

Digital Attenuator

31.0 dB, 5-Bit, TTL Driver, DC-3.0 GHz

Rev. V14

Features

- Attenuation: 1.0dB Steps to 31dB
- Single Positive Supply
- Contains internal DC to DC converter
- Low DC Power Consumption
- Small Footprint, JEDEC Package
- Integral TTL Driver
- 50 ohm Impedance
- CSP-1 Package

Description

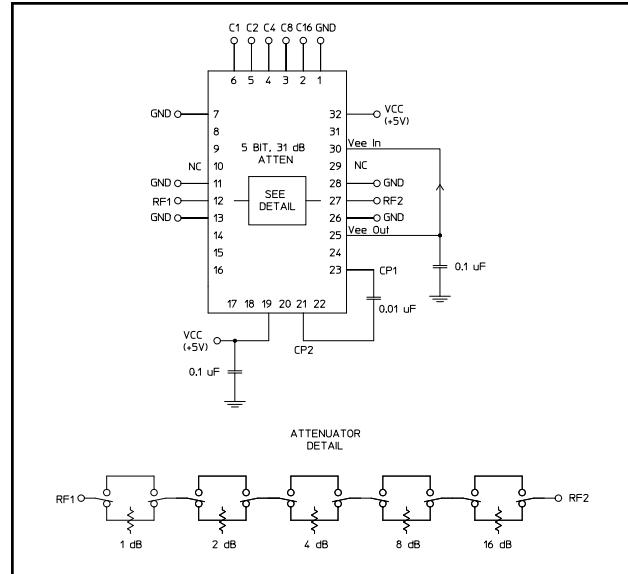
M/A-COM's AT90-1263 is a GaAs FET 5-bit digital attenuator with integral TTL driver. Step size is 1.0 dB providing 31 dB total attenuation range. This device is in an FQFP-N plastic surface mount package. The AT90-1263 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required. For dual supply designs without DC-DC converter noise, use AT90-0263.

Ordering Information

Part Number	Package
AT90-1263	Bulk Packaging
AT90-1263TR	1000 piece reel
AT90-1263-TB	Sample Test Board

Note: Reference Application Note M513 for reel size information.

Functional Schematic



Pin Configuration

Pin No.	Function	Pin No.	Function
1	GND	17	NC
2	C16	18	NC
3	C8	19	Vcc
4	C4	20	NC
5	C2	21	CP2
6	C1	22	NC
7	GND	23	CP1
8	NC	24	NC
9	NC	25	Vee ²
10	NC ¹	26	GND
11	GND	27	RF2
12	RF1	28	GND
13	GND	29	NC ¹
14	NC	30	Vee ²
15	NC	31	NC
16	NC	32	Vcc

1. Pins 10 & 29 must be isolated
2. The negative voltage Vee is produced internally and requires a 0.1 μ F cap to GND. Generated noise is typical of switching DC-DC Converters.
3. The exposed pad centered on the package bottom must be connected to RF and DC ground. (For PQFN Packages)

- **North America** Tel: 800.366.2266
- **Europe** Tel: +353.21.244.6400
- **India** Tel: +91.80.4155721
- **China** Tel: +86.21.2407.1588

Visit www.macomtech.com for additional data sheets and product information.

M/A-COM Technology Solutions Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Digital Attenuator

