Figure	: 4.5dB max.
TX Channel Gain	: 30dB min.	I.F. Frequency	: 600 MHz
TX Channel Noise Figure	: 10dB max.	I.F. Bandwidth	: ±100 MHz
Frequency Stability	: ±2 ppm	Image Rejection	: 15 dB
I.F. Input Power	: -5dBm ±1dB	D.C. Voltage	: +12V ±0.25V at 750mA -12V ±0.25V at 40mA

Alternative frequency ranges, higher power and extended BITE facilities are available as options.

## BLOCK DIAGRAM



## MECHANICAL CHARACTERISTICS

R.F. Connectors	:	TNC or SMA
Control & D.C. Connectors	:	Solder Pins
Size	:	100 x 80 x 40mm (Excluding Connectors)
Weight	:	600g

## ENVIRONMENTAL CONDITIONS

Operating Temperature Range	:	-40°C to +90°C
Storage Temperature Range	:	-54°C to +100°C

Designed to meet the environmental test requirements of MIL-STD-810C or similar standards related to military and airborne applications.

All specifications are typical and subject to change without notice

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**PULSED RADAR R.F. HEAD ASSEMBLY**

**4 TO 8 GHz**

**FEATURES**

- ◆ **High Stability**
- ◆ **Low Power Consumption**
- ◆ **High Gain**
- ◆ **Low Noise Figure**
- ◆ **High Output Power**

**DESCRIPTION**

MLTR-1300 Series Pulsed Transmitter/Receivers interface at antenna and baseband in radar systems where size and weight coupled with very high frequency stability are critical. Designed and manufactured in the U.K. these units feature high sensitivity with an A.G.C. control range of 80dB.

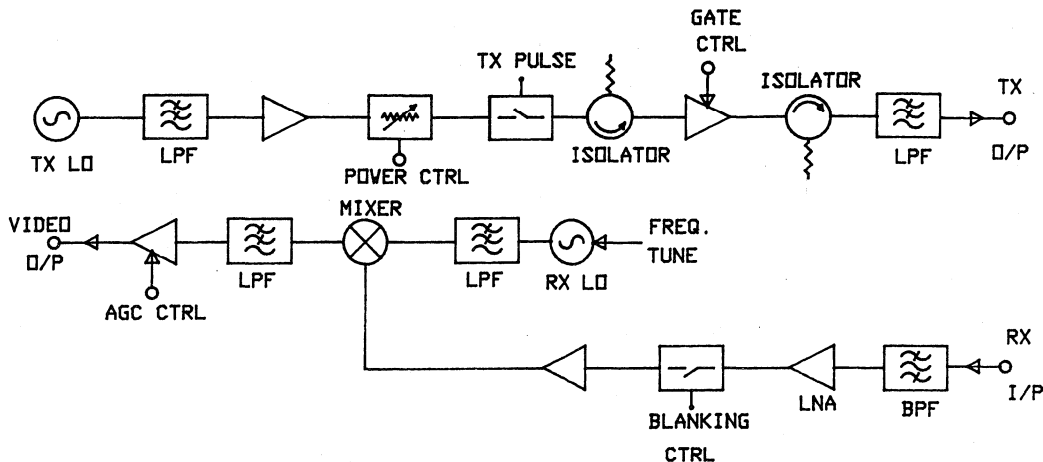
**SPECIFICATION**

TRANSMITTER	RECEIVER
R.F. Frequency : 4 to 8 GHz	RX Sensitivity : -88dBm
R.F. Bandwidth : ±100MHz	RX Noise Figure : 7dB max.
R.F. Output Power : -10 to +30dBm	RX Gain Control : 80dB min.
TX On/Off Ratio : 100dB	RX Blanking : 60dB min.
Video Bandwidth : 1 KHz to 10 MHz	D.C. Voltage : +15V ±5% at 430mA -15V ±5% at 230mA

Alternative frequency ranges, enhanced BITE and frequency agility are available as options.



## BLOCK DIAGRAM



## MECHANICAL CHARACTERISTICS

R.F. Connectors:	TNC or SMA
Control & D.C. Connectors	: D-Type
Size (length x width x height)	: 167 x 80 x 35mm (Excluding Connectors)
Weight	: 950g

## ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range	: -30°C to +50°C
Storage Temperature Range	: -50°C to +100°C

Designed to meet the environmental test requirements of MIL-STD-810C or similar standards related to military and airborne applications.

All specifications are typical and subject to change without notice

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## LOW NOISE RADAR R.F. HEAD ASSEMBLY

### 4 TO 8 GHz

### FEATURES

- ◆ **Low Size/Weight**
- ◆ **Hybrid Technology**
- ◆ **Frequency Agile**
- ◆ **Low Noise Figure**
- ◆ **Wide Dynamic Range**

### DESCRIPTION

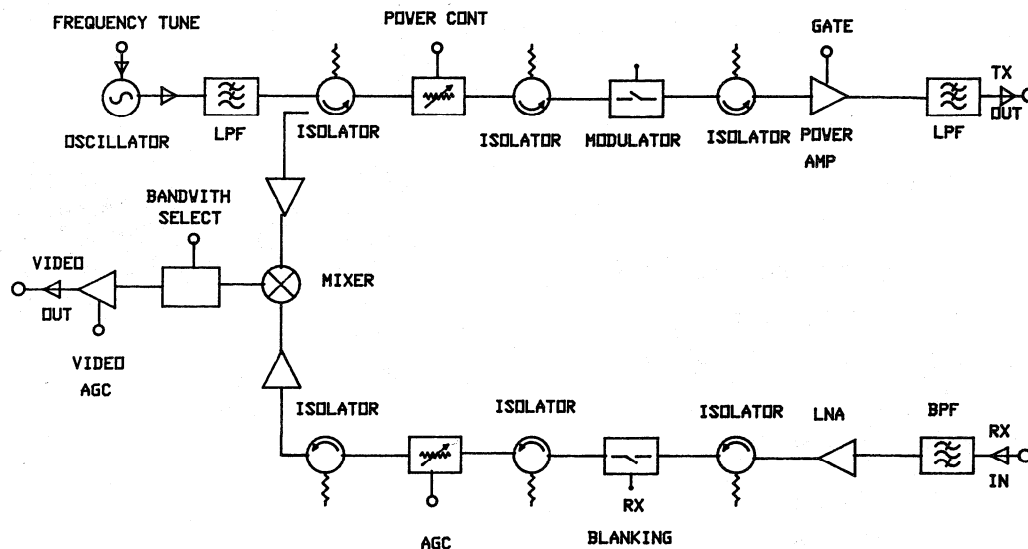
MLTR-1400 front ends, designed and manufactured in the U.K. are compact, pulsed, frequency agile Radar Heads interfacing directly with antenna and video processing circuitry intended for short range proximity measurement applications. Though designed for military use it is equally suitable for civil ranging equipment.

### SPECIFICATION

TRANSMITTER	RECEIVER
R.F. Frequency : 4 to 8 GHz	RX Sensitivity : -100dBm
R.F. Bandwidth : ±100MHz	RX Noise Figure : 5dB max.
TX Output Power : -30 to +30dBm	Video Bandwidth : 1 KHz to 25MHz
TX On/Off Ratio : 100dB min.	Video AGC : 30dB
R.F. AGC : 40dB	D.C. Voltage : +15v at 450mA max. -15V at 200mA max.
R.F. Tuning Range : ±40dB	

Alternative frequency ranges, receiver protection and enhanced BITE facilities are available as options.

## BLOCK DIAGRAM



## MECHANICAL CHARACTERISTICS

R.F. Connectors	:	TNC or SMA
Control & D.C. Connectors	:	D-Type
Size	:	320 x 120 x 25mm (Excluding Connectors)
Weight	:	1500g

## ENVIRONMENTAL CONDITIONS

Operating Temperature Range	:	-40°C to +70°C
Storage Temperature Range	:	-54°C to +100°C

Designed to meet the environmental test requirements of MIL-STD-810C or similar standards related to military and airborne applications.

All specifications are typical and subject to change without notice

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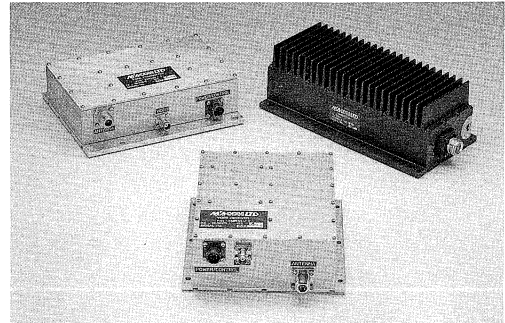
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## PORTABLE MICROWAVE VIDEO LINKS 1.2 TO 2.5 GHz

### FEATURES

- ◆ Colour or Monochrome Versions
- ◆ Fixed and Mobile Applications
- ◆ Switched Selection of Operating Frequencies
- ◆ Audio or Data Sub-Carrier
- ◆ 12 Volt Operation
- ◆ Optional Scrambler
- ◆ Range up to 10 km
- ◆ Fully Ruggedised & Weatherproof
- ◆ Simple & Quick to Deploy



### DESCRIPTION

M/A-COM Ltd's FM Video Remoting Links are designed for the transmission of high resolution video pictures over long, obscured, or non line of sight paths. Colour video signals meet CCIR 625 line PAL, SECAM and NTSC standards. These compact low cost systems find applications for surveillance, security monitoring, remote handling and operator training in built up areas where conventional wireless video links are unable to operate.

Transmitter and receiver units operate from 12 volts D.C. and interface directly with, respectively, the camera and T.V. monitor. Synthesised channel control allows the user to select the operating frequency and several links can therefore be used in the same area without mutual interference.

Options available include colour or monochrome; chrominance correction, to reduce colour 'flashing' in mobile applications; signal compression, to allow colour pictures to be transmitted over monochrome bandwidths; signal scrambling; and audio or data sub-carriers.

## SPECIFICATION

Frequency Range	: Synthesised within range 1.2 to 2.5 GHz, over 10% max bandwidth	Video Level	: 1V p-p into 75ohms
Stability	: $\pm 50$ ppm, over temperature	Spurious Output	: -70 dBC max.
Tx Deviation	: 2 MHz pk-pk mono 8 MHz pk-pk colour	Receiver Bandwidth	: 11 MHz mono 35 MHz colour
Output Power	: 0.25W, 1W or 2.5W options	12dB C/N Threshold	: -110 dBW (colour)
Video Bandwidth	: 3.0 MHz mono 5.5 MHz colour	Power Supply	: +11 to +15V D.C.
		TX Current	: 1.1A max (1W o/p)
		RX Current	: 0.85A max
		Audio/Data Bandwidth	: 8KHz, nominal

### ANTENNA OPTIONS - Linearly Polarised

	HIGH GAIN	OMNI-DIRECTIONAL
Gain	12 dBi	0dBi
Bandwidth	40 MHz	40 MHz
3dB Beamwidth Horizontal/Vertical	25°/25°	360°/90°
VSWR	1.3	1.3

Circularly polarised antennas are available for mobile link applications.

### MECHANICAL CHARACTERISTICS

RF Connectors	:	N Type, 50 Ohms
Video Connectors	:	BNC, 75 Ohms
Supply & Control Line Connectors	:	6 pin pattern 105 plug, shell size 10

	TRANSMITTER	TRANSMITTER (2.5W VERSION)	RECEIVER	HIGH GAIN ANTENNA	OMNI- ANTENNA
Dimensions (mm)	205 x 140 x 56.5	260 x 122 x 86.5	175 x 150 x 66	100 x 350 dia.	250 x 15 dia.
Weight (kg)	<3	<3.5	<2	2.0	0.2

### ENVIRONMENTAL CONDITIONS

Operating Temperature Range	:	-20°C to +45°C
Storage Temperature Range	:	-40°C to +85°C
EMC	:	To meet Def Stan 59-41 Part 3

All specifications are typical and subject to change without notice

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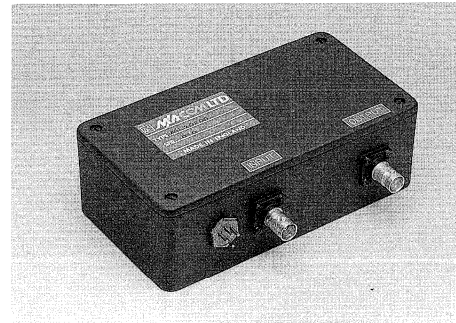
North America: 800 366 2266

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## COLOUR ADAPTOR & SECURITY SCRAMBLER

### FEATURES

- ◆ **Colour Transmission within Mono Bandwidth**
- ◆ **Coded Security Scrambling**
- ◆ **Complies with Government Specifications**
- ◆ **PAL/SECAM Compatible**
- ◆ **Chrominance Correction**
- ◆ **Portable/Field Applications**



### DESCRIPTION

ML 20800 Transmit Adaptor and ML 20801 Receiver Adaptor allow full colour security scrambled video transmission over any monochrome bandwidth video link, such as M/A-COM's ML 20000 Series. The adaptor is compatible with links operating on any RF frequency. Small size and low weight allow true portable operation for surveillance and monitoring applications.

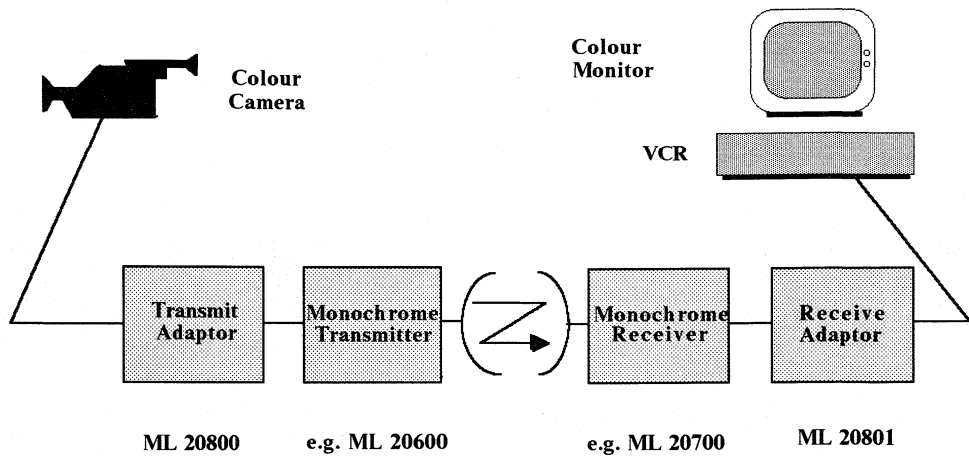
### SPECIFICATION

<b>ML 20800</b>	
VIDEO INPUT LEVEL	1V p-p $\pm 40\%$ , 75 Ohms
VIDEO OUTPUT LEVEL	1V p-p, 75 Ohms
MODULATION BANDWIDTH	3.5 MHz
POWER SUPPLY	+11 to +15V D.C. 80 mA max.

<b>ML 20801</b>	
VIDEO INPUT LEVEL	1V p-p 75 Ohms
VIDEO OUTPUT LEVEL	1V p-p 75 Ohms
CHROMINANCE CORRECTION	-18 to +8dBm
POWER SUPPLY	+11 to +15V D.C. 85 mA max.

<b>Video Standard:</b>	<b>U.K./European CCIR 625 line PAL/SECAM</b>
<b>Video Signal Noise:</b>	<b>67dB Lum. Wtd. minimum</b>
<b>Horizontal Resolution:</b>	<b>&gt;220 lines</b>



**TYPICAL APPLICATION:****MECHANICAL CHARACTERISTICS**

<b>Dimensions</b>	<b>ML 20800</b>	<b>:</b>	<b>82 x 152 x 50mm</b>
	<b>ML 20801</b>	<b>:</b>	<b>82 x 152 x 50mm</b>
<b>Weight</b>	<b>ML 20800</b>	<b>:</b>	<b>550g</b>
	<b>ML 20801</b>	<b>:</b>	<b>550g</b>
<b>Video Connectors</b>		<b>:</b>	<b>BNC Female 75 Ohm Unbalanced</b>
<b>Power Connectors</b>		<b>:</b>	<b>Amphenol 62GB</b>

**ENVIRONMENTAL CHARACTERISTICS**

<b>Operating Temperature Range</b>	<b>:</b>	<b>-10°C to +45°C</b>
<b>Storage Temperature Range</b>	<b>:</b>	<b>-40°C to +85°C</b>

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Europe: (44) 1344 869595

North America: 800 366 2266

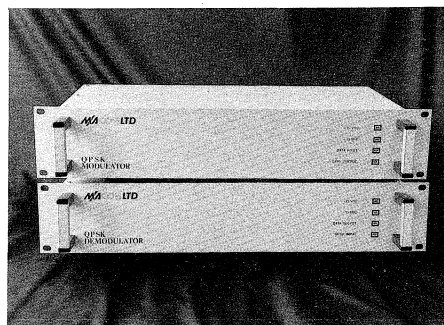
Asia Pacific: (81) 3 3226 1671

## DATA ABOVE VIDEO MODULATOR/DEMODULATOR

### 2.048 MBIT/S

### FEATURES

- ◆ **User Transparent**
- ◆ **QPSK Data Scrambled**
- ◆ **2.048 Mbps, HDB3 to CCIR G703**
- ◆ **Built-In Video/  
QPSK Carrier Diplexer**



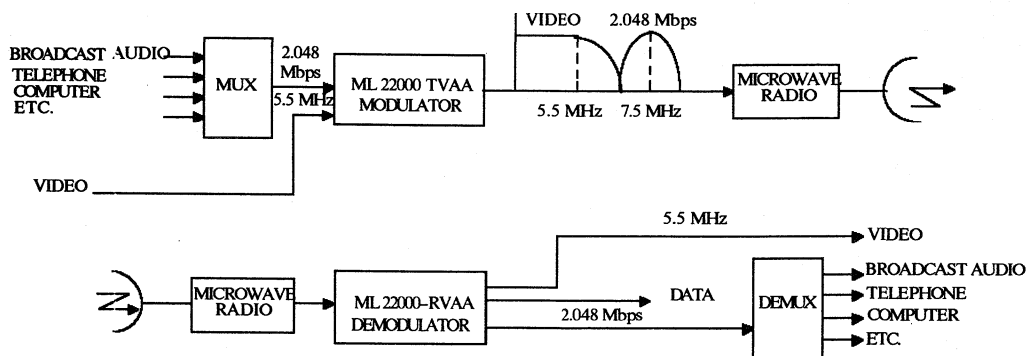
### DESCRIPTION

The ML 22000-TVAA modulator unit accepts a video signal of up to 5.5 MHz bandwidth and a 2.048 Mbps data stream on separate inputs. The digital signal is processed and used to QPSK modulate a 7.5 MHz carrier. This modulated carrier and the filtered video signal are then combined into a single output suitable for direct connection to an analogue microwave radio such as the M/A-COM Limited MLV-I Series. The ML 22000-RVAA demodulator unit separates the two signals into their original formats, making the combined modulator and demodulator transparent to the user.

### SPECIFICATION

<b>Modulator ML22000-TVAA</b>		<b>Demodulator ML22000-RVAA</b>	
DATA INPUT LEVEL	0.5V to 5V pk-pk Factory Preset	VIDEO INPUT LEVEL	1V pk-pk
VIDEO INPUT LEVEL	1V pk-pk	CARRIER INPUT LEVEL	-23dBm to 0dBm Internally Adjusted
<b>VIDEO TRANSFER CHARACTERISTICS</b>		DATA OUTPUT LEVEL	1V to 5V pk-pk Factory Preset
Amplitude Ripple	0.2dB max.	DATA OUTPUTS	Dual, Isolated
Insertion Loss	0.8dB max.	<b>VIDEO TRANSFER CHARACTERISTICS</b>	
C-L Gain Inequality	0.15dB max.	Amplitude Ripple	0.2dB max.
C-L Delay Inequality	±10nsec max.	Insertion Loss	0.8dB max.
CARRIER OUTPUT LEVEL	0.05 - 0.5V pk-pk Internally Preset	C-L Gain Inequality	0.15dB max.
Power Supply	230V, 50 Hz AC	C-L Delay Inequality	±10nsec max.
TVAA Consumption	10W	<b>QPSK SIGNAL BREAKTHROUGH</b>	
RVAA Consumption	10W		-50dBV max.

## BLOCK DIAGRAM



## ALARM INDICATORS

Regulated Supplies	:	LED
Data Presence	:	LED & Dual Changeover Relay
Carrier Presence	:	LED & Dual Changeover Relay

## MECHANICAL CHARACTERISTICS

RF Connectors	:	BNC 75 Ohm Rear Access
Total Unit Width	:	480mm (19 inch Rack Mount)
Total Unit Height	:	88mm (2U)
Total Unit Depth	:	300mm
Weight per Unit	:	6Kg

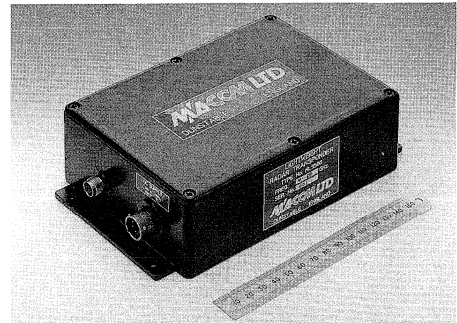
## ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range	:	-10 to +45°C
Storage Temperature Range	:	-40 to +85°C

All specifications are subject to change without notice

**LIGHTWEIGHT RADAR TRANSPONDER**
**9.2 TO 9.4 GHz**
**FEATURES**

- ◆ **Compact/Lightweight**
- ◆ **Rugged & Waterproof**
- ◆ **12/24V Operation**
- ◆ **Simple Installation**
- ◆ **25 Km Radius**
- ◆ **Operates With Any I-Band Radar**
- ◆ **Built-In Pre-Operational Test**


**DESCRIPTION**

Designed to enhance primary radar echoes for targets with small radar cross sections, ML 3500 transponders find application in UAVs, Approach Aids, Fast Patrol Boats, Buoys, Platforms and Towed Targets.

**SPECIFICATION**

Receive Frequency	: 9.0 to 9.6 GHz	Transmit Power	: 5W nom. (peak)
Receive Sensitivity	: -43 dBm min.	Frequency Stability	: ±5 MHz
Input Power	: 1kW peak (1us 1000:1)	Pulse Width	: 0.2 to 1.0us (Factory Set)
Interrogate Pulse Width	: 0.15 to 1.5 us	Duty Cycle	: 1% max.
Transmit Frequency	: 9.2 to 9.4 GHz (Factory Set)	Power Supply	: +12/+24V d.c. 10W

## MECHANICAL CHARACTERISTICS

<b>RF Connector</b>	:	<b>TNC Female</b>
<b>DC Connector</b>	:	<b>Amphenol 62GB</b>
<b>Size</b>	:	<b>120 x 170 x 55mm (Excluding connectors)</b>
<b>Weight</b>	:	<b>500g</b>

## ENVIRONMENTAL CHARACTERISTICS

<b>Operating Temperature Range</b>	:	<b>-20° to +50°C</b>
<b>Storage Temperature Range</b>	:	<b>-40°C to +85°C</b>

## OPERATION

The Transponder is designed for simple installation and operation, requiring connection only to a d.c. supply and a suitable antenna.

When used with radars with tuneable receivers or dedicated beacon channels, the Transponder transmit frequency can be selected to be offset from the radar frequency, allowing unwanted clutter to be removed.

The ML 3500 incorporates a built-in pre-launch operational test facility. When illuminated by the interrogating radar prior to launch the transponder produces a delayed response pulse providing a simulated response at approximately 8 Km range.

**All specifications are typical and subject to change without notice**

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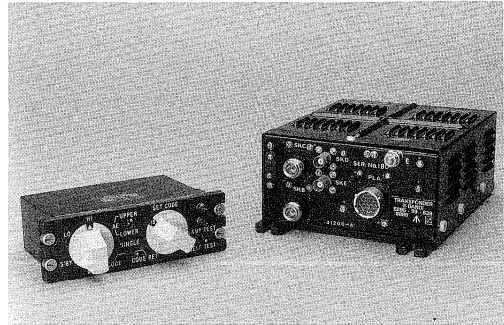
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**CODED RESPONSE TRANSPONDER**
**9310 MHz**
**FEATURES**

- ◆ **Twin Output/Omni Directional**
- ◆ **Full Self Test**
- ◆ **Cockpit Control Unit**
- ◆ **Easy Installation**
- ◆ **Full NATO Codification**
- ◆ **Support Test Equipment Available**


**DESCRIPTION**

Designed to operate with navigational radars, D 41200-A provides reliable tracking well beyond normal radar range and features a pilot selectable coded response facility.

**SPECIFICATION**

<b>TRANSPONDER (D41200-A)</b>			
Receive Frequency	: 9190 to 9290 MHz	Transmit Frequency	: 9310 MHz $\pm$ 7 MHz
	9360 to 9460 MHz	Transmit Power	: 135 to 300 W peak
Receive Sensitivity	: -93 dBW	Pulse Width	: 0.45 us
		Power Supply	: 28V d.c., 40W
<b>COCKPIT CONTROL UNIT (C41260-A)</b>			
High/Low Power Select		Code Select	
Antenna Select		Self Test	

## MECHANICAL CHARACTERISTICS

R.F. Connectors	:	N-Type
Suppression Connectors	:	BNC
DC/Control Connectors	:	6020
Size		
Transponder	:	217 x 160 x 82mm
Control Unit	:	147 x 117 x 48mm
Weight		
Transponder	:	2.7Kg
Control Unit	:	450g

## ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range	:	-40°C to +70°C
Storage Temperature Range	:	-40°C to +90°C

## APPLICATIONS

Close Range - Precision Approach/Control

Long Range - Navigation and Control

Search and Rescue

Individual Identification of Craft

Enhanced Radar Trace/Position Reporting

Oil Rig Identification/Navigation

Coastal Navigation and Surveillance

Air-to-Air Identification/Surveillance

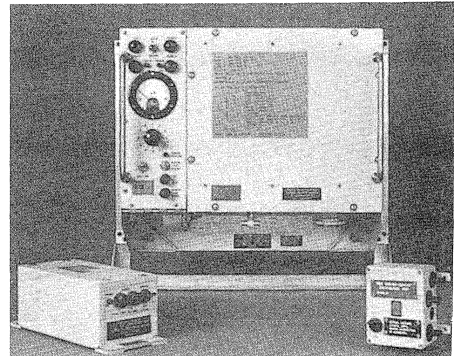
Marine Navigation/Beacon Systems

All specifications are typical and subject to change without notice



**OUT OF BAND TRANSPONDER REPLY RECEIVER**
**9310 MHz**
**FEATURES**

- ◆ Simple Radar Interface
- ◆ Easy Installation & Operation
- ◆ Six Outputs for Multi Display Systems
- ◆ User Selectable Coded/ Uncoded Operation
- ◆ Full NATO Codification


**DESCRIPTION**

D 40100-A interfaces with most I Band navigational radars providing reliable tracking outside normal radar range of platforms fitted with I Band Transponder type D 41200-A. Video code suppression is provided by the VCSU.

**SPECIFICATION**

<b>REPLY RECEIVER (D40100-A)</b>			
Rx Frequency	: 9310 MHz	Prepulse Amplitude	: +7 to +22V
Sensitivity	: -65 dBm, pulses	Prepulse Width	: 0.1 to 4 us
Noise Figure	: 10 dB	Power Supply	: 115V a.c. 115VA
Output Threshold	: +0.5V	Heater	: 115V a.c. 30VA
<b>VIDEO CODE SUPPRESSION UNIT (D41049-A)</b>			
Pulse Input Amplitude	: +0.5 to +10V	Pulse Output (uncoded)	: +5 to +7V
Pulse Input Width	: 0.2 to 2us	Power Supply	: 115V 5VA

## MECHANICAL CHARACTERISTICS

<b>R.F. Connector</b>	:	Waveguide 16
<b>Video Connectors</b>	:	BNC Triaxial
<b>Other Connectors</b>	:	PT-Type
<b>Size</b>		
<b>Reply Receiver</b>	:	405 x 200 x 455mm
<b>VCSU</b>	:	100 x 115 x 260mm
<b>Weight</b>		
<b>Reply Receiver</b>	:	15.5Kg
<b>VCSU</b>	:	3.5Kg

## ENVIRONMENTAL CHARACTERISTICS

<b>Operating Temperature Range</b>	:	0°C to +45°C
<b>Storage Temperature Range</b>	:	-20°C to +70°C

## APPLICATIONS

Close Range - Precision Approach/Control

Long Range - Navigation and Control

Search and Rescue

Individual Identification of Craft

Enhanced Radar Track/Position Reporting

Coastal Navigation and Surveillance

Marine Navigation/Beacon Systems

All specifications are typical and subject to change without notice

## I-BAND TRANSPONDER VERIFIER

### FEATURES

- ◆ **Low Cost**
- ◆ **Hand Held**
- ◆ **Self Contained and Simple to Use**
- ◆ **Battery Powered**
- ◆ **Checks Transponder Sensitivity, Output Power, Frequency and Coding Radiated From Aerial**
- ◆ **LED Pass/Fail Indication**
- ◆ **Compatible with Most I-Band Transponder Installations**
- ◆ **Designed and Built by M/A-COM Limited, the Manufacturer of the ARI 5983 I-Band Transponder in Service Throughout The World**

### DESCRIPTION

M/A-COM Ltd's Transponder Verifier is a simple, hand held device that allows dynamic checking of installed I-band transponder systems to be undertaken without the need to disconnect any cables. The Unit gives simple LED go/no go indications that the transponder's sensitivity, output power, frequency and coding are broadly correct, as a confidence check of simple systems or as a supplement to more complex systems' BITE.

## SPECIFICATION

Output Frequency	Factory set in range 9.0 to 9.6 GHz
Output Frequency Stability	±2 MHz over operating temperature
Output Pulse Parameters	Factory set to be compatible with transponder being checked
Output Power	+20dBm ERP minimum, via in-built aerial
Output Power Attenuation	40dB, settable via operator control
Input Frequency	Factory set in range 9.0 to 9.6 GHz
Input Dynamic Range	Compatible with transponder output powers from 5 to 300 Watts Will not be damaged by 1 kW 1µS pulses
Input Pulse Coding	Display presence and sequence of up to 6 pulses
Temperature Range	-20 to +40°C
Power Supply	Internal batteries
Weight	Approximately 4kg, including batteries
Size	Approximately 250 x 125 x 110 mm, including aerial

## OPERATION

The Transponder Verifier transmits a stream of interrogating pulses of controllable amplitude at the transponder aerial from a specified position. The transponder response is filtered to check that it is broadly of the right frequency, and its detected amplitude is compared with that derived from an operator-set threshold-level control. The operator varies this control until an LED indicator is extinguished. The position of the control then indicates the power transmitted by the transponder, whilst failure of the LED initially to illuminate indicates that the transponder's output is either of very low power or off frequency. By reducing the amplitude of the interrogating pulses until the LED is again extinguished, the operator can use the Verifier to give an indication of the transponder's receiver sensitivity. A group of other LEDs shows the pulse coding .

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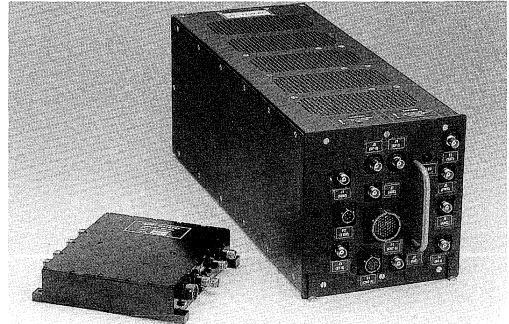
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## SOLID STATE INTERROGATOR AND ANTENNA COMPARATOR 1030/1090 MHz

### FEATURES

- ◆ **Whisper/Shout Facility**
- ◆ **Range and Bearing Outputs**
- ◆ **Low Power Consumption**
- ◆ **Sensitivity Time Control**
- ◆ **High Speed Receiver Blanking**
- ◆ **Self Check Calibration**
- ◆ **Full BITE**
- ◆ **Self Contained Antenna Comparator**



### DESCRIPTION

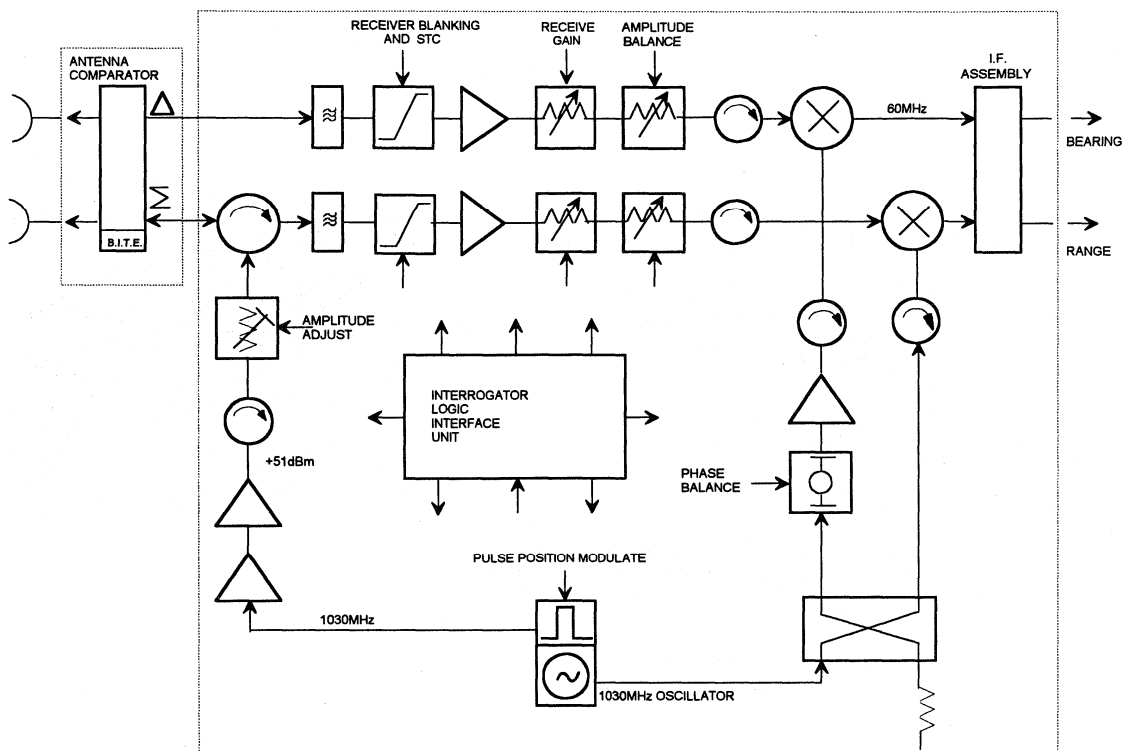
The ML 3700 SSR Interrogator/Comparator is designed to meet the requirements of ICAO Annex 10 and consists of an all solid-state Interrogator Unit (I.U.) and Antenna Comparator Unit (A.C.U.) which interface with the signal processor and antennas respectively. The I.U. incorporates a variable power interrogator transmitter and a dual channel monopulse receiver providing range and angle of arrival information from transponder replies.

The transmitter operates in Mode 3/A or Mode C, transmitting position coded pulses with amplitude control for whisper/shout operation. Full BITE is provided allowing self check receiver calibration via the antennas and the A.C.U.

High speed active and passive blanking protects the receiver against host transmitters and externally generated high power signals. Sensitivity Time Control allows for variation in signal strength and integral phase and gain balance provides self calibration.

The interrogator incorporates a logic interface unit which allows full control of both transmitter and receiver via a parallel data interface with the signal processor.

## BLOCK DIAGRAM



## SPECIFICATION

<u>RECEIVER</u>		<u>TRANSMITTER</u>	
Frequency	: 1090 MHz $\pm$ 5 MHz	Frequency	: 1030 MHz $\pm$ 0.1 MHz
Sensitivity	: -75dBm	Output Power Range	: 21dBW to 0dBW
Dynamic Range	: -15 to -70dBm	Amplitude Suppression	: 48dB
Rejection	: $\pm$ 12 MHz >-15dB $\pm$ 25 MHz >-50dB	Power Adjust Step Size	: 3dB
Blanking	: 50dB	Pulse Width	: 0.8 $\mu$ S
Blanking Speed	: 20nS	Rise Time	: 0.05 to 0.1 $\mu$ S
S.T.C. Range	: 28dB	Fall Time	: 0.05 to 0.2 $\mu$ S
Phase Adjustment	: 348°	Spacing	: Mode 3/-A 8 $\mu$ S Mode -C 21 $\mu$ S
Gain Adjustment	: 3.5dB in each channel	Interrogation Rate	: 250Hz max.
Power Supply	: 115V 400Hz	Power Supply	: 115V 400Hz

## MECHANICAL CHARACTERISTICS

<u>A.C.U.</u>		<u>INTERROGATOR</u>	
Size	: 45 x 185 x 155mm	Size	: ¾ ATR Long Enclosure
Weight	: 1.75Kg	Weight	: 20Kg

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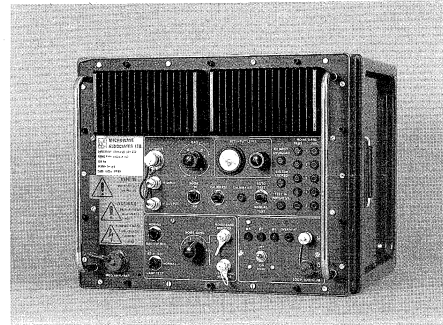
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## FEATURES

- ◆ Can be supplied to user requirements within the frequency bands B through to K
- ◆ FM and AM noise measurements
- ◆ Automatic self calibration
- ◆ CW and interrupted CW operation
- ◆ Automatic pass/fail indication
- ◆ Easy to use, accurate and consistent measurements



## DESCRIPTION

The ruggedised noise measurement equipment provides a facility for quick, simple and accurate measurement of phase and amplitude noise in R.F. systems. It can be used in the field to verify the performance of RF Systems by giving simple Pass/Fail indications. The RNME provides a measurement capability of up to 30 radar or RF channels, giving individual pass/fail indications for each of 5 sub divisions within the noise band.

## SPECIFICATION

Input Signal Frequency	: Factory set in range 70MHz to 40GHz
Bandwidth	: 10%
Measurement Channels	: 10 Channels Standard 30 Channels Options
Capture Range	: $\pm 1$ MHz
Input Power Level	: 0dBm to +23dBm
R.F. Connector	: 50 $\Omega$ N Type (Female)
Measurement Accuracy	: $\pm 2$ dB integrated noise within each of 5 preset noise measurement bands. (Up to 16 preset bands can be supplied as an option)
Suitable Baseband Analysers	: Marconi Instruments 2382, H.P. 3582, HP 3561
Weight	: 33Kg (max.)
Size	: Width 442mm Depth 469mm Height 354mm Suitable for 19" rack mounting
Temperature Range	: -10°C to +44°C
EMC	: To meet BS 3G 100, MIL STD -461
G.P.I.B.	: Optional, IEEE 488

Built in monitoring facilities with indications showing test in progress, system in lock, self test, and lamp test.

A baseband frequency demodulated output of the R.F. input signal is also provided.

**All specifications are subject to change without notice**

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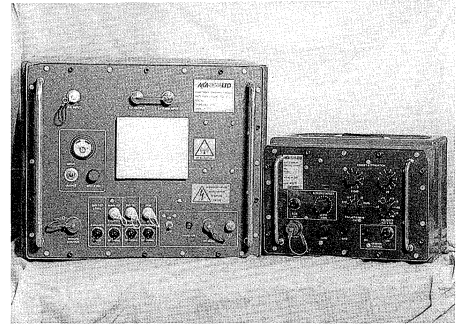
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## FEATURES

- ◆ **Ruggedised and Simple to Use**
- ◆ **Remote Control Operation**
- ◆ **No Synchronization Problems**
- ◆ **Compatible with All Modulations**
- ◆ **Selectable Dual Targets**
- ◆ **In Service with the Royal Air Force**



## DESCRIPTION

M/A-COM LTD's Target Generator, designed to operate in the harsh environment of first-line aircraft maintenance, allows dynamic testing of radar and similar systems by producing targets selectable in range, velocity and amplitude against an independently variable noise background. The unit is operated from the Remote Control Unit allowing the system under test to be exercised whilst its displays are monitored.

## SPECIFICATION

### Input Reference

Centre Frequency : I Band  
 Instantaneous Signal Bandwidth : >6MHz  
 Power Level : +23dBm peak  
 Modulation : ICW, Pulse, PC, CW  
 Connector : 50 $\Omega$  N Type

**Power Supply** : 115V, 400Hz, Single Phase

### Target Output Signals

Power (from in-built antenna) : -9dBm, peak ERP  
 Attenuation : 99dB in 1dB steps  
 Selected Target Ranges : 0.5, 7 or 20 nautical miles  
 Target Velocities : -600 to +3000 knots in calibrated 400 kts steps  
 Dual Targets : Fixed ranges with independently selectable velocities and amplitudes

### Noise Output

Centre Frequency : As reference input  
 Spectrum : Continuous white noise  
 Power (ERP) : -82dBm/Hz  
 Attenuation : 40dB in 2dB steps

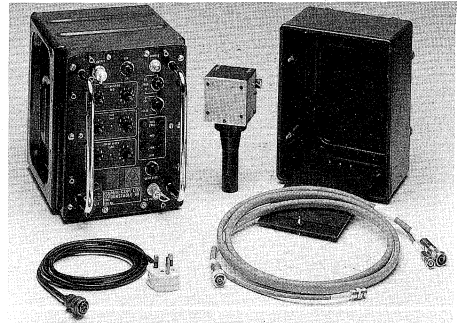
### Remote Control Link

RS 485 Serial

**All specifications are subject to change without notice**

## FEATURES

- ◆ Hand Portable
- ◆ Ruggedised
- ◆ CW or Pulsed Output
- ◆ Variable Output Power
- ◆ Extendable Antenna Arm



## DESCRIPTION

This portable E.W. Test Set simulates R.F. emitters allowing simple, fast assessment of E.W. system functional status without the need for connection to the equipment under test. Modulation, frequency and power levels are set on the front panel and the test set antenna is then placed in front of the E.W. receiver antenna, allowing several tests, including receiver sensitivity, to be performed.

An extendable antenna arm is provided to facilitate access to the receiver antenna.

## SPECIFICATION

Nominal Output Frequency	: Hi Band	8.000GHz
	: Lo Band	2.00GHz
Modulation	: Pulsed or CW	
Pulse Modulation	: PRI Range	100µs to 9900µs
	: Resolution	100s
	: Pulse Width	0.1µs to 9.9µs
	: Resolution	0.1µs
Output Power	: >12dBm (at zero attenuation setting)	
Output Attenuation	: Dynamic Range	0 - 70dB
	: Resolution	1dB
Battery	: Type	NiCd
	: Capacity	5 Hrs continuous use
	: Charging Voltage	110-250V, 50-400Hz
Environmental Conditions	: Designed to meet DEF STAN 66-31/1	
	: CAT IV Equipment including Temperature Range	
	: Operational	-20°C to +50°C
	: Storage	-40°C to +50°C
Weight	: <10Kg	
Case Type	: RAE ½ size with integral anti-vibration chassis	
Antenna	: Standard	Cavity backed spiral, right hand circular polarisation Left hand available to order

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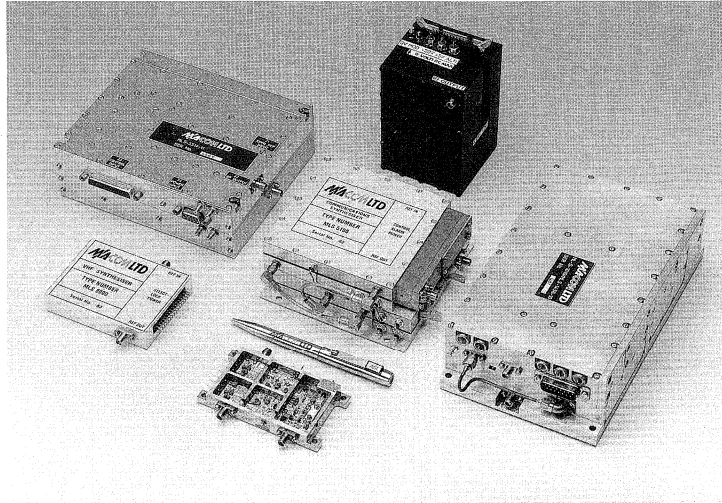
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# SYNTHESISERS AND PLOs

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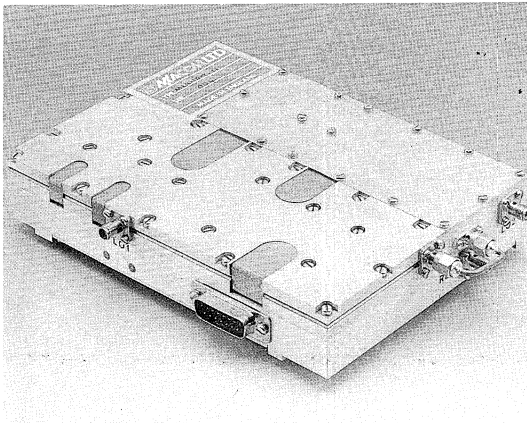
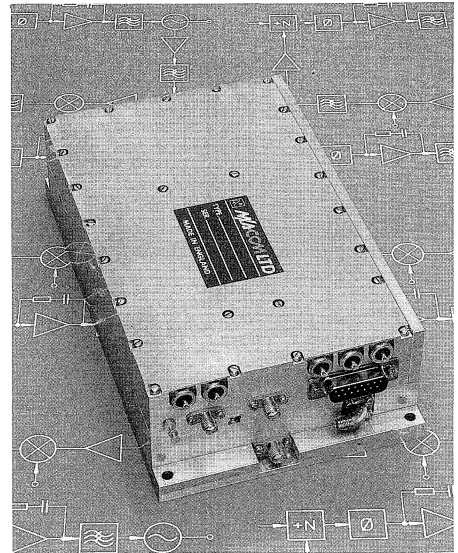
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## RADAR SYNTHESISERS

### CAPABILITY

- ◆ UHF to Millimetre Wave
- ◆ Low Phase Noise
- ◆ Small Steps
- ◆ Fast Switching
- ◆ High Stability
- ◆ Direct Modulation
- ◆ Custom Design
- ◆ Systems Understanding
- ◆ Special-to-Type Test Equipment



### TECHNIQUES

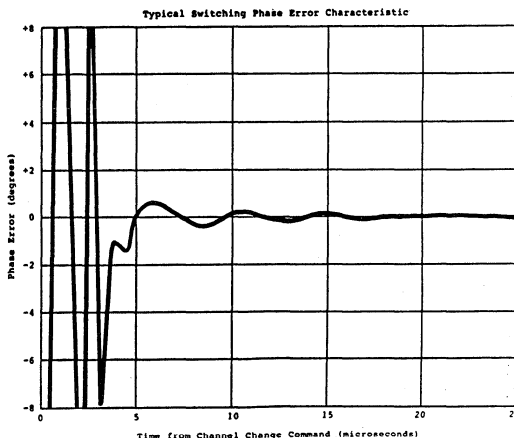
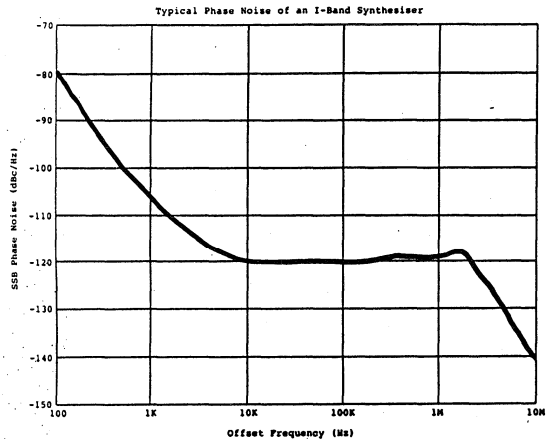
- ◆ Indirect
- ◆ Multiloop
- ◆ Phase Locked Direct
- ◆ Sampling
- ◆ Direct Digital
- ◆ Anti Vibration
- ◆ Temperature Stabilization
- ◆ Hybrid Assembly
- ◆ Nuclear Hardening

Radar synthesisers are almost invariably custom designs for performance or environmental reasons. After 20 years of close liaison with its customers, M./A-COM Ltd has the experience to employ the most appropriate synthesiser design and integration techniques to satisfy stringent system requirements in a cost-effective way.

Beyond the design stage, M./A-COM Ltd's strength lies in its depth of production capability which has helped to make it a world leader in the design, development and timely supply of reliable radar synthesisers for sea, land and air systems.

## ACHIEVEMENTS

- ◆ **-120dBc/Hz Phase Noise at 10KHz Offset at I Band**
- ◆ **1Hz Steps with -70dBc Spurious**
- ◆ **Missile Control Radar Synthesisers Qualified from -35 to +85°C**
- ◆ **Reliable Operation Under High Shock, Vibration and Radiation Levels**



- ◆ **Airborne Synthesisers with Under 5μS Switching**
- ◆ **Direct Modulation of Airborne Synthesisers**
- ◆ **Battlefield Manpack Radar Synthesiser Measuring Only 170 x 125 x 70mm**
- ◆ **Supply of First, Second and Third Line Rugged Test Equipment**

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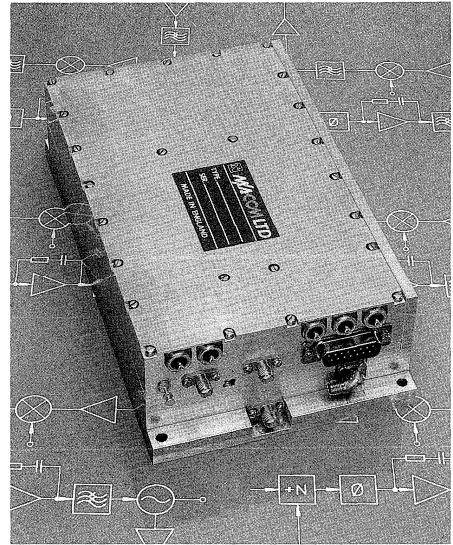
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## FAST SWITCHING LOW NOISE SYNTHESISER

### FEATURES

- ◆ Fast Switching
- ◆ Low Phase Noise and Spurious
- ◆ Small Size
- ◆ Fixed LO Outputs
- ◆ Full Military Specification



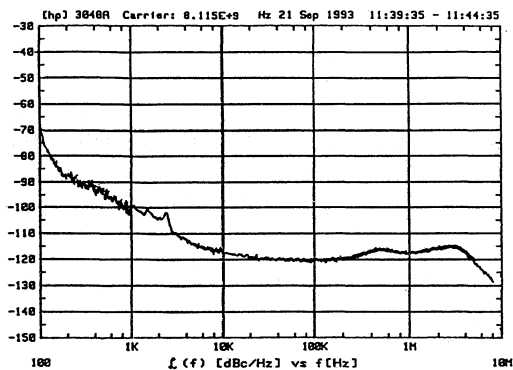
### DESCRIPTION

Designed for lightweight frequency agile radars MLS-1400 uses phase locked direct synthesis techniques to achieve fast switching ( $5\mu\text{S}$  to  $1^\circ$  phase error) in a compact outline. In addition to an agile synthesised 1st L.O. output, MLS-1400 provides two switched 2nd L.O. outputs in C band for dual down conversion.

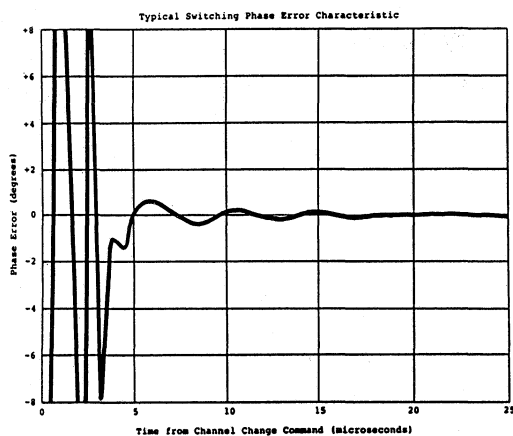
### SPECIFICATION

Output Frequency	: 6GHz to 18GHz	Spurious	: -80dBc, max.
Bandwidth	: 5% Typ.	Output Power	: +16dBm, min.
Channels	: 64, max.	Control Interface	: Binary, TTL
Switching Time	: $5\mu$ to $1^\circ$ , max.	Supplies	: +24, $\pm 15$ , +5V
Stability	: $\pm 50$ ppm	Total Power Consumption	: 30W max.
Phase Noise	: See over	C-Band Outputs	: 2, switched, +16dBm power

## PHASE NOISE



## SWITCHING TRANSIENT



## MECHANICAL

Size	:	<b>180 x 115 x 55mm</b> <b>(7 x 4.5 x 2 in., approx)</b>
Mass	:	<b>2.2kg</b>
R.F. Connectors	:	<b>SMA (F)</b>
Control Connectors	:	<b>D Type</b>
D.C. Connectors	:	<b>Solder Pins</b>

## ENVIRONMENTAL

Operating Temperature Range	:	<b>-54 to +85°C</b>
Vibration	:	<b>MIL-S-810D, or equivalent</b>

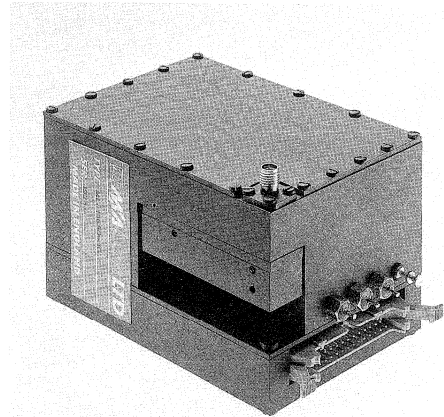
All specifications are typical and subject to change without notice

## IMPROVED PHASE NOISE SYNTHESISER

5 TO 15 GHz

### FEATURES

- ◆ Digital Frequency Selection
- ◆ Low Microphony
- ◆ Low Noise
- ◆ Low Phase Hits



### DESCRIPTION

MLS-3000 synthesisers are non-cavity, hard mountable, variable frequency crystal stabilised units featuring "Mix and Divide" technology for Digital Data, FM Communications and Radar applications where low close-to-carrier phase noise is critical.

### TYPICAL SPECIFICATION

<b>Frequency Start</b>	<b>(MHz)</b>	5060	6325	7590	8855	10120	11385	12650	
<b>Frequency End</b>	<b>(MHz)</b>	5800	7250	8700	10150	11600	13050	14500	
<b>Step Size (Min)</b>	<b>(KHz)</b>	400	500	600	700	800	900	1000	
<b>Output Power (Typ)</b>	<b>(dBm)</b>	18.0	17.5	17.0	16.0	15.0	13.0	11.0	
Tuning Range	:	500 MHz max.			Non Harmonic Spurious	:	-60 dBc max.		
Frequency Stability	:	±20 p.p.m. min.			Channel Selection	:	12Bit Parallel Input Binary		
Output Power Variation	:	±2 dB max.			Lock Failure Alarm	:	Low Impedance to Ground		
Noise Performance	:	See Over			Power Supply	:	+20V DC, 400mA		
Harmonic Spurious	:	-40 dBc max.				:	+5V DC, 50mA		

## NOISE PERFORMANCE

### Typical Noise Performance for a 10.5 GHz Synthesiser



**Integrated Phase Jitter** : **15 degrees rms**

**PAL Video Signal/Noise in  
10 KHz - 5 MHz Bandwidth** : **67dB Lum. wtd.**

**Telephony Signal/Noise at  
10 KHz Offset:** : **68 dB weighted**

## MECHANICAL CHARACTERISTICS

**Size** : **102 x 70 x 64mm**  
**RF Connectors** : **SMA**  
**D.C. Connectors** : **Solder Pin**  
**Control Connector** : **Ribbon Cable Header Socket**  
**Other Connector configurations available**

## ENVIRONMENTAL CHARACTERISTICS

**Operating Temperature Range** : **-30°C to +70°C**  
**Storage Temperature Range** : **-40°C to +85°C**

All specifications are typical and subject to change without notice

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North America: 800 366 2266

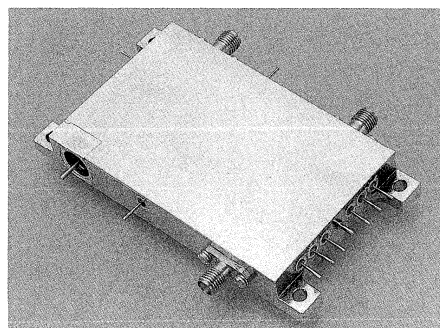
Asia Pacific: (81) 3 3226 1671

## DUAL OUTPUT SAMPLING SYNTHESISER

4 to 18 GHz

### FEATURES

- ◆ Independently Selectable Outputs
- ◆ Internal or External Reference
- ◆ Low Phase Noise
- ◆ Small Size/Low Power Consumption
- ◆ Hermetically Sealed



### DESCRIPTION

Designed for man portable applications, MLS-4000 synthesisers provide dual independent outputs to drive both transmitter and receiver in communications and radar applications.

### SPECIFICATION

Frequency Range	: 4 to 18 GHz	Output VSWR	: 1.5:1 max.
Bandwidth	: 500 MHz	External Reference	: 5, 10 or 20 MHz @ 0dBm nominal
Step Size	: 50 MHz min.	Monitor Output	: Lock Alarm
Output Power	: +10dBm nom.	Control Interface	: 2 x 3 bit binary TTL
Phase Noise SSB	: See Over	D.C. Supply Voltage	: +12 ±0.25V
Spurious Outputs	: -70dBc max.	Current Consumption	: 500mA max.

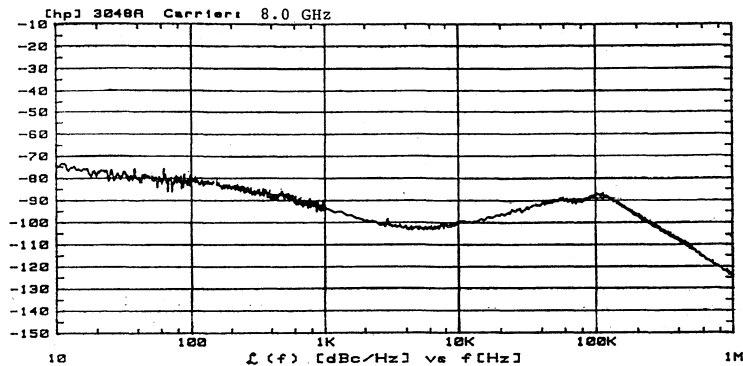
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## PHASE NOISE PERFORMANCE



The internal voltage controlled oscillator defines the phase noise performance at offset frequencies above approximately 100 Hz, irrespective of external reference performance.

## MECHANICAL CHARACTERISTICS

Size	:	80 x 50 x 10mm
Weight	:	100g max.
RF/Ref. Connectors	:	SMA Female
D.C. Connectors	:	Solder Pin
Control Connectors	:	Solder Pin

## ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range	:	-30°C to +60°C
Storage Temperature Range	:	-40°C to +85°C
Housing Seal	:	Hermetic

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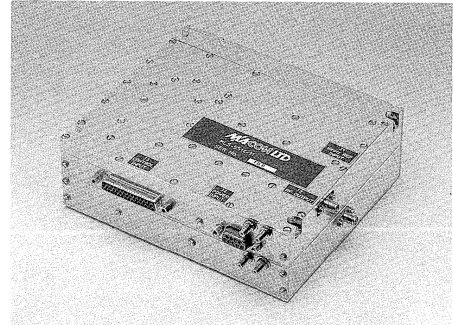
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## BROADBAND LOW NOISE SYNTHESISER

### 3 TO 18 GHz

#### FEATURES

- ◆ Bandwidth up to 1 GHz
- ◆ 1Hz Step Size Available
- ◆ Internal or External Reference
- ◆ Low Phase Noise and Spurious



#### DESCRIPTION

The low cost, general purpose MLS-5000 series synthesiser is designed to give low phase noise performance while providing up to 1 GHz bandwidth and very small step size. These devices are ideal for SATCOM ground stations, terrestrial communications and radar applications.

#### SPECIFICATION

Frequency Range	: 3 to 18 GHz	Spurious Outputs	: -70dBc max. up to 8GHz -65dBc max. above 8 GHz
Bandwidth	: 10% or 1 GHz, whichever is smaller	External Reference	: 5 or 10 MHz @ 0dBm nominal
Step Size	: 1 Hz min.	Monitor Outputs	: Power/Lock Alarm
Switching Speed	: 5ms max.	Control Interface	: RS232, Thumbwheel or Custom Design
Output Power	: +20dBm max.	D.C. Supply Voltage	: +15V, +5V
Phase Noise SSB	: See Over	Current Consumption	: 1.3A, 0.8A
Harmonics	: -20dBc max.		

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## PHASE NOISE PERFORMANCE

For designs using an external reference, the SSB phase noise will, for offsets less than approximately 20Hz from carrier, depend on the phase noise of the external reference.

**TYPICAL SSB PHASE NOISE (dBc/Hz)**  
(For 1 Hz Step Size)

Offset	At 3 GHz	At 10 GHz	At 15 GHz
200 Hz	-85	-74	-70
1 KHz	-98	-93	-90
10 KHz	-108	-106	-100
100 KHz	-110	-105	-100
1 MHz	-121	-119	-115

## MECHANICAL

RF/Ref. Connectors	:	SMA Female
D.C. Connectors	:	D-Type
Control Connectors	:	D-Type
Size (Approx.)	:	152 x 129 x 50mm
Mass (Typical)	:	1.5Kg

## ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range	:	-5°C to +75°C (baseplate)
Storage Temperature Range	:	-40°C to +85°C

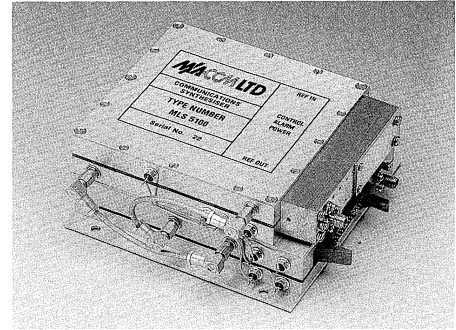
All specifications are subject to change without notice



## LOW COST SYNTHESISER

### FEATURES

- ◆ Available in S, C, X or Ku Bands
- ◆ 125kHz Step Size
- ◆ Internal or External Reference
- ◆ Complies with International Satellite Phase Noise and Spurious Masks
- ◆ Will Fit 1U High Racking



### DESCRIPTION

The MLS-5100 general purpose synthesiser is an extremely cost effective solution for VSAT, radar and microwave radio applications, providing noise and spurious performance to fit most requirements.

The units are of modular construction to give a low profile outline and can be supplied with a thumbwheel switch or remote frequency control capability.

### SPECIFICATION

Frequency Range	: S, C, X or Ku Bands. Contact the factory for your specific requirements	Spurious Outputs (at C Band)	: -70dBc to 1MHz from carrier -80dBc above 1MHz
Step Size	: 125KHz min.	External Reference	: 5 or 10MHz @0dBm nominal
Switching Time	: 200ms max.	Monitor Outputs	: Lock Alarms. TTL/CMOS compatible
Output Power	: +15dBm max.	Control Interface	: 14 BIT parallel TTL
Phase Noise SSB	: See over	D.C. Supply Voltage	: +15V, +5V
Harmonics	: -20dBc max. $\leq 3$ GHz -60dBc max. $\geq 3$ GHz	Current Consumption	: 0.7A, 0.7A

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## PHASE NOISE PERFORMANCE

SSB phase noise will depend on the external reference, where used, for offsets less than 50Hz from carrier.

### TYPICAL SSB PHASE NOISE (dBc/Hz)

Offset	At C Band	at X and Ku Bands
100Hz	-82	-76
1KHz	-98	-92
10KHz	-98	-92
100KHz	-98	-92
1MHz	-120	-114

## MECHANICAL

RF/Ref. Connectors	:	SMA Female
D.C. Control and Monitor Connections	:	26-Way IDC Connector
Size (Approx)	:	125 x 100 x 50mm (can be 125 x 200 x 25mm)
Mass (Typical)	:	1.2Kg

## ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range	:	0°C to +55°C (baseplate)
Storage Temperature Range	:	-40°C to +80°C

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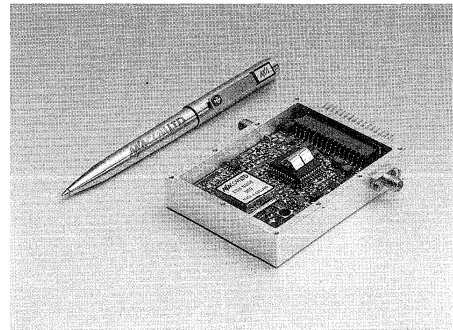
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**LOW COST HIGH PERFORMANCE**
**SYNTHESISER**
**FEATURES**

- ◆ **Low Phase Noise and Spurious**
- ◆ **10KHz Step Size**
- ◆ **Small Size**
- ◆ **Parallel Loading**
- ◆ **External Reference**


**DESCRIPTION**

This low cost, general purpose synthesiser gives excellent phase noise performance in a compact package. These devices are ideal building blocks for SATCOM ground stations, terrestrial communications, radar and system prototyping applications. They are available in a wide range of frequency bands and step sizes to match most channel plans. Please contact us to discuss your specific requirement.

**EXAMPLE SPECIFICATION**

Frequency Range	: 210 to 340MHz	External Reference	: 5, 10 or 20 MHz @ 3dBm nominal
Step Size	: 10KHz	Monitor Outputs	: Open Collector/Lock Alarm
Output Power	: +5dBm min.	Control Interface	: 8-bit Parallel TTL
Phase Noise SSB	: See Over	D.C. Supply Voltage	: +15V, +5V, -5V
Harmonics	: -20dBc max.	Current Consumption	: 0.13A, 0.4A, 0.01A
Spurious Outputs	: -70dBc max.		

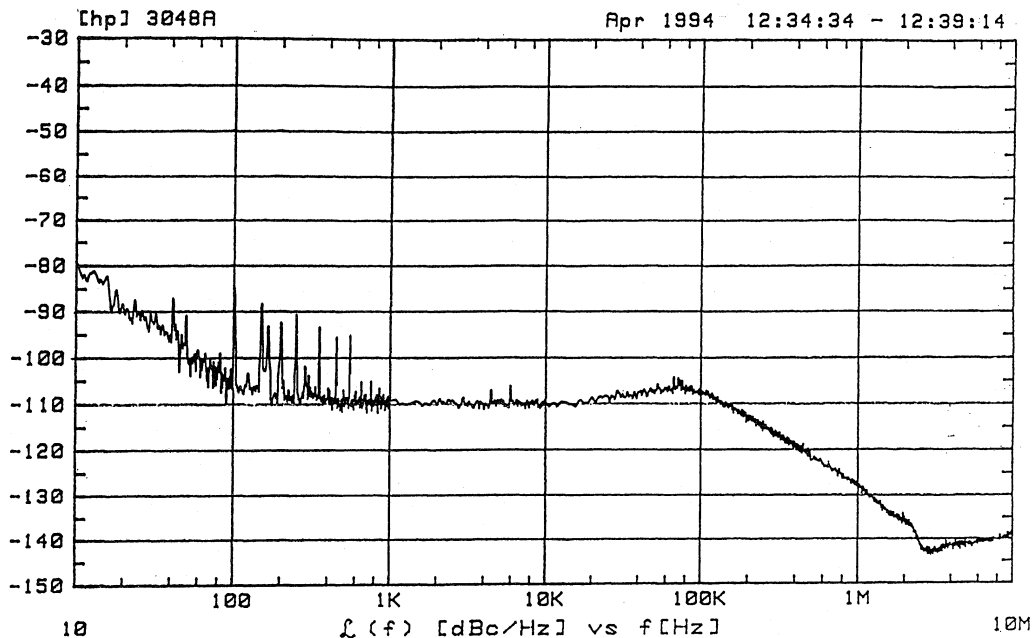
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## NOISE PERFORMANCE AT 308 MHz



## MECHANICAL CHARACTERISTICS

<b>RF/Ref. Connectors</b>	:	<b>SMA Female</b>
<b>D.C. and Control Connector</b>	:	<b>16 + 16 Way Socket</b>
<b>Size (Approx.)</b>	:	<b>80 x 60 x 20mm</b>
<b>Mass (Typical)</b>	:	<b>170g</b>

## ENVIRONMENTAL CHARACTERISTICS

<b>Operating Temperature Range</b>	:	<b>-10 to +70°C (baseplate)</b>
<b>Storage Temperature Range</b>	:	<b>-40 to +85°C</b>

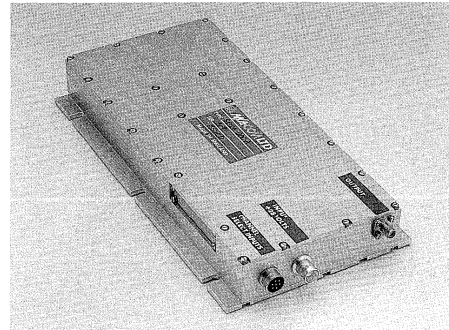
Specifications are subject to change without notice

## PHASE LOCKED MULTI CHANNEL SOURCES

1-18 GHz

### FEATURES

- ◆ Low Phase Noise
- ◆ Low Phase Hits
- ◆ Low Spurious
- ◆ Low Microphony
- ◆ Slimline Package



### DESCRIPTION

MLO-16000 series sources provide up to 10 customer selectable frequencies over a 4% bandwidth. A phase-locked oscillator referenced to switched crystals is followed by a multiplier/filter chain to derive the required output frequency. These rugged non-cavity phase-locked sources are suitable for all multi-channel radar and digital data or FM communications applications, particularly where the frequency plan demands uneven channel spacing.

### SPECIFICATION

Output Frequency	: Up to 10 discrete frequencies in any 4% Bandwidth	Phase Noise (SSB)	: See overleaf
Output Power (min.) (Suppressed during channel change)	: +17.5dBm	Harmonic Outputs	: -20dBc max.
Frequency Stability	: ±30 p.p.m. max.	Spurious Outputs	: -90dBc max.
		Switching Speed	: 30ms typical
		Power Supply	: +28V, 400mA max.

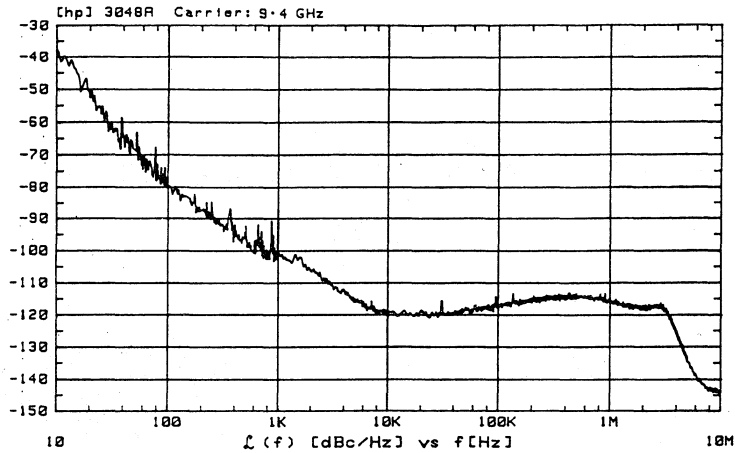
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### TYPICAL SSB PHASE NOISE



### MECHANICAL CHARACTERISTICS

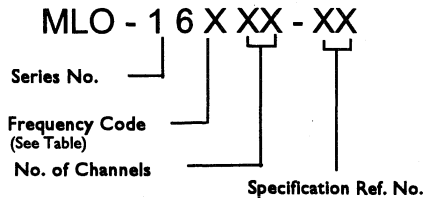
- R.F. Out Connector : SMA (F)
- D.C. Supplies/Controls : D-Type, or optional specials
- Size : 230 x 100 x 35mm typical  
excluding connectors and fixings

### ENVIRONMENTAL CHARACTERISTICS

- Operating Temperature Range : -40°C to +70°C
- Storage Temperature : -55°C to +85°C

Designed to meet the environmental test requirements of MIL-STD-810D or similar standards related to military and airborne applications.

### Ordering Information



Frequency Range	Code Number
1 - 2	1
2 - 4	2
4 - 8	3
8 - 12	4
12 - 18	5

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**REPLACEABLE CRYSTAL PHASE LOCKED OSCILLATOR**

**1 TO 17 GHz**

**FEATURES**

- ◆ **High Power**
- ◆ **Field Replaceable Crystal**
- ◆ **High Stability**
- ◆ **Low Phase Hits**
- ◆ **Low Noise**
- ◆ **Low Spurious**



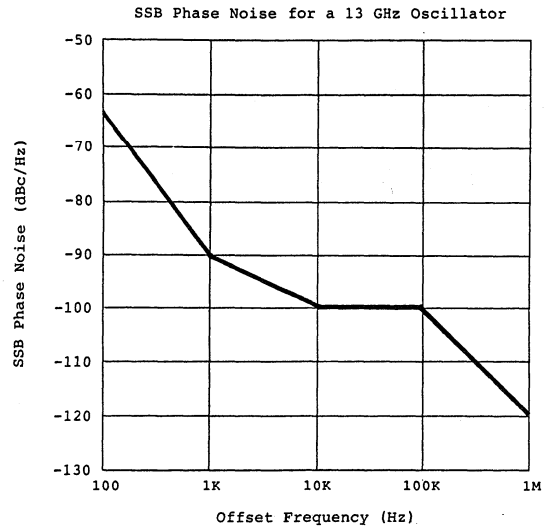
**DESCRIPTION**

MLO-27200 Series non-cavity phase locked oscillators are designed for use in Radar and Digital/F.M. communications systems. Field replaceable crystals, coupled with a wide range of output multipliers, result in extremely flexible frequency coverage.

**SPECIFICATION**

Output Frequency	: 1 to 17 GHz	Harmonic Spurious	: -40dBc
Discrete Freq. Range	: 500 MHz each Xtal	Non-Harmonic Spurious	: -70dBc
Output Power	: +18dBm at 6 GHz +14dBm at 13 GHz +10dBm at 17 GHz	Phase Noise	: See Over
Frequency Stability	: ±20 ppm	Power Supply	: +15V D.C. 300mA max.

## PHASE NOISE PERFORMANCE



## MECHANICAL CHARACTERISTICS

Size	:	140 x 92 x 25mm
Output Connectors	:	SMA Female
D.C. Supplies	:	Solder Pin

## ENVIRONMENTAL CONDITIONS

Operating Temperature Range	:	-40°C to +70°C
Storage Temperature Range	:	-40°C to +85°C

## OPTIONS

Higher Output Powers  
 $\pm 7$  ppm Frequency Stability  
 Lock Alarm

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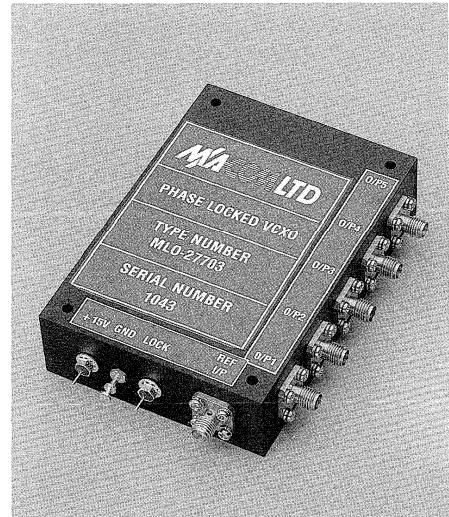
Asia Pacific: (81) 3 3226 1671



## PHASE LOCKED VOLTAGE CONTROLLED CRYSTAL OSCILLATORS

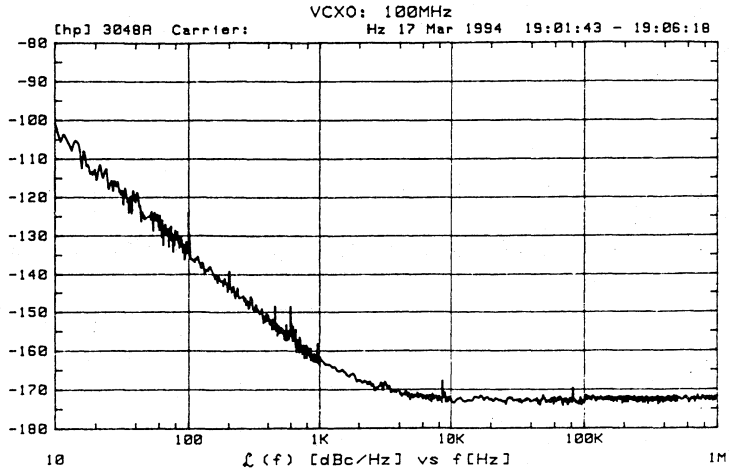
### FEATURES

- ◆ Extremely Low Phase Noise
- ◆ Low Spurious
- ◆ Multiple Outputs
- ◆ Lock Alarm



### DESCRIPTION

MLO-27703/4 is a phase-locked voltage controlled crystal oscillator (PLVCXO) that generates a low-noise, low spurious signal between 50 and 150 MHz when locked to a 5 or 10 MHz reference source. Up to 5 outputs are available, making the MLO-27703/4 an ideal interface between a station reference, such as an OCXO, and a series of PLOs or synthesisers, avoiding the requirement for each PLO or synthesiser to contain its own reference loop.



**SPECIFICATION**

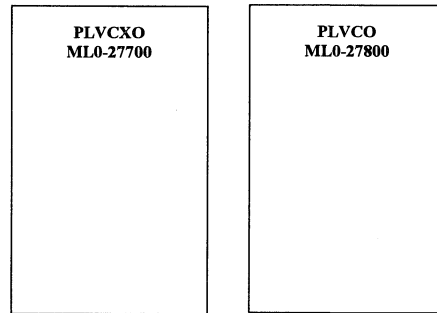
Output Frequency	Fixed, between 50 and 150MHz, and an integer of the reference input
Quantity of Outputs	Up to 5
Output Power (Single Output)	+13dBm ±1dB
Output Return Loss	14dB min.
Output Impedance	50 Ohm
Isolation Between Outputs	20dB min.
Monitor Outputs	Lock Alarm (TTL. +5V locked)
Spurious	-90dBc
Harmonics	-20dBc
Phase Noise:	See Graph
External Reference Frequency	5 or 10 MHz
External Reference Level	0 dBm ±3 dB
Power Supplies	+15V, 350mA
Dimensions	120 x 100 x 35mm
Connectors:	
R.F.	SMA (F)
L.F.	Solder Pins
Operating Temperature	-0 to +50°C

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## MINIATURE PHASE LOCKED OSCILLATOR MODULES

### FEATURES

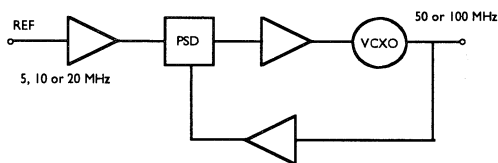
- ◆ **Miniaturised**
- ◆ **Low Phase Noise**
- ◆ **Low Power Consumption**
- ◆ **Proven Synthesiser Building Blocks**



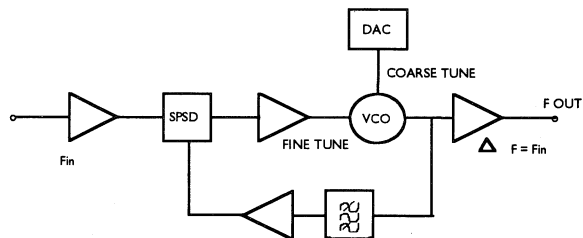
Full Size

### DESCRIPTION

MLO-27700 is a phase-locked voltage-controlled crystal oscillator (PLVCXO) that generates a 50 or 100 MHz low-noise signal of low spurious content when locked to a 5, 10 or 20 MHz reference source. MLO-27800 is a low-noise bipolar-transistor based PLO which accepts a 50 MHz or higher input and produces output steps equal in size to the input frequency across 500 MHz at C or X band.



**PLVCXO** (MLO-27700)



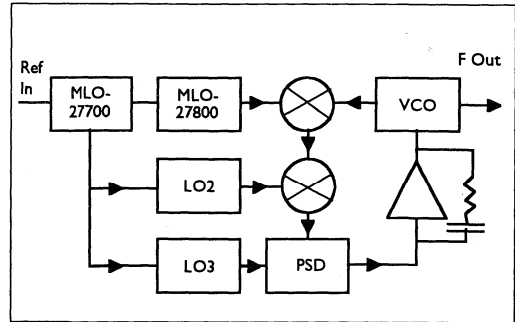
**PLVCO** (MLO-27800)

The PLVCO module contains a sampling phase-sensitive detector (SPSD) which generates a comb of the input frequency and, by phase comparison, locks the VCO to a harmonic of the input. The VCO is pre-steered by a DAC to ensure lock to the required harmonic is achieved.

Both units have a built-in regulator and are housed in hermetically sealed packages.

## APPLICATIONS

The PLVCO and PLVCO can be used as stand alone PL multipliers or fixed frequency PLOs. They can also be used together to build a miniature coarse step synthesiser, or as building blocks with other M/A-COM components in a synthesiser that gives finer steps (see right).



## SPECIFICATIONS

<u>PARAMETER</u>	<u>MLO-27700 PLVCO</u>	<u>MLO-27800 PLVCO</u>
Output Frequency	50 or 100 MHz	Any 500 MHz band from 4 to 10GHz
Output Step Size	-	50 MHz min.
Switching Time	-	30ms
Output Power	+18dBm ±2dB	+10dBm ±1dB
Output Return Loss	12dB min.	14dB min.
Output Impedance	50 Ohm	50 Ohm
Monitor Outputs	Lock Alarm	Lock Alarm
Spurious	-120dBc	-75dBc
Harmonics	-10dBc	-30dBc
Phase Noise:	@ 100 MHz	@ 8 GHz
	10 Hz -110*dBc/Hz	-65dBc/Hz
	100 Hz -125*dBc/Hz	-80dBc/Hz
	1 KHz -150*dBc/Hz	-90dBc/Hz
	10 KHz -160dBc/Hz	-100dBc/Hz
	100 KHz -160dBc/Hz	-90dBc/Hz
	1 MHz -160dBc/Hz	-125dBc/Hz
	* Depends on ext. ref. noise	
External Reference Frequency	5, 10 or 20 MHz	50 MHz min.
External Reference Level	0dBm ±3dB	0dBm ±3dB
Control Interface	-	Binary TTL
Power Supplies	+12V, 250mA	+12V, 130mA
Dimensions	50 x 30 x 12.5mm	50 x 25 x 12.5mm
Mass	50g	40g
Connectors:	R.F. Demountable SMA L.F. Solder Pins	Demountable SMA Solder Pins
Operating Temperature	-30 to +70°C	-30 to +70°C

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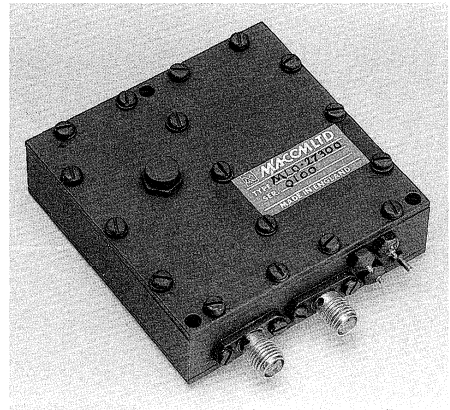
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**PHASED LOCKED DIELECTRIC RESONATOR OSCILLATOR  
2 TO 19 GHz OUTPUT**

**FEATURES**

- ◆ **Low Cost**
- ◆ **High Stability**
- ◆ **Low Phase Noise**
- ◆ **Low Phase Hits**
- ◆ **Internal or External Reference**


**DESCRIPTION**

MLO-27300 is a range of phase-locked dielectric resonator oscillators employing M/A-COM Ltd's established line of low-noise DROs. These PLDROs are designed for use in applications such as communications converters where low noise frequency generation at low cost is critical.

**SPECIFICATION**

Discrete Output Frequency	: 2 to 19 GHz	Spurious	: -70dBc
Output Power	: +10dBm	Harmonics	: -20dBc
Output Power Variation	: ±1.5dB	Phase Noise	: See Over
Load VSWR	: 1.5:1	Power Supply	: +15V 200mA
External Ref Frequency	: 100 MHz Typ.	Lock Alarm	: TTL Low Out of Lock

Higher output powers and internal reference are available as options.

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## PHASE NOISE PERFORMANCE

For designs using external reference the SSB phase noise will, for offsets less than approx. 10 KHz from carrier, depend on the phase noise of the external reference.

OFFSET	SSB PHASE NOISE (dBc/Hz)		
	at 3 GHz	at 8 GHz	at 13.5 GHz
10 KHz	-112	-104	-102
50 KHz	-123	-113	-102
100 KHz	-125	-115	-110
1 MHz	-135	-125	-125
10 MHz	-145	-135	-135

## MECHANICAL DESCRIPTION

Typical Size	:	3 GHz	:	80 x 80 x 25mm
		8 GHz and above	:	60 x 60 x 17.5mm
		(Actual size depends on output frequency)		
RF Connectors	:	SMA Female		
DC Connectors	:	Solder Pin		

## ENVIRONMENTAL CONDITIONS

Operating Temperature Range	:	-30 to +70°C
Storage Temperature Range	:	-55 to +85°C

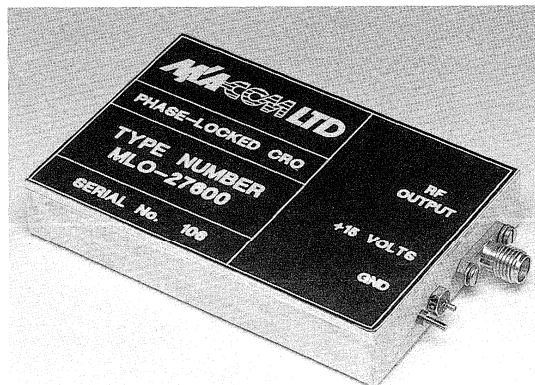
All specifications are typical and are subject to change without notice

PHASE LOCKED CERAMIC RESONATOR OSCILLATOR

0.5 TO 3.0 GHz

FEATURES

- ◆ Low Cost
- ◆ Low Noise
- ◆ Low Spurious
- ◆ High Stability
- ◆ Low Phase Hits
- ◆ Small Size



DESCRIPTION

MLO-27600 Series phase locked ceramic-resonator oscillators are designed for use as local oscillators in frequency converter systems. They supplement M/A-COM LTD's MLO-27300 microwave PLDROs below 3GHz where the size of DROs becomes impractical. As an option, the MLO-27600 may be locked to an external reference.

SPECIFICATION

Output Frequency	: Any discrete frequency in band 0.5 to 3.0 GHz	Harmonic Spurious	: -30dBc
Output Power	: +10dBm min.	Non-Harmonic Spurious	: -70dBc
Frequency Stability	: ±20 ppm or as external reference	Phase Noise	: See Over
		Power Supply	: +15V D.C. 60mA max.

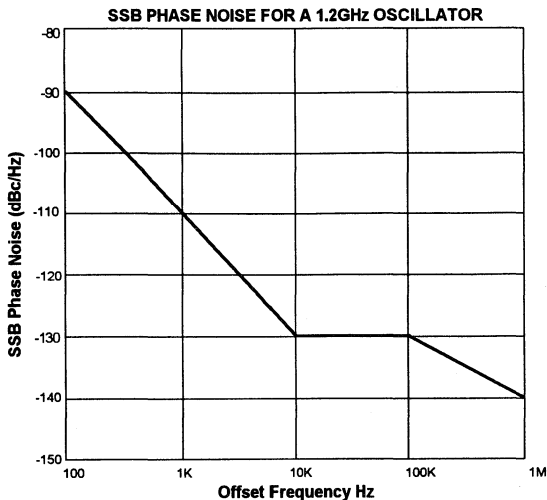
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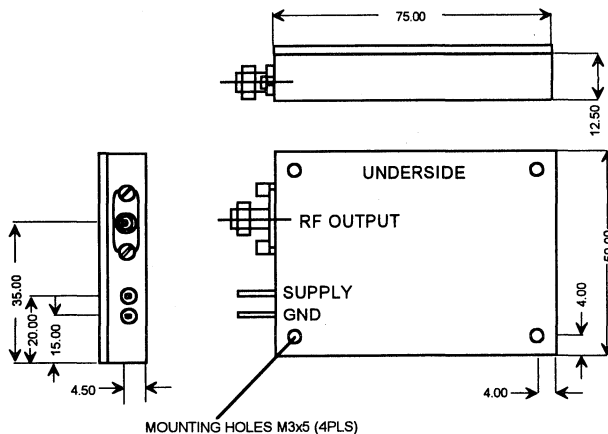
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## PHASE NOISE PERFORMANCE



## MECHANICAL CHARACTERISTICS



## ENVIRONMENTAL CONDITIONS

- Operating Temperature Range : -40°C to +70°C  
 Storage Temperature Range : -40°C to +85°C

## OPTIONS

External Reference

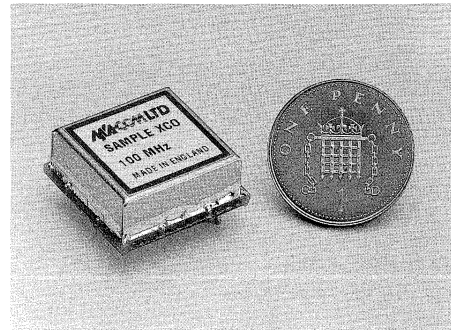
All specifications are typical and subject to change without notice



## LOW COST CRYSTAL OSCILLATORS

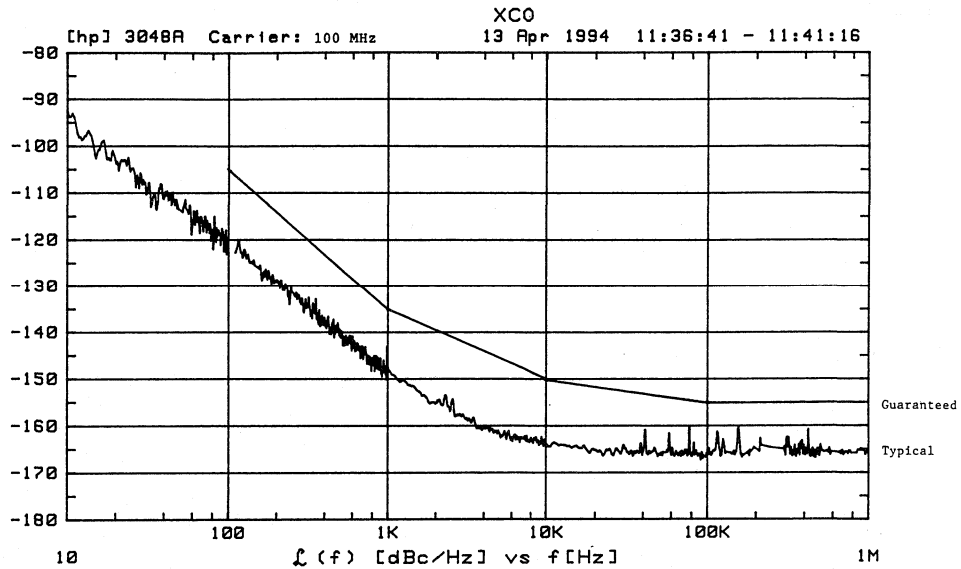
### FEATURES

- ◆ **Excellent Phase Noise**
- ◆ **40MHz to 125MHz**
- ◆ **Low Spurious**
- ◆ **Small Size**
- ◆ **Choice of Packaging**



### DESCRIPTION

The MLO-24000 Series of Crystal Oscillators make ideal references sources for telecommunications equipment or other systems requiring low phase noise frequency generation. These rugged Oscillators are available in packages for surface mounting or PCB mounting, at frequencies from 40 to 125MHz.



## SPECIFICATION

Output Frequency	Fixed, between 40 and 125MHz.
Output Power	+7dBm min.
Output Impedance	50 Ohms nom.
Stability	±50 ppm. Please consult the factory about other stabilities.
Spurious	-80dBc.
Harmonics	-20dBc.
Phase Noise	See Plot.
Power Supplies	+12V, 25mA.
Dimensions	PCB Package (Specify -P): 20.5 x 20.5 x 7mm excluding pins 3mm long (typical) by 0.6mm diameter Surface Mount Package (Specify -S): 23 x 23 x 7mm.
Operating Temperature	-30 to +70°C (case).

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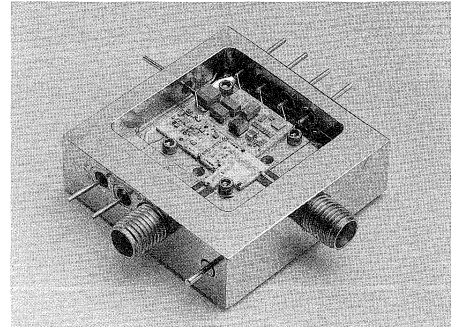
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**DIGITALLY TUNED MIC OSCILLATORS  
COVERING 3.7 TO 9.5 GHz****FEATURES**

- ◆ 500MHz Bandwidth
- ◆ Coarse and Fine Tuning
- ◆ Coupled Output
- ◆ Frequency Range to 9.5 GHz
- ◆ Military and Commercial Designs
- ◆ Hybrid MIC Construction

**DESCRIPTION**

The MLO 21000 Series Digitally Tuned Oscillators are designed for use in Frequency Synthesisers for Telecoms and Satcoms applications. It comprises a hybrid MIC Voltage Controlled Oscillator, derived from the MLO 30000 Series, a D/A Converter, and a temperature compensation circuit to minimise frequency drift. A coupled output is provided for use in a feedback loop.

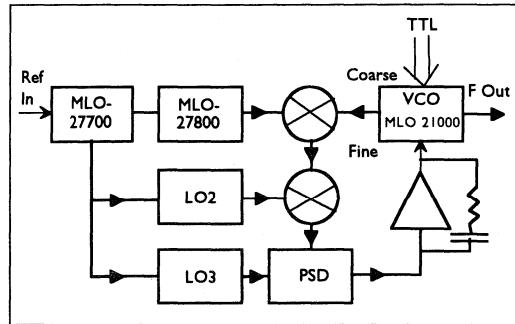
Coarse control, giving 50MHz steps, is from a 4 bit TTL signal, while fine tune control of frequency is from a tuning voltage.

**SPECIFICATION**

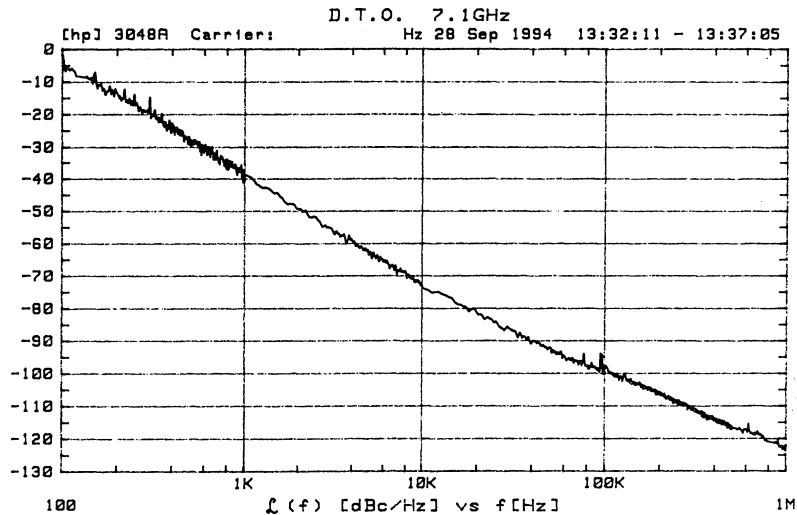
Frequency Range	:	3.7 to 9.5 GHz
Bandwidth	:	500MHz max.
Output Power	:	+10dBm $\pm$ 1dB
Coupled Output	:	0dBm $\pm$ 2dB
Coarse Frequency Control	:	4 Bit TTL
Fine Frequency Control	:	2 to 14V
Power Supply	:	+15Vdc @ 100mA max.
Pushing, +12 to +18V	:	100KHz/V max.
Fine Tuning Range	:	60MHz min.
Fine Tuning Linearity	:	2:1 typical
Phase Noise	:	See Plot
Frequency Drift with Temperature	:	$\pm$ 10 MHz from 25°C
Operating Temperature Range	:	-25 to +75°C
Storage Temperature Range	:	-40 to +85°C

### APPLICATION

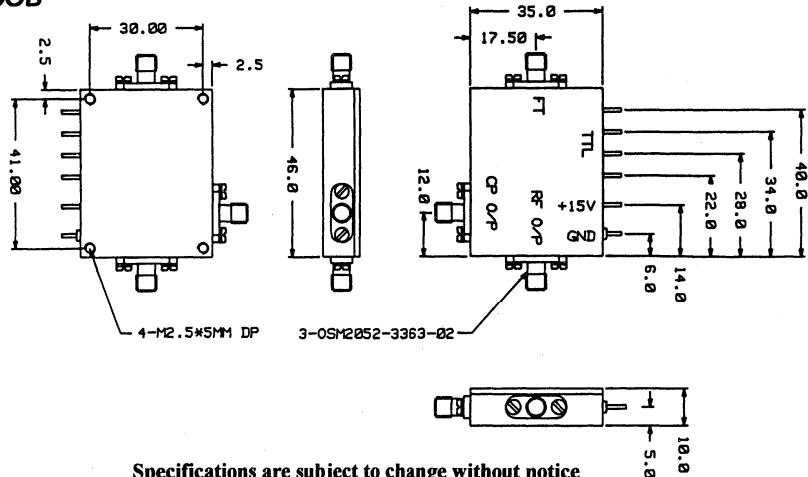
The MLO 21000 Digitally Tuned Oscillator can be used in conjunction with the MLO 27700 Phase Locked Voltage Controlled Crystal Oscillator and the MLO 27800 Phase Locked Voltage Controlled Oscillator in a frequency synthesiser as shown in the block diagram.



### TYPICAL SSB PHASE NOISE



### OUTLINE VCOB



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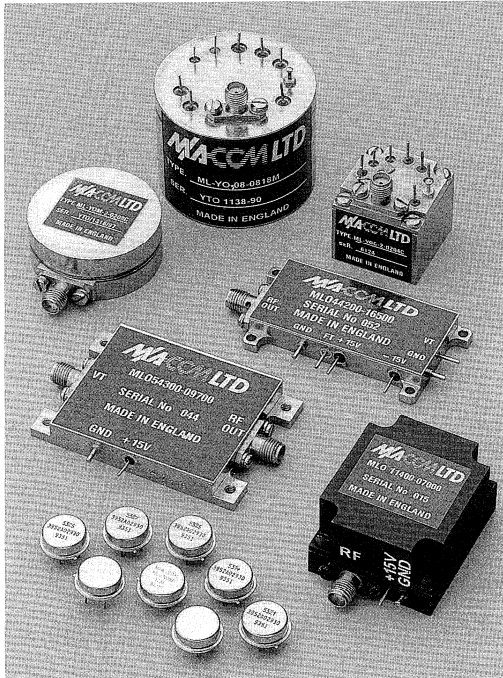


North America: 800 366 2266



Asia Pacific: (81) 3 3226 1671

# OSCILLATORS



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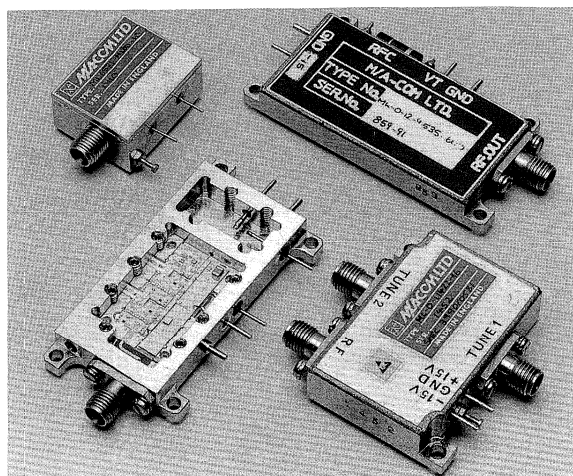
■ North America: 800 366 2266

■ Asia Pacific: (81) 3 3226 1671

**HIGH LINEARITY**  
**VOLTAGE CONTROLLED OSCILLATORS**  
**2 TO 18 GHz**

**FEATURES**

- ◆ High Tuning Linearity
- ◆ Low Phase Noise
- ◆ Fast Tuning Speeds
- ◆ High Output Powers
- ◆ High Reliability

**DESCRIPTION**

M/A-COM Ltd's range of high linearity voltage controlled oscillators (VCOs) provides excellent tuning linearity and phase noise over the moderate frequency bandwidths required for most systems applications.

These designs use a resonator stabilised silicon bipolar transistor as a negative resistance generator with a varactor diode serving as a voltage variable capacitor in a tuned circuit to vary the frequency of oscillation. This fundamental oscillator design is extended to 18 GHz with an integral frequency doubler. The MLO 30000 series uses a GaAs hyperabrupt junction varactor diode for optimum frequency tuning linearity. Careful selection of the varactor diodes, manufactured in-house by M/A-COM Ltd, produces a very large capacitance change together with a high degree of linearity which greatly simplifies the external voltage driver circuit required.

M/A-COM Ltd VCOs are constructed using discrete chip devices integrated into a conventional alumina MIC with laser welding of the finished VCO package providing a hermetic seal. This compact, rugged construction makes these VCOs suitable for the most severe environmental conditions encountered in military and hi-rel applications. The coaxial packages have removable SMA connectors, allowing the devices to be integrated directly into microstrip or stripline circuits.

VCOs have a wide variety of applications where oscillators with very fast tuning speeds over up to octave frequency bandwidths are required. VCOs give improved LO frequency tuning speed and output power flatness in radar receivers and rapid generation of jamming signals in ECM transmitters. Where an oscillator of high frequency stability is required, as in radar and communications synthesisers or frequency converters the VCO can be used in a phase-locked loop circuit. This produces a frequency stability comparable to that of the reference crystal oscillator. The phase-locked loop circuit can be designed to stabilise a single output frequency or to vary the oscillator frequency either continuously or in discrete steps as small as required.

The standard VCOs described cover a range of commonly used bandwidths with a choice of three output powers. M/A-COM Ltd also manufactures a wide range of custom designs to meet specific system specifications and VCOs integrated with other components. To discuss your requirements in detail please contact the factory for applications assistance.

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## SPECIFICATIONS (guaranteed -55°C to +85°C)

Centre Freq (GHz) Min/Max	Tuning Band (MHz) Min	Linearity (%) Max	Freq Drift (MHz) Max	Phase Noise at +25°C		Harmon Related Outputs (dBc) Max	Output Power (dBm) Min	Output Power Var (dB) Max	Power Supplies		Package Style	Part Number	
				@100KHz Max	@1MHz Max				@+15V (mA) Max	@-15V (mA) Max			
4.0 - 5.69	100	±1.0	25	-106	-126	-20	+10	±1.5	55	75	VCOA	MLO 31100	
							+15	±1.5	115	75	VCOB	MLO 31200	
							+20	±1.5	200	75	VCOB	MLO 31300	
	200	±1.0	25	-105	-125	-20	+10	±2.0	55	75	VCOA	MLO 32100	
							+15	±2.0	115	75	VCOB	MLO 32200	
							+20	±2.0	200	75	VCOB	MLO 32300	
	500	±1.0	25	-104	-124	-20	+10	±2.5	55	75	VCOA	MLO 33100	
							+15	±2.5	115	75	VCOB	MLO 33200	
							+20	±2.5	200	75	VCOB	MLO 33300	
5.7 - 7.49	200	±1.0	40	-99	-119	-20	+10	±2.0	55	75	VCOA	MLO 32100	
							+15	±2.0	115	75	VCOB	MLO 32200	
							+20	±2.0	200	75	VCOB	MLO 32300	
	500	±1.0	40	-97	-117	-20	+10	±2.5	55	75	VCOA	MLO 33100	
							+15	±2.5	115	75	VCOB	MLO 33200	
							+20	±2.5	200	75	VCOB	MLO 33300	
	7.5 - 9.49	1000	±5.0	40	-95	-115	-20	+10	±3.0	55	75	VCOA	MLO 34100
								+15	±3.0	115	75	VCOB	MLO 34200
								+20	±3.0	200	75	VCOB	MLO 34300
200		±1.0	75	-92	-112	-20	+10	±2.0	55	75	VCOA	MLO 32100	
							+15	±2.0	115	75	VCOB	MLO 32200	
							+20	±2.0	200	75	VCOB	MLO 32300	
500		±1.0	75	-90	-110	-20	+10	±2.5	55	75	VCOA	MLO 33100	
							+15	±2.5	115	75	VCOB	MLO 33200	
							+20	±2.5	200	75	VCOB	MLO 33300	
1000	±5.0	75	-90	-110	-20	+10	±3.0	55	75	VCOA	MLO 34100		
						+15	±3.0	115	75	VCOB	MLO 34200		
						+20	±3.0	200	75	VCOB	MLO 34300		
9.5 - 11.99	200	±1.0	50	-98	-118	-25	+10	±1.5	75	75	VCOB	MLO 32100	
							+15	±1.5	135	75	VCOB	MLO 32200	
							+20	±1.5	225	75	VCOC	MLO 32300	
	500	±1.0	50	-97	-117	-20	+10	±2.0	75	75	VCOB	MLO 33100	
							+15	±2.0	135	75	VCOB	MLO 33200	
							+20	±2.0	225	75	VCOC	MLO 33300	
	1000	±1.0	50	-96	-116	-15	+10	±2.5	75	75	VCOB	MLO 34100	
							+15	±2.5	135	75	VCOB	MLO 34200	
							+20	±2.5	225	75	VCOC	MLO 34300	
2000	±5.0	50	-94	-114	-10	+10	±3.0	75	75	VCOB	MLO 35100		
						+15	±3.0	135	75	VCOB	MLO 35200		
						+20	±3.0	225	75	VCOC	MLO 35300		

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## SPECIFICATIONS (guaranteed -55°C to +85°C)

Centre Freq (GHz) Min/Max	Tuning Band (MHz) Min	Linearity (%) Max	Freq Drift (MHz) Max	Phase Noise @ +25°C (dBc/Hz)		Harmon Related Outputs (dBc) Max	Output Power (dBm) Min	Output Power Var (dB) Max	Power Supplies		Package Style	Part Number
				@100KHz Max	@1MHz Max				@+15V (mA) Max	@-15V (mA) Max		
12.0 - 14.99	200	±1.0	75	-92	-112	-25	+10	±1.5	75	75	VCOB	MLO 32100
							+15	±1.5	135	75	VCOB	MLO 32200
							+20	±1.5	225	75	VCOC	MLO 32300
	500	±1.0	75	-90	-110	-20	+10	±2.0	75	75	VCOB	MLO 33100
							+15	±2.0	135	75	VCOB	MLO 33200
							+20	±2.0	225	75	VCOC	MLO 33300
	1000	±1.0	75	-88	-108	-15	+10	±2.5	75	75	VCOB	MLO 34100
							+15	±2.5	135	75	VCOB	MLO 34200
							+20	±2.5	225	75	VCOC	MLO 34300
	2000	±5.0	75	-86	-106	-10	+10	±3.0	75	75	VCOB	MLO 35100
							+15	±3.0	135	75	VCOB	MLO 35200
							+20	±3.0	225	75	VCOC	MLO 35300
15.0 - 18.0	200	±1.0	150	-84	-104	-25	+10	±1.5	75	75	VCOB	MLO 32100
							+15	±1.5	135	75	VCOB	MLO 32200
							+20	±1.5	225	75	VCOC	MLO 32300
	500	±1.0	150	-82	-102	-20	+10	±2.0	75	75	VCOB	MLO 33100
							+15	±2.0	135	75	VCOB	MLO 33200
							+20	±2.0	225	75	VCOC	MLO 33300
	1000	±1.0	150	-80	-100	-15	+10	±2.5	75	75	VCOB	MLO 34100
							+15	±2.5	135	75	VCOB	MLO 34200
							+20	±2.5	225	75	VCOC	MLO 34300
	2000	±5.0	150	-80	-100	-10	+10	±3.0	75	75	VCOB	MLO 35100
							+15	±3.0	135	75	VCOB	MLO 35200
							+20	±3.0	225	75	VCOC	MLO 35300

### NOTES

- Frequency pushing 100KHz/V maximum for voltages -13 to -18V
- Frequency pulling 0.01% maximum into a 1.5:1 VSWR load all phases
- Spurious outputs -60dBc maximum
- Tuning voltage in the range 0 to +20V, or other if required, an additional fine tune control is available as an option, please contact the factory for details.
- Typical settling time: 1µs from 50% VT to ±1 MHz (bandwidths up to 500 MHz)  
1µs from 50% VT to ±3 MHz (bandwidth over 500 MHz)
- Operating temperature range -55°C to +85°C  
Storage temperature range -55°C to +100°C  
Alternative 0°C to +65°C operating temperature range available, please contact the factory for details.
- All devices are supplied with removable SMA female connectors for RF output and tuning voltage and solder pins for dc supplies and ground. For other combinations contact the factory.
- When ordering please specify the centre frequency required in MHz as a 5 digit suffix to the part number above. e.g. for a centre frequency of 13500 MHz, bandwidth of 500 MHz and output power of +10dBm the part number would be MLO 33100-13500.

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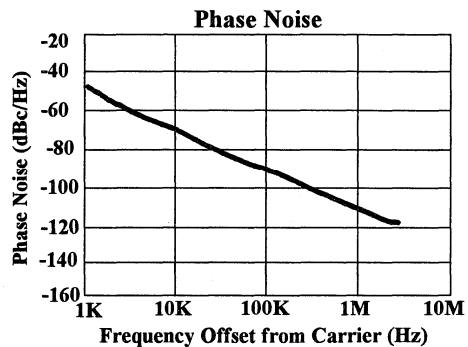
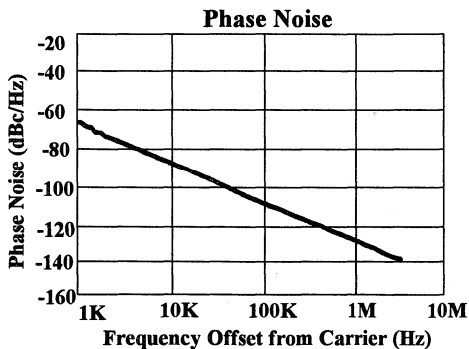
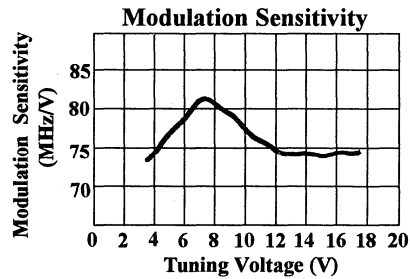
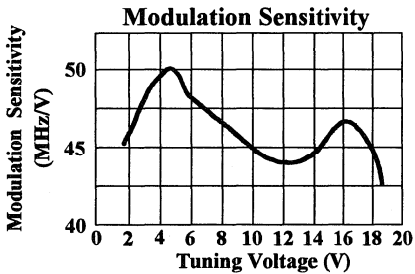
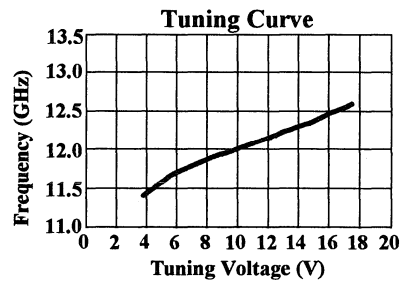
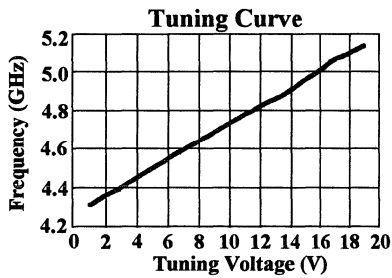
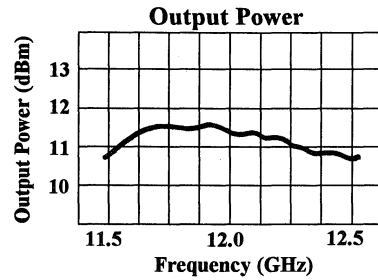
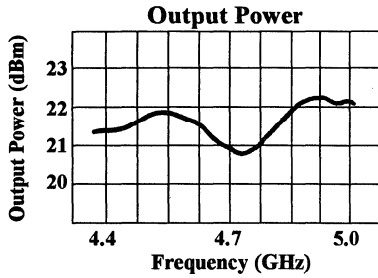
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**TYPICAL PERFORMANCE**

**PART NO. MLO33300-04700**

**PART NO. MLO34100-12000**



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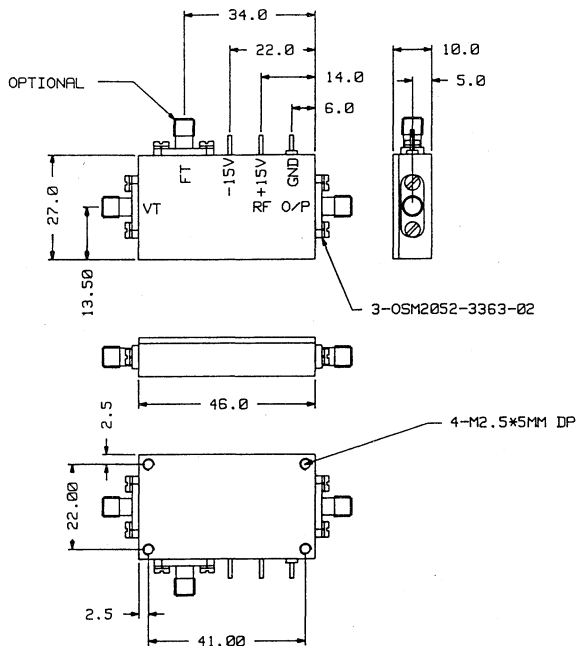
Europe: (44) 1344 869595

North America: 800 366 2266

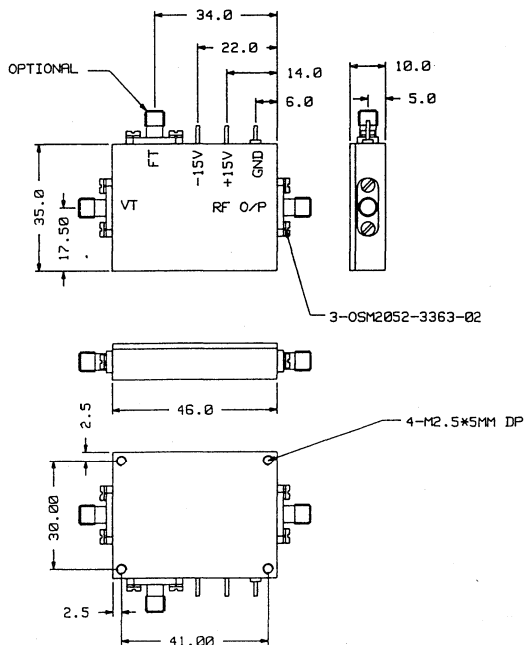
Asia Pacific: (81) 3 3226 1671

OUTLINE DRAWINGS

Package Style VCO A

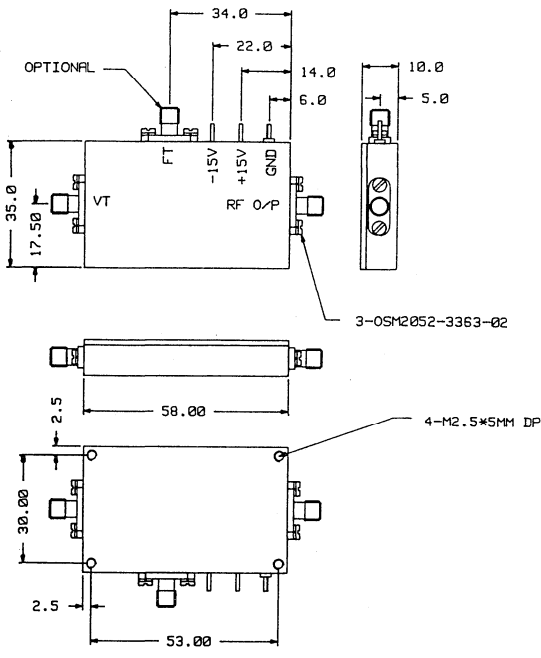


Package Style VCO B



# OUTLINE DRAWINGS

## Package Style VCO C



### DRAWING NOTES

Third Angle Projection

All dimensions in mm

Tolerances    x.x = ±0.5mm  
                   x.xx = ±0.2mm

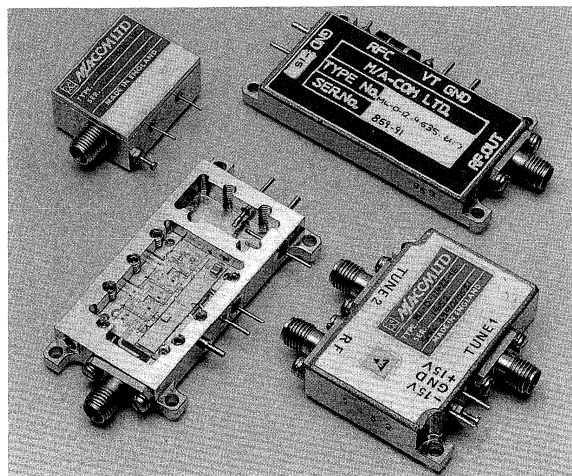
Standard Finish: Ni plate housing with alocrome lid

All specifications are subject to change without notice

## LOW PHASE NOISE VOLTAGE CONTROLLED OSCILLATORS 2 TO 18 GHz

### FEATURES

- ◆ Low Phase Noise
- ◆ High Linearity Tuning
- ◆ Fast Tuning Speeds
- ◆ High Output Powers
- ◆ High Reliability



### DESCRIPTION

M/A-COM Ltd's range of low phase noise voltage controlled oscillators (VCOs) provides excellent tuning linearity and phase noise over the moderate frequency bandwidths required for most systems applications.

These designs use a resonator stabilised silicon bipolar transistor as a negative resistance generator with a varactor diode serving as a voltage variable capacitor in a tuned circuit to vary the frequency of oscillation. This fundamental oscillator design is extended to 18 GHz with an integral frequency doubler. The MLO 40000 series has a silicon abrupt junction varactor diode for low phase noise performance. Careful selection of the varactor diodes, manufactured in-house by M/A-COM Ltd, produces a very large capacitance change together with a high degree of linearity which greatly simplifies the external voltage driver circuit required.

M/A-COM Ltd VCOs are constructed using discrete chip devices integrated into a conventional alumina MIC with laser welding of the finished VCO package providing a hermetic seal. This compact, rugged construction makes these VCOs suitable for the most severe environmental conditions encountered in military and hi-rel applications. The coaxial packages have removable SMA connectors allowing the devices to be integrated directly into microstrip or stripline circuits.

VCOs have a wide variety of applications where oscillators with very fast tuning speeds over up to octave frequency bandwidths are required. VCOs give improved LO frequency tuning speed and output power flatness in radar receivers and rapid generation of jamming signals in ECM transmitters. Where an oscillator of high frequency stability is required, as in radar and communications synthesisers or frequency converters the VCO can be used in a phase-locked loop circuit. This produces a frequency stability comparable to that of the reference crystal oscillator. The phase-locked loop circuit can be designed to stabilise a single output frequency or to vary the oscillator frequency either continuously or in discrete steps as small as required.

The standard VCOs described cover a range of commonly used bandwidths with a choice of three output powers. M/A-COM Ltd also manufactures a wide range of custom designs to meet specific system specifications and VCO assemblies for multi octave applications. To discuss your requirements in detail please contact the factory for applications assistance.

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## SPECIFICATIONS (guaranteed -55°C to +85°C)

Centre Freq (GHz) Min/Max	Tuning Band (MHz) Min	Linearity (%) Max	Freq Drift (MHz) Max	Phase Noise @ +25°C (dBc/Hz)		Harmon Related Outputs (dBc) Max	Output Power (dBm)		Power Supplies		Package Style	Part Number
				@100KHz Max	@1MHz Max		Min	Max	@+15V (mA) Max	@-15V (mA) Max		
4.0 - 5.69	100	±2.0	25	-110	-130	-20	+10	±1.5	55	75	VCOA	MLO 41100
							+15	±1.5	115	75	VCOB	MLO 41200
							+20	±1.5	200	75	VCOB	MLO 41300
	200	±5.0	25	-109	-129	-20	+10	±2.0	55	75	VCOA	MLO 42100
							+15	±2.0	115	75	VCOB	MLO 42200
							+20	±2.0	200	75	VCOB	MLO 42300
	500	±5.0	25	-108	-128	-20	+10	±2.5	55	75	VCOA	MLO 43100
							+15	±2.5	115	75	VCOB	MLO 43200
							+20	±2.5	200	75	VCOB	MLO 43300
5.7 - 7.49	100	±2.0	40	-105	-125	-20	+10	±1.5	55	75	VCOA	MLO 41100
							+15	±1.5	115	75	VCOB	MLO 41200
							+20	±1.5	200	75	VCOB	MLO 41300
	200	±5.0	40	-103	-123	-20	+10	±2.0	55	75	VCOA	MLO 42100
							+15	±2.0	115	75	VCOB	MLO 42200
							+20	±2.0	200	75	VCOB	MLO 42300
	500	±5.0	40	-102	-122	-20	+10	±2.5	55	75	VCOA	MLO 43100
							+15	±2.5	115	75	VCOB	MLO 43200
							+20	±2.5	200	75	VCOB	MLO 43300
7.5 - 9.49	200	±5.0	75	-102	-122	-25	+10	±1.5	75	75	VCOB	MLO 42100
							+15	±1.5	135	75	VCOB	MLO 42200
							+20	±1.5	225	75	VCOC	MLO 42300
	500	±5.0	75	-101	-121	-20	+10	±2.0	75	75	VCOB	MLO 43100
							+15	±2.0	135	75	VCOB	MLO 43200
							+20	±2.0	225	75	VCOC	MLO 43300
	1000	±10.0	75	-100	-120	-15	+10	±2.5	75	75	VCOB	MLO 44100
							+15	±2.5	135	75	VCOB	MLO 44200
							+20	±2.5	225	75	VCOC	MLO 44300
9.5 - 11.99	200	±2.0	50	-100	-120	-25	+10	±1.5	75	75	VCOB	MLO 42100
							+15	±1.5	135	75	VCOB	MLO 42200
							+20	±1.5	225	75	VCOC	MLO 42300
	500	±5.0	50	-100	-120	-20	+10	±2.0	75	75	VCOB	MLO 43100
							+15	±2.0	135	75	VCOB	MLO 43200
							+20	±2.0	225	75	VCOC	MLO 43300
	1000	±10.0	50	-99	-119	-15	+10	±2.5	75	75	VCOB	MLO 44100
							+15	±2.5	135	75	VCOB	MLO 44200
							+20	±2.5	225	75	VCOC	MLO 44300

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Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## SPECIFICATIONS (guaranteed -55°C to +85°C)

Centre Freq (GHz) Min/Max	Tuning Band (MHz) Min	Linearity (%) Max	Freq Drift (MHz) Max	Phase Noise @ +25°C (dBc/Hz)		Harmon Related Outputs (dBc) Max	Output Power (dBm) Min	Output Power Var (dB) Max	Power Supplies		Package Style	Part Number
				@100KHz Max	@1MHz Max				@+15V (mA) Max	@-15V (mA) Max		
12.0 - 14.99	200	±2.0	75	-99	-119	-25	+10	±1.5	75	75	VCOB	MLO 42100
							+15	±1.5	135	75	VCOB	MLO 42200
							+20	±1.5	225	75	VCOC	MLO 42300
							+10	±2.0	75	75	VCOB	MLO 43100
							+15	±2.0	135	75	VCOB	MLO 43200
							+20	±2.0	225	75	VCOC	MLO 43300
	500	±5.0	75	-96	-116	-20	+10	±2.5	75	75	VCOB	MLO 44100
							+15	±2.5	135	75	VCOB	MLO 44200
							+20	±2.5	225	75	VCOC	MLO 44300
							+10	±1.5	75	75	VCOB	MLO 42100
							+15	±1.5	135	75	VCOB	MLO 42200
							+20	±1.5	225	75	VCOC	MLO 42300
15.0 - 18.0	200	±2.0	150	-91	-111	-25	+10	±2.0	75	75	VCOB	MLO 43100
							+15	±2.0	135	75	VCOB	MLO 43200
							+20	±2.0	225	75	VCOC	MLO 43300
							+10	±2.5	75	75	VCOB	MLO 44100
							+15	±2.5	135	75	VCOB	MLO 44200
							+20	±2.5	225	75	VCOC	MLO 44300
	500	±5.0	150	-88	-108	-20	+10	±2.5	75	75	VCOB	MLO 44100
							+15	±2.5	135	75	VCOB	MLO 44200
							+20	±2.5	225	75	VCOC	MLO 44300
							+10	±2.5	75	75	VCOB	MLO 44100
							+15	±2.5	135	75	VCOB	MLO 44200
							+20	±2.5	225	75	VCOC	MLO 44300
1000	±10.0	150	-86	-106	-15	+10	±2.5	75	75	VCOB	MLO 44100	
						+15	±2.5	135	75	VCOB	MLO 44200	
						+20	±2.5	225	75	VCOC	MLO 44300	
						+10	±2.5	75	75	VCOB	MLO 44100	
						+15	±2.5	135	75	VCOB	MLO 44200	
						+20	±2.5	225	75	VCOC	MLO 44300	

### NOTES

- 1) Frequency pushing 100 KHz/V maximum for voltages -13 to -18V
- 2) Frequency pulling ±0.01% maximum into a 1.5:1 VSWR load all phases
- 3) Spurious outputs -60dBc maximum
- 4) Tuning voltage in the range 0 to +20V, or other if required, an additional fine tune control is available as an option, please contact the factory for details.
- 5) Typical settling time: 1us from 50% VT to ±1 MHz (bandwidth up to 500 MHz)  
1us from 50% VT to ±3 MHz (bandwidths over 500 MHz)
- 6) Operating temperature range -55°C to +85°C  
Storage temperature range -55°C to +100°C  
Alternative 0°C to +65°C operating temperature range available, please contact the factory for details.
- 7) All devices are supplied with removable SMA female connectors for RF output and tuning voltage and solder pins for dc supplies and ground. For other combinations contact the factory.
- 8) When ordering please specify the centre frequency required in MHz as a 5 digit suffix to the part number above e.g. for a centre frequency of 13500 MHz, bandwidth of 500 MHz and output power of +10dBm the part number would be MLO 43100-13500.

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Europe: (44) 1344 869595

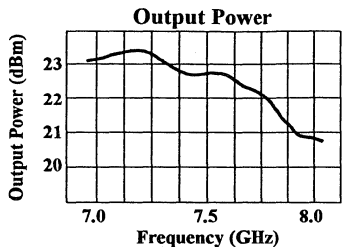
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

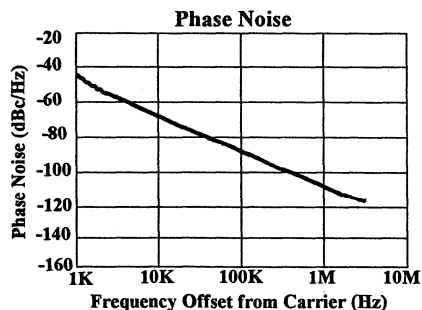
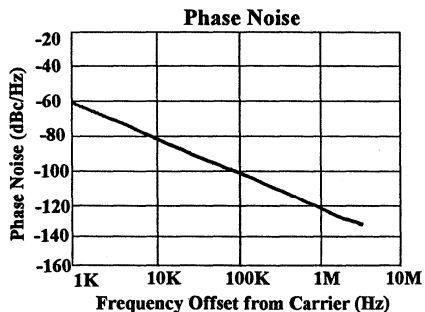
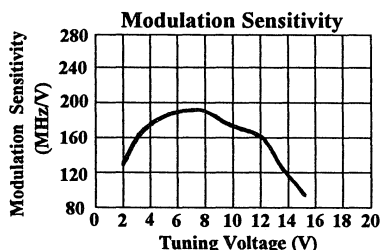
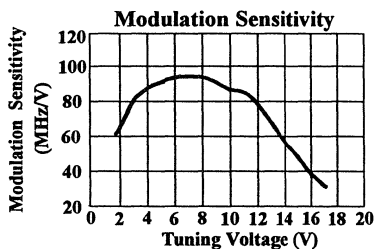
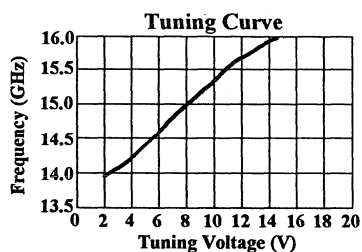
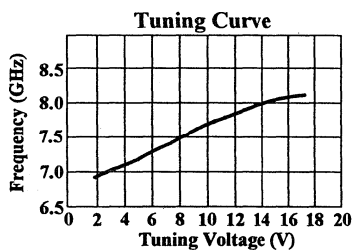
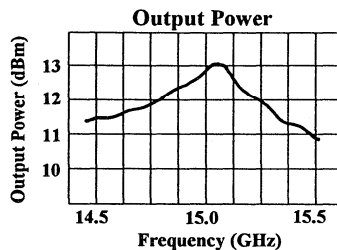


TYPICAL PERFORMANCE

PART NO. MLO44300-07500



PART NO. MLO44100-15000



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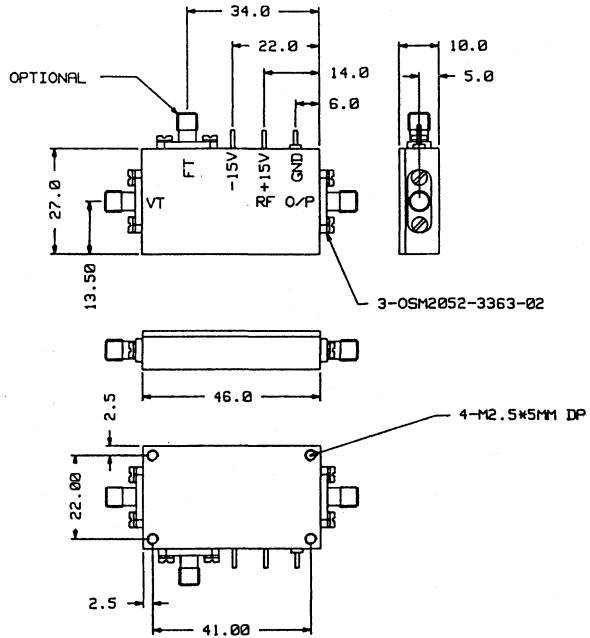
Europe: (44) 1344 869595

North America: 800 366 2266

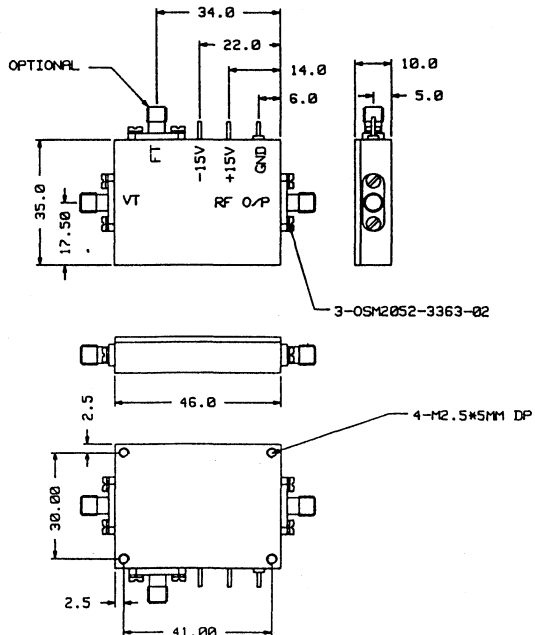
Asia Pacific: (81) 3 3226 1671

OUTLINE DRAWINGS

Package Style VCO A

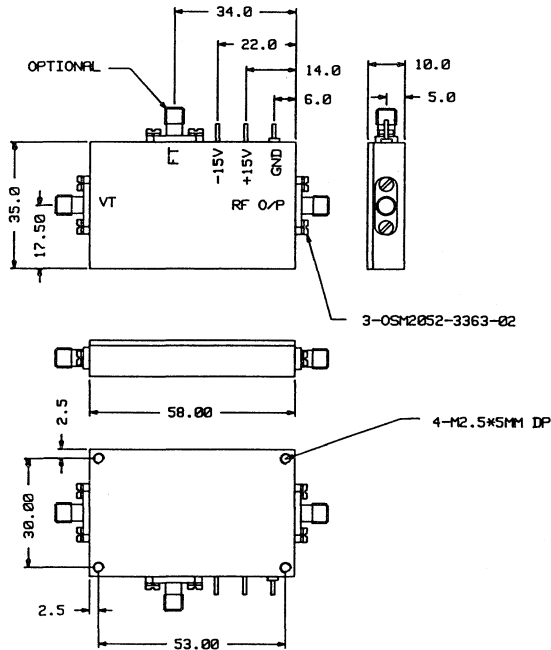


Package Style VCO B



OUTLINE DRAWINGS

Package Style VCO C



DRAWING NOTES

Third Angle Projection

All dimensions in mm

Tolerances x.x = ±0.5mm

x.xx = ±0.2mm

Standard Finish: Ni plate housing with alochrome lid.

