Freescale Semiconductor
Technical Data

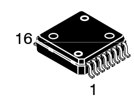
Document Number: MMG1001
Rev. 6, 7/2005

Replaced by MMG1001NT1. 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

MMG1001R2
MMG1001T1

870 MHz
19 dB GAIN
132-CHANNEL
CATV INTEGRATED AMPLIFIER MODULE



CASE 978-03
PFP-16

Features

- Specified for 79-, 112- and 132-Channel Loading
- Excellent Distortion Performance
- Built-in Input Diode Protection
- GaAs FET Transistor Technology
- Unconditionally Stable Under All Load Conditions
- In Tape and Reel. R2 Suffix = 1,500 Units per 16 mm, 13 inch Reel. T1 Suffix = 1,000 Units per 16 mm, 13 inch Reel.

Applications

- CATV Systems Operating in the 40 to 870 MHz Frequency Range
- Input Stage Amplifier in Optical Nodes, Line Extenders and Trunk Distribution Amplifiers for CATV Systems
- Output Stage Amplifier on Applications Requiring Low Power Dissipation and High Output Performance
- Driver Amplifier in Linear General Purpose Applications

Description

- 24 Vdc Supply or 12 Vdc Supply with Bias Change, 40 to 870 MHz, CATV Integrated Forward Amplifier Module

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
RF Voltage Input (Single Tone)	V_{in}	+65	dBmV
DC Supply Voltage 24 V Application 12 V Application	V_{CC}	 +26 +14	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	$R_{\theta JC}$	6.6	°C/W

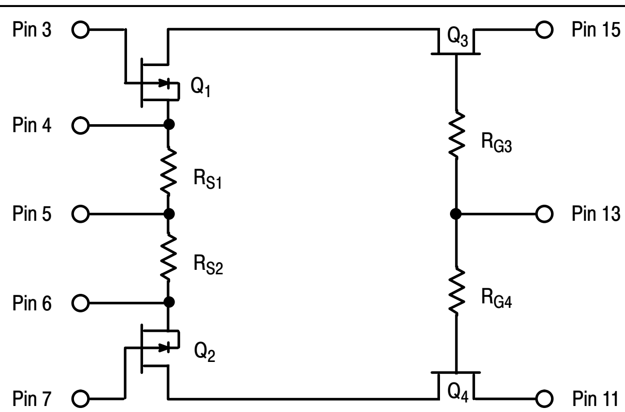
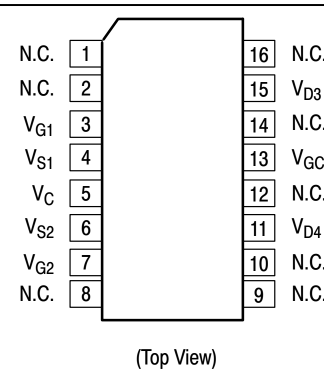


Figure 1. Functional Diagram



Note: Exposed backside flag is source terminal for transistors.

Figure 2. Pin Connections

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 for 24 V Application (V_{CC} = 24 Vdc, T_C = +30°C, 75 Ω system unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
Frequency Range		BW	40	—	870	MHz
Power Gain	50 MHz 870 MHz	G_p	— —	18 19	— —	dB
Slope	40 - 870 MHz	S	—	0.6	—	dB
Gain Flatness (40 - 870 MHz, Peak to Valley)		G_F	—	0.5	—	dB
Input Return Loss (Z_o = 75 Ohms)	f = 40-160 MHz f = 161-450 MHz f = 451-870 MHz	IRL	— —	21 19 22	— — —	dB
Output Return Loss (Z_o = 75 Ohms)	f = 40-400 MHz f = 401-870 MHz	ORL	— —	22 17	— —	dB
Composite Second Order (V_{out} = +44 dBmV/ch., Worst Case) (V_{out} = +46 dBmV/ch., Worst Case) (V_{out} = +48 dBmV/ch., Worst Case)	132-Channel FLAT 112-Channel FLAT 79-Channel FLAT	CSO_{132} CSO_{112} CSO_{79}	— — —	-65 -65 -71	-58 -59 -62	dBc
Cross Modulation Distortion @ Ch 2 (V_{out} = +44 dBmV/ch., FM = 55 MHz) (V_{out} = +46 dBmV/ch., FM = 55 MHz) (V_{out} = +48 dBmV/ch., FM = 55 MHz)	132-Channel FLAT 112-Channel FLAT 79-Channel FLAT	XMD_{132} XMD_{112} XMD_{79}	— — —	-64 -63 -62	-52 -52 -52	dBc
Composite Triple Beat (V_{out} = +44 dBmV/ch., Worst Case) (V_{out} = +46 dBmV/ch., Worst Case) (V_{out} = +48 dBmV/ch., Worst Case)	132-Channel FLAT 112-Channel FLAT 79-Channel FLAT	CTB_{132} CTB_{112} CTB_{79}	— — —	-63 -64 -65	-56 -56 -58	dBc
Noise Figure	50 MHz 870 MHz	NF	— —	4 4	5.0 5.0	dB
DC Current (V_{DC} = 24 V, T_C = -20° to +100°C)		I_{DC}	230	250	265	mA

