DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3227TB

5 V, SILICON GERMANIUM MMIC WIDEBAND AMPLIFIER

DESCRIPTION

The μPC3227TB is a silicon germanium (SiGe) monolithic integrated circuit designed as IF amplifier for DBS tuners. This IC is manufactured using our 50 GHz f_{max} UHS2 (Ultra High Speed Process) SiGe bipolar process.

FEATURES

- Low current : I_{CC} = 4.8 mA TYP. @ V_{CC} = 5.0 V
- Output power : $P_{O\ (sat)}$ = –1.0 dBm TYP. @ f = 1.0 GHz
  : $P_{O\ (sat)}$ = –3.5 dBm TYP. @ f = 2.2 GHz
- High linearity : $P_{O\ (1dB)}$ = –6.5 dBm TYP. @ f = 1.0 GHz
  : $P_{O\ (1dB)}$ = –8.0 dBm TYP. @ f = 2.2 GHz
- Power gain : G_P = 22.0 dB TYP. @ f = 1.0 GHz
  : G_P = 22.0 dB TYP. @ f = 2.2 GHz
- Noise Figure : NF = 4.7 dB TYP. @ f = 1.0 GHz
  : NF = 4.6 dB TYP. @ f = 2.2 GHz
- Supply voltage : V_{CC} = 4.5 to 5.5 V
- Port impedance : input/output 50 Ω

APPLICATIONS

- IF amplifiers in LNB for DBS converters etc.

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPC3227TB-E3	μPC3227TB-E3-A	6-pin super minimold (Pb-Free) Note	C3P	Embossed tape 8 mm wide. 1, 2, 3 pins face the perforation side of the tape. Qty 3 kpcs/reel.

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

Remark To order evaluation samples, please contact your nearby sales office.
Part number for sample order: μPC3227TB

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

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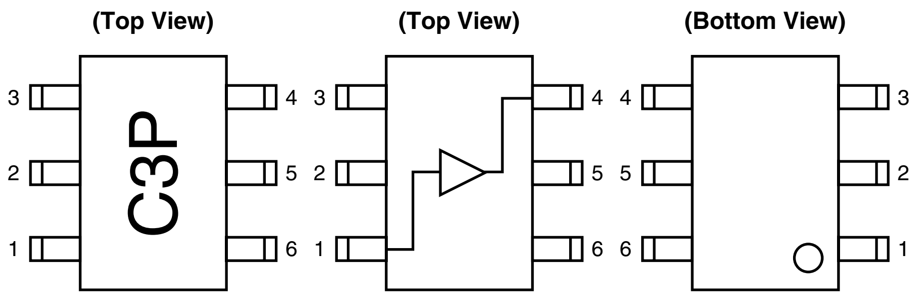
PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



Pin No.	Pin Name
1	INPUT
2	GND
3	GND
4	OUTPUT
5	GND
6	V_{CC}

PRODUCT LINE-UP OF 5 V-BIAS SILICON MMIC WIDEBAND AMPLIFIER
(T_A = +25°C, f = 1 GHz, V_{CC} = 5.0 V, Z_S = Z_L = 50 Ω)

Part No.	f_u (GHz)	$P_{O\,(sat)}$ (dBm)	G_P (dB)	NF (dB)	I_{CC} (mA)	Package	Marking
μPC2711TB	2.9	+1.0	13	5.0	12	6-pin super minimold	C1G
μPC2712TB	2.6	+3.0	20	4.5	12		C1H
μPC3215TB Note	2.9	+3.5	20.5	2.3	14		C3H
μPC3224TB	3.2	+4.0	21.5	4.3	9.0		C3K
μPC3227TB	3.2	–1.0	22	4.7	4.8		C3P

Note μPC3215TB is f = 1.5 GHz

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

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C	6.0	V
Total Circuit Current	I_{CC}	T_A = +25°C	15	mA
Power Dissipation	P_D	T_A = +85°C **Note**	270	mW
Operating Ambient Temperature	T_A		–40 to +85	°C
Storage Temperature	T_{stg}		–55 to +150	°C
Input Power	P_{in}	T_A = +25°C	+10	dBm

