

BIPOLAR ANALOG INTEGRATED CIRCUITS

μ PC2762T, μ PC2763T

3V-BIAS, MEDIUM-POWER HIGH-FREQUENCY SiMMIC AMPLIFIER FOR MOBILE COMMUNICATIONS

DESCRIPTION

μ PC2762T and μ PC2763T are silicon monolithic integrated circuits designed for the transmission (TX) stage buffers of mobile communications. The high frequency medium power output is suitable for RF-TX of cellular and cordless telephones. The RF characteristics are specified with wideband operation, but the improved characteristics in narrow band can be also available due to adjustment of external inductor (inductance, Q, etc.). 3 V supply operation is suitable for low voltage systems. Due to the 50 Ω cascable and mini-mold package, these ICs are suitable for high-density surface mounting.

These ICs are manufactured using NEC's 20 GHz fr NESAT™ III silicon bipolar process. This process uses silicon nitride passivation film and gold electrodes. These materials can protect chip surface from external pollution and prevent corrosion/migration. Thus, this series have excellent performance, uniformity and reliability.

FEATURES

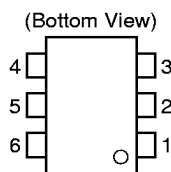
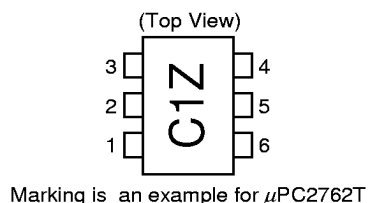
- Supply voltage : $V_{CC} = 3.0 \text{ V} \pm 0.3 \text{ V}$
- Medium output power : $P_{O(1dB)} = +8.0 \text{ dBm}_{TYP.} @ 0.9 \text{ GHz} - \mu\text{PC2762T}$
(with external inductor to gain wideband)
 $P_{O(1dB)} = +9.5 \text{ dBm}_{TYP.} @ 0.9 \text{ GHz} - \mu\text{PC2763T}$
(with external inductor to gain wideband)
- Wide band operation : $\mu\text{PC2762T} - G_P = 13 \text{ dB}_{TYP.}, f_u = 2.9 \text{ GHz}_{TYP.}, \mu\text{PC2763T} - G_P = 20 \text{ dB}_{TYP.},$
 $f_u = 2.4 \text{ GHz}_{TYP.}$
- 50 Ω cascable : 50 Ω input/output impedance
- High-density surface mounting : 6 pin mini mold package
- Adjacent channel interference : -60 dBc (reference) @ $f = 900 \text{ MHz}, \Delta f = \pm 50 \text{ kHz}, P_o = 4 \text{ dBm}$

ORDERING INFORMATION

PART NUMBER	PACKAGE	MARKINGS	SUPPLYING FORM	POWER GAIN @ $f = 0.9 \text{ GHz}$
$\mu\text{PC2762T-E3}$	6pin mini mold	C1Z	Embossed tape 8mm wide. Pin 1, 2, 3 face to perforation side of the tape. QTY 3 kp/reel.	13 dB _{TYP.}
$\mu\text{PC2763T-E3}$		C2A		20 dB _{TYP.}

Note To order evaluation samples, please contact your local NEC sales office. (Part number: $\mu\text{PC2762T}$, $\mu\text{PC2763T}$)

PIN CONNECTION



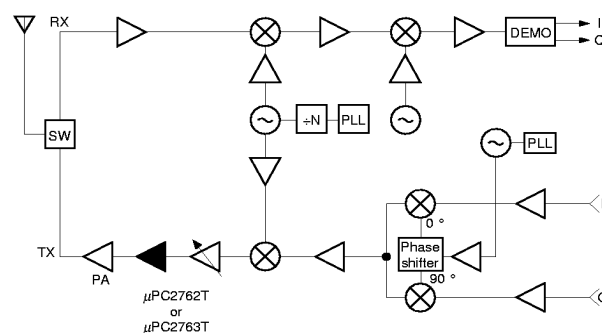
Pin No.	Pin name
1	Input
2	GND
3	GND
4	Output
5	GND
6	V_{CC}

Caution: Electro-static sensitive devices

SELECTOR GUIDE ($T_A = +25^\circ\text{C}$, $V_{CC} = V_{out} = 3.0\text{ V}$, $Z_L = Z_S = 50\ \Omega$)

TYPE		PART NUMBER	V_{CC} (V)	I_{CC} (mA)	G_P (dB)	f_u (GHz)	$P_{O(sat)}$ (dBm)	$P_{O(1dB)}$ (dBm)
5 V, 15 dB gain		μ PC2708T	5	26	15	2.9	+10	+8.5
5 V, 23 dB gain		μ PC2709T	5	26	23	2.3	+11.5	+9
3 V, 20 dB gain		μ PC2762T	3	26.5	13	2.9	+9	+8
3 V, 13 dB gain	+9.5 dBm output	μ PC2763T	3	27	20	2.4	+11	+9.5
	+11.5 dBm output	μ PC2771T	3	36	21	2.1	+12.5	+11.5

Notice Typical performance with TEST CIRCUIT. Please refer to ELECTRICAL CHARACTERISTICS in detail. To know the associated product listed above, please refer to each latest data sheet.

SYSTEM APPLICATION EXAMPLE**Digital cellular telephone**

Note The insertion point is different due to the specifications of conjunct devices.
For conjunction with your devices, refer to the data sheets to confirm their combination.

PIN FUNCTIONS

PIN	SYMBOL	APPLIED VOLTAGE (V)	DESCRIPTION	EQUIVALENT CIRCUIT
1	INPUT	—	High-frequency signal input pin. A internal matching circuit, configured with resistors, enables $50\ \Omega$ connection over a wide band. A multi-feedback circuit is designed to cancel the deviations of h_{FE} and resistance.	
2 3 5	GND	0	Ground pin. Form a ground pattern as wide as possible to minimize ground impedance.	
4	OUTPUT	2.7 - 3.3	High-frequency signal output pin. Connect an inductor between this pin and V_{CC} to supply current to the internal output transistors.	
6	V_{CC}		Power supply pin, which biases the internal input transistor. Excellent RF characteristics are obtained by employing a two-stage amplifier.	

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT	CONDITIONS
Supply Voltage	V _{CC}	3.6	V	T _A = +25 °C, pins 4 and 6.
Circuit Current	I _{CC}	70	mA	T _A = +25 °C
Power Dissipation	P _D	280	mW	Mounted on 50 × 50 × 1.6 mm double side copper clad epoxy glass PWB T _A = +85 °C
Operating Temperature	T _{A(opt)}	−40 to +85	°C	
Storage Temperature	T _{A(stg)}	−55 to +150	°C	
Input Power	P _{in}	+10	dBm	T _A = +25 °C

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	Notices
Supply Voltage	V _{CC}	2.7	3.0	3.3	V	The same voltage must be applied to pin 4 and 6.
Operating Temperature	T _{A(opt)}	−40	+25	+85	°C	

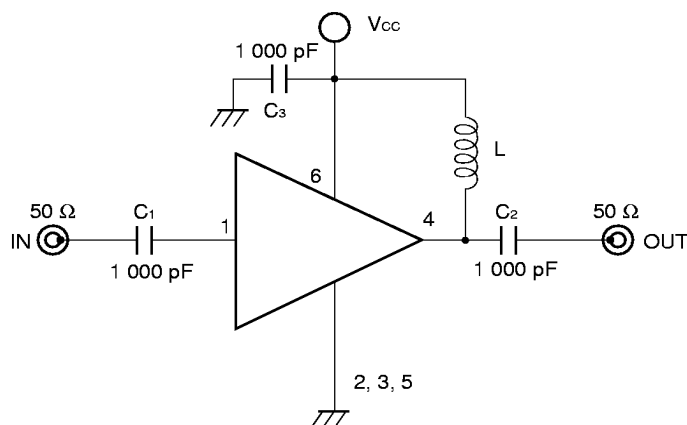
ELECTRICAL CHARACTERISTICS (T_A = +25 °C, V_{CC} = V_{out} = 3.0 V, Z_L = Z_s = 50 Ω)