(continued)

Table 4. Electrical Characteristics for 12 V Application (V_{CC} = 12 Vdc, T_C = +30°C, 75 Ω system unless otherwise noted) **(continued)**

Characteristic		Symbol	Min	Typ	Max	Unit
Frequency Range		BW	40	—	870	MHz
Power Gain	50 MHz 870 MHz	G_p	— —	18 19	— —	dB
Slope	40 - 870 MHz	S	—	0.6	—	dB
Gain Flatness (40 - 870 MHz, Peak to Valley)		G_F	—	0.5	—	dB
Input Return Loss (Z_o = 75 Ohms)	f = 40-160 MHz f = 161-450 MHz f = 451-870 MHz	IRL	— —	21 19 19	— — —	dB
Output Return Loss (Z_o = 75 Ohms)	f = 40-400 MHz f = 401-750 MHz f = 751-870 MHz	ORL	— — —	19 17 15	— — —	dB
Composite Second Order (V_{out} = +42 dBmV/ch., Worst Case) (V_{out} = +42 dBmV/ch., Worst Case)	112-Channel FLAT 79-Channel FLAT	CSO_{112} CSO_{79}	— —	-65 -71	— —	dBc
Cross Modulation Distortion @ Ch 2 (V_{out} = +42 dBmV/ch., FM = 55 MHz) (V_{out} = +42 dBmV/ch., FM = 55 MHz)	112-Channel FLAT 79-Channel FLAT	XMD_{112} XMD_{79}	— —	-63 -62	— —	dBc
Composite Triple Beat (V_{out} = +42 dBmV/ch., Worst Case) (V_{out} = +42 dBmV/ch., Worst Case)	112-Channel FLAT 79-Channel FLAT	CTB_{112} CTB_{79}	— —	-64 -65	— —	dBc
Noise Figure	50 MHz 870 MHz	NF	— —	4 4	5.0 5.0	dB
DC Current (V_{DC} = 12 V, T_C = -20° to +100°C)		I_{DC}	190	210	225	mA

