AT90-0413

Digital Attenuator
15.0 dB, 4-Bit, TTL Driver, DC-4.0 GHz

Rev. V7

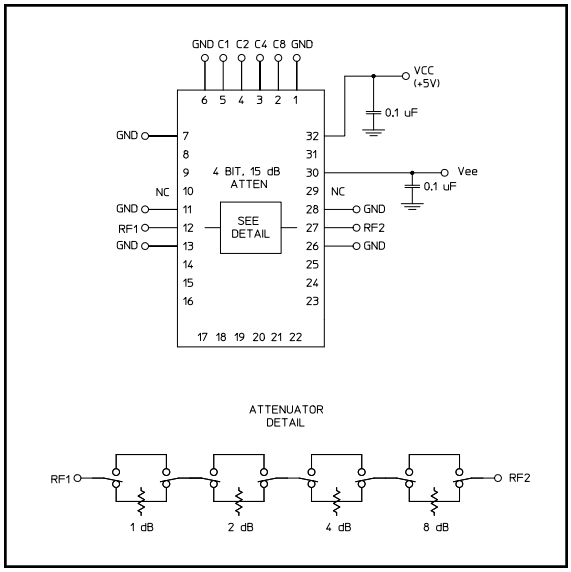
Features

- Attenuation: 1 dB Steps to 15 dB
- Low DC Power Consumption
- Small Footprint, JEDEC Package
- Integral TTL Driver
- 50 Ohm Impedance
- Test Boards Available
- Tape and Reel Packaging Available
- CSP-1 Package

Description

M/A-COM's AT90-0413 is a GaAs FET 4-Bit digital attenuator with integral driver. Step size is 1 dB providing a 15 dB attenuation range. This device is in an PQFN plastic surface mount package. The AT90-0413 is suited for applications where accuracy, fast speed, low power consumption and low costs are required.

Schematic with Off-Chip Components



Pin Configuration[2]

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

1. Pins 10 & 29 must be isolated.
2. The exposed pad centered on the package bottom must be connected to RF and DC ground. (For PQFN Packages)

Ordering Information

Part Number	Package
AT90-0413	Bulk Packaging
AT90-0413TR	1000 piece reel
AT90-0413-TB	Sample Test Board

Note: Reference Application Note M513 for reel size information.

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Electrical Specifications: T_A = 25°C

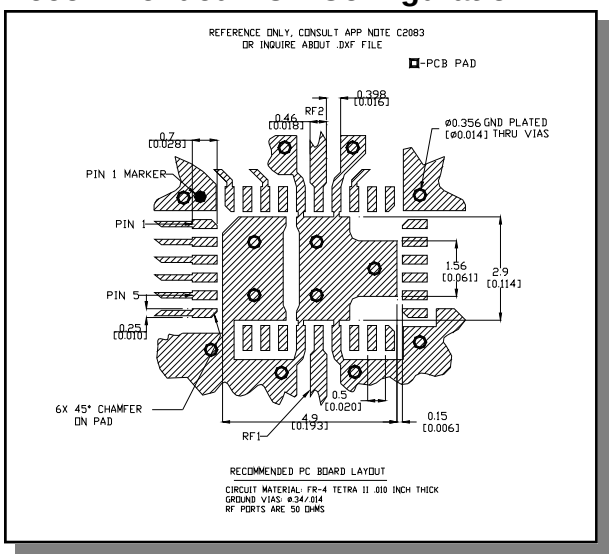
Parameter	Test Conditions	Frequency	Units	Min	Typ	Max
Insertion Loss	—	DC-2.5 GHz DC-4.0 GHz	dB dB	— —	2.0 2.5	2.5 3.0
Attenuation Accuracy	Individual Bits or Combination of Bits	DC-2.5 GHz DC-4.0 GHz	dB dB	— —	— —	±(0.3+4% of atten setting) ±(0.3+6% of atten setting)
VSWR	Full Attenuation Range	DC-2.5 GHz DC-4.0 GHz	Ratio Ratio	— —	1.5:1 1.8:1	1.8:1 2.0:1
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 0.5-4.0 GHz	dB dB	— —	+21 +29	— —
Input IP_3	Two-tone Inputs up to +5 dBm	50 MHz 0.5-4.0 GHz	dB dB	— —	+35 +48	— —
+Vcc	—	—	V	4.75	5.0	5.25
-Vee	—	—	V	-8.0	-5.0	-4.75
V_{IL} V_{IH}	LOW-level input voltage HIGH-level input voltage	— —	V V	0.0 2.0	— —	0.8 5.0
Iin (Input Leakage Current)	Vin = V_{CC} or GND	—	uA	-1.0	—	1.0
Icc (Quiescent Supply Current)	Vcntrl = V_{CC} or GND	—	uA	—	250	400
ΔIcc (Additional Supply Current Per TTL Input Pin)	V_{CC} = Max, Vcntrl = V_{CC} - 2.1 V	—	mA	—	—	1.0
I_{EE}	V_{EE} min to max, Vin = V_{IL} or V_{IH}	—	mA	-1.0	-0.2	—
Thermal Resistance θjc	—	—	°C/W	—	15	—