All specifications are subject to change without notice

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**BROADBAND  
VOLTAGE CONTROLLED OSCILLATORS****0.5 TO 20 GHz****FEATURES**

- ◆ **Broadband Frequency Ranges**
- ◆ **Fast Tuning Speed**
- ◆ **Low Tuning Voltage**
- ◆ **High Output Power**
- ◆ **High Reliability**

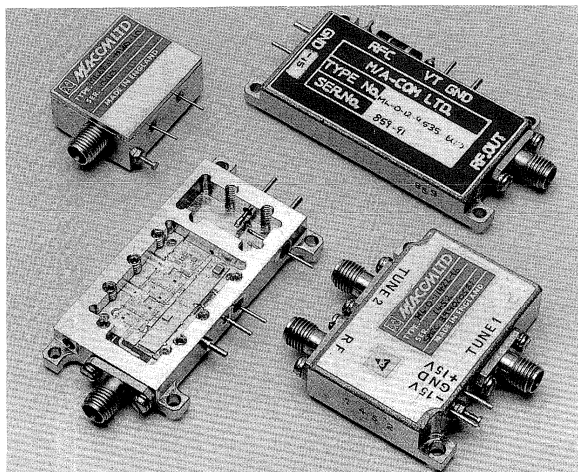
**DESCRIPTION**

M/A-COM Ltd's range of broadband voltage controlled oscillators (VCOs) offers excellent tuning characteristics over octave frequency bandwidths for wideband systems applications. These designs use a negative resistance transistor oscillator, for the lower frequencies this is a silicon bipolar device with GaAs FET devices extending the range to 20GHz. The frequency of oscillation is determined by one or more GaAs hyperabrupt varactor diodes acting as voltage variable capacitors in a resonant microstrip circuit. Careful selection of the varactor diodes, manufactured in house by M/A-COM Ltd, produces a very large capacitance change together with a high degree of linearity which greatly simplifies the external voltage driver circuit required. This design provides extremely high tuning rates, limited primarily by the internal impedance of the external driver circuit.

M/A-COM Ltd VCOs are constructed using discrete chip devices integrated into a conventional alumina MIC with laser welding of the finished VCO package providing an hermetic seal. This compact, rugged construction makes these VCOs suitable for the most severe environmental conditions encountered in military and hi-rel applications. The coaxial packages have removable SMA connectors, with the connectors removed the devices can be integrated directly into microstrip or stripline circuits.

These VCOs have a wide variety of applications where highly reliable oscillators with fast frequency agility over wide bandwidths are required. VCOs give improved LO frequency tuning speed and output power flatness in wideband EW receives and rapid generation of jamming signals in ECM transmitters. The wide bandwidths and compatibility with digital to analogue converters make these VCOs ideal building blocks for digitally tuned oscillators operating over multi-octave bandwidths.

The standard VCOs described cover a range of commonly used bandwidths with a choice of three output powers. M/A-COM Ltd also manufactures a wide range of custom designs to meet specific system specifications and VCO assemblies for multi-octave applications. To discuss your requirements in detail please contact the factory for applications assistance.



**SPECIFICATIONS** (guaranteed -55°C to +85°C)

Centre Freq (GHz) Min/Max	Tuning Band (MHz) Min	Freq Drift (MHz) Max	Phase Noise @ +25°C (dBc/Hz)		Harmon Related Outputs (dBc) Max	Output Power (dBm) Min	Output Power Variation (dB) Max	Current Consumption @ +15V (mA) Max	Package Style	Part Number
			@100KHz Max	@1MHz Max						
0.75 - 1.49	200	45	-108	-128	-12	+10	±2.0	100	VCOD	MLO 52100
						+15	±2.0	150	VCOD	MLO 52200
						+20	±2.0	200	VCOA	MLO 52300
	500	55	-105	-125	-10	+10	±2.0	100	VCOD	MLO 53100
						+15	±2.0	150	VCOD	MLO 53200
						+20	±2.0	200	VCOA	MLO 53300
1.5 - 2.99	200	78	-105	-125	-12	+10	±2.0	100	VCOD	MLO 52100
						+15	±2.0	150	VCOD	MLO 52200
						+20	±2.0	200	VCOA	MLO 52300
	500	82	-100	-120	-10	+10	±2.0	100	VCOD	MLO 53100
						+15	±2.0	150	VCOD	MLO 53200
						+20	±2.0	200	VCOA	MLO 53300
3.0 - 4.49	1000	88	-100	-120	-10	+10	±2.0	100	VCOD	MLO 54100
						+15	±2.0	150	VCOD	MLO 54200
						+20	±2.0	200	VCOA	MLO 54300
	500	106	-100	-120	-12	+10	±2.0	100	VCOD	MLO 53100
						+15	±2.0	150	VCOD	MLO 53200
						+20	±2.0	200	VCOA	MLO 53300
4.5 - 5.99	1000	113	-98	-118	-10	+10	±2.0	110	VCOD	MLO 54100
						+15	±2.0	175	VCOD	MLO 54200
						+20	±2.0	250	VCOA	MLO 54300
	2000	124	-95	-115	-10	+10	±2.5	110	VCOD	MLO 55100
						+15	±2.5	175	VCOA	MLO 55200
						+20	±2.5	260	VCOA	MLO 55300
4.5 - 5.99	1000	130	-98	-118	-12	+10	±2.5	110	VCOD	MLO 54100
						+15	±2.5	175	VCOA	MLO 54200
						+20	±2.5	260	VCOA	MLO 54300
	2000	140	-94	-114	-10	+10	±2.5	110	VCOD	MLO 55100
						+15	±2.5	175	VCOA	MLO 55200
						+20	±2.5	260	VCOA	MLO 55300
3000	150	-93	-113	-10	+10	±2.5	110	VCOD	MLO 56100	
					+15	±2.5	175	VCOA	MLO 56200	
					+20	±2.5	260	VCOA	MLO 56300	

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## SPECIFICATIONS (guaranteed -55°C to +85°C)

Centre Freq (GHz) Min/Max	Tuning Band (MHz) Min	Freq Drift (MHz) Max	Phase Noise @ +25°C (dBc/Hz)		Harmon Related Outputs (dBc) Max	Output Power (dBm) Min	Output Power Variation (dB) Max	Current Consumption @ +15V (mA) Max	Package Style	Part Number
			@100KHz Max	@1MHz Max						
6.0 - 7.99	2000	158	-90	-110	-12	+10	±2.5	120	VCOA	MLO 55100
						+15	±2.5	185	VCOA	MLO 55200
						+20	±2.5	270	VCOA	MLO 55300
	3000	166	-90	-110	-12	+10	±3.0	120	VCOA	MLO 56100
						+15	±3.0	185	VCOA	MLO 56200
						+20	±3.0	270	VCOA	MLO 56300
8.0 - 11.99	3000	203	-70	-90	-15	+10	±3.0	120	VCOA	MLO 56100
						+15	±3.0	185	VCOA	MLO 56200
						+20	±3.0	270	VCOA	MLO 56300
	4000	210	-70	-90	-12	+10	±3.0	120	VCOA	MLO 57100
						+15	±3.0	185	VCOA	MLO 57200
						+20	±3.0	270	VCOA	MLO 57300
12.0 - 16.0	4000	225	-58	-78	-20	+10	±3.0	150	VCOA	MLO 57100
						+15	±3.0	200	VCOA	MLO 57200
						+20	±3.0	290	VCOA	MLO 57300
	5000	232	-58	-78	-15	+10	±3.0	150	VCOA	MLO 58100
						+15	±3.0	200	VCOA	MLO 58200
						+20	±3.0	290	VCOA	MLO 58300
7000	260	-50	-70	-15	+10	±3.0	150	VCOA	MLO 59100	
					+15	±3.0	200	VCOA	MLO 59200	
						+20	±3.0	290	VCOA	MLO 59300

### NOTES

- 1) Frequency pushing 100 KHz/V maximum for voltages +13V TO +18V.
- 2) Frequency pulling 1MHz maximum into a 1.5:1 VSWR load all phases
- 3) Spurious outputs -60dBc maximum
- 4) Tuning voltage in the range 0 to +20V, or other if required, please contact the factory for details.
- 5) Case Operating temperature range -55°C to +85°C  
Storage temperature range -55°C to +100°C
- 6) All devices are supplied with removable SMA female connectors for RF output and tuning voltage and solder pins for dc supplies and ground. For other combinations contact the factory.
- 7) When ordering please specify the centre frequency required in MHz as a 5 digit suffix to the part number above e.g. for a centre frequency of 6000 MHz, bandwidth of 4000 MHz and output power of +10dBm the part number would be MLO 57100-06000.

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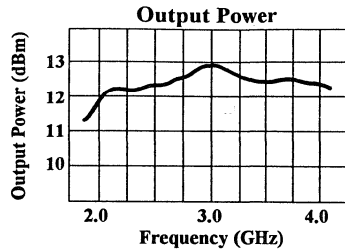
Europe: (44) 1344 869595

North America: 800 366 2266

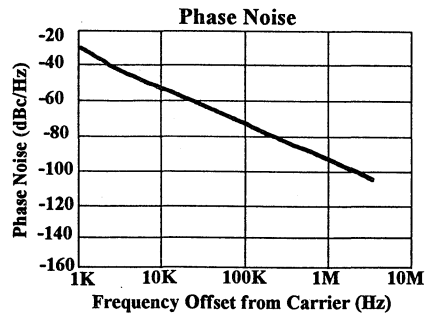
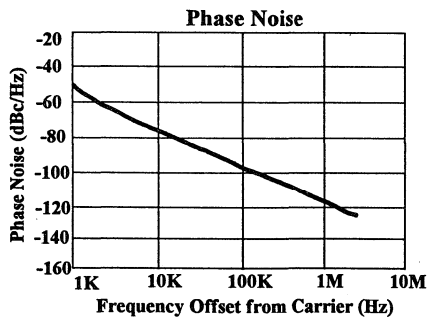
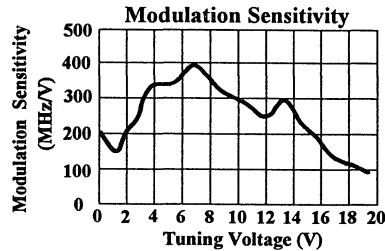
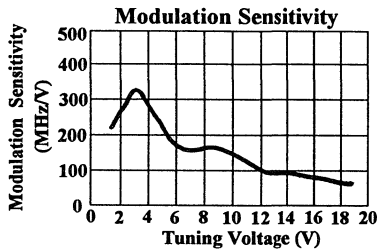
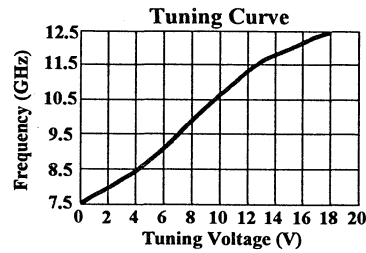
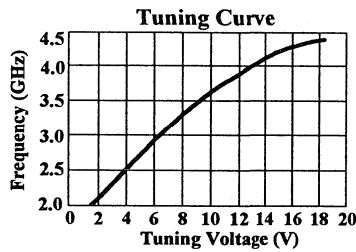
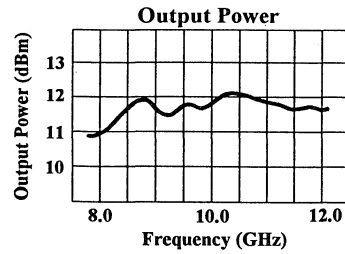
Asia Pacific: (81) 3 3226 1671

# TYPICAL PERFORMANCE

PART NO. MLO55100-03000



PART NO. MLO57100-10000



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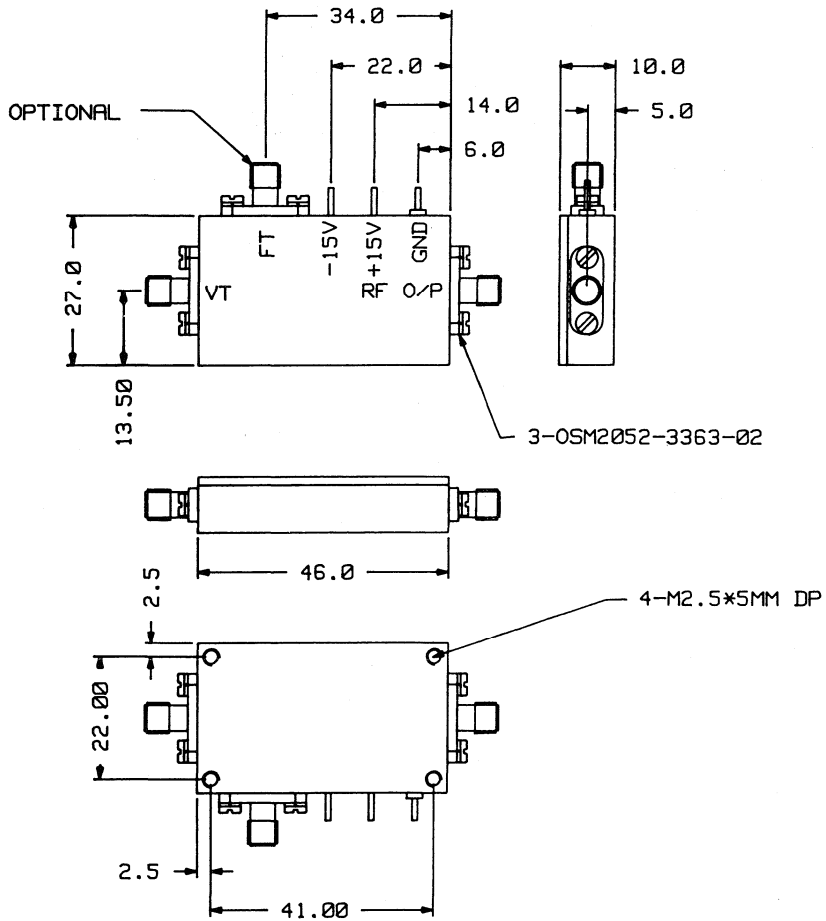
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

OUTLINE DRAWINGS

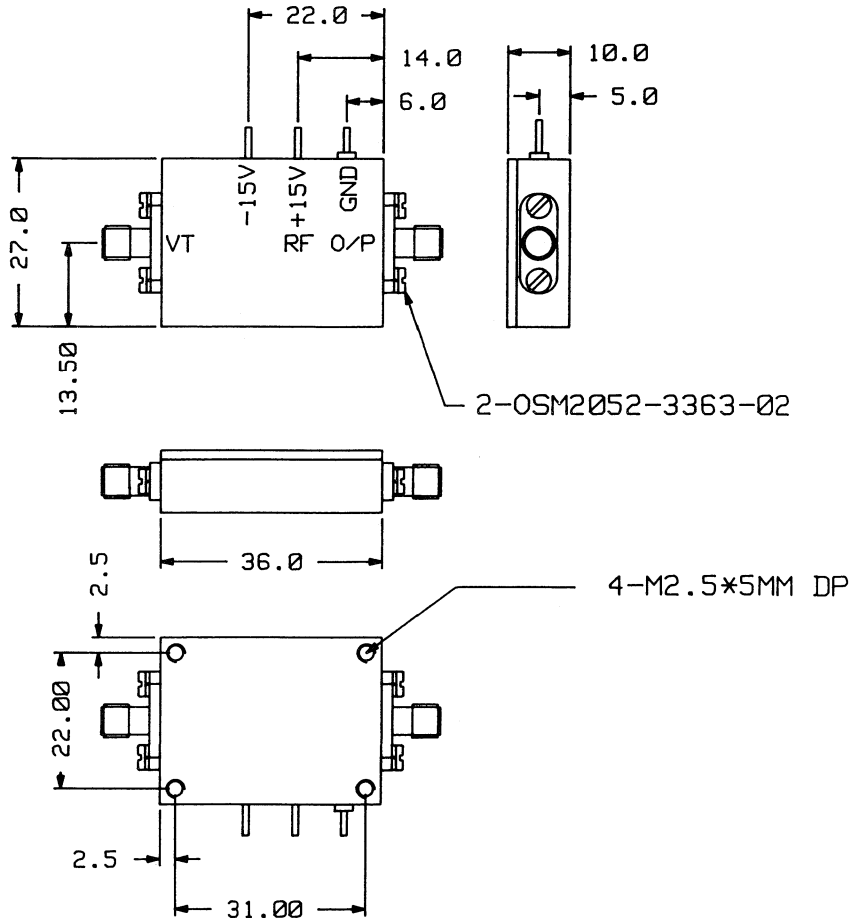
Package Style VCO A





## OUTLINE DRAWINGS

### Package Style VCO D



### DRAWING NOTES

Third Angle Projection

All dimensions in mm

Tolerances   x.x =  $\pm 0.5\text{mm}$   
                   x.xx =  $\pm 0.2\text{mm}$

Standard Finish: Ni plate housing with alochrome lid.

All specifications are subject to change without notice

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

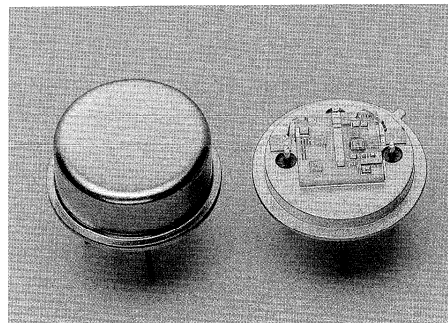
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**TO-8 PACKAGED  
VOLTAGE CONTROLLED OSCILLATORS****300MHz to 10GHz****FEATURES**

- ◆ **PCB Compatible**
- ◆ **Low Cost**
- ◆ **Mil and Commercial Designs**
- ◆ **Broad Frequency Ranges**
- ◆ **Low Phase Noise**

**DESCRIPTION**

M/A-COM Ltd's range of TO-8 voltage controlled oscillators (VCOs) provides excellent tuning linearity and phase noise for both narrow and broad bandwidth system applications.

These designs use either a silicon bipolar transistor or FET device, dependent on frequency, as the negative resistance generator. The frequency of oscillation is determined by a varactor diode which serves as a voltage variable capacitor in a tuned circuit. For wide bandwidth designs a GaAs hyperabrupt varactor is selected to give the greatest capacitance and therefore frequency, change against tuning voltage with the best linearity. For narrow bandwidth designs a silicon abrupt varactor offers the lowest phase noise performance. Careful selection of the varactor diodes, manufactured in house by M/A-COM Ltd, produces linear, monotonic tuning characteristics requiring only simple external driver circuits.

This range of VCOs are constructed using discrete chip devices integrated into a conventional alumina MIC which is packaged in a standard TO-8 outline. The package is hermetically sealed by resistance seam welding. This compact, rugged yet low cost construction allows simple installation on a conventional PCB and finds a wide range of applications in demanding military, hi-rel and commercial systems.

Where oscillators with very fast tuning speeds over up to octave frequency bandwidths are required VCOs offer significant performance advantages. VCOs give improved LO frequency tuning speed and output power flatness in microwave receivers and rapid generation of output signals in frequency agile transmitters. Where an oscillator with high frequency stability is required, as in radar or communications synthesisers and converters, the VCO can be used in a phase locked loop circuit. This produces a frequency stability comparable to that of the reference crystal oscillator. The phase locked loop circuit can be designed to stabilise a single output frequency or to vary the oscillator frequency continuously or in discrete steps as small as required.

MLO 60000 Series oscillators can be qualified for high reliability and military requirements in addition to the standard commercial specification. A wide range of custom designs is also available, please contact the factory to discuss your requirements.

**SPECIFICATIONS** (guaranteed -55°C to +85°C)

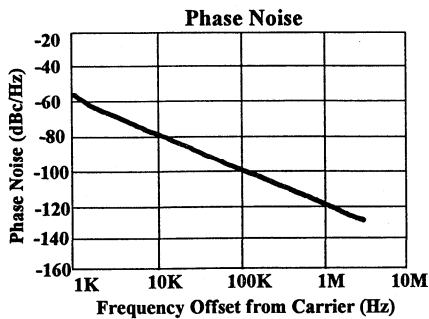
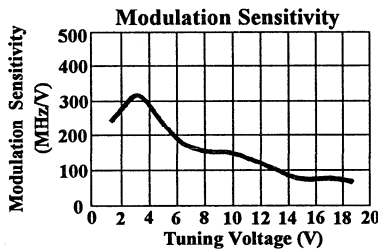
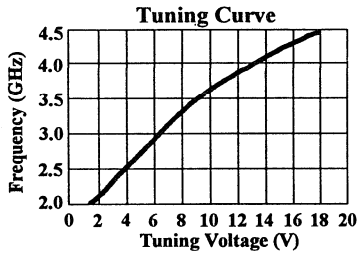
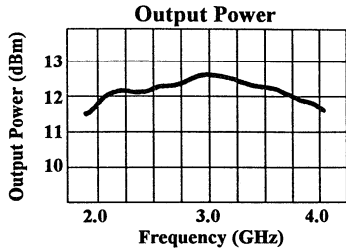
Centre Freq (GHz) Min/Max	Tuning Band (MHz) Min	Freq Pushing (MHz/V) Max	Freq Pulling (MHz) Max	Freq Drift (MHz) Max	Phase Noise @ +25°C (dBc/Hz)		Harmonic Related Outputs (dBc) Max	Output Power (dBm) Min	Output Power Variation (dB) Max	Current Consumption @ +15V (mA) Max	Part Number
					@100KHz Max	@1MHz Max					
0.5-0.74	100	1.5	40	30	-105	-125	-14	+10	±2.0	50	MLO 61100
	200	1.5	40	30	-105	-125	-14	+10	±2.0	50	MLO 62100
0.75-1.49	100	5	20	30	-108	-128	-15	+10	±2.0	50	MLO 61100
	200	5	20	35	-108	-128	-10	+10	±2.0	50	MLO 62100
	500	5	20	40	-108	-128	-10	+10	±2.5	50	MLO 63100
1.5 -2.99	100	15	40	40	-108	-128	-15	+10	±2.0	50	MLO 61100
	200	15	40	60	-105	-125	-10	+10	±2.0	50	MLO 62100
	500	15	40	70	-102	-122	-10	+10	±2.5	50	MLO 63100
	1000	15	60	90	-98	-118	-8	+10	±2.5	100	MLO 64100
3.0 -4.49	100	10	40	70	-100	-120	-15	+10	±2.0	50	MLO 61100
	200	10	40	70	-100	-120	-12	+10	±2.0	50	MLO 62100
	500	10	40	90	-100	-120	-10	+10	±2.5	50	MLO 63100
	1000	10	60	110	-100	-120	-10	+10	±2.5	100	MLO 64100
	2000	10	60	120	-98	-118	-10	+10	±2.5	100	MLO 65100
4.5 -5.99	100	10	50	100	-100	-120	-12	+10	±2.0	50	MLO 61100
	200	10	50	100	-100	-120	-12	+10	±2.0	50	MLO 62100
	500	10	50	110	-95	-115	-12	+10	±2.5	50	MLO 63100
	1000	16	70	110	-90	-110	-10	+10	±2.5	100	MLO 64100
	2000	16	70	120	-85	-105	-10	+10	±2.5	100	MLO 65100
	3000	35	70	130	-80	-100	-10	+10	±2.5	100	MLO 66100
6.0 -8.0	200	30	30	180	-85	-105	-12	+10	±2.0	100	MLO 62100
	500	30	30	200	-85	-105	-12	+10	±2.0	100	MLO 63100
	1000	30	30	220	-80	-100	-10	+10	±2.5	100	MLO 64100
	2000	30	30	220	-75	-95	-10	+10	±2.5	100	MLO 65100
	3000	30	30	250	-70	-90	-10	+10	±2.5	100	MLO 66100
4000	30	40	250	-60	-80	-10	+10	±2.5	100	MLO 67100	

**NOTES**

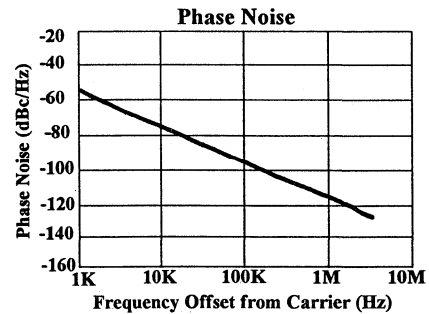
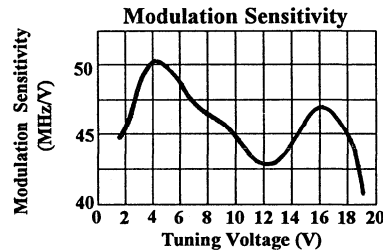
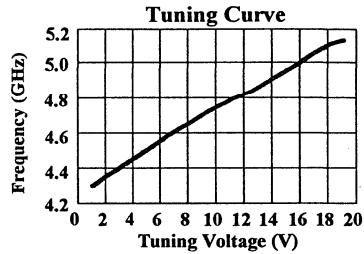
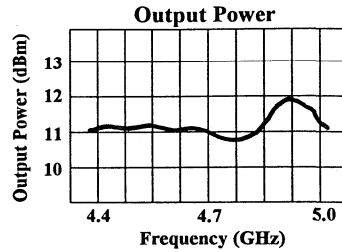
- 1) Frequency pushing See above for voltages +15V ± 5%.
- 2) Frequency pulling See above into a 1.5:1 VSWR load all phases.
- 3) Spurious outputs -60dBc maximum
- 4) Tuning voltage in the range 0 to +20V, or other if required, please contact the factory for details.
- 5) Case Operating temperature range -55°C to +85°C  
Storage temperature range -55°C to +100°C
- 6) When ordering please specify the centre frequency required in MHz as a 5 digit suffix to the part number above e.g. for a centre frequency of 5000 MHz, bandwidth of 200 MHz the part number would be MLO 62100-05000.

TYPICAL PERFORMANCE

PART NO. MLO65100-03000



PART NO. MLO63100-04700



M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

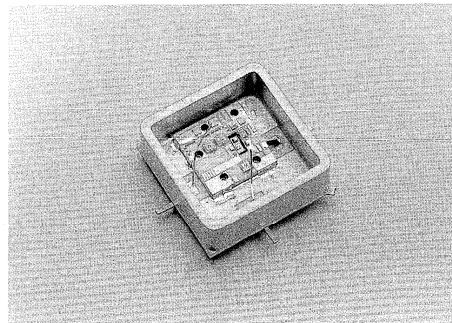
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671



**SURFACE MOUNT  
VOLTAGE CONTROLLED OSCILLATORS****300MHz to 5GHz****FEATURES**

- ◆ **Surface Mount PCB Compatible**
- ◆ **Low Cost**
- ◆ **Mil and Commercial Designs**
- ◆ **Broad Frequency Ranges**
- ◆ **Low Phase Noise**

**DESCRIPTION**

M/A-COM Ltd's range of surface mount voltage controlled oscillators (VCOs) provides excellent tuning linearity and phase noise for both narrow and broad bandwidth system applications.

These designs use either a silicon bipolar transistor or FET device, dependent on frequency, as the negative resistance generator. The frequency of oscillation is determined by a varactor diode which serves as a voltage variable capacitor in a tuned circuit. For wide bandwidth designs a GaAs hyperabrupt varactor is selected to give the greatest capacitance and therefore frequency, change against tuning voltage with the best linearity. For narrow bandwidth designs a silicon abrupt varactor offers the lowest phase noise performance. Careful selection of the varactor diodes, manufactured in house by M/A-COM Ltd, produces linear, monotonic tuning characteristics requiring only simple external driver circuits.

This range of VCOs are constructed using discrete chip devices integrated into a conventional alumina MIC which is packaged in a standard surface mount outline. The package is hermetically sealed by resistance seam welding. This compact, rugged yet low cost construction allows simple installation on a surface mount PCB and finds a wide range of applications in demanding military, hi-rel and commercial systems.

Where oscillators with very fast tuning speeds over up to octave frequency bandwidths are required VCOs offer significant performance advantages. VCOs give improved LO frequency tuning speed and output power flatness in microwave receivers and rapid generation of output signals in frequency agile transmitters. Where an oscillator with high frequency stability is required, as in radar or communications synthesisers and converters, the VCO can be used in a phase locked loop circuit. This produces a frequency stability comparable to that of the reference crystal oscillator. The phase locked loop circuit can be designed to stabilise a single output frequency or to vary the oscillator frequency continuously or in discrete steps as small as required.

MLO 70000 Series oscillators can be qualified for high reliability and military requirements in addition to the standard commercial specification. A wide range of custom designs is also available, please contact the factory to discuss your requirements.

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M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SPECIFICATIONS** (guaranteed -55°C to +85°C)

Centre Freq (GHz) Min/Max	Tuning Band (MHz) Min	Freq Pushing (MHz/V) Max	Freq Pulling (MHz) Max	Freq Drift (MHz) Max	Phase Noise @ +25°C (dBc/Hz)		Harmonic Related Outputs (dBc) Max	Output Power (dBm) Min	Output Power Variation (dB) Max	Current Consumption @ +15V (mA) Max	Part Number
					@100KHz Max	@1MHz Max					
0.5-0.74	100	1.5	40	30	-105	-125	-14	+10	±2.0	50	MLO 71100
	200	1.5	40	30	-105	-125	-14	+10	±2.0	50	MLO 72100
0.75-1.49	100	5	20	30	-108	-128	-15	+10	±2.0	50	MLO 71100
	200	5	20	35	-108	-128	-10	+10	±2.0	50	MLO 72100
	500	5	20	40	-108	-128	-10	+10	±2.5	50	MLO 73100
1.5-2.99	100	15	40	40	-108	-128	-15	+10	±2.0	50	MLO 71100
	200	15	40	60	-105	-125	-10	+10	±2.0	50	MLO 72100
	500	15	40	70	-102	-122	-10	+10	±2.5	50	MLO 73100
	1000	15	60	90	-98	-118	-8	+10	±2.5	100	MLO 74100
	100	10	40	70	-100	-120	-15	+10	±2.0	50	MLO 71100
3.0-4.0	200	10	40	70	-100	-120	-12	+10	±2.0	50	MLO 72100
	500	10	40	90	-100	-120	-10	+10	±2.5	50	MLO 73100
	1000	10	60	110	-100	-120	-10	+10	±2.5	100	MLO 74100
	2000	10	60	120	-98	-118	-10	+10	±2.5	100	MLO 75100

**NOTES**

- 1) Frequency pushing See above for voltages +15V ±5%.
- 2) Frequency pulling See above into a 1.5:1 VSWR load all phases.
- 3) Spurious outputs -60dBc maximum
- 4) Tuning voltage in the range 0 to +20V, or other if required, please contact the factory for details.
- 5) Case Operating temperature range -55°C to +85°C  
Storage temperature range -55°C to +100°C
- 6) When ordering please specify the centre frequency required in MHz as a 5 digit suffix to the part number above e.g. for a centre frequency of 5000 MHz, bandwidth of 200 MHz the part number would be MLO 72100-05000.

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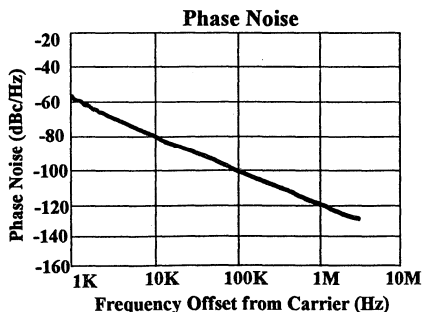
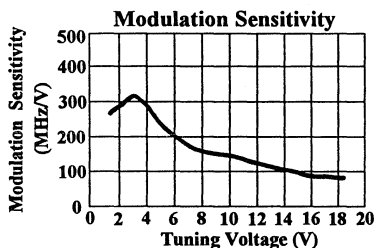
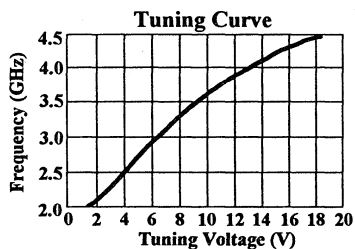
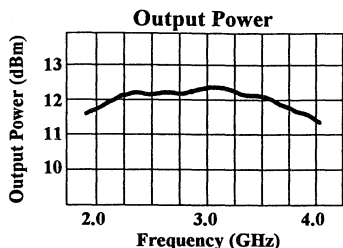
Europe: (44) 1344 869595

North America: 800 366 2266

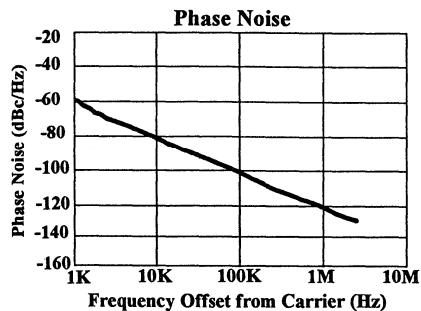
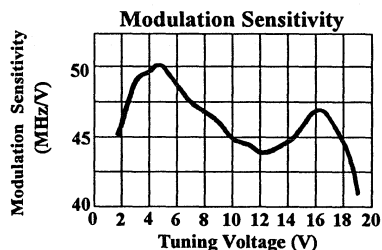
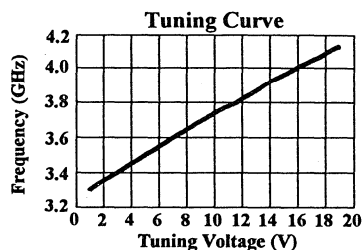
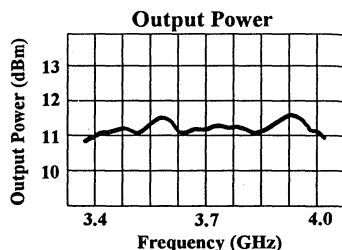
Asia Pacific: (81) 3 3226 1671

# TYPICAL PERFORMANCE

PART NO. MLO75100-03000



PART NO. MLO73100-03700



M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

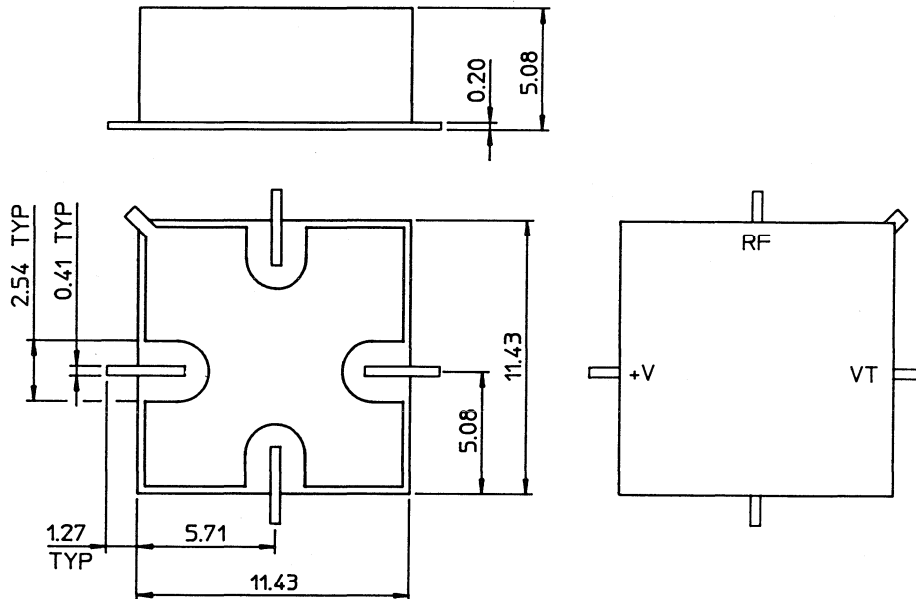
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671



## OUTLINE DRAWING



## DRAWING NOTES

Third Angle Projection.

All dimensions in mm.

Tolerances    x.x    =  $\pm 0.5$ mm  
                   x.xx    =  $\pm 0.2$ mm

Standard finish gold plate

All specifications are subject to change without notice

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

North America: 800 366 2266

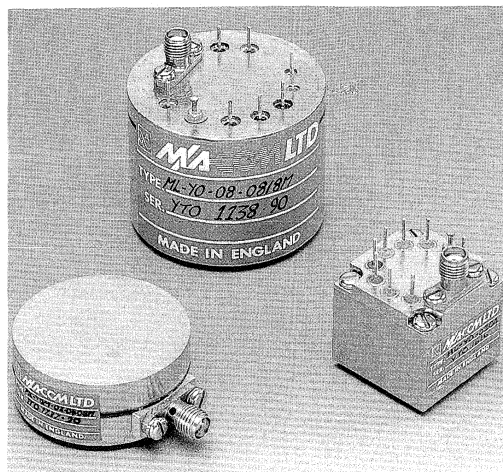
Asia Pacific: (81) 3 3226 1671

## YIG TUNED OSCILLATORS

### 2 to 20GHz

### FEATURES

- ◆ **Multioctave Tuning Ranges**
- ◆ **Miniature and Cube Packages**
- ◆ **High Linearity**
- ◆ **High Stability**
- ◆ **Low Phase Noise**



### DESCRIPTION

The YIG Tuned Oscillator (YTO) is a type of tuned oscillator where the frequency determining element is a sphere of YIG (Yttrium Iron Garnet) ferrite material. A property of YIG material is that its resonant frequency is directly proportional to the strength of an applied magnetic field. This enables it to be used as an electronically tuned cavity, sustaining oscillation in an active circuit. This active circuit, a negative resistance generator, is either a silicon bipolar transistor or a GaAs FET device in a negative feedback circuit. The oscillator output is then amplified by a buffer amplifier stage. Careful design and manufacture of the YTO produces a highly linear oscillator capable of octave and multioctave tuning bandwidths with high stability and low phase noise.

M/A-COM Ltd YTOs are constructed using discrete chip devices integrated into a conventional alumina MIC. This MIC, together with the YIG sphere and tuning coils is packaged in either a standard, miniature or cube package which is hermetically sealed by laser welding. This compact, rugged construction makes these VCOs suitable for a wide range of environmental conditions encountered in military, commercial and hi-rel applications.

YTOs have a wide range of applications where oscillators with very wide tuning bandwidth and high linearity are required. YTOs provide an attractive solution for wideband receiver local oscillators in ESM and ECM equipment and low noise synthesisers or sweep oscillators for spectrum analysers and signal generators. In addition to the main tuning coil the YTO has a low inductance FM tuning coil placed in close proximity to the YIG sphere. This coil allows fine tuning of the oscillator frequency to either phase lock the YTO or frequency modulate the output signal.

As well as the standard YTOs described M/A-COM Ltd also manufactures a wide range of custom designs to meet specific system specifications. Please contact the factory to discuss your requirements in detail.

**SPECIFICATIONS** (guaranteed -0°C to +65°C)

Frequency Range (GHz) Min.	Output Power (dBm) Min.	Output Power Variation (dB) Max.	Main Tune Linearity (%) Max.	Frequency Drift (MHz) Max.	Phase Noise @100KHz (dBc/Hz) Max.	Harmonic Outputs (dBc) Max.	Power Supplies			Package Style	Part Number
							Hysteresis (MHz) Max.	@+15V (mA) Max.	@-5V (mA) Max.		
2.0 - 4.0	+12	±2.5	±0.05	30	-115	-12	4	110	30	YTOA	MLYO-0204C
							5	150	30	YTOB	MLYOM-0204C
							5	110	30	YTOC	MLYOC-0204C
2.0 - 6.0	+12	±2.5	±0.05	30	-112	-12	5	110	30	YTOA	MLYO-0206C
							6	150	30	YTOB	MLYOM-0206C
							6	110	30	YTOC	MLYOC-0206C
2.0 - 8.0	+10	±2.5	±0.05	30	-110	-12	9	110	30	YTOA	MLYO-0208C
							10	150	30	YTOB	MLYOM-0208C
							10	110	30	YTOC	MLYOC-0208C
4.0 - 8.0	+12	±2.5	±0.05	30	-110	-12	6	110	30	YTOA	MLYO-0408C
							7	150	30	YTOB	MLYOM-0408C
							7	110	30	YTOC	MLYOC-0408C
6.0 - 12.0	+12	±3.0	±0.1	40	-98	-12	12	110	N/A	YTOA	MLYO-0612C
							14	150	N/A	YTOB	MLYOM-0612C
							13	110	N/A	YTOD	MLYOC-0612C
8.0 - 12.0	+12	±3.0	±0.15	40	-98	-12	6	110	N/A	YTOA	MLYO-0812C
							8	150	N/A	YTOB	MLYOM-0812C
							7	110	N/A	YTOD	MLYOC-0812C
8.0 - 16.0	+12	±3.0	±0.15	40	-95	-10	9	110	N/A	YTOA	MLYO-0816C
							10	110	N/A	YTOD	MLYOC-0816C
							15	110	N/A	YTOA	MLYO-0818C
8.0 - 18.0	+10	±3.0	±0.15	40	-95	-10	16	110	N/A	YTOD	MLYOC-0818C
							9	110	N/A	YTOA	MLYO-1218C
							10	110	N/A	YTOD	MLYOC-1218C
12.0 - 18.0	+12	±3.0	±0.15	40	-95	-10	10	110	N/A	YTOD	MLYOC-1218C
							12	110	N/A	YTOA	MLYO-1220C
							13	110	N/A	YTOD	MLYOC-1220C

**NOTES**

- 1) Frequency pushing  
+15V Supply 0.5MHz/V maximum  
-5V Supply 1.5MHz/V maximum
- 2) Frequency pulling  
2MHz maximum into a 1.5:1 VSWR load all phases
- 3) Spurious outputs  
-70dBc maximum
- 4) Main Tune Port  
Sensitivity 20MHz/mA ±5%  
Input Impedance 8 ohm, 100mH maximum MLYO Series  
12 ohm, 120mH maximum MLYOM Series  
10 ohm, 50mH maximum MLYOC Series
- 5) FM Port  
Sensitivity 300KHz/mA ±10%  
3dB Bandwidth 300KHz minimum  
Input Impedance 1ohm, 1.8µH maximum
- 6) Heater Power Supply  
+28V @ 30mA maximum, MLYO and MLYOC Series
- 7) Storage Temperature Range  
-54°C to +100°C

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

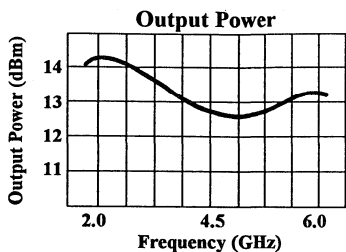
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

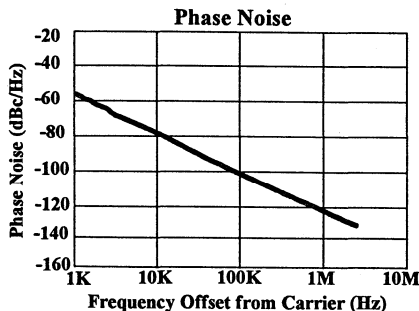
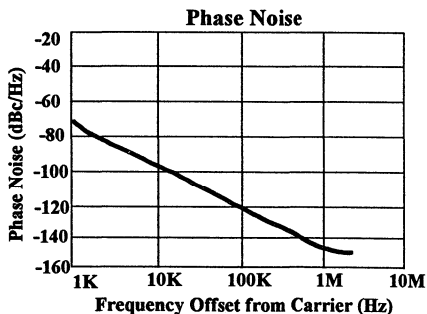
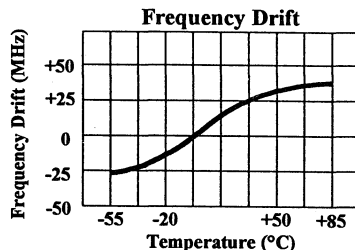
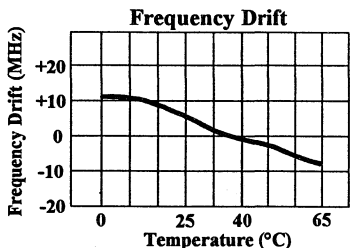
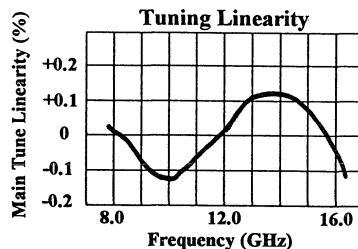
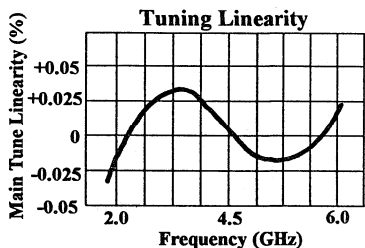
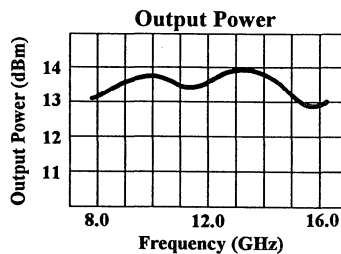


# TYPICAL PERFORMANCE

PART NO. MLYO-0206C



PART NO. MLYO-0816M



M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

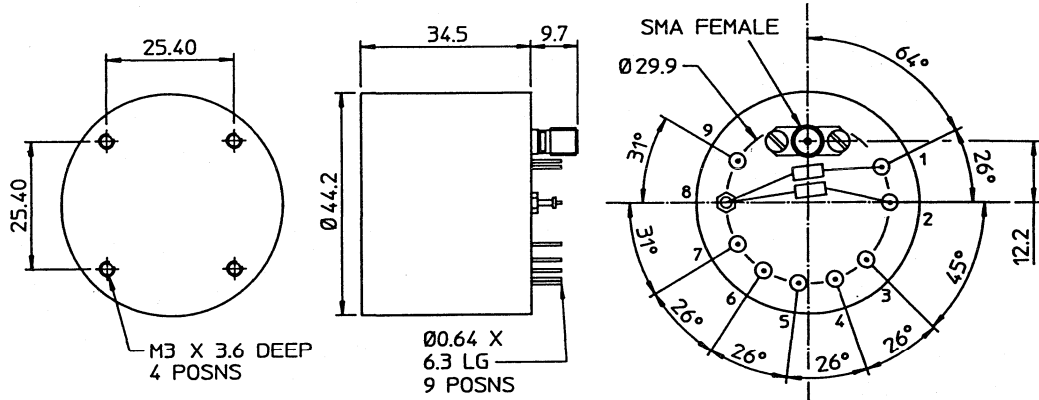
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

OUTLINE DRAWINGS

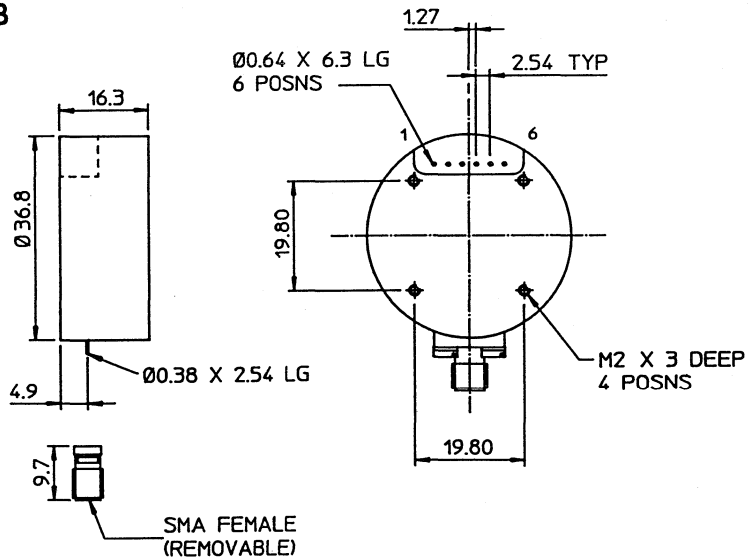
Package Style YTO A



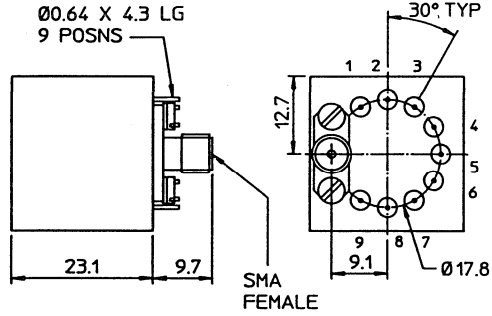
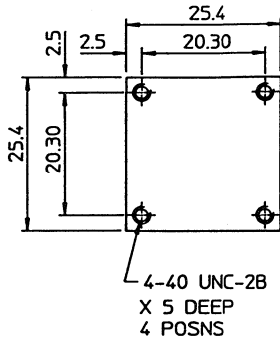
Pin No	Connection	Pin No	Connection
1	+15V	6	-Main Tune
2	-5V	7	-Heater
3	+FM	8	Gnd
4	-FM	9	+Heater
5	+Main Tune		

Package Style YTO B

Pin No	Connection
1	+15V
2	-5V
3	+Main Tune
4	-Main Tune
5	+FM
6	-FM

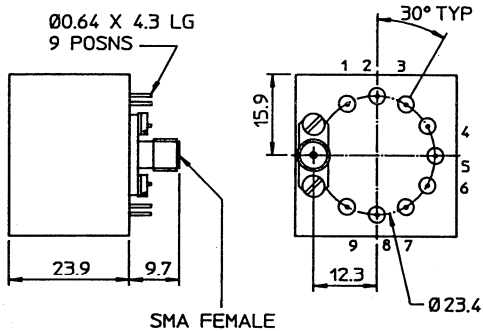
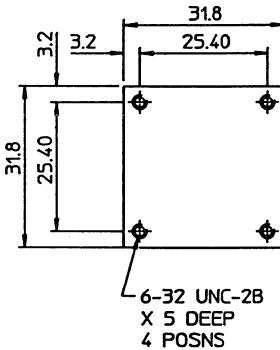


Package Style YTO C



Pin No	Connection	Pin No	Connection
1	+15V	6	-FM
2	-5V	7	Heater
3	+Tune	8	Gnd
4	-Tune	9	Heater
5	+FM		

Package Style YTO D



Pin No	Connection	Pin No	Connection
1	+15V	6	-FM
2	-5V	7	Heater
3	+Tune	8	Gnd
4	-Tune	9	Heater
5	+FM		

DRAWING NOTES

Third Angle Projection  
All dimensions in mm

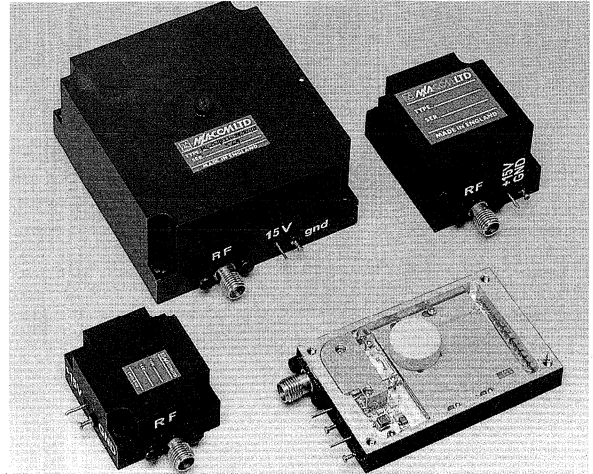
Tolerances    x.xx = ±0.5mm  
                  x.xx = ±0.2mm

Standard Finish: Stainless Steel

All specifications are subject to change without notice

**DIELECTRIC RESONATOR OSCILLATORS**  
**2 TO 20 GHz****FEATURES**

- ◆ **High Frequency Stability**
- ◆ **Low Phase Noise**
- ◆ **High Output Power**
- ◆ **Electronic Tuning**
- ◆ **Switched Output**

**DESCRIPTION**

M/A-COM Ltd's MLO 10000 series of dielectric resonator oscillators (DROs) provides a range of microwave signal sources which offer excellent frequency accuracy and temperature stability coupled with low phase noise, low power consumption and high reliability. The range includes fixed tuned DROs available with higher output power or switched output and an electronically tuned series with varactor tuning sufficient to provide full temperature compensation. Mechanical tuning is also available as an option.

All M/A-COM Ltd DROs are fundamental oscillators using thin film hybrid construction. The discrete bipolar or FET devices, passive devices, dielectric resonator and regulator are assembled in modular form prior to assembly into the coaxial housing which is then hermetically sealed. This compact, rugged construction makes these oscillators suitable for the environmental conditions encountered in both military and commercial applications.

DROs have many applications in microwave systems such as EW receivers, airborne radar, built in test equipment (BITE), transponders and communications. They can be used as fixed frequency local oscillators for up and down converters in microwave front ends, transmitter oscillators for commercial interrogation systems and, when electronically tuned, in phase locked loop systems.

In addition to the range of DROs described, M/A-COM Ltd also manufactures devices which have other component functions integrated within the same housing. Available options include higher output powers, coupled outputs, integral PIN diode attenuators for output power variation and selectable frequency sources of two or more DROs with a common switched output. For details of these options and to discuss other custom requirements please contact the factory for applications assistance.



**DESCRIPTION**

This series of DROs uses high Q dielectric resonators to produce highly stable low noise oscillators operating over the full military temperature range. All devices have an integral voltage regulator providing a stable output frequency for a wide variation of power supply voltage.

**SPECIFICATIONS**

Frequency Range (GHz)	Freq. Accuracy (all causes) (%)	Freq. Stability (ppm/°C) Max.	Output Power (dBm) Min.	Output Power Var (dB) Max.	Phase Noise (dBc/Hz)		Current Consump. at +15V (mA) Max.	Package Style	Part Number
	Max.				@10KHz Max.	@100KHz Max.			
2.000 - 3.999	±0.050	4	+10	±1.0	-100	-125	75	DA1	MLO 11200
4.000 - 5.999	±0.050	4	+10	±1.0	-100	-125	75	DB1	MLO 11300
6.000 - 7.999	±0.050	4	+10	±1.0	-100	-120	75	DC1	MLO 11400
8.000 - 11.999	±0.050	4	+10	±1.0	-90	-110	75	DD1	MLO 11500
12.000 - 17.999	±0.050	4	+10	±1.0	-80	-100	75	DE1	MLO 11600
18.000 - 20.000	±0.075	6	+10	±1.0	-70	-90	75	DE1	MLO 11700

**NOTES**

- 1) The frequency accuracy specification includes the variation of frequency with temperature, load VSWR, power supply voltage, ageing and the setting accuracy.
- 2) Frequency pulling ±0.02% maximum into a load VSWR 1.5:1 all phases
- 3) Frequency pushing 100 KHz maximum for supply voltage variation +12 to +18V
- 4) Harmonic Outputs -20dBc maximum
- 5) Spurious Outputs -60dBc maximum
- 6) Operating temperature range -55°C to +85°C  
Storage temperature range -55°C to +100°C
- 7) All standard devices have a fixed output frequency, however, mechanical tuning is also available as an option. Minimum tuning bandwidths ranges from ±5 MHz at 2 GHz to ±50 MHz at 20 GHz. Please contact the factory for further details.
- 8) Turn on time is 20us from application of dc voltage to within 10 MHz of final frequency.
- 9) All devices are supplied with a removable SMA female connector as standard, an SMA male connector can be specified as an option, please contact the factory.
- 10) When ordering please specify the exact output frequency required in MHz as a 5 digit suffix to the part number. e.g. for a frequency of 9825 MHz the part number would be MLO 11500-09825.

## DESCRIPTION

This series of DROs combines the high Q oscillator circuit with an integral buffer amplifier stage to provide higher output power. The buffer amplifier also reduces oscillator to load coupling to give minimum frequency pulling due to variations in load VSWR.

## SPECIFICATIONS

Frequency Range (GHz)	Freq. Accuracy (all causes) (%) Max.	Freq. Stability (ppm/°C) Max.	Output Power (dBm) Min.	Output Power Var (dB) Max.	Phase Noise (dBc/Hz)		Current Consump. at +15V (mA) Max.	Package Style	Part Number
					@10KHz Max.	@100KHz Max.			
2.000 - 3.999	±0.070	8	+20	±1.5	-100	-125	250	DA2	MLO 12200
4.000 - 5.999	±0.070	8	+20	±1.5	-100	-125	250	DB2	MLO 12300
6.000 - 7.999	±0.070	8	+20	±1.5	-100	-120	250	DC2	MLO 12400
8.000 - 11.999	±0.070	8	+20	±1.5	-90	-110	300	DD2	MLO 12500
12.000 - 17.999	±0.070	8	+20	±1.5	-80	-100	300	DE2	MLO 12600
18.000 - 20.000	±0.100	12	+20	±1.5	-70	-90	350	DE2	MLO 12700

## NOTES

- 1) The frequency accuracy specification includes the variation of frequency with temperature, load VSWR, power supply voltage, ageing and the setting accuracy.
- 2) Frequency pulling ±0.01% maximum into a load VSWR 1.5:1 all phases
- 3) Frequency pushing 100 KHz maximum for supply voltage variation +12 to +18V
- 4) Harmonic Outputs -15dBc maximum
- 5) Spurious Outputs -60dBc maximum
- 6) Operating temperature range -55°C to +85°C  
Storage temperature range -55°C to +100°C
- 7) All standard devices have a fixed output frequency, however, mechanical tuning is also available as an option. Minimum tuning bandwidths ranges from ±5 MHz at 2 GHz to ±50 MHz at 20 GHz. Please contact the factory for further details.
- 8) Turn on time is 20us from application of dc voltage to within 10 MHz of final frequency.
- 9) All devices are supplied with a removable SMA female connector as standard, an SMA male connector can be specified as an option, please contact the factory.
- 10) When ordering please specify the exact output frequency required in MHz as a 5 digit suffix to the part number. e.g. for a frequency of 9825 MHz the part number would be MLO 12500-09825.

## DESCRIPTION

Switched output DROs have an integral PIN diode switch and TTL driver to provide high isolation with fast rise and fall times. These DROs can be used to provide transmitter oscillators capable of high modulation rates or as BITE sources capable of producing fast rise time pulses for EW simulations.

## SPECIFICATIONS

Frequency Range (GHz)	Freq. Accuracy (all causes) (%) Max.	Freq. Stability (ppm/°C) Max.	Output Power (dBm) Min.	Output Power Var (dB) Max.	Phase Noise (dBc/Hz)		Switched Isolation (dB) Min.	Package Style	Part Number
					@10KHz Max.	@100KHz Max.			
2.000 - 3.999	±0.050	4	+10	±1.0	-100	-125	50	DA2	MLO 13200
4.000 - 5.999	±0.050	4	+10	±1.0	-100	-125	50	DB2	MLO 13300
6.000 - 7.999	±0.050	4	+10	±1.0	-100	-120	50	DC2	MLO 13400
8.000 - 11.999	±0.050	4	+10	±1.0	-90	-110	50	DD2	MLO 13500
12.000 - 17.999	±0.050	4	+10	±1.0	-80	-100	40	DE2	MLO 13600
18.000 - 20.000	±0.075	6	+10	±1.0	-70	-90	40	DE2	MLO 13700

## NOTES

- 1) The frequency accuracy specification includes the variation of frequency with temperature, load VSWR, power supply voltage, ageing and the setting accuracy.
- 2) Frequency pulling ±0.02% maximum into a load VSWR 1.5:1 all phases
- 3) Frequency pushing 100 KHz maximum for supply voltage variation +12 to +18V
- 4) Harmonic Outputs -20dBc maximum
- 5) Spurious Outputs -60dBc maximum
- 6) Transition Time 5ns maximum 10% to 90% detected RF output power
- 7) Switching Speed 20ns maximum 50% TTL input to 90% detected RF output power
- 8) Power Supplies +15V @ 130mA maximum  
-15V @ 10mA maximum
- 9) Control Input TTL '0' RF output on, TTL '1' RF output off
- 10) Operating temperature range -55°C to +85°C  
Storage temperature range -55°C to +100°C
- 11) All standard devices have a fixed output frequency, however, mechanical tuning is also available as an option. Minimum tuning bandwidths ranges from ±5 MHz at 2 GHz to ±50 MHz at 20 GHz. Please contact the factory for further details.
- 12) Turn on time is 20us from Application of dc voltage to within 10 MHz of final frequency.
- 13) All devices are supplied with a removable SMA female connector as standard, an SMA male connector can be specified as an option, please contact the factory.
- 14) When ordering please specify the exact output frequency required in MHz as a 5 digit suffix to the part number. e.g. for a frequency of 9825 MHz the part number would be MLO 13500-09825.

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Asia Pacific: (81) 3 3226 1671

## DESCRIPTION

M/A-COM Ltd electronically tuned DROs have a combination of high Q dielectric resonator circuit and varactor diode providing a tuning bandwidth sufficient to compensate for the variation of output frequency over the full military temperature range. These devices can be used with an external reference to provide phase locked oscillator performance.

## SPECIFICATIONS

Frequency Range (GHz)	Output Power (dBm) Min.	Output Power Variation (dB) Max.	Phase Noise (dBc/Hz)		Current Consumption at +15V (mA) Max.	Package Style	Part Number
			@10KHz Max.	@100KHz Max.			
2.000 - 3.999	+7	±2.0	-95	-115	75	DA1	MLO 14200
4.000 - 5.999	+7	±2.0	-95	-115	75	DB1	MLO 14300
6.000 - 7.999	+7	±2.0	-95	-115	75	DC1	MLO 14400
8.000 - 11.999	+7	±2.0	-85	-100	75	DD1	MLO 14500
12.000 - 17.999	+7	±2.0	-75	-90	75	DE1	MLO 14600
18.000 - 20.000	+7	±2.0	-65	-80	75	DE1	MLO 14700

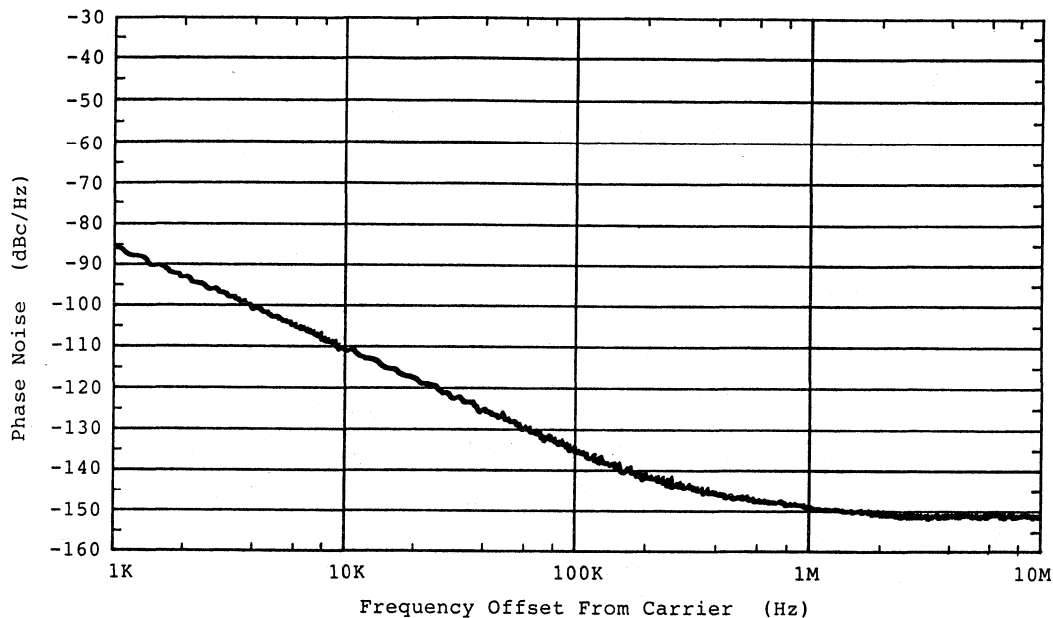
## NOTES

- 1) The electronic tuning bandwidth for each device is sufficient to compensate for the frequency drift across the full operating temperature range.
- 2) Frequency pulling ±0.02% maximum into a load VSWR 1.5:1 all phases
- 3) Frequency pushing 100 KHz maximum for supply voltage variation +12 to +18V
- 4) Harmonic Outputs -20dBc maximum
- 5) Spurious Outputs -60dBc maximum
- 6) Tuning voltage input (VT) in the range +2 to +20V.
- 7) Operating temperature range -55°C to +85°C  
Storage temperature range -55°C to +100°C
- 8) Turn on time is 20us from application of dc voltage to within 10 MHz of final frequency.
- 9) All devices are supplied with a removable SMA female connector as standard, an SMA male connector can be specified as an option, please contact the factory.
- 10) When ordering please specify the exact output frequency required in MHz as a 5 digit suffix to the part number: e.g. for a frequency of 9825 MHz the part number would be MLO 14500-09825.

**TYPICAL PERFORMANCE**

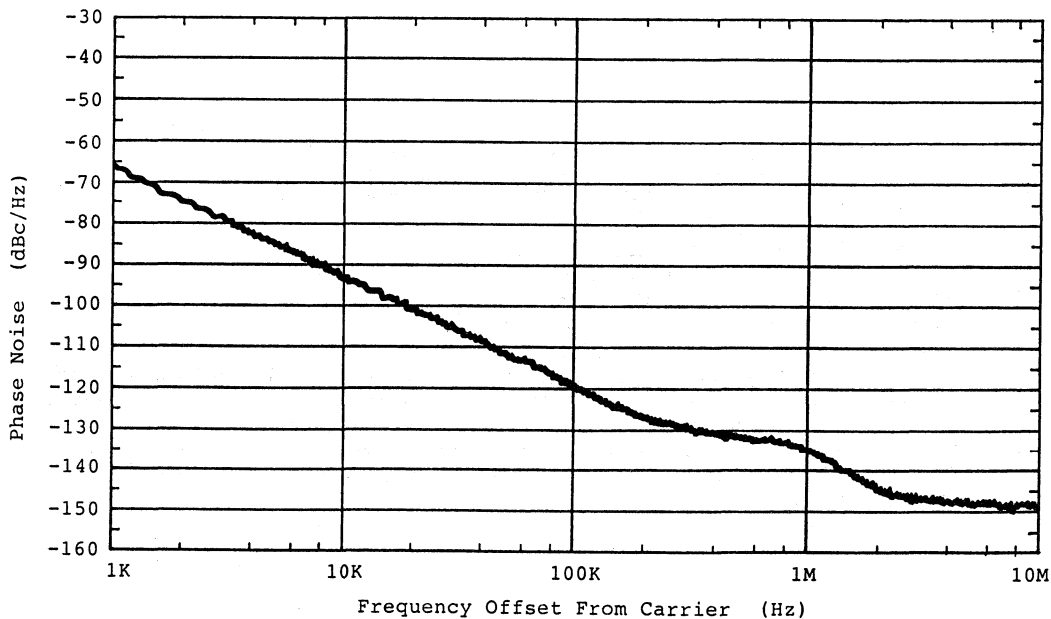
Single Side Band Phase Noise at 2.45 GHz

MLO 11200-02450



Single Side Band Phase Noise at 8.20 GHz

MLO 11500-08200



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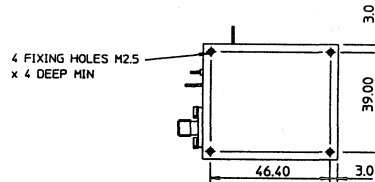
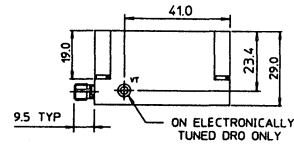
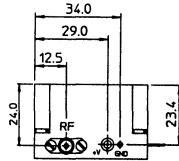
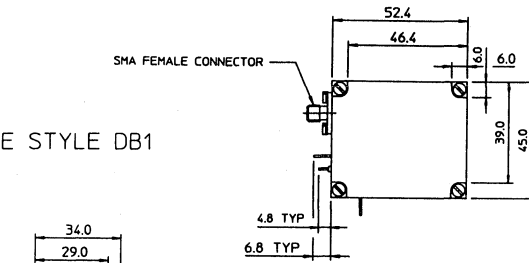
Europe: (44) 1344 869595

North America: 800 366 2266

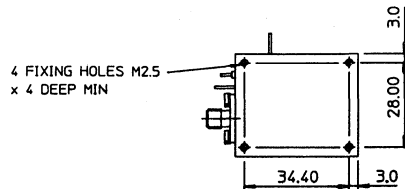
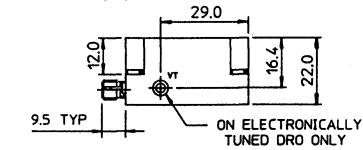
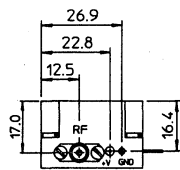
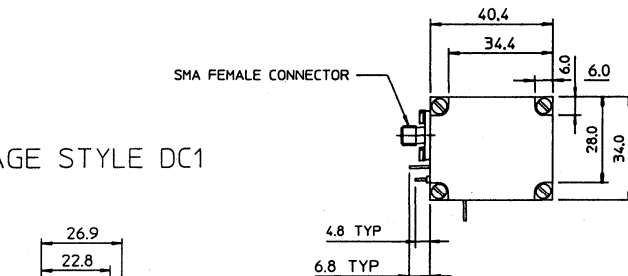
Asia Pacific: (81) 3 3226 1671

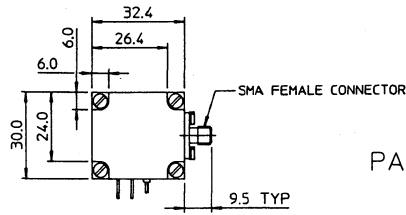


PACKAGE STYLE DB1

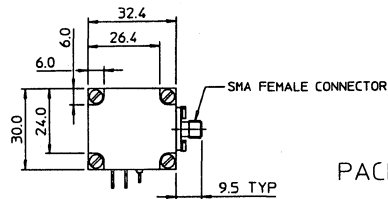
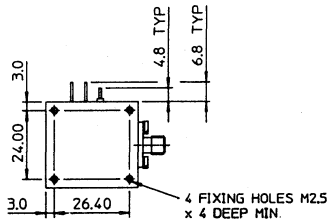
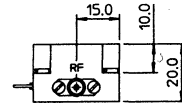
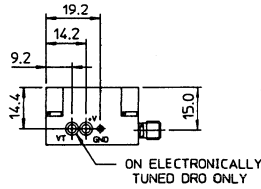


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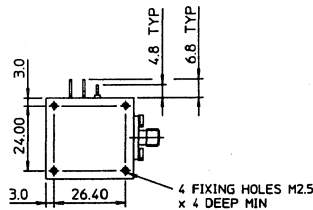
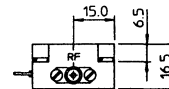
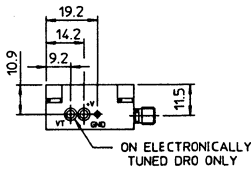




PACKAGE STYLE DD1



PACKAGE STYLE DE1



**DRAWING NOTES**

Third Angle Projection

All dimensions in mm

Tolerances x.x = ±0.5mm  
x.xx = ±0.2mm

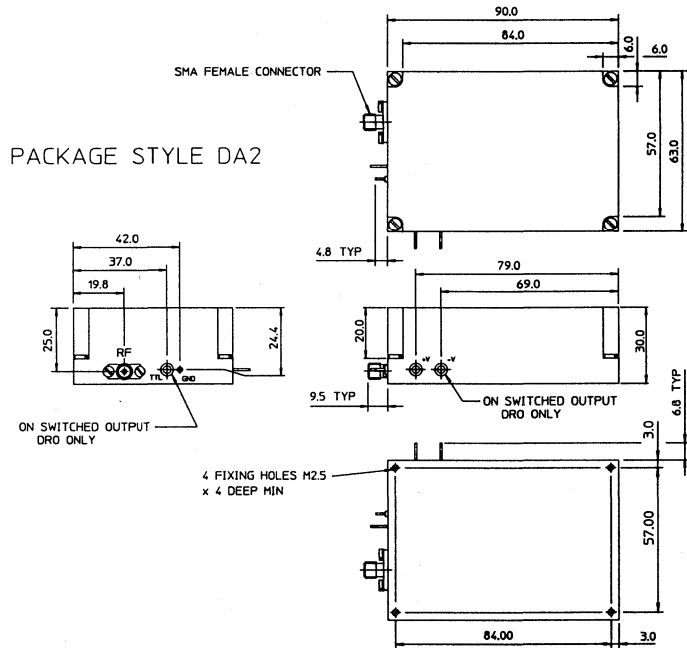
Standard Finish: Matt black paint to DTD 5555A

VT Solder Pin on Electronically Tuned DRO's only



# OUTLINE DRAWINGS

High Power (MLO 12000) and Switched Output (MLO 13000) DRO's



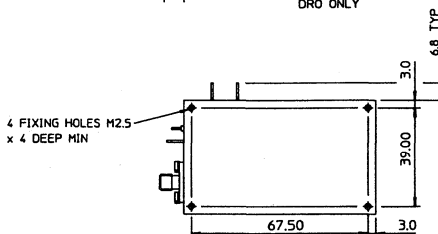
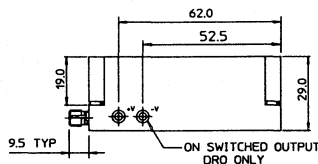
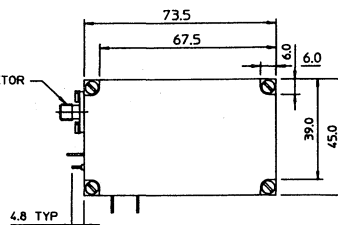
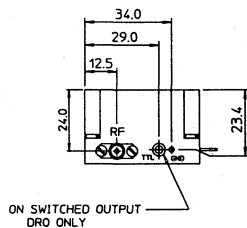
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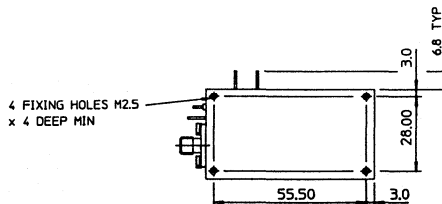
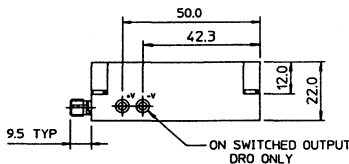
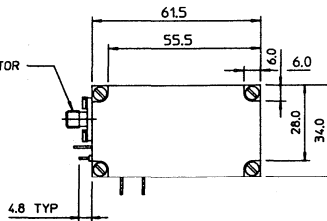
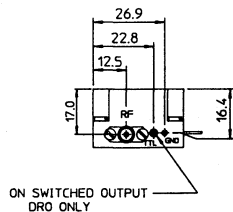
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PACKAGE STYLE DB2



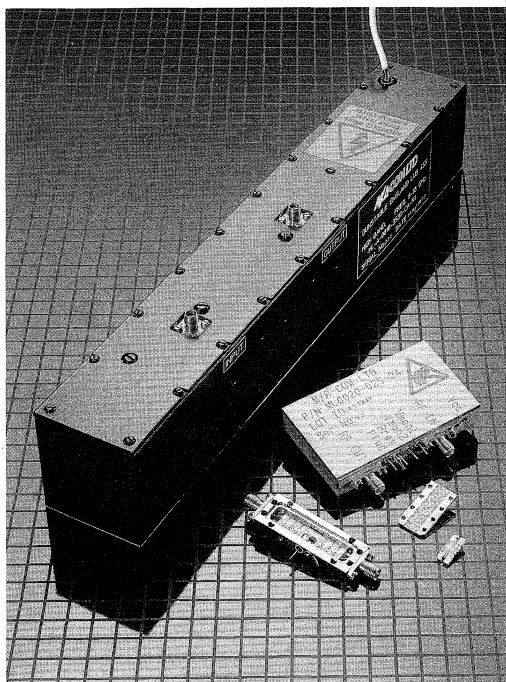
PACKAGE STYLE DC2





# AMPLIFIERS

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**BROADBAND GaAs FET AMPLIFIERS****0.5 TO 18.0 GHz****FEATURES**

- ◆ **Broad Frequency Ranges**
- ◆ **Low Noise Figures**
- ◆ **Wide Dynamic Ranges**
- ◆ **Temperature Compensation**
- ◆ **Miniature Outlines**

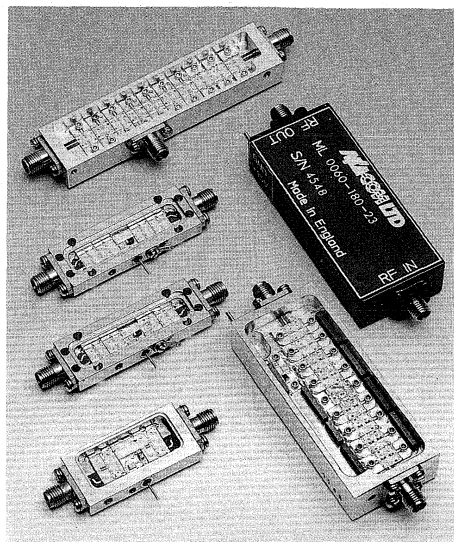
**DESCRIPTION**

The MLA 2000-000 series of broadband GaAs FET Amplifiers from M/A-COM Ltd is a comprehensive range of devices for octave and multi-octave applications from 0.5 to 18 GHz. The range includes standard low noise and medium power gain blocks available with or without temperature compensation as well as limiting amplifiers for output power compression. All amplifiers are available in either a standard or optional miniature package style.

The designs are based on a balanced hybrid approach giving excellent gain flatness and VSWR over very wide bandwidths. Construction of the amplifiers is by integration of the FET, HEMT or MMIC devices into either a conventional alumina MIC or a glass MIC (GMIC) with the complete amplifier assembly then hermetically sealed by laser welding. GMIC is a proprietary pseudo-monolithic MIC fabrication technique established by M/A-COM Ltd using a thin glass substrate bonded directly to a high conductivity silicon carrier. All the passive components are then photolithographically defined with the discrete FET devices mounted in via holes. The compact, rugged construction of these amplifiers makes them suitable for the most severe environmental conditions encountered in military and hi-rel applications.

Low noise amplifiers have a wide variety of uses in broadband EW and radar receivers and test equipment applications while medium power units can be used as driver amplifiers for high power TWTA's or as output amplifiers for ECM, decoy and target transmitters. Limiting amplifiers are used where an input signal with wide dynamic range is to be compressed to an output signal with very narrow dynamic range for subsequent signal processing and detection. Advances in solid state technology make these amplifiers suitable as direct replacements for TWTAs in many applications giving improved reliability at lower cost.

As well as the basic amplifiers described M/A-COM Ltd also manufactures devices with additional components integrated within the same housing. Available options include input limiters for passive high power protection, integral PIN attenuators for gain/sensitivity control, coupled outputs for successive detection and filters. For details of these options and to discuss other custom requirements please contact the factory for applications assistance.



## DESCRIPTION

This series of broadband low noise amplifiers offers non-temperature compensated performance over a variety of octave and multi-octave frequency bands. These amplifiers have a wide range of gain and output power options and are optimised for noise figure and dynamic range.

## SPECIFICATIONS (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number	
0.5 - 2.0	+12	16	±1.00	0.020	4.0	2.0	65	A1, A3	MLA 2130-101	
		32	±2.00	0.040	4.0	2.0	130	A1, A3	MLA 2130-102	
		48	±2.50	0.060	4.0	2.0	200	A1, A3	MLA 2130-103	
	+20	8	±1.00	0.010	5.0	2.0	150	A1, A3	MLA 2130-201	
		24	±2.00	0.030	4.0	2.0	200	A1, A3	MLA 2130-202	
		40	±2.50	0.040	4.0	2.0	270	A1, A3	MLA 2130-203	
	+23	8	±1.00	0.020	5.0	2.0	150	A1, A3	MLA 2130-301	
		16	±2.00	0.040	4.0	2.0	280	A1, A3	MLA 2130-302	
		32	±2.50	0.060	4.0	2.0	350	A1, A3	MLA 2130-303	
	2.0 - 8.0	+10	48	±3.00	0.080	4.0	2.0	420	B1, B3	MLA 2130-304
			18	±1.50	0.025	3.5	2.0	130	A1, A3	MLA 2140-101
			27	±1.50	0.035	3.5	2.0	200	B1, B3	MLA 2140-102
+15		36	±1.75	0.050	3.5	2.0	270	B1, B3	MLA 2140-103	
		18	±1.50	0.025	4.0	2.0	150	A1, A3	MLA 2140-201	
		27	±1.50	0.035	4.0	2.0	220	B1, B3	MLA 2140-202	
+18		36	±1.75	0.050	4.0	2.0	300	B1, B3	MLA 2140-203	
		18	±1.50	0.025	5.0	2.0	180	A1, A3	MLA 2140-301	
		27	±1.50	0.035	5.0	2.0	280	B1, B3	MLA 2140-302	
6.0 - 12.0		+10	36	±1.75	0.050	5.0	2.0	350	B1, B3	MLA 2140-303
			12	±1.00	0.025	3.8	2.0	100	A1, A2	MLA 2150-101
			23	±1.25	0.050	3.8	2.0	200	B1, B2	MLA 2150-102
	34		±1.75	0.075	3.8	2.0	300	B1, B2	MLA 2150-103	
	46		±2.00	0.100	3.8	2.0	400	C1, C2	MLA 2150-104	
	+15	52	±2.00	0.120	3.8	2.0	450	D1, D2	MLA 2150-105	
		11	±1.25	0.025	5.0	2.0	150	A1, A2	MLA 2150-201	
		22	±1.50	0.050	5.0	2.0	250	B1, B2	MLA 2150-202	
		33	±1.75	0.075	5.0	2.0	350	B1, B2	MLA 2150-203	
		44	±2.00	0.100	5.0	2.0	450	C1, C2	MLA 2150-204	
	+18	50	±2.00	0.120	5.0	2.0	500	D1, D2	MLA 2150-205	
		10	±1.25	0.025	7.0	2.0	175	A1, A2	MLA 2150-301	
21		±1.50	0.050	6.0	2.0	275	B1, B2	MLA 2150-302		
32		±1.75	0.075	6.0	2.0	400	B1, B2	MLA 2150-303		
42		±2.00	0.100	6.0	2.0	500	C1, C2	MLA 2150-304		
		48	±2.00	0.120	6.0	2.0	550	D1, D2	MLA 2150-305	

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**SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
12.0 - 18.0	+10	11	±1.00	0.025	4.2	2.0	100	A1, A2	MLA 2160-101
		22	±1.25	0.050	4.2	2.0	200	B1, B2	MLA 2160-102
		33	±1.75	0.075	4.2	2.0	300	B1, B2	MLA 2160-103
		44	±2.00	0.100	4.2	2.0	400	C1, C2	MLA 2160-104
		50	±2.00	0.120	4.2	2.0	450	D1, D2	MLA 2160-105
	+15	10	±1.00	0.025	6.0	2.0	150	A1, A2	MLA 2160-201
		21	±1.25	0.050	6.0	2.0	250	B1, B2	MLA 2160-202
		32	±1.75	0.075	6.0	2.0	350	B1, B2	MLA 2160-203
		43	±2.00	0.100	6.0	2.0	450	C1, C2	MLA 2160-204
		49	±2.00	0.120	6.0	2.0	500	D1, D2	MLA 2160-205
	+18	9	±1.00	0.025	8.0	2.0	175	A1, A2	MLA 2160-301
		20	±1.25	0.050	7.0	2.0	275	B1, B2	MLA 2160-302
		30	±1.75	0.075	7.0	2.0	400	B1, B2	MLA 2160-303
		40	±2.00	0.100	7.0	2.0	500	C1, C2	MLA 2160-304
		46	±2.00	0.120	7.0	2.0	550	D1, D2	MLA 2160-305
6.0 - 18.0	+10	11	±1.00	0.025	4.2	2.0	100	A1, A2	MLA 2170-101
		22	±1.50	0.050	4.2	2.0	200	B1, B2	MLA 2170-102
		33	±1.75	0.075	4.2	2.0	300	B1, B2	MLA 2170-103
		44	±2.00	0.100	4.2	2.0	400	C1, C2	MLA 2170-104
		50	±2.00	0.120	4.2	2.0	450	D1, D2	MLA 2170-105
	+15	10	±1.25	0.025	6.0	2.0	150	A1, A2	MLA 2170-201
		21	±1.50	0.050	6.0	2.0	250	B1, B2	MLA 2170-202
		32	±1.75	0.075	6.0	2.0	350	B1, B2	MLA 2170-203
		43	±2.00	0.100	6.0	2.0	450	C1, C2	MLA 2170-204
		49	±2.00	0.120	6.0	2.0	500	D1, D2	MLA 2170-205
	+18	9	±1.50	0.025	8.0	2.0	175	A1, A2	MLA 2170-301
		20	±1.50	0.050	7.0	2.0	275	B1, B2	MLA 2170-302
		30	±1.75	0.075	7.0	2.0	400	B1, B2	MLA 2170-303
		40	±2.00	0.100	7.0	2.0	500	C1, C2	MLA 2170-304
		46	±2.00	0.120	7.0	2.0	550	D1, D2	MLA 2170-305
2.0 - 18.0	+2	10	±1.00	0.018	4.8	2.2	50	A1, A2	MLA 2180-101
		20	±1.50	0.036	4.8	2.2	100	A1, A2	MLA 2180-102
	+12	10	±1.25	0.036	5.5	2.2	250	A1, A2	MLA 2180-201
		20	±2.00	0.072	5.5	2.2	500	B1, B2	MLA 2180-202
		30	±2.50	0.090	5.5	2.2	550	B1, B2	MLA 2180-203
	+17	7	±0.75	0.018	8.0	2.2	180	A1, A2	MLA 2180-301
		15	±1.50	0.036	8.5	2.2	360	A1, A2	MLA 2180-302
		20	±2.00	0.054	8.5	2.2	450	A1, A2	MLA 2180-303
		30	±2.50	0.072	8.5	2.2	500	B1, B2	MLA 2180-304

**NOTES**

- 1) Maximum input power without damage +20dBm (cw)
- 2) Third order intercept point is typically 10dB above P1dB
- 3) All amplifiers have reverse polarity and over voltage power supply protection
- 4) Alternative +8V and +12V power supplies are available on selected amplifiers, please contact the factory
- 5) All amplifiers are unconditionally stable for any input or output VSWR, any phase
- 6) Case operating temperature -55°C to +95°C  
Storage temperature -55°C to +125°C7)
- 7) Amplifiers are supplied in standard package styles (A1, B1, C1, D1) unless miniature option (A2, B2 etc) is specified.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

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**DESCRIPTION**

This series of broadband low noise amplifiers has an integral temperature compensation network giving flat gain response over the full military temperature range. These amplifiers operate over a variety of octave and multi-octave frequency bands with a wide range of gain and output power options, performance is optimised for noise figure and dynamic range.

**SPECIFICATIONS (guaranteed -55° C to +95° C)**

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
2.0 - 8.0	+10	17	±2.00	±0.75	4.5	2.0	130	A1, A3	MLA 2240-101
		25	±2.00	±1.00	4.5	2.0	200	B1, B3	MLA 2240-102
		34	±2.25	±1.25	4.5	2.0	270	B1, B3	MLA 2240-103
	+15	17	±2.00	±0.75	5.0	2.0	150	A1, A3	MLA 2240-201
		25	±2.00	±1.00	5.0	2.0	220	B1, B3	MLA 2240-202
		34	±2.25	±1.25	5.0	2.0	300	B1, B3	MLA 2240-203
	+18	17	±2.00	±0.75	6.0	2.0	180	A1, A3	MLA 2240-301
		25	±2.00	±1.00	6.0	2.0	280	B1, B3	MLA 2240-302
		34	±2.25	±1.25	6.0	2.0	350	B1, B3	MLA 2240-303
6.0 - 12.0	+10	10	±1.00	±0.75	6.2	2.0	100	A1, A2	MLA 2250-101
		19	±1.25	±1.00	5.2	2.0	200	B1, B2	MLA 2250-102
		28	±1.75	±1.50	5.2	2.0	300	B1, B2	MLA 2250-103
		38	±2.00	±2.00	5.2	2.0	400	C1, C2	MLA 2250-104
		44	±2.00	±2.00	5.2	2.0	500	D1, D2	MLA 2250-105
	+15	10	±1.25	±0.75	6.5	2.0	150	A1, A2	MLA 2250-201
		19	±1.50	±1.00	5.5	2.0	250	B1, B2	MLA 2250-202
		28	±1.75	±1.50	5.5	2.0	350	B1, B2	MLA 2250-203
		38	±2.00	±2.00	5.5	2.0	450	C1, C2	MLA 2250-204
		44	±2.00	±2.00	5.5	2.0	500	D1, D2	MLA 2250-205
	+18	9	±1.25	±0.75	7.5	2.0	175	A1, A2	MLA 2250-301
		18	±1.50	±1.00	6.5	2.0	275	B1, B2	MLA 2250-302
		27	±1.75	±1.50	6.5	2.0	400	B1, B2	MLA 2250-303
		36	±2.00	±2.00	6.5	2.0	500	C1, C2	MLA 2250-304
		42	±2.00	±2.00	6.5	2.0	550	D1, D2	MLA 2250-305
12.0 - 18.0	+10	9	±1.00	±0.75	6.5	2.0	100	A1, A2	MLA 2260-101
		18	±1.25	±1.00	5.5	2.0	200	B1, B2	MLA 2260-102
		27	±1.75	±1.50	5.5	2.0	300	B1, B2	MLA 2260-103
		36	±2.00	±2.00	5.5	2.0	400	C1, C2	MLA 2260-104
		41	±2.00	±2.00	5.5	2.0	500	D1, D2	MLA 2260-105
	+15	9	±1.00	±0.75	8.0	2.0	150	A1, A2	MLA 2260-201
		18	±1.25	±1.00	7.0	2.0	250	B1, B2	MLA 2260-202
		27	±1.75	±1.50	7.0	2.0	350	B1, B2	MLA 2260-203
		36	±2.00	±2.00	7.0	2.0	450	C1, C2	MLA 2260-204
		41	±2.00	±2.00	7.0	2.0	500	D1, D2	MLA 2260-205
	+18	8	±1.00	±0.75	9.0	2.0	175	A1, A2	MLA 2260-301
		17	±1.25	±1.00	8.0	2.0	275	B1, B2	MLA 2260-302
		26	±1.75	±1.50	7.0	2.0	400	B1, B2	MLA 2260-303
		34	±2.00	±2.00	7.0	2.0	500	C1, C2	MLA 2260-304
		39	±2.00	±2.00	7.0	2.0	550	D1, D2	MLA 2260-305

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**TEMPERATURE COMPENSATED  
BROADBAND LOW NOISE AMPLIFIER  
MLA 2200-000 SERIES**

**SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
6.0 - 18.0	+10	9	±1.00	±0.75	6.5	2.0	100	A1, A2	MLA 2270-101
		18	±1.50	±1.00	5.5	2.0	200	B1, B2	MLA 2270-102
		27	±1.75	±1.50	5.5	2.0	300	B1, B2	MLA 2270-103
		36	±2.00	±2.00	5.5	2.0	400	C1, C2	MLA 2270-104
		41	±2.00	±2.00	5.5	2.0	500	D1, D2	MLA 2270-105
		9	±1.25	±0.75	8.0	2.0	150	A1, A2	MLA 2270-201
	+15	18	±1.50	±1.00	7.0	2.0	250	B1, B2	MLA 2270-202
		27	±1.75	±1.50	7.0	2.0	350	B1, B2	MLA 2270-203
		36	±2.00	±2.00	7.0	2.0	450	C1, C2	MLA 2270-204
		41	±2.00	±2.00	7.0	2.0	500	D1, D2	MLA 2270-205
		8	±1.50	±0.75	9.0	2.0	175	A1, A2	MLA 2270-301
		17	±1.50	±1.00	8.0	2.0	275	B1, B2	MLA 2270-302
	+18	26	±1.75	±1.50	7.0	2.0	400	B1, B2	MLA 2270-303
		34	±2.00	±2.00	7.0	2.0	500	C1, C2	MLA 2270-304
		39	±2.00	±2.00	7.0	2.0	550	D1, D2	MLA 2270-305

**NOTES**

- 1) Maximum input power without damage +20dBm (CW)
- 2) Third order intercept point is typically 10dB above P1dB
- 3) All amplifiers have reverse polarity and over voltage power supply protection
- 4) Alternative +8V and +12V power supplies are available on selected amplifiers, please contact the factory
- 5) All amplifiers are unconditionally stable for any input or output VSWR, any phase
- 6) Case operating temperature -55°C to +95°C  
Storage temperature -55°C to +125°C
- 7) Amplifiers are supplied in standard package styles (A1, B1, C1, D1) unless miniature option (A2, B2 etc) is specified.

# BROADBAND MEDIUM POWER AMPLIFIERS

## MLA 2100-000 SERIES

### DESCRIPTION

This series of broadband medium power amplifiers offers non-temperature compensated performance over a variety of octave and multi-octave frequency bands. These amplifiers have a wide range of gain and output power options and are optimised for output power and flatness.

### SPECIFICATIONS (guaranteed @25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
2.0 - 8.0	+21	17	±2.00	0.025	7.5	2.0	300	A1, A3	MLA 2140-401
		26	±2.00	0.035	6.0	2.0	400	B1, B3	MLA 2140-402
		35	±2.00	0.050	6.0	2.0	480	B1, B3	MLA 2140-403
	+26	15	±2.00	0.025	8.0	2.0	350	A1, A3	MLA 2140-501
		24	±2.00	0.035	7.0	2.0	450	B1, B3	MLA 2140-502
		33	±2.00	0.050	6.0	2.0	550	B1, B3	MLA 2140-503
6.0 - 12.0	+21	10	±1.00	0.025	9.0	2.0	200	A1, A2	MLA 2150-401
		21	±1.25	0.050	8.0	2.0	300	B1, B2	MLA 2150-402
		31	±1.50	0.075	8.0	2.0	450	B1, B2	MLA 2150-403
	+25	42	±1.75	0.100	8.0	2.0	600	C1, C2	MLA 2150-404
		9	±1.00	0.025	9.0	2.0	300	A1, A2	MLA 2150-501
		20	±1.25	0.050	8.0	2.0	450	B1, B2	MLA 2150-502
12.0 - 18.0	+21	29	±1.50	0.075	8.0	2.0	600	B1, B2	MLA 2150-503
		40	±1.75	0.100	8.0	2.0	800	C1, C2	MLA 2150-504
		9	±1.00	0.025	10.0	2.0	200	A1, A2	MLA 2160-401
	+25	20	±1.25	0.050	9.0	2.0	300	B1, B2	MLA 2160-402
		30	±1.50	0.075	9.0	2.0	450	B1, B2	MLA 2160-403
		40	±1.75	0.100	9.0	2.0	600	C1, C2	MLA 2160-404
6.0 - 18.0	+21	8	±1.00	0.025	10.0	2.0	300	A1, A2	MLA 2160-501
		19	±1.25	0.050	9.0	2.0	450	B1, B2	MLA 2160-502
		28	±1.50	0.075	9.0	2.0	600	B1, B2	MLA 2160-503
	+25	38	±1.75	0.100	9.0	2.0	800	C1, C2	MLA 2160-504
		9	±1.25	0.025	10.0	2.0	200	A1, A2	MLA 2170-401
		20	±1.50	0.050	9.0	2.0	300	B1, B2	MLA 2170-402
6.0 - 18.0	+21	30	±1.75	0.075	9.0	2.0	450	B1, B2	MLA 2170-403
		40	±2.00	0.100	9.0	2.0	600	C1, C2	MLA 2170-404
		8	±1.25	0.025	10.0	2.0	300	A1, A2	MLA 2170-501
	+25	19	±1.50	0.050	9.0	2.0	450	B1, B2	MLA 2170-502
		28	±1.75	0.075	9.0	2.0	600	B1, B2	MLA 2170-503
		38	±2.00	0.100	9.0	2.0	800	C1, C2	MLA 2170-504

### NOTES

- 1) Higher output powers of up to +30dBm are available in non-standard outlines, please contact the factory
- 2) Maximum input power without damage +20dBm (CW)
- 2) Third order intercept point is typically 10dB above P1dB
- 3) All amplifiers have reverse polarity and over voltage power supply protection
- 4) Alternative +8V and +12V power supplies are available on selected amplifiers, please contact the factory
- 5) All amplifiers are unconditionally stable for any input or output VSWR, any phase
- 6) Case operating temperature -55°C to +95°C  
Storage temperature -55°C to +125°C
- 7) Amplifiers are supplied in standard package styles (A1, B1, C1, D1) unless miniature option (A2, B2 etc) is specified.

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TEMPERATURE COMPENSATED  
**BROADBAND MEDIUM POWER AMPLIFIERS**  
**MLA 2200-000 SERIES**

## DESCRIPTION

This series of broadband medium power amplifiers has an integral temperature compensation network giving flat gain response over the full military temperature range. These amplifiers operate over a variety of octave and multi-octave frequency bands with a wide range of gain and output power options, performance is optimised for output power and flatness.

## SPECIFICATIONS (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
2.0 - 8.0	+21	16	±2.00	±0.75	8.0	2.0	300	A1, A3	MLA 2240-401
		24	±2.00	±1.00	7.0	2.0	400	B1, B3	MLA 2240-402
		33	±2.00	±1.25	7.0	2.0	480	B1, B3	MLA 2240-403
	+26	14	±2.00	±0.75	9.0	2.0	350	A1, A3	MLA 2240-501
		22	±2.00	±1.00	8.0	2.0	450	B1, B3	MLA 2240-502
		31	±2.00	±1.25	7.0	2.0	550	B1, B3	MLA 2240-503
6.0 - 12.0	+21	9	±1.00	±0.75	10.0	2.0	200	A1, A2	MLA 2250-401
		20	±1.25	±1.00	9.0	2.0	300	B1, B2	MLA 2250-402
		29	±1.50	±1.50	9.0	2.0	450	C1, C2	MLA 2250-403
	+25	40	±1.75	±2.00	9.0	2.0	600	D1, D2	MLA 2250-404
		8	±1.00	±0.75	10.0	2.0	300	A1, A2	MLA 2250-501
		19	±1.25	±1.00	9.0	2.0	450	B1, B2	MLA 2250-502
12.0 - 18.0	+21	27	±1.50	±1.50	9.0	2.0	600	C1, C2	MLA 2250-503
		36	±1.75	±2.00	9.0	2.0	800	D1, D2	MLA 2250-504
		8	±1.00	±0.75	12.0	2.0	200	A1, A2	MLA 2260-401
	+25	18	±1.25	±1.00	10.0	2.0	300	B1, B2	MLA 2260-402
		27	±1.50	±1.25	10.0	2.0	450	C1, C2	MLA 2260-403
		36	±1.75	±2.00	10.0	2.0	600	D1, D2	MLA 2260-404
6.0 - 18.0	+21	7	±1.00	±0.75	12.0	2.0	300	A1, A2	MLA 2260-501
		17	±1.25	±1.00	10.0	2.0	450	B1, B2	MLA 2260-502
		25	±1.50	±1.25	10.0	2.0	600	C1, C2	MLA 2260-503
	+25	34	±1.75	±2.00	10.0	2.0	800	D1, D2	MLA 2260-504
		8	±1.25	±0.75	12.0	2.0	200	A1, A2	MLA 2270-401
		18	±1.50	±1.00	10.0	2.0	300	B1, B2	MLA 2270-402
+21	27	±1.75	±1.50	10.0	2.0	450	C1, C2	MLA 2270-403	
	36	±2.00	±2.00	10.0	2.0	600	D1, D2	MLA 2270-404	
	7	±1.25	±0.75	12.0	2.0	300	A1, A2	MLA 2270-501	
	17	±1.50	±1.00	10.0	2.0	450	B1, B2	MLA 2270-502	
+25	25	±1.75	±1.50	10.0	2.0	600	C1, C2	MLA 2270-503	
	34	±2.00	±2.00	10.0	2.0	800	D1, D2	MLA 2270-504	

## NOTES

- 1) Higher output powers of up to +30dBm are available in non-standard outlines, please contact the factory
- 2) Maximum input power without damage +20dBm (CW)
- 2) Third order intercept point is typically 10dB above P1dB
- 3) All amplifiers have reverse polarity and over voltage power supply protection
- 4) Alternative +8V and +12V power supplies are available on selected amplifiers, please contact the factory
- 5) All amplifiers are unconditionally stable for any input or output VSWR, any phase
- 6) Case operating temperature -55°C to +95°C  
Storage temperature -55°C to +125°C
- 7) Amplifiers are supplied in standard package styles (A1, B1, C1, D1) unless miniature option (A2, B2 etc) is specified.

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DESCRIPTION

This series of broadband limiting amplifiers offers temperature compensated performance over a wide variety of octave and multi-octave frequency bands. These amplifiers have a wide range of input and output power options and are optimised for output power flatness and harmonic distortion.

SPECIFICATIONS (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Saturated Output Power (dBm)		Saturated Power Flatness (dB) Max.	Input Power for Saturation (dBm)		Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
	Min.	Max.		Min.	Max.					
2.0 - 8.0	+14	+17	±1.0	-10	5.0	2.0	250	B1, B3	MLA 2340-101	
				-20	5.0	2.0	300	B1, B3	MLA 2340-102	
				-30	5.0	2.0	350	C1, C3	MLA 2340-103	
				-10	5.0	2.0	300	B1, B3	MLA 2340-201	
				-20	5.0	2.0	350	B1, B3	MLA 2340-202	
				-30	5.0	2.0	400	C1, C3	MLA 2340-203	
	+17	+20	±1.0	-10	5.0	2.0	350	B1, B3	MLA 2340-301	
				-20	5.0	2.0	400	B1, B3	MLA 2340-302	
				-30	5.0	2.0	450	C1, C3	MLA 2340-303	
				-10	6.0	2.0	300	C1, C2	MLA 2350-101	
				-20	6.0	2.0	350	C1, C2	MLA 2350-102	
				-30	6.0	2.0	400	D1, D2	MLA 2350-103	
6.0 - 12.0	+14	+17	±1.0	-10	6.0	2.0	350	C1, C2	MLA 2350-201	
				-20	6.0	2.0	400	D1, D2	MLA 2350-202	
				-30	6.0	2.0	450	D1, D2	MLA 2350-203	
				-10	6.0	2.0	500	C1, C2	MLA 2350-301	
				-20	6.0	2.0	550	D1, D2	MLA 2350-302	
				-30	6.0	2.0	600	D1, D2	MLA 2350-303	
	+17	+20	±1.0	-10	8.0	2.0	350	C1, C2	MLA 2360-101	
				-20	8.0	2.0	400	C1, C2	MLA 2360-102	
				-30	8.0	2.0	450	D1, D2	MLA 2360-103	
				-10	8.0	2.0	400	C1, C2	MLA 2360-201	
				-20	8.0	2.0	450	D1, D2	MLA 2360-202	
				-30	8.0	2.0	500	D1, D2	MLA 2360-203	
+20	+23	±1.0	-10	8.0	2.0	550	C1, C2	MLA 2360-301		
			-20	8.0	2.0	600	D1, D2	MLA 2360-302		
			-30	8.0	2.0	650	D1, D2	MLA 2360-303		
			-10	8.0	2.0	350	C1, C2	MLA 2370-101		
			-20	8.0	2.0	400	C1, C2	MLA 2370-102		
			-30	8.0	2.0	450	D1, D2	MLA 2370-103		
12.0 - 18.0	+14	+17	±1.0	-10	8.0	2.0	400	C1, C2	MLA 2370-201	
				-20	8.0	2.0	450	D1, D2	MLA 2370-202	
				-30	8.0	2.0	500	D1, D2	MLA 2370-203	
				-10	8.0	2.0	550	C1, C2	MLA 2370-301	
				-20	8.0	2.0	600	D1, D2	MLA 2370-302	
				-30	8.0	2.0	650	D1, D2	MLA 2370-303	
6.0 - 18.0	+17	+20	±1.0	-10	8.0	2.0	350	C1, C2	MLA 2370-101	
				-20	8.0	2.0	400	C1, C2	MLA 2370-102	
				-30	8.0	2.0	450	D1, D2	MLA 2370-103	
				-10	8.0	2.0	400	C1, C2	MLA 2370-201	
				-20	8.0	2.0	450	D1, D2	MLA 2370-202	
				-30	8.0	2.0	500	D1, D2	MLA 2370-203	
+20	+23	±1.0	-10	8.0	2.0	550	C1, C2	MLA 2370-301		
			-20	8.0	2.0	600	D1, D2	MLA 2370-302		
			-30	8.0	2.0	650	D1, D2	MLA 2370-303		

NOTES

- 1) Amplifiers saturating from lower input powers are available in non-standard outlines, please contact the factory.
- 2) Power output for 1dB gain compression is typically 4dB below saturated output power.
- 3) Maximum input power without damage +20dBm (CW)
- 4) Harmonic outputs are typically -12dBc
- 5) All amplifiers have reverse polarity and over voltage power supply protection
- 6) Alternative +8V and +12V power supplies are available on selected amplifiers, please contact the factory
- 7) All amplifiers are unconditionally stable for any input or output VSWR, any phase
- 8) Case operating temperature -55°C to +95°C  
Storage temperature -55°C to +125°C
- 9) Amplifiers are supplied in standard package styles (A1, B1, C1, D1) unless miniature option (A2, B2 etc) is specified.

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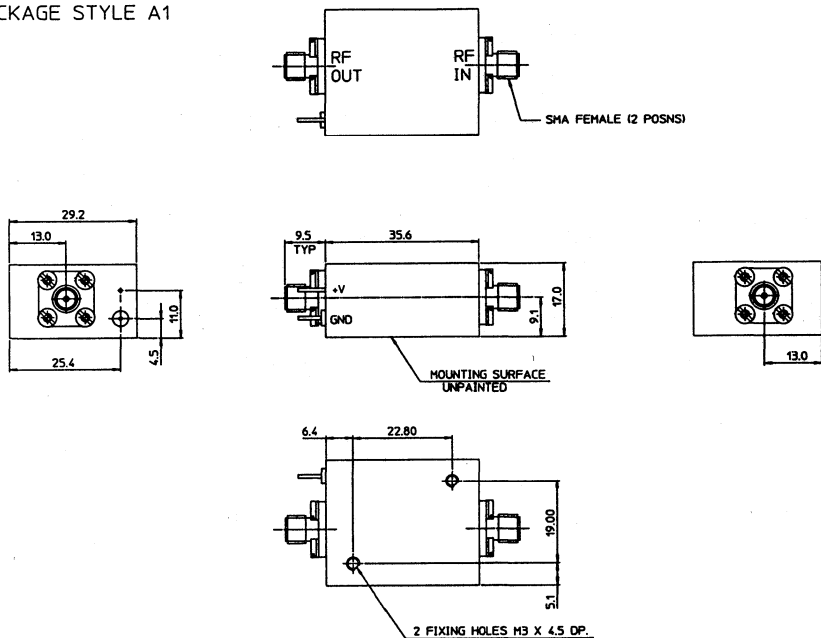
Europe: (44) 1344 869595

North America: 800 366 2266

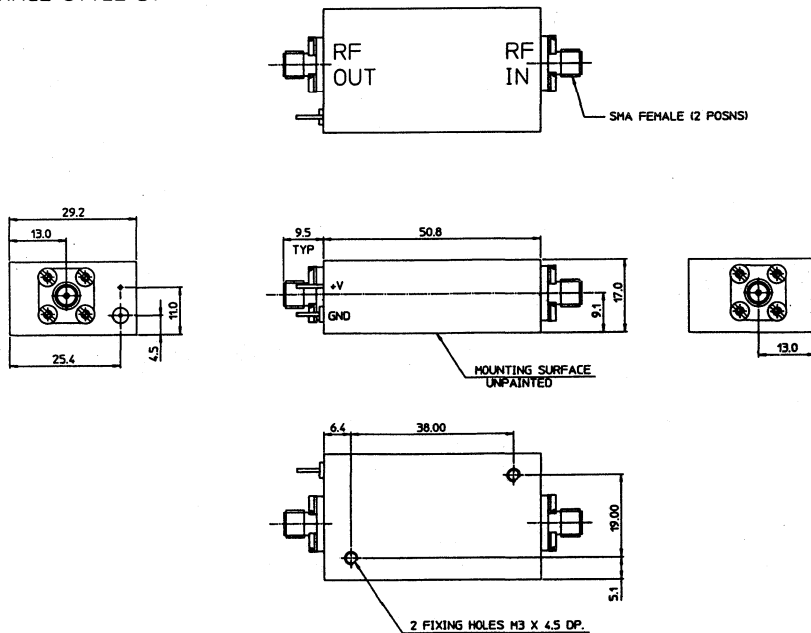
Asia Pacific: (81) 3 3226 1671

# STANDARD OUTLINE DRAWINGS

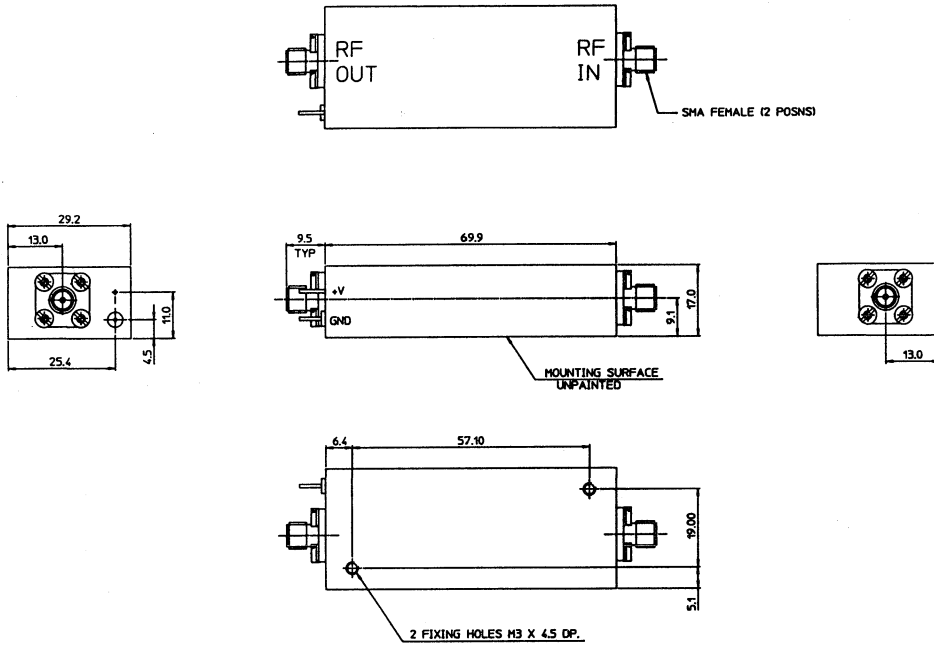
PACKAGE STYLE A1



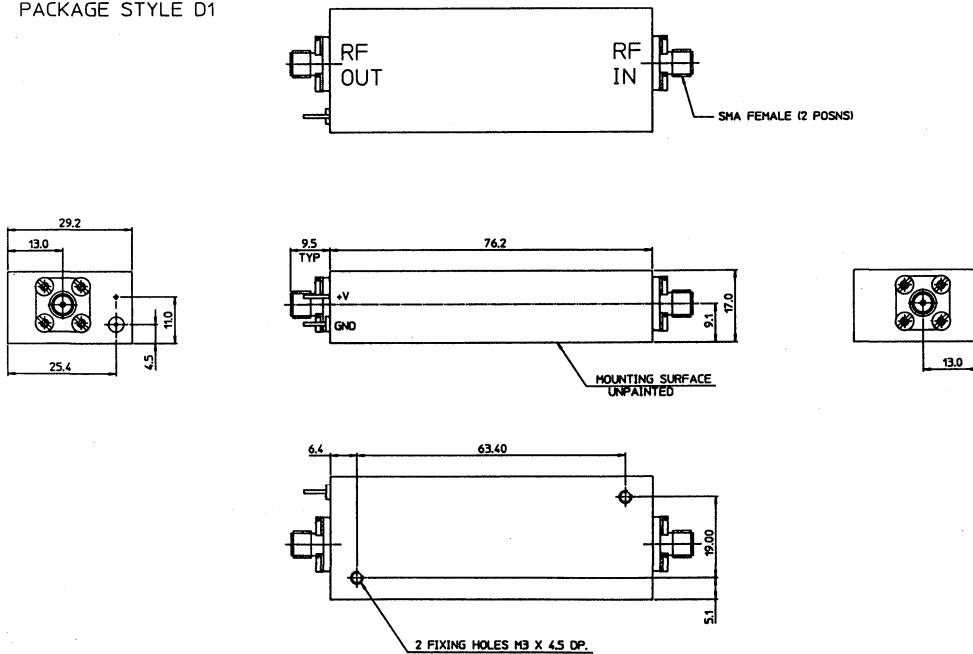
PACKAGE STYLE B1



PACKAGE STYLE C1

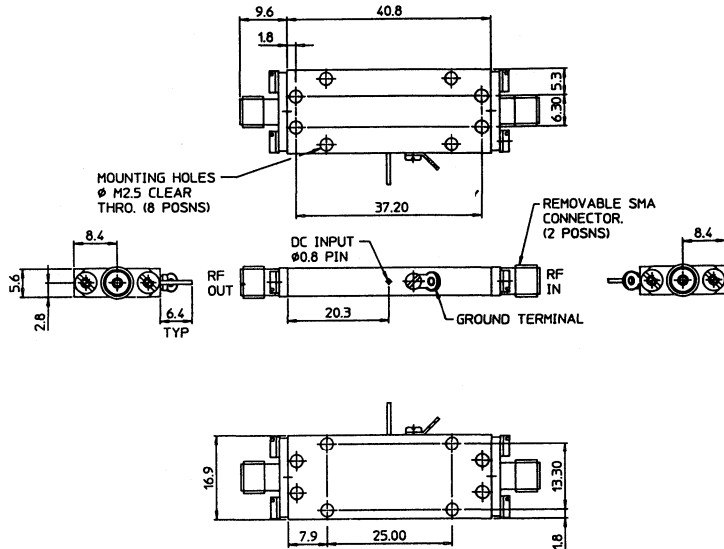


PACKAGE STYLE D1

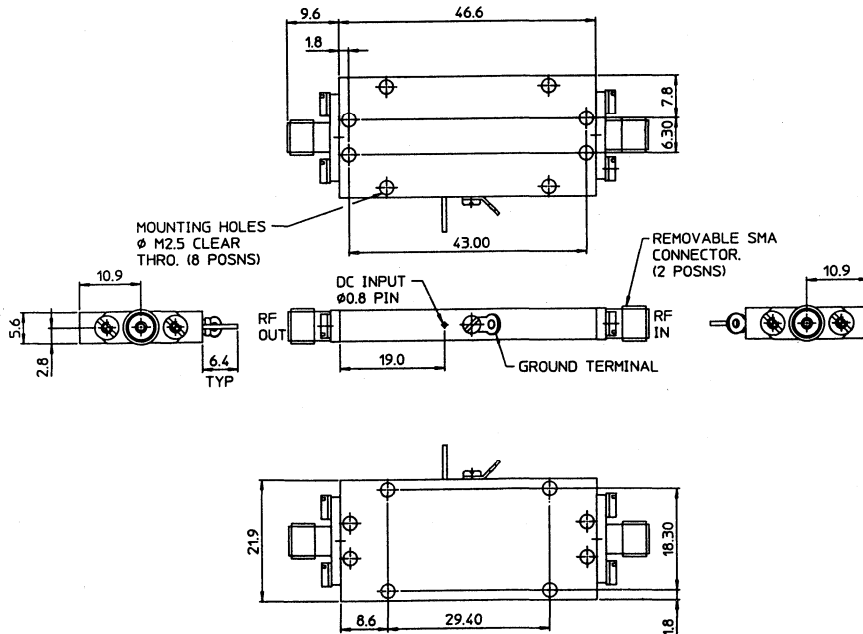


# MINIATURE OUTLINE DRAWINGS

PACKAGE STYLE A2



PACKAGE STYLE A3



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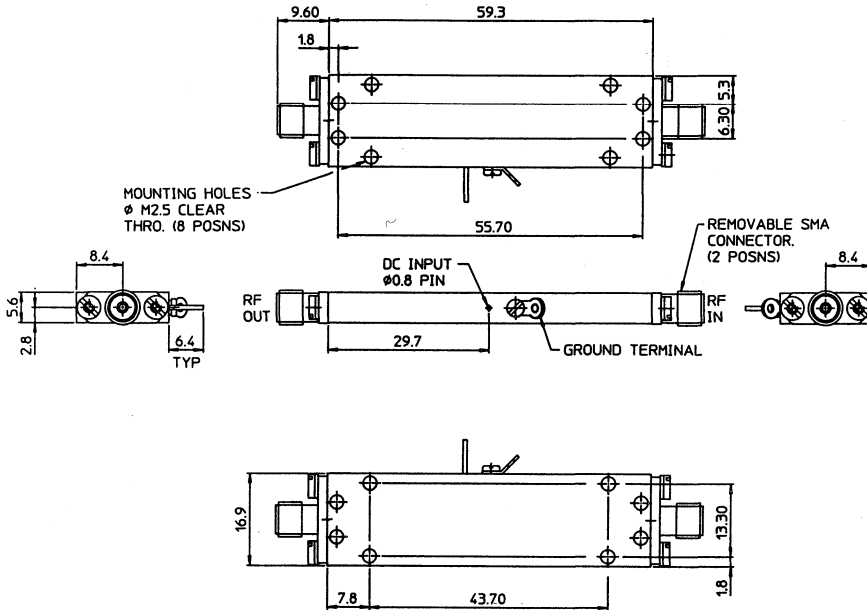
Europe: (44) 1344 869595

North America: 800 366 2266

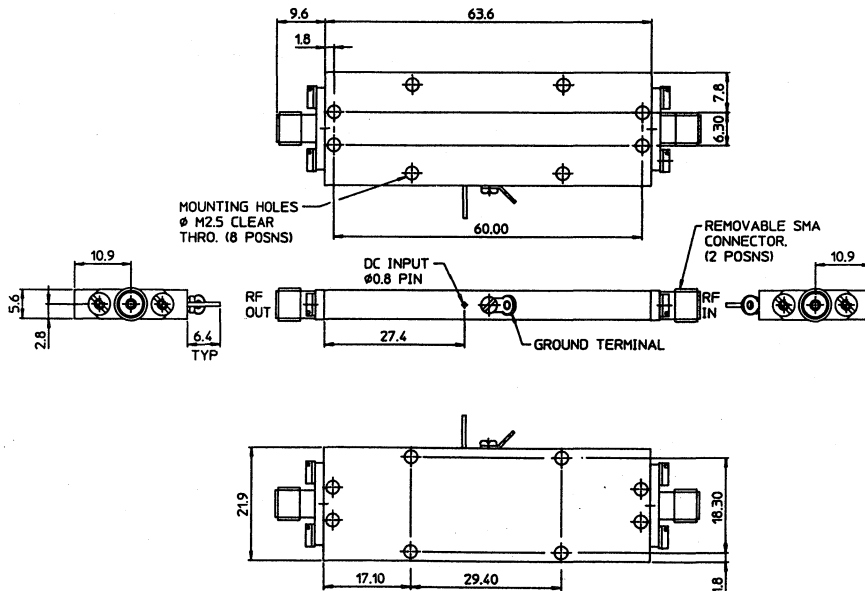
Asia Pacific: (81) 3 3226 1671



PACKAGE STYLE B2



PACKAGE STYLE B3



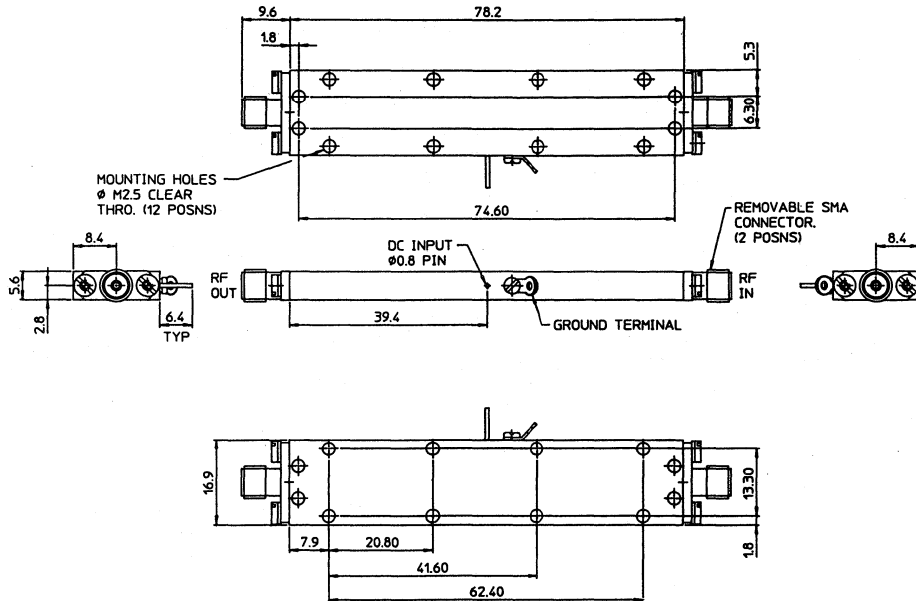
M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

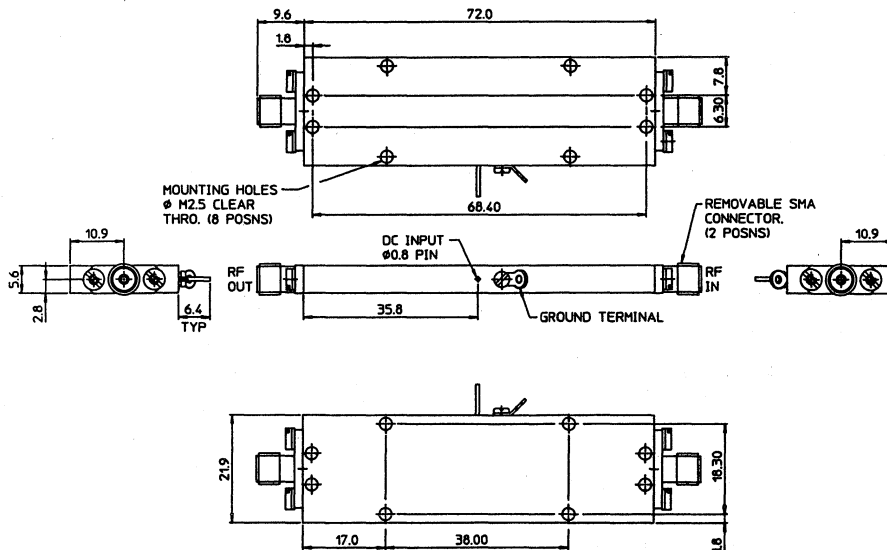
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

PACKAGE STYLE C2



PACKAGE STYLE C3



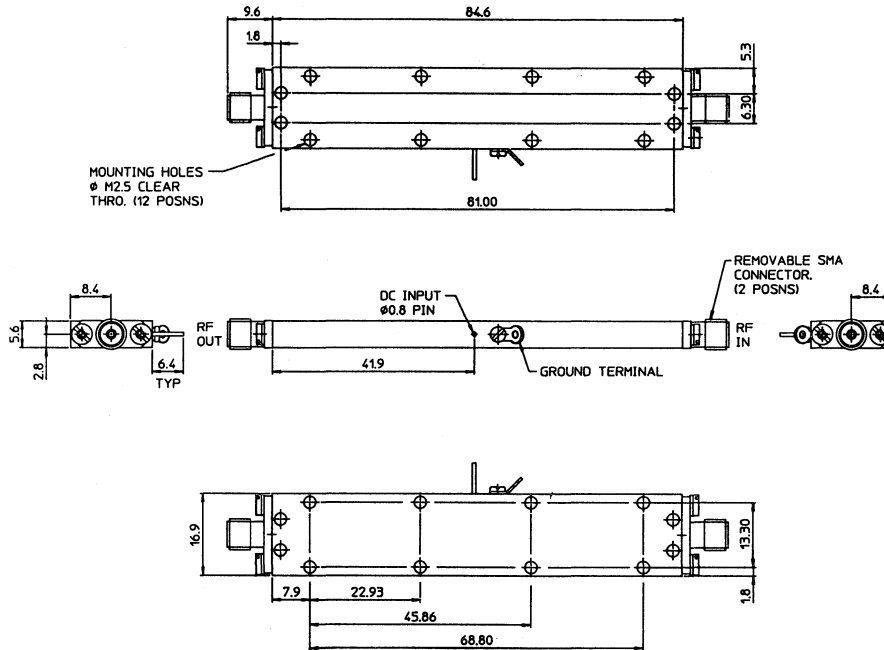
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North America: 800 366 2266

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## PACKAGE STYLE D2



## Drawing Notes

Third Angle Projection

All dimensions in mm

Tolerances x.x =  $\pm 0.5\text{mm}$ x.xx =  $\pm 0.1\text{mm}$ 

Standard Finish:

Standard packages: Matt black paint  
to DTD 5555A  
(A1, B1, C1, D1)

Miniature packages: Nickel Plate  
(A2, A3, B2, B3, C2, C3, D2)

All specifications subject to change without notice

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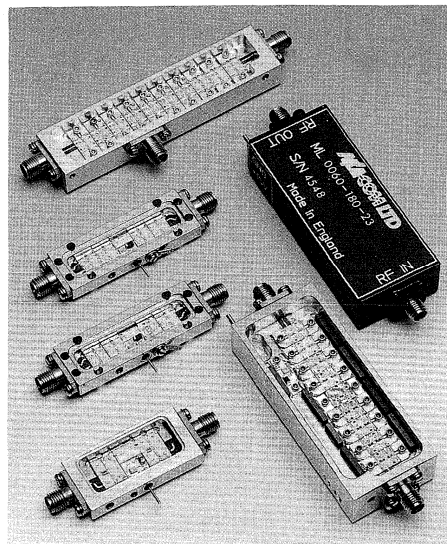
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**NARROWBAND GaAs FET AMPLIFIERS****0.5 TO 18.0 GHz****FEATURES**

- ◆ **Radar & Communications Bands**
- ◆ **Low Noise Figures**
- ◆ **Wide Dynamic Ranges**
- ◆ **Temperature Compensation**
- ◆ **Miniature Outlines**

**DESCRIPTION**

The MLA 2500-000 series of coaxial GaAs FET amplifiers from M/A-COM Ltd are designed for specific narrowband applications in the 0.5 to 18 GHz frequency range. Each frequency band includes a wide range of gain levels for both low noise and medium power amplifiers which are available with or without temperature compensation. All amplifiers are available in either a standard or optional miniature outline.

The designs are based on a balanced hybrid approach giving excellent gain flatness and VSWR as well as load independent stability. Construction of the amplifiers is by integration of the FET, MMIC or low noise HEMT devices into either a conventional alumina MIC or a glass MIC (GMIC) with the complete amplifier assembly then hermetically sealed by laser welding. GMIC is a proprietary pseudo-monolithic MIC fabrication technique established by M/A-COM Ltd using a thin glass substrate bonded directly to a high conductivity silicon carrier. All the passive components are then photolithographically defined with the discrete FET devices mounted in via holes. The compact, rugged construction of these amplifiers makes them suitable for the most severe environmental conditions encountered in military and hi-rel applications.

These amplifiers cover a wide variety of the most commonly used microwave frequency bands. Applications include airborne, naval and ground based radar receivers and transmitters, radar altimeters, military and commercial up and down links for satellite communications and terrestrial communications. Advances in solid state technology make these amplifiers suitable as direct replacements for TWTAs giving improved reliability at lower cost in such applications as airborne targets and transmitter drivers.

As well as the basic amplifiers described M/A-COM Ltd also manufactures devices with additional components integrated within the same housing. Available options include input limiters for passive high power protection, integral PIN attenuators for gain/sensitivity control, coupled outputs, filters, pulsed power supplies and waveguide inputs for LNAs. For details of these options and to discuss other custom requirements, please contact the factory for applications assistance.