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

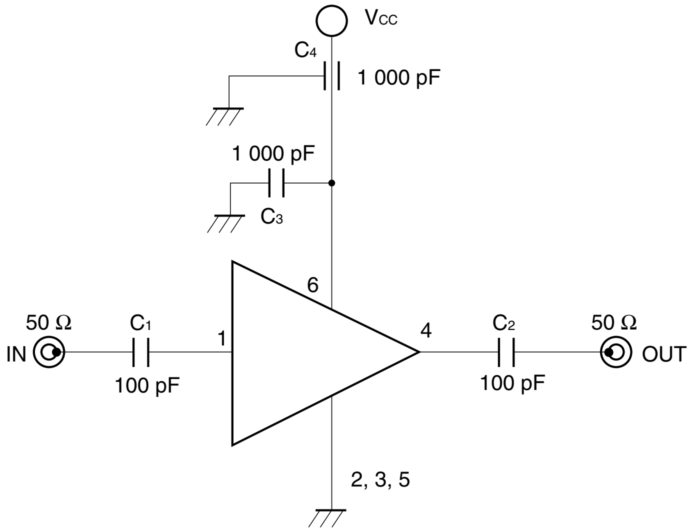
RECOMMENDED OPERATING RANGE

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}		4.5	5.0	5.5	V
Operating Ambient Temperature	T_A		–40	+25	+85	°C

ELECTRICAL CHARACTERISTICS (T_A = +25°C, V_{CC} = 5.0 V, Z_S = Z_L = 50 Ω)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No input signal	4.0	4.8	6.0	mA
Power Gain 1	G_P1	f = 0.1 GHz, P_{in} = –40 dBm	20.5	22.5	24.5	dB
Power Gain 2	G_P2	f = 1.0 GHz, P_{in} = –40 dBm	19.5	22.0	24.5	
Power Gain 3	G_P3	f = 1.8 GHz, P_{in} = –40 dBm	19.0	22.0	25.0	
Power Gain 4	G_P4	f = 2.2 GHz, P_{in} = –40 dBm	19.0	22.0	25.0	
Power Gain 5	G_P5	f = 2.6 GHz, P_{in} = –40 dBm	19.0	22.0	25.0	
Power Gain 6	G_P6	f = 3.0 GHz, P_{in} = –40 dBm	18.0	21.0	24.5	
Saturated Output Power 1	$P_{O(sat)}1$	f = 1.0 GHz, P_{in} = –12 dBm	–3.5	–1.0	–	dBm
Saturated Output Power 2	$P_{O(sat)}2$	f = 2.2 GHz, P_{in} = –12 dBm	–6.0	–3.5	–	
Gain 1 dB Compression Output Power 1	$P_{O(1 dB)}1$	f = 1.0 GHz	–9.0	–6.5	–	dBm
Gain 1 dB Compression Output Power 2	$P_{O(1 dB)}2$	f = 2.2 GHz	–11.0	–8.0	–	
Noise Figure 1	NF1	f = 1.0 GHz	–	4.7	5.5	dB
Noise Figure 2	NF2	f = 2.2 GHz	–	4.6	5.5	
Isolation 1	ISL1	f = 1.0 GHz, P_{in} = –40 dBm	35	40	–	dB
Isolation 2	ISL2	f = 2.2 GHz, P_{in} = –40 dBm	35	43	–	
Input Return Loss 1	$RL_{in}1$	f = 1.0 GHz, P_{in} = –40 dBm	7.5	10.5	–	dB
Input Return Loss 2	$RL_{in}2$	f = 2.2 GHz, P_{in} = –40 dBm	7.5	10.5	–	
Output Return Loss 1	$RL_{out}1$	f = 1.0 GHz, P_{in} = –40 dBm	10.0	13.5	–	dB
Output Return Loss 2	$RL_{out}2$	f = 2.2 GHz, P_{in} = –40 dBm	7.5	9.5	–	
Input 3rd Order Distortion Intercept Point 1	IIP_31	f1 = 1 000 MHz, f2 = 1 001 MHz, P_{in} = –40 dBm	–	–18.0	–	dBm
Input 3rd Order Distortion Intercept Point 2	IIP_32	f1 = 2 200 MHz, f2 = 2 201 MHz, P_{in} = –40 dBm	–	–20.5	–	
Output 3rd Order Distortion Intercept Point 1	OIP_31	f1 = 1 000 MHz, f2 = 1 001 MHz, P_{in} = –40 dBm	–	+4.0	–	dBm
Output 3rd Order Distortion Intercept Point 2	OIP_32	f1 = 2 200 MHz, f2 = 2 201 MHz, P_{in} = –40 dBm	–	+1.5	–	
2nd Order Intermodulation Distortion	IM_2	f1 = 1 000 MHz, f2 = 1 001 MHz, P_{in} = –40 dBm	–	30.5	–	dBc
K factor 1	K1	f = 1.0 GHz	–	3.8	–	–
K factor 2	K2	f = 2.2 GHz	–	3.9	–	–

