

BIPOLAR ANALOG INTEGRATED CIRCUIT  
 $\mu$ PC8102T

RF AMPLIFIER IC FOR 150 MHz TO 330 MHz PAGER SYSTEM

**DESCRIPTION**

$\mu$ PC8102T is a silicon monolithic integrated circuit designed as RF amplifier for 150 MHz to 330 MHz pager system. Due to 1 V supply voltage, this IC is suitable for low voltage pager system. The package is a 6 pin mini mold suitable for high-density surface mounting.

This IC is manufactured using NEC's 20 GHz fr NESAT™ III silicon bipolar process. This process uses silicon nitride passivation film and gold electrodes. These materials contribute excellent DC, AC performance. Thus, this process is utilized for 1 V voltage IC.

**FEATURES**

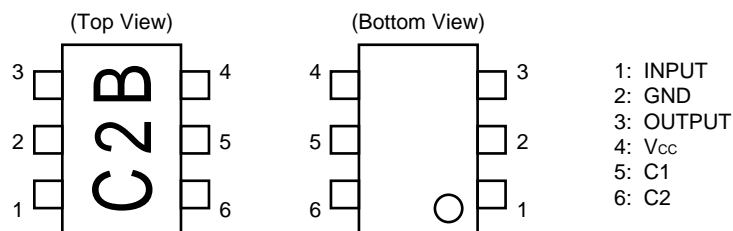
- 1 V supply voltage:  $V_{CC} = 0.9\text{ V to }2.0\text{ V}$
- Low noise figure:  $2.3\text{ dB}_{TYP.}$  @  $f_{in} = 150\text{ MHz}$  (with external matching circuit to optimize NF)
- Low current consumption:  $I_{CC} = 0.5\text{ mA}_{TYP.}$  @  $V_{CC} = 1.0\text{ V}$
- Gain available frequency:  $f_{RF} = 150\text{ MHz to }330\text{ MHz}$  (with external matching circuit)
- High-density surface mounting: 6 pin mini mold

**ORDERING INFORMATION**

PART NUMBER	PACKAGE	MARKING	SUPPLYING FORM
$\mu$ PC8102T-E3	6 pin mini mold	C2B	Embossed tape 8 mm wide. Pin 1, 2, 3 face to perforation side of tape. QTY 3 kp/Reel

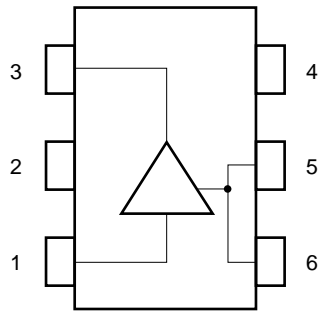
\* For evaluation sample order, please contact your local NEC sales office.  
 (Order number:  $\mu$ PC8102T).

**PIN CONNECTIONS**

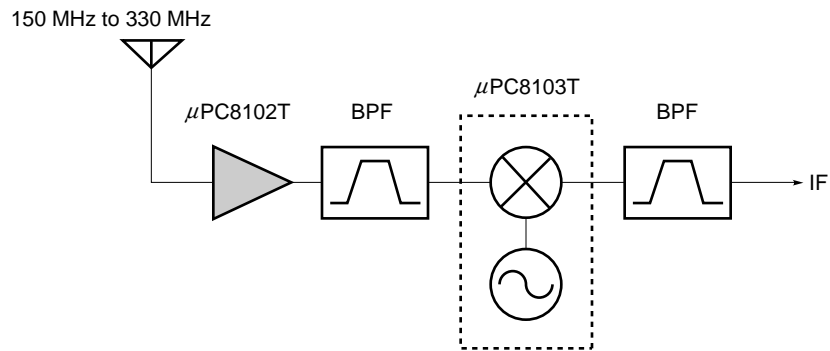


Caution Electro-static sensitive devices

INTERNAL BLOCK DIAGRAM



SYSTEM APPLICATION EXAMPLE AS PAGER



**PIN EXPLANATION**

PIN NO.	NAME	SUPPLY VOLTAGE (V)	PIN VOLTAGE (V)	FUNCTION AND APPLICATION	EQUIVALENT CIRCUIT
1	INPUT	—	0.75	RF signal input pin. This pin should be externally equipped with matching circuit in accordance with desired frequency.	
2	GND	0	—	This ground pin must be connected to the system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. Track length should be kept as short as possible.	
3	OUTPUT	C2 pin voltage must be applied through external matching inductor	—	Amplified signal output pin. This pin should be externally equipped with matching circuit in accordance with desired frequency.	
4	V <sub>CC</sub>	0.9 to 2.0	—	Supply voltage pin. Connect bypass capacitor (eg 1000 pF) to minimize ground impedance.	
5	C1	—	0.88	Ground with capacitance pin (eg 1000 pF).	
6	C2	—	0.85	AC ground pin for output	

**Note** Pin voltage values are described at V<sub>CC</sub> = 1 V.

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	CONDITION	RATINGS	UNIT
Supply Voltage	V <sub>CC</sub>	T <sub>A</sub> = +25 °C	2.2	V
Power Dissipation	P <sub>D</sub>	Mounted on 50 × 50 × 1.6 mm double copper clad epoxy glass PWB at T <sub>A</sub> = +85 °C	280	mW
Operating Temperature	T <sub>opt</sub>		-40 to +85	°C
Storage Temperature	T <sub>stg</sub>		-55 to +150	°C

**RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V <sub>CC</sub>	0.9	1.0	2.0	V
Operating Temperature	T <sub>opt</sub>	-40	+25	+85	°C
Operating Frequency	f <sub>opt</sub>	150		330	MHz

**Electric characteristic (T<sub>A</sub> = +25 °C, V<sub>CC</sub> = 1.0 V, Z<sub>s</sub> = Z<sub>L</sub> = 50 Ω)**

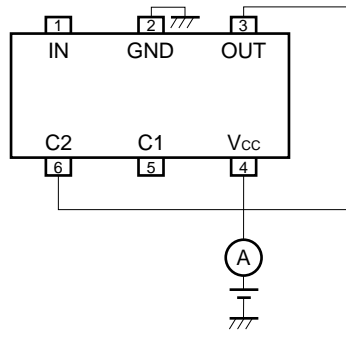
PARAMETER	SYMBOL	TEST CONDITIONS	μPC8102T			UNIT
			MIN.	TYP.	MAX.	
Circuit Current	I <sub>CC</sub>	No input signal, TEST CIRCUIT 1	0.30	0.5	0.65	mA
Power Gain	G <sub>P</sub>	f = 280 MHz, TEST CIRCUIT 3	10.0	13.5	16.5	dB
Output 3rd order intercept point	OIP <sub>3</sub>	f <sub>1</sub> = 150.000 MHz, f <sub>2</sub> = 150.025 MHz TEST CIRCUIT 2	—	-5	—	dBm

