DATA SHEET

BIPOLAR ANALOG INTEGRATED CIRCUITS

μPC2757TB, μPC2758TB

SILICON MMIC 1st FREQUENCY DOWN-CONVERTER FOR CELLULAR/CORDLESS TELEPHONE

DESCRIPTION

The μPC2757TB and μPC2758TB are silicon monolithic integrated circuit designed as 1st frequency down-converter for cellular/cordless telephone receiver stage. The ICs consist of mixer and local amplifier. The μPC2757TB features low current consumption and the μPC2758TB features improved intermodulation. From these two version, you can chose either IC corresponding to your system design. These TB suffix ICs which are smaller package than conventional T suffix ICs contribute to reduce your system size.

The μPC2757TB and μPC2758TB are manufactured using Renesas 20 GHz f_T 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 IC has excellent performance, uniformity and reliability.

FEATURES

- Wideband operation : f_{RFin} = 0.1 to 2.0 GHz, f_{IFout} = 20 to 300 MHz
- High-density surface mounting : 6-pin super minimold package
- Low current consumption : I_{CC} = 5.6 mA TYP. @ μPC2757TB
  I_{CC} = 11 mA TYP. @ μPC2758TB
- Supply voltage : V_{CC} = 2.7 to 3.3 V
- Minimized carrier leakage : Due to double balanced mixer
- Equable output impedance : Single-end push-pull IF amplifier
- Built-in power save function

APPLICATIONS

- Cellular/cordless telephone up to 2.0 GHz MAX. (example: GSM, PDC800M, PDC1.5G and so on): μPC2758TB
- Cellular/cordless telephone up to 2.0 GHz MAX. (example: CT1, CT2 and so on): μPC2757TB

ORDERING INFORMATION

Part Number	Package	Markings	Supplying Form	Product Type
μPC2757TB-E3	6-pin super minimold	C1X	Embossed tape 8 mm wide. Pin 1, 2, 3 face the tape perforation side. Qty 3kpcs/reel.	Low current consumption
μPC2758TB-E3		C1Y		High OIP_3

Remark To order evaluation samples, please contact your nearby sales office (Part number for sample order: μPC2757TB-A, μPC2758TB-A).

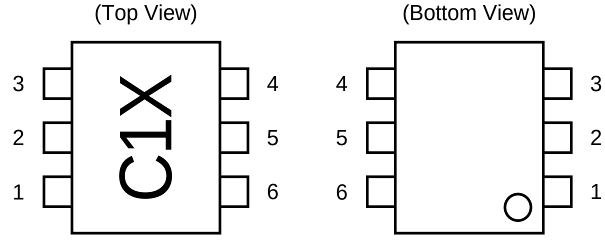
Caution Electro-static sensitive devices

Document No. P12771EJ3V0DS00 (3rd edition)
Date Published November 2000 N CP(K)

The mark ★ shows major revised points.

CONTENTS

1. PIN CONNECTIONS



Example marking is for μPC2757TB

μPC2757TB, μPC2758TB in common

Pin No.	Pin Name
1	RFinput
2	GND
3	LOinput
4	PS
5	V_{CC}
6	IFoutput

2. PRODUCT LINE-UP (T_A = +25°C, V_{CC} = V_{PS} = 3.0 V, Z_S = Z_L = 50 Ω)

Part No. \ Items	No RF I_{CC} (mA)	900 MHz SSB · NF (dB)	1.5 GHz SSB · NF (dB)	1.9 GHz SSB · NF (dB)	900 MHz CG (dB)	1.5 GHz CG (dB)	1.9 GHz CG (dB)	900 MHz IIP_3 (dBm)	1.5 GHz IIP_3 (dBm)	1.9 GHz IIP_3 (dBm)
μPC2757T μPC2757TB	5.6	10	10	13	15	15	13	–14	–14	–12
μPC2758T μPC2758TB	11	9	10	13	19	18	17	–13	–12	–11
μPC8112T μPC8112TB	8.5	9	11	11	15	13	13	–10	–9	–7

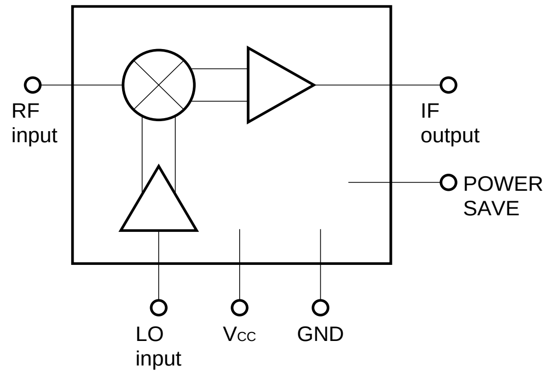
Part No. \ Items	900 MHz $P_{O(sat)}$ (dBm)	1.5 GHz $P_{O(sat)}$ (dBm)	1.9 GHz $P_{O(sat)}$ (dBm)	900 MHz RF_{LO} (dB)	1.5 GHz RF_{LO} (dB)	1.9 GHz RF_{LO} (dB)	IF Output Configuration	Packages
μPC2757T	–3	–	–8	–	–	–	Emitter follower	6-pin minimold
μPC2757TB								6-pin super minimold
μPC2758T	+1	–	–4	–	–	–		6-pin minimold
μPC2758TB								6-pin super minimold
μPC8112T	–2.5	–3	–3	–80	–57	–55	Open collector	6-pin minimold
μPC8112TB								6-pin super minimold

Remark Typical performance. Please refer to ELECTRICAL CHARACTERISTICS in detail.

Cautions 1. The μPC2757 and μPC2758's IIP_3 are calculated with ΔIM_3 = 3 which is the same IM_3 inclination as μPC8112. On the other hand, OIP_3 of Standard characteristics in page 7 is cross point IP.

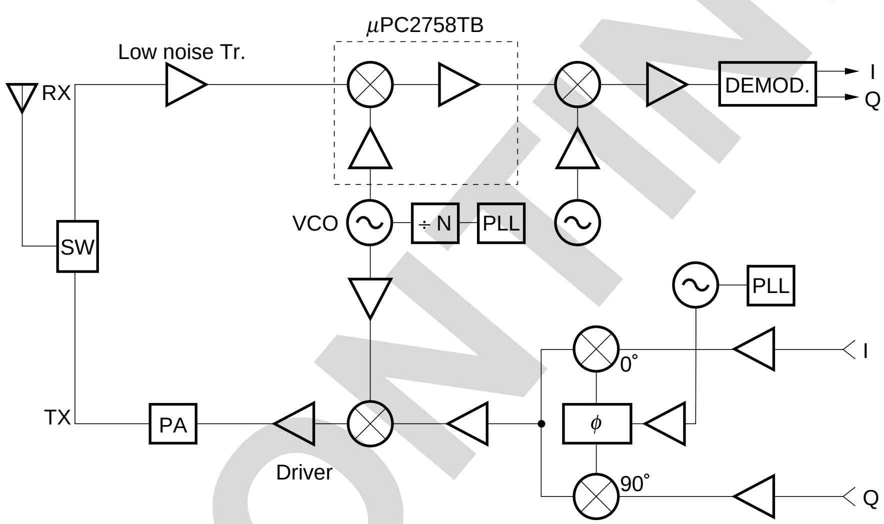
2. This document is to be specified for μPC2757TB, μPC2758TB. The other part number mentioned in this document should be referred to the data sheet of each part number.

