

### SMALL PACKAGE FREQUENCY UP-CONVERTER IC

#### DESCRIPTION

The  $\mu$ PC8172TK is a silicon monolithic integrated circuit designed as frequency up-converter for cellular telephone transmitter stage.

This TK suffix IC which is smaller package than conventional TB suffix IC contribute to reduce your system size.

This IC is manufactured using our 30 GHz  $f_{max}$  UHS0 (Ultra High Speed Process) silicon bipolar process.

#### FEATURES

- High output frequency :  $f_{RFout} = 0.8$  to 2.5 GHz
- Circuit current :  $I_{CC} = 9.0$  mA TYP.
- High-density surface mounting : 6-pin lead-less minimold package
- Supply voltage :  $V_{CC} = 2.7$  to 3.3 V

#### APPLICAIONS

- PCS1900M
- 2.4 GHz band transmitter/receiver system (wireless LAN etc.)
- RF module etc.

#### ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
$\mu$ PC8172TK-E2	$\mu$ PC8172TK-E2-A	6-pin lead-less minimold (1511) (Pb-Free) <sup>Note</sup>	6A	<ul style="list-style-type: none"> <li>• Embossed tape 8 mm wide</li> <li>• Pin 1, 6 face the perforation side of the tape</li> <li>• Qty 5 kpcs/reel</li> </ul>

**Note** With regards to terminal solder (the solder contains lead) plated products (conventionally plated), contact your nearby sales office.

**Remark** To order evaluation samples, contact your nearby sales office.  
Part number for sample order:  $\mu$ PC8172TK

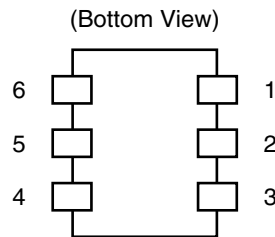
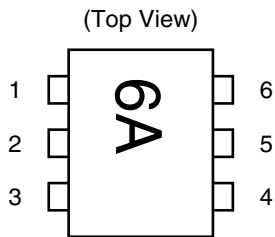
**Caution** Observe precautions when handling because these devices are sensitive to electrostatic discharge.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.  
Not all devices/types available in every country. Please check with local NEC Compound Semiconductor Devices representative for availability and additional information.

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1. PIN CONNECTIONS



Pin No.	Pin Name
1	IFinput
2	GND
3	LOinput
4	PS
5	Vcc
6	RFoutput

Caution Pin arrangement differs from the conventional 6-pin super mini-mold type (μPC8172TB).

2. PRODUCT LINE-UP

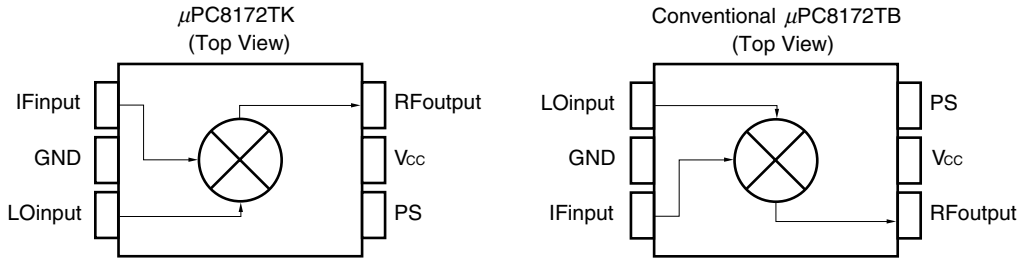
Part No.	Package	I <sub>CC</sub> (mA)	f <sub>RFout</sub> (GHz)	CG (dB)		
				@RF0.9 (GHz) <sup>Note</sup>	@RF1.9 (GHz)	@RF2.4 (GHz)
μPC8172TK	6-pin lead-less minimold	9.0	0.8 to 2.5	9.5	8.5	8.0
μPC8106TB	6-pin super minimold (1511)	9.0	0.4 to 2.0	9.0	7.0	–
μPC8109TB		5.0	0.4 to 2.0	6.0	4.0	–
μPC8163TB		16.5	0.8 to 2.0	9.0	5.5	–
μPC8172TB		9.0	0.8 to 2.5	9.5	8.5	8.0
μPC8187TB		15.0	0.8 to 2.5	11.0	11.0	10.0

Part No.	P <sub>O(sat)</sub> (dBm)			OIP <sub>3</sub> (dBm)		
	@RF0.9 (GHz) <sup>Note</sup>	@RF1.9 (GHz)	@RF2.4 (GHz)	@RF0.9 (GHz) <sup>Note</sup>	@RF1.9 (GHz)	@RF2.4 (GHz)
μPC8172TK	+0.5	0	–0.5	+7.5	+6.0	+4.0
μPC8106TB	–2.0	–4.0	–	+5.5	+2.0	–
μPC8109TB	–5.5	–7.5	–	+1.5	–1.0	–
μPC8163TB	+0.5	–2.0	–	+9.5	+6.0	–
μPC8172TB	+0.5	0	–0.5	+7.5	+6.0	+4.0
μPC8187TB	+4.0	+2.5	+1.0	+10.0	+10.0	+8.5

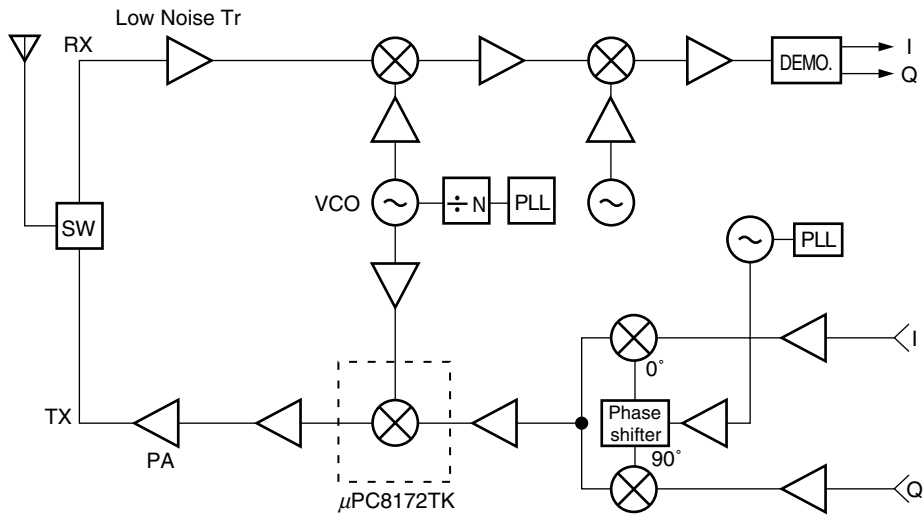
Note f<sub>RFout</sub> = 0.83 GHz @ μPC8163TB, μPC8187TB

Remarks 1. Typical performance. Please refer to **ELECTRICAL CHARACTERISTICS** in detail.  
 2. To know the associated product, please refer to each latest data sheet.

3. BLOCK DIAGRAM



4. SYSTEM APPLICATION EXAMPLE



**Caution** To know the associated products, please refer to each latest data sheet.

5. PIN EXPLANATION

Pin No.	Pin Name	Applied Voltage (V)	Pin Voltage (V) <small>Note</small>	Function and Applications	Internal Equivalent Circuit					
1	IFinput	–	1.3	This pin is IF input to double balanced mixer (DBM). The input is designed as high impedance. The circuit contributes to suppress spurious signal. Also this symmetrical circuit can keep specified performance insensitive to process-condition distribution. For above reason, double balanced mixer is adopted.						
2	GND	GND	–	GND pin. Ground pattern on the board should be formed as wide as possible. Track Length should be kept as short as possible to minimize ground impedance.						
3	LOinput	–	2.4	Local input pin. Recommendable input level is –10 to 0 dBm.						
5	V <sub>cc</sub>	2.7 to 3.3	–	Supply voltage pin.						
6	RFoutput	Same bias as V <sub>cc</sub> through external inductor	–	This pin is RF output from DBM. This pin is designed as open collector. Due to the high impedance output, this pin should be externally equipped with LC matching circuit to next stage.						
4	PS	V <sub>cc</sub> /GND	–	Power save control pin. Bias controls operation as follows. <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Pin bias</th> <th>Control</th> </tr> </thead> <tbody> <tr> <td>V<sub>cc</sub></td> <td>Operation</td> </tr> <tr> <td>GND</td> <td>Power Save</td> </tr> </tbody> </table>		Pin bias	Control	V <sub>cc</sub>	Operation	GND
Pin bias	Control									
V <sub>cc</sub>	Operation									
GND	Power Save									

**Note** Each pin voltage is measured with V<sub>CC</sub> = V<sub>PS</sub> = V<sub>RFout</sub> = 3.0 V

6. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Test Conditions	Ratings	Unit
Supply Voltage	V <sub>CC</sub>	T <sub>A</sub> = +25°C	3.6	V
PS pin input Voltage	V <sub>PS</sub>	T <sub>A</sub> = +25°C	3.6	V
Power Dissipation of Package	P <sub>D</sub>	T <sub>A</sub> = +85°C <b>Note</b>	203	mW
Operating Ambient Temperature	T <sub>A</sub>		-40 to +85	°C
Storage Temperature	T <sub>stg</sub>		-55 to +150	°C
Input Power	P <sub>in</sub>		+10	dBm

**Note** Mounted on double-side copper-clad 50 × 50 × 1.6 mm epoxy glass PWB

7. RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Remarks
Supply Voltage	V <sub>CC</sub>	2.7	3.0	3.3	V	Same voltage should be applied to pin 5 and pin 6.
Operating Ambient Temperature	T <sub>A</sub>	-40	+25	+85	°C	
Local Input Level	P <sub>LOin</sub>	-10	-5	0	dBm	Z <sub>s</sub> = 50 Ω (without matching)
RF Output Frequency	f <sub>RFout</sub>	0.8	-	2.5	GHz	With external matching circuit
IF Input Frequency	f <sub>IFin</sub>	50	-	600	MHz	

8. ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = +25°C, V<sub>CC</sub> = V<sub>RFout</sub> = 3.0 V, f<sub>IFin</sub> = 240 MHz, P<sub>LOin</sub> = -5 dBm, and V<sub>PS</sub> ≥ 2.7 V, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit	
Circuit Current	I <sub>CC</sub>	No signal	5.5	9.0	13	mA	
Circuit Current In Power Save Mode	I <sub>CC(PS)</sub>	V <sub>PS</sub> = 0 V	-	-	2.0	μA	
Conversion Gain	CG1	f <sub>RFout</sub> = 0.9 GHz <sup>Note1</sup>	P <sub>IFin</sub> = -30 dBm f <sub>IFin</sub> = 240 MHz	6.5	9.5	12.5	dB
	CG2	f <sub>RFout</sub> = 1.9 GHz <sup>Note2</sup>		5.5	8.5	11.5	dB
	CG3	f <sub>RFout</sub> = 2.4 GHz <sup>Note2</sup>		5.0	8.0	11.0	dB
Saturated RF output Power	P <sub>O(sat) 1</sub>	f <sub>RFout</sub> = 0.9 GHz <sup>Note1</sup>	P <sub>IFin</sub> = 0 dBm f <sub>IFin</sub> = 240 MHz	-2.5	+0.5	-	dBm
	P <sub>O(sat) 2</sub>	f <sub>RFout</sub> = 1.9 GHz <sup>Note2</sup>		-3.5	0	-	dBm
	P <sub>O(sat) 3</sub>	f <sub>RFout</sub> = 2.4 GHz <sup>Note2</sup>		-4.0	-0.5	-	dBm

**Notes 1.** f<sub>RFout</sub> < f<sub>LOin</sub> @ f<sub>RFout</sub> = 0.9 GHz

**2.** f<sub>LOin</sub> < f<sub>RFout</sub> @ f<sub>RFout</sub> = 1.9 GHz/2.4 GHz

**9. OTHER CHARACTERISTICS, FOR REFERENCE PURPOSES ONLY**

( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = V_{RFout} = 3.0\text{ V}$ ,  $P_{LOin} = -5\text{ dBm}$ , and  $V_{PS} \geq 2.7\text{ V}$ , unless otherwise specified)

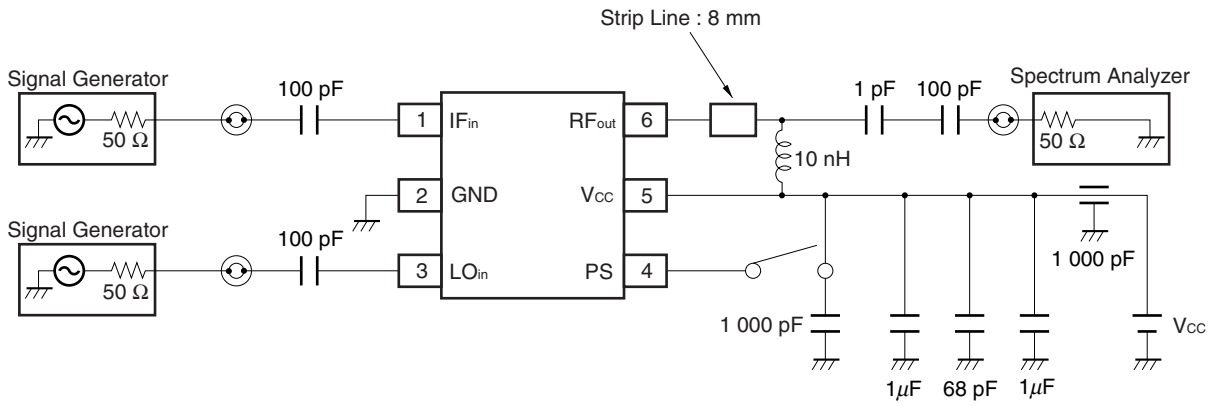
Parameter		Symbol	Test Conditions	Data	Unit
Output 3rd Order Distortion Intercept Point		OIP <sub>31</sub>	$f_{RFout} = 0.9\text{ GHz}$ <sup>Note1</sup>	+7.5	dBm
		OIP <sub>32</sub>	$f_{RFout} = 1.9\text{ GHz}$ <sup>Note2</sup>		
		OIP <sub>33</sub>	$f_{RFout} = 2.4\text{ GHz}$ <sup>Note2</sup>		
			$f_{Fin1} = 240\text{ MHz}$ $f_{Fin2} = 241\text{ MHz}$	+6.0	dBm
				+4.0	dBm
Input 3rd Order Distortion Intercept Point		IIP <sub>31</sub>	$f_{RFout} = 0.9\text{ GHz}$ <sup>Note1</sup>	-2.0	dBm
		IIP <sub>32</sub>	$f_{RFout} = 1.9\text{ GHz}$ <sup>Note2</sup>		
		IIP <sub>33</sub>	$f_{RFout} = 2.4\text{ GHz}$ <sup>Note2</sup>		
			$f_{Fin1} = 240\text{ MHz}$ $f_{Fin2} = 241\text{ MHz}$	-2.5	dBm
				-4.0	dBm
SSB Noise Figure		SSB-NF1	$f_{RFout} = 0.9\text{ GHz}$ , $f_{Fin} = 240\text{ MHz}$	9.5	dB
		SSB-NF2	$f_{RFout} = 1.9\text{ GHz}$ , $f_{Fin} = 240\text{ MHz}$	10.4	dB
		SSB-NF3	$f_{RFout} = 2.4\text{ GHz}$ , $f_{Fin} = 240\text{ MHz}$	10.6	dB
Power Save Response Time	Rise time	$T_{PS (rise)}$	$V_{PS} : \text{GND} \rightarrow V_{CC}$	1.0	μs
	Fall time	$T_{PS (fall)}$	$V_{PS} : V_{CC} \rightarrow \text{GND}$	1.5	μs

