

Replaced by MMG2001NT1. N suffix indicates 260°C reflow capable. The PFP-16 package has had lead-free terminations from its initial release.

# 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
- In Tape and Reel. T1 Suffix = 1,000 Units per 16 mm, 13 inch Reel.

## Applications

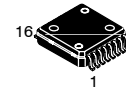
- CATV Systems Operating in the 40 to 870 MHz Frequency Range
- Output Stage Amplifier in Optical Nodes, Line Extenders and Trunk Distribution Amplifiers for CATV Systems
- Driver Amplifier in Linear General Purpose Applications

## Description

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

**MMG2001T1**

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



**CASE 978-03  
 PFP-16**

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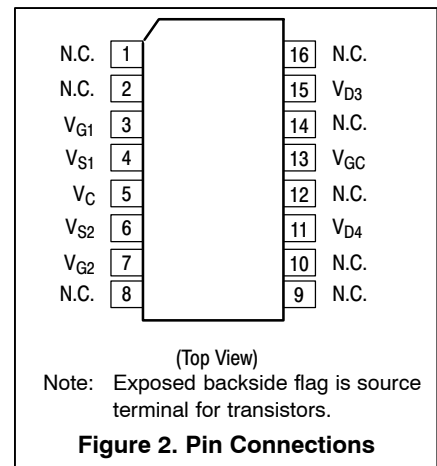
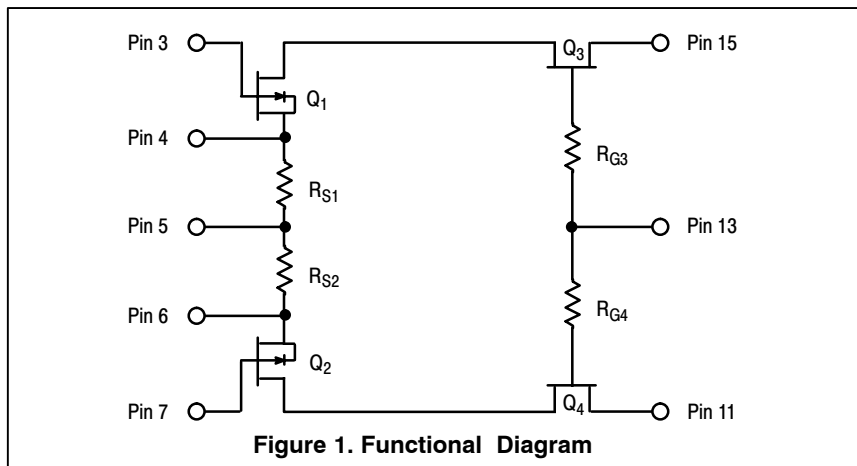
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**Table 1. Maximum Ratings**

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  $\Omega$  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