3. INTERNAL BLOCK DIAGRAM (μPC2757TB, μPC2758TB in common)

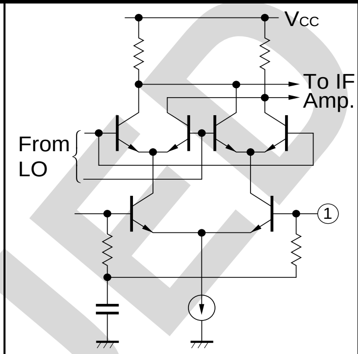
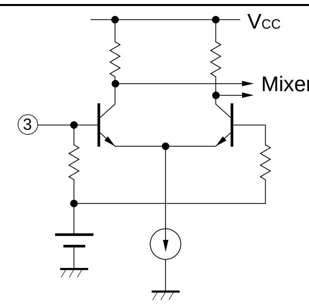
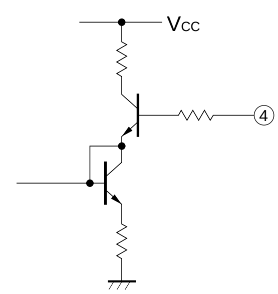
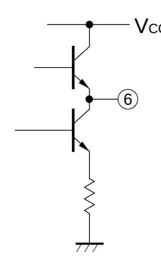


4. SYSTEM APPLICATION EXAMPLE

DIGITAL CELLULAR TELEPHONE



5. PIN EXPLANATION (Both μPC2757TB, 2758TB)

<table>
<tr><th>Pin No.</th><th>Pin Name</th><th>Applied Voltage (V)</th><th>Pin Voltage (V)Note</th><th>Function and Application</th><th>Internal Equivalent Circuit</th></tr>
<tr><td>1</td><td>RFinput</td><td>–</td><td>1.2</td><td>This pin is RF input for mixer designed as double balance type. This circuit contributes to suppress spurious signal with minimum LO and bias power consumption.
Also this symmetrical circuit can keep specified performance insensitive to process-condition distribution.</td><td>
</td></tr>
<tr><td>2</td><td>GND</td><td>GND</td><td>–</td><td>This pin is ground of IC.
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.)</td><td>–</td></tr>
<tr><td>3</td><td>LOinput</td><td>–</td><td>1.3</td><td>This pin is LO input for local buffer designed as differential amplifier. Recommendable input level is –15 to 0 dBm. Also this symmetrical circuit can keep specified performance insensitive to process-condition distribution.</td><td>
</td></tr>
<tr><td>4</td><td>PS</td><td>VCC or GND</td><td>–</td><td>This pin is for power-save function. This pin can control ON/OFF operation with bias as follows;
<table><tr><th></th><th>Bias: V</th><th>Operation</th></tr><tr><td rowspan="2">VPS</td><td>≥ 2.5</td><td>ON</td></tr><tr><td>0 to 0.5</td><td>OFF</td></tr></table>Rise time/fall time using this pin are approximately 10 μs.</td><td>
</td></tr>
<tr><td>5</td><td>VCC</td><td>2.7 to 3.3</td><td>–</td><td>Supply voltage 3.0 ±0.3 V for operation. Must be connected bypass capacitor. (example: 1 000 pF) to minimize ground impedance.</td><td>–</td></tr>
<tr><td>6</td><td>IFoutput</td><td>–</td><td>1.7</td><td>This pin is output from IF buffer amplifier designed as single-ended push-pull type. This pin is assigned for emitter follower output with low-impedance. In the case of connecting to high-impedance stage, please attach external matching circuit.</td><td>
</td></tr>
</table>

Note Each pin voltage is measured at VCC = 3.0 V

6. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C	5.5	V
★ Power Dissipation of Package Allowance	P_D	Mounted on 50 × 50 × 1.6 mm double sided copper clad epoxy glass board at T_A = +85°C	270	mW
Operating Ambient Temperature	T_A		–40 to +85	°C
Storage Temperature	T_{stg}		–55 to +150	°C
PS Pin Voltage	V_{PS}	T_A = +25°C	5.5	V

7. RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}	2.7	3.0	3.3	V
Operating Ambient Temperature	T_A	–40	+25	+85	°C
LO Input Power	P_{LOin}	–15	–10	0	dBm

8. ELECTRICAL CHARACTERISTICS (T_A = +25°C, V_{CC} = V_{PS} = 3.0 V, P_{LOin} = –10 dBm, Z_S = Z_L = 50 Ω)

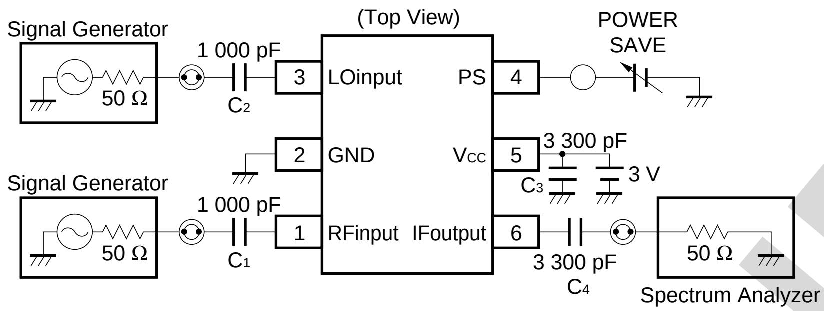
Parameter	Symbol	Conditions	μPC2757TB			μPC2758TB			Unit
			MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Circuit Current	I_{CC}	No input signal	3.7	5.6	7.7	6.6	11	14.8	mA
RF Input Frequency	f_{RFin}	CG ≥ (CG1 –3 dB) f_{IFout} = 130 MHz constant	0.1	–	2.0	0.1	–	2.0	GHz
IF Output Frequency	f_{IFout}	CG ≥ (CG1 –3 dB) f_{RFin} = 0.8 GHz constant	20	–	300	20	–	300	MHz
Conversion Gain 1	CG1	f_{RFin} = 0.8 GHz, f_{IFout} = 130 MHz P_{RFin} = –40 dBm, Upper local	12	15	18	16	19	22	dB
Conversion Gain 2	CG2	f_{RFin} = 2.0 GHz, f_{IFout} = 250 MHz P_{RFin} = –40 dBm, Lower local	10	13	16	14	17	20	dB
SSB Noise Figure 1	SSB • NF1	f_{RFin} = 0.8 GHz, f_{IFout} = 130 MHz, SSB mode, Upper local	–	10	13	–	9	12	dB
SSB Noise Figure 2	SSB • NF2	f_{RFin} = 2.0 GHz, f_{IFout} = 250 MHz, SSB mode, Lower local	–	13	16	–	13	15	dB
Saturated Output Power 1	$P_{O(sat)}$ 1	f_{RFin} = 0.8 GHz, f_{IFout} = 130 MHz P_{RFin} = –10 dBm, Upper local	–11	–3	–	–7	+1	–	dBm
Saturated Output Power 2	$P_{O(sat)}$ 2	f_{RFin} = 2.0 GHz, f_{IFout} = 250 MHz P_{RFin} = –10 dBm, Lower local	–11	–8	–	–7	–4	–	dBm