PARAMETER	SYMBOL	μ PC2762T			μ PC2763T			UNIT	CONDITION
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
Circuit Current	I _{CC}	—	26.5	35	—	27	35	mA	No input signals
Power Gain	G _P	11 11.5	13 14.5	16 17.5	18 16.5	20 19.5	23 22.5	dB	f = 0.9 GHz f = 1.9 GHz
Noise Figure	NF	— —	6.5 7.0	8.0 8.5	— —	5.5 5.5	7.0 7.0	dB	f = 0.9 GHz f = 1.9 GHz
Upper Limit Operating Frequency	f _u	2.7	2.9	—	2.0	2.4	—	GHz	3 dB less than the gain at 0.1 GHz
Isolation	ISL	22 20	27 25	— —	25 24	30 29	— —	dB	f = 0.9 GHz f = 1.9 GHz
Input Return Loss	PL _{in}	6.0 5.5	9.0 8.5	— —	8.0 9.0	11.0 12.0	— —	dB	f = 0.9 GHz f = 1.9 GHz
Output Return Loss	RL _{out}	8.0 9.0	11.0 12.0	— —	5.0 6.0	8.0 9.0	— —	dB	f = 0.9 GHz f = 1.9 GHz
1dB Compression Output	P _{O(1dB)}	+5.5 +4.5	+8.0 +7.0	— —	+7.0 +4.0	+9.5 +6.5	— —	dBm	f = 0.9 GHz f = 1.9 GHz

STANDARD CHARACTERISTICS FOR REFERENCE (T_A = +25 °C, V_{CC} = V_{out} = 3.0 V, Z_L = Z_s = 50 Ω)

PARAMETER	SYMBOL	μ PC2762T			μ PC2763T			UNIT	CONDITION	
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.			
Saturated Output Power	P _{O(sat)}	— —	+9.0 +8.5	— —	— —	+11 +8.0	— —	dBm	f = 0.9 GHz f = 1.9 GHz	
Adjacent Channel Interference	P _{adj}	— —	−64 −64	— —	— —	−61 −62	— —	dBc	f = 900 MHz π / 4QPSK P _O = +4 dBm	Δf = ± 50 kHz Δf = ± 100 kHz
3rd Order Intermodulation Distortion	IM ₃	— —	−16 −10	— —	— —	−27 −14	— —	dBc	2 sine wave input. Output of each tone P _O = +4 dBm	f ₁ = 900 MHz f ₂ = 902 MHz f ₁ = 1.9 GHz f ₂ = 1.902 GHz

TEST CIRCUIT



Components of test circuit for measuring electrical characteristics

	TYPE	VALUE
C ₃	Capacitor	1 000 pF
L	Bias Tee	1 000 nH
C ₁ to C ₂	Bias Tee	1 000 pF

Example of actual application components

	TYPE	VALUE	OPERATING FREQUENCY
C ₁ to C ₃	Chip capacitor	1 000 pF	100 MHz or higher
L	Chip inductor	50 nH	900 MHz band
		10 nH	2.5 GHz band

INDUCTOR FOR THE OUTPUT PIN

The internal output transistor of this IC consumes 20 mA, to output medium power. To supply current for output transistor, connect an inductor between the V_{cc} pin (pin 6) and output pin (pin 4). Select large value inductance, as listed above.

The inductor has both DC and AC effects. In terms of DC, the inductor biases the output transistor with minimum voltage drop to output enable high level. In terms of AC, the inductor make output-port-impedance higher to get enough gain. In this case, large inductance and Q is suitable.

For above reason, select an inductance of 100 Ω or over impedance in the operating frequency. The gain is a peak in the operating frequency band, and suppressed at lower frequencies.

The recommendable inductance can be chosen from example of actual application components list as shown above.

CAPACITORS FOR THE V_{cc}, INPUT, AND OUTPUT PINS

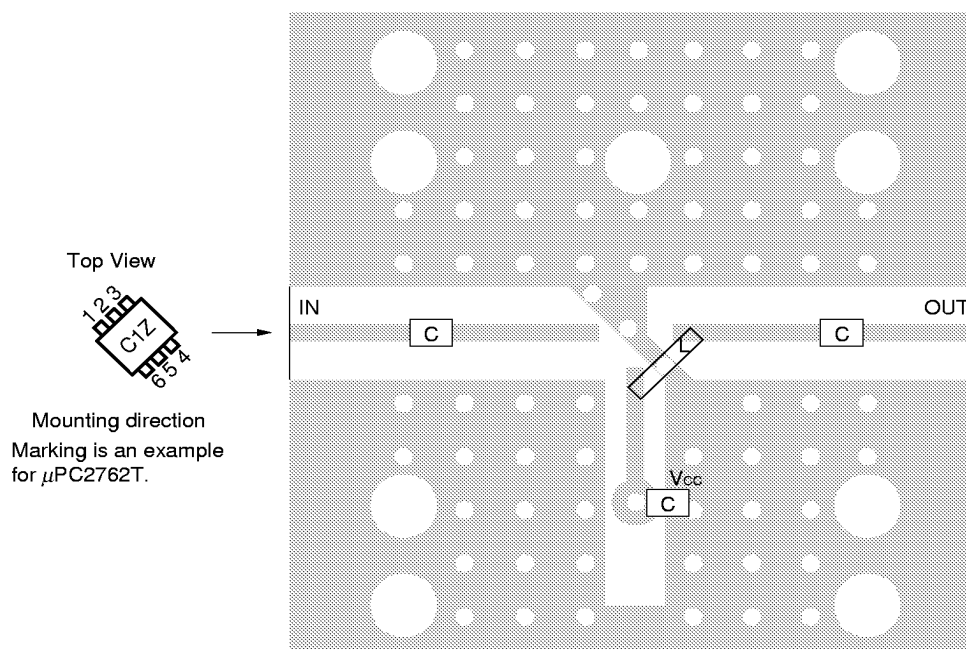
Capacitors of 1 000 pF are recommendable as the bypass capacitor for the V_{cc} pin and the coupling capacitors for the input and output pins.

The bypass capacitor connected to the V_{cc} pin is used to minimize ground impedance of V_{cc} pin. So, stable bias can be supplied against V_{cc} fluctuation.

The coupling capacitors, connected to the input and output pins, are used to cut the DC and minimize RF serial impedance. Their capacitance are therefore selected as lower impedance against a 50 Ω load. The capacitors thus perform as high pass filters, suppressing low frequencies to DC.

To obtain a flat gain from 100 MHz upwards, 1 000 pF capacitors are used in the test circuit. In the case of under 10 MHz operation, increase the value of coupling capacitor such as 10 000 pF. Because the coupling capacitors are determined by equation, $C = 1/(2\pi R f c)$.