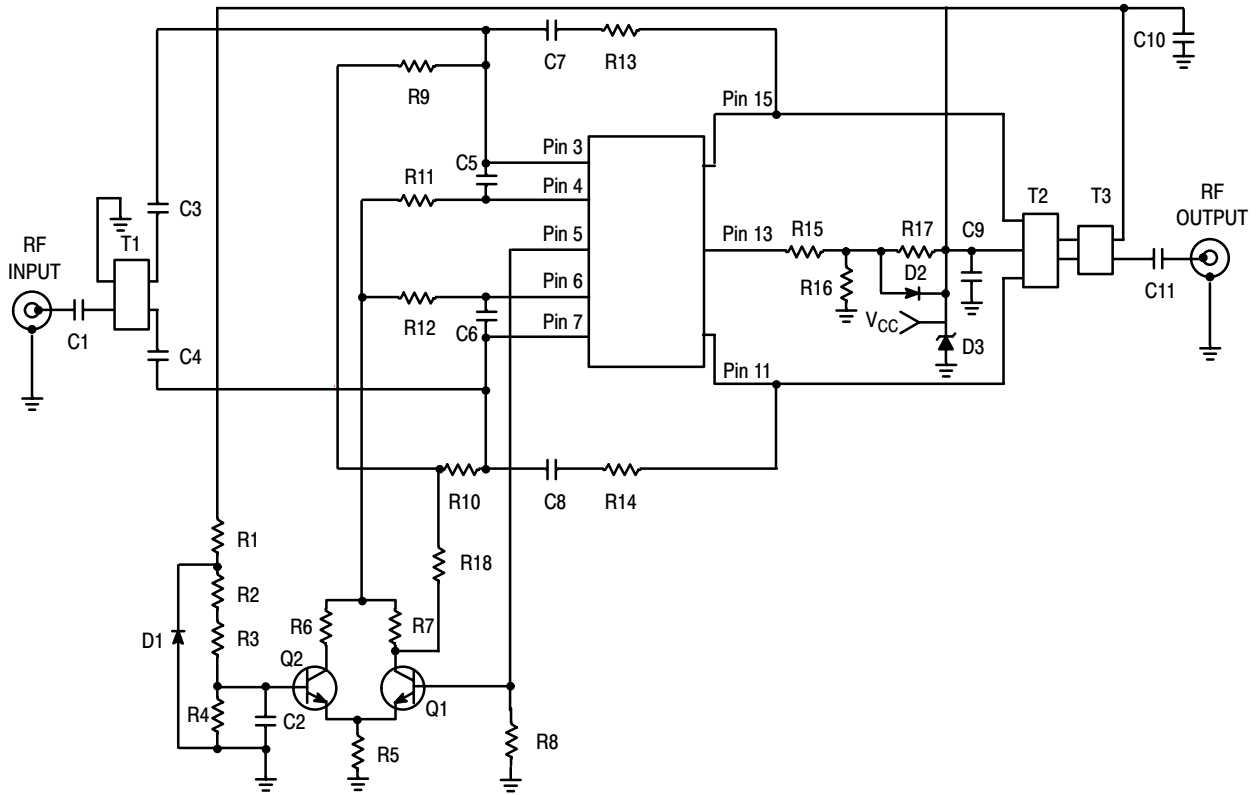
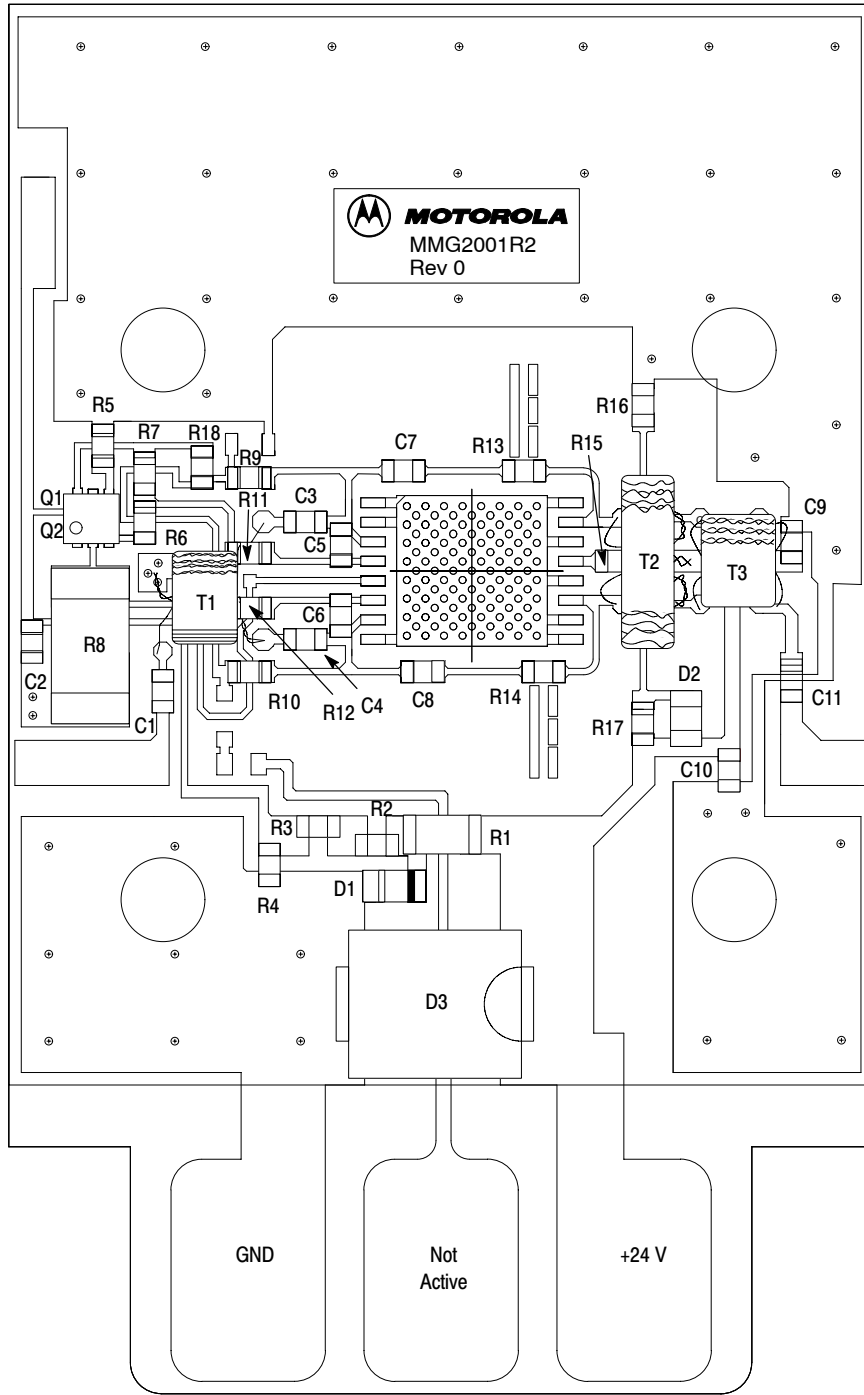