**Note** External matching circuits should be attached to input and output pins.

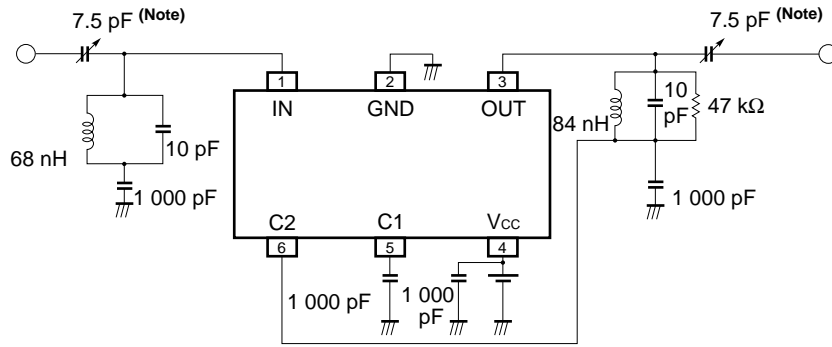
**Standard characteristics for reference (Sample: I<sub>CC</sub> = 0.55 mA, Condition: T<sub>A</sub> = +25 °C, V<sub>CC</sub> = 1.0 V)**

PARAMETER	SYMBOL	CONDITIONS	Reference value	UNIT
matched with 50 Ω				
Power Gain 1	G <sub>P1</sub>	f = 150 MHz, TEST CIRCUIT 2	20.6	dB
Noise Figure 1	NF1		3.6	dB
Power Gain 2	G <sub>P2</sub>	f = 280 MHz, TEST CIRCUIT 3	14.7	dB
Noise Figure 2	NF2		4.0	dB
Power Gain 3	G <sub>P3</sub>	f = 330 MHz, TEST CIRCUIT 5	14.5	dB
Noise Figure 3	NF3		4.1	dB
matched to optimize NF				
Power Gain 4	G <sub>P4</sub>	f = 150 MHz, TEST CIRCUIT 2	19.4	dB
Noise Figure 4	NF4		2.3	dB
Power Gain 5	G <sub>P5</sub>	f = 280 MHz, TEST CIRCUIT 4	14.0	dB
Noise Figure 5	NF5		2.9	dB
Power Gain 6	G <sub>P6</sub>	f = 330 MHz, TEST CIRCUIT 6	11.6	dB
Noise Figure 6	NF6		3.1	dB

TEST CIRCUIT 1

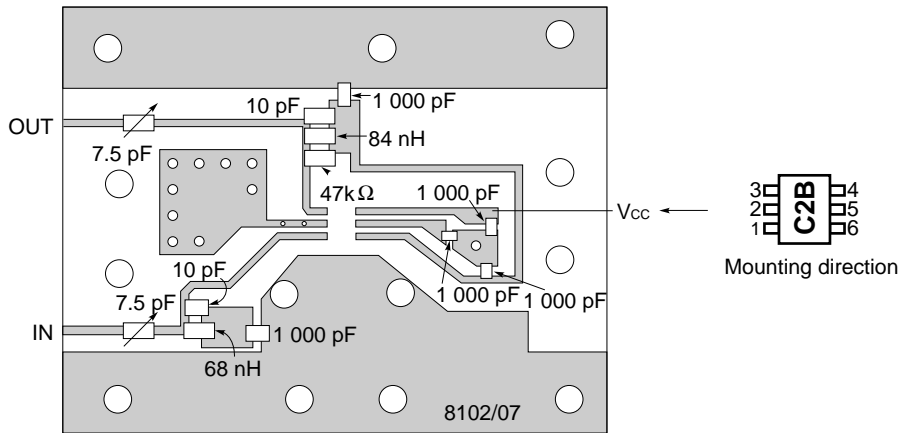


TEST CIRCUIT 2 (150 MHz) <Matched with 50 Ω or matched to optimize NF>



**Note** Matching can be adjusted with trimmer condenser.

ILLUSTRATION OF THE TEST CIRCUIT 2 ASSEMBLED ON EVALUATION BOARD



**Note**

- (\*1) 35 × 42 × 0.4 mm double copper clad polyimide board
- (\*2) Back side: GND pattern
- (\*3) Solder plated on pattern
- (\*4) ○ ○ : Through holes

TEST CIRCUIT 3 (280 MHz) <Matched with 50  $\Omega$ >

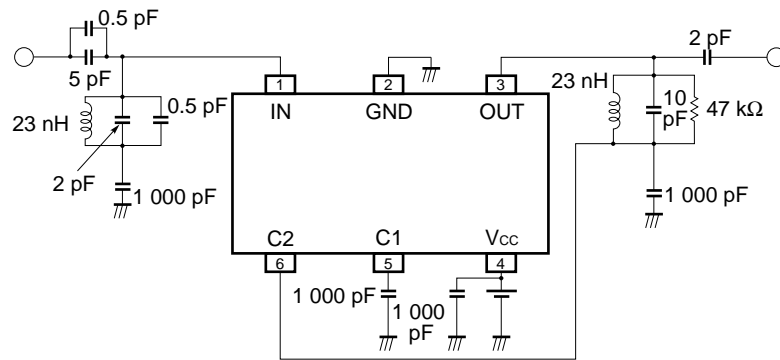
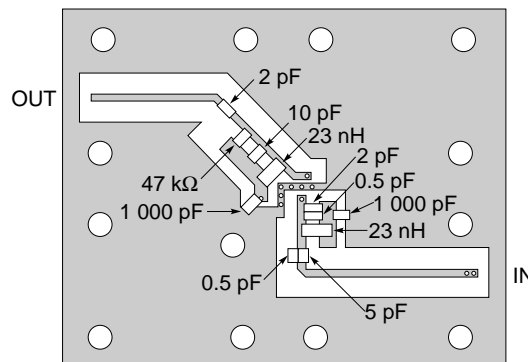
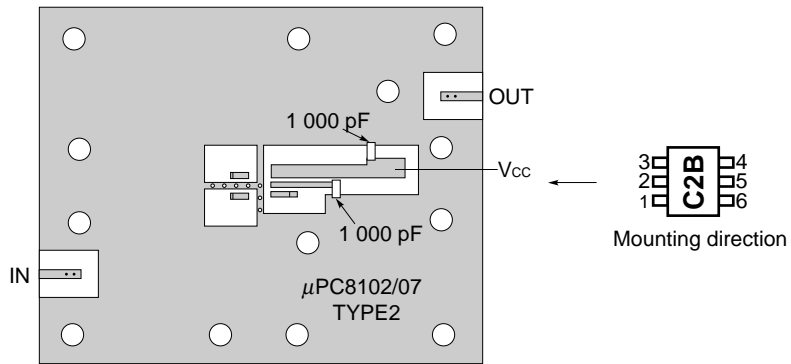