TEST CIRCUIT



The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

COMPONENTS OF TEST CIRCUIT FOR MEASURING ELECTRICAL CHARACTERISTICS

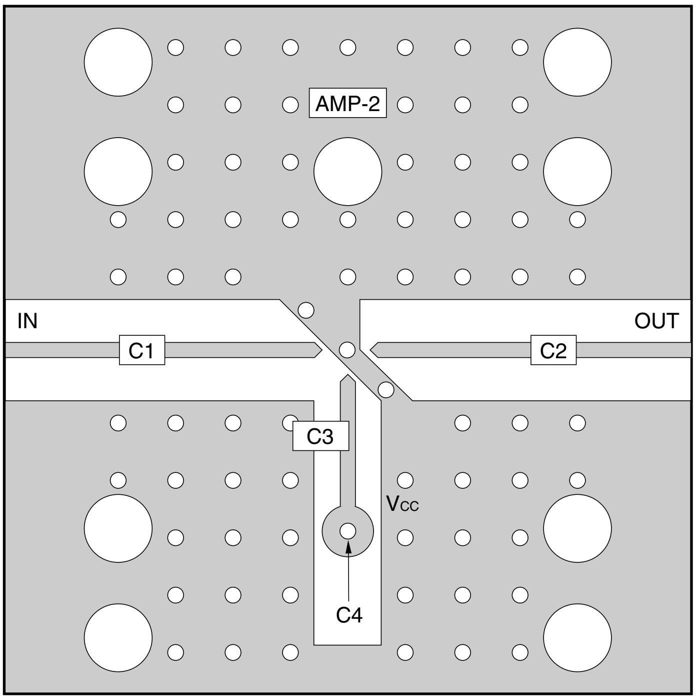
	Type	Value
C1, C2	Chip Capacitor	100 pF
C3	Chip Capacitor	1 000 pF
C4	Feed-through Capacitor	1 000 pF