9. STANDARD CHARACTERISTICS FOR REFERENCE
(Unless otherwise specified: T_A = +25°C, V_{CC} = V_{PS} = 3.0 V, P_{LOin} = –10 dBm, Z_S = Z_L = 50 Ω)

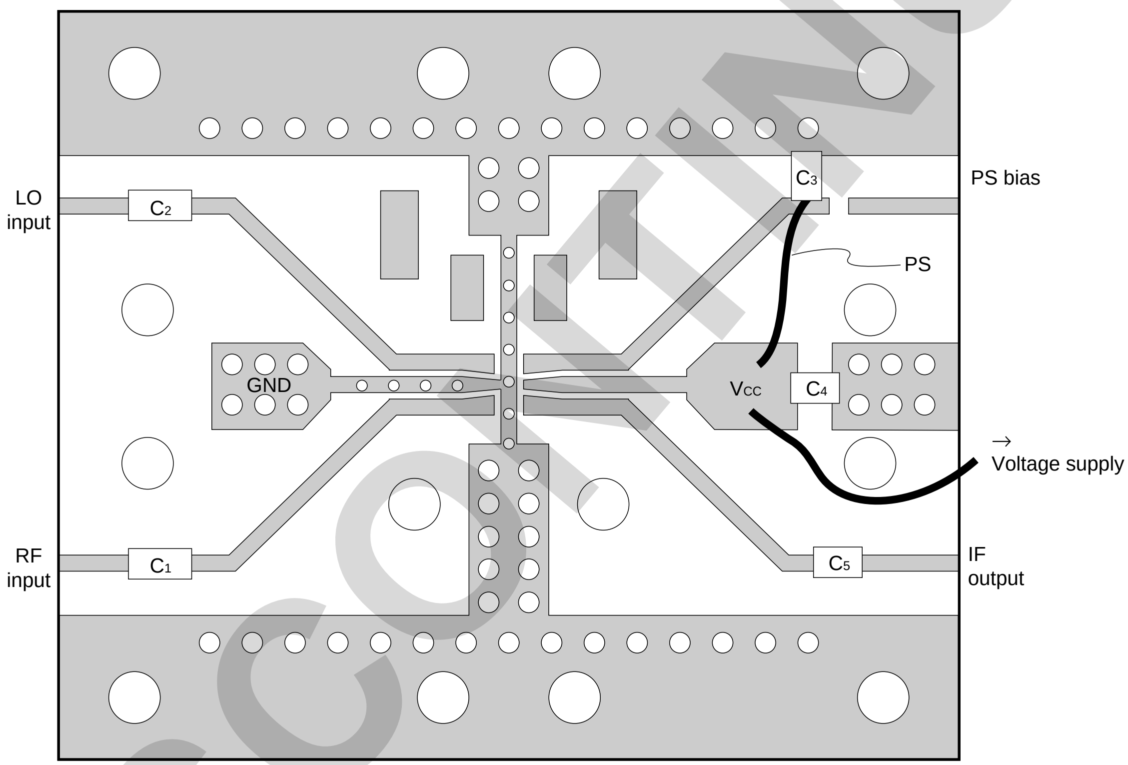
Parameter	Symbol	Conditions	Reference Value		Unit
			μPC2757TB	μPC2758TB	
3rd Order Distortion Output Intercept Point	OIP_3	f_{RFin} = 0.8 to 2.0 GHz, f_{IFout} = 0.1 GHz, Cross point IP	+5	+11	dBm
LO Leakage at RF pin	LO_{rf}	f_{LOin} = 0.8 to 2.0 GHz	–35	–30	dBm
LO Leakage at IF pin	LO_{if}	f_{LOin} = 0.8 to 2.0 GHz	–23	–15	dBm
Circuit Current at Power Save Mode	$I_{CC(PS)}$	V_{PS} = 0.5 V	0.1	0.1	μA

10. TEST CIRCUIT

μPC2757TB, μPC2758TB



★ 11. ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



Component List

No.	Value
C_1, C_2	1 000 pF
C_3 to C_5	3 300 pF

Notes 1. 35 × 42 × 0.4 mm double sided copper clad polyimide board.

2. Back side: GND pattern

3. Solder plated on pattern

4. ○: Through holes

Application explanation

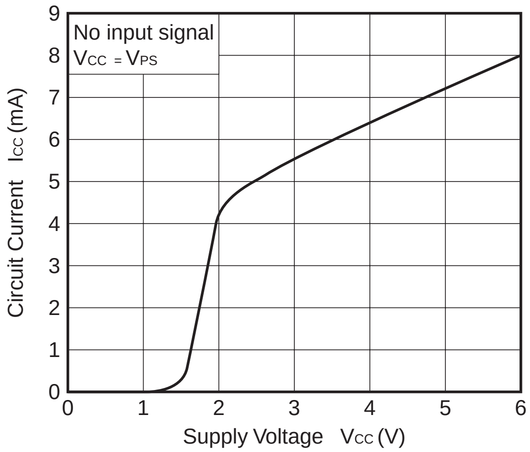
This IC is guaranteed on the test circuit constructed with 50 Ω equipment and transmission line.

This IC, however, does not have 50 Ω input/output impedance, but electrical characteristics such as conversion gain and intermodulation distortion are described herein on these conditions without impedance matching. So, you should understand that conversion gain and intermodulation distortion at input level will vary when you improve VS of RF input with external circuit (50 Ω termination or impedance matching.)

