

Gallium Arsenide CATV Integrated Amplifier Module

Features

- Specified for 79-, 112- and 132-Channel Loading
- Excellent Distortion Performance
- Higher Output Capability
- Built-in Input Diode Protection
- GaAs FET Transistor Technology
- Unconditionally Stable Under All Load Conditions
- RoHS Compliant
- In Tape and Reel. T1 Suffix = 1,000 Units per 16 mm, 13 inch Reel.

Applications

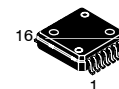
- CATV Systems Operating in the 40 to 870 MHz Frequency Range
- Output Stage Amplifier in Optical Nodes, Line Extenders and Trunk Distribution Amplifiers for CATV Systems
- Driver Amplifier in Linear General Purpose Applications

Description

- 24 Vdc Supply, 40 to 870 MHz, CATV Integrated Forward Power Doubler Amplifier Module

MMG2001NT1

**870 MHz
21 dB GAIN
132-CHANNEL
CATV INTEGRATED AMPLIFIER
MODULE**



**CASE 978-03
PFP-16**

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Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
RF Voltage Input (Single Tone)	V_{in}	+70	dBmV
DC Supply Voltage	V_{CC}	+26	Vdc
Operating Case Temperature Range	T_C	-20 to +100	°C
Storage Temperature Range	T_{stg}	-40 to +100	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	4.7	°C/W

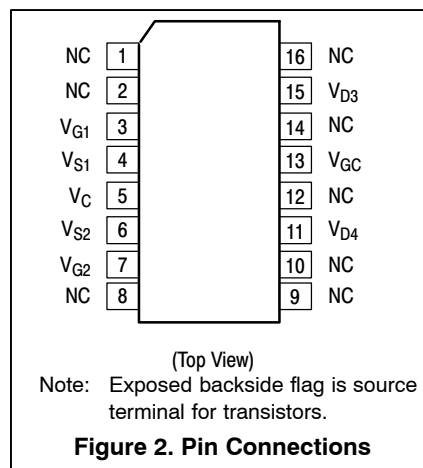
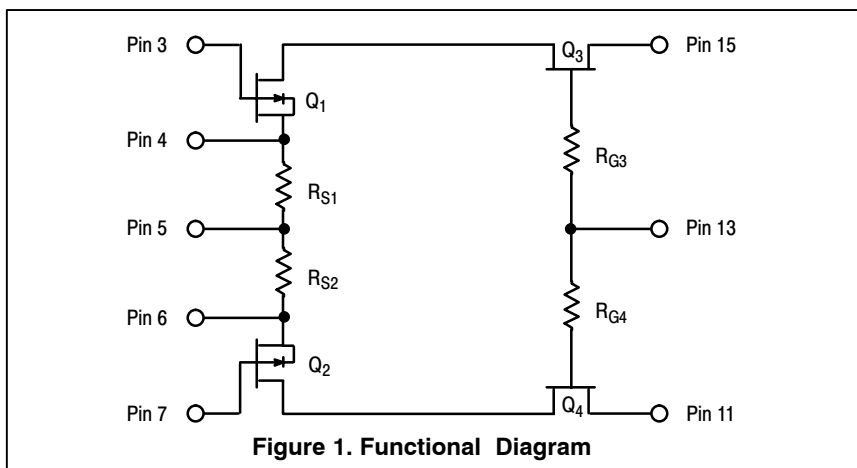


Table 3. ESD Protection Characteristics

Test Conditions	Class
Human Body Model	1 (minimum)
Machine Model	M1 (minimum)
Charge Device Model	C5 (minimum)

Table 4. Moisture Sensitivity Level

Test Methodology	Rating	Package Peak Temperature	Unit
Per JESD 22-A113, IPC/JEDEC J-STD-020	3	260	°C

