DATA SHEET

BIPOLAR ANALOG INTEGRATED CIRCUITS

μPC2746T, 2747T, 2748T

3V BIAS SILICON MMIC AMPLIFIERS FOR 900 MHz BAND MOBILE TELEPHONE

FEATURES

- Low voltage operation – Single supply voltage 3.0 V TYP. minimum operating voltage 1.8 V
- Wide Band Operation – μPC2746T: G_p = 19 dB TYP., f_u = 1.5 GHz/μPC2747T: G_p = 12 dB TYP., f_u = 1.8 GHz
- Low Noise Figure – μPC2747T: NF = 3.3 dB TYP./μPC2748T: NF = 2.8 dB TYP. @900 MHz
- Packaged in 6 pin mini mold suitable for high-density surface mounting.

DESCRIPTION

μPC2746T to μPC2748T are silicon monolithic integrated circuits designed as buffer amplifiers for 900 MHz band cellular and cordless telephone applications, etc. These high isolation amplifiers suit to local buffers. These ICs operate on 3 V TYP. (minimum operating voltage 1.8 V) and therefore are suitable for hand-held, battery-operated systems. Due to the line-up with various performance, this series can be selected correspondingly to user's system design.

μPC2746T to μPC2748T are manufactured using NEC's 20 GHz f_T NESAT™ III silicon bipolar process. This process uses silicon nitride passivation film and gold metalization wirings. These materials can protect chip surface from external pollution and prevent corrosion/migration. Thus, these ICs have excellent performance, uniformity and reliability.

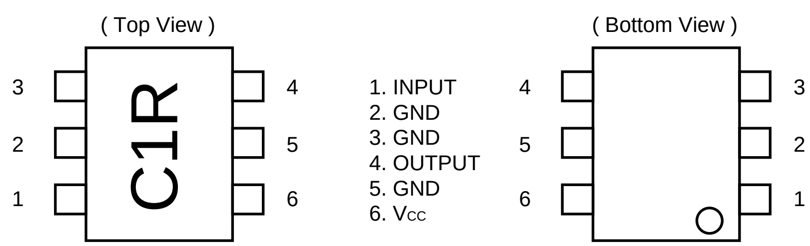
ORDER INFORMATION

PART NUMBER	PACKAGE	MARKING	SUPPLYING FORM	PRODUCT TYPE (TYP.)
μPC2746T-E3	6 pin mini mold	C1R	Embossed tape 8 mm wide. QTY 3 K/Reel Pin 1, 2, 3 face to perforation side of the tape.	19 dB gain/wideband
μPC2747T-E3		C1S		12 dB gain/3.3 dB NF
μPC2748T-E3		C1T		19 dB gain/2.8 dB NF

Remarks To order evaluation samples, please contact your local NEC office. (Order number: μPC2746T, μPC2747T, μPC2748T)

PIN CONNECTIONS

Markings is an example for μPC2746T



Caution: Electro-static sensitive devices

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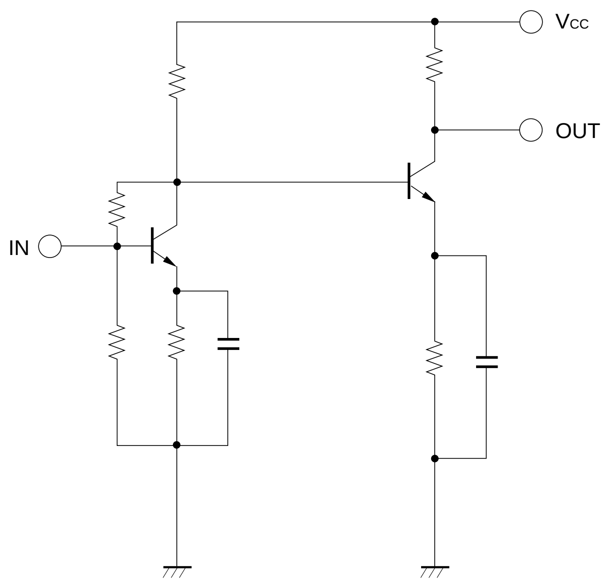
SELECTOR GUIDE (T_A = +25 °C, V_{CC} = 3.0 V, Z_L = Z_S = 50 Ω)

Features	Device number	I_{CC} (mA)	G_P (dB)	NF (dB)	f_u (GHz)	$P_{O(sat)}$ (dBm)
19 dB gain/Wide band	μPC2746T	7.5	19	4.0	1.5	0
12 dB gain/3.3 dB NF	μPC2747T	5	12	3.3	1.8	–7
19 dB gain/2.8 dB NF	μPC2748T	6	19	2.8	0.2–1.5	–3.5

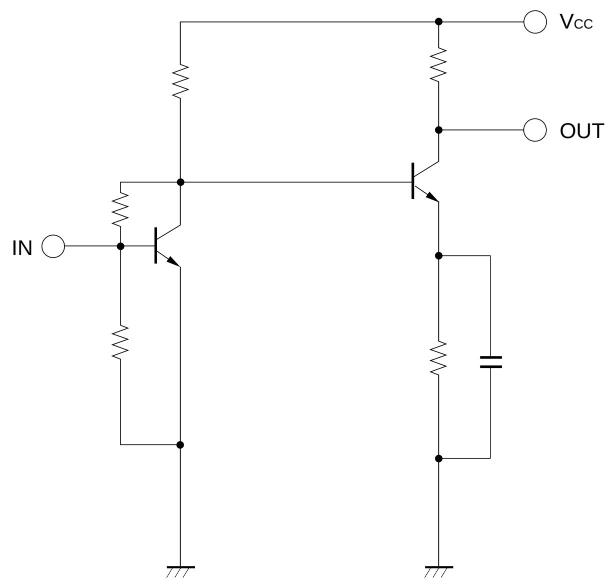
***** Typical Performance. Please refer to ELECTRICAL CHARACTERISTICS in detail.

EQUIVALENT CIRCUITS

μPC2746T



μPC2747T, 2748T



ABSOLUTE MAXIMUM RATINGS

Supply Voltage	V_{CC}	T_A = +25 °C	4.0	V
Total circuit current	I_{CC}	T_A = +25 °C	15*	mA
Total Power dissipation	P_D	Mounted on 50 × 50 × 1.6 mm epoxy glass PWB (T_A = +85 °C)	280	mW
Operating temperature	T_{opt}	ambient temperature	–40 to +85	°C
Storage temperature	T_{stg}	ambient temperature	–55 to +150	°C
Input power	P_{in}	T_A = +25 °C	0	dBm

* except μPC2746T: 16 mA

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage	Vcc	2.7	3.0	3.3	V
Operating temperature	Topt	–40	+25	+85	°C

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

PARAMETER	SYMBOL	μPC2746T			UNIT	TEST CONDITIONS
		MIN.	TYP.	MAX.		
Circuit current	I_{CC}	5.0	7.5	10.0	mA	No input signal
Power Gain	G_P	16	19	21	dB	f = 500 MHz
Noise Figure	NF		4.0	5.5	dB	f = 500 MHz
Upper limit operating frequency	f_u	1.1	1.5		GHz	3 dB down below flat gain at 0.1 GHz
Isolation	ISL	40	45		dB	f = 500 MHz
Input return loss	RL_{in}	10	13		dB	f = 500 MHz
Output return loss	RL_{out}	5.5	8.5		dB	f = 500 MHz
Maximum output level	$P_{O(sat)}$	–3	0		dBm	f = 500 MHz, P_{in} = –6 dBm

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

PARAMETER	SYMBOL	μPC2747T			μPC2748T			UNIT	TEST CONDITIONS
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
Circuit current	Icc	3.8	5	7	4.5	6	8	mA	No input signal
Power Gain	G_P	9	12	14	16	19	21	dB	f = 900 MHz
Noise Figure	NF		3.3	4.5		2.8	4.0	dB	f = 900 MHz
Lower limit operating frequency	f_L	–	–	–		0.2	0.4	GHz	3 dB down below flat gain at 0.9 GHz
Upper limit operating frequency	f_u	1.5	1.8		1.2	1.5		GHz	3 dB down below flat gain at 0.9 GHz
Isolation	ISL	35	40		35	40		dB	f = 900 MHz
Input return loss	RL_{in}	11	14		8.5	11.5		dB	f = 900 MHz
Output return loss	RL_{out}	7	10		5.5	8.5		dB	f = 900 MHz
Maximum output level	$P_{O(sat)}$	–9.5	–7		–6	–3.5		dBm	f = 900 MHz, P_{in} = –8 dBm