ILLUSTRATION OF TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD

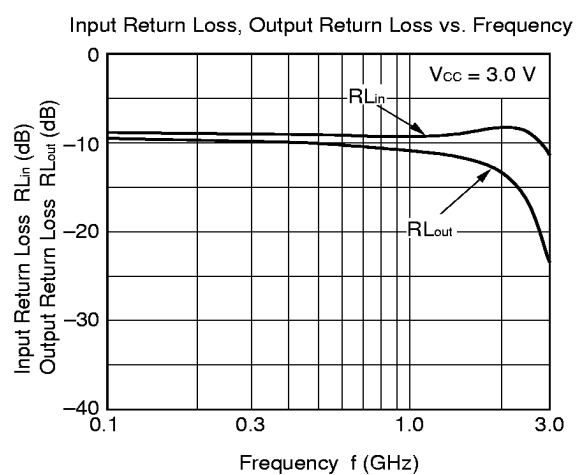
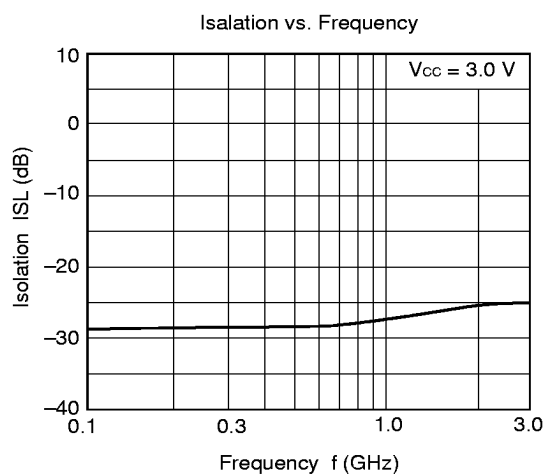
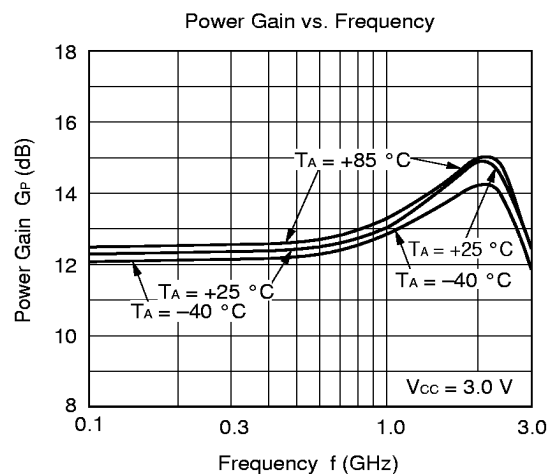
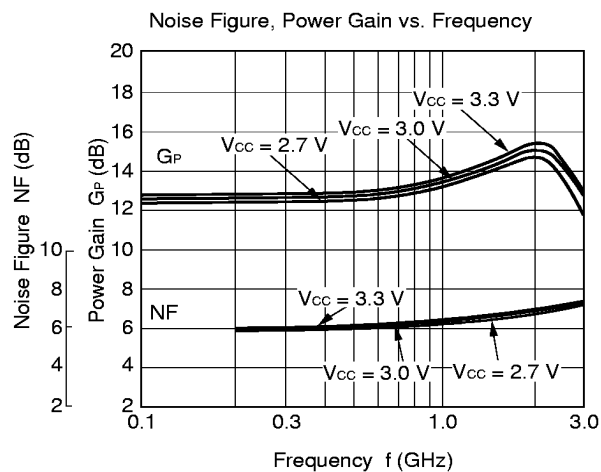
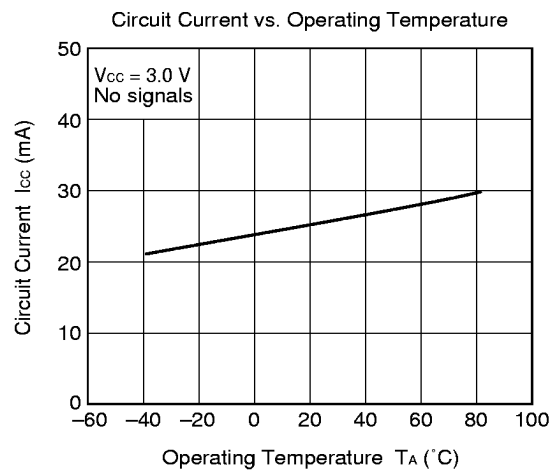
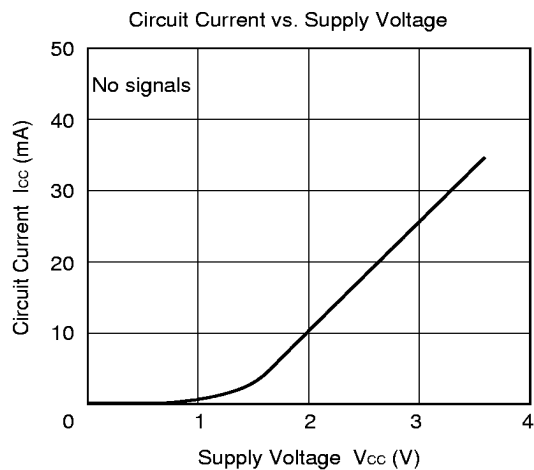


Component list for Application Example

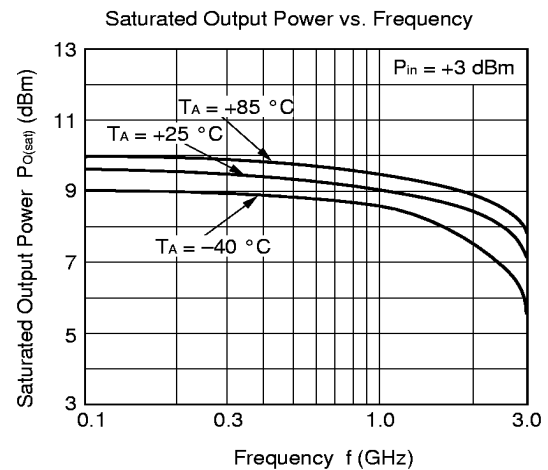
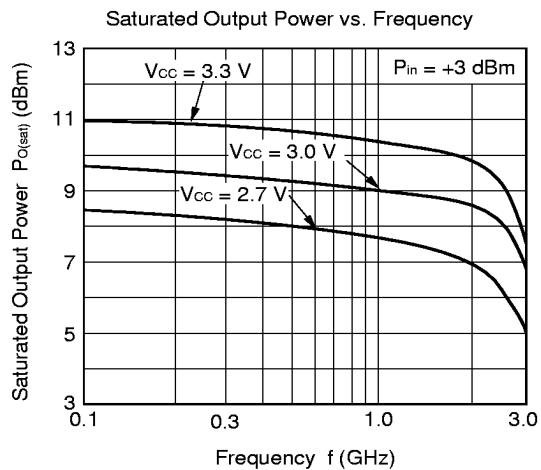
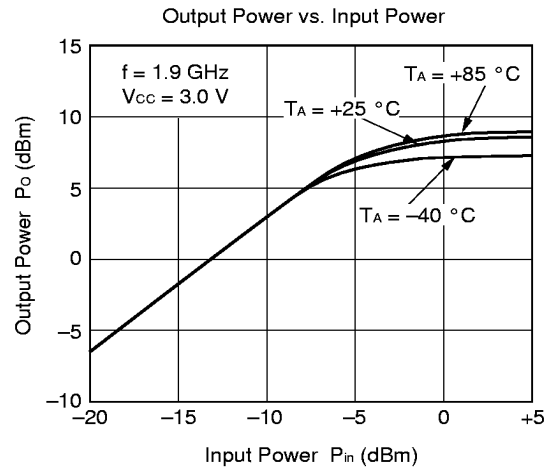
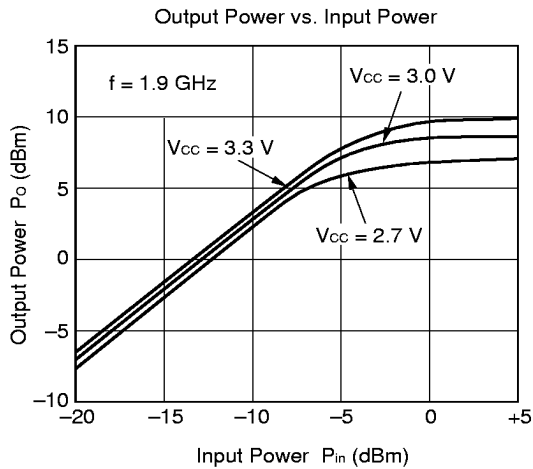
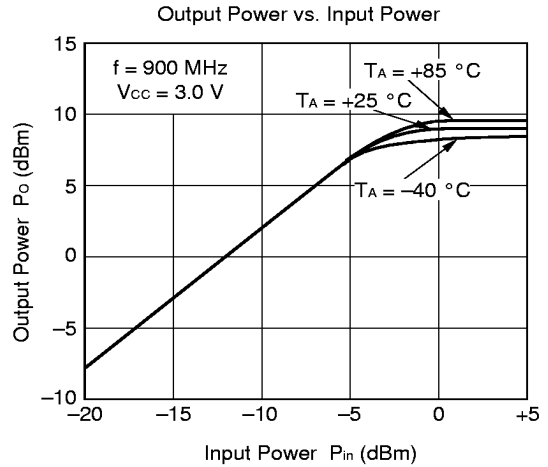
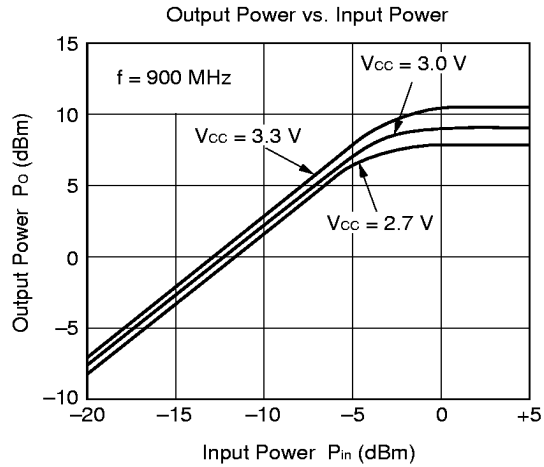
SYMBOL	Value
C	1 000 pF
L	10 nH etc.