Table 5. Electrical Characteristics ($V_{CC} = 24$ Vdc, $T_C = +45^\circ\text{C}$, 75 Ω system unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Frequency Range	BW	40	—	870	MHz
Power Gain	G_p	—	19	—	dB
		40 MHz	21	—	
		870 MHz	—	—	
Slope	S	—	0.8	—	dB
Gain Flatness (40 - 870 MHz, Peak to Valley)	G_F	—	0.5	—	dB
Input Return Loss ($Z_o = 75$ Ohms)	IRL	—	21	—	dB
		f = 40-160 MHz	19	—	
		f = 161-450 MHz	22	—	
		f = 451-870 MHz	—	—	
Output Return Loss ($Z_o = 75$ Ohms)	ORL	—	22	—	dB
		f = 40-400 MHz	17	—	
		f = 401-870 MHz	—	—	
Composite Second Order					dBc
($V_{out} = +48$ dBmV/ch., Worst Case)	132-Channel FLAT	CSO_{132}	—	-68	-60
($V_{out} = +48$ dBmV/ch., Worst Case)	112-Channel FLAT	CSO_{112}	—	-70	-62
($V_{out} = +48$ dBmV/ch., Worst Case)	79-Channel FLAT	CSO_{79}	—	-74	-66
($V_{out} = +56$ dBmV @ 870 MHz Equiv)	112-Channel, 12 dB Tilt	CSO_{112}	—	-63	—
($V_{out} = +56$ dBmV @ 870 MHz Equiv)	112-Channel, 13.5 dB Tilt	CSO_{112}	—	-62	—
($V_{out} = +56$ dBmV @ 870 MHz Equiv)	112-Channel, 17 dB Tilt	CSO_{112}	—	-61	—
($V_{out} = +58$ dBmV @ 870 MHz Equiv)	79-Channel, 12 dB Tilt	CSO_{79}	—	-67	—
($V_{out} = +58$ dBmV @ 870 MHz Equiv)	79-Channel, 13.5 dB Tilt	CSO_{79}	—	-72	—
($V_{out} = +58$ dBmV @ 870 MHz Equiv)	79-Channel, 17 dB Tilt	CSO_{79}	—	-71	—
Cross Modulation Distortion @ Ch 2					dBc
($V_{out} = +48$ dBmV/ch., FM = 55 MHz)	132-Channel FLAT	XMD_{132}	—	-55	-53
($V_{out} = +48$ dBmV/ch., FM = 55 MHz)	112-Channel FLAT	XMD_{112}	—	-57	-55
($V_{out} = +48$ dBmV/ch., FM = 55 MHz)	79-Channel FLAT	XMD_{79}	—	-60	-58
($V_{out} = +56$ dBmV @ 870 MHz Equiv)	112-Channel, 12 dB Tilt	XMD_{112}	—	-51	—
($V_{out} = +56$ dBmV @ 870 MHz Equiv)	112-Channel, 13.5 dB Tilt	XMD_{112}	—	-53	—
($V_{out} = +56$ dBmV @ 870 MHz Equiv)	112-Channel, 17 dB Tilt	XMD_{112}	—	-56	—
($V_{out} = +58$ dBmV @ 870 MHz Equiv)	79-Channel, 12 dB Tilt	XMD_{79}	—	-58	—
($V_{out} = +58$ dBmV @ 870 MHz Equiv)	79-Channel, 13.5 dB Tilt	XMD_{79}	—	-60	—
($V_{out} = +58$ dBmV @ 870 MHz Equiv)	79-Channel, 17 dB Tilt	XMD_{79}	—	-65	—
Composite Triple Beat					dBc
($V_{out} = +48$ dBmV/ch., Worst Case)	132-Channel FLAT	CTB_{132}	—	-56	-54
($V_{out} = +48$ dBmV/ch., Worst Case)	112-Channel FLAT	CTB_{112}	—	-60	-58
($V_{out} = +48$ dBmV/ch., Worst Case)	79-Channel FLAT	CTB_{79}	—	-66	-64
($V_{out} = +56$ dBmV @ 870 MHz Equiv)	112-Channel, 12 dB Tilt	CTB_{112}	—	-58	—
($V_{out} = +56$ dBmV @ 870 MHz Equiv)	112-Channel, 13.5 dB Tilt	CTB_{112}	—	-59	—
($V_{out} = +56$ dBmV @ 870 MHz Equiv)	112-Channel, 17 dB Tilt	CTB_{112}	—	-62	—
($V_{out} = +58$ dBmV @ 870 MHz Equiv)	79-Channel, 12 dB Tilt	CTB_{79}	—	-64	—
($V_{out} = +58$ dBmV @ 870 MHz Equiv)	79-Channel, 13.5 dB Tilt	CTB_{79}	—	-69	—
($V_{out} = +58$ dBmV @ 870 MHz Equiv)	79-Channel, 17 dB Tilt	CTB_{79}	—	-72	—
Noise Figure	NF	—	4.0	4.5	dB
		50 MHz	—	4.0	4.5
		550 MHz	—	4.0	4.5
		750 MHz	—	4.0	4.5
		870 MHz	—	4.0	4.5
DC Current ($V_{DC} = 24$ V, $T_C = 45^\circ\text{C}$)	I_{DC}	410	425	440	mA