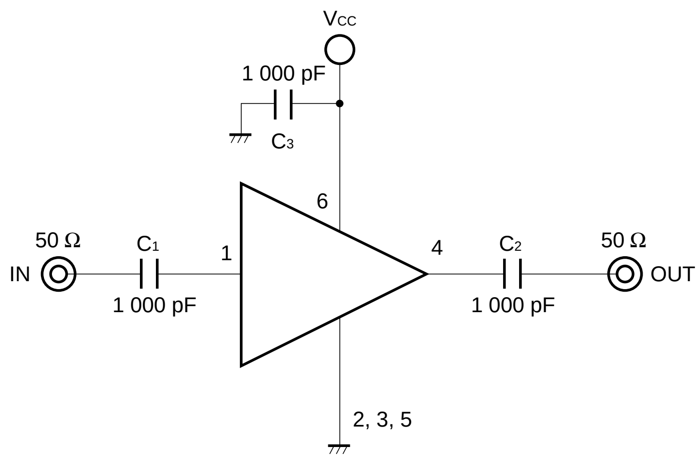
Standard characteristics for reference (T_A = +25 °C, Z_L = Z_S = 50 Ω)

FEATURES	SYMBOL	Reference value	Unit	TEST CONDITIONS
		μPC2746T		
Circuit current	I_{CC}	4.5	mA	V_{CC} = 1.8 V, No input signal
Power Gain	G_P	18.5 14	dB	V_{CC} = 3.0 V, f = 1 GHz V_{CC} = 1.8 V, f = 500 MHz
Noise Figure	NF	4.2 5.0	dB	V_{CC} = 3.0 V, f = 1 GHz V_{CC} = 1.8 V, f = 500 MHz
Upper limit operating frequency	f_u	1.1	GHz	3 dB down below flat gain at 0.1 GHz, V_{CC} = 1.8 V
Isolation	ISL	38 37	dB	V_{CC} = 3.0 V, f = 1 GHz V_{CC} = 1.8 V, f = 500 MHz
Input return loss	RL_{in}	10 10	dB	V_{CC} = 3.0 V, f = 1 GHz V_{CC} = 1.8 V, f = 500 MHz
Output return loss	RL_{out}	8.5 9.5	dB	V_{CC} = 3.0 V, f = 1 GHz V_{CC} = 1.8 V, f = 500 MHz
Maximum output level	$P_{O(sat)}$	–1 –8	dBm	V_{CC} = 3.0 V, f = 1 GHz, P_{in} = –6 dBm V_{CC} = 1.8 V, f = 500 MHz, P_{in} = –10 dBm
3rd order intermodulation distortion	IM_3	51 37	dBc	V_{CC} = 3.0 V, P_{out} = –20 dBm, f_1 = 500 MHz, f_2 = 502 MHz V_{CC} = 1.8 V, P_{out} = –20 dBm, f_1 = 500 MHz, f_2 = 502 MHz

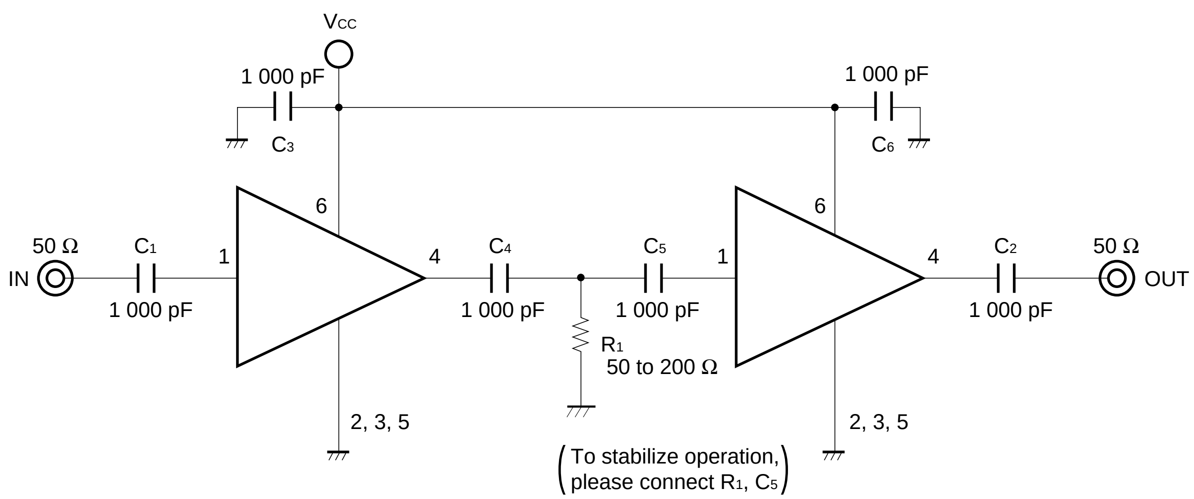
Standard characteristics for reference (T_A = +25 °C, Z_L = Zs = 50 Ω)

FEATURES	SYMBOL	Reference value		Unit	TEST CONDITIONS
		μPC2747T	μPC2748T		
Circuit current	I_{CC}	3.0	3.5	mA	V_{CC} = 1.8 V, No input signal
Power Gain	G_P	5.5	11.5	dB	V_{CC} = 1.8 V, f = 900 GHz
Noise Figure	NF	5.2	4.5	dB	V_{CC} = 1.8 V, f = 900 MHz
Lower limit operating frequency	f_L	-	0.2	GHz	3 dB down below flat gain at 0.9 GHz, V_{CC} = 1.8 V
Upper limit operating frequency	f_u	1.8	1.5	GHz	3 dB down below flat gain at 0.9 GHz, V_{CC} = 1.8 V
Isolation	ISL	34	34	dB	V_{CC} = 1.8 V, f = 900 MHz
Input return loss	RL_{in}	11	10	dB	V_{CC} = 1.8 V, f = 900 MHz
Output return loss	RL_{out}	13	12	dB	Vcc = 1.8 V, f = 900 MHz
Maximum output level	$P_{O(sat)}$	–13.7	–10	dBm	Vcc = 1.8 V, f = 900 MHz, P_{in} = –8 dBm
3rd order intermodulation distortion	IM_3	34 20	38 28	dBc	V_{CC} = 3.0 V, P_{out} = –20 dBm, f_1 = 900 MHz, f_2 = 902 MHz V_{CC} = 1.8 V, P_{out} = –20 dBm, f_1 = 900 MHz, f_2 = 902 MHz

TEST CIRCUIT



EXAMPLE OF APPLICATION CIRCUIT



The application circuits and their parameters are for references only and are not intended for use in actual design-in's.

Capacitors for Vcc, input and output pins

1000 pF capacitors are recommendable as bypass capacitor for Vcc pin and coupling capacitors for input/output pins.

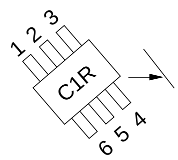
Bypass capacitor for Vcc pin is intended to minimize Vcc pin's ground impedance. Therefore, stable bias can be supplied against Vcc fluctuation.

Coupling capacitors for input/output pins are intended to minimize RF serial impedance and cut DC.

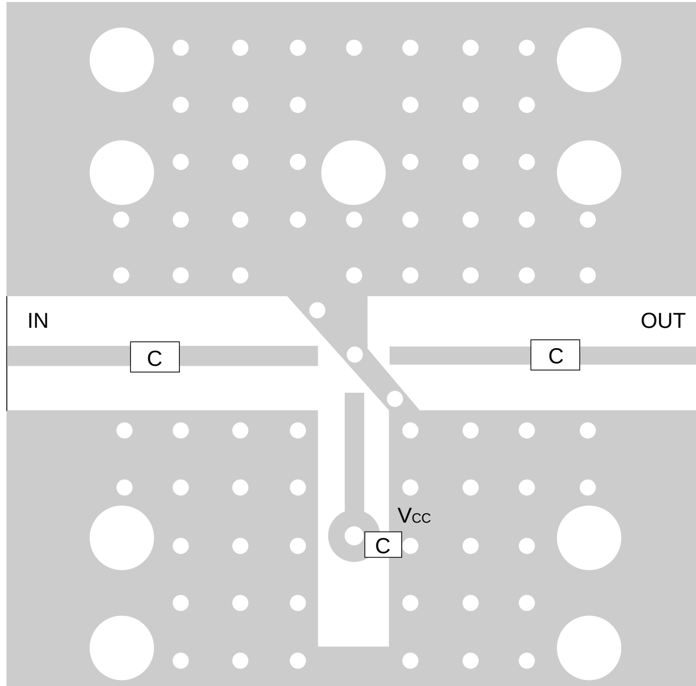
To get flat gain from 100 MHz up, 1 000 pF capacitors are assembled on the test circuit. [Actually, 1 000 pF capacitors give flat gain at least 10 MHz. In the case of under 10 MHz operation, increase the value of coupling capacitor such as 2 200 pF. Because the coupling capacitors are determined by the equation of C=1/(2 p fZs).]