31.0 dB, 5-Bit, TTL Driver, DC-3.0 GHz

Rev. V14

Electrical Specifications: $T_A = 25^\circ\text{C}$, $Z_0 = 50\Omega$

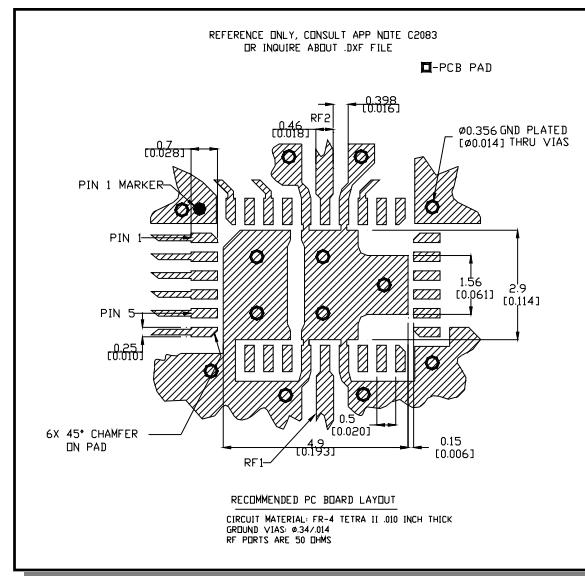
Parameter	Test Conditions	Frequency	Units	Min	Typ	Max
Insertion Loss	—	DC - 3.0 GHz	dB	—	3.5	3.8
Attenuation Accuracy	Individual Bits 1-2-4-8-16 dB	DC - 3.0 GHz	dB	—	—	$\pm(3 + 5\%)$ of atten setting
	Any Combination of Bits 1 to 31 dB	DC - 3.0 GHz	dB	—	—	$\pm(5 + 7\%)$ of atten setting
VSWR	Full Range	DC - 3.0 GHz	Ratio	—	2.0:1	2.2:1
Switching Speed	50% Cntl to 90%/10% RF 10% to 90% or 90% to 10%	— —	ns ns	— —	75 20	150 50
1 dB Compression	— —	50 MHz 0.5 - 3.0 GHz	dBm dBm	— —	+21 +24	— —
Input IP ₃	Two-tone inputs up to +5 dBm	50 MHz	dB	—	+35	—
		0.5-3.0 GHz	dB	—	+48	—
V _{cc}	—	—	V	4.75	5.0	5.25
V _{IL} V _{IH}	LOW-level input voltage HIGH-level input voltage	— —	V	0.0 2.0	— —	0.8 5.0
lin (Input Leakage Current)	V _{in} = V _{cc} or GND	—	uA	-1.0	—	1.0
I _{cc} ⁴	V _{cc} min to max, Logic "0" or "1"	—	mA	—	6	10
Turn-on Current ⁵	For guaranteed start-up	—	mA	—	—	125
ΔI _{cc} (Additional Supply Current Per TTL Input Pin)	V _{cc} = Max, V _{ctrl} = V _{cc} - 2.1 V	—	mA	—	—	1.0
Switching Noise	Generated from DC-DC Converter with recommended capacitors	3.5 MHz	dBm	—	-93	—
Thermal Resistance θ _{jc}	—	—	°C/W	—	35	—

- During turn-on, the device requires an initial start up current (I_{cc}) specified as "Turn-on Current". Once operational, I_{cc} will drop to the specified levels.
- The DC-DC converter is guaranteed to start in 100 μs as long as the power supplies have the maximum turn-on current available for start up.

Absolute Maximum Ratings^{6,7}

Parameter	Absolute Maximum
Max. Input Power 0.05 GHz 0.5 - 3.0 GHz	+27 dBm +34 dBm
V _{cc}	-0.5V ≤ V _{cc} ≤ +6.0V
V _{in} ⁸	-0.5V ≤ V _{in} ≤ V _{cc} + 0.5V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +125°C

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- M/A-COM does not recommend sustained operation near these survivability limits.
- Standard CMOS TTL interface, latch-up will occur if logic signal is applied prior to power supply.

Recommended PCB Configuration⁹9. Application Note S2083 is available on line at www.macom.com

ADVANCED: Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

- North America Tel: 800.366.2266
- India Tel: +91.80.4155721
- Europe Tel: +353.21.244.6400
- China Tel: +86.21.2407.1588

Visit www.macomtech.com for additional data sheets and product information.