CAPACITORS FOR V_{CC} AND INPUT PINS

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

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

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



COMPONENT LIST

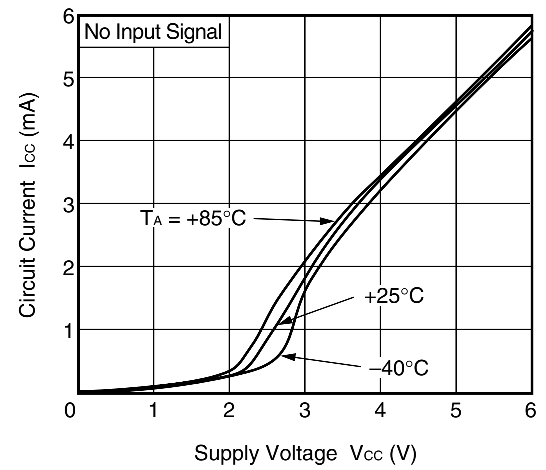
	Value
C1, C2	100 pF
C3, C4	1 000 pF

Notes

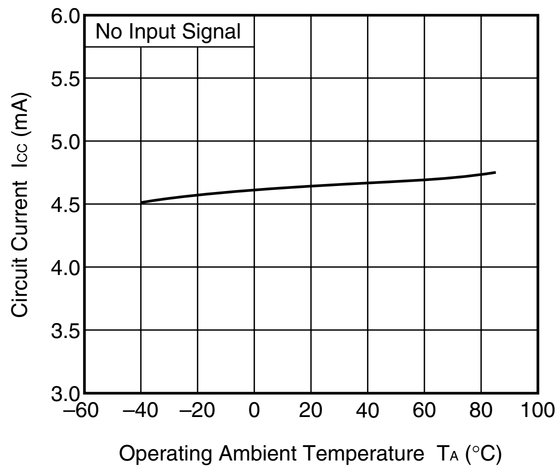
1. 30 × 30 × 0.4 mm double sided copper clad polyimide board.
2. Back side: GND pattern
3. Solder plated on pattern
4. o ◯: Through holes

TYPICAL CHARACTERISTICS (T_A = +25°C, V_{CC} = 5.0 V, Z_S = Z_L = 50 Ω, unless otherwise specified)

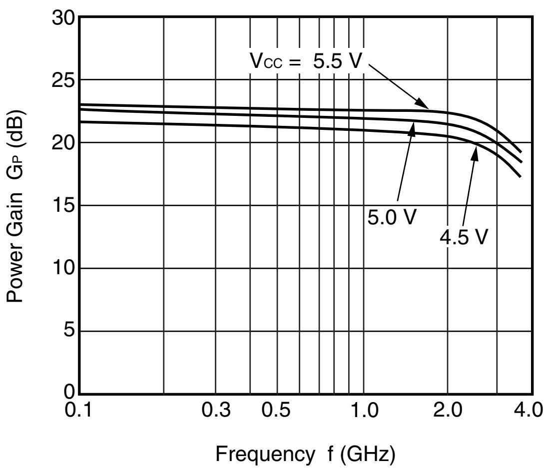
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



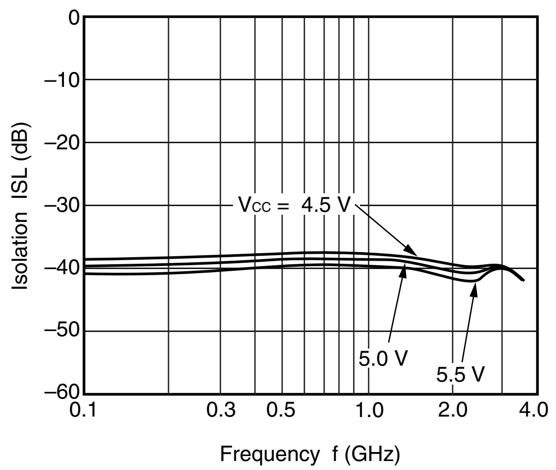
CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