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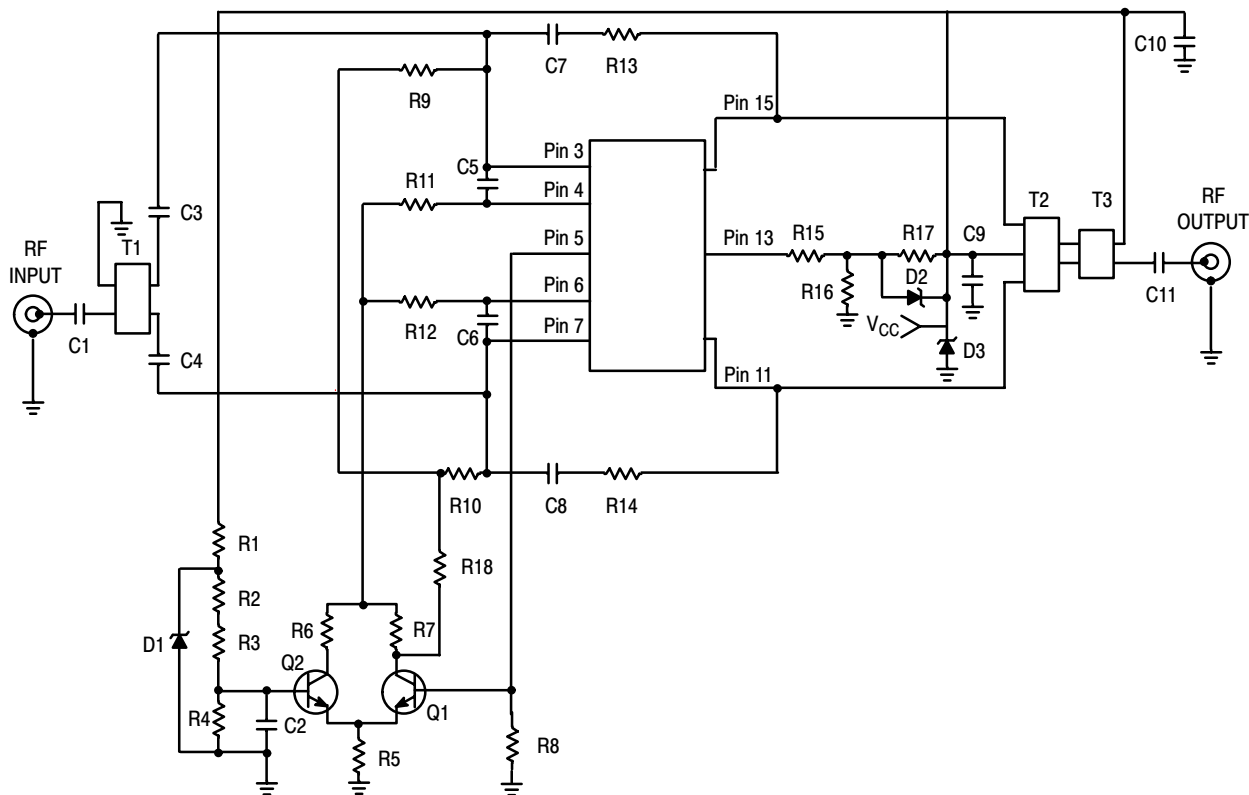
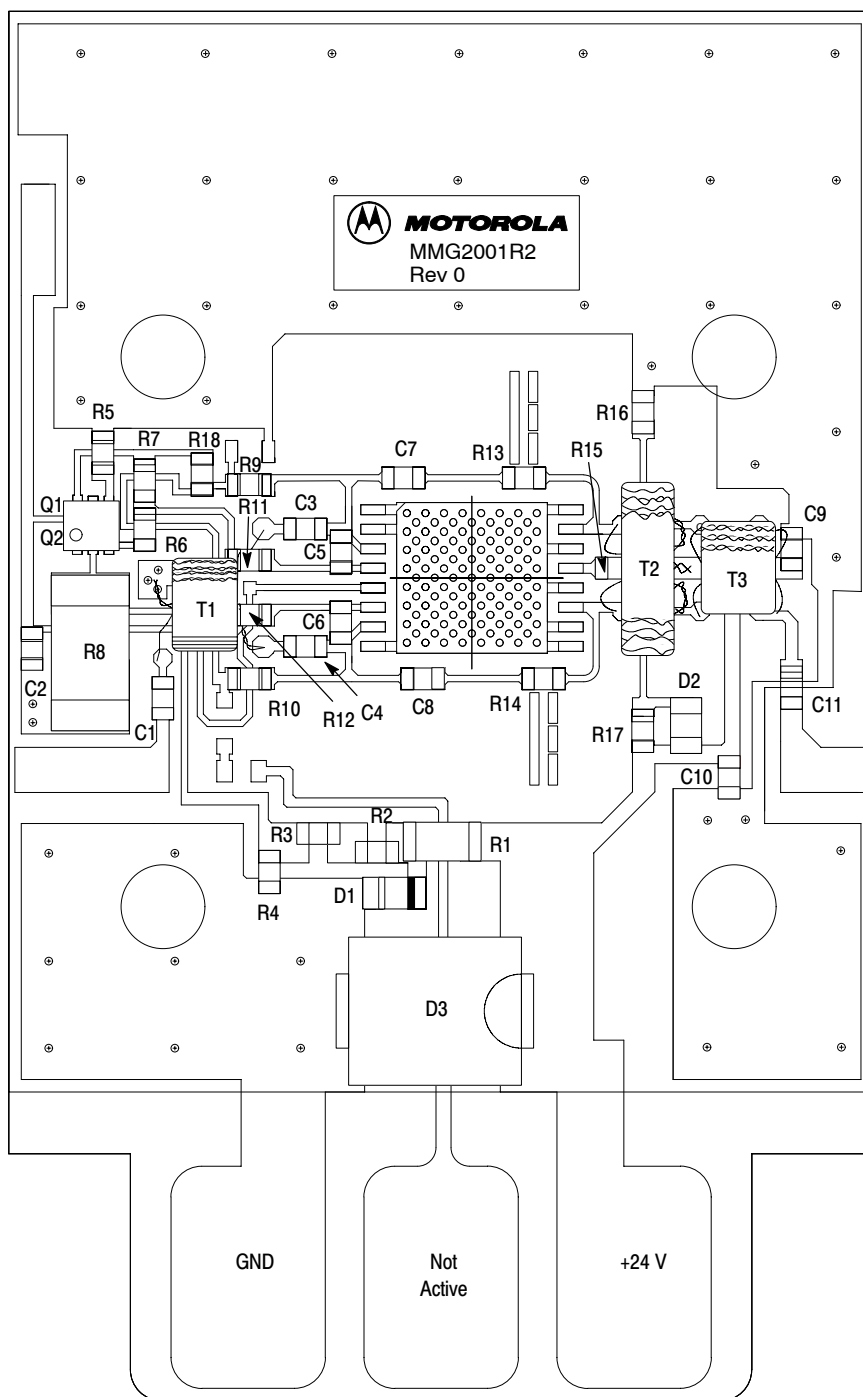