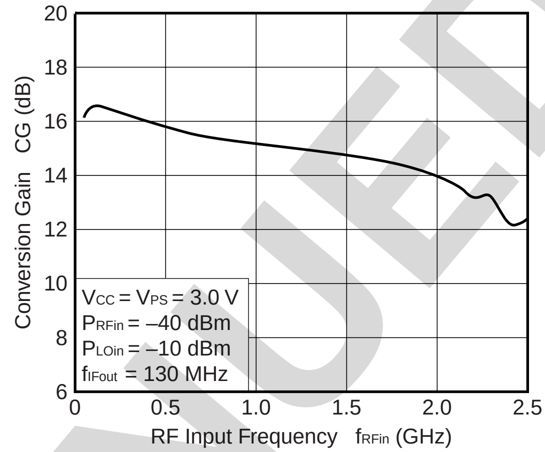
12. TYPICAL CHARACTERISTICS (T_A = +25°C, on Measurement Circuit)

12.1 μPC2757TB

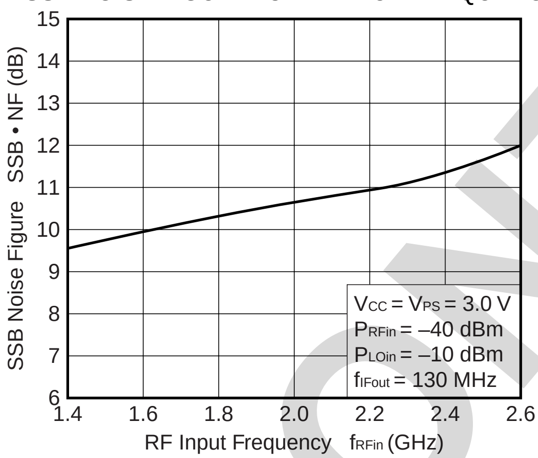
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



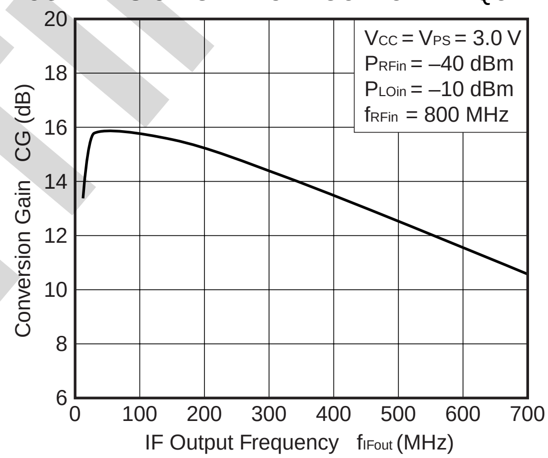
CONVERSION GAIN vs. RF INPUT FREQUENCY



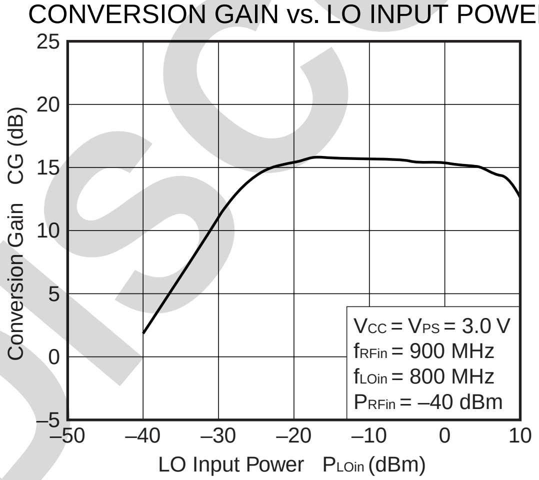
SSB NOISE FIGURE vs. RF INPUT FREQUENCY



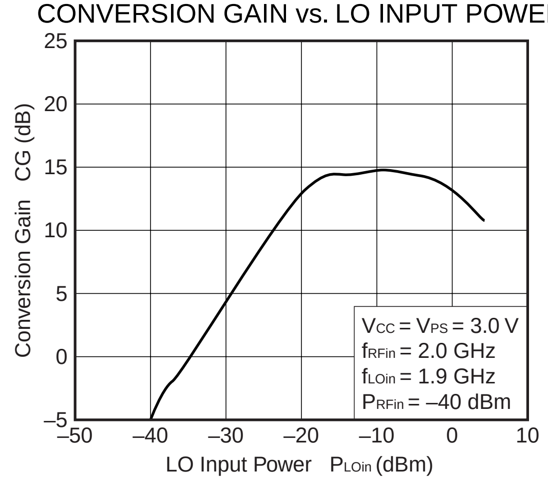
CONVERSION GAIN vs. IF OUTPUT FREQUENCY



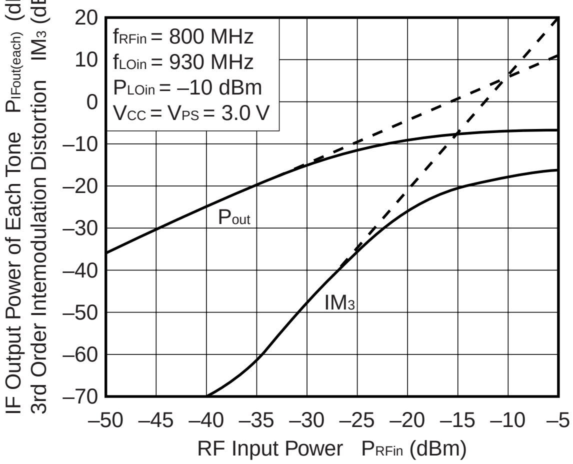
CONVERSION GAIN vs. LO INPUT POWER



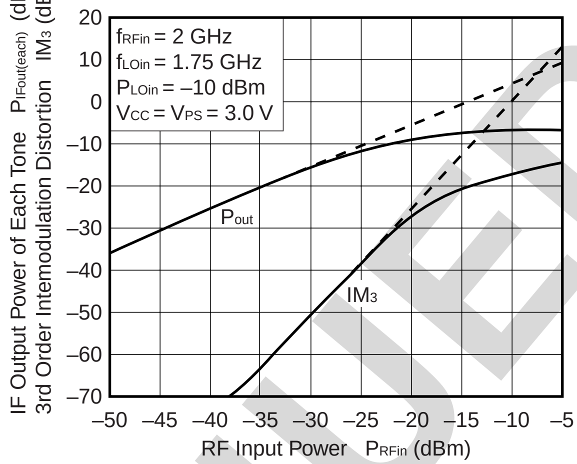
CONVERSION GAIN vs. LO INPUT POWER



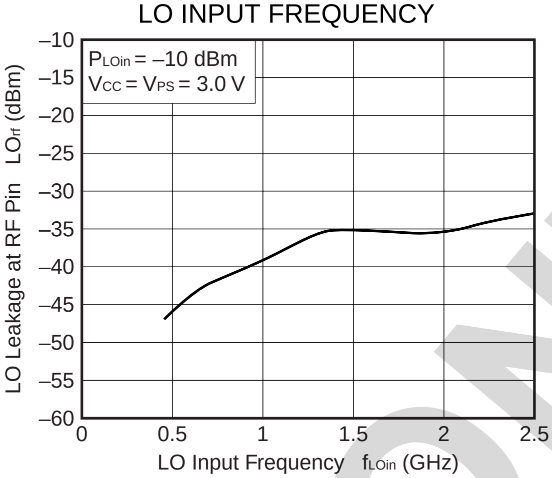
IF OUTPUT POWER OF EACH TONE, IM_3 vs. RF INPUT POWER