Illustration of the test circuit assembled on evaluation board

Top View



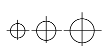
Mounting direction
(Marking is an example for μPC2746T)



Component List

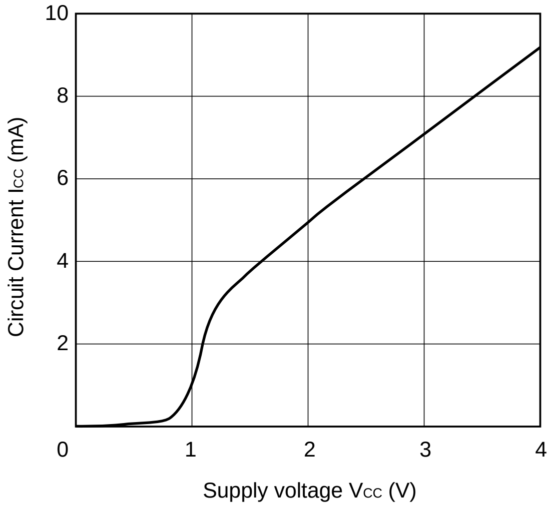
	Value
C	1 000 pF

Note

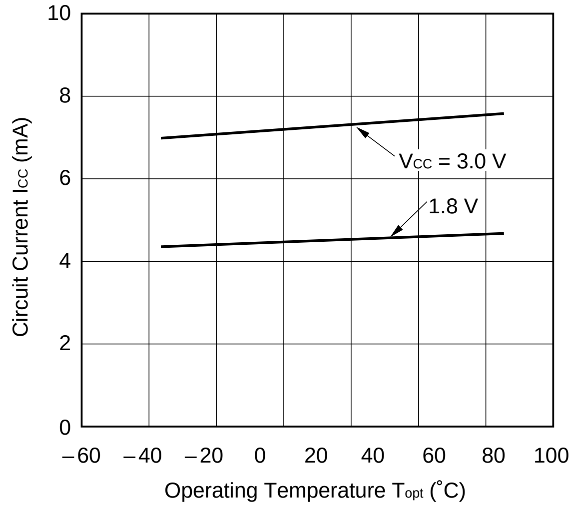
1. 30 × 30 ×0.4 mm double sided copper clad polyimide board.
2. Back side: GND pattern
3. Solder plated on pattern
4.  : Through holes