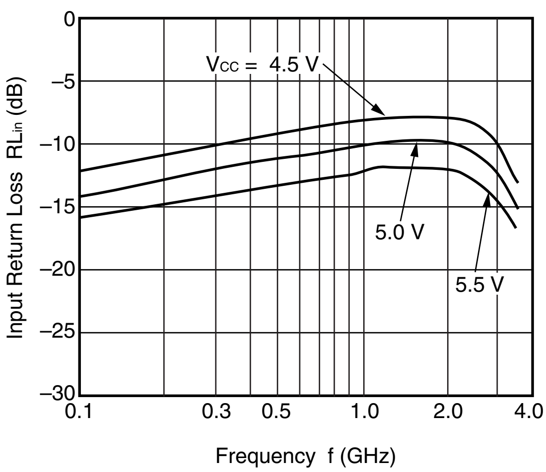
POWER GAIN vs. FREQUENCY



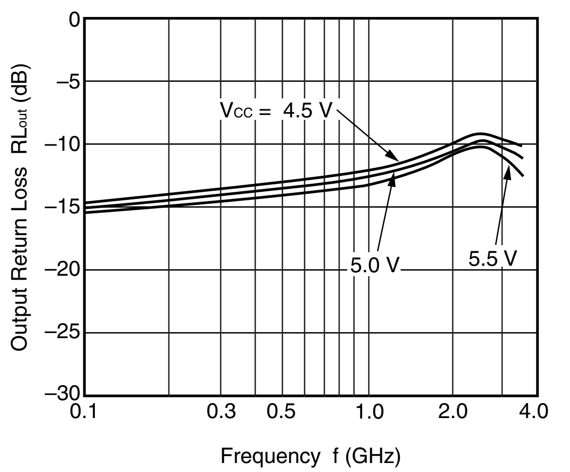
ISOLATION vs. FREQUENCY



INPUT RETURN LOSS vs. FREQUENCY

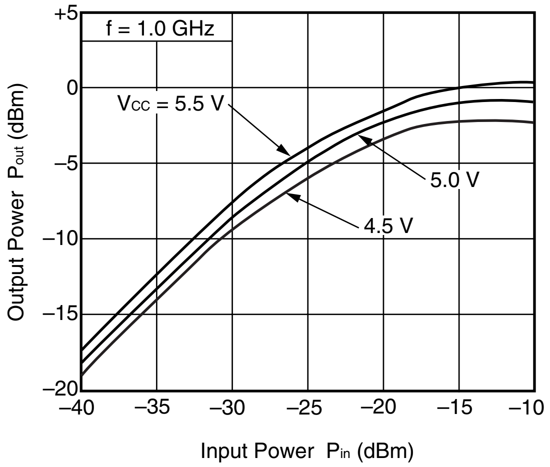


OUTPUT RETURN LOSS vs. FREQUENCY

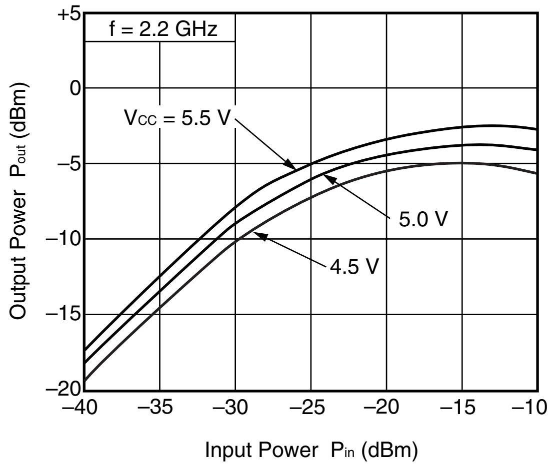


Remark The graphs indicate nominal characteristics.