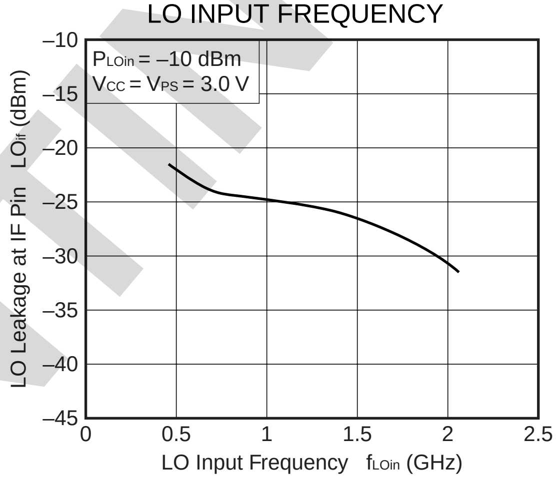
IF OUTPUT POWER OF EACH TONE, IM_3 vs. RF INPUT POWER



LO LEAKAGE AT RF PIN vs. LO INPUT FREQUENCY



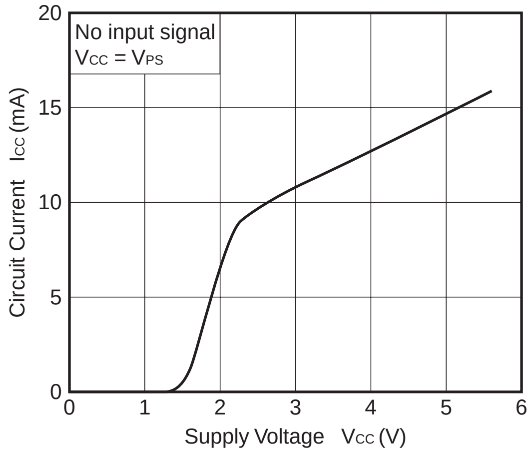
LO LEAKAGE AT IF PIN vs. LO INPUT FREQUENCY



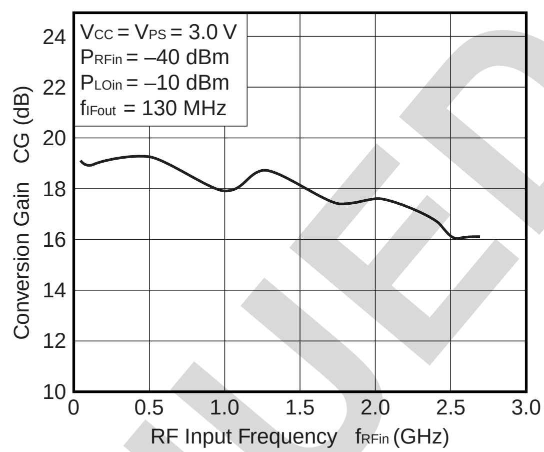
Remark The graphs indicate nominal characteristics.

12.2 μPC2758TB

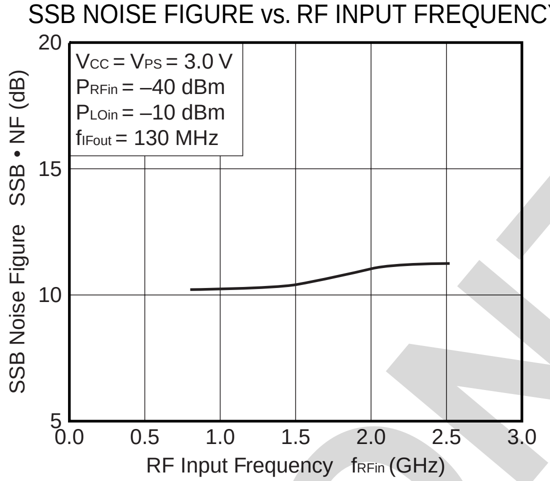
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