Figure 3. MMG2001T1 50-870 MHz Test Circuit Schematic

Table 6. MMG2001T1 50-870 MHz Test Circuit Component Designations and Values

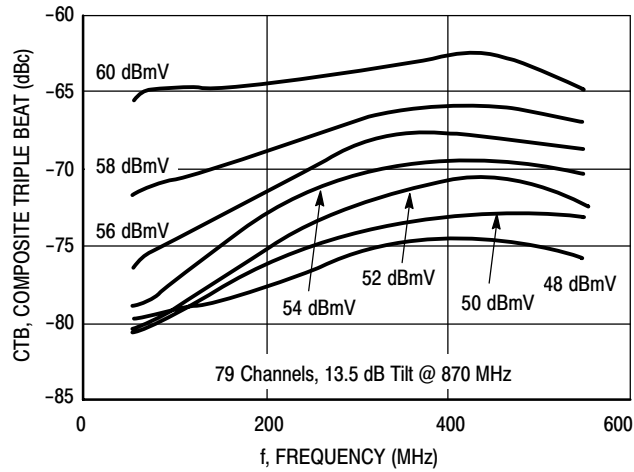
Designation	Description
C1, C7, C8, C11	220 pF Chip Capacitors (0603)
C2, C3, C4, C9, C10	0.01 $\mu$ F Chip Capacitors (0603)
C5, C6	1.8 pF Chip Capacitors (0603)
D1	5.1 V Zener Diode, On/MM3Z5V1T1
D2	27 V Zener Diode, On/MM3Z27VT1
D3	Transient Voltage Suppressor, On/1.5k27A/1.5SMC27AT3
Q1, Q2	Dual Transistors Package, On/MBT3904DW1T1
R1	2.2 k $\Omega$ , 1/4 W Chip Resistor (1206)
R2	680 $\Omega$ Chip Resistor (0603)
R3	180 $\Omega$ Chip Resistor (0603)
R4	1600 $\Omega$ Chip Resistor (0603)
R5	820 $\Omega$ Chip Resistor (0603)
R6	120 $\Omega$ Chip Resistor (0603)
R7	1.5 k $\Omega$ Chip Resistor (0603)
R8	8 $\Omega$ , 1 W Chip Resistor (2512)
R9, R10, R15	470 $\Omega$ Chip Resistors (0603)
R11, R12	18 $\Omega$ Chip Resistors (0603)
R13, R14	680 $\Omega$ Chip Resistors (0603)
R16	2.4 k $\Omega$ Chip Resistor (0603)
R17	6.2 k $\Omega$ Chip Resistor (0603)
R18	0 $\Omega$ Chip Resistor (0603)
T1	Input Transformer, 77PC016E080
T2	Output Transformer, 77PC016E071
T3	Output Transformer, 77PC016E072
PCB	FR4, 62 mil, $\epsilon_r = 4.81$