Figure 3. MMG2001NT1 50-870 MHz Test Circuit Schematic

Table 6. MMG2001NT1 50-870 MHz Test Circuit Component Designations and Values

Designation	Description	Part Number	Manufacturer
C1, C7, C8, C11	220 pF Chip Capacitors	C0603C221J5RAC	Kemet
C2, C3, C4, C9, C10	0.01 μ F Chip Capacitors	C0603C103J5RAC	Kemet
C5, C6	1.8 pF Chip Capacitors	06035J1R8BS	AVX
D1	5.1 V Zener Diode	MM3Z5V1T1G	ON Semi
D2	27 V Zener Diode	MM3Z27VT1G	ON Semi
D3	Transient Voltage Suppressor	1.5SMC27AT3G	ON Semi
Q1, Q2	Dual Transistors Package	MBT3904DW1T1G	ON Semi
R1	2.2 k Ω , 1/4 W Chip Resistor	CRCW12062201FKTA	Vishay
R2, R13, R14	680 Ω , 1/10 W Chip Resistors	CRCW06036800FKTA	Vishay
R3	180 Ω , 1/10 W Chip Resistor	CRCW06031800FKTA	Vishay
R4	1600 Ω , 1/10 W Chip Resistor	CRCW06031601FKTA	Vishay
R5	820 Ω , 1/10 W Chip Resistor	CRCW06038200FKTA	Vishay
R6	120 Ω , 1/10 W Chip Resistor	CRCW06031200FKTA	Vishay
R7	1.5 k Ω , 1/10 W Chip Resistor	CRCW06031501FKTA	Vishay
R8	8 Ω , 1 W Chip Resistor	CRCW251208R0FKTA	Vishay
R9, R10, R15	470 Ω , 1/10 W Chip Resistors	CRCW06034700FKTA	Vishay
R11, R12	18 Ω , 1/10 W Chip Resistors	CRCW06030018FKTA	Vishay
R16	2.4 k Ω , 1/10 W Chip Resistor	CRCW06032401FKTA	Vishay
R17	6.2 k Ω , 1/10 W Chip Resistor	CRCW06036201FKTA	Vishay
R18	0 Ω , 1/10 W Chip Resistor	CRCW06030000FKTA	Vishay
T1	Input Transformer	None	None
T2	Output Transformer	None	None
T3	Output Transformer	None	None
PCB	FR4, 62 mil, $\epsilon_r = 4.81$	None	None



Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 4. MMG2001NT1 50-870 MHz Test Circuit Component Layout