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**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
2.0 - 2.4	+12	12	±0.20	0.012	1.5	1.8	80	A1, A3	MLA 2541-101
		24	±0.40	0.024	1.5	1.8	160	A1, A3	MLA 2541-102
		36	±0.50	0.036	1.5	1.8	240	B1, B3	MLA 2541-103
		48	±0.50	0.050	1.5	1.8	320	B1, B3	MLA 2541-104
	+18	11	±0.20	0.012	3.0	1.6	100	A1, A3	MLA 2541-201
		23	±0.40	0.024	2.0	1.6	180	A1, A3	MLA 2541-202
		35	±0.50	0.036	2.0	1.6	260	B1, B3	MLA 2541-203
		46	±0.50	0.050	2.0	1.6	340	B1, B3	MLA 2541-204
	+21	10	±0.30	0.012	4.0	1.6	120	A1, A3	MLA 2541-301
		22	±0.40	0.024	3.0	1.6	220	A1, A3	MLA 2541-302
		34	±0.50	0.036	2.0	1.6	300	B1, B3	MLA 2541-303
		45	±0.50	0.050	2.0	1.6	380	B1, B3	MLA 2541-304
	+26	9	±0.30	0.012	6.0	1.8	200	A1, A3	MLA 2541-401
		20	±0.40	0.024	4.0	1.8	320	A1, A3	MLA 2541-402
		31	±0.50	0.036	3.0	1.8	420	B1, B3	MLA 2541-403
		43	±0.50	0.050	3.0	1.8	500	B1, B3	MLA 2541-404
	+29	7	±0.50	0.012	7.0	1.8	400	A1, A3	MLA 2541-501
		16	±0.75	0.024	6.0	1.8	600	A1, A3	MLA 2541-502
		26	±1.00	0.036	5.0	1.8	700	B1, B3	MLA 2541-503
		36	±1.00	0.050	4.0	1.8	800	B1, B3	MLA 2541-504

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
2.0 - 2.4	+12	10	±0.30	±0.50	2.5	1.8	80	A1, A3	MLA 2641-101
		21	±0.50	±0.75	2.2	1.8	160	A1, A3	MLA 2641-102
		32	±0.60	±1.00	2.2	1.8	240	B1, B3	MLA 2641-103
		43	±0.60	±1.50	2.2	1.8	320	B1, B3	MLA 2641-104
	+18	9	±0.30	±0.50	4.0	1.6	100	A1, A3	MLA 2641-201
		20	±0.50	±0.75	3.0	1.6	180	A1, A3	MLA 2641-202
		31	±0.60	±1.00	3.0	1.6	260	B1, B3	MLA 2641-203
		42	±0.60	±1.50	3.0	1.6	340	B1, B3	MLA 2641-204
	+21	8	±0.30	±0.50	5.0	1.6	120	A1, A3	MLA 2641-301
		19	±0.50	±0.75	4.0	1.6	220	A1, A3	MLA 2641-302
		30	±0.60	±1.00	3.0	1.6	300	B1, B3	MLA 2641-303
		41	±0.60	±1.50	3.0	1.6	380	B1, B3	MLA 2641-304
	+26	7	±0.30	±0.50	6.0	1.8	200	A1, A3	MLA 2641-401
		18	±0.50	±0.75	5.0	1.8	320	A1, A3	MLA 2641-402
		28	±0.60	±1.00	4.0	1.8	420	B1, B3	MLA 2641-403
		37	±0.60	±1.50	4.0	1.8	500	B1, B3	MLA 2641-404
	+29	6	±0.50	±0.50	8.0	1.8	400	A1, A3	MLA 2641-501
		15	±0.75	±0.75	7.0	1.8	600	A1, A3	MLA 2641-502
		25	±1.00	±1.00	6.0	1.8	700	B1, B3	MLA 2641-503
		33	±1.00	±1.50	5.0	1.8	800	B1, B3	MLA 2641-504

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**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
2.4 - 2.7	+12	12	±0.203	0.012	1.5	1.8	80	A1, A3	MLA 2542-101
		24	±0.40	0.024	1.5	1.8	160	A1, A3	MLA 2542-102
		36	±0.50	0.036	1.5	1.8	240	B1, B3	MLA 2542-103
		48	±0.50	0.050	1.5	1.8	320	B1, B3	MLA 2542-104
	+18	11	±0.20	0.012	3.0	1.6	100	A1, A3	MLA 2542-201
		23	±0.40	0.024	2.0	1.6	180	A1, A3	MLA 2542-202
		35	±0.50	0.036	2.0	1.6	260	B1, B3	MLA 2542-203
		46	±0.50	0.050	2.0	1.6	340	B1, B3	MLA 2542-204
	+21	10	±0.30	0.012	4.0	1.6	120	A1, A3	MLA 2542-301
		22	±0.40	0.024	3.0	1.6	270	A1, A3	MLA 2542-302
		34	±0.50	0.036	2.0	1.6	300	B1, B3	MLA 2542-303
		45	±0.50	0.050	2.0	1.6	380	B1, B3	MLA 2542-304
	+26	9	±0.30	0.012	6.0	1.8	200	A1, A3	MLA 2542-401
		20	±0.40	0.024	4.0	1.8	320	A1, A3	MLA 2542-402
		31	±0.50	0.036	3.0	1.8	420	B1, B3	MLA 2542-403
		43	±0.50	0.050	3.0	1.8	500	B1, B3	MLA 2542-404
	+29	7	±0.50	0.012	7.0	1.8	400	A1, A3	MLA 2542-501
		16	±0.75	0.024	6.0	1.8	600	A1, A3	MLA 2542-502
		26	±1.00	0.036	5.0	1.8	700	B1, B3	MLA 2542-503
		36	±1.00	0.050	4.0	1.8	800	B1, B3	MLA 2542-504

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
2.4 - 2.7	+12	10	±0.3	±0.5	2.5	1.8	80	A1, A3	MLA 2642-101
		21	±0.5	±0.7	2.2	1.8	160	A1, A3	MLA 2642-102
		32	±0.6	±1.0	2.2	1.8	240	B1, B3	MLA 2642-103
		43	±0.6	±1.5	2.2	1.8	320	B1, B3	MLA 2642-104
	+18	9	±0.3	±0.5	4.0	1.6	100	A1, A3	MLA 2642-201
		20	±0.5	±0.7	3.0	1.6	180	A1, A3	MLA 2642-202
		31	±0.6	±1.0	3.0	1.6	260	B1, B3	MLA 2642-203
		42	±0.6	±1.5	3.0	1.6	340	B1, B3	MLA 2642-204
	+21	8	±0.3	±0.5	5.0	1.6	120	A1, A3	MLA 2642-301
		19	±0.5	±0.7	4.0	1.6	220	A1, A3	MLA 2642-302
		30	±0.6	±1.0	3.0	1.6	300	B1, B3	MLA 2642-303
		41	±0.6	±1.5	3.0	1.6	380	B1, B3	MLA 2642-304
	+26	7	±0.3	±0.5	6.0	1.8	200	A1, A3	MLA 2642-401
		18	±0.5	±0.7	5.0	1.8	320	A1, A3	MLA 2642-402
		29	±0.6	±1.0	4.0	1.8	420	B1, B3	MLA 2642-403
		40	±0.6	±1.5	4.0	1.8	500	B1, B3	MLA 2642-404
	+29	6	±0.5	±0.5	8.0	1.8	400	A1, A3	MLA 2642-501
		15	±0.7	±0.7	7.0	1.8	600	A1, A3	MLA 2642-502
		25	±1.0	±1.0	6.0	1.8	700	B1, B3	MLA 2642-503
		33	±1.0	±1.5	5.0	1.8	800	B1, B3	MLA 2642-504

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**UNCOMPENSATED SPECIFICATIONS (guaranteed @ +25°C)**

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
2.7 - 3.1	+12	12	±0.20	0.012	1.5	1.8	80	A1, A3	MLA 2543-101
		24	±0.40	0.024	1.5	1.8	160	A1, A3	MLA 2543-102
		36	±0.50	0.036	1.5	1.8	240	B1, B3	MLA 2543-103
		48	±0.50	0.050	1.5	1.8	320	B1, B3	MLA 2543-104
	+18	11	±0.20	0.012	3.0	1.6	100	A1, A3	MLA 2543-201
		23	±0.40	0.024	2.0	1.6	180	A1, A3	MLA 2543-202
		35	±0.50	0.036	2.0	1.6	260	B1, B3	MLA 2543-203
		46	±0.50	0.050	2.0	1.6	340	B1, B3	MLA 2543-204
	+21	10	±0.30	0.012	4.0	1.6	120	A1, A3	MLA 2543-301
		22	±0.40	0.024	3.0	1.6	220	A1, A3	MLA 2543-302
		34	±0.50	0.036	2.0	1.6	300	B1, B3	MLA 2543-303
		45	±0.50	0.050	2.0	1.6	380	B1, B3	MLA 2543-304
	+26	9	±0.30	0.012	6.0	1.8	200	A1, A3	MLA 2543-401
		20	±0.40	0.024	4.0	1.8	320	A1, A3	MLA 2543-402
		31	±0.50	0.036	3.0	1.8	420	B1, B3	MLA 2543-403
		43	±0.50	0.050	3.0	1.8	500	B1, B3	MLA 2543-404
	+29	7	±0.50	0.012	7.0	1.8	400	A1, A3	MLA 2543-501
		16	±0.75	0.024	6.0	1.8	600	A1, A3	MLA 2543-502
		26	±1.00	0.036	5.0	1.8	700	B1, B3	MLA 2543-503
		36	±1.00	0.050	4.0	1.8	800	B1, B3	MLA 2543-504

**TEMPERATURE COMPENSATED SPECIFICATIONS (guaranteed -55°C to +95°C)**

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
2.7 - 3.1	+12	10	±0.30	±0.50	2.5	1.8	80	A1, A3	MLA 2643-101
		21	±0.50	±0.75	2.2	1.8	160	A1, A3	MLA 2643-102
		32	±0.60	±1.00	2.2	1.8	240	B1, B3	MLA 2643-103
		43	±0.60	±1.50	2.2	1.8	320	B1, B3	MLA 2643-104
	+18	9	±0.30	±0.50	4.0	1.6	100	A1, A3	MLA 2643-201
		20	±0.50	±0.75	3.0	1.6	180	A1, A3	MLA 2643-202
		31	±0.60	±1.00	3.0	1.6	260	B1, B3	MLA 2643-203
		42	±0.60	±1.50	3.0	1.6	340	B1, B3	MLA 2643-204
	+21	8	±0.30	±0.50	5.0	1.6	120	A1, A3	MLA 2643-301
		19	±0.50	±0.75	4.0	1.6	220	A1, A3	MLA 2643-302
		30	±0.60	±1.00	3.0	1.6	300	B1, B3	MLA 2643-303
		41	±0.60	±1.50	3.0	1.6	380	B1, B3	MLA 2643-304
	+26	7	±0.30	±0.50	6.0	1.8	200	A1, A3	MLA 2643-401
		18	±0.50	±0.75	5.0	1.8	320	A1, A3	MLA 2643-402
		28	±0.60	±1.00	4.0	1.8	420	B1, B3	MLA 2643-403
		37	±0.60	±1.50	4.0	1.8	500	B1, B3	MLA 2643-404
	+29	6	±0.50	±0.50	8.0	1.8	400	A1, A3	MLA 2643-501
		15	±0.75	±0.75	7.0	1.8	600	A1, A3	MLA 2643-502
		25	±1.00	±1.00	6.0	1.8	700	B1, B3	MLA 2643-503
		33	±1.00	±1.50	5.0	1.8	800	B1, B3	MLA 2643-504

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**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
3.1 - 3.5	+12	12	±0.20	0.012	1.5	1.8	80	A1, A3	MLA 2544-101
		24	±0.40	0.024	1.5	1.8	160	A1, A3	MLA 2544-102
		36	±0.50	0.036	1.5	1.8	240	B1, B3	MLA 2544-103
		48	±0.50	0.050	1.5	1.8	320	B1, B3	MLA 2544-104
	+18	11	±0.20	0.012	3.0	1.6	100	A1, A3	MLA 2544-201
		23	±0.40	0.024	2.0	1.6	180	A1, A3	MLA 2544-202
		35	±0.50	0.036	2.0	1.6	260	B1, B3	MLA 2544-203
		46	±0.50	0.050	2.0	1.6	340	B1, B3	MLA 2544-204
	+21	10	±0.30	0.012	4.0	1.6	120	A1, A3	MLA 2544-301
		22	±0.40	0.024	3.0	1.6	270	A1, A3	MLA 2544-302
		34	±0.50	0.036	2.0	1.6	300	B1, B3	MLA 2544-303
		45	±0.50	0.050	2.0	1.6	380	B1, B3	MLA 2544-304
	+26	9	±0.30	0.012	6.0	1.8	200	A1, A3	MLA 2544-401
		20	±0.40	0.024	4.0	1.8	320	A1, A3	MLA 2544-402
		31	±0.50	0.036	3.0	1.8	420	B1, B3	MLA 2544-403
	+29	43	±0.50	0.050	3.0	1.8	500	B1, B3	MLA 2544-404
		7	±0.50	0.012	7.0	1.8	400	A1, A3	MLA 2544-501
		16	±0.75	0.024	6.0	1.8	600	A1, A3	MLA 2544-502
		26	±1.00	0.036	5.0	1.8	700	B1, B3	MLA 2544-503
			36	±1.00	0.050	4.0	1.8	800	B1, B3

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
3.1 - 3.5	+12	10	±0.30	±0.50	2.5	1.8	80	A1, A3	MLA 2644-101
		21	±0.50	±0.75	2.2	1.8	160	A1, A3	MLA 2644-102
		32	±0.60	±1.00	2.2	1.8	240	B1, B3	MLA 2644-103
		43	±0.60	±1.50	2.2	1.8	320	B1, B3	MLA 2644-104
	+18	9	±0.30	±0.50	4.0	1.6	100	A1, A3	MLA 2644-201
		20	±0.50	±0.75	3.0	1.6	180	A1, A3	MLA 2644-202
		31	±0.60	±1.00	3.0	1.6	260	B1, B3	MLA 2644-203
		42	±0.60	±1.50	3.0	1.6	340	B1, B3	MLA 2644-204
	+21	8	±0.30	±0.50	5.0	1.6	120	A1, A3	MLA 2644-301
		19	±0.50	±0.75	4.0	1.6	220	A1, A3	MLA 2644-302
		30	±0.60	±1.00	3.0	1.6	300	B1, B3	MLA 2644-303
		41	±0.60	±1.50	3.0	1.6	380	B1, B3	MLA 2644-304
	+26	7	±0.30	±0.50	6.0	1.8	200	A1, A3	MLA 2644-401
		18	±0.50	±0.75	5.0	1.8	320	A1, A3	MLA 2644-402
		29	±0.60	±1.00	4.0	1.8	420	B1, B3	MLA 2644-403
	+29	40	±0.60	±1.50	4.0	1.8	500	B1, B3	MLA 2644-404
		6	±0.50	±0.50	8.0	1.8	400	A1, A3	MLA 2644-501
		15	±0.75	±0.75	7.0	1.8	600	A1, A3	MLA 2644-502
		25	±1.00	±1.00	6.0	1.8	700	B1, B3	MLA 2644-503
			33	±1.00	±1.50	5.0	1.8	800	B1, B3

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**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
3.7 - 4.2	+12	11	±0.30	0.012	1.5	1.8	80	A1, A3	MLA 2545-101
		22	±0.40	0.024	1.5	1.8	160	A1, A3	MLA 2545-102
		33	±0.50	0.036	1.5	1.8	240	B1, B3	MLA 2545-103
		44	±0.50	0.050	1.5	1.8	320	B1, B3	MLA 2545-104
	+18	10	±0.30	0.012	4.0	1.6	100	A1, A3	MLA 2545-201
		20	±0.40	0.024	3.0	1.6	180	A1, A3	MLA 2545-202
		30	±0.50	0.036	3.0	1.6	260	B1, B3	MLA 2545-203
		40	±0.50	0.050	3.0	1.6	340	B1, B3	MLA 2545-204
	+21	9	±0.40	0.012	5.0	1.6	120	A1, A3	MLA 2545-301
		19	±0.50	0.024	4.0	1.6	220	A1, A3	MLA 2545-302
		29	±0.50	0.036	3.0	1.6	300	B1, B3	MLA 2545-303
		39	±0.50	0.050	3.0	1.6	380	B1, B3	MLA 2545-304
	+26	8	±0.40	0.012	6.0	1.8	200	A1, A3	MLA 2545-401
		17	±0.50	0.024	5.0	1.8	320	A1, A3	MLA 2545-402
		27	±0.50	0.036	4.0	1.8	420	B1, B3	MLA 2545-403
		37	±0.50	0.050	3.0	1.8	500	B1, B3	MLA 2545-404
	+29	7	±0.50	0.012	7.0	1.8	400	A1, A3	MLA 2545-501
		16	±0.75	0.024	6.0	1.8	600	A1, A3	MLA 2545-502
		26	±1.00	0.036	5.0	1.8	700	B1, B3	MLA 2545-503
		36	±1.0	0.050	4.0	1.8	800	B1, B3	MLA 2545-504

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
3.7 - 4.2	+12	9	±0.40	±0.50	2.5	1.8	80	A1, A3	MLA 2645-101
		18	±0.50	±0.75	2.5	1.8	160	A1, A3	MLA 2645-102
		27	±0.50	±1.00	2.5	1.8	240	B1, B3	MLA 2645-103
		36	±0.50	±1.50	2.5	1.8	320	B1, B3	MLA 2645-104
	+18	8	±0.40	±0.50	5.0	1.6	100	A1, A3	MLA 2645-201
		17	±0.50	±0.75	4.0	1.6	180	A1, A3	MLA 2645-202
		26	±0.50	±1.00	4.0	1.6	260	B1, B3	MLA 2645-203
		35	±0.50	±1.50	4.0	1.6	340	B1, B3	MLA 2645-204
	+21	8	±0.40	±0.50	6.0	1.6	120	A1, A3	MLA 2645-301
		17	±0.50	±0.75	5.0	1.6	220	A1, A3	MLA 2645-302
		26	±0.50	±1.00	4.0	1.6	300	B1, B3	MLA 2645-303
		35	±0.50	±1.50	4.0	1.6	380	B1, B3	MLA 2645-304
	+26	7	±0.50	±0.50	7.0	1.8	200	A1, A3	MLA 2645-401
		16	±0.50	±0.75	6.0	1.8	320	A1, A3	MLA 2645-402
		25	±0.50	±1.00	5.0	1.8	420	B1, B3	MLA 2645-403
		34	±0.50	±1.50	4.0	1.8	500	B1, B3	MLA 2645-404
	+29	6	±0.50	±0.50	8.0	1.8	400	A1, A3	MLA 2645-501
		15	±0.75	±0.75	7.0	1.8	600	A1, A3	MLA 2645-502
		23	±1.00	±1.00	6.0	1.8	700	B1, B3	MLA 2645-503
		30	±1.00	±1.50	5.0	1.8	800	B1, B3	MLA 2645-504

**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
4.0 - 4.6	+12	11	±0.30	0.012	1.5	1.8	80	A1, A3	MLA 2546-101
		22	±0.40	0.024	1.5	1.8	160	A1, A3	MLA 2546-102
		33	±0.50	0.036	1.5	1.8	240	B1, B3	MLA 2546-103
		44	±0.50	0.050	1.5	1.8	320	B1, B3	MLA 2546-104
	+18	10	±0.30	0.012	4.0	1.6	100	A1, A3	MLA 2546-201
		20	±0.40	0.024	3.0	1.6	180	A1, A3	MLA 2546-202
		30	±0.50	0.036	3.0	1.6	260	B1, B3	MLA 2546-203
		40	±0.50	0.050	3.0	1.6	340	B1, B3	MLA 2546-204
	+21	9	±0.40	0.012	5.0	1.6	120	A1, A3	MLA 2546-301
		19	±0.50	0.024	4.0	1.6	220	A1, A3	MLA 2546-302
		29	±0.50	0.036	3.0	1.6	300	B1, B3	MLA 2546-303
		39	±0.50	0.050	3.0	1.6	380	B1, B3	MLA 2546-304
	+26	8	±0.40	0.012	6.0	1.8	200	A1, A3	MLA 2546-401
		17	±0.50	0.024	5.0	1.8	320	A1, A3	MLA 2546-402
		27	±0.50	0.036	4.0	1.8	420	B1, B3	MLA 2546-403
		37	±0.50	0.050	3.0	1.8	500	B1, B3	MLA 2546-404
	+29	7	±0.50	0.012	7.0	1.8	400	A1, A3	MLA 2546-501
		16	±0.75	0.024	6.0	1.8	600	A1, A3	MLA 2546-502
		26	±1.00	0.036	5.0	1.8	700	B1, B3	MLA 2546-503
		36	±1.00	0.050	4.0	1.8	800	B1, B3	MLA 2546-504

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
4.0 - 4.6	+12	9	±0.40	±0.50	2.5	1.8	80	A1, A3	MLA 2646-101
		18	±0.50	±0.75	2.5	1.8	160	A1, A3	MLA 2646-102
		27	±0.50	±1.00	2.5	1.8	240	B1, B3	MLA 2646-103
		36	±0.50	±1.50	2.5	1.8	320	B1, B3	MLA 2646-104
	+18	8	±0.40	±0.50	5.0	1.6	100	A1, A3	MLA 2646-201
		17	±0.50	±0.75	4.0	1.6	180	A1, A3	MLA 2646-202
		26	±0.50	±1.00	4.0	1.6	260	B1, B3	MLA 2646-203
		35	±0.50	±1.50	4.0	1.6	340	B1, B3	MLA 2646-204
	+21	8	±0.40	±0.50	6.0	1.6	120	A1, A3	MLA 2646-301
		17	±0.50	±0.75	5.0	1.6	220	A1, A3	MLA 2646-302
		26	±0.50	±1.00	4.0	1.6	300	B1, B3	MLA 2646-303
		35	±0.50	±1.50	4.0	1.6	380	B1, B3	MLA 2646-304
	+26	7	±0.50	±0.50	7.0	1.8	200	A1, A3	MLA 2646-401
		16	±0.50	±0.75	6.0	1.8	320	A1, A3	MLA 2646-402
		25	±0.50	±1.00	5.0	1.8	420	B1, B3	MLA 2646-403
		34	±0.50	±1.50	4.0	1.8	500	B1, B3	MLA 2646-404
	+29	6	±0.50	±0.50	8.0	1.8	400	A1, A3	MLA 2646-501
		15	±0.75	±0.75	7.0	1.8	600	A1, A3	MLA 2646-502
		23	±1.00	±1.00	6.0	1.8	700	B1, B3	MLA 2646-503
		30	±1.00	±1.50	5.0	1.8	800	B1, B3	MLA 2646-504

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**UNCOMPENSATED SPECIFICATIONS (guaranteed @ +25°C)**

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
4.4 - 5.0	+12	11	±0.30	0.012	1.5	1.8	80	A1, A3	MLA 2547-101
		22	±0.40	0.024	1.5	1.8	160	A1, A3	MLA 2547-102
		33	±0.50	0.036	1.5	1.8	240	B1, B3	MLA 2547-103
		44	±0.50	0.050	1.5	1.8	320	B1, B3	MLA 2547-104
	+18	10	±0.30	0.012	4.0	1.6	100	A1, A3	MLA 2547-201
		20	±0.40	0.024	3.0	1.6	180	A1, A3	MLA 2547-202
		30	±0.50	0.036	3.0	1.6	260	B1, B3	MLA 2547-203
		40	±0.50	0.050	3.0	1.6	340	B1, B3	MLA 2547-204
	+21	9	±0.40	0.012	5.0	1.6	120	A1, A3	MLA 2547-301
		19	±0.50	0.024	4.0	1.6	220	A1, A3	MLA 2547-302
		29	±0.50	0.036	3.0	1.6	300	B1, B3	MLA 2547-303
		39	±0.50	0.050	3.0	1.6	380	B1, B3	MLA 2547-304
	+26	8	±0.40	0.012	6.0	1.8	200	A1, A3	MLA 2547-401
		17	±0.50	0.024	5.0	1.8	320	A1, A3	MLA 2547-402
		27	±0.50	0.036	4.0	1.8	420	B1, B3	MLA 2547-403
		37	±0.50	0.050	3.0	1.8	500	B1, B3	MLA 2547-404
	+29	7	±0.50	0.012	7.0	1.8	400	A1, A3	MLA 2547-501
		16	±0.75	0.024	6.0	1.8	600	A1, A3	MLA 2547-502
		26	±1.00	0.036	5.0	1.8	700	B1, B3	MLA 2547-503
		36	±1.00	0.050	4.0	1.8	800	B1, B3	MLA 2547-504

**TEMPERATURE COMPENSATED SPECIFICATIONS (guaranteed -55°C to +95°C)**

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
4.4 - 5.0	+12	9	±0.40	±0.50	2.5	1.8	80	A1, A3	MLA 2647-101
		18	±0.50	±0.75	2.5	1.8	160	A1, A3	MLA 2647-102
		27	±0.50	±1.00	2.5	1.8	240	B1, B3	MLA 2647-103
		36	±0.50	±1.50	2.5	1.8	320	B1, B3	MLA 2647-104
	+18	8	±0.40	±0.50	5.0	1.6	100	A1, A3	MLA 2647-201
		17	±0.50	±0.75	4.0	1.6	180	A1, A3	MLA 2647-202
		26	±0.50	±1.00	4.0	1.6	260	B1, B3	MLA 2647-203
		35	±0.50	±1.50	4.0	1.6	340	B1, B3	MLA 2647-204
	+21	8	±0.40	±0.50	6.0	1.6	120	A1, A3	MLA 2647-301
		17	±0.50	±0.75	5.0	1.6	220	A1, A3	MLA 2647-302
		26	±0.50	±1.00	4.0	1.6	300	B1, B3	MLA 2647-303
		35	±0.50	±1.50	4.0	1.6	380	B1, B3	MLA 2647-304
	+26	7	±0.50	±0.50	7.0	1.8	200	A1, A3	MLA 2647-401
		16	±0.50	±0.75	6.0	1.8	320	A1, A3	MLA 2647-402
		25	±0.50	±1.00	5.0	1.8	420	B1, B3	MLA 2647-403
		34	±0.50	±1.50	4.0	1.8	500	B1, B3	MLA 2647-404
	+29	6	±0.50	±0.50	8.0	1.8	400	A1, A3	MLA 2647-501
		15	±0.75	±0.75	7.0	1.8	600	A1, A3	MLA 2647-502
		23	±1.00	±1.00	6.0	1.8	700	B1, B3	MLA 2647-503
		30	±1.00	±1.50	5.0	1.8	800	B1, B3	MLA 2647-504

**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
5.0 - 5.5	+12	11	±0.30	0.012	1.5	1.8	80	A1, A3	MLA 2548-101
		22	±0.40	0.024	1.5	1.8	160	A1, A3	MLA 2548-102
		33	±0.50	0.036	1.5	1.8	240	B1, B3	MLA 2548-103
		44	±0.50	0.050	1.5	1.8	320	B1, B3	MLA 2548-104
	+18	10	±0.30	0.012	4.0	1.6	100	A1, A3	MLA 2548-201
		20	±0.40	0.024	3.0	1.6	180	A1, A3	MLA 2548-202
		30	±0.50	0.036	3.0	1.6	260	B1, B3	MLA 2548-203
		40	±0.50	0.050	3.0	1.6	340	B1, B3	MLA 2548-204
	+21	9	±0.40	0.012	5.0	1.6	120	A1, A3	MLA 2548-301
		19	±0.50	0.024	4.0	1.6	220	A1, A3	MLA 2548-302
		29	±0.50	0.036	3.0	1.6	300	B1, B3	MLA 2548-303
		39	±0.50	0.050	3.0	1.6	380	B1, B3	MLA 2548-304
	+26	8	±0.40	0.012	6.0	1.8	200	A1, A3	MLA 2548-401
		17	±0.50	0.024	5.0	1.8	320	A1, A3	MLA 2548-402
		27	±0.50	0.036	4.0	1.8	420	B1, B3	MLA 2548-403
		37	±0.50	0.050	3.0	1.8	500	B1, B3	MLA 2548-404
	+29	7	±0.50	0.012	7.0	1.8	400	A1, A3	MLA 2548-501
		16	±0.75	0.024	6.0	1.8	600	A1, A3	MLA 2548-502
		26	±1.00	0.036	5.0	1.8	700	B1, B3	MLA 2548-503
		36	±1.00	0.050	4.0	1.8	800	B1, B3	MLA 2548-504

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
5.0 - 5.5	+12	9	±0.40	±0.50	2.5	1.8	80	A1, A3	MLA 2648-101
		18	±0.50	±0.75	2.5	1.8	160	A1, A3	MLA 2648-102
		27	±0.50	±1.00	2.5	1.8	240	B1, B3	MLA 2648-103
		36	±0.50	±1.50	2.5	1.8	320	B1, B3	MLA 2648-104
	+18	8	±0.40	±0.50	5.0	1.6	100	A1, A3	MLA 2648-201
		17	±0.50	±0.75	4.0	1.6	180	A1, A3	MLA 2648-202
		26	±0.50	±1.00	4.0	1.6	260	B1, B3	MLA 2648-203
		35	±0.50	±1.50	4.0	1.6	340	B1, B3	MLA 2648-204
	+21	8	±0.40	±0.50	6.0	1.6	120	A1, A3	MLA 2648-301
		17	±0.50	±0.75	5.0	1.6	220	A1, A3	MLA 2648-302
		26	±0.50	±1.00	4.0	1.6	300	B1, B3	MLA 2648-303
		35	±0.50	±1.50	4.0	1.6	380	B1, B3	MLA 2648-304
	+26	7	±0.50	±0.50	7.0	1.8	200	A1, A3	MLA 2648-401
		16	±0.50	±0.75	6.0	1.8	320	A1, A3	MLA 2648-402
		25	±0.50	±1.00	5.0	1.8	420	B1, B3	MLA 2648-403
		34	±0.50	±1.50	4.0	1.8	500	B1, B3	MLA 2648-404
	+29	6	±0.50	±0.50	8.0	1.8	400	A1, A3	MLA 2648-501
		15	±0.75	±0.75	7.0	1.8	600	A1, A3	MLA 2648-502
		24	±1.00	±1.00	6.0	1.8	700	B1, B3	MLA 2648-503
		32	±1.00	±1.50	5.0	1.8	800	B1, B3	MLA 2648-504

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**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
5.5 - 6.5	+12	11	±0.30	0.012	1.5	1.8	80	A1, A3	MLA 2549-101
		22	±0.40	0.024	1.5	1.8	160	A1, A3	MLA 2549-102
		33	±0.50	0.036	1.5	1.8	240	B1, B3	MLA 2549-103
		44	±0.50	0.050	1.5	1.8	320	B1, B3	MLA 2549-104
	+18	10	±0.30	0.012	4.0	1.6	100	A1, A3	MLA 2549-201
		20	±0.40	0.024	3.0	1.6	180	A1, A3	MLA 2549-202
		30	±0.50	0.036	3.0	1.6	260	B1, B3	MLA 2549-203
		40	±0.50	0.050	3.0	1.6	340	B1, B3	MLA 2549-204
	+21	9	±0.40	0.012	5.0	1.6	120	A1, A3	MLA 2549-301
		19	±0.50	0.024	4.0	1.6	220	A1, A3	MLA 2549-302
		29	±0.50	0.036	3.0	1.6	300	B1, B3	MLA 2549-303
		39	±0.50	0.050	3.0	1.6	380	B1, B3	MLA 2549-304
	+26	8	±0.40	0.012	6.0	1.8	200	A1, A3	MLA 2549-401
		17	±0.50	0.024	5.0	1.8	320	A1, A3	MLA 2549-402
		27	±0.50	0.036	4.0	1.8	420	B1, B3	MLA 2549-403
		37	±0.50	0.050	3.0	1.8	500	B1, B3	MLA 2549-404
	+29	7	±0.50	0.012	7.0	1.8	400	A1, A3	MLA 2549-501
		16	±0.75	0.024	6.0	1.8	600	A1, A3	MLA 2549-502
26		±1.00	0.036	5.0	1.8	700	B1, B3	MLA 2549-503	
36		±1.00	0.050	4.0	1.8	800	B1, B3	MLA 2549-504	

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
5.5 - 6.5	+12	9	±0.40	±0.50	2.5	1.8	80	A1, A3	MLA 2649-101
		18	±0.50	±0.75	2.5	1.8	160	A1, A3	MLA 2649-102
		27	±0.50	±1.00	2.5	1.8	240	B1, B3	MLA 2649-103
		36	±0.50	±1.50	2.5	1.8	320	B1, B3	MLA 2649-104
	+18	8	±0.40	±0.50	5.0	1.6	100	A1, A3	MLA 2649-201
		17	±0.50	±0.75	4.0	1.6	180	A1, A3	MLA 2649-202
		26	±0.50	±1.00	4.0	1.6	260	B1, B3	MLA 2649-203
		35	±0.50	±1.50	4.0	1.6	340	B1, B3	MLA 2649-204
	+21	8	±0.40	±0.50	6.0	1.6	120	A1, A3	MLA 2649-301
		17	±0.50	±0.75	5.0	1.6	220	A1, A3	MLA 2649-302
		26	±0.50	±1.00	4.0	1.6	300	B1, B3	MLA 2649-303
		35	±0.50	±1.50	4.0	1.6	380	B1, B3	MLA 2649-304
	+26	7	±0.50	±0.50	7.0	1.8	200	A1, A3	MLA 2649-401
		16	±0.50	±0.75	6.0	1.8	320	A1, A3	MLA 2649-402
		25	±0.50	±1.00	5.0	1.8	420	B1, B3	MLA 2649-403
		34	±0.50	±1.50	4.0	1.8	500	B1, B3	MLA 2649-404
	+29	6	±0.50	±0.50	8.0	1.8	400	A1, A3	MLA 2649-501
		15	±0.75	±0.75	7.0	1.8	600	A1, A3	MLA 2649-502
24		±1.00	±1.00	6.0	1.8	700	B1, B3	MLA 2649-503	
32		±1.00	±1.50	5.0	1.8	800	B1, B3	MLA 2649-504	

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**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25° C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
5.9 - 6.4	+12	11	±0.30	0.012	1.5	1.8	80	A1, A3	MLA 2551-101
		22	±0.40	0.024	1.5	1.8	160	A1, A3	MLA 2551-102
		33	±0.50	0.036	1.5	1.8	240	B1, B3	MLA 2551-103
		44	±0.50	0.050	1.5	1.8	320	B1, B3	MLA 2551-104
	+18	10	±0.30	0.012	4.0	1.6	100	A1, A3	MLA 2551-201
		20	±0.40	0.024	3.0	1.6	180	A1, A3	MLA 2551-202
		30	±0.50	0.036	3.0	1.6	260	B1, B3	MLA 2551-203
		40	±0.50	0.050	3.0	1.6	340	B1, B3	MLA 2551-204
	+21	9	±0.40	0.012	5.0	1.6	120	A1, A3	MLA 2551-301
		19	±0.50	0.024	4.0	1.6	220	A1, A3	MLA 2551-302
		29	±0.50	0.036	3.0	1.6	300	B1, B3	MLA 2551-303
		39	±0.50	0.050	3.0	1.6	380	B1, B3	MLA 2551-304
	+26	8	±0.40	0.012	6.0	1.8	200	A1, A3	MLA 2551-401
		17	±0.50	0.024	5.0	1.8	320	A1, A3	MLA 2551-402
		27	±0.50	0.036	4.0	1.8	420	B1, B3	MLA 2551-403
		37	±0.50	0.050	3.0	1.8	500	B1, B3	MLA 2551-404
	+29	7	±0.50	0.012	7.0	1.8	400	A1, A3	MLA 2551-501
		16	±0.75	0.024	6.0	1.8	600	A1, A3	MLA 2551-502
		26	±1.00	0.036	5.0	1.8	700	B1, B3	MLA 2551-503
		36	±1.00	0.050	4.0	1.8	800	B1, B3	MLA 2551-504

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55° C to +95° C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
5.9 - 6.4	+12	9	±0.40	±0.50	2.5	1.8	80	A1, A3	MLA 2651-101
		18	±0.50	±0.75	2.5	1.8	160	A1, A3	MLA 2651-102
		27	±0.50	±1.00	2.5	1.8	240	B1, B3	MLA 2651-103
		36	±0.50	±1.50	2.5	1.8	320	B1, B3	MLA 2651-104
	+18	8	±0.40	±0.50	5.0	1.6	100	A1, A3	MLA 2651-201
		17	±0.50	±0.75	4.0	1.6	180	A1, A3	MLA 2651-202
		26	±0.50	±1.00	4.0	1.6	260	B1, B3	MLA 2651-203
		35	±0.50	±1.50	4.0	1.6	340	B1, B3	MLA 2651-204
	+21	8	±0.40	±0.50	6.0	1.6	120	A1, A3	MLA 2651-301
		17	±0.50	±0.75	5.0	1.6	220	A1, A3	MLA 2651-302
		26	±0.50	±1.00	4.0	1.6	300	B1, B3	MLA 2651-303
		35	±0.50	±1.50	4.0	1.6	380	B1, B3	MLA 2651-304
	+26	7	±0.50	±0.50	7.0	1.8	200	A1, A3	MLA 2651-401
		16	±0.50	±0.75	6.0	1.8	320	A1, A3	MLA 2651-402
		25	±0.50	±1.00	5.0	1.8	420	B1, B3	MLA 2651-403
		34	±0.50	±1.50	4.0	1.8	500	B1, B3	MLA 2651-404
	+29	6	±0.50	±0.50	8.0	1.8	400	A1, A3	MLA 2651-501
		15	±0.75	±0.75	7.0	1.8	600	A1, A3	MLA 2651-502
		24	±1.00	±1.00	6.0	1.8	700	B1, B3	MLA 2651-503
		32	±1.00	±1.50	5.0	1.8	800	B1, B3	MLA 2651-504

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**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
6.4 - 7.2	+12	11	±0.30	0.012	1.5	1.8	80	A1, A3	MLA 2552-101
		22	±0.40	0.024	1.5	1.8	160	A1, A3	MLA 2552-102
		33	±0.50	0.036	1.5	1.8	240	B1, B3	MLA 2552-103
		44	±0.50	0.050	1.5	1.8	320	B1, B3	MLA 2552-104
	+18	10	±0.30	0.012	4.0	1.6	100	A1, A3	MLA 2552-201
		20	±0.40	0.024	3.0	1.6	180	A1, A3	MLA 2552-202
		30	±0.50	0.036	3.0	1.6	260	B1, B3	MLA 2552-203
		40	±0.50	0.050	3.0	1.6	340	B1, B3	MLA 2552-204
	+21	9	±0.40	0.012	5.0	1.6	120	A1, A3	MLA 2552-301
		19	±0.50	0.024	4.0	1.6	220	A1, A3	MLA 2552-302
		29	±0.50	0.036	3.0	1.6	300	B1, B3	MLA 2552-303
		39	±0.50	0.050	3.0	1.6	380	B1, B3	MLA 2552-304
	+26	8	±0.40	0.012	6.0	1.8	200	A1, A3	MLA 2552-401
		17	±0.50	0.024	5.0	1.8	320	A1, A3	MLA 2552-402
		27	±0.50	0.036	4.0	1.8	420	B1, B3	MLA 2552-403
	+29	37	±0.50	0.050	3.0	1.8	500	B1, B3	MLA 2552-404
		7	±0.50	0.012	7.0	1.8	400	A1, A3	MLA 2552-501
		16	±0.75	0.024	6.0	1.8	600	A1, A3	MLA 2552-502
		26	±1.00	0.036	5.0	1.8	700	B1, B3	MLA 2552-503
			36	±1.00	0.050	4.0	1.8	800	B1, B3

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
6.4 - 7.2	+12	9	±0.40	±0.50	2.5	1.8	80	A1, A3	MLA 2652-101
		18	±0.50	±0.75	2.5	1.8	160	A1, A3	MLA 2652-102
		27	±0.50	±1.00	2.5	1.8	240	B1, B3	MLA 2652-103
		36	±0.50	±1.50	2.5	1.8	320	B1, B3	MLA 2652-104
	+18	8	±0.40	±0.50	5.0	1.6	100	A1, A3	MLA 2652-201
		17	±0.50	±0.75	4.0	1.6	180	A1, A3	MLA 2652-202
		26	±0.50	±1.00	4.0	1.6	260	B1, B3	MLA 2652-203
		35	±0.50	±1.50	4.0	1.6	340	B1, B3	MLA 2652-204
	+21	8	±0.40	±0.50	6.0	1.6	120	A1, A3	MLA 2652-301
		17	±0.50	±0.75	5.0	1.6	220	A1, A3	MLA 2652-302
		26	±0.50	±1.00	4.0	1.6	300	B1, B3	MLA 2652-303
		35	±0.50	±1.50	4.0	1.6	380	B1, B3	MLA 2652-304
	+26	7	±0.50	±0.50	7.0	1.8	200	A1, A3	MLA 2652-401
		16	±0.50	±0.75	6.0	1.8	320	A1, A3	MLA 2652-402
		25	±0.50	±1.00	5.0	1.8	420	B1, B3	MLA 2652-403
		34	±0.50	±1.50	4.0	1.8	500	B1, B3	MLA 2652-404
	+29	6	±0.50	±0.50	8.0	1.8	400	A1, A3	MLA 2652-501
		15	±0.75	±0.75	7.0	1.8	600	A1, A3	MLA 2652-502
		24	±1.00	±1.00	6.0	1.8	700	B1, B3	MLA 2652-503
		32	±1.00	±1.50	5.0	1.8	800	B1, B3	MLA 2652-504

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**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
7.2 - 7.8	+12	10	±0.30	0.012	1.5	1.8	80	A1, A2	MLA 2553-101
		20	±0.40	0.024	1.5	1.8	160	A1, A2	MLA 2553-102
		30	±0.50	0.036	1.5	1.8	240	B1, B2	MLA 2553-103
		40	±0.50	0.050	1.5	1.8	320	B1, B2	MLA 2553-104
	+18	10	±0.30	0.012	4.0	1.6	100	A1, A2	MLA 2553-201
		20	±0.40	0.024	4.0	1.6	180	A1, A2	MLA 2553-202
		30	±0.50	0.036	4.0	1.6	260	B1, B2	MLA 2553-203
		40	±0.50	0.050	4.0	1.6	340	B1, B2	MLA 2553-204
	+21	10	±0.30	0.012	5.0	1.6	120	A1, A2	MLA 2553-301
		20	±0.40	0.024	4.0	1.6	220	A1, A2	MLA 2553-302
		30	±0.50	0.036	4.0	1.6	300	B1, B2	MLA 2553-303
		40	±0.50	0.050	4.0	1.6	380	B1, B2	MLA 2553-304
	+26	8	±0.30	0.012	6.0	1.8	280	A1, A2	MLA 2553-401
		18	±0.40	0.024	5.0	1.8	400	A1, A2	MLA 2553-402
		28	±0.50	0.036	4.0	1.8	480	B1, B2	MLA 2553-403
		38	±0.50	0.050	4.0	1.8	560	B1, B2	MLA 2553-404
	+29	7	±0.50	0.012	8.0	1.8	400	A1, A2	MLA 2553-501
		16	±0.75	0.024	6.0	1.8	600	A1, A2	MLA 2553-502
		26	±1.00	0.036	5.0	1.8	700	B1, B2	MLA 2553-503
		36	±1.00	0.050	4.0	1.8	800	B1, B2	MLA 2553-504

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
7.2 - 7.8	+12	8	±0.30	±0.50	2.5	1.8	80	A1, A2	MLA 2653-101
		17	±0.40	±0.75	2.5	1.8	160	A1, A2	MLA 2653-102
		26	±0.50	±1.00	2.5	1.8	240	B1, B2	MLA 2653-103
		35	±0.50	±1.50	2.5	1.8	320	B1, B2	MLA 2653-104
	+18	8	±0.30	±0.50	6.0	1.6	100	A1, A2	MLA 2653-201
		17	±0.40	±0.75	5.0	1.6	180	A1, A2	MLA 2653-202
		26	±0.50	±1.00	5.0	1.6	260	B1, B2	MLA 2653-203
		35	±0.50	±1.50	5.0	1.6	340	B1, B2	MLA 2653-204
	+21	7	±0.30	±0.50	7.0	1.6	120	A1, A2	MLA 2653-301
		16	±0.40	±0.75	6.0	1.6	220	A1, A2	MLA 2653-302
		25	±0.50	±1.00	5.0	1.6	300	B1, B2	MLA 2653-303
		34	±0.50	±1.50	5.0	1.6	380	B1, B2	MLA 2653-304
	+26	6	±0.30	±0.50	8.0	1.8	280	A1, A2	MLA 2653-401
		15	±0.40	±0.75	7.0	1.8	400	A1, A2	MLA 2653-402
		24	±0.50	±1.00	6.0	1.8	480	B1, B2	MLA 2653-403
		33	±0.50	±1.50	5.0	1.8	560	B1, B2	MLA 2653-404
	+29	5	±0.50	±0.50	9.0	1.8	400	A1, A2	MLA 2653-501
		14	±0.75	±0.75	7.0	1.8	600	A1, A2	MLA 2653-502
		22	±1.00	±1.00	6.0	1.8	700	B1, B2	MLA 2653-503
		30	±1.00	±1.50	5.0	1.8	800	B1, B2	MLA 2653-504

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**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
7.9 - 8.4	+12	10	±0.30	0.012	1.5	1.8	80	A1, A2	MLA 2554-101
		20	±0.40	0.024	1.5	1.8	160	A1, A2	MLA 2554-102
		30	±0.50	0.036	1.5	1.8	240	B1, B2	MLA 2554-103
		40	±0.50	0.050	1.5	1.8	320	B1, B2	MLA 2554-104
	+18	10	±0.30	0.012	4.0	1.6	100	A1, A2	MLA 2554-201
		20	±0.40	0.024	4.0	1.6	180	A1, A2	MLA 2554-202
		30	±0.50	0.036	4.0	1.6	260	B1, B2	MLA 2554-203
		40	±0.50	0.050	4.0	1.6	340	B1, B2	MLA 2554-204
	+21	10	±0.30	0.012	5.0	1.6	120	A1, A2	MLA 2554-301
		20	±0.40	0.024	4.0	1.6	220	A1, A2	MLA 2554-302
		30	±0.50	0.036	4.0	1.6	300	B1, B2	MLA 2554-303
		40	±0.50	0.050	4.0	1.6	380	B1, B2	MLA 2554-304
	+26	8	±0.30	0.012	6.0	1.8	280	A1, A2	MLA 2554-401
		18	±0.40	0.024	5.0	1.8	400	A1, A2	MLA 2554-402
		28	±0.50	0.036	4.0	1.8	480	B1, B2	MLA 2554-403
		38	±0.50	0.050	4.0	1.8	560	B1, B2	MLA 2554-404
	+29	7	±0.50	0.012	8.0	1.8	400	A1, A2	MLA 2554-501
		16	±0.75	0.024	6.0	1.8	600	A1, A2	MLA 2554-502
		26	±1.00	0.036	5.0	1.8	700	B1, B2	MLA 2554-503
		36	±1.00	0.050	4.0	1.8	800	B1, B2	MLA 2554-504

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
7.9 - 8.4	+12	8	±0.30	±0.50	2.5	1.8	80	A1, A2	MLA 2654-101
		17	±0.40	±0.75	2.5	1.8	160	A1, A2	MLA 2654-102
		26	±0.50	±1.00	2.5	1.8	240	B1, B2	MLA 2654-103
		35	±0.50	±1.50	2.5	1.8	320	B1, B2	MLA 2654-104
	+18	8	±0.30	±0.50	6.0	1.6	100	A1, A2	MLA 2654-201
		17	±0.40	±0.75	5.0	1.6	180	A1, A2	MLA 2654-202
		26	±0.50	±1.00	5.0	1.6	260	B1, B2	MLA 2654-203
		35	±0.50	±1.50	5.0	1.6	340	B1, B2	MLA 2654-204
	+21	7	±0.30	±0.50	7.0	1.6	120	A1, A2	MLA 2654-301
		16	±0.40	±0.75	6.0	1.6	220	A1, A2	MLA 2654-302
		25	±0.50	±1.00	5.0	1.6	300	B1, B2	MLA 2654-303
		34	±0.50	±1.50	5.0	1.6	380	B1, B2	MLA 2654-304
	+26	6	±0.30	±0.50	8.0	1.8	280	A1, A2	MLA 2654-401
		15	±0.40	±0.75	7.0	1.8	400	A1, A2	MLA 2654-402
		24	±0.50	±1.00	6.0	1.8	480	B1, B2	MLA 2654-403
		33	±0.50	±1.50	5.0	1.8	560	B1, B2	MLA 2654-404
	+29	5	±0.50	±0.50	9.0	1.8	400	A1, A2	MLA 2654-501
		14	±0.75	±0.75	7.0	1.8	600	A1, A2	MLA 2654-502
		22	±1.00	±1.00	6.0	1.8	700	B1, B2	MLA 2654-503
		30	±1.00	±1.50	5.0	1.8	800	B1, B2	MLA 2654-504

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**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
8.5 - 9.5	+12	10	±0.30	0.012	1.5	1.8	80	A1, A2	MLA 2555-101
		20	±0.40	0.024	1.5	1.8	160	A1, A2	MLA 2555-102
		30	±0.50	0.036	1.5	1.8	240	B1, B2	MLA 2555-103
		40	±0.50	0.050	1.5	1.8	320	B1, B2	MLA 2555-104
	+18	10	±0.30	0.012	4.0	1.6	100	A1, A2	MLA 2555-201
		20	±0.40	0.024	4.0	1.6	180	A1, A2	MLA 2555-202
		30	±0.50	0.036	4.0	1.6	260	B1, B2	MLA 2555-203
		40	±0.50	0.050	4.0	1.6	340	B1, B2	MLA 2555-204
	+21	10	±0.30	0.012	5.0	1.6	120	A1, A2	MLA 2555-301
		20	±0.40	0.024	4.0	1.6	220	A1, A2	MLA 2555-302
		30	±0.50	0.036	4.0	1.6	300	B1, B2	MLA 2555-303
		40	±0.50	0.050	4.0	1.6	380	B1, B2	MLA 2555-304
	+26	8	±0.30	0.012	6.0	1.8	280	A1, A2	MLA 2555-401
		18	±0.40	0.024	5.0	1.8	400	A1, A2	MLA 2555-402
		28	±0.50	0.036	4.0	1.8	480	B1, B2	MLA 2555-403
		38	±0.50	0.050	4.0	1.8	560	B1, B2	MLA 2555-404
	+28	7	±0.50	0.012	8.0	1.8	400	A1, A2	MLA 2555-501
		16	±0.75	0.024	7.0	1.8	600	A1, A2	MLA 2555-502
		26	±1.00	0.036	6.0	1.8	700	B1, B2	MLA 2555-503
		36	±1.00	0.050	5.0	1.8	800	B1, B2	MLA 2555-504

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
8.5 - 9.5	+12	8	±0.30	±0.50	2.5	1.8	80	A1, A2	MLA 2655-101
		17	±0.40	±0.75	2.5	1.8	160	A1, A2	MLA 2655-102
		26	±0.50	±1.00	2.5	1.8	240	B1, B2	MLA 2655-103
		35	±0.50	±1.50	2.5	1.8	320	B1, B2	MLA 2655-104
	+18	8	±0.30	±0.50	6.0	1.6	100	A1, A2	MLA 2655-201
		17	±0.40	±0.75	5.0	1.6	180	A1, A2	MLA 2655-202
		26	±0.50	±1.00	5.0	1.6	260	B1, B2	MLA 2655-203
		35	±0.50	±1.50	5.0	1.6	340	B1, B2	MLA 2655-204
	+21	7	±0.30	±0.50	7.0	1.6	120	A1, A2	MLA 2655-301
		16	±0.40	±0.75	6.0	1.6	220	A1, A2	MLA 2655-302
		25	±0.50	±1.00	5.0	1.6	300	B1, B2	MLA 2655-303
		34	±0.50	±1.50	5.0	1.6	380	B1, B2	MLA 2655-304
	+26	6	±0.30	±0.50	8.0	1.8	280	A1, A2	MLA 2655-401
		15	±0.40	±0.75	7.0	1.8	400	A1, A2	MLA 2655-402
		24	±0.50	±1.00	6.0	1.8	480	B1, B2	MLA 2655-403
		33	±0.50	±1.50	5.0	1.8	560	B1, B2	MLA 2655-404
	+28	6	±0.50	±0.50	9.0	1.8	400	A1, A2	MLA 2655-501
		14	±0.75	±0.75	8.0	1.8	600	A1, A2	MLA 2655-502
		24	±1.00	±1.00	7.0	1.8	700	B1, B2	MLA 2655-503
		32	±1.00	±1.50	6.0	1.8	800	B1, B2	MLA 2655-504

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**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
9.5 - 10.5	+12	10	±0.30	0.012	1.5	1.8	80	A1, A2	MLA 2556-101
		20	±0.40	0.024	1.5	1.8	160	A1, A2	MLA 2556-102
		30	±0.50	0.036	1.5	1.8	240	B1, B2	MLA 2556-103
		40	±0.50	0.050	1.5	1.8	320	B1, B2	MLA 2556-104
	+18	10	±0.30	0.012	4.0	1.6	100	A1, A2	MLA 2556-201
		20	±0.40	0.024	4.0	1.6	180	A1, A2	MLA 2556-202
		30	±0.50	0.036	4.0	1.6	260	B1, B2	MLA 2556-203
		40	±0.50	0.050	4.0	1.6	340	B1, B2	MLA 2556-204
	+21	10	±0.30	0.012	5.0	1.6	120	A1, A2	MLA 2556-301
		20	±0.40	0.024	4.0	1.6	220	A1, A2	MLA 2556-302
		30	±0.50	0.036	4.0	1.6	300	B1, B2	MLA 2556-303
		40	±0.50	0.050	4.0	1.6	380	B1, B2	MLA 2556-304
	+26	9	±0.30	0.012	6.0	1.8	280	A1, A2	MLA 2556-401
		18	±0.40	0.024	5.0	1.8	400	A1, A2	MLA 2556-402
		28	±0.50	0.036	4.0	1.8	480	B1, B2	MLA 2556-403
		38	±0.50	0.050	4.0	1.8	560	B1, B2	MLA 2556-404

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
9.5 - 10.5	+12	10	±0.30	±0.50	2.5	1.8	80	A1, A2	MLA 2656-101
		20	±0.40	±0.75	2.2	1.8	160	B1, B2	MLA 2656-102
		27	±0.50	±1.00	2.2	1.8	240	B1, B2	MLA 2656-103
		35	±0.50	±1.50	2.2	1.8	320	B1, B2	MLA 2656-104
	+18	8	±0.30	±0.50	6.0	1.6	100	A1, A2	MLA 2656-201
		17	±0.40	±0.75	5.0	1.6	180	B1, B2	MLA 2656-202
		26	±0.50	±1.00	5.0	1.6	260	B1, B2	MLA 2656-203
		35	±0.50	±1.50	5.0	1.6	340	B1, B2	MLA 2656-204
	+21	7	±0.30	±0.50	7.0	1.6	120	A1, A2	MLA 2656-301
		16	±0.40	±0.75	6.0	1.6	220	B1, B2	MLA 2656-302
		25	±0.50	±1.00	5.0	1.6	300	B1, B2	MLA 2656-303
		34	±0.50	±1.50	5.0	1.6	380	B1, B2	MLA 2656-304
	+26	7	±0.30	±0.50	8.0	1.8	280	A1, A2	MLA 2656-401
		15	±0.40	±0.75	7.0	1.8	400	B1, B2	MLA 2656-402
		24	±0.50	±1.00	6.0	1.8	480	B1, B2	MLA 2656-403
		33	±0.50	±1.50	5.0	1.8	560	B1, B2	MLA 2656-404

**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
10.7 - 11.7	+12	13	±0.30	0.024	2.5	1.8	100	A1, A2	MLA 2557-101
		20	±0.40	0.036	2.5	1.8	150	A1, A2	MLA 2557-102
		33	±0.50	0.060	2.5	1.8	250	B1, B2	MLA 2557-103
		40	±0.50	0.072	2.5	1.8	300	C1, C2	MLA 2557-104
	+18	11	±0.30	0.024	6.0	1.6	150	A1, A2	MLA 2557-201
		18	±0.40	0.036	5.0	1.6	200	A1, A2	MLA 2557-202
		31	±0.50	0.060	5.0	1.6	300	B1, B2	MLA 2557-203
		38	±0.50	0.072	5.0	1.6	400	C1, C2	MLA 2557-204
	+21	10	±0.40	0.024	7.0	1.6	200	A1, A2	MLA 2557-301
		17	±0.50	0.036	6.0	1.6	250	A1, A2	MLA 2557-302
		30	±0.50	0.060	5.0	1.6	350	B1, B2	MLA 2557-303
		37	±0.50	0.072	5.0	1.6	450	C1, C2	MLA 2557-304
	+26	9	±0.40	0.024	8.0	1.8	250	A1, A2	MLA 2557-401
		16	±0.50	0.036	7.0	1.8	300	A1, A2	MLA 2557-402
		29	±0.50	0.060	6.0	1.8	400	B1, B2	MLA 2557-403
		36	±0.50	0.072	5.5	1.8	500	C1, C2	MLA 2557-404

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
10.7 - 11.7	+12	11	±0.40	±0.50	3.5	1.8	100	A1, A2	MLA 2657-101
		17	±0.50	±1.00	3.5	1.8	150	B1, B2	MLA 2657-102
		29	±0.50	±1.50	3.5	1.8	250	C1, C2	MLA 2657-103
		40	±0.50	±2.00	3.5	1.8	300	C1, C2	MLA 2657-104
	+18	9	±0.40	±0.50	8.0	1.6	150	A1, A2	MLA 2657-201
		14	±0.50	±1.00	7.0	1.6	200	B1, B2	MLA 2657-202
		25	±0.50	±1.50	6.0	1.6	300	C1, C2	MLA 2657-203
		36	±0.50	±2.00	6.0	1.6	400	C1, C2	MLA 2657-204
	+21	8	±0.40	±0.50	9.0	1.6	200	A1, A2	MLA 2657-301
		13	±0.50	±1.00	8.0	1.6	250	B1, B2	MLA 2657-302
		24	±0.50	±1.50	7.0	1.6	350	C1, C2	MLA 2657-303
		35	±0.50	±2.00	6.0	1.6	450	C1, C2	MLA 2657-304
	+26	7	±0.40	±0.50	10.0	1.8	250	A1, A2	MLA 2657-401
		12	±0.50	±1.00	9.0	1.8	300	B1, B2	MLA 2657-402
		23	±0.50	±1.50	8.0	1.8	400	C1, C2	MLA 2657-403
		34	±0.50	±2.00	7.0	1.8	500	C1, C2	MLA 2657-404

**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
11.7 - 12.8	+12	13	±0.30	0.024	2.5	1.8	100	A1, A2	MLA 2558-101
		20	±0.40	0.036	2.5	1.8	150	A1, A2	MLA 2558-102
		33	±0.50	0.060	2.5	1.8	250	B1, B2	MLA 2558-103
		40	±0.50	0.072	2.5	1.8	300	C1, C2	MLA 2558-104
	+18	11	±0.30	0.024	6.0	1.6	150	A1, A2	MLA 2558-201
		18	±0.40	0.036	5.0	1.6	200	A1, A2	MLA 2558-202
		31	±0.50	0.060	5.0	1.6	300	B1, B2	MLA 2558-203
		38	±0.50	0.072	5.0	1.6	400	C1, C2	MLA 2558-204
	+21	10	±0.40	0.024	7.0	1.6	200	A1, A2	MLA 2558-301
		17	±0.50	0.036	6.0	1.6	250	A1, A2	MLA 2558-302
		30	±0.50	0.060	5.0	1.6	350	B1, B2	MLA 2558-303
		37	±0.50	0.072	5.0	1.6	450	C1, C2	MLA 2558-304
	+26	9	±0.40	0.024	8.0	1.8	250	A1, A2	MLA 2558-401
		16	±0.50	0.036	7.0	1.8	300	A1, A2	MLA 2558-402
		29	±0.50	0.060	6.0	1.8	400	B1, B2	MLA 2558-403
		36	±0.50	0.072	5.5	1.8	500	C1, C2	MLA 2558-404

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
11.7 - 12.8	+12	11	±0.40	±0.50	3.5	1.8	100	A1, A2	MLA 2658-101
		17	±0.50	±1.00	3.5	1.8	150	B1, B2	MLA 2658-102
		29	±0.50	±1.50	3.5	1.8	250	C1, C2	MLA 2658-103
		40	±0.50	±2.00	3.5	1.8	300	C1, C2	MLA 2658-104
	+18	9	±0.40	±0.50	8.0	1.6	150	A1, A2	MLA 2658-201
		14	±0.50	±1.00	7.0	1.6	200	B1, B2	MLA 2658-202
		25	±0.50	±1.50	6.0	1.6	300	C1, C2	MLA 2658-203
		36	±0.50	±2.00	6.0	1.6	400	C1, C2	MLA 2658-204
	+21	8	±0.40	±0.50	9.0	1.6	200	A1, A2	MLA 2658-301
		13	±0.50	±1.00	8.0	1.6	250	B1, B2	MLA 2658-302
		24	±0.50	±1.50	7.0	1.6	350	C1, C2	MLA 2658-303
		35	±0.50	±2.00	6.0	1.6	450	C1, C2	MLA 2658-304
	+26	7	±0.40	±0.50	10.0	1.8	250	A1, A2	MLA 2658-401
		12	±0.50	±1.00	9.0	1.8	300	B1, B2	MLA 2658-402
		23	±0.50	±1.50	8.0	1.8	400	C1, C2	MLA 2658-403
		34	±0.50	±2.00	7.0	1.8	500	C1, C2	MLA 2658-404

### UNCOMPENSATED SPECIFICATIONS (guaranteed @ +25° C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
12.2 - 12.8	+12	13	±0.30	0.024	2.5	1.8	100	A1, A2	MLA 2561-101
		20	±0.40	0.036	2.5	1.8	150	A1, A2	MLA 2561-102
		33	±0.50	0.060	2.5	1.8	250	B1, B2	MLA 2561-103
		40	±0.50	0.072	2.5	1.8	300	C1, C2	MLA 2561-104
	+18	11	±0.30	0.024	6.0	1.6	150	A1, A2	MLA 2561-201
		18	±0.40	0.036	5.0	1.6	200	A1, A2	MLA 2561-202
		31	±0.50	0.060	5.0	1.6	300	B1, B2	MLA 2561-203
		38	±0.50	0.072	5.0	1.6	400	C1, C2	MLA 2561-204
	+21	10	±0.40	0.024	7.0	1.6	200	A1, A2	MLA 2561-301
		17	±0.50	0.036	6.0	1.6	250	A1, A2	MLA 2561-302
		30	±0.50	0.060	5.0	1.6	350	B1, B2	MLA 2561-303
		37	±0.50	0.072	5.0	1.6	450	C1, C2	MLA 2561-304
	+26	9	±0.40	0.024	8.0	1.8	250	A1, A2	MLA 2561-401
		16	±0.50	0.036	7.0	1.8	300	A1, A2	MLA 2561-402
		29	±0.50	0.060	6.0	1.8	400	B1, B2	MLA 2561-403
		36	±0.50	0.072	5.5	1.8	500	C1, C2	MLA 2561-404

### TEMPERATURE COMPENSATED SPECIFICATIONS (guaranteed -55° C to +95° C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
12.2 - 12.8	+12	11	±0.40	±0.50	3.5	1.8	100	A1, A2	MLA 2661-101
		17	±0.50	±1.00	3.5	1.8	150	B1, B2	MLA 2661-102
		29	±0.50	±1.50	3.5	1.8	250	C1, C2	MLA 2661-103
		40	±0.50	±2.00	3.5	1.8	300	C1, C2	MLA 2661-104
	+18	9	±0.40	±0.50	8.0	1.6	150	A1, A2	MLA 2661-201
		14	±0.50	±1.00	7.0	1.6	200	B1, B2	MLA 2661-202
		25	±0.50	±1.50	6.0	1.6	300	C1, C2	MLA 2661-203
		36	±0.50	±2.00	6.0	1.6	400	C1, C2	MLA 2661-204
	+21	8	±0.40	±0.50	9.0	1.6	200	A1, A2	MLA 2661-301
		13	±0.50	±1.00	8.0	1.6	250	B1, B2	MLA 2661-302
		24	±0.50	±1.50	7.0	1.6	350	C1, C2	MLA 2661-303
		35	±0.50	±2.00	6.0	1.6	450	C1, C2	MLA 2661-304
	+26	7	±0.40	±0.50	10.0	1.8	250	A1, A2	MLA 2661-401
		12	±0.50	±1.00	9.0	1.8	300	B1, B2	MLA 2661-402
		23	±0.50	±1.50	8.0	1.8	400	C1, C2	MLA 2661-403
		34	±0.50	±2.00	7.0	1.8	500	C1, C2	MLA 2661-404

### UNCOMPENSATED SPECIFICATIONS (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
12.8 - 13.3	+12	13	±0.30	0.024	2.5	1.8	100	A1, A2	MLA 2562-101
		20	±0.40	0.036	2.5	1.8	150	A1, A2	MLA 2562-102
		33	±0.50	0.060	2.5	1.8	250	B1, B2	MLA 2562-103
		40	±0.50	0.072	2.5	1.8	300	C1, C2	MLA 2562-104
	+18	11	±0.30	0.024	6.0	1.6	150	A1, A2	MLA 2562-201
		18	±0.40	0.036	5.0	1.6	200	A1, A2	MLA 2562-202
		31	±0.50	0.060	5.0	1.6	300	B1, B2	MLA 2562-203
		38	±0.50	0.072	5.0	1.6	400	C1, C2	MLA 2562-204
	+21	10	±0.40	0.024	7.0	1.6	200	A1, A2	MLA 2562-301
		17	±0.50	0.036	6.0	1.6	250	A1, A2	MLA 2562-302
		30	±0.50	0.060	5.0	1.6	350	B1, B2	MLA 2562-303
		37	±0.50	0.072	5.0	1.6	450	C1, C2	MLA 2562-304
	+26	9	±0.40	0.024	8.0	1.8	250	A1, A2	MLA 2562-401
		16	±0.50	0.036	7.0	1.8	300	A1, A2	MLA 2562-402
		29	±0.50	0.060	6.0	1.8	400	B1, B2	MLA 2562-403
		36	±0.50	0.072	5.5	1.8	500	C1, C2	MLA 2562-404

### TEMPERATURE COMPENSATED SPECIFICATIONS (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
12.8 - 13.3	+12	11	±0.40	±0.50	3.5	1.8	100	A1, A2	MLA 2662-101
		17	±0.50	±1.00	3.5	1.8	150	B1, B2	MLA 2662-102
		29	±0.50	±1.50	3.5	1.8	250	C1, C2	MLA 2662-103
		40	±0.50	±2.00	3.5	1.8	300	C1, C2	MLA 2662-104
	+18	9	±0.40	±0.50	8.0	1.6	150	A1, A2	MLA 2662-201
		14	±0.50	±1.00	7.0	1.6	200	B1, B2	MLA 2662-202
		25	±0.50	±1.50	6.0	1.6	300	C1, C2	MLA 2662-203
		36	±0.50	±2.00	6.0	1.6	400	C1, C2	MLA 2662-204
	+21	8	±0.40	±0.50	9.0	1.6	200	A1, A2	MLA 2662-301
		13	±0.50	±1.00	8.0	1.6	250	B1, B2	MLA 2662-302
		24	±0.50	±1.50	7.0	1.6	350	C1, C2	MLA 2662-303
		35	±0.50	±2.00	6.0	1.6	450	C1, C2	MLA 2662-304
	+26	7	±0.40	±0.50	10.0	1.8	250	A1, A2	MLA 2662-401
		12	±0.50	±1.00	9.0	1.8	300	B1, B2	MLA 2662-402
		23	±0.50	±1.50	8.0	1.8	400	C1, C2	MLA 2662-403
		34	±0.50	±2.00	7.0	1.8	500	C1, C2	MLA 2662-404

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### UNCOMPENSATED SPECIFICATIONS (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
13.3 - 14.0	+12	13	±0.30	0.024	2.5	1.8	100	A1, A2	MLA 2563-101
		20	±0.40	0.036	2.5	1.8	150	A1, A2	MLA 2563-102
		33	±0.50	0.060	2.5	1.8	250	B1, B2	MLA 2563-103
		40	±0.50	0.072	2.5	1.8	300	C1, C2	MLA 2563-104
	+18	11	±0.30	0.024	6.0	1.6	150	A1, A2	MLA 2563-201
		18	±0.40	0.036	5.0	1.6	200	A1, A2	MLA 2563-202
		31	±0.50	0.060	5.0	1.6	300	B1, B2	MLA 2563-203
		38	±0.50	0.072	5.0	1.6	400	C1, C2	MLA 2563-204
	+21	10	±0.40	0.024	7.0	1.6	200	A1, A2	MLA 2563-301
		17	±0.50	0.036	6.0	1.6	250	A1, A2	MLA 2563-302
		30	±0.50	0.060	5.0	1.6	350	B1, B2	MLA 2563-303
		37	±0.50	0.072	5.0	1.6	450	C1, C2	MLA 2563-304
	+26	9	±0.40	0.024	8.0	1.8	250	A1, A2	MLA 2563-401
		16	±0.50	0.036	7.0	1.8	300	A1, A2	MLA 2563-402
		29	±0.50	0.060	6.0	1.8	400	B1, B2	MLA 2563-403
		36	±0.50	0.072	5.5	1.8	500	C1, C2	MLA 2563-404

### TEMPERATURE COMPENSATED SPECIFICATIONS (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
13.3 - 14.0	+12	11	±0.40	±0.50	3.5	1.8	100	A1, A2	MLA 2663-101
		17	±0.50	±1.00	3.5	1.8	150	B1, B2	MLA 2663-102
		29	±0.50	±1.50	3.5	1.8	250	C1, C2	MLA 2663-103
		40	±0.50	±2.00	3.5	1.8	300	C1, C2	MLA 2663-104
	+18	9	±0.40	±0.50	8.0	1.6	150	A1, A2	MLA 2663-201
		14	±0.50	±1.00	7.0	1.6	200	B1, B2	MLA 2663-202
		25	±0.50	±1.50	6.0	1.6	300	C1, C2	MLA 2663-203
		36	±0.50	±2.00	6.0	1.6	400	C1, C2	MLA 2663-204
	+21	8	±0.40	±0.50	9.0	1.6	200	A1, A2	MLA 2663-301
		13	±0.50	±1.00	8.0	1.6	250	B1, B2	MLA 2663-302
		24	±0.50	±1.50	7.0	1.6	350	C1, C2	MLA 2663-303
		35	±0.50	±2.00	6.0	1.6	450	C1, C2	MLA 2663-304
	+26	7	±0.40	±0.50	10.0	1.8	250	A1, A2	MLA 2663-401
		12	±0.50	±1.00	9.0	1.8	300	B1, B2	MLA 2663-402
		23	±0.50	±1.50	8.0	1.8	400	C1, C2	MLA 2663-403
		34	±0.50	±2.00	7.0	1.8	500	C1, C2	MLA 2663-404



**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
14.0 - 14.5	+12	13	±0.30	0.024	2.5	1.8	100	A1, A2	MLA 2564-101
		20	±0.40	0.036	2.5	1.8	150	A1, A2	MLA 2564-102
		33	±0.50	0.060	2.5	1.8	250	B1, B2	MLA 2564-103
		40	±0.50	0.072	2.5	1.8	300	C1, C2	MLA 2564-104
	+18	11	±0.30	0.024	6.0	1.6	150	A1, A2	MLA 2564-201
		18	±0.40	0.036	5.0	1.6	200	A1, A2	MLA 2564-202
		31	±0.50	0.060	5.0	1.6	300	B1, B2	MLA 2564-203
		38	±0.50	0.072	5.0	1.6	400	C1, C2	MLA 2564-204
	+21	10	±0.40	0.024	7.0	1.6	200	A1, A2	MLA 2564-301
		17	±0.50	0.036	6.0	1.6	250	A1, A2	MLA 2564-302
		30	±0.50	0.060	5.0	1.6	350	B1, B2	MLA 2564-303
		37	±0.50	0.072	5.0	1.6	450	C1, C2	MLA 2564-304
	+26	9	±0.40	0.024	8.0	1.8	250	A1, A2	MLA 2564-401
		16	±0.50	0.036	7.0	1.8	300	A1, A2	MLA 2564-402
		29	±0.50	0.060	6.0	1.8	400	B1, B2	MLA 2564-403
		36	±0.50	0.072	5.5	1.8	500	C1, C2	MLA 2564-404

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
14.0 - 14.5	+12	11	±0.40	±0.50	3.5	1.8	100	A1, A2	MLA 2664-101
		17	±0.50	±1.00	3.5	1.8	150	B1, B2	MLA 2664-102
		29	±0.50	±1.50	3.5	1.8	250	C1, C2	MLA 2664-103
		40	±0.50	±2.00	3.5	1.8	300	C1, C2	MLA 2664-104
	+18	9	±0.40	±0.50	8.0	1.6	150	A1, A2	MLA 2664-201
		14	±0.50	±1.00	7.0	1.6	200	B1, B2	MLA 2664-202
		25	±0.50	±1.50	6.0	1.6	300	C1, C2	MLA 2664-203
		36	±0.50	±2.00	6.0	1.6	400	C1, C2	MLA 2664-204
	+21	8	±0.40	±0.50	9.0	1.6	200	A1, A2	MLA 2664-301
		13	±0.50	±1.00	8.0	1.6	250	B1, B2	MLA 2664-302
		24	±0.50	±1.50	7.0	1.6	350	C1, C2	MLA 2664-303
		35	±0.50	±2.00	6.0	1.6	450	C1, C2	MLA 2664-304
	+26	7	±0.40	±0.50	10.0	1.8	250	A1, A2	MLA 2664-401
		12	±0.50	±1.00	9.0	1.8	300	B1, B2	MLA 2664-402
		23	±0.50	±1.50	8.0	1.8	400	C1, C2	MLA 2664-403
		34	±0.50	±2.00	7.0	1.8	500	C1, C2	MLA 2664-404

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**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number	
14.5 - 15.5	+12	13	±0.30	0.024	2.5	1.8	100	A1, A2	MLA 2565-101	
		20	±0.40	0.036	2.5	1.8	150	A1, A2	MLA 2565-102	
		33	±0.50	0.060	2.5	1.8	250	B1, B2	MLA 2565-103	
		40	±0.50	0.072	2.5	1.8	300	C1, C2	MLA 2565-104	
	+18	11	±0.30	0.024	6.0	1.6	150	A1, A2	MLA 2565-201	
		18	±0.40	0.036	5.0	1.6	200	A1, A2	MLA 2565-202	
		31	±0.50	0.060	5.0	1.6	300	B1, B2	MLA 2565-203	
		38	±0.50	0.072	5.0	1.6	400	C1, C2	MLA 2565-204	
	+21	10	±0.40	0.024	7.0	1.6	200	A1, A2	MLA 2565-301	
		17	±0.50	0.036	6.0	1.6	250	A1, A2	MLA 2565-302	
		30	±0.50	0.060	5.0	1.6	350	B1, B2	MLA 2565-303	
		37	±0.50	0.072	5.0	1.6	450	C1, C2	MLA 2565-304	
		+26	9	±0.40	0.024	8.0	1.8	250	A1, A2	MLA 2565-401
			16	±0.50	0.036	7.0	1.8	300	A1, A2	MLA 2565-402
	29		±0.50	0.060	6.0	1.8	400	B1, B2	MLA 2565-403	
			36	±0.50	0.072	5.5	1.8	500	C1, C2	MLA 2565-404

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
14.5 - 15.5	+12	11	±0.40	±0.50	3.5	1.8	100	A1, A2	MLA 2665-101
		17	±0.50	±1.00	3.5	1.8	150	B1, B2	MLA 2665-102
		29	±0.50	±1.50	3.5	1.8	250	C1, C2	MLA 2665-103
		40	±0.50	±2.00	3.5	1.8	300	C1, C2	MLA 2665-104
	+18	9	±0.40	±0.50	8.0	1.6	150	A1, A2	MLA 2665-201
		14	±0.50	±1.00	7.0	1.6	200	B1, B2	MLA 2665-202
		25	±0.50	±1.50	6.0	1.6	300	C1, C2	MLA 2665-203
		36	±0.50	±2.00	6.0	1.6	400	C1, C2	MLA 2665-204
	+21	8	±0.40	±0.50	9.0	1.6	200	A1, A2	MLA 2665-301
		13	±0.50	±1.00	8.0	1.6	250	B1, B2	MLA 2665-302
		24	±0.50	±1.50	7.0	1.6	350	C1, C2	MLA 2665-303
		35	±0.50	±2.00	6.0	1.6	450	C1, C2	MLA 2665-304
	+26	7	±0.40	±0.50	10.0	1.8	250	A1, A2	MLA 2665-401
		12	±0.50	±1.00	9.0	1.8	300	B1, B2	MLA 2665-402
		23	±0.50	±1.50	8.0	1.8	400	C1, C2	MLA 2665-403
			34	±0.50	±2.00	7.0	1.8	500	C1, C2

**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
15.5 - 16.5	+12	11	±0.40	0.025	4.0	1.8	100	A1, A2	MLA 2566-101
		22	±0.50	0.050	4.0	1.8	200	B1, B2	MLA 2566-102
		33	±0.50	0.075	4.0	1.8	300	B1, B2	MLA 2566-103
		44	±0.50	0.100	4.0	1.8	400	C1, C2	MLA 2566-104
	+18	10	±0.40	0.025	7.0	1.6	150	A1, A2	MLA 2566-201
		21	±0.50	0.050	6.0	1.6	250	B1, B2	MLA 2566-202
		32	±0.50	0.075	6.0	1.6	350	B1, B2	MLA 2566-203
		43	±0.50	0.100	6.0	1.6	450	C1, C2	MLA 2566-204
	+21	10	±0.50	0.025	8.0	1.6	200	A1, A2	MLA 2566-301
		21	±0.50	0.050	7.0	1.6	300	B1, B2	MLA 2566-302
		32	±0.50	0.075	6.0	1.6	400	B1, B2	MLA 2566-303
		43	±0.50	0.100	6.0	1.6	500	C1, C2	MLA 2566-304
	+26	9	±0.50	0.025	9.0	1.8	300	A1, A2	MLA 2566-401
		19	±0.50	0.050	8.0	1.8	400	B1, B2	MLA 2566-402
		30	±0.50	0.075	7.0	1.8	500	B1, B2	MLA 2566-403
		40	±0.50	0.100	6.0	1.8	600	C1, C2	MLA 2566-404

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
15.5 - 16.5	+12	9	±0.40	±0.50	5.0	1.8	100	A1, A2	MLA 2666-101
		18	±0.50	±1.00	5.0	1.8	200	B1, B2	MLA 2666-102
		28	±0.50	±1.50	5.0	1.8	300	C1, C2	MLA 2666-103
		38	±0.50	±2.00	5.0	1.8	400	C1, C2	MLA 2666-104
	+18	8	±0.40	±0.50	8.0	1.6	150	A1, A2	MLA 2666-201
		17	±0.50	±1.00	7.0	1.6	250	B1, B2	MLA 2666-202
		27	±0.50	±1.50	7.0	1.6	350	C1, C2	MLA 2666-203
		37	±0.50	±2.00	7.0	1.6	450	C1, C2	MLA 2666-204
	+21	8	±0.50	±0.50	9.0	1.6	200	A1, A2	MLA 2666-301
		17	±0.50	±1.00	8.0	1.6	300	B1, B2	MLA 2666-302
		27	±0.50	±1.50	7.0	1.6	400	C1, C2	MLA 2666-303
		36	±0.50	±2.00	7.0	1.6	500	C1, C2	MLA 2666-304
	+26	7	±0.50	±0.50	10.0	1.8	300	A1, A2	MLA 2666-401
		16	±0.50	±1.00	9.0	1.8	400	B1, B2	MLA 2666-402
		25	±0.50	±1.50	8.0	1.8	500	C1, C2	MLA 2666-403
		34	±0.50	±2.00	7.0	1.8	600	C1, C2	MLA 2666-404

**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25° C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
16.5 - 17.5	+12	11	±0.40	0.025	4.0	1.8	100	A1, A2	MLA 2567-101
		22	±0.50	0.050	4.0	1.8	200	B1, B2	MLA 2567-102
		33	±0.50	0.075	4.0	1.8	300	B1, B2	MLA 2567-103
		44	±0.50	0.100	4.0	1.8	400	C1, C2	MLA 2567-104
	+18	10	±0.40	0.025	7.0	1.6	150	A1, A2	MLA 2567-201
		21	±0.50	0.050	6.0	1.6	250	B1, B2	MLA 2567-202
		32	±0.50	0.075	6.0	1.6	350	B1, B2	MLA 2567-203
		43	±0.50	0.100	6.0	1.6	450	C1, C2	MLA 2567-204
	+21	10	±0.50	0.025	8.0	1.6	200	A1, A2	MLA 2567-301
		21	±0.50	0.050	7.0	1.6	300	B1, B2	MLA 2567-302
		32	±0.50	0.075	6.0	1.6	400	B1, B2	MLA 2567-303
		43	±0.50	0.100	6.0	1.6	500	C1, C2	MLA 2567-304
	+26	9	±0.50	0.025	9.0	1.8	300	A1, A2	MLA 2567-401
		19	±0.50	0.050	8.0	1.8	400	B1, B2	MLA 2567-402
		30	±0.50	0.075	7.0	1.8	500	B1, B2	MLA 2567-403
		40	±0.50	0.100	6.0	1.8	600	C1, C2	MLA 2567-404

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55° C to +95° C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
16.5 - 17.5	+12	9	±0.40	±0.50	5.0	1.8	100	A1, A2	MLA 2667-101
		18	±0.50	±1.00	5.0	1.8	200	B1, B2	MLA 2667-102
		28	±0.50	±1.50	5.0	1.8	300	C1, C2	MLA 2667-103
		38	±0.50	±2.00	5.0	1.8	400	C1, C2	MLA 2667-104
	+18	8	±0.40	±0.50	8.0	1.6	150	A1, A2	MLA 2667-201
		17	±0.50	±1.00	7.0	1.6	250	B1, B2	MLA 2667-202
		27	±0.50	±1.50	7.0	1.6	350	C1, C2	MLA 2667-203
		37	±0.50	±2.00	7.0	1.6	450	C1, C2	MLA 2667-204
	+21	8	±0.50	±0.50	9.0	1.6	200	A1, A2	MLA 2667-301
		17	±0.50	±1.00	8.0	1.6	300	B1, B2	MLA 2667-302
		27	±0.50	±1.50	7.0	1.6	400	C1, C2	MLA 2667-303
		36	±0.50	±2.00	7.0	1.6	500	C1, C2	MLA 2667-304
	+26	7	±0.50	±0.50	10.0	1.8	300	A1, A2	MLA 2667-401
		16	±0.50	±1.00	9.0	1.8	400	B1, B2	MLA 2667-402
		25	±0.50	±1.50	8.0	1.8	500	C1, C2	MLA 2667-403
		34	±0.50	±2.00	7.0	1.8	600	C1, C2	MLA 2667-404

**UNCOMPENSATED SPECIFICATIONS** (guaranteed @ +25°C)

Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
17.5 - 19.5	+12	11	±0.40	0.025	4.0	1.8	100	A1, A2	MLA 2568-101
		22	±0.50	0.050	4.0	1.8	200	B1, B2	MLA 2568-102
		33	±0.50	0.075	4.0	1.8	300	B1, B2	MLA 2568-103
		44	±0.50	0.100	4.0	1.8	400	C1, C2	MLA 2568-104
	+18	10	±0.40	0.025	7.0	1.8	150	A1, A2	MLA 2568-201
		21	±0.50	0.050	6.0	1.8	250	B1, B2	MLA 2568-202
		32	±0.50	0.075	6.0	1.8	350	B1, B2	MLA 2568-203
		43	±0.50	0.100	6.0	1.8	450	C1, C2	MLA 2568-204
	+21	10	±0.50	0.025	8.0	1.8	200	A1, A2	MLA 2568-301
		21	±0.50	0.050	7.0	1.8	300	B1, B2	MLA 2568-302
		32	±0.50	0.075	6.0	1.8	400	B1, B2	MLA 2568-303
		43	±0.50	0.100	6.0	1.8	500	C1, C2	MLA 2568-304
	+24	9	±0.50	0.025	9.0	1.8	300	A1, A2	MLA 2568-401
		19	±0.50	0.050	8.0	1.8	400	B1, B2	MLA 2568-402
		30	±0.50	0.075	7.0	1.8	500	B1, B2	MLA 2568-403
		40	±0.50	0.100	6.0	1.8	600	C1, C2	MLA 2568-404

**TEMPERATURE COMPENSATED SPECIFICATIONS** (guaranteed -55°C to +95°C)

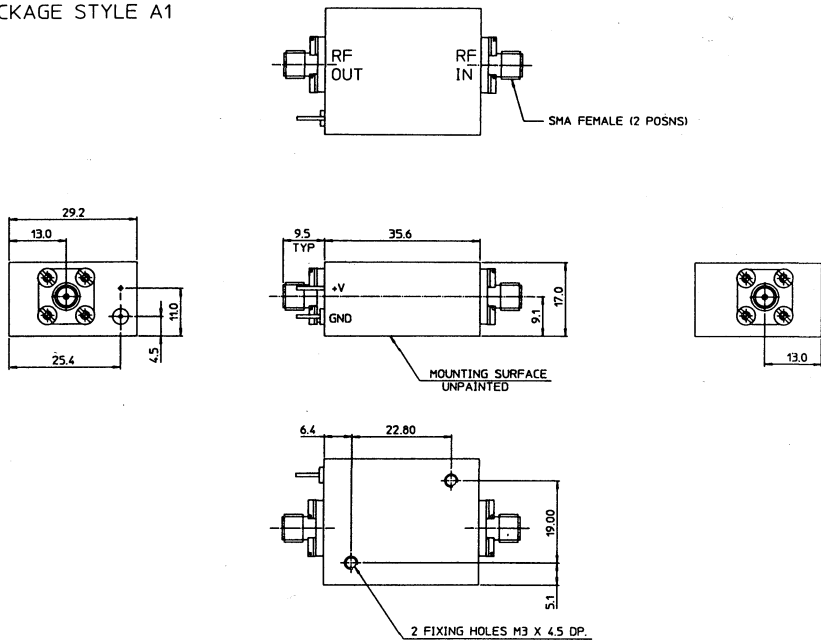
Frequency Range (GHz)	Output Power at 1dB Gain Comp (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation with Temp (dB/°C) Max.	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current at +15V (mA)	Package Styles	Part Number
17.5 - 19.5	+12	9	±0.40	±0.50	5.0	1.8	100	A1, A2	MLA 2668-101
		18	±0.50	±1.00	5.0	1.8	200	B1, B2	MLA 2668-102
		28	±0.50	±1.50	5.0	1.8	300	C1, C2	MLA 2668-103
		38	±0.50	±2.00	5.0	1.8	400	C1, C2	MLA 2668-104
	+18	8	±0.40	±0.50	8.0	1.8	150	A1, A2	MLA 2668-201
		17	±0.50	±1.00	7.0	1.8	250	B1, B2	MLA 2668-202
		27	±0.50	±1.50	7.0	1.8	350	C1, C2	MLA 2668-203
		37	±0.50	±2.00	7.0	1.8	450	C1, C2	MLA 2668-204
	+21	8	±0.50	±0.50	9.0	1.8	200	A1, A2	MLA 2668-301
		17	±0.50	±1.00	8.0	1.8	300	B1, B2	MLA 2668-302
		27	±0.50	±1.50	7.0	1.8	400	C1, C2	MLA 2668-303
		36	±0.50	±2.00	7.0	1.8	500	C1, C2	MLA 2668-304
	+24	7	±0.50	±0.50	10.0	1.8	300	A1, A2	MLA 2668-401
		16	±0.50	±1.00	9.0	1.8	400	B1, B2	MLA 2668-402
		25	±0.50	±1.50	8.0	1.8	500	C1, C2	MLA 2668-403
		34	±0.50	±2.00	7.0	1.8	600	C1, C2,	MLA 2668-404

## NOTES

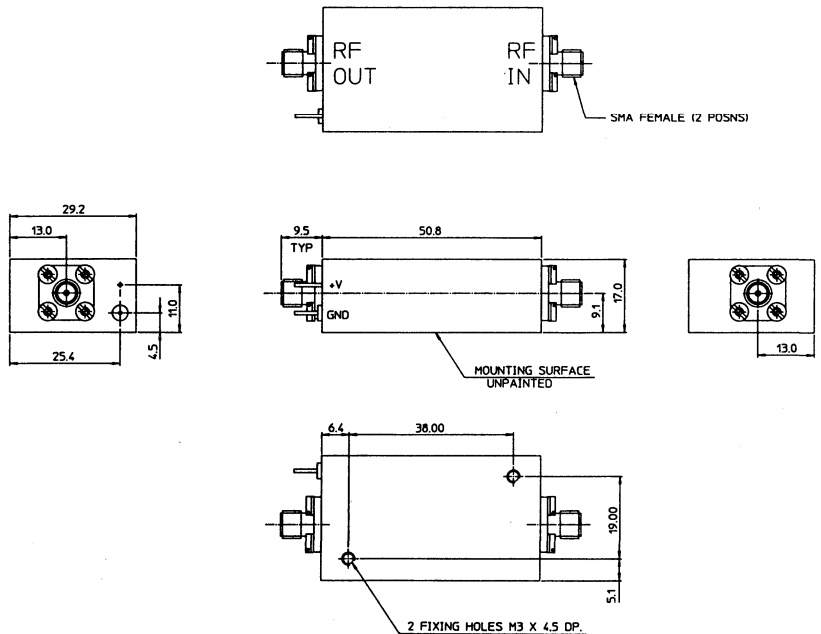
- 1) Other frequency bands are available, please contact the factory with your requirements.
- 2) Higher output powers for each frequency band are available in non-standard outlines, please contact the factory.
- 3) Maximum input power without damage is +20dBm (CW), higher power handling is available with an optional input limiter, please contact the factory.
- 4) Third order intercept point is typically 10dB above P1dB.
- 5) All amplifiers have an integral voltage regulator giving reverse polarity and over voltage power supply protection.
- 6) Alternative +8V and +12V power supplies are available on selected amplifiers, please contact the factory.
- 7) All amplifiers are unconditionally stable for any input or output VSWR, any phase.
- 8) All amplifiers are supplied in the standard coaxial outline (A1, B1, C1) unless the optional miniature outline (A2, A3, B2, B3, C2) is specified.
- 9) Waveguide inputs are available on selected amplifiers, please contact the factory.
- 10) Case operating temperature                   -55°C to +95°C  
Storage temperature range                   -55°C to +125°C.

# STANDARD OUTLINE DRAWINGS

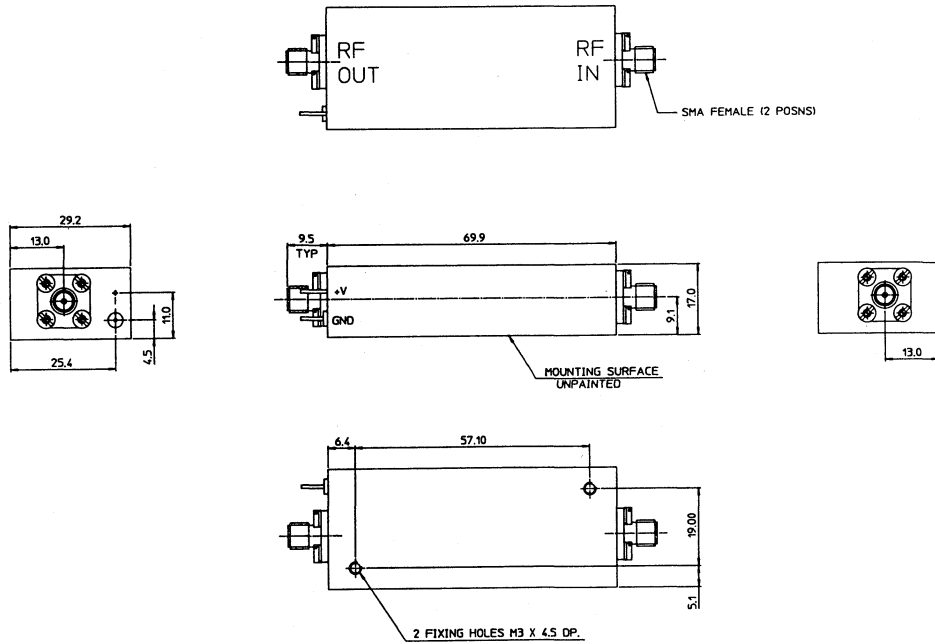
PACKAGE STYLE A1



PACKAGE STYLE B1

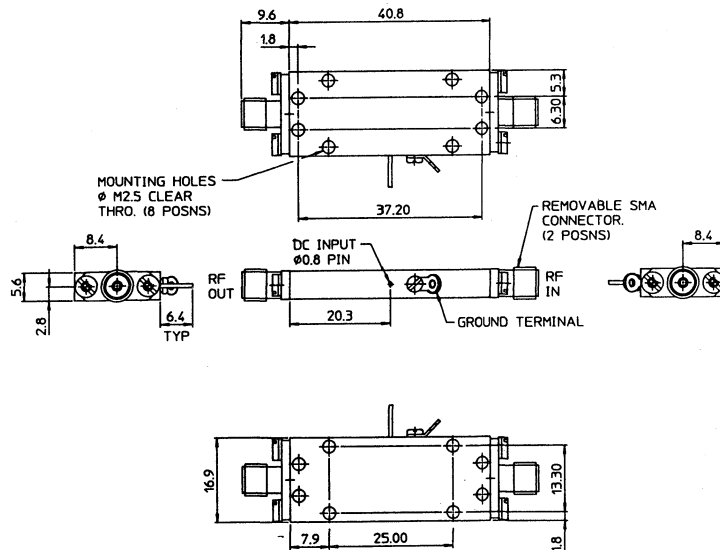


PACKAGE STYLE C1



MINIATURE OUTLINE DRAWINGS

PACKAGE STYLE A2



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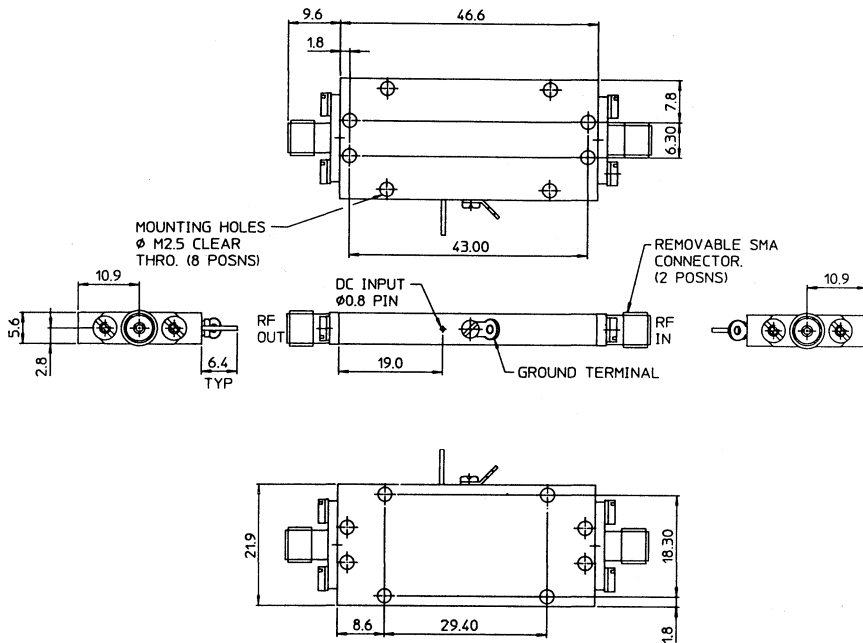
Europe: (44) 1344 869595

North America: 800 366 2266

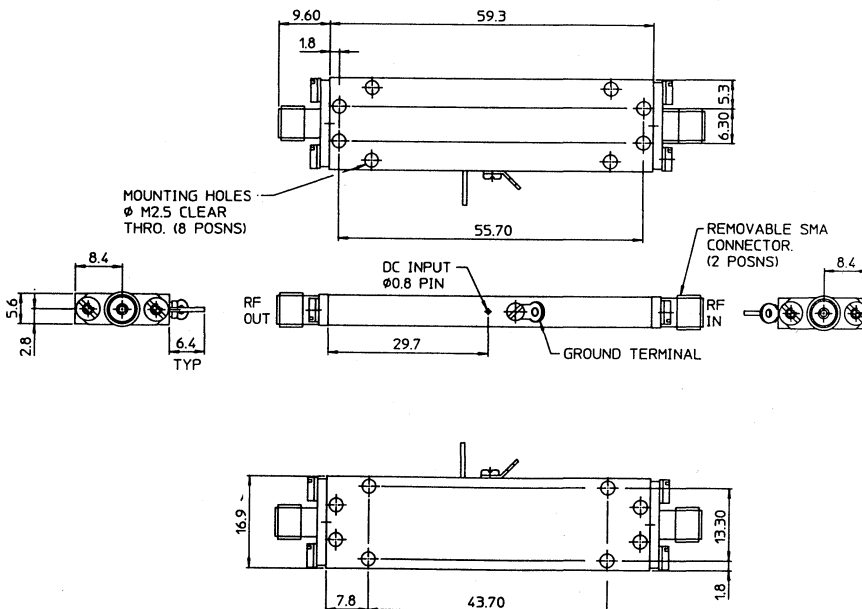
Asia Pacific: (81) 3 3226 1671



PACKAGE STYLE A3



PACKAGE STYLE B2



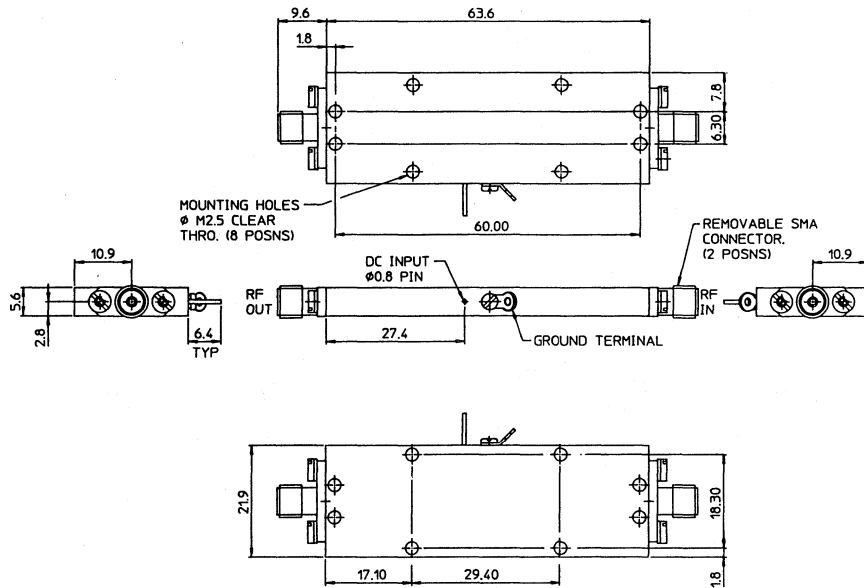
M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

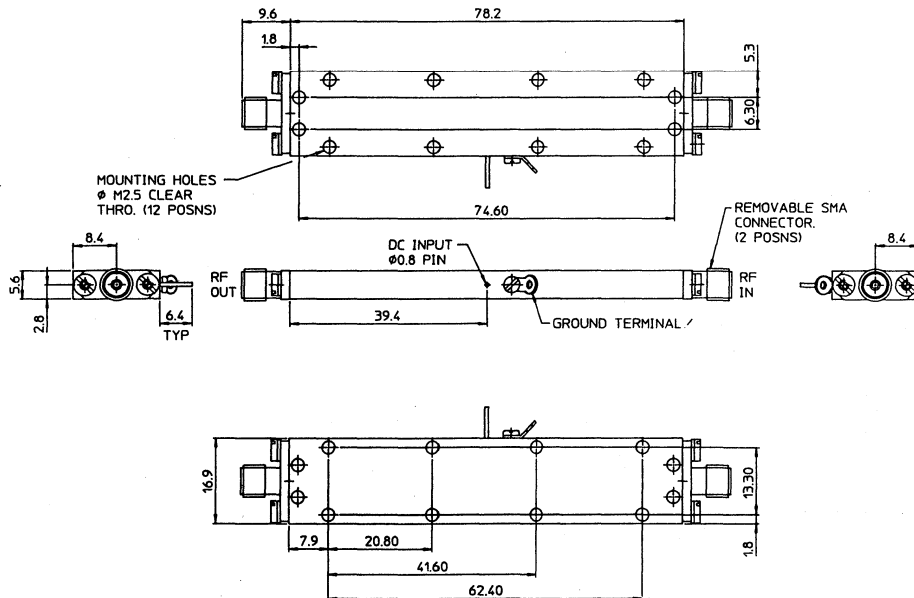
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

PACKAGE STYLE B3



PACKAGE STYLE C2



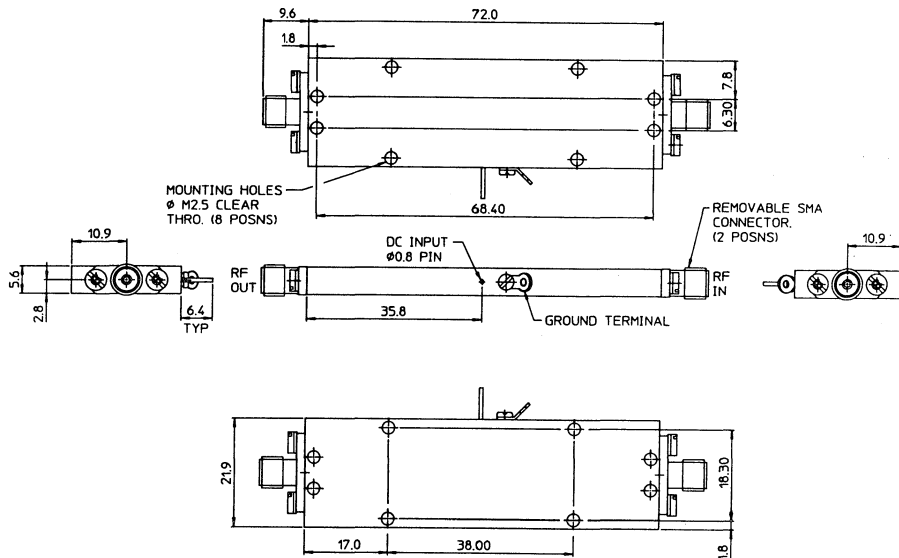
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North America: 800 366 2266

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## PACKAGE STYLE C3



## DRAWING NOTES

Third Angle Projection

All dimensions in mm

Tolerances    x.x    =     $\pm 0.5$ mm  
                   x.xx   =     $\pm 0.1$ mm

Standard Finish:

Standard packages: Matt black paint  
 to DTD 5555A  
 (A1, B1, C1)

Miniature packages: Nickel plate  
 (A2, A3, B2, B3, C2, C3)

All specifications subject to change without notice

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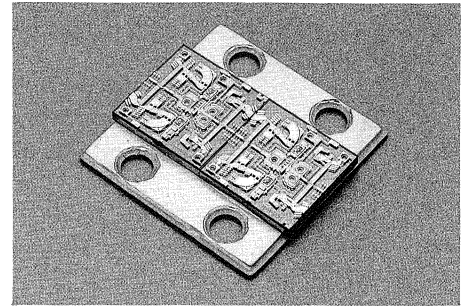
Asia Pacific: (81) 3 3226 1671

**MICROWAVE COMMON MODULE**  
**BROADBAND GaAs FET AMPLIFIERS**  
**2.0 TO 18.0GHz**



**FEATURES**

- ◆ **MiCM 20 Compatible**
- ◆ **Def Stan & CECC Specifications**
- ◆ **Direct 50ohm Microstrip Interfaces**
- ◆ **Broad Frequency Ranges**
- ◆ **Wide Dynamic Ranges**



**DESCRIPTION**

The modular amplifiers in this series are miniature carrier mounted balanced designs providing a range of gain levels and output powers over the 2 to 18GHz frequency range. Devices provide for direct integration with other MiCM components as well as existing microstrip circuitry. The package styles are compatible with the MiCM 20 standard, DEF STAN 59-90 (Part 1) Microwave Common Modules, Part 1: Interfaces and fixings for use up to 20GHz and Draft Basic Specification CECC 00 017 Microwave Common Modules, General Requirements and Interfaces and fixings for use up to 20GHz.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Output Power at 1dB Gain Compression (dBm) Min.	Gain (dB) Min.	Gain Flatness (dB) Max.	Gain Variation (dB/°C)	Noise Figure (dB) Max.	Input and Output VSWR Max.	DC Current @+8V (mA)	Package Style	Part Number
2.0 - 8.0	+5	18	±1.50	0.024	4.5	1.8	80	3	MLA 2940-101
		20	±1.50	0.024	6.0	1.8	100	3	MLA 2940-102
	+12	17	±1.50	0.024	7.0	1.8	150	3	MLA 2940-201
	+18	16	±2.00	0.024	8.0	1.8	200	3	MLA 2940-301
6.0 - 12.0	+5	6	±0.50	0.012	4.0	2.0	45	1	MLA 2950-101
		7	±0.50	0.012	5.0	2.0	50	1	MLA 2950-102
		12	±1.00	0.024	5.0	2.0	80	2	MLA 2950-103
		13	±1.00	0.024	6.0	2.0	100	2	MLA 2950-104
	+12	5	±1.00	0.012	6.0	2.0	70	1	MLA 2950-201
		10	±1.50	0.024	7.0	2.0	130	2	MLA 2950-202
	+18	4	±1.50	0.012	8.0	2.0	100	1	MLA 2950-301
		9	±2.00	0.024	9.0	2.0	180	2	MLA 2950-302
12.0 - 18.0	+5	5	±0.50	0.012	5.0	2.0	45	1	MLA 2960-101
		6	±0.50	0.012	6.0	2.0	50	1	MLA 2960-102
		10	±1.00	0.024	5.5	2.0	80	2	MLA 2960-103
	+12	12	±1.00	0.024	6.5	2.0	100	2	MLA 2960-104
		5	±1.00	0.012	7.0	2.0	70	1	MLA 2960-201
	+18	10	±1.50	0.024	8.0	2.0	130	2	MLA 2960-202
		3.5	±1.00	0.012	9.0	2.0	100	1	MLA 2960-301
		8	±1.50	0.024	10.0	2.0	180	2	MLA 2960-302
6.0 - 18.0	+5	5	±0.50	0.012	5.0	2.0	45	1	MLA 2970-101
		6	±0.50	0.012	6.0	2.0	50	1	MLA 2970-102
		10	±1.00	0.024	5.5	2.0	80	2	MLA 2970-103
	+12	12	±1.00	0.024	6.5	2.0	100	2	MLA 2970-104
		5	±1.00	0.012	7.0	2.0	70	1	MLA 2970-201
	+18	10	±1.50	0.024	8.0	2.0	130	2	MLA 2970-202
		3.5	±1.50	0.012	9.0	2.0	100	1	MLA 2970-301
		8	±2.00	0.024	10.0	2.0	180	2	MLA 2970-302

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**NOTES**

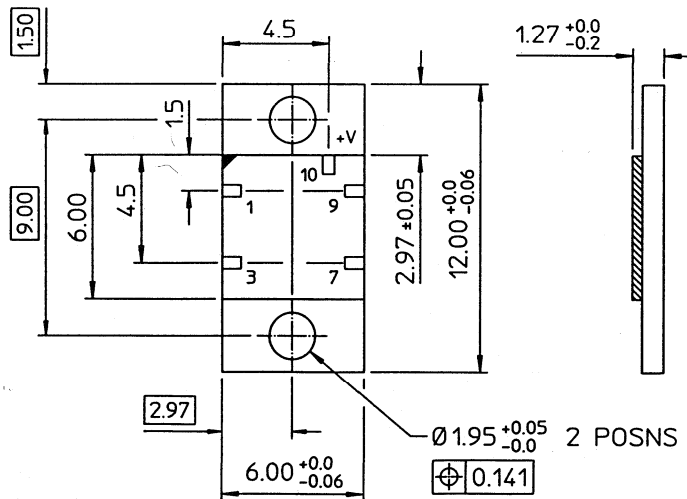
1. Maximum input power without damage +20dBm (CW).
2. Third order intercept point is typically 10dB above P1dB.
3. All amplifiers are unconditionally stable for any input or output VSWR any phase.
4. Alternative +5V power supply available on selected amplifiers, please consult the factory.
5. Case operating temperature -55°C to +95°C  
Storage temperature -55°C to +125°C  
Maximum solder/epoxy attachment temperature +150°C.
6. Flanges have clearance holes for M1.6 screws (maximum head diameter 2.7mm).
7. Bonding pads are typically 0.5mm x 0.5mm.
8. Modules are available with left handed or right handed inputs and outputs as below:-

Package Style	LEFT HANDED		RIGHT HANDED	
	Input Port	Output Port	Input Port	Output Port
1	1	7	3	9
2	1	13	3	11
3	2	20	6	16

To specify left handed modules add L as a suffix to the part number and for right handed modules add R when ordering.

**OUTLINE DRAWINGS**

**PACKAGE STYLE 1**



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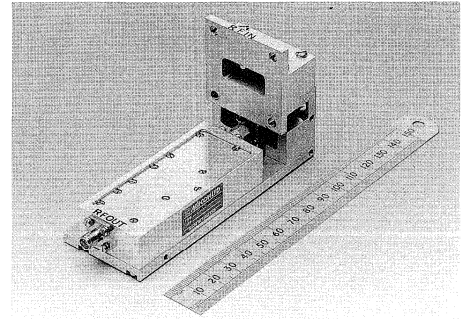


**SWITCHED LOW NOISE AMPLIFIER**

**8 to 12 GHz**

**FEATURES**

- ◆ 10ns Output Switching
- ◆ Isolated Input
- ◆ Overload Protection



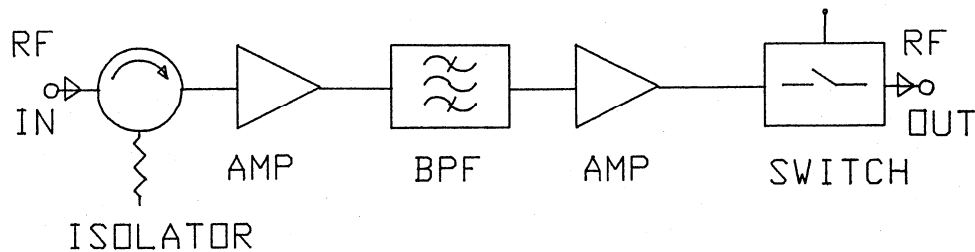
**DESCRIPTION**

Intended for Radar and Telecoms applications MLA-30000 amplifier assemblies incorporate reverse polarity and overload protection and meet full military airborne specifications.

**SPECIFICATION**

Frequency Range	: 8 to 12 GHz	Third Order Intercept	: +33dBm min.
Bandwidth	: 5%	Modulation Depth	: 60dB min.
Gain	: 25dB min.	Switching Speed	: 10ns max.
Flatness	: ±2dB	Input/Output VSWR	: 1.5:1 max.
R.F. Input Power	: +20dBm peak 50us/10%	Noise Figure	: 3dB max.
1dB Compression	: +23dBm min.	Power Supply	: 5V ±3% 10W max.

Alternative frequencies, input filtering, limiter protection and coaxial input are available as options.

**BLOCK DIAGRAM****MECHANICAL**

<b>R.F. Input</b>	:	<b>Waveguide 16 (R100)</b>
<b>R.F. Output</b>	:	<b>SMA Female</b>
<b>D.C. &amp; Switch Command</b>	:	<b>Solder Pins</b>
<b>Dimensions</b>	:	<b>120.0 x 45.0 x 65.0mm (excluding connectors)</b>
<b>Weight</b>	:	<b>300g</b>

**ENVIRONMENTAL**

<b>Operating Temperature</b>	:	<b>-54°C to +85°C</b>
<b>Storage Temperature</b>	:	<b>-54°C to +100°C</b>

**Designed to meet the environmental test requirements of MIL-STD-810C or similar standards related to military and airborne applications.**

**All specifications are subject to change without notice**

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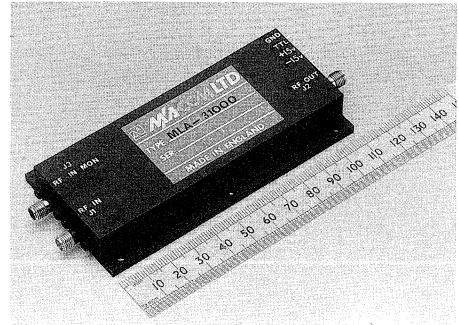
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671



**TWT DRIVER AMPLIFIERS**
**2 TO 18 GHz**
**FEATURES**

- ◆ Pulse Mode Operation
- ◆ Low Output Power Variation
- ◆ Temperature Compensated
- ◆ Low Size/Weight
- ◆ D.C. Reverse Polarity Protection


**DESCRIPTION**

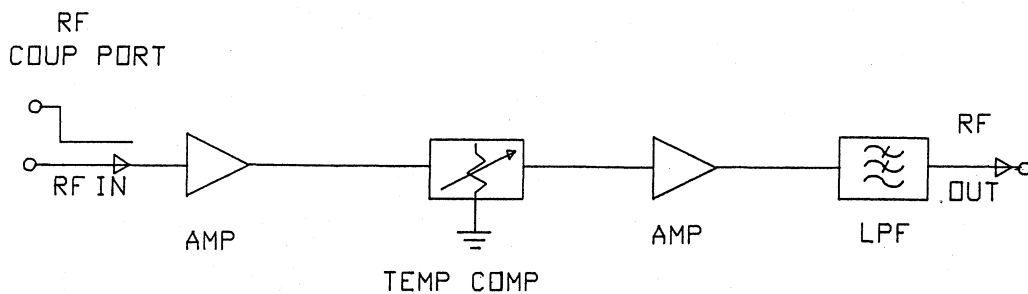
Designed and manufactured in the U.K., the MLA-31000 range of S.S.P.A.s feature a tightly controlled output power window switchable for driving TWTs in Radar and Telecommunications applications.

**SPECIFICATION**

R.F. Frequency	: 8 to 12 GHz	R.F. Coupled Output	: -14dBm nom.
R.F. Bandwidth	: 500 MHz	Input VSWR	: 1.5:1 max.
R.F. Output Power	: +33dBm ±1dB	Output VSWR	: 1.5:1 max.
Noise Figure	: 10dB max.	D.C. Input	: +15V ±5% -15V ±5%
Harmonics/Spurious	: -15dBc max.	Average D.C. Power	: 15 W
R.F. Input Power	: -4 to +2dBm		

Alternative frequency ranges and extended BITE facilities are available as options.

## BLOCK DIAGRAM



## MECHANICAL CHARACTERISTICS

<b>R.F. Input &amp; R.F. Output</b>	:	<b>SMA Female</b>
<b>R.F. Coupled Port</b>	:	<b>SMA Female</b>
<b>D.C. &amp; TTL Compatible</b>	:	<b>Solder Pins</b>
<b>Weight</b>	:	<b>300 g</b>
<b>Dimensions</b>	:	<b>110 x 55 x 15mm</b> <b>(Excluding Connectors)</b>

## ENVIRONMENTAL CONDITIONS

<b>Operating Temperature</b>	:	<b>-54°C to +70°C</b>
<b>Storage Temperature</b>	:	<b>-54°C to +100°C</b>

**Designed to meet the environmental test requirements of MIL-STD-810C or similar standards related to military and airborne applications.**

All specifications are subject to change without notice

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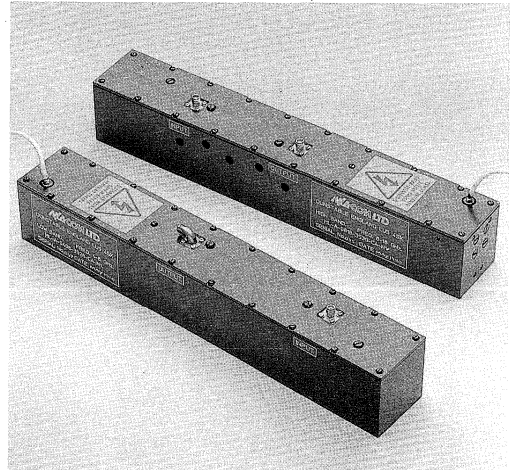
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**BROADBAND GaAs FET POWER AMPLIFIERS  
FOR TWTA REPLACEMENT  
4.0 TO 18.0GHz**

**FEATURES**

- ◆ **Direct TWTA Replacement**
- ◆ **Integral Power Supply**
- ◆ **Solid State Design**
- ◆ **High Reliability**
- ◆ **Qualified for Airborne Use**



**DESCRIPTION**

This series of amplifiers has been developed by M/A-COM Ltd to be form fit and function replacements for travelling wave tube (TWT) amplifiers. These replacement amplifiers are of an all solid state design, combining GaAs FET amplifier and 115V, 400Hz single phase power supply in one integrated assembly. They are designed for radar, communications and EW applications and offer a lower cost, higher reliability alternative to TWT amplifiers.

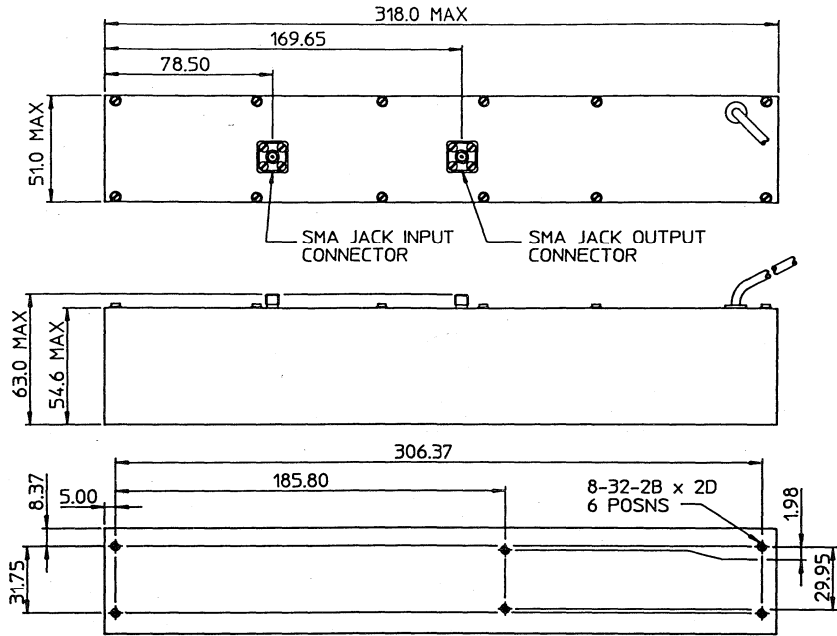
Specifications are given below for two devices in the range. Amplifiers are available to operate over a wide variety of frequency ranges, gain levels, output powers and power supply voltages, please contact the factory for details.

**SPECIFICATIONS @ +25°C**

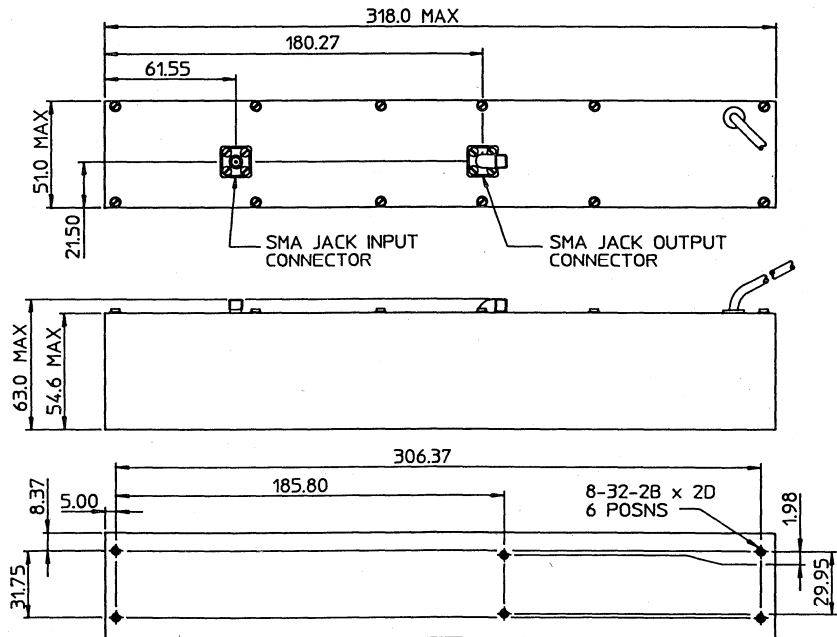
PART NUMBER	MLA 2440-603	MLA 2470-703
Frequency Range	4.0 - 8.0 GHz	8.0 - 18.0 GHz
Small Signal Gain	30dB (min)	30dB (min)
Output Power	25 - 30dBm	27 - 33dBm
Noise Figure	4.0dB (max)	7.0dB (max)
VSWR	2.5:1 (max)	2.5:1 (max)
Power Supply	115V, 400Hz a.c.	115V, 400Hz a.c.
Power Consumption	40W (max)	50W (max)
Operating Temperature	-40°C to +85°C	-40°C to 85°C
Mass	2Kg (max)	2Kg (max)
MTBF (AUF @ +50°C)	18500 Hours	11600 Hours

OUTLINE DRAWINGS

MLA 2470-703



MLA 2440-603



Drawing Notes  
Third Angle Projection  
All dimensions in mm

Tolerances  
x.x = ±0.5mm  
x.xx = ±0.2mm

Standard Finish Matt Black Paint to DTD 5555A

All specifications are subject to change without notice

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# RECEIVER PROTECTORS

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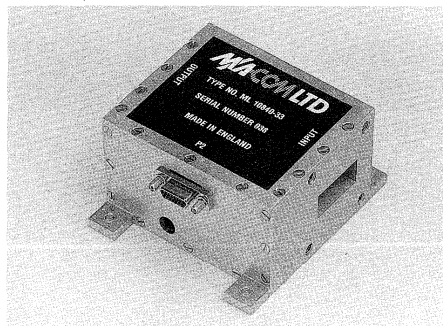
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**HIGH POWER SOLID STATE  
RECEIVER PROTECTOR  
8.5 TO 10.5GHz**

**FEATURES**

- ◆ High Mean and Peak Power
- ◆ Broadband Interference Protection
- ◆ Built In Test Facility
- ◆ High Isolation
- ◆ Pressure Sealed


**DESCRIPTION**

The ML 10840-33 is a high reliability solid state receiver protector, designed for high peak and mean power radar applications. During the transmission period, active drive circuitry switches the device into a high isolation state and monitors the units condition through B.I.T. circuitry. Passive override gives protection against high peak levels of in band interference power, this peak power capability reduces at out of band frequencies, complimenting the roll off of the radar system antenna filters.

**SPECIFICATION**

Frequency Range	: 8.5 to 10.5 GHz	Maximum Mean Power (Interference)	: 16W
Bandwidth	: 5%	Maximum Duty Cycle (Interference)	: 100%
Peak Input Power Normal Operation	: 2kW	Total Leakage Power	: 13dBm
Mean Input Power Normal Operation	: 200W	Recovery Time	: 0.8µs
Maximum Pulse Duration Normal Operation	: 36µs	Insertion Loss	: 1dB
Switched Isolation	: 65dB	VSWR	: 1.4:1
Maximum Peak Power (Interference)	: 16kW	B.I.T. Response Time	: 200ns
		Power Supplies	: +5V -18V

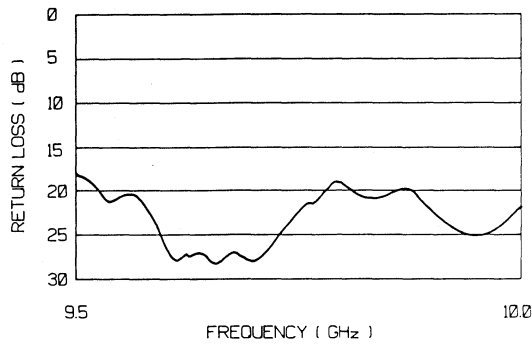
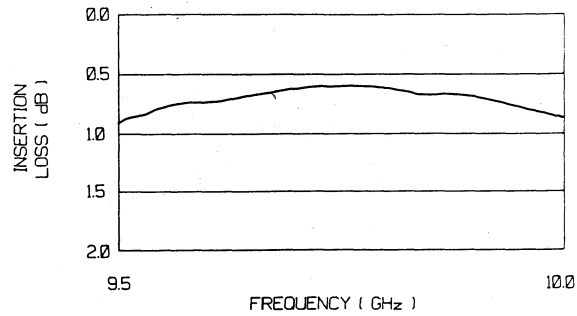
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Europe: (44) 1344 869595

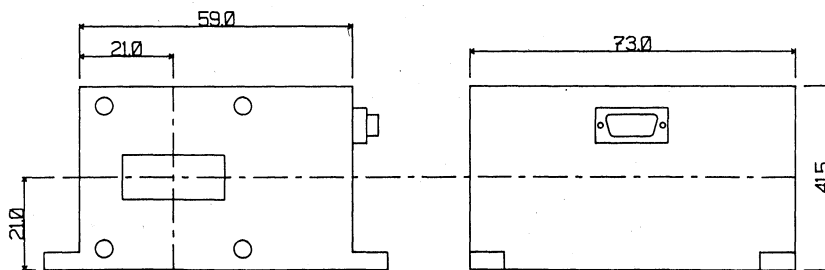
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## TYPICAL PERFORMANCE



## OUTLINE DRAWING



**R.F. Input/Output** : WG 16 (WR 90) Standard Flange with 4 x M4 tapped holes  
**D.C. Supplies & Logic** : 15 Way Micro-D Connector

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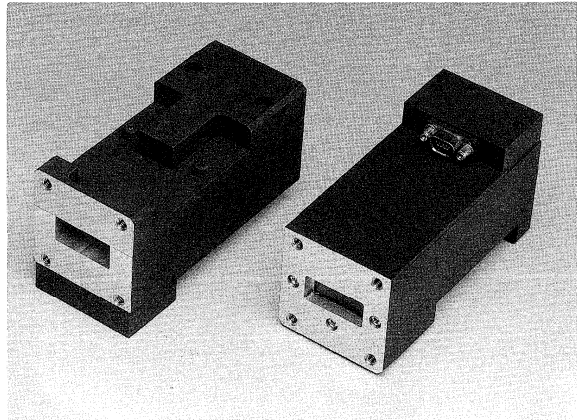
Asia Pacific: (81) 3 3226 1671



**HIGH POWER SOLID STATE  
RECEIVER PROTECTOR  
8.5 - 10.5GHz**

**FEATURES**

- ◆ High Peak and Mean Power
- ◆ Fast Switching
- ◆ Long Pulse Duration
- ◆ Passive Protection
- ◆ Integral B.I.T.
- ◆ Matched Sets


**DESCRIPTION**

The ML 10840-41 Receiver Protector is designed to operate in airborne radar systems. Active protection from the transmitter power is provided when the device is switched to a high isolation state on logic input command. In this mode a BIT output indicates correct operation of the PIN diodes. Passive protection from external interfering signals is provided both with the power supplies connected (power up) and disconnected (power down).

**SPECIFICATION**

Frequency Range	: 8.5 to 10.5 GHz	Peak Power (power down interference conditions)	: 300W
Bandwidth	: 5%	Pulse Duration	: 25µs
Peak Input Power Normal Operation	: 5kW	Duty	: 4%
Mean Input Power	: 200W	Recovery to 1dB (power up)	: 200ns
Pulse Duration	: 25µs	Flat Leakage	: 20mW
Peak Power (fault operation)	: 55kW	Spike Leakage	: 500mW
Switched Isolation	: 63dB	Insertion Loss	: 0.8dB
Recovery Time to 1dB	: 200ns	V.S.W.R.	: 1.3:1
B.I.T. Switching Time	: 200ns	Phase Tracking	: ±5°
Peak Power (power up interference conditions)	: 5kW	Power Supplies	: +5V -15V

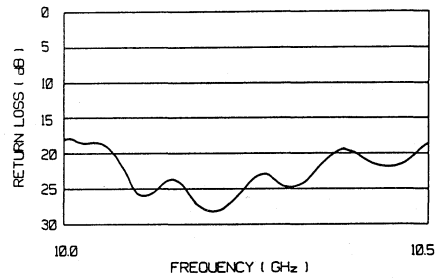
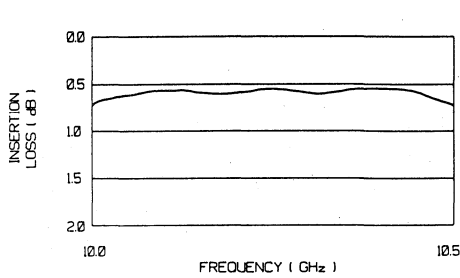
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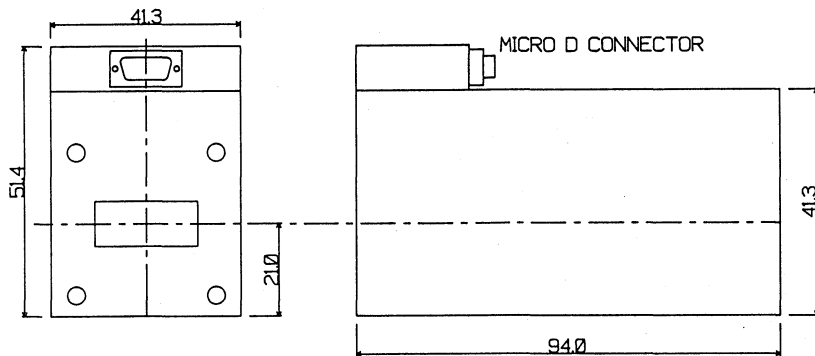
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### TYPICAL PERFORMANCE



### OUTLINE DRAWING

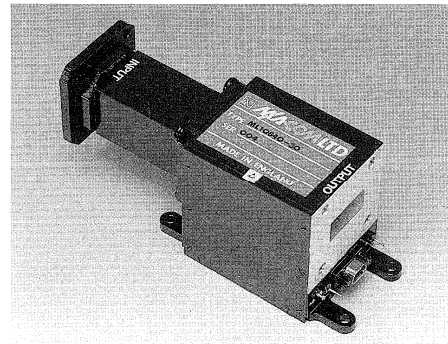


**R.F. Input/Output : WR 16 Standard Plain Flange, M4 tapped holes**  
**Logic/D.C. Supplies : 9 Pin Micro D Connector**

Specifications are typical and subject to change without notice

**SOLID STATE RECEIVER PROTECTOR**
**FILTER ASSEMBLY**
**9.0 TO 9.5 GHz**
**FEATURES**

- ◆ **High Peak Power**
- ◆ **Broadband Protection**
- ◆ **Low Loss**
- ◆ **Integral BITE**
- ◆ **Active and Passive Protection**


**DESCRIPTION**

Designed for the 9.0 - 9.5 GHz radar band ML 10840-30 receiver protectors incorporate a unique quasi-bandpass filter design providing more than 30dB protection against interfering signals from 7 to 18 GHz and 10mW leakage from both 9.0 to 9.5 GHz and 11.5 to 12.5 GHz. BITE output is provided by a PIN diode current monitor.

**SPECIFICATION**

ACTIVE PERFORMANCE		PASSIVE PERFORMANCE	
Frequency Range	: 9.0 to 9.5 GHz 11.5 to 12.5 GHz	Frequency Range	: 7.0 to 18 GHz
Peak Power	: 10kW, 2.0us pulse 0.2% duty	Peak Power	: 100W, 5.0us 1% duty
Flat Leakage	: 10mW	C.W. Power	: 10W
Switching Speed (to High Loss)	: 150ns 50% TTL to 1% RF	Flat Leakage	: 100mW
(to Low Loss)	: 500ns 50% TTL to 1dB of insertion loss	Spike Leakage	: 10nJ
Insertion Loss	: 1.0dB	Recovery Time	: 1.0us to 1dB of insertion loss
Return Loss	: 16.0dB	BITE Response Time	: 150us
		Power Supply	: +5V D.C. -15V D.C.

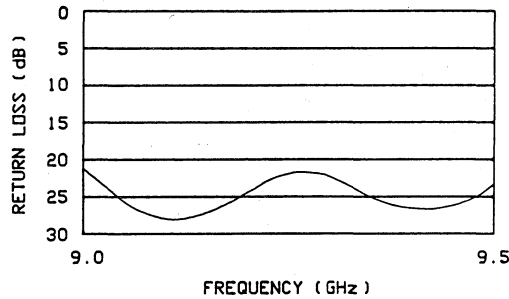
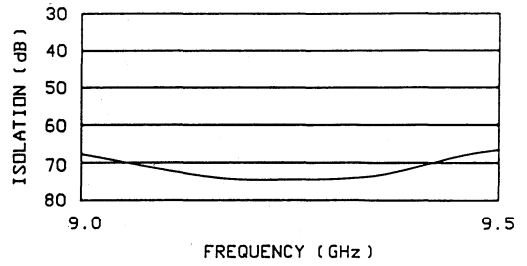
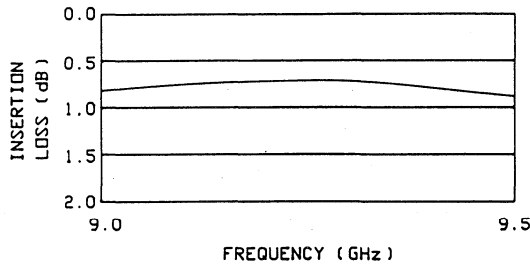
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Europe: (44) 1344 869595

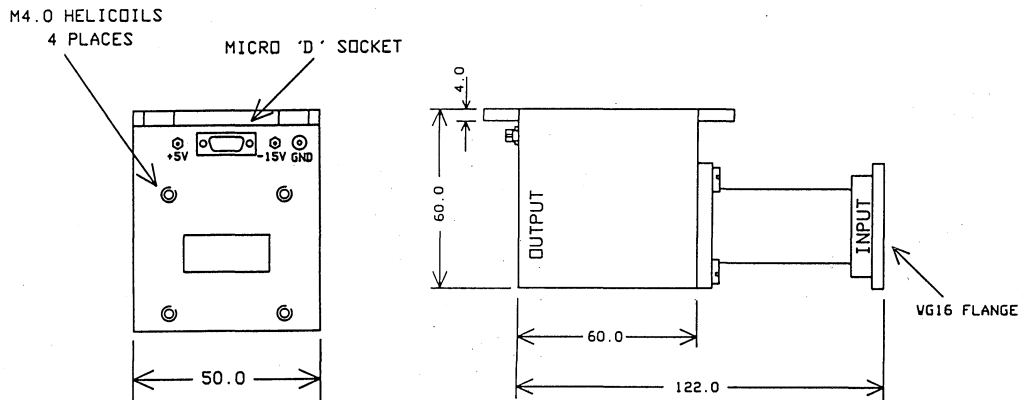
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**TYPICAL PERFORMANCE**



**OUTLINE DRAWING**



**MECHANICAL CHARACTERISTICS**

<b>R.F. Connectors</b>	:	<b>WG 16 Standard Flange</b>
<b>Control Connectors</b>	:	<b>Micro D Connector</b>
<b>D.C. Connectors</b>	:	<b>Solder PIN</b>

All specifications are typical and subject to change without notice

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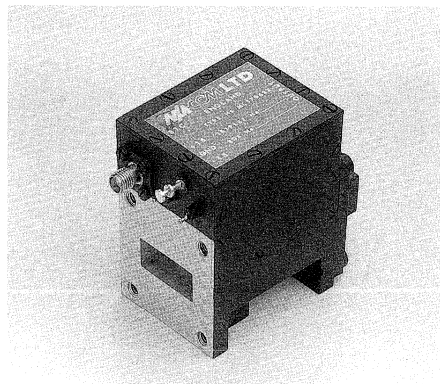
North America: 800 366 2266

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**PASSIVE RECEIVER PROTECTOR  
WITH S.T.C. ATTENUATION  
8.5 TO 10.5GHz**

**FEATURES**

- ◆ **Passive Protection**
- ◆ **Fault Protection**
- ◆ **Linearised S.T.C.**
- ◆ **Temperature Compensated Attenuation**
- ◆ **Matched Sets**



**DESCRIPTION**

Designed for use in mono-pulse airborne radar systems, the ML 17062X is a passive receiver protector capable of handling high levels of peak and mean power. Low leakage levels are ensured through the careful selection of PIN diodes manufactured in house by M/A-COM Ltd.