M/A-COM Technology Solutions Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Digital Attenuator

31.0 dB, 5-Bit, TTL Driver, DC-3.0 GHz

Rev. V14

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

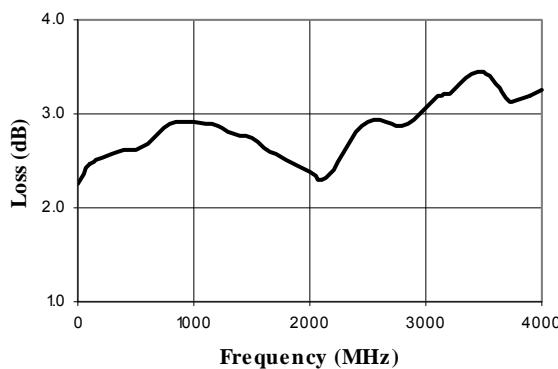
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Moisture Sensitivity

The MSL rating for this part is defined as Level 2 per IPC/JEDEC J-STD-020. Parts shall be stored and/or baked as required for MSL Level 2 parts.

Typical Performance Curves

Insertion Loss

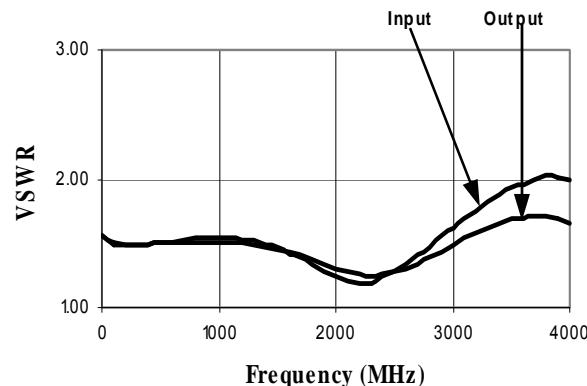


Truth Table (Digital Attenuator)

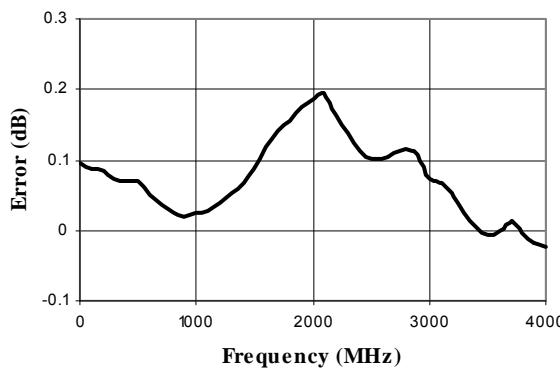
C16	C8	C4	C2	C1	Attenuation
0	0	0	0	0	Loss, Reference
0	0	0	0	1	1.0 dB
0	0	0	1	0	2.0 dB
0	0	1	0	0	4.0 dB
0	1	0	0	0	8.0 dB
1	0	0	0	0	16.0 dB
1	1	1	1	1	31.0 dB