Note for Evaluation board

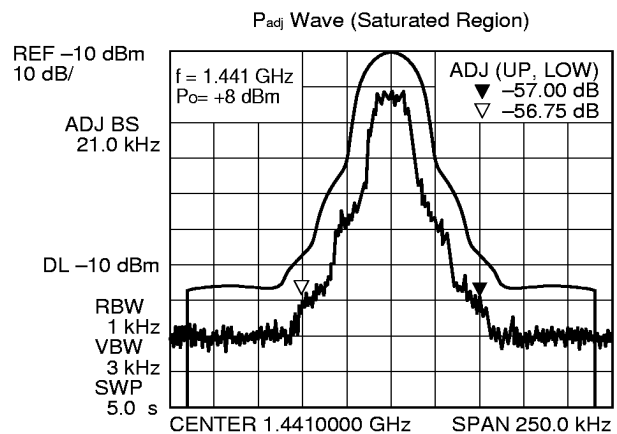
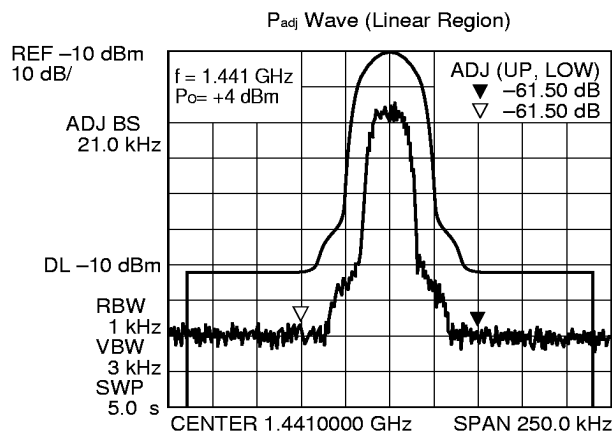
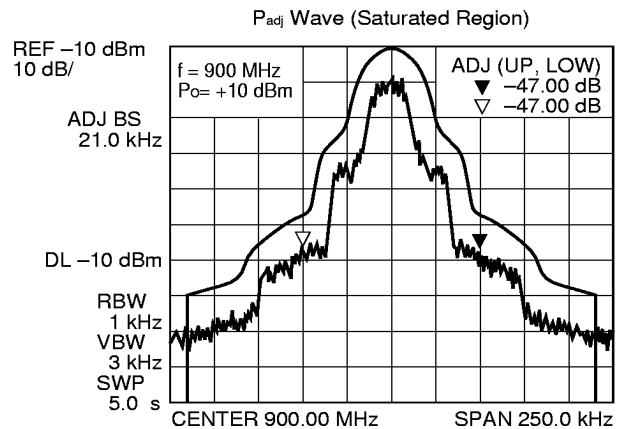
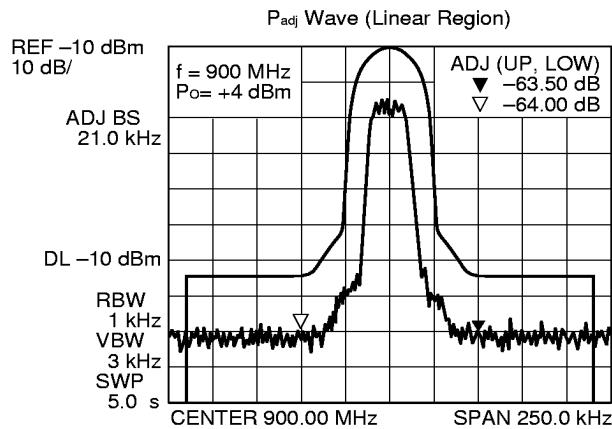
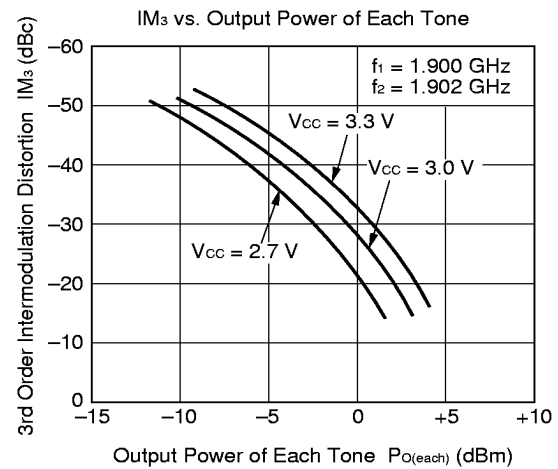
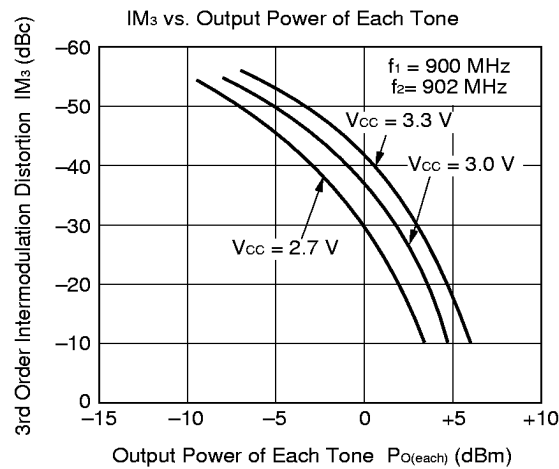
- (1) Double sided copper clad $30 \times 30 \times 0.4$ mm polyimide board
- (2) Solder plated pattern
- (3) ○ : Through holes
- (4) Back side: GND pattern