**Notes1.**  $f_{RFout} < f_{LOin}$  @  $f_{RFout} = 0.9\text{ GHz}$

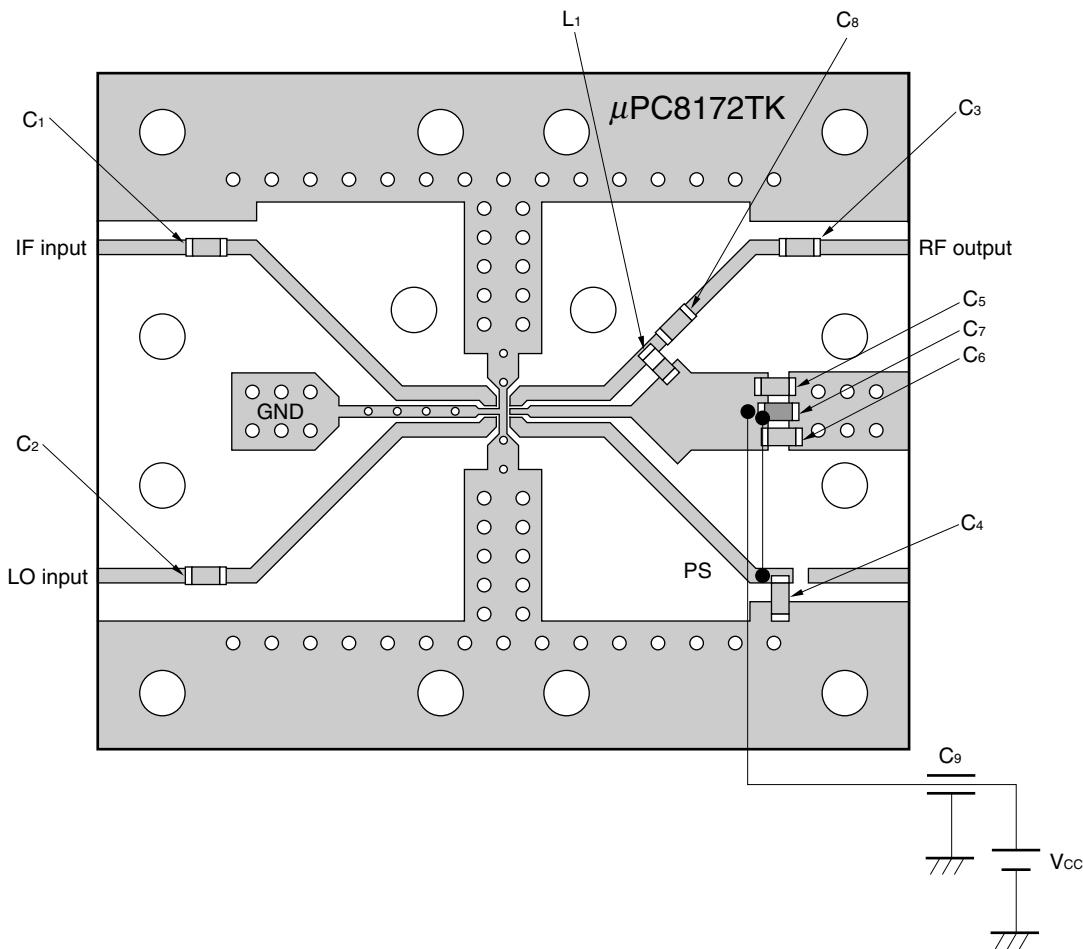
**2.**  $f_{LOin} < f_{RFout}$  @  $f_{RFout} = 1.9\text{ GHz}/2.4\text{ GHz}$

★ 10. TEST CIRCUIT

10.1 TEST CIRCUIT 1 ( $f_{RFout} = 0.9\text{ GHz}$ )



EXAMPLE OF TEST CIRCUIT 1 ASSEMBLED ON EVALUATION BOARD

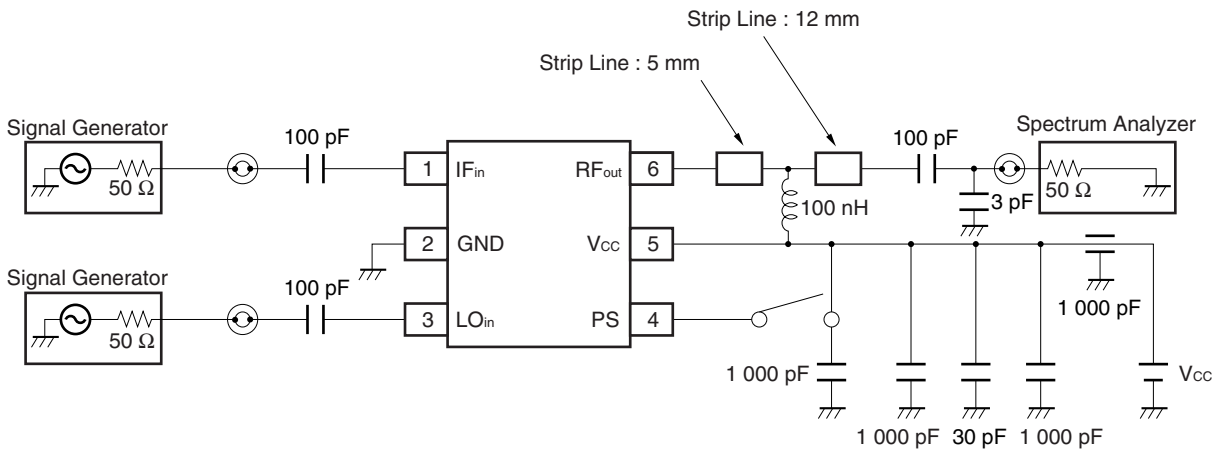


COMPONENT LIST

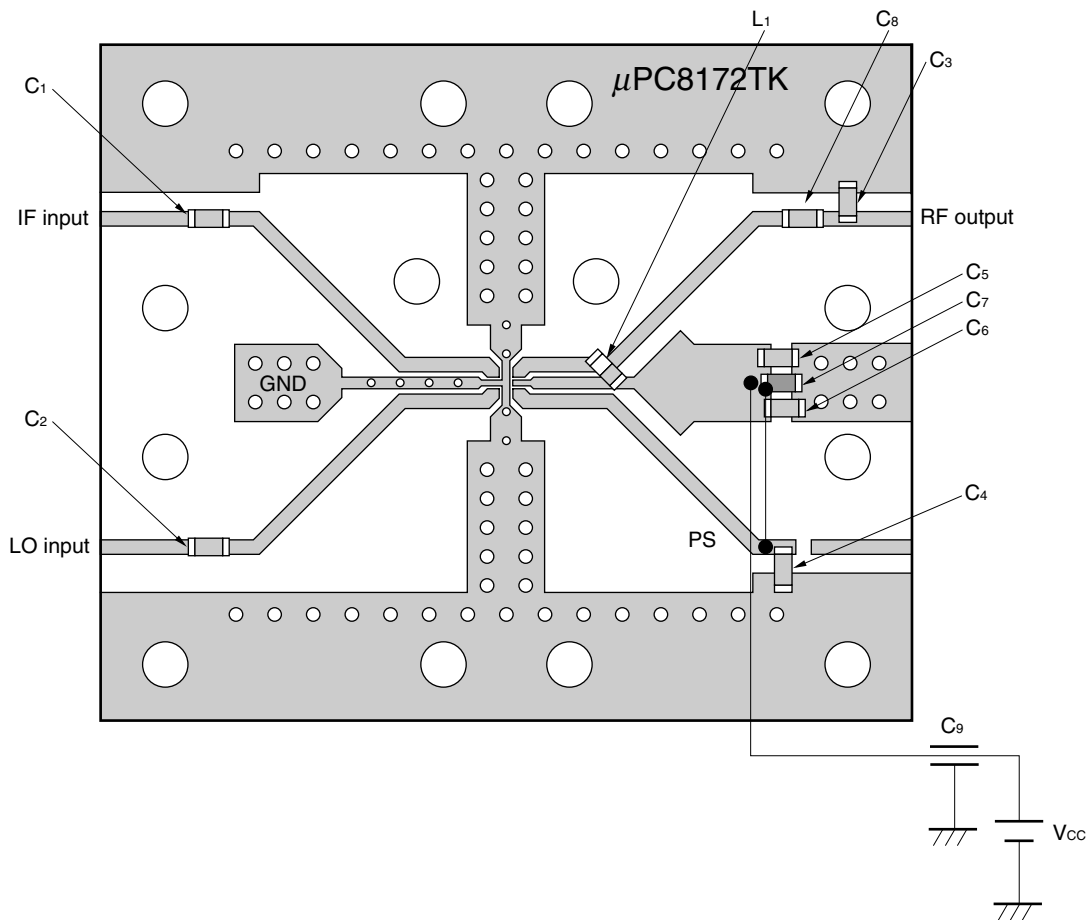
Form	Symbol	Value	Type code	Maker
Chip capacitor	C <sub>1</sub> , C <sub>2</sub> , C <sub>3</sub>	100 pF	GRM39CH101J50PT	murata
	C <sub>4</sub>	1 000 pF	GRM39B102K50PT	murata
	C <sub>5</sub> , C <sub>6</sub>	1 μF	GRM39F105Z10PT	murata
	C <sub>7</sub>	68 pF	GRM39CH680J50PT	murata
	C <sub>8</sub>	1 pF	GRM39CH010C50PT	murata
Feed-through Capacitor	C <sub>9</sub>	1 000 pF	DFT301-801 × 7R102S50	murata
Chip inductor	L <sub>1</sub>	10 nH	LL1608-F10N	TOKO

- (\*1) 35 × 42 × 0.4 mm polyimide board, double-sided copper clad
- (\*2) Ground pattern on rear of the board
- (\*3) Solder plated patterns
- (\*4) ○○: Through holes

10.2 TEST CIRCUIT 2 ( $f_{RFout} = 1.9\text{ GHz}$ )



EXAMPLE OF TEST CIRCUIT 2 ASSEMBLED ON EVALUATION BOARD

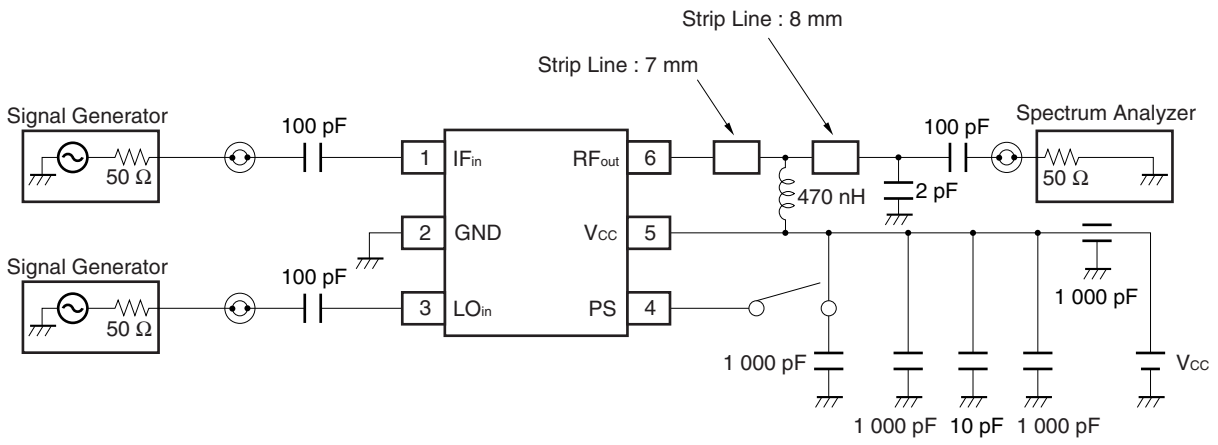


COMPONENT LIST

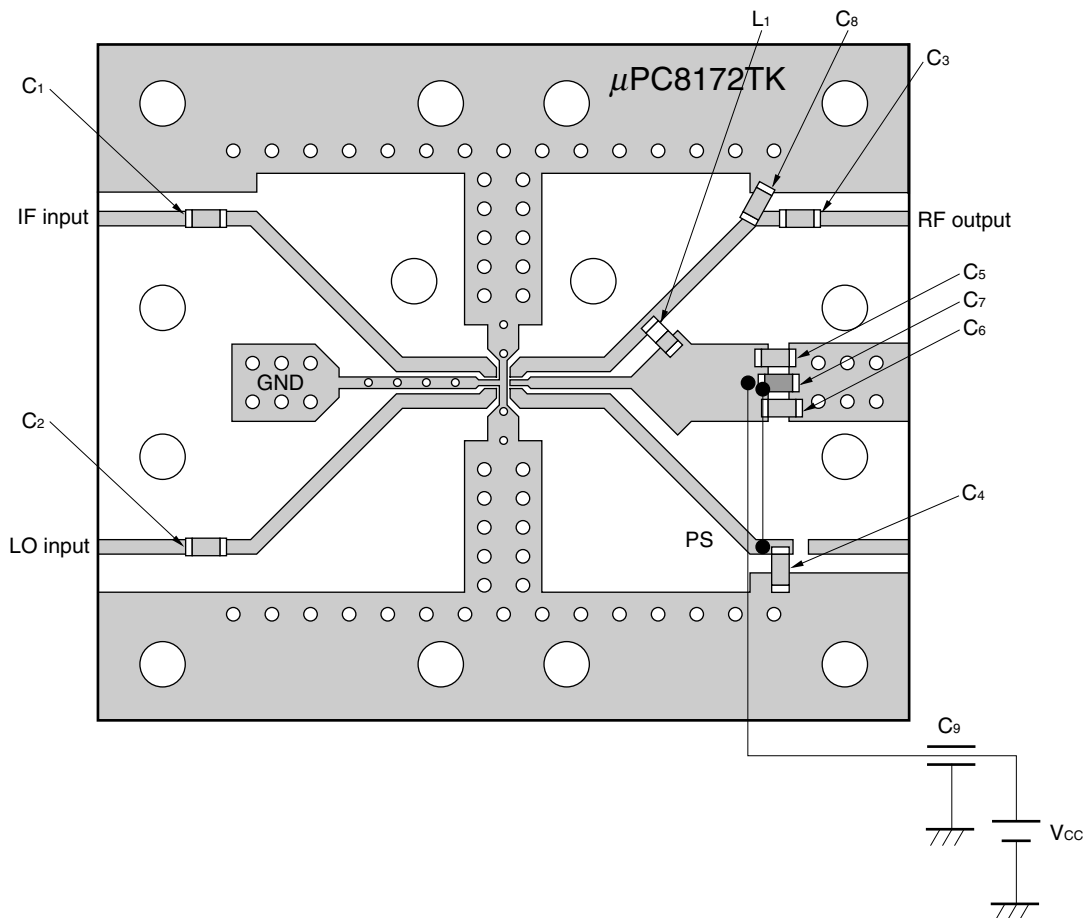
Form	Symbol	Value	Type code	Maker
Chip capacitor	C <sub>1</sub> , C <sub>2</sub> , C <sub>3</sub>	100 pF	GRM39CH101J50PT	murata
	C <sub>4</sub> , C <sub>5</sub> , C <sub>6</sub>	1 000 pF	GRM39B102K50PT	murata
	C <sub>7</sub>	30 pF	GRM39CH300J50PT	murata
	C <sub>8</sub>	3 pF	GRM39CH030C50PT	murata
Feed-through Capacitor	C <sub>9</sub>	1 000 pF	DFT301-801 × 7R102S50	murata
Chip inductor	L <sub>1</sub>	100 nH	LL1608-FR10	TOKO