Absolute Maximum Ratings [3,4]

Parameter	Absolute Maximum
Max. Input Power 0.05 GHz 0.5 - 4.0 GHz	 +27 dBm +34 dBm
V_{CC}	-0.5V ≤ V_{CC} ≤ +7.0V
V_{EE}	-8.5V ≤ V_{EE} ≤ +0.5V
V_{CC} - V_{EE}	-0.5V ≤ V_{CC} - V_{EE} ≤ 14.5V
Vin[5]	-0.5V ≤ Vin ≤ V_{CC} + 0.5V
Operating Temperature	-40ºC to +85ºC
Storage Temperature	-65ºC to +125ºC

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

Recommended PCB Configuration[6]



6. Application Note S2083 is available on line at www.macom.com

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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.

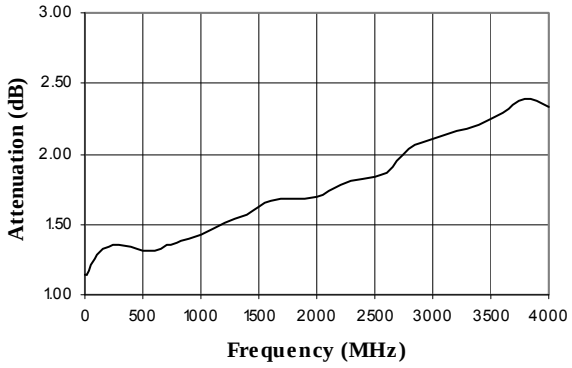
Truth Table (Digital Attenuator)

C8	C4	C2	C1	Attenuation
0	0	0	0	Loss, Reference
0	0	0	1	1.0 dB
0	0	1	0	2.0 dB
0	1	0	0	4.0 dB
1	0	0	0	8.0 dB
1	1	1	1	15.0 dB