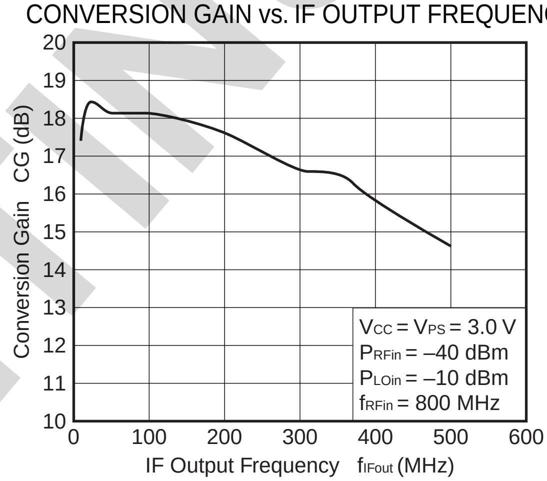
CONVERSION GAIN vs. RF INPUT FREQUENCY



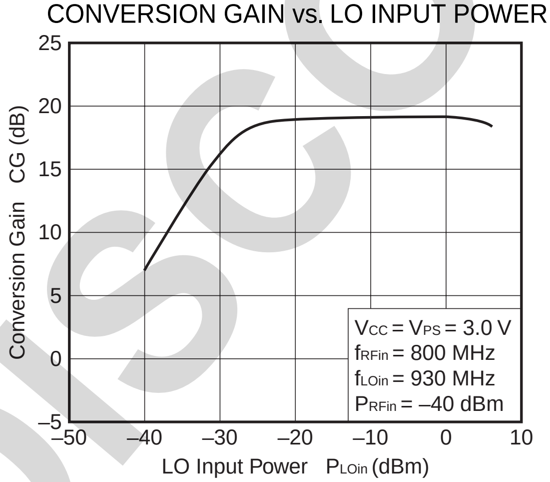
SSB NOISE FIGURE vs. RF INPUT FREQUENCY



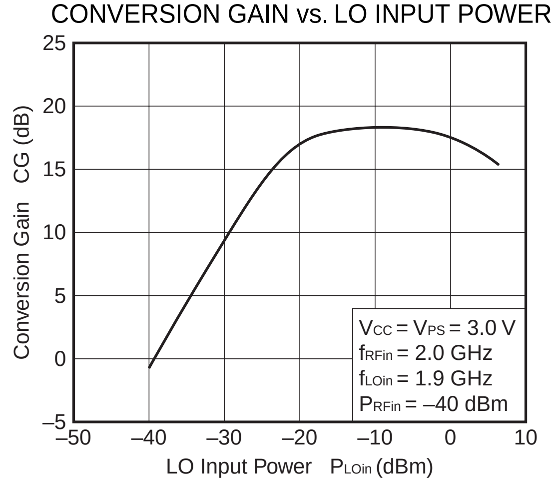
CONVERSION GAIN vs. IF OUTPUT FREQUENCY



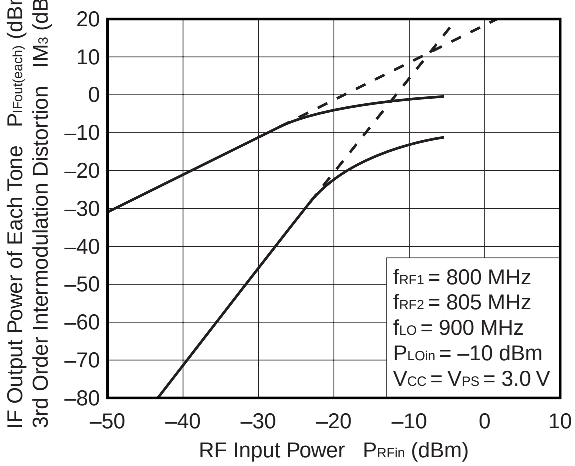
CONVERSION GAIN vs. LO INPUT POWER



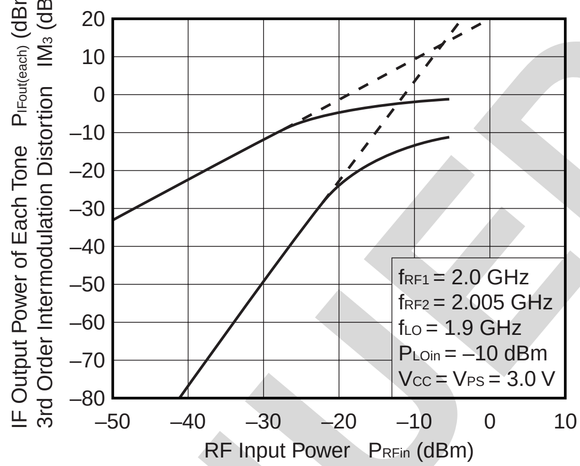
CONVERSION GAIN vs. LO INPUT POWER



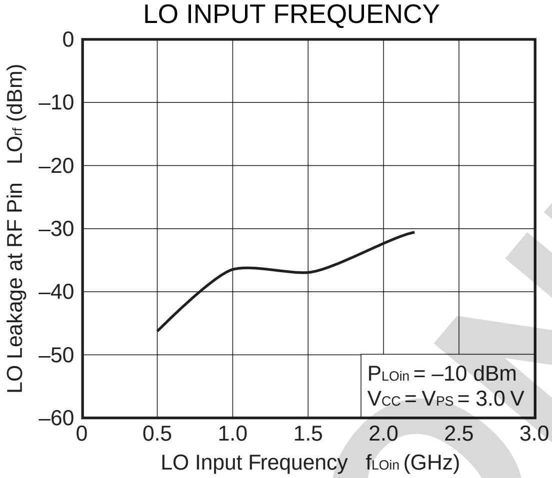
IF OUTPUT POWER OF EACH TONE,
IM3 vs. RF INPUT POWER



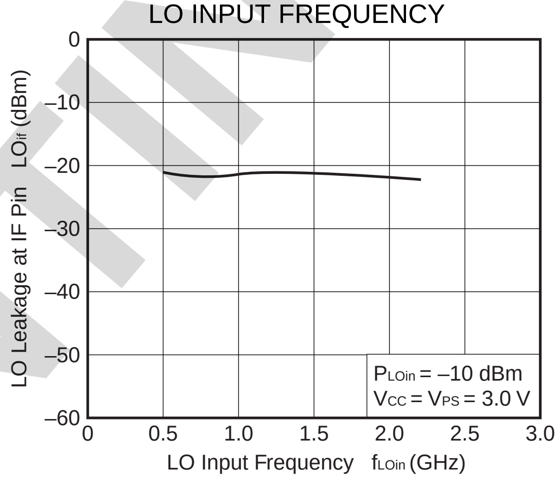
IF OUTPUT POWER OF EACH TONE,
IM3 vs. RF INPUT POWER



LO LEAKAGE AT RF PIN vs.
LO INPUT FREQUENCY



LO LEAKAGE AT IF PIN vs.
LO INPUT FREQUENCY

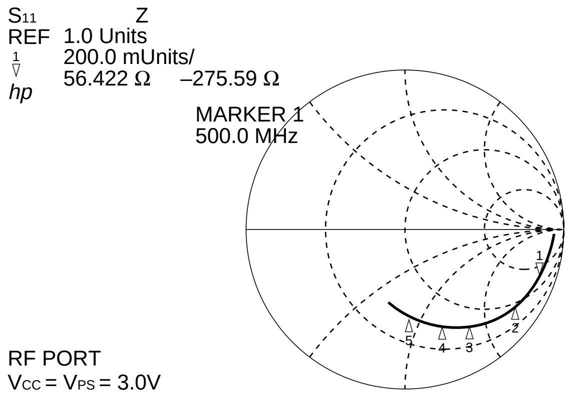


Remark The graphs indicate nominal characteristics.