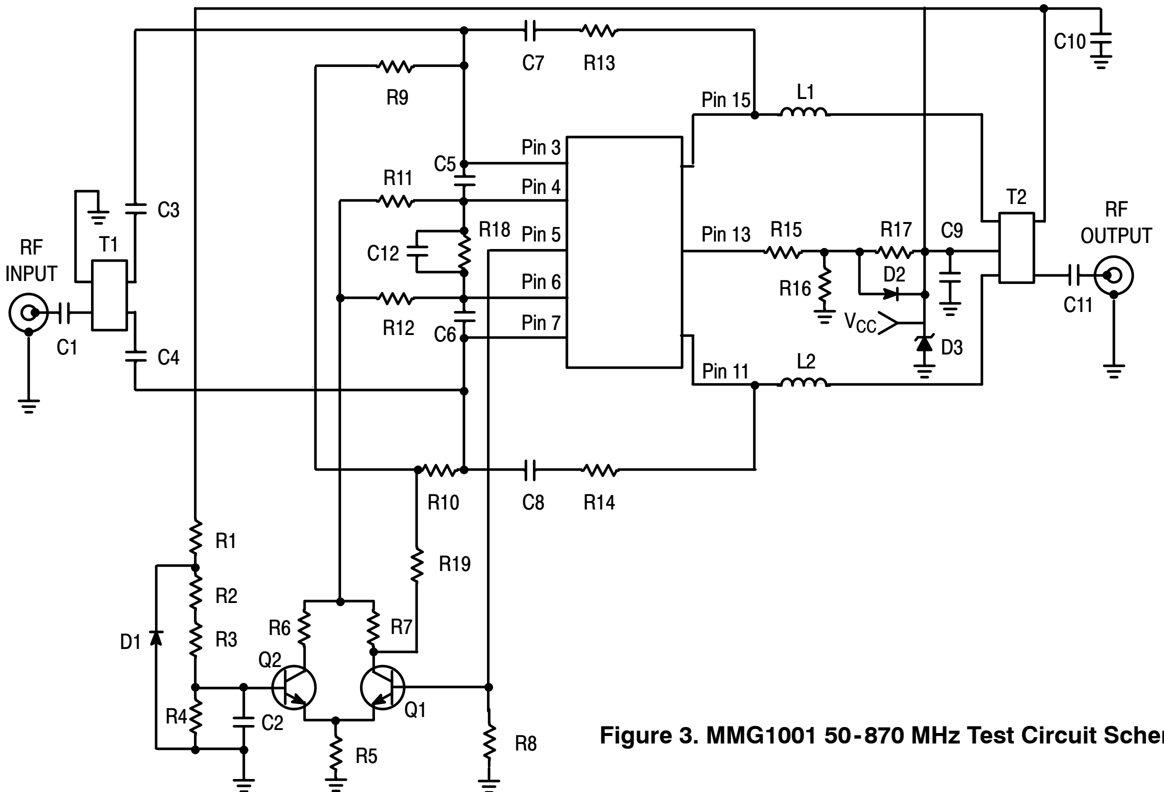
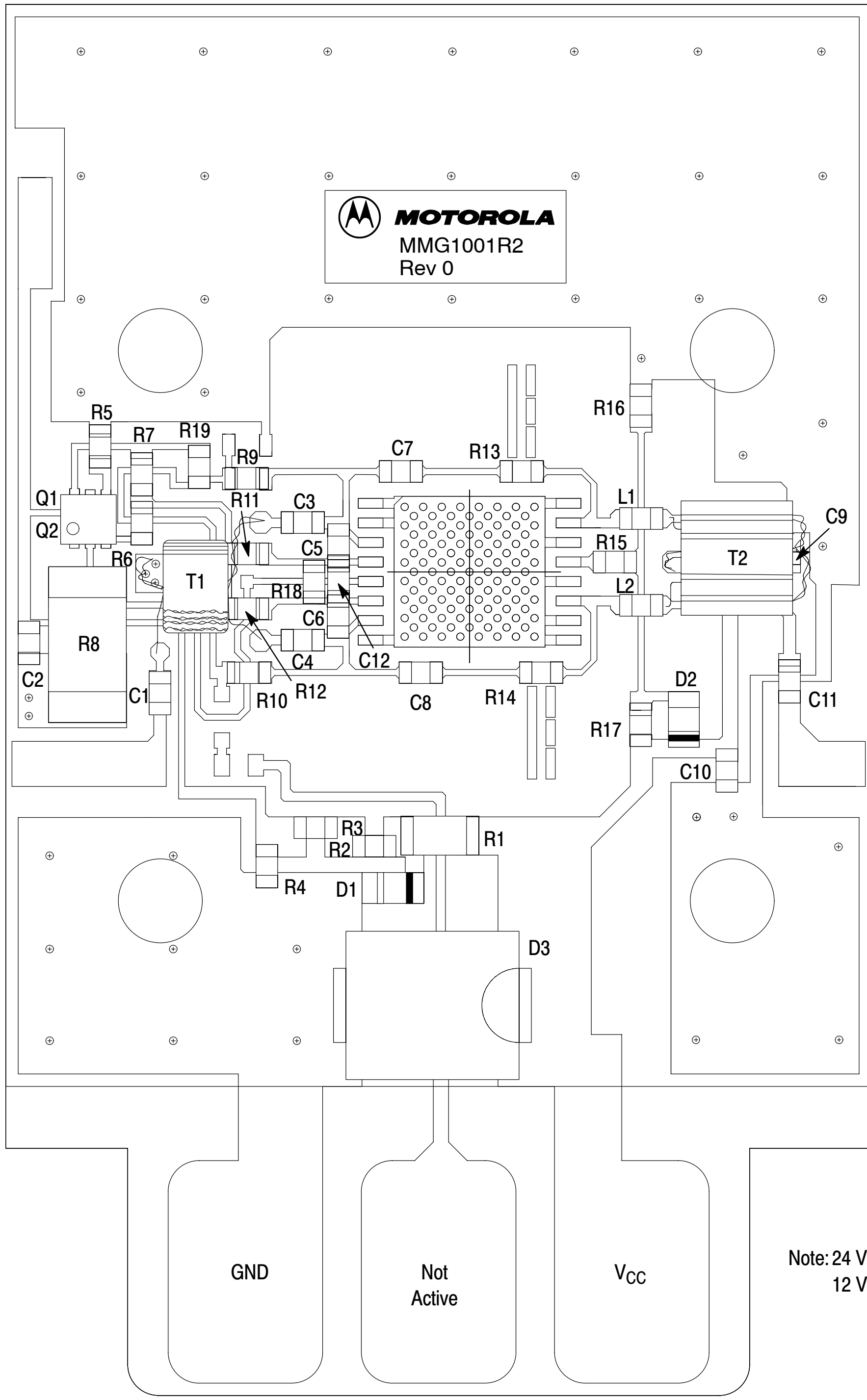