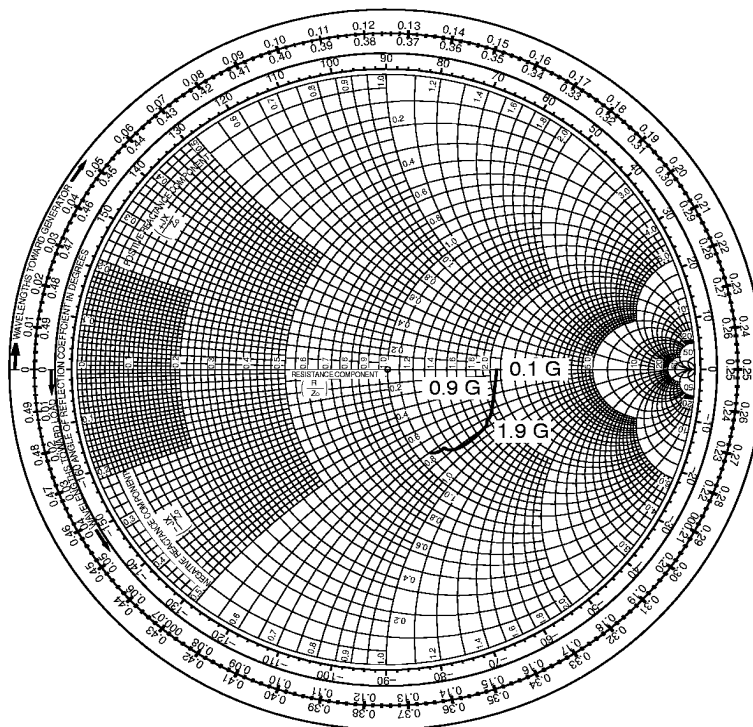
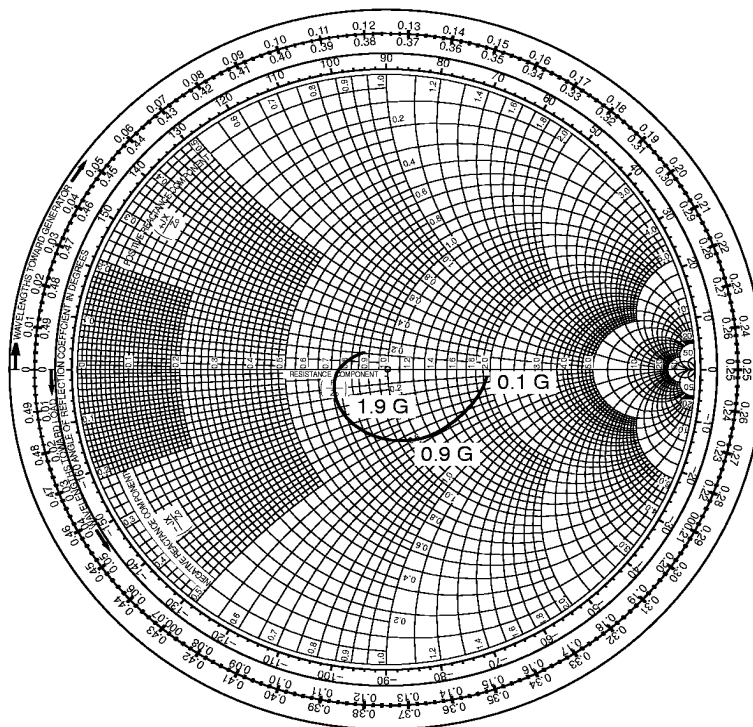
TYPICAL CHARACTERISTICS ($T_A = +25\text{ }^{\circ}\text{C}$)— μ PC2762T—

— μ PC2762T—



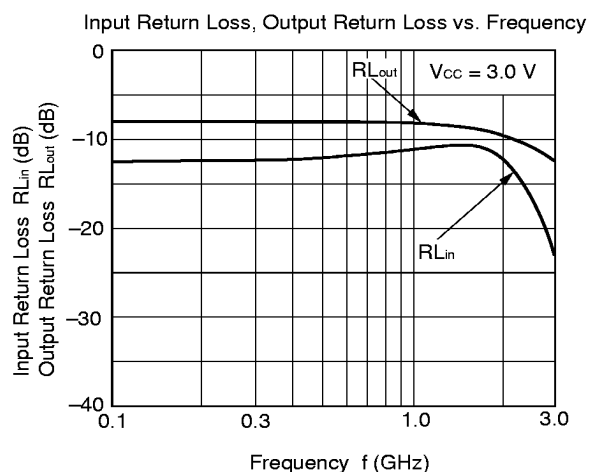
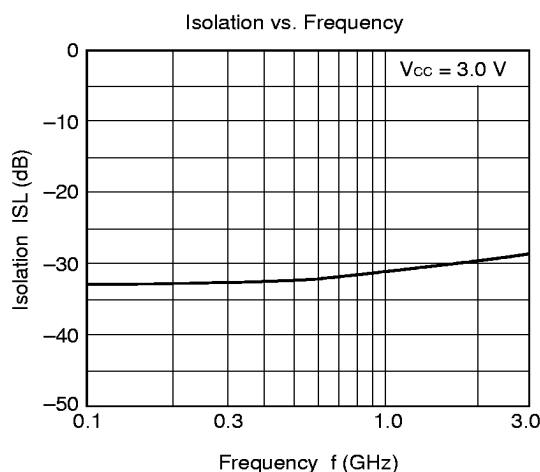
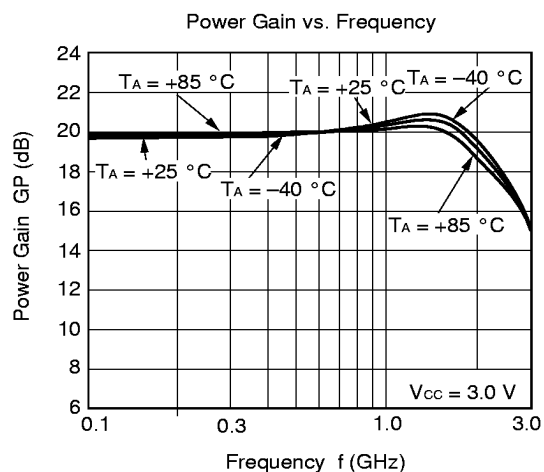
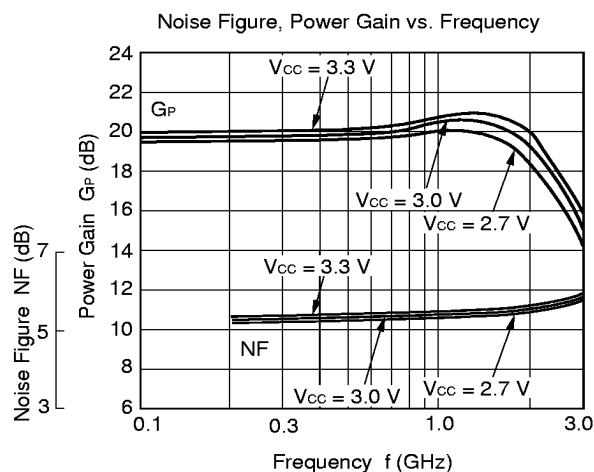
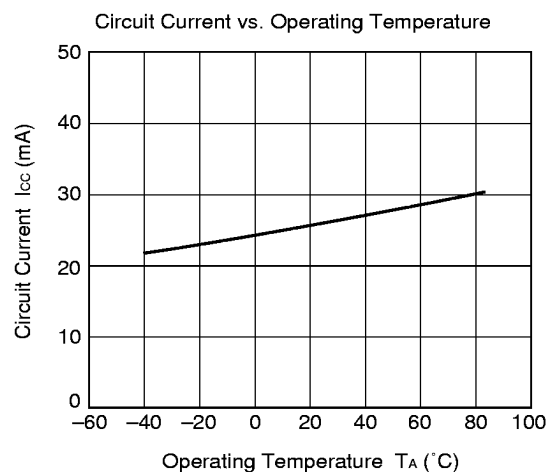
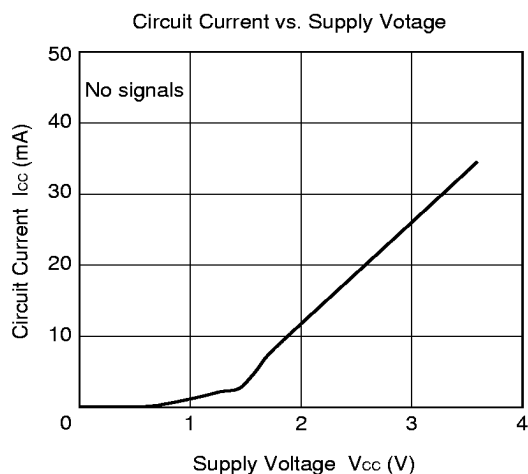