13. S-PARAMETERS

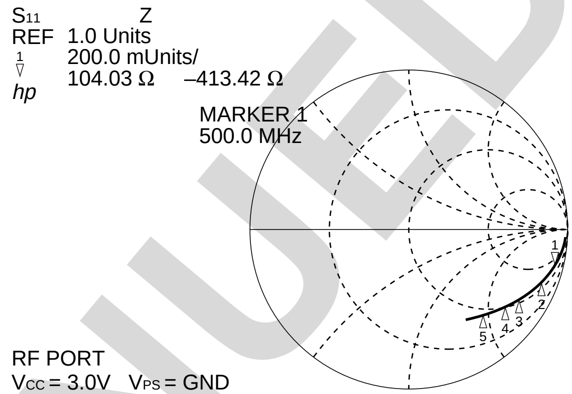
13.1 μPC2757TB

Calibrated on pin of DUT



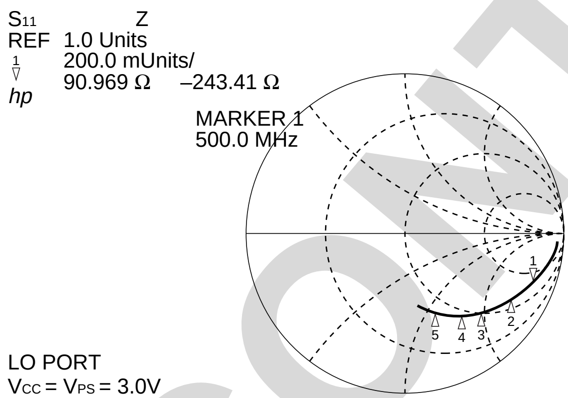
RF PORT
$V_{CC} = V_{PS}$ = 3.0V
1:500 MHz 56.422 Ω -j275.59 Ω
2:900 MHz 38.68 Ω -j152.71 Ω
3:1 500 MHz 31.699 Ω -j88.102 Ω
4:1 900 MHz 29.209 Ω -j65.926 Ω
5:2 500 MHz 29.209 Ω -j44.758 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



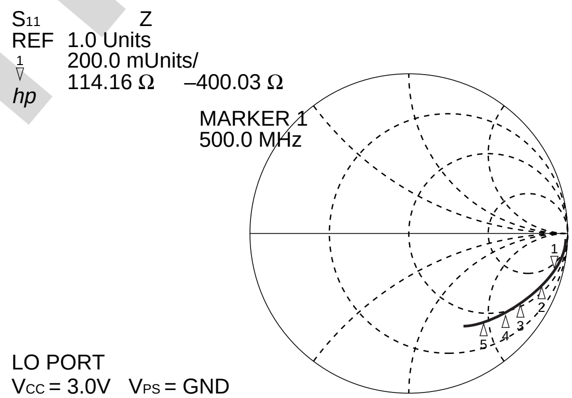
RF PORT
V_{CC} = 3.0V V_{PS} = GND
1:500 MHz 104.03 Ω -j413.42 Ω
2:900 MHz 74.82 Ω -j243.06 Ω
3:1 500 MHz 59.266 Ω -j154.98 Ω
4:1 900 MHz 51.227 Ω -j124.55 Ω
5:2 500 MHz 43.996 Ω -j95.117 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



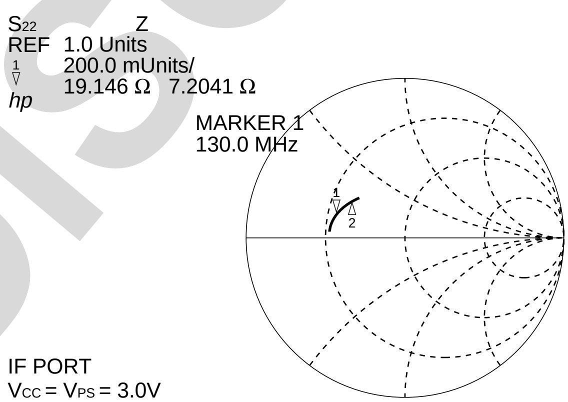
LO PORT
$V_{CC} = V_{PS}$ = 3.0V
1:500 MHz 90.969 Ω -j243.41 Ω
2:900 MHz 67.828 Ω -j150.32 Ω
3:1 500 MHz 51.488 Ω -j97.273 Ω
4:1 900 MHz 44.621 Ω -j77.352 Ω
5:2 500 MHz 39.627 Ω -j56.738 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



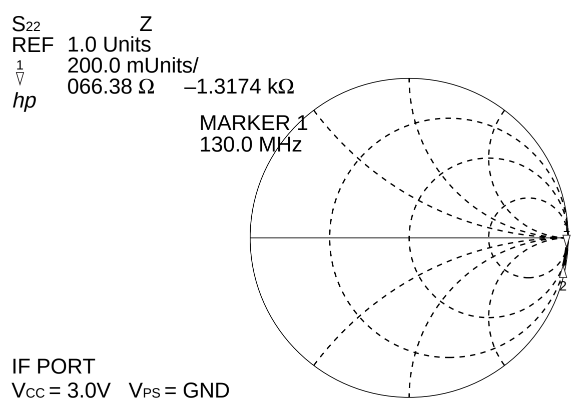
LO PORT
V_{CC} = 3.0V V_{PS} = GND
1:500 MHz 114.16 Ω -j400.03 Ω
2:900 MHz 75.133 Ω -j242.73 Ω
3:1 500 MHz 53.516 Ω -j154.21 Ω
4:1 900 MHz 44.789 Ω -j124.74 Ω
5:2 500 MHz 37.004 Ω -j93.828 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



IF PORT
$V_{CC} = V_{PS}$ = 3.0V
1:130 MHz 19.146 Ω -j7.2041 Ω
2:250 MHz 22.73 Ω -j12.909 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz



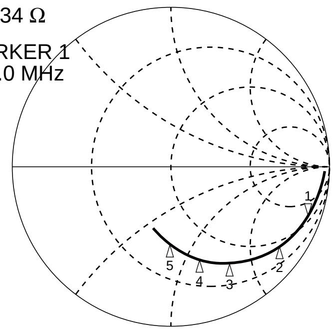
IF PORT
V_{CC} = 3.0V V_{PS} = GND
1:130 MHz 66.38 Ω -j1.3174 kΩ
2:250 MHz 88.281 Ω -j725.41 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz

13.2 μPC2758TB

Calibrated on pin of DUT

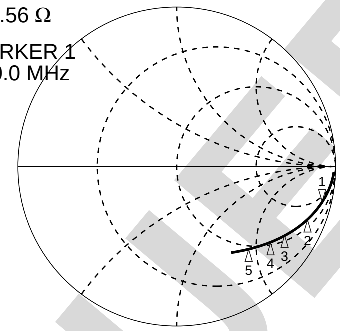
S_{11} Z
REF 1.0 Units
1 ▽ 200.0 mUnits/
63.312 Ω –261.34 Ω
hp



RF PORT
$V_{CC} = V_{PS} = 3.0V$
1:500 MHz 63.312 Ω -j261.34 Ω
2:900 MHz 40.227 Ω -j142.36 Ω
3:1 500 MHz 32.441 Ω -j79.68 Ω
4:1 900 MHz 31.107 Ω -j58.273 Ω
5:2 500 MHz 30.871 Ω -j39.08 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz

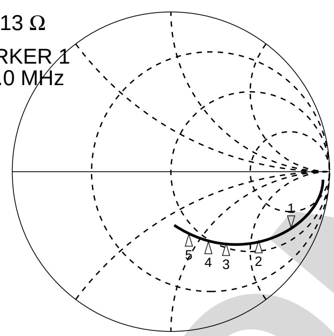
S_{11} Z
REF 1.0 Units
1 ▽ 200.0 mUnits/
107.13 Ω –395.56 Ω
hp



RF PORT
$V_{CC} = 3.0V$ V_{PS} = GND
1:500 MHz 107.13 Ω -j395.56 Ω
2:900 MHz 78.711 Ω -j234.41 Ω
3:1 500 MHz 61.922 Ω -j148.82 Ω
4:1 900 MHz 52.629 Ω -j119.55 Ω
5:2 500 MHz 44.766 Ω -j90.578 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz

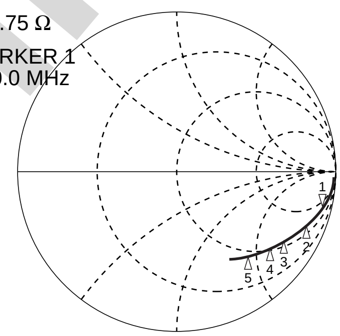
S_{11} Z
REF 1.0 Units
1 ▽ 200.0 mUnits/
73.398 Ω –188.13 Ω
hp



LO PORT
$V_{CC} = V_{PS} = 3.0V$
1:500 MHz 73.398 Ω -j188.13 Ω
2:900 MHz 64.551 Ω -j112.66 Ω
3:1 500 MHz 53.133 Ω -j72.941 Ω
4:1 900 MHz 48.111 Ω -j57.307 Ω
5:2 500 MHz 44.541 Ω -j41.564 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz

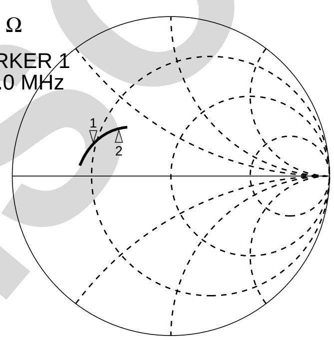
S_{11} Z
REF 1.0 Units
1 ▽ 200.0 mUnits/
100.31 Ω –374.75 Ω
hp



LO PORT
$V_{CC} = 3.0V$ V_{PS} = GND
1:500 MHz 100.31 Ω -j374.75 Ω
2:900 MHz 73.148 Ω -j223.07 Ω
3:1 500 MHz 57.719 Ω -j144.02 Ω
4:1 900 MHz 50.738 Ω -j119.52 Ω
5:2 500 MHz 41.836 Ω -j90.25 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz

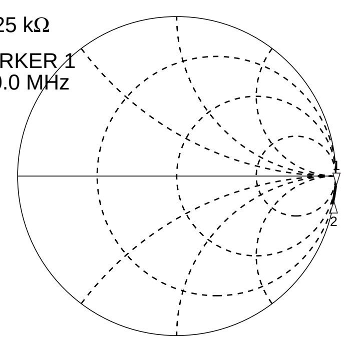
S_{22} Z
REF 1.0 Units
1 ▽ 200.0 mUnits/
15.696 Ω 9.5011 Ω
hp



IF PORT
$V_{CC} = V_{PS} = 3.0V$
1:130 MHz 15.696 Ω -j9.5811 Ω
2:250 MHz 21.4 Ω -j16.331 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz

S_{22} Z
REF 1.0 Units
1 ▽ 200.0 mUnits/
106.69 Ω –1.3425 kΩ
hp

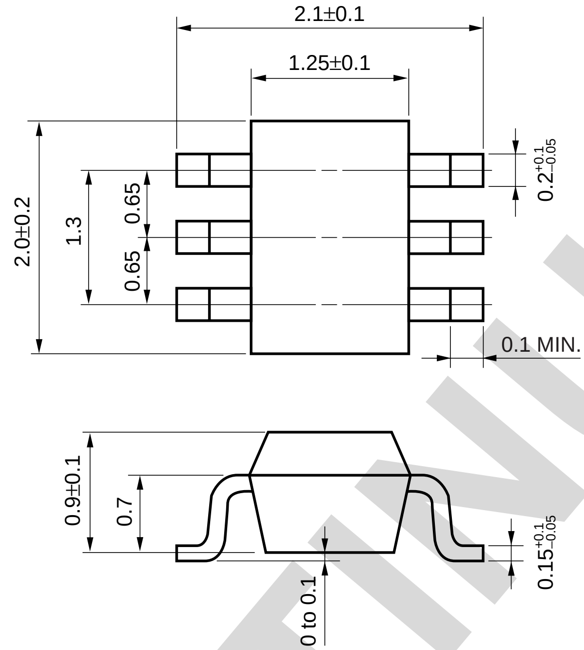


IF PORT
$V_{CC} = 3.0V$ V_{PS} = GND
1:130 MHz 106.69 Ω -j1.3425 kΩ
2:250 MHz 83.75 Ω -j711.47 Ω

START 0.050000000 GHz
STOP 3.000000000 GHz

★ **14. PACKAGE DIMENSIONS**

6-PIN SUPER MINIMOLD (UNIT: mm)



15. NOTE ON CORRECT USE

(1) Observe precautions for handling because of electrostatic sensitive devices.
(2) Form a ground pattern as widely as possible to minimize ground impedance (to prevent undesired oscillation).
Keep the track length of the ground pins as short as possible.
(3) Connect a bypass capacitor (example: 1 000 pF) to the V_{CC} pin.
(4) The DC cut capacitor must be attached to input pin.

16. RECOMMENDED SOLDERING CONDITIONS

This product should be soldered under the following recommended conditions.

Soldering Method	Soldering Condition	Recommended Condition Symbol
Infrared Reflow	Package peak temperature: 235°C or below Time: 30 seconds or less (at 210°C) Count: 3, Exposure limit: None[Note]	IR35-00-3
VPS	Package peak temperature: 215°C or below Time: 40 seconds or less (at 200°C) Count: 3, Exposure limit: None[Note]	VP15-00-3
Wave Soldering	Soldering bath temperature: 260°C or below Time: 10 seconds or less Count: 1, Exposure limit: None[Note]	WS60-00-1
Partial Heating	Pin temperature: 300°C Time: 3 seconds or less (per side of device) Exposure limit: None[Note]	–

Note After opening the dry pack, keep it in a place below 25°C and 65% RH for the allowable storage period.

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

For details of recommended soldering conditions for surface mounting, refer to information document SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E).

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