- (\*1) 35 × 42 × 0.4 mm polyimide board, double-sided copper clad
- (\*2) Ground pattern on rear of the board
- (\*3) Solder plated patterns
- (\*4) ○○: Through holes

10.3 TEST CIRCUIT 3 ( $f_{RFout} = 2.4\text{ GHz}$ )



EXAMPLE OF TEST CIRCUIT 3 ASSEMBLED ON EVALUATION BOARD



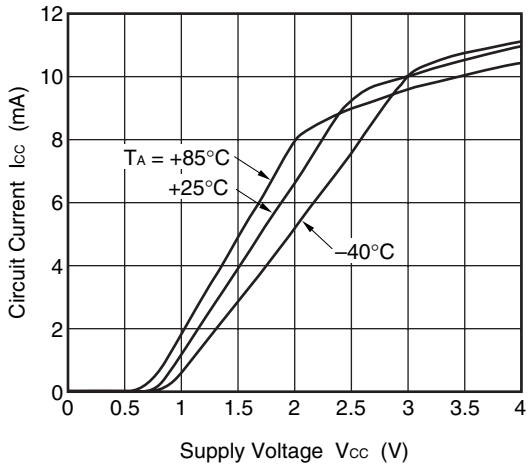
COMPONENT LIST

Form	Symbol	Value	Type code	Maker
Chip capacitor	C <sub>1</sub> , C <sub>2</sub> , C <sub>3</sub>	100 pF	GRM39CH101J50PT	murata
	C <sub>4</sub> , C <sub>5</sub> , C <sub>6</sub>	1 000 pF	GRM39B102K50PT	murata
	C <sub>7</sub>	10 pF	GRM39CH100D50PT	murata
	C <sub>8</sub>	2 pF	GRM39CH020C50PT	murata
Feed-through Capacitor	C <sub>9</sub>	1 000 pF	DFT301-801 × 7R102S50	murata
Chip inductor	L <sub>1</sub>	470 nH	LL2012-FR47	TOKO

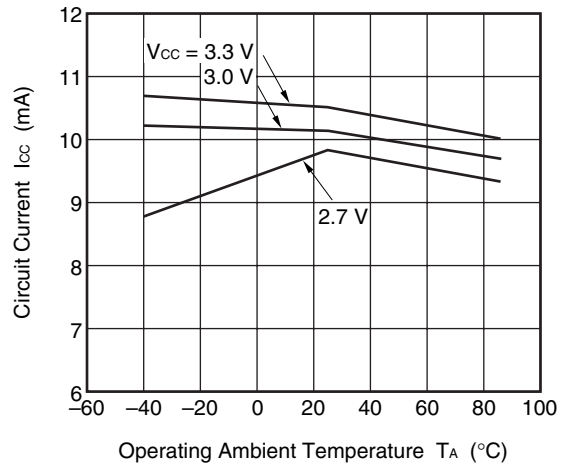
- (\*1) 35 × 42 × 0.4 mm polyimide board, double-sided copper clad
- (\*2) Ground pattern on rear of the board
- (\*3) Solder plated patterns
- (\*4) ○○: Through holes

★ 11. TYPICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise specified)

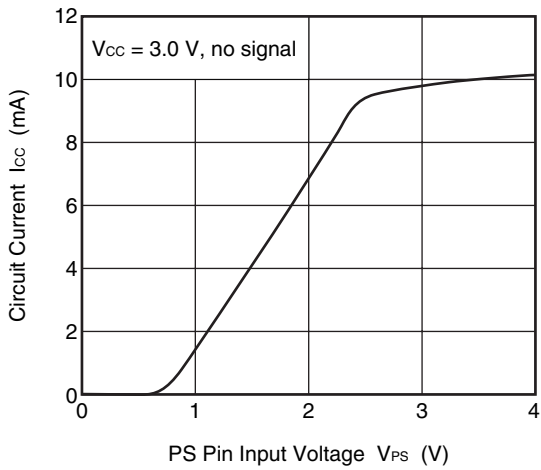
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



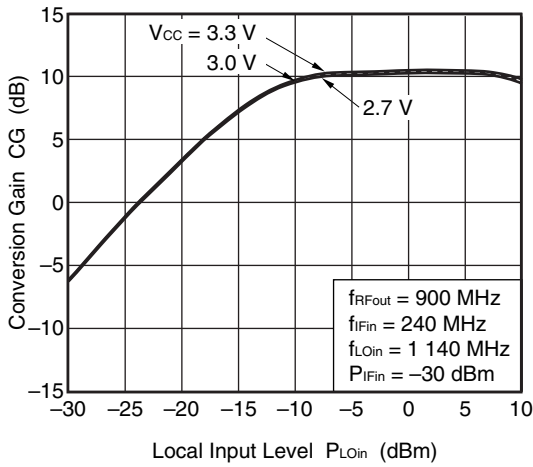
CIRCUIT CURRENT vs. PS PIN INPUT VOLTAGE



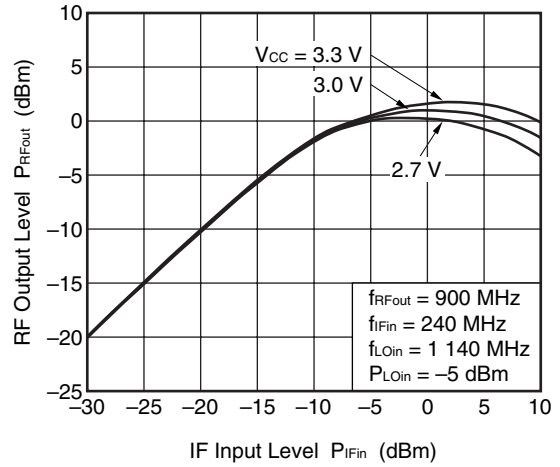
**Remark** The graphs indicate nominal characteristics.

11.1  $f_{RFout} = 900$  MHz MATCHING

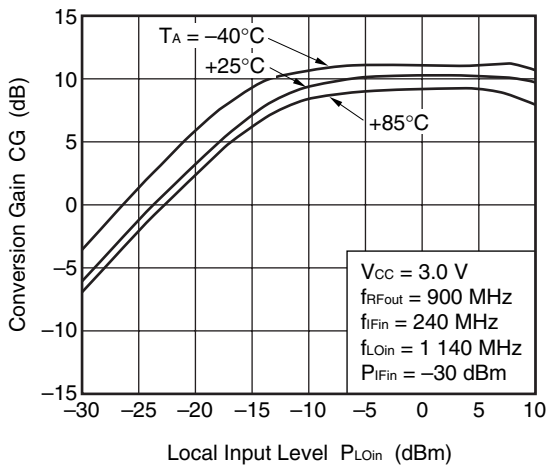
CONVERSION GAIN vs. LOCAL INPUT LEVEL



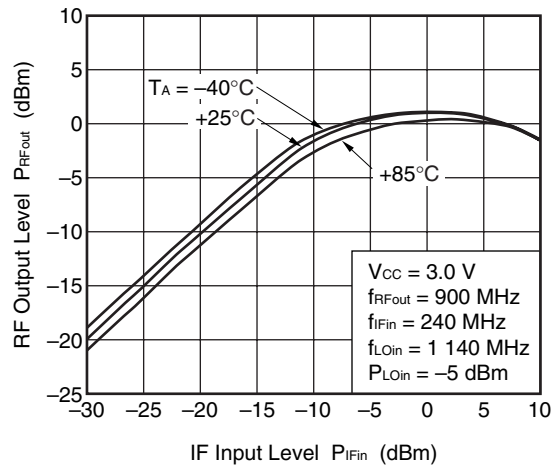
RF OUTPUT LEVEL vs. IF INPUT LEVEL



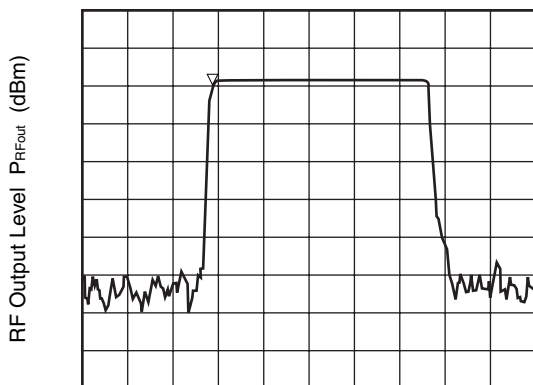
CONVERSION GAIN vs. LOCAL INPUT LEVEL



RF OUTPUT LEVEL vs. IF INPUT LEVEL



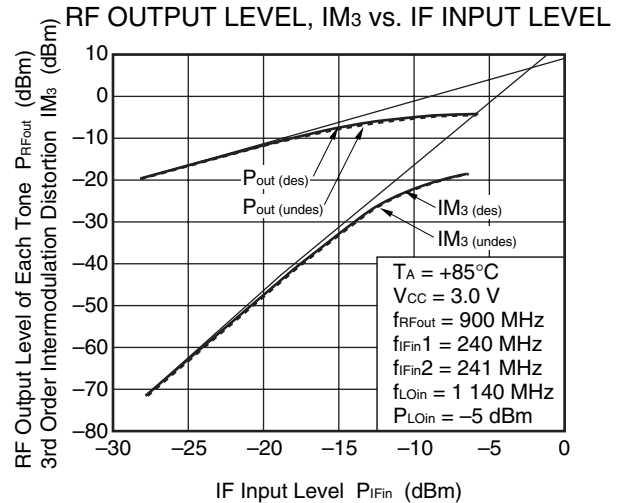
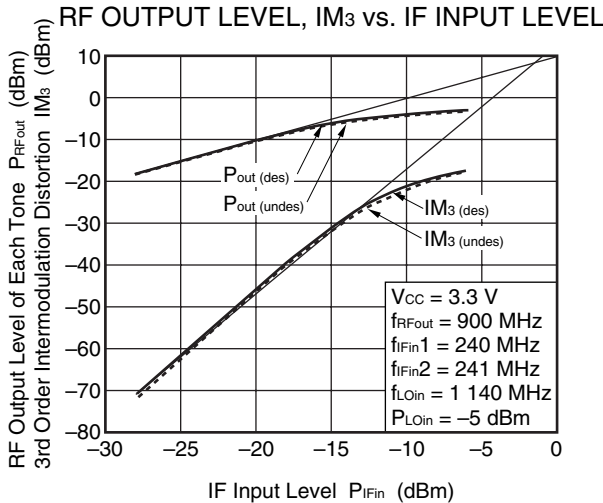
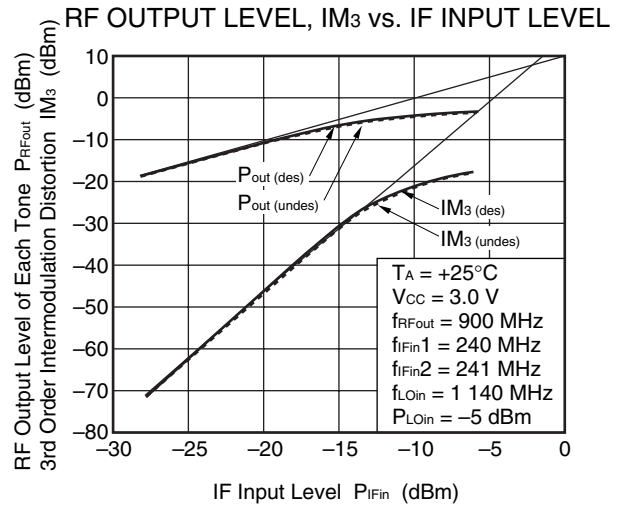
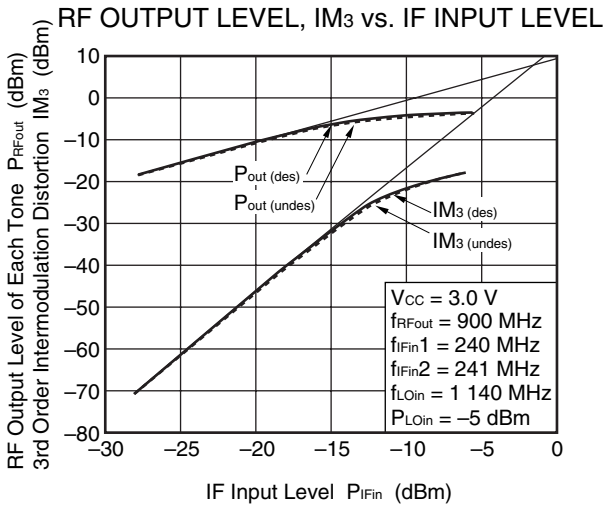
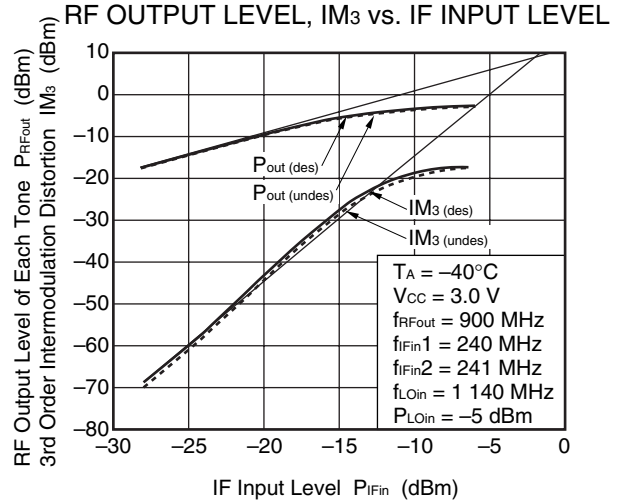
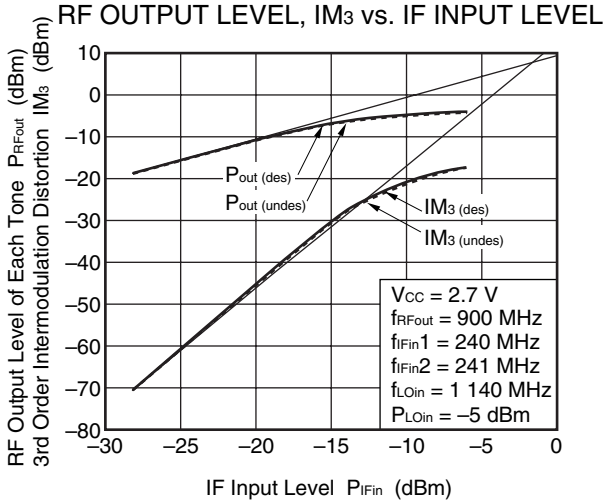
PS PIN CONTROL RESPONSE TIME