TYPICAL CHARACTERISTICS (T_A = +25 ˚C) – μPC2746T –

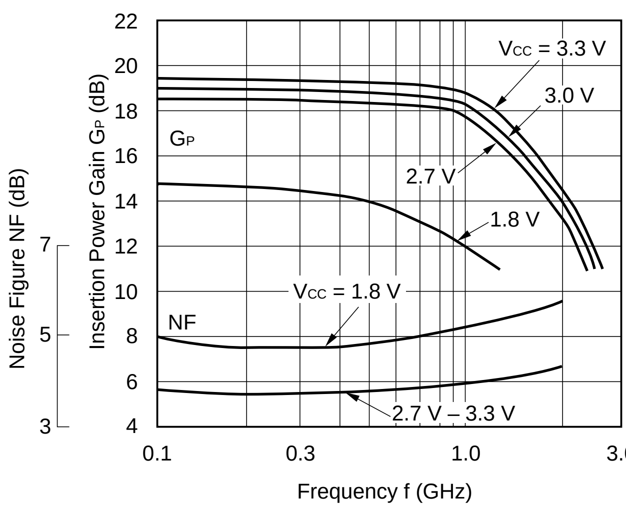
I_{CC} - V_{CC}



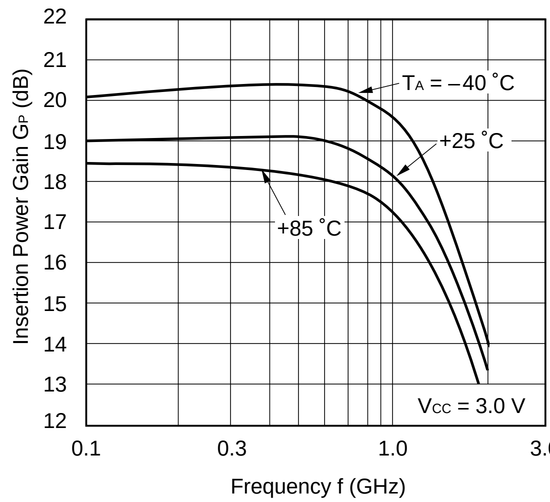
I_{CC} - T_{opt}



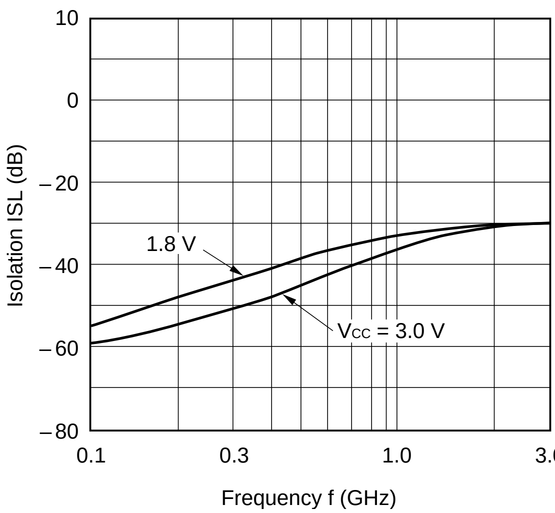
NF, G_P - f



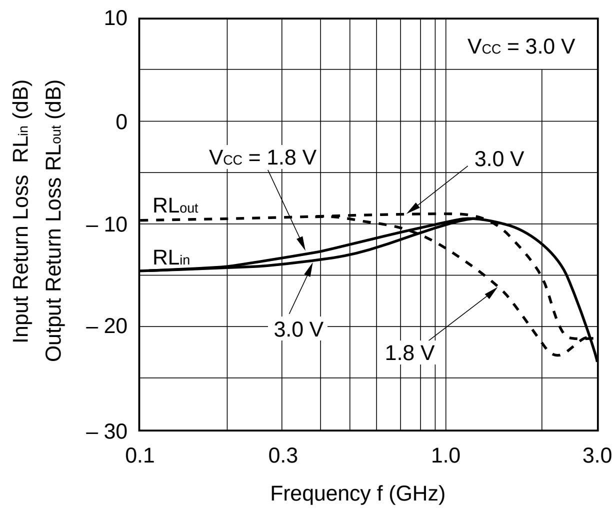
G_P - f



ISL - f

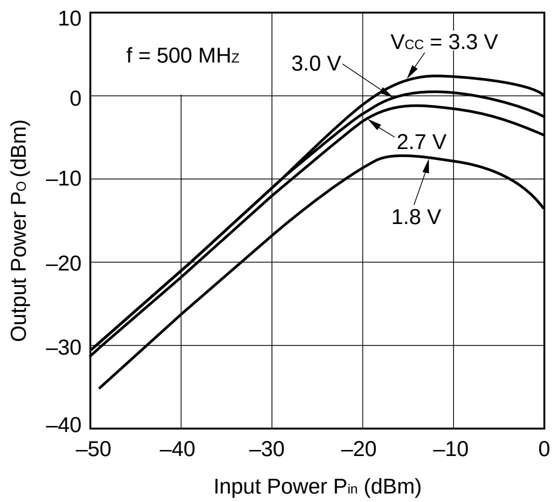


RL_{in}, RL_{out} - f

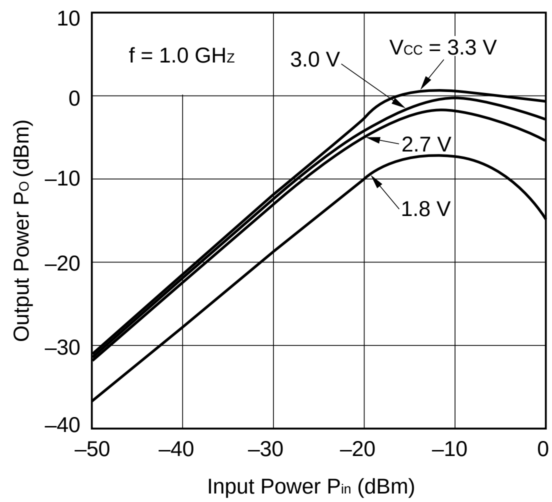


– μPC2746T –

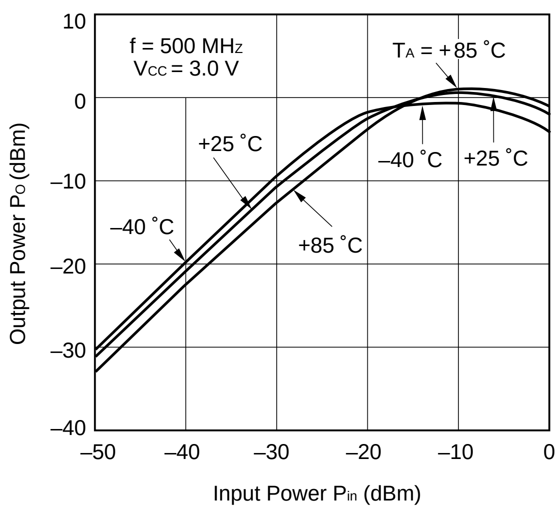
P_O - P_{in}



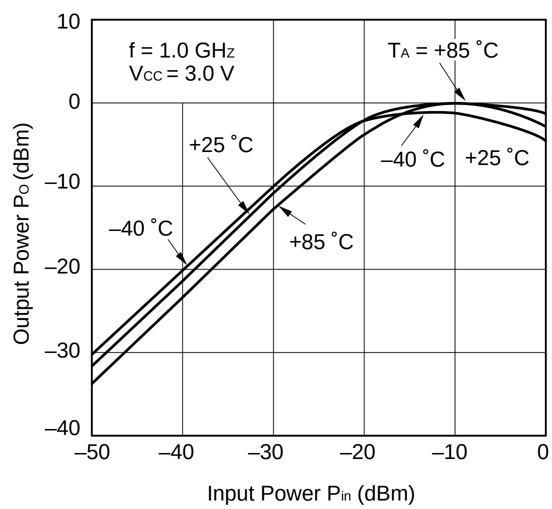
P_O - P_{in}



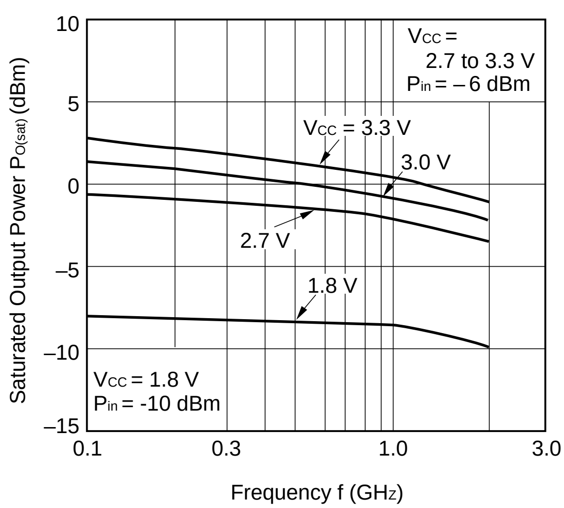
P_O - P_{in}



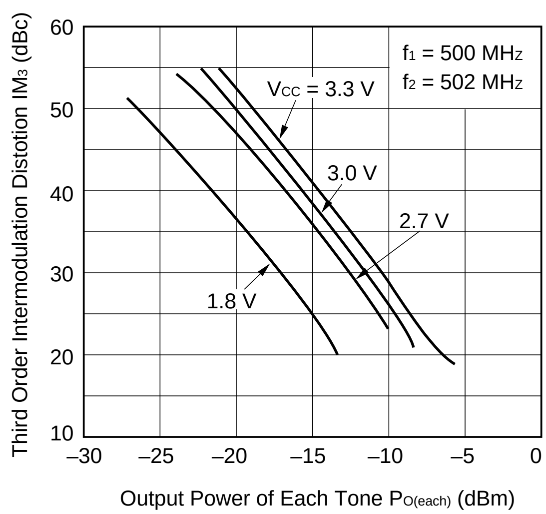
P_O - P_{in}



$P_{O(sat)}$ - f

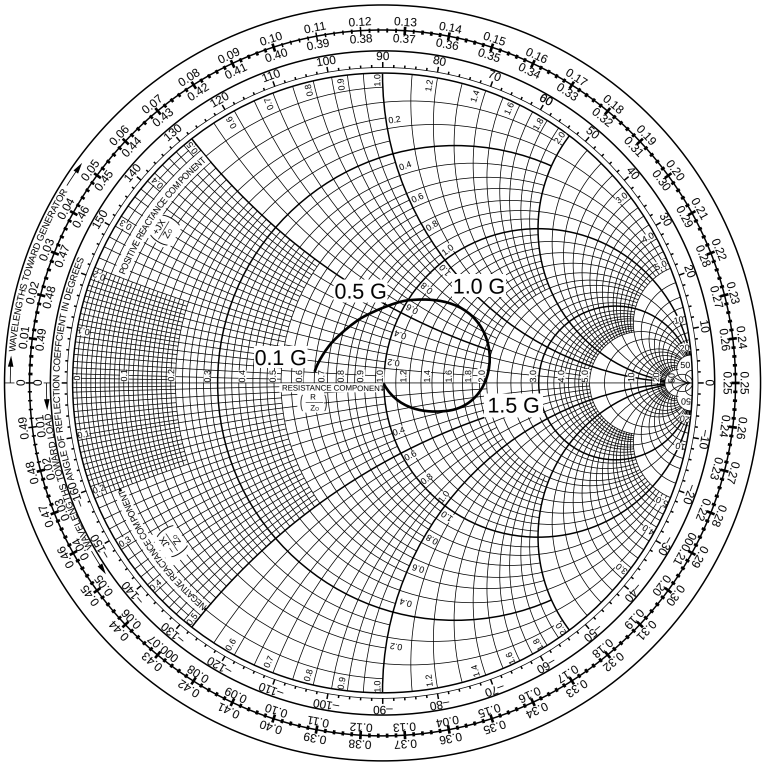


IM_3 - $P_{O(each)}$

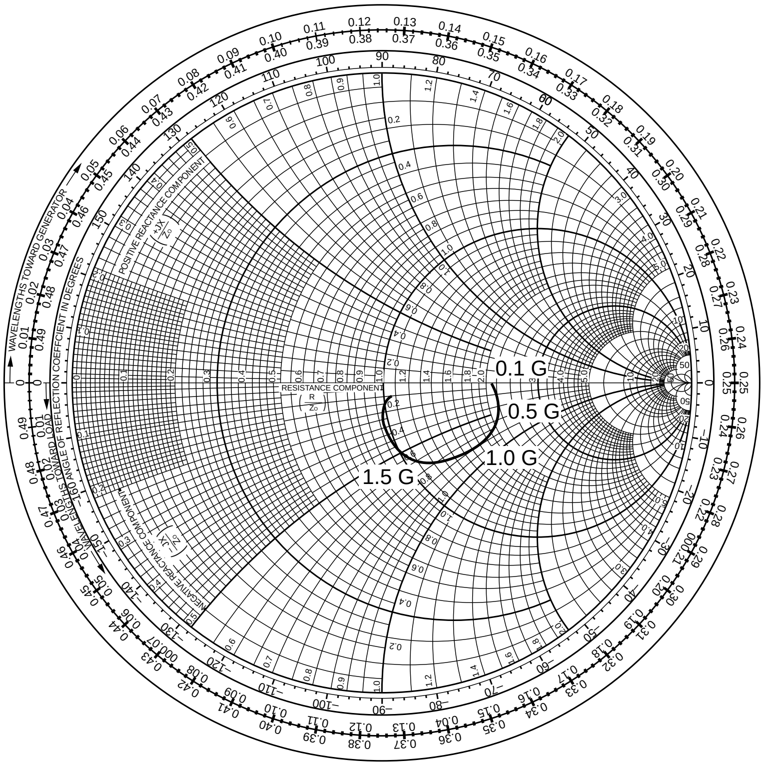


S Parameter – μPC2746T –

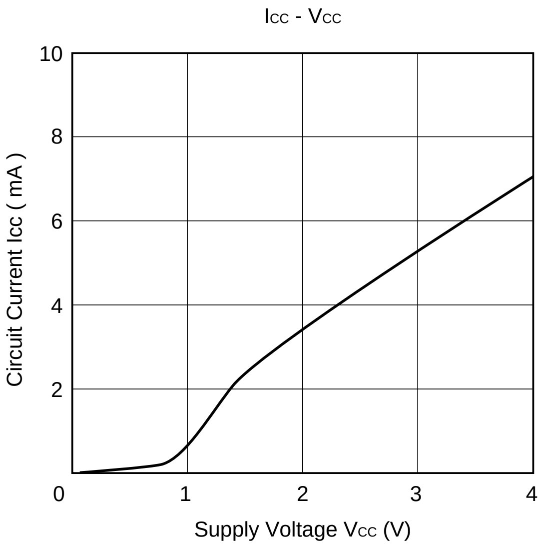
S_{11}-FREQUENCY (V_{CC} = 3.0 V)