TYPICAL CHARACTERISTICS

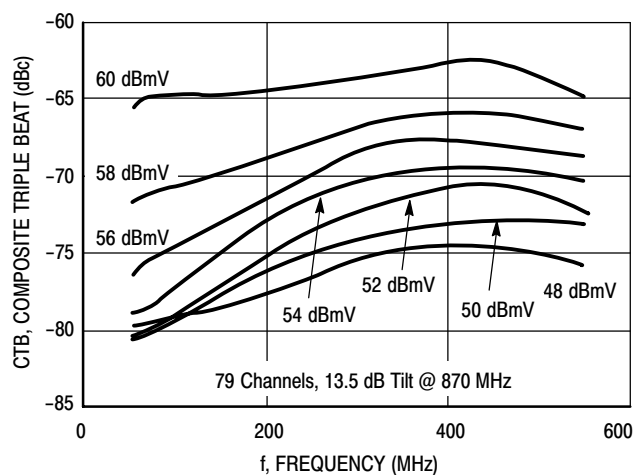


Figure 5. Composite Triple Beat versus Frequency

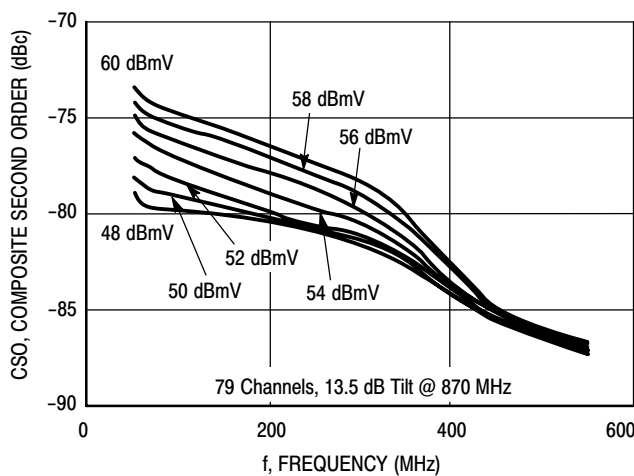


Figure 6. Composite Second Order versus Frequency

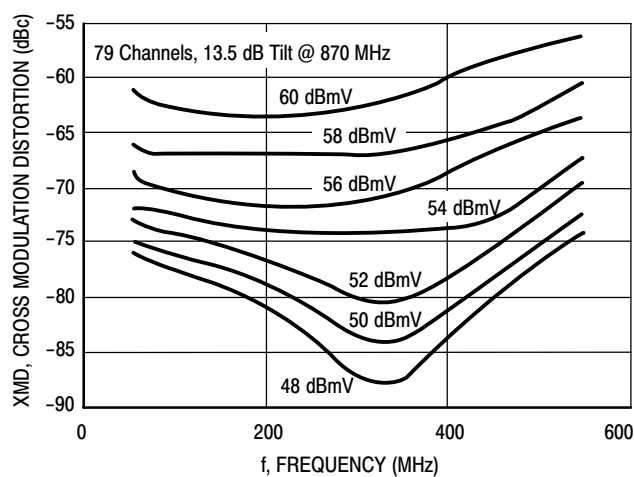
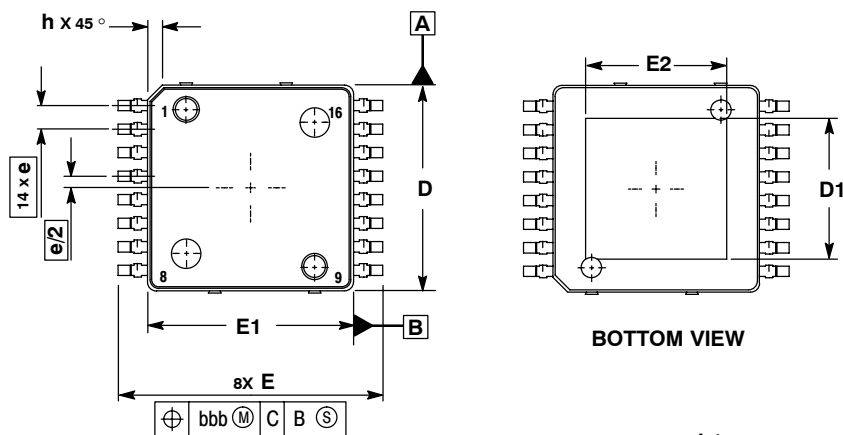


Figure 7. Cross Modulation Distortion versus Frequency

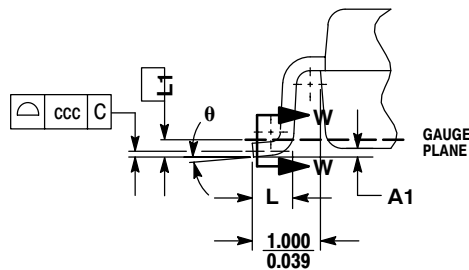
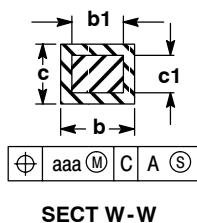
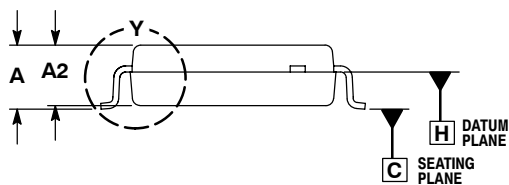
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PACKAGE DIMENSIONS



- NOTES:
1. CONTROLLING DIMENSION: MILLIMETER.
 2. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
 3. DATUM PLANE -H- IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
 4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.250 PER SIDE. DIMENSIONS D AND E1 DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE -H-.
 5. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION IS 0.127 TOTAL IN EXCESS OF THE b DIMENSION AT MAXIMUM MATERIAL CONDITION.
 6. DATUMS -A- AND -B- TO BE DETERMINED AT DATUM PLANE -H-.



DIM	MILLIMETERS	
	MIN	MAX
A	2.000	2.300
A1	0.025	0.100
A2	1.950	2.100
D	6.950	7.100
D1	4.372	5.180
E	8.850	9.150
E1	6.950	7.100
E2	4.372	5.180
L	0.466	0.720
L1	0.250 BSC	
b	0.300	0.432
b1	0.300	0.375
c	0.180	0.279
c1	0.180	0.230
e	0.800 BSC	
h	---	0.600
θ	0°	7°
aaa	0.200	
bbb	0.200	
ccc	0.100	

DETAIL Y

CASE 978-03
ISSUE C
PFP-16

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REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
5	Oct. 2006	<ul style="list-style-type: none"> • Replaced "N suffix indicates 260°C reflow capable" bullet with RoHS Compliant, p. 1
6	Mar. 2007	<ul style="list-style-type: none"> • Updated Part Numbers in Table 6, Component Designations and Values, to RoHS compliant part numbers and added Manufacturer column, p. 3

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