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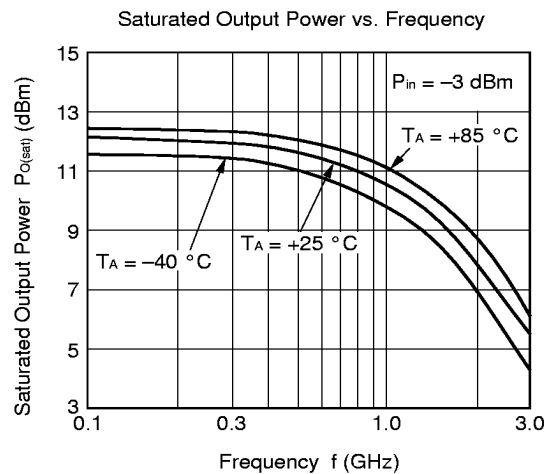
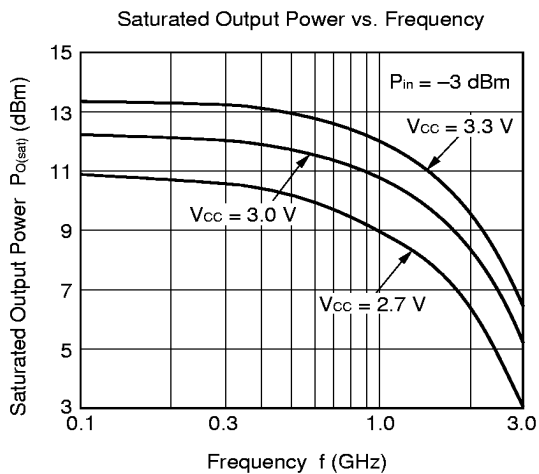
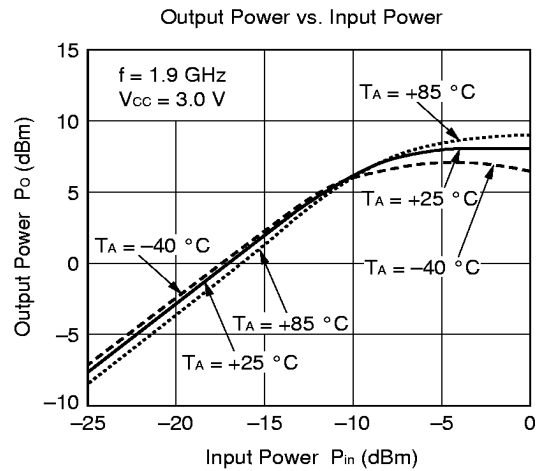
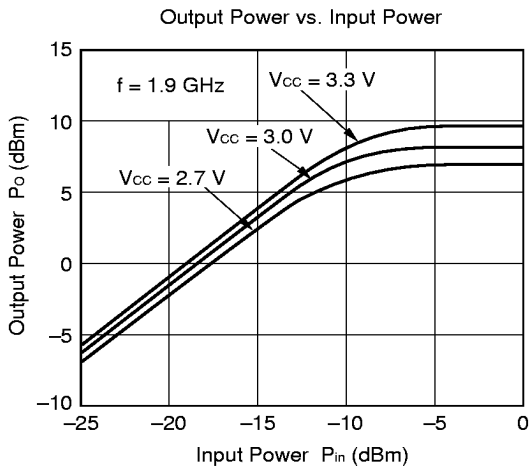
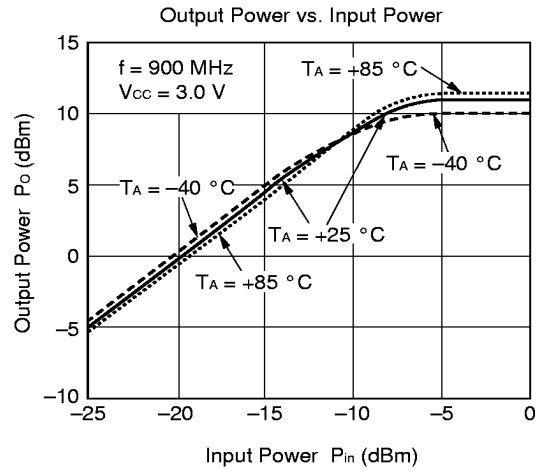
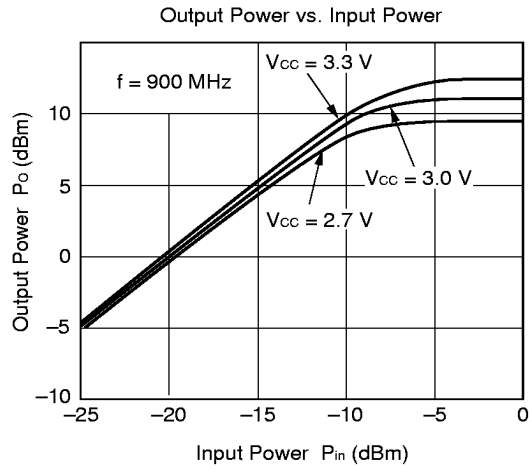
S Parameter — μ PC2762T—S₁₁ – FREQUENCY (V_{cc} = 3.0 V)S₂₂ – FREQUENCY (V_{cc} = 3.0 V)