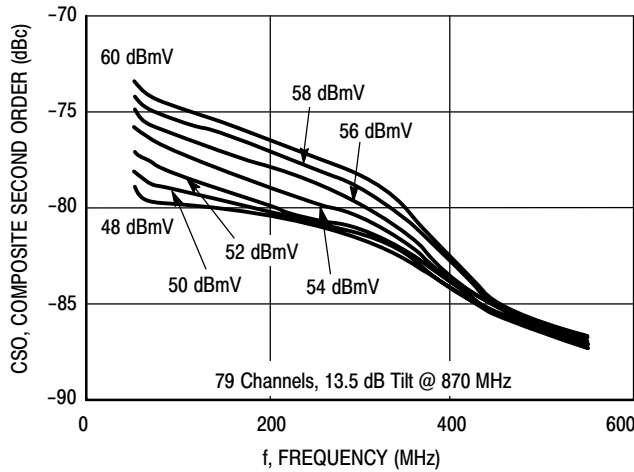
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**Figure 4. MMG2001T1 50-870 MHz Test Circuit Component Layout**

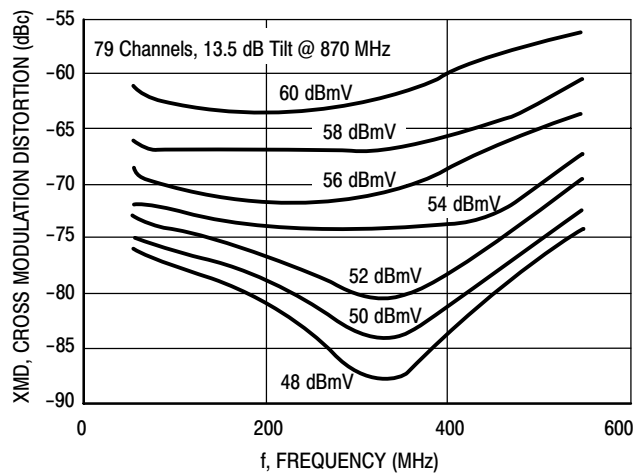
**TYPICAL CHARACTERISTICS**



**Figure 5. Composite Triple Beat versus Frequency**



**Figure 6. Composite Second Order versus Frequency**



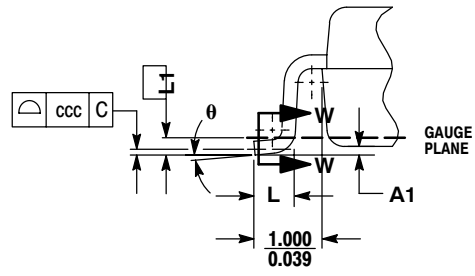
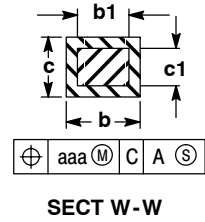
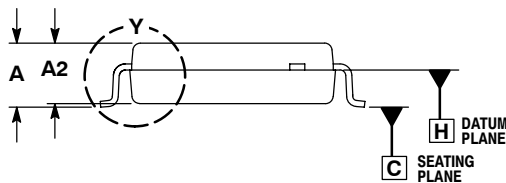
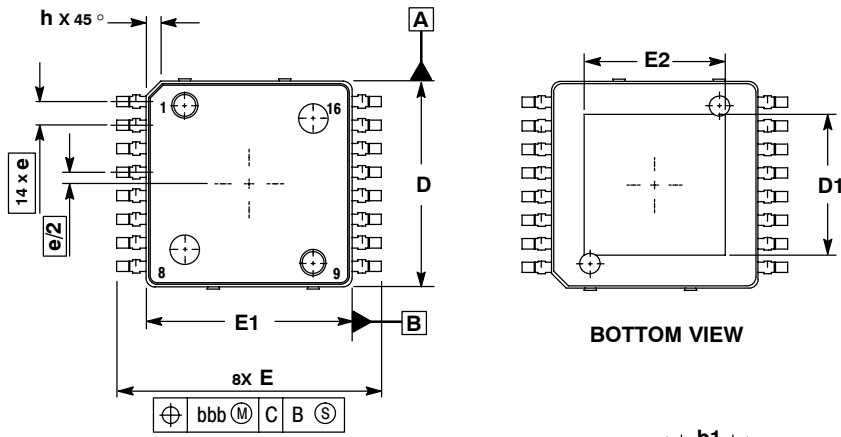
**Figure 7. Cross Modulation Distortion versus Frequency**

# NOTES

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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	

**CASE 978-03  
ISSUE C  
PFP-16**

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