Figure 3. MMG1001 50-870 MHz Test Circuit Schematic

Table 6. MMG1001 50-870 MHz Test Circuit Component Designations and Values

Designation	Description (24 V Application)	Description (12 V Application)
C1, C7, C8, C11	220 pF Chip Capacitors (0603)	220 pF Chip Capacitors (0603)
C2, C3, C4, C9, C10	0.01 μF Chip Capacitors (0603)	0.01 μF Chip Capacitors (0603)
C5, C6	1.8 pF Chip Capacitors (0603)	1.8 pF Chip Capacitors (0603)
C12	5.6 pF Chip Capacitor (0603)	5.6 pF Chip Capacitor (0603)
D1	5.1 V Zener Diode, On/MM3Z5V1T1	5.1 V Zener Diode, On/MM3Z5V1T1
D2	27 V Zener Diode, On/MM3Z27VT1	27 V Zener Diode, On/MM3Z27VT1
D3	Transient Voltage Suppressor, On/1.5k27A/1.5SMC27AT3	Transient Voltage Suppressor, On/1.5k27A/1.5SMC27AT3
L1, L2	22 nH Chip Inductors (0603)	22 nH Chip Inductors (0603)
Q1, Q2	Dual Transistors Package, On/MBT3904DW1T1	Dual Transistors Package, On/MBT3904DW1T1
R1	2.2 kΩ, 1/4 W Chip Resistor (1206)	820 Ω, 1/4 W Chip Resistor (1206)
R2	560 Ω Chip Resistor (0603)	560 Ω Chip Resistor (0603)
R3	82 Ω Chip Resistor (0603)	40 Ω Chip Resistor (0603)
R4	820 Ω Chip Resistors (0603)	150 Ω Chip Resistors (0603)
R5	820 Ω Chip Resistors (0603)	100 Ω Chip Resistors (0603)
R6	120 Ω Chip Resistor (0603)	120 Ω Chip Resistor (0603)
R7	1.5 kΩ Chip Resistor (0603)	1.5 kΩ Chip Resistor (0603)
R8	12 Ω, 1 W Chip Resistor (2512)	4.8 Ω, 1 W Chip Resistor (2512)
R9, R10, R15	470 Ω Chip Resistors (0603)	470 Ω Chip Resistors (0603)
R11, R12	18 Ω Chip Resistors (0603)	18 Ω Chip Resistors (0603)
R13, R14	910 Ω Chip Resistors (0603)	910 Ω Chip Resistors (0603)
R16	2 kΩ Chip Resistor (0603)	2.7 kΩ Chip Resistor (0603)
R17	6.2 kΩ Chip Resistor (0603)	6.2 kΩ Chip Resistor (0603)
R18	15 Ω Chip Resistor (0603)	15 Ω Chip Resistor (0603)
R19	0 Ω Chip Resistor (0603)	0 Ω Chip Resistor (0603)
T1	Input Transformer, Mot/77PC016E068	Input Transformer, 77PC016E068
T2	Output Transformer, Mot/77PC016E061	Output Transformer, 77PC016E061
PCB	FR4, 62 mil, ε_r = 4.81	FR4, 62 mil, ε_r = 4.81



Note: 24 V Application, V_{CC} = 24 V
12 V Application, V_{CC} = 12 V

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. MMG1001 50-870 MHz Test Circuit Component Layout

ARCHIVE INFORMATION

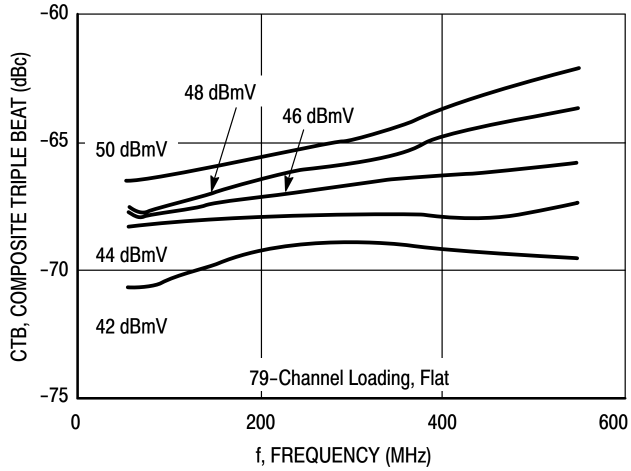


Figure 5. Composite Triple Beat versus Frequency

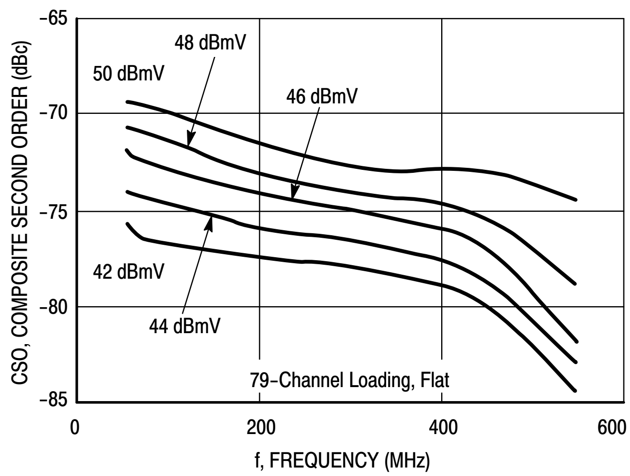


Figure 6. Composite Second Order versus Frequency

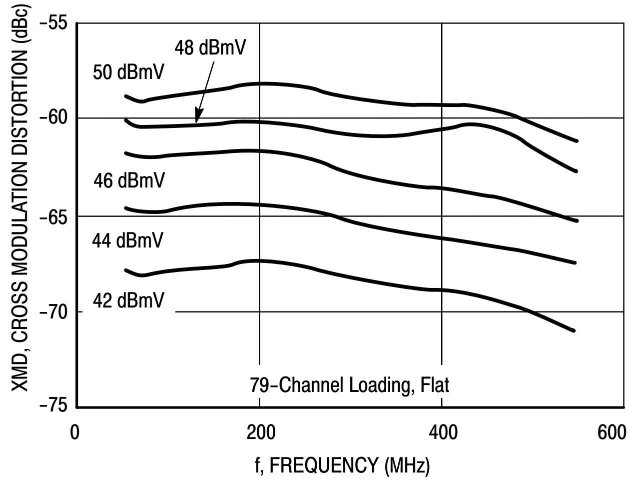


Figure 7. Cross Modulation Distortion versus Frequency

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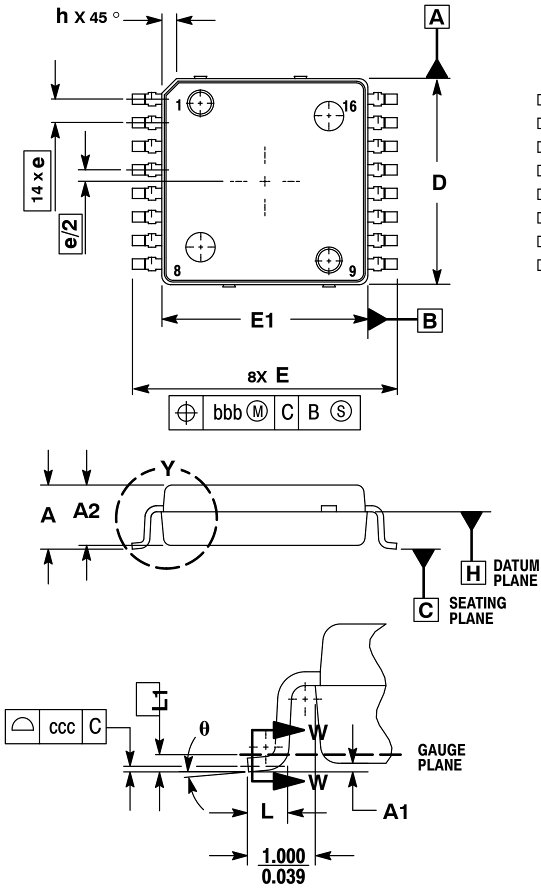
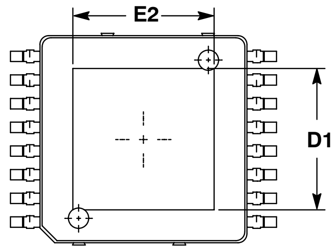
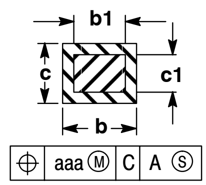
PACKAGE DIMENSIONS



DETAIL Y



BOTTOM VIEW



SECT W-W

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-.

	MILLIMETERS	
DIM	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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