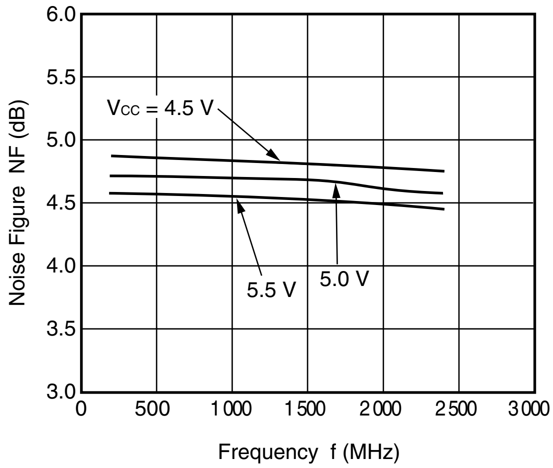
OUTPUT POWER vs. INPUT POWER



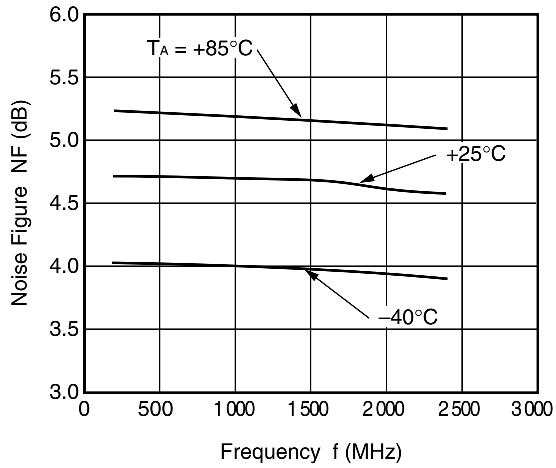
OUTPUT POWER vs. INPUT POWER



NOISE FIGURE vs. FREQUENCY



NOISE FIGURE vs. FREQUENCY



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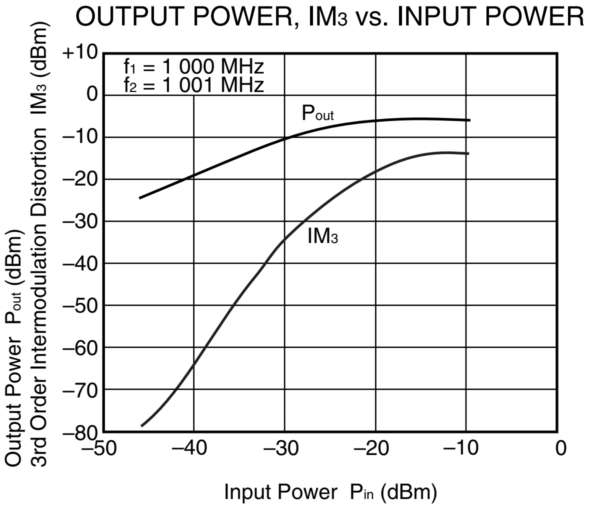
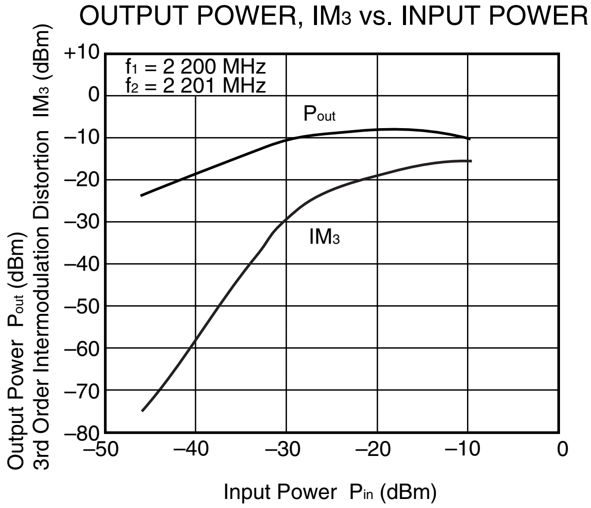
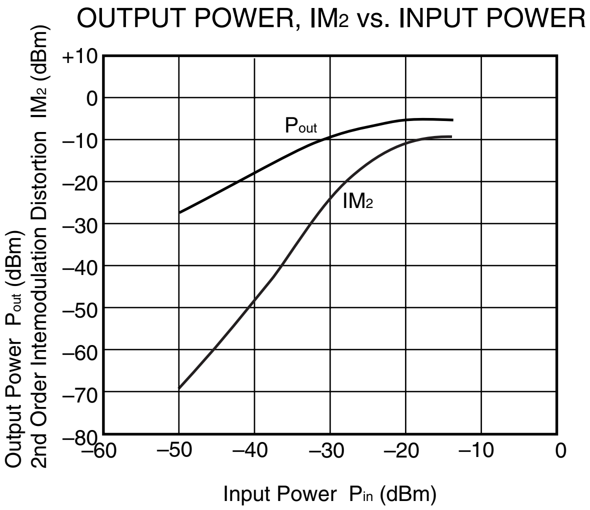
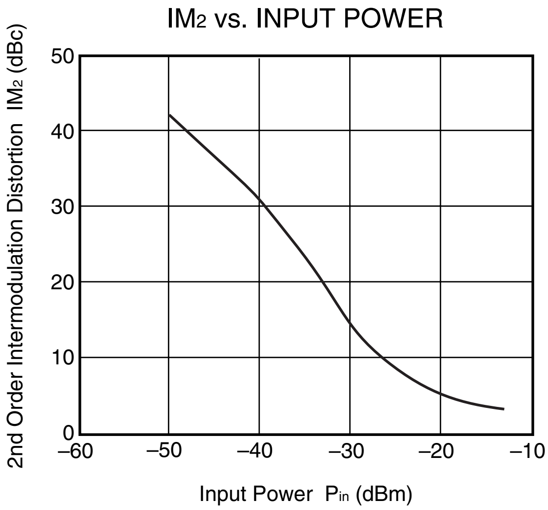