REF LVL = 0 dBm       $V_{CC} = 3.0$  V  
 10 dB/DIV (vertical axis)     $f_{RFout} = 0.9$  GHz  
 ATT = 10 dB                     $f_{IFin} = 240$  MHz  
 CENTER = 0.9 GHz             $P_{IFin} = -30$  dBm  
 SPAN = 0 Hz                     $f_{LOin} = 1\ 140$  MHz  
 RBW = 2 MHz                     $P_{LOin} = -5$  dBm  
 VBW = 3 MHz                     $\Delta MKR -20.0$  dBm,  $14.7$   $\mu$ s  
 SWP = 50  $\mu$ sec  
 5  $\mu$ sec/DIV (horizontal axis)

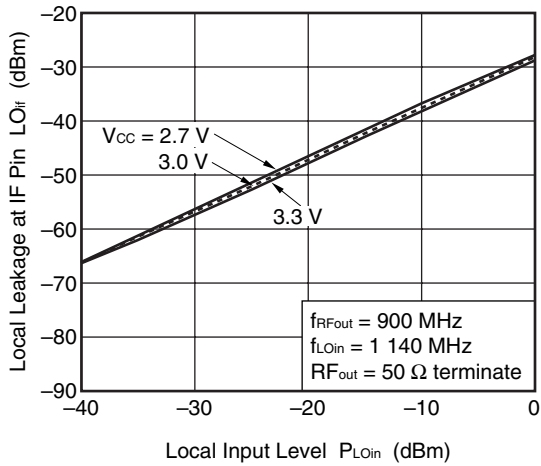
Response Time ( $\mu$ s)

**Remark** The graphs indicate nominal characteristics.

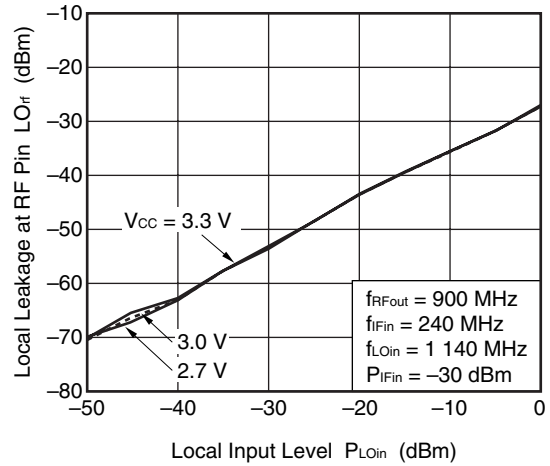


**Remark** The graphs indicate nominal characteristics.

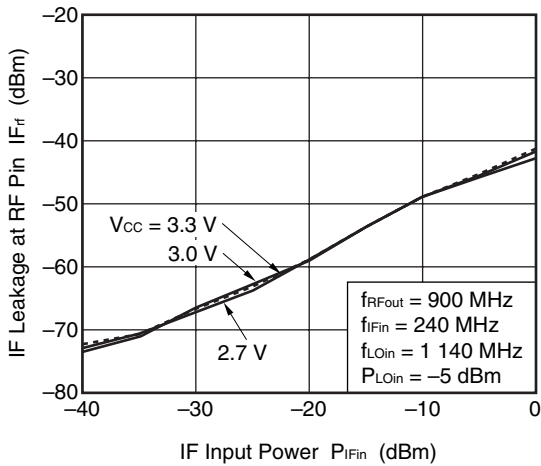
LOCAL LEAKAGE AT IF PIN  
vs. LOCAL INPUT LEVEL



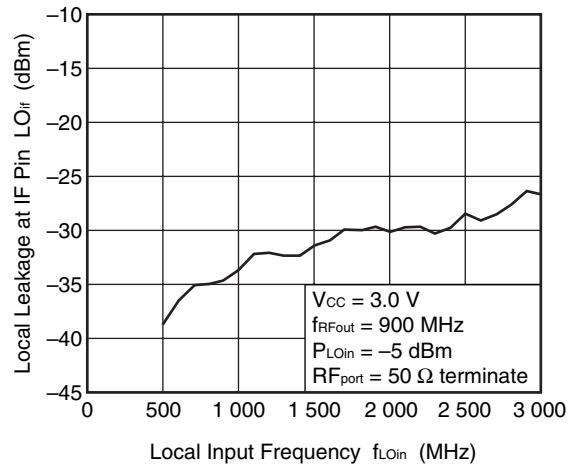
LOCAL LEAKAGE AT RF PIN  
vs. LOCAL INPUT LEVEL



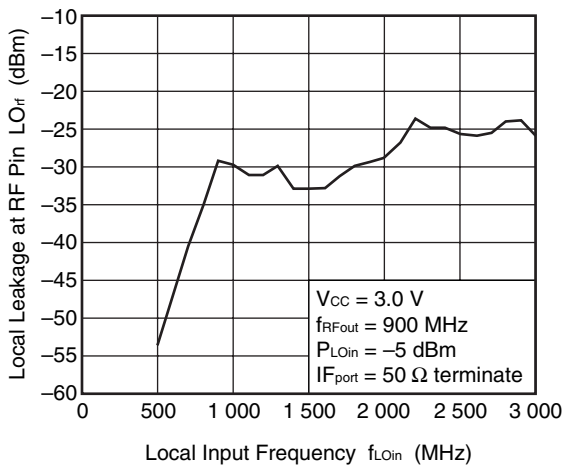
IF LEAKAGE AT RF PIN  
vs. IF INPUT POWER



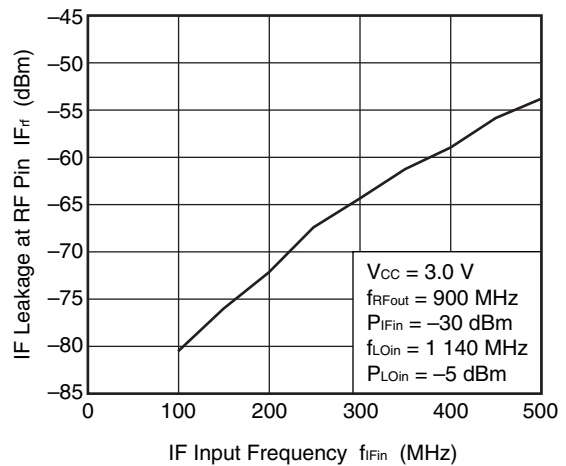
LOCAL LEAKAGE AT IF PIN  
vs. LOCAL INPUT FREQUENCY



LOCAL LEAKAGE AT RF PIN  
vs. LOCAL INPUT FREQUENCY

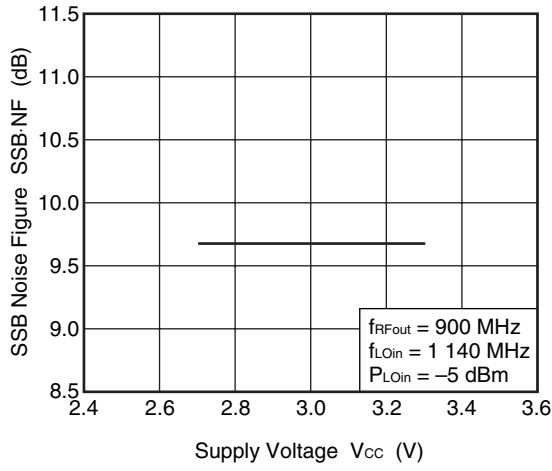


IF LEAKAGE AT RF PIN  
vs. IF INPUT FREQUENCY

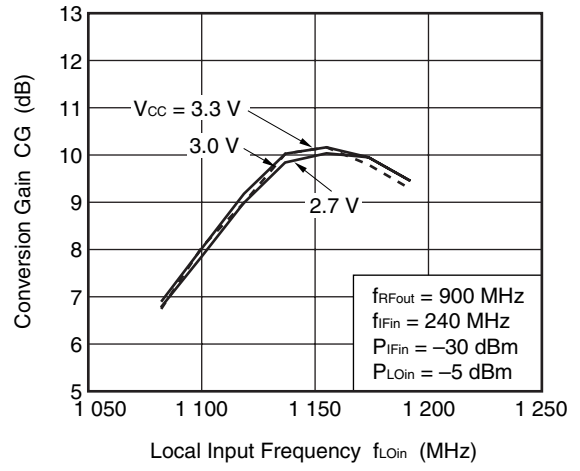


**Remark** The graphs indicate nominal characteristics.

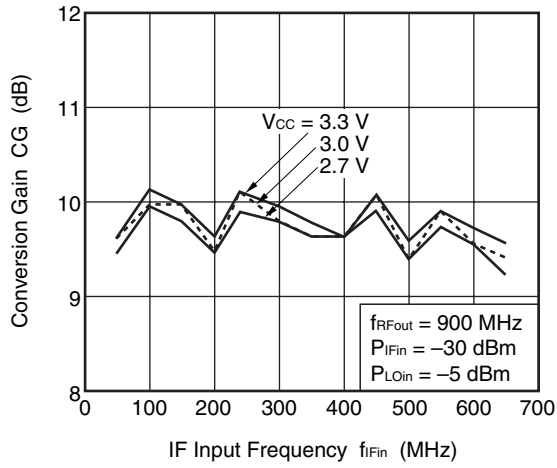
SSB NOISE FIGURE vs. SUPPLY VOLTAGE



CONVERSION GAIN vs. LOCAL INPUT FREQUENCY



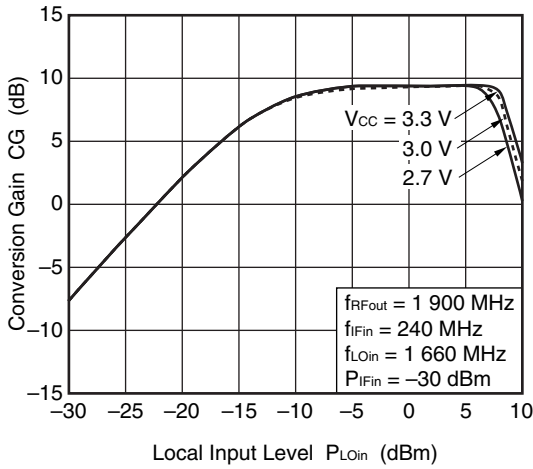
CONVERSION GAIN vs. IF INPUT FREQUENCY



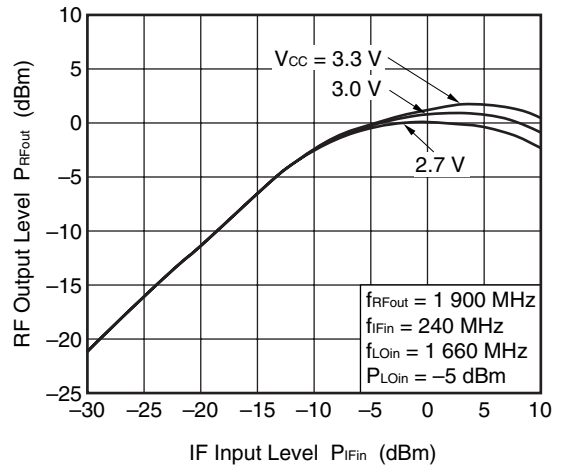
**Remark** The graphs indicate nominal characteristics.