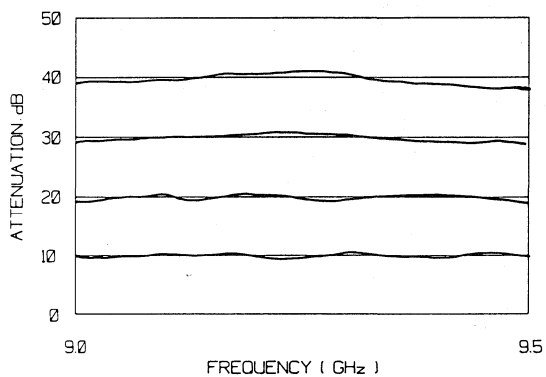
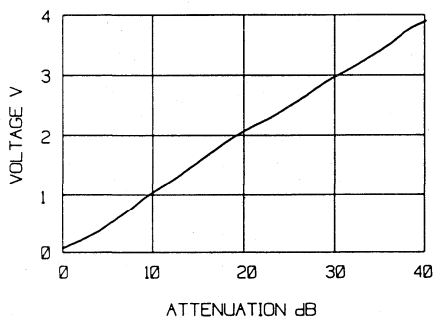
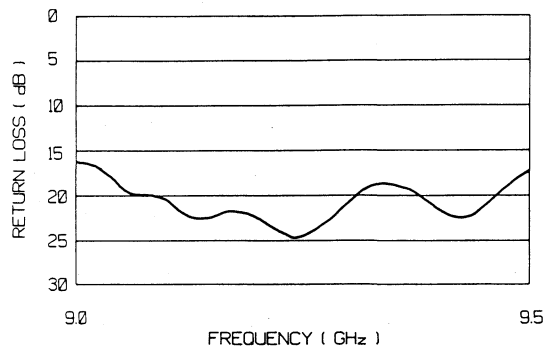
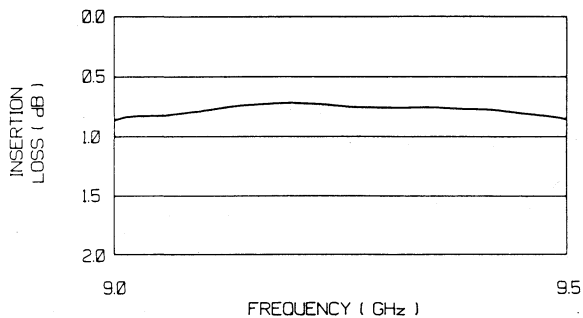
Using sophisticated techniques the passive limiter also provides 40dB of temperature compensated linearised sensitivity time control (STC).

Devices can be supplied as phase and amplitude matched sets through all levels of STC attenuation.

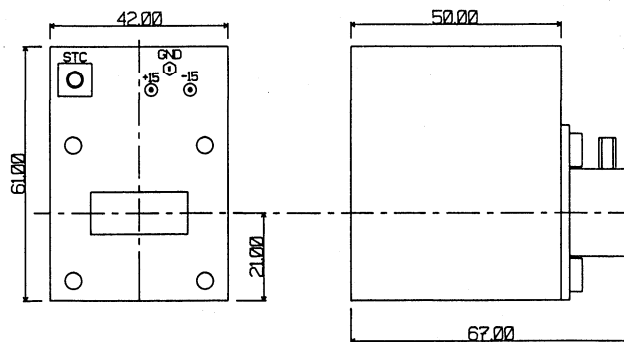
**SPECIFICATION**

Frequency Range	: 8.5 to 10.5 GHz	VSWR	: 1.4:1
Bandwidth	: 5%	S.T.C. Range	: 40dB
Peak Power (Normal)	: 1kW	S.T.C. Voltage	: 0 to 4V
Peak Power (Fault)	: 5kW	S.T.C. Accuracy to Set Point	: ±1dB or 10% whichever is higher
Pulse Duration	: 25µs	Phase Matching	: ±5°
Duty Cycle	: 2%	Amplitude Matching	: ±2.0dB
Spike Leakage	: 300mW	Voltage Supplies	: ±15V
Flat Leakage	: 50mW		
Insertion Loss	: 1.0dB		

### TYPICAL PERFORMANCE



### OUTLINE DRAWING



- R.F. Input** : **WG 16 (WR 90) Standard Flange**
- R.F. Output** : **SMA Female**
- S.T.C. Input** : **SMA Female**
- D.C. Supplies** : **Solder Pins**

Specifications are typical and subject to change without notice

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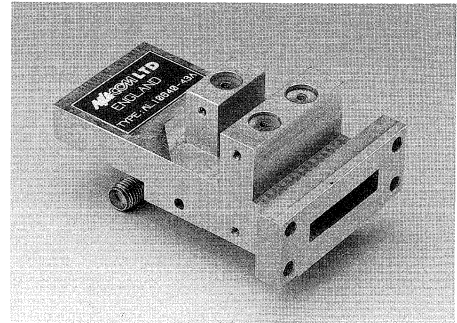
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SOLID STATE  
RECEIVER PROTECTOR  
8.5 - 11.0GHz**

**FEATURES**

- ◆ **Broadband Interference Protection**
- ◆ **High Peak Power Protection**
- ◆ **Passive Operation**
- ◆ **Rugged Construction**
- ◆ **Low Loss**



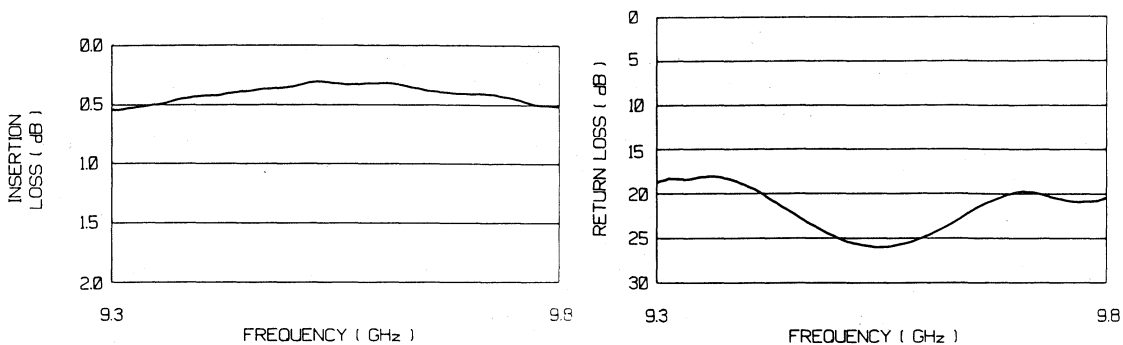
**DESCRIPTION**

The ML 10840-34 is designed as first stage protection for radar receivers from high peak power interference over a wide bandwidth while offering low loss in the radar receiver band. The device is pressure sealed and is designed to operate under the high levels of shock and vibration found in airborne environments.

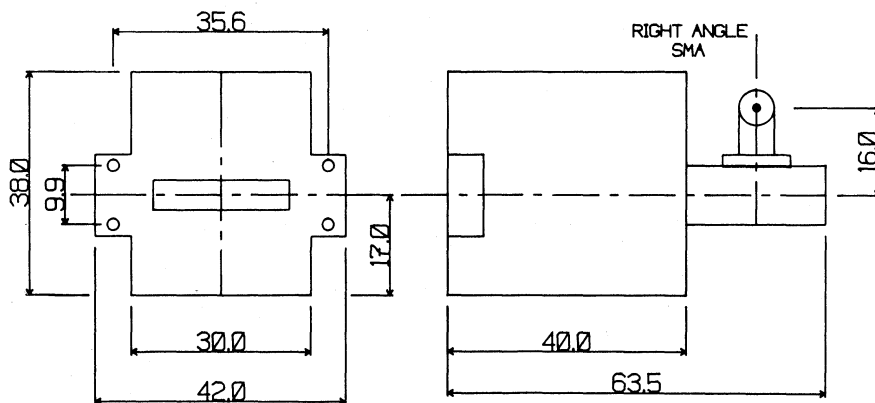
**SPECIFICATION**

Protection Frequency Range	: 8.5 to 11 GHz	Total Leakage Power	: 10W
Low Loss Bandwidth	: 5%	Spike Leakage Power	: 10W
Maximum Pulse Duration	: 100µs	Insertion Loss	: 0.7dB
Maximum Duty	: 100%	Return Loss	: 15dB
Maximum Peak Power	: 8kW	Recovery Time to 0.5dB	: 1µs
Maximum Mean Power	: 8W		

## TYPICAL PERFORMANCE



## OUTLINE DRAWING



Specifications are typical and subject to change without notice

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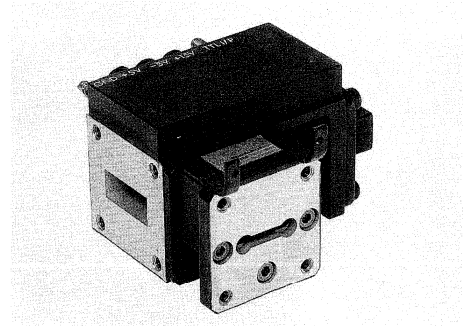
Asia Pacific: (81) 3 3226 1671



**ACTIVE NON-REFLECTIVE RECEIVER PROTECTOR  
8 - 12 GHz**

**FEATURES**

- ◆ **High Mean Power**
- ◆ **Fast Switching**
- ◆ **Low Leakage**
- ◆ **Low Loss**
- ◆ **Solid State Reliability**



**DESCRIPTION**

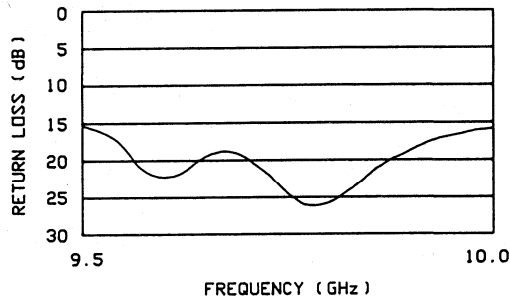
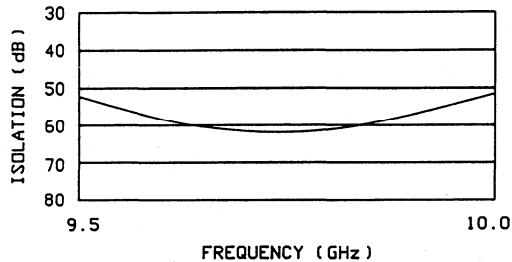
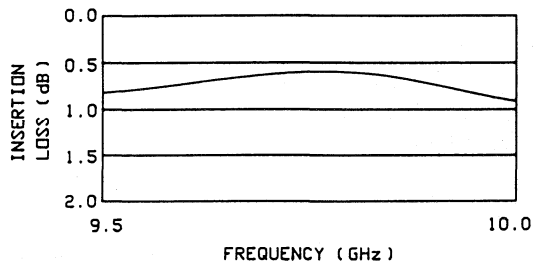
ML 10840-32 Series receiver protectors are designed for use on FM CW radars where high mean power handling with low leakage and zero spikes are critical. These units employ in-house produced plated heat-sink P.I.N. diodes to provide good thermal performance with fast switching. During radar transmission a pre-pulse switches transmit power into a dummy load on the third port, any load reflected power being attenuated by an internal passive limiter. A post-pulse returns the unit to the low loss receive state, both operations taking less than 150ns.

**SPECIFICATION**

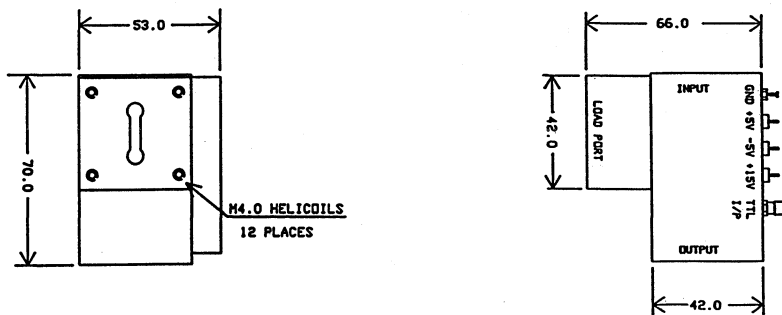
Frequency Range	: 8 to 12 GHz	Power Handling	: 200W C.W. >500W pulse
Bandwidth	: 5%	Spike Leakage	: Zero
Insertion Loss	: 1.0dB	Flat Leakage	: -50dB w.r.t. input power
Return Loss	: 14dB low loss state 10dB high loss state	Power Supply	: +15V +5V -5V
Switching Speed	: 150ns 50% TTL to 20dB Isolation 50% TTL to 1dB insertion loss	Operating Temperature Range	: -45°C to +85°C

Coaxial receiver output, increased bandwidth and reflective versions are available as options.

### TYPICAL PERFORMANCE



### OUTLINE DRAWING



### MECHANICAL CHARACTERISTICS

R.F. Connectors	:	WG 16 Standard Plain Flange
D.C. Connectors	:	Solder Pin
Control Connector	:	SMA

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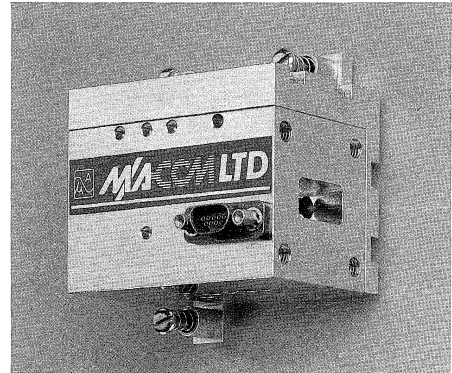
Asia Pacific: (81) 3 3226 1671

## SWITCHED RECEIVER PROTECTOR

**12.4 TO 18.0 GHz**

### FEATURES

- ◆ High Peak Power
- ◆ Active and Passive Protection
- ◆ Low Loss
- ◆ Integral BITE
- ◆ Solid State Reliability



### DESCRIPTION

ML 10850-24 receiver protectors consist of an active switched section followed by a passive limiter. In switched mode the unit provides 55dB transmit pulse attenuation but also provides full power passive protection under system fault conditions. Diode condition monitors provide BITE output.

### SPECIFICATION

Frequency Range	: 12.4 to 18 GHz	Flat Leakage (Active)	: 55dB isolation
Bandwidth	: 5%	Flat Leakage (Passive)	: 100mW
Peak Power	: 1KW, 5us, pulse	Spike Leakage (Passive)	: 10nJ
Switching Speed (to High Loss)	: 100ns 50% TTL to 20dB isolation	Insertion Loss	: 0.8dB
Switching Speed (to Low Loss)	: 500ns 50% TTL to 1dB of insertion loss	Return Loss (Low Loss State)	: 18dB
Recovery Time	: 1us to 1dB of (Passive) insertion loss	BITE Response Time	: 150ns
		Power Supply	: +5V D.C. -15V D.C.

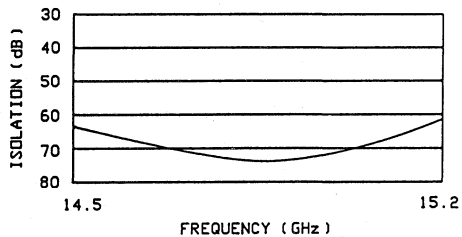
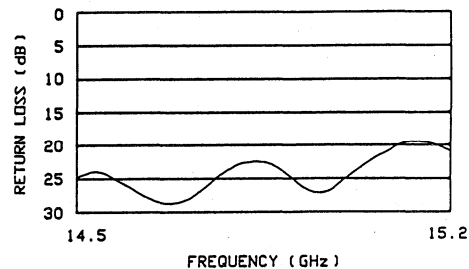
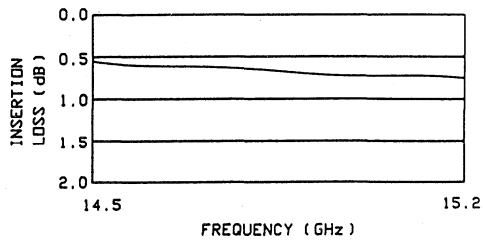
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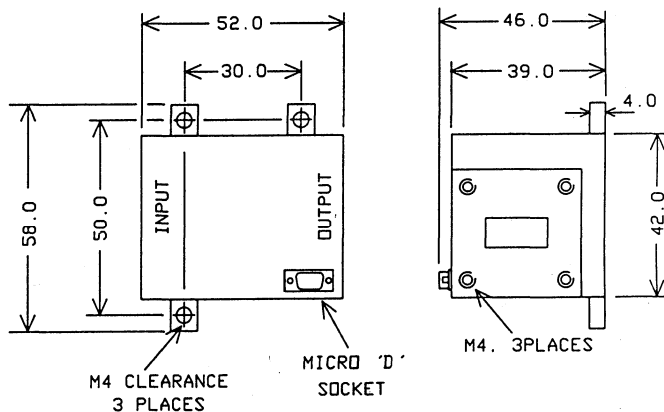
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

### TYPICAL PERFORMANCE



### OUTLINE DRAWING



### MECHANICAL CHARACTERISTICS

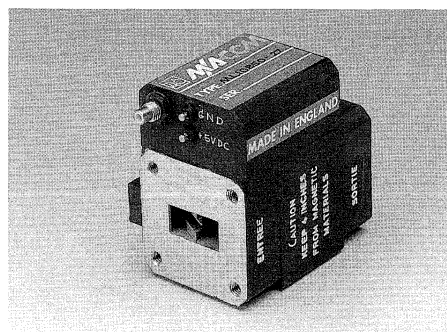
- R.F. Connectors : WG 18 Standard Plain Flange
- Logic/D.C. Connectors : Micro D

All specifications are typical and subject to change without notice

**NON REFLECTIVE RECEIVER PROTECTOR  
WITH ATTENUATOR  
12.4 TO 18.0 GHz**

**FEATURES**

- ◆ Isolated Input/Output
- ◆ Switched Attenuator
- ◆ Phase Matched
- ◆ Low Loss



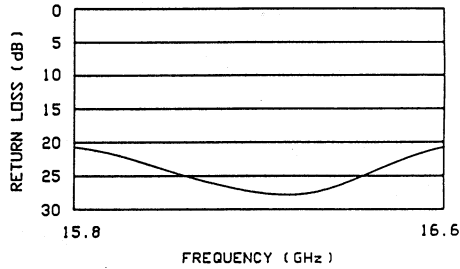
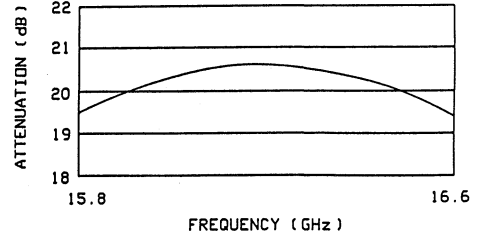
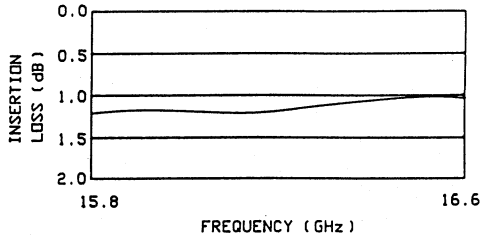
**DESCRIPTION**

The ML 10850-27 is a solid state passive receiver protector with an integral switched attenuator function. This is controlled from a TTL command signal switching 20dB attenuation within 100ns. Input and output slimline isolators ensure a good RF match under all conditions.

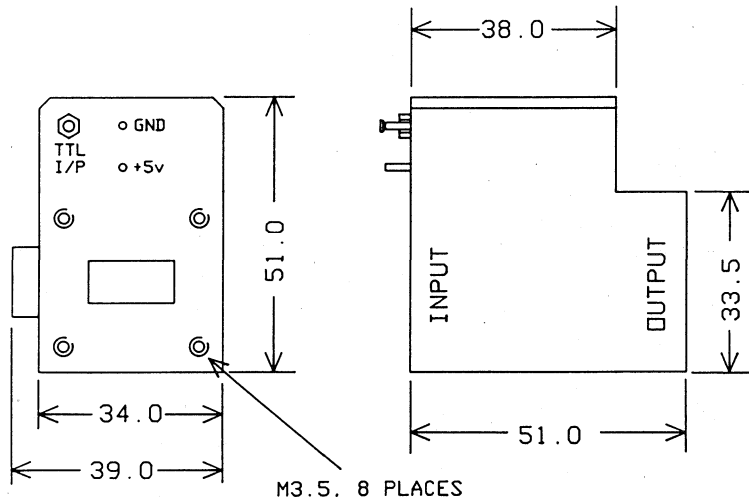
**SPECIFICATION**

Frequency Range	: 12.4 to 18.0 GHz	Attenuation Switching Speed	
Bandwidth	: 5%	50% TTL to	
Peak Power (Atten On)	: 1KW	90% R.F. Power	: 100ns
5 KHz p.r.f., 3nJ energy		50% TTL to	
Peak Power (Atten Off)	: 2W	10% R.F. Power	: 100ns
5 KHz p.r.f., 1.0µS pulse		Phase Tracking	: ±5°
Spike Leakage	: 10 nJ	Insertion Phase Offset	: ±10°
Flat Leakage	: 50mW	Return Loss (Input and Output)	: 18dB
Insertion Loss (Atten Off)	: 1.5 dB	Reverse Isolation	: 35dB
Switched Attenuation	: 20dB	Power Supply	: +5V D.C.

**TYPICAL PERFORMANCE**



**OUTLINE DRAWING**



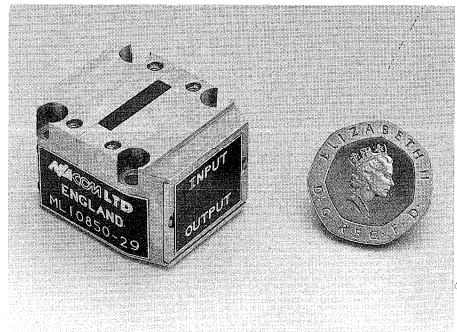
- R.F. Connectors** : **WG 18 Standard Plain Flange**
- D.C. Connectors** : **Solder Pin**
- Control Connector** : **Solder Pin**

All specifications are typical and subject to change without notice

**FAST RECOVERY SOLID STATE  
RECEIVER PROTECTOR  
13 TO 15GHz**

**FEATURES**

- ◆ **Fast Recovery Time**
- ◆ **Passive Protection**
- ◆ **Compact Outline**
- ◆ **High Mean Power**
- ◆ **Matched Sets**

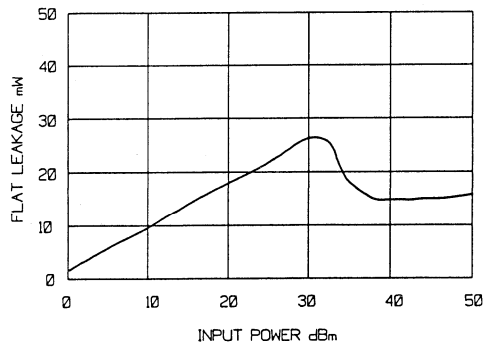
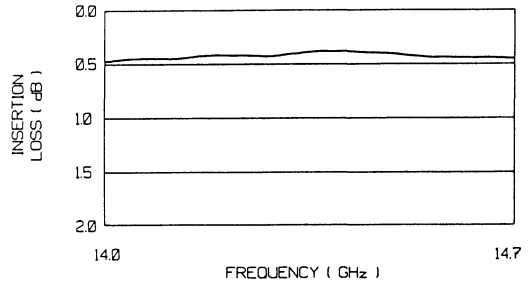
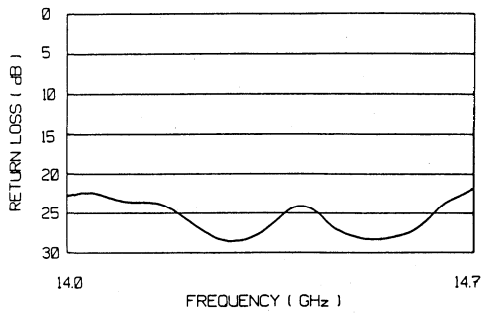

**DESCRIPTION**

The ML 10850-29 is a lightweight reduced height waveguide, all solid-state passive receiver protector designed to meet stringent missile environmental specifications. It combines a high mean power handling capability with very fast recovery time and can be supplied in phase and amplitude matched sets. Both peak and mean power handling are enhanced by the use of M/A-COM's unique Plated Heat Sink NIP diodes.

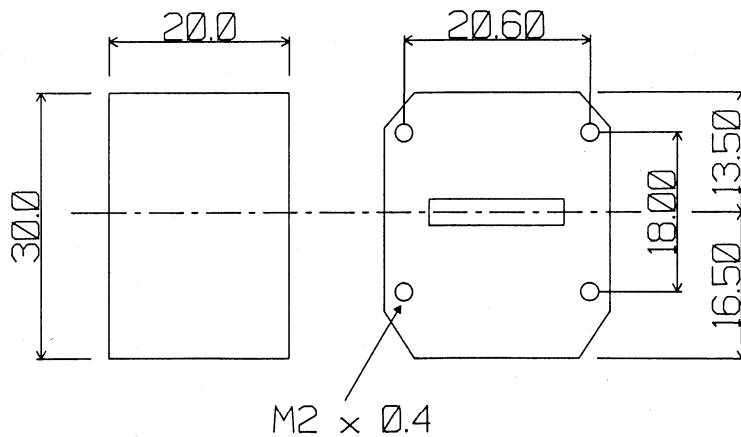
**SPECIFICATION**

Frequency Range	: 13 to 15GHz	Recovery Time	: 50ns
Bandwidth	: 5%	Insertion Loss	: 0.5dB max. @ 25°C 1.0dB max. @ 125°C
Peak Power Handling	: 100W, 1.0μs	VSWR	: 1.4:1
Mean Power Handling	: 25W	Phase Tracking	: ±5°
Flat Leakage	: +15dBm maximum	Amplitude Matching	: ±0.2dB
Spike Leakage	: +20dBm maximum		

**TYPICAL PERFORMANCE**



**OUTLINE DRAWING**



Specifications are typical and subject to change without notice

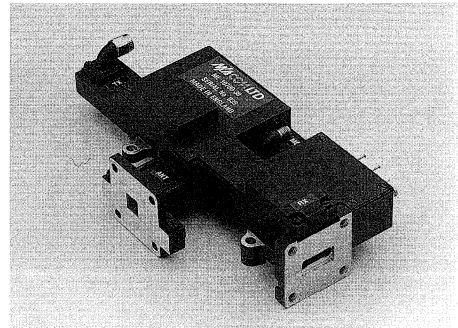


## WAVEGUIDE DUPLEXING INTEGRATED PACKAGE

12.5 TO 17.5GHz

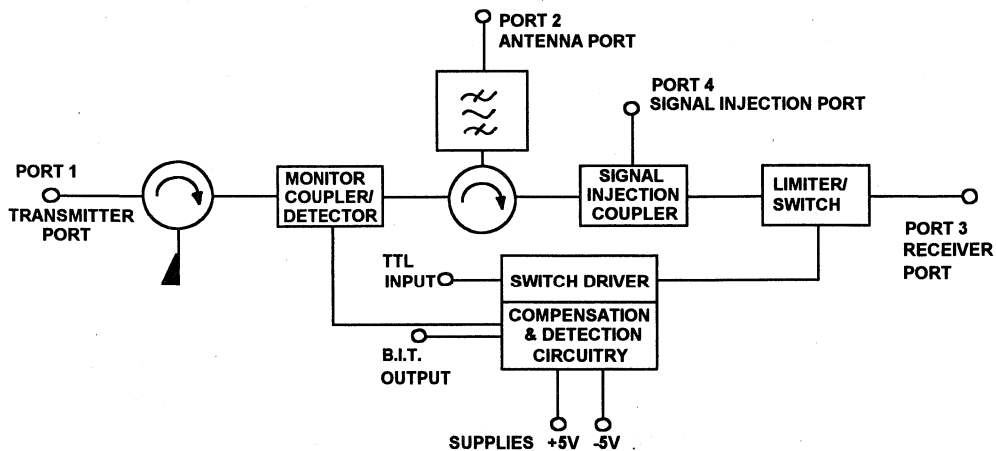
### FEATURES

- ◆ Low Tx and Rx Losses
- ◆ Optimised VSWR
- ◆ Broadband Tx and Rx Protection
- ◆ Lightweight Compact Assembly
- ◆ All Solid State Reliability
- ◆ Fast Switching



### DESCRIPTION

The ML 10700-30 is a lightweight assembly designed to interface between the transmitter, antenna and receiver of a man portable radar system, and incorporates protection to both the transmitter and receiver from specific in and out of band signals. The assembly consists of an isolator, transmitter power monitor, circulator, receiver signal injection port, solid state limiter and band pass filter. Integral circuitry is used to switch the limiter during transmission and to provide a B.I.T. signal indicating correct transmitter function.



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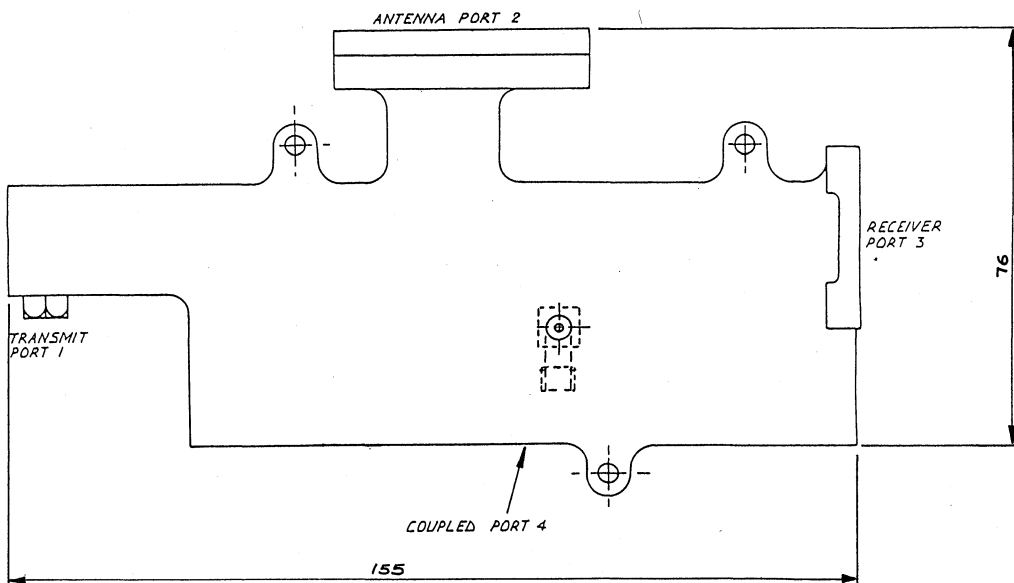
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Asia Pacific: (81) 3 3226 1671

## SPECIFICATION

Frequency	: 14 to 17GHz	Isolation Port 2 to Port 1	: 20dB
Bandwidth	: 3%	Limiter Switching Speed	: 200ns
Transmitter Power	: 5W C.W.	VSWR Port 1	: 1.3:1
Interference Peak Power	: 100W	VSWR Port 2	: 1.4:1
Interference Pulse Duration	: 10 $\mu$ s	VSWR Port 3	: 1.5:1
Flat Leakage Receiver Port	: 17dBm	VSWR Port 4	: 2:1
Spike Leakage Receiver Port	: 27dBm	Filter Rejection	fo - 1.5GHz : >25dB fo +3.5GHz : >15dB
Insertion Loss Port 1 to 2	: 1.25dB	Power Supplies	: $\pm$ 5V
Insertion Loss Port 2 to 3	: 1.45dB	Switch Logic Input	: TTL
Insertion Loss Port 4 to 3	: 25dB	B.I.T. Logic Output	: TTL
Isolation Port 1 to Port 3	: 58dB		

## OUTLINE DRAWING



Port 1 SMA Male  
 Port 2 Waveguide Flange  
 Port 3 Waveguide Flange  
 Port 4 SMA Female

Switch Control Line )  
 Transmitter BIT ) Solder Pins  
 Power Supplies )  
 Ground Terminal )

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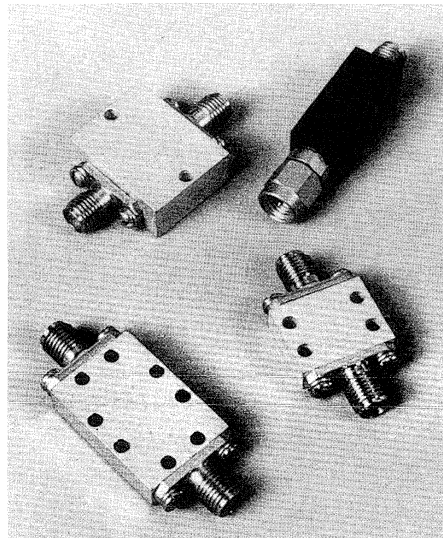
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■ North America: 800 366 2266

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**PIN DIODE LIMITERS****1 MHz TO 40 GHz****FEATURES**

- ◆ **Broad Frequency Ranges**
- ◆ **High Power Handling**
- ◆ **Low Leakage Power**
- ◆ **Low Insertion Loss**
- ◆ **Wide Range of Package Styles**

**DESCRIPTION**

The ML 6700-000 Series of PIN diode limiters from M/A-COM Ltd offers a comprehensive selection of passive protection devices for every application from 1 MHz to 40 GHz. PIN diode limiters are used to passively protect power sensitive components such as amplifiers and mixers from high input powers that would otherwise cause costly failure of these components. The high breakdown voltage and good thermal conductivity of PIN diodes give protection from both high peak and high average powers.

Construction of the limiters is by integration of the chip diode directly into an MIC circuit. Careful control of the diode junction capacitance and bonding geometry ensure optimum high frequency performance over very broad bandwidths.

The range of limiters is split into categories for applications which call for specific requirements such as high peak power handling, low leakage power etc. Each category of limiter is available in a wide range of compact package styles. Where devices are supplied without connectors electrical performance is measured in a standard M/A-COM Ltd test fixture.

When specifying PIN diode limiters for system use there are a number of performance trade offs to consider. In general both peak and average power handling are reduced as frequency increases. For a given input power the leakage power level is directly related to the compression point of the limiter, nominally the 1dB compression point will be 10dB below the flat leakage level. The specifications for each design show in detail the parameters to consider when specifying a PIN diode limiter. As it is possible to offer only a small selection of the available designs in this data sheet please contact the factory directly if the limiter you require is not included here.

## DESCRIPTION

M/A-COM Ltd's standard range of broadband limiters offer multi-octave performance with peak power handling up to 1kW and leakage power down to 100mW. All the devices include internal dc return and dc blocking capacitors at input and output for all package styles. To specify the full part number, including package style and connector configuration please refer to page 210.

## SPECIFICATIONS

Frequency Range (GHz)	Max Peak Power (W)	Max CW Power (W)	Max Leakage Power (mW)	Max Recovery Time (ns)	Max Insertion Loss (dB)	Max VSWR	Available Package Styles	Part Number
0.001 - 0.1	25	5	100	500	0.3	1.3	0,2,4,6	ML 6711-1XY
0.1 - 0.5	50	5	100	500	0.4	1.3	0,2,4,6	ML 6712-1XY
	100	2	100	100	0.5	1.4	1,3,5,7,9	ML 6713-1XY
0.5 - 2.0	500	5	150	250	0.6	1.4	1,3,5,7	ML 6713-2XY
	1000	10	200	1000	0.8	1.4	1,3,5,7	ML 6713-3XY
	100	2	100	100	0.9	1.6	0,2,4,6,8	ML 6714-1XY
2.0 - 6.0	500	5	150	250	1.0	1.6	0,2,4,6	ML 6714-2XY
	1000	10	200	1000	1.2	1.6	1,3,5,7	ML 6714-3XY
	100	2	100	100	1.5	1.8	0,2,4,6,8	ML 6715-1XY
6.0 - 12.0	500	5	150	250	1.6	1.8	0,2,4,6	ML 6715-2XY
	1000	10	200	1000	2.0	1.8	0,2,4,6	ML 6715-3XY
	100	2	100	100	2.1	2.0	0,2,4,6,8	ML 6716-1XY
12.0 - 18.0	500	5	150	250	2.3	2.0	0,2,4,6	ML 6716-2XY
	100	2	100	100	2.1	2.0	0,2,4,6,8	ML 6717-1XY
6.0 - 18.0	500	5	150	250	2.3	2.0	0,2,4,6	ML 6717-2XY
	100	2	100	100	2.3	2.0	0,2,4,6,8	ML 6718-1XY
0.5 - 18.0	500	5	150	250	2.5	2.0	0,2,4,6	ML 6718-2XY
	100	2	100	100	4.0	2.5	0,2	ML 6719-1XY
18.0 - 40.0	300	5	150	250	5.0	2.5	0,2	ML 6719-2XY

## NOTES:

- (1) Peak power rated at 10us pulse length, 1% duty ratio, 0.001 to 6 GHz  
1us pulse length, 1% duty ratio, 6 to 40 GHz
- (2) Spike leakage 20nJ above flat leakage
- (3) Recovery time measured to 3dB of low loss state
- (4) Insertion loss and VSWR measured at -10dBm input power
- (5) 1dB compression point +7dBm min.
- (6) Case operating temperature -55°C to +85°C
- (7) Storage temperature -55°C to +125°C

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**DESCRIPTION**

M/A-COM Ltd's range of low leakage limiters offer ultra low leakage powers for protection of particularly sensitive receiver components. All of the devices include internal dc return and dc blocking capacitors at input and output for all package styles. To specify the full part number, including package style and connector configuration please refer to page 210.

**SPECIFICATIONS**

Frequency Range (GHz)	Max Peak Power (W)	Max CW Power (W)	Max Leakage Power (mW)	Max Recovery Time (ns)	Max Insertion Loss (dB)	Max VSWR	Available Package Styles	Part Number
0.001 - 0.1	25	5	50	500	0.4	1.3	0,2,4,6	ML 6721-1XY
0.1 - 0.5	50	5	50	500	0.5	1.3	0,2,4,6	ML 6722-1XY
0.5 - 2.0	100	2	25	100	0.6	1.4	1,3,5,7,9	ML 6723-1XY
	500	5	50	250	0.7	1.4	1,3,5,7	ML 6723-2XY
2.0 - 6.0	100	2	25	100	1.0	1.6	0,2,4,6,8	ML 6724-1XY
	500	5	50	250	1.1	1.6	0,2,4,6	ML 6724-2XY
6.0 - 12.0	100	2	25	100	1.6	1.8	0,2,4,6,8	ML 6725-1XY
	500	5	50	250	1.7	1.8	0,2,4,6	ML 6725-2XY
12.0 - 18.0	100	2	25	100	2.3	2.0	0,2,4,6,8	ML 6726-1XY
6.0 - 18.0	100	2	25	100	2.3	2.0	0,2,4,6,8	ML 6727-1XY
0.5 - 18.0	100	2	25	100	2.3	2.0	0,2,4,6,8	ML 6728-1XY
18.0 - 40.0	100	2	50	100	4.2	2.5	0,2	ML 6729-1XY

**NOTES:**

- (1) Peak power rated at 1us pulse length, 1% duty ratio,
- (2) Spike leakage 20nJ above flat leakage
- (3) Recovery time measured to 3dB of low loss state
- (4) Insertion loss and VSWR measured at -10dBm input power
- (5) 1dB compression point +3dBm min.
- (6) Case operating temperature -55°C to +85°C
- (7) Storage temperature -55°C to +125°C

## DESCRIPTION

M/A-COM Ltd's range of high peak power limiters offer multi-octave limiting of peak powers up to 4 kW to a leakage level of 100mW. All of the devices include internal dc return and dc blocking capacitors at input and output for all package styles. To specify the full part number including package style and connector configuration please refer to page 210.

## SPECIFICATIONS

Frequency Range (GHz)	Max Peak Power (W)	Max CW Power (W)	Max Leakage Power (mW)	Max Recovery Time (ns)	Max Insertion Loss (dB)	Max VSWR	Available Package Styles	Part Number
0.5 - 2.0	4000	40	100	5000	1.1	1.4	1,3,5	ML 6733-1XY
2.0 - 6.0	4000	40	100	5000	1.4	1.6	1,3,5	ML 6734-1XY
6.0 - 12.0	2000	20	100	2000	2.1	1.8	1,3,5	ML 6735-1XY
12.0 - 18.0	1000	10	100	1000	2.5	2.0	1,3,5	ML 6736-1XY
6.0 - 18.0	1000	10	100	1000	2.5	2.0	1,3,5	ML 6737-1XY
0.5 - 18.0	1000	10	100	1000	2.5	2.0	1,3,5	ML 6738-1XY
18.0 - 40.0	1000	10	100	1000	5.0	2.5	1,3	ML 6739-1XY

### NOTES:

- (1) Peak power rated at 1us pulse length, 1% duty ratio
- (2) Spike leakage 20nJ above flat leakage
- (3) Recovery time measured to 3dB of low loss state
- (4) Insertion loss and VSWR measured at -10dBm input power
- (5) 1dB compression point +7dBm min
- (6) Case operating temperature -55°C to +85°C
- (7) Storage temperature -55°C to +125°C

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**DESCRIPTION**

M/A-COM Ltd's range of high average power limiters offer multi-octave performance with CW or average power handling up to 100W. Pulse conditions of up to 100us pulse length with 10% duty cycle allow these devices to limit high power signals from a wide variety of sources. All the devices include internal dc return and dc blocking capacitors at input and output for all package styles. To specify the full part number, including package style and connector configuration please refer to page 210.

**SPECIFICATIONS**

Frequency Range (GHz)	Max Peak Power (W)	Max CW Power (W)	Max Leakage Power (mW)	Max Pulse Length (us)	Max Duty Ratio (%)	Max Insertion Loss (dB)	Max VSWR	Available Package Styles	Part Number
0.001 - 0.1	-	50	100	-	-	0.8	1.3	1,3,5	ML 6741-1XY
0.1 - 0.5	-	50	100	-	-	1.0	1.3	1,3,5	ML 6742-1XY
0.5 - 2.0	1000	100	100	100	10	1.2	1.4	1,3,5	ML 6743-1XY
2.0 - 6.0	1000	100	100	10	10	1.5	1.6	1,3,5	ML 6744-1XY
6.0 - 12.0	1000	50	100	5	2	2.2	1.8	1,3,5	ML 6745-1XY
12.0 - 18.0	500	20	100	1	1	2.7	2.0	1,3,5	ML 6746-1XY
6.0 - 18.0	500	20	100	1	1	2.7	2.0	1,3,5	ML 6747-1XY
0.5 - 18.0	500	20	100	1	1	2.7	2.0	1,3,5	ML 6748-1XY
18.0 - 40.0	300	10	100	1	1	5.0	2.5	1,3	ML 6749-1XY

**NOTES:**

- (1) Recovery time 5us, measured to 3dB of low loss state
- (2) Spike leakage 20nJ above flat leakage
- (3) Insertion loss and VSWR measured at -10dBm input power
- (4) 1dB compression point +7dBm min.
- (5) Case operating temperature -55°C to +85°C
- (6) Storage temperature -55°C to +125°C



**DESCRIPTION**

M/A-COM Ltd's range of low cost limiters offers a compact microstrip compatible limiter for protection from peak powers up to 200W peak. The devices are available in a miniature hermetic package (see page 214) for direct integration into microstrip and stripline circuits. All the devices include an internal dc return but external dc blocking capacitors are required.

**SPECIFICATIONS**

Frequency Range (GHz)	Max Peak Power (W)	Max CW Power (W)	Max Leakage Power (mW)	Max Recovery Time (us)	Max Insertion Loss (dB)	Max VSWR	Part Number
0.001 - 0.1	25	1	100	10	0.2	1.2	ML 6751-100
0.1 - 0.5	25	1	100	10	0.25	1.2	ML 6752-100
0.5 - 2.0	100	2	100	10	0.35	1.3	ML 6753-100
2.0 - 6.0	100	2	100	10	0.4	1.3	ML 6754-100
6.0 - 12.0	100	2	100	10	0.5	1.4	ML 6755-100
12.0 - 18.0	50	1	100	10	0.8	2.0	ML 6756-100
6.0 - 18.0	50	1	100	10	0.8	2.0	ML 6757-100
0.5 - 18.0	50	1	100	10	1.0	2.5	ML 6758-100

**NOTES:**

- (1) Peak power rated at 1us pulse length 0.1% duty ratio
- (2) Spike leakage 20nJ above flat leakage
- (3) Recovery time measured to 3dB of low loss state
- (4) Insertion loss and VSWR measured at -10dBm input power
- (5) 1dB compression point +7 dBm min
- (6) Case operating temperature -55°C to +85°C
- (7) Storage temperature -55°C to +125°C

**DESCRIPTION**

M/A-COM Ltd's range of switchable limiters offer multi-octave passive protection combined with a switchable isolation state for active protection and system blanking or calibration. The devices have an integral TTL compatible driver, TTL '0' selects the low loss, passive state, TTL '1' selects the isolation state. The devices survive high power in both states. All the devices include internal dc return and dc blocking capacitors at input and output. All the devices are available in a standard coaxial package (see page 214). To specify the full part number including connector configuration please refer to page 210.

**SPECIFICATIONS**

Frequency Range (GHz)	Max Peak Power (W)	Max CW Power (W)	Max Leakage Power (mW)	Max Recovery Time (ns)	Max Insertion Loss (dB)	Max VSWR	Min Blanking Isolation (dB)	Part Number
0.5 - 2.0	100	2	100	200	0.7	1.4	50	ML 6763-10YD
	500	5	100	500	0.8	1.4	50	ML 6763-20YD
2.0 - 6.0	100	2	100	200	1.1	1.6	55	ML 6764-10YD
	500	5	100	500	1.2	1.6	55	ML 6764-20YD
6.0 - 12.0	100	2	100	200	1.7	1.8	60	ML 6765-10YD
	500	5	100	500	1.8	1.8	60	ML 6765-20YD
12.0 - 18.0	100	2	100	200	2.8	2.0	60	ML 6766-10YD
	500	5	100	500	2.9	2.0	60	ML 6766-20YD
6.0 - 18.0	100	2	100	200	2.9	2.0	60	ML 6767-10YD
	500	5	100	500	3.0	2.0	60	ML 6767-20YD
0.5 - 18.0	100	2	100	200	2.9	2.0	60	ML 6768-10YD
	500	5	100	500	3.0	2.0	60	ML 6768-20YD
18.0 - 40.0	100	2	100	200	5.0	2.5	50	ML 6769-10YD
	300	3	100	500	6.0	2.5	50	ML 6769-20YD

**NOTES:**

- (1) Peak power rated at 1us pulse length 0.1% duty ratio
- (2) Spike leakage 20nJ above flat leakage
- (3) Recovery time measured to 3dB of low loss state
- (4) Insertion loss and VSWR measured at -10dBm input power
- (5) 1dB compression point +7 dBm min.
- (6) Switching speed 100ns measured from 50% TTL to 90% detected RF
- (7) Power supply +5V @ 50mA typ.
- (8) Case operating temperature -55°C to +85°C
- (9) Storage temperature -55°C to +125°C

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## PART NUMBER SPECIFICATION

Each limiter electrical specification is available in a wide range of coaxial and module package styles. Coaxial devices have either fixed or removable SMA connectors and module packages are microstrip or stripline compatible. All package RF interfaces have 50 ohm impedance.

To define the complete part number for a specific device combine the part number for the required electrical specification from the data sheet with the option numbers for package style (x) and connector configuration (y) from the tables below:

## PACKAGE STYLE

PACKAGE STYLE	X	PACKAGE STYLE	X
Coaxial length 26.0mm	0	Coaxial, Removable Connector, length 24.9mm	5
Coaxial length 31.0mm	1	Hermetic Module, length 8.38mm	6
Coaxial, length 26.0mm with fixing holes	2	Hermetic Module, length 13.50mm	7
Coaxial, length 31.0mm with fixing holes	3	MiCM, length 6mm	8
Coaxial, Removable Connector, length 13.5mm	4	MiCM, length 12mm	9

## CONNECTOR CONFIGURATION

INPUT	OUTPUT	Y
Module, Non-Connectorised		0
SMA female	SMA female	1
SMA male	SMA female	2
SMA female	SMA male	3
SMA male	SMA male	4

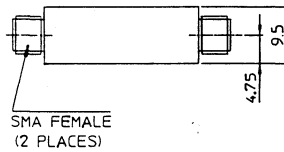
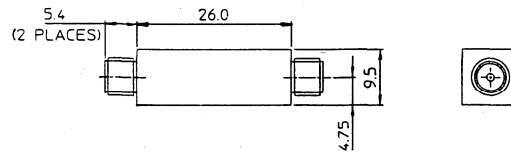
The available package styles for each device are listed in the data sheets.

**Example part number:** For a standard broadband limiter, frequency 6 to 12 GHz, 100W peak power, package style 2 with male input, female output the part number would be **ML 6715-122**.

## OUTLINE DRAWINGS

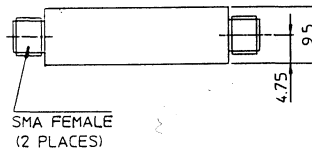
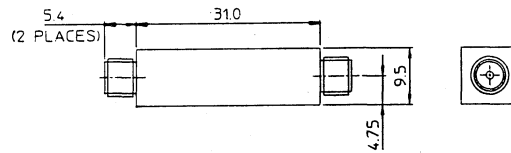
### PACKAGE STYLE 0

Coaxial, length 26.0mm



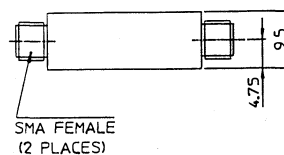
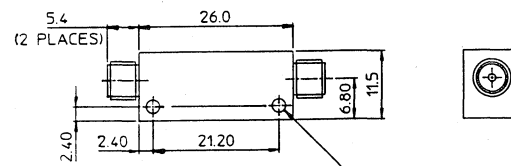
### PACKAGE STYLE 1

Coaxial, length 31.0mm



### PACKAGE STYLE 2

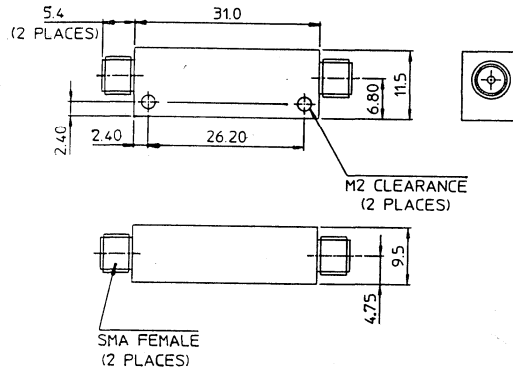
Coaxial, length 26.0mm with fixing holes



## OUTLINE DRAWINGS

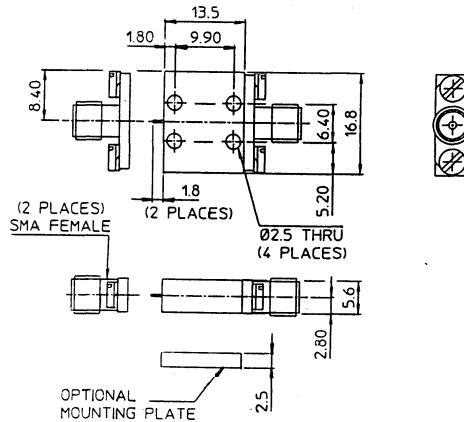
### PACKAGE STYLE 3

Coaxial, length 31.0mm with fixing holes



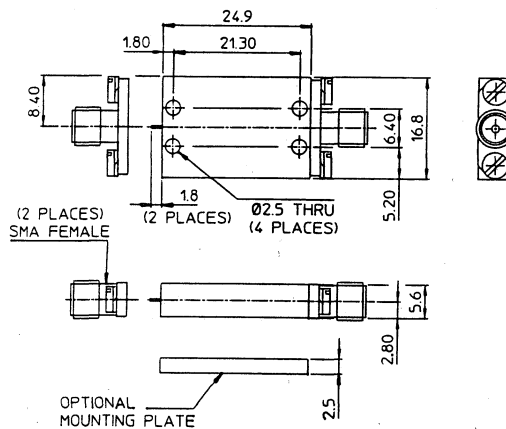
### PACKAGE STYLE 4

Coaxial, removable connector, length 13.5mm



### PACKAGE STYLE 5

Coaxial, removable connector, length 24.9mm



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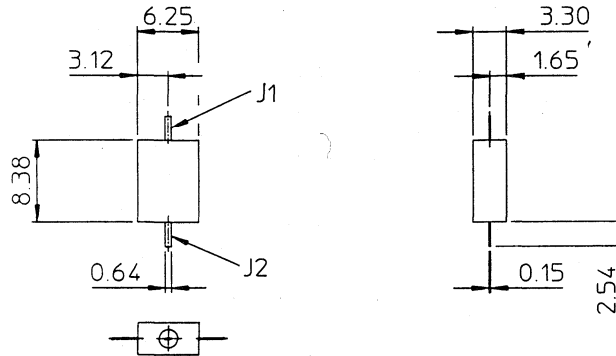
Europe: (44) 1344 869595

North America: 800 366 2266

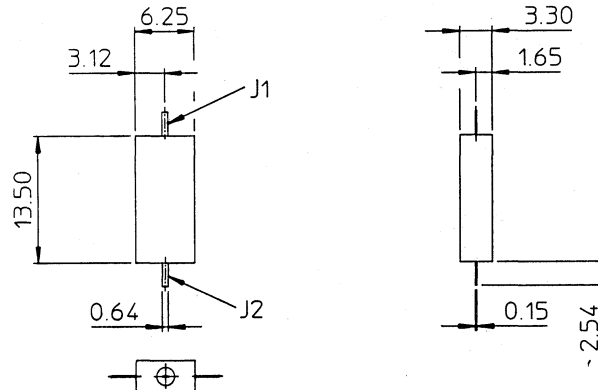
Asia Pacific: (81) 3 3226 1671

## OUTLINE DRAWINGS

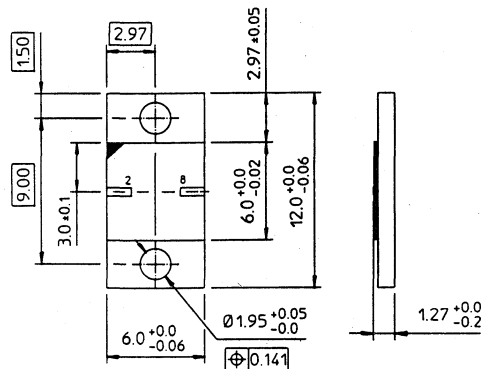
**PACKAGE STYLE 6**  
Hermetic Module, length 8.38mm



**PACKAGE STYLE 7**  
Hermetic Module, length 13.50mm

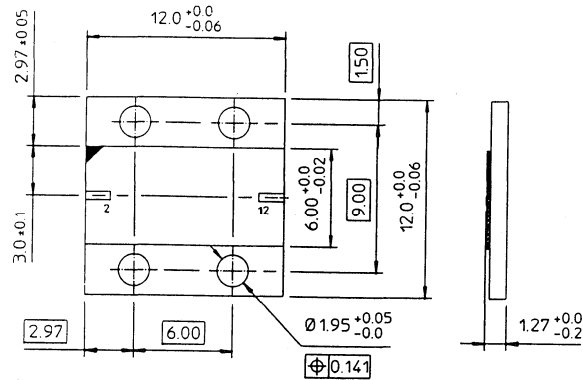


**PACKAGE STYLE 8-MiCM Type Code S2A2-12F6-2-8-N**  
MiCM, length 6mm

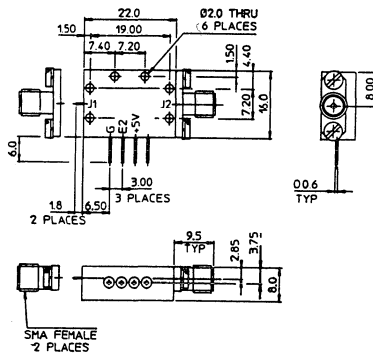


# OUTLINE DRAWINGS

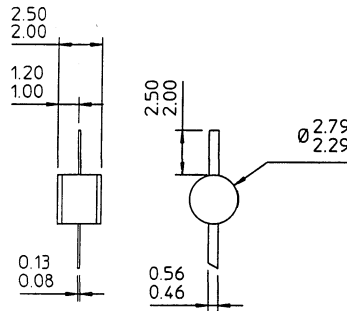
PACKAGE STYLE 9-MiCM Type Code S2A2-12F12-2-12-N  
 MiCM, length 12mm



## SWITCHABLE LIMITER OUTLINE ML 6760-000D SERIES



## LOW COST LIMITER OUTLINE ML 6750-000 SERIES



### Drawing Notes

Third Angle Projection  
 All dimensions in mm

Standard Finish:

Input port marked by dot

Coaxial units are silver plate to Def Stan 03/9 for use with microstrip or matt black paint to DTD 5555A  
 Modules are gold plate finish

Tolerances    X.X =  $\pm 0.5$ mm  
                   X.XX =  $\pm 0.2$ mm

All specifications subject to change without notice

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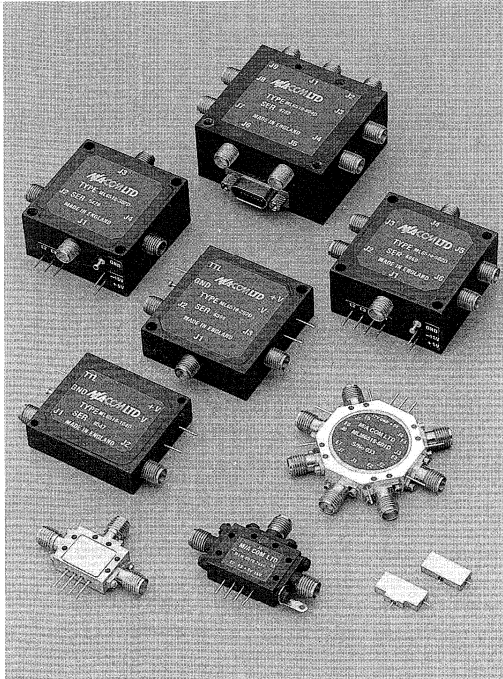
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

# SWITCHES AND ATTENUATORS

## Contents



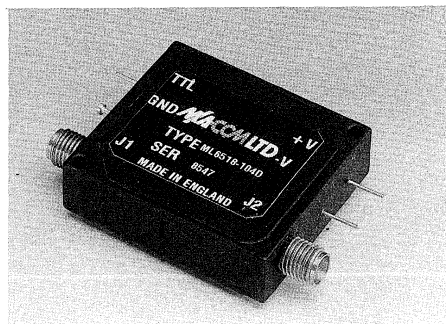
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**SPST REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ High Isolation
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

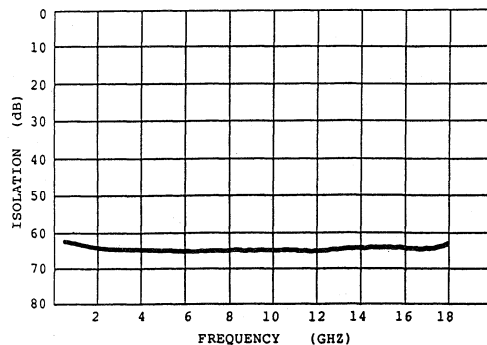
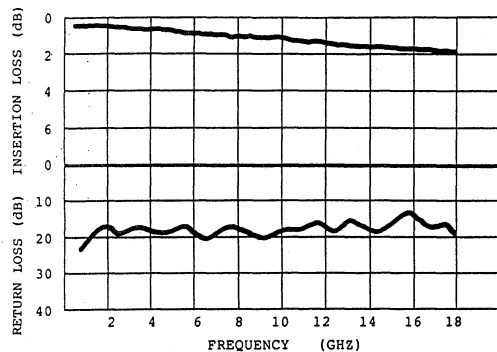
The ML 6510-100D Series of SPST switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with SMA male or female connectors.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	0.7	1.5	60	3	15	0.5	0.1	ML6513-101D
				30	200	10	2	ML6513-102D
2.0 - 6.0	1.1	1.6	65	3	15	0.5	0.1	ML6514-101D
				30	200	10	2	ML6514-102D
6.0 - 12.0	1.8	1.7	65	3	15	0.5	0.1	ML6515-101D
				30	200	10	2	ML6515-102D
12.0 - 18.0	2.2	1.9	60	3	15	0.5	0.1	ML6516-101D
				30	200	10	2	ML6516-102D
6.0 - 18.0	2.2	1.9	60	3	15	0.5	0.1	ML6517-101D
				30	200	10	2	ML6517-102D
0.5 - 18.0	2.2	1.9	60	3	15	0.5	0.1	ML6518-101D
				30	200	10	2	ML6518-102D

## Typical Performance

### ML 6518-102D



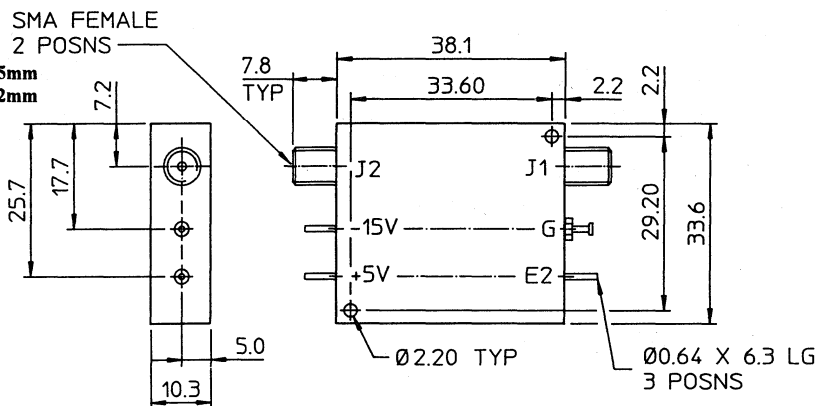
## Outline Drawing

### Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Standard Finish: **Matt**  
black paint to  
DTD 5555A



## NOTES

- 1) J1 is RF input, J2 is RF output
- 2) Power supplies required +5V @ 50mA maximum, -15V @ 10mA maximum.  
Other combinations available on request, please contact the factory for further details.
- 3) E2 is TTL control input, TTL logic '0' is low loss, TTL logic '1' is isolation,
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available, please contact the factory.
- 6) Transition time is defined as 10% to 90% detected RF  
Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C.

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

**All specifications are typical and subject to change without notice.**

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

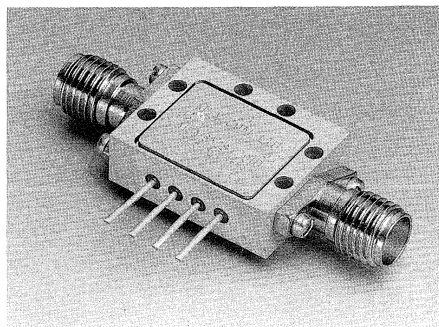
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

SPST REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz

FEATURES

- ◆ Broad Frequency Ranges
- ◆ Miniature Outline
- ◆ Removable Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



DESCRIPTION

The MLM 6510-100D Series of SPST switches from M/A-COM Ltd offers high isolation and low insertion loss in a miniature outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with removable SMA male or female connectors. Without connectors the devices may be integrated directly into microstrip circuits.

SPECIFICATIONS @ +25°C

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	0.7	1.5	60	3	15	0.5	0.1	MLM6513-101D
				30	200	10	2	MLM6513-102D
2.0 - 6.0	1.1	1.6	65	3	15	0.5	0.1	MLM6514-101D
				30	200	10	2	MLM6514-102D
6.0 - 12.0	1.8	1.7	65	3	15	0.5	0.1	MLM6515-101D
				30	200	10	2	MLM6515-102D
12.0 - 18.0	2.2	1.9	60	3	15	0.5	0.1	MLM6516-101D
				30	200	10	2	MLM6516-102D
6.0 - 18.0	2.2	1.9	60	3	15	0.5	0.1	MLM6517-101D
				30	200	10	2	MLM6517-102D
0.5 - 18.0	2.2	1.9	60	3	15	0.5	0.1	MLM6518-101D
				30	200	10	2	MLM6518-102D

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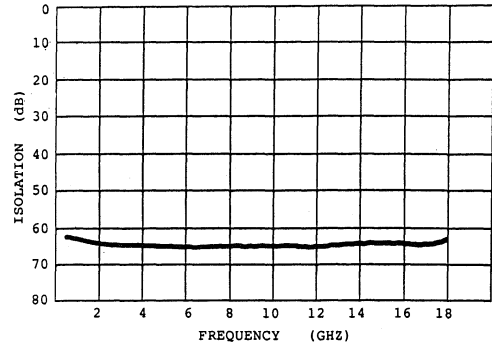
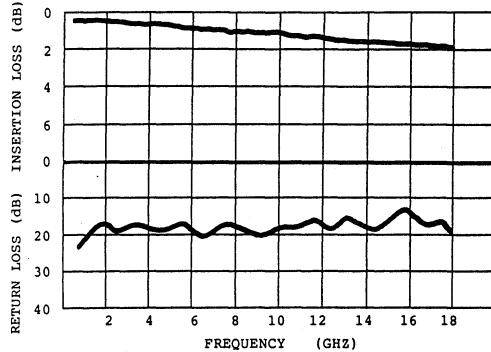
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North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

### MLM 6518-101D



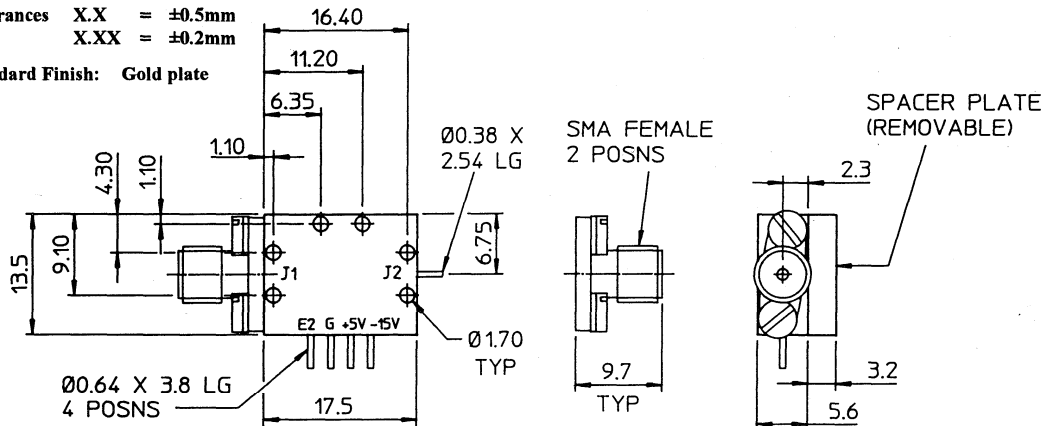
## Outline Drawing

### Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Standard Finish: Gold plate



## NOTES

- 1) J1 is RF input, J2 is RF output
- 2) Power supplies required +5V @ 50mA maximum, -15V @ 10mA maximum. Other combinations available on request, please contact the factory for further details.
- 3) E2 is TTL control input, TTL logic '0' is low loss, TTL logic '1' is isolation,
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available, please contact the factory.
- 6) Transition time is defined as 10% to 90% detected RF Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C.

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications are subject to change without notice.

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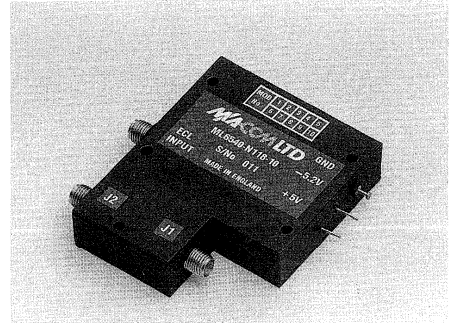
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SPST REFLECTIVE SWITCH  
WITH ECL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ ECL Compatible
- ◆ Fast Switching
- ◆ Broad Frequency Ranges
- ◆ SMA Connectors
- ◆ Hermetically Sealed



**DESCRIPTION**

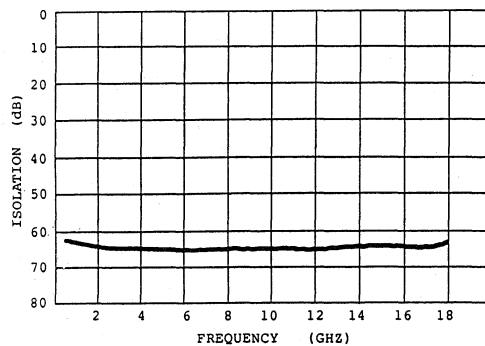
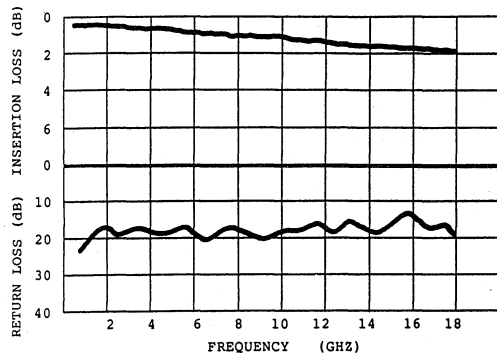
The ML6550-100D series of ECL switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard coaxial outline. All the switches have an integral ECL compatible driver giving fast switching speed and high modulation rate. Devices are supplied with either SMA male or female connectors for RF and ECL connections, other ECL connectors can be specified, contact the factory.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max CW Power (W)	Part Number
0.5 - 2.0	0.7	1.5	60	3	15	0.02	ML6553-101D
2.0 - 6.0	1.1	1.6	65	3	15	0.02	ML6554-101D
6.0 - 12.0	1.8	1.7	65	3	15	0.02	ML6555-101D
12.0 - 18.0	2.2	1.9	60	3	15	0.02	ML6556-101D
6.0 - 18.0	2.2	1.9	60	3	15	0.02	ML6557-101D
0.5 - 18.0	2.2	1.9	60	3	15	0.02	ML6558-101D

## Typical Performance

## ML6558-101D



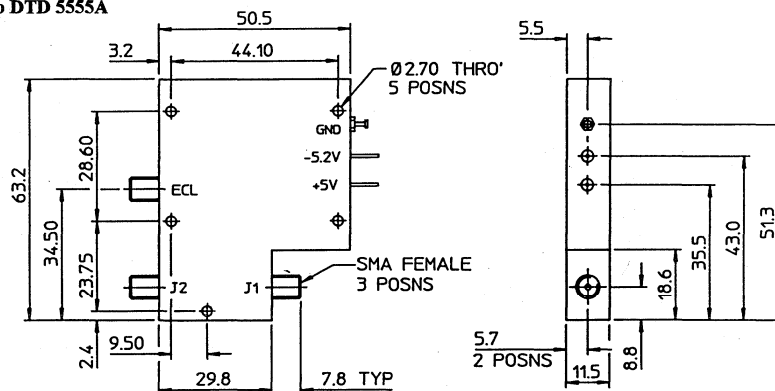
## Outline Drawing

## Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
 X.XX =  $\pm 0.2$ mm

Standard Finish: Matt black paint  
 to DTD 5555A



## NOTES:

- 1) J1 is RF input, J2 is RF output.
- 2) Power supplies required +5V @ 30mA maximum, -5.2V @ 90mA maximum.
- 3) ECL input, ECL logic '0' is low loss, ECL logic '1' is isolation.
- 4) ECL logic '0' is -1.8V to -1.6V, ECL logic '1' is -1.0V to -0.8V.
- 5) Control modulation PRF DC to 50MHz, minimum pulse width 8ns.
- 6) Any combination of SMA male/female connectors is available, please contact the factory.
- 7) Transmission time is defined as 10% to 90% detected RF.  
Switching time is defined as 50% ECL to 90% detected RF.
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

All specifications subject to change without notice

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Europe: (44) 1344 869595

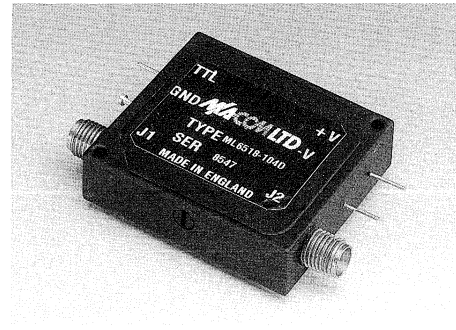
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SPST NON-REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ High Isolation
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



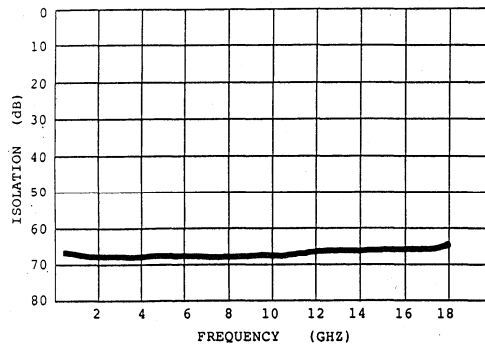
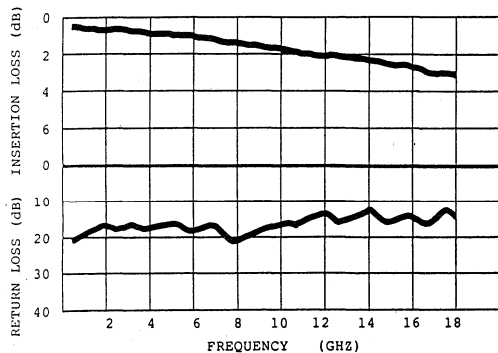
**DESCRIPTION**

The ML 6520-100D Series of SPST non-reflective switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with SMA male or female connectors.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.0	1.5	65	10	30	0.1	0.1	ML6523-101D
				50	250	1.0	0.5	ML6523-102D
2.0 - 6.0	1.4	1.6	65	10	30	0.1	0.1	ML6524-101D
				50	250	1.0	0.5	ML6524-102D
6.0 - 12.0	2.2	1.7	65	10	30	0.1	0.1	ML6525-101D
				50	250	1.0	0.5	ML6525-102D
12.0 - 18.0	2.7	1.9	60	10	30	0.1	0.1	ML6526-101D
				50	250	1.0	0.5	ML6526-102D
6.0 - 18.0	2.7	1.9	60	10	30	0.1	0.1	ML6527-101D
				50	250	1.0	0.5	ML6527-102D
0.5 - 18.0	2.7	1.9	60	10	30	0.1	0.1	ML6528-101D
				50	250	1.0	0.5	ML6528-102D

## Typical Performance ML6528-102D



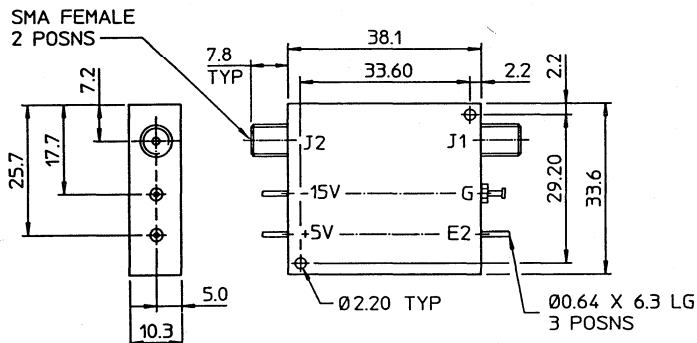
## Outline Drawing

### Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Standard Finish: Matt black paint  
to DTD 5555A



## NOTES:

- 1) J1 is RF input (non reflective), J2 RF output.
- 2) Power supplies required +5V @ 50mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- 3) E2 is TTL control input, TTL logic '0' is low loss, TTL logic '1' is isolation,
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available, please contact the factory.
- 6) Transition time is defined as 10% to 90% detected RF  
Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C.

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

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Europe: (44) 1344 869595

North America: 800 366 2266

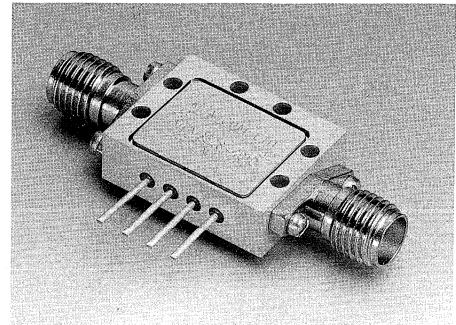
Asia Pacific: (81) 3 3226 1671



**SPST NON-REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ **Broad Frequency Ranges**
- ◆ **Miniature Outline**
- ◆ **Removable Connectors**
- ◆ **Hermetically Sealed**
- ◆ **TTL Compatible**



**DESCRIPTION**

The MLM 6520-100D Series of SPST non-reflective switches from M/A-COM Ltd offers high isolation and low insertion loss in a miniature outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with removable SMA male or female connectors. Without connectors the devices may be integrated directly into microstrip circuits.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.0	1.5	65	10	30	0.1	0.1	MLM6523-101D
				50	250	1.0	0.5	MLM6523-102D
2.0 - 6.0	1.4	1.6	65	10	30	0.1	0.1	MLM6524-101D
				50	250	1.0	0.5	MLM6524-102D
6.0 - 12.0	2.2	1.7	65	10	30	0.1	0.1	MLM6525-101D
				50	250	1.0	0.5	MLM6525-102D
12.0 - 18.0	2.7	1.9	60	10	30	0.1	0.1	MLM6526-101D
				50	250	1.0	0.5	MLM6526-102D
6.0 - 18.0	2.7	1.9	60	10	30	0.1	0.1	MLM6527-101D
				50	250	1.0	0.5	MLM6527-102D
0.5 - 18.0	2.7	1.9	60	10	30	0.1	0.1	MLM6528-101D
				50	250	1.0	0.5	MLM6528-102D

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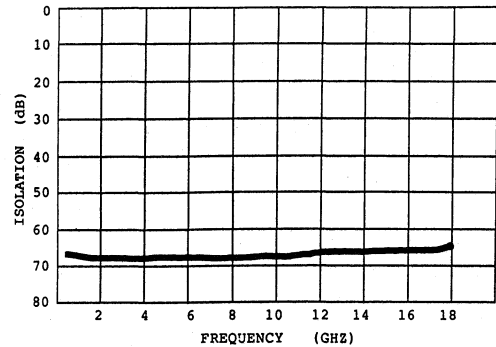
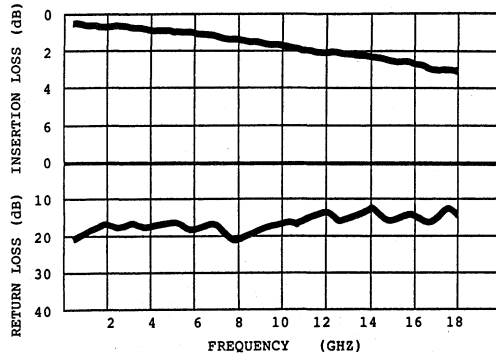
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

# Typical Performance

## MLM6528-102D



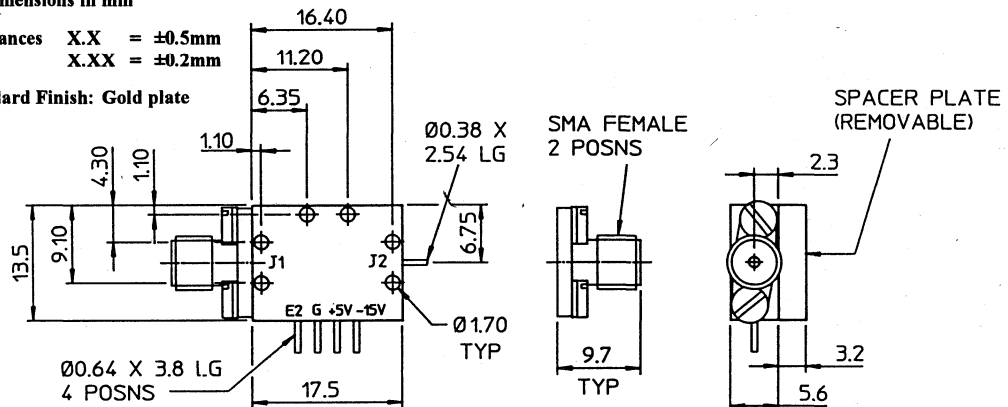
## Outline Drawing

### Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5\text{mm}$   
X.XX =  $\pm 0.2\text{mm}$

Standard Finish: Gold plate



### NOTES:

- 1) J1 is RF input (non reflective), J2 RF output.
- 2) Power supplies required +5V @ 50mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- 3) E2 is TTL control input, TTL logic '0' is low loss, TTL logic '1' is isolation,
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available, please contact the factory.
- 6) Transition time is defined as 10% to 90% detected RF Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C.

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

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Europe: (44) 1344 869595

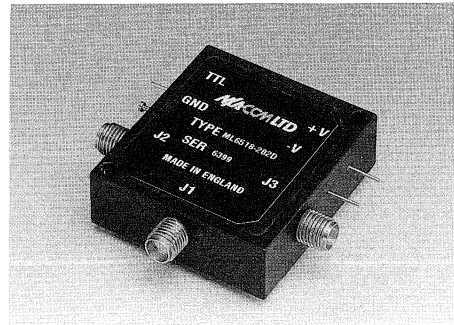
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SPDT REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ High Isolation
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

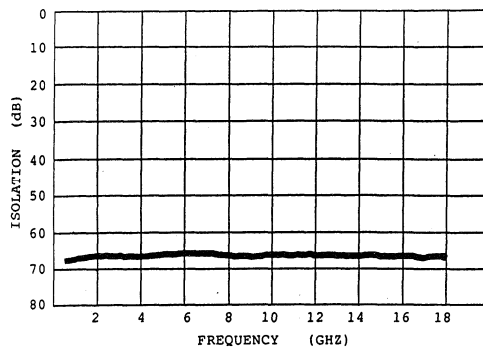
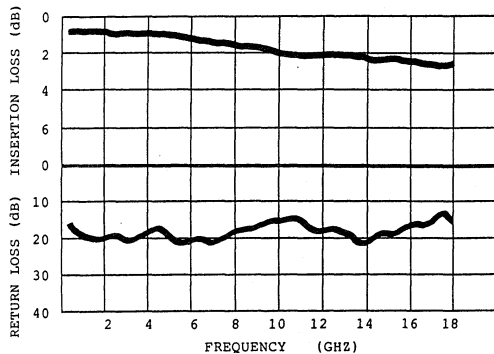
The ML 6510-200D Series of SPDT switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Standard switches have independent TTL control, single TTL control is available as an option. Devices are supplied with SMA male or female connectors.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.1	1.4	65	10	30	0.1	0.1	ML6513-201D
				50	250	1.0	0.5	ML6513-202D
2.0 - 6.0	1.5	1.6	65	10	30	0.1	0.1	ML6514-201D
				50	250	1.0	0.5	ML6514-202D
6.0 - 12.0	2.2	1.8	65	10	30	0.1	0.1	ML6515-201D
				50	250	1.0	0.5	ML6515-202D
12.0 - 18.0	2.6	2.0	60	10	30	0.1	0.1	ML6516-201D
				50	250	1.0	0.5	ML6516-202D
6.0 - 18.0	2.6	2.0	60	10	30	0.1	0.1	ML6517-201D
				50	250	1.0	0.5	ML6517-202D
0.5 - 18.0	2.6	2.0	60	10	30	0.1	0.1	ML6518-201D
				50	250	1.0	0.5	ML6518-202D

## Typical Performance

## ML6518-202D



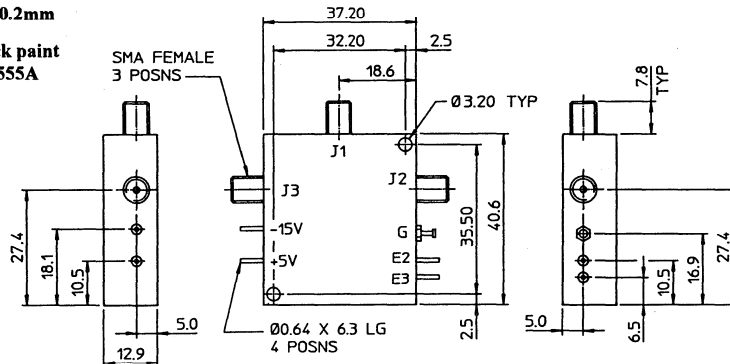
## Outline Drawing

## Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Standard Finish: Matt black paint  
to DTD 5555A



## NOTES:

- 1) J1 is RF common, J2, J3 are RF input/outputs.
- 2) Power supplies required +5V @ 70mA maximum, -15V @ 50mA maximum.  
Other combinations available on request, please contact the factory for further details.
- 3) E2, E3 are independent TTL control inputs. For each channel TTL '0' is Low Loss, TTL '1' is isolation. For single TTL control using pin E2 only with TTL '0' J1-J2 low loss and TTL '1' J1-J3 low loss add 'S' as a suffix to the part number when ordering, e.g. ML 6518-202DS.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available, please contact the factory.
- 6) Transition time is defined as 10% to 90% detected RF  
Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

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Europe: (44) 1344 869595

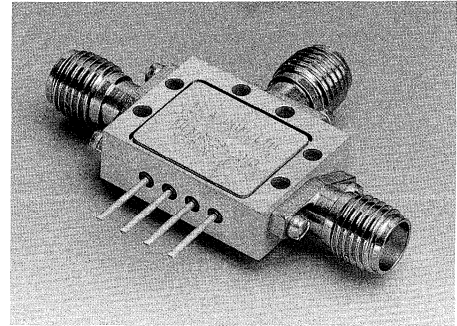
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SPDT REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Miniature Outline
- ◆ Removable Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

The MLM 6510-200D Series of SPDT switches from M/A-COM Ltd offers high isolation and low insertion loss in a miniature outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Standard switches have independent TTL control, single TTL control is available as an option. Devices are supplied with removable SMA male or female connectors. Without connectors the devices may be integrated directly into microstrip circuits.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.1	1.4	55	10	30	0.1	0.1	MLM6513-201D
				50	250	1.0	0.5	MLM6513-202D
2.0 - 6.0	1.5	1.6	60	10	30	0.1	0.1	MLM6514-201D
				50	250	1.0	0.5	MLM6514-202D
6.0 - 12.0	2.2	1.8	60	10	30	0.1	0.1	MLM6515-201D
				50	250	1.0	0.5	MLM6515-202D
12.0 - 18.0	2.6	2.0	55	10	30	0.1	0.1	MLM6516-201D
				50	250	1.0	0.5	MLM6516-202D
6.0 - 18.0	2.6	2.0	55	10	30	0.1	0.1	MLM6517-201D
				50	250	1.0	0.5	MLM6517-202D
0.5 - 18.0	2.6	2.0	55	10	30	0.1	0.1	MLM6518-201D
				50	250	1.0	0.5	MLM6518-202D

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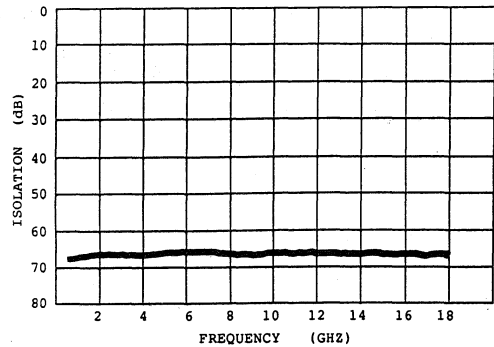
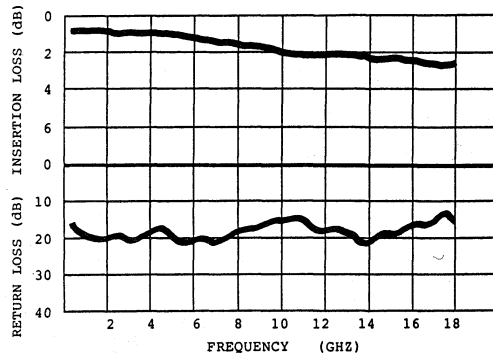
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

## MLM6518-202D



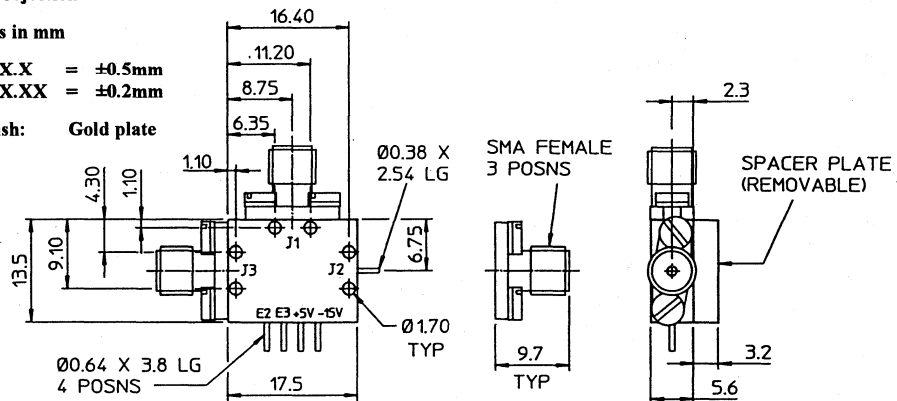
## Outline Drawing

## Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5\text{mm}$   
 X.XX =  $\pm 0.2\text{mm}$

Standard Finish: Gold plate



## NOTES

- 1) J1 is RF common, J2, J3 are RF input/outputs.
- 2) Power supplies required +5V @ 70mA maximum, -15V @ 50mA maximum.  
Other combinations available on request, please contact the factory for further details.
- 3) E2, E3 are independent TTL control inputs. For each channel TTL '0' is Low Loss,  
TTL '1' is isolation. For single TTL control using pin E2 only with TTL '0' J1-J2 low loss, and TTL '1' J1-J3 low loss add 'S' as a suffix to the part number when ordering e.g. MLM 6518-201DS.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available, please contact the factory.
- 6) Transition time is defined as 10% to 90% detected RF  
Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

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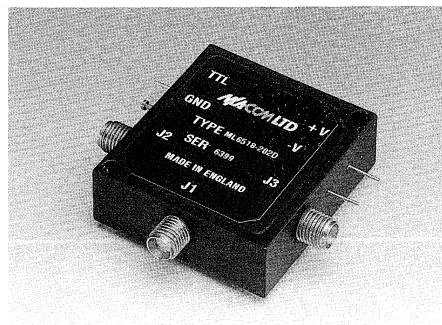
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

SPDT NON-REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz

FEATURES

- ◆ Broad Frequency Ranges
- ◆ High Isolation
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



DESCRIPTION

The ML 6520-200D Series of SPDT non-reflective switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Standard switches have independent TTL control, single TTL control is available as an option. Devices are supplied with SMA male or female connectors.

SPECIFICATIONS @ +25°C

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.4	1.4	65	10	30	0.1	0.1	ML6523-201D
				50	250	1.0	0.5	ML6523-202D
2.0 - 6.0	1.8	1.6	65	10	30	0.1	0.1	ML6524-201D
				50	250	1.0	0.5	ML6524-202D
6.0 - 12.0	2.6	1.8	65	10	30	0.1	0.1	ML6525-201D
				50	250	1.0	0.5	ML6525-202D
12.0 - 18.0	3.1	2.0	60	10	30	0.1	0.1	ML6526-201D
				50	250	1.0	0.5	ML6526-202D
6.0 - 18.0	3.1	2.0	60	10	30	0.1	0.1	ML6527-201D
				50	250	1.0	0.5	ML6527-202D
0.5 - 18.0	3.1	2.0	60	10	30	0.1	0.1	ML6528-201D
				50	250	1.0	0.5	ML6528-202D

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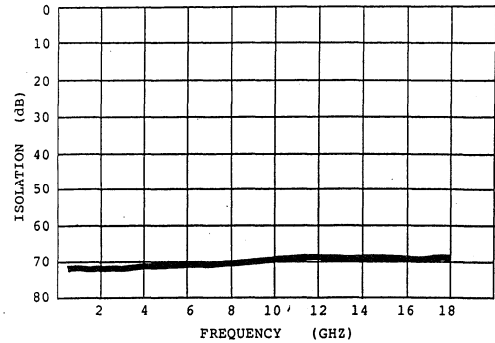
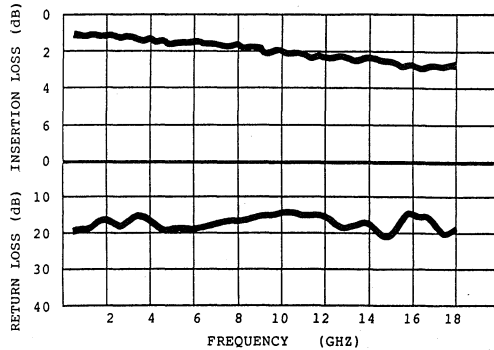
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

## ML6528-202D



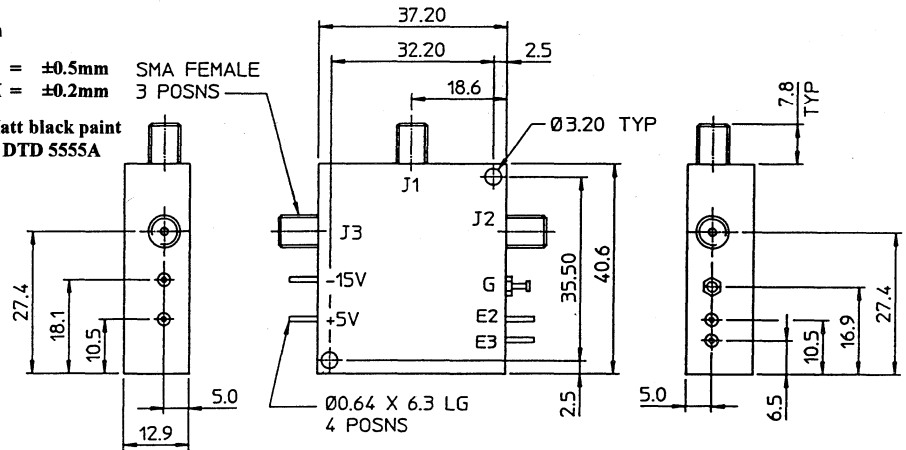
## Outline Drawing

## Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5\text{mm}$  SMA FEMALE  
 X.XX =  $\pm 0.2\text{mm}$  3 POSNS

Standard Finish: Matt black paint to DTD 5555A



## NOTES:

- J1 is RF common, J2, J3 are RF input/outputs (non reflective)
- Power supplies required +5V @ 70mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- E2, E3 are independent TTL control inputs. For each channel TTL Logic '0' is low loss, TTL logic '1' is isolation.  
 For single TTL control using pin E2 only, with TTL '0' J1-J2 low loss and, TTL '1' J1- J3 low loss add 'S' as suffix to the part number when ordering. e.g. ML6528-201DS.
- TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- Any combination of SMA male/female connectors is available.
- Transition time is defined as 10% to 90% detected RF Switching time is defined as 50% TTL to 90% detected RF
- Case operating temperature -55°C to +85°C  
 Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice

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North America: 800 366 2266

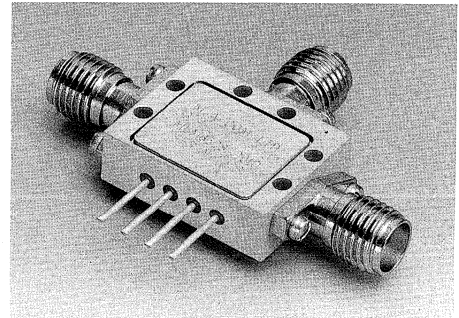
Asia Pacific: (81) 3 3226 1671



**SPDT NON-REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ **Broad Frequency Ranges**
- ◆ **Miniature Outline**
- ◆ **Removable Connectors**
- ◆ **Hermetically Sealed**
- ◆ **TTL Compatible**



**DESCRIPTION**

The MLM 6520-200D Series of SPDT non-reflective switches from M/A-COM Ltd offers high isolation and low insertion loss in a miniature outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Standard switches have independent TTL control, single TTL control is available as an option. Devices are supplied with removable SMA male or female connectors. Without connectors the devices may be integrated directly into microstrip circuits.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.4	1.4	55	10	30	0.1	0.1	MLM6523-201D
				50	250	1.0	0.5	MLM6523-202D
2.0 - 6.0	1.8	1.6	60	10	30	0.1	0.1	MLM6524-201D
				50	250	1.0	0.5	MLM6524-202D
6.0 - 12.0	2.6	1.8	60	10	30	0.1	0.1	MLM6525-201D
				50	250	1.0	0.5	MLM6525-202D
12.0 - 18.0	3.1	2.0	55	10	30	0.1	0.1	MLM6526-201D
				50	250	1.0	0.5	MLM6526-202D
6.0 - 18.0	3.1	2.0	55	10	30	0.1	0.1	MLM6527-201D
				50	250	1.0	0.5	MLM6527-202D
0.5 - 18.0	3.1	2.0	55	10	30	0.1	0.1	MLM6528-201D
				50	250	1.0	0.5	MLM6528-202D

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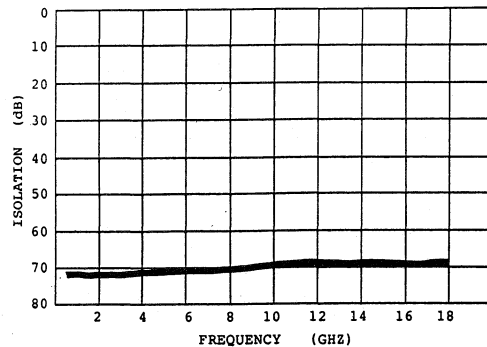
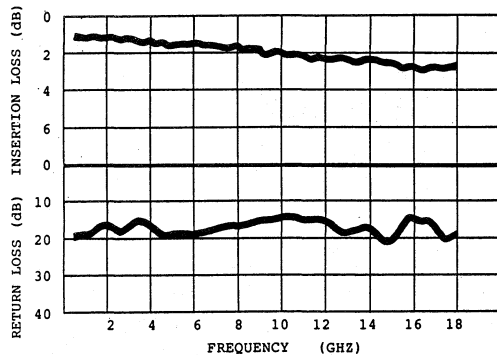
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

### MLM6528-202D



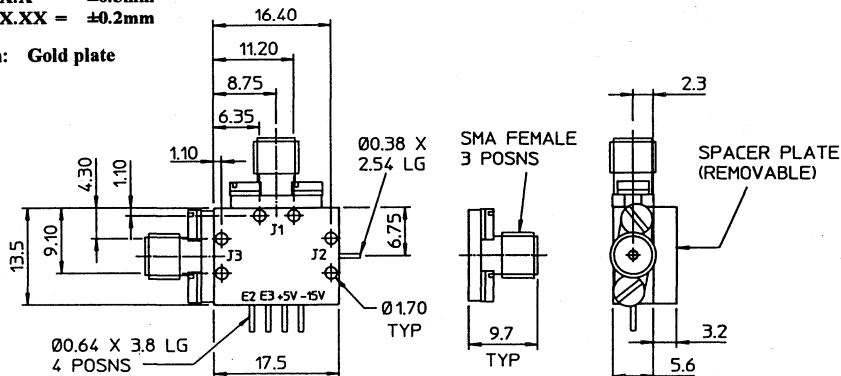
## Outline Drawing

### Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Standard Finish: Gold plate



### NOTES:

- 1) J1 is RF common, J2, J3 are RF input/outputs (non reflective)
- 2) Power supplies required +5V @ 70mA maximum, -15V @ 50mA maximum.  
Other combinations available on request, please contact the factory for further details.
- 3) E2, E3 are independent TTL control inputs. For each channel TTL Logic '0' is low loss, TTL logic '1' is isolation. For single TTL control using pin E2 only with TTL '0' J1-J2 low loss and TTL '1' J1-J3 low loss add 'S' as a suffix to the part number when ordering e.g. MLM 6528-201DS.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available.
- 6) Transition time is defined as 10% to 90% detected RF Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice

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Europe: (44) 1344 869595

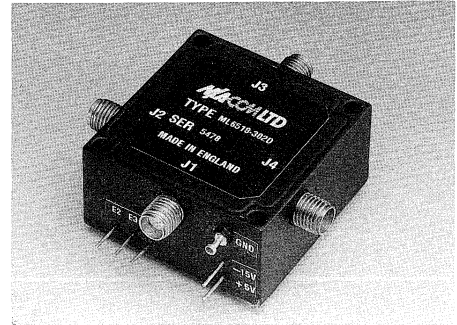
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SP3T REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ **Broad Frequency Ranges**
- ◆ **High Isolation**
- ◆ **SMA Connectors**
- ◆ **Hermetically Sealed**
- ◆ **TTL Compatible**



**DESCRIPTION**

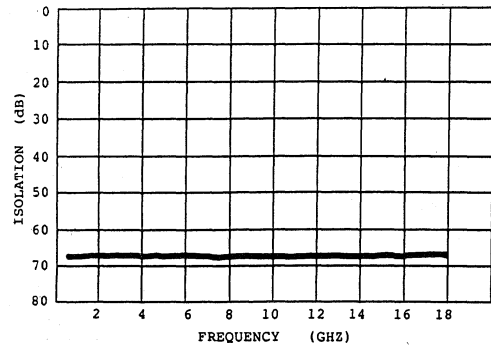
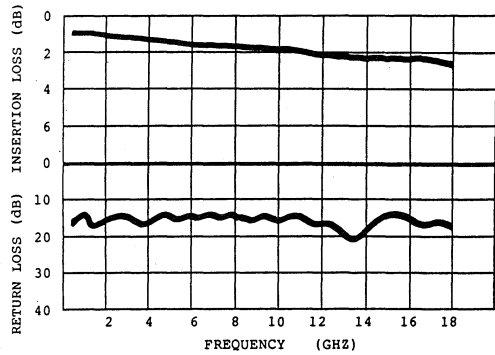
The ML 6510-300D Series of SP3T switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with SMA male or female connectors. As an option a multiway D connector can be specified for d.c. connections.

**SPECIFICATIONS @+25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.4	1.4	65	10	30	0.1	0.1	ML6513-301D
				50	250	1.0	0.5	ML6513-302D
2.0 - 6.0	1.8	1.6	65	10	30	0.1	0.1	ML6514-301D
				50	250	1.0	0.5	ML6514-302D
6.0 - 12.0	2.5	1.8	65	10	30	0.1	0.1	ML6515-301D
				50	250	1.0	0.5	ML6515-302D
12.0 - 18.0	2.9	2.0	60	10	30	0.1	0.1	ML6516-301D
				50	250	1.0	0.5	ML6516-302D
6.0 - 18.0	2.9	2.0	60	10	30	0.1	0.1	ML6517-301D
				50	250	1.0	0.5	ML6517-302D
0.5 - 18.0	2.9	2.0	60	10	30	0.1	0.1	ML6518-301D
				50	250	1.0	0.5	ML6518-302D

## Typical Performance

## ML6518-302D



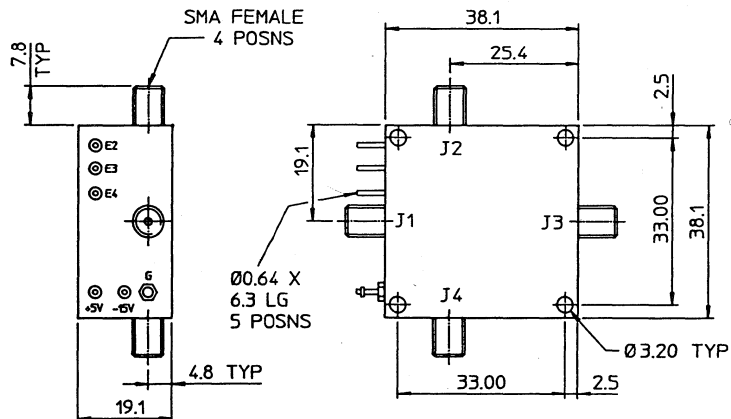
## Outline Drawing

## Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
 X.XX =  $\pm 0.2$ mm

Standard Finish: Matt Black Paint  
 to DTD 5555A



## NOTES:

- J1 is RF common, J2, J3, J4 are RF input/outputs.
- Power supplies required +5V @ 100mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- E2, E3, E4 are independent TTL control inputs. For each channel TTL '0' is Low Loss, TTL '1' is isolation. A decoded control input is available as an option, please contact the factory.
- TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- Any combination of SMA male/female connectors is available.
- Transition time is defined as 10% to 90% detected RF  
Switching time is defined as 50% TTL to 90% detected RF
- Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

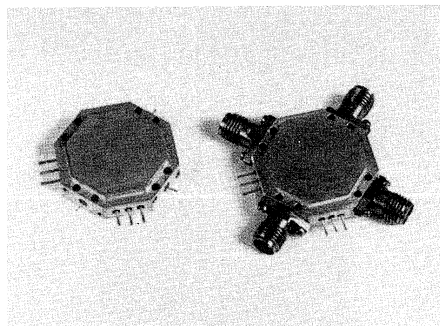
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SP3T REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Miniature Outline
- ◆ Removable Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible


**DESCRIPTION**

The MLM 6510-300D Series of SP3T switches from M/A-COM Ltd offers high isolation and low insertion loss in a miniature outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with removable SMA male or female connectors. Without connectors the devices may be integrated directly into microstrip circuits.

**SPECIFICATIONS @ 25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.4	1.4	65	10	30	0.1	0.1	MLM6513-301D
				50	250	1.0	0.5	MLM6513-302D
2.0 - 6.0	1.8	1.6	65	10	30	0.1	0.1	MLM6514-301D
				50	250	1.0	0.5	MLM6514-302D
6.0 - 12.0	2.5	1.8	65	10	30	0.1	0.1	MLM6515-301D
				50	250	1.0	0.5	MLM6515-302D
12.0 - 18.0	2.9	2.0	60	10	30	0.1	0.1	MLM6516-301D
				50	250	1.0	0.5	MLM6516-302D
6.0 - 18.0	2.9	2.0	60	10	30	0.1	0.1	MLM6517-301D
				50	250	1.0	0.5	MLM6517-302D
0.5 - 18.0	2.9	2.0	60	10	30	0.1	0.1	MLM6518-301D
				50	250	1.0	0.5	MLM6518-302D

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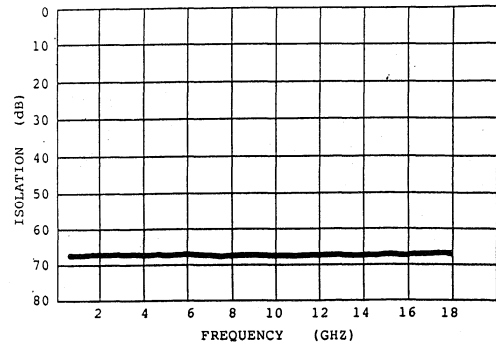
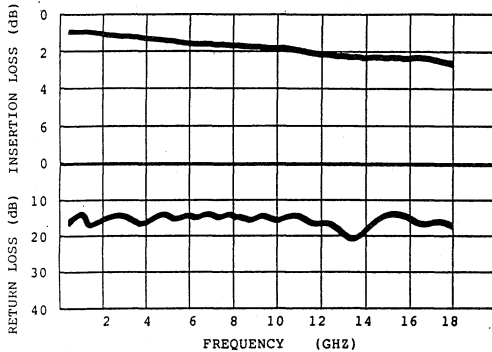
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

### MLM6518-302D



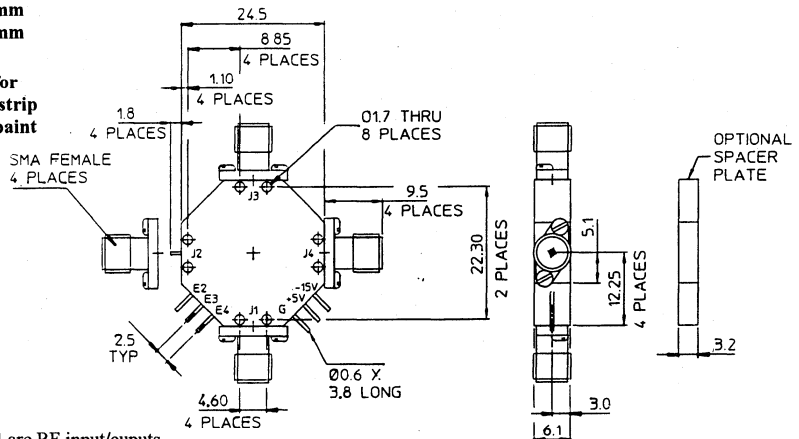
## Outline Drawing

### Third Angle Projection

All dimensions in mm

Tolerances  
 X.X =  $\pm 0.5$ mm  
 X.XX =  $\pm 0.2$ mm

Standard Finish: Silver plate to Def Stan 03/9 for use with microstrip or matt black paint to DTD 5555A



### NOTES:

- J1 is RF common, J2, J3, J4 are RF input/outputs.
- Power supplies required +5V @ 100mA maximum, -15V @ 50mA maximum.  
Other combinations available on request, please contact the factory for further details.
- E2, E3, E4 are independent TTL control inputs. For each channel TTL '0' is Low Loss, TTL '1' is isolation. A decoded control input is available as an option, please contact the factory.
- TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- Any combination of SMA male/female connectors is available.
- Transition time is defined as 10% to 90% detected RF  
Switching time is defined as 50% TTL to 90% detected RF
- Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

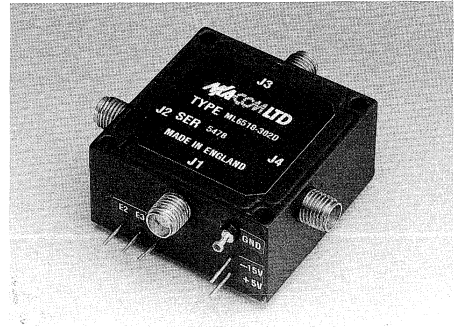
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SP3T NON-REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ High Isolation
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

The ML 6520-300D Series of SP3T non-reflective switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with SMA male or female connectors. As an option a multiway D connector can be specified for d.c. connections.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.7	1.4	65	10	30	0.1	0.1	ML6523-301D
				50	250	1.0	0.5	ML6523-302D
2.0 - 6.0	2.1	1.6	65	10	30	0.1	0.1	ML6524-301D
				50	250	1.0	0.5	ML6524-302D
6.0 - 12.0	2.9	1.8	65	10	30	0.1	0.1	ML6525-301D
				50	250	1.0	0.5	ML6525-302D
12.0 - 18.0	3.4	2.0	60	10	30	0.1	0.1	ML6526-301D
				50	250	1.0	0.5	ML6526-302D
6.0 - 18.0	3.4	2.0	60	10	30	0.1	0.1	ML6527-301D
				50	250	1.0	0.5	ML6527-302D
0.5 - 18.0	3.4	2.0	60	10	30	0.1	0.1	ML6528-301D
				50	250	1.0	0.5	ML6528-302D

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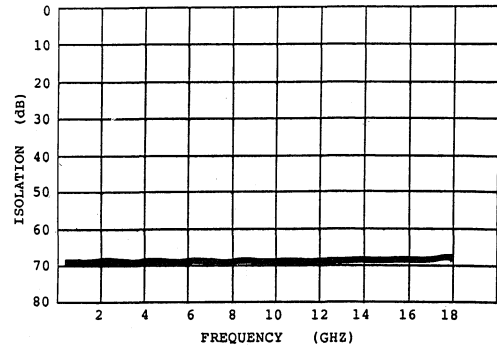
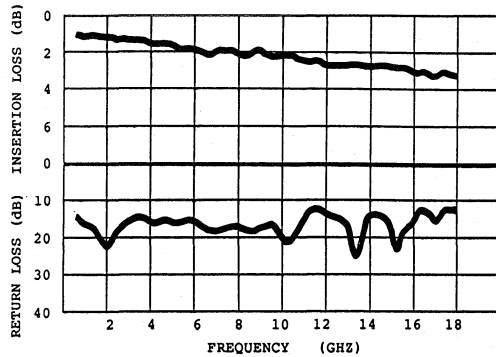
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

## ML6528-302D



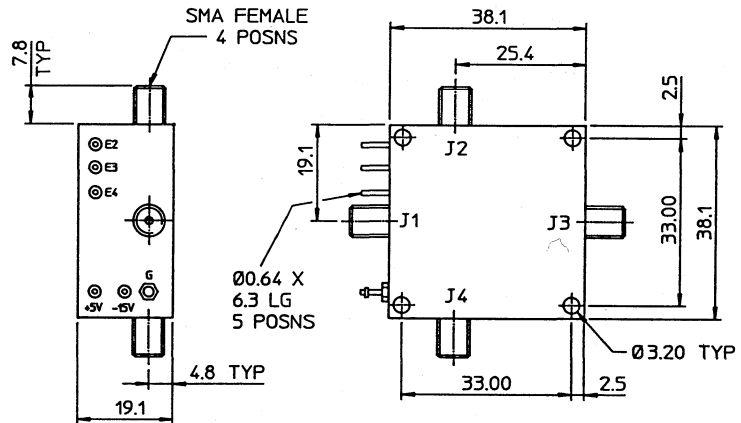
## Outline Drawing

## Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5\text{mm}$   
 X.XX =  $\pm 0.2\text{mm}$

Standard Finish: Matt black paint  
 to DTD 5555A



## NOTES:

- 1) J1 is RF common, J2, J3, J4 are RF input/outputs (non reflective)
- 2) Power supplies required +5V @ 100mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- 3) E2, E3, E4 are independent TTL control inputs. For each channel TTL '0' is Low Loss, TTL '1' is isolation. A decoded control input is available as an option, please contact the factory.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available.
- 6) Transition time is defined as 10% to 90% detected RF.  
Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

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Europe: (44) 1344 869595

North America: 800 366 2266

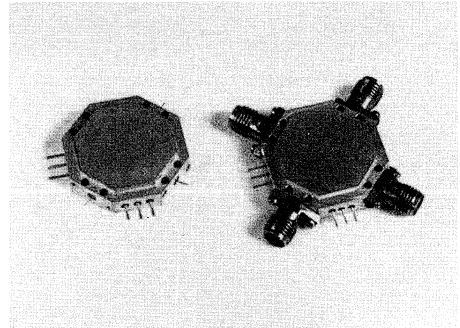
Asia Pacific: (81) 3 3226 1671



**SP3T NON-REFLECTIVE SWITCH**  
**WITH TTL COMPATIBLE DRIVER**  
**0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Miniature Outline
- ◆ Removable Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

The MLM 6520-300D Series of SP3T non-reflective switches from M/A-COM Ltd offers high isolation and low insertion loss in a miniature outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with removable SMA male or female connectors. Without connectors the devices may be integrated directly into microstrip circuits.

**SPECIFICATIONS**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.7	1.4	65	10	30	0.1	0.1	MLM6523-301D
				50	250	1.0	0.5	MLM6523-302D
2.0 - 6.0	2.1	1.6	65	10	30	0.1	0.1	MLM6524-301D
				50	250	1.0	0.5	MLM6524-302D
6.0 - 12.0	2.9	1.8	65	10	30	0.1	0.1	MLM6525-301D
				50	250	1.0	0.5	MLM6525-302D
12.0 - 18.0	3.4	2.0	60	10	30	0.1	0.1	MLM6526-301D
				50	250	1.0	0.5	MLM6526-302D
6.0 - 18.0	3.4	2.0	60	10	30	0.1	0.1	MLM6527-301D
				50	250	1.0	0.5	MLM6527-302D
0.5 - 18.0	3.4	2.0	60	10	30	0.1	0.1	MLM6528-301D
				50	250	1.0	0.5	MLM6528-302D

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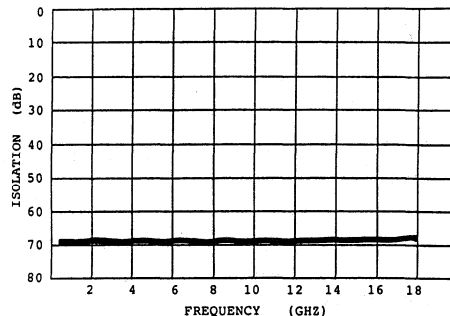
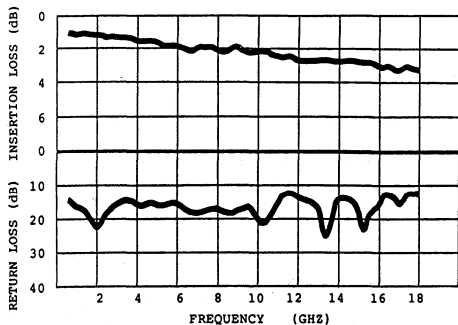
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

## MLM6528-302D



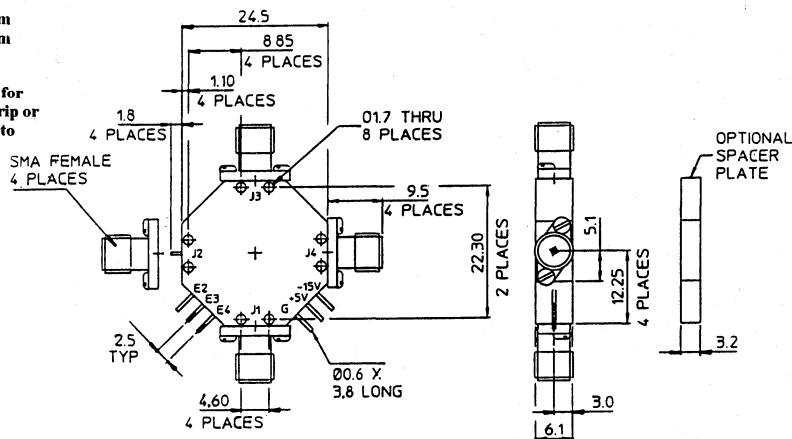
## Outline Drawing

## Third Angle Projection

## All dimensions in mm

Tolerances X.X =  $\pm 0.5\text{mm}$   
X.XX =  $\pm 0.2\text{mm}$

Material: Silver plate to DEF STAN 03/9 for use with microstrip or matt black paint to DTD 5555A



## NOTES:

- 1) J1 is RF common, J2, J3, J4 are RF input/outputs (non reflective)
- 2) Power supplies required +5V @ 100mA maximum, 15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- 3) E2, E3, E4 are independent TTL control inputs. For each channel TTL '0' is Low Loss, TTL '1' is isolation. A decoded control input is available as an option, please contact the factory.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available.
- 6) Transition time is defined as 10% to 90% detected RF.  
Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C.

This data sheet describes a standard range of PIN diode switch modules available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

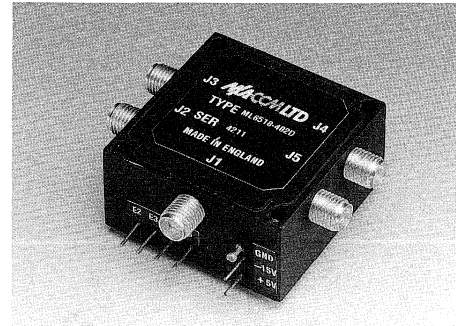
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SP4T REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ High Isolation
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

The ML 6510-400D Series of SP4T switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with SMA male or female connectors. As an option a multiway D connector can be specified for d.c. connections.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.6	1.4	65	10	30	0.1	0.1	ML6513-401D
				50	250	1.0	0.5	ML6513-402D
2.0 - 6.0	2.0	1.6	65	10	30	0.1	0.1	ML6514-401D
				50	250	1.0	0.5	ML6514-402D
6.0 - 12.0	2.7	1.8	65	10	30	0.1	0.1	ML6515-401D
				50	250	1.0	0.5	ML6515-402D
12.0 - 18.0	3.1	2.0	60	10	30	0.1	0.1	ML6516-401D
				50	250	1.0	0.5	ML6516-402D
6.0 - 18.0	3.1	2.0	60	10	30	0.1	0.1	ML6517-401D
				50	250	1.0	0.5	ML6517-402D
0.5 - 18.0	3.1	2.0	60	10	30	0.1	0.1	ML6518-401D
				50	250	1.0	0.5	ML6518-402D

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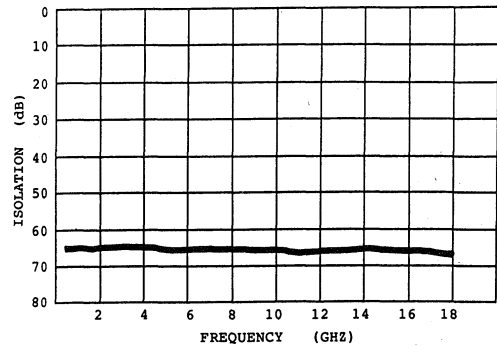
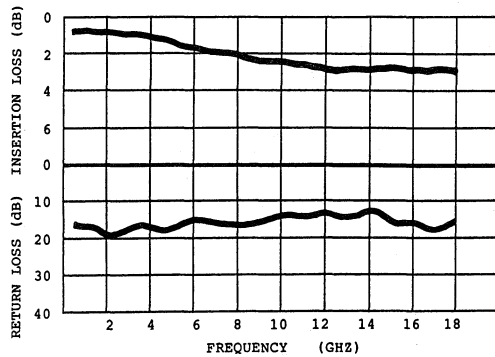
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

### ML6518-402D



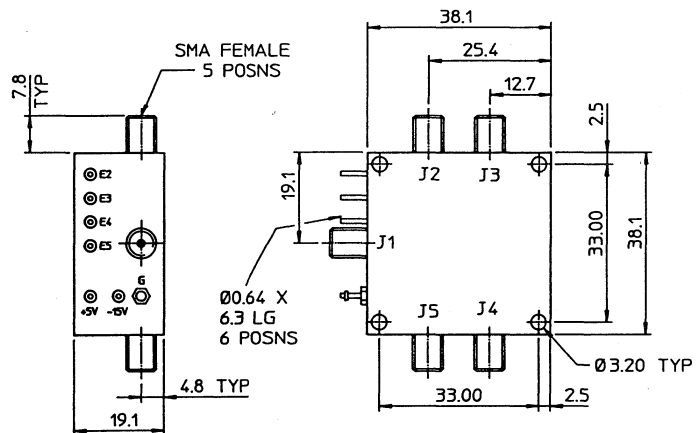
## Outline Drawing

### Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Standard Finish: Matt Black  
to DTD 5555A



### NOTES:

- J1 is RF common, J2, J3, J4, J5 are RF input/outputs.
- Power supplies required +5V @ 120mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- E2, E3, E4, E5 are independent TTL control inputs. For each channel TTL '0' is low loss, TTL '1' is isolation. A decoded control input is available as an option, please contact the factory.
- TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- Any combination of SMA male/female connectors is available.
- Transition time is defined as 10% to 90% detected RF  
Switching time is defined as 50% TTL to 90% detected RF
- Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

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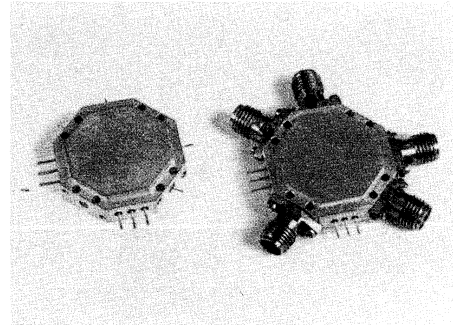
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SP4T REFLECTIVE SWITCH**  
**WITH TTL COMPATIBLE DRIVER**  
**0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Miniature Outline
- ◆ Removable Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

The MLM 6510-400D Series of SP4T switches from M/A-COM Ltd offers high isolation and low insertion loss in a miniature outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with removable SMA male or female connectors. Without connectors the devices may be integrated directly into microstrip circuits.

**SPECIFICATIONS**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.6	1.4	65	10	30	0.1	0.1	MLM6513-401D
				50	250	1.0	0.5	MLM6513-402D
2.0 - 6.0	2.0	1.6	65	10	30	0.1	0.1	MLM6514-401D
				50	250	1.0	0.5	MLM6514-402D
6.0 - 12.0	2.7	1.8	65	10	30	0.1	0.1	MLM6515-401D
				50	250	1.0	0.5	MLM6515-402D
12.0 - 18.0	3.1	2.0	60	10	30	0.1	0.1	MLM6516-401D
				50	250	1.0	0.5	MLM6516-402D
6.0 - 18.0	3.1	2.0	60	10	30	0.1	0.1	MLM6517-401D
				50	250	1.0	0.5	MLM6517-402D
0.5 - 18.0	3.1	2.0	60	10	30	0.1	0.1	MLM6518-401D
				50	250	1.0	0.5	MLM6518-402D

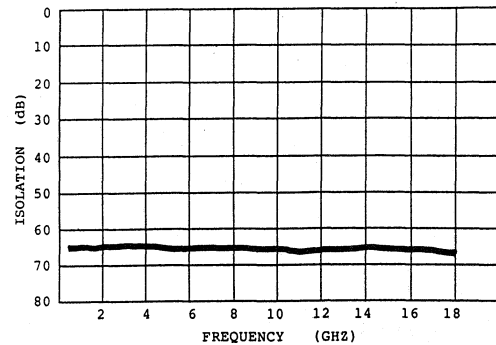
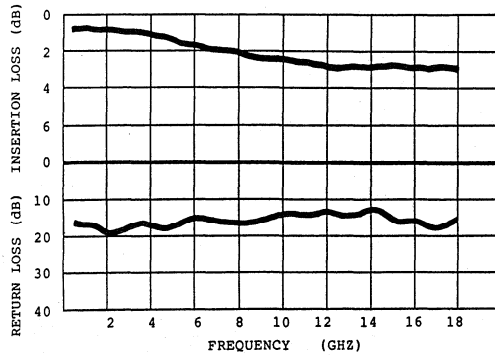
M/A-COM Ltd, Humphys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance MLM6518-402D



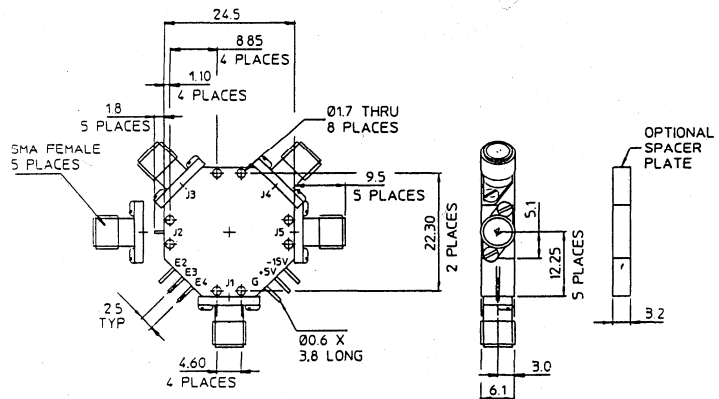
## Outline Drawing

Third Angle Projection

All dimensions in mm

Tolerances X.X = ±0.5mm  
X.XX = ±0.2mm

Standard Finish: Silver plate to Def Stan 03/9 for use with microstrip or matt black to DTD 5555A



## NOTES:

- J1 is RF common, J2, J3, J4, J5 are RF input/outputs.
- Power supplies required +5V @ 120mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- E2, E3, E4 are decoded TTL control inputs, truth table as below:

E2	E3	E4	RF Port to J1
0	1	1	J2
1	0	1	J3
0	0	1	J4
1	1	0	J5
1	1	1	None (all isolating)
- TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- Any combination of SMA male/female connectors is available.
- Transition time is defined as 10% to 90% detected RF. Switching time is defined as 50% TTL to 90% detected RF
- Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

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Europe: (44) 1344 869595

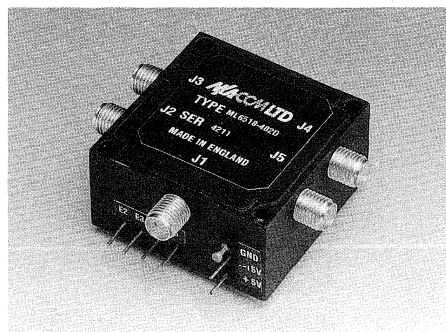
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SP4T NON-REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ High Isolation
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

The ML 6520-400D Series of SP4T non-reflective switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with SMA male or female connectors. As an option a multiway D connector can be specified for d.c. connection.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.9	1.4	65	10	30	0.1	0.1	ML6523-401D
				50	250	1.0	0.5	ML6523-402D
2.0 - 6.0	2.3	1.6	65	10	30	0.1	0.1	ML6524-401D
				50	250	1.0	0.5	ML6524-402D
6.0 - 12.0	3.1	1.8	65	10	30	0.1	0.1	ML6525-401D
				50	250	1.0	0.5	ML6525-402D
12.0 - 18.0	3.6	2.0	60	10	30	0.1	0.1	ML6526-401D
				50	250	1.0	0.5	ML6526-402D
6.0 - 18.0	3.6	2.0	60	10	30	0.1	0.1	ML6527-401D
				50	250	1.0	0.5	ML6527-402D
0.5 - 18.0	3.6	2.0	60	10	30	0.1	0.1	ML6528-401D
				50	250	1.0	0.5	ML6528-402D

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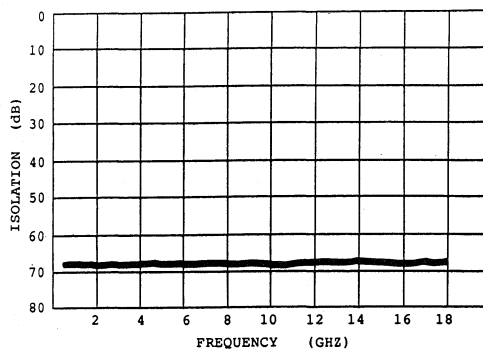
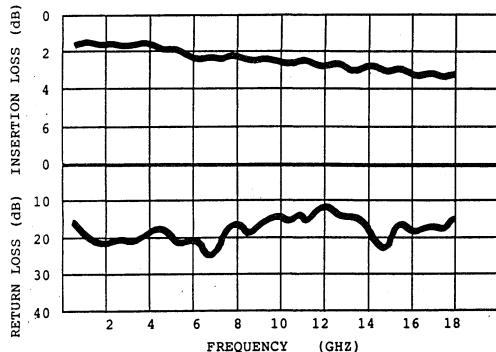
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

## ML6528-402D



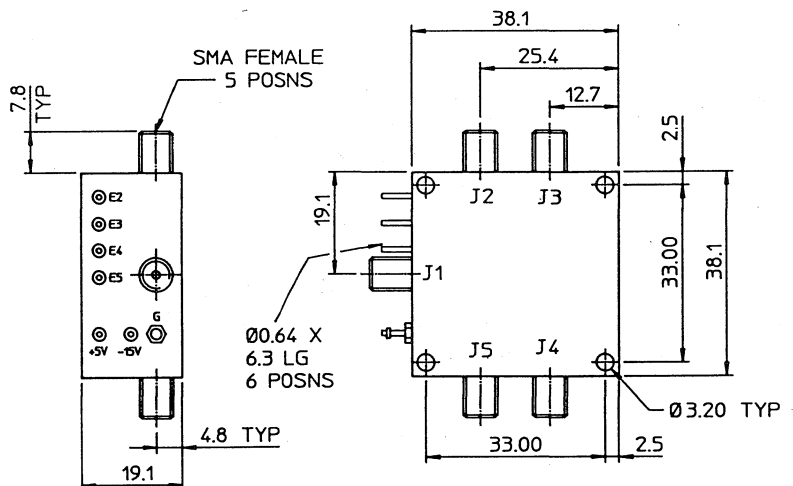
## Outline Drawing

## Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Standard Finish: Matt black paint  
to DTD 5555A



## NOTES:

- 1) J1 is RF common, J2, J3, J4, J5 are RF input/outputs (non reflective)
- 2) Power supplies required +5V @ 120mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- 3) E2, E3, E4, E5 are independent TTL control inputs. For each channel TTL '0' is low loss, TTL '1' is isolation. A decoded control input is available as an option, please consult the factory.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available.
- 6) Transition time is defined as 10% to 90% detected RF  
Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

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Europe: (44) 1344 869595

North America: 800 366 2266

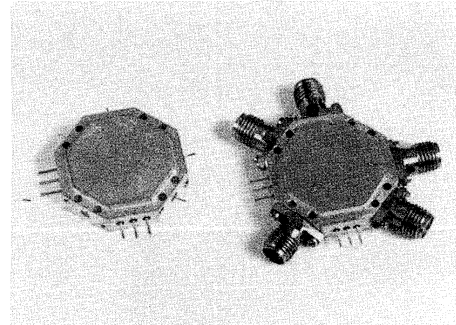
Asia Pacific: (81) 3 3226 1671



**SP4T NON-REFLECTIVE SWITCH**  
**WITH TTL COMPATIBLE DRIVER**  
**0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Miniature Outline
- ◆ Removable Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

The MLM 6520-400D Series of SP4T non-reflective switches from M/A-COM Ltd offers high isolation and low insertion loss in a miniature outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with removable SMA male or female connectors. Without connectors the devices may be integrated directly into microstrip circuits.