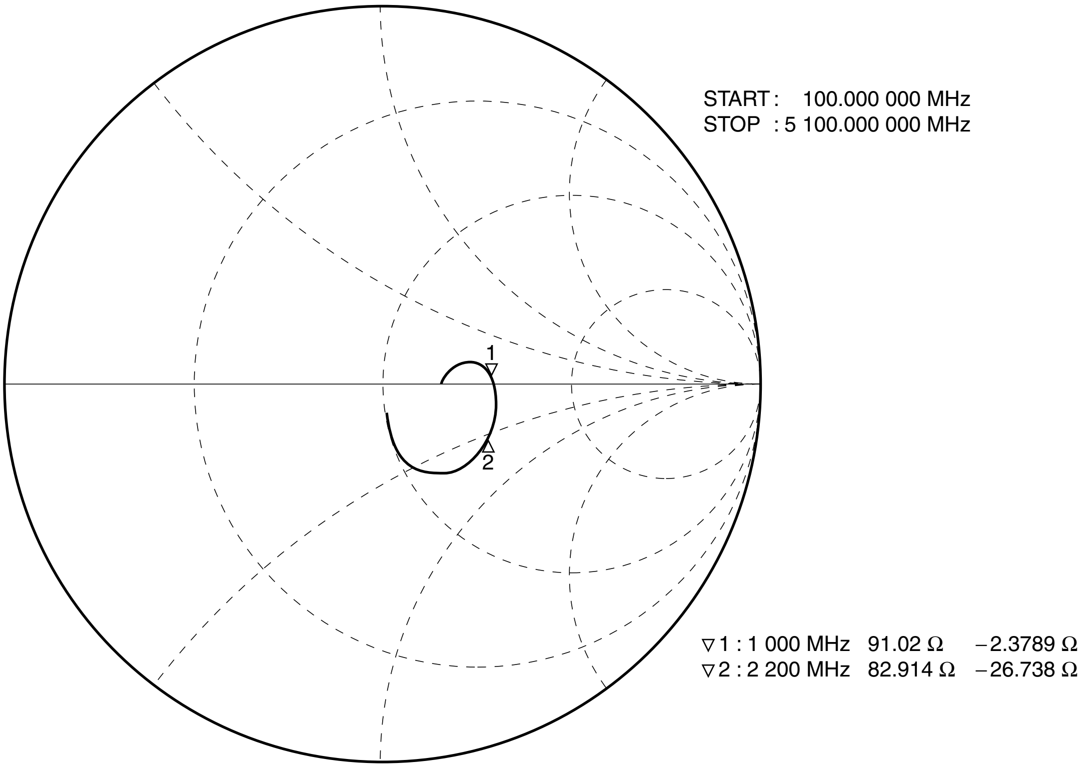




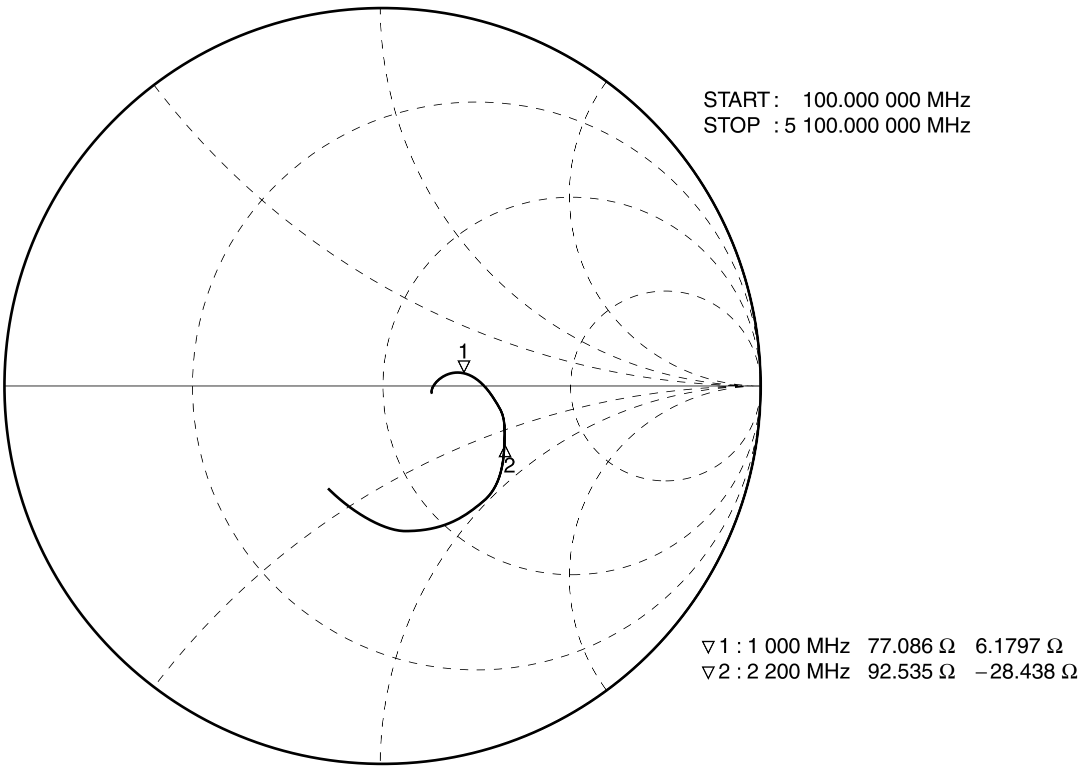
Remark The graphs indicate nominal characteristics.

S-PARAMETERS (T_A = +25°C, V_{CC} = 5.0 V, P_{in} = −40 dBm)

S_{11}−FREQUENCY

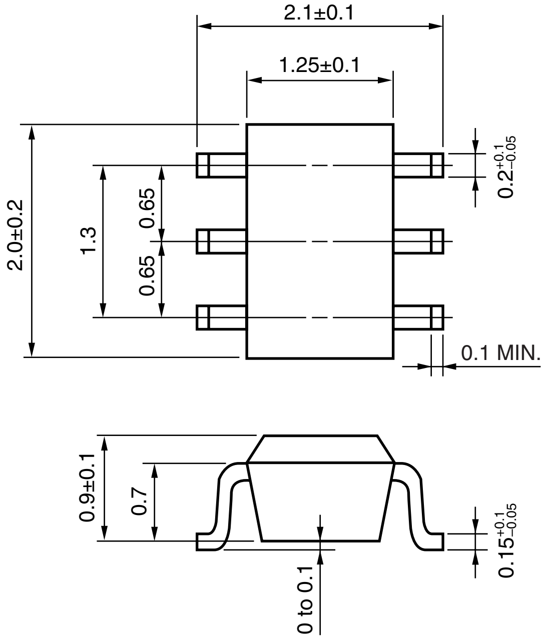


S_{22}−FREQUENCY



PACKAGE DIMENSIONS

6-PIN SUPER MINIMOLD (UNIT: mm)



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).
All the ground terminals must be connected together with wide ground pattern to decrease impedance difference.

(3) The bypass capacitor should be attached to the V_{CC} line.

(4) The DC cut capacitor must be attached to input and output pin.

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	IR260
	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	
Wave Soldering	Peak temperature (molten solder temperature)	: 260°C or below	WS260
	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	
Partial Heating	Peak temperature (terminal temperature)	: 350°C or below	HS350
	Soldering time (per side of device)	: 3 seconds or less	
	Maximum chlorine content of rosin flux (% mass)	: 0.2%(Wt.) or below	

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

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