11.2  $f_{RFout} = 1\ 900\ MHz$  MATCHING

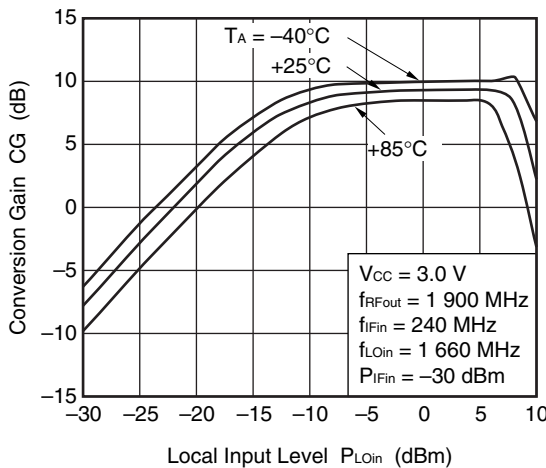
CONVERSION GAIN vs. LOCAL INPUT LEVEL



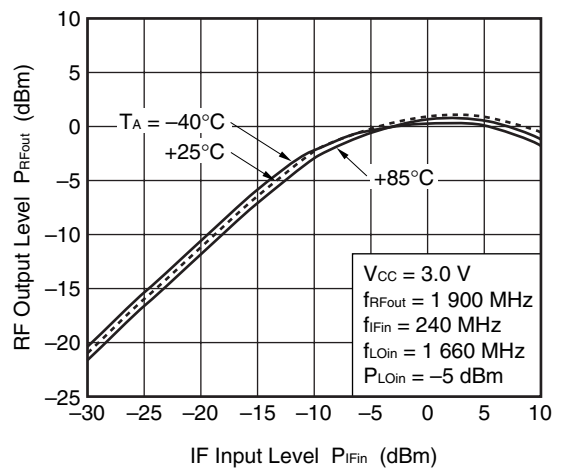
RF OUTPUT LEVEL vs. IF INPUT LEVEL



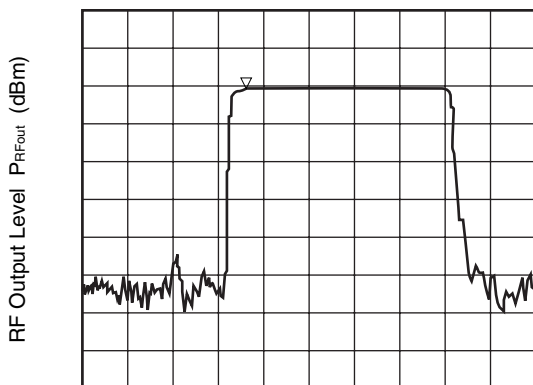
CONVERSION GAIN vs. LOCAL INPUT LEVEL



RF OUTPUT LEVEL vs. IF INPUT LEVEL



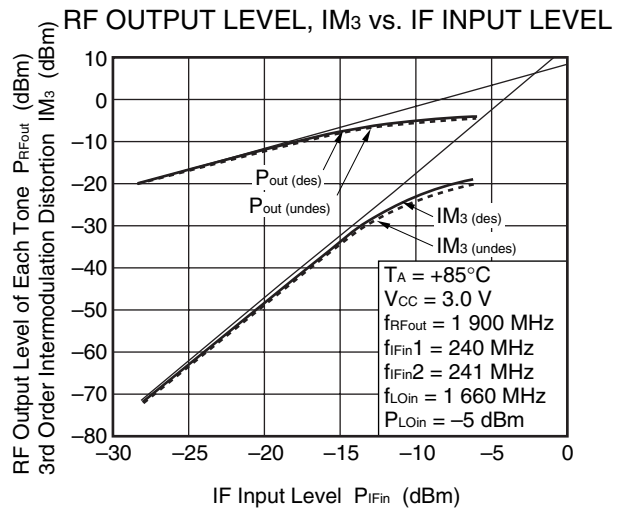
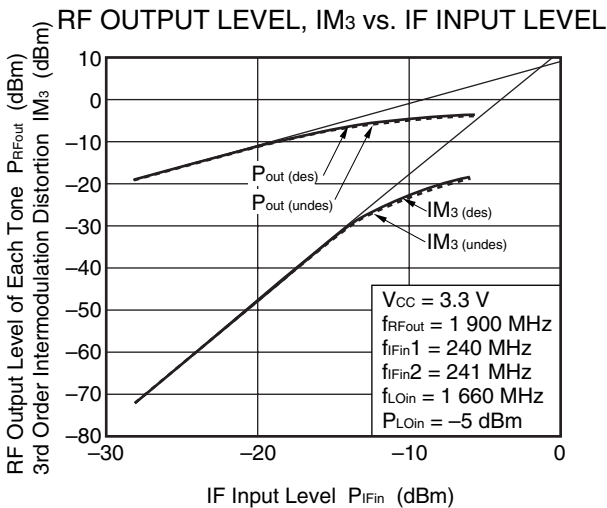
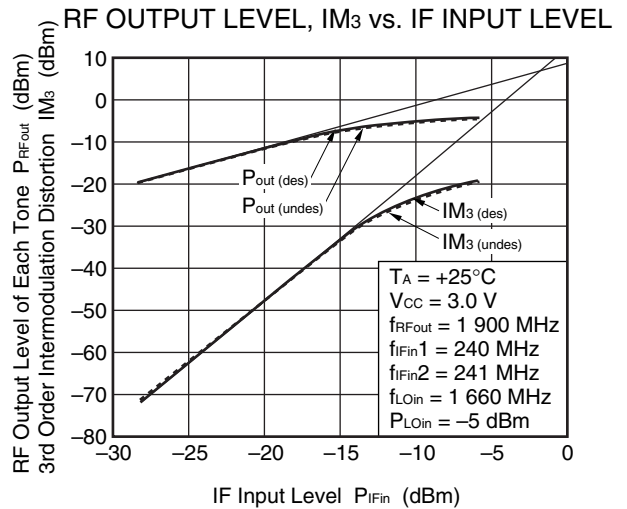
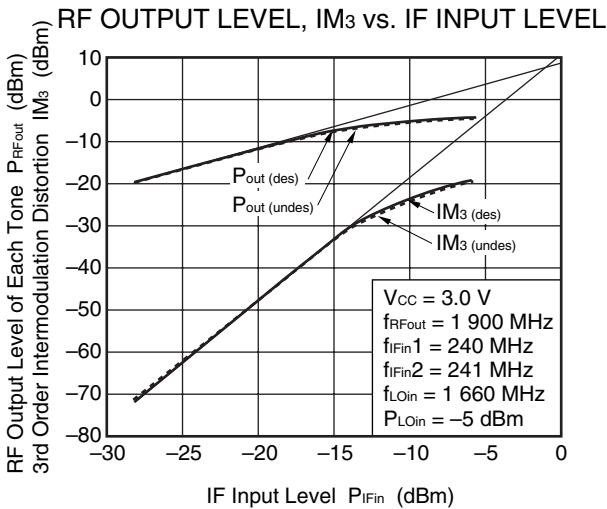
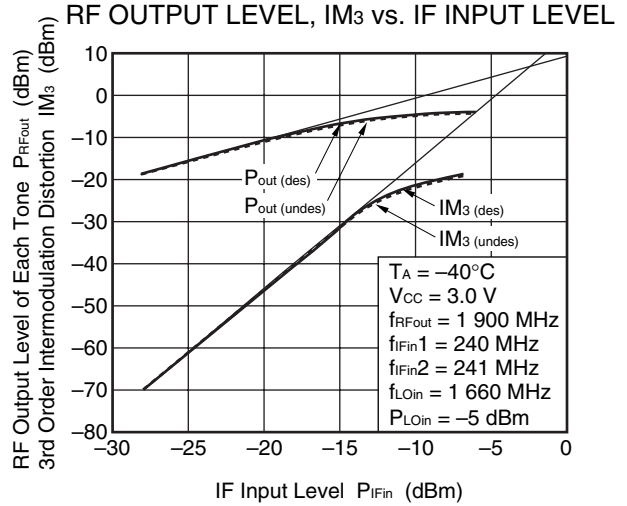
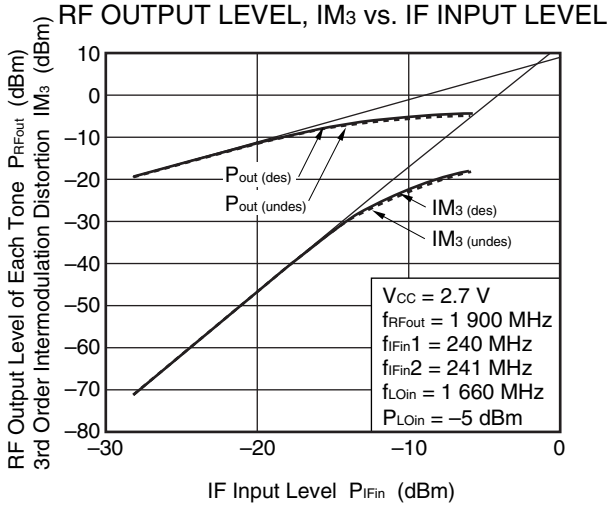
PS PIN CONTROL RESPONSE TIME



REF LVL = 0 dBm       $V_{CC} = 3.0\ V$   
 10 dB/DIV (vertical axis)     $f_{RFout} = 1.9\ GHz$   
 ATT = 10 dB             $f_{IFin} = 240\ MHz$   
 CENTER = 1.9 GHz         $P_{IFin} = -30\ dBm$   
 SPAN = 0 Hz              $f_{LOin} = 1\ 660\ MHz$   
 RBW = 2 MHz             $P_{LOin} = -5\ dBm$   
 VBW = 3 MHz             $\Delta MKR -21.0\ dBm, 17.9\ \mu s$   
 SWP = 50  $\mu sec$   
 5  $\mu sec$ /DIN (horizontal axis)

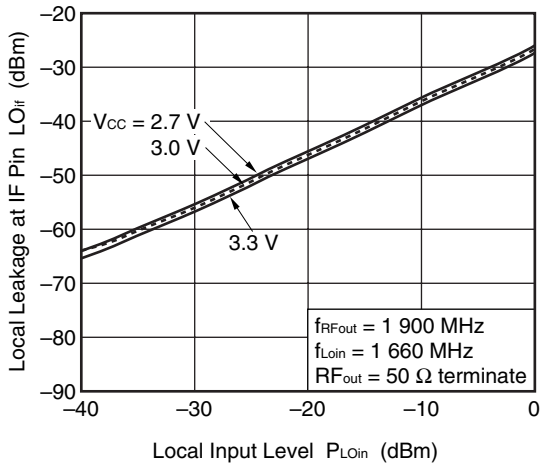
Response Time ( $\mu s$ )

**Remark** The graphs indicate nominal characteristics.

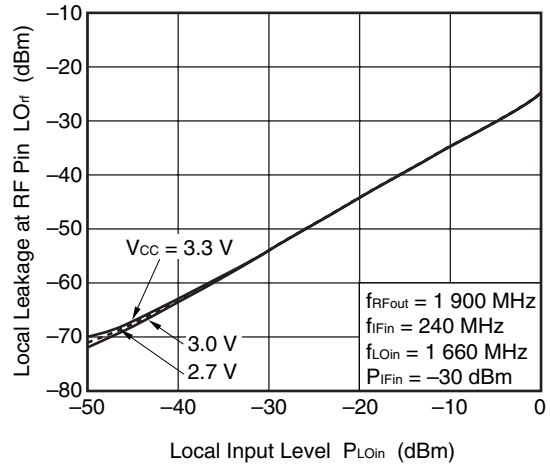


**Remark** The graphs indicate nominal characteristics.

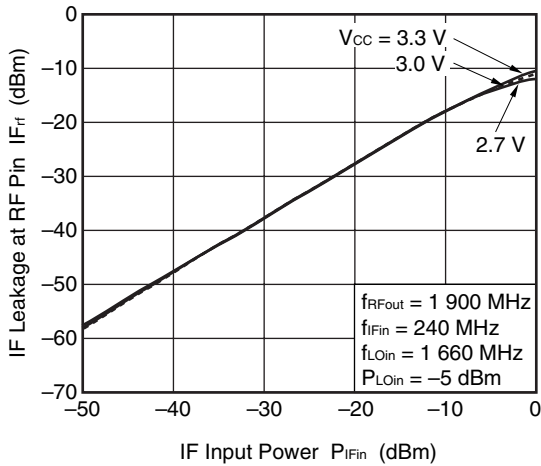
LOCAL LEAKAGE AT IF PIN vs. LOCAL INPUT LEVEL



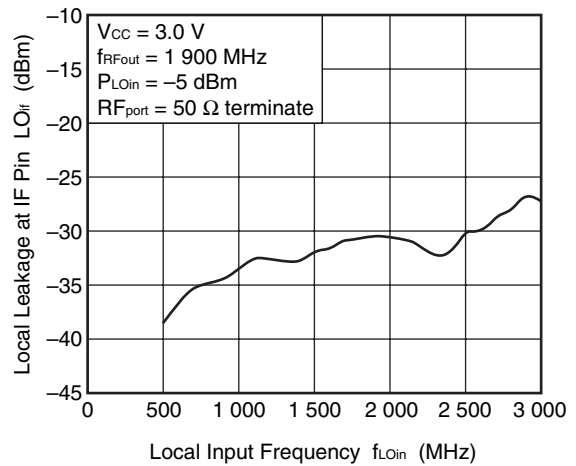
LOCAL LEAKAGE AT RF PIN vs. LOCAL INPUT LEVEL



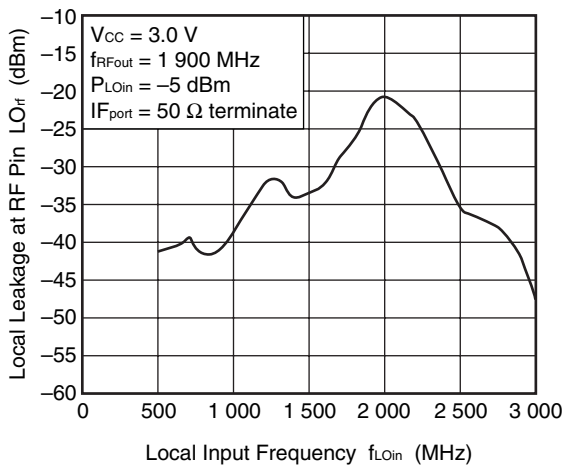
IF LEAKAGE AT RF PIN vs. IF INPUT POWER



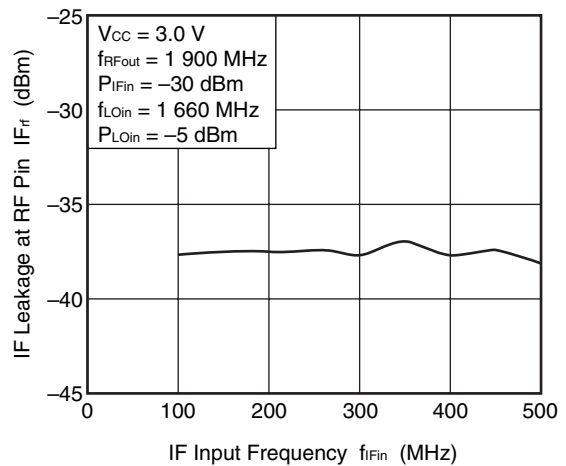
LOCAL LEAKAGE AT IF PIN vs. LOCAL INPUT FREQUENCY