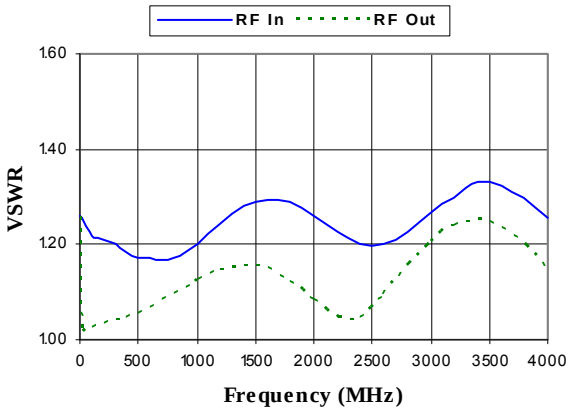
0 = TTL Low. 1 = TTL High

Typical Performance Curves

Insertion Loss



VSWR @ Insertion Loss



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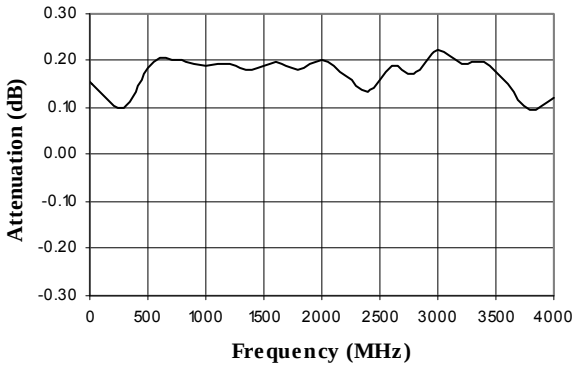
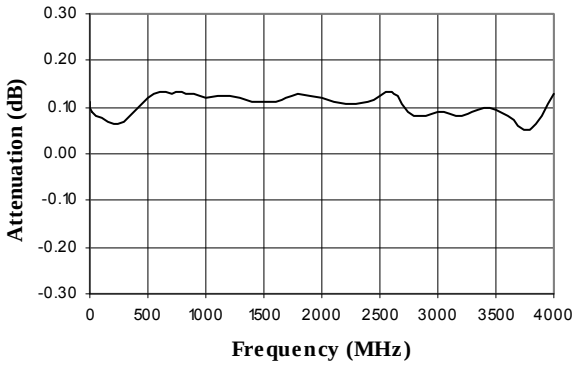
Typical Performance Curves