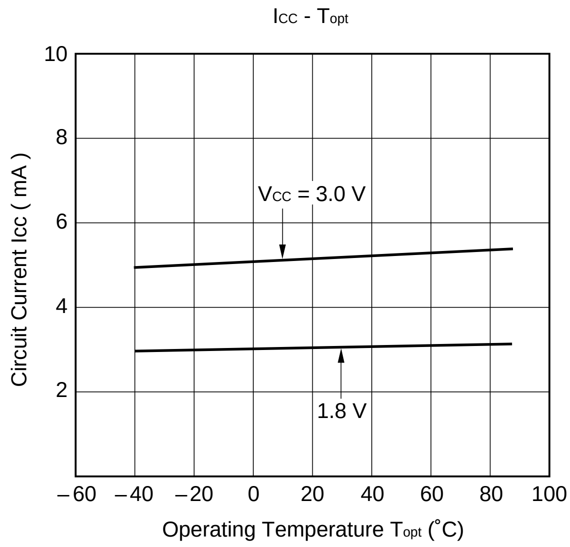


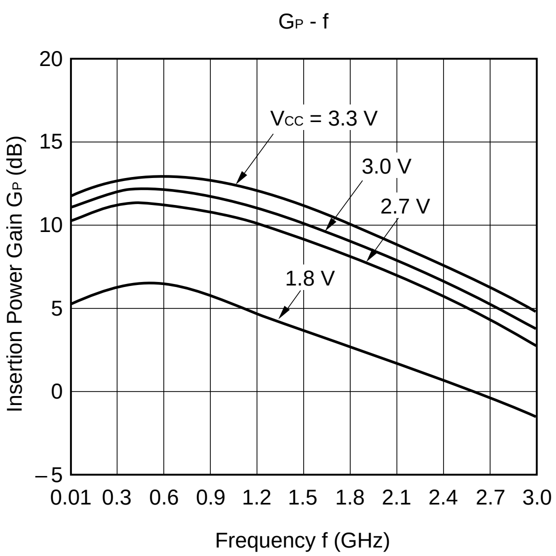
S_{22}-FREQUENCY (V_{CC} = 3.0 V)

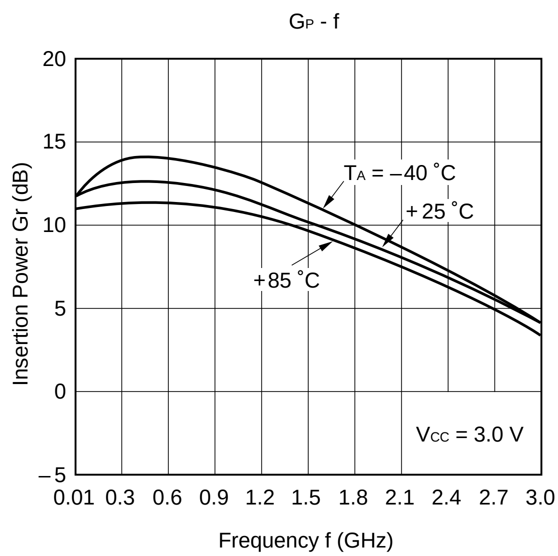


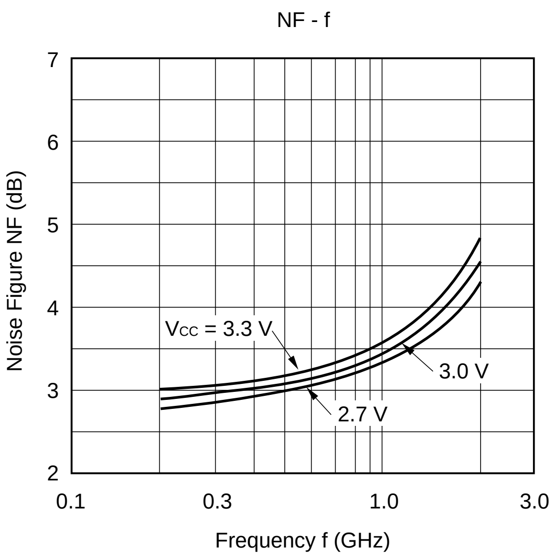
TYPICAL CHARACTERISTICS (T_A = +25 ˚C) – μPC2747T –