ILLUSTRATION OF THE TEST CIRCUIT 3 ASSEMBLED ON EVALUATION BOARD



**Note**

- (\*1) 35 × 42 × 0.4 mm double copper clad polyimide board
- (\*2) Solder plated on pattern
- (\*3) ○ ○ : Through holes

TEST CIRCUIT 4 (280 MHz) <Matched to optimize NF>

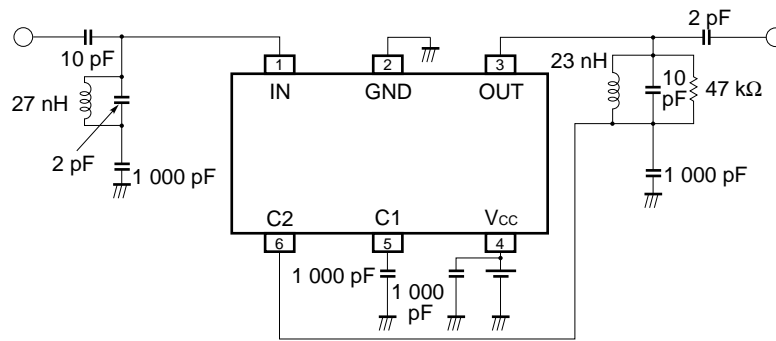
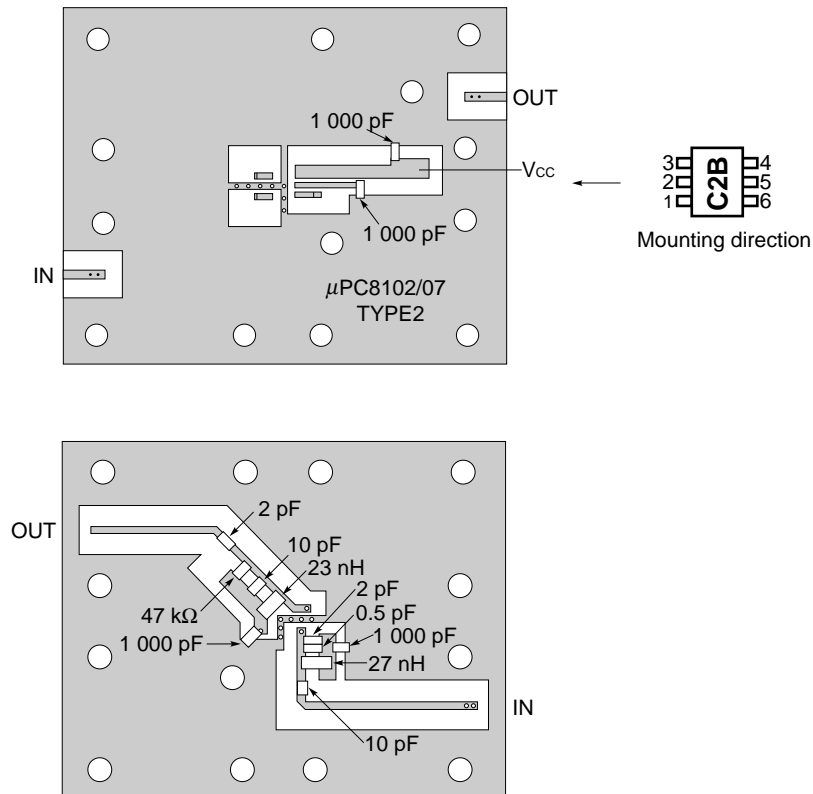


ILLUSTRATION OF THE TEST CIRCUIT 4 ASSEMBLED ON EVALUATION BOARD



**Note**

- (\*1) 35 × 42 × 0.4 mm double copper clad polyimide board
- (\*2) Solder plated on pattern
- (\*3) ○ ○ : Through holes



TEST CIRCUIT 5 (330 MHz) <Matched with 50  $\Omega$ >

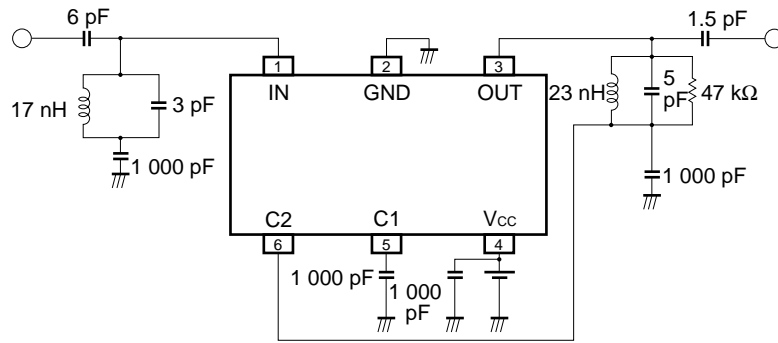
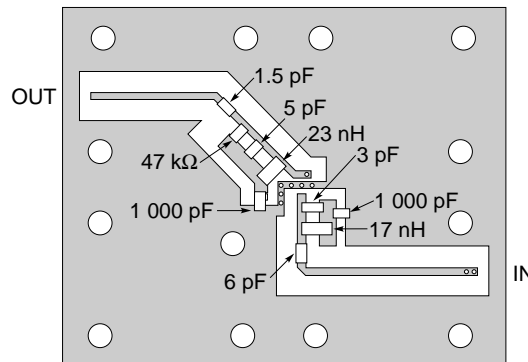
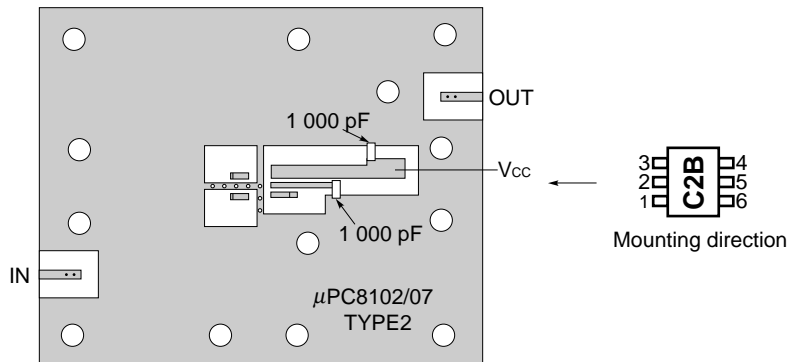


ILLUSTRATION ON THE TEST CIRCUIT 5 ASSEMBLED ON EVALUATION BOARD



**Note**

- (\*1) 35 × 42 × 0.4 mm double copper clad polyimide board
- (\*2) Solder plated on pattern
- (\*3) ○ ○ : Through holes