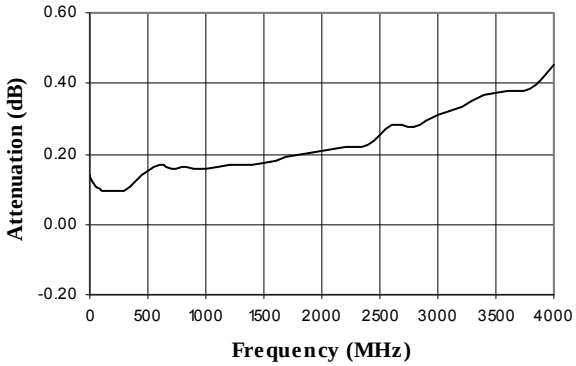
Attenuation Error, 1 dB Bit



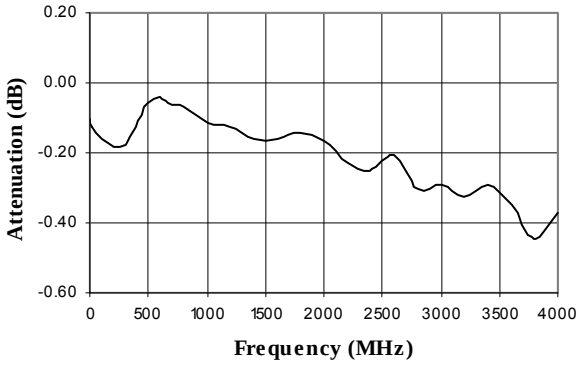
Attenuation Error, 2 dB Bit



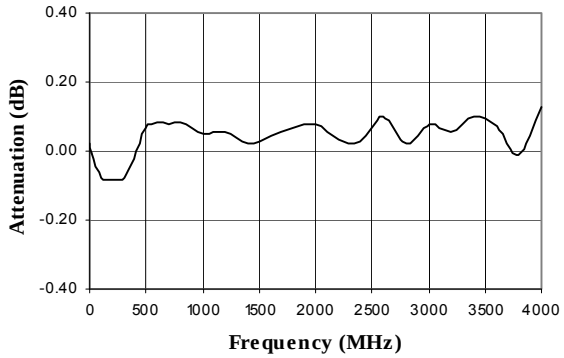
Attenuation Error, 4 dB Bit



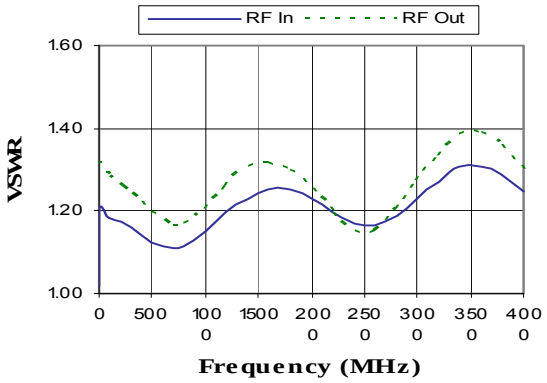
Attenuation Error, 8 dB Bit



Attenuation Error, Max. Attenuation



VSWR, 1 dB Bit



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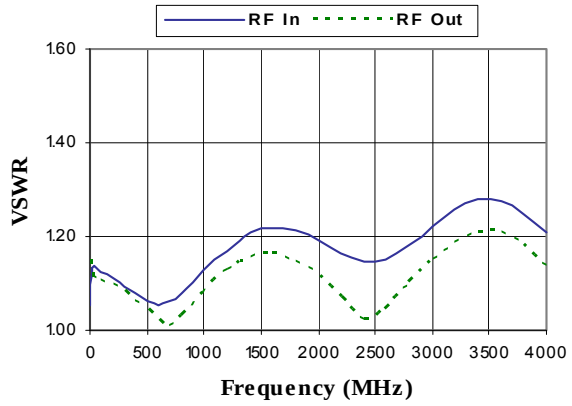
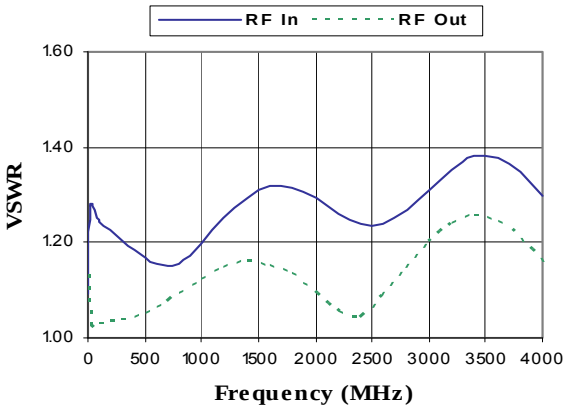
Typical Performance Curves