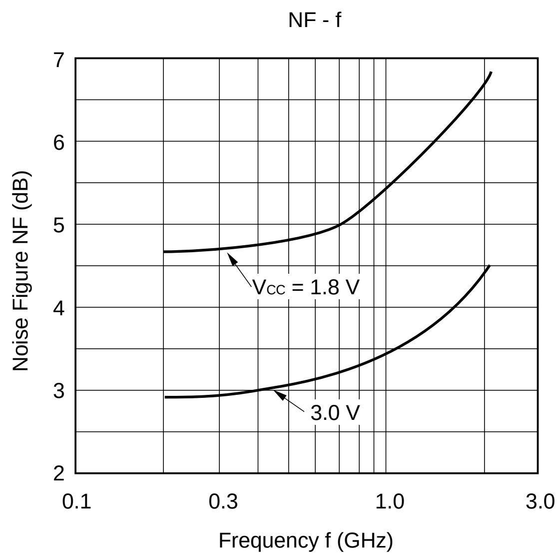






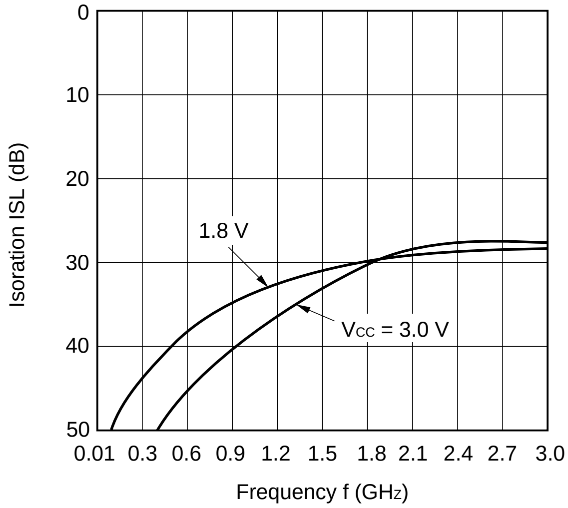




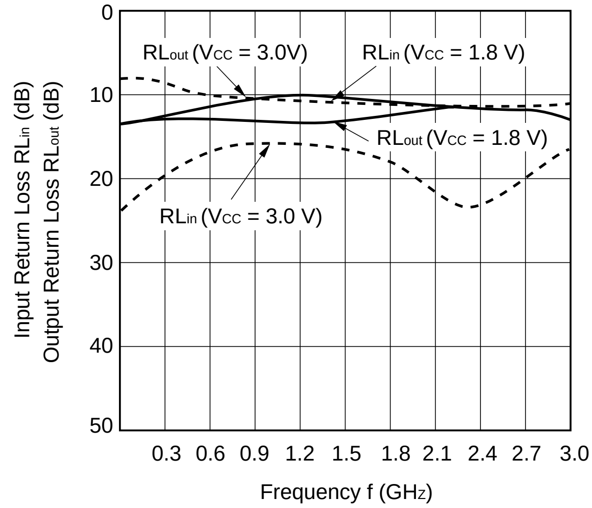


– μPC2747T –

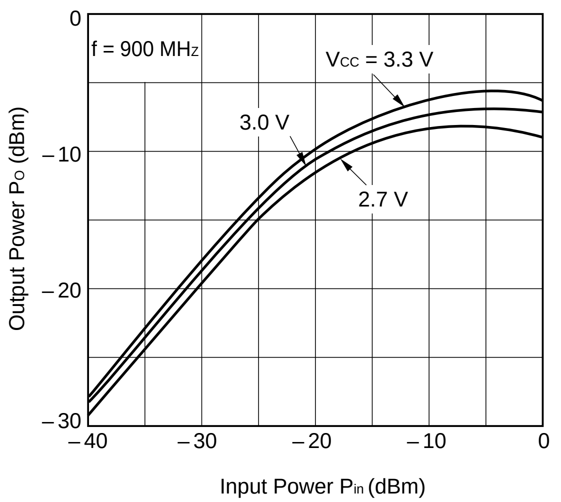
ISL - f



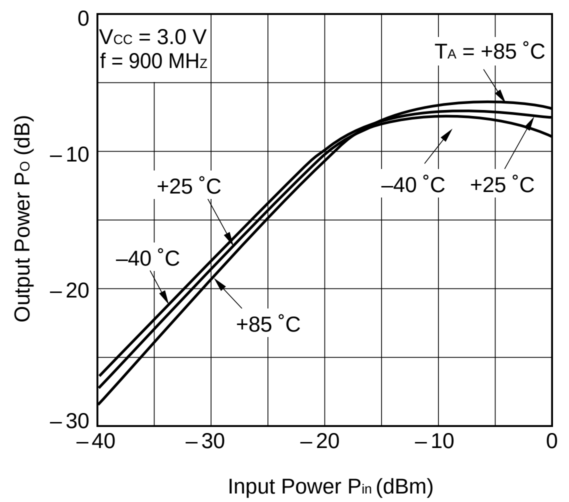
RLin, RLout - f



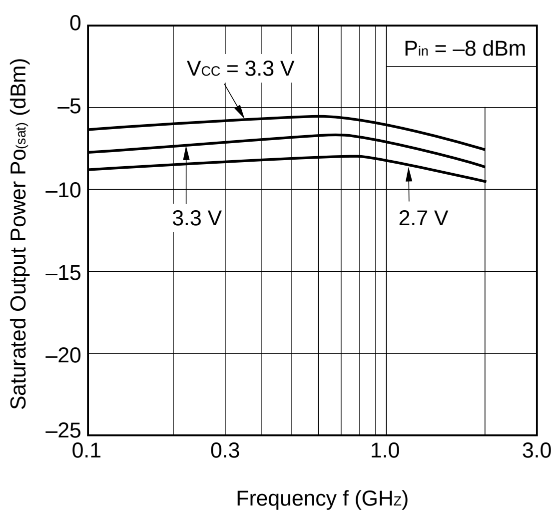
PO - Pin



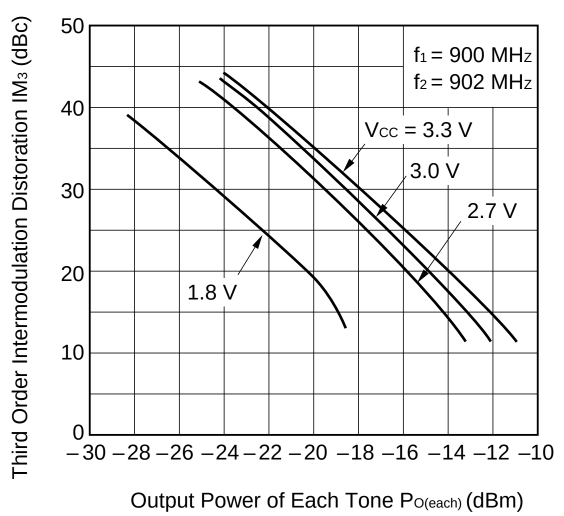
PO - Pin



PO (sat) - f

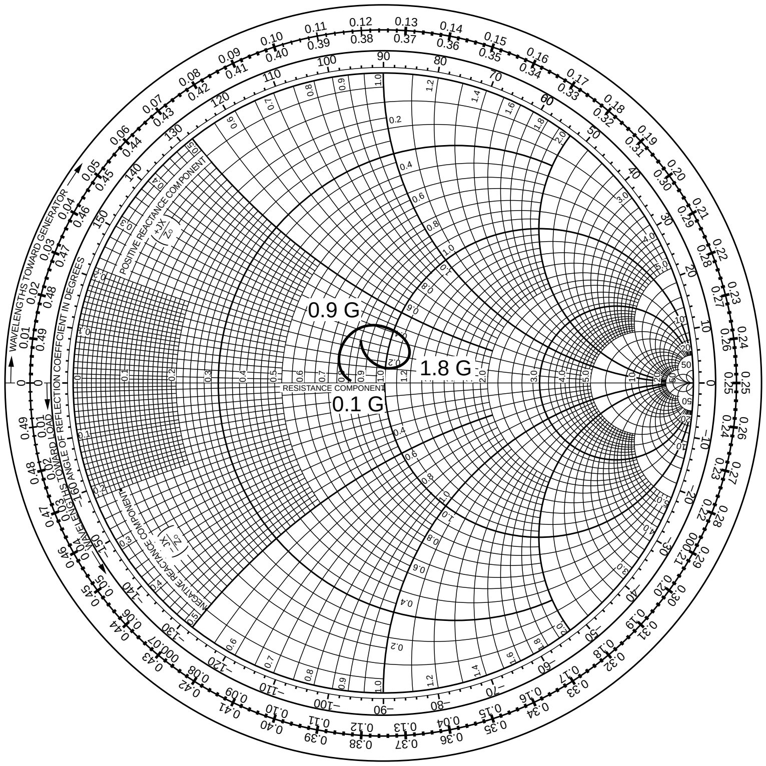


IM3 - PO (each)

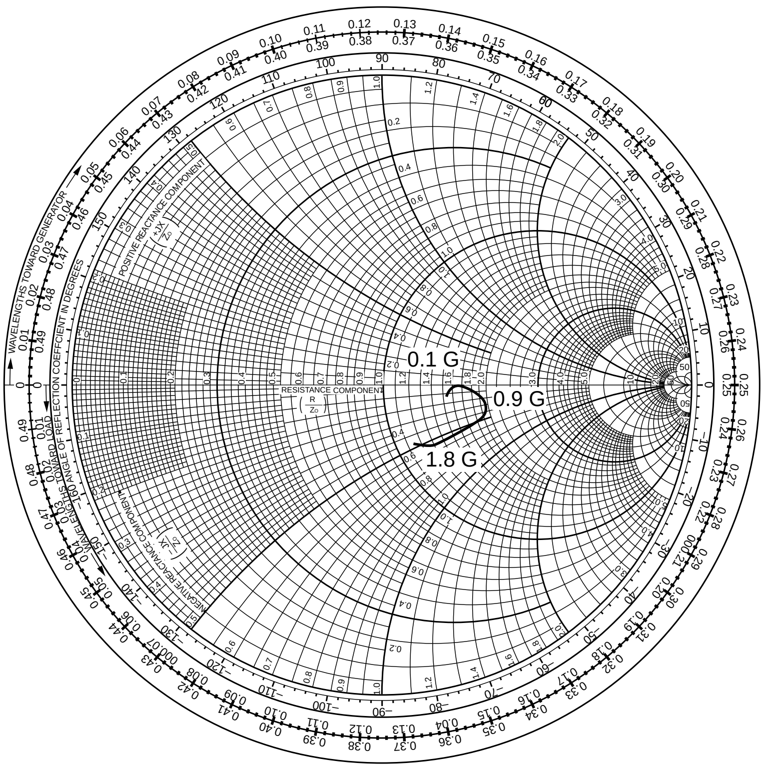


S Parameter (TA = +25 ˚C) – μPC2747T –

S11-FREQUENCY (VCC = 3.0 V)

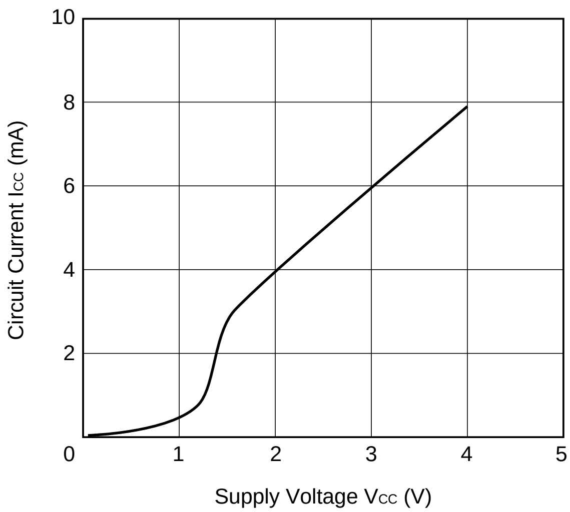


S22-FREQUENCY (VCC = 3.0 V)