TEST CIRCUIT 6 (330 MHz) <Matched to optimize NF>

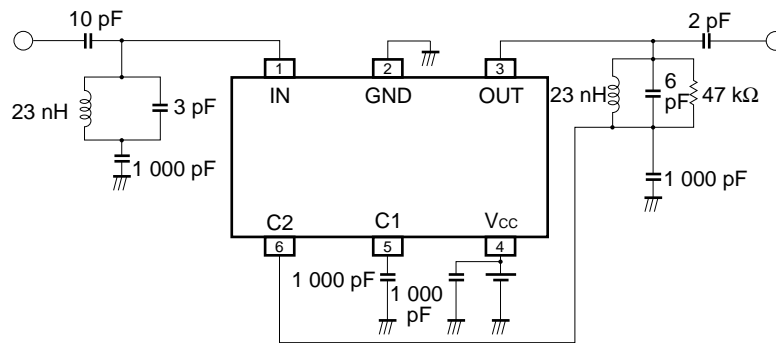
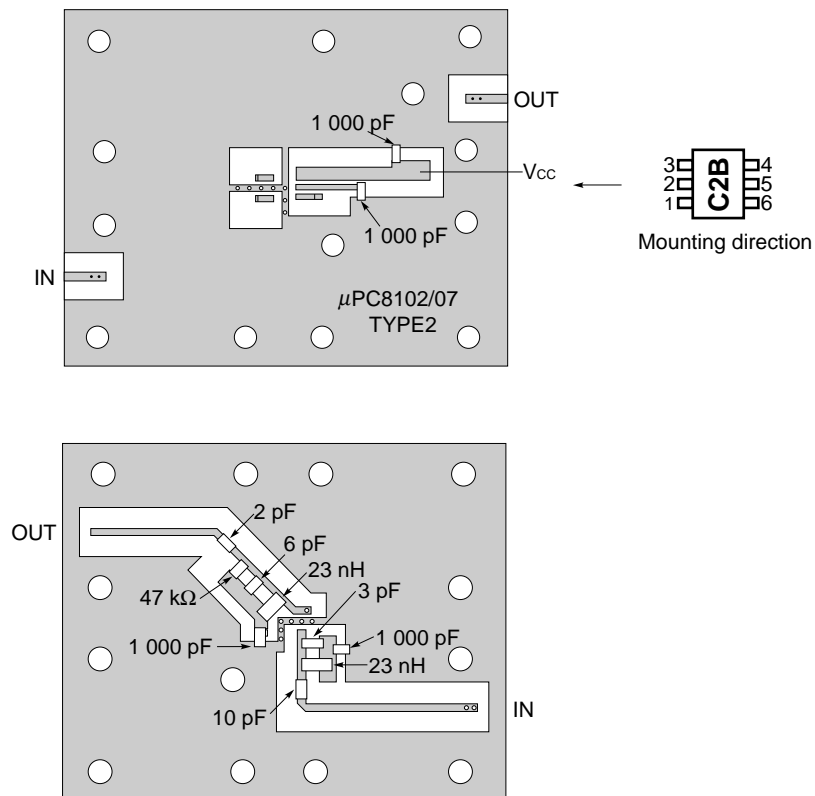


ILLUSTRATION ON THE TEST CIRCUIT 6 ASSEMBLED ON EVALUATION BOARD

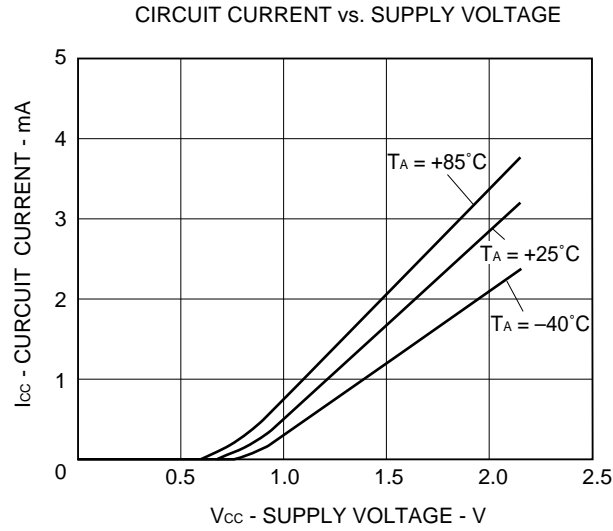


**Note**

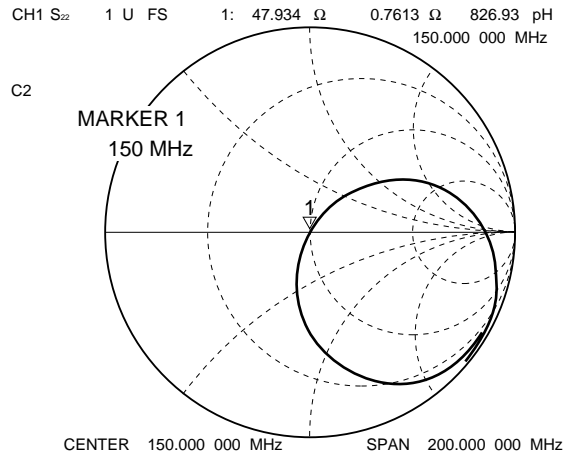
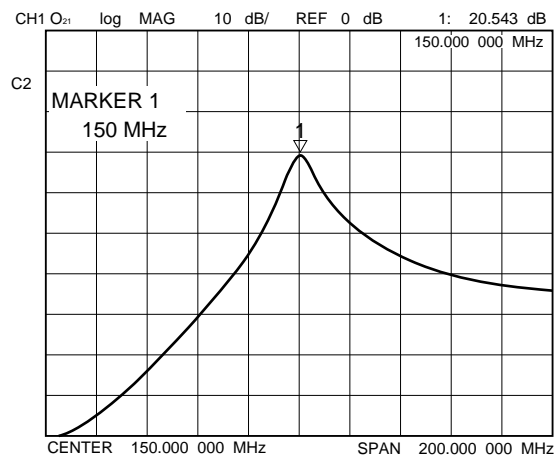
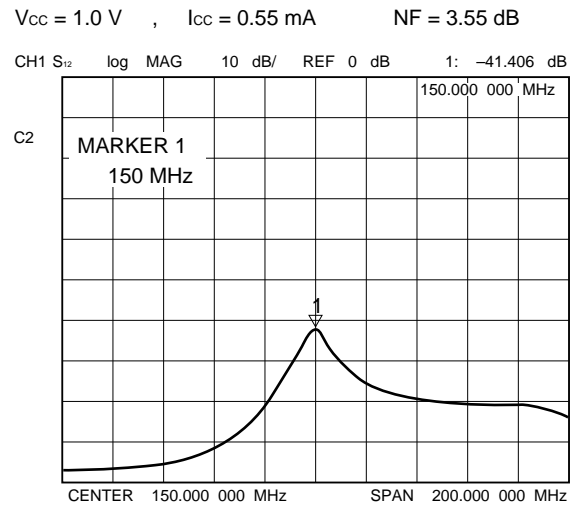
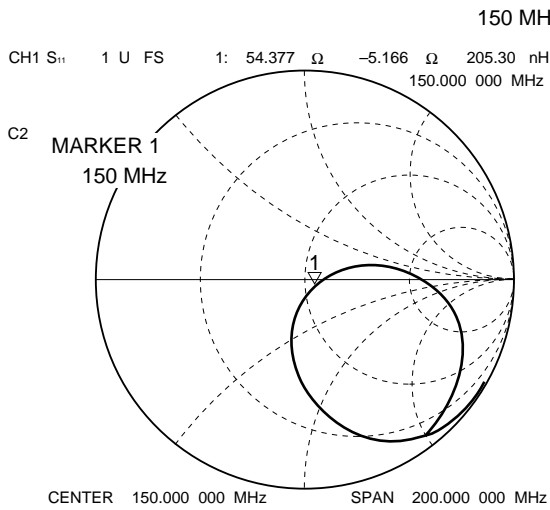
- (\*1) 35 × 42 × 0.4 mm double copper clad polyimide board
- (\*2) Solder plated on pattern
- (\*3) ○ ○ : Through holes