LOCAL LEAKAGE AT RF PIN vs. LOCAL INPUT FREQUENCY

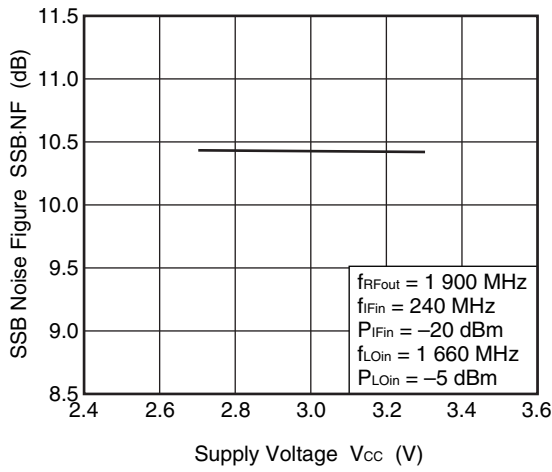


IF LEAKAGE AT RF PIN vs. IF INPUT FREQUENCY

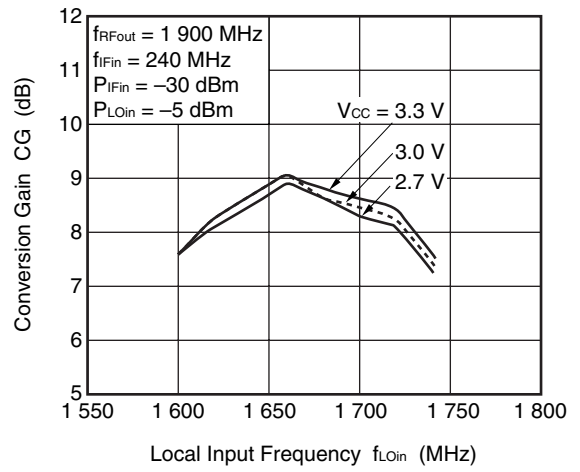


**Remark** The graphs indicate nominal characteristics.

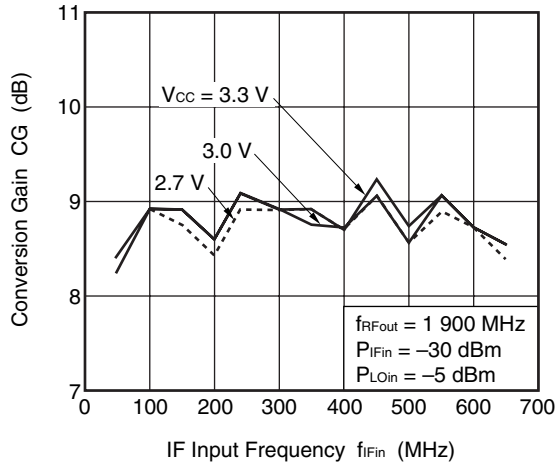
SSB NOISE FIGURE vs. SUPPLY VOLTAGE



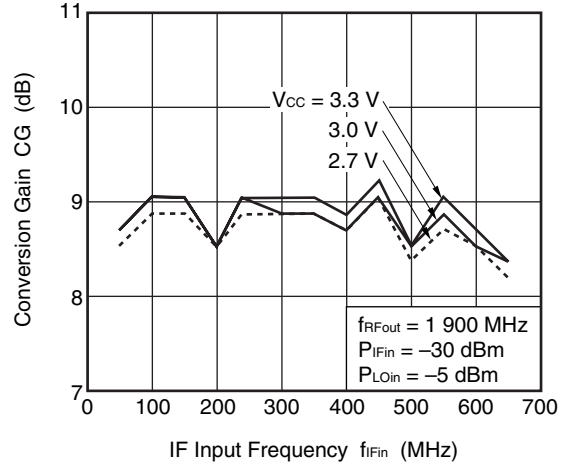
CONVERSION GAIN vs. LOCAL INPUT FREQUENCY



CONVERSION GAIN vs. IF INPUT FREQUENCY ( $f_{LOin} < f_{RFout}$ )



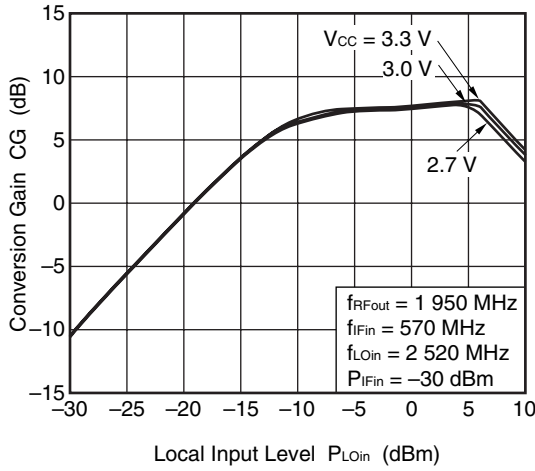
CONVERSION GAIN vs. IF INPUT FREQUENCY ( $f_{LOin} > f_{RFout}$ )



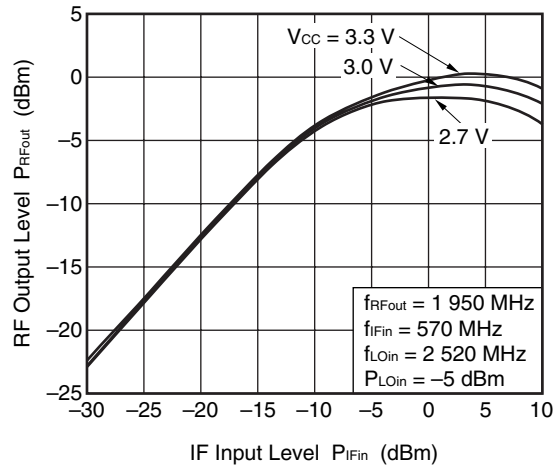
**Remark** The graphs indicate nominal characteristics.

11.3  $f_{RFout} = 1\ 950\ MHz$  MATCHING

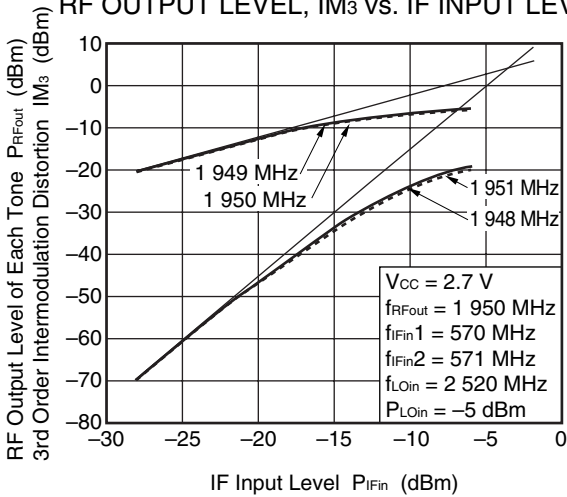
CONVERSION GAIN vs. LOCAL INPUT LEVEL



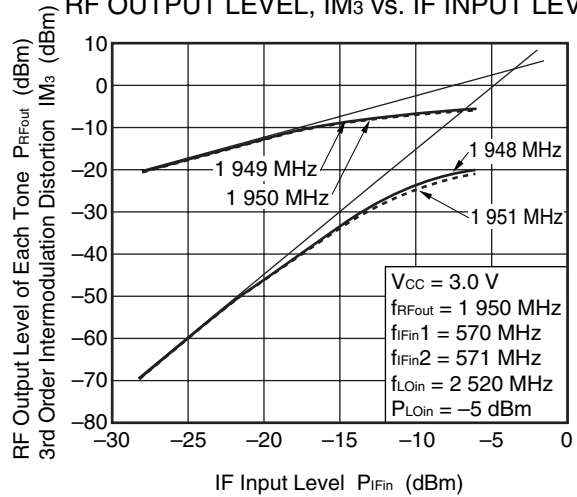
RF OUTPUT LEVEL vs. IF INPUT LEVEL



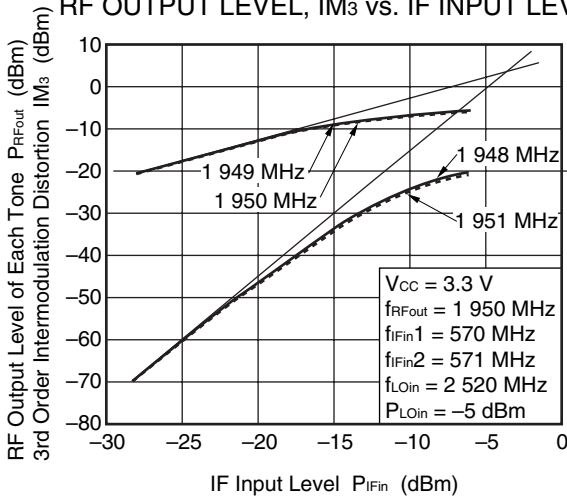
RF OUTPUT LEVEL, IM<sub>3</sub> vs. IF INPUT LEVEL



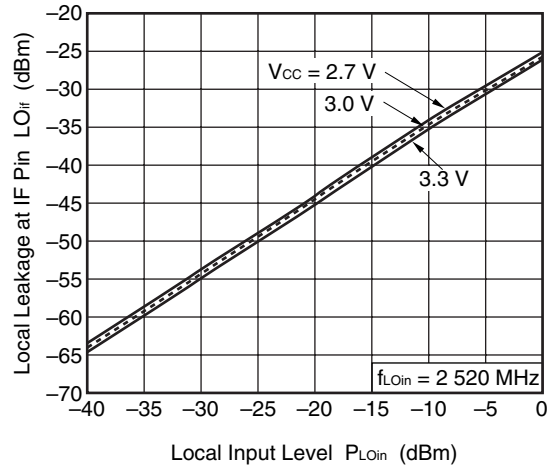
RF OUTPUT LEVEL, IM<sub>3</sub> vs. IF INPUT LEVEL



RF OUTPUT LEVEL, IM<sub>3</sub> vs. IF INPUT LEVEL

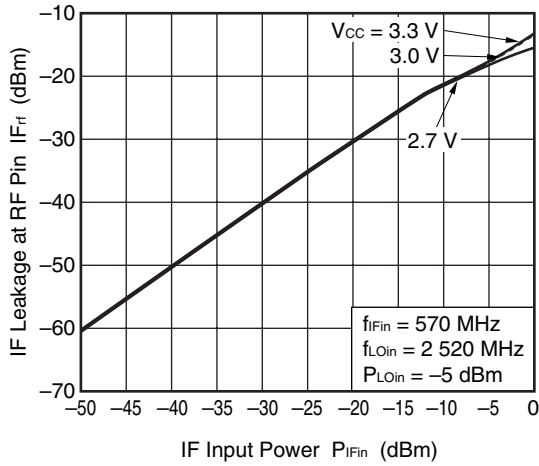


LOCAL LEAKAGE AT IF PIN vs. LOCAL INPUT LEVEL

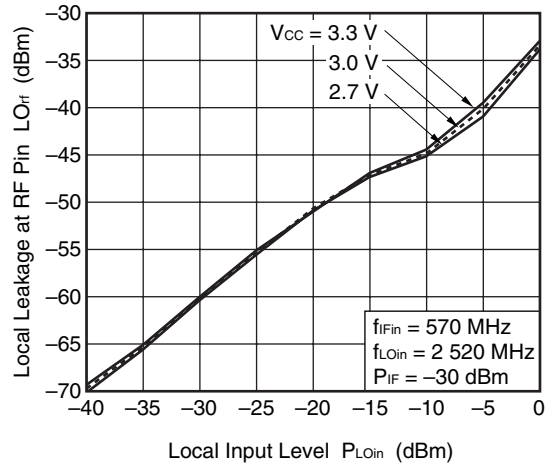


**Remark** The graphs indicate nominal characteristics.

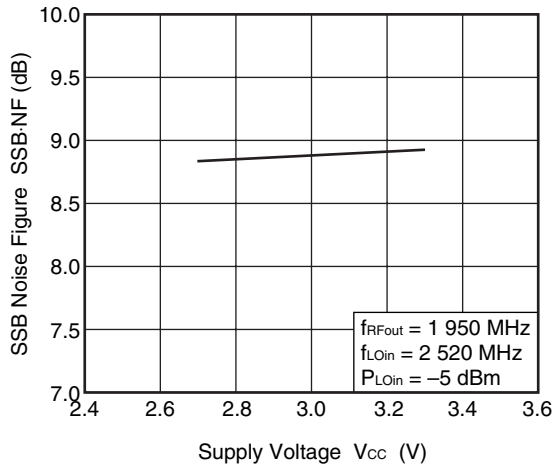
IF LEAKAGE AT RF PIN vs. IF INPUT POWER



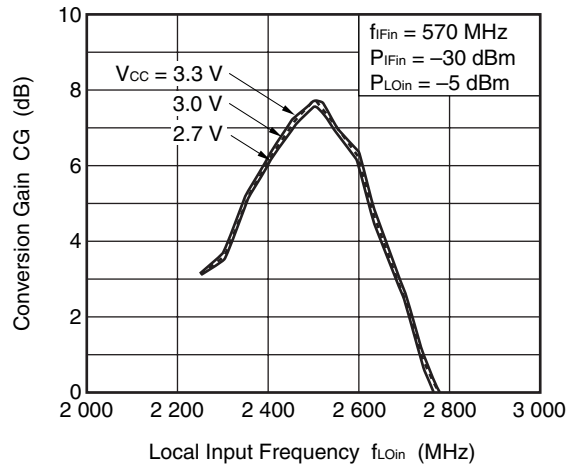
LOCAL LEAKAGE AT RF PIN vs. LOCAL INPUT LEVEL



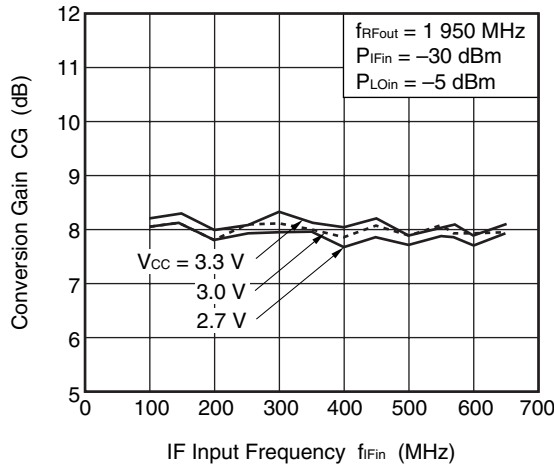
SSB NOISE FIGURE vs. SUPPLY VOLTAGE



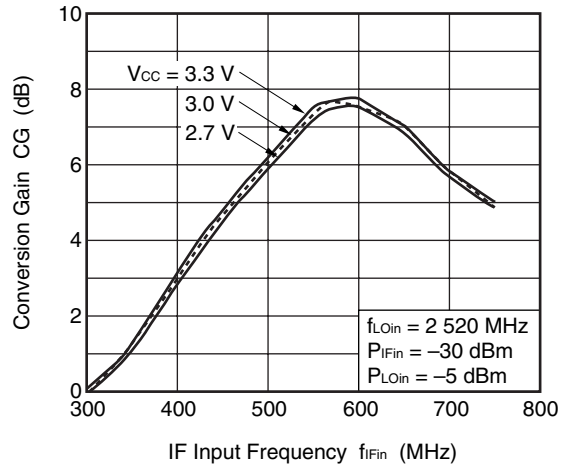
CONVERSION GAIN vs. LOCAL INPUT FREQUENCY



CONVERSION GAIN vs. IF INPUT FREQUENCY



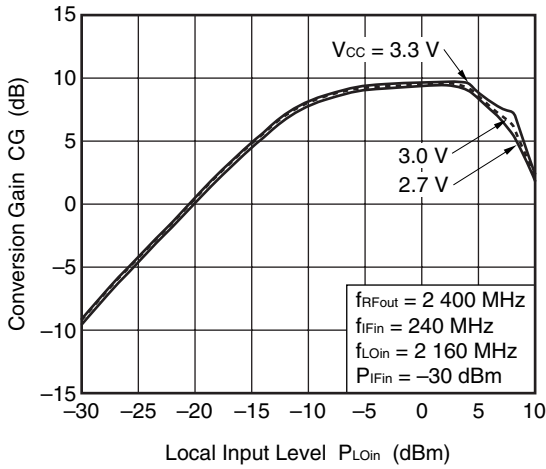
CONVERSION GAIN vs. IF INPUT FREQUENCY



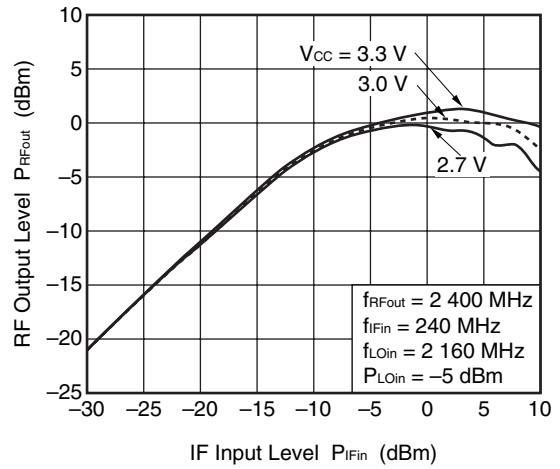
**Remark** The graphs indicate nominal characteristics.