**SPECIFICATIONS**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.9	1.4	65	10	30	0.1	0.1	MLM6523-401D
				50	250	1.0	0.5	MLM6523-402D
2.0 - 6.0	2.3	1.6	65	10	30	0.1	0.1	MLM6524-401D
				50	250	1.0	0.5	MLM6524-402D
6.0 - 12.0	3.1	1.8	65	10	30	0.1	0.1	MLM6525-401D
				50	250	1.0	0.5	MLM6525-402D
12.0 - 18.0	3.6	2.0	60	10	30	0.1	0.1	MLM6526-401D
				50	250	1.0	0.5	MLM6526-402D
6.0 - 18.0	3.6	2.0	60	10	30	0.1	0.1	MLM6527-401D
				50	250	1.0	0.5	MLM6527-402D
0.5 - 18.0	3.6	2.0	60	10	30	0.1	0.1	MLM6528-401D
				50	250	1.0	0.5	MLM6528-402D

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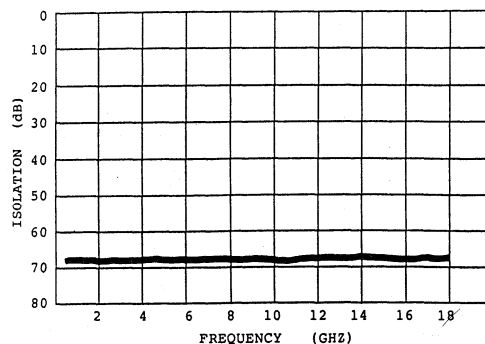
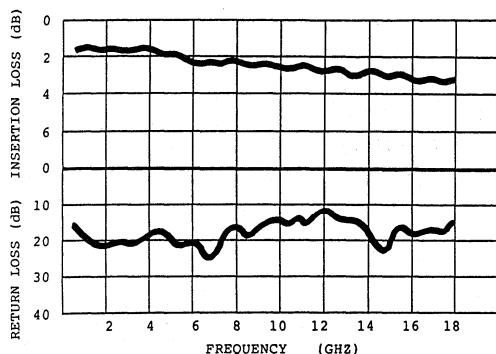
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

## MLM6528-402D



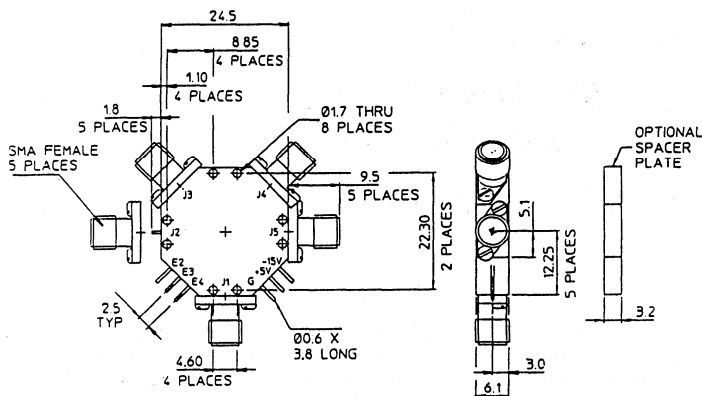
## Outline Drawing

## Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5\text{mm}$   
 X.XX =  $\pm 0.2\text{mm}$

Standard Finish: Silver plate to Def Stan 03/9 for use with microstrip or matt black paint to DTD 5555A



## NOTES:

- 1) J1 is RF common, J2, J3, J4, J5 are RF input/outputs (non reflective)
- 2) Power supplies required +5V @ 120mA maximum, -15V @ 50mA maximum.  
Other combinations available on request, please contact the factory for further details.
- 3) E2, E3, E4 are decoded TTL control inputs, truth table as below:
 

E2	E3	E4	RF Port to J1
0	1	1	J2
1	0	1	J3
0	0	1	J4
1	1	0	J5
1	1	1	None (All isolating)
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available.
- 6) Transition time is defined as 10% to 90% detected RF Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

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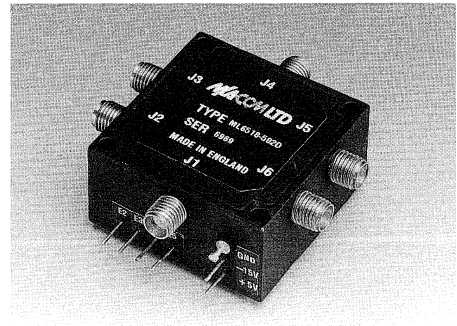
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

SP5T REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz

FEATURES

- ◆ Broad Frequency Ranges
- ◆ High Isolation
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



DESCRIPTION

The ML 6510-500D Series of SP5T switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with SMA male or female connectors. As an option a multiway D connector can be specified for d.c. connections.

SPECIFICATIONS @ +25°C

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.8	1.4	65	10	30	0.1	0.1	ML6513-501D
				50	250	1.0	0.5	ML6513-502D
2.0 - 6.0	2.2	1.6	65	10	30	0.1	0.1	ML6514-501D
				50	250	1.0	0.5	ML6514-502D
6.0 - 12.0	2.9	1.8	65	10	30	0.1	0.1	ML6515-501D
				50	250	1.0	0.5	ML6515-502D
12.0 - 18.0	3.3	2.0	60	10	30	0.1	0.1	ML6516-501D
				50	250	1.0	0.5	ML6516-502D
6.0 - 18.0	3.3	2.0	60	10	30	0.1	0.1	ML6517-501D
				50	250	1.0	0.5	ML6517-502D
0.5 - 18.0	3.3	2.0	60	10	30	0.1	0.1	ML6518-501D
				50	250	1.0	0.5	ML6518-502D

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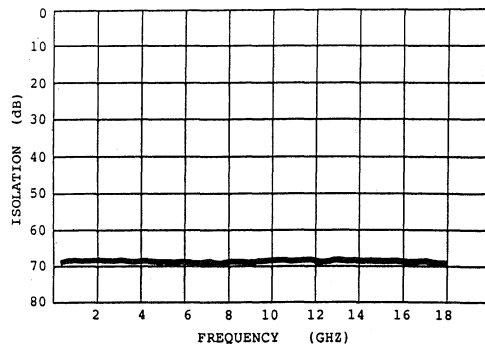
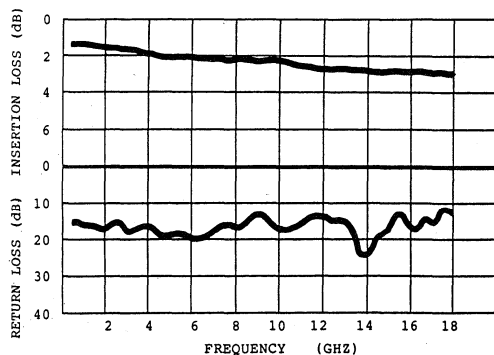
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

### ML6518-502D



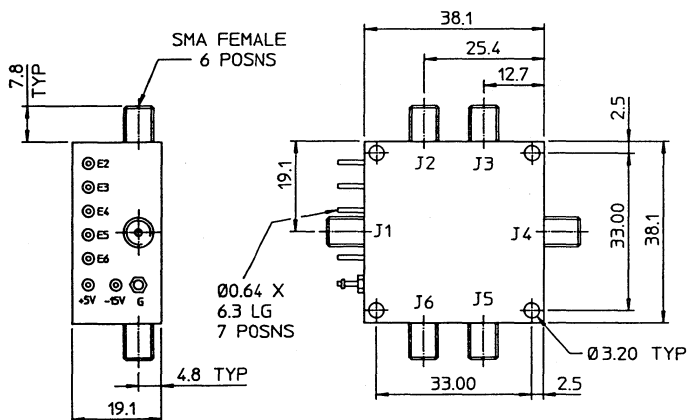
## Outline Drawing

### Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Standard Finish: Matt black paint  
to DTD 5555A



### NOTES:

- 1) J1 is RF common, J2, J3, J4, J5, J6 are RF input/outputs.
- 2) Power supplies required +5V @ 140mA maximum, -15V @ 50mA maximum.  
Other combinations available on request, please contact the factory for further details.
- 3) E2, E3, E4, E5, E6 are independent TTL control inputs. For each channel TTL '0' is low loss, TTL '1' is isolation. A decoded control input is available as an option, please contact the factory.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available.
- 6) Transition time is defined as 10% to 90% detected RF  
Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

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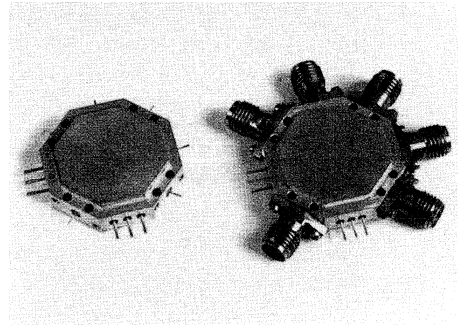
Asia Pacific: (81) 3 3226 1671

**SP5T REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER**

**0.5 TO 18.0 GHz**

**FEATURES**

- ◆ **Broad Frequency Ranges**
- ◆ **Miniature Outline**
- ◆ **Removable Connectors**
- ◆ **Hermetically Sealed**
- ◆ **TTL Compatible**


**DESCRIPTION**

The MLM 6510-500D Series of SP5T switches from M/A-COM Ltd offers high isolation and low insertion loss in a miniature outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with removable SMA male or female connectors. Without connectors the devices may be integrated directly into microstrip circuits.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.8	1.4	65	10	30	0.1	0.1	MLM6513-501D
				50	250	1.0	0.5	MLM6513-502D
2.0 - 6.0	2.2	1.6	65	10	30	0.1	0.1	MLM6514-501D
				50	250	1.0	0.5	MLM6514-502D
6.0 - 12.0	2.9	1.8	65	10	30	0.1	0.1	MLM6515-501D
				50	250	1.0	0.5	MLM6515-502D
12.0 - 18.0	3.3	2.0	60	10	30	0.1	0.1	MLM6516-501D
				50	250	1.0	0.5	MLM6516-502D
6.0 - 18.0	3.3	2.0	60	10	30	0.1	0.1	MLM6517-501D
				50	250	1.0	0.5	MLM6517-502D
0.5 - 18.0	3.3	2.0	60	10	30	0.1	0.1	MLM6518-501D
				50	250	1.0	0.5	MLM6518-502D

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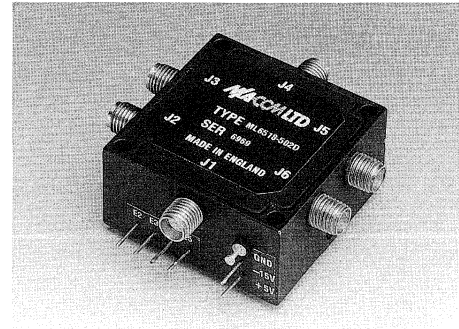
Asia Pacific: (81) 3 3226 1671



**SP5T NON-REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ **Broad Frequency Ranges**
- ◆ **High Isolation**
- ◆ **SMA Connectors**
- ◆ **Hermetically Sealed**
- ◆ **TTL Compatible**



**DESCRIPTION**

The ML 6520-500D Series of SP5T non-reflective switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with SMA male or female connectors. As an option a multiway D connector can be specified for d.c. connections.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	2.1	1.4	65	10	30	0.1	0.1	ML6523-501D
				50	250	1.0	0.5	ML6523-502D
2.0 - 6.0	2.5	1.6	65	10	30	0.1	0.1	ML6524-501D
				50	250	1.0	0.5	ML6524-502D
6.0 - 12.0	3.3	1.8	65	10	30	0.1	0.1	ML6525-501D
				50	250	1.0	0.5	ML6525-502D
12.0 - 18.0	3.8	2.0	60	10	30	0.1	0.1	ML6526-501D
				50	250	1.0	0.5	ML6526-502D
6.0 - 18.0	3.8	2.0	60	10	30	0.1	0.1	ML6527-501D
				50	250	1.0	0.5	ML6527-502D
0.5 - 18.0	3.8	2.0	60	10	30	0.1	0.1	ML6528-501D
				50	250	1.0	0.5	ML6528-502D

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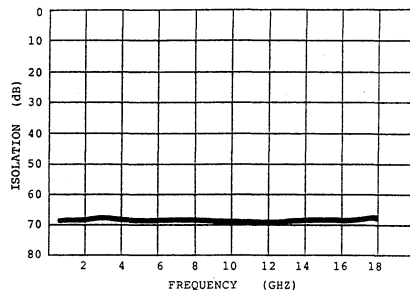
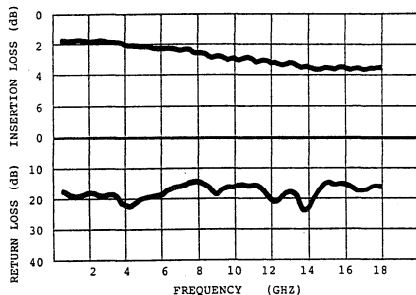
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

### ML6528-502D



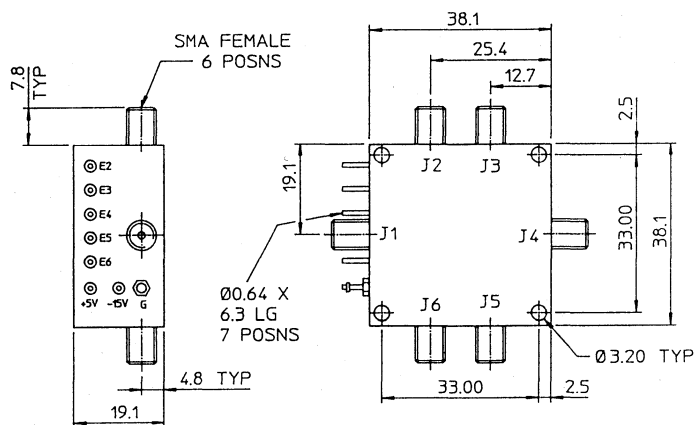
## Outline Drawing

### Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Standard Finish: Matt black to  
DTD 5555A



### NOTES:

- 1) J1 is RF common, J2, J3, J4, J5, J6 are RF input/outputs (non reflective).
- 2) Power supplies required +5V @ 140mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- 3) E2, E3, E4, E5, E6 are independent TTL control inputs. For each channel TTL '0' is low loss, TTL '1' is isolation. A decoded control input is available as an option, please contact the factory.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available.
- 6) Transition time is defined as 10% to 90% detected RF  
Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

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North America: 800 366 2266

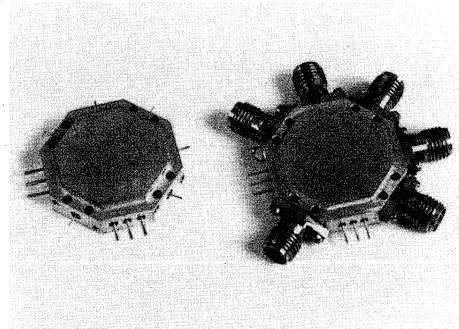
Asia Pacific: (81) 3 3226 1671



**SP5T NON-REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ **Broad Frequency Ranges**
- ◆ **Miniature Outline**
- ◆ **Removable Connectors**
- ◆ **Hermetically Sealed**
- ◆ **TTL Compatible**



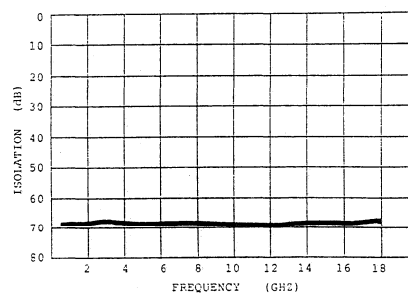
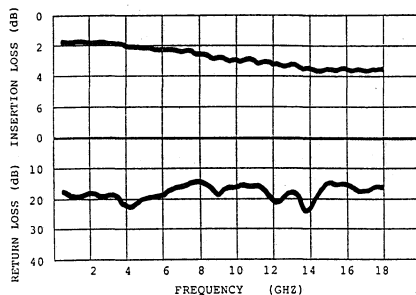
**DESCRIPTION**

The MLM 6520-500D Series of SP5T non-reflective switches from M/A-COM Ltd offers high isolation and low insertion loss in a miniature outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with removable SMA male or female connectors. Without connectors the devices may be integrated directly into microstrip circuits.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	2.1	1.4	65	10	30	0.1	0.1	MLM6523-501D
				50	250	1.0	0.5	MLM6523-502D
2.0 - 6.0	2.5	1.6	65	10	30	0.1	0.1	MLM6524-501D
				50	250	1.0	0.5	MLM6524-502D
6.0 - 12.0	3.3	1.8	65	10	30	0.1	0.1	MLM6525-501D
				50	250	1.0	0.5	MLM6525-502D
12.0 - 18.0	3.8	2.0	60	10	30	0.1	0.1	MLM6526-501D
				50	250	1.0	0.5	MLM6526-502D
6.0 - 18.0	3.8	2.0	60	10	30	0.1	0.1	MLM6527-501D
				50	250	1.0	0.5	MLM6527-502D
0.5 - 18.0	3.8	2.0	60	10	30	0.1	0.1	MLM6528-502D
				50	250	1.0	0.5	MLM6528-502D

## Typical Performance MLM6528-502D



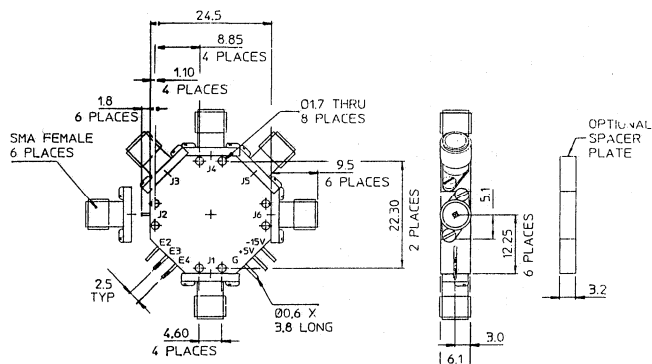
## Outline Drawing

### Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Standard Finish: Silver plate to Def Stan 03/9 for use with microstrip or matt black to DTD 5555A



## NOTES:

- J1 is RF common, J2, J3, J4, J5, J6 are RF input/outputs (non reflective).
- Power supplies required +5V @ 140mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- E2, E3, E4 are decoded TTL control inputs, truth table as below:
 

E2	E3	E4	RF Port to J1
0	1	1	J2
1	0	1	J3
0	0	1	J4
1	1	0	J5
0	1	0	J6
1	1	1	None (All isolating)
- TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- Any combination of SMA male/female connectors is available.
- Transition time is defined as 10% to 90% detected RF. Switching time is defined as 50% TTL to 90% detected RF
- Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

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Europe: (44) 1344 869595

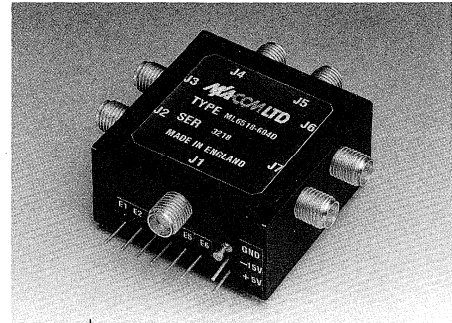
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SP6T REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ High Isolation
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

The ML 6510-600D Series of SP6T switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with either SMA male or female connectors and solder pins for d.c. connections as standard. As an option a multiway D connector can be specified for d.c. connections.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	2.0	1.4	65	10	30	0.1	0.1	ML6513-601D
				50	250	1.0	0.5	ML6513-602D
2.0 - 6.0	2.4	1.6	65	10	30	0.1	0.1	ML6514-601D
				50	250	1.0	0.5	ML6514-602D
6.0 - 12.0	3.1	1.8	65	10	30	0.1	0.1	ML6515-601D
				50	250	1.0	0.5	ML6515-602D
12.0 - 18.0	3.5	2.0	60	10	30	0.1	0.1	ML6516-601D
				50	250	1.0	0.5	ML6516-602D
6.0 - 18.0	3.5	2.0	60	10	30	0.1	0.1	ML6517-601D
				50	250	1.0	0.5	ML6517-602D
0.5 - 18.0	3.5	2.0	60	10	30	0.1	0.1	ML6518-601D
				50	250	1.0	0.5	ML6518-602D

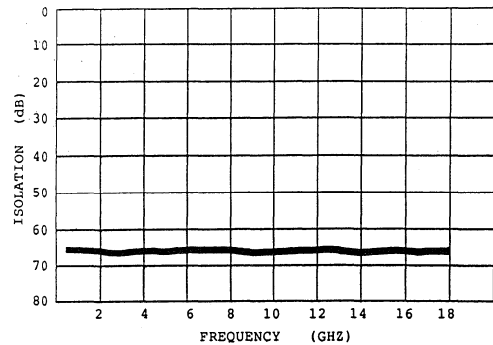
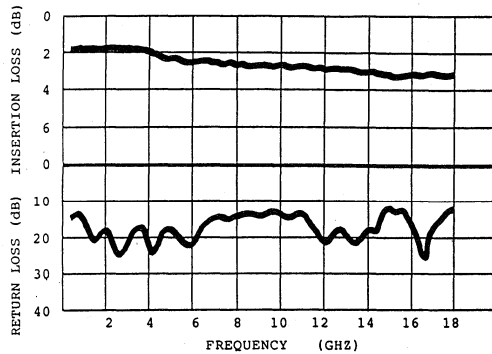
M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**ML6518-601D**



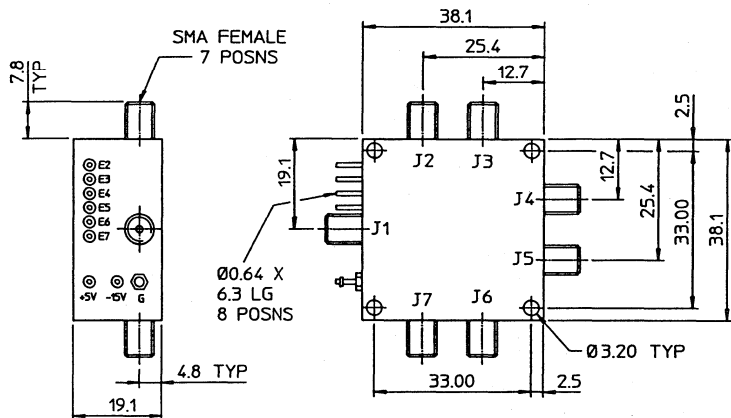
**Outline Drawing**

Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
 X.XX =  $\pm 0.2$ mm

Standard Finish: Matt black  
 paint to  
 DTD 5555A



**NOTES:**

- 1) J1 is RF common, J2, J3, J4, J5, J6 J7 are RF input/outputs.
- 2) Power supplies required +5V @ 160mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- 3) E2, E3, E4, E5, E6, E7 are independent TTL control inputs. For each channel TTL '0' is Low Loss, TTL '1' is isolation. A decoded control input is available as an option, please contact the factory.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available, please contact the factory.
- 6) Transition time is defined as 10% to 90% detected RF. Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
 Storage temperature -55°C to +125°C

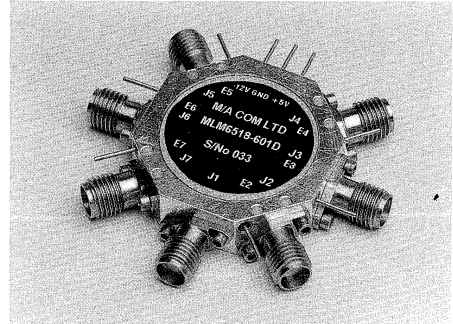
This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

**All specifications subject to change without notice.**

SP6T REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz

FEATURES

- ◆ Broad Frequency Ranges
- ◆ Miniature Outline
- ◆ Removable Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



DESCRIPTION

The MLM 6510-600D Series of SP6T switches from M/A-COM Ltd offers high isolation and low insertion loss in a miniature outline. All the switches have integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with removable SMA male or female connectors and solder pins for d.c. connections as standard. Without connectors the devices may be integrated directly into microstrip circuits.

SPECIFICATIONS @ +25°C

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	2.0	1.4	65	10	30	0.1	0.1	MLM6513-601D
				50	250	1.0	0.5	MLM6513-602D
2.0 - 6.0	2.4	1.6	65	10	30	0.1	0.1	MLM6514-601D
				50	250	1.0	0.5	MLM6514-602D
6.0 - 12.0	3.1	1.8	65	10	30	0.1	0.1	MLM6515-601D
				50	250	1.0	0.5	MLM6515-602D
12.0 - 18.0	3.5	2.0	60	10	30	0.1	0.1	MLM6516-601D
				50	250	1.0	0.5	MLM6516-602D
6.0 - 18.0	3.5	2.0	60	10	30	0.1	0.1	MLM6517-601D
				50	250	1.0	0.5	MLM6517-602D
0.5 - 18.0	3.5	2.0	60	10	30	0.1	0.1	MLM6518-601D
				50	250	1.0	0.5	MLM6518-602D

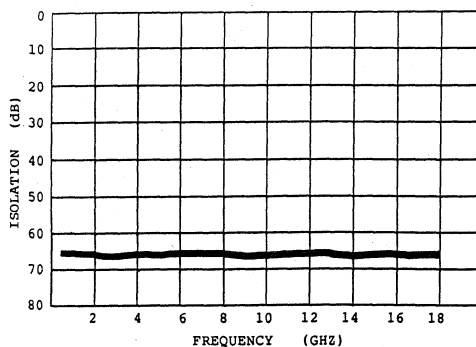
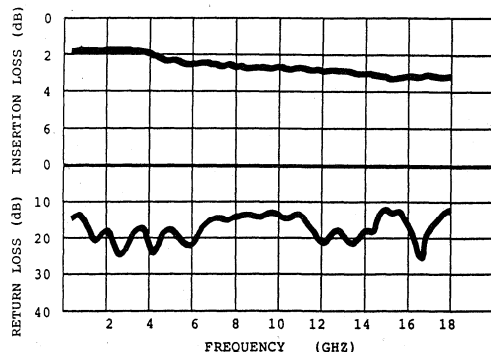
M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**MLM6518-601D**

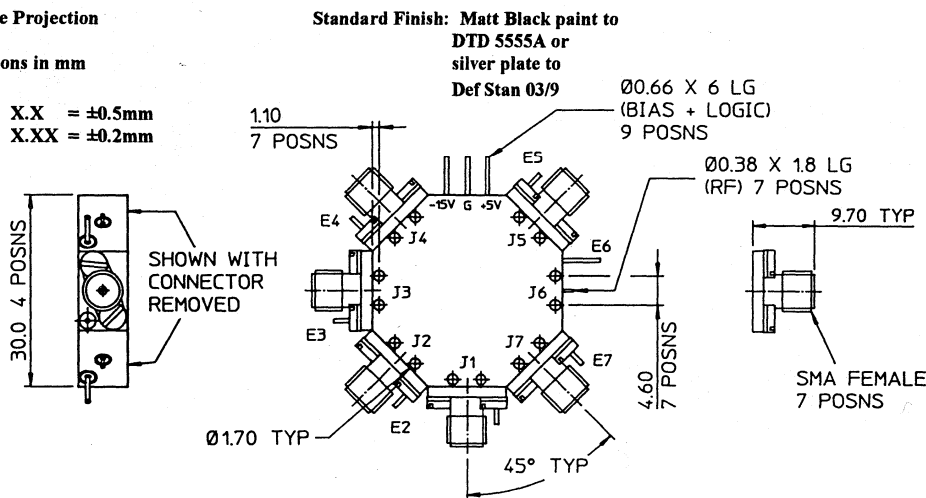


**Outline Drawing**

Third Angle Projection

All dimensions in mm

Tolerances X.X = ±0.5mm  
 X.XX = ±0.2mm



**NOTES:**

- 1) J1 is RF common, J2, J3, J4, J5, J6, J7 are RF input/outputs.
- 2) Power supplies required +5V @ 160mA maximum, -15V @ 50mA maximum.  
 Other combinations available on request, please contact the factory for further details.
- 3) E2, E3, E4, E5, E6, E7 are independent TTL control inputs. For each channel TTL '0' is Low Loss, TTL '1' is isolation.  
 A decoded control input is available as an option, please contact the factory.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available, please contact the factory.
- 6) Transition time is defined as 10% to 90% detected RF  
 Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
 Storage temperature -55°C to +125°C

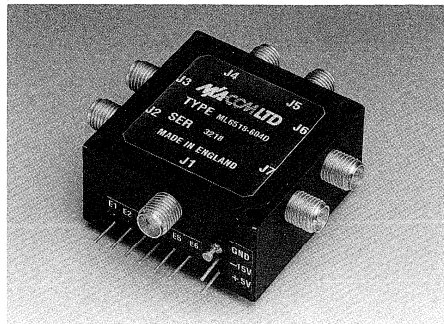
This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

**All specifications subject to change without notice.**

**SP6T NON-REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ High Isolation
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

The ML 6520-600D Series of SP6T non-reflective switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with standard SMA male or female connectors and solder pins for d.c. connections as standard. As an option a multiway D connector can be specified for d.c. connections.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	2.3	1.4	65	10	30	0.1	0.1	ML6523-601D
				50	250	1.0	0.5	ML6523-602D
2.0 - 6.0	2.7	1.6	65	10	30	0.1	0.1	ML6524-601D
				50	250	1.0	0.5	ML6524-602D
6.0 - 12.0	3.5	1.8	65	10	30	0.1	0.1	ML6525-601D
				50	250	1.0	0.5	ML6525-602D
12.0 - 18.0	4.0	2.0	60	10	30	0.1	0.1	ML6526-601D
				50	250	1.0	0.5	ML6526-602D
6.0 - 18.0	4.0	2.0	60	10	30	0.1	0.1	ML6527-601D
				50	250	1.0	0.5	ML6527-602D
0.5 - 18.0	4.0	2.0	60	10	30	0.1	0.1	ML6528-601D
				50	250	1.0	0.5	ML6528-602D

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North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

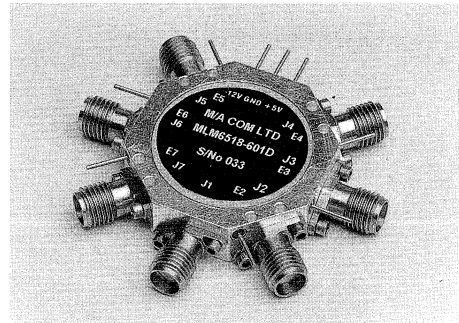




**SP6T NON-REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Miniature Outline
- ◆ Removable Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



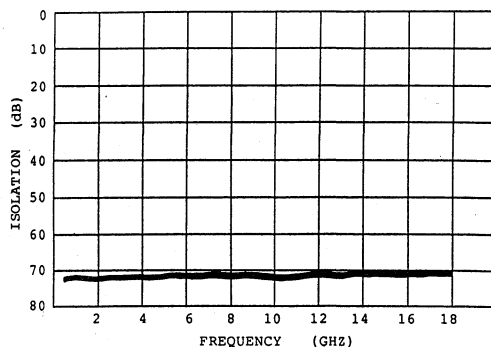
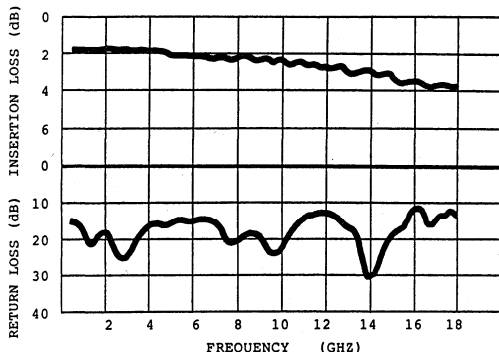
**DESCRIPTION**

The MLM 6520-600D Series of SP6T non-reflective switches from M/A-COM Ltd offers high isolation and low insertion loss in a miniature outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with removable SMA male or female connectors and solder pins for d.c. connections as standard. Without connectors the devices may be integrated directly into microstrip circuits.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	2.3	1.4	65	10	30	0.1	0.1	MLM6523-601D
				50	250	1.0	0.5	MLM6523-602D
2.0 - 6.0	2.7	1.6	65	10	30	0.1	0.1	MLM6524-601D
				50	250	1.0	0.5	MLM6524-602D
6.0 - 12.0	3.5	1.8	65	10	30	0.1	0.1	MLM6525-601D
				50	250	1.0	0.5	MLM6525-602D
12.0 - 18.0	4.0	2.0	60	10	30	0.1	0.1	MLM6526-601D
				50	250	1.0	0.5	MLM6526-602D
6.0 - 18.0	4.0	2.0	60	10	30	0.1	0.1	MLM6527-601D
				50	250	1.0	0.5	MLM6527-602D
0.5 - 18.0	4.0	2.0	60	10	30	0.1	0.1	MLM6528-601D
				50	250	1.0	0.5	MLM6528-602D

**MLM6528-602D**



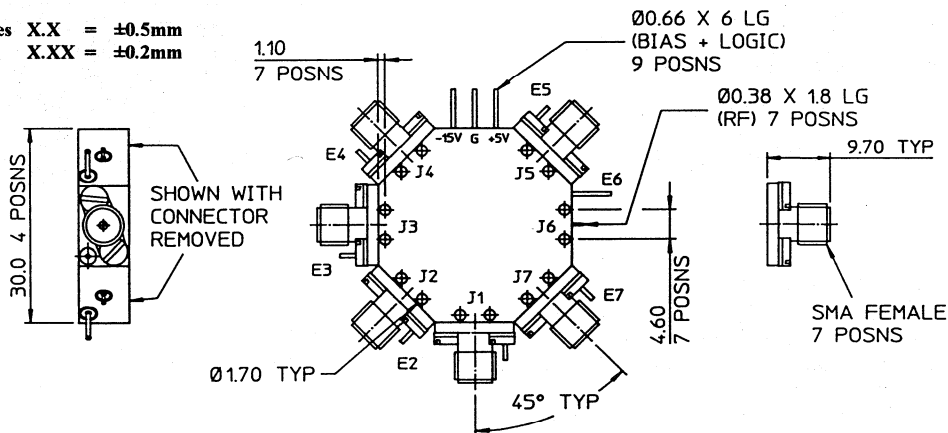
**Outline Drawing**

**Third Angle Projection**

**Standard Finish: Matt black paint to DTD 5555A or Silver Plate to Def Stan 03/9**

All dimensions in mm

Tolerances X.X = ±0.5mm  
 X.XX = ±0.2mm



**NOTES:**

- 1) J1 is RF common, J2, J3, J4, J5, J6, J7 are RF input/outputs (non reflective)
- 2) Power supplies required +5V @ 160mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- 3) E2, E3, E4, E5, E6, E7 are independent TTL control inputs. For each channel TTL '0' is Low Loss, TTL '1' is isolation. A decoded control input is available as an option, please contact the factory.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available, please contact the factory.
- 6) Transition time is defined as 10% to 90% detected RF  
 Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
 Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

**All specifications subject to change without notice.**

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

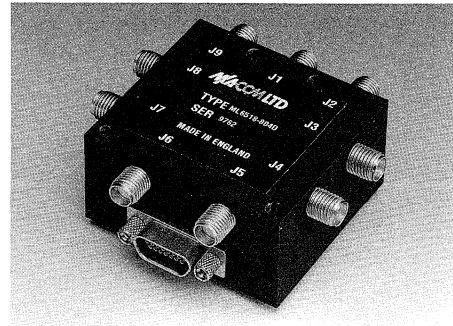
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SP8T REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ High Isolation
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

The ML 6510-800D Series of SP8T switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with either SMA male or female connectors and multiway D connector or optional solder pins for d.c. connections.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	2.4	1.4	65	10	30	0.1	0.1	ML6513-801D
				50	250	1.0	0.5	ML6513-802D
2.0 - 6.0	2.8	1.6	65	10	30	0.1	0.1	ML6514-801D
				50	250	1.0	0.5	ML6514-802D
6.0 - 12.0	3.5	1.8	65	10	30	0.1	0.1	ML6515-801D
				50	250	1.0	0.5	ML6515-802D
12.0 - 18.0	3.9	2.0	60	10	30	0.1	0.1	ML6516-801D
				50	250	1.0	0.5	ML6516-802D
6.0 - 18.0	3.9	2.0	60	10	30	0.1	0.1	ML6517-801D
				50	250	1.0	0.5	ML6517-802D
0.5 - 18.0	3.9	2.0	60	10	30	0.1	0.1	ML6518-801D
				50	250	1.0	0.5	ML6518-802D

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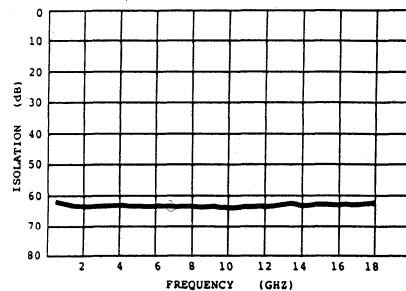
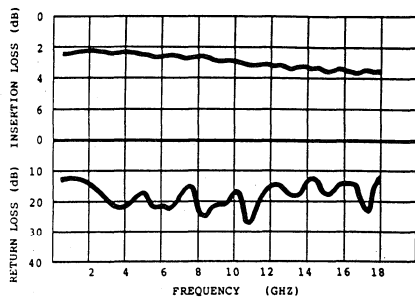
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

REF: DS40-2  
**Typical Performance**  
**ML6518-801D**

ML 6510-800D SERIES



**Outline Drawing**

Third Angle Projection

All dimensions in mm

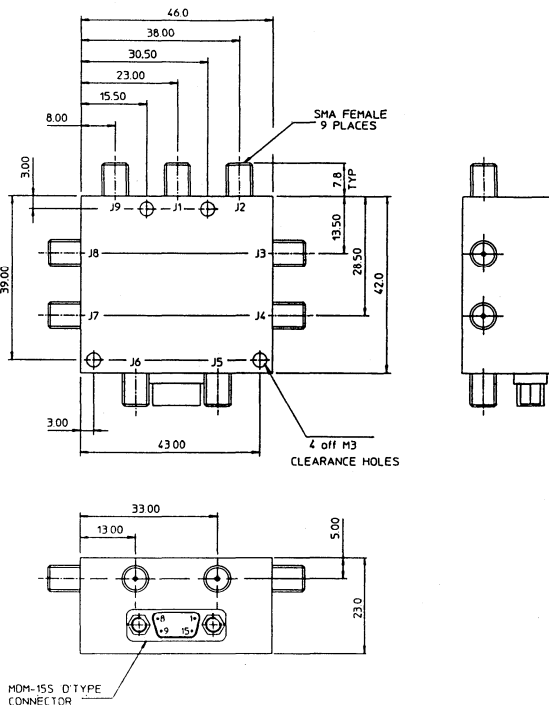
Tolerances X.X =  $\pm 0.5$ mm  
 X.XX =  $\pm 0.2$ mm

Standard Finish:

Matt black paint  
 to DTD 5555A

D Connector Pin Out

Pin Number	Function
1	E2
2	E3
3	E4
4	E5
5	E6
6	E7
7	E8
8	E9
9	+5V
10	Gnd
11	Gnd
12	Gnd
13	Gnd
14	Gnd
15	-15V



**NOTES:**

- 1) J1 is RF common, J2, J3, J4, J5, J6, J7, J8, J9 are RF input/outputs.
- 2) Power supplies required +5V @ 200mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- 3) E2, E3, E4, E5, E6, E7, E8, E9 are independent TTL control inputs. For each channel TTL '0' is Low Loss, TTL '1' is isolation. A decoded control input is available as an option, please contact the factory.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available, please contact the factory.
- 6) Transition time is defined as 10% to 90% detected RF Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
 Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the PIN diode switches available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

**All specifications subject to change without notice.**

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

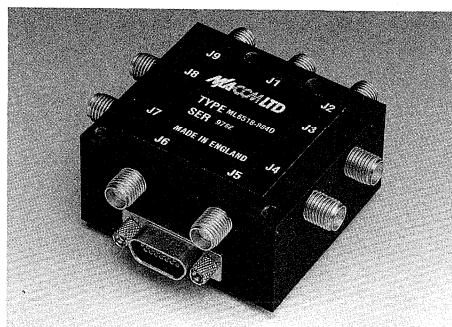
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SP8T NON-REFLECTIVE SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ High Isolation
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



**DESCRIPTION**

The ML 6520-800D Series of SP8T switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with either SMA male or female connectors and multiway D connector or optional solder pins for d.c. connections.

**SPECIFICATIONS @+25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	2.7	1.4	65	10	30	0.1	0.1	ML6523-801D
				50	250	1.0	0.5	ML6523-802D
2.0 - 6.0	3.1	1.6	65	10	30	0.1	0.1	ML6524-801D
				50	250	1.0	0.5	ML6524-802D
6.0 - 12.0	3.9	1.8	65	10	30	0.1	0.1	ML6525-801D
				50	250	1.0	0.5	ML6525-802D
12.0 - 18.0	4.4	2.0	60	10	30	0.1	0.1	ML6526-801D
				50	250	1.0	0.5	ML6526-802D
6.0 - 18.0	4.4	2.0	60	10	30	0.1	0.1	ML6527-801D
				50	250	1.0	0.5	ML6527-802D
0.5 - 18.0	4.4	2.0	60	10	30	0.1	0.1	ML6528-801D
				50	250	1.0	0.5	ML6528-802D

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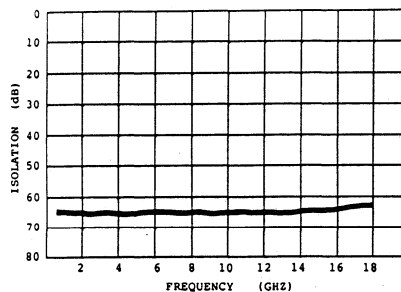
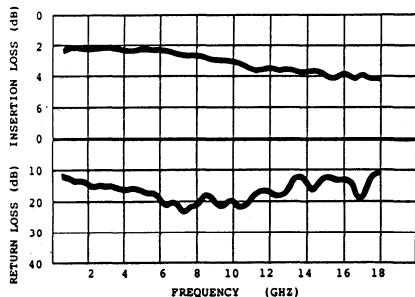
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

REF: DS46-2  
**Typical Performance**  
**ML6528-801D**

ML 6520-800D SERIES



**Outline Drawing**

Third Angle Projection

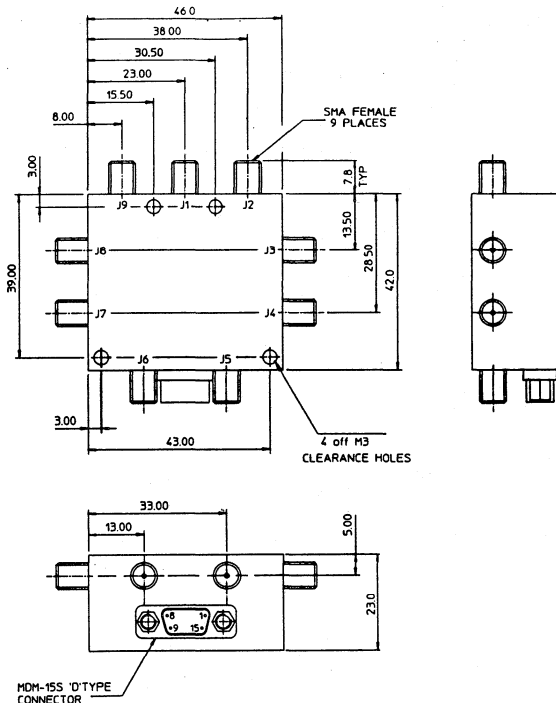
All dimensions in mm

Tolerances X.X =  $\pm 0.5\text{mm}$   
 X.XX =  $\pm 0.2\text{mm}$

Standard Finish: Matt black paint  
 to DTD 5555A

**DC Connector Pin Out**

Pin Number	Function
1	E2
2	E3
3	E4
4	E5
5	E6
6	E7
7	E8
8	E9
9	+5V
10	Gnd
11	Gnd
12	Gnd
13	Gnd
14	Gnd
15	-15V



**NOTES:**

- 1) J1 is RF common, J2, J3, J4, J5, J6, J7, J8, J9 are RF input/outputs (non reflective).
- 2) Power supplies required +5V @ 200mA maximum, -15V @ 50mA maximum. Other combinations available on request, please contact the factory for further details.
- 3) E2, E3, E4, E5, E6, E7, E8, E9 are independent TTL control inputs. For each channel TTL '0' is Low Loss, TTL '1' is isolation. A decoded control input is available as an option, please contact the factory.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available, please contact the factory.
- 6) Transition time is defined as 10% to 90% detected RF Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C. Storage temperature -55°C to +125°C

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Europe: (44) 1344 869595

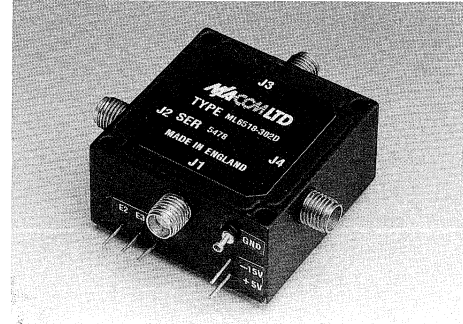
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

DPDT TRANSFER SWITCH  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz

FEATURES

- ◆ Broad Frequency Ranges
- ◆ Low Insertion Loss
- ◆ SMA Connectors
- ◆ Hermetically Sealed
- ◆ TTL Compatible



DESCRIPTION

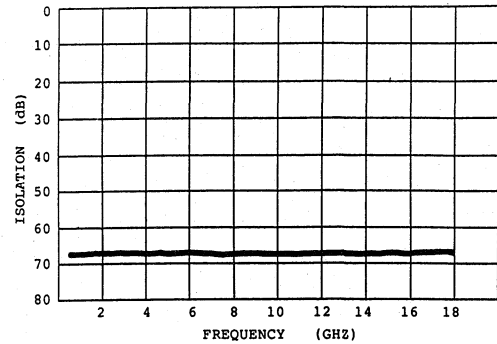
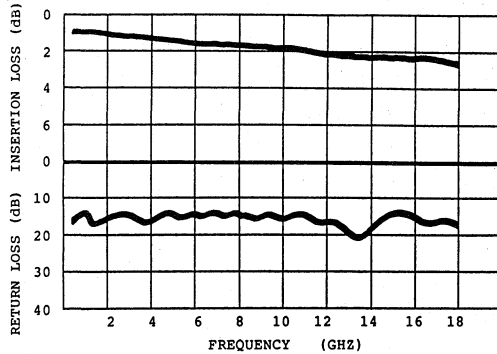
The ML 6560-200D series of DPDT transfer switches from M/A-COM Ltd offers high isolation and low insertion loss in a standard coaxial outline. All the switches have an integral TTL compatible driver with fast switching or higher power handling options available as standard. Devices are supplied with either SMA male or female connectors. As an option a multiway D connector can be specified for d.c. connections.

SPECIFICATIONS @ +25°C

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.2	1.4	65	10	30	0.1	0.1	ML6563-201D
				50	250	1.0	0.5	ML6563-202D
2.0 - 6.0	1.6	1.6	65	10	30	0.1	0.1	ML6564-201D
				50	250	1.0	0.5	ML6564-202D
6.0 - 12.0	2.0	1.8	65	10	30	0.1	0.1	ML6565-201D
				50	250	1.0	0.5	ML6565-202D
12.0 - 18.0	2.5	2.0	60	10	30	0.1	0.1	ML6566-201D
				50	250	1.0	0.5	ML6566-202D
6.0 - 18.0	2.5	2.0	60	10	30	0.1	0.1	ML6567-201D
				50	250	1.0	0.5	ML6567-202D
0.5 - 18.0	2.7	2.0	60	10	30	0.1	0.1	ML6568-201D
				50	250	1.0	0.5	ML6568-202D

## Typical Performance

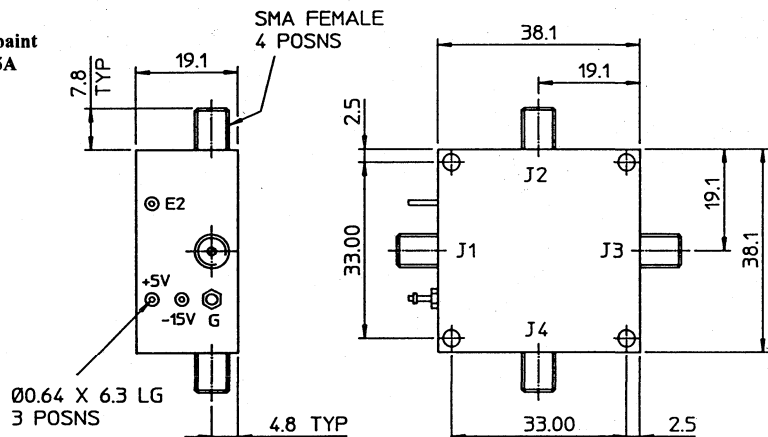
## ML6568-201D



## Outline Drawing

## Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mmX.XX =  $\pm 0.2$ mmStandard Finish: Matt black paint  
to DTD 5555A

## NOTES:

- 1) J1, J3 are RF inputs, J2, J4 are RF outputs.
- 2) Power supplies required +5V @ 120mA maximum, -15V @ 80mA maximum. Other combinations available on request, please contact the factory for further details.
- 3) E2 is TTL control input, TTL '0' J1-J2 and J3-J4 low loss.  
TTL '1' J1-J4 and J3-J2 low loss.
- 4) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V
- 5) Any combination of SMA male/female connectors is available, please consult the factory.
- 6) Transition time is defined as 10% to 90% detected RF.  
Switching time is defined as 50% TTL to 90% detected RF
- 7) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C

All specifications subject to change without notice

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671



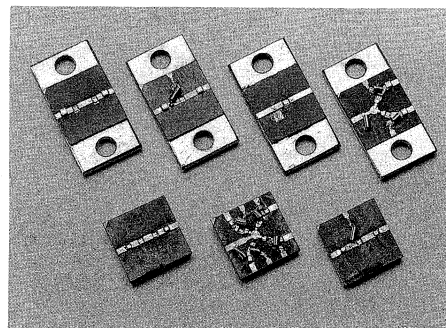
**MICROWAVE COMMON MODULE  
SPST REFLECTIVE SWITCH**

**0.5 TO 18.0 GHz**



**FEATURES**

- ◆ **MiCM 20 Compatible**
- ◆ **Def Stan & CECC Specifications**
- ◆ **Direct 50 ohm Microstrip Interface**
- ◆ **Low Insertion Loss**
- ◆ **Broad Frequency Ranges**



**DESCRIPTION**

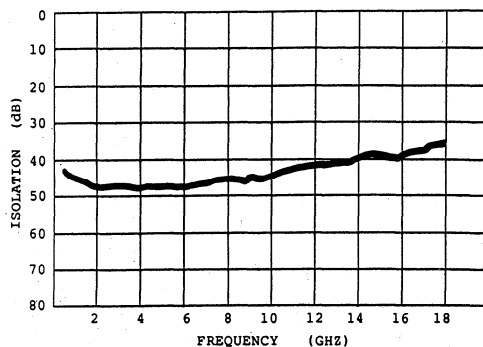
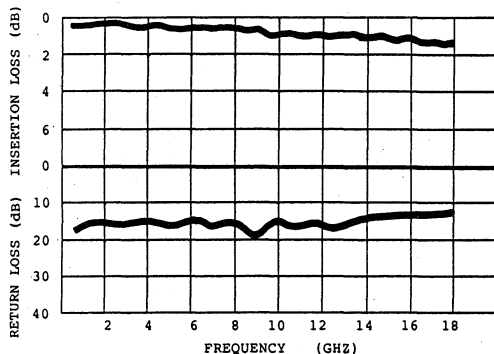
The M/A-COM Ltd range of MiCM SPST switches are miniaturised carrier mounted components providing high isolation, low loss and fast switching speed in the frequency range 0.5 to 18 GHz. Devices provide for direct integration with other MiCM components as well as existing microstrip circuitry. The package styles are compatible with the MiCM 20 standard, DEF STAN 59-90 (Part 1) Microwave Common Modules, Part 1: Interfaces and Fixings for use up to 20 GHz and Draft Basic Specification CECC 00 017 Microwave Common Modules, General Requirements and Interfaces and Fixings for use up to 20 GHz.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	0.5	1.5	40	3	0.5	0.1	ML6593-101
				30	10	2.0	ML6593-102
2.0 - 6.0	0.8	1.6	45	3	0.5	0.1	ML6594-101
				30	10	2.0	ML6594-102
6.0 - 12.0	1.3	1.7	40	3	0.5	0.1	ML6595-101
				30	10	2.0	ML6595-102
12.0 - 18.0	1.7	1.9	35	3	0.5	0.1	ML6596-101
				30	10	2.0	ML6596-102
6.0 - 18.0	1.7	1.9	35	3	0.5	0.1	ML6597-101
				30	10	2.0	ML6597-102
0.5 - 18.0	1.7	1.9	35	3	0.5	0.1	ML6598-101
				30	10	2.0	ML6598-102

## Typical Performance

## ML6598-102



## Outline Drawing - MiCM Type Code S2A2-12F12-2-12-N

Third Angle Projection

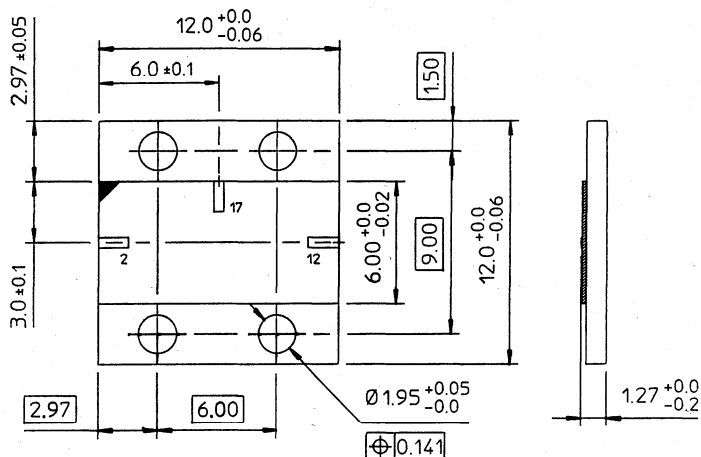
All dimensions in mm

Tolerances X.X =  $\pm 0.2\text{mm}$   
X.XX =  $\pm 0.1\text{mm}$

Carrier Material: Kovar with  
gold plate finish

Substrate Material: RT Duroid 5870

Port	Function
2	RF Input
12	RF Output
17	Bias Input



## NOTES:

- 1) J1 is RF input, J2 is RF output.
- 2) Devices contain internal bias network and dc blocking capacitors on both input and output.
- 3) DC bias requirements +1V @ 50mA typical, +100mA maximum for isolation  
-10V typical, -15V maximum for low loss
- 4) Transition time is defined as 10% to 90% detected RF as measured with standard M/A-COM Ltd driver.
- 5) Flanged package styles have clearance holes for M1.6 screw (maximum head diameter 2.7mm).
- 6) Bonding pads are typically 0.5mm x 0.5mm.
- 7) Case operating temperature -55°C to +85°C
- 8) Storage temperature -55°C to +125°C.
- 9) Maximum solder/epoxy attachment temperature +130°C.

This data sheet describes a standard range of PIN diode switch modules available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance on MiCM compatible devices.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

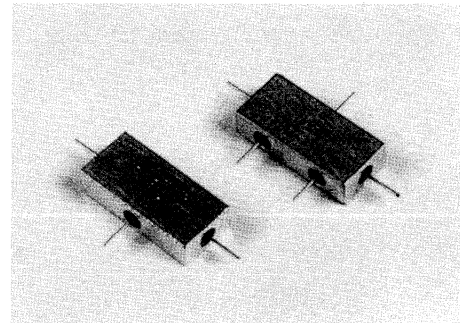
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SPST REFLECTIVE SWITCH MODULE  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Stripline Compatible
- ◆ Compact Outline
- ◆ Hermetic Package
- ◆ Internal Bias Circuitry


**DESCRIPTION**

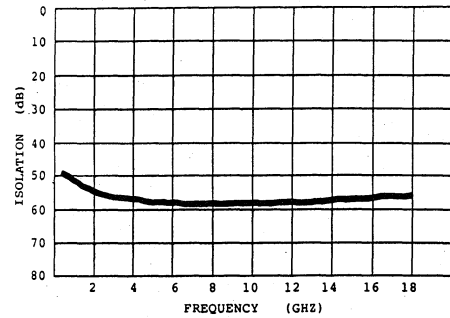
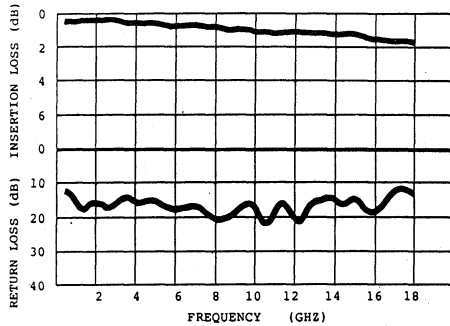
The ML 6530-100 Series of SPST switch modules from M/A-COM Ltd offers high isolation and low insertion loss in a miniature stripline compatible package. Devices are supplied complete with internal bias network and dc blocks to simplify integration into circuits.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	0.6	1.4	45	3	0.5	0.1	ML6533-101
				30	10	2	ML6533-102
2.0 - 6.0	0.9	1.6	55	3	0.5	0.1	ML6534-101
				30	10	2	ML6534-102
6.0 - 12.0	1.5	1.8	55	3	0.5	0.1	ML6535-101
				30	10	2	ML6535-102
12.0 - 18.0	1.9	2.0	55	3	0.5	0.1	ML6536-101
				30	10	2	ML6536-102
6.0 - 18.0	1.9	2.0	55	3	0.5	0.1	ML6537-101
				30	10	2	ML6537-102
0.5 - 18.0	1.9	2.0	45	3	0.5	0.1	ML6538-101
				30	10	2	ML6538-102

## Typical Performance

## ML 6538-102



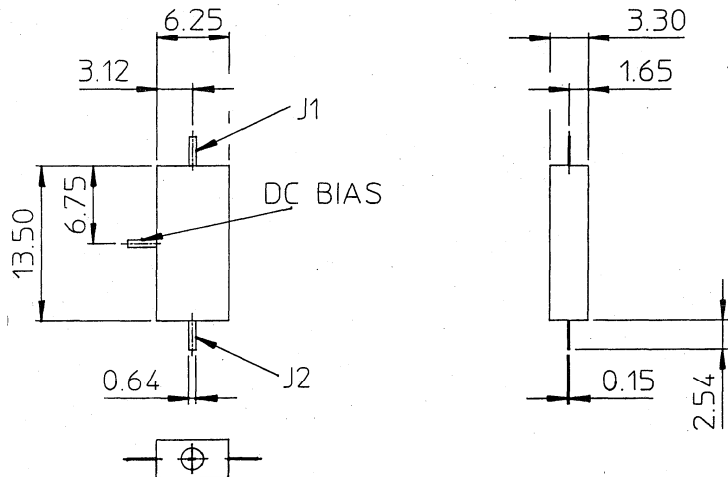
## Outline Drawing

## Third Angle Projection

All dimensions in mm

Tolerances X.X=  $\pm 0.5\text{mm}$   
X.XX =  $\pm 0.2\text{mm}$

Material: Kovar/Glass with  
gold plate finish



## NOTES:

- 1) Devices contain internal bias network and dc blocking capacitors on both input and output.
- 2) DC bias requirements +1V @ 50mA typical, 100mA maximum for isolation  
-10V typical, -15V maximum for low loss
- 3) Transition time is defined as 10% to 90% detected RF as measured with standard M/A-COM Ltd driver.
- 4) Case operating temperature -55°C to +85°C
- 5) Storage temperature -55°C to +125°C

This data sheet describes a standard range of PIN diode switch modules available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

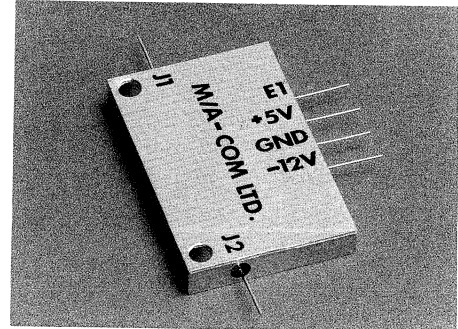
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SPST REFLECTIVE SWITCH MODULE**  
**WITH TTL COMPATIBLE DRIVER**  
**0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Stripline Compatible
- ◆ Compact Outline
- ◆ Hermetic Package
- ◆ TTL Compatible



**DESCRIPTION**

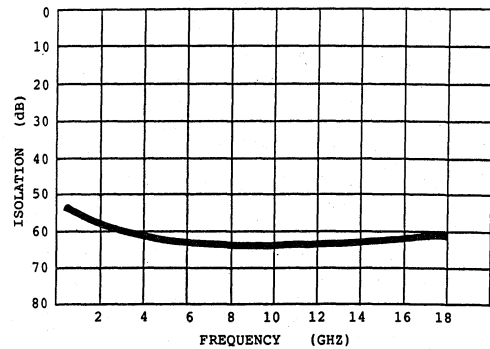
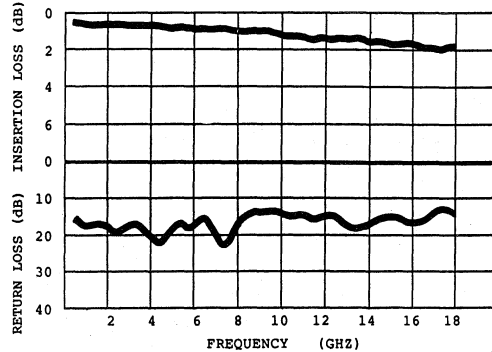
The ML 6530-100D Series of switch modules from M/A-COM Ltd offers high isolation and low insertion loss in a miniature stripline compatible package. All the switches have an integral TTL compatible driver with fast switching or high power handling options available as standard. Control is by single TTL input.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	0.7	1.4	50	3	15	0.5	0.1	ML6533-101D
				30	200	10	2	ML6533-102D
2.0 - 6.0	1.1	1.6	55	3	15	0.5	0.1	ML6534-101D
				30	200	10	2	ML6534-102D
6.0 - 12.0	1.7	1.8	60	3	15	0.5	0.1	ML6535-101D
				30	200	10	2	ML6535-102D
12.0 - 18.0	2.1	2.0	60	3	15	0.5	0.1	ML6536-101D
				30	200	10	2	ML6536-102D
6.0 - 18.0	2.1	2.0	60	3	15	0.5	0.1	ML6537-101D
				30	200	10	2	ML6537-102D
0.5 - 18.0	2.1	2.0	50	3	15	0.5	0.1	ML6538-101D
				30	200	10	2	ML6538-102D

## Typical Performance

### ML 6538-102D



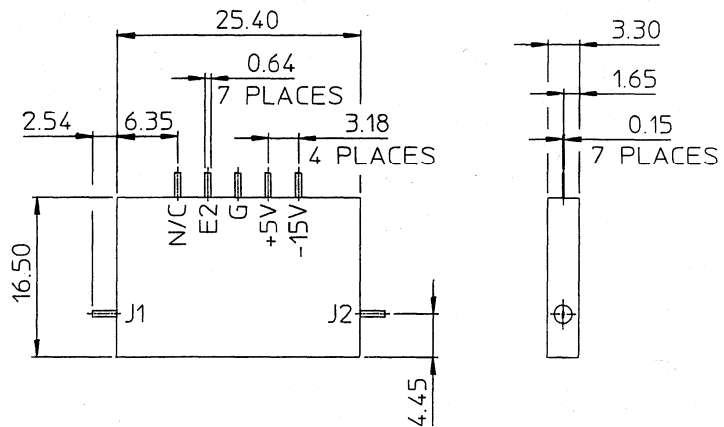
## Outline Drawing

Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5\text{mm}$   
X.XX =  $\pm 0.2\text{m}$

Material: Kovar/Glass with gold plate finish



## NOTES:

- 1) J1 is RF input, J2 is RF output
- 2) Power supplies required +5V @ 50mA maximum, -15V @ 10mA maximum
- 3) E2 is TTL control input. TTL Logic '0' is low loss, TTL Logic '1' is isolation
- 4) TTL Logic '0' is 0 to 0.8V, TTL Logic '1' is 2.0 to 5.5V
- 5) Transition time is defined as 10% to 90% detected RF. Switching speed is defined as 50% TTL to 90% detected RF
- 6) Case operating temperature -55°C to +85°C
- 7) Storage temperature -55°C to +125°C

This data sheet describes a standard range of PIN diode switch modules available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

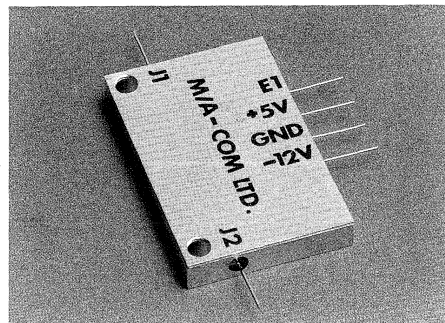
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SPST NON-REFLECTIVE SWITCH MODULE  
WITH INTEGRAL TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Stripline Compatible
- ◆ Compact Outline
- ◆ Hermetic Package
- ◆ TTL Compatible



**DESCRIPTION**

The ML 6540-100D Series of non-reflective switch modules from M/A-COM Ltd offers high isolation and low insertion loss in a miniature stripline compatible package. All the switches have an integral TTL compatible driver, with fast switching or high power handling options available as standard. Control is by single TTL input.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.0	1.4	50	10	30	0.1	0.1	ML6543-101D
				50	250	1.0	0.5	ML6543-102D
2.0 - 6.0	1.4	1.6	55	10	30	0.1	0.1	ML6544-101D
				50	250	1.0	0.5	ML6544-102D
6.0 - 12.0	2.1	1.8	60	10	30	0.1	0.1	ML6545-101D
				50	250	1.0	0.5	ML6545-102D
12.0 - 18.0	2.6	2.0	60	10	30	0.1	0.1	ML6546-101D
				50	250	1.0	0.5	ML6546-102D
6.0 - 18.0	2.6	2.0	60	10	30	0.1	0.1	ML6547-101D
				50	250	1.0	0.5	ML6547-102D
0.5 - 18.0	2.6	2.0	50	10	30	0.1	0.1	ML6548-101D
				50	250	1.0	0.5	ML6548-102D

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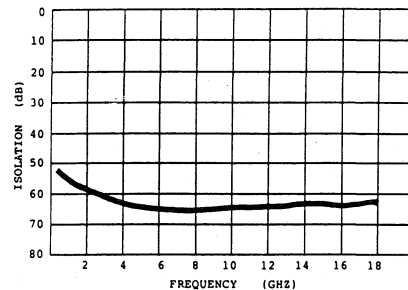
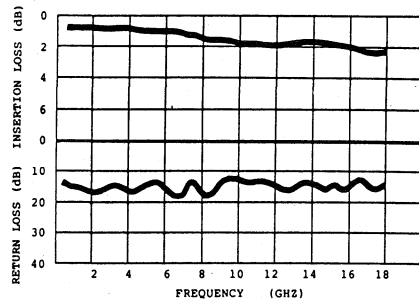
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

## ML6548-102D



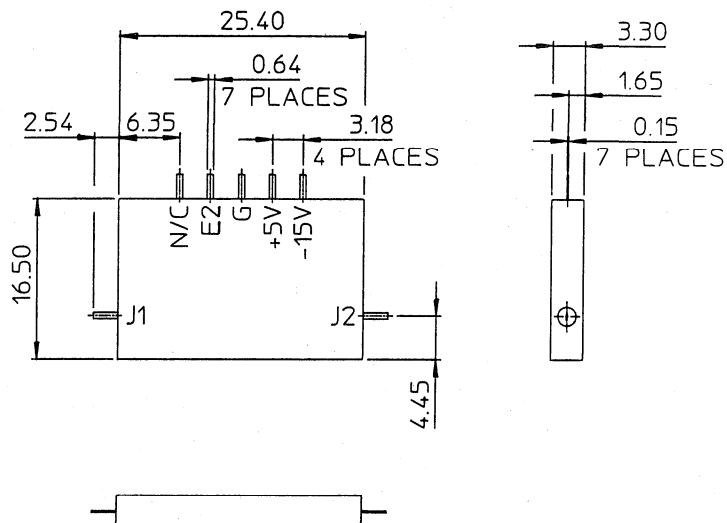
## Outline Drawing

Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5\text{mm}$   
 X.XX =  $\pm 0.2\text{mm}$

Material: Kovar/Glass with  
 gold plate finish



## NOTES:

- 1) J1 is RF input (non reflective), J2 is RF output.
- 2) Power supplies required +5V @ 50mA maximum, -15V @ 50mA maximum
- 3) E2 is TTL control input. TTL Logic '0' is low loss, TTL Logic '1' is isolation
- 4) TTL Logic '0' is 0 to 0.8V, TTL Logic '1' is 2.0 to 5.5V
- 5) Transition time is defined as 10% to 90% detected RF. Switching speed is defined as 50% TTL to 90% detected RF
- 6) Case operating temperature -55°C to +85°C
- 7) Storage temperature -55°C to +125°C

This data sheet describes a standard range of PIN diode switch modules available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

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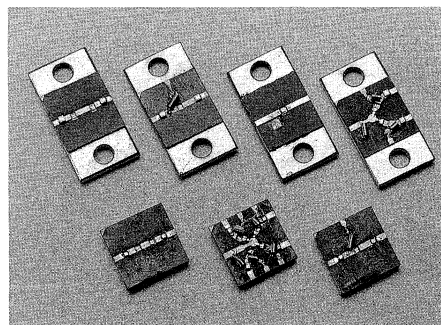


**MICROWAVE COMMON MODULE  
SPDT REFLECTIVE SWITCH  
0.5 TO 18.0 GHz**



**FEATURES**

- ◆ **MiCM 20 Compatible**
- ◆ **Def Stan and CECC Specifications**
- ◆ **Direct 50 ohm Microstrip Interface**
- ◆ **Low Insertion Loss**
- ◆ **Broad Frequency Ranges**



**DESCRIPTION**

The M/A-COM Ltd range of MiCM SPDT switches are miniaturised carrier mounted components providing high isolation, low loss and fast switching speed in the frequency range 0.5 to 18 GHz. Devices provide for direct integration with other MiCM components as well as existing microstrip circuitry. The package styles are compatible with the MiCM 20 standard, DEF STAN 59-90 (Part 1) Microwave Common Modules, Part 1: Interfaces and Fixings for use up to 20 GHz and Draft Basic Specification CECC 00 017 Microwave Common Modules, General Requirements and Interfaces and Fixings for use up to 20 GHz.

**SPECIFICATIONS @ +25°C**

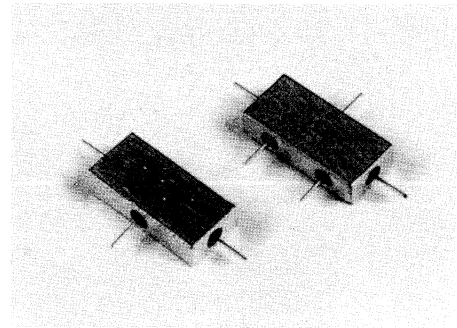
Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	0.7	1.4	50	10	0.1	0.1	ML6593-201
				50	1.0	0.5	ML6593-202
2.0 - 6.0	1.0	1.6	45	10	0.1	0.1	ML6594-201
				50	1.0	0.5	ML6594-202
6.0 - 12.0	1.5	1.8	40	10	0.1	0.1	ML6595-201
				50	1.0	0.5	ML6595-202
12.0 - 18.0	1.9	2.0	35	10	0.1	0.1	ML6596-201
				50	1.0	0.5	ML6596-202
6.0 - 18.0	1.9	2.0	35	10	0.1	0.1	ML6597-201
				50	1.0	0.5	ML6597-202
0.5 - 18.0	1.9	2.0	35	10	0.1	0.1	ML6598-201
				50	1.0	0.5	ML6598-202



**SPDT REFLECTIVE SWITCH MODULE  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Stripline Compatible
- ◆ Compact Outline
- ◆ Hermetic Package
- ◆ Internal Bias Circuitry



**DESCRIPTION**

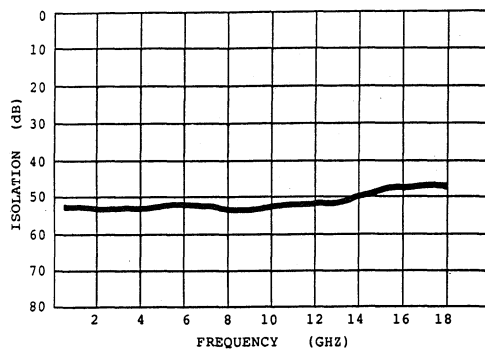
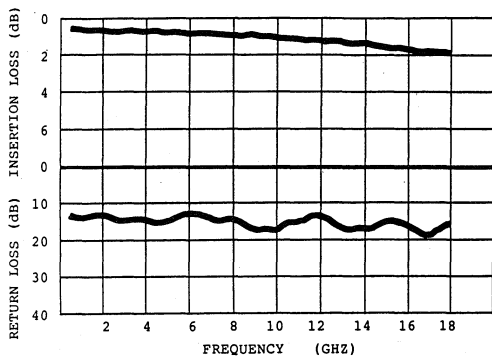
The ML 6530-200 Series of SPDT switch modules from M/A-COM Ltd offers high isolation and low insertion loss in a miniature stripline compatible package. Devices are supplied complete with internal bias network and dc blocks to simplify integration into circuits.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	0.8	1.4	60	10	0.1	0.1	ML6533-201
				50	1.0	0.5	ML6533-202
2.0 - 6.0	1.1	1.6	60	10	0.1	0.1	ML6534-201
				50	1.0	0.5	ML6534-202
6.0 - 12.0	1.7	1.8	50	10	0.1	0.1	ML6535-201
				50	1.0	0.5	ML6535-202
12.0 - 18.0	2.1	2.0	40	10	0.1	0.1	ML6536-201
				50	1.0	0.5	ML6536-202
6.0 - 18.0	2.1	2.0	40	10	0.1	0.1	ML6537-201
				50	1.0	0.5	ML6537-202
0.5 - 18.0	2.1	2.0	40	10	0.1	0.1	ML6538-201
				50	1.0	0.5	ML6538-202

## Typical Performance

## ML6538-202



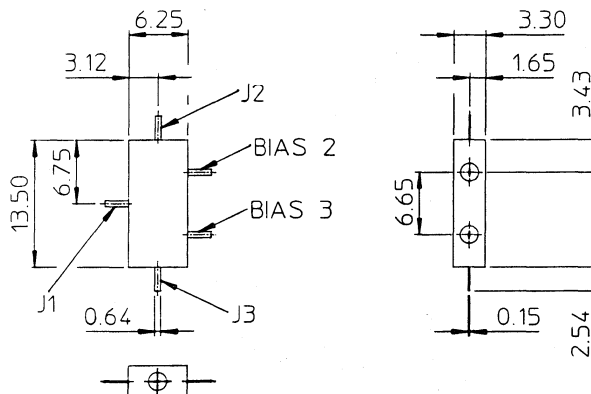
## Outline Drawing

## Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Material: Kovar/Glass with  
gold plate finish



## NOTES:

- 1) Devices contain internal bias network and dc blocking capacitors on both input and output.
- 2) DC bias requirements +1V @ 50mA typical, 100mA maximum for isolation  
(each channel) -1V @ 50mA typical, 100mA maximum for low loss
- 3) Transition time is defined as 10% to 90% detected RF as measured with standard M/A-COM Ltd driver.
- 4) Case operating temperature -55°C to +85°C
- 5) Storage temperature -55°C to +125°C

This data sheet describes a standard range of PIN diode switch modules available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

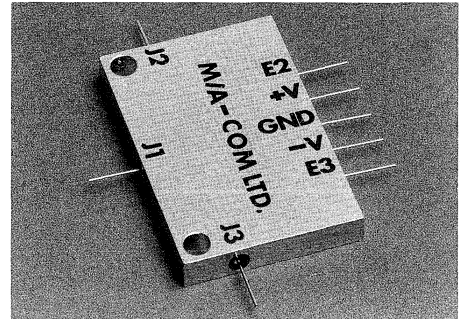
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SPDT REFLECTIVE SWITCH MODULE  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Stripline Compatible
- ◆ Compact Outline
- ◆ Hermetic Package
- ◆ TTL Compatible



**DESCRIPTION**

The ML 6530-200D Series of switch modules from M/A-COM Ltd offers high isolation and low insertion loss in a miniature stripline compatible package. All the switches have an integral TTL compatible driver, with fast switching or high power handling options available as standard. Control is by dual independent TTL inputs.

**SPECIFICATIONS**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	0.9	1.4	50	10	30	0.1	0.1	ML6533-201D
				50	250	1.0	0.5	ML6533-202D
2.0 - 6.0	1.3	1.6	55	10	30	0.1	0.1	ML6534-201D
				50	250	1.0	0.5	ML6534-202D
6.0 - 12.0	1.9	1.8	55	10	30	0.1	0.1	ML6535-201D
				50	250	1.0	0.5	ML6535-202D
12.0 - 18.0	2.3	2.0	50	10	30	0.1	0.1	ML6536-201D
				50	250	1.0	0.5	ML6536-202D
6.0 - 18.0	2.3	2.0	50	10	30	0.1	0.1	ML6537-201D
				50	250	1.0	0.5	ML6537-202D
0.5 - 18.0	2.3	2.0	50	10	30	0.1	0.1	ML6538-201D
				50	250	1.0	0.5	ML6538-202D

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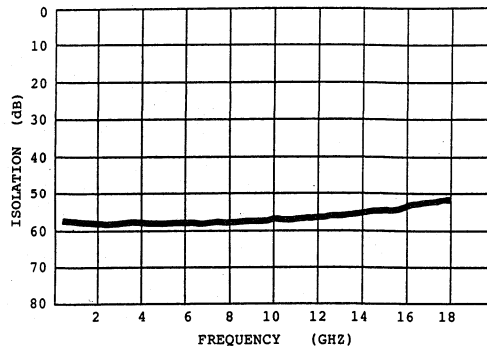
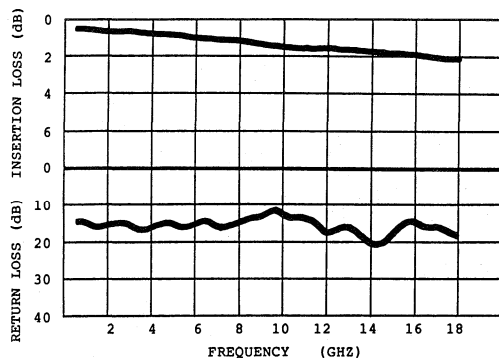
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

## ML6538-202D



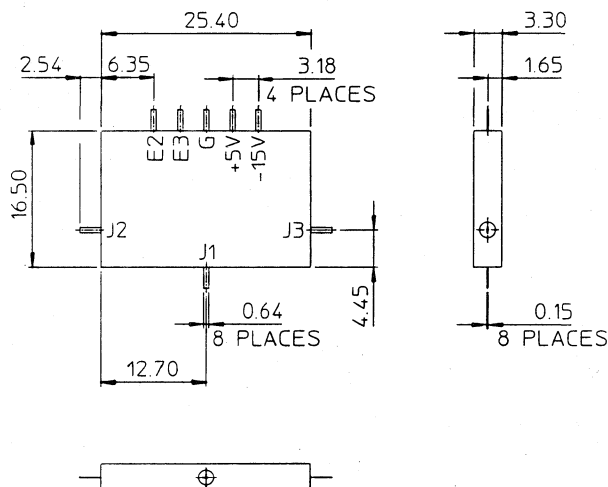
## Outline Drawing

Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Material: Kovar/Glass with  
gold plate finish



## NOTES:

- 1) J1 is RF common, J2, J3 are RF input/outputs.
- 2) Power supplies required +5V @ 70mA maximum, -15V @ 50mA maximum
- 3) E2, E3 are independent TTL control inputs. For each channel TTL Logic '0' is low loss, TTL Logic '1' is isolation. Single TTL control is available as an option, please contact the factory.
- 4) TTL Logic '0' is 0 to 0.8V, TTL Logic '1' is 2.0 to 5.5V
- 5) Transition time is defined as 10% to 90% detected RF  
Switching speed is defined as 50% TTL to 90% detected RF
- 6) Case operating temperature -55°C to +85°C
- 7) Storage temperature -55°C to +125°C

This data sheet describes only a standard range of PIN diode switch modules available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

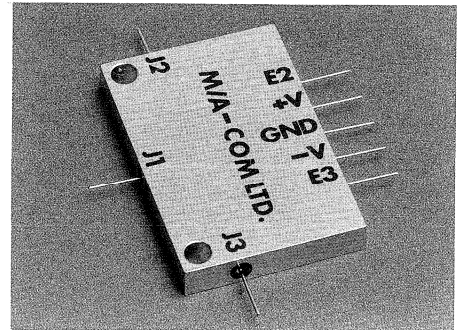
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SPDT NON-REFLECTIVE SWITCH MODULE**
**WITH INTEGRAL TTL DRIVER**
**0.5 TO 18.0 GHz**
**FEATURES**

- ◆ **Broad Frequency Ranges**
- ◆ **Stripline Compatible**
- ◆ **Compact Outline**
- ◆ **Hermetic Package**
- ◆ **TTL Compatible**


**DESCRIPTION**

The ML 6540-200D Series of SPDT non-reflective switch modules from M/A-COM Ltd offers high isolation and low insertion loss in a miniature stripline compatible package. All the switches have integral TTL compatible driver with fast switching or high power handling options available as standard. Control is by dual independent TTL inputs.

**SPECIFICATIONS**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.3	1.4	50	10	30	0.1	0.1	ML6543-201D
				50	250	1.0	0.5	ML6543-202D
2.0 - 6.0	1.7	1.6	55	10	30	0.1	0.1	ML6544-201D
				50	250	1.0	0.5	ML6544-202D
6.0 - 12.0	2.5	1.8	55	10	30	0.1	0.1	ML6545-201D
				50	250	1.0	0.5	ML6545-202D
12.0 - 18.0	3.0	2.0	50	10	30	0.1	0.1	ML6546-201D
				50	250	1.0	0.5	ML6546-202D
6.0 - 18.0	3.0	2.0	50	10	30	0.1	0.1	ML6547-201D
				50	250	1.0	0.5	ML6547-202D
0.5 - 18.0	3.0	2.0	50	10	30	0.1	0.1	ML6548-201D
				50	250	1.0	0.5	ML6548-202D

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

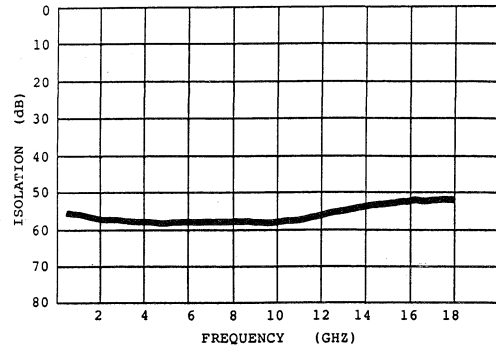
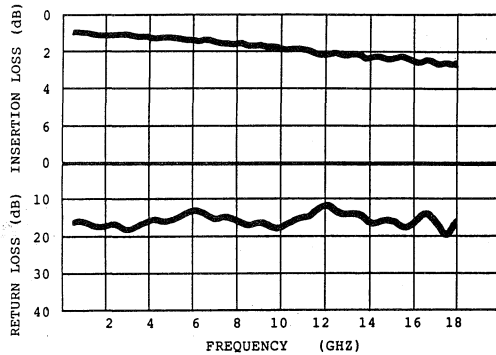
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

## ML6548-202D



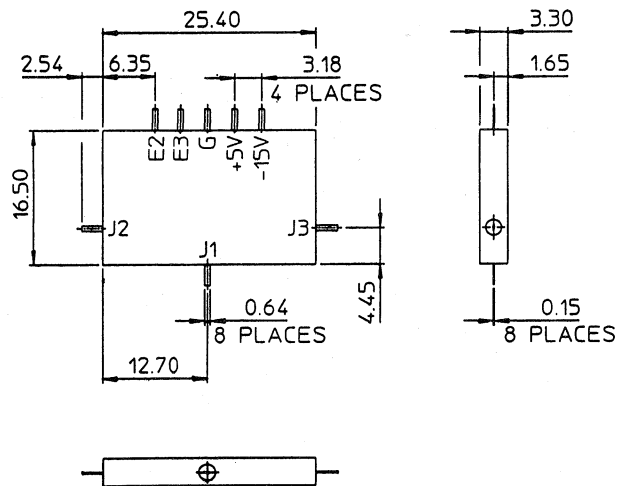
## Outline Drawing

Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5\text{mm}$   
 X.XX =  $\pm 0.2\text{mm}$

Material: Kovar/Glass with  
 gold plate finish



## NOTES:

- 1) J1 is RF common, J2, J3 are RF inputs/outputs (non reflective)
- 2) Power supplies required +5V @ 70mA maximum, -15V @ 50mA maximum
- 3) E2, E3 are independent TTL control inputs. For each channel TTL Logic '0' is low loss, TTL Logic '1' is isolation. Single TTL control is available as an option, please consult the factory.
- 4) TTL Logic '0' is 0 to 0.8V, TTL Logic '1' is 2.0 to 5.5V
- 5) Transition time is defined as 10% to 90% detected RF  
 Switching speed is defined as 50% TTL to 90% detected RF
- 6) Case operating temperature  $-55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- 7) Storage temperature  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$

This data sheet describes a small selection of the PIN diode switch modules available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671



**MICROWAVE COMMON MODULE**

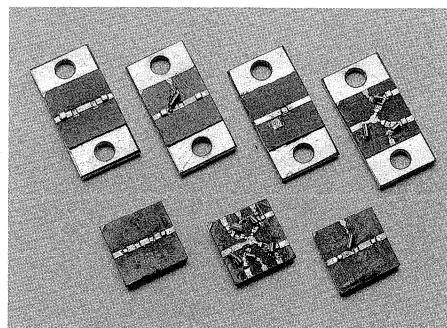
**SP3T REFLECTIVE SWITCH**

**0.5 TO 18.0 GHz**



**FEATURES**

- ◆ MiCM 20 Compatible
- ◆ Def Stan and CECC Specifications
- ◆ Direct 50 ohm Microstrip Interface
- ◆ Low Insertion Loss
- ◆ Broad Frequency Ranges



**DESCRIPTION**

The M/A-COM Ltd range of MiCM SP3T switches are miniaturised carrier mounted components providing high isolation, low loss and fast switching speed in the frequency range 0.5 to 18 GHz. Devices provide for direct integration with other MiCM components as well as existing microstrip circuitry. The package styles are compatible with the MiCM 20 standard, DEF STAN 59-90 (Part 1) Microwave Common Modules, Part 1: Interfaces and Fixings for use up to 20 GHz and Draft Basic Specification CECC 00 017 Microwave Common Modules, General Requirements and Interfaces and Fixings for use up to 20 GHz.

**SPECIFICATIONS**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.0	1.4	50	10	0.1	0.1	ML6593-301
				50	1.0	0.5	ML6593-302
2.0 - 6.0	1.3	1.6	45	10	0.1	0.1	ML6594-301
				50	1.0	0.5	ML6594-302
6.0 - 12.0	1.8	1.8	40	10	0.1	0.1	ML6595-301
				50	1.0	0.5	ML6595-302
12.0 - 18.0	2.2	2.0	35	10	0.1	0.1	ML6596-301
				50	1.0	0.5	ML6596-302
6.0 - 18.0	2.2	2.0	35	10	0.1	0.1	ML6597-301
				50	1.0	0.5	ML6597-302
0.5 - 18.0	2.2	2.0	35	10	0.1	0.1	ML6598-301
				50	1.0	0.5	ML6598-302

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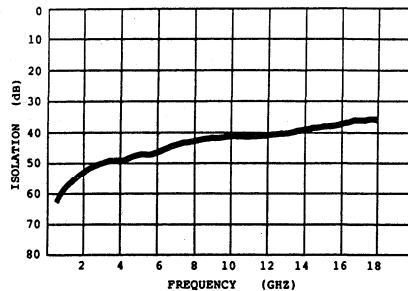
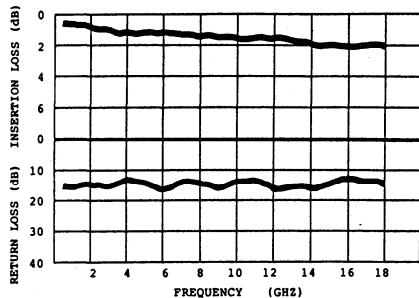
Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance

## ML6598-302



## Outline Drawing - MiCM Type Code S2A2-6UF6-2-5,8,11-N

Third Angle Projection

All dimensions in mm

Tolerances

X.X =  $\pm 0.2$ mmX.XX =  $\pm 0.1$ mm

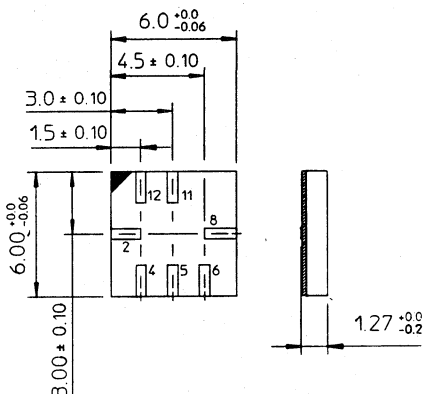
Carrier Material:

Kovar with  
gold plate finish

Substrate Material:

RT Duroid 5870

Port	Function
2	RF Common
4	Bias (J4)
5	RF Output (J4)
6	Bias (J3)
8	RF Output (J3)
11	RF Output (J2)
12	Bias (J2)



## NOTES:

- 1) J1 is RF common, J2, J3, J4 are RF input/outputs.
- 2) Devices contain internal bias network and dc blocking capacitors on both input and outputs
- 3) DC bias requirements  $+1V @ 50mA$  typical, 100mA maximum for isolation  
 $-1V @ 50mA$  typical, 100mA maximum for low loss
- 4) Transition time is defined as 10% to 90% detected RF as measured with standard M/A-COM Ltd driver.
- 5) Flanged package styles have clearance holes for M1.6 screw (maximum head diameter 2.7mm).
- 6) Bonding pads are typically 0.5mm x 0.5mm.
- 7) Case operating temperature  $-55^{\circ}C$  to  $+85^{\circ}C$
- 8) Storage temperature  $-55^{\circ}C$  to  $+125^{\circ}C$ .
- 9) Maximum solder/epoxy attachment temperature  $+130^{\circ}C$ .

This data sheet describes a standard range of PIN diode switch modules available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance on MiCM compatible devices.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

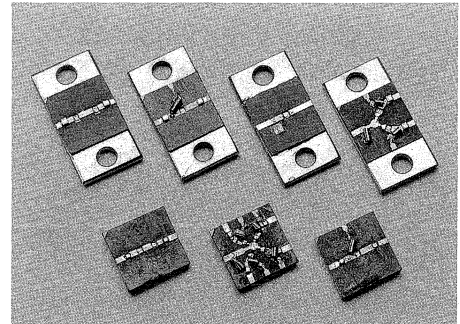
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**MICROWAVE COMMON MODULE**
**SP4T REFLECTIVE SWITCH**
**0.5 TO 18.0 GHz**

**FEATURES**

- ◆ **MiCM 20 Compatible**
- ◆ **Def Stan and CECC Specifications**
- ◆ **Direct 50 ohm Microstrip Interface**
- ◆ **Low Insertion Loss**
- ◆ **Broad Frequency Ranges**


**DESCRIPTION**

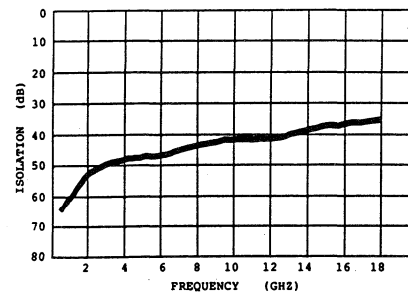
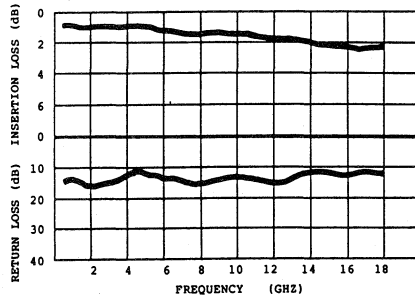
The M/A-COM Ltd range of MiCM SP4T switches are miniaturised carrier mounted components providing high isolation, low loss and fast switching speed in the frequency range 0.5 to 18 GHz. Devices provide for direct integration with other MiCM components as well as existing microstrip circuitry. The package styles are compatible with the MiCM 20 standard, DEF STAN 59-90 (Part 1) Microwave Common Modules, Part 1: Interfaces and Fixings for use up to 20 GHz and Draft Basic Specification CECC 00 017 Microwave Common Modules, General Requirements and Interfaces and Fixings for use up to 20 GHz.

**SPECIFICATIONS**

Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Peak Power (W)	Max CW Power (W)	Part Number
0.5 - 2.0	1.2	1.4	50	10	0.1	0.1	ML6593-401
				50	1.0	0.5	ML6593-402
2.0 - 6.0	1.5	1.6	45	10	0.1	0.1	ML6594-401
				50	1.0	0.5	ML6594-402
6.0 - 12.0	2.0	1.8	40	10	0.1	0.1	ML6595-401
				50	1.0	0.5	ML6595-402
12.0 - 18.0	2.5	2.0	35	10	0.1	0.1	ML6596-401
				50	1.0	0.5	ML6596-402
6.0 - 18.0	2.5	2.0	35	10	0.1	0.1	ML6597-401
				50	1.0	0.5	ML6597-402
0.5 - 18.0	2.5	2.0	35	10	0.1	0.1	ML6598-401
				50	1.0	0.5	ML6598-402

## Typical Performance

## ML6598-402



## Outline Drawing – MiCM Type Code S2A2-6UF6-2-4,7,9,12-N

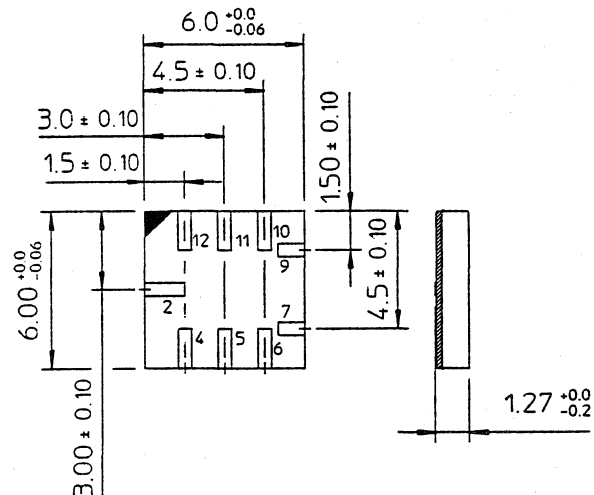
## Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.2$ mm  
X.XX =  $\pm 0.1$ mm

Carrier Material: Kovar with gold plate finish  
Substrate Material: RT Duroid 5870

PORT	FUNCTION
2	RF Common
4	RF Output (J5)
5	Bias (J5)
6	Bias (J4)
7	RF Output (J4)
9	RF Output (J3)
10	Bias (J3)
11	Bias (J2)
12	RF Output (J2)



## NOTES:

- 1) J1 is common, J2, J3, J4, J5 are RF input/outputs.
- 2) Devices contain internal bias network and dc blocking capacitors on both input and outputs.
- 3) DC bias requirements  $+1V @ 50mA$  typical, 100mA maximum for isolation (each channel)  
 $-1V @ 50mA$  typical, 100mA maximum for low loss
- 4) Transition time is defined as 10% to 90% detected RF as measured with standard M/A-COM Ltd driver.
- 5) Flanged package styles have clearance holes for M1.6 screw (maximum head diameter 2.7mm).
- 6) Bonding pads are typically 0.5mm x 0.5mm.
- 7) Case operating temperature  $-55^{\circ}C$  to  $+85^{\circ}C$
- 8) Storage temperature  $-55^{\circ}C$  to  $+125^{\circ}C$ .
- 9) Maximum solder/epoxy attachment temperature  $+130^{\circ}C$ .

This data sheet describes a standard range of PIN diode switch modules available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance on MiCM compatible devices.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

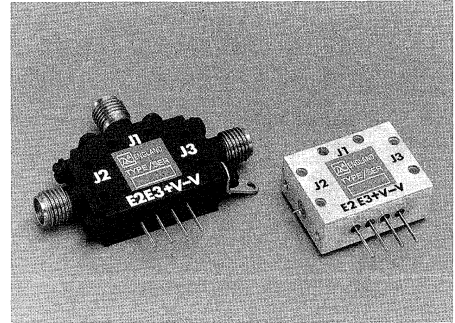
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**REFLECTIVE GaAs MMIC SWITCHES  
WITH TTL COMPATIBLE DRIVERS  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ **Broad Frequency Ranges**
- ◆ **Fast Switching Speed**
- ◆ **Low Video Generation**
- ◆ **Low Current Consumption**
- ◆ **TTL Compatible**


**DESCRIPTION**

M/A-COM offers a range of GaAs MMIC switches using the latest FET devices for operation up to 18 GHz. All the switches incorporate a fast switching TTL compatible driver and are packaged in miniature coaxial outlines with removable SMA connectors. Without connectors the devices can be integrated directly into microstrip circuits. These devices offer fast switching speeds with low video generation levels.

**SPECIFICATIONS @ +25°C**
**Operating Bandwidth 0.5 to 18.0 GHz, all devices**

Switch Type	Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Input Power (dBm)	Part Number
SPST	0.5 - 2.0	1.6	1.7	50	5	15	+15	MLM6578-101D
	2.0 - 8.0	2.0	2.0	35				
	8.0 - 18.0	2.5	2.0	30				
SPDT	0.5 - 2.0	1.8	1.7	50	5	15	+15	MLM6578-201D
	2.0 - 8.0	2.5	2.0	35				
	8.0 - 18.0	3.0	2.0	30				
SP4T	0.5 - 2.0	3.1	1.7	50	5	15	+15	MLM6578-401D
	2.0 - 8.0	4.0	2.0	35				
	8.0 - 18.0	5.0	2.0	30				

Video Generation	: 20mV pk-pk max. measured into 50 ohm, 400 MHz bandwidth								
Power Supplies	: +5V @ 20mA max., -5V @ 20mA max. (SPST, SPDT) +5V @ 50mA max., -5V @ 50mA max. (SP4T)								
TTL Control Input	: SPST		: SPDT			: SP4T			
	E2	J1-J2	E2	J1-J2	J1-J3	E2	E3	E4	RF Port to J1
	0	Low Loss	0	Low Loss	Isolation	0	0	1	J2
	1	Isolation	1	Isolation	Low Loss	0	1	0	J3
						1	0	1	J4
						1	1	0	J5
TTL Logic '0' is 0 to 0.8V	TTL Logic '1' is 2.0 to								

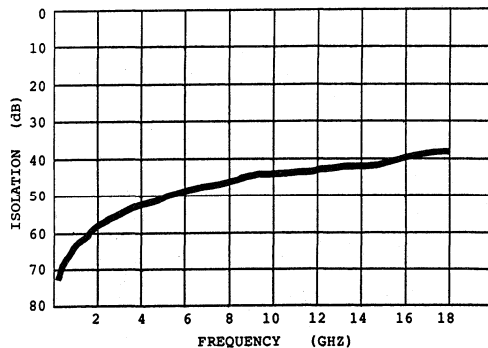
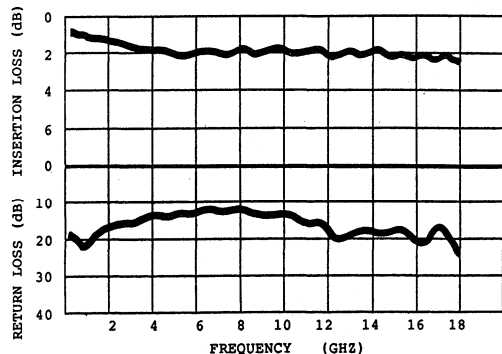
M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

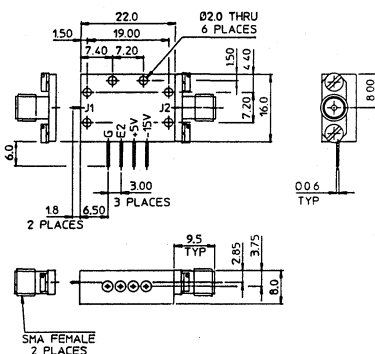
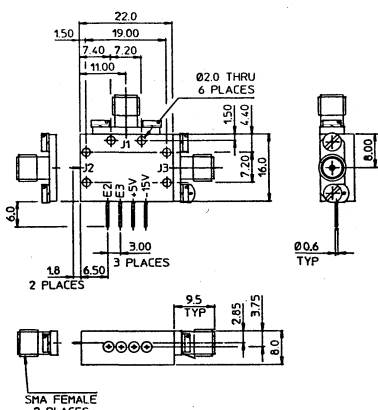
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## Typical Performance MLM6578-201D



## Outline Drawings



### Third Angle Projection

All dimensions in mm

Tolerances X.X = ±0.5mm

X.XX = ±0.2mm

Standard Finish: Silver plate to

Def Stan 03/9 for use with microstrip or matt black paint to DTD 5555A

### NOTES:

- 1) All outlines J1 is RF common other ports are RF input/outputs.
- 2) Any combination of SMA male/female connectors is available, please contact the factory
- 3) Transition time is defined as 10% to 90% detected RF Switching speed is defined as 50% TTL to 90% detected RF
- 4) Case operating temperature -55°C to +85°C
- 5) Storage temperature -55°C to +125°C

This data sheet describes only a small selection of the GaAs MMIC switches available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

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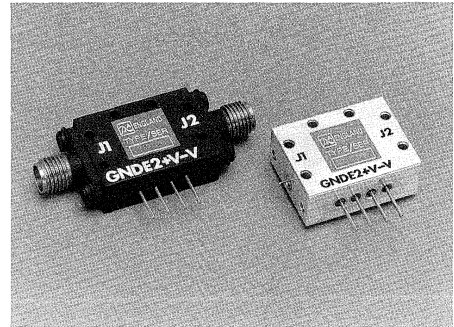
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**NON REFLECTIVE GaAs MMIC SWITCHES  
WITH TTL COMPATIBLE DRIVERS  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ **Broad Frequency Ranges**
- ◆ **Fast Switching Speed**
- ◆ **Low Video Generation**
- ◆ **Low Current Consumption**
- ◆ **TTL Compatible**


**DESCRIPTION**

M/A-COM offers a range of GaAs MMIC FET switches using the latest FET devices for operation up to 18 GHz. All the switches incorporate a fast switching TTL compatible driver and are packaged in miniature coaxial outlines with removable SMA connectors. Without connectors the devices can be integrated directly into microstrip circuits. These devices offer fast switching speeds with low video generation levels.

**SPECIFICATIONS @ +25°C**
**Operating Bandwidth 0.5 to 18.0 GHz all devices**

Switch Type	Frequency Range (GHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	Max Transition Time (ns)	Max Switching Speed (ns)	Max Input Power (dBm)	Part Number
SPST	0.5 - 2.0	1.8	1.7	50	5	15	+15	MLM6588-101D
	2.0 - 8.0	2.3	2.0	40				
	8.0 - 18.0	2.8	2.0	35				
SPDT	0.5 - 2.0	2.0	1.7	50	5	15	+15	MLM6588-201D
	2.0 - 8.0	3.0	2.0	40				
	8.0 - 18.0	3.5	2.0	35				
SP4T	0.5 - 2.0	3.5	1.7	50	5	15	+15	MLM6588-401D
	2.0 - 8.0	4.5	2.0	40				
	8.0 - 18.0	5.5	2.0	35				

Video Generation	20mV pk-pk max. measured into 50 ohm, 400 MHz bandwidth								
Power Supplies	+5V @ 15mA max., -5V @ 15mA max. (SPST, SPDT) +5V @ 45mA max., -5V @ 45mA max. (SP4T)								
TTL Control Input	SPST			SPDT			SP4T		
	E2	J1-J2	E2	J1-J2	J1-J3	E2	E3	E4	RF Port to J1
	0	Low Loss	0	Low Loss	Isolation	0	0	1	J2
	1	Isolation	1	Isolation	Low Loss	0	1	0	J3
						1	0	1	J4
						1	1	0	J5
TTL Logic '0' is 0 to 0.8V	TTL Logic '1' is 2.0 to 5.5V								

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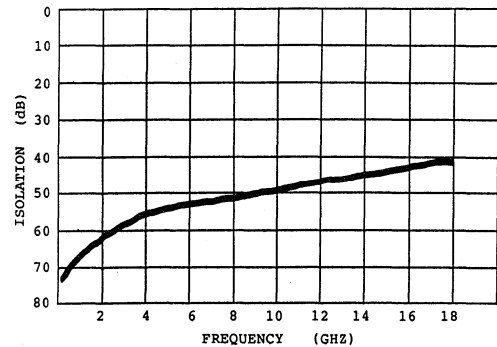
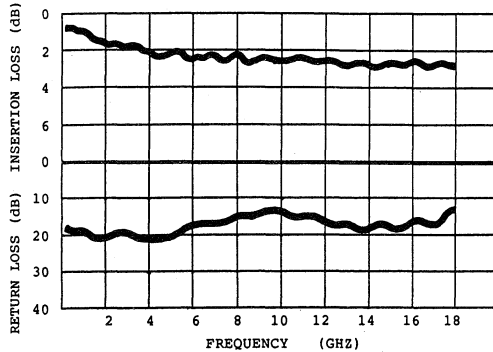
Europe: (44) 1344 869595

North America: 800 366 2266

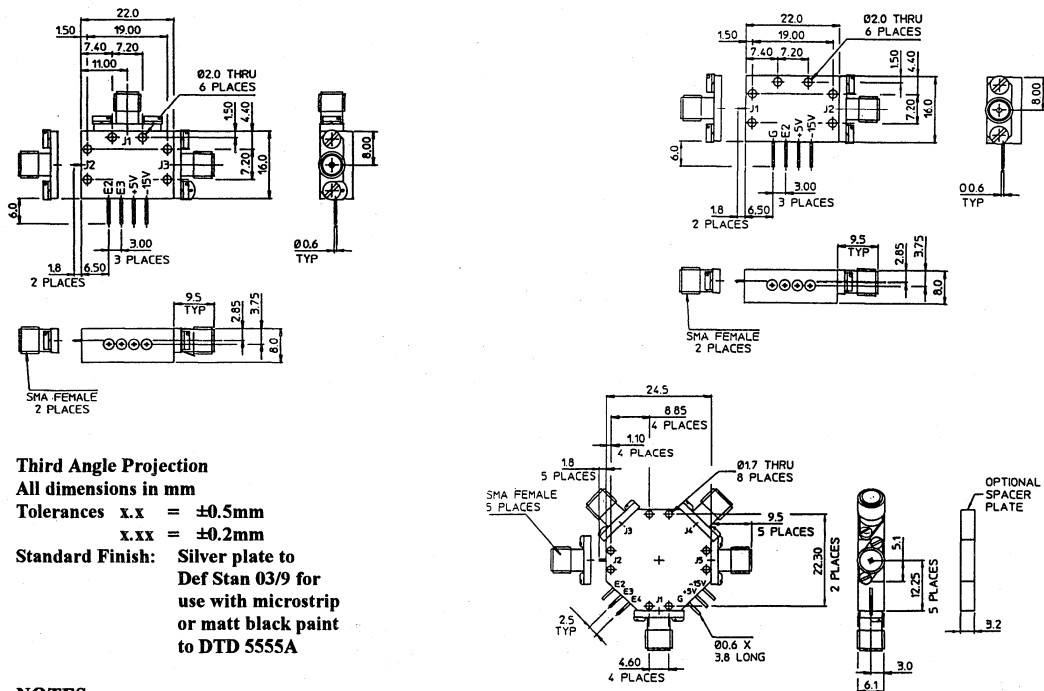
Asia Pacific: (81) 3 3226 1671

## Typical Performance

## MLM6588-201D



## Outline Drawings



## Third Angle Projection

All dimensions in mm

Tolerances x.x =  $\pm 0.5\text{mm}$ x.xx =  $\pm 0.2\text{mm}$ 

Standard Finish: Silver plate to Def Stan 03/9 for use with microstrip or matt black paint to DTD 5555A

## NOTES

- 1) All outlines J1 is RF common other ports are RF input/outputs (non-reflective)
- 2) Any combination of SMA male/female connectors is available, please contact the factory
- 3) Transition time is defined as 10% to 90% detected RF Switching speed is defined as 50% TTL to 90% detected RF
- 4) Case operating temperature  $-55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- 5) Storage temperature  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$

This data sheet describes only a small selection of the GaAs MMIC switches available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

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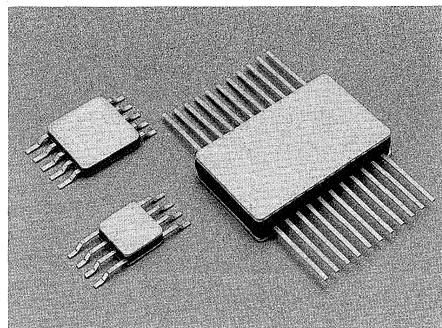
Asia Pacific: (81) 3 3226 1671



**SPST NON-REFLECTIVE GaAs MMIC SWITCH  
WITH INTEGRAL TTL COMPATIBLE DRIVER  
5 TO 2000 MHz**

**FEATURES**

- ◆ **High Isolation**
- ◆ **Ultra Fast Switching Speed**
- ◆ **Low Current Consumption**
- ◆ **Surface Mount Package**
- ◆ **Low Video Generation**


**DESCRIPTION**

The MLW 100MD SPST Switch is part of a range of RF and microwave control components manufactured by M/A-COM Ltd in the UK using the latest GaAs FET device technology. The MLW 100MD has matched RF ports and integral TTL compatible fast switching driver circuitry. The device is supplied in a miniature hermetic package suitable for surface mount printed circuit boards; stripline compatible and coaxial outlines are also available as options.

**SPECIFICATION @+25°C**
**Operating bandwidth 5 to 2000 MHz**

<b>Over Frequency Range (MHz)</b>	<b>Max Insertion Loss (dB)</b>	<b>Max VSWR</b>	<b>Min Isolation (dB)</b>	<b>1dB Compression Point (dBm)</b>
5 - 300	0.8	1.3	60	+13
300 - 1000	1.0	1.4	50	+21
1000 - 2000	1.2	1.6	35	+27
Transition Time	5ns max 10% to 90% detected RF			
Switching Speed	25ns max 50% TTL to 90% detected RF			
Video Breakthrough	20mV max. measured into 300 MHz bandwidth			
Power Supplies	+5V @ 15mA max -5V @ 15mA max			
TTL Command Input	TTL '0' Low Loss, TTL '1' Isolation			
TTL Logic '0'	0 to 0.8V			
TTL Logic '1'	2.0 to 5.5V			

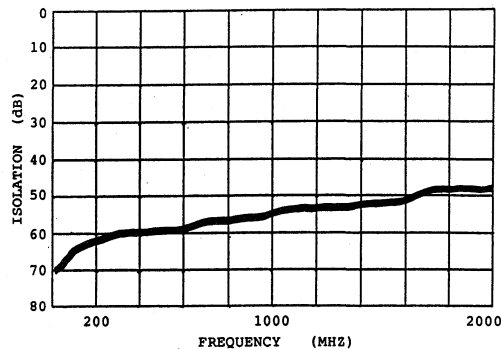
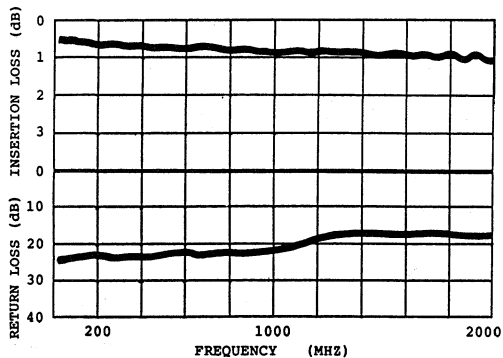
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## TYPICAL PERFORMANCE



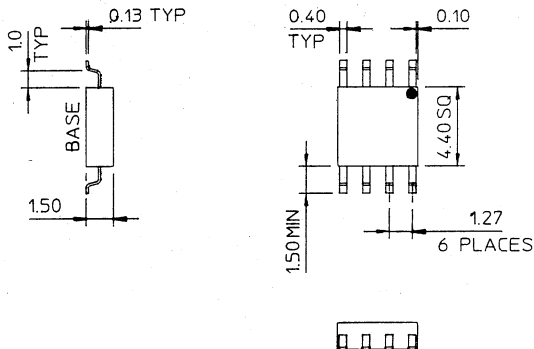
## OUTLINE DRAWING

Third Angle Projection

All dimensions in mm

Tolerances x.x =  $\pm 0.5$ mm  
x.xx =  $\pm 0.2$ mmMaterial: Kovar/Glass with  
gold plate finish

Port 1 marked with dot.



## TERMINAL NOTATION

1	J1 RF Input	5	-V Negative Power Supply
2	G Ground	6	G Ground
3	+V Positive Power Supply	7	G Ground
4	C2 TTL Control (J2)	8	J2 RF Output

Case Ground

## MAXIMUM RATINGS

Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-55°C to +100°C
RF Input Power	+23dBm

This product is one of a range of GaAs control components which includes multithrow switches, digital attenuators, delay lines and phase shifters. For further information on these and other M/A-COM Ltd products please contact the factory.

All specifications subject to change without notice

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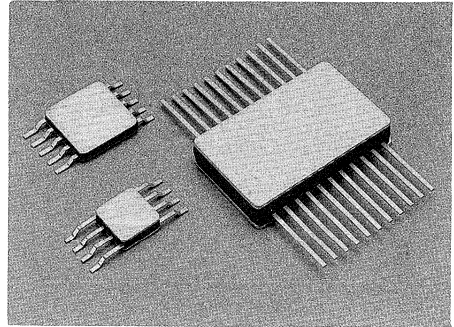
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**SPDT NON-REFLECTIVE GaAs MMIC SWITCH**  
**WITH INTEGRAL TTL COMPATIBLE DRIVER**  
**5 TO 2000 MHZ**

**FEATURES**

- ◆ High Isolation
- ◆ Ultra Fast Switching Speed
- ◆ Low Current Consumption
- ◆ Surface Mount Package
- ◆ Low Video Generation


**DESCRIPTION**

The MLW 200MD SPDT switch is part of a range of RF and microwave control components manufactured by M/A-COM Ltd in the UK using the latest GaAs FET device technology. The MLW 200MD has matched RF ports and integral TTL compatible fast switching driver circuitry. The device is supplied in a miniature hermetic package suitable for surface mount printed circuit boards, stripline compatible and coaxial outlines are also available as options.

**SPECIFICATION**
**Operating Bandwidth 5 to 2000 MHz**

Frequency Range (MHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	1dB Compression Point (dBm)
5 - 300	0.9	1.3	60	+10
300 - 1000	1.2	1.4	50	+15
1000 - 2000	1.5	1.6	45	+18

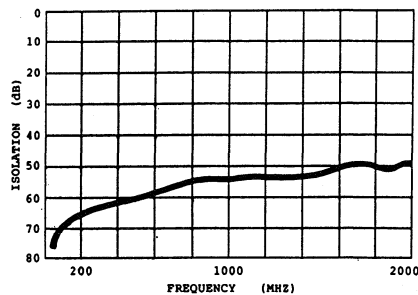
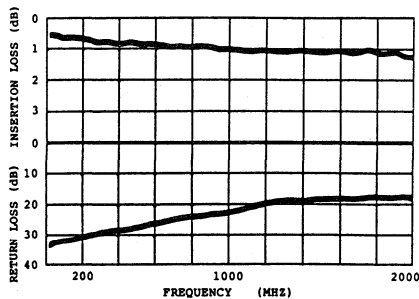
Transition Time	: 5ns max 10% to 90% detected RF
Switching Speed	: 25ns max 50% TTL to 90% detected RF
Video Breakthrough	: 20mV pk-pk maximum measured into 50 ohm, 400 MHz bandwidth
Power Supplies	: +5V @ 20mA max -5V @ 20mA max
TTL Control Input	: TTL '0' Low Loss TTL '1' Isolation
TTL Logic '0'	: 0 to 0.8V
TTL Logic '1'	: 2.0 to 5.5V

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## OUTLINE DRAWING

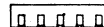
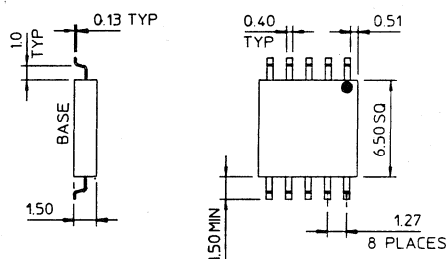
Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5\text{mm}$   
 X.XX =  $\pm 0.2\text{mm}$

Material: Kovar/Glass with #  
 gold plate finish

Port 1 marked with a dot



## Terminal Notation

1	J2	RF Input	6	J1	RF Common
2	G	Ground	7	G	Ground
3	-V	Negative Power Supply	8	+V	Positive Power Supply
4	C3	TTL Control (J3)	9	G	Ground
5	C2	TTL Control (J2)	10	J3	RF Output
					Case Ground

## Maximum Ratings

Operating Temperature Range	:	-40°C to +85°C
Storage Temperature Range	:	-55°C to +100°C
RF Input Power	:	+23dBm

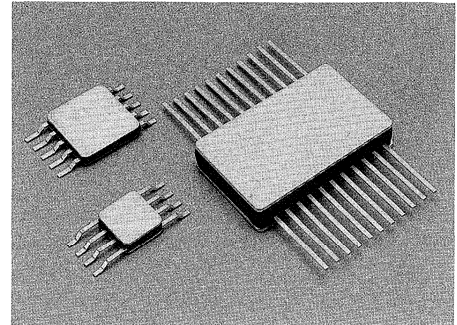
This product is one of a range of GaAs control components which includes multithrow switches, digital attenuators, delay lines and phase shifters. For further information on these and other M/A-COM Ltd products, please contact the factory.

All specifications are subject to change without notice

**SP3T NON-REFLECTIVE GaAs MMIC SWITCH**  
**WITH INTEGRAL TTL COMPATIBLE DRIVER**  
**5 TO 2000 MHZ**

**FEATURES**

- ◆ High Isolation
- ◆ Fast Switching Speed
- ◆ Ultra Low Current Consumption
- ◆ Surface Mount Package
- ◆ Low Video Generation


**DESCRIPTION**

The MLW 300MD SP3T switch is part of a range of RF and microwave control components manufactured by M/A-COM Ltd in the UK using the latest GaAs FET device technology. The MLW 300MD has matched RF ports and integral TTL compatible fast switching driver circuitry. The device is supplied in a miniature hermetic package suitable for surface mount printed circuit boards, stripline compatible and coaxial outlines are also available as options.

**SPECIFICATION**
**Operating Bandwidth 5 to 2000 MHz**

Frequency Range (MHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	1dB Compression Point (dBm)
5.0 - 300	1.2	1.4	55	+10
300 - 1000	1.5	1.6	45	+15
1000 - 2000	1.8	1.8	40	+18

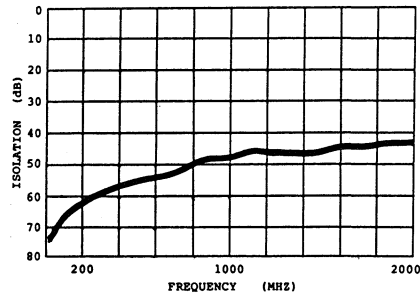
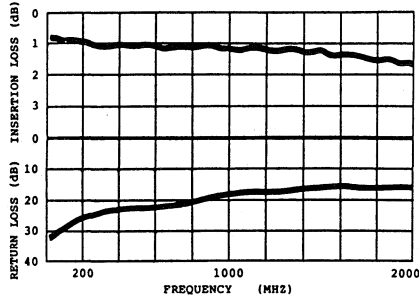
Transition Time	: 20ns max 10% to 90% detected RF			
Switching Speed	: 200ns max 50% TTL to 90% detected RF			
Video Breakthrough	: 20mV pk-pk maximum measured into 50 ohm, 400 MHz bandwidth			
Power Supplies	: +5V @ 5mA max -5V @ 5mA max			
TTL Control Input	<b>C2</b>	<b>C3</b>	<b>C4</b>	<b>RF Port to J1</b>
	0	1	1	J2
	1	0	1	J3
	1	1	0	J4
	1	1	1	None (all isolating)
TTL Logic '0'	: 0 to 0.8V			
TTL Logic '1'	: 2.0 to 5.5V			

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**OUTLINE DRAWING**

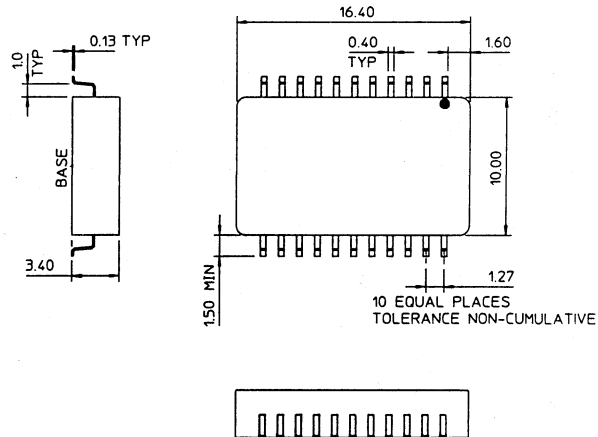
Third Angle Projection

All dimensions in mm

Tolerances X.X = ±0.5mm  
 X.XX = ±0.2mm

Material: Kovar/Glass with gold plate finish

Port 1 marked with dot



**Terminal Notation**

1 C2 TTL Control (J2)	8 G Ground	15 G Ground
2 C3 TTL Control (J3)	9 -V Negative Power Supply	16 G Ground
3 C4 TTL Control (J4)	10 +V Positive Power Supply	17 J3 RF Output
4 G Ground	11 G Ground	18 G Ground
5 G Ground	12 G Ground	19 G Ground
6 J1 RF Common	13 G Ground	20 J2 RF Output
7 G Ground	14 J4 RF Output	21 G Ground
		22 G Ground
		Case Ground

**Maximum Ratings**

- Operating Temperature Range : -40°C to +85°C
- Storage Temperature Range : -55°C TO +100°C
- RF Input Power : +23dBm

This product is one of a range of GaAs control components which includes multithrow switches, digital attenuators, delay lines and phase shifters. For further information on these and other M/A-COM Ltd products, please contact the factory.

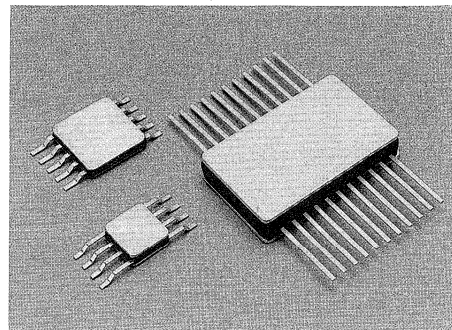
All specifications are subject to change without notice

**SP4T NON-REFLECTIVE GaAs MMIC SWITCH  
WITH INTEGRAL TTL COMPATIBLE DRIVER**

**5 TO 2000 MHZ**

**FEATURES**

- ◆ High Isolation
- ◆ Fast Switching Speed
- ◆ Ultra Low Current Consumption
- ◆ Surface Mount Package
- ◆ Low Video Generation



**DESCRIPTION**

The MLW 400MD SP4T switch is part of a range of RF and microwave control components manufactured by M/A-COM Ltd in the UK using the latest GaAs FET device technology. The MLW 400MD has matched RF ports and integral TTL compatible fast switching driver circuitry. The device is supplied in a miniature hermetic package suitable for surface mount printed circuit boards, stripline compatible and coaxial outlines are also available as options.

**SPECIFICATION**

Operating Bandwidth 5 to 2000 MHz

Frequency Range (MHz)	Max Insertion Loss (dB)	Max VSWR	Min Isolation (dB)	1dB Compression Point (dBm)	
5 - 300	1.4	1.5	45	+10	
300 - 1000	1.7	1.7	40	+15	
1000 - 2000	2.2	2.0	35	+18	
Transition Time : 20ns max 10% to 90% detected RF Switching Speed : 200ns max 50% TTL to 90% detected RF Video Breakthrough : 20mV pk-pk maximum measured into 50 ohm, 400 MHz bandwidth Power Supplies : +5V @ 5mA max : -5V @ 5mA max					
TTL Control	C2	C3	C4	C5	RF Port to J1
	0	1	1	1	J2
	1	0	1	1	J3
	1	1	0	1	J4
	1	1	1	0	J5
	1	1	1	1	(None all isolating)
TTL Logic '0'	: 0 to 0.8V				
TTL Logic '1'	: 2.0 to 5.5V				

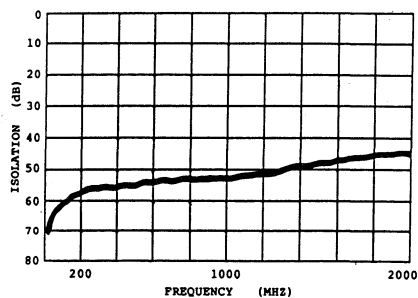
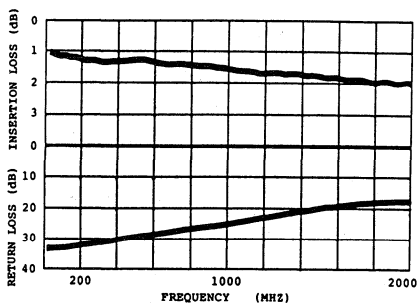
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North America: 800 366 2266

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## Typical Performance



## OUTLINE DRAWING

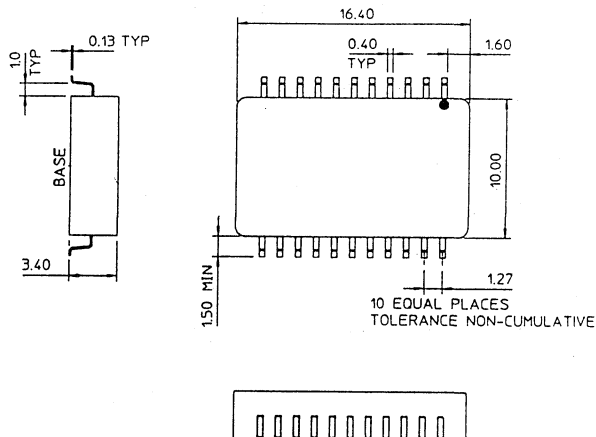
Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Material: Kovar/Glass with  
gold plate finish

Port 1 marked with dot.



## Terminal Notation

1	C2	TTL Control (J2)	8	G	Ground	15	J4	RF Output
2	C3	TTL Control (J3)	9	+V	Positive Power Supply	16	G	Ground
3	-V	Negative Power Supply	10	C4	TTL Control (J4)	17	G	Ground
4	G	Ground	11	C5	TTL Control (J5)	18	G	Ground
5	G	Ground	12	J5	RF Output	19	J3	RF Output
6	J1	RF Common	13	G	Ground	20	G	Ground
7	G	Ground	14	G	Ground	21	G	Ground
						22	J2	RF Output
								Case Ground

## Maximum Ratings

Operating Temperature Range	:	-40°C to +85°C
Storage Temperature Range	:	-55°C TO +100°C
RF Input Power	:	+23dBm

This product is one of a range of GaAs control components which includes multithrow switches, digital attenuators, delay lines and phase shifters. For further information on these and other M/A-COM Ltd products, please contact the factory.

All specifications are subject to change without notice

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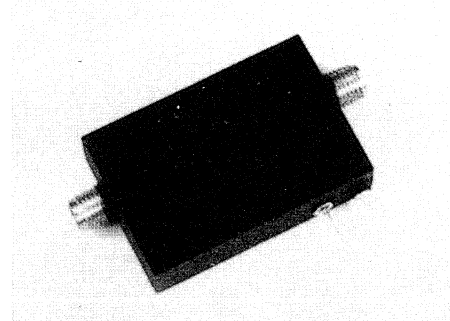


**REFLECTIVE ATTENUATOR**

**1.0 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Low Insertion Loss
- ◆ Current Controlled
- ◆ Low Cost
- ◆ Hermetically Sealed



**DESCRIPTION**

The ML 6610-100 Series of reflective attenuators from M/A-COM Ltd offers continuously variable attenuation over a wide dynamic range. Attenuation control is achieved by bias current variation. Octave bandwidth performances are obtained using a matched RF circuit giving good VSWR over the full frequency range. Devices are supplied in a standard SMA coaxial package, other outlines are available as options please contact the factory.