TYPICAL CHARACTERISTICS ($T_A = +25^\circ\text{C}$)

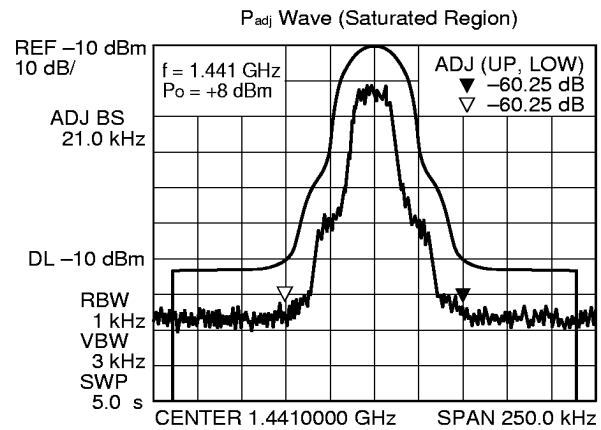
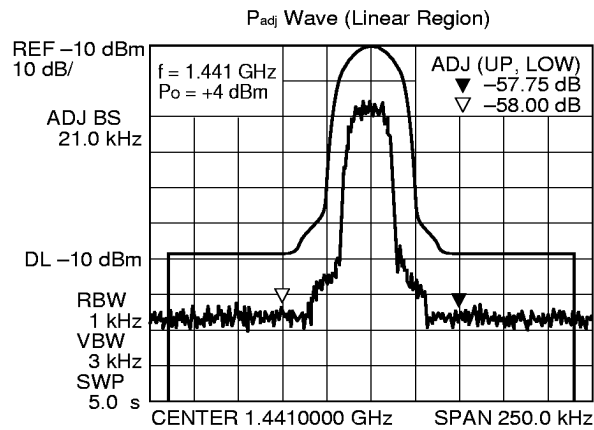
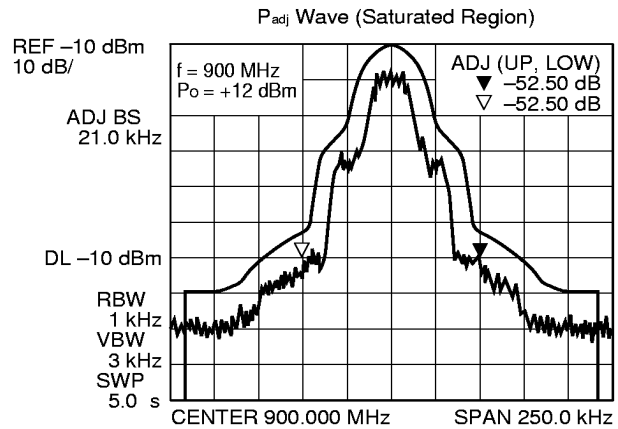
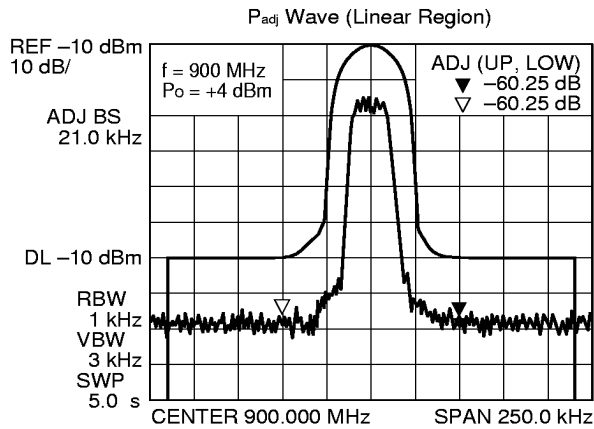
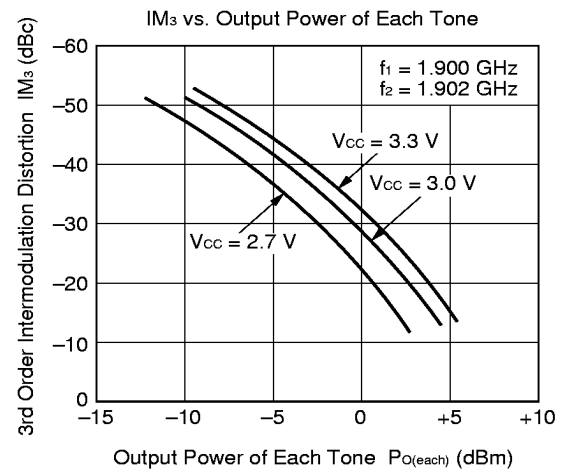
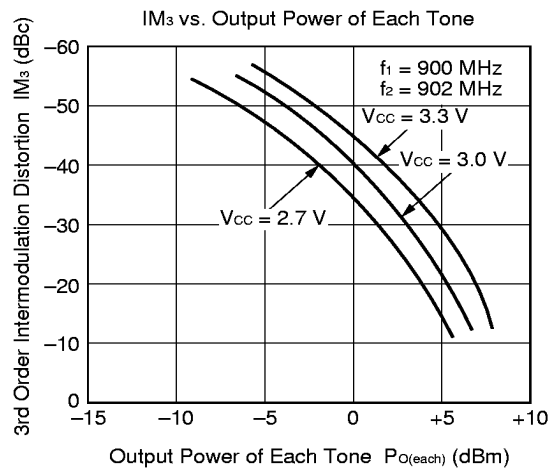
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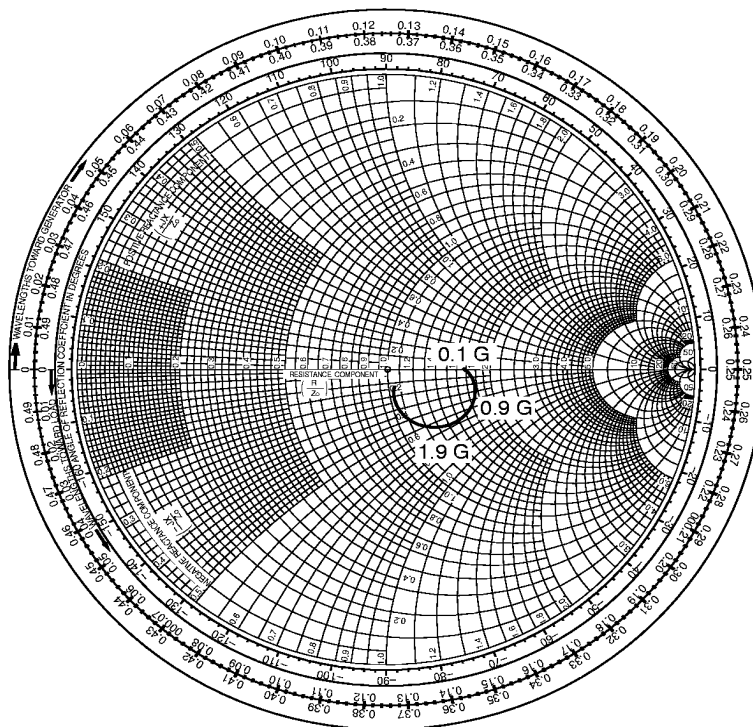
— μ PC2763T—



— μ PC2763T—



S₁₁ – FREQUENCY (V_{CC} = 3.0 V)

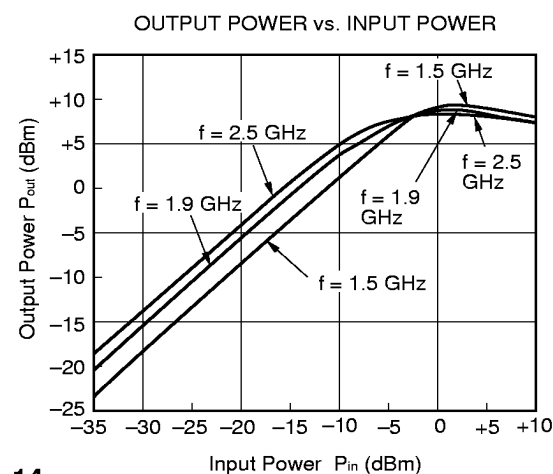
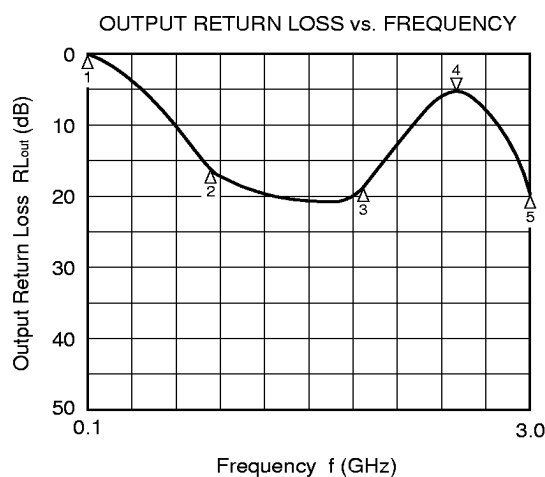
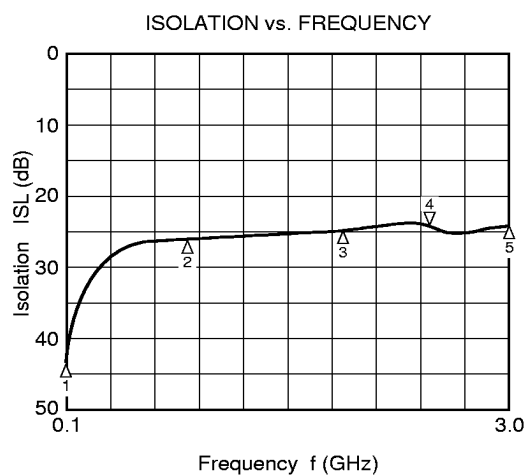
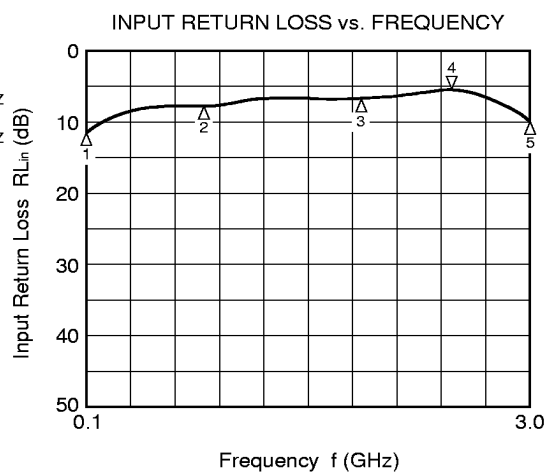
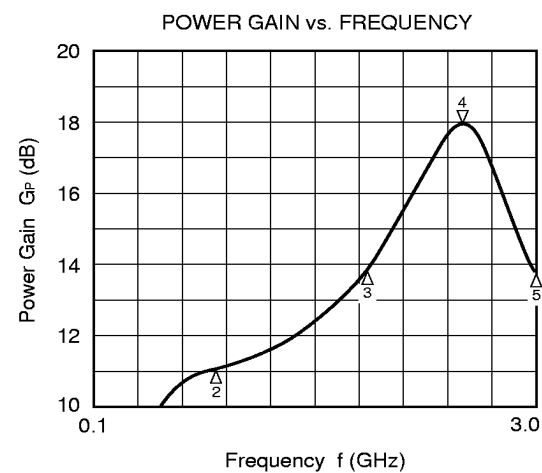


The image shows a circular Smith Chart with a shaded region. The shaded region is bounded by a radial line at 180 degrees and a curve labeled '0.9G' and '1.9G'. The chart includes scales for SWR, dBS, and reflection coefficients. The shaded region is labeled 'SWR = 1.9' and 'dBS = 1.9'.

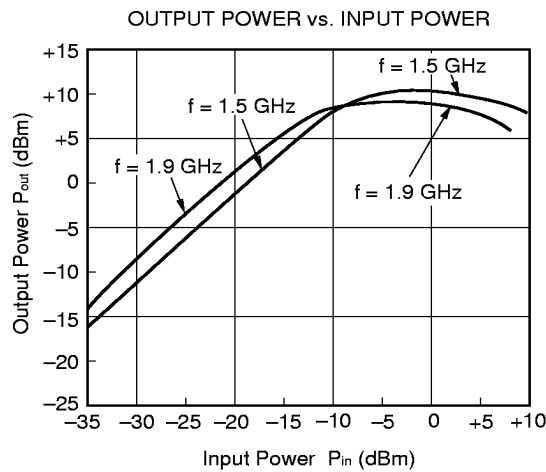
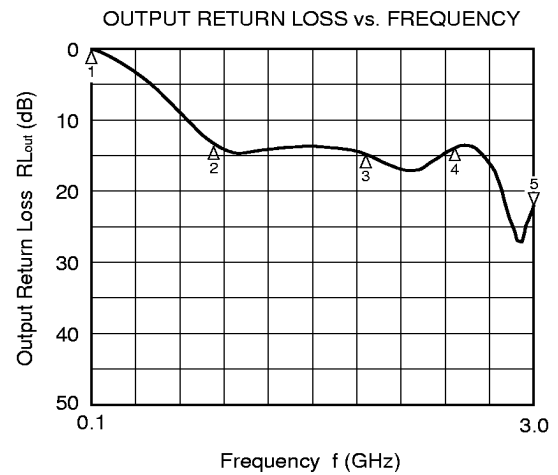
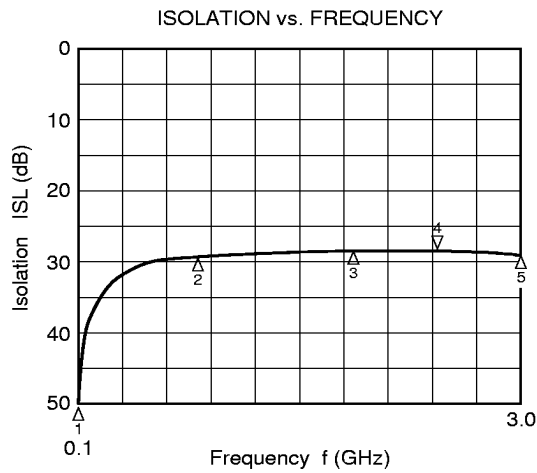
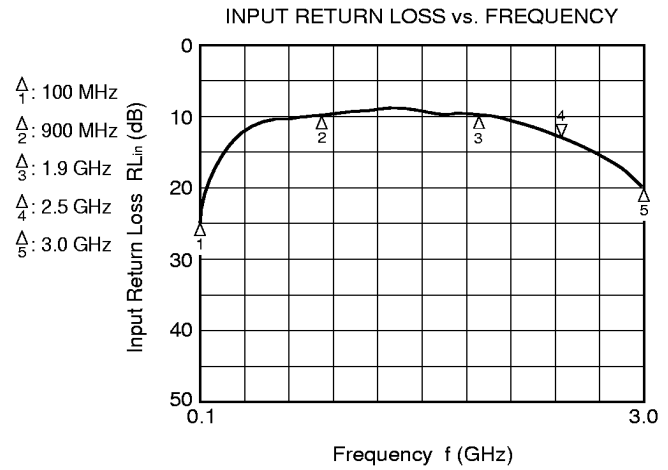
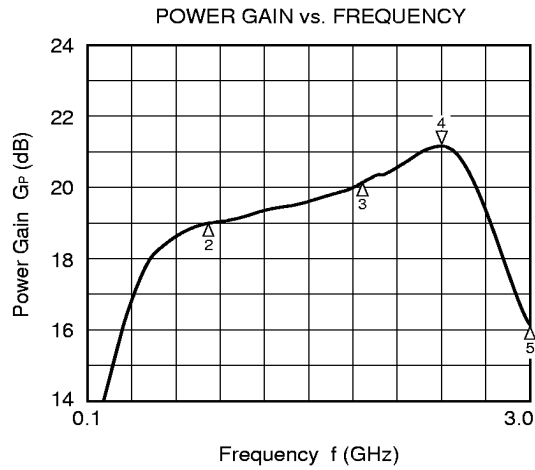
—CHARACTERISTIC CURVES WITH ACTUAL APPLICATION COMPONENTS EXAMPLE—

Specifications of sample chip inductor

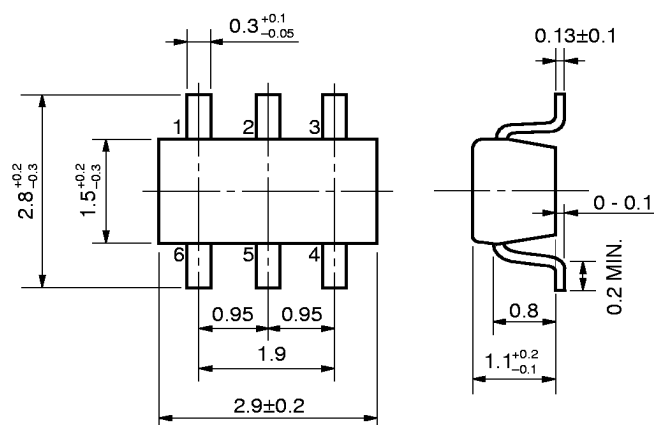
Manufacturer	Product name	Inductance: nH	Q TYP.	DC resistance	Self-resonance frequency	Allowable current
Murata Mfg. Co, Ltd.	LQN2A10NM	10	60	$0.25 \leq 0$	1 000 MHz	770 mA

— μ PC2762T—

— μ PC2763T—



DIMENSIONS OF 6-PIN MINI-MOLD PACKAGE (Units: mm)



NOTES 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). All the ground pins must be connected together with wide ground pattern to decrease impedance difference.
- (3) The bypass capacitor should be attached to the Vcc pin.
- (4) The inductor must be attached between V_{cc} and output pin. The inductance value should be determined in accordance with desired frequency.
- (5) The DC cut capacitor must be each attached to the input and output pins.

RECOMMENDED SOLDERING CONDITIONS

The conditions listed below shall be satisfied when soldering this product.

Consult your NEC sales offices when using any other soldering process, or when soldering is done under different conditions.

 μ PC2762T, μ PC2763T

SOLDERING PROCESS	SOLDERING CONDITIONS	SYMBOL
Infrared ray reflow	Peak package surface temperature : 235 °C Reflow time : 30 seconds MAX. (at 210 °C or more) Number of reflow processes : 3 Exposure limit ^{Note} : None	IR35-00-3
VPS	Peak package surface temperature : 215 °C Reflow time : 40 seconds MAX. (at 200 °C or more) Number of reflow processes : 3 Exposure limit ^{Note} : None	VP15-00-3
Wave soldering	Solder temperature : 260 °C Flow time : 10 seconds MAX. Number of flow processes : 1 Exposure limit ^{Note} : None	WS60-00-1
Partial heating method	Solder temperature : 300 °C or less Flow time : 3 seconds MAX./pin Exposure limit ^{Note} : None	

Note Exposure limit before soldering after dry-pack package is opened.

Storage conditions: Temperature of 25 °C and maximum relative humidity of 65 %

Caution Do not apply more than a single process at once, except for "Partial heating method".

For details of the recommended soldering conditions, refer to the "SMD Surface Mount Technology Manual" (C10535EJ7V01F00).