11.4  $f_{RFout} = 2\ 400\ \text{MHz}$  MATCHING

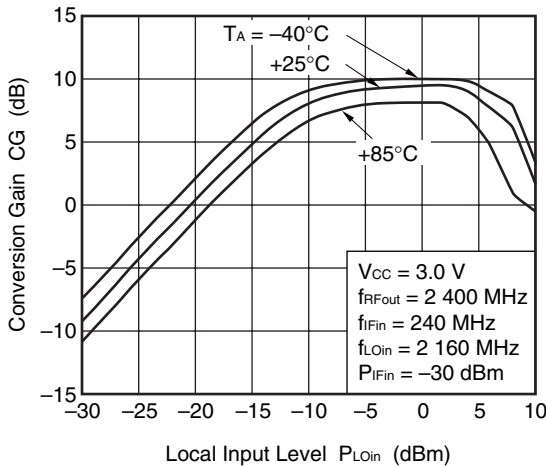
CONVERSION GAIN vs. LOCAL INPUT LEVEL



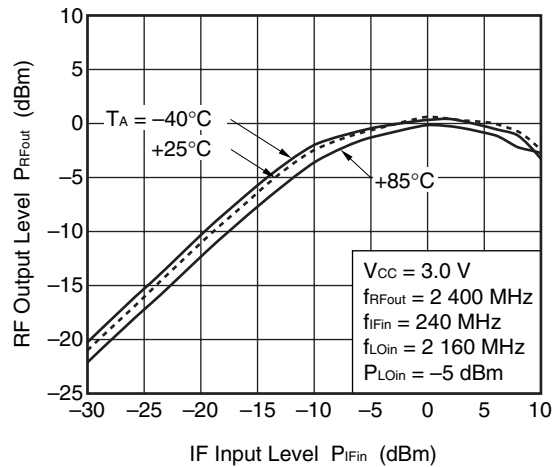
RF OUTPUT LEVEL vs. IF INPUT LEVEL



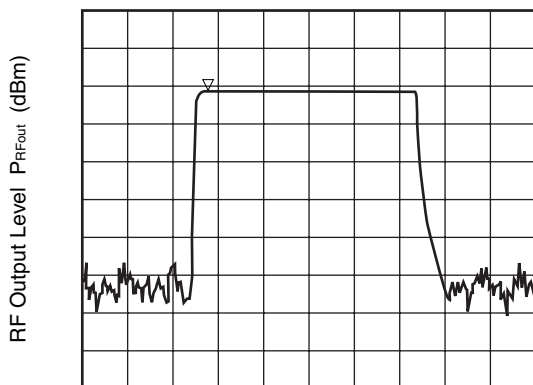
CONVERSION GAIN vs. LOCAL INPUT LEVEL



RF OUTPUT LEVEL vs. IF INPUT LEVEL



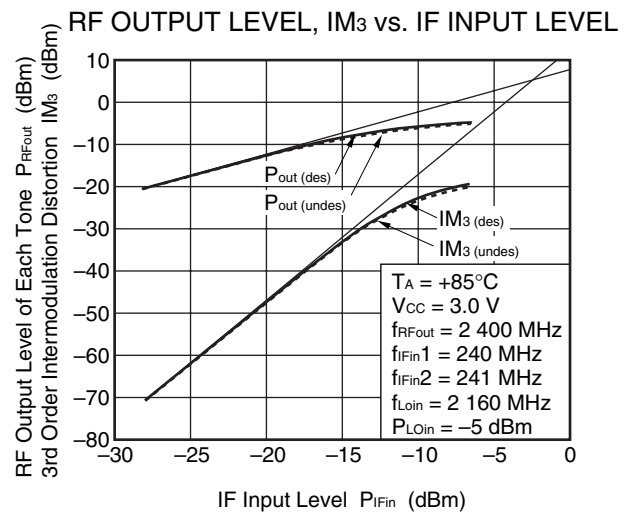
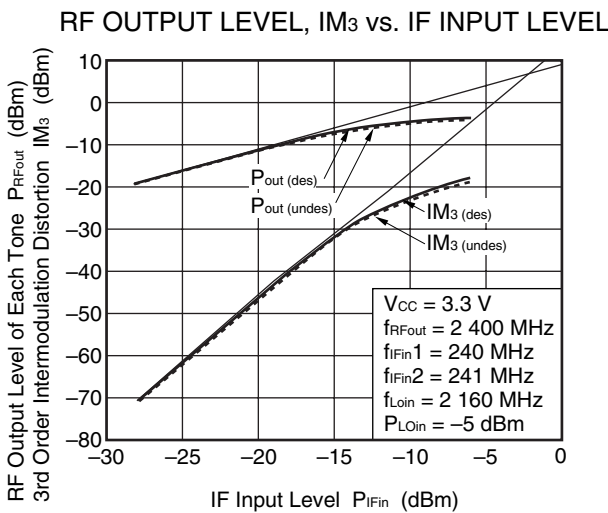
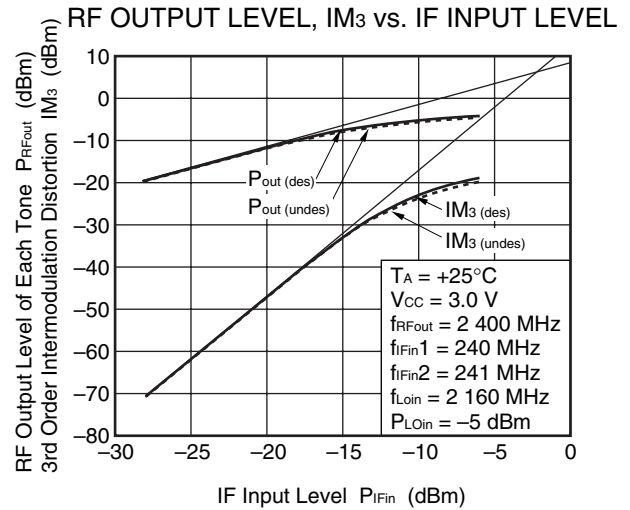
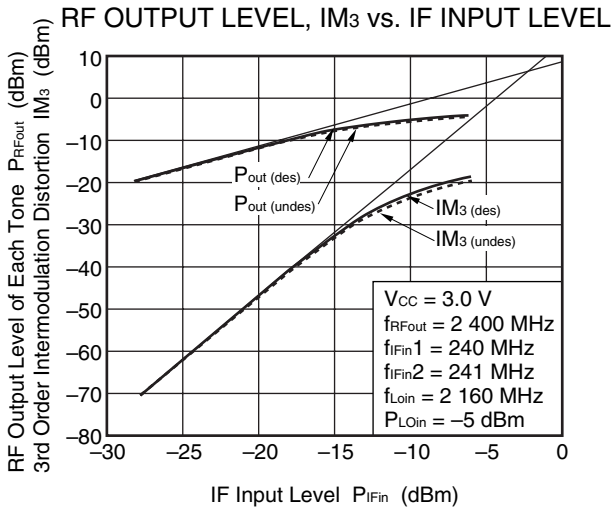
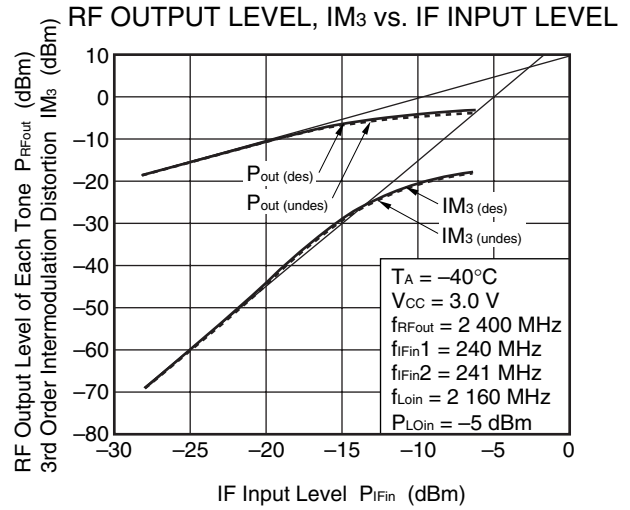
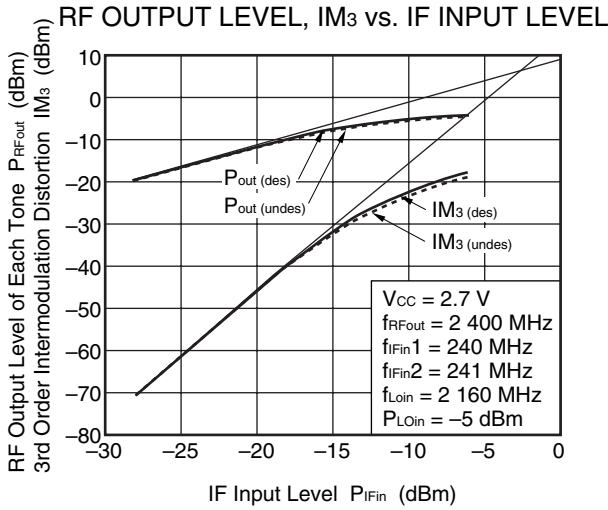
PS PIN CONTROL RESPONSE TIME



REF LVL = 0 dBm       $V_{CC} = 3.0\ \text{V}$   
 10 dB/DIV (vertical axis)       $f_{RFout} = 2.4\ \text{GHz}$   
 ATT = 10 dB       $f_{IFin} = 240\ \text{MHz}$   
 CENTER = 2.4 GHz       $P_{IFin} = -30\ \text{dBm}$   
 SPAN = 0 Hz       $f_{LOin} = 2\ 160\ \text{MHz}$   
 RBW = 2 MHz       $P_{LOin} = -5\ \text{dBm}$   
 VBW = 3 MHz       $\Delta\text{MKR} = -21.5\ \text{dBm}, 13.8\ \mu\text{s}$   
 SWP = 50  $\mu\text{sec}$   
 5  $\mu\text{sec}/\text{DIN}$  (horizontal axis)

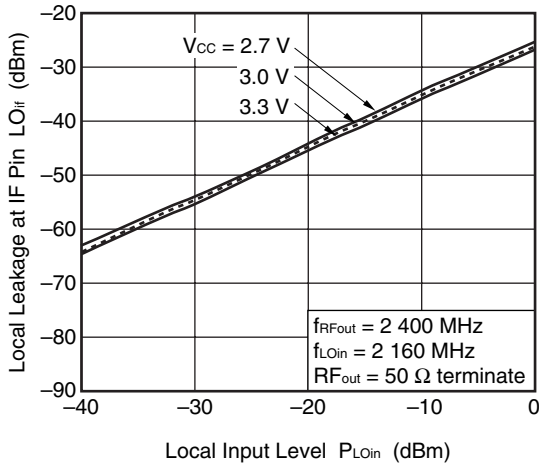
Response Time ( $\mu\text{s}$ )

**Remark** The graphs indicate nominal characteristics.

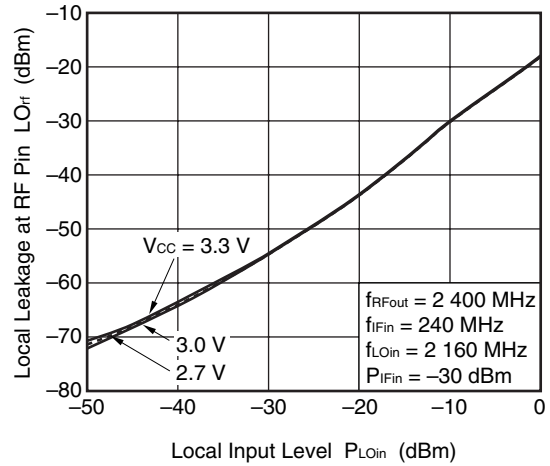


**Remark** The graphs indicate nominal characteristics.

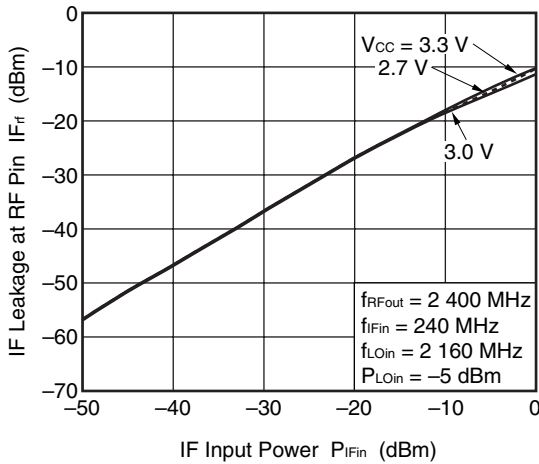
LOCAL LEAKAGE AT IF PIN  
vs. LOCAL INPUT LEVEL