**SPECIFICATIONS**

Frequency Range (GHz)	Min Dynamic Range (dB)	Atten. Accuracy (Note 7) (dB) (%)	Max. Insertion Loss (dB)	Max VSWR (Low Loss)	Max Transition Time (ns)	Max Input Power (mW)	Current for Max Atten. (mA)	Part Number
1.0 2.0	40	±1.0 ±5	0.6	1.5	50	5	2.0	ML 6613-101
					5000	50	5.0	ML 6613-102
	60	±1.0 ±5	0.7	1.5	50	5	3.0	ML 6613-103
					5000	50	10.0	ML 6613-104
2.0 4.0	40	±1.0 ±5	0.8	1.6	50	10	2.0	ML 6614-101
					5000	100	5.0	ML 6614-102
	60	±1.0 ±5	1.0	1.6	50	10	3.0	ML 6614-103
					5000	100	10.0	ML 6614-104
4.0 8.0	40	±1.0 ±5	1.2	1.6	50	20	2.0	ML 6615-101
					5000	200	5.0	ML 6615-102
	60	±1.0 ±5	1.4	1.6	50	20	3.0	ML 6615-103
					5000	200	10.0	ML 6615-104
8.0 12.0	40	±1.0 ±5	1.6	1.7	50	20	2.0	ML 6616-101
					5000	200	5.0	ML 6616-102
	60	±1.0 ±5	1.8	1.7	50	20	3.0	ML 6616-103
					5000	200	10.0	ML 6616-104
12.0 18.0	40	±1.0 ±6	2.0	1.9	50	20	2.0	ML 6617-101
					5000	200	5.0	ML 6617-102
	60	±1.0 ±6	2.2	1.9	50	20	3.0	ML 6617-103
					5000	200	10.0	ML 6617-104
8.0 18.0	40	±1.0 ±10	2.0	1.9	50	20	2.0	ML 6618-101
					5000	200	5.0	ML 6618-102
	60	±1.0 ±10	2.2	1.9	50	20	3.0	ML 6618-103
					5000	200	10.0	ML 6618-104

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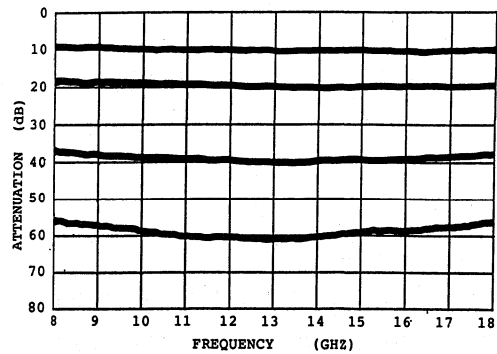
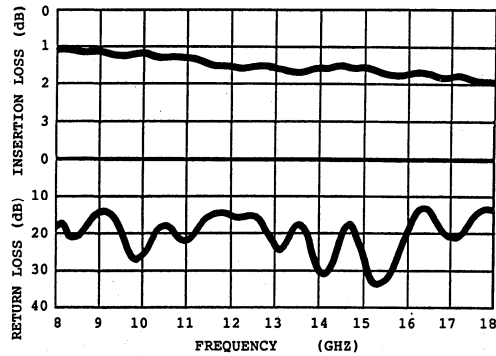
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## Typical Performance

### ML 6618-104



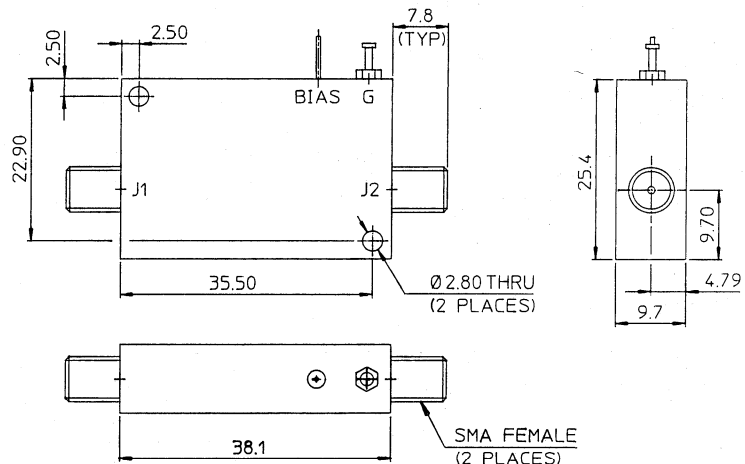
## Outline Drawing

### Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5\text{mm}$   
X.XX =  $\pm 0.2\text{mm}$

Standard Finish: Matt black paint  
to DTD 5555A



### NOTES:

- 1) J1 is RF input, J2 is RF output
- 2) Device is reflective input and output except in low loss state
- 3) DC bias requirements 0 to -10V for low loss, 0 to 10mA for attenuation
- 4) Any combination of SMA male/female connectors is available, please contact the factory
- 5) Transition time is defined as 10% to 90% detected RF
- 6) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C
- 7) Attenuation accuracy is specified in both dB and as a percentage of the attenuation setting. For any setting the higher of these figures will apply as the maximum specification. Attenuation accuracy includes the effects of frequency and temperature.

This data sheet describes a standard range of reflective attenuators available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

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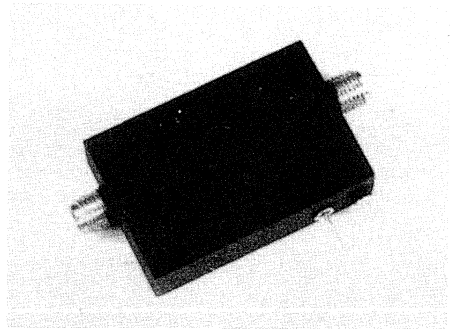
Asia Pacific: (81) 3 3226 1671

**ABSORPTIVE ATTENUATOR**

**1.0 TO 18.0 GHz**

**FEATURES**

- ◆ Broad Frequency Ranges
- ◆ Absorptive Input and Output
- ◆ Current Controlled
- ◆ TRATT RF Design
- ◆ Hermetically Sealed



**DESCRIPTION**

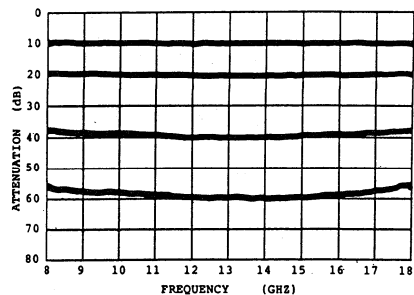
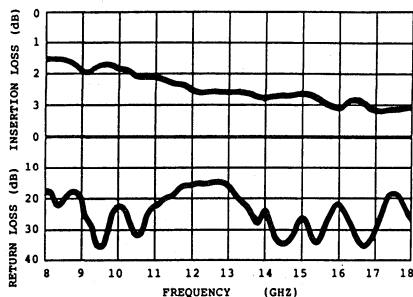
The ML 6620-100 Series of absorptive attenuators from M/A-COM Ltd offers continuously variable attenuation over a wide dynamic range. Attenuation control is achieved by bias current variation. Octave bandwidth performances are obtained using a tapered resistance RF circuit giving good VSWR over the full frequency and attenuation ranges. Devices are supplied in a standard SMA coaxial package, other outlines are available as options, please contact the factory.

**SPECIFICATIONS**

Frequency Range (GHz)	Min Dynamic Range (dB)	Atten. Accuracy (Note 7) (dB) (%)	Max. Insertion Loss (dB)	Max VSWR (Any State)	Max Transition Time (ns)	Max Input Power (mW)	Current for Max Atten. (mA)	Part Number
1.0 2.0 (any 25% band)	40	±0.4 ±2	1.2	1.3	50	5	2.0	ML 6623-101
					5000	50	5.0	ML 6623-102
	60	±0.4 ±2	1.4	1.3	50	5	3.0	ML 6623-103
					5000	50	10.0	ML 6623-104
2.0 4.0 (any 35% band)	40	±0.4 ±3	1.6	1.4	50	10	2.0	ML 6614-101
					5000	100	5.0	ML 6624-102
	60	±0.4 ±3	1.8	1.4	50	10	3.0	ML 6624-103
					5000	100	10.0	ML 6624-104
4.0 8.0 (any 50% band)	40	±0.7 ±4	2.0	1.6	50	20	2.0	ML 6625-101
					5000	200	5.0	ML 6625-102
	60	±0.7 ±4	2.2	1.6	50	20	3.0	ML 6625-103
					5000	200	10.0	ML 6625-104
8.0 12.0 (full band)	40	±1.0 ±5	2.3	1.7	50	20	2.0	ML 6626-101
					5000	200	5.0	ML 6626-102
	60	±1.0 ±5	2.5	1.7	50	20	3.0	ML 6626-103
					5000	200	10.0	ML 6626-104
12.0 18.0 (full band)	40	±1.0 ±6	3.0	1.9	50	20	2.0	ML 6627-101
					5000	200	5.0	ML 6627-102
	60	±1.0 ±6	3.4	1.9	50	20	3.0	ML 6627-103
					5000	200	10.0	ML 6627-104
8.0 18.0 (full band)	40	±1.0 ±10	3.0	2.0	50	20	2.0	ML 6628-101
					5000	200	5.0	ML 6628-102
	60	±1.0 ±10	3.4	2.2	50	20	3.0	ML 6628-103
					5000	200	10.0	ML 6628-104

## Typical Performance

### ML 6628-104



## Outline Drawing

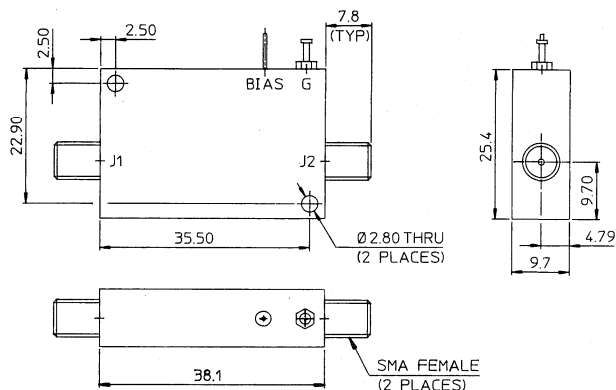
### Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm

X.XX =  $\pm 0.2$ mm

Standard Finish: matt black paint  
to DTD 5555A



### NOTES:

- 1) J1 is RF input, J2 is RF output
- 2) The device is absorptive on both input and output.
- 3) DC bias requirements 0 to -10V for low loss, 0 to +10mA for attenuation
- 4) Any combination of SMA male/female connectors is available, please contact the factory.
- 5) Transition time is defined as 10% to 90% detected RF.
- 6) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C
- 7) Attenuation accuracy is specified in both dB and as a percentage of the attenuation setting.  
For any setting the higher of these figures will apply as the maximum specification.  
Attenuation accuracy includes the effects of frequency and temperature.

This data sheet describes a range of absorptive attenuators available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

**All specifications subject to change without notice.**

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

North America: 800 366 2266

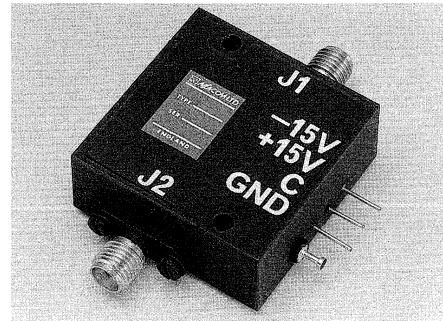
Asia Pacific: (81) 3 3226 1671

**MINIATURE ABSORPTIVE ATTENUATOR  
WITH LINEARISED DRIVER**

**1.0 TO 18.0 GHz**

**FEATURES**

- ◆ High Accuracy/Linearity
- ◆ Temperature Compensated
- ◆ Fast Switching Speed
- ◆ Miniature Outline
- ◆ Hermetically Sealed

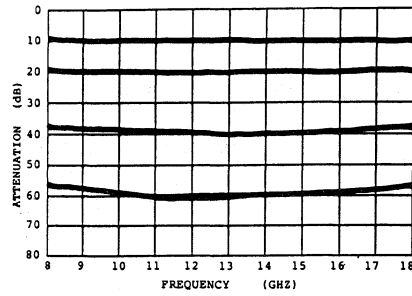
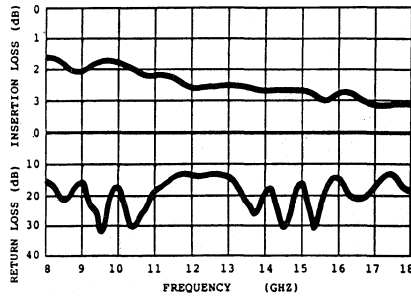

**DESCRIPTION**

The ML 6650-100D Series of linearised attenuators from M/A-COM Ltd offers continuously variable attenuation over a wide dynamic range. Attenuation control is achieved by control voltage variation with excellent linearity and temperature stability. The hybrid linearising driver circuit and matched RF circuit are packaged in a miniature coaxial outline with removable SMA connectors. Without connectors the devices may be integrated directly into microstrip circuits.

**SPECIFICATIONS**

Frequency Range (GHz)	Min Dynamic Range (dB)	Atten. Accuracy (Note 11) (dB) (%)	Max. Insertion Loss (dB)	Max VSWR (Any State)	Max Transition Time (us)	Max Switching Speed (us)	Part Number
1.0 2.0	40	±0.4 ±2	1.2	1.3	0.5	1.5	ML 6653-101D
(any 25% band)	60	±0.4 ±2	1.4	1.3	0.5	1.5	ML 6653-102D
2.0 4.0	40	±0.4 ±3	1.6	1.4	0.5	1.5	ML 6654-101D
(any 35% band)	60	±0.4 ±3	1.8	1.4	0.5	1.5	ML 6654-102D
4.0 8.0	40	±0.7 ±4	2.0	1.6	0.5	1.5	ML 6655-101D
(any 50% band)	60	±0.7 ±4	2.2	1.6	0.5	1.5	ML 6655-102D
8.0 12.0	40	±1.0 ±5	2.3	1.7	0.5	1.5	ML 6656-101D
(full band)	60	±1.0 ±5	2.5	1.7	0.5	1.5	ML 6656-102D
12.0 18.0	40	±1.0 ±6	3.0	1.9	0.5	1.5	ML 6657-101D
(full band)	60	±1.0 ±6	3.4	1.9	0.5	1.5	ML 6657-102D
8.0 18.0	40	±1.0 ±10	3.0	2.0	0.5	1.5	ML 6658-101D
(full band)	60	±1.0 ±10	3.4	2.2	0.5	1.5	ML 6658-102D

**ML 6658-102D**



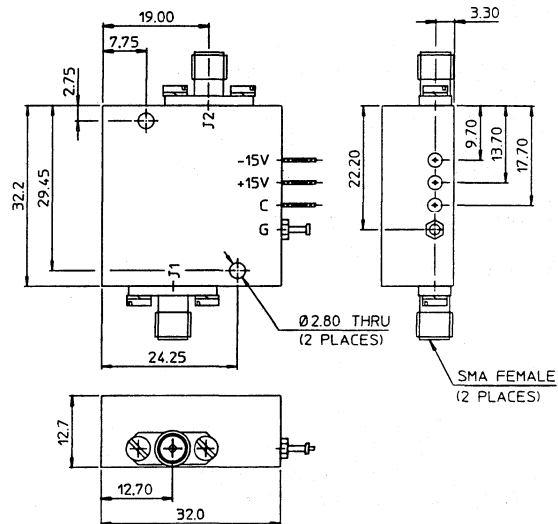
**Outline Drawing**

Third Angle Projection

All dimensions in mm

Tolerances X.X = ±0.5mm  
 X.XX = ±0.2mm

Standard Finish: matt black paint  
 to DTD 5555A



**NOTES:**

- 1) J1 is RF input, J2 is RF output
- 2) The device is absorptive on both input and output.
- 3) Power supplies required +15V @ 100mA maximum, -15V @ 100mA maximum
- 4) Transfer function 10dB/volt standard, other functions available as options, please contact the factory.
- 5) Maximum RF input power +17dBm below 2 GHz, +20dBm above 2 GHz.
- 6) Tuning voltage input impedance 10 Kohm.
- 7) Any combination of SMA male/female connectors is available, please contact the factory.
- 8) Transition time is defined as 10% to 90% detected RF.
- 9) Switching speed is defined as 50% control voltage to 90% detected RF.
- 10) Case operating temperature -55°C to +85°C.  
 Storage temperature -55°C to +125°C
- 11) Attenuation accuracy specification includes variation with frequency and temperature and voltage/attenuation linearity. Accuracy is specified in both dB and as a percentage, for any attenuation setting the higher of these figures will apply as the maximum specification.

This data sheet describes a range of linearised attenuators available from M/A-COM Ltd. An extensive library of non standard devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

**All specifications subject to change without notice.**

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Europe: (44) 1344 869595

North America: 800 366 2266

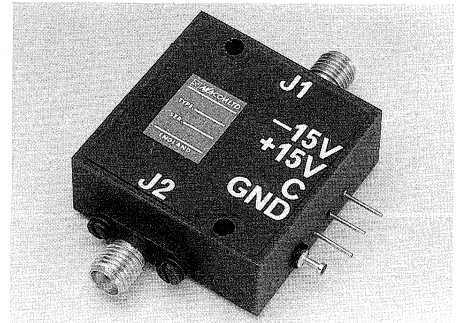
Asia Pacific: (81) 3 3226 1671

**MINIATURE DIGITAL ABSORPTIVE ATTENUATOR  
WITH TTL COMPATIBLE DRIVER**

**1.0 TO 18.0 GHz**

**FEATURES**

- ◆ High Attenuation Accuracy
- ◆ Guaranteed Monotonicity
- ◆ Temperature Compensated
- ◆ Fast Switching Speed
- ◆ Miniature Outline



**DESCRIPTION**

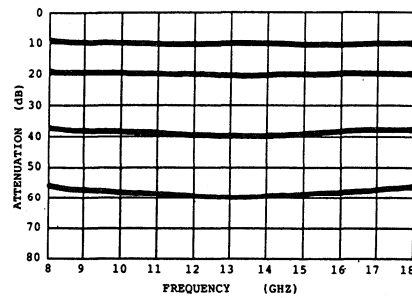
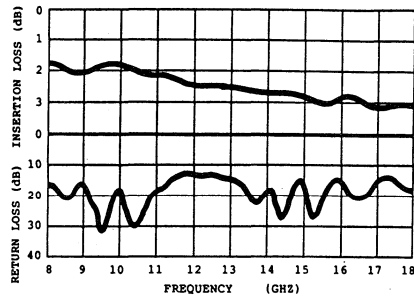
The ML 6660-100D Series of digital attenuators from M/A-COM Ltd offers high accuracy attenuation over wide dynamic ranges. Attenuation control is by 7 bit digital TTL input for 0.5dB step size and 6 bit input for 1.0dB step size. The matched RF and digital driver circuits are fully hybridised and packaged in a miniature coaxial outline with removable SMA connectors. Devices are hermetically sealed and operate over the full military temperature range.

**SPECIFICATIONS**

Frequency Range (GHz)	Min Dynamic Range (dB)	Min Step Size (dB)	Atten. Accuracy (Note 11) (dB) (%)	Max. Insertion Loss (dB)	Max VSWR (Any State)	Max Transition Time (us)	Max Switching Speed (us)	Part Number
1.0 2.0	40	0.5	±0.4 ±2	1.2	1.3	0.75	1.75	ML 6663-101D
(any 25% band)	60	1.0	±0.4 ±2	1.4	1.3	0.75	1.75	ML 6663-102D
2.0 4.0	40	0.5	±0.4 ±3	1.6	1.4	0.75	1.75	ML 6664-101D
(any 35% band)	60	1.0	±0.4 ±3	1.8	1.4	0.75	1.75	ML 6664-102D
4.0 8.0	40	0.5	±0.7 ±4	2.0	1.6	0.75	1.75	ML 6665-101D
(any 50% band)	60	1.0	±0.7 ±4	2.2	1.6	0.75	1.75	ML 6665-102D
8.0 12.0	40	0.5	±1.0 ±5	2.3	1.7	0.75	1.75	ML 6666-101D
(full band)	60	1.0	±1.0 ±5	2.5	1.7	0.75	1.75	ML 6666-102D
12.0 18.0	40	0.5	±1.0 ±6	3.0	1.9	0.75	1.75	ML 6667-101D
(full band)	60	1.0	±1.0 ±6	3.4	1.9	0.75	1.75	ML 6667-102D
8.0 18.0	40	0.5	±1.0 ±10	3.0	2.0	0.75	1.75	ML 6668-101D
(full band)	60	1.0	±1.0 ±10	3.4	2.2	0.75	1.75	ML 6668-102D

## Typical Performance

### ML 6668-102D



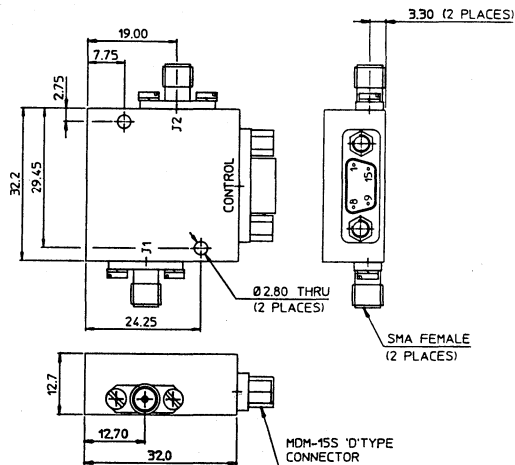
## Outline Drawing

### Third Angle Projection

All dimensions in mm

Tolerances X.X =  $\pm 0.5$ mm  
X.XX =  $\pm 0.2$ mm

Standard Finish: matt black paint  
to DTD 5555A



## NOTES:

- 1) J1 is RF input, J2 is RF output
- 2) The device is absorptive on both input and output.
- 3) Power supplies required +15V @ 100mA maximum, -15V @ 100mA maximum
- 4) Control input is 6 bit binary TTL for 1.0dB step size or 7 bit binary TTL for 0.5dB step size. For each bit TTL '0' selects low loss state TTL '1' selects attenuation state.
- 5) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V.
- 6) Maximum RF input power +17dBm below 2 GHz, +20dBm above 2 GHz.
- 7) Any combination of SMA male/female connectors is available, please contact the factory.
- 8) Transition time is defined as 10% to 90% detected RF.
- 9) Switching speed is defined as 50% TTL to 90% detected RF.
- 10) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C.
- 11) Attenuation accuracy specification includes variation with frequency and temperature and setting accuracy. Accuracy is specified in both dB and as a percentage, for any attenuation setting the higher of these figures will apply as the maximum specification.

This data sheet gives an introduction to the range of digital attenuators available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

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M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

North America: 800 366 2266

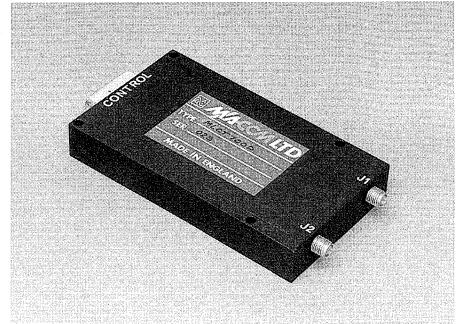
Asia Pacific: (81) 3 3226 1671



**DIGITAL ABSORPTIVE ATTENUATOR  
WITH TTL COMPATIBLE DRIVER  
1.0 TO 18.0 GHz**

**FEATURES**

- ◆ High Attenuation Accuracy
- ◆ Guaranteed Monotonicity
- ◆ Temperature Compensated
- ◆ Fast Switching Speed
- ◆ Hermetically Sealed



**DESCRIPTION**

The ML 6670-100D Series of digital attenuators from M/A-COM Ltd offers high accuracy attenuation over wide dynamic ranges. Attenuation control is by 7 bit digital TTL input for 0.5dB step size and 6 bit input for 1.0dB step size. Two options are available in each frequency band offering either fast switching speed or high power handling. The matched RF hybrid circuit and surface mount driver circuit are packaged in an hermetic coaxial outline. The use of PIN diode and surface mount technology coupled with automated test facilities ensure a high quality product at minimum cost.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Min Dynamic Range (dB)	Min Step Size (dB)	Atten. Accuracy (Note 10) (dB) (%)	Max. Insertion Loss (dB)	Max VSWR (Any State)	Max Transition Time (us)	Max Switching Speed (us)	Max Input Power (dBm)	Part Number
1.0 - 2.0 (any 25% band)	60	1.0	±0.4 ±2	1.4	1.3	2	4	+20	ML 6673-601D
						10	15	+27	ML 6673-602D
	40	0.5	±0.4 ±2	1.2	1.3	2	4	+20	ML 6673-701D
						10	15	+27	ML 6673-702D
2.0 - 4.0 (any 35% band)	60	1.0	±0.4 ±3	1.8	1.4	2	4	+20	ML 6674-601D
						10	15	+27	ML 6674-602D
	40	0.5	±0.4 ±3	1.6	1.4	2	4	+20	ML 6674-701D
						10	15	+27	ML 6674-702D
4.0 - 8.0 (any 50% band)	60	1.0	±1.0 ±4	2.2	1.6	2	4	+20	ML 6675-601D
						10	15	+27	ML 6675-602D
	40	0.5	±0.5 ±4	2.0	1.6	2	4	+20	ML 6675-701D
						10	15	+27	ML 6675-702D
8.0 - 12.0 (full band)	60	1.0	±1.0 ±5	2.5	1.7	2	4	+20	ML 6676-601D
						10	15	+27	ML 6676-602D
	40	0.5	±0.5 ±5	2.3	1.7	2	4	+20	ML 6676-701D
						10	15	+27	ML 6676-702D
12.0 - 18.0 (full band)	60	1.0	±1.0 ±6	3.7	1.9	2	4	+20	ML 6677-601D
						10	15	+27	ML 6677-602D
	40	0.5	±0.5 ±6	3.2	1.9	2	4	+20	ML 6677-701D
						10	15	+27	ML 6677-702D
8.0 - 18.0 (full band)	60	1.0	±1.0 ±10	4.5	2.2	2	4	+20	ML 6678-601D
						10	15	+27	ML 6678-602D
	40	0.5	±0.5 ±10	4.0	2.2	2	4	+20	ML 6678-701D
						10	15	+27	ML 6678-702D

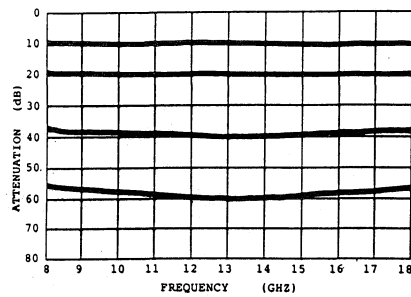
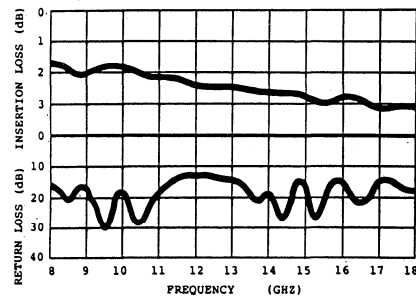
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Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**ML 6678-602D**



**Outline Drawing**

**Third Angle Projection**

All dimensions in mm

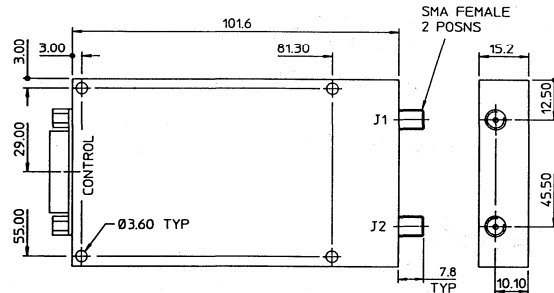
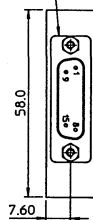
Tolerances X.X = ±0.5mm

X.XX = ±0.2mm

Standard Finish: Matt black paint  
to DTD 5555A

D Connector	Pin Out
1, 2, 3, 4, 9, 10	No Connection
5	TTL 6
6	TTL 4
7	TTL 2
8	+5V
11	Ground
12	TTL 7 (7 Bit only)
13	TTL 5
14	TTL 3
15	TTL 1 (LSB)

15 WAY 'D' TYPE  
(Male) ITT DA15P



**NOTES:**

- 1) J1 is RF input, J2 is RF output
- 2) The device is absorptive on both input and output.
- 3) Power supply required +5V @ 100mA maximum.
- 4) Control input is 6 bit binary TTL for 1.0dB step size or 7 bit binary TTL for 0.5dB step size. For each bit TTL '0' selects low loss state TTL '1' selects attenuation state.
- 5) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V.
- 6) Any combination of SMA male/female connectors is available, please contact the factory.
- 7) Transition time is defined as 10% to 90% detected RF.
- 8) Switching speed is defined as 50% TTL to 90% detected RF.
- 9) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C.
- 10) Attenuation accuracy specification includes variation with frequency and temperature and setting accuracy. Accuracy is specified in both dB and as a percentage, for any attenuation setting the higher of these figures will apply as the maximum specification.

This data sheet gives an introduction to the range of digital attenuators available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

**All specifications subject to change without notice.**

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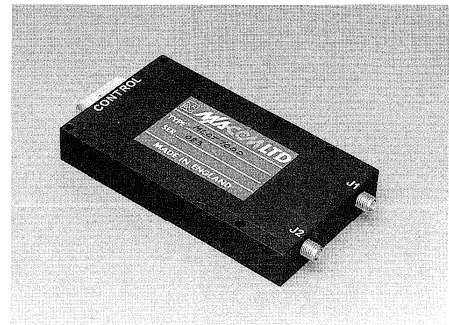
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**DIGITAL PIN DIODE ATTENUATOR**  
**WITH TTL COMPATIBLE DRIVER**  
**700 TO 1100 MHz**

**FEATURES**

- ◆ 80dB Dynamic Range
- ◆ High Setting Accuracy
- ◆ TTL Compatible
- ◆ 1 Watt Power Rating
- ◆ Designed for Cellular Applications


**DESCRIPTION**

Designed primarily for commercial applications the MLCT 700D offers precision attenuation control over an instantaneous bandwidth from 700 MHz to 1100 MHz. Attenuation setting is by 7 bit TTL control (HCMOS Option available) over the range of 0dB to 80dB in 1dB steps. The setting accuracy over the full frequency range and temperature range of -30°C to +70°C, is better than ±0.4dB to 20dB and better than ±2% above 20dB. In the zero attenuation state the insertion loss is less than 1.2dB while the input and output ports have better than 1.40:1 VSWR for any attenuation setting.

**SPECIFICATION**

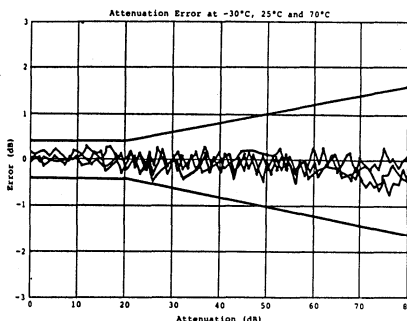
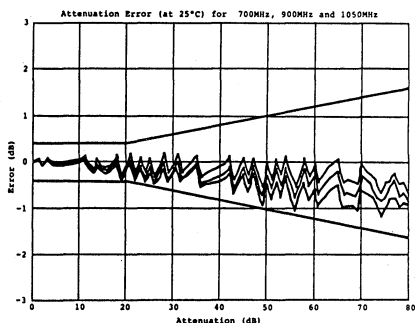
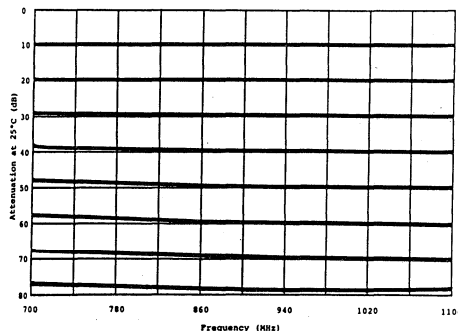
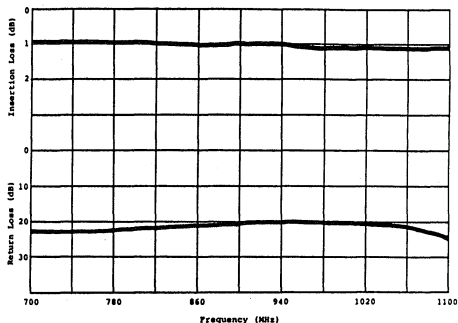
Frequency Range	:	700 - 1100 MHz.
Attenuation Range	:	80dB min.
Attenuation Step Size	:	1dB min.
Attenuation Accuracy	:	±0.4dB or ±2%, whichever is greater.
Control	:	7 Bit binary in 1, 2, 4, 8, 16, 32 and 64dB steps.
Switching Speed	:	70us max, 50% logic to 90% RF.
Insertion Loss	:	1.2dB max.
Return Loss	:	16dB min.
RF Power Rating	:	+30dBm max.
Control Signal	:	TTL (HCMOS Option).
Power Supply	:	+5V, 100mA max.

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

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Asia Pacific: (81) 3 3226 1671



## MECHANICAL CHARACTERISTICS

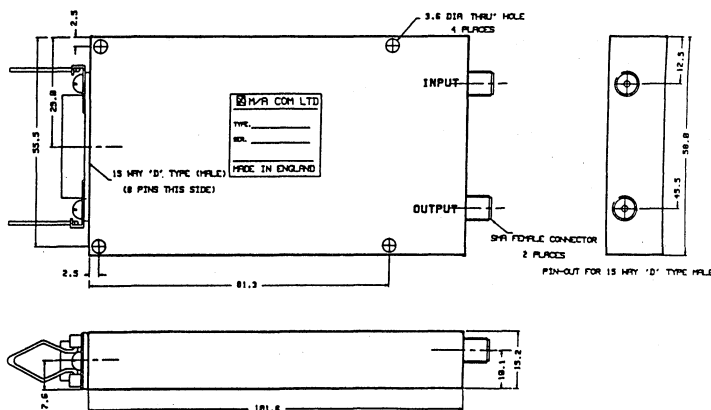
Third Angle Projection

All dimensions in mm

Tolerances  
 x.x = ±0.5mm  
 x.xx = ±0.2mm

Standard Finish: Matt black paint to DTD 5555A

Control Pin	Function
1,2,3,4,9,10	Not connected
5	TTL (32dB bit)
6	TTL (8dB bit)
7	TTL (2dB bit)
8	+5V
11	Ground
12	TTL (64dB bit)
13	TTL (16dB bit)
14	TTL (4dB bit)
15	TTL (1dB bit)



### NOTES:

- 1) J1 is RF input, J2 is RF output.
- 2) TTL Logic '0' is 0 to 0.8V, TTL Logic '1' is 2.0 to 5.5V
- 3) Any combination of SMA male or female connectors is available, please contact the factory
- 4) Transition time is defined as 10% to 90% detected RF.  
Switching time is defined as 50% TTL to 90% detected RF.
- 5) Case operating temperature is -30°C to +70°C  
Storage temperature is -50°C to +100°C

All specifications are subject to change without notice

M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

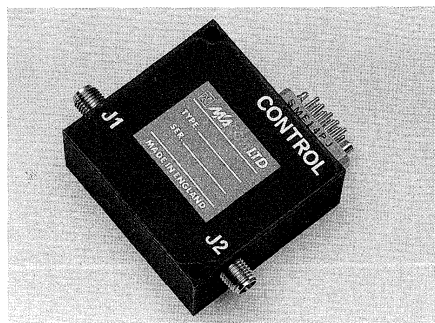
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**6 BIT DIGITAL SWITCHED PAD ATTENUATOR  
WITH TTL COMPATIBLE DRIVER  
0.5 TO 18.0 GHz**

**FEATURES**

- ◆ **Broad Frequency Ranges**
- ◆ **High Attenuation Accuracy**
- ◆ **Low Harmonic Distortion**
- ◆ **Fast Switching Speed**
- ◆ **Low Intermodulation Products**


**DESCRIPTION**

The ML 6680-600D Series of switched pad attenuators from M/A-COM Ltd offers high accuracy attenuation over ultra broadband frequency ranges controlled by a 6 bit TTL input. The fully hybridised RF and driver circuits are packaged in an hermetic coaxial outline. These devices have the advantages of fast switching speeds and low harmonic generation as well as higher power handling over very broad bands.

**SPECIFICATIONS @ +25°C**

Frequency Range (GHz)	Min Dynamic Range (dB)	Min Step Size (dB)	Atten. Accuracy (Note 11)		Max. Insertion Loss (dB)	Max VSWR (Any State)	Max Transition Time (ns)	Max Switching Speed (ns)	Part Number
			(dB)	(%)					
0.5 - 2.0	15.75	0.25	±0.25	±5	4.0	1.4	50	200	ML 6683-601D
	31.50	0.50	±0.50	±5	4.0	1.4	50	200	ML 6683-602D
	63.00	1.00	±1.00	±5	4.0	1.4	50	200	ML 6683-603D
2.0 - 6.0	15.75	0.25	±0.25	±5	5.0	1.5	50	200	ML 6684-601D
	31.50	0.50	±0.50	±5	5.0	1.5	50	200	ML 6684-602D
	63.00	1.00	±1.00	±5	5.0	1.5	50	200	ML 6684-603D
6.0 - 12.0	15.75	0.25	±0.25	±5	6.0	1.6	50	200	ML 6685-601D
	31.50	0.50	±0.50	±5	6.0	1.6	50	200	ML 6685-602D
	63.00	1.00	±1.00	±5	6.0	1.6	50	200	ML 6685-603D
12.0 - 18.0	15.75	0.25	±0.25	±6	10.0	2.0	50	200	ML 6686-601D
	31.50	0.50	±0.50	±6	10.0	2.0	50	200	ML 6686-602D
	63.00	1.00	±1.00	±6	10.0	2.0	50	200	ML 6686-603D
6.0 - 18.0	15.75	0.25	±0.25	±7	10.0	2.0	50	200	ML 6687-601D
	31.50	0.50	±0.50	±7	10.0	2.0	50	200	ML 6687-602D
	63.00	1.00	±1.00	±7	10.0	2.0	50	200	ML 6687-603D
0.5 - 18.0	15.75	0.25	±0.25	±10	11.0	2.5	50	200	ML 6688-601D
	31.50	0.50	±0.50	±10	11.0	2.5	50	200	ML 6688-602D
	63.00	1.00	±1.00	±10	11.0	2.5	50	200	ML 6688-603D

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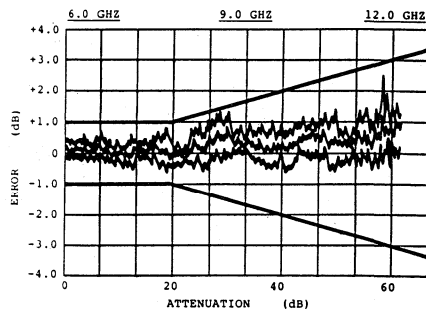
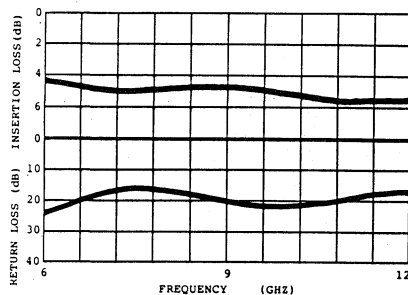
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## Typical Performance

### ML 6685-603D



## Outline Drawing

### Third Angle Projection

All dimensions in mm

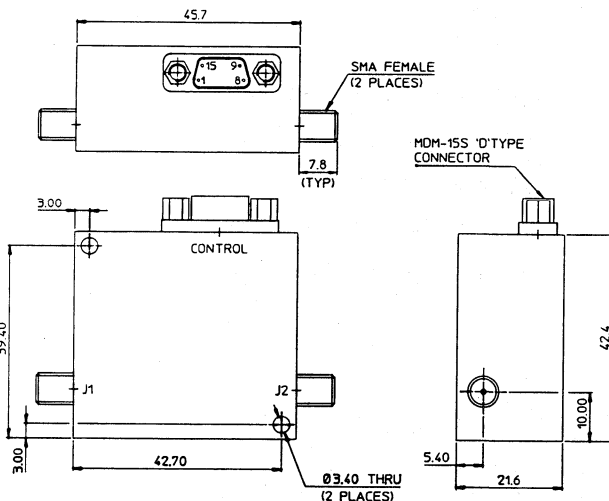
Tolerances X.X =  $\pm 0.5$ mm

X.XX =  $\pm 0.2$ mm

Standard Finish: Matt black paint  
to DTD 5555A

### D Connector Pin Out

1,2,3,4,9,10,	no connection
5	TTL 6 (MSB)
6	TTL 4
7	TTL 2
8	+5V
11	Ground
12	-15V
13	TTL 5
14	TTL 3
15	TTL 1 (LSB)



### NOTES:

- 1) J1 is RF input, J2 is RF output
- 2) The device is absorptive on both input and output.
- 3) Power supplies required +5V @ 250mA maximum, -15V @ 100mA maximum.
- 4) Control input is 6 bit binary TTL. For each bit TTL '0' selects low loss state TTL '1' selects attenuation state.
- 5) TTL logic '0' is 0 to 0.8V, TTL logic '1' is 2.0 to 5.5V.
- 6) Maximum RF input power +23dBm
- 7) Any combination of SMA male/female connectors is available, please contact the factory.
- 8) Transition time is defined as 10% to 90% detected RF.
- 9) Switching speed is defined as 50% TTL to 90% detected RF.
- 10) Case operating temperature -55°C to +85°C  
Storage temperature -55°C to +125°C.
- 11) Attenuation accuracy specification includes variation with frequency and temperature and setting accuracy. Accuracy is specified in both dB and as a percentage, for any attenuation setting the higher of these figures will apply as the maximum specification.

This data sheet gives an introduction to the range of switched pad attenuators available from M/A-COM Ltd. An extensive library of devices backed by in-house design and engineering support is available to meet specialised customer requirements, please contact the factory for applications assistance.

All specifications subject to change without notice.

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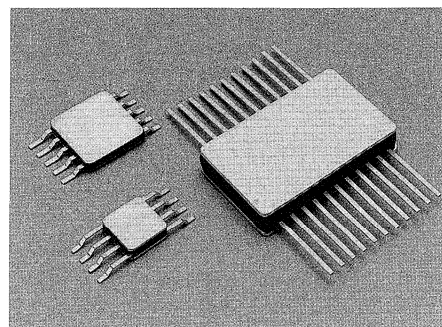
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**3 BIT GaAs MMIC DIGITAL ATTENUATOR  
WITH INTEGRAL TTL COMPATIBLE DRIVER  
50 TO 2000 MHz**

**FEATURES**

- ◆ High Attenuation Accuracy
- ◆ High Temperature Stability
- ◆ Fast Switching Speed
- ◆ Low Current Consumption
- ◆ Surface Mount Package



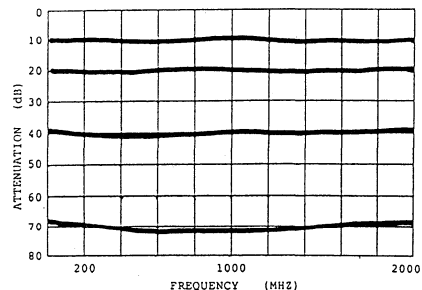
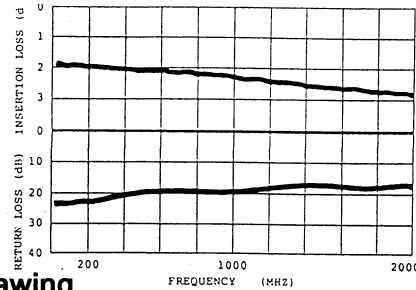
**DESCRIPTION**

The MLT 300D Digital Attenuator utilises GaAs MMIC devices integrated with a TTL compatible driver to provide accurate, high speed attenuation control. The device has a dynamic range of 70dB digitally variable in 10dB steps by a 3 bit TTL input. The device is supplied in a miniature hermetic package suitable for surface mount printed circuit boards, stripline compatible and coaxial outlines are also available as options.

**SPECIFICATION @ +25°C**

Frequency Range	: 50 to 2000 MHz
Insertion Loss	: 3.0dB Maximum
VSWR	: 1.4 maximum any attenuation state
Attenuation Range	: 70dB
Attenuation Step Size	: 10dB
Attenuation Accuracy	: $\pm 1.0\text{dB}$ or $\pm 5\%$ maximum (with frequency & temperature) whichever is greater
RF Input Power	: +23dBm maximum
Transition Time	: 20ns maximum, 10% to 90% detected RF
Switching Speed	: 200ns maximum, 50% TTL to 90% detected RF
Power Supply	: +5V @ 5mA maximum
Control Inputs	: TTL Compatible, See Truth Table

### Typical Performance



### Outline Drawing

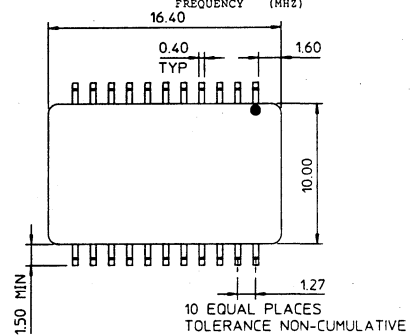
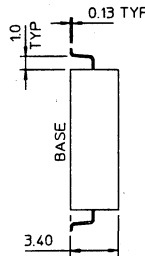
Third Angle Projection

All dimensions in mm

Tolerances: x.x = ±0.5mm  
x.xx = ±0.2mm

Material: Kovar/Glass with gold plate finish

Port 1 marked with dot.



### Terminal Notation

- 1. +V Positive Power Supply
- 2. G Ground
- 3. G Ground
- 4. C1 TTL Control (10dB bit)
- 5. G Ground
- 6. C2 TTL Control (20dB bit)
- 7. G Ground

- 8. C3 TTL Control (40dB bit)
- 9. G Ground
- 10. G Ground
- 11. G Ground
- 12. J1 RF Input
- 13. G Ground
- 14. G Ground



- 15. G Ground
  - 16. G Ground
  - 17. G Ground
  - 18. G Ground
  - 19. G Ground
  - 20. G Ground
  - 21. G Ground
  - 22. J2 RF Output
- Case Ground

### Truth Table

TTL CONTROL INPUT			ATTENUATION SETTING
C1	C2	C3	
0	0	0	Insertion Loss State 10dB 20dB 40dB
1	0	0	
0	1	0	
0	0	1	
Any Combination			Sum of Bits Selected
TTL Logic '0' is 0 to 0.8V, TTL '1' is 2.0 to 5.5V			

### Maximum Ratings

- Operating Temperature Range : -40°C to +85°C
- Storage Temperature Range : -55°C to +100°C
- RF Input Power : +23dBm

This data sheet describes one of a series of digital attenuators available from M/A-COM Ltd. Other combinations of dynamic range and step size are available as standard, please contact the factory for further information.

All specifications are subject to change without notice.

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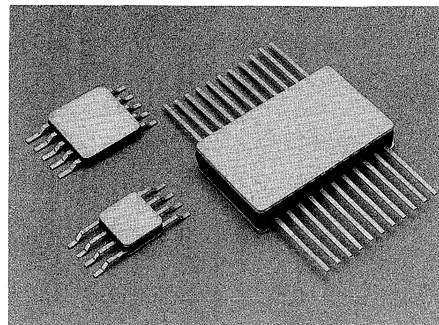
Asia Pacific: (81) 3 3226 1671



**4 BIT GaAs MMIC DIGITAL ATTENUATOR  
WITH INTEGRAL TTL COMPATIBLE DRIVER  
50 TO 2000 MHz**

**FEATURES**

- ◆ **High Attenuation Accuracy**
- ◆ **High Temperature Stability**
- ◆ **Fast Switching Speed**
- ◆ **Low Current Consumption**
- ◆ **Surface Mount Package**



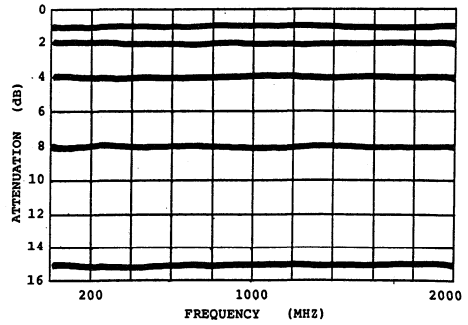
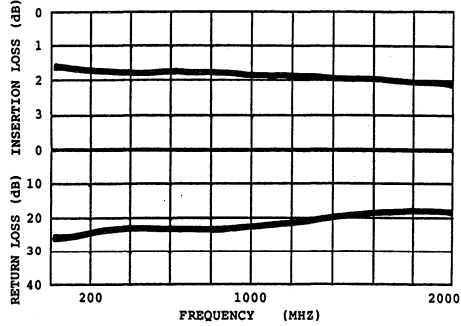
**DESCRIPTION**

The MLT 400D Digital Attenuator utilises GaAs MMIC devices integrated with a TTL compatible driver to provide accurate, high speed attenuation control. The device has a dynamic range of 15dB digitally variable in 1dB steps by a 4 bit TTL input. The device is supplied in a miniature hermetic package suitable for surface mount printed circuit boards, stripline compatible and coaxial outlines are also available as options.

**SPECIFICATION @ +25°C**

Frequency Range	: 50 to 2000 MHz
Insertion Loss	: 2.3dB Maximum
VSWR	: 1.4 maximum any attenuation state
Attenuation Range	: 15dB
Attenuation Step Size	: 1dB
Attenuation Accuracy	: $\pm 0.5$ dB or $\pm 5\%$ maximum (with frequency & temperature) whichever is greater
RF Input Power	: +23dBm maximum
Transition Time	: 20ns maximum 10% to 90% detected RF
Switching Speed	: 200ns maximum 50% TTL to 90% detected RF
Power Supply	: +5V @ 5mA maximum
Control Inputs	: TTL Compatible, See Truth Table

**Typical Performance**



**Outline Drawing**

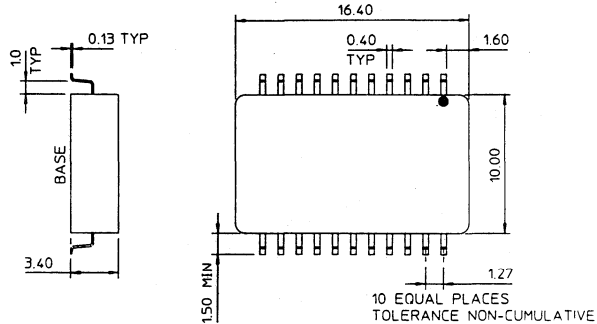
Third Angle Projection

All dimensions in mm

Tolerances: x.x = ±0.5mm  
x.xx = ±0.2mm

Material: Kovar/Glass with gold plated finish

Port 1 marked with dot



**Terminal Notation**

- |                |                  |  |
|----------------|------------------|--|
| 1. J1 RF Input | 8. G Ground      | 15. TTL Control (1.0dB bit)              |
| 2. G Ground    | 9. G Ground      | 16. TTL Control (2.0dB bit)              |
| 3. G Ground    | 10. G Ground     | 17. TTL Control (4.0dB bit)              |
| 4. G Ground    | 11. G Ground     | 18. TTL Control (8.0dB bit)              |
| 5. G Ground    | 12. J2 RF Output | 19. G Ground                             |
| 6. G Ground    | 13. G Ground     | 20. G Ground                             |
| 7. G Ground    | 14. G Ground     | 21. G Ground                             |
|                |                  | 22. +V Positive Power Supply Case Ground |

**Truth Table**

**TTL CONTROL INPUT**

0	0	0	0
1	0	0	0
0	1	0	0
0	0	1	0
0	0	0	1

Any combination

TTL Logic '0' is 0 to 0.8V, TTL '1' is 2.0 to 5.5V

**ATTENUATION SETTING**

Insertion Loss State
1.0dB
2.0dB
4.0dB
8.0dB

Sum of bits selected

**Maximum Ratings**

- Operating Temperature Range : -40°C to +85°C  
 Storage Temperature Range : -55°C to +100°C  
 RF Input Power : +23dBm

This data sheet describes one of a series of digital attenuators available from M/A-COM Ltd. Other combinations of dynamic range and step size are available as standard, please contact the factory for further information.

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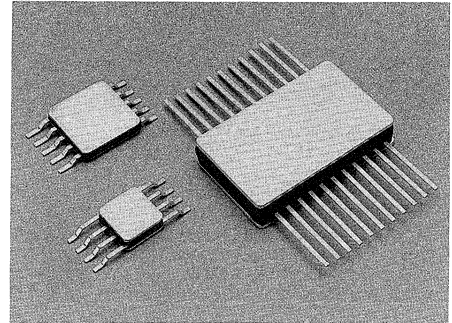
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

**5 BIT GaAs MMIC DIGITAL ATTENUATOR  
WITH INTEGRAL TTL COMPATIBLE DRIVER  
50 TO 2000 MHz**

**FEATURES**

- \* **High Attenuation Accuracy**
- \* **High Temperature Stability**
- \* **Fast Switching Speed**
- \* **Low Current Consumption**
- \* **Surface Mount Package**



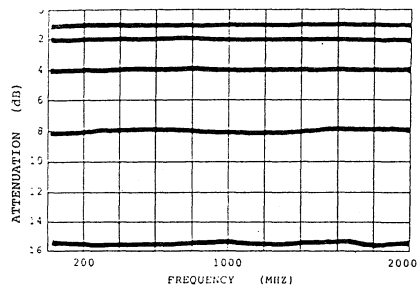
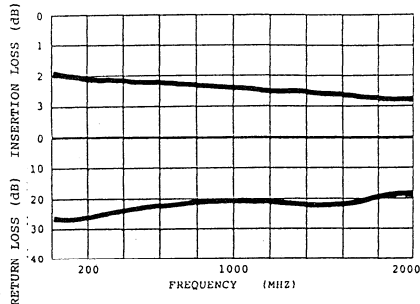
**DESCRIPTION**

The MLT 500D Digital Attenuator utilises GaAs MMIC devices integrated with a TTL compatible driver to provide accurate, high speed attenuation control. The device has a dynamic range of 15.5dB digitally variable in 0.5dB steps by a 5 bit TTL input. The device is supplied in a miniature hermetic package suitable for surface mount printed circuit boards, stripline compatible and coaxial outlines are also available as options.

**SPECIFICATION @ +25°C**

Frequency Range	:	50 to 2000 MHz
Insertion Loss	:	3.0dB Maximum
VSWR	:	1.4 maximum any attenuation state
Attenuation Range	:	15.5dB
Attenuation Step Size	:	0.5dB
Attenuation Accuracy	:	±0.5dB or ±5% maximum (with frequency & temperature) whichever is greater
RF Input Power	:	+23dBm maximum
Transition Time	:	20ns maximum 10% to 90% detected RF
Switching Speed	:	200ns maximum 50% TTL to 90% detected RF
Power Supply	:	+5V @ 5mA maximum,
Control Inputs	:	TTL Compatible, See Truth Table

## Typical Performance



## Outline Drawing

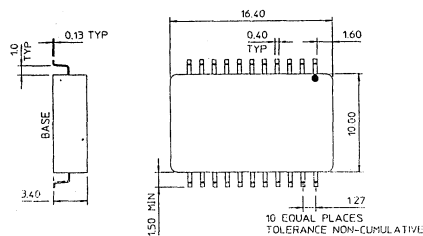
### Third Angle Projection

All dimensions in mm

Tolerances: x.x =  $\pm 0.5$ mm  
x.xx =  $\pm 0.2$ mm

Material: Kovar/Glass with  
gold plated finish

Port 1 marked with dot.



## Terminal Notation

1. J1 RF Input	8. G Ground	15. C1 TTL Control (0.5dB bit)
2. G Ground	9. G Ground	16. C2 TTL Control (1.0dB bit)
3. G Ground	10. G Ground	17. C3 TTL Control (2.0dB bit)
4. G Ground	11. G Ground	18. C4 TTL Control (4.0dB bit)
5. G Ground	12. J2 RF Output	19. C5 TTL Control (8.0dB bit)
6. G Ground	13. G Ground	20. G Ground
7. G Ground	14. G Ground	21. G Ground
		22. +V Positive Power Supply
		Case Ground

## Truth Table

TTL CONTROL INPUT					ATTENUATION SETTING	
C1	C2	C3	C4	C5		
0	0	0	0	0	Insertion Loss State	
1	0	0	0	0	0.5dB	
0	1	0	0	0	1.0dB	
0	0	1	0	0	2.0dB	
0	0	0	1	0	4.0dB	
0	0	0	0	1	8.0dB	
Any combination					Sum of bits selected	
TTL Logic '0' is 0 to 0.8V, TTL '1' is 2.0 to 5.5V						

## Maximum Ratings

Operating Temperature Range	: -40°C to +85°C
Storage Temperature Range	: -55°C to +100°C
RF Input Power	: +23dBm

This data sheet describes one of a series of digital attenuators available from M/A-COM Ltd. Other combinations of dynamic range and step size are available as standard. Please contact the factory for further information.

All specifications are subject to change without notice

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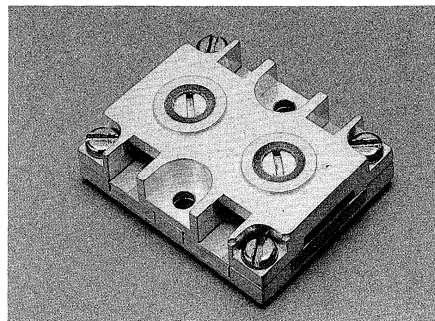
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**VARIABLE MINIATURE ATTENUATOR**
**0.7 TO 2.2 GHz**
**FEATURES**

- ◆ 180° Linear Adjustment
- ◆ 3dB Dynamic Range
- ◆ Miniature Size, Low Weight
- ◆ Space Qualified


**DESCRIPTION**

The MLT-1000 consists of two separate passive attenuators in a simple miniature housing. 180° adjustment provides 0.25 to 1.75 dB linear attenuation with minimal phase variation and flat response over temperature. These units are designed for pre-set trimming applications where amplitude tracking is critical and are suitable for direct bonding to microstrip or surface mount use.

**SPECIFICATION**

Frequency (GHz)	Insertion Loss (Min Atten.) (dB)	Insertion Loss (Max Atten.) (dB)	VSWR	Phase Variation (Degrees)	Insertion Loss Flatness (dB)
1.52 - 1.66	0.25	1.75	1.3:1	±2°	0.05

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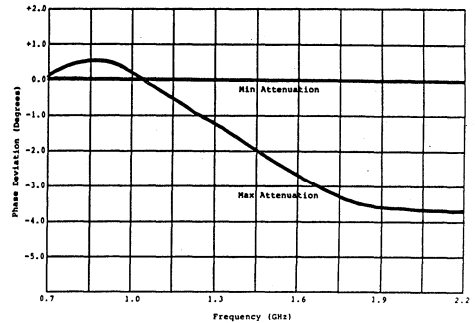
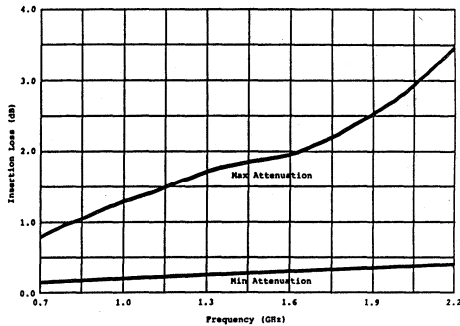
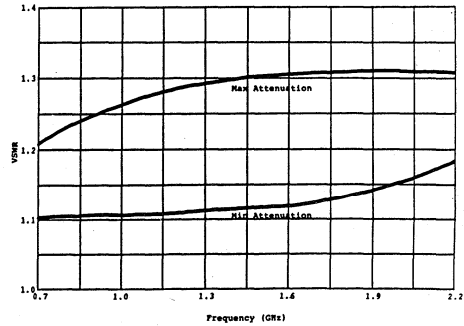
Asia Pacific: (81) 3 3226 1671

### TYPICAL PERFORMANCE CURVES

Optimised Frequency : 1.52 - 1.66 GHz

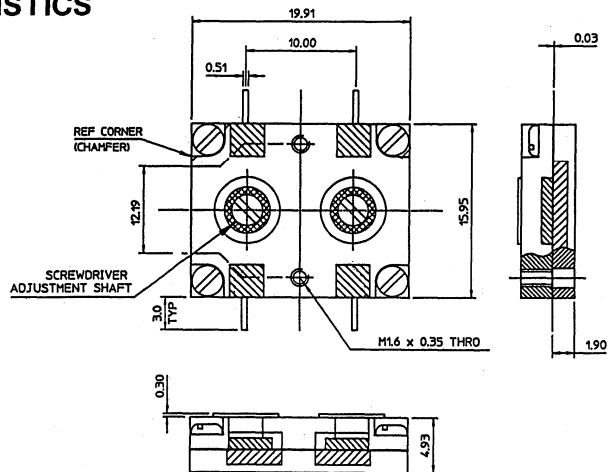
Operating Temperature : -20°C to +80°C

Power Handling (CW) : 1 Watt



### MECHANICAL CHARACTERISTICS

Weight : 3.5g



### ENVIRONMENTAL CHARACTERISTICS

Operating Temperature Range : -40°C to +85°C

Storage Temperature Range : -40°C to +85°C

All specifications are typical and subject to change without notice

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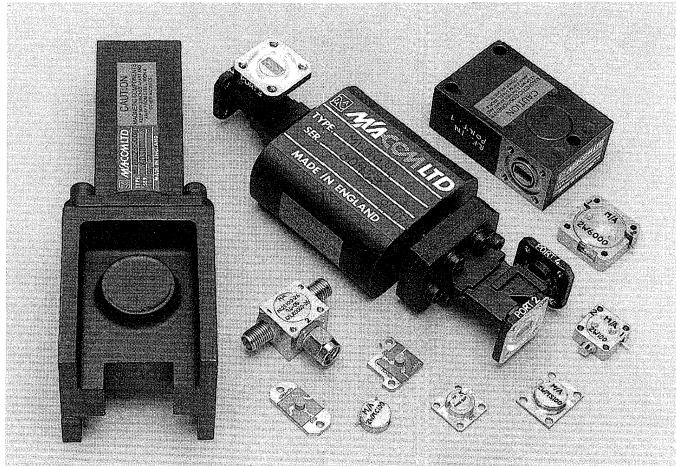
North America: 800 366 2266



Asia Pacific: (81) 3 3226 1671

# FERRITE COMPONENTS AND FILTERS

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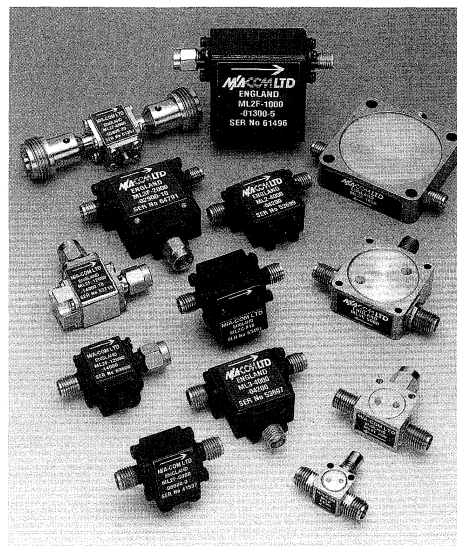
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## COAXIAL ISOLATORS AND CIRCULATORS 0.3 TO 20.0 GHz

### FEATURES

- ◆ SMA and N Type Connectors
- ◆ Space Qualified Versions
- ◆ European Manufacture
- ◆ Magnetically Shielded
- ◆ Coaxial Standard Outlines
- ◆ Ferropac Miniature Outlines
- ◆ High Power Options



### DESCRIPTION

The ML 2/3 Series of magnetically shielded isolators and circulators are rugged components suitable for all types of connectorised coaxial microwave circuits. Devices are available to cover all the standard frequency ranges for both narrowband and over octave bandwidth applications.

Each frequency range is available in either standard coaxial or miniature ferropac coaxial outlines. The standard coaxial series offer well proven, balanced stripline designs with excellent r.f. performance at low cost. The ferropac coaxial series offer similar performance in fully magnetically shielded miniature packages. For both types excellent temperature stability is achieved with the use of integral magnetic compensation circuits.

Devices are supplied as standard with stainless steel SMA (or N type where indicated) female connectors. Options such as alternative frequency ranges, connector type and location, termination type and location, power handling and orientation are available, please contact the factory for details.

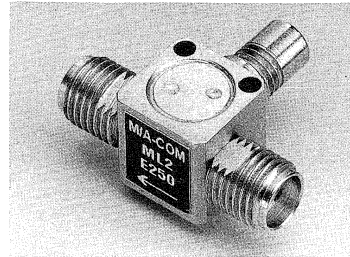
Ferropac Coaxial Isolators

ML 2E Series

Ferropac Coaxial Circulators

ML 3E Series

A series of fully magnetically shielded miniature, coaxial isolators and circulators with SMA connectors. Both narrowband and broadband frequency ranges are specified.



## SPECIFICATIONS (guaranteed over operating temperature range)

Frequency Range (GHz)	Band-Width (%)	Min Isolation (dB)	Max. Insertion Loss (dB)		Circulator Rated Power (W)		Operating Temperature (°C)	Package Style	Part Number
			Loss (dB)	Max. VSWR	Peak (W)	Ave (W)			
0.30 - 0.42	5	18	0.5	1.25	500	50	-30 to +71	F2	ML 2E 1000
0.42 - 0.60	10	18	0.5	1.25	500	50	-30 to +71	F2	ML 2E 2000
0.50 - 0.75	10	18	0.5	1.25	500	50	-30 to +71	F3	ML 2E 3000
0.75 - 1.00	10	18	0.5	1.25	500	50	-30 to +71	F3	ML 2E 4000
1.00 - 1.60	12	18	0.5	1.25	500	50	-55 to +95	F3	ML 2E 5000
1.60 - 2.00	10	18	0.5	1.25	500	50	-55 to +95	F4	ML 2E 6000
1.00 - 2.00	FULL	16	0.6	1.35	200	50	0 to +50	F1	ML 2E 400F
1.50 - 3.00	FULL	17	0.6	1.35	500	50	-5 to +60	F2	ML 2E 450F
2.00 - 3.70	15	18	0.5	1.25	500	50	-55 to +95	F4	ML 2E 8000
2.50 - 3.90	5	18	0.5	1.25	500	50	-55 to +95	F5	ML 2E 9000
2.00 - 4.00	FULL	17	0.6	1.35	500	50	-10 to +70	F3	ML 2E 500F
2.60 - 5.20	FULL	17	0.6	1.35	500	50	-25 to +80	F4	ML 2E 550F
3.00 - 6.00	FULL	18	0.5	1.30	500	50	-30 to +85	F4	ML 2E 600F
3.90 - 8.00	15	18	0.5	1.25	500	50	-55 to +95	F5	ML 2E 100
4.00 - 8.00	FULL	18	0.5	1.30	500	50	-45 to +95	F4	ML 2E 650F
5.00 - 10.00	FULL	17	0.6	1.35	500	50	-55 to +95	F4	ML 2E 700F
6.00 - 12.00	FULL	18	0.6	1.30	500	50	-55 to +95	F4	ML 2E 750F
8.00 - 12.40	FULL	20	0.5	1.25	500	50	-55 to +95	F6	ML 2E 800F
8.00 - 16.00	FULL	17	0.6	1.35	500	50	-55 to +95	F6	ML 2E 850F
8.00 - 18.00	FULL	15	0.7	1.45	500	50	-55 to +95	F6	ML 2E 900F
8.00 - 20.00	20	18	0.6	1.25	500	50	-55 to +95	F6	ML 2E 250
11.00 - 16.00	10	20	0.4	1.25	500	50	-55 to +95	F7	ML 2E 200
12.00 - 18.00	FULL	18	0.6	1.50	500	50	-55 to +95	F6	ML 2E 950F
16.00 - 18.00	FULL	20	0.5	1.25	500	50	-55 to +95	F7	ML 2E 960F

### NOTES:

- 1) Isolators are specified by ML 2 prefix, circulators have ML 3 prefix.
- 2) To specify units with a narrow bandwidth add the centre frequency in MHz as a five digit suffix to the Part number. e.g. ML 3E 3000 - 00600 is a circulator with centre frequency of 600 MHz and bandwidth of 10%. Full bandwidth units have 'F' as a suffix to the part number, e.g. ML2E 600F.
- 3) Standard rotation is clockwise when viewed from top face, 1-2-3-1, reverse rotation available on request.
- 4) Isolator maximum absorbed power rating is 1 Watt average as standard.

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## Standard Coaxial Isolators

## ML 2F &amp; G Series

## Standard Coaxial Circulators

## ML 3F &amp; G Series

A series of standard coaxial isolators and circulators with SMA or N type connectors. Both narrowband and broadband frequency ranges are specified.



## SPECIFICATIONS (guaranteed over operating temperature range)

Frequency Range (GHz)	Band-Width (%)	Min Isolation (dB)	Max. Insertion Loss (dB)	Max. VSWR	Circulator Rated Power		Operating Temperature (°C)	Package Style	Part Number
					Peak (W)	Ave (W)			
0.47 - 0.86	20	16	0.5	1.40	340	200	0 to +60	F8	ML 2F 400
0.50 - 1.05	10	19	0.45	1.25	2000	100	0 to +71	F9	ML 2F 500
0.96 - 1.65	15	19	0.45	1.25	2000	100	-30 to +71	F10	ML 2F 1000
1.00 - 2.00	FULL	16	0.6	1.4	350	100	0 to +60	F11	ML 2G 1500F
		18@25°C		1.30@25°C					
1.57 - 2.20	15	19	0.45	1.25	350	100	-55 to +70	F12	ML 2F 1500
2.00 - 3.10	15	20	0.35	1.25	350	75	-55 to +70	F13	ML 2F 2000
2.90 - 4.00	20	20	0.35	1.25	350	75	-55 to +70	F13	ML 2F 3000
2.00 - 4.00	FULL	17	0.5	1.35	350	100	0 to +60	F14	ML 2G 3000F
		18@25°C	0.4@25°C	1.25@25°C					
2.60 - 5.20	FULL	17	0.6	1.35	350	100	-40 to +70	F14	ML 2G 3900F
		20@25°C	0.4@25°C	1.25@25°C					
3.70 - 6.00	20	20	0.3	1.25	350	50	-55 to +80	F15	ML 2F 4000
4.00 - 8.00	FULL	18	0.4	1.25	250	50	-50 to +85	F16	ML 2G 6100F
		19@25°C							
4.80 - 9.60	FULL	16	0.6	1.4	250	50	-50 to +85	F17	ML 2G 7200F
		19@25°C	0.5@25°C	1.25@25°C					
5.00 - 12.00	20	20	0.35	1.25	350	30	-55 to +85	F18	ML 2F 5000
6.00 - 12.00	FULL	18	0.6	1.35	350	30	-40 to +80	F19	ML 2G 9000F
		20@25°C	0.5@25°C	1.25@25°C					
7.00 - 12.40	FULL	17	0.65	1.25	250	30	-40 to +70	F20	ML 2G 9700F
		20@25°C							
8.00 - 12.40	FULL	17	0.6	1.35	250	50	-40 to +85	F21	ML 2G 10200F
		19@25°C	0.5@25°C	1.25@25°C					
8.00 - 16.00	FULL	17	0.6	1.35	250	50	-50 to +85	F21	ML 2G 12000F
				1.25@25°C					
12.00 - 18.00	20	18	0.6	1.35	350	30	-50 to +85	F18	ML 2F 12000
		20@25°C	0.5@25°C	1.25@25°C					
12.40 - 18.00	FULL	17	0.9	1.35	250	50	-50 to +85	F22	ML 2G 15200F
		19@25°C							
7.50 - 18.00	FULL	15	1.0	1.5	250	30	-45 to +85	F23	ML 2G 718F
8.00 - 18.00	FULL	16	0.9	1.40	250	30	-45 to +85	F23	ML 2G 818F
6.00 - 18.00	FULL	10	1.4	1.9	250	30	-45 to +85	F24	ML 2G 618F
			1.25@25°C						

## NOTES:

- Isolators are specified by ML 2 prefix, circulators have ML 3 prefix.
- To specify units with a narrow bandwidth add the centre frequency in MHz as a five digit suffix to the Part number. e.g. ML 3F 1500 - 01800 is a circulator with centre frequency of 1800 MHz and bandwidth of 15%. Full bandwidth units have 'F' as a suffix to the part number, e.g. ML2G 7200F.
- Standard rotation is clockwise when viewed from top face 1-2-3-1, reverse rotation available on request.
- The Standard Connectors are SMA female except for ML 2F 400 which are N type female.
- Isolator maximum absorbed power rating is determined by the load rating specified by the package style option, see outline drawings.

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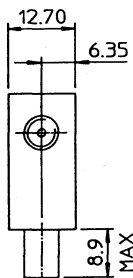
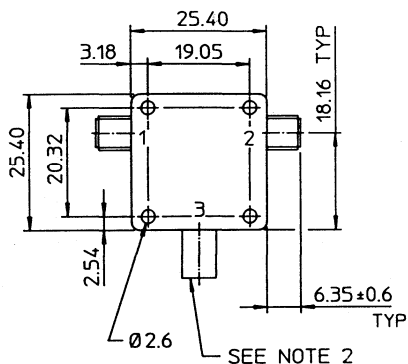
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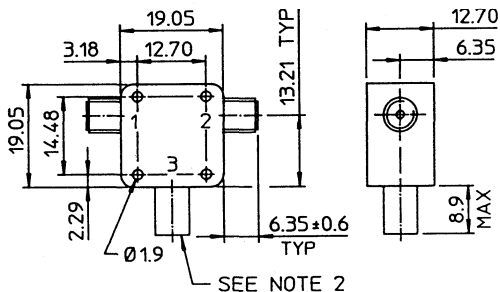


Package Style F3



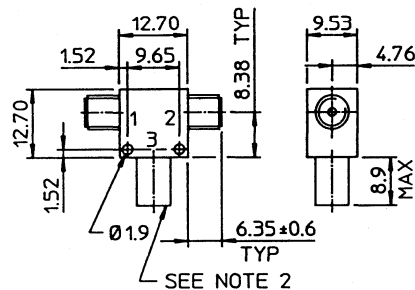
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Package Style F4



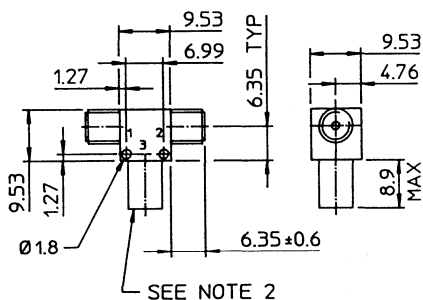
Weight: 40gms max

Package Style F5



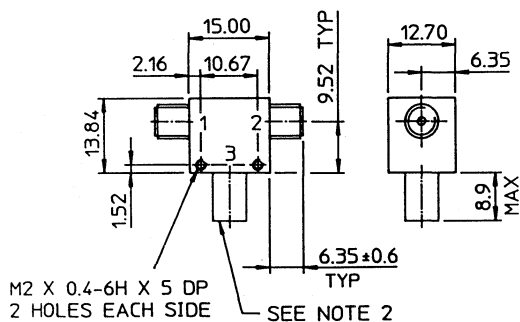
Weight: 25gms max

Package Style F6



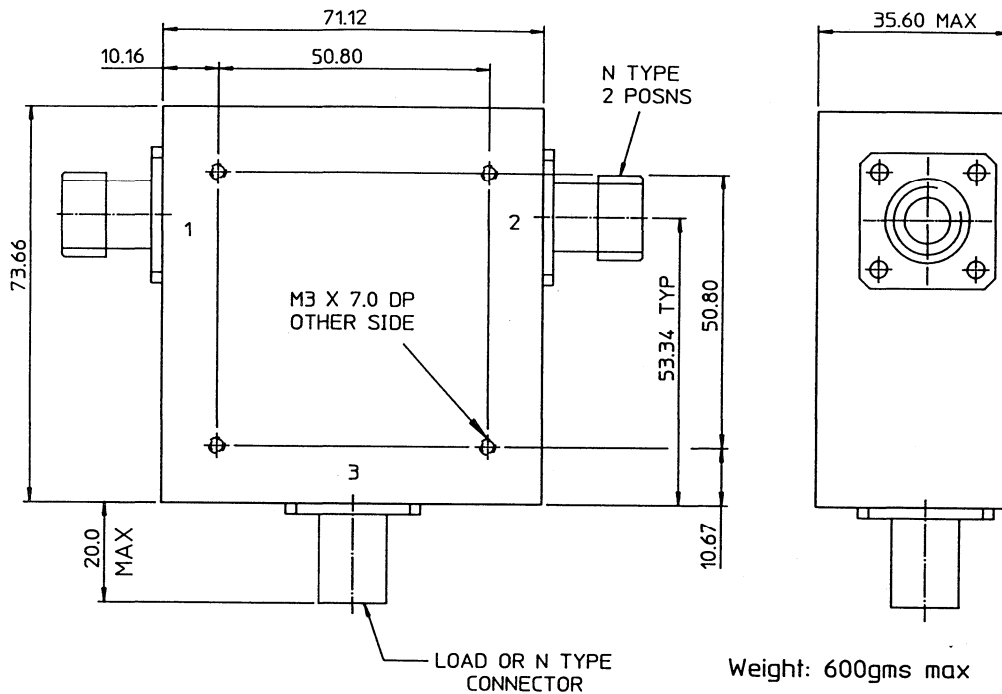
Weight: 20gms max

Package Style F7



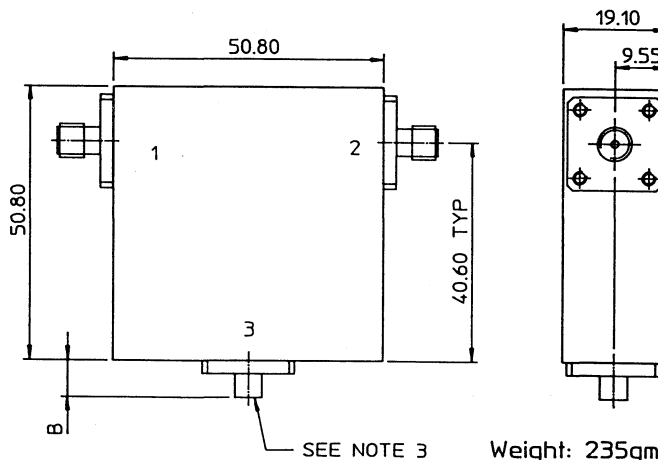
Weight: 30gms max

Package Style F8



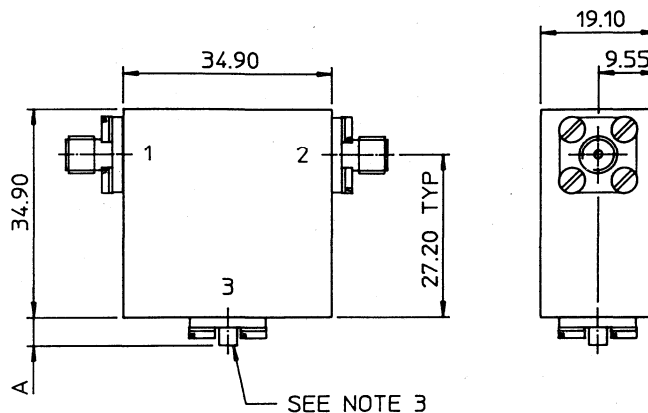
Weight: 600gms max

Package Style F9



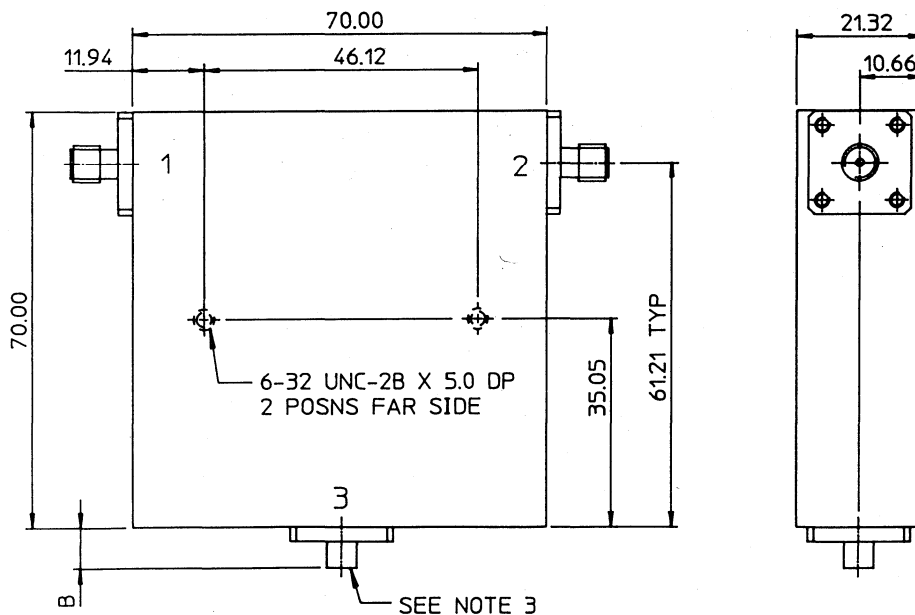
Weight: 235gms max

### Package Style F10



Weight: 120gms max

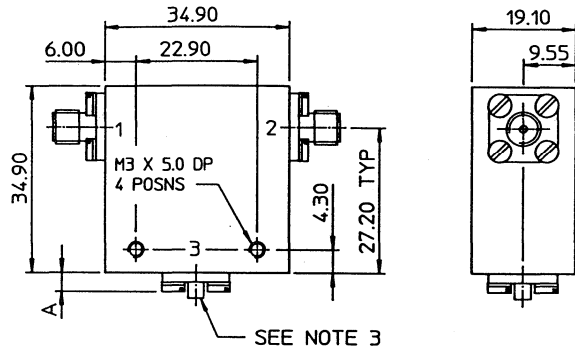
### Package Style F11



Weight: 360gms max

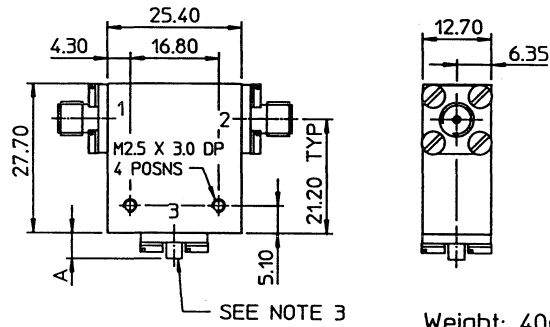


## Package Style F12



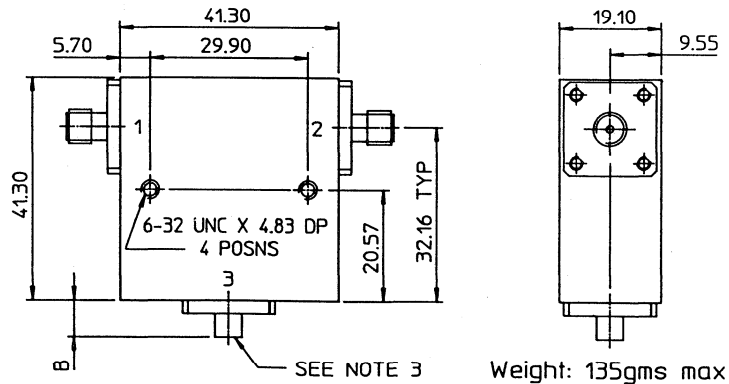
## Package Style F13

Weight: 120gms max



Weight: 40gms max

## Package Style F14



Weight: 135gms max

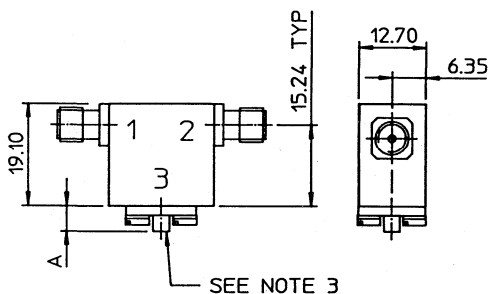
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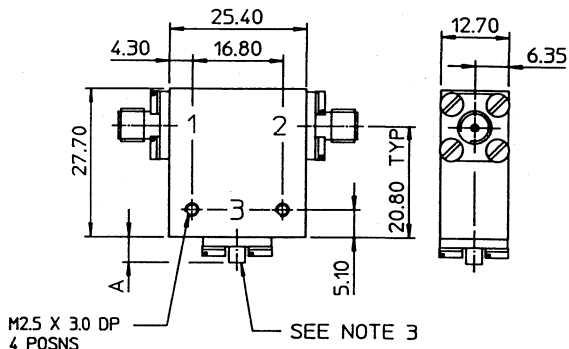
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Package Style F15



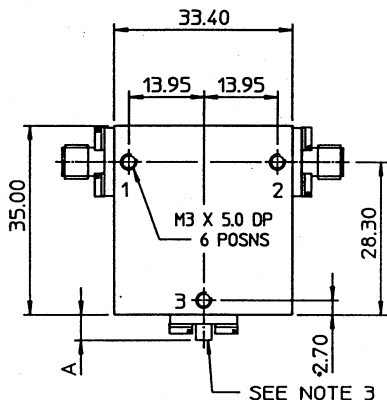
Weight: 30gms Max

Package Style F16



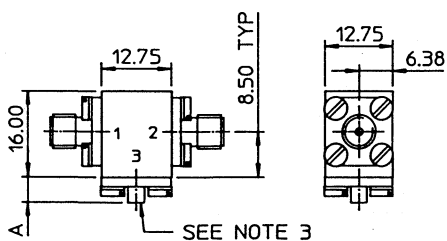
Weight: 40gms Max

Package Style F17



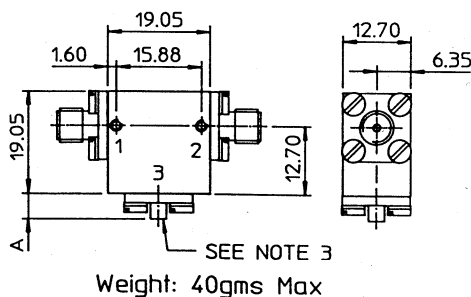
Weight: 130gms Max

Package Style F18



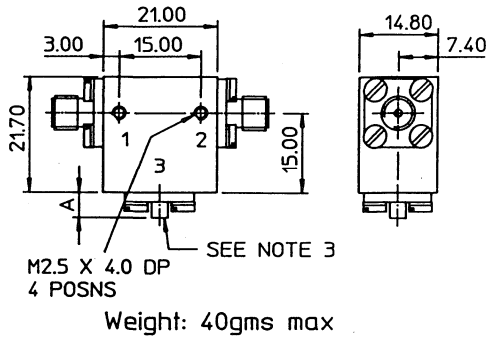
Weight: 28gms Max

Package Style F19

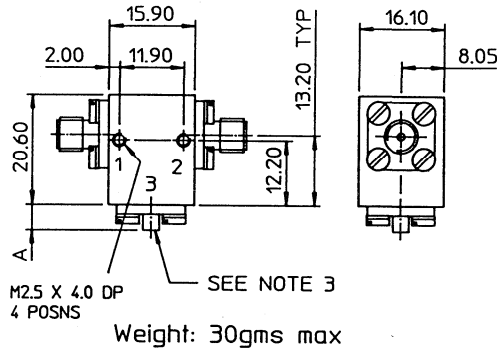


Weight: 40gms Max

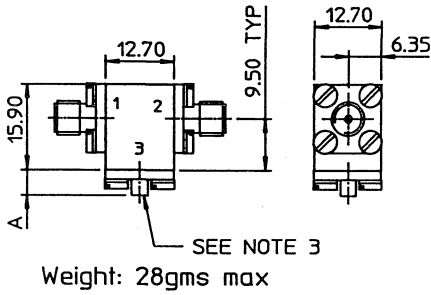
Package Style F20



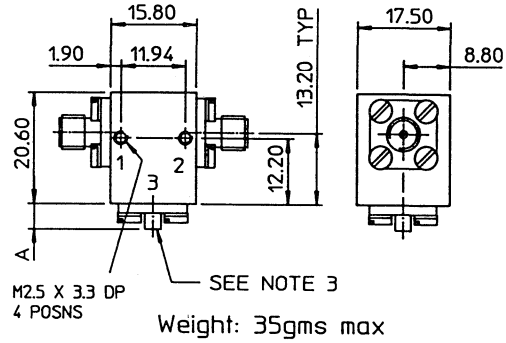
Package Style F21



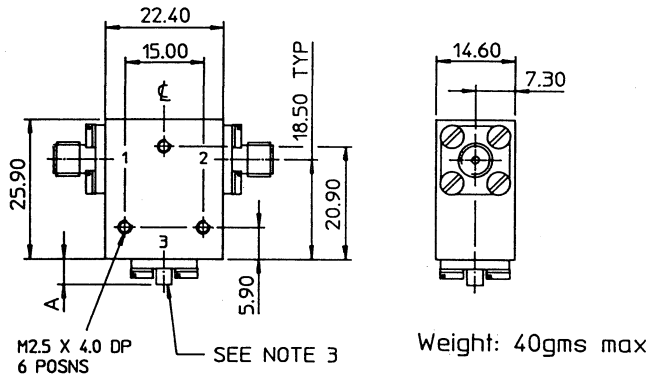
Package Style F22



Package Style F23



Package Style F24



All specifications are subject to change without notice

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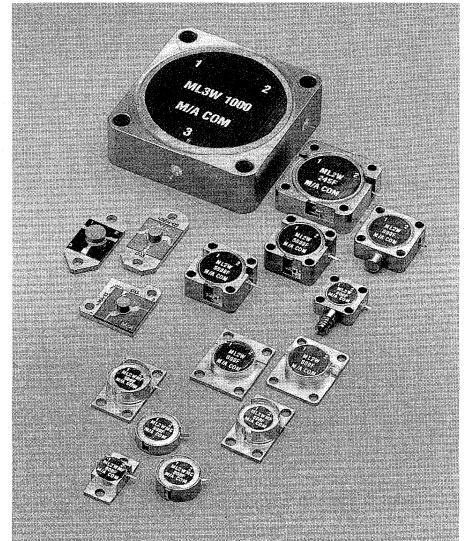
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**DROP-IN**  
**ISOLATORS AND CIRCULATORS**  
**1.0 TO 26.0 GHz**

**FEATURES**

- ◆ Ferropac, Ferropill & Ferrodisc
- ◆ Microstrip & Stripline Circuits.
- ◆ Space Qualified Versions
- ◆ European Manufacture
- ◆ Magnetically Shielded
- ◆ Small Size, Low Weight
- ◆ Wide Range of Outlines

**DESCRIPTION**

The ML 2/3 Series of drop-in isolators and circulators are miniaturised rugged components suitable for all types of microwave integrated circuits. Devices are available to cover all the standard frequency ranges for both narrowband and up to octave bandwidth applications.

The devices available are grouped into three circuit types. Ferropac is a fully magnetically shielded balanced stripline design supplied in a miniature stainless steel package with tab connectors. Ferropill is a similar shielded design but is available in sub-miniature packages for smallest size and lowest weight. Ferropill devices have either tab connectors or are pre-mounted on alumina substrates for direct tape bonding into microstrip circuits. Ferrodisc is an unshielded microstrip junction circulator constructed on a ferrite substrate. The device uses a single ferrite element with the circuit pattern printed on one side and the ground plane on the other. With a single or double permanent magnet structure included on the substrate the ferrodisc offers a complete, self contained device suitable for direct tape bonding into 50 ohm microstrip circuits with low VSWR.

All devices are available in a range of package styles and orientations together with alternative frequency ranges and options for termination type, tab type and power handling, please contact the factory for details.

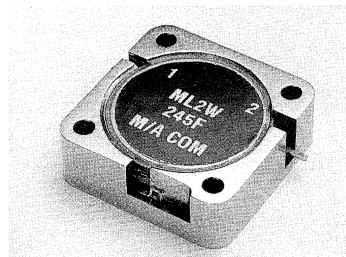
Ferropac Isolators

ML 2W Series

Ferropac Circulators

ML 3W Series

A series of fully magnetically shielded miniature drop-in isolators and circulators with tab connectors. Both narrowband and broadband frequency ranges are specified.



## SPECIFICATIONS (guaranteed over operating temperature range)

Frequency Range (GHz)	Band-Width (%)	Min Isolation (dB)	Max. Insertion Loss (dB)	Max. VSWR	Circulator Rated Power		Operating Temperature (°C)	Package Style	Part Number
					Peak (W)	Aver (W)			
1.0 - 1.5	10	17	0.6	1.35	500	50	-54 to +95	FP1	ML2W 5000
		20@25°C	0.5@25°C	1.25@25°C					
1.610 - 1.660	Full	23	0.25	1.15	500	10	-40 to +80	FP2 Note 1	ML2W 1600F
1.930 - 1.970	Full	20	0.4	1.20	100	20	-20 to +70	FP3 Note 2	ML2W 1900F
1.5 - 2.0	5	20	0.5	1.25	500	50	-54 to +95	FP4	ML2W 6000
2.0 - 3.0	10	20	0.6	1.25	100	50	-54 to +95	FP4	ML2W 8000
2.00 - 4.00	Full	16	0.6	1.40	25	1	-10 to +70	FP5	ML2W 500F
2.00 - 4.00	10	20	0.4	1.30	25	1	-10 to +70	FP5	ML2W 500
2.40 - 2.50	Full	20	0.5	1.25	500	50	-40 to +80	FP4	ML2W 245F
2.70 - 3.40	10	20	0.5	1.25	50	5	-54 to +95	FP4	ML2W 9000
3.80 - 8.00	10	18	0.5	1.3	500	50	-54 to +95	FP6	ML2W 100
		20@25°C	0.4@25°C	1.25@25°C					
4.00 - 8.00	Full	16	0.6	1.40	500	50	-40 to +80	FP4	ML2W 650F
5.75 - 5.85	Full	20	0.3	1.25	100	10	-40 to +80	FP7 Note 3	ML2W 5800F
8.00 - 12.00	Full	17	0.6	1.4	500	50	-40 to +95	FP6	ML2W 800F
		20@25°C	0.4@25°C	1.3@25°C					
8.00 - 12.00	10	20	0.4	1.30	500	50	-54 to +95	FP6	ML2W 800
12.00 - 18.00	10	18	0.5	1.4	500	50	-54 to +95	FP8	ML2W 250
		20@25°C	0.4@25°C	1.25@25°C					
12.00 - 18.00	Full	17	0.7	1.50	500	50	-54 to +95	FP8	ML2W 950F

### NOTES:

- 1) Inmarsat frequency band, isolator load max rated power 5W ave.
- 2) PCN band.
- 3) Autotoll band.
- 4) Isolators are specified by ML 2 prefix, circulators have ML 3 prefix.
- 5) To specify units with a narrow bandwidth add the centre frequency in MHz as a five digit suffix to the Part number.  
e.g. ML 3W 8000 - 02500 is a circulator with centre frequency of 2500 MHz and bandwidth of 10%. Full bandwidth units have 'F' as a suffix to the part number e.g. ML2W 245F.
- 6) Standard rotation is clockwise when viewed from top face 1-2-3-1, reverse rotation available on request.
- 7) Isolator maximum absorbed power rating is 1 Watt average.

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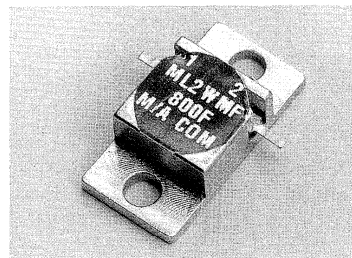
Ferropill Isolators

ML 2WM Series

Ferropill Circulators

ML 3WM Series

A series of sub-miniature fully magnetically shielded miniature drop-in isolators and circulators. Circular, rectangular and flange outlines have tab connectors, alumina outlines are suitable for direct tape bonding into microstrip circuits.



## SPECIFICATIONS (guaranteed -54°C to +95°C)

Frequency Range (GHz)	Band-Width (%)	Min Isolation (dB)	Max. Insertion Loss (dB)	Max. VSWR	Circulator Rated Power		Package Style	Part Number		
					Peak (W)	Ave (W)				
4.0 - 8.0	10	18 20 @25°C	0.6 0.4 @25°C	1.3 1.2 @25°C	50	0.7	Circular	FM1	ML2 WMC	100
							Rectangular	FM2	ML2 WMR	100
							Flange (note 1)	FM3	ML2 WMF	100
							Alumina	FM4	ML2 WMS	100
8.0 - 12.0	10	18 20 @25°C	0.6 0.4 @25°C	1.35 1.2 @25°C	50	0.5	Circular	FM5	ML2 WMC	800
							Rectangular	FM6	ML2 WMR	800
							Flange (note 1)	FM7	ML2 WMF	800
							Alumina	FM4	ML2 WMS	800
8.0 - 12.0	Full	16	0.7	1.5	50	0.7	Circular	FM1	ML2 WMC	800F
							Rectangular	FM2	ML2 WMR	800F
							Flange (note 1)	FM3	ML2 WMF	800F
							Alumina	FM4	ML2 WMS	800F
12.0 - 18.0	10	18 20 @25°C	0.7 0.5 @25°C	1.4 1.25 @25°C	50	0.5	Circular	FM5	ML2 WMC	950
							Rectangular	FM6	ML2 WMR	950
							Flange (note 1)	FM7	ML2 WMF	950
							Alumina	FM8	ML2 WMS	950
12.0 - 18.0	Full	16 18 @25°C	1.0 0.7 @25°C	1.5 1.4 @25°C	50	0.7	Circular	FM5	ML2 WMC	950F
							Rectangular	FM6	ML2 WMR	950F
							Flange (note 1)	FM7	ML2 WMF	950F
							Alumina	FM8	ML2 WMS	950F
18.0 - 26.0	5	16	0.8	1.4	50	0.7	Alumina	FM8	ML2 WMS	200

### NOTES:

- 1) This flange package style is only available as an isolator.
- 2) Isolators are specified by ML 2 prefix, circulators have ML 3 prefix.
- 3) To specify units with a narrow bandwidth add the centre frequency in MHz as a five digit suffix to the Part number. e.g. ML 3WMR 800 - 10200 is a circulator in a Rectangular package style with a centre frequency of 10200 MHz and bandwidth of 10%. Full bandwidth units have 'F' as a suffix to the part number e.g. ML2WMR 800F.
- 4) Standard rotation is clockwise when viewed from top face 1-2-3-1, reverse rotation available on request.
- 5) Isolator maximum absorbed power rating is 0.5 Watt average.

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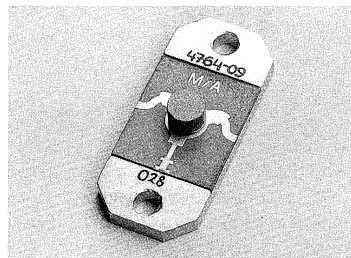
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Ferrodisc Isolators

ML 2S Series

Ferrodisc Circulators

ML 3S Series



A series of miniature, microstrip junction circulators and isolators printed directly on ferrite substrates. Devices are suitable for direct tape bonding into microstrip circuits.

## SPECIFICATIONS (guaranteed over operating temperature range)

Frequency Range (GHz)	Band-Width (%)	Min Isolation (dB)	Max. Insertion Loss (dB)		Circulator Rated Power		Operating Temperature (°C)	Package Style	Part Number
			Min	Max	Peak (W)	Ave (W)			
1.70 - 2.00	6	20	0.4	1.30	10	5	0 to +50	FD1	ML2S 170
1.70 - 2.07	Full	18	0.5	1.30	10	5	0 to +50	FD1	ML2S 170F
2.00 - 2.50	10	20	0.4	1.30	10	5	0 to +50	FD2	ML2S 200
2.40 - 2.70	Full	20	0.4	1.30	10	5	0 to +50	FD3	ML2S 240F
2.70 - 3.10	Full	20	0.4	1.30	10	5	0 to +50	FD4	ML2S 270F
3.10 - 4.20	10	20	0.4	1.30	10	5	0 to +50	FD5	ML2S 310
3.70 - 4.40	10	20	0.4	1.30	10	5	0 to +50	FD6	ML2S 370
4.00 - 8.00	Full	16	0.6	1.40	10	5	0 to +50	FD7	ML2S 400F
4.40 - 5.90	10	20	0.4	1.30	10	5	0 to +50	FD8	ML2S 440
5.90 - 7.250	10	20	0.4	1.30	10	5	0 to +50	FD9	ML2S 590
6.00 - 8.00	Full	18	1.0	1.30	10	5	0 to +50	FD10	ML2S 600F
7.25 - 8.40	10	20	0.4	1.30	10	5	0 to +50	FD11	ML2S 725
8.50 - 11.70	10	20	0.4	1.30	10	5	0 to +50	FD12	ML2S 850
11.40 - 11.71	Full	20	0.4	1.30	10	5	0 to +50	FD13	ML2S 1140S
11.40 - 12.40	Full	20	0.4	1.30	10	5	0 to +50	FD14	ML2S 1140F
11.70 - 12.00	Full	20	0.4	1.30	10	5	0 to +50	FD13	ML2S 1170F
11.80 - 13.00	Full	18	0.5	1.30	10	5	0 to +50	FD14	ML2S 1180F
11.90 - 12.11	Full	20	0.4	1.30	10	5	0 to +50	FD13	ML2S 1190S
12.00 - 13.80	8	20	0.4	1.30	10	5	0 to +50	FD14	ML2S 1200
12.20 - 16.90	Full	15	1.0	1.50	10	5	0 to +50	FD15	ML2S 1220F
12.25 - 12.75	Full	20	0.4	1.30	10	5	0 to +50	FD13	ML2S 1240F
12.50 - 12.80	Full	20	0.4	1.30	10	5	0 to +50	FD13	ML2S 1250S
12.50 - 14.50	Full	17	0.5	1.40	10	5	0 to +50	FD16	ML2S 1250F
14.00 - 14.50	Full	20	0.5	1.30	10	5	0 to +50	FD13	ML2S 1400S
14.00 - 17.50	7	20	0.5	1.30	10	5	0 to +50	FD17	ML2S 1400
14.50 - 17.50	12	18	0.6	1.40	10	5	0 to +50	FD17	ML2S 1450
15.50 - 17.50	Full	18	0.6	1.50	10	5	0 to +50	FD17	ML2S 1550F

### NOTES

- 1) Isolators are specified by ML 2 prefix, circulators have ML 3 prefix.
- 2) To specify units with a narrow bandwidth add the centre frequency in MHz as a five digit suffix to the Part number. e.g. ML 3S 850 - 10200 is a circulator with centre frequency of 10200 MHz and bandwidth of 10%. Full bandwidth units have 'F' or 'S' as a suffix to the part number e.g. ML2S 1140F. Standard rotation is clockwise when viewed from top face 1-2-3-1, reverse rotation available on request.
- 3) Isolator maximum absorbed power rating is 100mW average.
- 4) Performance as measured in factory test fixtures with pressure contact direct to SMA-F connectors.
- 5) Standard metalisation is thin film gold finish other options available on request.
- 6)

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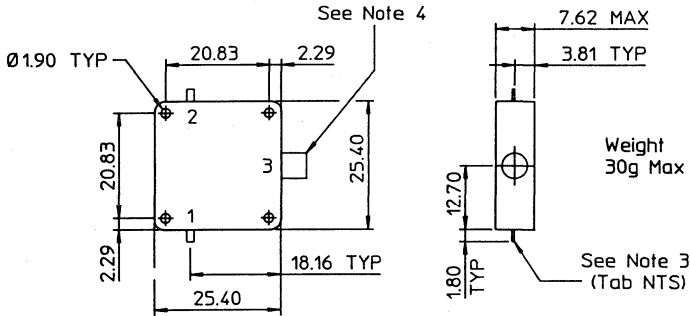
Asia Pacific: (81) 3 3226 1671

# Outline Drawings - Ferropac ML2W and ML3W Series

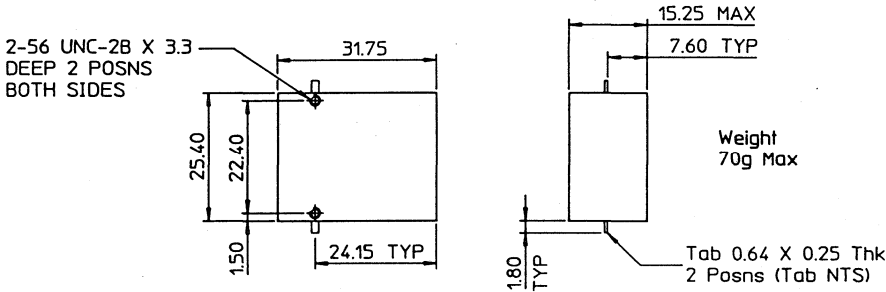
### NOTES

- 1) All dimensions in mm, tolerances x.x = ±0.5mm, x.xx = ±0.2mm
- 2) Scale 1:1 approx.
- 3) Tab size 0.64mm wide, 0.13mm thick
- 4) Isolator termination length 3.0mm typ, 5.1mm max.
- 5) Finish stainless steel with nickel plate

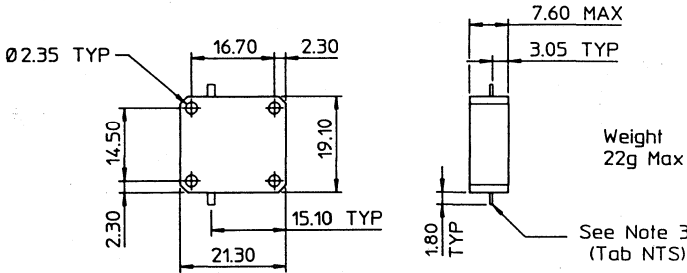
### Package Style FP1 - Standard Rectangular Outlines



### Package Style FP2

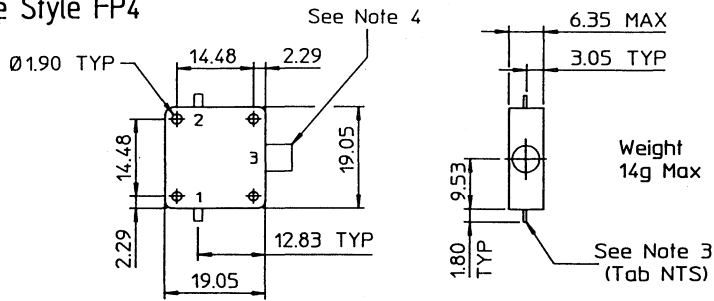


### Package Style FP3

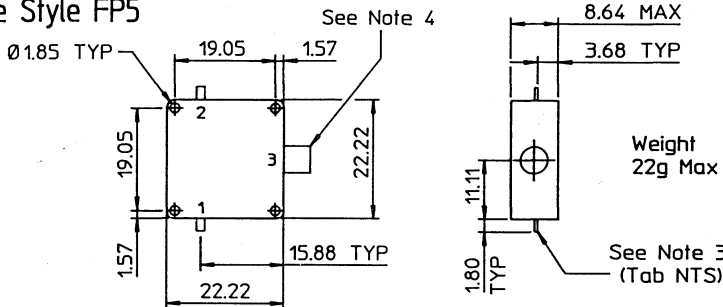




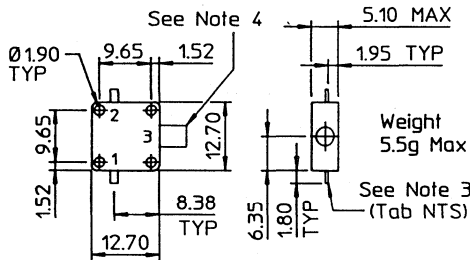
Package Style FP4



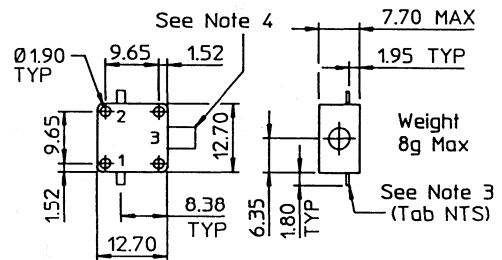
Package Style FP5



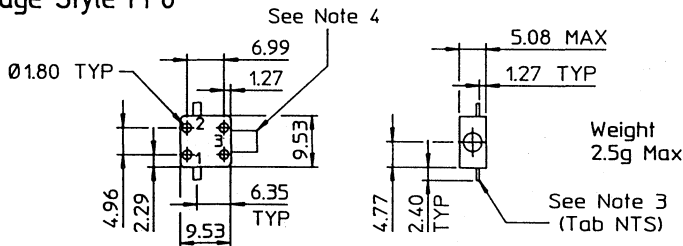
Package Style FP6



Package Style FP7



Package Style FP8

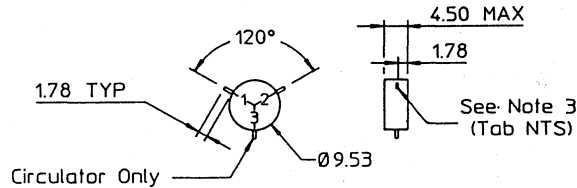


## Outline Drawings - Ferropill ML2WM and ML3WM Series

### NOTES

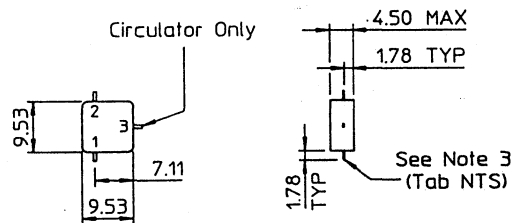
- 1) All dimensions in mm, tolerances x.x = ±0.5mm, x.xx = ±0.2mm
- 2) Scale 1:1 approx.
- 3) Tab size 0.64mm wide, 0.13mm thick
- 4) Finish gold plate.

### Package Style FM1 - Circular Outline



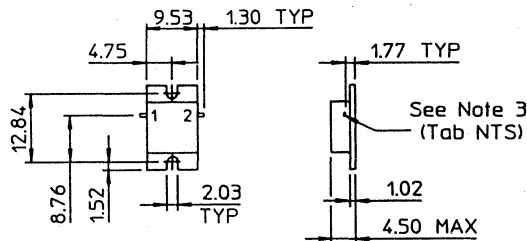
Weight  
2.5g Max

### Package Style FM2 - Rectangular Outline



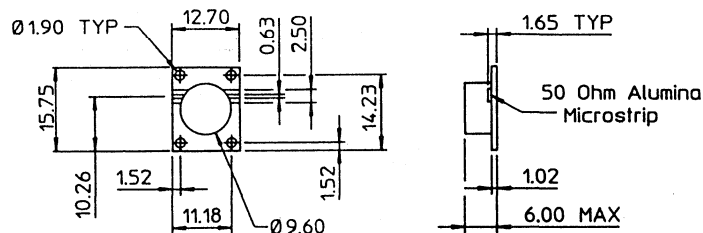
Weight  
2.5g Max

### Package Style FM3 - Flange Outline



Weight  
2.5g Max

### Package Style FM4 - Alumina Outline



Weight  
3g Max

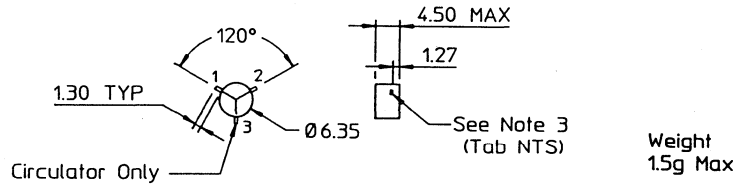
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Europe: (44) 1344 869595

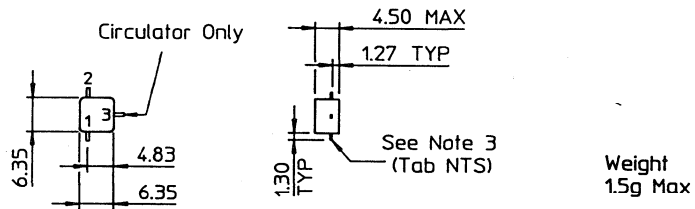
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

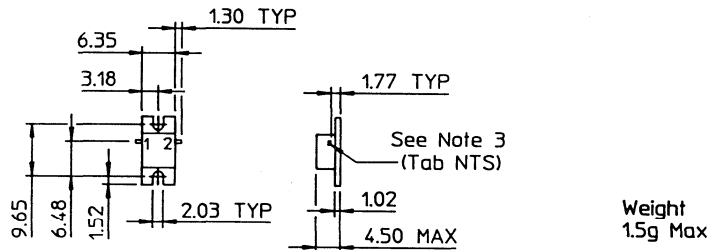
Package Style FM5 - Circular Outline



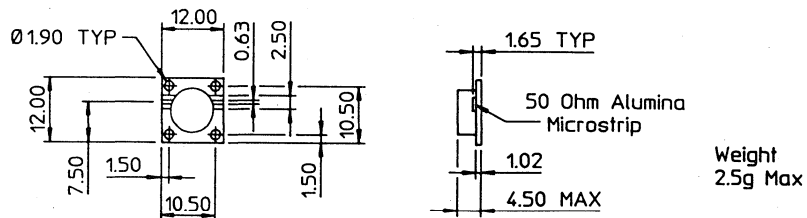
Package Style FM6 - Rectangular Outline



Package Style FM7 - Flange Outline



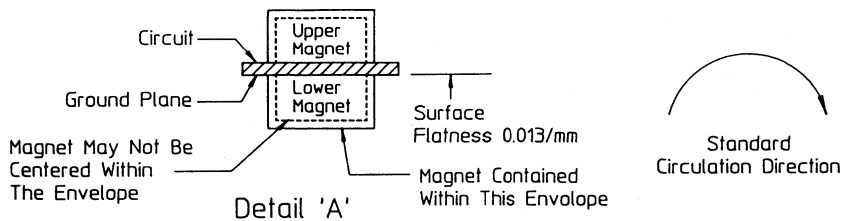
Package Style FM8 - Alumina Outline



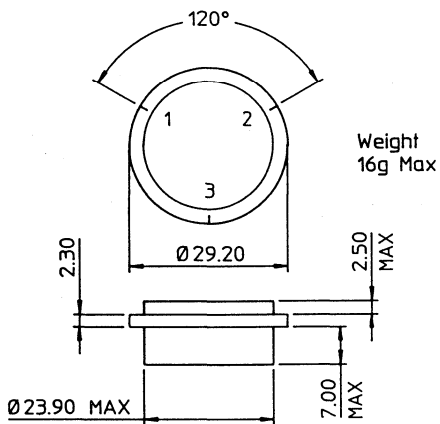
# Outline Drawings - Ferrodisc ML2S and ML3S Series

NOTES

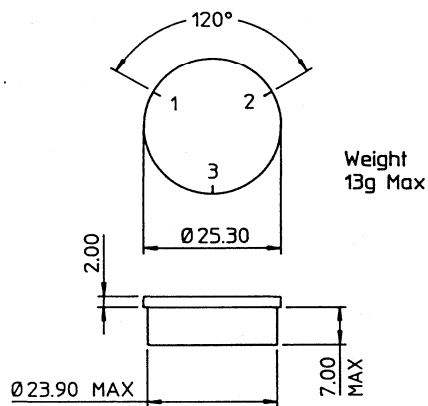
- 1) All dimensions in mm, tolerances x.x = ±0.5mm, x.xx = ±0.2mm
- 2) Scale 1:1 approx.
- 3) Detail 'A' applies to all circular and rectangular packages.
- 4) Carrier and circuit finish gold plate.



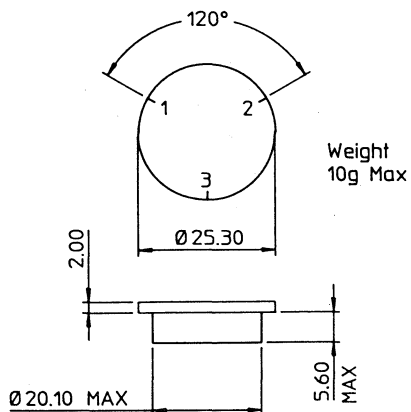
Package Style FD1



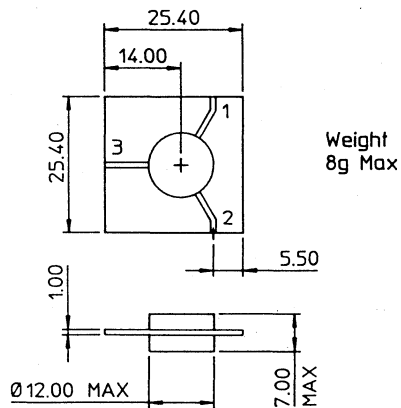
Package Style FD2



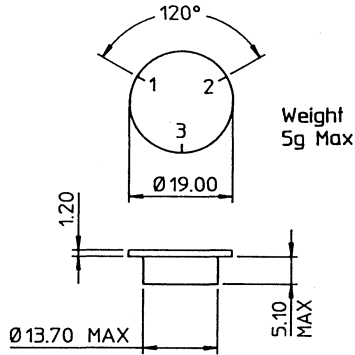
Package Style FD3



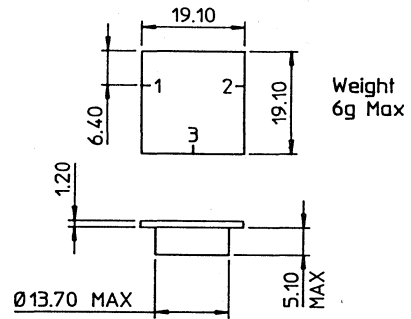
Package Style FD4



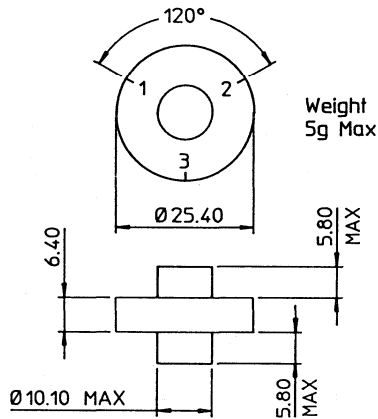
Package Style FD5



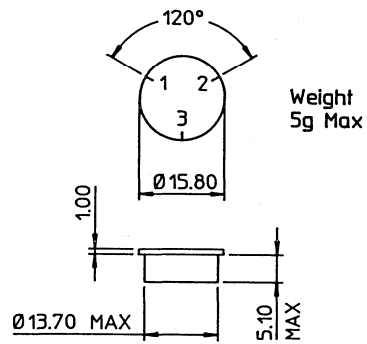
Package Style FD6



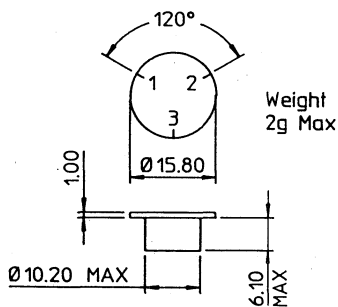
Package Style FD7



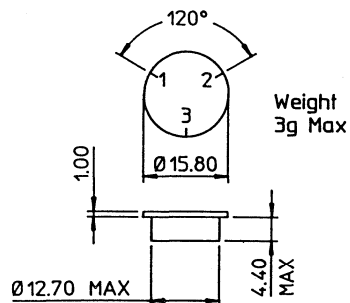
Package Style FD8



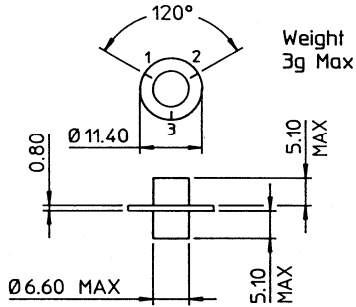
Package Style FD9



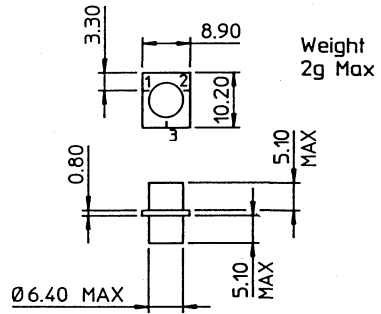
Package Style FD10



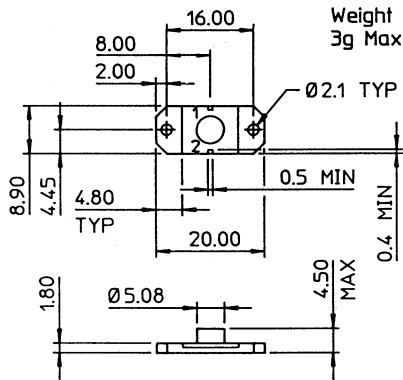
Package Style FD11



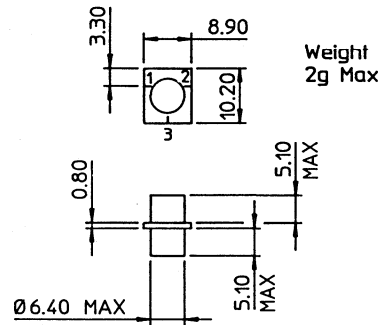
Package Style FD12



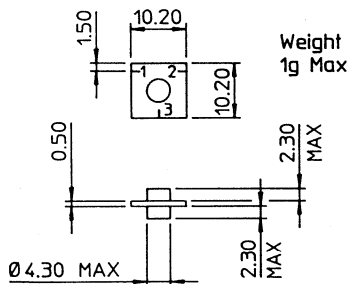
Package Style FD13



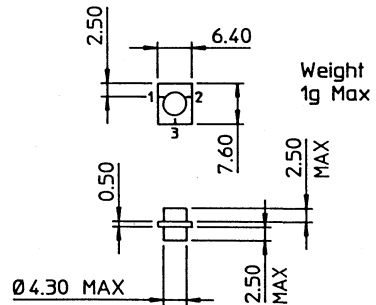
Package Style FD14



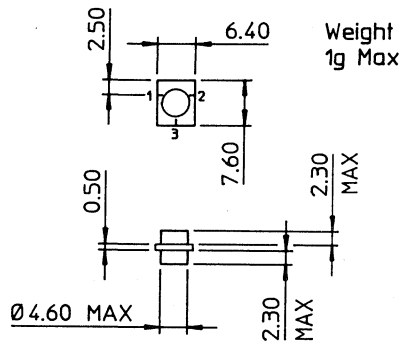
Package Style FD15



Package Style FD16



## Package Style FD17

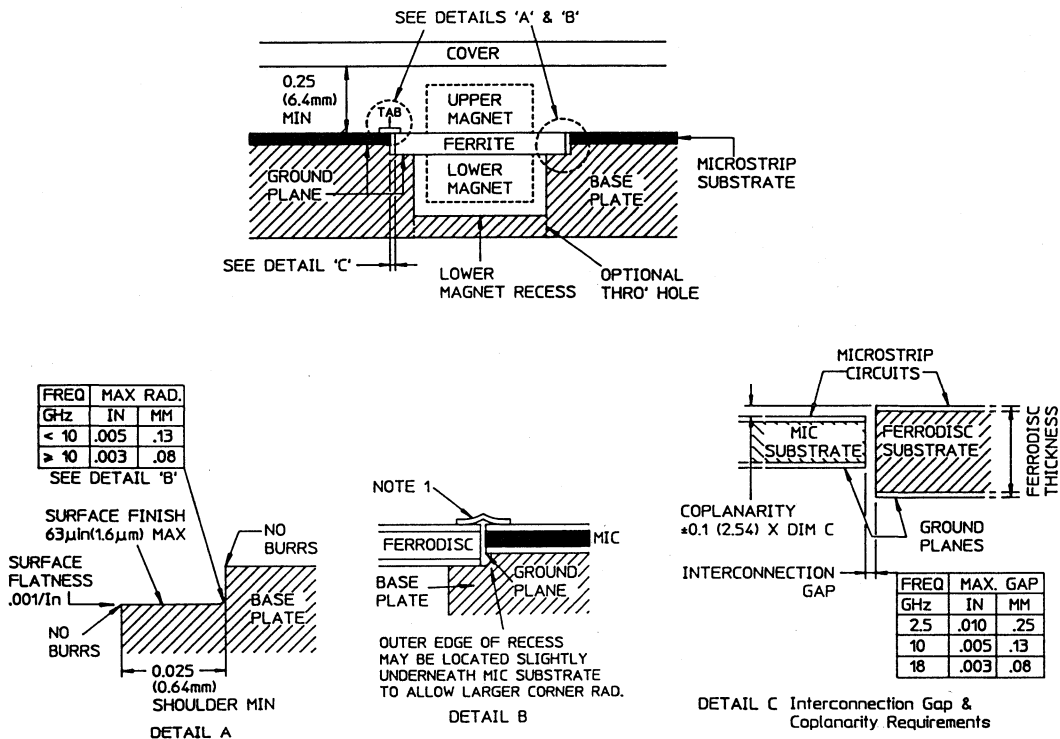


# INSTALLATION NOTES, FERRODISC

**TEMPERATURE EXPOSURE:** A Ferrodisc circulator can withstand 250°C short-term without damage. A standard Ferrodisc isolator with an internal soldered chip resistor, can withstand 205°C. High temperature options are available.

**CIRCUIT CONNECTION:** Most of the ceramic MIC connection methods are suitable for Ferrodisc devices. Metal ribbons (tabs) with thicknesses 0.03 to 0.05 mm are typically used. Suitable connection techniques include solder, reflow solder, welding and ultrasonic bonding.

**MOUNTING TO MAGNETIC CARRIERS:** The presence of a magnetic carrier, such as Kovar or steel, may affect Ferrodisc electrical performance. Carrier mounting is preferably a factory operation or, as a minimum, an unmounted replica of the carrier should be used in final factory tuning.



Note 1. Tab should be bent slightly to allow for thermal expansion effects. Linear coefficient of thermal expansion for Ferrodisc substrate is 8-9 PPM/°C



**ISOLATOR TERMINATIONS:** The soldered internal chip resistor in standard Ferrodisc isolators is nominally rated for 100 mW dissipation. Special options include a 1 W chip and high temperature solders. In isolator applications where reverse power significantly exceeds 1 W, a Ferrodisc circulator with an external termination is recommended.

**SPACE-QUALIFIED/HIGH RELIABILITY FERRODISCS:** Special versions of Ferrodisc devices are available and are currently being used in various satellite and missile applications.

**SPECIAL OPTIONS:** A wide variety of special options is available with frequency, temperature, power rating and mechanical configuration as the key variables. Other options include special chip terminations and solders, carrier mounting and impedances other than 50 ohms. Consult the factory to discuss special requirements.

**All specifications are subject to change without notice**

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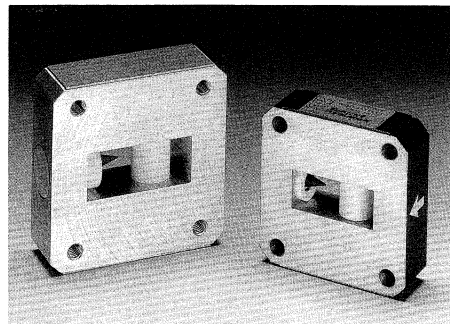
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■ Asia Pacific: (81) 3 3226 1671

**MINIATURE WAVEGUIDE  
SLIMLINE ISOLATORS  
7.3 TO 26.5 GHz**

**FEATURES**

- ◆ 20dB Isolation
- ◆ Lightweight
- ◆ European Manufacture
- ◆ Space Qualified Versions

**DESCRIPTION**

This series of miniature waveguide isolators is available in waveguide sizes from WG 16 (WR 90) to WG 20 (WR42) and manufactured to the same external dimensions as the normal WG flange. Variations in bandwidth and frequency range other than those specified are possible.

All units are manufactured in aluminium with clearance holes as standard or tapped holes on request.

**Maximum Ratings**

Operating Temperature Range	-10 to +60°C
Storage Temperature Range	-40 to +85°C
Peak Power (Forward)	1kW
Average Power (Forward)	10W
Reverse Power (Termination Power Handling)	1W Average 1kW Peak

## SPECIFICATIONS @ +25°C

Frequency Range (GHz)	Model Number	Min. Isolation (dB)	Max. Insertion Loss (dB)	Max. VSWR
<b>Waveguide 15 (WR112)</b>		FLANGE SIZE (mm) : a = 47.6, b = 47.6		
7.3 - 7.5	ML8R15C	20.0	0.5	1.35
7.5 - 7.7	ML8R15D	20.0	0.5	1.35
7.7 - 7.9	ML8R15E	20.0	0.5	1.35
7.9 - 8.1	ML8R15F	20.0	0.5	1.35
8.1 - 8.3	ML8R15G	20.0	0.5	1.35
8.3 - 8.5	ML8R15H	20.0	0.5	1.35
8.5 - 8.7	ML8R15J	20.0	0.5	1.35
<b>Waveguide 16 (WR 90)</b>		FLANGE SIZE (mm) : a = 41.3, b = 41.3		
8.2 - 8.4	ML8R16A	20.0	0.4	1.25
8.3 - 8.5	ML8R16B	20.0	0.4	1.25
8.5 - 8.7	ML8R16C	20.0	0.4	1.25
8.7 - 8.9	ML8R16D	20.0	0.4	1.25
8.9 - 9.1	ML8R16E	20.0	0.4	1.25
9.1 - 9.3	ML8R16F	20.0	0.4	1.25
9.2 - 9.4	ML8R16G	20.0	0.4	1.25
9.3 - 9.5	ML8R16H	20.0	0.4	1.25
9.5 - 9.7	ML8R16J	20.0	0.4	1.25
9.7 - 9.9	ML8R16K	20.0	0.4	1.25
9.9 - 10.1	ML8R16L	20.0	0.4	1.25
10.1 - 10.3	ML8R16M	20.0	0.4	1.25
10.3 - 10.5	ML8R16N	20.0	0.4	1.25
10.5 - 10.7	ML8R16P	20.0	0.4	1.25
10.7 - 10.9	ML8R16Q	20.0	0.4	1.25
10.9 - 11.1	ML8R16R	20.0	0.4	1.25
11.1 - 11.3	ML8R16S	20.0	0.4	1.25
11.3 - 11.5	ML8R16T	20.0	0.4	1.25
11.5 - 11.7	ML8R16U	20.0	0.4	1.25
11.7 - 11.9	ML8R16V	20.0	0.4	1.25
11.9 - 12.1	ML8R16W	20.0	0.4	1.25
12.1 - 12.3	ML8R16X	20.0	0.4	1.25

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## SPECIFICATIONS @ +25°C

Frequency Range (GHz)	Model Number	Min. Isolation (dB)	Max. Insertion Loss (dB)	Max. VSWR
<b>Waveguide 17 (WR 75)</b>		<b>FLANGE SIZE (mm) : a = 38.1, b = 38.1</b>		
10.1 - 10.3	ML8R17A	20.0	0.4	1.25
10.3 - 10.5	ML8R17B	20.0	0.4	1.25
10.5 - 10.7	ML8R17C	20.0	0.4	1.25
10.7 - 10.9	ML8R17D	20.0	0.4	1.25
10.9 - 11.1	ML8R17E	20.0	0.4	1.25
11.1 - 11.3	ML8R17F	20.0	0.4	1.25
11.3 - 11.5	ML8R17G	20.0	0.4	1.25
11.5 - 11.7	ML8R17H	20.0	0.4	1.25
11.7 - 11.9	ML8R17J	20.0	0.4	1.25
11.9 - 12.1	ML8R17K	20.0	0.4	1.25
12.1 - 12.3	ML8R17L	20.0	0.4	1.25
12.3 - 12.5	ML8R17M	20.0	0.4	1.25
12.5 - 12.7	ML8R17N	20.0	0.4	1.25
12.7 - 12.9	ML8R17P	20.0	0.4	1.25
12.9 - 13.1	ML8R17Q	20.0	0.4	1.25
13.1 - 13.3	ML8R17R	20.0	0.4	1.25
13.3 - 13.5	ML8R17S	20.0	0.4	1.25
13.5 - 13.7	ML8R17T	20.0	0.4	1.25
13.7 - 13.9	ML8R17U	20.0	0.4	1.25
13.9 - 14.1	ML8R17V	20.0	0.4	1.25

## SPECIFICATIONS @ 25°C

Frequency Range (GHz)	Model Number	Min. Isolation (dB)	Max. Insertion Loss (dB)	Max. VSWR
<b>Waveguide 18 (WR62)</b>			<b>FLANGE SIZE (mm) : a = 33.3, b = 33.3</b>	
12.4 - 12.6	ML8R18A	20.0	0.3	1.20
12.6 - 12.8	ML8R18B	20.0	0.3	1.20
12.8 - 13.0	ML8R18C	20.0	0.3	1.20
13.0 - 13.2	ML8R18D	20.0	0.3	1.20
13.2 - 13.4	ML8R18E	20.0	0.3	1.20
13.4 - 13.6	ML8R18F	20.0	0.3	1.20
13.5 - 13.7	ML8R18G	20.0	0.3	1.20
13.7 - 13.9	ML8R18H	20.0	0.3	1.20
13.9 - 14.1	ML8R18J	20.0	0.3	1.20
14.1 - 14.3	ML8R18K	20.0	0.3	1.20
14.3 - 14.5	ML8R18L	20.0	0.3	1.20
14.4 - 14.6	ML8R18M	20.0	0.3	1.20
14.5 - 15.5	ML8R18N	20.0	0.3	1.20
14.6 - 14.8	ML8R18P	20.0	0.3	1.20
14.9 - 15.1	ML8R18Q	20.0	0.3	1.20
15.0 - 15.5	ML8R18R	20.0	0.3	1.20
15.0 - 16.0	ML8R18S	20.0	0.3	1.20
15.0 - 17.5	ML8R18T	13.0	0.5	1.50
15.5 - 16.5	ML8R18U	20.0	0.3	1.20
15.5 - 17.5	ML8R18V	15.0	0.4	1.40
16.0 - 17.0	ML8R18W	20.0	0.3	1.20
17.0 - 17.5	ML8R18X	20.0	0.3	1.20
17.5 - 18.0	ML8R18Y	20.0	0.3	1.20

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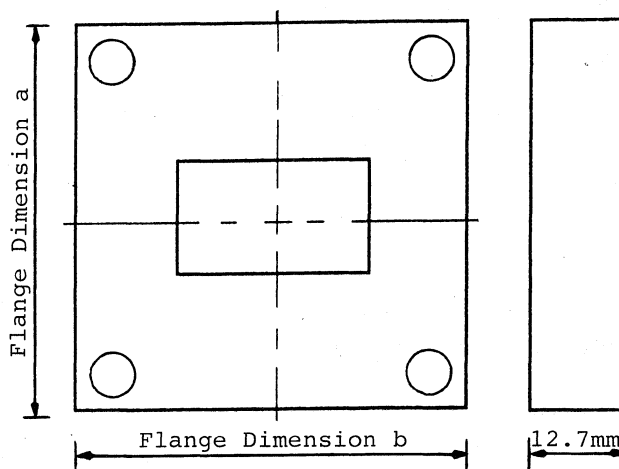
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Frequency Range (GHz)	Model Number	Min. Isolation (dB)	Max. Insertion Loss (dB)	Max. VSWR
<b>Waveguide 20 (WR 42)</b>		FLANGE SIZE (mm) : a = 22.2, b = 22.2		
18.0 - 18.5	ML8R20A	20.0	0.5	1.25
18.5 - 19.0	ML8R20B	20.0	0.5	1.25
19.0 - 19.5	ML8R20C	20.0	0.5	1.25
19.5 - 20.0	ML8R20D	20.0	0.5	1.25
20.0 - 20.5	ML8R20E	20.0	0.5	1.25
20.5 - 21.0	ML8R20F	20.0	0.5	1.25
21.0 - 21.5	ML8R20G	20.0	0.5	1.25
21.5 - 22.0	ML8R20H	20.0	0.5	1.25
22.5 - 23.0	ML8R20J	20.0	0.5	1.25
23.0 - 23.5	ML8R20K	20.0	0.5	1.25
23.5 - 24.0	ML8R20L	20.0	0.5	1.25
24.0 - 24.5	ML8R20M	20.0	0.5	1.25
24.5 - 25.5	ML8R20N	20.0	0.3	1.20
25.5 - 25.7	ML8R20P	20.0	0.3	1.20
26.0 - 26.5	ML8R20Q	20.0	0.5	1.25

## MECHANICAL OUTLINE



All specifications are subject to change without notice

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Europe: (44) 1344 869595

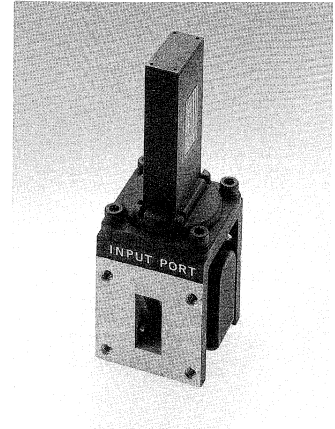
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## I BAND WAVEGUIDE JUNCTION HIGH POWER ISOLATOR 8.5 TO 9.6GHz

### FEATURES

- ◆ Low Loss
- ◆ High Reliability
- ◆ High Power Handling



### DESCRIPTION

This Waveguide Junction Isolator operates over the frequency range 8.5 to 9.6GHz and is designed to handle peak and average powers of 15kW and 300W respectively.

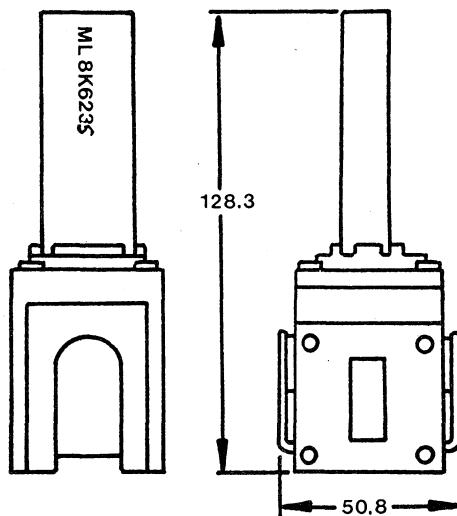
### SPECIFICATION

Frequency Range	: 8.5 to 9.6GHz
V.S.W.R.	: 1.15:1 (max.)
Insertion Loss	: 0.3dB (max.)
Isolation	: 20dB (min.)
Peak Power	: 15kW (max.)
Average Power	: 300W (max.)

### ENVIRONMENTAL SPECIFICATION

Operating Temperature	: -54°C to +85°C
Storage Temperature	: -62°C to +85°C

## OUTLINE DRAWING



Dimensions in MM

## MECHANICAL SPECIFICATION

Waveguide Size	: WG22 (WR 28)
Pressure Rating	: 15 PSIG
Weight	: 300g approx.
Device Protective Finish	: Matt Black Epoxy

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North America: 800 366 2266

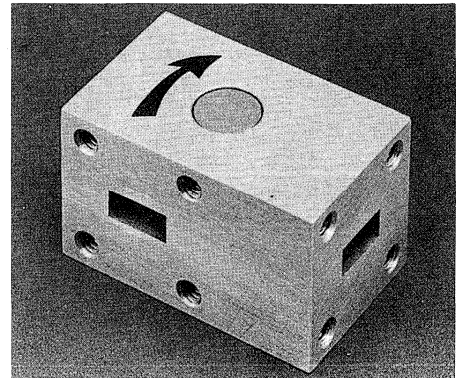
Asia Pacific: (81) 3 3226 1671



## K BAND WAVEGUIDE JUNCTION ISOLATORS AND CIRCULATORS 26.5 TO 40GHz

### FEATURES

- ◆ Low Loss
- ◆ High Isolation
- ◆ Compact Size
- ◆ Lightweight



### DESCRIPTION

The ML 2K/3K Series of waveguide junction isolators and circulators are reliable, rugged and lightweight devices with excellent electrical performance. The units are finished in chromate to DEF-STAN 03-18 with optional paint or silver/gold plate available on request.

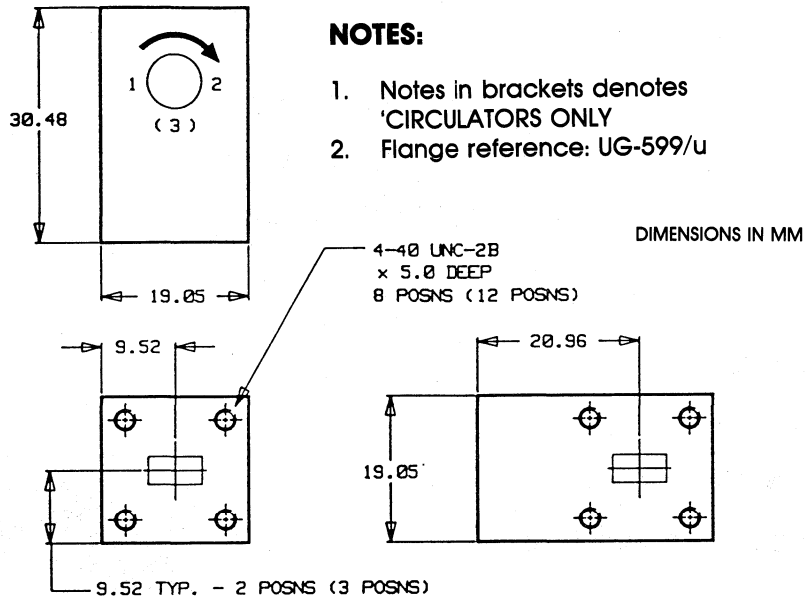
### SPECIFICATION

Frequency Range	: 26.5 to 40GHz
Operating Bandwidth	: 1, 2 or 3GHz, specify on order
V.S.W.R.	: 1.18:1 (max.)
Insertion Loss	: 0.35dB (max.)
Isolation	: 22dB (min.)
Power Handling	: 1kW peak 1W mean

### ENVIRONMENTAL SPECIFICATION

Operating Temperature	: -55°C to +85°C
Storage Temperature	: -60°C to +90°C

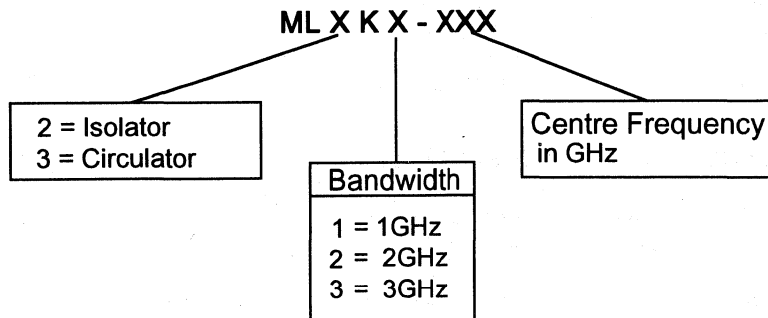
**OUTLINE DRAWING**



**MECHANICAL SPECIFICATION**

Waveguide Size : WG22 (WR 28)  
Weight : 30g approx.

**ORDERING INFORMATION:**



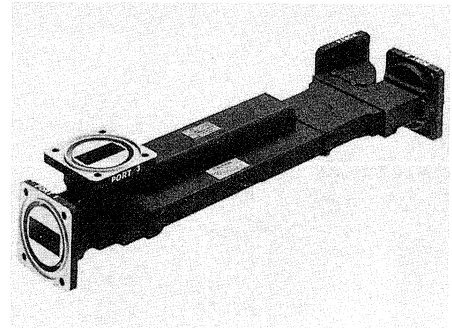
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**I BAND HIGH POWER  
4 PORT CIRCULATOR  
8.5 TO 9.6GHz**

**FEATURES**

- ◆ Low Loss
- ◆ High Reliability
- ◆ High Power Handling

**DESCRIPTION**

This 4-Port differential phase shift circulator operates over the frequency range 8.5 to 9.6 GHz and is designed to handle peak and average powers at 200kW and 300W respectively.

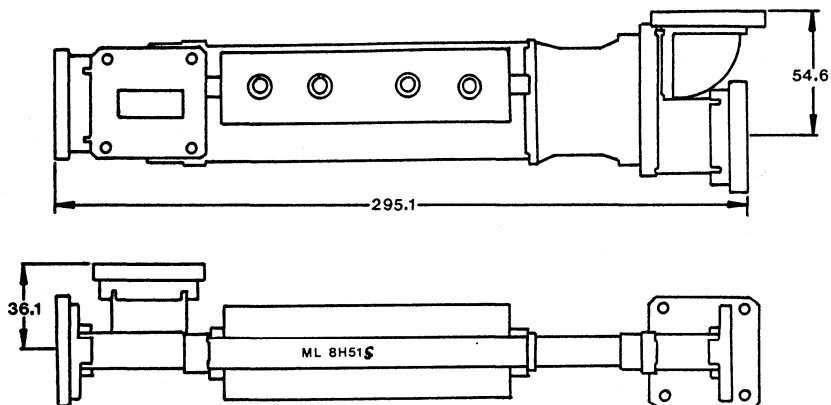
**SPECIFICATION**

Frequency Range	: 8.5 to 9.6GHz
V.S.W.R.	: 1.15:1 (max.)
Insertion Loss	: 0.4dB (max.)
Isolation	: 20dB (min.)
Peak Power	: 200kW (max.)
Average Power	: 300W (max.)

**ENVIRONMENTAL SPECIFICATION**

Operating Temperature	: -30°C to +70°C
Storage Temperature	: -40°C to +85°C
Shock	: 15g, 11ms
Vibration	: 10g, 10-400Hz

## OUTLINE DRAWING



Dimensions in MM

## MECHANICAL SPECIFICATION

Waveguide Size	: WG15 (WR 112)
Pressure Rating	: 30 PSIA
Weight	: 1.2Kg approx.
Device Protective Finish	: Matt Black Epoxy

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Europe: (44) 1344 869595

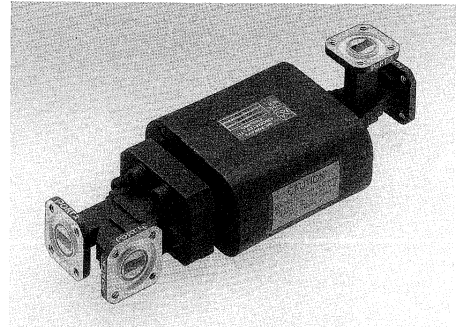
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

## K BAND HIGH POWER 4 PORT CIRCULATOR 34.5 TO 35.5GHz

### FEATURES

- ◆ Low Loss
- ◆ High Reliability
- ◆ High Power Handling



### DESCRIPTION

This 4-Port differential phase shift circulator operates over the frequency range 34.5 to 35.5 GHz and is designed to handle peak and average powers at 5kW max. and 150W max. respectively.

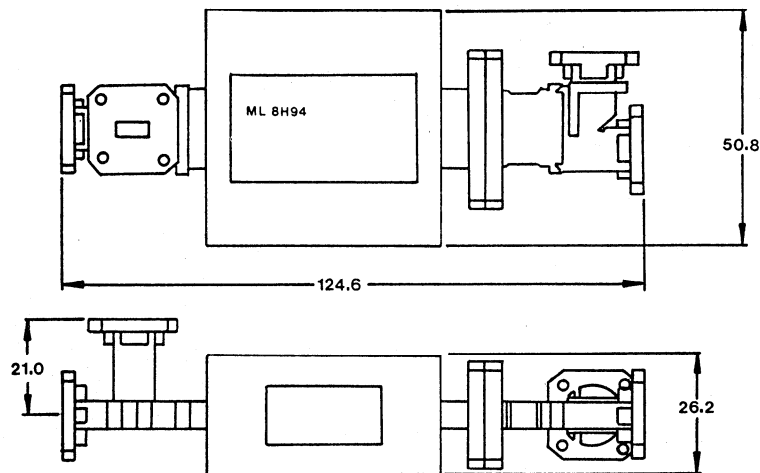
### SPECIFICATION

Frequency Range	: 34.5 to 35.5GHz
V.S.W.R.	: 1.2:1 (max.)
Insertion Loss	: 0.35dB (max.)
Isolation	: 20dB (min.)
Peak Power	: 5kW (max.)
Average Power	: 150W (max.)

### ENVIRONMENTAL SPECIFICATION

Operating Temperature	: -30°C to +80°C
Storage Temperature	: -40°C to +85°C

## OUTLINE DRAWING



Dimensions in MM

## MECHANICAL SPECIFICATION

Waveguide Size	: WG22 (WR 28)
Pressure Rating	: 35 PSIA
Weight	: 680g approx.
Device Protective Finish	: Matt Black Epoxy

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Europe: (44) 1344 869595

North America: 800 366 2266

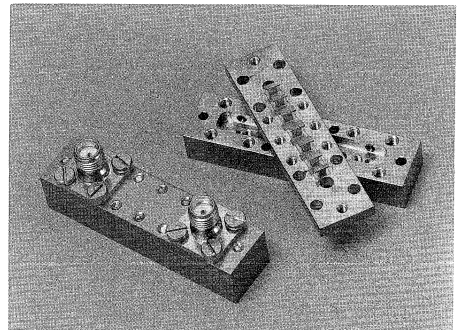
Asia Pacific: (81) 3 3226 1671

**BROADBAND REJECTION**

**500 MHz – 26 GHz**

**FEATURES**

- ◆ **Low Loss**
- ◆ **Bandpass**
- ◆ **> 4.5 x  $f_c$  Rejection**
- ◆ **Choice of Terminations**



**DESCRIPTION**

MLF-1000 series filters are designed for applications where low loss and broadband rejection are critical. Comblines units provide rejection over bandwidths greater than 4.5 times centre frequency while interdigital designs provide low loss over at least twice centre frequency. Electrical and mechanical parameters are optimised against customer requirements and removable connector versions are available for integration applications.

**SPECIFICATION**

	<u>Comblines</u>	<u>Interdigital</u>
Frequency Range	: 0.5 to 20 GHz	2.0 to 26 GHz
Bandwidth	: 1 to 15%	2 to 20%
Rejection Band	: >4.5 x $f_c$	>2 x $f_c$
Termination	: SMA, N Type, Solder Pin	

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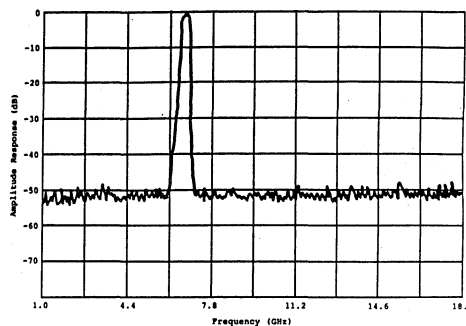
North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

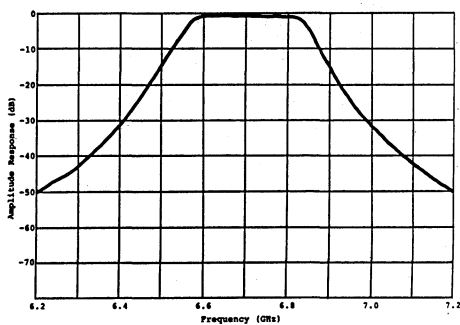
### TYPICAL PERFORMANCE

Centre Frequency : 6.7 GHz  
 Bandwidth : 500 MHz  
 Insertion Loss : 1.5 dB  
 VSWR : 1.5:1  
 40dB Rejection : 1 - 6.2 GHz  
 7.2 - 18 GHz

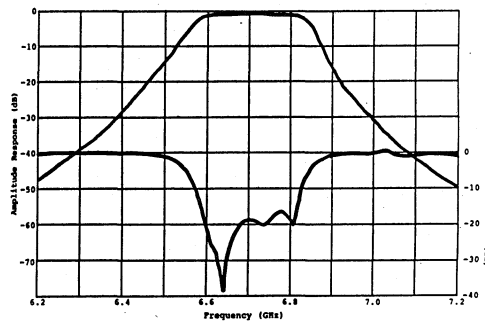
#### Broadband



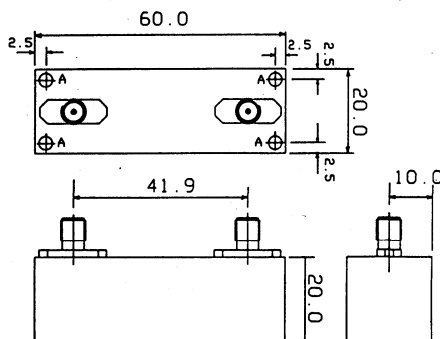
#### Predicted



#### Measured



### STANDARD OUTLINE



A HOLES 3.2 DIA 4 PLACES  
 CONNECTORS SMA FEMALE 2 PLACES

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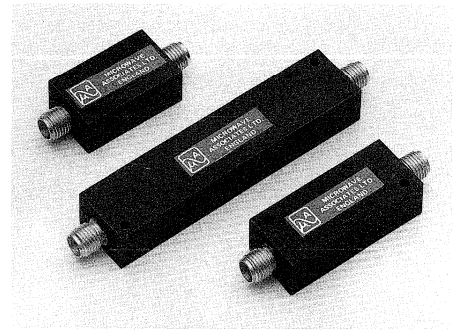
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Asia Pacific: (81) 3 3226 1671



**LOW PASS BANDPASS HIGHPASS**
**10 MHz – 1.5 GHz**
**FEATURES**

- ◆ Low Size & Weight
- ◆ Choice of Response
- ◆ Choice of Termination
- ◆ MiCM Carriers


**DESCRIPTION**

MLF-1100 series filters are designed for applications where size and weight are critical. An extensive CAD library allows rapid realisation of topologies to meet customer electrical and mechanical requirements. High Q values are ensured through ATE characterisation of inductors. Open carrier designs are also available for drop-in use in switches filter banks etc.

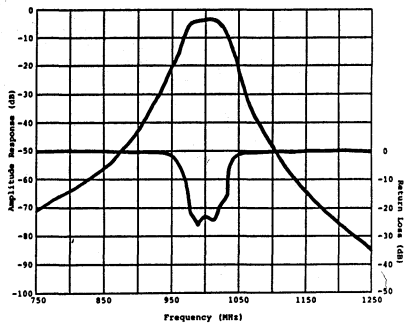
**SPECIFICATION**

Frequency Range	:	0.01 to 1.5 GHz
Bandwidth	:	1 to 70%
Termination	:	SMA, N Type, Solder Pin

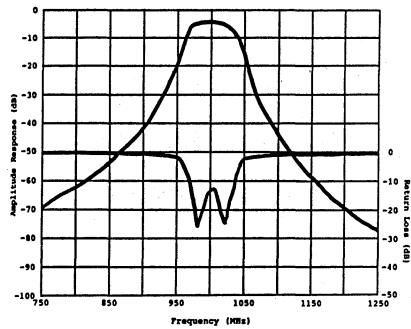
### TYPICAL PERFORMANCE (Band Pass)

Centre Frequency	:	1.0 GHz
Bandwidth	:	50 MHz
Insertion Loss	:	5 dB
VSWR	:	2:1
Rejection	:	50dB at 850 and 1150 MHz

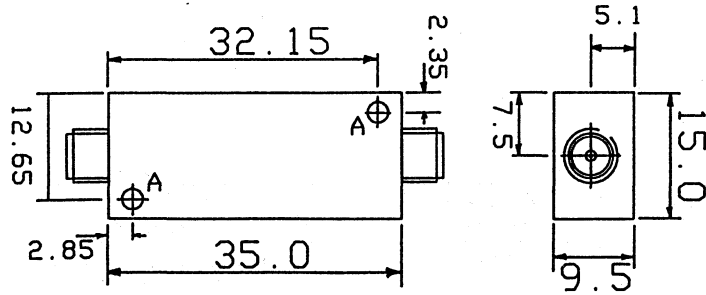
**Predicted**



**Measured**



### STANDARD OUTLINE



A HOLES 2.5 DIA. 2 PLACES  
CONNECTORS SMA FEMALE 2 PLACES

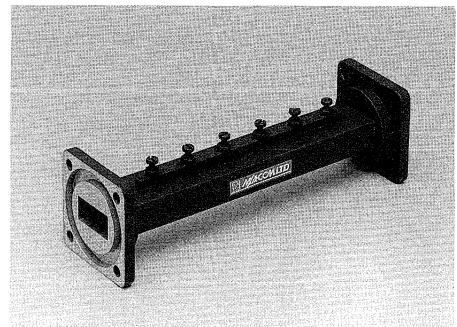
All specifications are typical and subject to change without notice

**WAVEGUIDE FILTERS**

**2 TO 60 GHZ**

**FEATURES**

- ◆ Bandpass
- ◆ Low Loss
- ◆ High Frequency Capability
- ◆ High Power Handling
- ◆ Choice of Terminations



**DESCRIPTION**

The MLF-1200 series of waveguide post and iris coupled bandpass filters are distinguished by their low loss and high peak power handling over frequencies extending into the millimetre-wave region. Power handling is primarily dependant on frequency and bandwidth, but is much higher than that achievable with other types of filter. An extensive library of designs is available to suit individual power handling requirements.

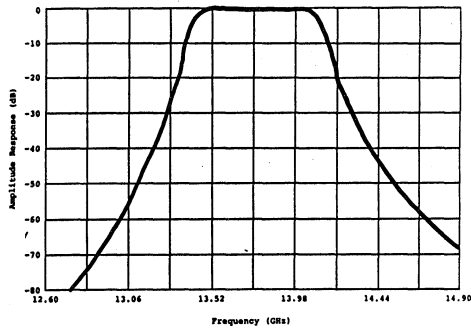
**SPECIFICATION**

Frequency Range (GHz)	Percentage Bandwidth	Terminations
2 - 60	0.1 - 20	Flanged (Standard/Choked) Coaxial Transitions (SMA/N-Type)

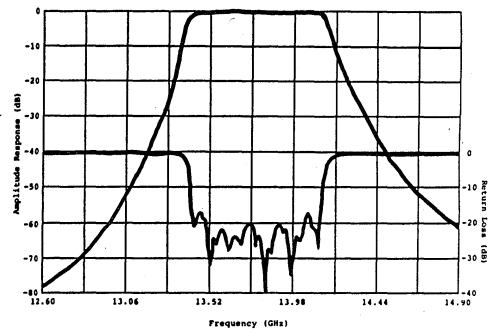
### TYPICAL PERFORMANCE

Centre Frequency	:	13.75 GHz
Bandwidth	:	500 MHz
Insertion Loss	:	0.3dB
VSWR	:	1.3:1
40dB Rejection	:	<13.1 GHz, >14.5 GHz

**Predicted**

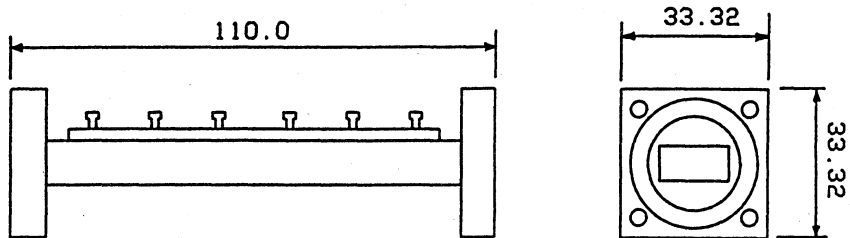


**Measured**



### TYPICAL OUTLINE

Flange size and length dependent on frequency. Example selected for performance indicated above.



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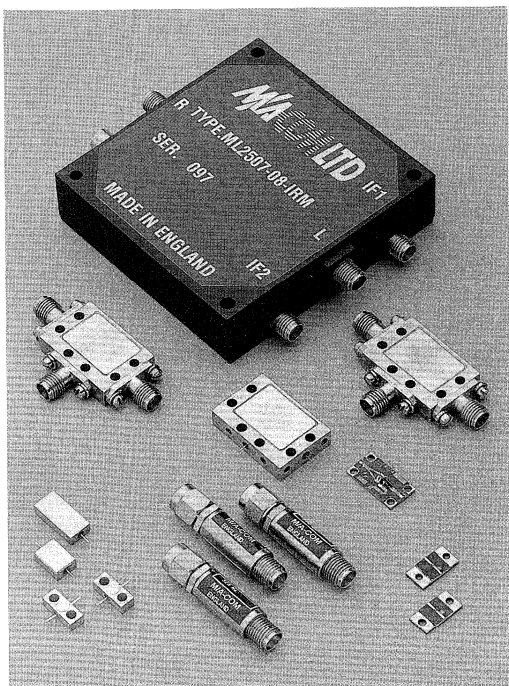
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# MIXERS AND DETECTORS

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an AMP company

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**MIXERS****1.0 TO 18.0 GHz****FEATURES**

- ◆ **Double Balanced**
- ◆ **Image Rejection**
- ◆ **Broad Frequency Ranges**
- ◆ **Low Conversion Loss**
- ◆ **Coaxial and Drop-in Packages**

**DESCRIPTION**

M/A-COM Ltd provides a wide range of high performance mixers covering the frequency range from 1GHz to 18GHz in a variety of coaxial and drop in package styles.

Double balanced mixers offer high isolation for all three ports, low conversion loss and good 50ohm match at all ports. Three versions of each mixer type are available with different nominal local oscillator drive levels and respective compression point and third order intercept. Both low and microwave frequency IF ranges are available. Double balanced mixers incorporate four Schottky barrier diodes and two wideband transformers. The designs are optimised to match the diodes and construct the transformers for balance and noise figure.

For wideband low noise downconversion applications where rejection of the downconverted RF image frequency is critical M/A-COM Ltd offers a range of octave plus bandwidth image rejection mixers. These incorporate the double balanced mixer designs together with the necessary in phase and 90 degree splitters and combiner. For upconversion applications where the requirement is to modulate a local oscillator carrier signal with the IF baseband signal and transmit only one sideband a range of single sideband modulators is available.

M/A-COM Ltd has a wide experience in the development and production of custom components and can offer mixers with optimised performance, non-standard package outlines or integrated with other components such as isolators, limiters, amplifiers and oscillators to provide complex mixer assemblies. Please contact the factory for applications assistance.

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## DESCRIPTION

This series of double balanced mixers offers a range of RF frequencies with either low or high IF frequency bands and low, medium or high barrier Schottky diodes. The microstrip mixer is packaged in an hermetic housing with removable SMA connectors. With the connectors removed the device can be integrated directly into microstrip and stripline circuits.

## SPECIFICATIONS @ +25°C

RF/LO Frequency Range (GHz)	3dB IF Band-Width (GHz) Min.	L-R Isolation (dB) Min.	L-I Isolation (dB) Min.	LO Input Range (dBm) Min/Max	Conversion Loss (dB) Typ/Max	RF Input 1dB Compression Point (dBm) Min.	RF Input 3rd Order Intercept (dBm) Min.	Part Number
2.0 - 8.0	DC-1.0	20	15	+7/+11	7.0/10.5	+2	+12	ML2401-04-DBL
				+11/+15	7.0/10.5	+5	+15	ML2401-04-DBM
				+15/+18	7.5/11.0	+8	+18	ML2401-04-DBH
8.0 - 12.0	DC-1.0	20	15	+7/+11	6.5/8.0	+2	+12	ML2501-04-DBL
				+11/+15	6.5/8.0	+5	+15	ML2501-04-DBM
				+15/+18	7.0/8.5	+8	+18	ML2501-04-DBH
12.0 - 18.0	DC-1.0	20	15	+7/+11	7.0/9.0	+2	+12	ML2601-04-DBL
				+11/+15	7.0/9.0	+5	+15	ML2601-04-DBM
				+15/+18	7.5/9.5	+8	+18	ML2601-04-DBH
12.0 - 18.0	0.7-6.0	20	15	+7/+11	6.0/9.5	+2	+12	ML2602-04-DBL
				+11/+15	6.0/9.5	+5	+15	ML2602-04-DBM
				+15/+18	6.5/10.0	+8	+18	ML2602-04-DBH
6.0 - 18.0	DC-1.0	20	15	+7/+11	6.5/9.5	+2	+12	ML2701-04-DBL
				+11/+15	6.5/9.5	+5	+15	ML2701-04-DBM
				+15/+18	7.0/10.0	+8	+18	ML2701-04-DBH
6.0 - 18.0	0.7-6.0	20	15	+7/+11	6.0/9.5	+2	+12	ML2702-04-DBL
				+11/+15	6.0/9.5	+5	+15	ML2702-04-DBM
				+15/+18	6.5/10.0	+8	+18	ML2702-04-DBH
2.0 - 18.0	DC-1.0	20	12	+7/+11	7.0/10.0	+2	+12	ML2901-04-DBL
				+11/+15	7.0/10.0	+5	+15	ML2901-04-DBM
				+15/+18	7.5/10.5	+8	+18	ML2901-04-DBH
2.0 - 18.0	0.7-6.0	20	15	+7/+11	6.5/9.5	+2	+12	ML2902-04-DBL
				+11/+15	6.5/9.5	+5	+15	ML2902-04-DBM
				+15/+18	7.0/10.0	+8	+18	ML2902-04-DBH

### NOTES:

1. Maximum RF input power 100mW (L, M suffix), 200mW (H suffix).
2. All measurements performed in a 50ohm system.
3. VSWR typically 3.0:1 (RF, LO), 4.0:1 (IF).
4. Case operating temperature -55°C to +85°C.  
Storage temperature -55°C to +125°C.

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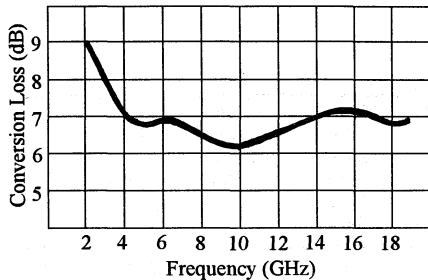
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North America: 800 366 2266

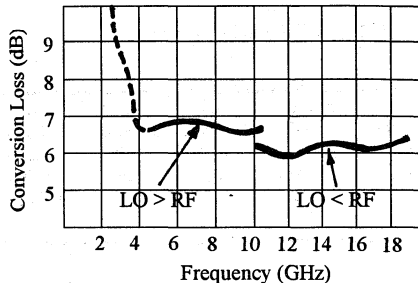
Asia Pacific: (81) 3 3226 1671

# TYPICAL PERFORMANCE

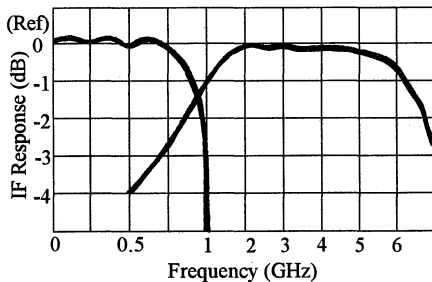
**CONVERSION LOSS (IF = 300 MHz)**



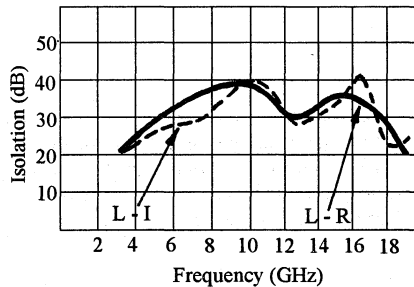
**CONVERSION LOSS (IF = 3 GHz)**



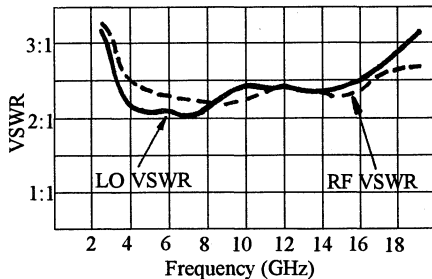
**IF RESPONSE**



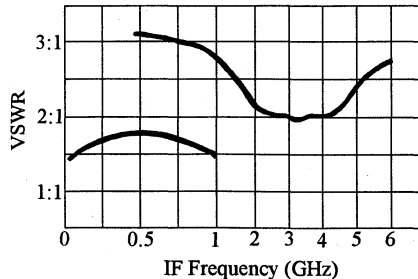
**ISOLATION**



**LO, RF VSWR**



**IF VSWR**



## DESCRIPTION

This miniature mixer design offers broadband RF performance together with a high IF frequency range. The hybrid triple balanced circuit is an open substrate configuration for direct integration into microstrip circuits with minimum loss.

## SPECIFICATIONS @ +25°C

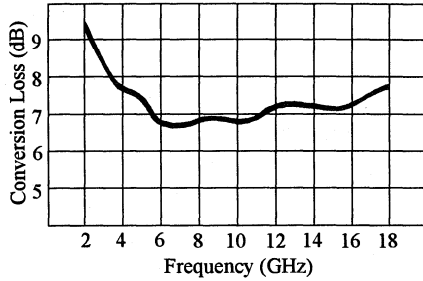
RF/LO Frequency Range (GHz)	3dB IF Band- Width (GHz) Min.	L-R Isolation (dB) Min.	L-I Isolation (dB) Min.	LO Input Range (dBm) Min/Max	Conversion Loss (dB) Typ/Max	RF Input 1dB Compression Point (dBm) Min.	RF Input 3rd Order Intercept (dBm) Min.	Part Number
2.0 - 18.0	0.5 - 8.0	20	15	+7/+11	7.0/10.0	+2	+12	ML2902-10-DBL
				+11/+15	7.0/10.0	+5	+15	ML2902-10-DBM
				+15/+18	7.5/10.5	+8	+18	ML2902-10-DBH

### NOTES:

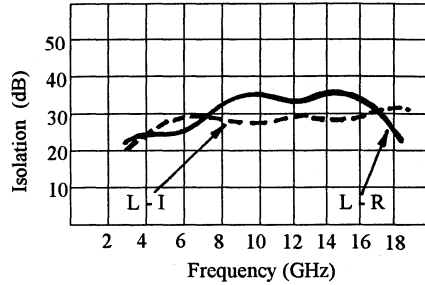
1. Maximum RF input power 100mW (L, M suffix), 200mW (H suffix).
2. All measurements performed in a 50ohm system.
3. VSWR typically 3.0:1 (RF, LO), 4.0:1 (IF).
4. Case operating temperature -55°C to +85°C.  
Storage temperature -55°C to +125°C.

TYPICAL PERFORMANCE

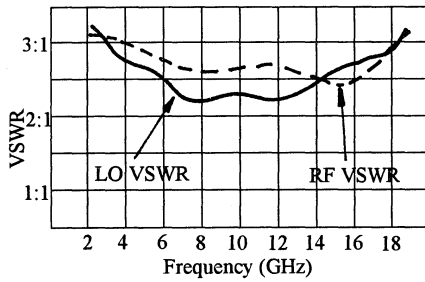
CONVERSION LOSS (IF = 500 MHz)



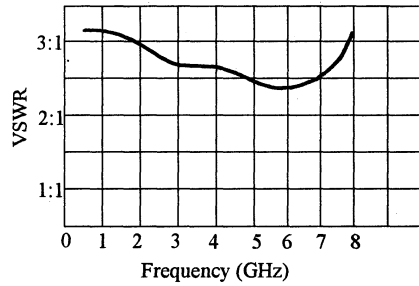
ISOLATION



LO, RF VSWR



IF VSWR



## DESCRIPTION

These image rejection mixers offer octave plus RF bandwidths and a selectable IF bandwidth for downconversion applications where rejection of the image frequency is required. The hybrid circuit is hermetically packaged with SMA connector interfaces for a wide variety of environmental conditions and system applications.

## SPECIFICATIONS @ +25°C

RF/LO Frequency Range (GHz)	L-R Isolation (dB) Min.	L-I Isolation (dB) Min.	VSWR (Ratio)		I Typ	Image Rejection (dB) Min	LO Input Range (dBm) Min/Max	Conversion Loss (dB) Typ/Max	RF Input 1dB Compression Point (dBm) Min.	Part Number
			R Typ	L Typ						
1.0 - 2.0	20	20	1.7	2.0	1.5	18	+9/+13	6.5/8.0	+3	ML21XX-08-IRL
							+13/+17	6.5/8.5	+9	ML21XX-08-IRM
							+17/+21	7.0/9.0	+13	ML21XX-08-IRH
2.0 - 4.0	20	23	1.7	2.0	1.5	18	+9/+13	6.0/8.0	+3	ML22XX-08-IRL
							+13/+17	6.0/8.5	+9	ML22XX-08-IRM
							+17/+21	6.5/9.0	+13	ML22XX-08-IRH
4.0 - 8.0	20	23	1.7	2.0	1.5	18	+9/+13	6.0/8.0	+3	ML23XX-08-IRL
							+13/+17	6.0/8.5	+9	ML23XX-08-IRM
							+17/+21	6.5/9.0	+13	ML23XX-08-IRH
2.0 - 8.0	20	23	1.7	2.0	1.5	18	+9/+13	7.0/8.0	+3	ML24XX-08-IRL
							+13/+17	7.0/8.5	+9	ML24XX-08-IRM
							+17/+21	7.5/9.0	+13	ML24XX-08-IRH
8.0 - 12.0	20	23	1.8	2.5	1.5	17	+9/+13	7.0/9.5	+3	ML25XX-08-IRL
							+13/+17	7.0/10.0	+9	ML25XX-08-IRM
							+17/+21	7.5/11.0	+13	ML25XX-08-IRH
12.0 - 18.0	18	23	1.8	2.5	1.5	17	+9/+13	8.0/10.5	+3	ML26XX-08-IRL
							+13/+17	8.0/11.0	+9	ML26XX-08-IRM
							+17/+21	8.5/12.0	+13	ML26XX-08-IRH
8.0 - 18.0	18	23	1.8	2.5	1.5	15	+9/+13	8.5/10.5	+3	ML28XX-08-IRL
							+13/+17	8.5/11.0	+9	ML28XX-08-IRM
							+17/+21	9.0/12.0	+13	ML28XX-08-IRH

### NOTES:

1. Maximum RF input power 400mW to any port.
2. All measurements performed in a 50ohm system.
3. The desired IF output will appear at the IF 1 port when the RF input frequency is above the LO frequency.
4. Image rejection measured at centre IF frequency.
5. Case operating temperature -55°C to +85°C.  
Storage temperature -55°C to +125°C.

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## IF SELECTION TABLE

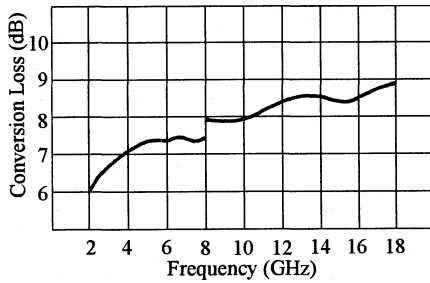
Replace the 'XX' in the part number with the required IF frequency code as below.

'XX'	IF Frequency Range
05	20 - 40 MHz
06	40 - 80 MHz
07	80 - 160 MHz
08	100 - 200 MHz

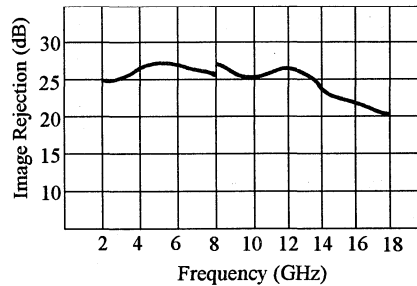
Other IF ranges are also available, please consult the factory for details.

## TYPICAL PERFORMANCE

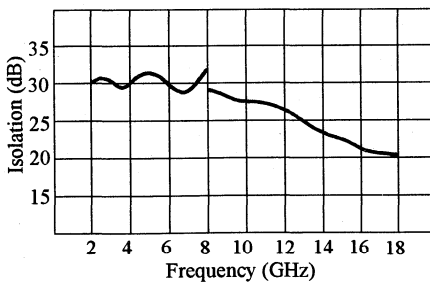
### CONVERSION LOSS



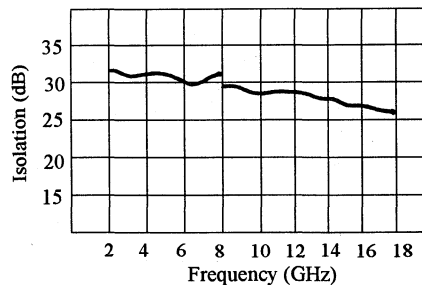
### IMAGE REJECTION



### L-R ISOLATION



### L-I ISOLATION



## DESCRIPTION

These single sideband modulators offer octave plus RF bandwidths and a selectable IF bandwidth for upconversion applications where single sideband transmission is required. The hybrid circuit is hermetically packaged with SMA connector interfaces for a wide variety of environmental conditions and system applications.

## SPECIFICATIONS @ +25°C

RF/LO Frequency Range (GHz)	L-R Isolation (dB) Min.	L-I Isolation (dB) Min.	VSWR (Ratio)			Sideband Suppress -ion (dB) Min	LO (Carrier) Range (dBm) Min/Max	Conversion Loss (dB) Typ/Max	IF Input 1dB Compression Point (dBm) Min.	Part Number
			R Typ	L Typ	I Typ					
1.0 - 2.0	20	20	1.7	2.0	1.5	18	+9/+13	6.0/8.5	+3	ML21XX-08-SSL
							+13/+17	6.0/9.0	+9	ML21XX-08-SSM
							+17/+21	6.5/9.5	+13	ML21XX-08-SSH
2.0 - 4.0	20	23	1.7	2.0	1.5	18	+9/+13	6.0/8.5	+3	ML22XX-08-SSL
							+13/+17	6.0/9.0	+9	ML22XX-08-SSM
							+17/+21	6.5/9.5	+13	ML22XX-08-SSH
4.0 - 8.0	20	23	1.7	2.0	1.5	18	+9/+13	6.5/8.5	+3	ML23XX-08-SSL
							+13/+17	6.5/9.0	+9	ML23XX-08-SSM
							+17/+21	7.0/9.5	+13	ML23XX-08-SSH
2.0 - 8.0	20	23	1.7	2.0	1.5	18	+9/+13	7.5/8.5	+3	ML24XX-08-SSL
							+13/+17	7.5/9.0	+9	ML24XX-08-SSM
							+17/+21	8.0/9.5	+13	ML24XX-08-SSH
8.0 - 12.0	20	23	1.8	2.5	1.5	17	+9/+13	7.5/10.0	+3	ML25XX-08-SSL
							+13/+17	7.5/10.5	+9	ML25XX-08-SSM
							+17/+21	8.0/11.5	+13	ML25XX-08-SSH
12.0 - 18.0	18	23	1.8	2.5	1.5	17	+9/+13	8.0/11.0	+3	ML26XX-08-SSL
							+13/+17	8.0/11.5	+9	ML26XX-08-SSM
							+17/+21	8.5/12.5	+13	ML26XX-08-SSH
8.0 - 18.0	18	23	1.8	2.5	1.5	15	+9/+13	8.5/11.0	+3	ML28XX-08-SSL
							+13/+17	8.5/11.5	+9	ML28XX-08-SSM
							+17/+21	9.0/12.5	+13	ML28XX-08-SSH

### NOTES:

1. Maximum RF input power 400mW to any port.
2. All measurements performed in a 50ohm system.
3. Conversion loss measured relative to IF input level
4. Sideband suppression measured relative to desired sideband output level.
5. RF output frequency will be above the carrier frequency when IF input modulation signal is applied to IF 1 port.
6. Case operating temperature -55°C to +85°C.  
Storage temperature -55°C to +125°C.

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## IF SELECTION TABLE

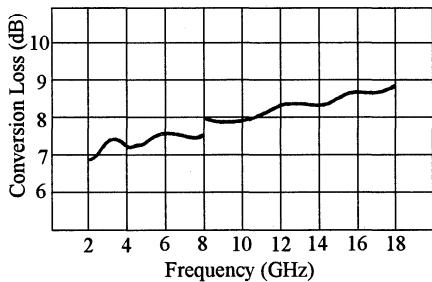
Replace the 'XX' in the part number with the required IF frequency code as below.

'XX'	IF Frequency Range
05	20 - 40 MHz
06	40 - 80 MHz
07	80 - 160 MHz
08	100 - 200 MHz

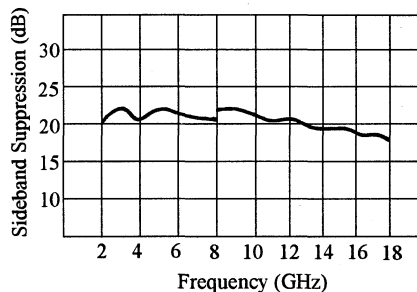
Other IF ranges are also available, please consult the factory for details.

## TYPICAL PERFORMANCE

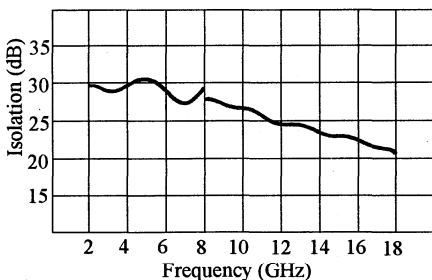
**CONVERSION LOSS**



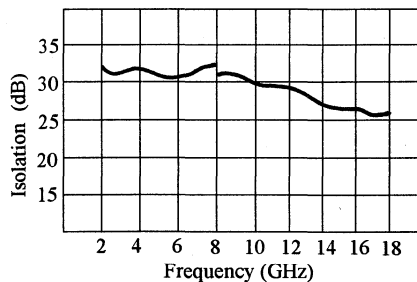
**SIDEBAND SUPPRESSION**



**L-R ISOLATION**



**L-I ISOLATION**

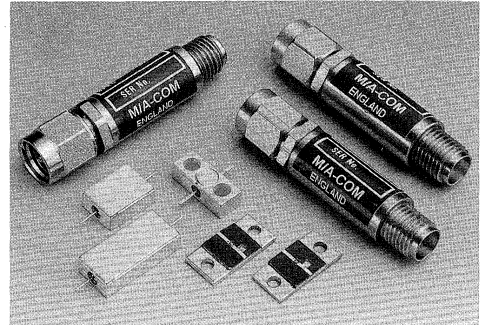






**DETECTORS****0.1 TO 18.0 GHz****FEATURES**

- ◆ **Schottky & Tunnel Diode**
- ◆ **Limiter Detectors**
- ◆ **Broad Frequency Ranges**
- ◆ **High Sensitivities**
- ◆ **Coaxial & Drop-in**

**DESCRIPTION**

The M/A-COM Ltd detector range uses both silicon based Schottky barrier diodes and germanium based tunnel diodes. In both types RF detection is achieved through the non-linear, current voltage characteristics of a semiconductor junction. In Schottky diodes this junction is established between a metal and either p or n type doped silicon and is typically between 0.3V (low barrier) and 0.8V (high barrier) depending on the materials. In tunnel diodes the junction is a pn type formed between two doped semiconductors. When the doping is sufficiently heavy on both sides of the junction the potential barrier becomes thin enough for electrons to 'tunnel' through the barrier giving rise to a negative resistance. The probability of tunnelling increases as the size of the junction is decreased. Germanium is used as the semiconductor material with a potential barrier of the order of 0.6V.

These diode types are selected to offer optimum performance for a wide range of applications. Tunnel diodes offer the best temperature stability, video bandwidth, rise time and wideband RF match. Schottky detectors are chosen for their rugged construction, highest output voltage and best sensitivity. Biased Schottky detectors offer additional advantages by providing higher burnout levels, lower video resistance and improved temperature stability and RF match.

These detectors are manufactured using chip diodes, avoiding the performance degrading effects of package parasitics, matched into a hybrid microstrip circuit giving wide frequency band operation. The circuit also incorporates the d.c. return and R.F. bypass elements and where used the PIN diode limiter. The complete assembly is then hermetically sealed into either a coaxial or modular housing. Package styles available include coaxial types with both fixed and removable SMA connectors and module types for both solder and mechanical attachment in stripline and microstrip assemblies. Detectors are also offered in the Common Module (MiCM) format for direct integration with other MiCM components as well as existing microstrip circuits. The package styles are compatible with the MiCM 20 Standard, DEF STAN 59-90 (Part 1) Microwave Common Modules, Part 1: Interfaces and Fixings for use up to 20 GHz and with the Draft CECC 00 017 Issue 1 Basic Specification: Microwave Common Modules for use up to 20 GHz.

M/A-COM Ltd also offers a custom design capability for detectors with optimised performance and detectors integrated with other circuit functions such as couplers, attenuators and isolators. Please contact the factory for applications assistance.

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## DESCRIPTION

Tunnel diode detectors generally offer the best temperature stability. The low video resistance of tunnel diodes also provides the widest video bandwidth and fastest rise time. Tunnel diode detectors also offer the best inherent RF match, without special input matching. Open circuit voltage sensitivity and RF power handling are less than the equivalent silicon Schottky detector but the tunnel detector's low video impedance and zero bias operation enables dc and ac coupling with video and log video amplifiers.

This series of detectors provides a usable 67dB dynamic range from nominal  $T_{ss}$  of -50dBm to maximum saturation at +17dBm. Within this range square law response is from  $T_{ss}$  to -15dBm, linear response from -15dBm to +5dBm and saturation from +5dBm to +17dBm. Above +17dBm diode damage and subsequent burnout occurs.

## SPECIFICATIONS @ +25°C

Frequency Range (GHz)	Voltage Sensitivity (K) (mV/mW) Min.	VSWR (Ratio) Max.	Flatness (dB) Max.	$T_{ss}$ (dBm) Min.	RF Bypass Capacitance (pF) Typ.	Rise Time (ns) Typ.	Video Resistance (ohms) Typ.	Part Number
0.1 - 2.0	800	2.0	±0.5	-50	100	15	120	ML 7700X-0020
2.0 - 8.0	800	2.0	±0.6	-50	20	4	120	ML 7700X-0021
8.0 - 18.0	500	2.3	±1.0	-50	20	4	100	ML 7700X-0022
2.0 - 18.0	500	2.5	±1.5	-50	20	4	100	ML 7700X-0023

### NOTES

- Available package styles for these detectors are A, D, J, H or M. To specify the package style please replace 'X' with the required letter in the above part numbers, e.g. for a coaxial package detector the part number is ML 7700A-0020.
- Detectors are normally supplied with negative (-) output voltage polarity, referenced to case ground, positive (+) output polarity is available for most parts. To specify positive output please add suffix 'P' to the end of the part number e.g. ML 7700A-0020P.
- Minimum open circuit voltage sensitivity (K) is the ratio of output voltage to input RF power and is measured at -20dBm RF input power into 30kohm external video load resistance ( $R_L$ ).
- VSWR is measured at -20dBm RF input power into 100 ohm external video load resistance ( $R_L$ ).
- Tangential signal sensitivity ( $T_{ss}$ ) is defined as the RF input power which produces an 8dB video output to noise voltage ratio and is measured using a video amplifier restricted to 2MHz bandwidth and having a noise contribution of 3dB maximum.
- Pulse rise time ( $t_r$ ) is measured into an external load ( $R_L$ ) of 100 ohms with 12pF in parallel.
- Video resistance is measured at -20dBm RF input power.
- Case operating temperature -55°C to +95°C  
Storage temperature -55°C to +125°C.

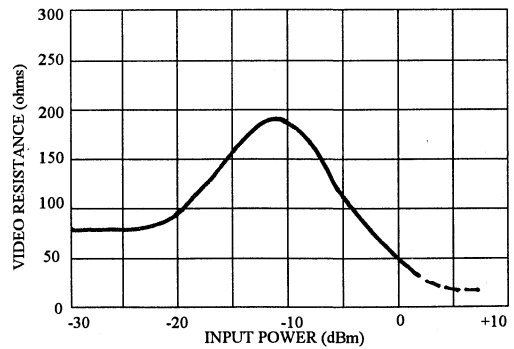
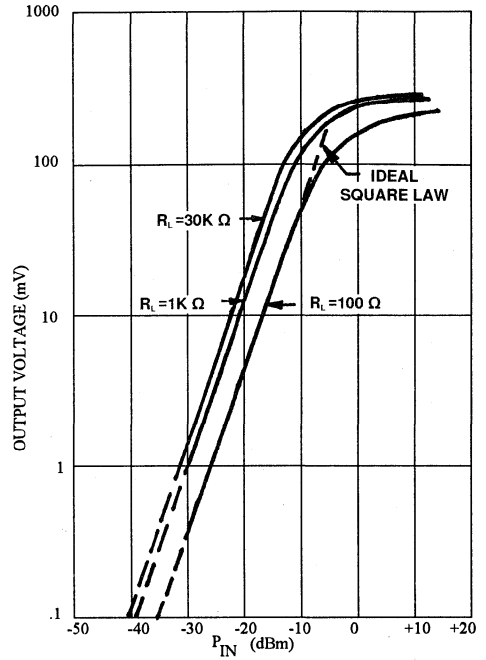
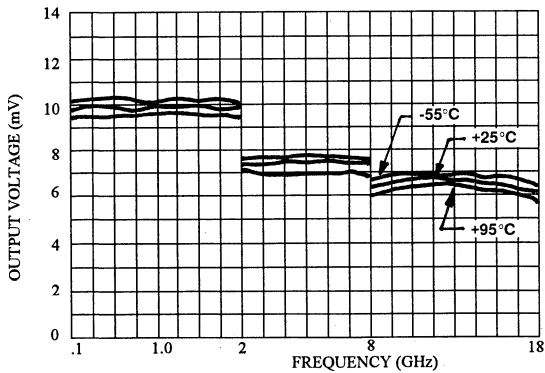
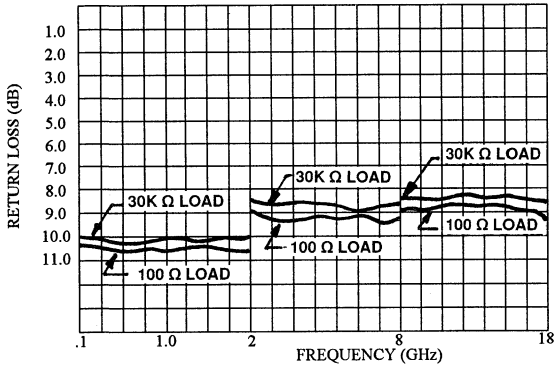
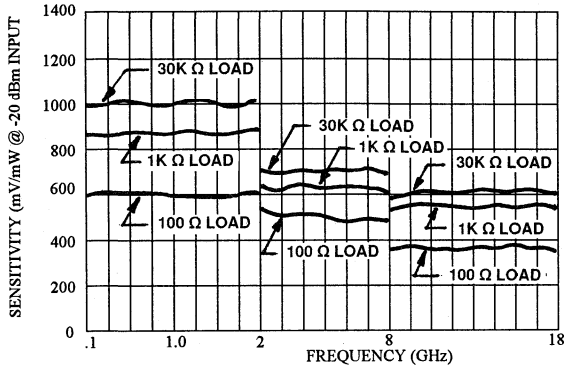
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TYPICAL PERFORMANCE



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# LIMITER TUNNEL DIODE DETECTORS

## ML 7718-0000 SERIES

### DESCRIPTION

This series of limiter-detectors offers similar performance advantages to the standard tunnel diode detectors but with extended RF input power range. A silicon PIN diode is integrated at the input of the device to provide passive protection for input powers up to +30dBm peak. Dependent on the video load resistance limiting starts at +10 to +17dBm input power. Limiting is reflective rather than absorptive.

### SPECIFICATIONS @ +25°C

Frequency Range (GHz)	Voltage Sensitivity (K) (mV/mW)	VSWR (Ratio)		Peak Input Power (dBm)	Flatness (dB)	T <sub>ss</sub> (dBm)	RF Bypass Capacitance (pF)	Rise Time (ns)	Video Resistance (ohms)	Part Number
	Min.	Max.	Max.	Max.	Max.	Min.	Typ.	Typ.	Typ.	
0.1 - 2.0	800	2.0	+30	±0.7	-48	100	15	120	ML 7718X-0020	
2.0 - 8.0	800	2.5	+30	±0.6	-48	20	10	120	ML 7718X-0021	
8.0 - 18.0	500	3.5	+30	±1.2	-48	20	6	100	ML 7718X-0022	
2.0 - 18.0	500	4.0	+30	±1.75	-48	20	8	100	ML 7718X-0023	

### NOTES

- Available package styles for these detectors are A, D, N or L. To specify the package style please replace 'X' with the required letter in the above part numbers, e.g. for a coaxial package detector the part number is ML 7718A-0020.
- Detectors are normally supplied with negative (-) output voltage polarity, referenced to case ground, positive (+) output polarity is available for most parts. To specify positive output please add suffix 'P' to the end of the part number e.g. ML 7718A-0020P.
- Minimum open circuit voltage sensitivity (K) is the ratio of output voltage to input RF power and is measured at -20dBm RF input power into 30kohm external video load resistance (R<sub>L</sub>).
- VSWR is measured at -20dBm RF input power into 100 ohm external video load resistance (R<sub>L</sub>).
- Peak power is rated at 1µs pulse length, 0.001% duty cycle. Maximum CW power is +23dBm.
- Tangential signal sensitivity (T<sub>ss</sub>) is defined as the RF input power which produces an 8dB video output to noise voltage ratio and is measured using a video amplifier restricted to 2MHz bandwidth and having a noise contribution of 3dB maximum.
- Pulse rise time (t<sub>r</sub>) is measured into an external load (R<sub>L</sub>) of 100 ohms with 12pF in parallel.
- Video resistance is measured at -20dBm RF input power.
- Case operating temperature -55°C to +95°C  
Storage temperature -55°C to +125°C.

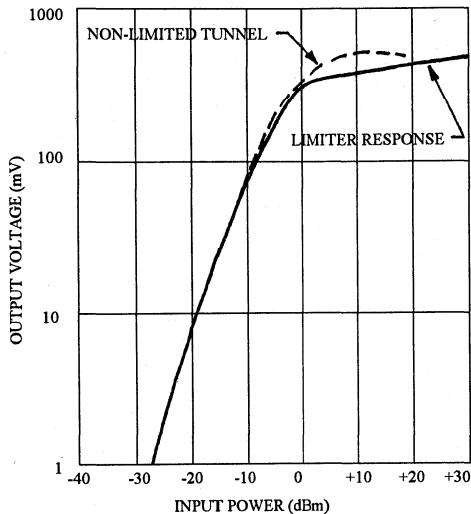
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TYPICAL PERFORMANCE



## DESCRIPTION

This series of biased Schottky detectors offers high output voltage and sensitivity combined with mechanical and electrical ruggedness. Biased Schottky detectors offer additional advantages over the unbiased equivalent by providing higher burnout levels, lower video resistance and improved temperature stability. Within this range the usable input power range of 71dB is from  $T_{ss}$  to +20dBm. Within this range square law response is from  $T_{ss}$  to -15dBm, linear response from -15dBm to +6dBm and saturation from +6dBm to +20dBm. Above +23dBm diode damage and subsequent burnout occurs.

## SPECIFICATIONS @ +25°C

Frequency Range (GHz)	Voltage Sensitivity (K)	VSWR (Ratio)	Flatness (dB) Max.	$T_{ss}$ (dBm) Min.	RF Bypass	Rise Time (ns) Typ.	Video Resist	Part Number
	(mV/mW) Min.				Capacitance (pF) Typ.		ance (ohms) Typ.	
0.1 - 2.0	1700	3.5	±0.7	-51	100	50	300	ML 7709X-0020
2.0 - 8.0	1900	3.5	±0.6	-51	20	15	300	ML 7709X-0021
8.0 - 18.0	2000	4.0	±1.0	-51	20	15	300	ML 7709X-0022
2.0 - 18.0	1800	4.5	±1.5	-51	20	15	300	ML 7709X-0023

### NOTES

1. Available package styles for these detectors are A, D, J, H or M. To specify the package style please replace 'X' with the required letter in the above part numbers, e.g. for a coaxial package detector the part number is ML 7709A-0020.
2. Detectors are normally supplied with negative (-) output voltage polarity, referenced to case ground, positive (+) output polarity is available for most parts. To specify positive output please add suffix 'P' to the end of the part number e.g. ML 7709A-0020P.
3. Minimum open circuit voltage sensitivity (K) is the ratio of output voltage to input RF power and is measured with 100µA forward bias applied via the video port, at -20dBm RF input power and into 30kohm external video load resistance ( $R_L$ ).
4. VSWR is measured at -20dBm RF input power into 500 ohms external video load resistance ( $R_L$ ) with 200µA forward bias applied via the video port.
5. Tangential signal sensitivity ( $T_{ss}$ ) is defined as the RF input power which produces an 8dB video output to noise voltage ratio and is measured using a video amplifier restricted to 2MHz bandwidth and having a noise contribution of 3dB maximum.
6. Pulse rise time ( $t_r$ ) is measured into an external load ( $R_L$ ) of 1kohm with 12pF in parallel and 100µA bias applied through a 30kohm series resistor.
7. Video resistance is measured at -20dBm RF input power with 100µA bias.
8. Case operating temperature -55°C to +125°C  
Storage temperature -55°C to +125°C.

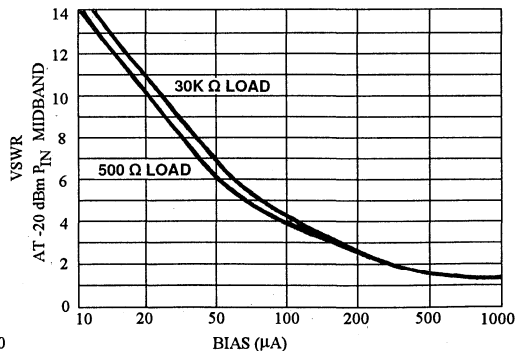
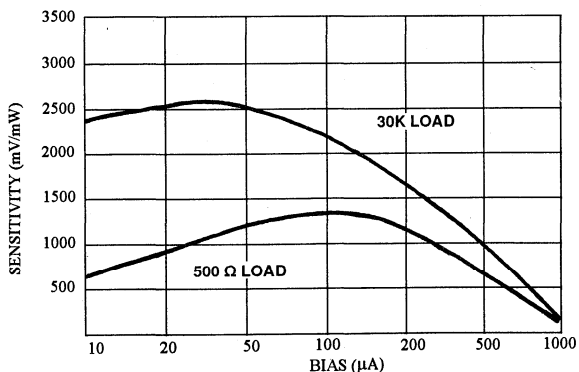
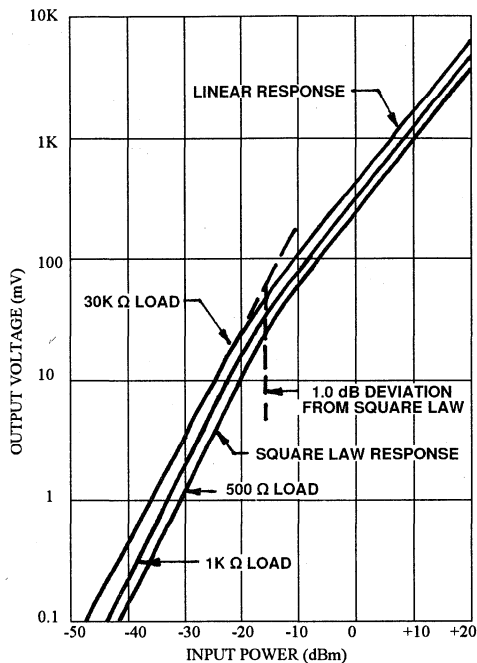
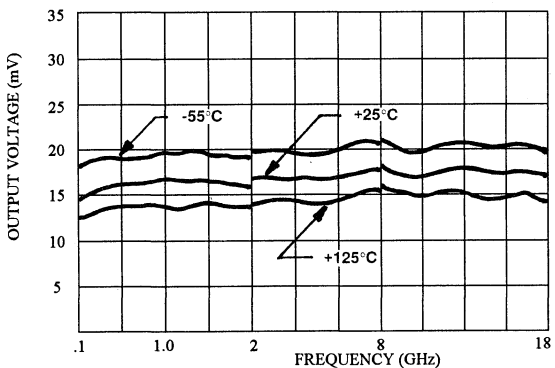
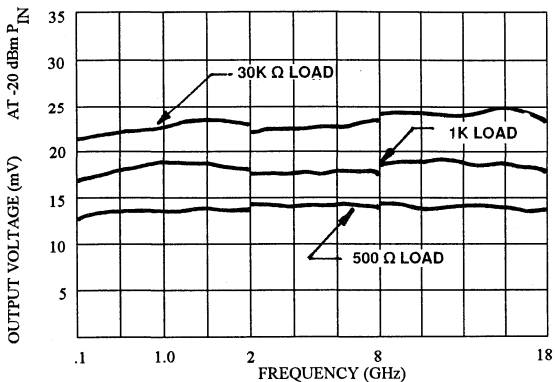
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TYPICAL PERFORMANCE



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# BIASED SCHOTTKY LIMITER DETECTORS ML 7715-0000 SERIES

## DESCRIPTION

This series of limiter detectors offers similar performance below limiting to the standard biased Schottky detectors with the added capability of higher RF input power handling of up to +50dBm pulsed. A silicon PIN diode is integrated at the input of the device to provide passive high power protection.

The usable RF input power range is from  $T_{ss}$  to +10dBm, including square law and linear response regions. Above +10dBm and up to +50dBm the RF input is limited and reflected back to the source.

## SPECIFICATIONS @ +25°C

Frequency Range (GHz)	Voltage Sensitivity (K)	VSWR (Ratio)	Peak Input Power	Flatness (dB)	$T_{ss}$ (dBm)	RF Bypass Capacitance	Rise Time (ns)	Video Resistance	Part Number
	(mV/mW) Min.		(dBm) Max.			(pF) Typ.		(ohms) Typ.	
0.1 - 2.0	1700	6.5	+50	±0.9	-50	100	50	300	ML 7715X-0020
2.0 - 8.0	1900	6.0	+50	±0.8	-50	20	15	300	ML 7715X-0021
8.0 - 18.0	2000	6.0	+50	±1.2	-50	20	15	300	ML 7715X-0022
2.0 - 18.0	1800	6.0	+50	±1.7	-50	20	15	300	ML 7715X-0023

### NOTES

- Available package styles for these detectors are A, D, N or L. To specify the package style please replace 'X' with the required letter in the above part numbers, e.g. for a coaxial package detector the part number is ML 7715A-0020.
- Detectors are normally supplied with negative (-) output voltage polarity, referenced to case ground, positive (+) output polarity is available for most parts. To specify positive output please add suffix 'P' to the end of the part number e.g. ML 7715A-0020P.
- Minimum open circuit voltage sensitivity (K) is the ratio of output voltage to input RF power and is measured with 100µA forward bias applied via the video port, at -20dBm RF input power and into 30kohm external video load resistance ( $R_L$ ).
- VSWR is measured at -20dBm RF input power into 500 ohms external video load resistance ( $R_L$ ) with 200µA forward bias applied via the video port.
- Peak power is rated at 1µs pulse length, 0.001% duty cycle. Maximum CW power is +30dBm.
- Tangential signal sensitivity ( $T_{ss}$ ) is defined as the RF input power which produces an 8dB video output to noise voltage ratio and is measured using a video amplifier restricted to 2MHz bandwidth and having a noise contribution of 3dB maximum.
- Pulse rise time ( $t_r$ ) is measured into an external load ( $R_L$ ) of 1kohm with 12pF in parallel and 100µA bias applied through a 30kohm series resistor.
- Video resistance is measured at -20dBm RF input power and 100µA bias.
- Case operating temperature -55°C to +125°C  
Storage temperature -55°C to +125°C.

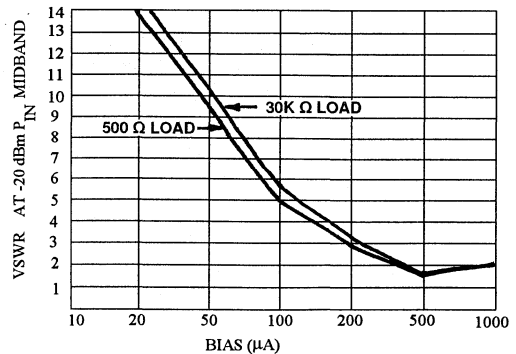
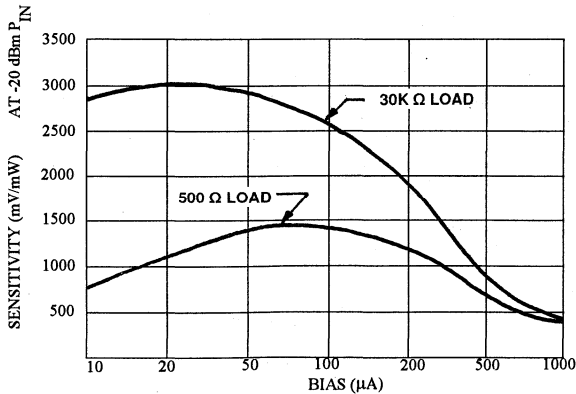
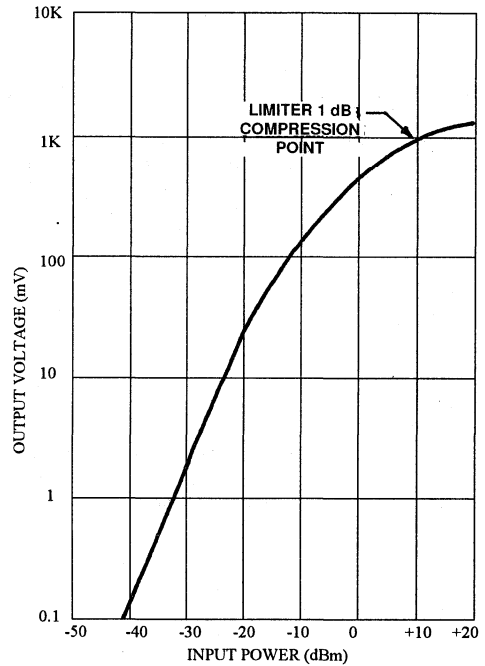
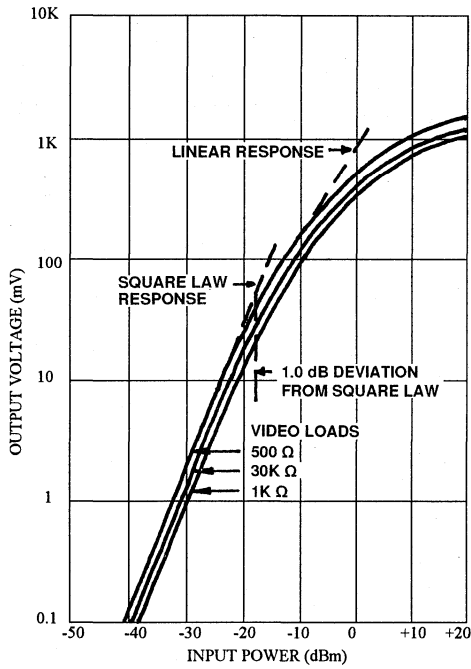
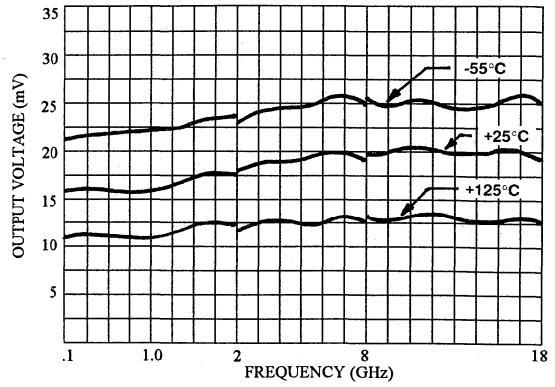
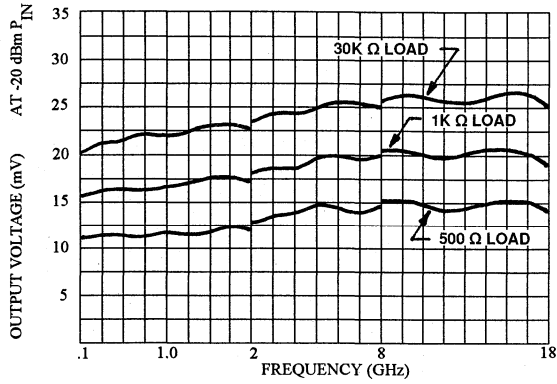
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TYPICAL PERFORMANCE



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# ZERO BIAS SCHOTTKY DETECTORS

## ML 7744-0000 SERIES

### DESCRIPTION

Zero bias Schottky detectors offer generally higher voltage sensitivities over greater RF bandwidths when compared with biased Schottky detectors and require no external DC bias. However, the RF impedance of the diode is substantially higher than the biased Schottky or tunnel diode resulting in diminished input match to 50 ohms. These detectors are also more temperature sensitive and performance severely degrades below -20°C. The performance of this series of detectors can be modified with certain trade offs e.g. improved VSWR with reduced sensitivity or improved sensitivity for reduced bandwidth.

The usable RF input range of 72dB is from  $T_{ss}$  to +20dBm. Within this range square law response is from  $T_{ss}$  to -21dBm, linear response from -21dBm to +20dBm. Above +23dBm diode damage and subsequent burn out occurs.

### SPECIFICATIONS @ +25°C

Frequency Range (GHz)	Voltage Sensitivity (K)	Flatness (dB)	$T_{ss}$ (dBm)	RF Bypass Capacitance (pF)	Rise Time (ns)	Video Resistance (ohms)	Part Number
	Min.	Max.	Min.	Typ.	Typ.	Typ.	
0.1 - 2.0	1700	±0.7	-52	100	20	3000	ML 7744X-0020
2.0 - 8.0	2000	±0.6	-52	20	10	3000	ML 7744X-0021
8.0 - 18.0	1600	±1.0	-52	20	10	3000	ML 7744X-0022
2.0 - 18.0	1600	±1.5	-52	20	10	3000	ML 7744X-0023

### NOTES

1. Available package styles for these detectors are A, D, J, H or M. To specify the package style please replace 'X' with the required letter in the above part numbers, e.g. for a coaxial package detector the part number is ML 7744A-0020.
2. Detectors are normally supplied with negative (-) output voltage polarity, referenced to case ground, positive (+) output polarity is available for most parts. To specify positive output please add suffix 'P' to the end of the part number e.g. ML 7744A-0020P.
3. Minimum open circuit voltage sensitivity (K) is the ratio of output voltage to input RF power and is measured at -20dBm RF input power into 30kohm external video load resistance ( $R_L$ ).
4. Tangential signal sensitivity ( $T_{ss}$ ) is defined as the RF input power which produces an 8dB video output to noise voltage ratio and is measured using a video amplifier restricted to 2MHz bandwidth and having a noise contribution of 3dB maximum.
5. Pulse rise time (t) is measured into an external load ( $R_L$ ) of 100ohms with 12pF in parallel and 0dBm RF power applied.
6. Video resistance is measured at -20dBm RF input power.
7. Case operating temperature -20°C to +125°C  
Storage temperature -55°C to +125°C.

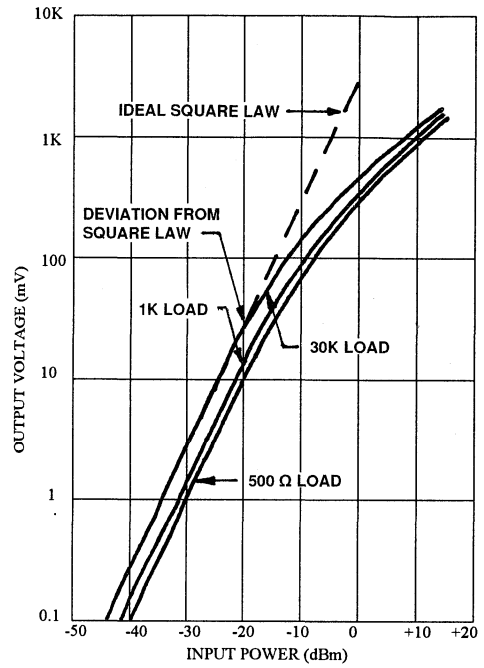
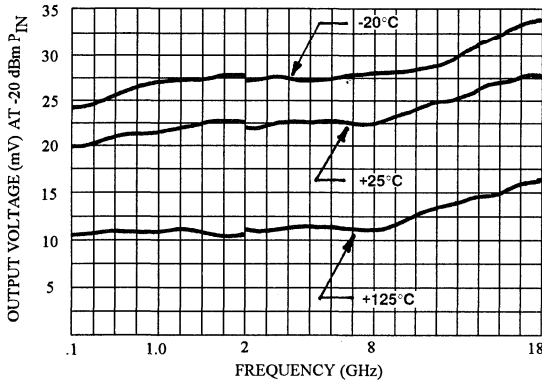
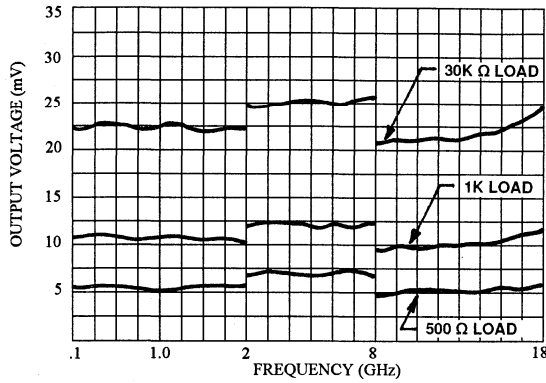
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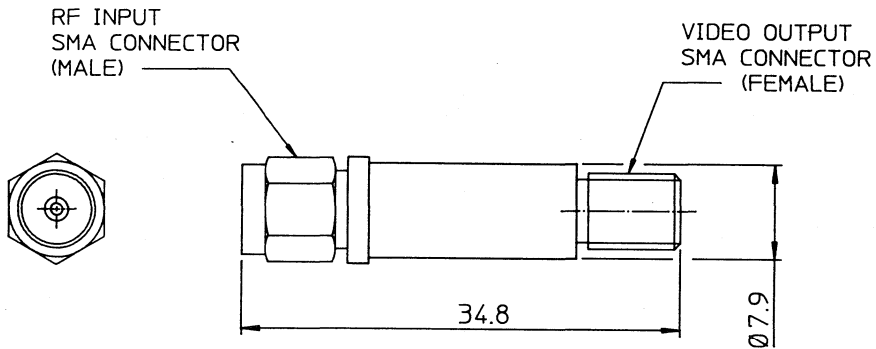
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TYPICAL PERFORMANCE

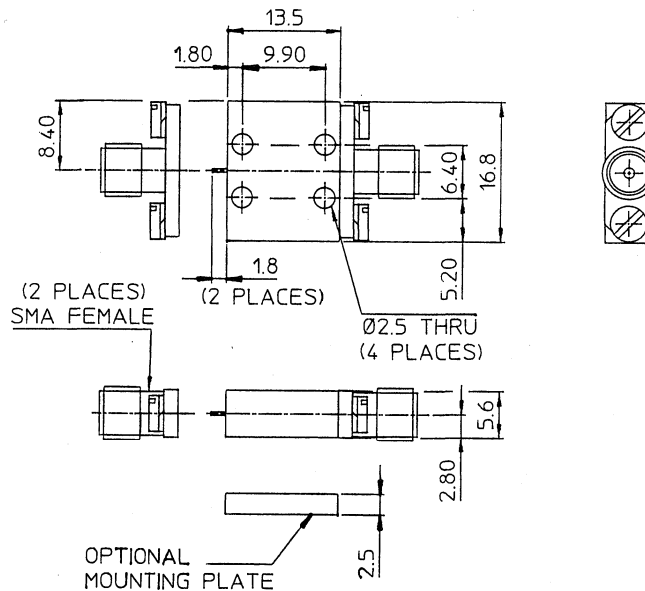


OUTLINE DRAWINGS

Package Style A  
Coaxial, SMA connectors

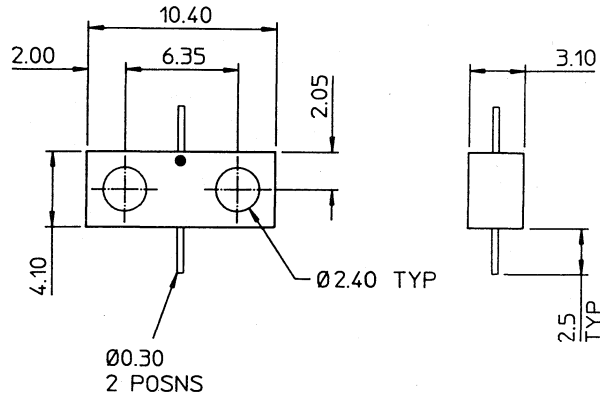


Package Style D  
Coaxial, removable SMA connectors

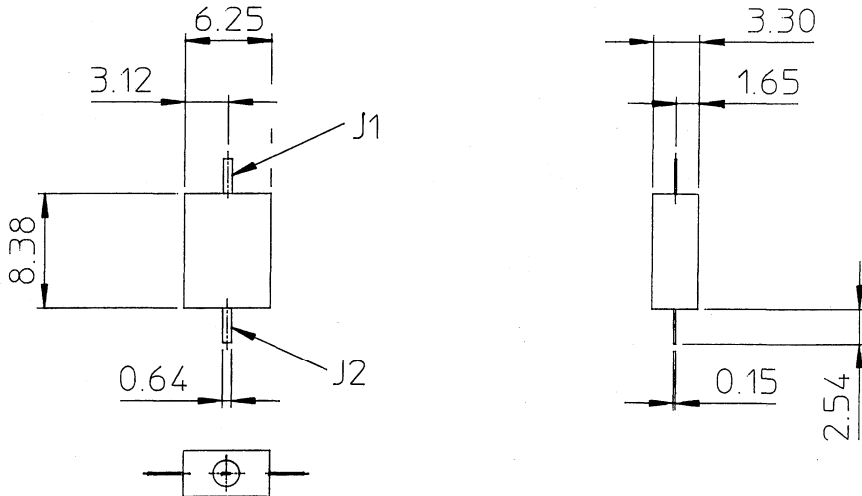


OUTLINE DRAWINGS

Package Style H  
Bolt Channel Stripline



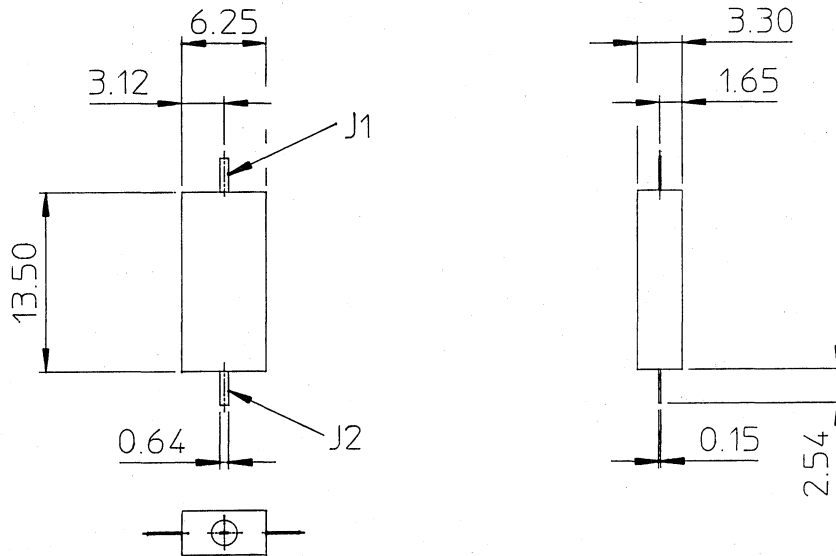
Package Style J  
Module, length 8.38mm





## OUTLINE DRAWINGS

Package Style N  
Module, length 13.50mm



## DRAWING NOTES

Third Angle Projection

All dimensions in mm

Tolerances x.x =  $\pm 0.5\text{mm}$   
x.xx =  $\pm 0.2\text{mm}$

Input port (J1) marked by dot

Standard Finish: Coaxial Units (A) stainless steel  
(D) silver plate finish

Modular Units are gold plate finish

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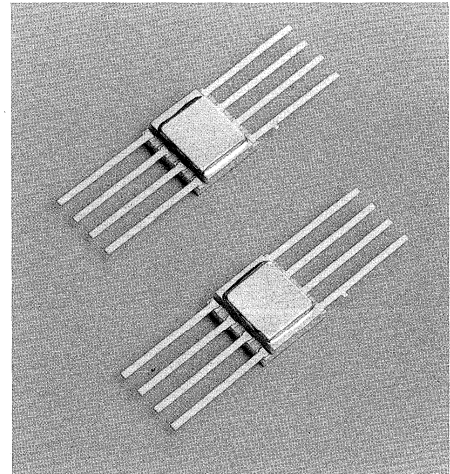
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## SAMPLING PHASE DETECTOR 1.0 - 20GHz

### FEATURES

- ◆ Complete Phase Detector Circuit
- ◆ Low Reference Oscillator Drive Capability
- ◆ Microstrip Compatible Package
- ◆ Phase Locking to 20GHz
- ◆ Space Qualified Versions Using Diodes Certified to ESA/SCC 5010



### DESCRIPTION

The ML 7799-0000 Series of Sampling Phase Detectors consists of a hybrid circuit with a fast step recovery diode, coupling capacitors and a pair of low barrier Schottky Diodes. A summing resistor network can be included internally as an option to optimise beat note output voltage and phase noise contribution.

Sampling Phase Detectors compare the phase from a stable reference oscillator and a VCO whose frequencies are harmonically related.

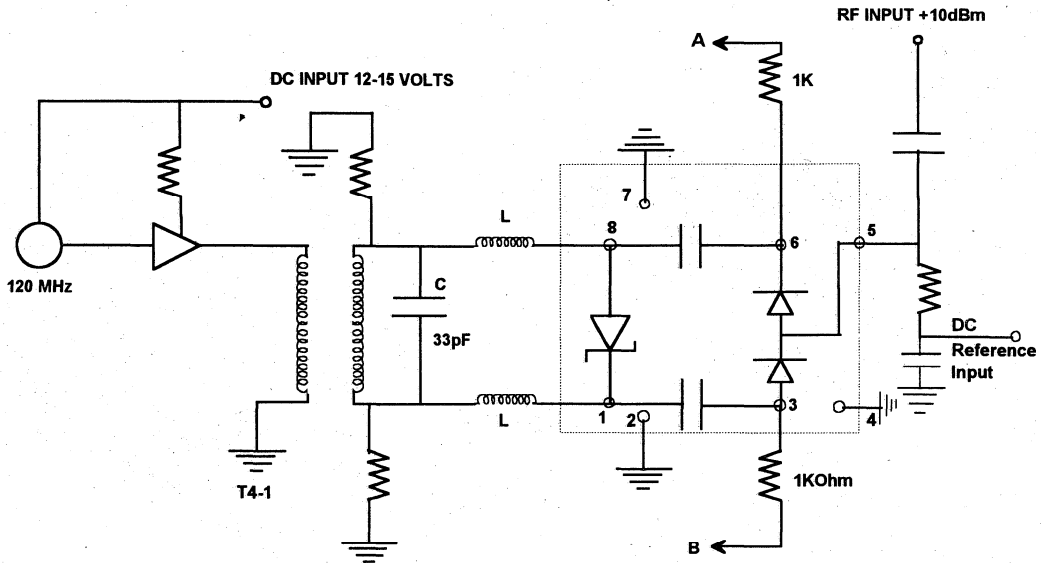
A reference oscillator rf input signal is applied to a step recovery diode which generates a harmonically rich impulse signal. This harmonic signal is applied as a local oscillator to the balanced mixer. A sample of the VCO signal is mixed with the balanced mixer, to generate an error voltage proportional in magnitude and polarity to the phase difference between these signals. The error voltage can be applied as feedback to the VCO to create a phase locked loop.

### TYPICAL SPECIFICATION AT 25°C

PART NUMBER	STEP RECOVERY DIODES			COUPLING CAPACITORS	SCHOTTKY SAMPLING DIODES			FREQUENCY GHz
	$C_{f,6}$ (pF) Typ.	$T_L$ (ns) Typ.	$T_T$ (ps) Typ.	C (pF) Typ.	$C_{j0}$ (pF) Typ.	$V_F$ (V) Typ.	$R_s$ (Ohms) Typ.	
ML 7799-0002	.50	20	50	0.8 - 1.5	0.40	0.25	8	2
ML 7799-0012	.35	20	50	0.5 - 0.8	0.25	0.35	9	12
ML 7799-0020	.35	20	50	0.4 - 0.6	0.15	0.35	13	20

Maximum Operating and Storage Temperature Range -65°C to +125°C

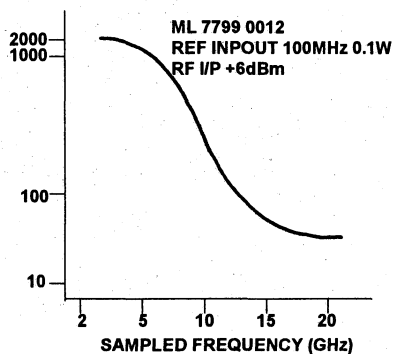
### TYPICAL CIRCUIT APPLICATION



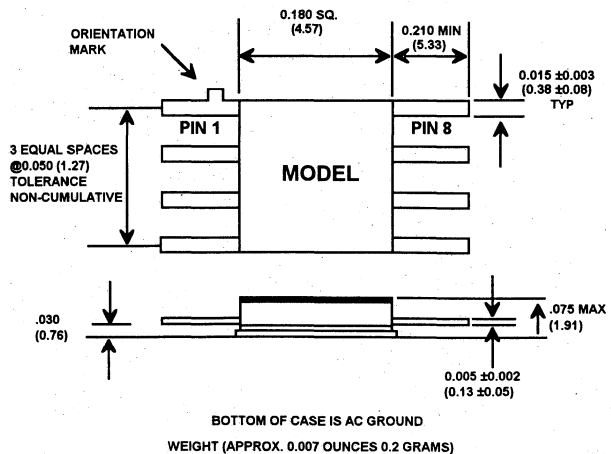
#### NOTE

Varying the ratio of L and C in above circuit will optimise the conduction period of the sampling diode for a particular RF input frequency. Output voltages at points A & B are summed in a high impedance differential amplifier. Summing resistors can be included within the package.

### TYPICAL PERFORMANCE



### OUTLINE DRAWING Package Style C



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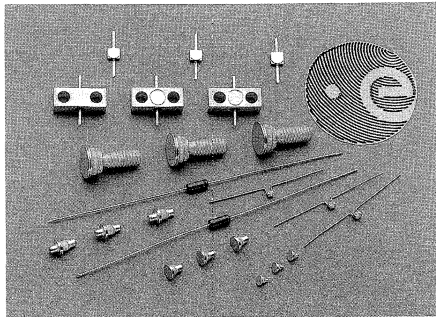


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# MICROWAVE SEMICONDUCTORS



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**SILICON SCHOTTKY MIXER DIODES  
SPECIFICATIONS @ +25°C**

**LOW BARRIER**

Low barrier diodes are required for applications where the local oscillator drive level is between -10dBm and +10dBm.

Type Number	Test Frequency (GHz)	Noise Figure (dB) Max	VSWR Max	Z <sub>IF</sub> Range (Ohms)	Package Description	Case Style
ML40103	9.375	6.5	1.5	250 - 450	Glass Axial Lead	54
ML40104	9.375	7.0	2.0	250 - 450	Glass Axial Lead	54
ML40121	9.375	6.5	-	250 - 450	LID	81
ML40100	9.375	6.0	1.5	250 - 450	Ceramic MQM	119
ML40101	9.375	6.5	1.5	250 - 450	Ceramic MQM	119
ML40102	9.375	7.0	2.0	250 - 450	Ceramic MQM	119
ML40105	9.375	6.0	1.5	250 - 450	Ceramic Pill	120, 276
ML40106	9.375	6.5	1.5	250 - 450	Ceramic Pill	120, 276
ML40107	9.375	7.0	2.0	250 - 450	Ceramic Pill	120, 276
ML40126	9.375	6.0	1.5	250 - 450	Hermetic Stripline	186
ML40127	9.375	6.5	1.5	250 - 450	Hermetic Stripline	186
ML40128	9.375	7.0	2.0	250 - 450	Hermetic Stripline	186
ML40110	16.0	6.5	1.5	250 - 450	Ceramic MQM	119
ML40111	16.0	7.0	2.0	250 - 450	Ceramic MQM	119
ML40115	16.0	6.5	1.5	250 - 450	Ceramic Pill	120, 276
ML40116	16.0	7.0	2.0	250 - 450	Ceramic Pill	120, 276

**MEDIUM BARRIER**

Medium barrier diodes are required for applications where local oscillator drive level is between -5dBm and +15dBm.

Type Number	Test Frequency (GHz)	Noise Figure (dB) Max	VSWR Max	Z <sub>IF</sub> Range (Ohms)	Package Description	Case Style
ML40129	3.0	5.5	1.5	125 - 250	Glass Axial Lead	54
ML40130	3.0	6.5	1.5	125 - 250	Glass Axial Lead	54
ML40131	3.0	7.5	2.0	125 - 250	Glass Axial Lead	54
ML40132	3.0	5.5	1.6	200 - 400	MQM	81
ML40133	3.0	6.0	1.6	200 - 400	MQM	119
ML40134	3.0	6.5	1.8	200 - 400	MQM	119
ML40135	6.0	5.5	1.5	200 - 500	Stripline	120, 276
ML40136	6.0	6.0	1.5	200 - 500	Stripline	120, 276
ML40137	6.0	7.0	2.0	200 - 500	Stripline	120, 276
ML40153	9.375	6.5	1.5	250 - 400	Glass Axial Lead	54
ML40154	9.375	7.0	2.0	200 - 400	Glass Axial Lead	54
ML40138	9.375	7.5	2.0	250 - 500	Glass Axial Lead	54
ML40139	9.375	8.5	1.8	250 - 500	Glass Axial Lead	54
ML40171	9.375	6.5	-	250 - 500	LID	81
ML40151	9.375	6.5	1.5	250 - 400	Ceramic MQM	119
ML40152	9.375	7.0	2.0	250 - 400	Ceramic MQM	119
ML40155	9.375	6.0	1.5	250 - 500	Ceramic Pill	120, 276
ML40156	9.375	6.5	1.5	250 - 500	Ceramic Pill	120, 276
ML40157	9.375	7.0	2.0	250 - 500	Ceramic Pill	120, 276
ML40176	9.375	6.0	-	250 - 450	Hermetic Stripline	186
ML40177	9.375	6.5	-	250 - 450	Hermetic Stripline	186
ML40178	9.375	7.0	-	250 - 450	Hermetic Stripline	186
ML40140	16.0	6.5	2.0	300 - 550	Coaxial	11
ML40141	16.0	7.0	2.0	350 - 550	Coaxial	11
ML40142	16.0	7.5	2.0	300 - 550	Coaxial	11
ML40143	16.0	8.0	2.5	300 - 550	Coaxial	11
ML40160	16.0	6.5	1.5	250 - 450	Ceramic MQM	119
ML40161	16.0	7.0	2.0	250 - 450	Ceramic MQM	119
ML40165	16.0	6.5	1.5	250 - 450	Ceramic Pill	120, 276
ML40166	16.0	7.0	2.0	250 - 450	Ceramic Pill	120, 276

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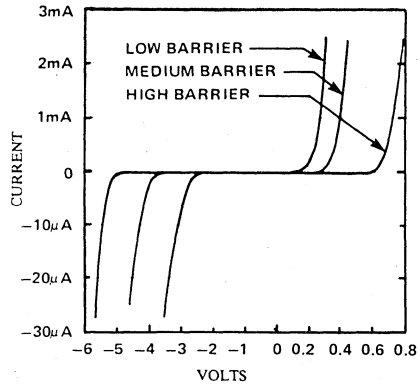
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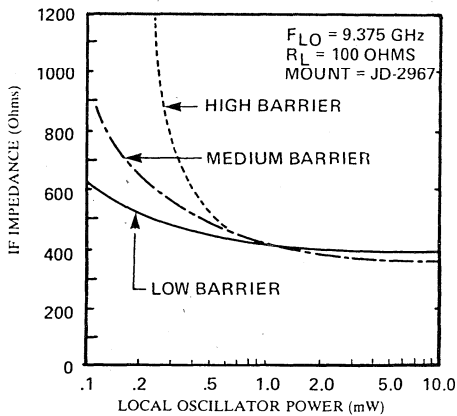
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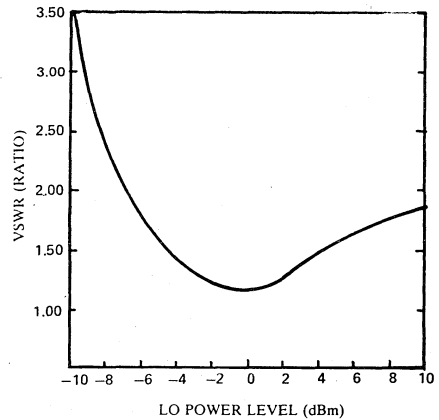
TYPICAL PERFORMANCE



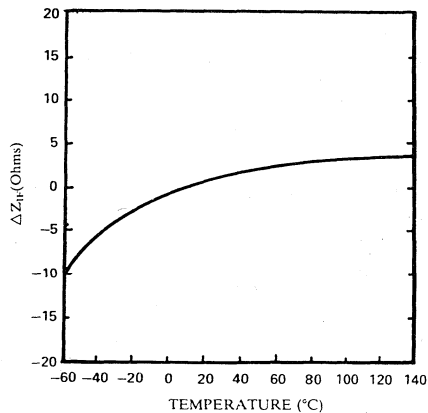
I-V CHARACTERISTICS AND BARRIER HEIGHTS FOR SCHOTTKY MIXER DIODES



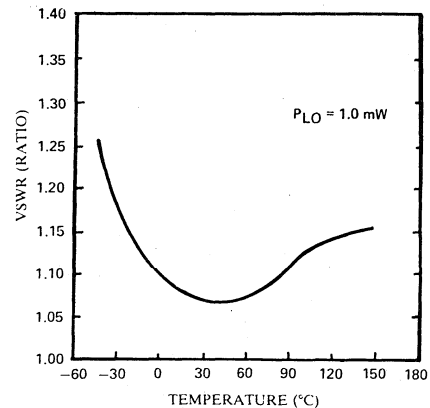
IF IMPEDANCE VS LOCAL OSCILLATOR DRIVE



RF IMPEDANCE VS LOCAL OSCILLATOR POWER



CHANGE IN IF IMPEDANCE VS TEMPERATURE



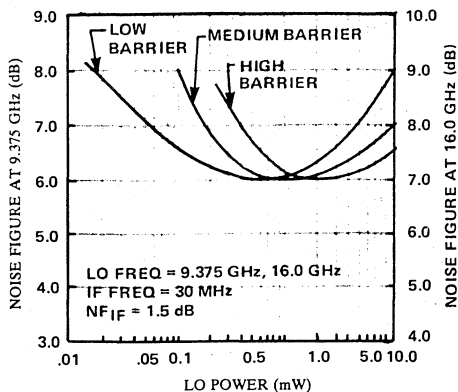
RF IMPEDANCE VS TEMPERATURE

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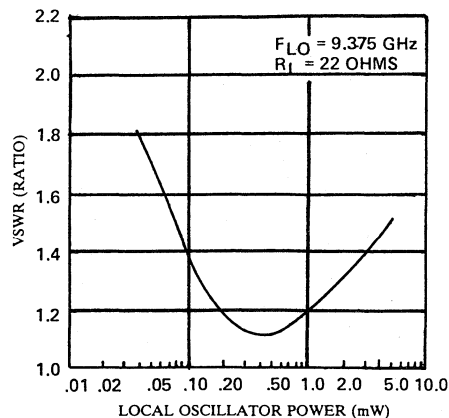
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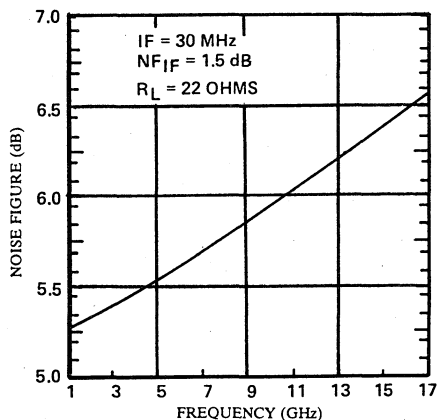
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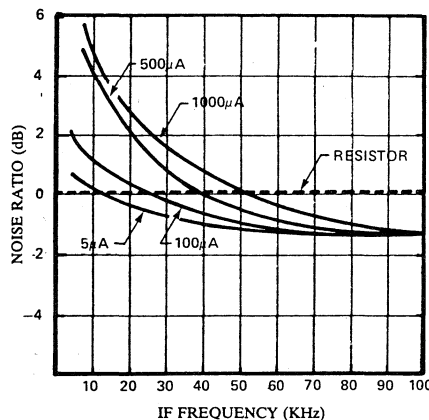
SCHOTTKY BARRIER NOISE FIGURE VS LO POWER



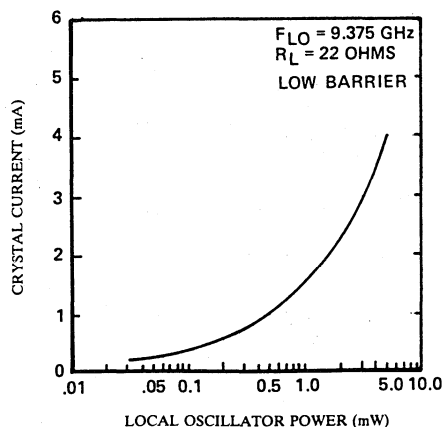
VSWR VS LOCAL OSCILLATOR DRIVE



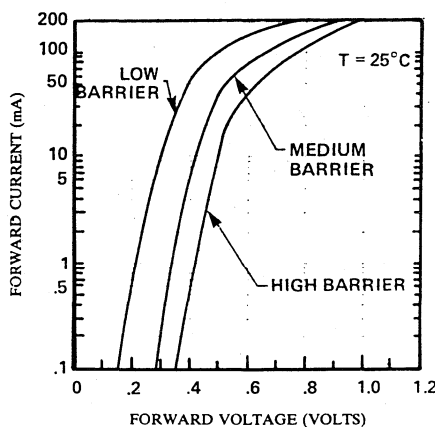
NOISE FIGURE VS FREQUENCY



DIODE NOISE RATIO VS IF FREQUENCY



CRYSTAL CURRENT VS LOCAL OSCILLATOR DRIVE



FORWARD CURRENT VS FORWARD VOLTAGE

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## SILICON SCHOTTKY DETECTOR DIODES

These low barrier diodes are suitable for use in waveguide, coaxial and stripline applications. They feature high sensitivity, and low I/F noise. These diodes are listed by increasing frequency, grouped by package style and  $T_{ss}$ . Other case styles are available upon request.

### SPECIFICATIONS @ +25°C

#### PACKAGED N-TYPE DETECTOR DIODES

Type Number	Test Frequency (GHz)	Tangential Signal Sens. $T_{ss}$ (dBm) Min	Video Impedance Range (kOhms)	Package Description	Case Style
ML40053	3.0	-55	1 - 2	Glass Axial Lead	54
ML40052	3.0	-50	1 - 2	Glass Axial Lead	54
ML40064	3.0	-55	1 - 2	Ceramic MQM	119
ML40063	3.0	-50	1 - 2	Ceramic MQM	119
ML40261	3.0	-55	1 - 2	Hermetic Stripline	186
ML40260	3.0	-50	1 - 2	Hermetic Stripline	186
ML40202	10.0	-55	1 - 2	Glass Axial Lead	54
ML40204	10.0	-52	1 - 2	Glass Axial Lead	54
ML40072	10.0	-50	1 - 2	Glass Axial Lead	54
ML40201	10.0	-55	1 - 2	Ceramic MQM	119
ML40203	10.0	-52	1 - 2	Ceramic MQM	119
ML40065	10.0	-50	1 - 2	Ceramic MQM	119
ML40207	10.0	-55	1 - 2	Ceramic Pill	120/276
ML40208	10.0	-52	1 - 2	Ceramic Pill	120/276
ML40264	10.0	-55	1 - 2	Hermetic Stripline	186
ML40263	10.0	-52	1 - 2	Hermetic Stripline	186
ML40262	10.0	-50	1 - 2	Hermetic Stripline	186
ML40205	16.0	-52	1 - 2	Ceramic MQM	119
ML40206	16.0	-50	1 - 2	Ceramic MQM	119
ML40215	16.0	-52	1 - 2	Ceramic Pill	120/276
ML40216	16.0	-50	1 - 2	Ceramic Pill	120/276
ML40267	36.0	-49	1 - 2	Ceramic Pill	119
ML40268	36.0	-49	1 - 2	Ceramic Pill	120

#### NOTES

- Schottky barrier junction diodes are thermocompression bonded in case style 119 and 120. Case style 54 uses pressure contacts. The standard case style is given for each model number. Other case styles are available upon request. For additional information, contact the factory.
- $T_{ss}$  is measured with a video amplifier bandwidth of 2MHz and nominal amplifier noise figure of 3dB. DC impedance is 10K ohms. The dc Bias is 20 $\mu$ A.
- Video Impedance is measured with RF Power = -30dBm. The dc forward bias is +20 $\mu$ A.
- Storage/Operating Temperature -65°C to +150°C
- Power Ratings at 25°C
 

Maximum Peak Incident RF Power	S-X Band 1 Watt for 1 microsecond maximum pulse length Ku-K Band 0.5 watt for 1 microsecond maximum pulse length
Maximum CW RF Power	S-X Band 150mW Ku-K Band 100mW
Derate Linearly to Zero at 150°C	
- Solder Temperature Ratings
 

(case style 54, 276, 186)	230°C for 5 seconds, 1mm from package
(case style 120)	200°C for 5 seconds

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## PACKAGED P-TYPE DETECTOR DIODES

Type Number	Test Frequency (GHz)	Tangential	Sensitivity (mV/mW) Min	Video		Case Style
		Signal		Impedance		
		Sens. $T_{ss}$ (dBm) Min		Range (k Ohms) Min. Max.		
ML40252	10.0	-55	5000	1.2	- 1.8	54
ML40254	10.0	-52	3500	1.2	- 1.8	54
ML40251	10.0	-55	5000	1.2	- 1.8	119
ML40253	10.0	-52	3500	1.2	- 1.8	119
ML40257	10.0	-55	5000	1.2	1.8	120
ML40258	10.0	-52	3500	1.2	- 1.8	120
ML40257	10.0	-55	5000	1.2	- 1.8	276
ML40258	10.0	-52	3500	1.2	- 1.8	276
ML40255	16.0	-52	3500	1.2	- 1.8	119
ML40256	16.0	-50	3000	1.2	- 1.8	119
ML40265	16.0	-52	3500	1.2	- 1.8	120
ML40266	16.0	-50	3000	1.2	- 1.8	120
ML40265	16.0	-52	3500	1.2	- 1.8	276
ML40268	16.0	-50	3000	1.2	- 1.8	276

## NOTES

- $T_{ss}$  is measured with a video amplifier bandwidth of 2MHz and noise figure of 3dB. Impedance is 10 kilohm and dc bias is +20 $\mu$ A.
- Video impedance is measured with RF power = -30dBm. The DC forward bias is +20 $\mu$ A.
- Sensitivity is measured at the indicated test frequency and at -30dBm RF power with  $R_L = 10K$  ohms and DC forward bias +20 $\mu$ A.
- Alternative case styles are available on request.
- Storage/Operating Temperature -65°C to +150°C
- Power Ratings at 25°C  
 Maximum Peak Incident RF Power S-X Band 1 Watt for 1 microsecond maximum pulse length  
 Ku-K Band 0.5 watt for 1 microsecond maximum pulse length  
 Maximum CW RF Power S-X Band 150mW  
 Ku-K Band 100mW  
 Derate Linearly to Zero at 150°C
- Solder Temperature Ratings  
 (case style 54, 276, 186) 230°C for 5 seconds, 1mm from package  
 (case style 120) 200°C for 5 seconds

TYPICAL PERFORMANCE

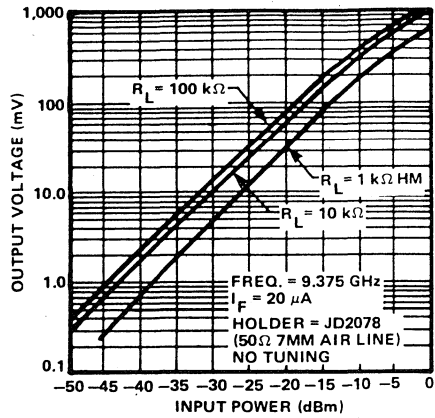


FIG. 1 ML 40200 Series Nominal Output Voltage at X Band (Forward Bias)

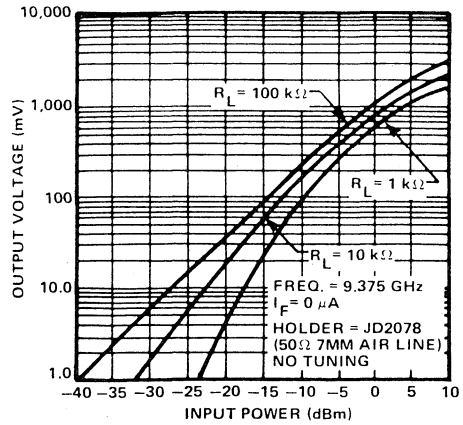


FIG. 2 ML 40200 Series Nominal Output Voltage An X Band (with zero bias)

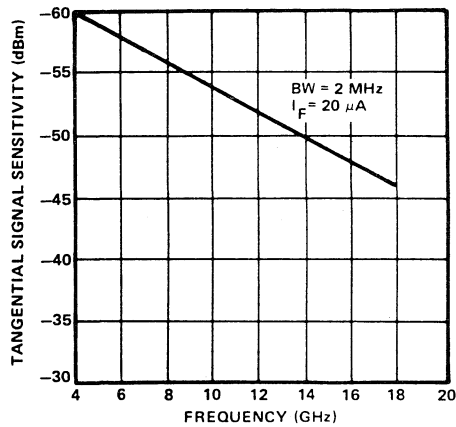


FIG. 3 ML 40200 Series Nominal Tangential Signal Sensitivity vs. Frequency

TYPICAL PERFORMANCE

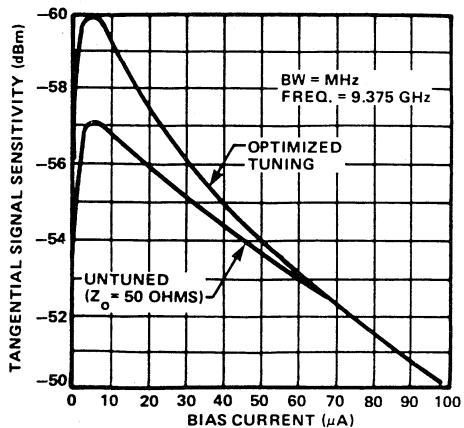


FIG. 4 ML 40200 Series Nominal Tangential Signal Sensitivity vs. Bias Current at X Band

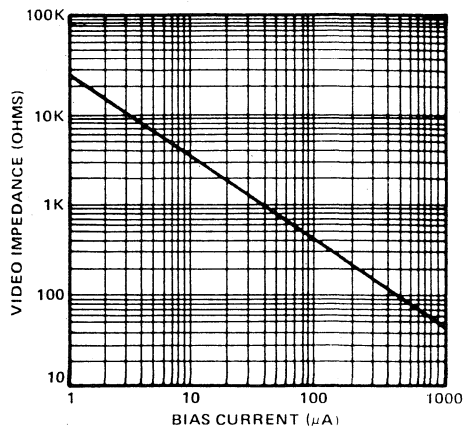


FIG. 5 ML 40200 Series Nominal Video Impedance vs. Bias Current

## SILICON STEP RECOVERY DIODES

A snap varactor is a silicon epitaxial diffused device designed to store charge when conducting in the forward direction. Conduction continues for a short time under reverse bias until the stored charge is swept out by the reverse drive. At this point conduction ceases very abruptly. Lifetime is a measure of the time the diode will maintain the stored charge and the snap time (transition time) is the speed at which reverse conduction ceases.

These diodes find application in high efficiency multiplier and up/down converter applications and for comb generators.

### SPECIFICATIONS @ +25°C

Type Number	Breakdown Voltage (V)	Capacitance		Thermal Resistance (°C/W)	Minority Carrier Lifetime (ns)		Snap Time (ps)		Standard Case Style
		Cj-6 (pf)	Max.		Min.	Typ.	Max.	Typ.	
ML4402	15	0.20	0.45	60	7	15	50	40	30
ML4404	15	0.20	0.45	60	10	20	100	70	30
ML4405	20	0.40	0.80	45	10	20	120	90	30
ML4406	30	0.70	1.2	35	15	30	150	100	30
ML4407	45	1.0	2.5	30	35	80	200	150	30
ML4408	60	2.0	4.0	25	50	150	500	350	30
ML4409	75	3.5	8.0	12	100	400	1500	600	30

### NOTES

1. Breakdown Voltage measured at  $I_R = 10\mu\text{A}$
2. Junction capacitance measured at  $f = 1\text{MHz}$ .
3. Minority carrier lifetime measured at  $I_F = 10\text{mA}$ .
4. Thermal resistance measurement is based on an infinite heat sink.
5. Alternative case styles available on request.
6. Storage/Operating Temperature  $-65^\circ\text{C}$  to  $+150^\circ\text{C}$
7. Power Dissipation =  $\frac{150^\circ\text{C} - T_{\text{AMBIENT}}}{\text{Thermal Resistance}}$

## SELECTING SILICON MULTIPLIER VARACTORS

### SELECTION CRITERIA

The use of Snap varactor diodes results in:

High Efficiency

Both Low and High Order Multipliers

Comb Generation

The Snap varactor is an epitaxial diffused device designed to store charge when conducting in the forward direction. Conduction continues for a short time under reverse bias until the stored charge is swept out by the reverse drive. At this point conduction ceases very abruptly. The diode's minority carrier lifetime is a measure of the time the diode will maintain the stored charge and snap time is the speed at which reverse conduction ceases.

When selecting a multiplier diode, the following circuit parameters must be considered.

- Input Frequency
- Output Frequency
- Output Bandwidth
- Output Power
- Circuit Type (coaxial, stripline, waveguide etc.)

The choice of varactor type depends on the results required.

One thing that must be kept in mind is that efficiency, power output and bandwidth are all relative terms and are as much a function of good multiplier design practice as diode selection.

### IMPORTANT ELECTRICAL PARAMETERS:

#### Breakdown Voltage ( $V_B$ )

The minimum required breakdown voltage of the varactor can be obtained by:

$$V_B = K \sqrt{\frac{2P_o}{F_m C_{T-6}}}$$

Where:

$P_o$	=	Power out at $F_{out}$ (Watts)
$F_m$	=	Input frequency (Hertz)
$C_{T-6}$	=	Total Capacitance @ -6 Volts (F)
$K$	=	0.8 for $N \leq 4$ ( $N$ = order of multiplication)
$K$	=	1.5 for $N > 4$

**Bias Resistor Selection ( $R_b$ )**

The bias resistor value can be calculated by:

$$R_b = \frac{5T_L}{N^2 C_{T-6}}$$

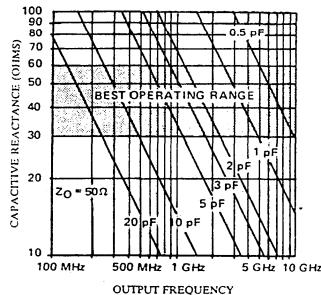
Where:

- $T_L$  = Lifetime (Seconds)
- $N$  = Order of Multiplication
- $C_{T-6}$  = Total Capacitance @ -6 Volts (F)

**Capacitance ( $C_T$ )**

The capacitive reactance of the varactor at the operating bias should be a minimum of 30 ohms and preferably a maximum of 60 ohms at the output frequency (if the diode environment is 50 ohms). Special higher power circuits can be used with lower reactances, but efficiency will suffer.

An additional constraint is imposed because this capacitance must be compatible with the required diode thermal resistance. Thermal resistance is inversely proportional to capacitance.



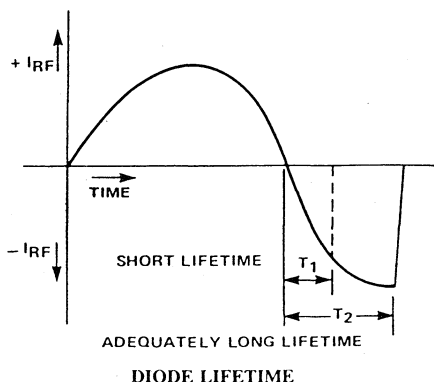
MULTIPLIER VARACTOR CAPACITIVE REACTANCE VS FREQUENCY

**Minority Carrier Lifetime ( $T_L$ )**

Lifetime is a measure of the time required for stored charge to be recovered. It should be long enough for the diode to permit RF current to reach a negative peak before it 'snaps' back to a high impedance state.

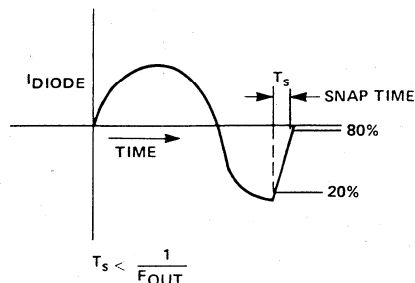
The lifetime of a diode should be a minimum of 10 times the length of a period of the input frequency, i.e.:

$$T_L \geq \frac{10}{F_{IN}} \text{ and } \frac{20 \text{ to } 30}{F_m} \text{ is a better choice.}$$



**Snap Time ( $T_s$ )**

The snap time or transition time in a stored charge device is the time for the diode to switch from a conducting to a non-conducting state. This is usually measured between the 20% and 80% recovery points. Snap time should be less than a period of the output frequency.

**Package Parasitics ( $L_p, C_p$ )**

The diode package parasitics should be small enough so that the series and parallel resonances will be well above the maximum output frequency. Package parasitics for most common case styles are listed in the case style index.

**Thermal Resistance**

The thermal resistance of the diode must be small enough to allow the diode to remain within the maximum allowable operating temperature. It must be commensurate with the power to be dissipated, i.e.:

$$\theta = \frac{T_{max} - T_A}{P}$$

Where:

$\theta$  = Thermal Resistance ( $^{\circ}\text{C}/\text{W}$ )

$T_{Max}$  = Recommended maximum allowable diode temperature ( $150^{\circ}\text{C}$ )

$T_A$  = Heat sink maximum temperature ( $^{\circ}\text{C}$ )

$P$  = Power dissipated in the diode under worst case  
- (Power in - Power out) (Watts)



## GALLIUM ARSENIDE MULTIPLIER VARACTOR DIODES

The ML 48700 Series of Gallium Arsenide Abrupt Junction Multiplier Varactors is specifically designed to provide solid state, high order multiplication at output frequencies extending to 100GHz. All varactors in this series are available in either package or chip form. The cathode is the heat sink end of the package.

This series of Gallium Arsenide Multiplier Varactors is intended for medium power harmonic generation with high conversion efficiency. These diodes may be used to double or triple the frequency outputs of Gunn or IMPATT oscillators in millimeter wave radar and communications systems. They are also useful in local oscillators and in millimeter wave phase shifters, modulators and upconverters.

### SPECIFICATIONS @ +25°C

Breakdown Voltage (V)		F <sub>CO</sub> (GHz)	C <sub>J0</sub> Range (pF)			
Min			0.150 - 0.249	0.250 - 0.349	0.350 - 0.449	0.450 - 0.549
15	200				ML48704A	ML48705A
15	250			ML48703A	ML48704B	ML48705B
15	300		ML48702A	ML48703B	ML48704C	ML48705C
15	350	ML48701A	ML48702B	ML48703C	ML48704D	ML48705D
15	400	ML48701B	ML48702C	ML48703D	ML48704E	ML48705E
15	450	ML48701C	ML48702D	ML48703E		
15	500	ML48701D	ML48702E			
15	550	ML48701E				
25	200			ML48708A	ML48709A	ML48710A
25	250		ML48707A	ML48708B	ML48709B	ML48710B
25	300	ML48706A	ML48707B	ML48708C		
25	350	ML48706B	ML48707C			
25	400	ML48706C				

### NOTES

- Junction capacitance (C<sub>J0</sub>) is measured at 1MHz and 0 volts on a bridge which has been balanced with a shielded test holder connected in place, but open circuited.
- Cut-off frequency measurements (F<sub>CO</sub>) are made at 0 volts. See curve of Figure 1 showing typical F<sub>CO</sub> (cut-off at -6 volts) versus F<sub>CO</sub> (cut-off at 0 volts) performance curve.
- All GaAs multiplier diodes are available in the following case styles 30, 31, 32, 36, 91, 92, 94, 95, 120, 126, 128, 155, 166, 168. When ordering, specify the desired case by adding the case designation as a suffix to the model number.
- Nominal package parasitics (C<sub>p</sub> and L<sub>s</sub>) are given for each case style with the outline drawing. The C<sub>p</sub> tolerances listed are typically ±0.02pF.
- The measured series resonant frequency of each varactor can be supplied with the diode to special order.
- $\Delta N_1 = \frac{C_{J0} - C_{J6}}{C_{J0}} = 0.52$  Typical,  $\beta = \frac{C_{J0} + 0.5}{C_{J0} - 3} = 2.20$  Typical
- Breakdown voltage is measured at -10μA. Other breakdown voltages are available on special request.
- Storage/Operating Temperature -65°C to +150°C.

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TYPICAL PERFORMANCE

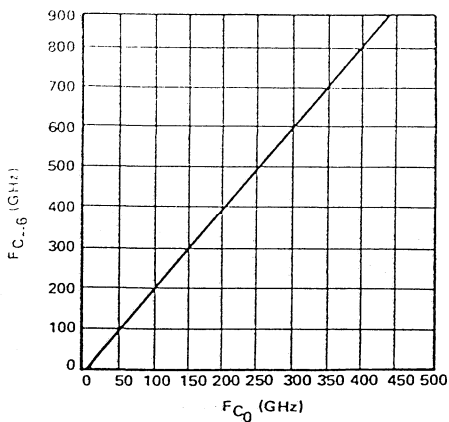


FIGURE 1. RELATIONSHIP BETWEEN CUT-OFF FREQUENCY AT ZERO AND SIX VOLTS IN GaAs VARACTOR DIODES.

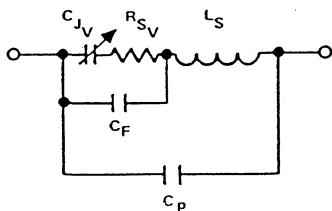


FIGURE 3. VARACTOR DIODE EQUIVALENT CIRCUIT

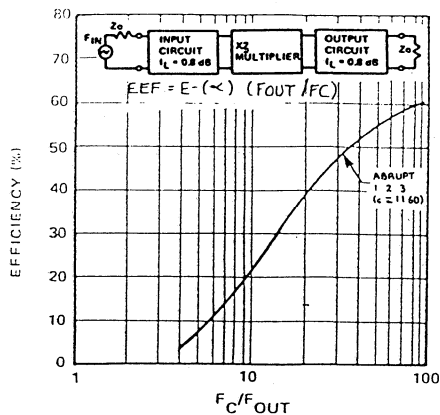


FIGURE 2. EFFICIENCY OF X3 GaAs VARACTOR MULTIPLIERS

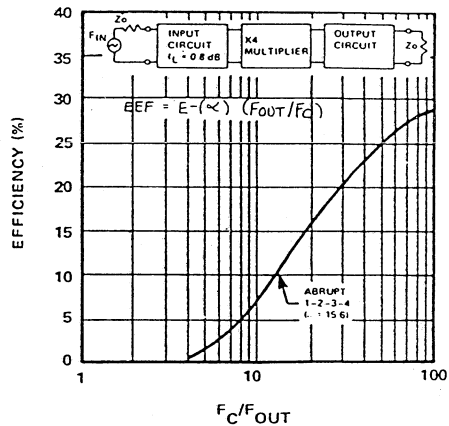


FIGURE 4. EFFICIENCY OF X4 GaAs VARACTOR MULTIPLIERS

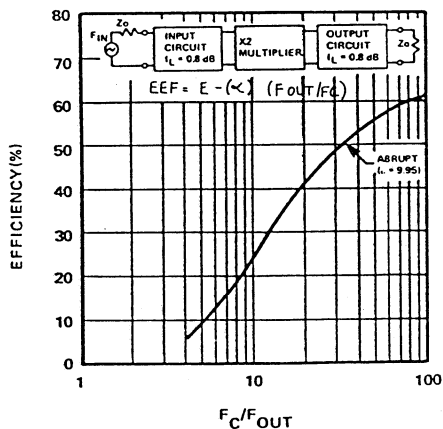


FIGURE 5. EFFICIENCY OF X2 GaAs VARACTOR MULTIPLIERS

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## CERAMIC PACKAGED SILICON TUNING VARACTOR DIODES

The ML 4300 Series of silicon microwave tuning varactor diodes has been designed to obtain the highest Q possible. Each device in this series has a high density silicon dioxide passivation which results in exceptionally low leakage currents and low post tuning drift.

This series is ideally suited for frequency tuning applications up to 20GHz. These devices are designed for use in solid state electronic tuning of transistor, Gunn and IMPATT oscillators. They may also be used in tunable filters, phase shifters, up and down converters and low order multipliers.

### SPECIFICATIONS @ +25°C

Type Number	Breakdown Voltage		Capacitance		Capacitance Ratio $C_{T0}/C_{TVB}$	Quality Factor Min.	Std. Case Style
	Volts (V)		$C_{T-6}$ (pF)				
	Min.	Min.	Typ.	Max.			
ML4310	25	0.40	0.5	0.60	2.3	5500	30
ML4311	25	0.56	0.7	0.84	3.0	5000	30
ML4312	25	0.76	0.9	1.06	3.4	5000	30
ML4313	25	1.00	1.2	1.40	3.7	4800	30
ML4314	25	1.55	1.8	2.05	4.1	4500	30
ML4315	25	1.90	2.2	2.50	4.3	4000	30
ML4316	25	2.30	2.7	3.10	4.4	4000	30
ML4317	25	2.85	3.3	3.75	4.6	3500	30
ML4318	25	3.40	3.9	4.40	4.6	3000	30
ML4319	25	4.10	4.7	5.30	4.7	3000	30
ML4331	40	0.56	0.7	0.84	3.4	4000	30
ML4332	40	0.74	0.9	1.06	4.0	3800	30
ML4333	40	1.00	1.2	1.40	4.3	3500	30
ML4334	40	1.55	1.8	2.05	5.0	3000	30
ML4335	40	1.90	2.2	2.50	5.3	2700	30
ML4336	40	2.30	2.7	3.10	5.5	2700	30
ML4337	40	2.85	3.3	3.75	5.7	2400	30
ML4338	40	3.40	3.9	4.40	5.8	2200	30
ML4339	40	4.10	4.7	5.30	6.0	2000	30
ML4340	40	4.90	5.6	6.30	6.0	2000	30
ML4341	40	5.90	6.8	7.70	6.2	1800	30
ML4342	40	7.20	8.2	9.20	6.3	1700	30
ML4343	40	8.70	10.0	11.3	6.3	1600	30
ML4351	60	0.56	0.7	0.84	3.5	2300	30
ML4352	60	0.74	0.9	1.06	4.2	2200	30
ML4353	60	1.00	1.2	1.40	4.5	2000	30
ML4354	60	1.55	1.8	2.05	5.5	1800	30
ML4355	60	1.90	2.2	2.50	5.8	1700	30
ML4356	60	2.30	2.7	3.10	6.1	1700	30
ML4357	60	2.85	3.3	3.75	6.4	1600	30
ML4358	60	3.40	3.9	4.40	6.5	1500	30
ML4359	60	4.10	4.7	5.30	6.7	1400	30
ML4360	60	4.90	5.6	6.30	6.8	1400	30
ML4361	60	5.90	6.8	7.70	6.9	1200	30
ML4362	60	7.20	8.2	9.20	7.0	1200	30
ML4363	60	8.70	10.0	11.3	7.1	1000	30
ML4364	60	10.6	12.0	13.4	7.2	1000	30
ML4365	60	13.0	15.0	17.0	7.3	1000	30

#### NOTES

1. Alternative Case Styles Available on Request.
2. Storage/Operating Temperature Range -65°C to +150°C

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## HIGH Q GaAs ABRUPT JUNCTION TUNING VARACTOR DIODES

The ML 4500 Series of gallium arsenide microwave tuning varactors is a family of abrupt junction devices featuring "Q factors" in excess of 4000. This series is specifically designed for broadband high Q tuning performance from VHF to 40GHz. Each device in this series is available in a wide selection of ceramic packages.

Typical applications for this series include solid-state tuning of VCOs using transistors, Gunn diodes or IMPATT diodes, as well as voltage tunable filter and amplifier circuits.

### SPECIFICATIONS @ +25°C

Type Number	Total Capacitance			Total Capacitance Ratio $C_{T0}/C_{TVB}$ Max.	Quality Factor Min.	Breakdown Voltage (V) Min.	Standard Case Style
	Min.	Typical	Max.				
ML4512	0.40	0.57	0.74	2.0	7000	30	96
ML4513	0.75	0.87	0.99	2.3	7000	30	96
ML4514	1.00	1.25	1.49	2.6	7000	30	96
ML4515	1.50	1.75	1.99	2.8	7000	30	30
ML4516	2.00	2.25	2.49	3.1	6000	30	30
ML4517	2.50	2.75	2.99	3.4	6000	30	30
ML4518	3.00	3.50	3.99	3.6	6000	30	30
ML4519	4.00	4.50	4.99	3.7	6000	30	30
ML4520	5.00	5.50	5.99	3.8	6000	30	30
ML4532	0.40	0.57	0.74	2.4	6000	45	96
ML4533	0.75	0.87	0.99	2.7	6000	45	96
ML4534	1.00	1.25	1.49	3.0	6000	45	96
ML4535	1.50	1.75	1.99	3.5	6000	45	30
ML4536	2.00	2.25	2.49	4.3	5000	45	30
ML4537	2.50	2.75	2.99	4.5	5000	45	30
ML4538	3.00	3.50	3.99	4.6	5000	45	30
ML4539	4.00	4.50	4.99	4.7	5000	45	30
ML4540	5.00	5.50	5.99	4.8	5000	45	30
ML4552	0.40	0.57	0.74	2.5	5000	60	96
ML4553	0.75	0.87	0.99	2.8	5000	60	96
ML4554	1.00	1.25	1.49	3.1	5000	60	96
ML4555	1.50	1.75	1.99	3.6	5000	60	30
ML4556	2.00	2.25	2.49	4.5	4000	60	30
ML4557	2.50	2.75	2.99	4.7	4000	60	30
ML4558	3.00	3.50	3.99	4.9	4000	60	30
ML4559	4.00	4.50	4.99	5.1	4000	60	30
ML4560	5.00	5.50	5.99	5.3	4000	60	30

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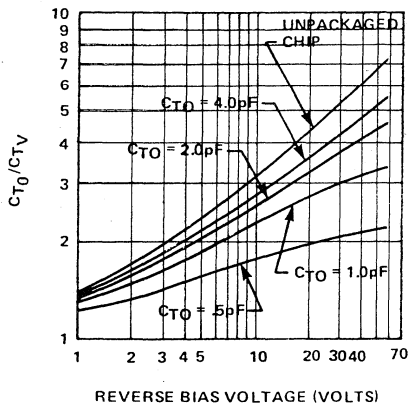
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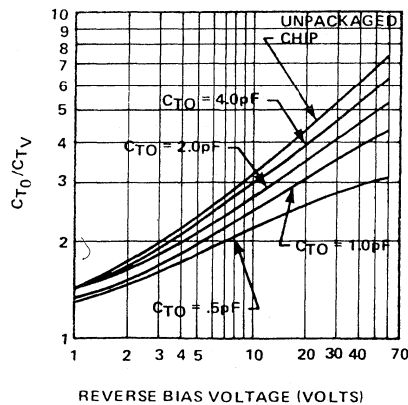
**NOTES:**

1. GaAs tuning varactors are available in alternative case styles as well as in chip form. When ordering, specify the desired case by adding the case designation as a suffix to the type number. For example: ML 4512-30.
2. Case parasitics ( $C_p$  and  $L_s$ ) are given along with case outlines. The  $C_p$  values listed typically have tolerances of  $\pm 0.02\text{pF}$ .
3. Breakdown voltage ( $V_b$ ) is measured at  $10\mu\text{A}$  of reverse bias current.
4. Diode Q is measured by a modified DeLoach technique at  $-4$  volts and extrapolated to  $50\text{MHz}$ . (A copy of the article "Determination of Varactor Parameters by a Modified DeLoach Method" is available on request).
5. Capacitance is measured at  $1\text{MHz}$  on a bridge which has been balanced with a shielded test holder connected in place but open circuited. These test holders are available for purchase. Please contact the factory for further information.
6. Customers should specify, within the range indicated, the required capacitance. The nominal tolerance is  $\pm 10\%$  of customer requested value. Closer tolerance are available on request.
7. All junctions are abrupt (i.e.  $\gamma \sim 0.50$ )  
 Where:  $\frac{C_{J0}}{C_{JV}} = \left(1 + \frac{V_R}{1.2}\right)^\gamma$   
 Total capacitance ratios will vary with case choice due to differences in case capacitance ( $C_p$ ).  
 The figures below show typical ratios for the 30 and 96 case styles.
8. Parasitic inductance ( $L_s$ ) has been determined at X-Band using a modified DeLoach method measurement.
9. Storage/Operating Temperature Range  $-65^\circ\text{C}$  to  $+150^\circ\text{C}$ .

**TYPICAL PERFORMANCE**



**CAPACITANCE CHANGE RATIOS FOR GaAs TUNING VARACTORS (CASE STYLE 30)**



**CAPACITANCE CHANGE RATIOS FOR GaAs TUNING VARACTORS (CASE STYLE 96)**

## CERAMIC GaAs HYPERABRUPT TUNING VARACTOR DIODES

The ML 4572 to ML 4580 Series of tuning varactors are hyperabrupt junction gallium arsenide devices. These series offer especially high "Q factors" (up to 4000) that permit excellent tuning performance from VHF to 40 GHz.

With these devices, linear tuning of frequency with bias voltage can be achieved for VCOs with moderate tuning bands using transistors, Gunn's or IMPATTs as well as with tunable filters and amplifiers. These diodes are an excellent choice for modulator applications where better linearity or nearly constant modulation sensitivity is desired.

### SPECIFICATIONS @ +25°C

Type Number	Total Capacitance $C_{T-d}$ (pF)			Total Capacitance Ratio $C_{TO}/C_{TVB}$	Quality Factor	Breakdown Voltage (V)	Standard Case Style
	Min.	Typical	Max.	Max.	Min.	Min.	
ML4572	0.40	0.57	0.74	5.5	4000	25	96
ML4573	0.75	0.87	0.99	6.0	3500	25	96
ML4574	1.00	1.25	1.49	7.0	3000	25	96
ML4575	1.50	1.75	1.99	8.5	3000	25	96
ML4576	2.00	2.25	2.49	9.0	2500	25	96
ML4577	2.50	2.75	2.99	9.0	2500	25	96
ML4578	3.00	3.50	3.99	9.5	2000	25	96
ML4579	4.00	4.50	4.99	9.5	2000	25	30
ML4580	5.00	5.50	5.99	10.0	2000	25	30

### NOTES

- The capacitance law of the diode chip is of the form.

$$C(V_R = 0.1V) = 2.75A \text{ pF}$$

$$C(V_R = 0.3V) = 2.6A \text{ pF.}$$

$$C(V_R = 1.0V) = 1.85A \text{ pF.}$$

$$C(V_R = 4.0V) = 0.485A \text{ pF.}$$

$$C(V_R = 10V) = 0.30A \text{ pF.}$$

$$C(V_R = 25V) = 0.26A \text{ pF.}$$

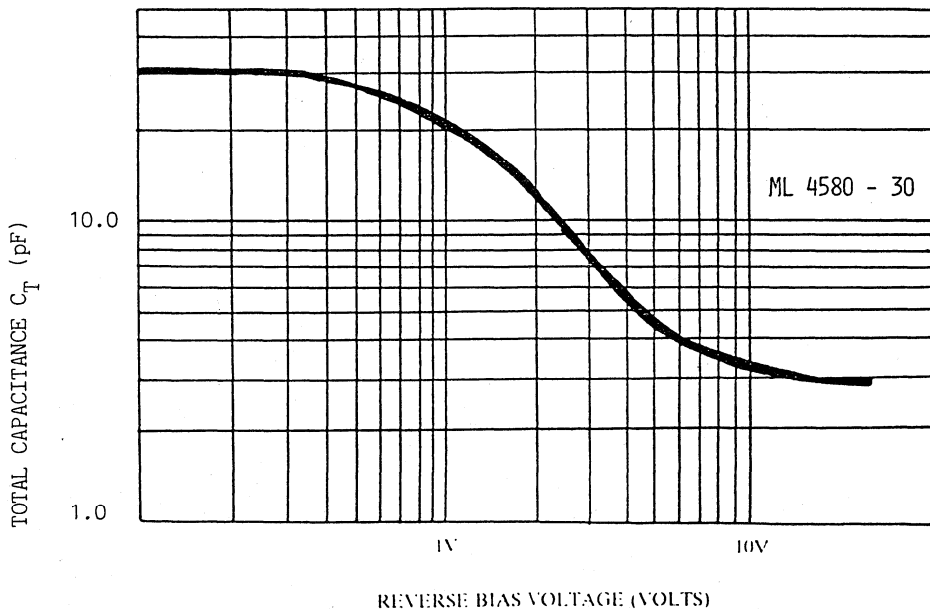
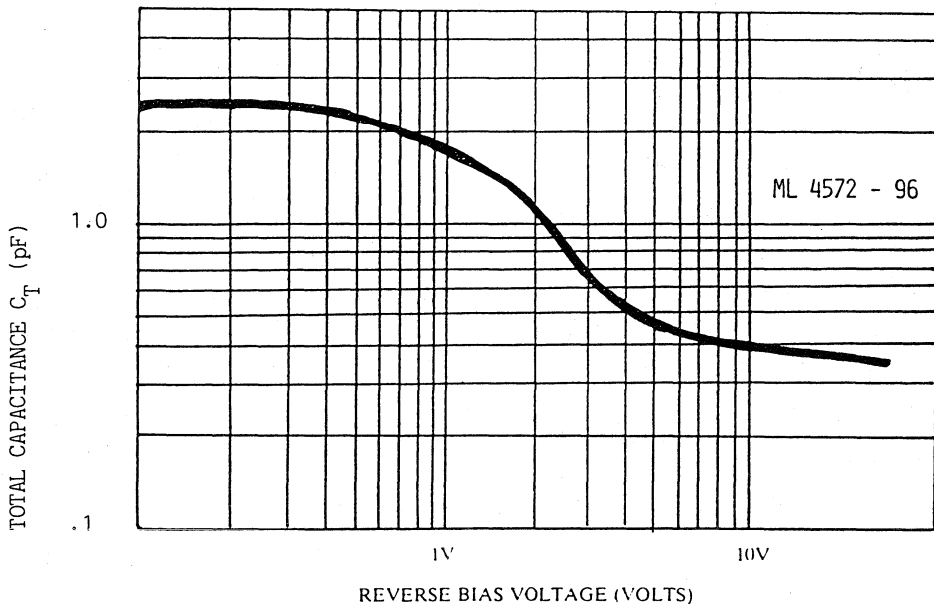
$$\text{Where } A = \frac{C_d(V_R = 4.0V) - C_p}{0.485}$$

$C_d$  = total capacitance

$C_p$  = case capacitance

- GaAs Hyperabrupt Tuning Varactors are available in alternative case styles as well as in chip form. When ordering specify the desired case by adding the case designation as a suffix to the type number for example ML 4572-96.

TYPICAL PERFORMANCE





## CERAMIC GaAs CONSTANT GAMMA TUNING VARACTOR DIODES

The ML 46450 and ML 46470 Series of tuning varactors are hyperabrupt junction gallium arsenide devices featuring a constant gamma. These series offer especially high "Q factors" (up to 4000) that permit excellent tuning performance from VHF to 40GHz. With these devices, linear tuning of frequency with bias voltage can be achieved for VCOs with wide tuning bands using transistors, Gunns or IMPATTs as well as with tunable filters and amplifiers. These diodes are an excellent choice for modulator applications where better linearity or nearly constant modulation sensitivity is desired.

### SPECIFICATIONS @ +25°C

#### ML 46450 SERIES

Type Number	Case Style	Total Capacitance $C_{T-4}$ (±10%) (pF)	Capacitance Ratio (2/20) Min./Max.	Quality Factor Min.
ML46450	30	0.5	2.0/2.7	4000
ML46451	30	0.7	2.9/4.1	4000
ML46452	30	1.0	3.6/5.2	3000
ML46453	30	1.2	3.6/5.2	3000
ML46454	30	1.5	3.8/5.5	3000
ML46455	30	1.8	4.1/6.1	3000
ML46456	30	2.0	4.1/6.1	3000
ML46457	30	2.2	4.1/6.1	3000
ML46458	30	2.7	4.5/6.7	2000
ML46459	30	3.3	4.5/6.7	2000
ML46460	30	3.7	4.7/7.1	2000
ML46461	30	4.7	4.8/7.2	1500
ML46462	30	5.6	4.9/7.4	1500
ML46463	30	6.8	4.9/7.4	1500
ML46464	30	8.2	5.0/7.6	1500
ML46465	30	10.0	5.0/7.6	1500

#### ML 46470 SERIES

Type Number	Case Style	Total Capacitance $C_{T-4}$ (±10%) (pF)	Capacitance Ratio (2/20) Min./Max.	Quality Factor Min.
ML46470	30	0.5	2.2/3.2	4000
ML46471	30	0.7	3.6/5.3	4000
ML46472	30	1.0	4.8/7.1	3000
ML46473	30	1.2	4.8/7.1	3000
ML46474	30	1.5	5.0/7.4	3000
ML46475	30	1.8	6.6/8.7	3000
ML46476	30	2.0	6.6/8.7	3000
ML46477	30	2.2	6.6/8.7	3000
ML46478	30	2.7	6.4/10.0	2000
ML46479	30	3.3	6.4/10.0	2000
ML46480	30	3.7	6.8/11.0	2000
ML46481	30	4.7	6.9/11.1	1500
ML46482	30	5.6	7.2/11.5	1500
ML46483	30	6.8	7.2/11.5	1500
ML46484	30	8.2	7.2/11.5	1500
ML46485	30	10.0	7.5/12.0	1500

#### NOTES

- All GaAs tuning varactors are available as standard in the ODS 30 package. Alternative package styles including chip form are available on request. When ordering, specify the desired case style by adding the case designation as a suffix to the type number.
- Case parasitics ( $C_p$  and  $L_p$ ) are given in the case styles section. The  $C_p$  values listed typically have tolerances of ±0.02 pF.
- The nominal tolerances at -4 Volts is ±10%. Closer tolerances are available upon request. By adding the suffix A to the part number a tolerance of ±5% can be obtained.
- Gamma is within the limits of  $0.90 < \gamma < 1.10$  and  $1.13 < \gamma < 1.40$  for the ML 46450 and ML 46470 series respectively over the voltage range of 2-20 Volts. Total capacitance of the packaged diodes will deviate from constant gamma characteristics due to differences in case capacitance ( $C_p$ ).

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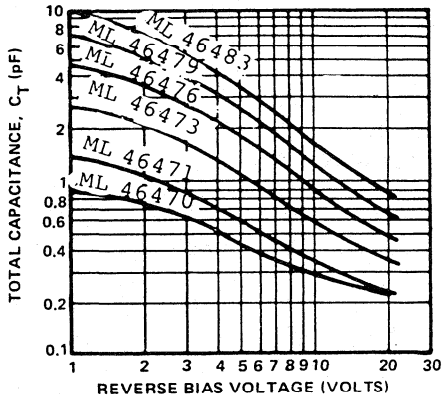
Europe: (44) 1344 869595

North America: 800 366 2266

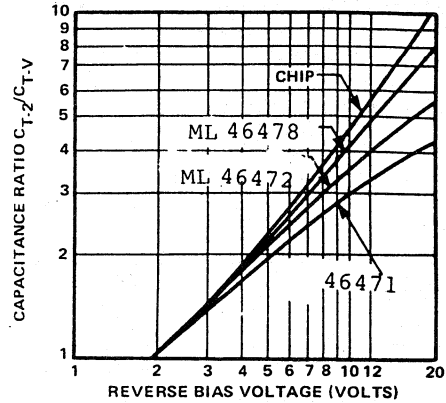
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5. Capacitance is measured at 1 MHz using a shielded test holder.
6. Diode Q is measured by the modified DeLoach technique at -4 Volts and extrapolated to 50MHz.
7. Parasitic inductance ( $L_p$ ) has been determined at X Band using the modified DeLoach method measurement.
8. Breakdown voltage ( $V_b$ ) is 22V minimum measured at 10 microamps.
9. The total capacitance and capacitance ratios shown are for devices houses in case style 30. Other cases styles will result in different values.

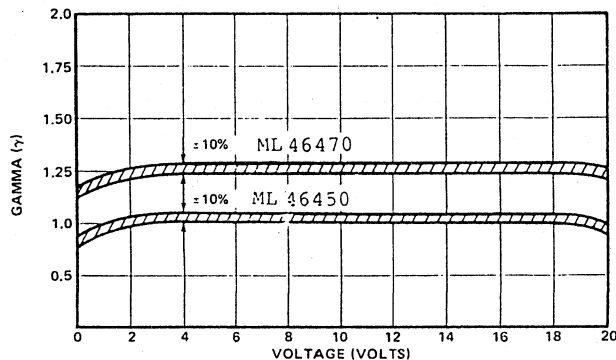
### TYPICAL PERFORMANCE



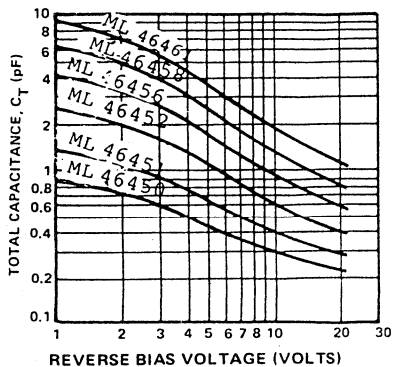
TOTAL CAPACITANCE vs REVERSE BIAS VOLTAGE  
(CASE STYLE 30)



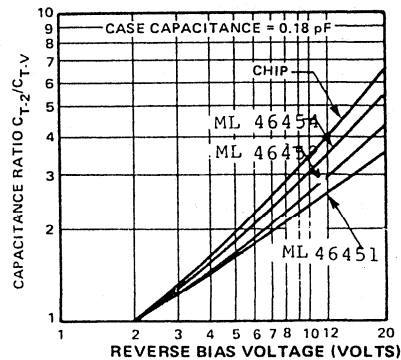
CAPACITANCE RATIO vs REVERSE BIAS VOLTAGE  
(CASE STYLE 30)



GAMMA vs VOLTAGE



TOTAL CAPACITANCE vs REVERSE BIAS VOLTAGE  
(CASE STYLE 30)



CAPACITANCE RATIO vs REVERSE BIAS VOLTAGE  
(CASE STYLE 30)

## FAST SWITCHING PIN AND NIP DIODES

The ML 4600 Series of PIN and NIP diodes are designed for control applications such as RF switching, limiting, duplexing, phase shifting, modulation and pulse forming. They are designed to provide two impedance states, one approaching an open circuit when reverse biased and the other a short circuit when forward biased.

Optimised dc and RF parameters are obtained by employing high quality P on P+ and N on N+ epitaxial silicon and careful control of device processing. The complete range of diodes is achieved by optimisation of the diodes 'I' region width and junction area.

### SPECIFICATIONS @ +25°C

Type Number	Breakdown Voltage (V)		Capacitance C <sub>T-10</sub> (pF)		Forward Resistance (Ohms)		Minority Carrier Switching Lifetime (ns)		Thermal Resistance (°C/W)		Standard Case Style
	Min.	Typ.	Typ.	Max.	Typ.	Max.	Typ.	Typ.	Typ.	Max.	
	ML4603	35	-	0.15	0.20	1.5	1.7	150	15	-	
ML4604	35	-	0.35	0.40	0.9	1.0	150	15	-	500	54
ML4605	35	-	1.10	1.20	0.7	0.8	150	15	-	500	54
ML4606	100	-	0.15	0.20	1.5	1.7	350	35	-	500	54
ML4607	100	-	0.35	0.40	0.9	1.0	350	35	-	500	54
ML4608	100	-	1.10	1.20	0.7	0.8	350	35	-	500	54
ML4610	15	25	0.35	0.40	1.2	1.5	10	1	70	80	30
ML4611	40	60	0.30	0.35	1.3	1.5	20	2	60	70	30
ML4612	40	60	0.40	0.50	1.0	1.3	20	2	50	60	30
ML4614	70	90	0.30	0.35	1.3	1.5	60	6	50	60	30
ML4615	70	90	0.40	0.50	1.0	1.3	60	6	40	50	30
ML4617	100	120	0.30	0.35	1.3	1.5	120	12	40	50	30
ML4618	100	120	0.40	0.50	1.0	1.3	120	12	40	45	30
ML4619	100	120	0.50	0.60	0.8	1.0	120	12	35	40	30
ML4622	150	180	0.30	0.35	1.0	1.3	250	25	40	45	30
ML4623	150	180	0.40	0.50	0.8	1.0	250	25	35	40	30
ML4624	150	180	0.50	0.60	0.6	0.8	250	25	30	35	30
ML4627	200	250	0.30	0.35	1.0	1.3	400	40	35	40	30
ML4628	200	250	0.40	0.50	0.8	1.0	400	40	30	35	30
ML4629	200	250	0.50	0.60	0.6	0.8	400	40	25	30	30

### NOTES

1. Breakdown Voltage measured at I<sub>r</sub> = 10uA.
2. Junction capacitance measured at f = 1MHz.
3. Minority carrier lifetime measured at I<sub>r</sub> = 10mA.
4. Thermal resistance measurement is based on an infinite heat sink.
5. Forward bias series resistance measured at I<sub>r</sub> = 40mA and f = 3.3GHz.
6. The following types are available as NIP diodes, add suffix 'P'.  
4610P, 4611P, 4612P, 4614P, 4615P, 4617P, 4618P, 4619P, 4622P, 4623P, 4624P, 4627P, 4628P, 4629P.
7. Alternative case styles available on request. The above diodes are also available in chip form.
8. Storage/Operating Temperature Range -65°C to +150°C

## HIGH POWER PIN DIODES

ML 4640 and 4650 high breakdown PIN diodes exhibit low thermal resistance and are designed for use in high power switches, receiver protectors and phase shifters from 0.1 to 18GHz.

## SPECIFICATIONS @ +25°C

Type Number	Breakdown Voltage (V)		Capacitance C <sub>T-50</sub> (pF)		Forward Resistance (Ohms)		Minority Carrier Switching Lifetime (μs)		Time (ns)		Thermal Resistance (°C/W)		Standard Case Style
	Min.	Typ.	Typ.	Max.	Typ.	Max.	Typ.	Typ.	Typ.	Max.	Typ.	Max.	
	ML4640	300	350	0.30	0.35	1.0	1.3	0.5	50	25	30	30	
ML4641	300	350	0.40	0.45	0.8	1.0	0.75	75	20	25	30	30	
ML4642	300	350	0.50	0.60	0.6	0.8	1.0	100	20	25	30	30	
ML4643	300	350	0.70	0.80	0.5	0.7	1.0	100	15	20	30	30	
ML4644	400	450	0.30	0.35	1.0	1.3	1.0	100	20	25	30	30	
ML4645	400	450	0.40	0.45	0.8	1.0	1.5	150	20	25	30	30	
ML4646	400	450	0.50	0.60	0.6	0.8	2.0	200	15	20	30	30	
ML4647	400	450	0.70	0.80	0.5	0.7	2.0	200	10	15	43	43	
ML4648	500	550	0.30	0.35	1.0	1.3	1.0	100	20	25	30	30	
ML4649	500	550	0.40	0.45	0.8	1.0	1.5	150	15	20	30	30	
ML4650	500	550	0.50	0.60	0.6	0.8	2.0	200	10	15	30	30	
ML4651	500	550	0.70	0.80	0.5	0.7	2.0	200	10	15	43	43	
ML4652	600	650	0.30	0.35	1.0	1.3	1.5	150	15	25	30	30	
ML4653	600	650	0.40	0.45	0.8	1.0	2.0	200	10	20	30	30	
ML4654	600	650	0.50	0.60	0.6	0.8	3.0	300	10	15	30	30	
ML4655	600	650	0.70	0.80	0.5	0.7	3.0	300	7	15	43	43	

## NOTES

1. Breakdown Voltage measured at I<sub>r</sub> = 10uA.
2. Junction capacitance measured at f = 1MHz.
3. Minority carrier lifetime measured at I<sub>r</sub> = 10mA.
4. Thermal resistance measurement is based on an infinite heat sink.
5. Forward bias series resistance measured at I<sub>r</sub> = 40mA and f = 3.3GHz.
6. Devices are Cathode heat sink.
7. Alternative case styles available on request.
8. Storage/Operating Temperature Range -65°C to +150°C.
9. Maximum Power Dissipation =  $\frac{150^{\circ}\text{C} - T_{\text{AMBIENT}}}{\text{Thermal Resistance}}$

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## BROADBAND PIN DIODES

The ML 4660 and 4670 Series contain a passivated PIN diode chip mounted in shunt within a broadband hermetically sealed package that eliminates the reliability problems associated with devices using epoxy seals. These devices have low VSWR from 0.1 to 18GHz and feature low insertion loss at zero or reverse bias. This matched design eliminates the bandwidth limiting parasitics of conventional packages by incorporating the lead and chip as part of a 50 Ohm microwave circuit.

These PIN devices are intended for microstrip and stripline control circuits as well as for direct replacements for existing non-hermetic epoxy encapsulated devices. They can function as power switches, limiters, phase-shifters, attenuators, and duplexers. The package flexibility allows the use of high power, high voltage PIN chips that can switch up to 5kW peak RF power or thin PIN's that can switch in less than 10 nanoseconds.

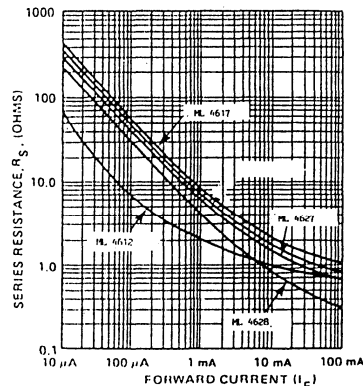
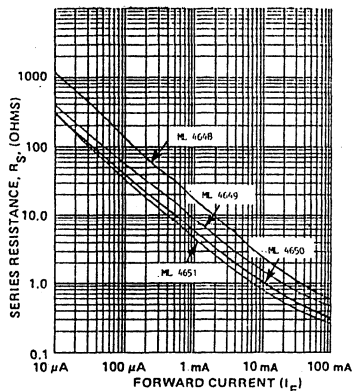
## SPECIFICATIONS @ +25°C

Type Number	Frequency Range (GHz)	Insertion Loss (dB)		Isolation (dB) Typ.	Switching Time (ns)	Breakdown Voltage (V)		Thermal Resistance (°C/W)		Heatsink Polarity	Case Styles	
		Typ.	Max. Min.			Min.	Typ.	Typ.	Max.			
ML4660	0.1 - 18.0	1.0	1.5	20	25	1	15	25	80	100	Cathode	144,114,115,116
ML4661	0.1 - 12.0	0.5	0.7	20	25	2	40	60	60	80	Cathode	144,114,115,116
ML4662	0.1 - 12.0	0.5	0.7	20	25	2	40	60	40	60	Anode	144,114,115,116
ML4663	0.1 - 12.0	0.5	0.7	20	25	6	70	90	60	80	Cathode	144,114,115,116
ML4664	0.1 - 12.0	0.5	0.7	20	25	6	70	90	30	40	Anode	144,114,115,116
ML4665	0.1 - 12.0	0.5	0.7	20	25	12	100	120	30	40	Cathode	144,114,115,116
ML4666	0.1 - 12.0	0.5	0.7	20	25	12	100	120	20	30	Anode	144,114,115,116
ML4667	0.1 - 12.0	0.5	0.7	20	25	25	150	180	30	40	Cathode	144,114,115,116
ML4668	0.1 - 12.0	0.5	0.7	20	25	25	150	180	15	25	Anode	144,114,115,116
ML4669	0.1 - 12.0	0.7	1.0	20	25	40	200	250	25	35	Cathode	144,114,115,116
ML4670	0.1 - 12.0	0.7	1.0	20	25	40	200	250	15	25	Anode	144,114,115,116
ML4671	0.1 - 12.0	0.7	1.0	20	25	50	300	250	25	30	Cathode	144,114,115,116
ML4672	0.1 - 12.0	0.7	1.0	20	25	100	400	450	20	25	Cathode	144,114,115,116
ML4673	0.1 - 12.0	0.7	1.0	20	25	100	500	550	20	25	Cathode	144,114,115,116
ML4674	0.1 - 12.0	0.7	1.0	20	25	150	600	650	15	25	Cathode	144,114,115,116

## NOTES

- Breakdown Voltage measured at  $I_R = 10\mu A$ .
- Switching time is 10% to 90% detected RF as measured with standard M/A-COM LTD driver.
- Alternative case styles available on request.
- Storage/Operating Temperature = -65°C to +150°C
- Maximum Power Dissipation =  $\frac{150^\circ C - T_{AMBIENT}}{\text{Thermal Resistance}}$

## TYPICAL PERFORMANCE



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## SILICON DIOXIDE PASSIVATED CHIP PIN DIODES

The ML 4P 100 Series of passivated PIN diode chips are produced using modern processing techniques. Each chip type has an optimally tailored junction profile and sputtered gold metallisation. Implicit in our processing techniques are diode uniformity and quality. Our unique total in-house capability allows for a broad spectrum of epitaxial resistivities and thicknesses for specific design requirements. Multiple mesa chips can also be supplied upon request.

## SPECIFICATIONS @ +25°C

Type Number	Breakdown Voltage (V)	Junction Capacitance (pF)	Series Resistance (Ohms)	Minority Carrier Lifetime (ns)	Reverse Recovery Time (ns)	Thermal Resistance (°C/W)
	Min.	Max.	Max.	Typ.	Typ.	Max.
ML4P 150	20	0.10@ -10V	1.5	10	2	60
ML4P 151	30	0.05@ -10V	2.0	10	2	60
ML4P 152	30	0.10@ -10V	1.2	10	2	50
ML4P 153	30	0.15@ -10V	0.9	10	2	40
ML4P 154	30	0.20@ -10V	1.0	10	2	35
ML4P 155	40	0.05@ -10V	2.0	15	4	55
ML4P 156	40	0.10@ -10V	1.2	15	4	45
ML4P 157	60	0.10@ -50V	1.5	50	6	50
ML4P 158	60	0.15@ -50V	1.2	60	6	40
ML4P 159	60	0.20@ -50V	1.0	65	7	35
ML4P 160	100	0.05@ -50V	1.9	80	8	60
ML4P 161	100	0.10@ -50V	1.2	90	9	45
ML4P 162	100	0.15@ -50V	1.2	100	10	30
ML4P 163	100	0.20@ -50V	1.0	120	15	25
ML4P 164	200	0.02@ -50V	2.5	150	10	100
ML4P 165	200	0.05@ -50V	2.0	170	20	80
ML4P 166	200	0.10@ -50V	1.5	190	20	45
ML4P 167	200	0.15@ -50V	1.2	220	30	30
ML4P 168	500	0.10@ -50V	1.5	350	40	30
ML4P 169	500	0.15@ -50V	1.2	370	40	30
ML4P 170	500	0.20@ -50V	1.0	380	40	20

## NOTES

1. Breakdown Voltage measured at  $I_R = 10\mu\text{A}$ .
2. Junction capacitance measured at  $f = 1\text{MHz}$ .
3. Series resistance is measured at a forward current of 100mA and a frequency of 3.3GHz.
4. Minority carrier lifetime is determined with  $I_F = 10\text{mA}$  and  $I_R = 6\text{mA}$  at the 90% recovery point.
5. Reverse recovery time is measured at the 90% recovery point with  $I_F = 20\text{mA}$  and  $I_R = 200\text{mA}$ .
6. Devices are cathode heat sink, for anode heat sink please contact the factory.
7. Alternative case styles available on request.
8. Storage/Operating Temperature  $-65^\circ\text{C}$  to  $+150^\circ\text{C}$ .

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## HIGH CW POWER PLATED HEATSINK PIN AND NIP DIODES

This series of PIN and NIP diodes apply our unique plated heat sink (PHS) process in order to reduce both thermal resistance and series resistance. The reduced series resistance makes the low capacitance versions ideally suited to high frequency operations. The low value of thermal resistance ensures high C.W. power handling whilst maintaining the fast switching speed.

### SPECIFICATIONS @ +25°C

Type Number	Breakdown Voltage (V)		Capacitance $C_{T10}$ (pF)		Forward Resistance (Ohms)		Minority Carrier Switching Lifetime (ns)		Thermal Resistance (°C/W)		Standard Case Style
	Min.	Typ.	Typ.	Max.	Typ.	Max.	Typ.	Typ.	Typ.	Max.	
	ML4609	15	25	0.40	0.50	0.8	1.0	10	1	40	
ML4613	40	60	0.40	0.50	0.8	1.0	20	2	35	40	30
ML4616	70	90	0.40	0.50	0.8	1.0	60	6	30	35	30
ML4620	100	120	0.40	0.50	0.8	1.0	120	12	25	30	30
ML4621	100	120	0.50	0.60	0.6	0.8	120	12	20	25	30
ML4625	150	200	0.40	0.50	0.6	0.8	250	25	20	25	30
ML4626	150	200	0.50	0.60	0.5	0.7	250	25	15	20	30
ML4630	200	250	0.40	0.50	0.6	0.8	400	40	15	20	30
ML4631	200	250	0.50	0.60	0.5	0.7	400	40	12	15	30

### NOTES

1. Breakdown Voltage measured at  $I_r = 10\mu\text{A}$ .
2. Junction capacitance measured at  $f = 1\text{MHz}$ .
3. Minority carrier lifetime measured at  $I_r = 10\text{mA}$ .
4. Thermal resistance measurement is based on an infinite heat sink.
5. Forward bias series resistance measured at  $I_r = 100\text{mA}$  and  $f = 3.3\text{GHz}$ .
6. Switching time is 10% to 90% detected RF as measured with standard M/A-COM LTD driver.
7. Alternative case styles available on request.

## SILICON LIMITER PIN DIODES

The ML 4200 Series is a range of oxide passivated silicon mesa diodes designed for limiter applications, especially those requiring low turn-on.

Use of special silane grown epitaxial silicon, together with differential etching and gold diffusion techniques, produces thin base diodes of low series resistance and closely controlled minority carrier lifetime. Combined with low inductance packaging, these properties allow operation over a broad frequency range up to 18GHz. Hermetic sealing and oxide passivation provide rugged reliable diodes capable of withstanding stringent environmental requirements.

### SPECIFICATIONS @+25°C

Type Number	Breakdown Voltage (V)		Capacitance C <sub>JO</sub> (pf)		Forward Resistance (Ohms)		Thermal Resistance (°C/W)	Minority Carrier Lifetime (ns)	Standard Case Style
	Min.	Typ.	Min.	Max.	Typ.	Max.	Max.	Typ.	
	ML4202	15	25	0.30	0.35	0.8	1.0	60	15
ML4204	15	25	0.20	0.25	1.0	1.2	70	15	30
ML4206	15	25	0.10	0.15	1.2	1.5	80	10	30
ML4207	50	60	0.30	0.35	0.8	1.0	50	20	30
ML4208	50	60	0.20	0.25	1.0	1.2	60	20	30
ML4209	50	60	0.10	0.15	1.2	1.5	70	15	30

### TYPICAL LIMITER PERFORMANCE

Type Number	Peak P <sub>IN</sub> @ 10μs (W) Max	Threshold (dB) Typ	Leakage P <sub>OUT</sub> (dBm) Typ	CW P <sub>IN</sub> (W) Max	Recovery Time (ns) Typ
ML4202	200	10	24	3	15
ML4204	150	10	23	2	15
ML4206	100	10	22	2	10
ML4207	400	15	29	4	20
ML4208	300	15	28	3	10
ML4209	200	15	27	3	15

### NOTES

- Breakdown Voltage measured at I<sub>R</sub> = 10μA.
- Forward bias resistance at 40mA measured at 3.3GHz.
- Junction capacitance measured at 1MHz.
- Minority carrier lifetime at I<sub>F</sub> = 10mA and  $\frac{I_F}{I_R} = 1.7$
- Threshold is defined as the input power at which a limiter has 1dB additional insertion loss over its 0dBm value (1dB compression).
- Typical limiter performance at 1.0GHz.
- Alternative case styles available on request.
- Storage/Operating Temperature Range -65°C to +150°C



## MEDIUM AND HIGH POWER CW GUNN DIODES

The ML 4900 Series of Gunn diodes is designed to operate using the bulk negative resistive effect and features low fm and am noise characteristics while accomplishing a one-step conversion from dc to microwave energy using a single low voltage power supply. The heatsink or threaded end of the package is negative polarity (cathode heatsink).

These devices are ideally suited for use in low noise sources such as local oscillators, locking oscillators, and low and medium power transmitter applications.

The high power Gunn diodes in this series can be used in phase locked oscillators or as reflection amplifiers in point to point communications link and telemetry systems.

### SPECIFICATIONS @ +25°C

#### MEDIUM POWER GUNN DIODES

Type Number	Frequency Range (GHz)	Output Power (mW) Min.	Operating Voltage (V)		Operating Current (mA)		Thermal Resistance (°C/W) Max.	Case Style
			Typ.	Max.	Min.	Max.		
ML4901	5.0 - 8.0	100	10	14	350	500	25	111
ML4902	5.0 - 8.0	250	10	14	500	700	17	111
ML4903	8.0 - 12.4	100	8	12	450	650	24	111
ML4904	8.0 - 12.4	250	8	12	750	1050	15	111
ML4905	12.4 - 18.0	100	6	10	500	750	24	111
ML4906	12.4 - 18.0	250	6	10	850	1050	15	111

#### HIGH POWER GUNN DIODES

Type Number	Frequency Range (GHz)	CW Output Power (mW) Min.	Bias Voltage (V) Typ.	Input Power (W) Max.	Threshold Current (A) Max.	Temperature Change (°C) Max.	Case Style
ML4911	8.0 - 12.4	500	12.0	16.5	2.5	185	111

#### NOTES

- All diodes are burned in with a dc bias equal to ( $V_{op} + 1.0$  Volts) for 48 hours at a minimum case temperature of 85°C.
- The mount used for the diode must provide an adequate thermal path away from the diode stud. When first using the diode it is always advisable to ensure adequate heat sinking by monitoring the diode case temperature ( $T_c$ ) with a thermocouple placed in the screwdriver slot at the base of the stud. The threshold current in the actual oscillator at 25°C should not be less than 95% of the indicated threshold current. The current through the diode, below the threshold voltage, may be written as  $I = C/T^n$ , where T is the absolute temperature of the junction, a is a material dependent parameter (whose value usually lies between 0.6 and 1.10), and C is a constant. Since the current is inversely proportional to the junction temperature, the threshold current decreases rather rapidly with increasing temperature.
- Case styles 111, 118 and 138 are standard. Their metallic contacts are copper. The top lid is soldered on to the ceramic. Extreme care should therefore be taken in soldering any lead to the lid. The temperature of the lid should not exceed 235°C for more than a few seconds during soldering. Other case styles are available on request.

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## HIGH FREQUENCY CW GUNN DIODES - 18 TO 100GHZ

This series of high frequency Gunn diodes features low noise (both AM and FM), good efficiency and one-step conversion from dc to microwave energy using a single, low voltage power supply.

These devices are ideally suited for use as paramp pump sources and as transmitters in point to point telecommunications links. The noise performance of these diodes is better than that of comparable reflex klystrons, thus making them attractive for use as local oscillators for noise measurements of mixer diodes.

### SPECIFICATIONS @ +25°C

Type Number	Frequency Range (GHz)	Operating Voltage (V) Max.	Operating Current at VG Max. (mA)	Threshold Current (mA) Max.	Output Power (mW) Min.	Case Style
ML4921	18 - 22	8.0	1600	2400	250	138
ML4922	18 - 22	8.0	1200	1800	100	138
ML4923	18 - 22	8.0	800	1200	50	138
ML4931	22 - 27	7.0	1600	2400	250	138
ML4932	22 - 27	7.0	1200	1800	100	138
ML4933	22 - 27	7.0	800	1200	50	138
ML4941	27 - 32	6.5	1600	2400	200	138
ML4942	27 - 32	6.5	1200	1800	100	138
ML4943	27 - 32	6.5	800	1200	50	138
ML4951	32 - 40	6.0	1600	2400	150	138
ML4952	32 - 40	6.0	1200	1800	100	138
ML4953	32 - 40	6.0	800	1200	50	138
ML4961	40 - 50	4.5	1600	2400	100	138
ML4962	40 - 50	4.5	1200	1800	75	138
ML4963	40 - 50	4.5	800	1200	50	138
ML4971	50 - 60	4.5	1600	2400	60	138
ML4972	50 - 60	4.5	1200	1800	45	138
ML4973	50 - 60	4.5	800	1200	30	138
ML4981	90 - 100	4.0	900	1400	10	138
ML4982	90 - 100	4.0	1100	1700	20	138
ML4983	90 - 100	4.0	1300	2000	30	138

### NOTES

1. Typical bandwidth is  $\pm 5\%$ . The minimum indicated output power is guaranteed into a critically coupled load over the indicated bandwidth centred around the frequency specified by the customer. Higher power diodes are available on special request.
2. The operating voltage, in general, decreases as the centre frequency of operation increases.
3. The heat sink (threshold end) is negative polarity.
4. The maximum threshold current is typically 1.5 times the maximum operating current.
5. Alternative case styles available on request.

## GALLIUM ARSENIDE IMPATT DIODES

Gallium Arsenide Impatt Diodes are available as flat profile, high low profile and low high low profile devices. These terms describe the doping profile in the active region of the device.

For high low and low high low profiles the avalanche region is more closely confined in the region of peak electric field. This reduces the ratio of avalanche region width to total drift region width and leads to an increase in efficiency.

Gallium Arsenide Impatt diodes are ideally suited for use as basic oscillators for communication systems. Many are also useful as intermediate or final stage amplifiers in either pulsed or CW modes with lower AM and FM noise compared to Silicon Impatts.

The following ranges of Gallium Arsenide Impatts indicate the devices currently available.

### SPECIFICATIONS @ +25°C

#### CW DEVICES (FLAT PROFILE)

Type Number	Operating Frequency Range (GHz)	Output Power (W)		Efficiency (%)	Thermal Resist. (°C/W)		Operating Voltage (V) Typ.	Operating Current (mA) Typ.	Junction Capacitance (pF)		Case Style
		Min.	Typ.		Min.	Max.			Min.	Typ.	
ML4112	8.0 - 9.5	0.50	0.70	10	25	70	100	0.5	111, 91		
ML4114	9.5 - 11.0	0.50	0.70	10	25	65	100	0.5	111, 91		
ML4116	11.0 - 12.5	0.50	0.70	10	25	55	120	0.5	111, 91		
ML4117	17.0 - 19.0	0.40	0.50	7	35	35	150	0.4	118, 275		
ML4119	32.0 - 36.0	0.20	0.25	6	45	22	160	0.3	118, 275		

#### CW DEVICES (HIGH-LOW PROFILE)

Type Number	Operating Frequency Range (GHz)	Output Power (W)		Efficiency (%)	Thermal Resist. (°C/W)		Operating Voltage (V) Typ.	Operating Current (mA) Typ.	Junction Capacitance (pF)		Case Style
		Min.	Typ.		Min.	Max.			Min.	Typ.	
ML4115A	9.0 - 11.0	2.00	2.20	17	12	55	250	1.7	111, 91		
ML4116A	11.0 - 15.0	1.20	1.50	16	20	45	200	1.3	111, 91		
ML4117A	15.0 - 18.0	1.00	1.20	15	25	35	200	1.0	118, 275		
ML4118A	18.0 - 22.0	0.50	0.65	14	35	32	150	0.8	118, 275		
ML4119A	22.0 - 28.0	0.40	0.45	11	40	27	150	0.7	118, 275		
ML4120A	28.0 - 36.0	0.35	0.40	12	45	18	180	0.6	118		

#### 4.0 WATT CW DEVICES (LOW HIGH LOW PROFILE)

Type Number	Operating Frequency Range (GHz)	Output Power (W)		Efficiency (%)	Thermal Resist. (°C/W)		Operating Voltage Range (V)	Operating Current (mA) Max.	Junction Capacitance (pF)		Case Style
		Min.	Typ.		Min.	Max.			Min.	Max.	
ML4141	6.0 - 8.0	4.0	4.5	20	11	60 - 75	375	16 - 24	111		
ML4142	8.00 - 10.0	3.8	4.1	20	11	50 - 60	425	20 - 30	111		
ML4143	10.0 - 12.0	3.8	4.1	20	11	40 - 50	500	20 - 30	111		

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## PULSED DEVICES

Type Number	Operating Frequency Range (GHz)	Peak	Min. Efficiency (%)	Thermal Resist. (°C/W)	Operating Voltage (V)	Operating Current (mA)	Junction Capacitance (pF)	Case Style
		Output Power (W)						
		Min.	Min.	Max.	Typ.	Typ.	Typ.	
ML4135B	9.0 - 11.0	12	17	7	70	1.0	4.8	111, 91
ML4136B	11.0 - 15.0	10	16	10	60	0.8	3.6	111, 91
ML4137B	15.0 - 18.0	6	15	12	50	0.8	3.0	275
ML4138B	18.0 - 22.0	5	14	15	40	0.8	2.4	275
ML4139B	22.0 - 28.0	3	11	19	35	0.7	2.0	275
ML4140B	28.0 - 36.0	1.5	12	25	30	0.65	1.5	275
ML46043-(2-chip)	8.5 - 10.0	25	16	5	100	1.5	2.5	274

## NOTES

1. Package capacitance and inductance are shown with the case style drawing at the rear of this catalogue.  
Available case styles:

<u>CASE STYLE</u>	<u>PACKAGE DESCRIPTION</u>	<u>CASE STYLE</u>	<u>PACKAGE DESCRIPTION</u>
92	Ceramic-Metal Double Pronged	274	Ceramic-Metal Stud
111	Ceramic-Metal Stud	275	Ceramic-Metal Stud

Alternative case styles are available on request.

2. These diodes will deliver at least the minimum specified output power into a critically coupled load at a customer specified frequency in the indicated range.
3. Thermal resistance is obtained by measuring the change in breakdown voltage with d.c. current.
4. Junction capacitance is measured at 1.0MHz at ( $V_B - 1$ ) volts.
5. Efficiency =  $\frac{RF\ Power\ Out_{x1}}{DC\ Power\ In}$
6. Duty Cycle 15-30%; Pulse Width 1 to 5µS.

## SILICON SINGLE DRIFT IMPATT DIODES

The ML 4700 Series of single drift silicon impatt diodes are specifically designed for use as fundamental frequency (direct dc to RF conversion) microwave oscillators and amplifiers in the frequency range 5-35GHz.

The devices feature a P+NN+ silicon mesa construction on an integral plated heat sink. (PHS). When reverse biased into avalanche breakdown, electrons generated in the avalanche zone travel across the drift region and are collected at the N+ contact. The resultant phase delay between voltage and current produces negative resistance at microwave frequencies. The low thermal resistance PHS construction gives maximum DC power dissipation capability and hence high RF output powers. Diodes operating at frequencies higher than 35GHz are available on request.

### SPECIFICATIONS @ +25°C

Type Number	Frequency Range (GHz)	CW Power Output (mW)		Efficiency (%)		Thermal Resistance (°/W)		Case Style
		Typ.	Min.	Typ.	Min.	Typ.	Max.	
ML4703	5 - 8	750	600	7.0	6.0	14	16	30
ML4704	8 - 10	750	600	7.0	6.0	10	18	30
ML4705	10 - 12	700	550	6.0	5.0	10	18	30
ML4706	12 - 14	450	400	5.0	4.0	20	23	30
ML4707	14 - 17	300	250	4.0	3.0	23	25	30
ML4708	17 - 20	250	200	4.0	3.0	25	30	118
ML4709	20 - 24	250	200	4.0	3.0	25	30	118
ML4710	24 - 28	250	200	4.0	3.0	28	30	118
ML4711	28 - 32	250	200	4.0	3.0	32	35	118
ML4712	32 - 36	200	150	4.0	3.0	40	45	118
ML4703S	5 - 8	1000	900	6.5	5.5	10	12	30
ML4704S	8 - 10	900	800	6.5	5.5	11	13	30
ML4705S	10 - 12	900	800	6.5	5.5	12	14	30
ML4803	5 - 8	1600	1500	6.5	6.0	6	7	101
ML4804	8 - 10	1300	1200	6.5	6.0	7.5	8.5	101

Type Number	Breakdown Voltage (V)	Junction Capacitance (pF)	Operating Voltage (V)	Operating Current (mA)
	Typ.	Typ.	Typ.	Typ.
ML4703	100	0.60	120	90
ML4704	82	0.50	100	105
ML4705	70	0.50	90	110
ML4706	60	0.45	80	110
ML4707	45	0.40	55	13
ML4708	42	0.30	48	130
ML4709	35	0.30	40	160
ML4710	32	0.30	38	160
ML4711	28	0.25	34	170
ML4712	24	0.25	30	170
ML4703S	100	1.10	125	125
ML4704S	82	1.00	105	140
ML4705S	70	0.80	92	160
ML4803	100	1.40	135	180
ML4804	82	1.00	110	190

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## NOTES

1. Efficiency =  $\frac{RF\ Power\ Out}{DC\ Power\ In} \times 1$
2. Thermal Resistance (Junction to Case). Change in breakdown voltage is directly proportional to the rise in junction temperature for junction temperatures between 25°C and 100°C. Using the Haitz method (\*) thermal resistance is calculated from measurements of this change and of the power dissipated in the junction.
3. Alternative case styles are available on request.
4. Reverse breakdown voltage, measured at  $I_r = 10\mu A$ .
5. Junction capacitance, measured at 1.0MHz at (VB -1) volts.
6. A current stabilised power supply is recommended.

♦ R.H. Haitz et al. "a method for heat flow resistance measurements in avalanche diodes". I.E.E.E. TRANS Electron Devices ED-16 P438 May 1969.

## MNS MICROWAVE CHIP CAPACITORS

The ML4M Series of MNS (metal-nitride-silicon) silicon chip capacitors is designed specifically for high reliability and repeatable performance in microwave circuit applications. These devices utilise a low pressure chemical vapour deposition (LPCVD) technique that results in a very dense uniform nitride layer. These devices exhibit higher and improved ruggedness over similar MOS, MIS and ceramic capacitors. Sputtered gold contacts are used to provide a highly reliable metal-to-semiconductor adhesion and an easily bondable metal pad on each side of the capacitor chip. M/A-COM Ltd MNS capacitors have shown no measurable capacitance change when subjected to the rated standoff voltage at 150°C.

The ML4M Series of chip capacitors is an excellent choice for use in hybrid microwave circuits up to Ku-band, where low loss, high reliability, small size and temperature stability are prime concerns.

These chip capacitors are suited for applications requiring dc blocks, coupling capacitors, bypass capacitors, capacitive loads and tuning elements of oscillators, multipliers and filters.

### SPECIFICATIONS @ +25°C

#### CHIP CAPACITORS WITH ROUND BONDING PADS

Type Number	Capacitance (pF) ±10%	Standoff Voltage Rating (V) Max	Chip Style	Nominal Top Contact Diameter (Mils)
ML4M2001	1	200	132	3.5
ML4M2002	2	200	132	4.5
ML4M2005	5	200	132	6.0
ML4M1010	10	100	132	6.0
ML4M2010	10	200	132	8.0
ML4M1020	20	100	132	11.0
ML4M2020	20	200	132	11.5
ML4M1030	30	100	132	11.0
ML4M2030	30	200	132	14.0
ML4M1040	40	100	132	13.0
ML4M2040	40	200	199	16.0
ML4M1050	50	100	132	14.0
ML4M2050	50	200	199	18.0
ML4M1060	60	100	199	16.0
ML4M2060	60	200	199	20.0
ML4M1080	80	100	199	18.0
ML4M2080	80	200	199	23.0
ML4M1100	100	100	199	20.0
ML4M2100	100	200	200	26.0
ML4M1125	125	100	199	22.0
ML4M2125	125	200	200	29.0
ML4M1150	150	100	200	25.0
ML4M2150	150	200	200	31.5
ML4M1200	200	100	200	28.0
ML4M2200	200	200	201	36.0
ML4M1250	250	100	200	32.0
ML4M2250	250	200	201	41.0
ML4M1300	300	100	201	35.0
ML4M2300	300	200	263	45.0
ML4M1600	600	100	263	48.0
ML4M2600	600	200	267	64.0

#### CHIP CAPACITORS WITH SQUARE BONDING PADS

Type Number	Capacitance (pF) ±10%	Max Standoff Voltage Rating (V)	Chip Style
ML4M3010	10	200	350
ML4M3020	20	200	351
ML4M3030	30	200	352
ML4M3040	40	200	353
ML4M3050	50	100	354
ML4M3060	60	100	355
ML4M3070	70	50	356
ML4M3080	80	100	357
ML4M3100	100	50	358
ML4M3150	150	50	359

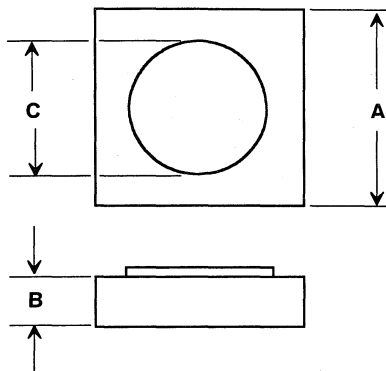
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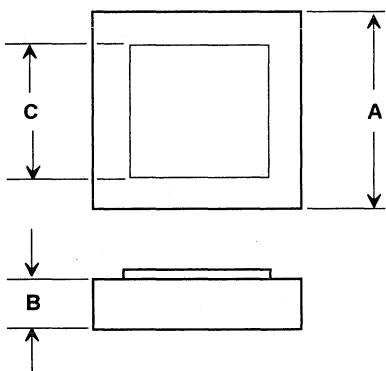
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## CHIP STYLES



Note: For 'C' dimension on above case styles, see specifications.

Chip Style	Dimension	Inches		Millimeters	
		Min.	Max.	Min.	Max.
132	A	0.130	0.024	0.51	0.61
	B	0.003	0.006	0.08	0.15
199	A	0.020	0.031	0.69	0.79
	B	0.004	0.005	0.10	0.13
200	A	0.037	0.041	0.94	1.04
	B	0.004	0.005	0.10	0.13
201	A	0.047	0.051	1.19	1.30
	B	0.004	0.005	0.10	0.13
263	A	-	0.060	-	1.52
	B	0.004	0.005	0.10	0.13
267	A	-	0.070	-	1.78
	B	0.004	0.005	0.10	0.13



## NOTES

- 5% capacitance tolerance is available on request.
- Other capacitance and standoff voltage values are available on request.
- Capacitance measured at 1 MHz.
- Temperature coefficient of capacitance is nominally 180 PPM/°C.
- Device failure may occur if standoff voltage ratio is exceeded.
- Operating temperature -55°C to +200°C
- Storage temperature -55°C to +225°C.

Chip Style	Dimension	Inches		Millimeters	
		Min.	Max.	Min.	Max.
350	A	0.013	0.021	0.46	0.53
	B	-	0.005	-	0.13
	C	-	0.009	-	0.23
351	A	0.018	0.021	0.46	0.53
	B	-	0.005	-	0.13
	C	-	0.012	-	0.30
352	A	0.018	0.021	0.46	0.53
	B	-	0.005	-	0.13
	C	-	0.015	-	0.38
353	A	0.020	0.023	0.51	0.58
	B	-	0.005	-	0.13
	C	-	0.017	-	0.43
354	A	0.020	0.023	0.51	0.58
	B	-	0.005	-	0.13
	C	-	0.018	-	0.46
355	A	0.018	0.021	0.46	0.53
	B	-	0.005	-	0.13
	C	-	0.014	-	0.36
356	A	0.018	0.021	0.46	0.53
	B	-	0.005	-	0.13
	C	-	0.011	-	0.28
357	A	0.020	0.023	0.51	0.58
	B	-	0.005	-	0.13
	C	-	0.017	-	0.43
358	A	0.018	0.021	0.46	0.53
	B	-	0.005	-	0.13
	C	-	0.013	-	0.33
359	A	0.018	0.021	0.46	0.53
	B	-	0.005	-	0.13
	C	-	0.016	-	0.41

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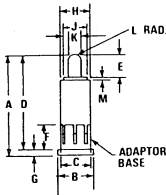
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# CASE STYLE INDEX

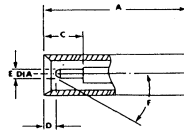
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DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.800	0.840	20.32	21.34
H	0.292	0.296	7.42	7.52
C	0.246	0.250	6.25	6.35
D	0.180	0.183	4.57	4.63
E	0.180	0.190	4.57	4.83
F	0.193	0.192	4.90	5.05
G	0.047	0.057	1.19	1.45
H	0.222	0.240	5.64	6.10
J	0.195	0.215	4.95	5.46
K	0.092	0.094	2.34	2.39
L	0.030	0.046	0.76	1.17
M	0.020	0.030	0.51	0.76

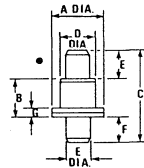
C<sub>1</sub> 0.12 pF Typical  
L<sub>1</sub> 0.50 nH Typical

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DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.224	0.266	5.64	6.74
B	0.215	0.220	5.46	5.59
C	0.147	--	3.73	--
D	0.011	0.028	0.28	0.71
E	0.031	0.033	0.79	0.84
F	42°	48°	42°	48°

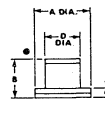
30



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.119	0.127	3.02	3.23
B	0.095	0.097	2.16	2.46
C	0.205	0.225	5.21	5.72
D	0.060	0.064	1.52	1.63
E	0.060	0.064	1.52	1.63
F	0.060	0.064	1.52	1.63
G	0.016	0.024	0.41	0.61
H	0.079	0.083	2.01	2.11

MAX C<sub>1</sub> 0.18 of Typical    MIN C<sub>1</sub> 0.18 of Typical  
L<sub>1</sub> 0.80 nH Typical        L<sub>1</sub> 0.80 nH Typical

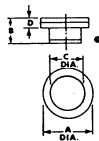
31



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.119	0.127	3.02	3.23
B	0.085	0.097	2.16	2.46
C	0.016	0.024	0.41	0.61
D	0.077	0.083	1.96	2.11

C<sub>1</sub> 0.18 of Typical  
L<sub>1</sub> 0.60 nH Typical

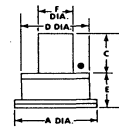
32



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.118	0.125	3.02	3.18
B	0.065	0.065	1.40	1.65
C	0.077	0.083	1.96	2.11
D	--	0.025	--	0.64

C<sub>1</sub> 0.30 pF Typical  
L<sub>1</sub> 0.40 nH Typical

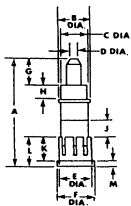
33



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.058	0.062	1.47	1.57
B	0.050	0.060	1.27	1.52
C	0.029	0.031	0.74	0.79
D	0.085	0.092	2.16	2.32
E	0.022	0.028	0.56	0.71
F	0.024	0.026	0.61	0.66

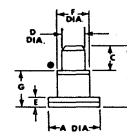
C<sub>1</sub> 0.23 pF Typical  
L<sub>1</sub> 0.20 nH Typical

34



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.788	0.824	20.26	20.93
B	--	0.240	--	6.10
C	0.205	0.215	5.21	5.46
D	0.092	0.096	2.34	2.44
E	0.246	0.250	6.25	6.35
F	0.292	0.296	7.42	7.52
G	0.180	0.180	4.57	4.63
H	0.100	--	2.54	--
J	0.067	--	1.70	--
K	0.195	0.199	4.95	5.05
L	0.246	0.250	6.25	6.35
M	0.050	0.056	1.27	1.42

36



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.119	0.125	3.02	3.18
B	0.143	0.163	3.63	4.14
C	0.050	0.064	1.52	1.63
D	0.050	0.064	1.52	1.63
E	--	0.025	--	0.64
F	0.077	0.083	1.96	2.11
G	0.086	0.090	2.18	2.44

MAX C<sub>1</sub> 0.18 of Typical    MIN C<sub>1</sub> 0.18 of Typical  
L<sub>1</sub> 0.80 nH Typical        L<sub>1</sub> 0.80 nH Typical

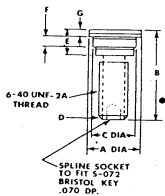
M/A-COM Ltd, Humphrys Road, Dunstable, Bedfordshire, LU5 4SX United Kingdom.

Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

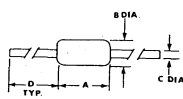
43



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.250	0.265	6.40	6.73
B	0.440	0.460	11.18	11.68
C	0.208	0.212	5.28	5.38
D	0.070	45° REF	0.51	45° REF
E	0.119	0.131	3.02	3.33
F	50 REF			
G	0.025	0.035	0.64	0.89

C<sub>p</sub> = 0.75 pF Typical  
L<sub>1</sub> = 0.50 nH Typical

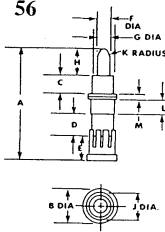
54



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.145	0.165	3.68	4.19
B	0.068	0.075	1.72	1.91
C	0.014	0.016	0.35	0.41
D	1.000	1.500	25.40	38.10

C<sub>p</sub> = 0.06 pF Typical  
L<sub>1</sub> = 1.00 nH Typical

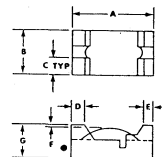
56



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.766	0.787	19.46	20.12
B	0.240		6.10	
C	0.130 R-F		3.30 REF	
D	0.145	0.155	3.68	3.94
E	0.180	0.190	4.57	4.83
F	0.092	0.105	2.34	2.67
G	0.155	0.165	3.94	4.19
H	0.180	0.190	4.57	4.83
J	0.185	0.195	4.70	4.95
K	0.030	0.046	0.76	1.17
L	0.095	0.105	2.41	2.67
M	0.030		0.76	

C<sub>p</sub> = 0.35 pF Typical  
L<sub>1</sub> = 3.0 nH Typical

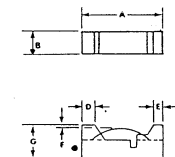
81



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.027	0.028	1.83	1.98
B	0.038	0.043	0.97	1.09
C	0.010	0.026	0.25	0.51
D	0.012	--	0.30	--
E	0.009	--	0.23	--
F	0.003	--	0.08	--
G	0.029	0.035	0.74	0.89

C<sub>p</sub> = 0.20 pF Typical  
L<sub>1</sub> = 0.50 nH Typical

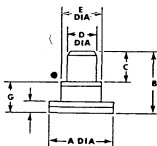
81A



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.072	0.078	1.83	1.98
B	0.038	0.043	0.33	0.51
C	0.010	0.020	0.25	0.51
D	0.012	--	0.30	--
E	0.009	--	0.23	--
F	0.003	--	0.08	--
G	0.029	0.035	0.74	0.89

C<sub>p</sub> = 0.20 pF Typical  
L<sub>1</sub> = 0.50 nH Typical

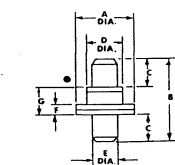
91



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.119	0.127	3.02	3.23
B	0.115	0.129	2.92	3.28
C	0.060	0.064	1.52	1.63
D	0.060	0.062	1.52	1.57
E	0.077	0.083	1.96	2.11
F	0.016	0.024	0.41	0.61
G	0.055	0.065	1.40	1.65

C<sub>p</sub> = 0.30 pF Typical  
L<sub>1</sub> = 0.40 nH Typical

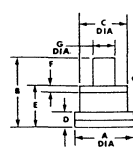
92



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.119	0.127	3.02	3.23
B	0.174	0.194	4.42	4.93
C	0.060	0.064	1.53	1.63
D	0.077	0.083	1.96	2.11
E	0.060	0.062	1.52	1.63
F	0.016	0.024	0.41	0.61
G	0.055	0.065	1.40	1.65

C<sub>p</sub> = 0.30 pF Typical  
L<sub>1</sub> = 0.40 nH Typical

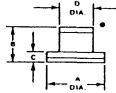
93



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.059	0.069	1.50	1.75
B	0.070	0.080	1.78	2.03
C	0.047	0.053	1.19	1.35
D	--	0.015	--	0.38
E	0.040	0.050	1.02	1.27
F	0.008	0.010	0.10	0.25
G	0.024	0.026	0.61	0.66

C<sub>p</sub> = 0.15 pF Typical  
L<sub>1</sub> = 0.17 nH Typical

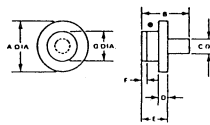
94



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.078	0.086	1.98	2.18
B	0.040	0.050	1.02	1.27
C	--	0.015	--	0.38
D	0.047	0.053	1.19	1.35

C<sub>p</sub> = 0.15 µF Typical  
L<sub>s</sub> = 0.17 mH Typical

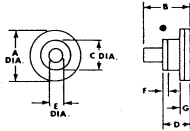
95



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.078	0.086	1.98	2.18
B	0.070	0.080	1.78	2.03
C	0.024	0.026	0.61	0.66
D	--	0.015	--	0.38
E	0.040	0.050	1.02	1.27
F	0.004	0.010	0.10	0.25
G	0.047	0.053	1.19	1.35

C<sub>p</sub> = 0.15 µF Typical  
L<sub>s</sub> = 0.17 mH Typical

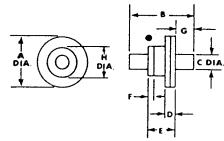
96



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.078	0.086	1.98	2.18
B	0.070	0.080	1.78	2.03
C	0.047	0.053	1.19	1.35
D	0.040	0.050	1.02	1.27
E	0.024	0.026	0.61	0.66
F	0.004	0.010	0.10	0.25
G	--	0.015	--	0.38

C<sub>p</sub> = 0.15 µF Typical  
L<sub>s</sub> = 0.17 mH Typical

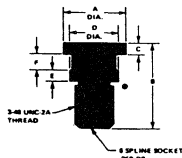
97



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.078	0.086	1.98	2.18
B	0.100	0.110	2.54	2.79
C	0.024	0.026	0.61	0.66
D	--	0.015	--	0.38
E	0.040	0.050	1.02	1.27
F	0.004	0.010	0.10	0.25
G	0.029	0.031	0.74	0.79
H	0.047	0.053	1.19	1.35

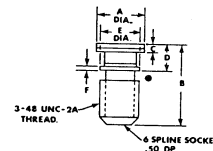
C<sub>p</sub> = 0.15 µF Typical  
L<sub>s</sub> = 0.17 mH Typical

101



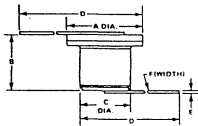
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.155	0.165	3.94	4.19
B	0.205	0.225	5.21	5.72
C	--	0.030	--	0.76
D	0.120	0.130	3.05	3.30
E	--	0.030	--	0.76
F	--	0.045 REF	--	1.15 REF

103



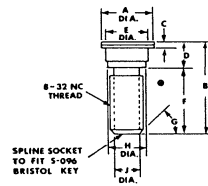
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.119	0.127	3.02	3.23
B	0.188	0.208	4.78	5.28
C	0.016	0.028	0.41	0.61
D	0.058	0.071	1.47	1.80
E	0.098	0.102	2.49	2.59
F	0.009	0.011	0.23	0.28

108



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.119	0.127	3.02	3.23
B	0.085	0.097	2.16	2.46
C	0.077	0.083	1.96	2.11
D	0.915	1.025	24.77	26.04
E	0.002	0.004	0.05	0.25
F	0.077	0.083	1.96	2.11

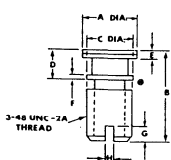
109



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.259	0.267	6.58	6.76
B	0.436	0.456	11.07	11.58
C	0.027	0.033	0.69	0.84
D	0.118	0.134	3.00	3.40
E	0.207	0.213	5.26	5.41
F	0.217	0.223	5.55	5.70
G	400	500	400	500
H	0.193	0.199	4.90	5.05
J	0.110	0.130	2.79	3.30

C<sub>p</sub> = 0.75 µF Typical  
L<sub>s</sub> = 0.75 mH Typical

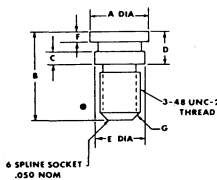
111



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.119	0.127	3.02	3.23
B	0.188	0.208	4.78	5.28
C	0.098	0.102	2.49	2.59
D	0.057	0.071	1.45	1.80
E	0.016	0.024	0.41	0.61
F	0.009	0.011	0.23	0.28
G	0.025	0.046	0.64	1.14
H	0.015	0.025	0.38	0.64

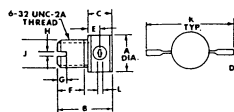
C<sub>p</sub> = 0.27 µF Typical  
L<sub>s</sub> = 0.30 mH Typical

112



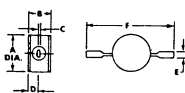
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.139	0.149	3.53	3.78
B	0.205	0.225	5.21	5.72
C	--	0.030	--	0.76
D	0.074	0.084	1.88	2.13
E	0.120	0.130	3.05	3.30
F	--	0.025	--	0.64
G	450 ± 0.020		450 ± 0.51	

114



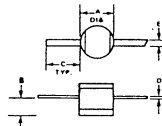
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	--	0.255	--	6.48
B	0.380	0.400	9.65	10.16
C	0.120	0.140	3.05	3.56
D	0.030	0.060	0.76	1.52
E	0.058	0.072	1.47	1.83
F	0.205	--	5.21	--
G	0.050	0.070	1.27	1.78
H	0.025	0.035	0.64	0.89
J	0.131	0.137	3.33	3.48
K	0.635	0.695	16.13	17.65
L	0.007	0.006	0.05	0.152

115



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	--	0.255	--	6.48
B	0.120	0.140	3.05	3.56
C	0.002	0.006	0.05	0.15
D	0.058	0.072	1.47	1.83
E	0.030	0.060	0.76	1.52
F	0.660	0.670	16.76	17.01

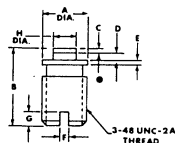
116



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.090	0.110	2.29	2.79
B	0.032	0.038	0.81	0.94
C	0.095	0.105	2.41	2.67
D	0.003	0.005	0.08	0.13
E	0.018	0.022	0.46	0.56

Cp = 0.05 of Typical

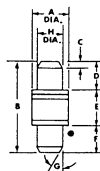
118



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.098	0.102	2.49	2.59
B	0.185	0.185	4.19	4.70
C	0.008	0.012	0.20	0.30
D	0.014	0.018	0.36	0.46
E	0.008	0.012	0.20	0.31
F	0.015	0.025	0.38	0.64
G	0.025	0.045	0.64	1.14
H	0.048	0.052	1.22	1.32

Cp = 0.22 of Typical  
L1 = 0.16 nH Typical

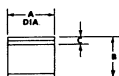
119



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.078	0.086	1.98	2.18
B	0.190	0.210	4.83	5.33
C	0.009	0.015	0.23	0.38
D	0.060	0.064	1.52	1.63
E	0.070	0.082	1.78	2.08
F	0.060	0.064	1.52	1.63
G	25°	35°	20°	35°
H	0.060	0.064	1.52	1.63

Cp = 0.15 of Typical  
L1 = 0.50 nH Typical

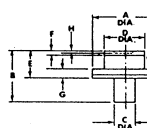
120



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.051	0.055	1.30	1.40
B	0.040	0.050	1.02	1.27
C	--	0.015	--	0.38

Cp = 0.13 of Typical  
L1 = 0.40 nH Typical

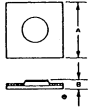
128



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.077	0.083	1.96	2.11
B	0.0545	0.0675	1.384	1.715
C	0.022	0.028	0.56	0.71
D	0.047	0.053	1.19	1.35
E	0.0295	0.0295	0.749	0.75
F	0.002	0.007	0.05	0.18
G	0.010	0.015	0.25	0.38
H	0.0015	0.0030	0.038	0.076

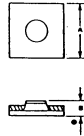
Cp = 0.23 of Typical  
L1 = 0.20 nH Typical

130



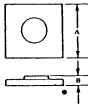
DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.075	0.095	1.90	2.41
B	0.0085	0.0105	0.021	0.026

131



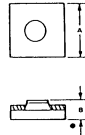
DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.030	0.035	0.76	0.91
B	0.0085	0.0105	0.216	0.267

132



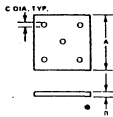
DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.020	0.024	0.51	0.61
B	0.003	0.006	0.08	0.15

134



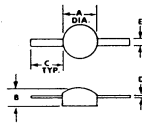
DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.0135	0.0165	0.34	0.42
B	0.0035	0.0045	0.09	0.11

135



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.013	0.017	0.33	0.43
B	0.004	0.006	0.10	0.15
C	0.001	--	0.03	--

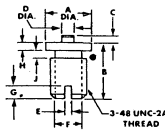
137



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.090	0.110	2.29	2.79
B	--	0.050	--	1.27
C	0.095	0.105	2.41	2.67
D	0.003	0.005	0.08	0.13
E	0.018	0.022	0.46	0.56

C<sub>p</sub> = 0.05 pF Typical

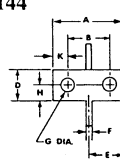
138



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.113	0.118	2.87	3.00
B	0.140	0.145	3.56	3.68
C	0.016	0.019	0.41	0.48
D	0.027	0.034	0.69	0.86
E	0.015	0.025	0.38	0.64
F	0.068	0.070	1.73	1.78
G	0.025	0.045	0.64	1.14
H	0.018	0.022	0.46	0.56
J	0.015	0.025	0.38	0.64

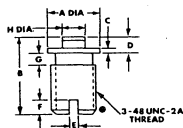
C<sub>p</sub> = 0.18 pF Typical  
L<sub>1</sub> = 0.10 nH Typical

144



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.405	0.415	10.16	10.51
B	0.240	0.260	6.10	6.50
C	0.120	0.130	3.05	3.30
D	0.155	0.165	3.94	4.17
E	0.195	0.215	4.95	5.46
F	0.015	0.035	0.38	0.89
G	0.092	0.100	2.34	2.54
H	0.075	0.085	1.91	2.16
J	0.056	0.066	1.42	1.68
K	0.075	0.085	1.91	2.16

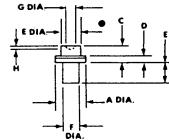
148



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.113	0.118	2.87	3.00
B	0.167	0.167	4.24	4.25
C	0.018	0.022	0.46	0.56
D	0.040	0.052	1.02	1.32
E	0.015	0.025	0.38	0.64
F	0.035	0.045	0.89	1.14
G	0.025	0.035	0.64	0.89
H	0.048	0.052	1.22	1.32

C<sub>p</sub> = 0.26 pF Typical  
L<sub>1</sub> = 0.16 nH Typical

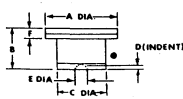
155



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.043	0.047	1.09	1.19
B	0.026	0.034	0.66	0.86
C	0.022	0.028	0.56	0.71
D	0.007	0.010	0.18	0.25
E	0.029	0.031	0.74	0.79
F	0.024	0.026	0.61	0.66
G	0.010	0.016	0.25	0.41
H	0.001	0.002	0.03	0.05

C<sub>p</sub> = 0.13 pF Typical  
L<sub>1</sub> = 0.17 nH Typical

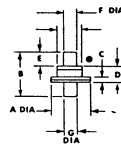
166



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.043	0.047	1.09	1.19
B	0.026	0.033	0.66	0.84
C	0.029	0.031	0.74	0.79
D	0.001	0.002	0.03	0.05
E	0.010	0.016	0.25	0.41
F	0.006	0.008	0.15	0.20

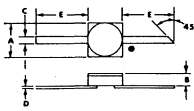
C<sub>p</sub> 0.13 pF Typical  
L<sub>1</sub> 0.16 nH Typical

168

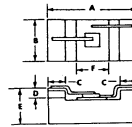


DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.079	0.081	2.01	2.06
B	0.084	0.096	2.13	2.43
C	0.008	0.010	0.20	0.25
D	0.028	0.032	0.71	0.81
E	0.028	0.032	0.71	0.81
F	0.024	0.026	0.61	0.66
G	0.024	0.026	0.61	0.66
H	0.049	0.051	1.24	1.30

C<sub>p</sub> = 0.23 pF Typical  
L<sub>1</sub> = 0.20 nH Typical

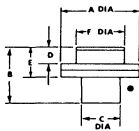


DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.094	0.102	2.39	2.59
B	0.001	0.004	0.25	1.12
C	0.019	0.021	0.48	0.53
D	0.0025	0.0035	0.06	0.08
E	0.130	0.170	3.30	4.32



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.065	0.060	1.60	1.52
B	0.024	0.030	0.61	0.76
C	0.007	0.014	0.18	0.36
D	0.007	—	0.18	—
E	0.017	0.027	0.43	0.69
F	0.020	—	0.51	—

191



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.078	0.082	1.98	2.08
B	0.048	0.059	1.22	1.50
C	0.038	0.042	0.97	1.07
D	0.015	0.019	0.38	0.48
E	0.027	0.034	0.69	0.86
F	0.045	0.052	1.14	1.40

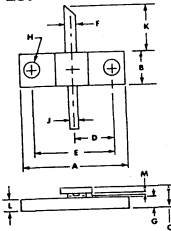
C<sub>2</sub> = 0.36 μF Typical  
L<sub>1</sub> = 0.10 mH Typical

255



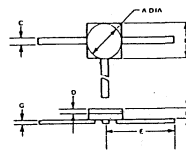
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.075	0.085	1.90	2.16
B	0.045	0.055	1.14	1.40

259



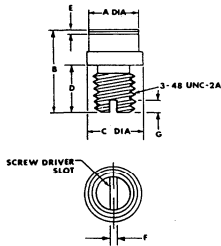
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.595	0.605	15.11	15.37
B	0.166	0.170	4.22	4.32
C	0.115	0.125	2.92	3.18
D	0.214	0.219	5.44	5.56
E	0.428	0.438	10.87	11.13
F	0.048	0.052	1.22	1.32
G	0.045	0.055	1.14	1.39
H	0.091	0.095	2.31	2.41
J	0.032	0.036	0.81	0.91
K	0.200	—	5.08	—
L	0.061	0.071	1.55	1.80
M	0.004	0.006	0.10	0.15

270



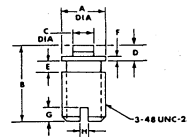
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.094	0.102	2.39	2.59
B	0.094	0.102	2.39	2.59
C	0.019	0.021	0.48	0.53
D	0.013	0.017	0.33	0.43
E	0.200	—	5.08	—
F	0.025	0.035	0.64	0.89
G	0.0027	0.0033	0.069	0.084

273



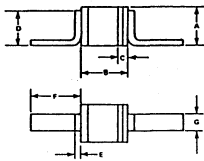
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.120	0.130	3.05	3.30
B	0.188	0.218	5.03	5.54
C	0.120	0.130	3.05	3.30
D	0.110	0.120	2.79	3.05
E	—	0.025	—	0.64
F	0.015	0.025	0.38	0.64
G	0.030	0.040	0.76	1.02

275



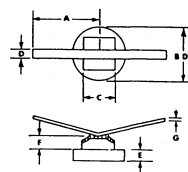
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.113	0.118	2.87	3.00
B	0.159	0.170	4.04	4.55
C	0.048	0.052	1.22	1.32
D	0.033	0.044	0.84	1.12
E	0.025	0.035	0.64	0.89
F	0.018	0.027	0.46	0.69
G	0.035	0.045	0.89	1.14
H	0.015	0.025	0.38	0.64

276



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.040	0.060	1.02	1.53
B	0.040	0.060	1.02	1.53
C	—	0.015	—	0.38
D	0.051	0.055	1.30	1.40
E	—	0.005	—	0.13
F	0.240	0.260	6.10	6.60
G	0.015	0.025	0.38	0.64

280



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.125	—	3.18	—
B	0.090	0.100	2.29	2.54
C	0.083	0.067	1.60	1.70
D	0.0095	0.0105	0.24	0.27
E	—	0.015	—	0.38
F	0.010	0.014	0.25	0.36
G	0.008	0.013	0.019	0.032

## EQUIVALENT PARTS LIST

The majority of C.V. register and commercial microwave diodes can be provided depending on demand. M/A-COM Ltd also provides a second source of direct equivalents to other manufacturers devices, the majority of which are approved for space use. A comprehensive equivalents list is provided below.

PART NUMBER	DIODE DESCRIPTION	M/A-COM LTD EQUIVALENT
IN 5719*	Silicon PIN	ML4622-54
5082-0132	Silicon Multiplier Varactor (Step Recovery)	ML4406-30
5082-0300	Silicon Multiplier Varactor (Step Recovery)	ML4409-111
5082-0320	Silicon Multiplier Varactor (Step Recovery)	ML4405-111
5082-0335	Silicon Multiplier Varactor (Step Recovery)	ML4404-30
5082-0523	Silicon Multiplier Varactor (Step Recovery)	ML4405-30
5082-0800	Silicon Multiplier Varactor (Step Recovery)	ML4409-111
5082-0805	Silicon Multiplier Varactor (Step Recovery)	ML4408-30
5082-0810	Silicon Multiplier Varactor (Step Recovery)	ML4407-30
5082-0830	Silicon Multiplier Varactor (Step Recovery)	ML4406-30
5082-0835	Silicon Multiplier Varactor (Step Recovery)	ML4402-30
5082-0885	Silicon Multiplier Varactor (Step Recovery)	ML4402-120
5082-2200	Silicon Schottky (Medium Barrier)	ML40150-186
5082-2701	Silicon Schottky (Medium Barrier)	ML40150-120
5082-2711	Silicon Schottky (Medium Barrier)	ML40150-119
5082-2773	Silicon Schottky (Medium Barrier)	ML40150-120
5082-3001*	Silicon PIN	ML4627-54
5082-3042*	Silicon PIN	ML4614-54
5082-3043*	Silicon PIN	ML4611-54
5082-3077*	Silicon PIN	ML4611-54
5082-3101	Silicon PIN	ML4627P-94
5082-3102	Silicon PIN	ML4630-94
5082-3141*	Silicon PIN	ML4663-144
5082-3188	Silicon PIN	ML4605-54
5082-3201	Silicon PIN	ML4627P-30
5082-3202	Silicon PIN	ML4630-30
5082-3303	Silicon PIN	ML4627-30
5082-3304	Silicon PIN	ML4640-30
AH 152	GaAs Abrupt Junction Tuning Varactor	ML4512-30
AH 153	GaAs Abrupt Junction Tuning Varactor	ML4512-30
AH 154	GaAs Abrupt Junction Tuning Varactor	ML4513-30
AH 155	GaAs Abrupt Junction Tuning Varactor	ML4514-30
AH 156	GaAs Abrupt Junction Tuning Varactor	ML4515-30
AH 160	GaAs Abrupt Junction Tuning Varactor	ML4532-30
AH 161	GaAs Abrupt Junction Tuning Varactor	ML4532-30
AH 162	GaAs Abrupt Junction Tuning Varactor	ML4533-30
AH 163	GaAs Abrupt Junction Tuning Varactor	ML4534-30
AH 164	GaAs Abrupt Junction Tuning Varactor	ML4535-30
AH 165	GaAs Abrupt Junction Tuning Varactor	ML4552-30
AH 166	GaAs Abrupt Junction Tuning Varactor	ML4552-30
AH 167	GaAs Abrupt Junction Tuning Varactor	ML4553-30
AH 168	GaAs Abrupt Junction Tuning Varactor	ML4554-30
AH 169	GaAs Abrupt Junction Tuning Varactor	ML4555-30

\* and all Hi-Rel Versions (Jan TX, TXB, TXV, TXVB).

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Europe: (44) 1344 869595

North America: 800 366 2266

Asia Pacific: (81) 3 3226 1671

PART NUMBER	DIODE DESCRIPTION	M/A-COM LTD EQUIVALENT
AH 365	GaAs Gunn	ML4923
AH 366	GaAs Gunn	ML4923
AH 367	GaAs Gunn	ML4933
AH 368	GaAs Gunn	ML4933
AH 369	GaAs Gunn	ML4922
AH 370	GaAs Gunn	ML4922
AH 371	GaAs Gunn	ML4932
AH 372	GaAs Gunn	ML4932
AH 411	GaAs Gunn	ML4901
AH 412	GaAs Gunn	ML4901
AH 413	GaAs Gunn	ML4901
AH 414	GaAs Gunn	ML4902
AH 415	GaAs Gunn	ML4902
AH 416	GaAs Gunn	ML4902
AH 443	GaAs Gunn	ML4903
AH 444	GaAs Gunn	ML4903
AH 445	GaAs Gunn	ML4903
AH 446	GaAs Gunn	ML4903
AH 447	GaAs Gunn	ML4904
AH 448	GaAs Gunn	ML4904
AH 449	GaAs Gunn	ML4904
AH 450	GaAs Gunn	ML4904
AH 479	GaAs Gunn	ML4905
AH 480	GaAs Gunn	ML4905
AH 481	GaAs Gunn	ML4905
AH 482	GaAs Gunn	ML4905
AH 483	GaAs Gunn	ML4906
AH 484	GaAs Gunn	ML4906
AH 485	GaAs Gunn	ML4906
AH 486	GaAs Gunn	ML4906
AH 487	GaAs Gunn	ML4906
AH 488	GaAs Gunn	ML4906
AH 489	GaAs Gunn	ML4906
AH 490	GaAs Gunn	ML4906
AH 601	GaAs Gunn	ML4943
AH 602	GaAs Gunn	ML4943
AH 603	GaAs Gunn	ML4943/ML4953
AH 604	GaAs Gunn	ML4953
AH 605	GaAs Gunn	ML4953
AH 606	GaAs Gunn	ML4942
AH 607	GaAs Gunn	ML4942
AH 608	GaAs Gunn	ML4942/ML4952
AH 609	GaAs Gunn	ML4952
AH 610	GaAs Gunn	ML4952
AH 611	GaAs Gunn	ML4941
AH 612	GaAs Gunn	ML4941
AH 613	GaAs Gunn	ML4941/ML4951
AH 614	GaAs Gunn	ML4951
AH 615	GaAs Gunn	ML4951
AH 616	GaAs Gunn	ML4963
AH 617	GaAs Gunn	ML4963
AH 618	GaAs Gunn	ML4963
AH 619	GaAs Gunn	ML4972
AH 620	GaAs Gunn	ML4972
AH 621	GaAs Gunn	ML4961
AH 622	GaAs Gunn	ML4961
AH 623	GaAs Gunn	ML4961
AH 624	GaAs Gunn	ML4971
AH 800	GaAs Gunn	ML4982
AH 801	GaAs Gunn	ML4983

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PART NUMBER	DIODE DESCRIPTION	M/A-COM LTD EQUIVALENT
BAT-14-014	Silicon Schottky Mixer (Medium Barrier)	ML40021-276
BAT-14-034	Silicon Schottky Mixer (Medium Barrier)	ML40020-276
BAT-14-044	Silicon Schottky Mixer (Medium Barrier)	ML40021-276
BAT-14-064	Silicon Schottky Mixer (Medium Barrier)	ML40020-276
BAT-14-074	Silicon Schottky Mixer (Medium Barrier)	ML40150-276
BAT-14-094	Silicon Schottky Mixer (Medium Barrier)	ML40151-276
BAT-14-104	Silicon Schottky Mixer (Medium Barrier)	ML40160-276
BAT-14-114	Silicon Schottky Mixer (Medium Barrier)	ML40161-276
BAT-14-124	Silicon Schottky Mixer (Medium Barrier)	ML40161-276
BBY24-S1	Silicon Abrupt Junction Tuning Varactor	ML4364
BBY25-S1	Silicon Abrupt Junction Tuning Varactor	ML4365
BBY33BB-2	Silicon Abrupt Junction Tuning Varactor	ML4317-119
BBY33DA-2	Silicon Abrupt Junction Tuning Varactor	ML4314-30
BXY18A2	Silicon Multiplier Varactor (Step Recovery)	ML4405-120
BXY18AB2	Silicon Multiplier Varactor (Step Recovery)	ML4405-120
BXY18AB6	Silicon Multiplier Varactor (Step Recovery)	ML4404-120
BXY42BA-3	Silicon PIN	ML4611-276
BXY42BA-5	Silicon PIN	ML4611-119
BXY42BA-6	Silicon PIN	ML4611-30
BXY43A	Silicon PIN	ML4622-276
BXY43B	Silicon PIN	ML4622-276
BXY43C	Silicon PIN	ML4623-276
BXY44K	Silicon PIN	ML4627-276
CLA 3131-01	Silicon Limiter	ML4204
CLA 3131-02	Silicon Limiter	ML4202
CLA 3132-01	Silicon Limiter	ML4208
CLA 3132-02	Silicon Limiter	ML4207
CLA 3134-01	Silicon Limiter	ML4206
CLA 3134-02	Silicon Limiter	ML4204
CLA 3135-01	Silicon Limiter	ML4209
CLA 3135-02	Silicon Limiter	ML4208
CSB 7002-01	Silicon PIN	ML4614
CSB 7002-02	Silicon PIN	ML4614
CSB 7002-03	Silicon PIN	ML4615
CSB 7002-04	Silicon PIN	ML4615
CSB 7002-05	Silicon PIN	ML4611
CSB 7002-06	Silicon PIN	ML4611
CSB 7002-07	Silicon PIN	ML4612
CSB 7003-01	Silicon PIN	ML4617
CSB 7003-02	Silicon PIN	ML4617
CSB 7003-03	Silicon PIN	ML4618
CSB 7003-04	Silicon PIN	ML4619
CSB 7201-01	Silicon PIN	ML4627
CSB 7201-02	Silicon PIN	ML4628
CSB 7201-03	Silicon PIN	ML4629

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PART NUMBER	DIODE DESCRIPTION	M/A-COM LTD EQUIVALENT
CV 2154	Mixer/Detector	CV 2154
CV 2155	Mixer/Detector	CV 2155
CV 7108	Mixer/Detector	CV 7108
CV 7109	Mixer/Detector	CV 7109
CV 7181	Mixer/Detector	CV 7181
CV 7182	Mixer/Detector	CV 7182
CV 7183	Mixer/Detector	CV 7183
CV 7186	Mixer/Detector	CV 7186
CV 7377	Mixer/Detector	CV 7377
CV 7378	Mixer/Detector	CV 7378
CV 7771	Mixer/Detector	CV 7771
CV 7772	Mixer/Detector	CV 7772
CV 7776	Mixer/Detector	CV 7776
CV 7777	Mixer/Detector	CV 7777
CV 7838	Mixer/Detector	CV 7838
CV 7839	Mixer/Detector	CV 7839
CV 8163	Mixer/Detector	CV 8163
CV 8164	Mixer/Detector	CV 8164
DC 1321-1579	Mixer/Detector	On Application
DC 2011-2652	P.I.N. Diode	
DC4301-4375	Tuning Varactor	
DGB 807X	GaAs Gunn	ML4981
DGB 817X	GaAs Gunn	ML4982
DGB 826X	GaAs Gunn	ML4973
DGB 827X	GaAs Gunn	ML4983
DGB 834X	GaAs Gunn	ML4923/ML4933
DGB 835X	GaAs Gunn	ML4943/ML4953
DGB 836X	GaAs Gunn	ML4963
DGB 841X	GaAs Gunn	ML4901
DGB 842X	GaAs Gunn	ML4903
DGB 843X	GaAs Gunn	ML4905
DGB 844X	GaAs Gunn	ML4922/ML4932
DGB 845X	GaAs Gunn	ML4942/ML4952
DGB 846X	GaAs Gunn	ML4962
DGB 851X	GaAs Gunn	ML4902
DGB 852X	GaAs Gunn	ML4904
DGB 853X	GaAs Gunn	ML4906
DGB 854X	GaAs Gunn	ML4921/ML4931
DGB 855X	GaAs Gunn	ML4941/ML4951
DGB 856X	GaAs Gunn	ML4961
DGB 865X	GaAs Gunn	ML4941
DGB 881X	GaAs Gunn	ML4910
DGB 8882	GaAs Gunn	ML4911
DGB 924X	GaAs Gunn	ML4923/ML4933
DGB 925X	GaAs Gunn	ML4943/ML4953
DGB 931X	GaAs Gunn	ML4901
DGB 932X	GaAs Gunn	ML4903
DGB 933X	GaAs Gunn	ML4905
DGB 934X	GaAs Gunn	ML4922/ML4932
DGB 935X	GaAs Gunn	ML4942/ML4952
DGB 941X	GaAs Gunn	ML4902
DGB 942X	GaAs Gunn	ML4904
DGB 943X	GaAs Gunn	ML4906
DGB 944X	GaAs Gunn	ML4921/ML4931
DH 252	Silicon Multiplier Varactor	ML4407
DH 256	Silicon Multiplier Varactor	ML4406
DH 267	Silicon Multiplier Varactor	ML4404
DH 292	Silicon Multiplier Varactor	ML4405

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PART NUMBER	DIODE DESCRIPTION	M/A-COM LTD EQUIVALENT
DH 301	Silicon Schottky Mixer (Medium Barrier)	ML40019-119
DH 302	Silicon Schottky Mixer (Medium Barrier)	ML40020-119
DH 303	Silicon Schottky Mixer (Medium Barrier)	ML40021-119
DH 312	Silicon Schottky Mixer (Medium Barrier)	ML40152-119
DH 313	Silicon Schottky Mixer (Medium Barrier)	ML40151-119
DH 314	Silicon Schottky Mixer (Medium Barrier)	ML40150-119
DH 322	Silicon Schottky Mixer (Medium Barrier)	ML40161-119
DH 323	Silicon Schottky Mixer (Medium Barrier)	ML40160-119
DH 324	Silicon Schottky Mixer (Medium Barrier)	ML40160-119
DH 378	GaAs Schottky Mixer Diodes	ML40461-119
DH 379	GaAs Schottky Mixer Diodes	ML40462-119
DH 383	GaAs Schottky Mixer Diodes	ML40463/ML40464-119
DH 384	GaAs Schottky Mixer Diodes	ML40463/ML40464-119
DH 401	Silicon PIN	ML4619
DH 402	Silicon PIN	ML4624
DH 403	Silicon PIN	ML4629
DH 404	Silicon PIN	ML4641
DH 405	Silicon PIN	ML4623
DH 407	Silicon PIN	ML4642
DH 408	Silicon PIN	ML4642
DH 409	Silicon PIN	ML4643
DH 531	Silicon PIN	ML4612
DH 532	Silicon PIN	ML4615
DH 601	Silicon Limiter	ML4202
DH 602	Silicon Limiter	ML4202
DH 603	Silicon Limiter	ML4207
DH 604	Silicon Limiter	ML4207
DH 622	Silicon Limiter	ML4204
DH 623	Silicon Limiter	ML4204
DH 624	Silicon Limiter	ML4204
DH 625	Silicon Limiter	ML4206
DH 740	Silicon Abrupt Junction Tuning Varactor	ML4331/ML4332
DH 741	Silicon Abrupt Junction Tuning Varactor	ML4333
DH 742	Silicon Abrupt Junction Tuning Varactor	ML4334
DH 743	Silicon Abrupt Junction Tuning Varactor	ML4336
DH 744	Silicon Abrupt Junction Tuning Varactor	ML4338
DH 745	Silicon Abrupt Junction Tuning Varactor	ML4339
DH 746	Silicon Abrupt Junction Tuning Varactor	ML4340
DH 747	Silicon Abrupt Junction Tuning Varactor	ML4341
DH 7812A	Silicon Abrupt Junction Tuning Varactor	ML4342
DH 7813A	Silicon Abrupt Junction Tuning Varactor	ML4343
DH 790	Silicon Abrupt Junction Tuning Varactor	ML4311/ML4312
DH 791	Silicon Abrupt Junction Tuning Varactor	ML4313
DH 792	Silicon Abrupt Junction Tuning Varactor	ML4314
DH 793	Silicon Abrupt Junction Tuning Varactor	ML4316
DH 794	Silicon Abrupt Junction Tuning Varactor	ML4318
DH 795	Silicon Abrupt Junction Tuning Varactor	ML4319
DH 801	Silicon PIN	ML4642
DH 802 or 80050	Silicon PIN	ML4650
DH 803 or 80052	Silicon PIN	ML4651
DMC 5504	Silicon Schottky Mixer (Medium Barrier)	ML40150
DMF 4018	Silicon Schottky Mixer (Medium Barrier)	ML40150
DMF 4019	Silicon Schottky Mixer (Medium Barrier)	ML40150
DMF 6106	Silicon Schottky Mixer (Medium Barrier)	ML40150
DMF 6107	Silicon Schottky Mixer (Medium Barrier)	ML40160
DMF 6887	Silicon Schottky Mixer (Medium Barrier)	ML40021
DMF 6898	Silicon Schottky Mixer (Medium Barrier)	ML40021

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PART NUMBER	DIODE DESCRIPTION	M/A-COM LTD EQUIVALENT
DMK 4058	GaAs Schottky Mixer	ML40464
DMK 5068	GaAs Schottky Mixer	ML40462
DMK 6600	GaAs Schottky Mixer	ML40461
DMK 6601	GaAs Schottky Mixer	ML40461
DMK 6602	GaAs Schottky Mixer	ML40462
DMK 6603	GaAs Schottky Mixer	ML40464
DSA 6925	Silicon PIN	ML4649-30
DSA 6925A	Silicon PIN	ML4650-30
DSA 6928	Silicon PIN	ML4649-56
DSA 6928A	Silicon PIN	ML4650-56
DSA 6928B	Silicon PIN	ML4651-56
DVB 6100-A	Silicon Multiplier Varactor (Step Recovery)	ML4404-30
DVB 6100-C	Silicon Multiplier Varactor (Step Recovery)	ML4405-30
DVB 6101-A	Silicon Multiplier Varactor (Step Recovery)	ML4406-30
DVB 6102-C	Silicon Multiplier Varactor (Step Recovery)	ML4407-30
DVB 6103-D	Silicon Multiplier Varactor (Step Recovery)	ML4408-30
DVB 6104-B	Silicon Multiplier Varactor (Step Recovery)	ML4409-30
DVB 6104-C	Silicon Multiplier Varactor (Step Recovery)	ML4409-30
DVE 4575-B	GaAs Abrupt Tuning Varactor	ML4512-96
DVE 4575-C	GaAs Abrupt Tuning Varactor	ML4512-96
DVE 4575-D	GaAs Abrupt Tuning Varactor	ML4513-96
DVE 4575-E	GaAs Abrupt Tuning Varactor	ML4513-96
DVE 4575-F	GaAs Abrupt Tuning Varactor	ML4514-96
DVE 4575-G	GaAs Abrupt Tuning Varactor	ML4515-96
DVE 4575-H	GaAs Abrupt Tuning Varactor	ML4515-96
DVE 4551-B	GaAs Abrupt Tuning Varactor	ML4512-30
DVE 4551-C	GaAs Abrupt Tuning Varactor	ML4512-30
DVE 4551-D	GaAs Abrupt Tuning Varactor	ML4513-30
DVE 4551-E	GaAs Abrupt Tuning Varactor	ML4513-30
DVE 4551-F	GaAs Abrupt Tuning Varactor	ML4514-30
DVE 4551-G	GaAs Abrupt Tuning Varactor	ML4515-30
DVE 4551-H	GaAs Abrupt Tuning Varactor	ML4515-30
DVE 6953-B	GaAs Abrupt Tuning Varactor	ML4532-96
DVE 6953-C	GaAs Abrupt Tuning Varactor	ML4532-96
DVE 6953-D	GaAs Abrupt Tuning Varactor	ML4533-96
DVE 6953-E	GaAs Abrupt Tuning Varactor	ML4533-96
DVE 6953-F	GaAs Abrupt Tuning Varactor	ML4534-96
DVE 6953-G	GaAs Abrupt Tuning Varactor	ML4534-96
DVE 6953-H	GaAs Abrupt Tuning Varactor	ML4535-96
DVE 6953-J	GaAs Abrupt Tuning Varactor	ML4536-96
DVE 6953-K	GaAs Abrupt Tuning Varactor	ML4537-96
DVH 6731-01	Silicon Abrupt Tuning Varactor	ML4310-30
DVH 6731-02	Silicon Abrupt Tuning Varactor	ML4310-30
DVH 6731-03	Silicon Abrupt Tuning Varactor	ML4311-30
DVH 6731-04	Silicon Abrupt Tuning Varactor	ML4312-30
DVH 6731-05	Silicon Abrupt Tuning Varactor	ML4313-30
DVH 6741-02	Silicon Abrupt Tuning Varactor	ML4331-30
DVH 6741-03	Silicon Abrupt Tuning Varactor	ML4331-30
DVH 6741-04	Silicon Abrupt Tuning Varactor	ML4332-30
DVH 6741-05	Silicon Abrupt Tuning Varactor	ML4333-30
DVH 6761-02	Silicon Abrupt Tuning Varactor	ML4351-30
DVH 6761-03	Silicon Abrupt Tuning Varactor	ML4351-30
DVH 6761-04	Silicon Abrupt Tuning Varactor	ML4352-30
DVH 6761-05	Silicon Abrupt Tuning Varactor	ML4353-30
MH 151	Silicon PIN	ML4669
MH 153	Silicon PIN	ML4670
VBC	Tuning Varactor	On Application
VKT	Tuning Varactor	
VSA	Tuning Varactor	
VSE	Mutliplier Varactor	
VUE	Multiplier Varactor	

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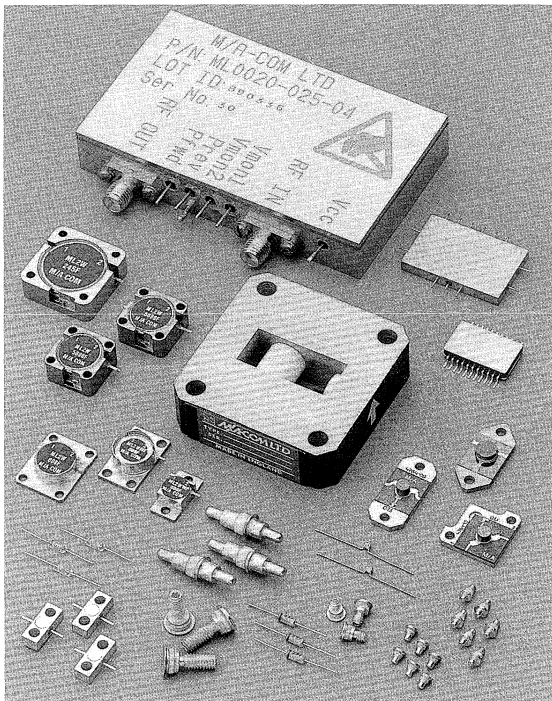
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# SPACE QUALIFIED PARTS

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## **INTRODUCTION**

M/A-COM LTD has developed and manufactured advanced microwave semiconductors, components and sub-systems for space, communications and military applications in the UK since 1967, and has supplied parts qualified to ESA and project specifications for space payloads since 1976.

M/A-COM LTD employs 230 skilled personnel, including 50 graduate engineers engaged on new product designs and development: 50 personnel are engaged on space related activities. The Company has the responsibility for space related business in Europe, for the M/A-COM Inc. Group of Companies.

The UK headquarters of the Company is located at Humphrys Road, Dunstable, 30 miles north of London. All space qualification programmes are carried out in clean room areas at the site at Featherstone Road, Wolverton Mill, Milton Keynes: this plant is located 50 miles north of London.

Approved to ISO 9001, CECC and BS 9000, M/A-COM LTD is experienced in working to both ESA and MIL Standard Class S quality assurance procedures.

Under contract to the British National Space Centre (BNSC) and the European Space Research and Technology Centre (ESTEC), M/A-COM LTD has completed qualification testing to ESA/SCC 5010 of its complete range of UK manufactured microwave diodes. These devices appear on the ESA/SCC Qualified Products List (QPL) as the only full range of microwave semiconductors.

## **FACILITIES**

Facilities for the design, development and production of microwave components, sub-systems and equipment include 4000 square metres at the Dunstable site, and 4000 square metres of purpose built Semiconductor and thin film plant at the Milton Keynes site, of which more than 1000 square metres are clean room areas.

The Semiconductor and Components groups are situated in Milton Keynes, where at present some 100 employees are engaged in the development and manufacture of microwave semiconductors, thin film hybrid components and integrated assemblies. Design and production disciplines and controls are maintained at a level consistent with that demanded by space payload manufacturers.

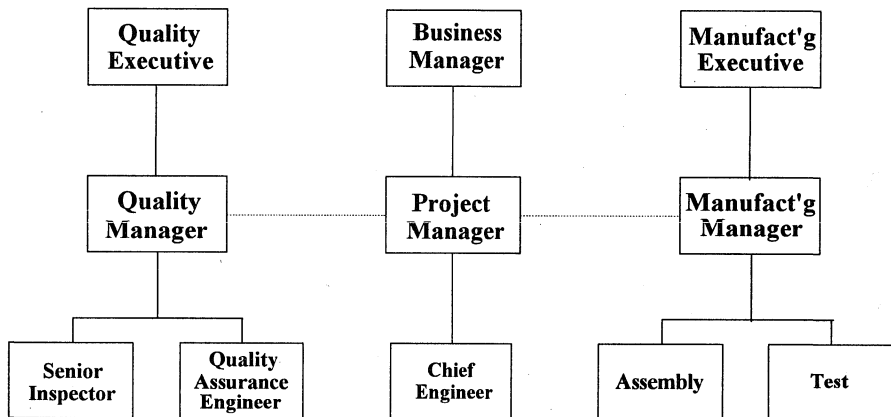
## **ASSESSMENT**

M/A-COM LTD has comprehensive electronic test facilities. Almost all environmental tests required for evaluation and qualification programmes are performed in-house.

## MANAGEMENT

The Project Organisation is depicted below. The Project Manager acts as the focus for all internal and external matters related to the project and is able to call on resources from Engineering, Manufacturing and support functions as required. The Company operates a "Matrix Management" system. This allows the Project Manager to concentrate on the Project and its execution whilst such matters as personnel, administration and detailed technical matters are addressed within the resource departments.

## SPACE PROJECT ORGANISATION



## QUALITY AND RELIABILITY

M/A-COM LTD is dedicated to the manufacture of high quality, reliable products to meet the needs defined by its customers. Achieving customer requirements, as defined by the specification, is the responsibility of all M/A-COM LTD employees. Electronic components and piece parts are selected in accordance with programme requirements. Wherever possible, components are procured from generic devices which are listed in ESA QPL, the customer's Qualified Parts List (QPL), or which have been qualified by M/A-COM LTD for application in space on a previous project. In addition, M/A-COM LTD will write detailed procurement specifications and up-screen all other components to appropriate ESA/SCC or MIL-STD specifications, as required by the customer.



## SPACE AUDITS

M/A-COM LTD has been successfully audited by the following organisations:

- ESA/SCC
- British Aerospace
- IGG Components Technology
- ERA Technology
- CNES
- Alcatel Espace
- Tadiran Limited
- MBT (Israel Aircraft Industries Ltd)
- British National Space Centre and ESTEC
- Matra-Marconi Space (UK) Limited
- Technologica

## SPACE PROGRAMMES

M/A-COM LTD has supplied fully screened products to the following Space Programmes:

- Marecs
- Olympus
- Intelsat
- Skynet
- Italsat
- Eutelsat
- Hot Bird Plus
- Telecom 2
- ISO
- Hispasat
- Locstar
- Envisat
- RA2
- Meteosat
- Inmarsat
- Korea Sat
- EMS
- Artemis
- Helios
- Eureka
- Cassini
- Huygens
- Polar Platform

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## MICROWAVE SEMICONDUCTORS

Formal ESA Qualification Approval has been achieved by M/A-COM Ltd for a complete family of semiconductor diodes to ESA/SCC 5010.

Published ESA/SCC Detail Specifications are available on request, covering the following:

- Tuning Varactors, Abrupt, Silicon
- Tuning Varactors, Abrupt, Gallium Arsenide
- Tuning Varactors, Hyperabrupt, Gallium Arsenide
- Multiplier Varactors, (Step Recovery), Silicon
- Multiplier Varactors, Gallium Arsenide
- PIN, Limiters, Silicon
- PIN, Fast Switching, Silicon
- PIN, High Power, Silicon
- PIN, Broadband, Silicon
- Gunn Devices, Gallium Arsenide
- Schottky Barrier, Mixers, Silicon (medium barrier)
- Schottky Barrier, Mixers, Gallium Arsenide

Outline specifications for the above with reference to the ESA/SCC detail specifications are shown on the following pages of this catalogue.

A large range of special devices space qualified by project is also available, please contact the factory to discuss these in more detail.

**SILICON ABRUPT JUNCTION MICROWAVE TUNING VARACTOR DIODES**

Available in pill, stripline and pill-with-tabs packages

Breakdown Voltage	Typical Total Capacitance $C_T$ (at -4V) (pF)	Capacitance Ratio (Min)	Type No.	ESA/SCC Detail Specification No.	Package Styles ODS No.
25V	0.50 to 3.00 3.30 to 4.70	2.3 to 4.4 4.6 to 4.7	ML4310 to ML4316 ML4317 to ML4319	5512/003 5512/003	30,31,33, 36, 96, 97, 103, 118, 120,186, 276 30, 31, 36, 103, 118, 186
40V	0.70 to 2.15 2.70 to 9.95	3.4 to 5.3 5.5 to 6.3	ML4331 to ML4335 ML4336 to ML4343	5512/004 5512/005	30,31,33, 36, 96, 97, 103, 118, 120,186,276 30, 31, 36, 103, 118, 186
60V	0.70 to 1.75 2.20 to 6.8 8.2 to 15.1	3.5 to 5.5 5.8 to 6.9 7.0 to 7.3	ML4351 to ML4354 ML4355 to ML4361 ML4362 to ML4365	5512/006 5512/007 5512/007	30,31,33, 36, 96, 97, 103, 118, 120, 186, 276 30, 31, 36, 103, 118, 186 30, 31, 36, 103

**CHART III(a) CATEGORY 1 (HTRB only)**

**GALLIUM ARSENIDE MICROWAVE TUNING VARACTOR DIODES**

**ABRUPT AND HYPERABRUPT JUNCTION**

Available in pill, stripline and pill-with-tabs packages

Breakdown Voltage	Typical Total Capacitance $C_T$ (at -4V) (pF)	Minimum Total Capacitance Ratio	Type No.	ESA/SCC Detail Specification No.	Package Styles ODS No.
30V Abrupt Junction	0.57 to 3.50 4.50 to 5.50	1.8 to 3.6 3.7 to 3.8	ML4512 to ML4518 ML4519 to ML4520	5512/002 5512/014	30,31,33,36,94,95,96,97,103,118,120,186,276
45V Abrupt Junction	0.57 to 3.50 4.50 to 5.50	2.2 to 4.6 4.7 to 4.8	ML4532 to ML4538 ML4539 to ML4540	5512/008 5512/014	As Above.
60V Abrupt Junction	0.57 to 3.50 4.50 to 5.50	2.3 to 4.9 5.1 to 5.3	ML4552 to ML4558 ML4559 to ML4560	5512/009 5512/014	As Above.
25V Hyper-abrupt Junction	0.57 to 2.25 2.75 to 5.50	5.5 to 9.0 9.0 to 10.0	ML4572 to ML4576 ML4577 to ML4580	5512/013 5512/012	As Above.

**CHART III(a) CATEGORY 1 (HTRB only)**

**SILICON MICROWAVE MULTIPLIER VARACTOR DIODES**

Available in pill, module and stripline

ESA/SCC Detail Specification No. 5512/001

Breakdown Voltage	Typical Junction Capacitance $C_j$ (at -6V) (pF)	Typical Minority Carrier Lifetime $T_L$ (ns)	Typical Transition Time $T_t$ (ps)	Type No.	Package Styles ODS No.
15V	0.3	15 to 20	40 to 70	ML4402 to ML4404	30, 31, 32, 34, 43, 56, 91, 92, 96, 97, 111, 120, 144B, 148, 186
20V	0.6	20	90	ML4405	As Above.
30V	0.9	30	100	ML4406	As Above.
45V	1.7	80	150	ML4407	As Above.
60V	3.0	150	350	ML4408	30, 31, 32, 34, 43, 56, 91, 92, 111, 144B, 148
75V	5.7	400	600	ML4409	34, 43, 56, 101, 144B

**CHART III(a) CATEGORY 3 (HTRB & Power Burn-In)**

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**GALLIUM ARSENIDE MICROWAVE MULTIPLIER VARACTOR DIODES**  
Available in pill, stripline and pill-with-tabs packages

Breakdown Voltage	Typical Total Capacitance $C_T$ (at 0V) (pF)	Typical Junction Capacitance $C_T$ (at 0V) (pF)	Type No.	ESA/SCC Detail Specification No.	Package Styles ODS No.
15V	0.40 to 0.80	0.20 to 0.60	ML48701E to ML48705E	5512/010	30, 31, 36, 94, 95, 96, 97, 118, 120, 138
25V	0.40 to 0.60 0.70 to 0.80	0.20 to 0.40 0.50 to 0.60	ML48706C to ML48708C ML48709B to ML48710B	5512/011 5512/011	As Above.

**CHART III(a) CATEGORY 1 (HTRB only)**

**SILICON MICROWAVE LIMITER DIODES**  
Available in pill, stripline and pill-with-tabs packages

Breakdown Voltage	Typical Junction Capacitance $C_j$ (at 0V) (pF)	Typical Minority Carrier Lifetime $T_L$ (ns)	Type No.	ESA/SCC Detail Specification No.	Package Styles ODS No.
15V	0.30 0.2 0.10	15 15 10	ML4202 ML4204 ML4206	5513/001 5513/001 5513/001	30, 31, 32, 34, 36, 43, 56, 91, 92, 94, 95, 96, 97, 101, 103, 118, 120, 128, 138, 148, 186, 255, 275, 276
50V	0.30 to 0.10	20 to 15	ML4207 to ML4209	5513/007	As Above.

**CHART III(a) CATEGORY 3 (HTRB & Power Burn-In)**

**SILICON MICROWAVE P.I.N. DIODES (NORMAL POLARITY)**

Available in pill, stripline and pill-with-tabs packages

Breakdown Voltage	Typical Total Capacitance C <sub>j</sub> (at -10V) (pF)	Typical Minority Carrier Lifetime T <sub>L</sub> (ns)	Type No.	ESA/SCC Detail Specification No.	Package Styles ODS No.
15V	0.15	10	ML4610	5513/009	30,31,32,34,36,43,56,91,92,94,95,97,101,103,118,120,128,138,148,186,255,275,276
40V	0.10 to 0.2	20	ML4611 to ML4612	5513/010	As above.
70V	0.10 to 0.2	60	ML4614 to ML4615	5513/010	As above.
100V	0.10 to 0.30	120	ML4617 to ML4619	5513/009	As above.
150V	0.10 to 0.30	250	ML4622 to ML4624	5513/014	As above.
200V	0.10 to 0.30	500	ML4627 to ML4629	5513/015	As above.
300V	0.10 to 0.20 0.30 to 0.50	500 to 800 1000 to 1000	ML4640 to ML4641 ML4642 to ML4643	5513/012 5513/012	30,31,32,34,36,43,56,91,92,101,103,186,255 30,31,32,34,36,43,56,91,92,101,103,255
400V	0.1 0.20 to 0.30 0.5	1000 1500 to 2000 2000	ML4644 ML4645 to ML4646 ML4647	5513/012 5513/012 5513/012	30,31,32,34,36,43,56,91,92,101,103,186,255 30,31,32,34,36,43,56,91,92,101,103,186,255 36,43,56,101
500V	0.1 0.20 to 0.30 0.5	1000 1500 to 2000 2000	ML4648 ML4649 to ML4650 ML4651	5513/013 5513/013 5513/013	30,31,32,34,36,43,56,91,92,101,103,186,255 30,31,32,34,36,43,56,91,92,101,103,186,255 36,43,56,101
600V	0.1 0.20 - 0.30 0.5	1500 2000 to 3000 3000	ML4652 ML4653 to ML4654 ML4655	5513/013 5513/013 5513/013	30,31,32,34,36,43,56,91,92,101,103,186,255 30,31,32,34,36,43,56,91,92,101,103,186,255 36,43,56,101

**CHART III(a) CATEGORY 3 (HTRB & Power Burn-In)**

**SILICON MICROWAVE P.I.N. DIODES (REVERSE POLARITY)**

Available in pill, stripline and pill-with-tabs packages

Breakdown Voltage	Typical Junction Capacitance C <sub>T</sub> (at -10V) (pF)	Typical Minority Carrier Lifetime T <sub>L</sub> (ns)	Type No.	ESA/SCC Detail Specification No.	Package Styles ODS No.
15V	0.20	10	ML4609	5513/008	30,31,32,34,36,43,56,91,92,94,95,96,97,101,103,118,120,128,138,148,186,255,275,276
40V	0.10 to 0.20 0.20	20 20	ML4611P to ML4612P ML4613	5513/020 5513/008	As Above.
70V	0.10 to 0.20 0.20	60 60	ML4614P to ML4615P ML4616	5513/020 5513/008	As Above.
100V	0.10 to 0.30 0.20 to 0.30	120 120	ML4617P to ML4619P ML4620 to ML4621	5513/002 5513/011	As Above.
150V	0.10 to 0.30 0.20 to 0.30	250 250	ML4622P to ML4624P ML4625 to ML4626	5513/018 5513/011	As Above.
200V	0.10 to 0.30 0.20 to 0.30	400 400	ML4627P to ML4629P ML4630 to ML4631	5513/019 5513/003	As Above.

**CHART III(a) CATEGORY 3 (HTRB & Power Burn-In)**

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**SILICON MICROWAVE P.I.N. DEVICES - GLASS ENCAPSULATED**

Breakdown Voltage	Typical Junction Capacitance C <sub>j</sub> (at -10V) (pF)	Typical Minority Carrier Lifetime T <sub>L</sub> (ns)	Type No.	ESA/SCC Detail Specification No.	Package Styles ODS No.
35V	0.10 to 1.05	150	ML4603 to ML4605	5513/004	54
100V	0.10 to 1.05	350	ML4606 to ML4608	5513/004	54

**CHART III(a) CATEGORY 3 (HTRB & Power Burn-In)**

**SILICON MICROWAVE P.I.N. DIODES - BROADBAND**  
**Available in stripline and module packages (ODS 116 & ODS 144)**

Frequency Range 0.1 to 12GHz  
 \*Extended Frequency Range 0.1 to 18GHz

Breakdown Voltage	Typical Insertion Loss (dB)	Typical Isolation (dB)	Typical Minority Carrier Lifetime T <sub>L</sub> (ns)	Type No.	ESA/SCC Detail Specification No.
15V	1.0	25	15	ML4660*	5513/005
40V	0.5	25	25	ML4661 ML4661P ML4662	5513/005 5513/016 5513/016
70V	0.5	25	80	ML4663 ML4663P ML4664	5513/005 5513/016 5513/016
100V	0.5	25	150	ML4665 ML4665P ML4666	5513/005 5513/016 5513/016
150V	0.5	25	250	ML4667 ML4667P ML4668	5513/005 5513/016 5513/016
200V	0.7	25	400	ML4669 ML4669P ML4670	5513/005 5513/016 5513/016
300V to 600V	0.7 to 1.0	25	600 to 2400	ML4671 to ML4674	5513/005

**CHART III(a) CATEGORY 3 (HTRB & Power Burn-In)**

**GALLIUM ARSENIDE MICROWAVE GUNN DIODES**  
Available in pill packages only

<b>Operating Frequency</b>	<b>Minimum Output Power Po (mW)</b>	<b>Maximum Operating Current I<sub>op</sub> (mA)</b>	<b>Type No.</b>	<b>ESA/SCC Detail Specification No.</b>	<b>Package Styles ODS No.</b>
5 to 8GHz	100 to 250 500	500 to 700 1500	ML4901 to ML4902 ML4910	5511/002 5511/002	30, 111, 118, 148, 275
8 to 12.4GHz	100 to 250 500	650 to 1050 1500	ML4903 to ML4904 ML4911	5511/002 5511/002	As Above.
12.4 to 18.0GHz	100 to 250	750 to 1050	ML4905 to ML4906	5511/002	As Above.
18.0 to 22.0GHz	250 to 50	1700 to 800	ML4921 to ML4923	5511/001	111, 118, 138, 275
22.0 to 27.0GHz	250 to 50	1700 to 800	ML4931 to ML4933	5511/001	As Above.
27.0 to 32.0GHz	200 to 50	1700 to 800	ML4941 to ML4943	5511/001	As Above.
32.0 to 40.0GHz	150 to 50	1700 to 800	ML4951 to ML4953	5511/001	118, 138, 275
40.0 to 50.0GHz	100 to 50	1700 to 800	ML4961 to ML4963	5511/001	As Above.
50.0 to 60.0GHz	60 to 30	1700 to 800	ML4971 to ML4973	5511/001	As Above.
90.0 to 100.0GHz	5 to 15	1100 to 1500	ML4981 to ML4983	5511/001	As Above.

**CHART III(a) CATEGORY 2 (Power Burn-In Only)**

**SILICON MICROWAVE SCHOTTKY MIXER DIODES (MEDIUM BARRIER)**

Available in pill, stripline and pill-with-tabs packages

Test Frequency	Maximum Total Capacitance $C_T$ (at 0V) (pF) (ODS 119)	Maximum Noise Figure N.F. (dB)	Type No.	ESA/SCC Detail Specification No.	Package Styles ODS No.
3.000 GHz	0.77	7.0 to 6.0	ML40019 to ML40021	5513/006	118, 119, 120, 148, 186, 255, 275, 276
9.375 GHz	0.42	6.5 to 7.5	ML40150 to ML40152	5513/006	As above
16.000 GHz	0.37	7.0 to 7.5	ML40160 to ML40161	5513/006	As above

**CHART III(a) CATEGORY 3 (HTRB & Power Burn-In)****GALLIUM ARSENIDE MICROWAVE SCHOTTKY MIXER DIODES**

Available in pill, stripline and pill-with-tabs packages

Test Frequency	Maximum Total Capacitance $C_T$ (at 0V) (pF) (ODS 119)	Noise Figure N.F. (dB) Typ Max	Type No.	ESA/SCC Detail Specification No.	Package Styles ODS No.
9.375 GHz	0.31	5.0 to 6.5	ML40461	5513/021	118, 119, 120, 148, 186, 255, 275, 276
16.000 GHz	0.31	5.5 to 7.0	ML40462	5513/021	As above
24.000 GHz	0.29	6.5 to 7.5	ML40463	5513/021	As above
36.000 GHz	0.28	7.0 to 7.5	ML40464	5513/021	As above

**CHART III(a) CATEGORY 3 (HTRB & Power Burn-In)**



**TEST AND ACCEPTANCE SCHEDULES**

Charts II, III(a) and V have been derived from the European Space Agency/Space Components Coordination Group (ESA/SCC) test schedules for Production, Burn-In and Electrical Measurements and Lot Acceptance respectively. The paragraph numbers relate to the paragraph numbers in the ESA/SCC Generic Specification No. 5010.

**CHART II FINAL PRODUCTIONS TESTS**

<b>Scanning Electron Microscope (S.E.M.) Inspection (Sample)</b>	
<b>Radiation Test (Sample) (1)</b>	
<b>Para. 9.1.</b>	<b>100% Internal Visual Inspection</b>
<b>Para. 9.2.1.</b>	<b>Bond Strength Test (Sample)</b>
<b>Para. 9.2.2.</b>	<b>Die Sheat Test (Sample)</b>
<b>Para. 9.3.</b>	<b>Encapsulation</b>
<b>Para. 9.4.</b>	<b>High Temperature Stabilisation Bake</b>
<b>Para. 9.9.3.</b>	<b>Electrical Measurements at Room Temperature</b>
<b>Para. 9.5.</b>	<b>Thermal Shock</b>
<b>Para. 9.6.</b>	<b>Constant Acceleration</b>
<b>Para. 9.7.</b>	<b>PIND Test (2)</b>
<b>Para. 9.8.1.</b> <b>Para. 9.8.2.</b>	<b>Seal Test, Fine Leak Seal Test, Gross Leak</b>
<b>Para. 9.9.3.</b>	<b>Electrical Measurements at Room Temperature</b>
<b>Para. 7.1.1.(b) &amp; Para. 9.2.2.</b>	<b>Pre-burn-in (168 hrs max)</b>
<b>Para. 9.9.3.</b>	<b>Electrical Measurements at Room Temperature</b>
<b>Para. 9.9.2.</b>	<b>Electrical Measurements at High Temperature</b>
<b>Para. 4.4.</b>	<b>Marking (plus Serialisation for Level 'B' only)</b>
<b>Para. 9.10.</b>	<b>External Visual Inspection: Sampling AQL 1%, Level II</b>
<b>Para. 9.11.</b>	<b>Dimensions Check</b>

**NOTES**

1. If specified on purchase order.
2. for all cavity devices of Testing Level 'B' except diodes with transparent packages.

**To Chart III**

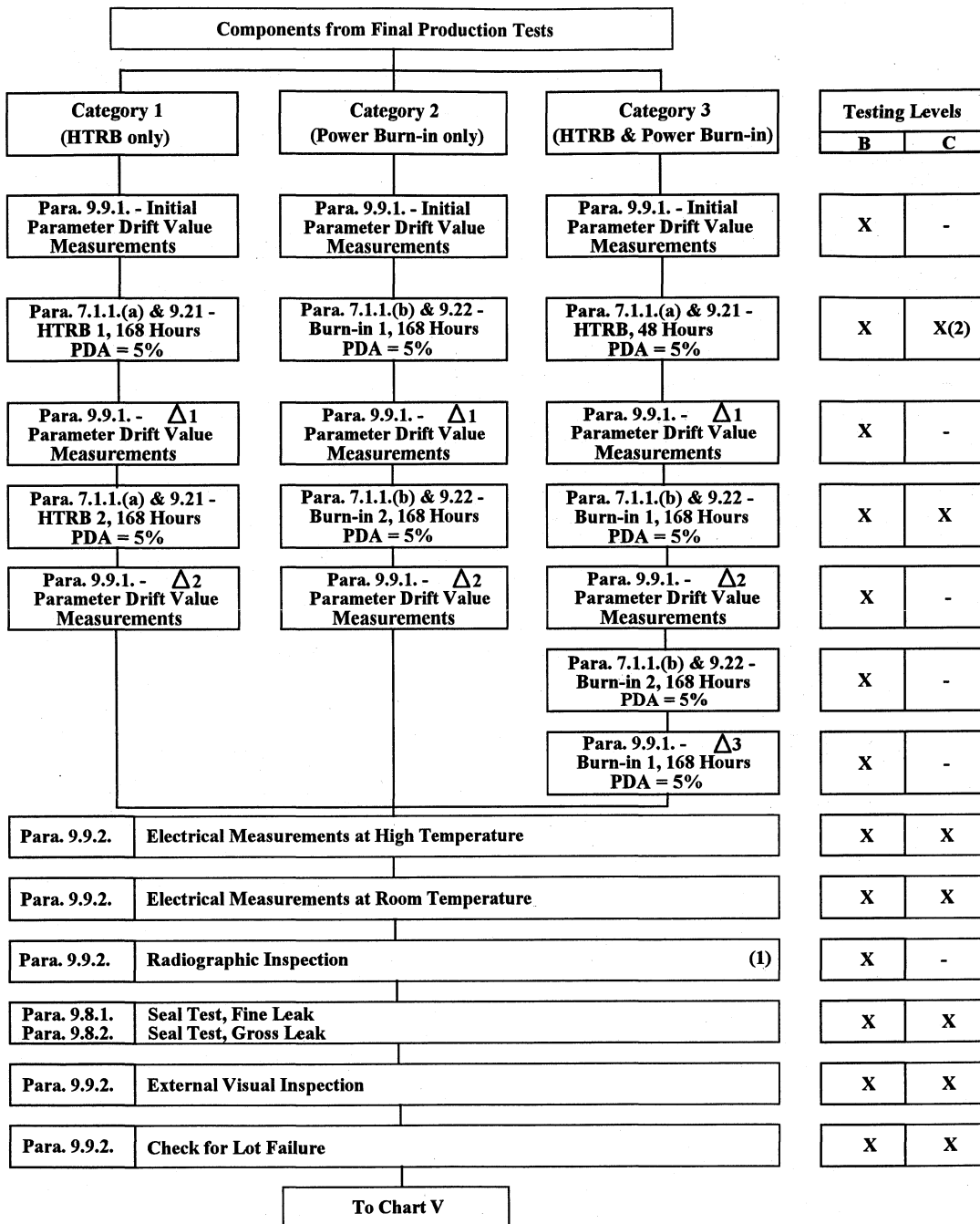
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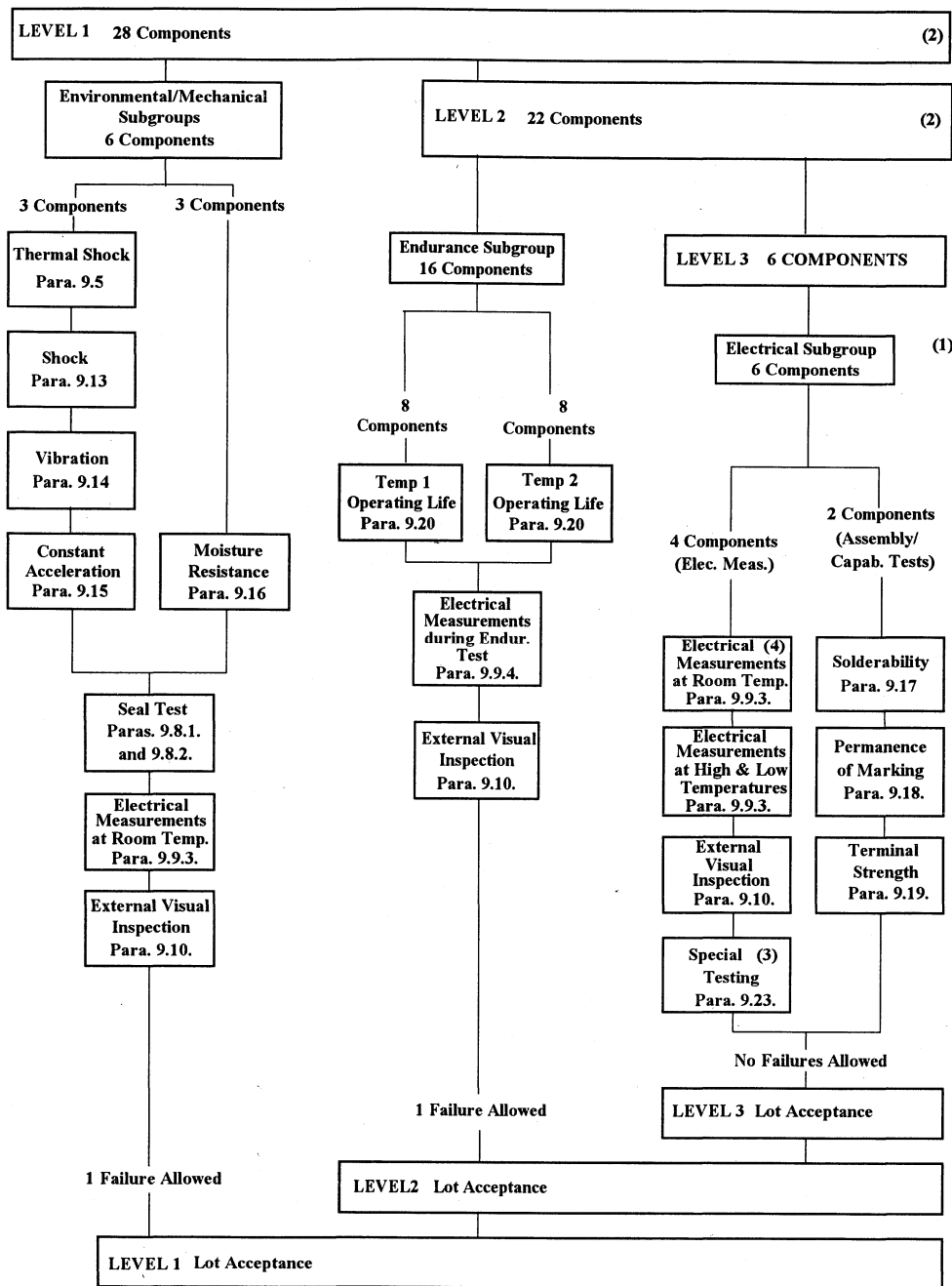
**CHART III(a) BURN IN AND ELECTRICAL MEASUREMENTS FOR MICROWAVE DIODES**



**NOTES**

1. Except diodes with transparent packages.

**CHART V - LOT ACCEPTANCE TESTS**



**NOTES**

1. These parts may be electrical rejects.
2. For distribution within the sample, see Para. 8.2.2.
3. If no special testing is specified in the Detail Specification, these parts are deliverable.
4. If the a.c. measurements of Chart III(a) are witnessed by the Orderer, then they need not be repeated here. d.c. measurements shall be performed.

## MICROWAVE COMPONENTS

The following M/A-COM products are suitable for space applications and many have received project-related approvals:

- Thin Film Circuits
- Packaged MMIC Assemblies
- Ferrite Isolators and Circulators
  - Microstrip Compatible Drop-in
  - Coaxial
  - Waveguide
- Control Components
  - PIN Diode Switches
  - MMIC Switch Modules
  - Phase Shifters
  - Attenuators
  - Limiters
- Mixer Modules
- Detectors
- Amplifiers
- Oscillators
- Integrated Assemblies

Standard electrical specifications for these components are shown in the preceding sections of this catalogue.

For more details on the qualification status of these parts please contact the factory.

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