CHARACTERISTICS ( $T_A = +25\text{ }^\circ\text{C}$  unless otherwise specified)

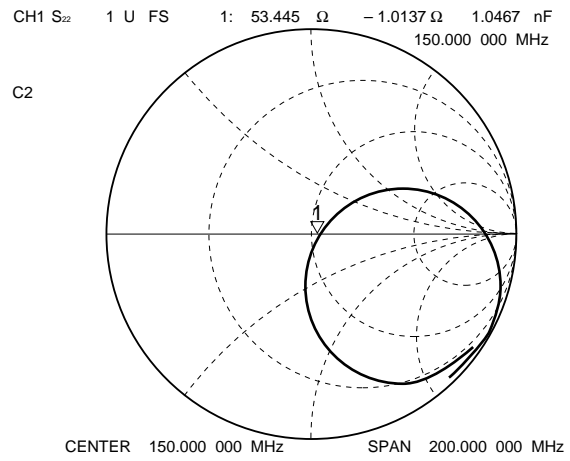
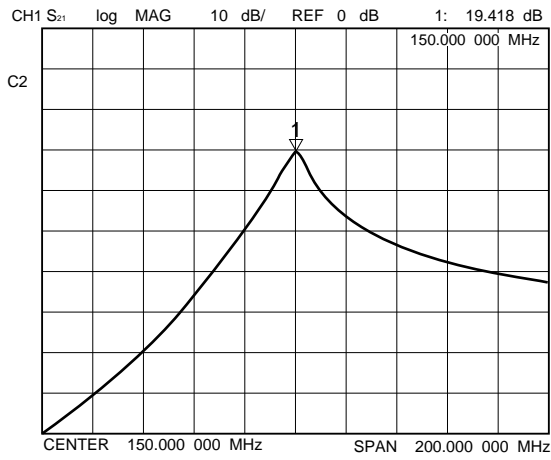
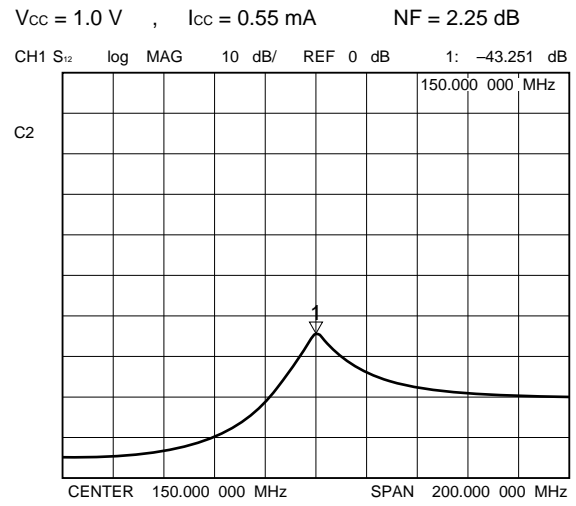
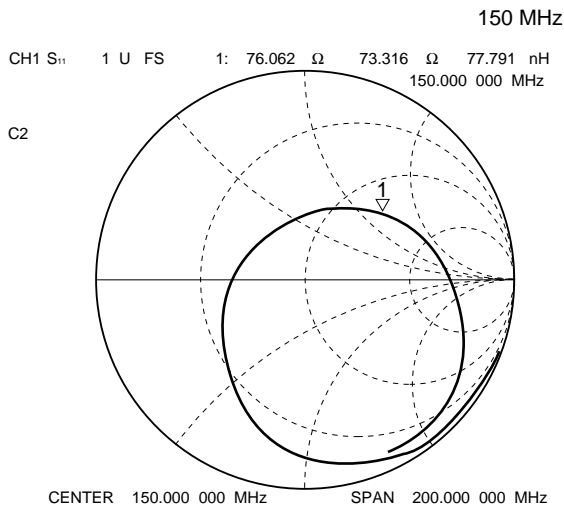
- TEST CIRCUIT 1 -



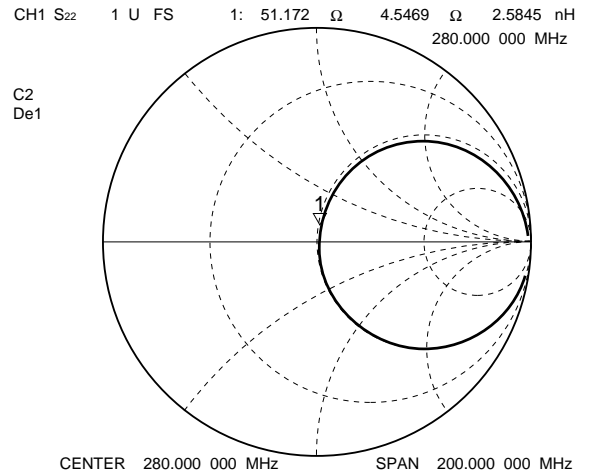
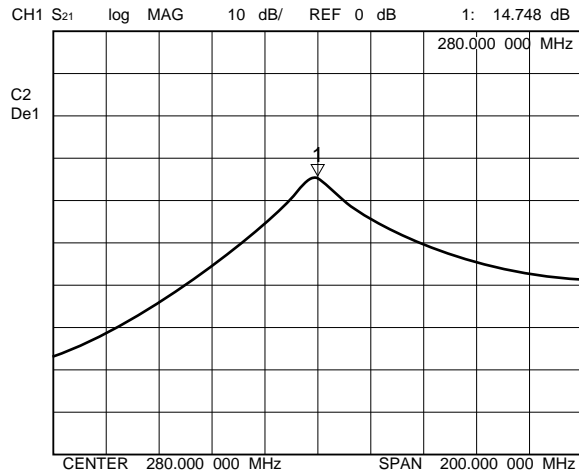
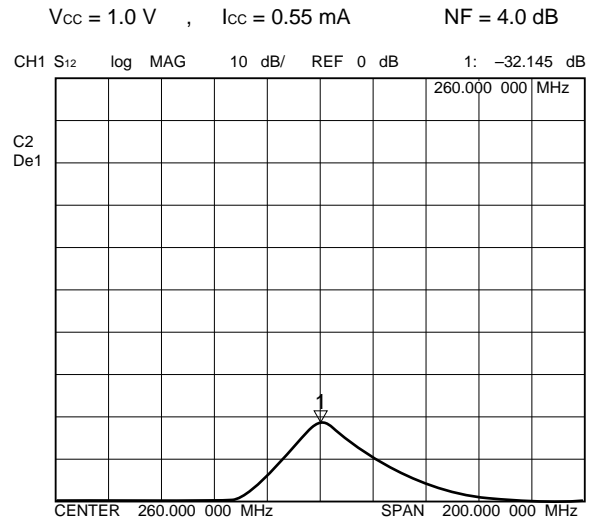
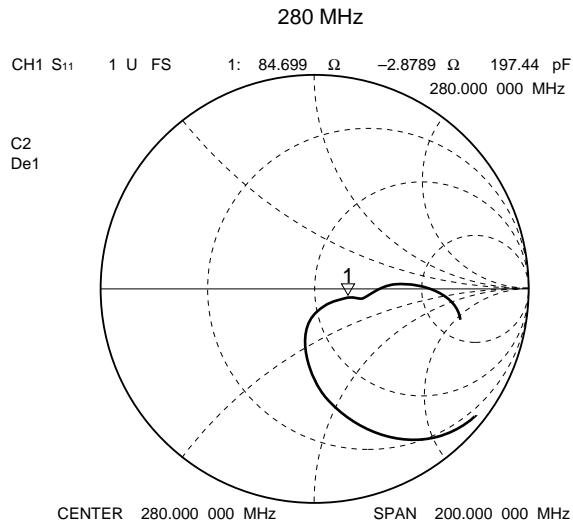
- TEST CIRCUIT 2 (matched with 50  $\Omega$ ) -



- TEST CIRCUIT 2 (matched to optimize NF) -



- TEST CIRCUIT 3 (matched with 50  $\Omega$ ) -

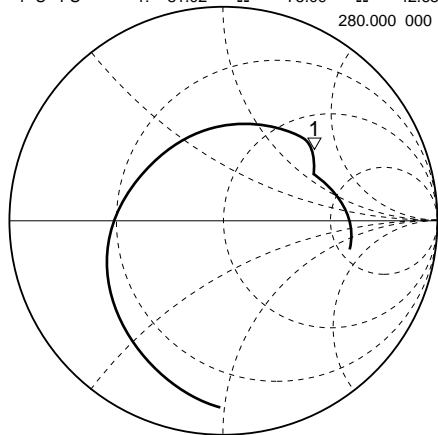


- TEST CIRCUIT 4 (matched to optimize NF) -

280 MHz  $V_{CC} = 1.0\text{ V}$  ,  $I_{CC} = 0.55\text{ mA}$   $T_A = 25\text{ }^\circ\text{C}$  NF = 2.93 dB

CH1 S<sub>11</sub> 1 U FS 1: 81.02  $\Omega$  75.09  $\Omega$  42.682 nH  
280.000 000 MHz

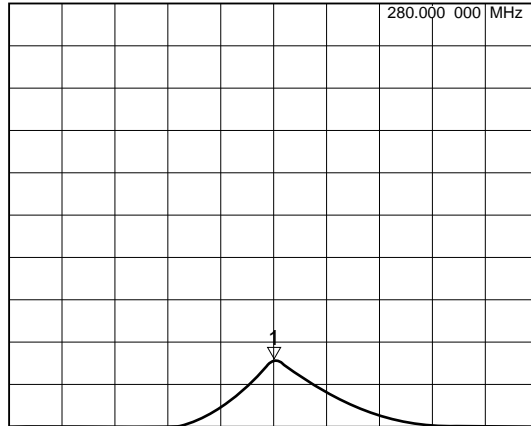
C2  
De1



CENTER 280.000 000 MHz SPAN 200.000 000 MHz

CH1 S<sub>12</sub> log MAG 10 dB/ REF 0 dB 1: -33.561 dB  
280.000 000 MHz

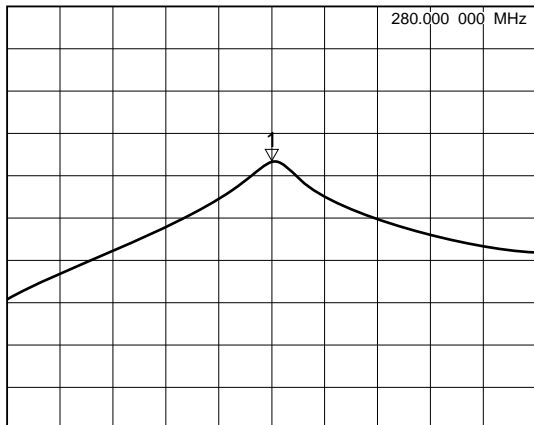
C2  
De1



CENTER 280.000 000 MHz SPAN 200.000 000 MHz

CH1 S<sub>21</sub> log MAG 10 dB/ REF 0 dB 1: 14.087 dB  
280.000 000 MHz

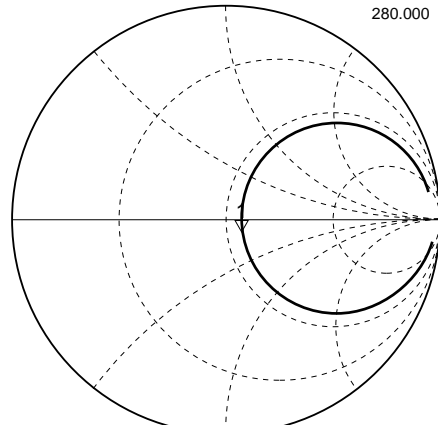
C2  
De1



CENTER 280.000 000 MHz SPAN 200.000 000 MHz

CH1 S<sub>22</sub> 1 U FS 1: 56.415  $\Omega$  -6.4043  $\Omega$  67.633 pF  
280.000 000 MHz

C2  
De1



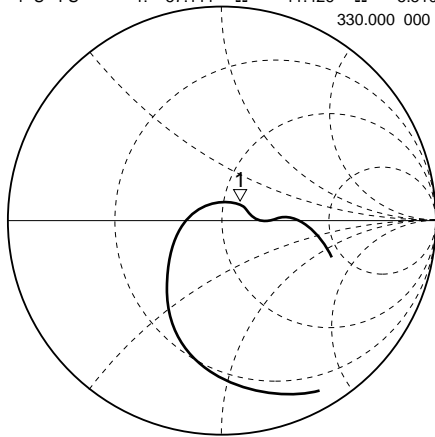
CENTER 280.000 000 MHz SPAN 200.000 000 MHz

- TEST CIRCUIT 5 (matched with 50  $\Omega$ ) -

330 MHz  $V_{CC} = 1.0 V$  ,  $I_{CC} = 0.55 mA$  NF = 4.1 dB

CH1 S<sub>11</sub> 1 U FS 1: 57.111  $\Omega$  11.426  $\Omega$  5.5105 nH  
330.000 000 MHz

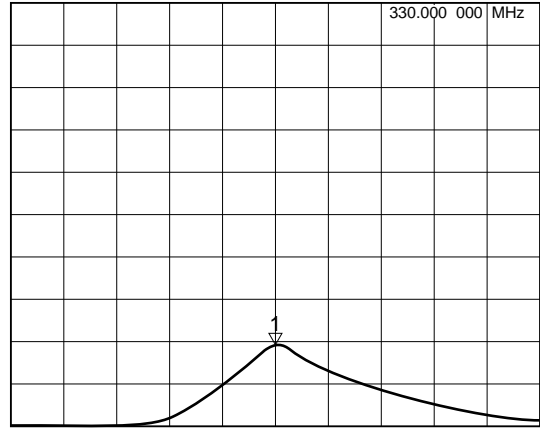
C2  
De1



CENTER 330.000 000 MHz SPAN 200.000 000 MHz

CH1 S<sub>12</sub> log MAG 10 dB/ REF 0 dB 1: -30.38 dB  
330.000 000 MHz

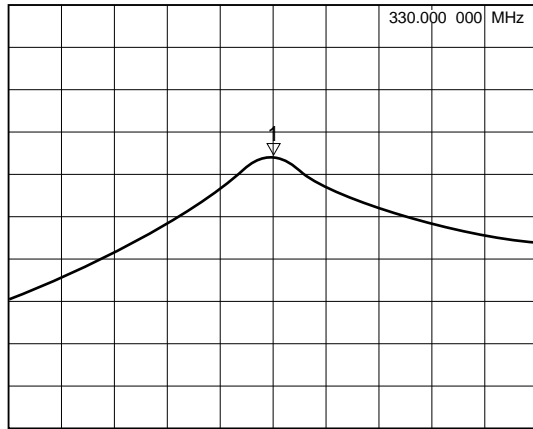
C2



CENTER 330.000 000 MHz SPAN 200.000 000 MHz

CH1 S<sub>21</sub> log MAG 10 dB/ REF 0 dB 1: 14.479 dB  
330.000 000 MHz

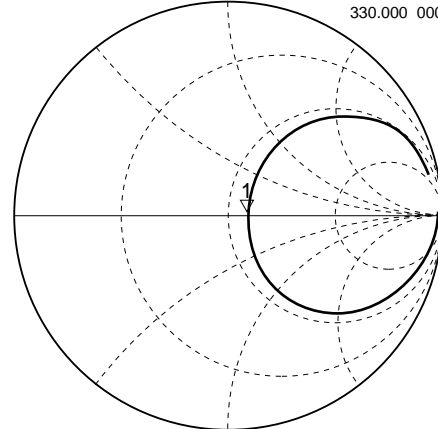
C2  
De1



CENTER 330.000 000 MHz SPAN 200.000 000 MHz

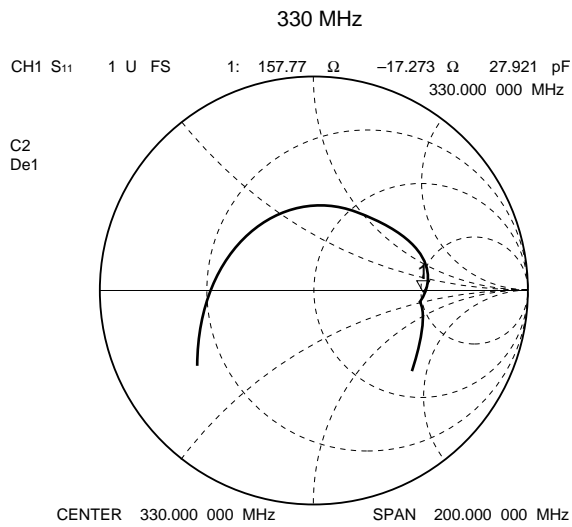
CH1 S<sub>22</sub> 1 U FS 1: 60.922  $\Omega$  -91.797  $\Omega$  5.2539 nF  
330.000 000 MHz

C2  
De1

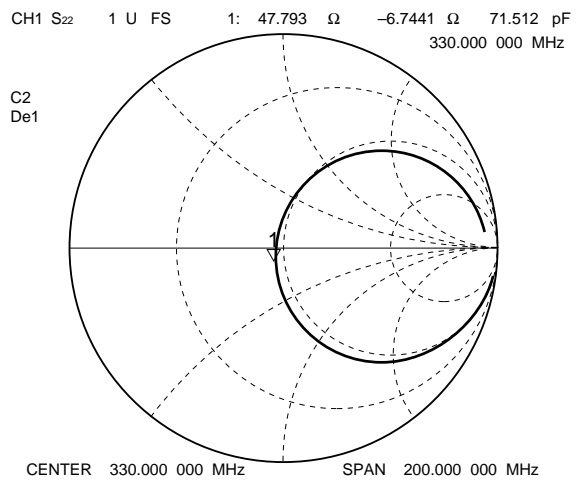
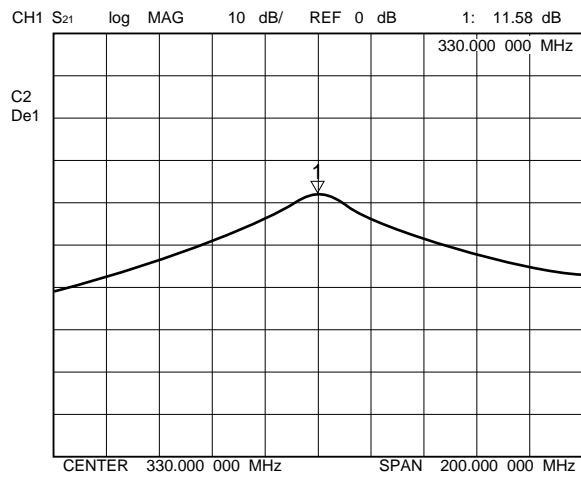
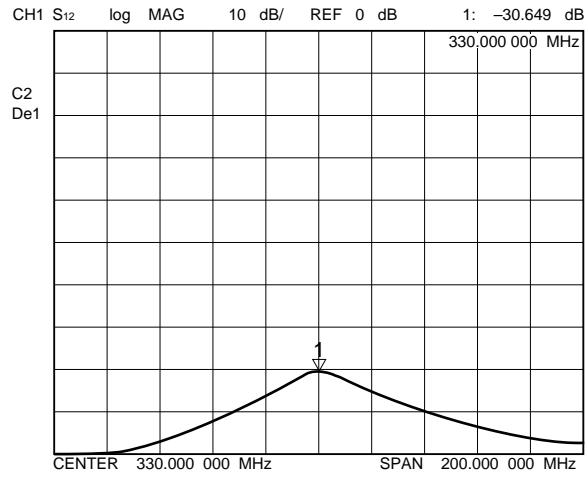


CENTER 330.000 000 MHz SPAN 200.000 000 MHz

- TEST CIRCUIT 6 (matched to optimize NF) -

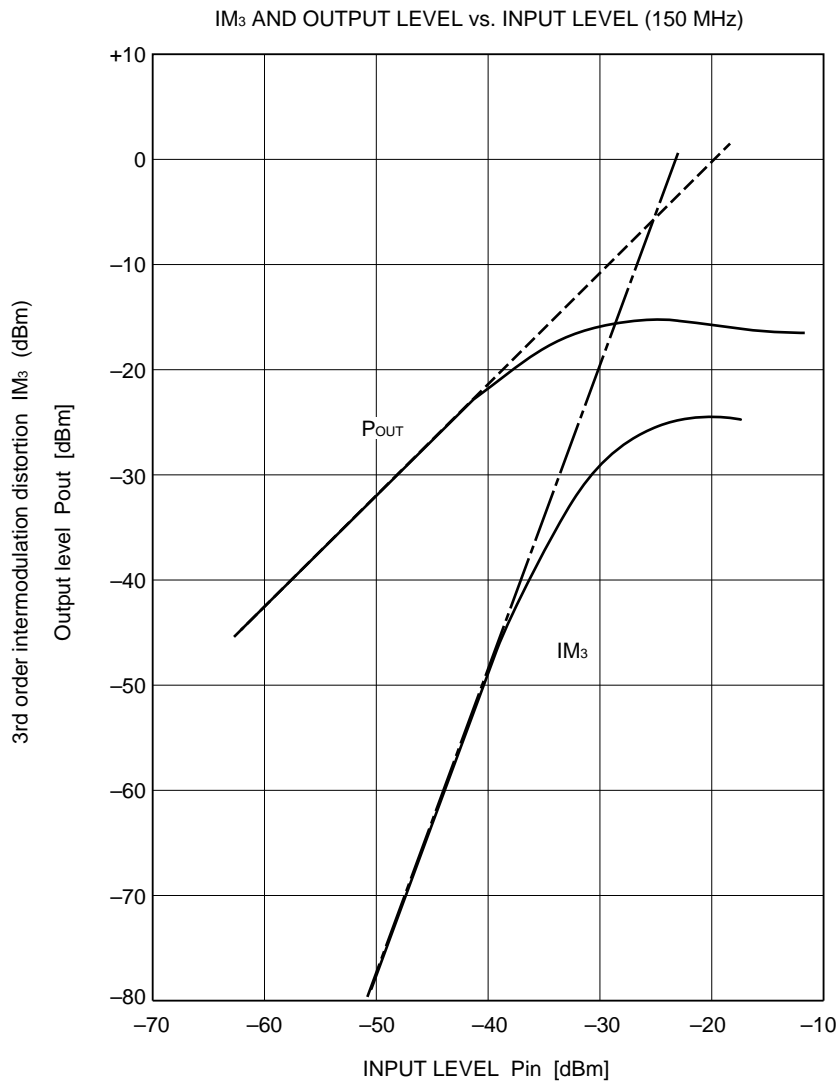


V<sub>CC</sub> = 1.00 V , I<sub>CC</sub> = 0.55 mA NF = 3.14 dB

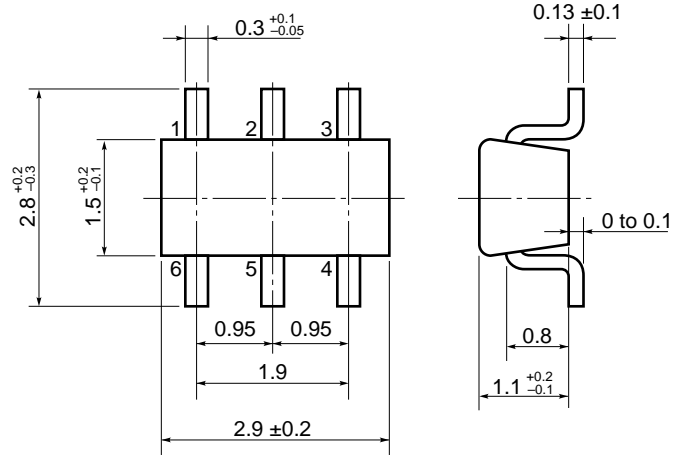




- TEST CIRCUIT 2 -



6 PIN MINI MOLD PACKAGE DIMENSIONS (Unit: mm)



**NOTE ON CORRECT USE**

- (1) Observe precautions for handling because of electro-static sensitive devices.
- (2) Form a ground pattern as wide as possible to minimize ground impedance (to prevent undesired oscillation).
- (3) Keep the track length of the ground pins as short as possible.
- (4) The bypass capacitor (eg 1 000 pF) should be attached to the V<sub>CC</sub> pin.
- (5) The matching circuit must be each attached to input and output pins.

**RECOMMENDED SOLDERING CONDITIONS**

This product should be soldered in the following recommended conditions. Other soldering methods and conditions than the recommended conditions are to be consulted with our sales representatives.

μPC8102T

Soldering process	Soldering conditions	Recommended condition symbol
Infrared ray reflow	Package peak temperature: 235 °C, Hour: within 30 s. (more than 210 °C), Time: 3 time, Limited days: no.*	IR35-00-3
VPS	Package peak temperature: 215 °C, Hour: within 40 s. (more than 200 °C), Time: 3 time, Limited days: no.*	VP15-00-3
Wave Soldering	Soldering tub temperature: less than 260 °C, Hour: within 10 s. Time: 1 time, Limited days: no.*	WS60-00-1
Pin part heating	Pin area temperature: less than 300 °C, Hour: within 3 s/pin. Limited days: no.*	

\* It is the storage days after opening a dry pack, the storage conditions are 25 °C, less than 65 % RH.

**Note** The combined use of soldering method is to be avoided (However, except the pin area heating method).

For details of recommended soldering conditions for surface mounting, refer to information document **SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535EJ7V0IF00)**.

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NEC devices are classified into the following three quality grades:

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Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices in “Standard” unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact NEC Sales Representative in advance.

Anti-radioactive design is not implemented in this product.