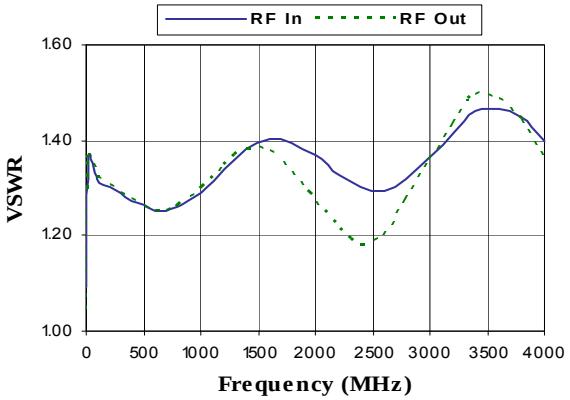
VSWR, 2 dB Bit



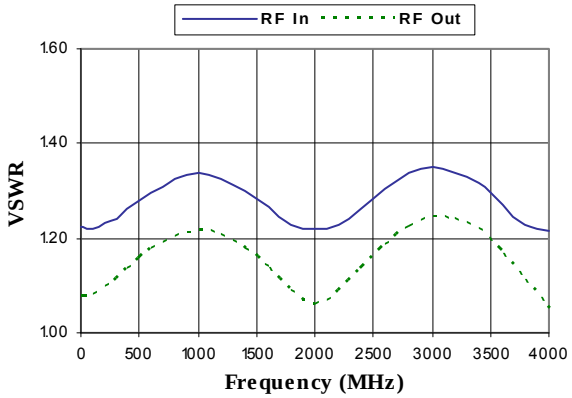
VSWR, 4 dB Bit



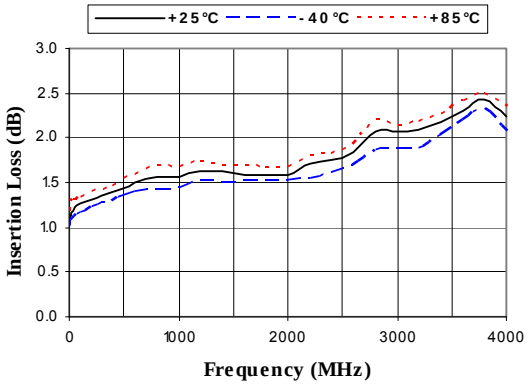
VSWR, 8 dB Bit



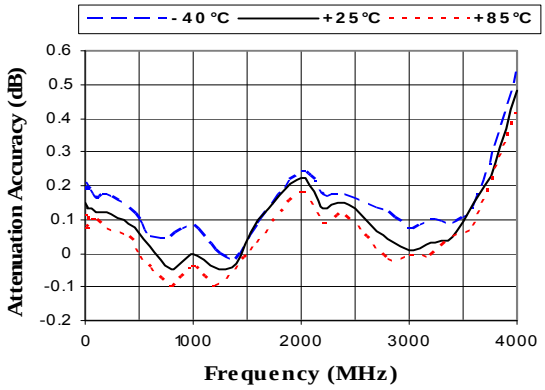
VSWR, Max. Attenuation



Insertion Loss vs. Temperature



1 dB Bit vs. Temperature



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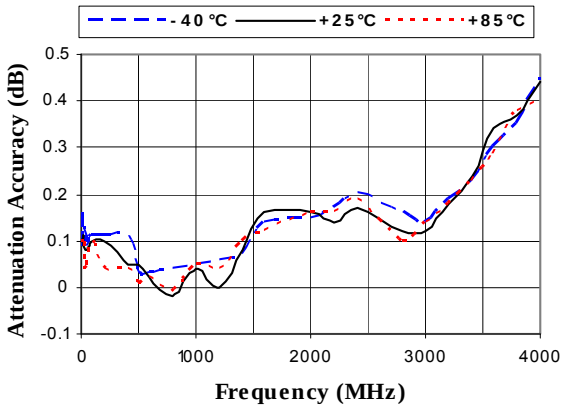
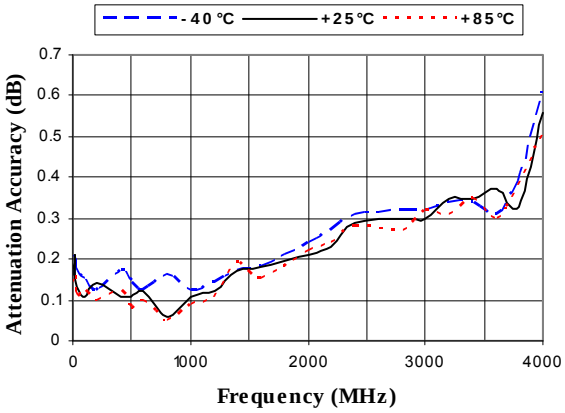
Typical Performance Curves