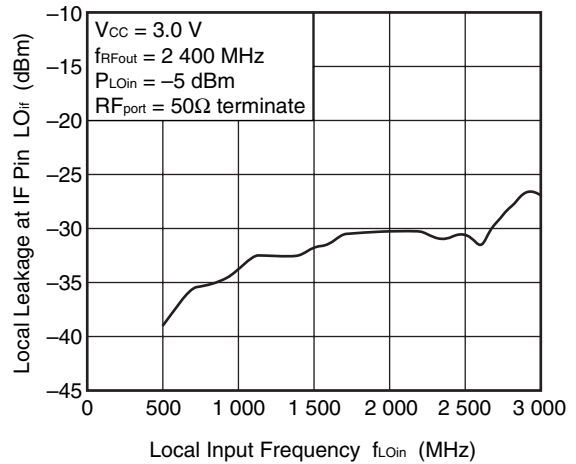
LOCAL LEAKAGE AT RF PIN  
vs. LOCAL INPUT LEVEL



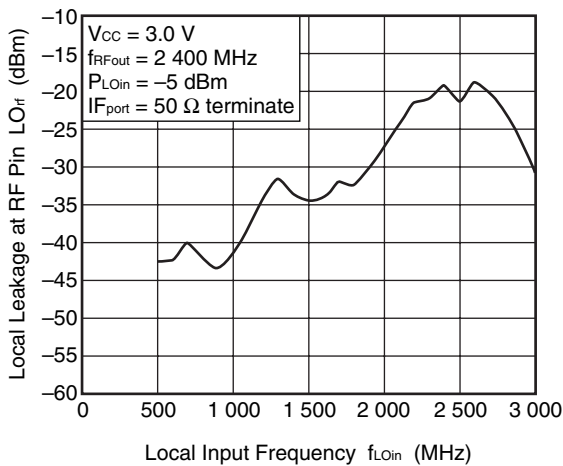
IF LEAKAGE AT RF PIN  
vs. IF INPUT POWER



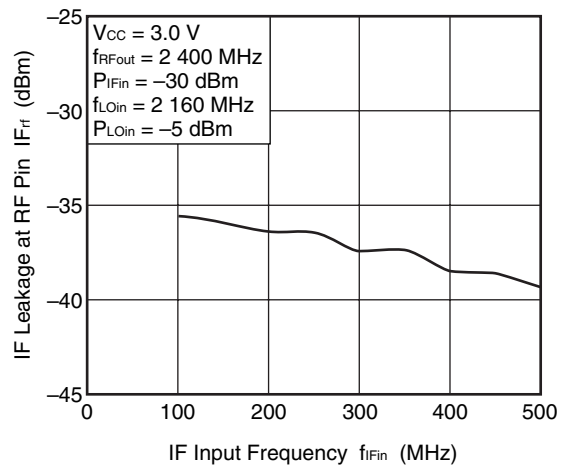
LOCAL LEAKAGE AT IF PIN  
vs. LOCAL INPUT FREQUENCY



LOCAL LEAKAGE AT RF PIN  
vs. LOCAL INPUT FREQUENCY

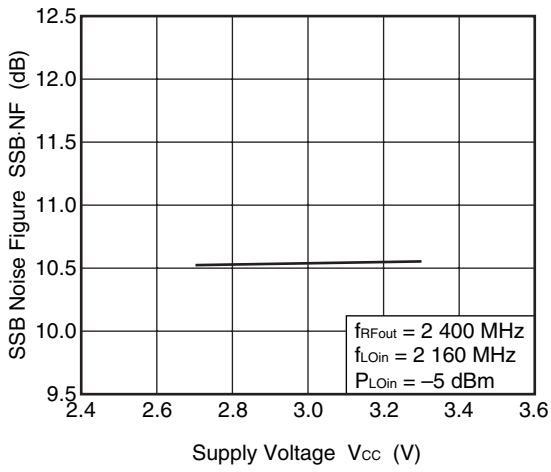


IF LEAKAGE AT RF PIN  
vs. IF INPUT FREQUENCY

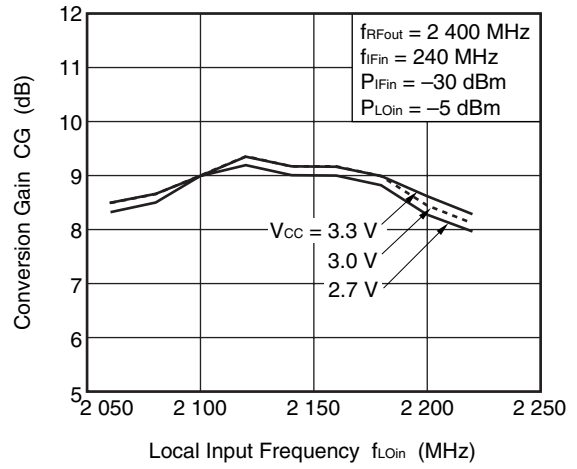


**Remark** The graphs indicate nominal characteristics.

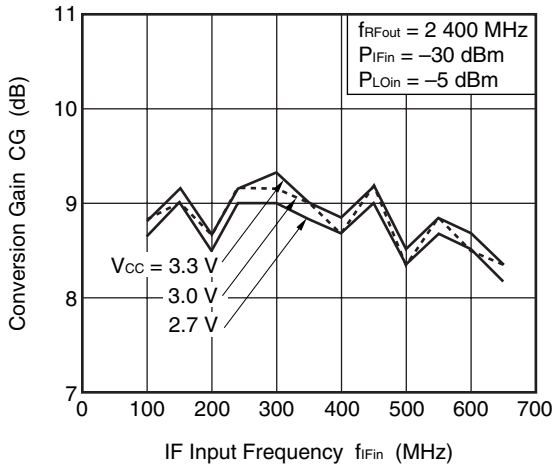
SSB NOISE FIGURE vs. SUPPLY VOLTAGE



CONVERSION GAIN vs. LOCAL INPUT FREQUENCY



CONVERSION GAIN vs. IF INPUT FREQUENCY

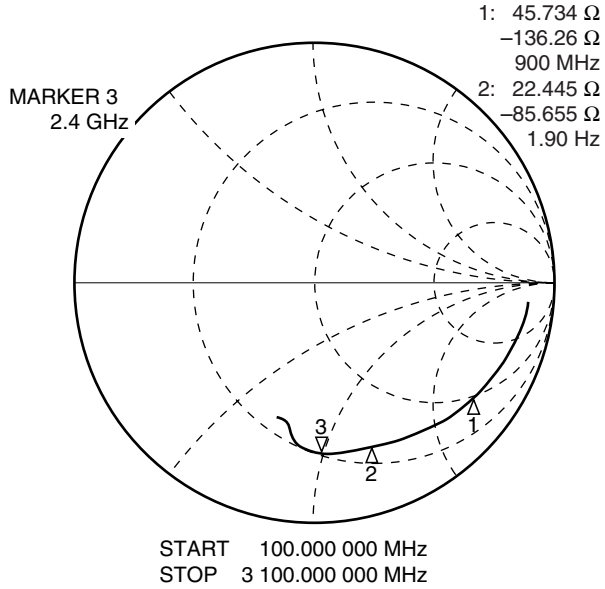


**Remark** The graphs indicate nominal characteristics.

★ 12. S-PARAMETERS

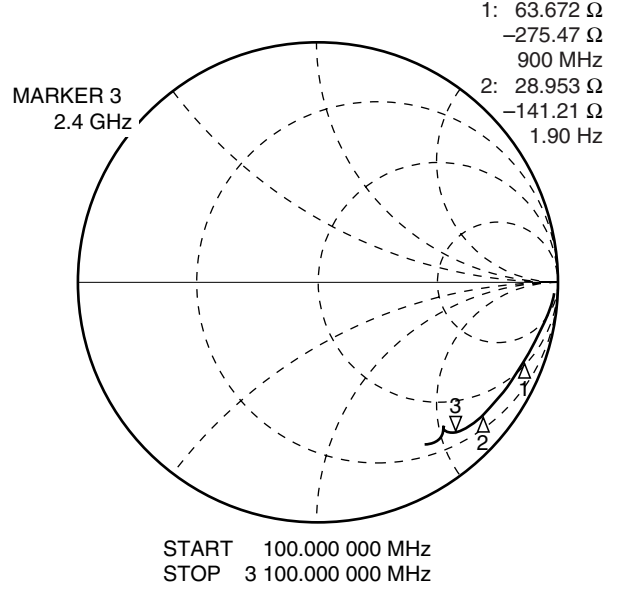
LO port Impedance (at L loaded)

CH1 B<sub>11</sub> 1 U FB B : 17.816  $\Omega$  -49.146  $\Omega$  1.3493 pF  
2 400.000 000 MHz



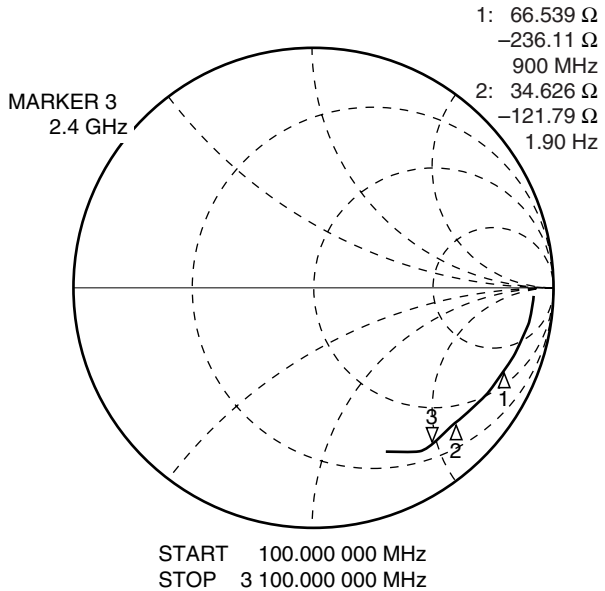
RF port Impedance (at L loaded)

CH1 B<sub>22</sub> 1 U FB B : 22.96  $\Omega$  -107.45  $\Omega$  617.19 fF  
2 400.000 000 MHz



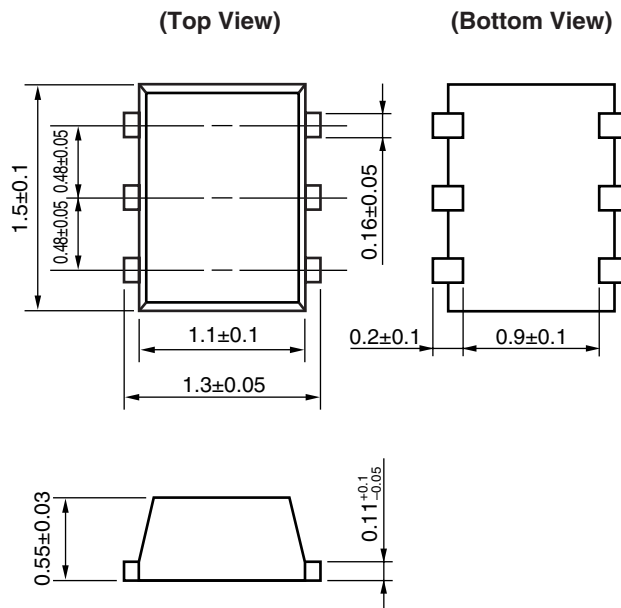
IF port Impedance (at L loaded)

CH1 B<sub>11</sub> 1 U FB B : 25.383  $\Omega$  -96.613  $\Omega$  672.47 fF  
2 400.000 000 MHz



★ 13. PACKAGE DIMENSIONS

6-PIN LEAD-LESS MINIMOLD (1511) (UNIT: mm)



Remark ( ) : Reference value

**14. NOTES ON CORRECT USE**

- (1) Observe precautions for handling because of electro-static sensitive devices.
- (2) Form a ground pattern as widely as possible to minimize ground impedance (to prevent undesired oscillation).
- (3) Connect a bypass capacitor (example : 1 000 pF) to the V<sub>CC</sub> pin.
- (4) Connect a matching circuit to the RF output pin.
- (5) The DC cut capacitor must be attached to input and output pin.

**15. RECOMMENDED SOLDERING CONDITIONS**

This product should be soldered and mounted under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your nearby sales office.

Soldering Method	Soldering Conditions	Condition Symbol
Infrared Reflow	Peak temperature (package surface temperature) : 260°C or below Time at peak temperature : 10 seconds or less Time at temperature of 220°C or higher : 60 seconds or less Preheating time at 120 to 180°C : 120±30 seconds Maximum number of reflow processes : 3 times Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	IR260
Wave Soldering	Peak temperature (molten solder temperature) : 260°C or below Time at peak temperature : 10 seconds or less Preheating temperature (package surface temperature) : 120°C or below Maximum number of flow processes : 1 time Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	WS260
Partial Heating	Peak temperature (terminal temperature) : 350°C or below Soldering time (per side of device) : 3 seconds or less Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	HS350

**Caution Do not use different soldering methods together (except for partial heating).**

When the product(s) listed in this document is subject to any applicable import or export control laws and regulation of the authority having competent jurisdiction, such product(s) shall not be imported or exported without obtaining the import or export license.

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  - (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).

M8E 00.4-0110

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► For further information, please contact

**NEC Compound Semiconductor Devices, Ltd.** <http://www.ncsd.necel.com/>

E-mail: [salesinfo@ml.ncsd.necel.com](mailto:salesinfo@ml.ncsd.necel.com) (sales and general)

[techinfo@ml.ncsd.necel.com](mailto:techinfo@ml.ncsd.necel.com) (technical)

Sales Division TEL: +81-44-435-1588 FAX: +81-44-435-1579

**NEC Compound Semiconductor Devices Hong Kong Limited**

E-mail: [ncsd-hk@elhk.nec.com.hk](mailto:ncsd-hk@elhk.nec.com.hk) (sales, technical and general)

Hong Kong Head Office TEL: +852-3107-7303 FAX: +852-3107-7309

Taipei Branch Office TEL: +886-2-8712-0478 FAX: +886-2-2545-3859

Korea Branch Office TEL: +82-2-558-2120 FAX: +82-2-558-5209

**NEC Electronics (Europe) GmbH** <http://www.ee.nec.de/>

TEL: +49-211-6503-0 FAX: +49-211-6503-1327

**California Eastern Laboratories, Inc.** <http://www.cel.com/>

TEL: +1-408-988-3500 FAX: +1-408-988-0279