0 = TTL Low; 1 = TTL High

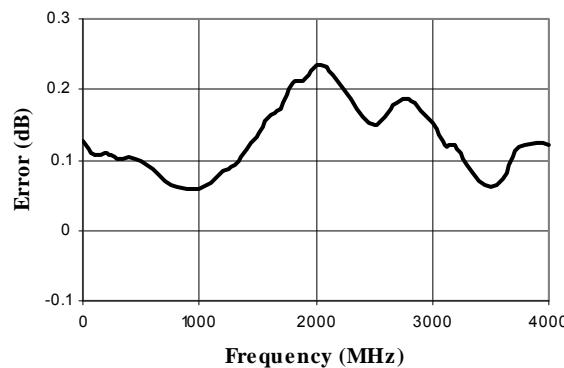
VSWR @ Insertion Loss



Attenuation Error, 1 dB Bit



Attenuation Error, 2 dB Bit



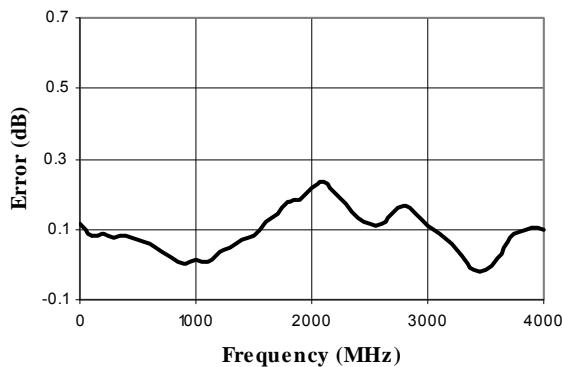
Digital Attenuator

31.0 dB, 5-Bit, TTL Driver, DC-3.0 GHz

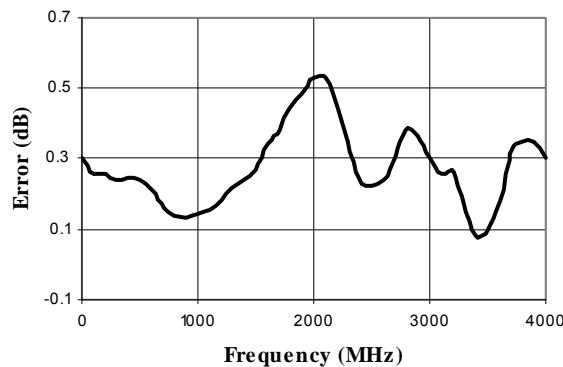
Rev. V14

Typical Performance Curves

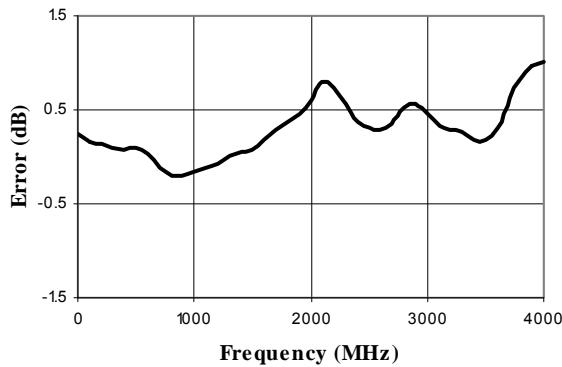
Attenuation Error, 4 dB Bit



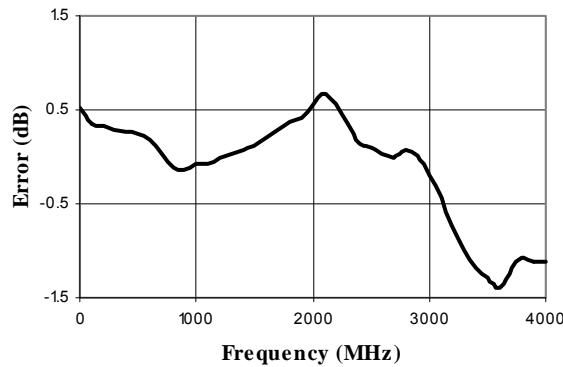
Attenuation Error, 8 dB Bit



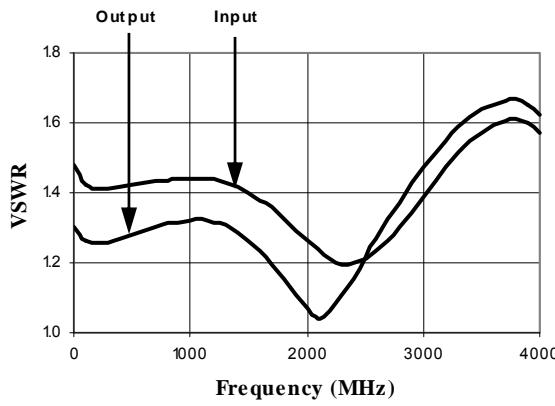
Attenuation Error, 16 dB Bit



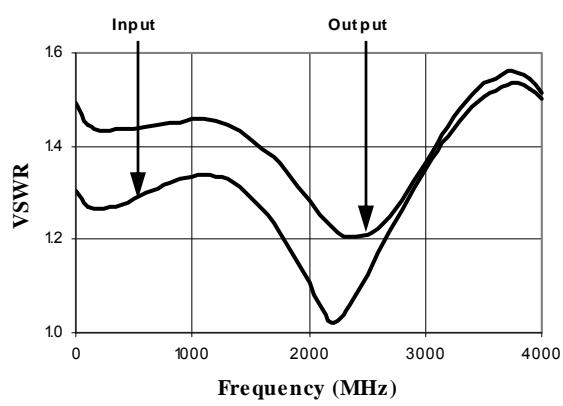
Attenuation Error, Max. Attenuation



VSWR, 1 dB Bit



VSWR, 2 dB Bit



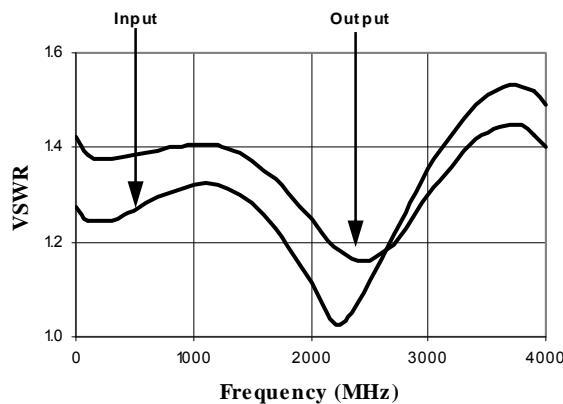
Digital Attenuator

31.0 dB, 5-Bit, TTL Driver, DC-3.0 GHz

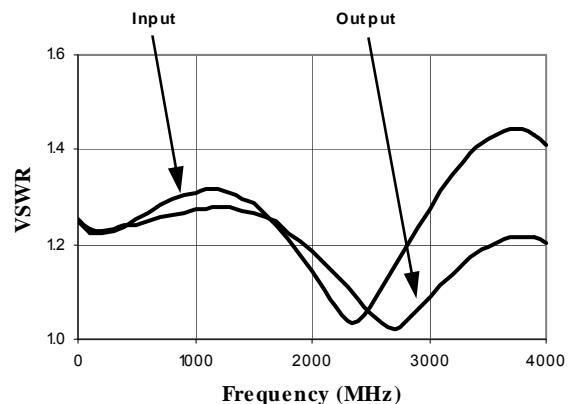
Rev. V14

Typical Performance Curves

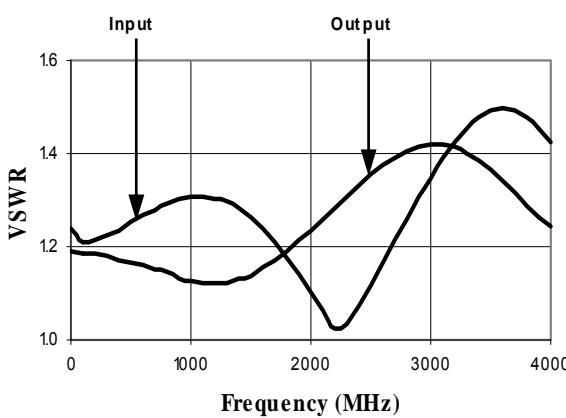
VSWR, 4 dB Bit



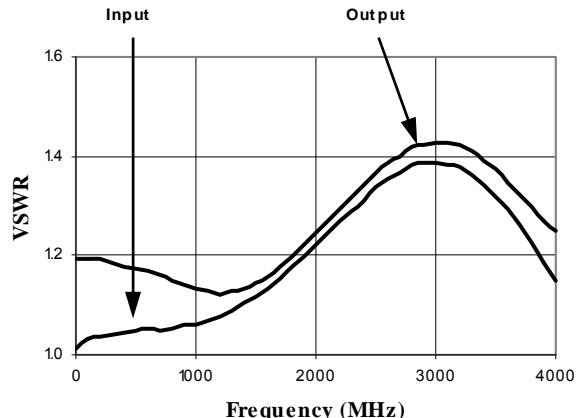
VSWR, 8 dB Bit



VSWR, 16 dB Bit



VSWR, Maximum Attenuation



ADVANCED: Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

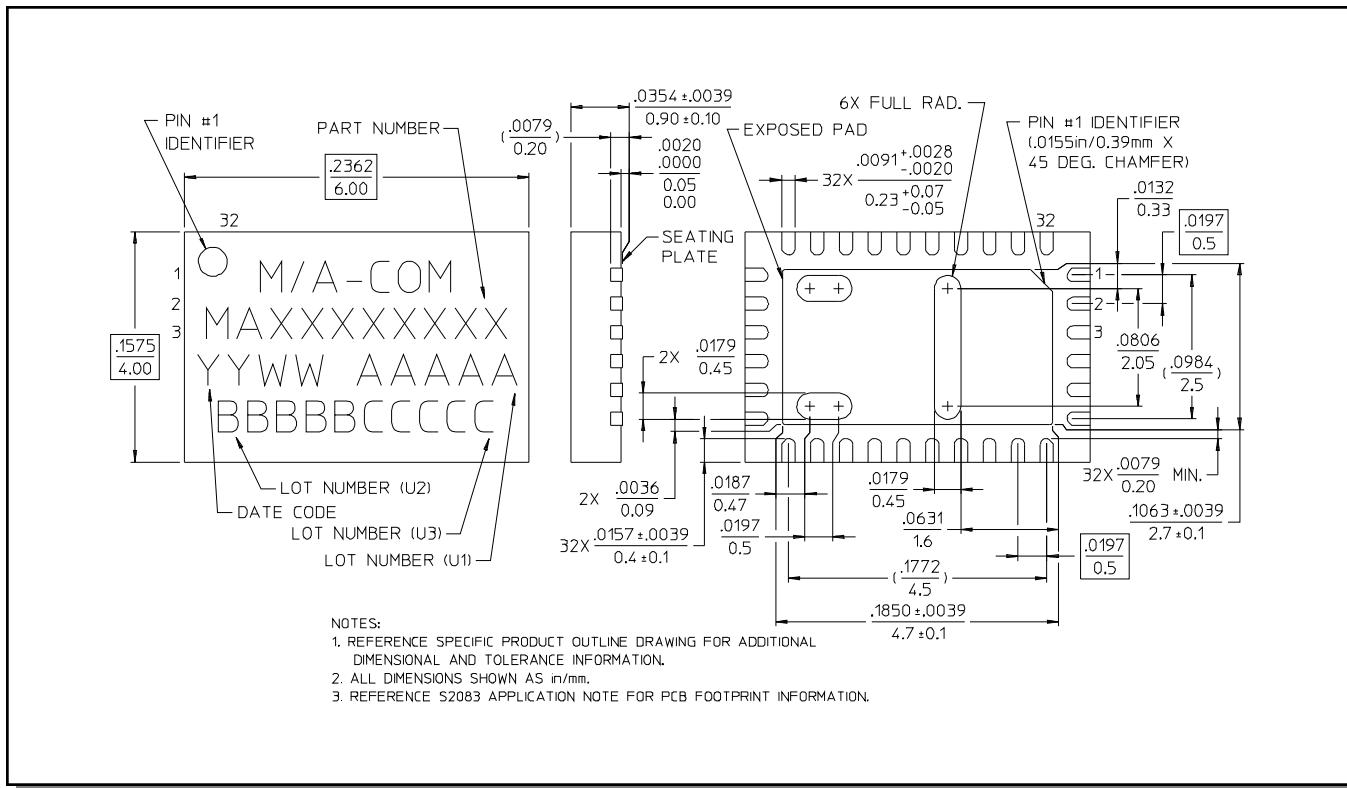
PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

- **North America** Tel: 800.366.2266
- **India** Tel: +91.80.4155721
- **Europe** Tel: +353.21.244.6400
- **China** Tel: +86.21.2407.1588

Visit www.macomtech.com for additional data sheets and product information.

M/A-COM Technology Solutions Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

CSP-1, 4 x 6 mm, 32-lead PQFN[†]



[†] Reference Application Note M538 for lead-free solder reflow recommendations.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[M/A-COM Technology Solutions:](#)

[AT90-1263TR](#)