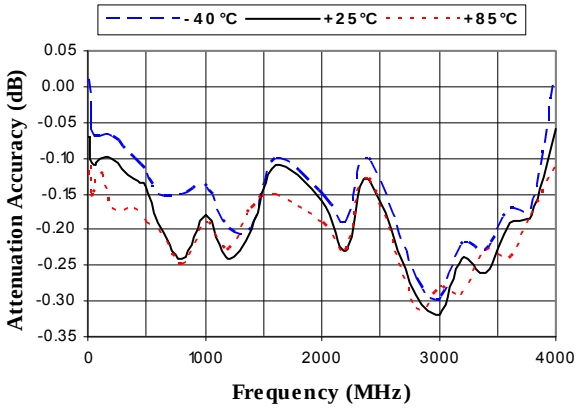
2 dB Bit vs. Temperature



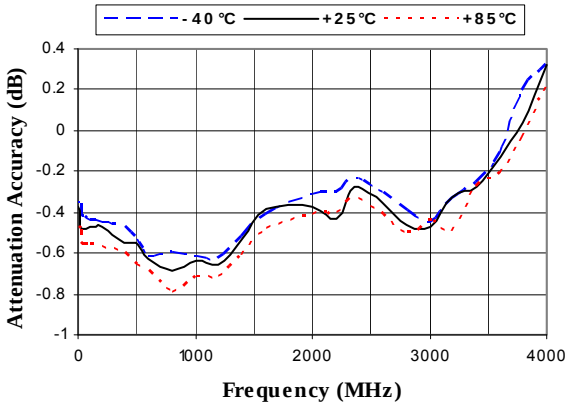
4 dB Bit vs. Temperature



8 dB Bit vs. Temperature



Max. Attenuation vs. Temperature



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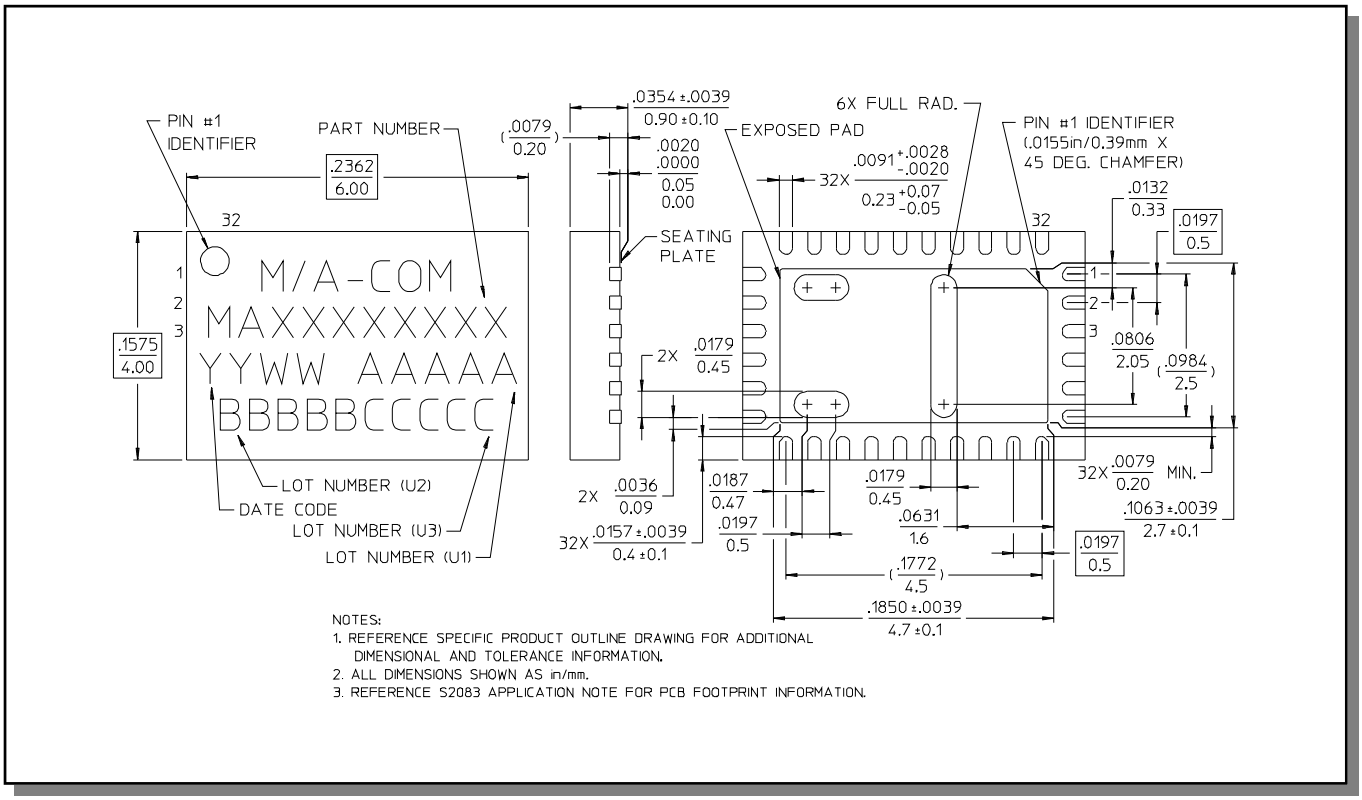
CSP-1, 4 x 6 mm, 32-lead PQFN†



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