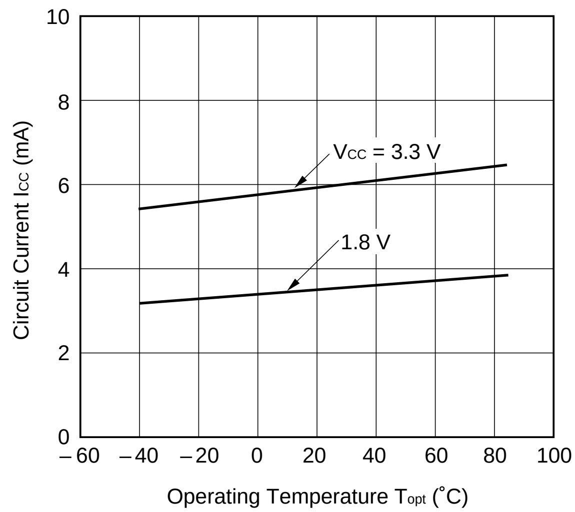


TYPICAL CHARACTERISTICS (T_A = +25 °C) – μPC2748T –

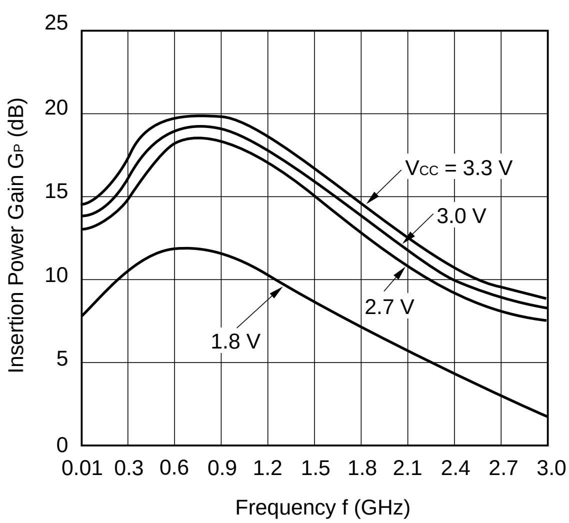
I_{CC} - V_{CC}



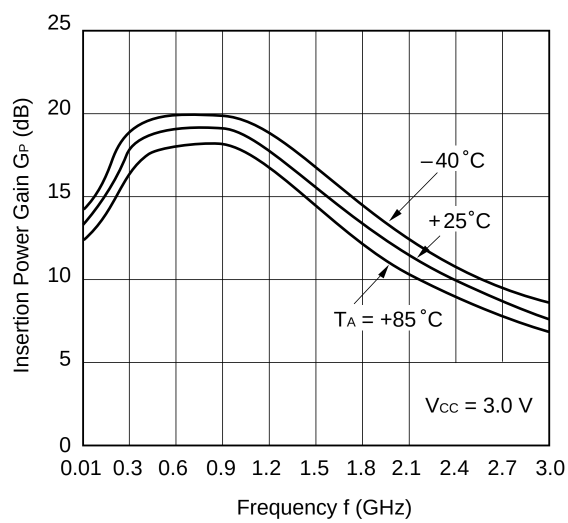
I_{CC} - T_{opt}



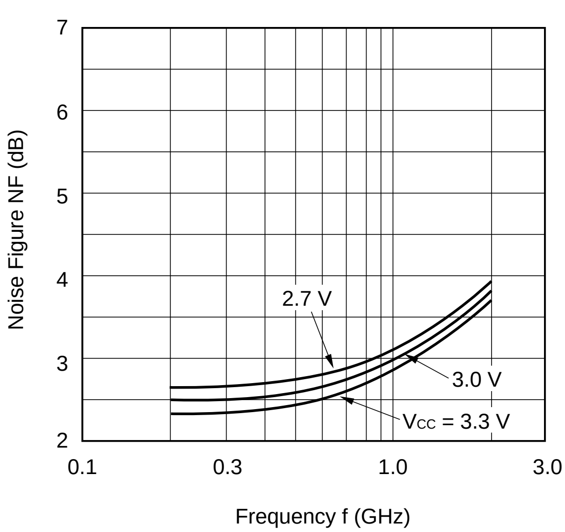
G_P - f



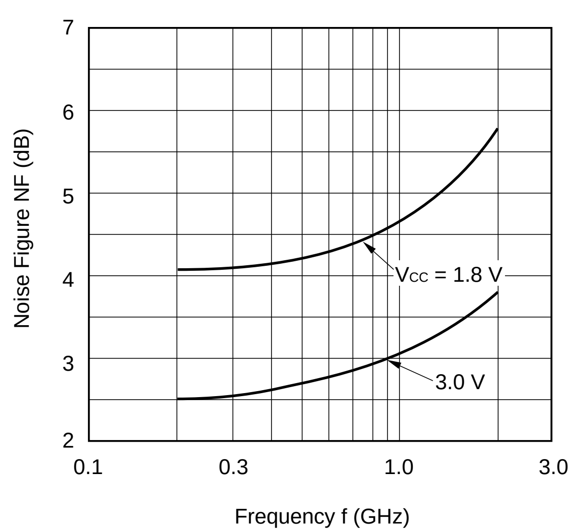
G_P - f



NF - f

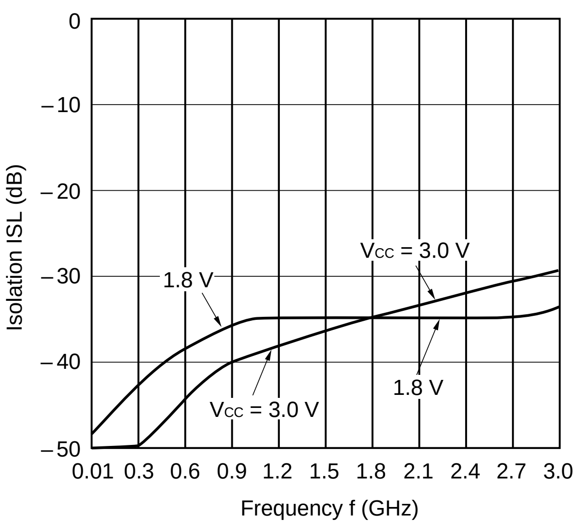


NF - f

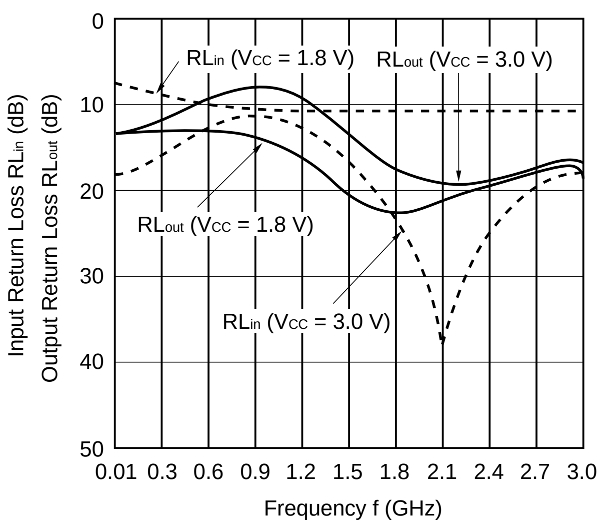


– μPC2748T –

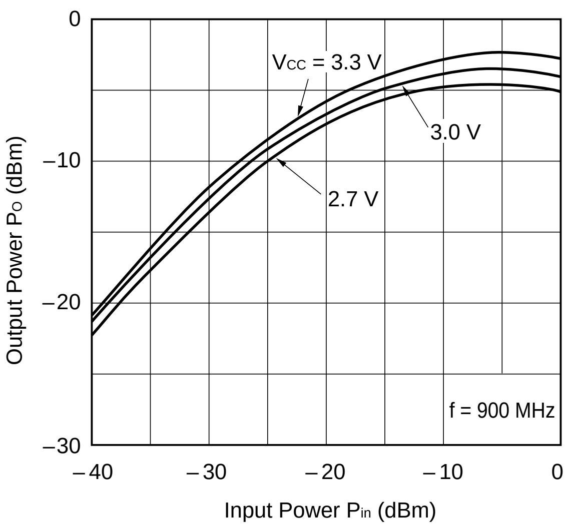
ISL - f



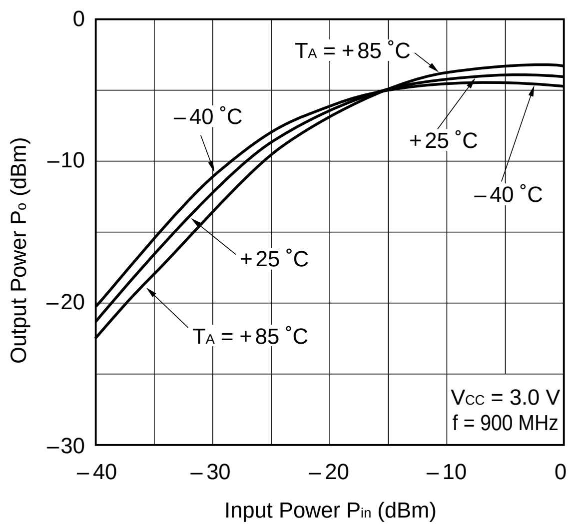
RLin, RLout - f



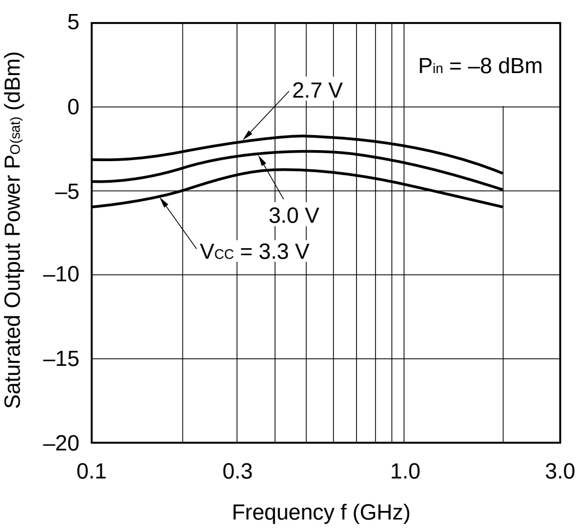
PO - Pin



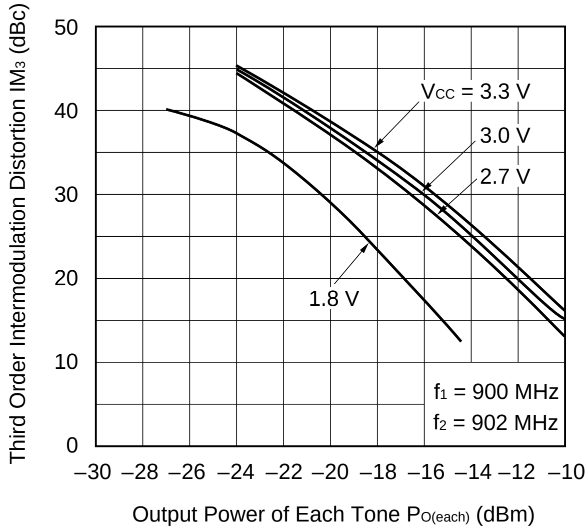
PO - Pin



PO(sat) - f

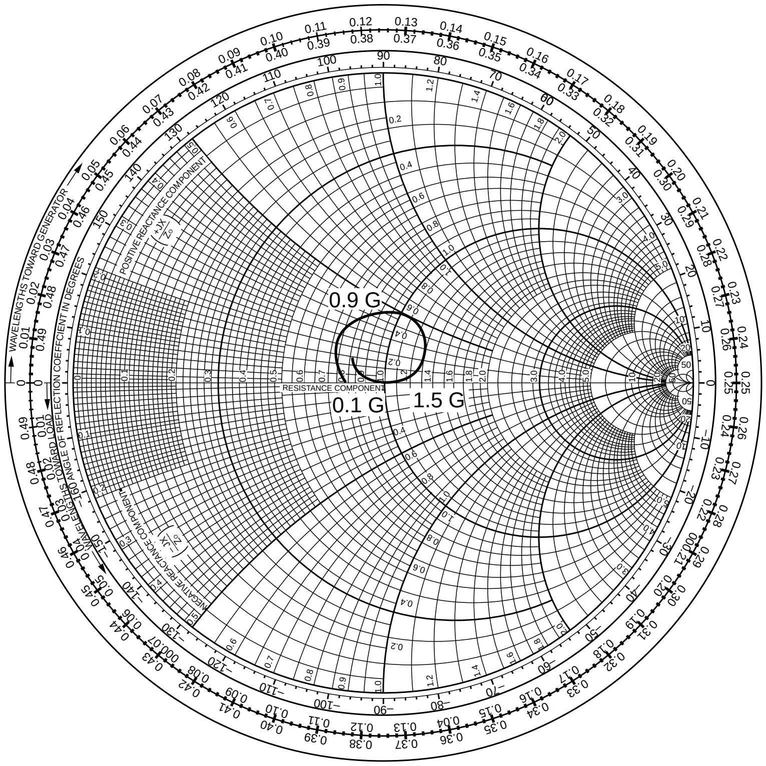


IM3 - PO(each)

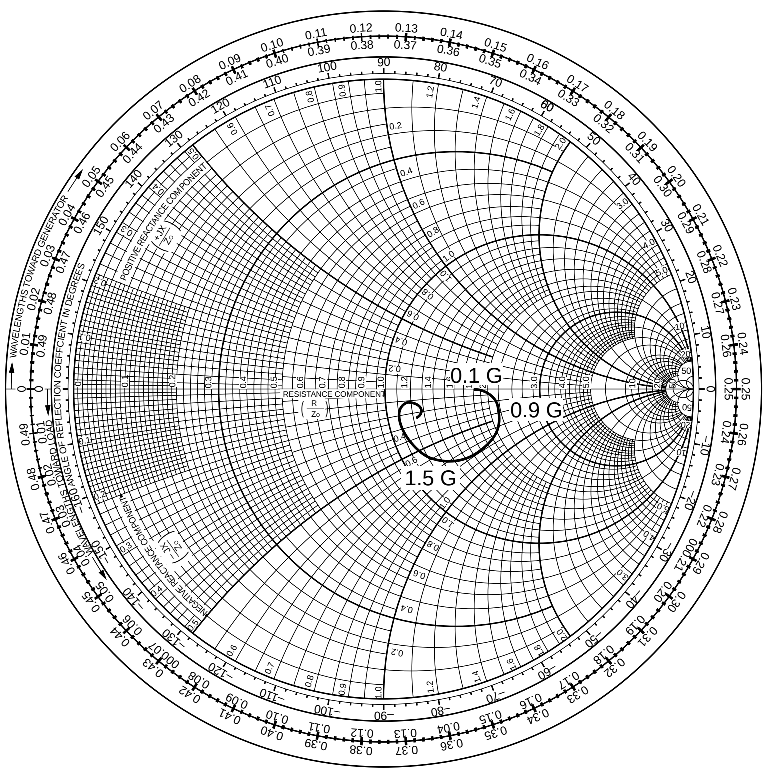


S Parameter – μPC2748T –

S_{11}-FREQUENCY (V_{CC} = 3.0 V)

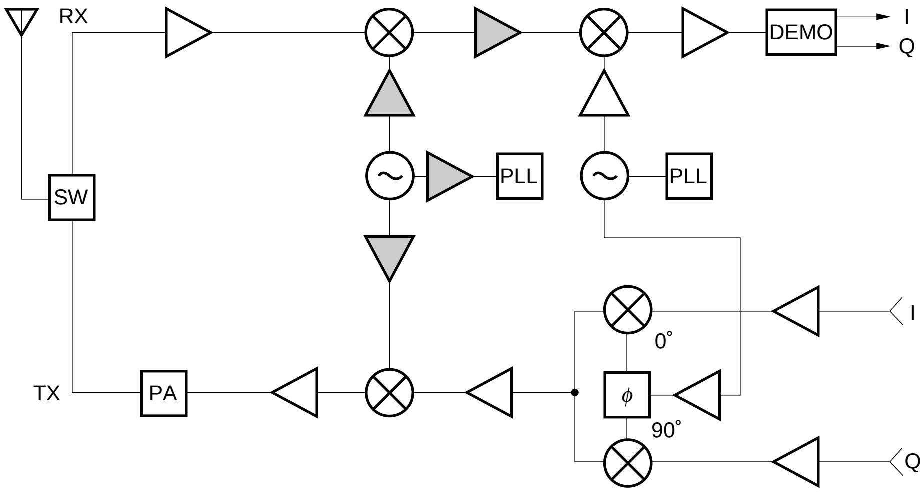


S_{22}-FREQUENCY (V_{CC} = 3.0 V)



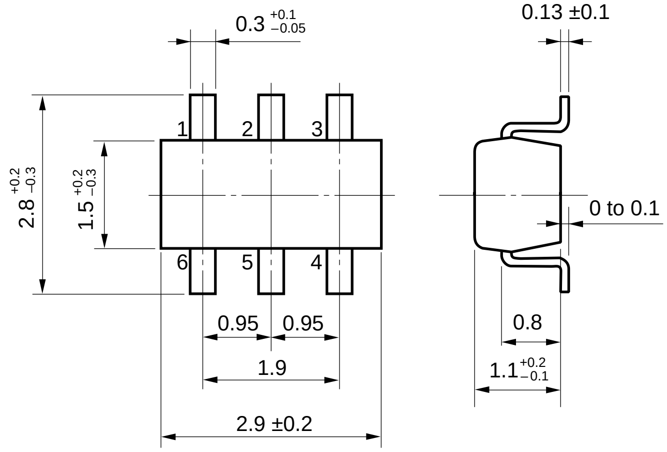
Typical System Application

Digital Cellular System Block Diagram



: μPC2746T, 2747T, 2748T applicable

6 PIN MINI MOLD PACKAGE DIMENSIONS (Unit: mm)



NOTE ON CORRECT USE

(1) Observe precausions for handling because of electro-static sensitive devices.
(2) Form a ground pattern as wide as possible to minimize ground impedance (to prevent undesired operation).
(3) Keep the wiring length of the ground pins as short as possible.
(4) Connect a bypass capacitor (e.g. 1 000 pF) to the V_{CC} pin.

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.

μPC2746T, 2747T, 2748T

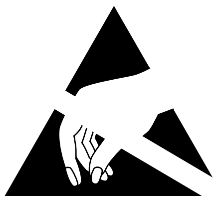
Soldering method	Soldering conditions	Recommended condition symbol
Infrared ray reflow	Package peak temperature: 235 ˚C, Hour: within 30 s. (more than 210˚ C) Time: 3 times, Limited days: no.*	IR35-00-3
VPS	Package peak temperature: 215 ˚C, Hour: within 40 s. (more than 200 ˚C) Time: 3 times, Limited days: no.*	VP15-00-3
Wave soldering	Soldering tub temperature: less than 260˚ C, Hour: within 10 s. Time: 1 times, Limited days: no.*	WS60-00-1
Pin part heating	Pin area temperature: 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 1. 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 (C10537EJ7V0IF00).

[MEMO]



ATTENTION

OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES