

To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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3.3 V, SILICON GERMANIUM MMIC WIDE BAND AMPLIFIER

DESCRIPTION

The μPC3242TB is a silicon germanium monolithic integrated circuit designed as IF amplifier for DBS LNB.

This device exhibits low noise figure and high power gain characteristics.

This IC is manufactured using our UHSK3 (Ultra High Speed Process) silicon germanium bipolar process.

FEATURES

- Low current : $I_{CC} = 4.3 \text{ mA TYP.}$
- Power gain : $G_P = 22 \text{ dB TYP. @ } f = 1.0 \text{ GHz}$
: $G_P = 22 \text{ dB TYP. @ } f = 2.2 \text{ GHz}$
- Gain flatness : $\Delta G_P = 0.4 \text{ dB TYP. @ } f = 1.0 \text{ to } 2.2 \text{ GHz}$
- Noise figure : $NF = 4.0 \text{ dB TYP. @ } f = 1.0 \text{ GHz}$
: $NF = 4.0 \text{ dB TYP. @ } f = 2.2 \text{ GHz}$
- High linearity : $P_{O(1 \text{ dB})} = -7.5 \text{ dBm TYP. @ } f = 1.0 \text{ GHz}$
: $P_{O(1 \text{ dB})} = -9.5 \text{ dBm TYP. @ } f = 2.2 \text{ GHz}$
- Supply voltage : $V_{CC} = +3.0 \text{ to } +3.6 \text{ V}$
- Port impedance : input/output 50Ω

APPLICATIONS

- IF amplifiers in DBS LNB, other L-band amplifiers, etc.

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPC3242TB-E3	μPC3242TB-E3-A	6-pin super minimold (Pb-Free)	C3Z	• Embossed tape 8 mm wide • Pin 1, 2, 3 face the perforation side of the tape • Qty 3 kpcs/reel

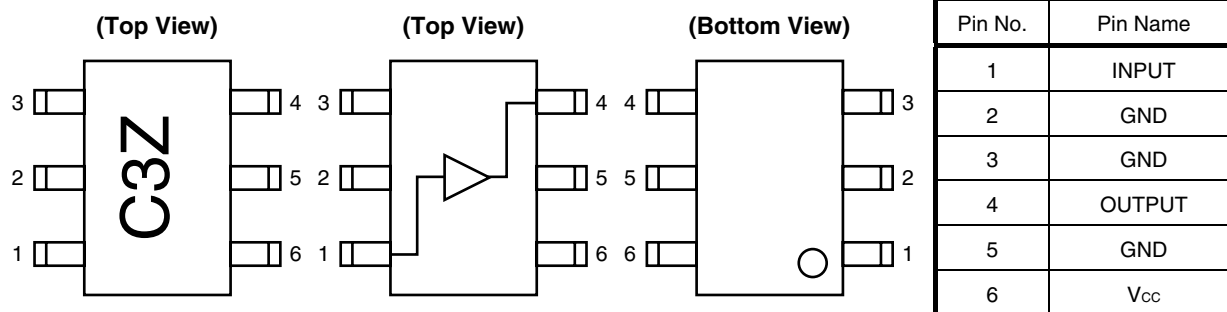
Remark To order evaluation samples, please contact your nearby sales office.

Part number for sample order: μPC3242TB

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

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PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



PRODUCT LINE-UP OF 5 V or 3.3 V-BIAS SILICON MMIC WIDE BAND AMPLIFIER

(T_A = +25°C, V_{CC} = +5.0 V or +3.3 V, Z_S = Z_L = 50 Ω)

Part No.	V _{CC} (V)	I _{CC} (mA)	G _P (dB)	NF (dB)	P _O (sat) (dBm)	P _O (1 dB) (dBm)	Package	Marking
μPC2711TB	+5.0	12.0	13.0 (1.0 GHz)	5.0 (1.0 GHz)	+1.0 (1.0 GHz)	—	6-pin super minimold	C1G
μPC2712TB		12.0	20.0 (1.0 GHz)	4.5 (1.0 GHz)	+3.0 (1.0 GHz)	—		C1H
μPC3215TB		14.0	20.5 (1.5 GHz)	2.3 (1.5 GHz)	+3.5 (1.5 GHz)	+1.5 (1.5 GHz)		C3H
μPC3224TB		9.0	21.5 (1.0 GHz)	4.3 (1.0 GHz)	+4.0 (1.0 GHz)	−3.5 (1.0 GHz)		C3K
			21.5 (2.2 GHz)	4.3 (2.2 GHz)	+1.5 (2.2 GHz)	−5.5 (2.2 GHz)		
μPC3227TB	4.8	22.0 (1.0 GHz)	4.7 (1.0 GHz)	−1.0 (1.0 GHz)	−6.5 (1.0 GHz)	C3P		
		22.0 (2.2 GHz)	4.6 (2.2 GHz)	−3.5 (2.2 GHz)	−8.0 (2.2 GHz)			
μPC3240TB	+3.3	13.0	25.0 (1.0 GHz)	4.3 (1.0 GHz)	—	+1.0 (1.0 GHz)	C3W	
			24.5 (2.2 GHz)	4.5 (2.2 GHz)	—	−4.0 (2.2 GHz)		
μPC3242TB		4.3	22.0 (1.0 GHz)	4.0 (1.0 GHz)	−0.5 (1.0 GHz)	−7.5 (1.0 GHz)	C3Z	
			22.0 (2.2 GHz)	4.0 (2.2 GHz)	−4.0 (2.2 GHz)	−9.5 (2.2 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	4.0	V
Total Circuit Current	I _{CC}	T _A = +25°C	10	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}		+3.0	+3.3	+3.6	V
Operating Ambient Temperature	T _A		−40	+25	+85	°C

ELECTRICAL CHARACTERISTICS ($T_A = +25^\circ\text{C}$, $V_{CC} = +3.3\text{ V}$, $Z_S = Z_L = 50\ \Omega$, unless otherwise specified)

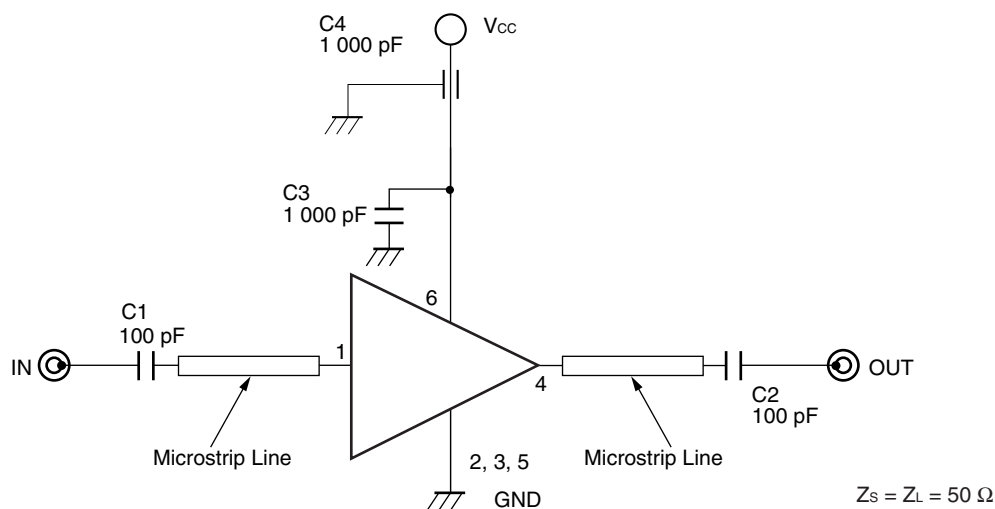
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No input signal	3.6	4.3	5.0	mA
Power Gain 1	G_{P1}	$f = 0.25\text{ GHz}$, $P_{in} = -40\text{ dBm}$	19	22	25	dB
Power Gain 2	G_{P2}	$f = 1.0\text{ GHz}$, $P_{in} = -40\text{ dBm}$	19	22	25	
Power Gain 3	G_{P3}	$f = 1.8\text{ GHz}$, $P_{in} = -40\text{ dBm}$	19	22	25	
Power Gain 4	G_{P4}	$f = 2.2\text{ GHz}$, $P_{in} = -40\text{ dBm}$	19	22	25	
Gain 1 dB Compression Output Power 1	$P_{O(1\text{ dB})1}$	$f = 1.0\text{ GHz}$	-10	-7.5	-	dBm
Gain 1 dB Compression Output Power 2	$P_{O(1\text{ dB})2}$	$f = 2.2\text{ GHz}$	-12.5	-9.5	-	
Noise Figure 1	NF1	$f = 1.0\text{ GHz}$	-	4.0	4.8	dB
Noise Figure 2	NF2	$f = 2.2\text{ GHz}$	-	4.0	4.8	
Isolation 1	ISL1	$f = 1.0\text{ GHz}$, $P_{in} = -40\text{ dBm}$	31	36.5	-	dB
Isolation 2	ISL2	$f = 2.2\text{ GHz}$, $P_{in} = -40\text{ dBm}$	34	40.5	-	
Input Return Loss 1	RL_{in1}	$f = 1.0\text{ GHz}$, $P_{in} = -40\text{ dBm}$	10	14	-	dB
Input Return Loss 2	RL_{in2}	$f = 2.2\text{ GHz}$, $P_{in} = -40\text{ dBm}$	6	8.5	-	
Output Return Loss 1	RL_{out1}	$f = 1.0\text{ GHz}$, $P_{in} = -40\text{ dBm}$	8	11	-	dB
Output Return Loss 2	RL_{out2}	$f = 2.2\text{ GHz}$, $P_{in} = -40\text{ dBm}$	8	11	-	

STANDARD CHARACTERISTICS FOR REFERENCE

($T_A = +25^\circ\text{C}$, $V_{CC} = +3.3\text{ V}$, $Z_S = Z_L = 50\ \Omega$, unless otherwise specified)

Parameter	Symbol	Test Conditions	Reference Value	Unit
Power Gain 5	G_{P5}	$f = 2.6\text{ GHz}$, $P_{in} = -40\text{ dBm}$	20.5	dB
Power Gain 6	G_{P6}	$f = 3.0\text{ GHz}$, $P_{in} = -40\text{ dBm}$	19	
Gain Flatness	ΔG_P	$f = 1.0\text{ to }2.2\text{ GHz}$, $P_{in} = -40\text{ dBm}$	0.4	dB
Saturated Output Power 1	$P_{O(sat)1}$	$f = 1.0\text{ GHz}$, $P_{in} = -15\text{ dBm}$	-0.5	dBm
Saturated Output Power 2	$P_{O(sat)2}$	$f = 2.2\text{ GHz}$, $P_{in} = -15\text{ dBm}$	-4.0	
K factor 1	K1	$f = 1.0\text{ GHz}$, $P_{in} = -40\text{ dBm}$	2.5	-
K factor 2	K2	$f = 2.2\text{ GHz}$, $P_{in} = -40\text{ dBm}$	3.4	-
Output 3rd Order Intercept Point 1	OIP ₃₁	$f_1 = 1\ 000\text{ MHz}$, $f_2 = 1\ 001\text{ MHz}$	1.5	dBm
Output 3rd Order Intercept Point 2	OIP ₃₂	$f_1 = 2\ 200\text{ MHz}$, $f_2 = 2\ 201\text{ MHz}$	-0.5	
Input 3rd Order Intercept Point 1	IIP ₃₁	$f_1 = 1\ 000\text{ MHz}$, $f_2 = 1\ 001\text{ MHz}$	-20	dBm
Input 3rd Order Intercept Point 2	IIP ₃₂	$f_1 = 2\ 200\text{ MHz}$, $f_2 = 2\ 201\text{ MHz}$	-22	
2nd Order Intermodulation Distortion	IM ₂	$f_1 = 1\ 000\text{ MHz}$, $f_2 = 1\ 001\text{ MHz}$, $P_{in} = -40\text{ dBm/ tone}$	22	dBc
2nd Harmonics	2f ₀	$f_0 = 1.0\text{ GHz}$, $P_{in} = -40\text{ dBm}$	28.5	dBc

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

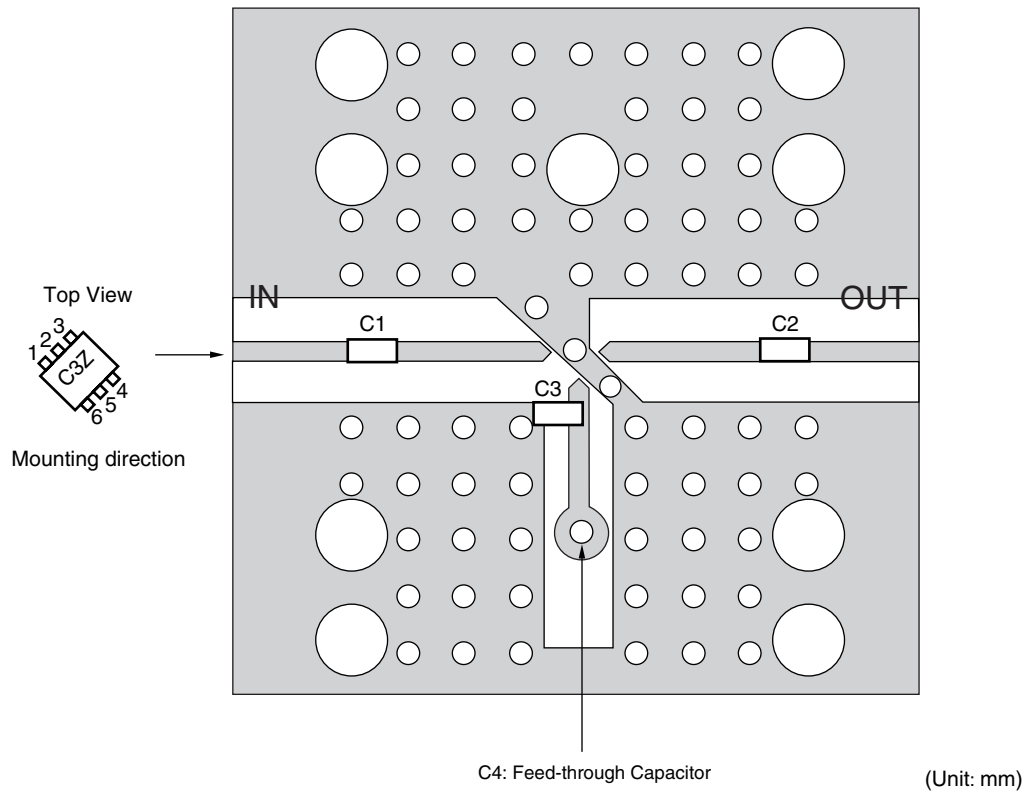
CAPACITORS FOR THE V_{CC} , INPUT AND OUTPUT PINS

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

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

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

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



COMPONENT LIST

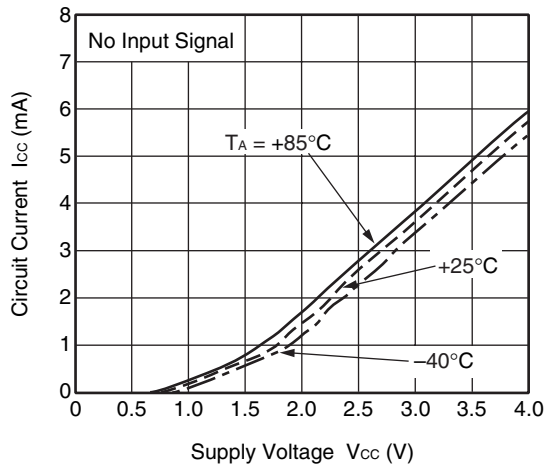
	Type	Value	Size
C1, C2	Chip Capacitor	100 pF	1608
C3	Chip Capacitor	1 000 pF	1608
C4	Feed-through Capacitor	1 000 pF	—

Notes

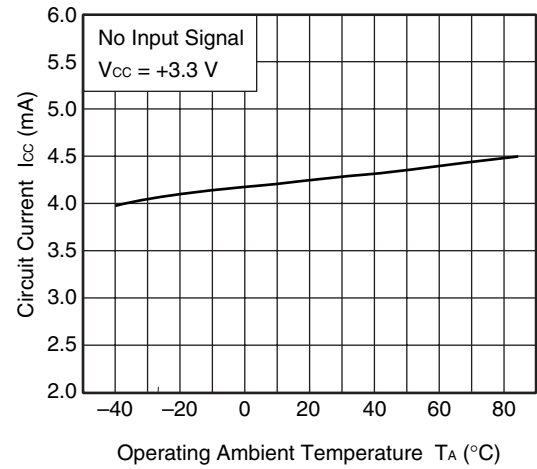
1. 30 × 30 × 0.4 mm double sided 35 μ m copper clad polyimide board.
2. Back side: GND pattern
3. Au plated on pattern
4. o○: Through holes

TYPICAL CHARACTERISTICS ($T_A = +25^\circ\text{C}$, $V_{CC} = +3.3\text{ V}$, $Z_S = Z_L = 50\ \Omega$, unless otherwise specified)

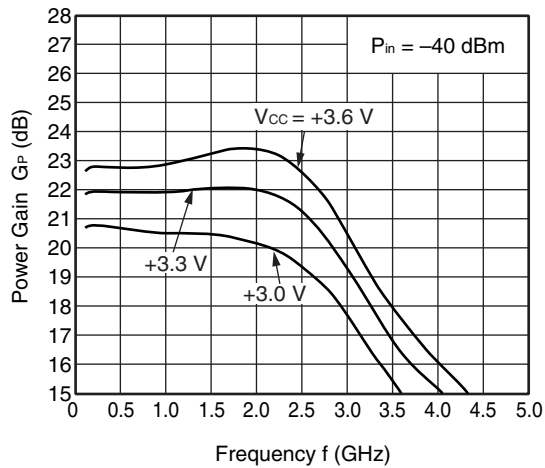
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



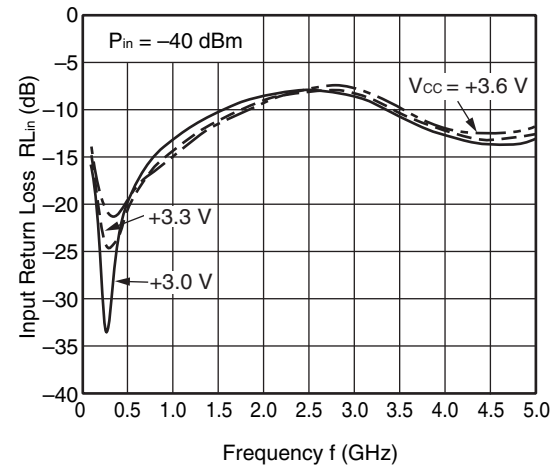
CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



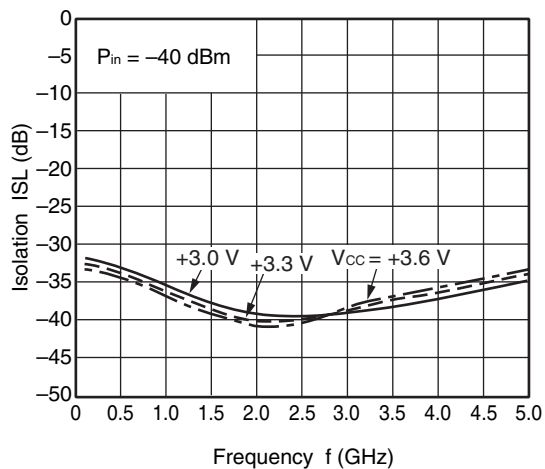
POWER GAIN vs. FREQUENCY



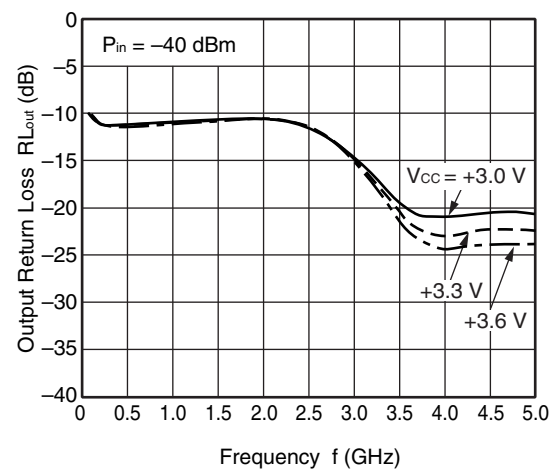
INPUT RETURN LOSS vs. FREQUENCY



ISOLATION vs. FREQUENCY

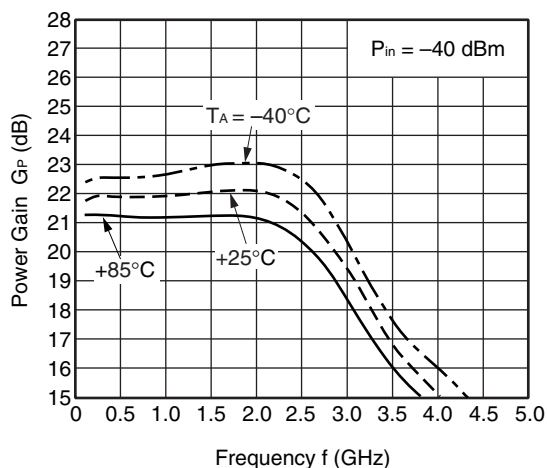


OUTPUT RETURN LOSS vs. FREQUENCY

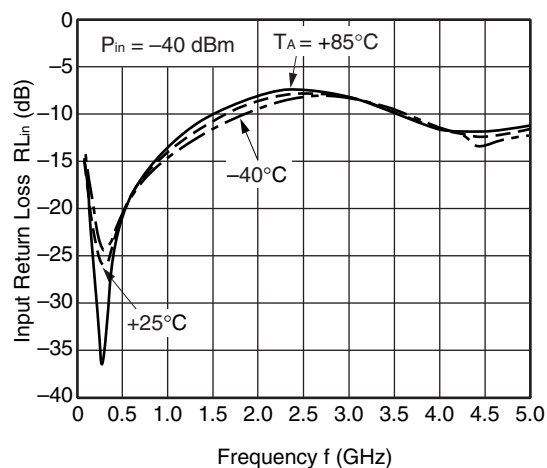


Remark The graphs indicate nominal characteristics.

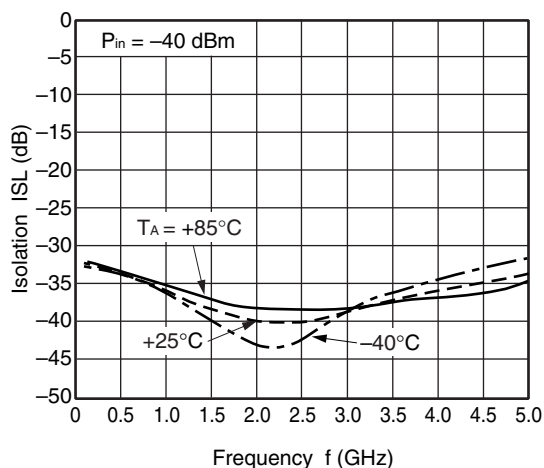
POWER GAIN vs. FREQUENCY



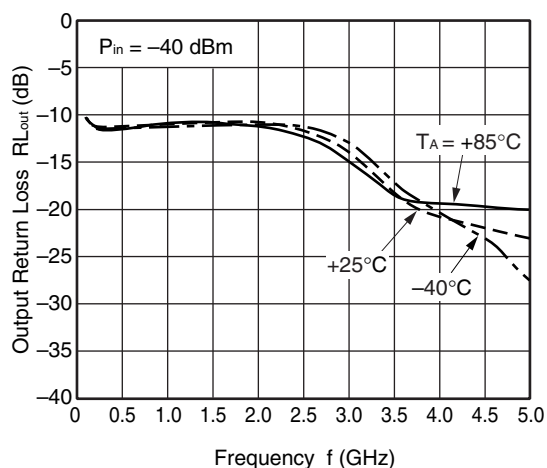
INPUT RETURN LOSS vs. FREQUENCY



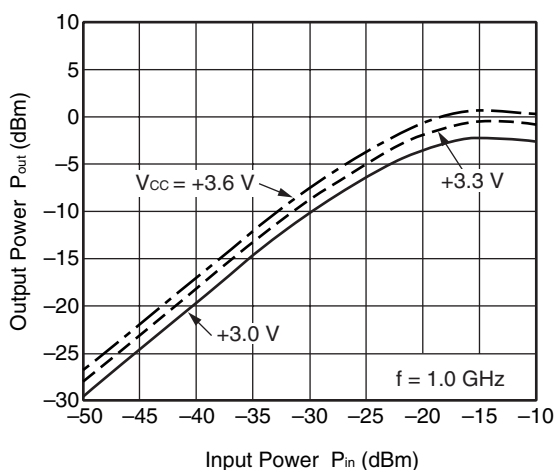
ISOLATION vs. FREQUENCY



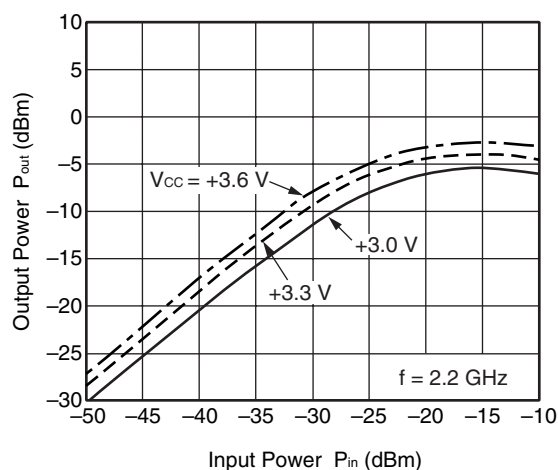
OUTPUT RETURN LOSS vs. FREQUENCY



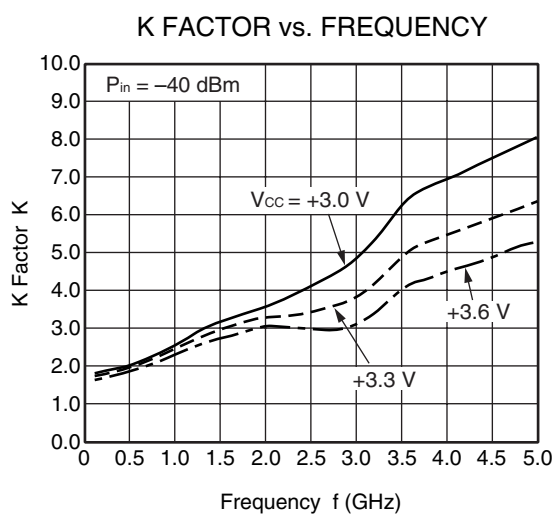
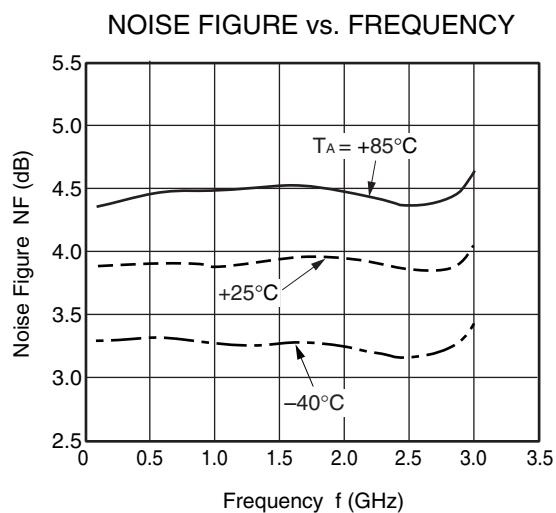
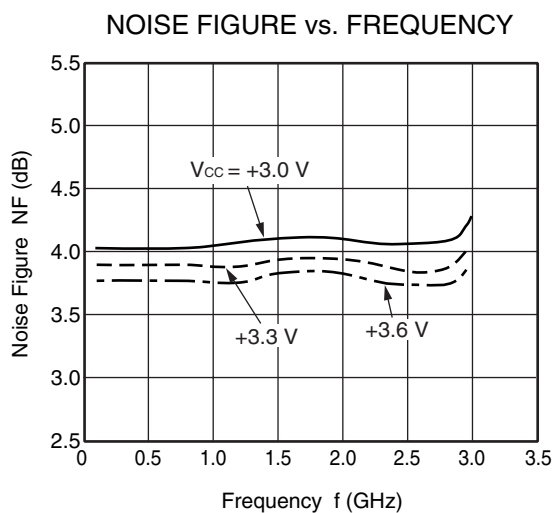
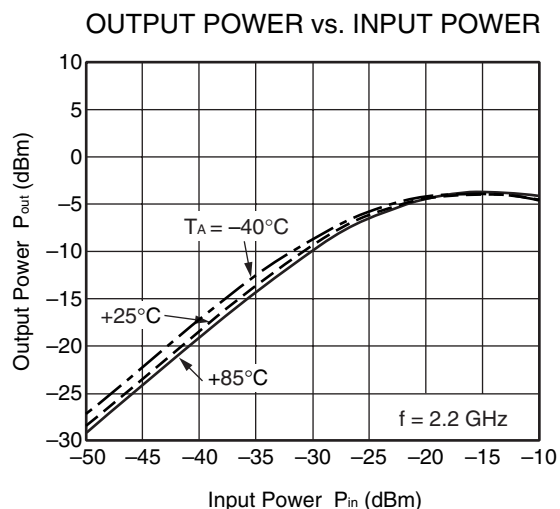
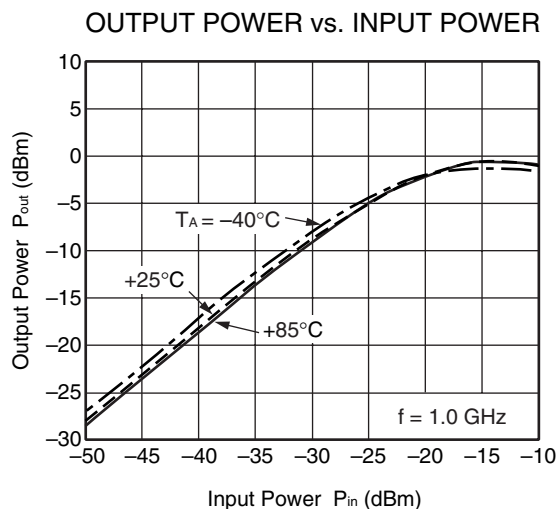
OUTPUT POWER vs. INPUT POWER



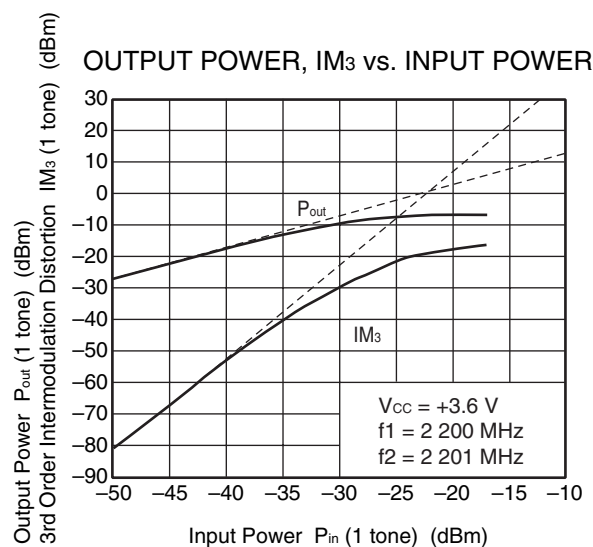
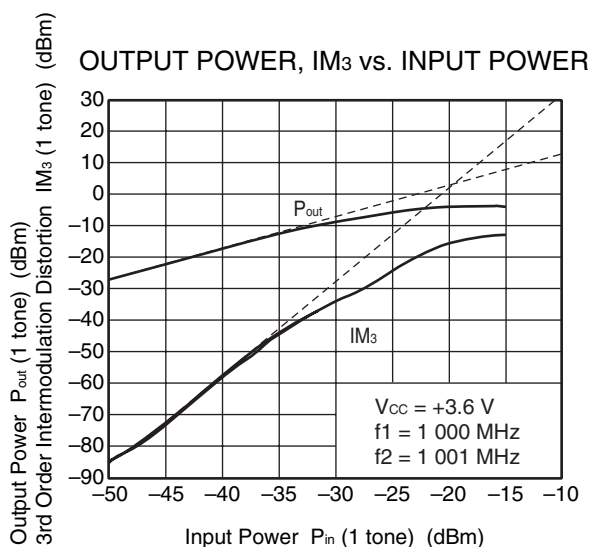
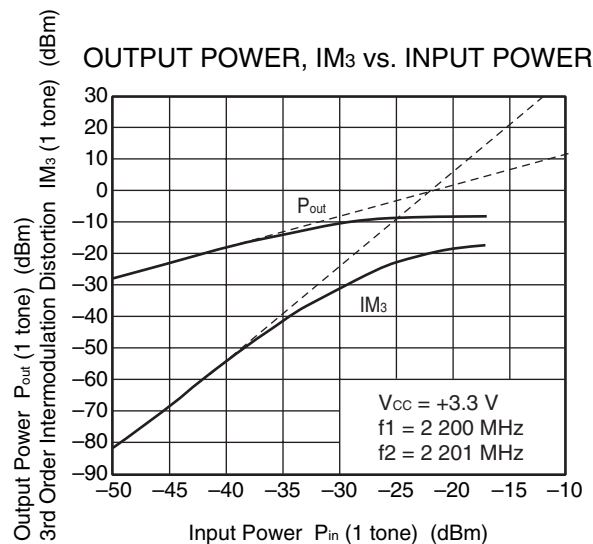
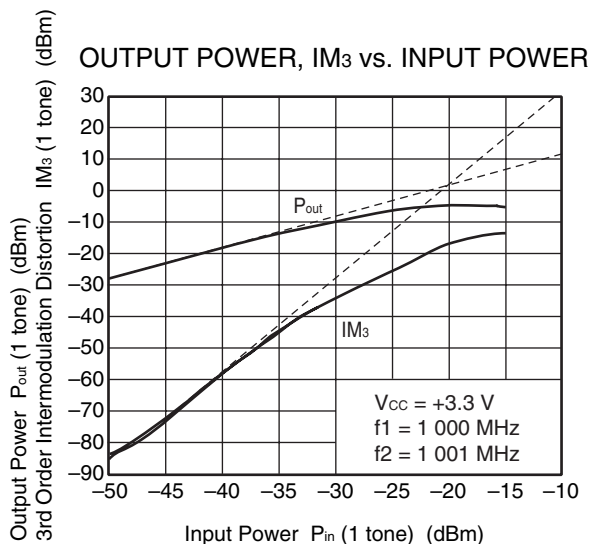
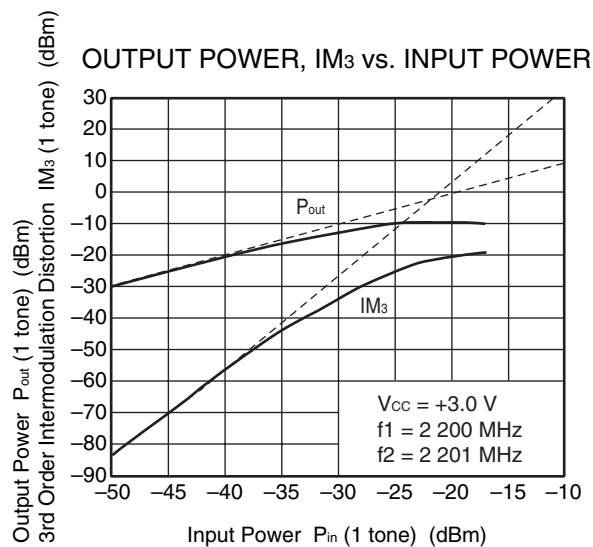
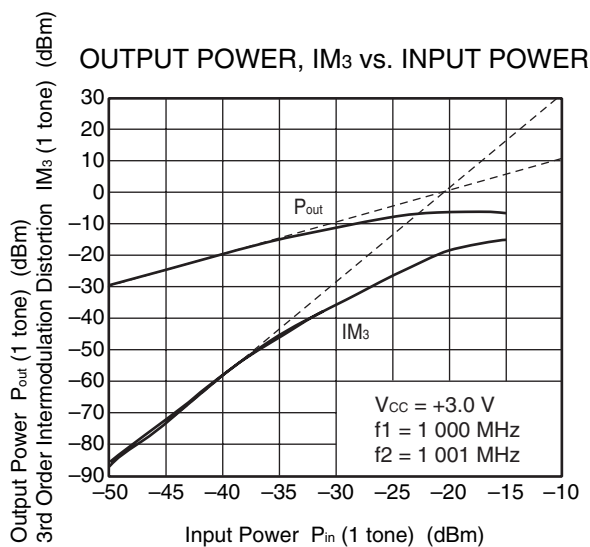
OUTPUT POWER vs. INPUT POWER



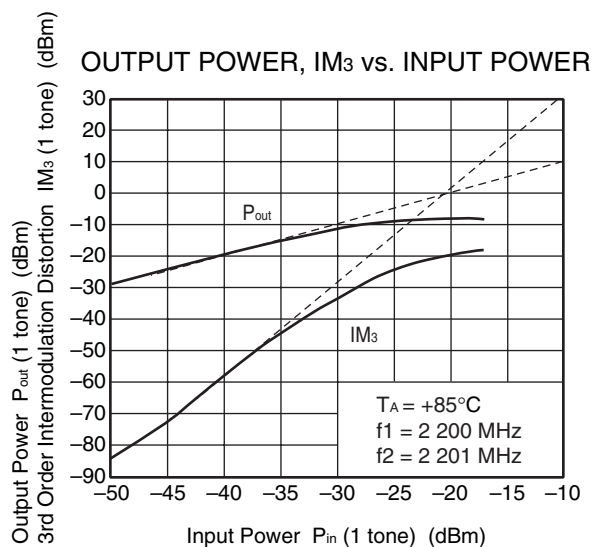
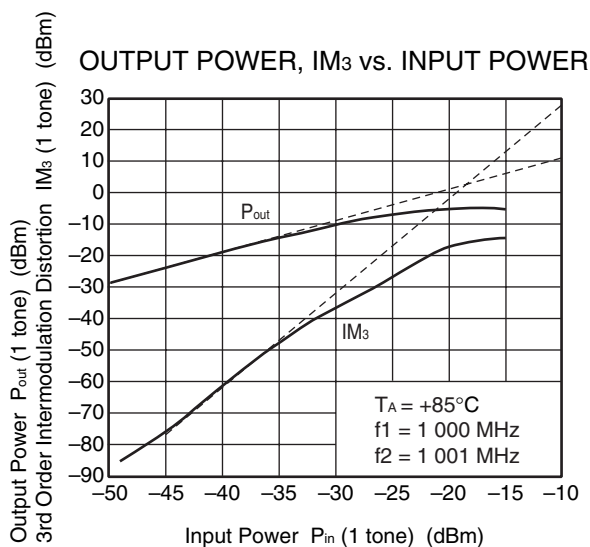
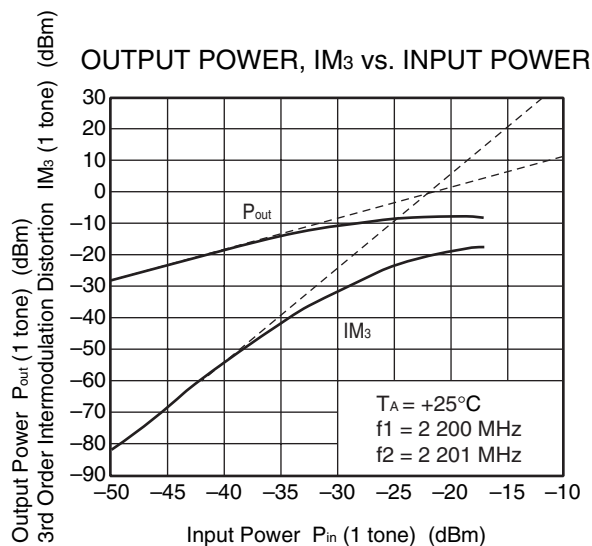
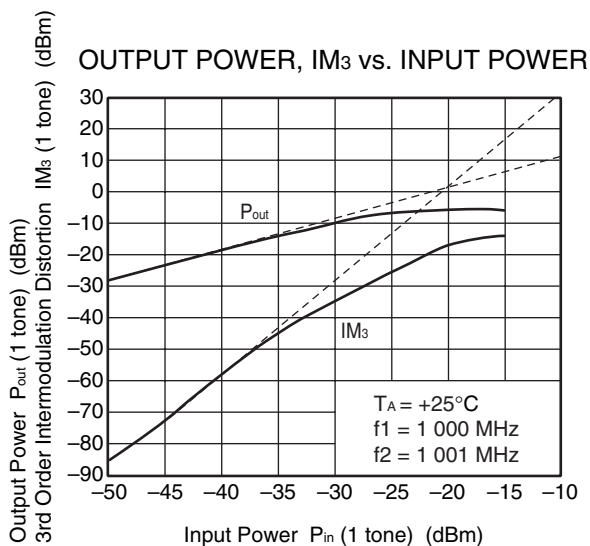
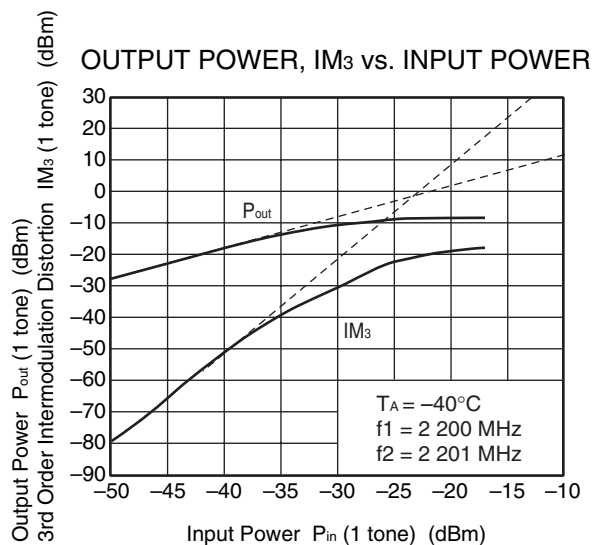
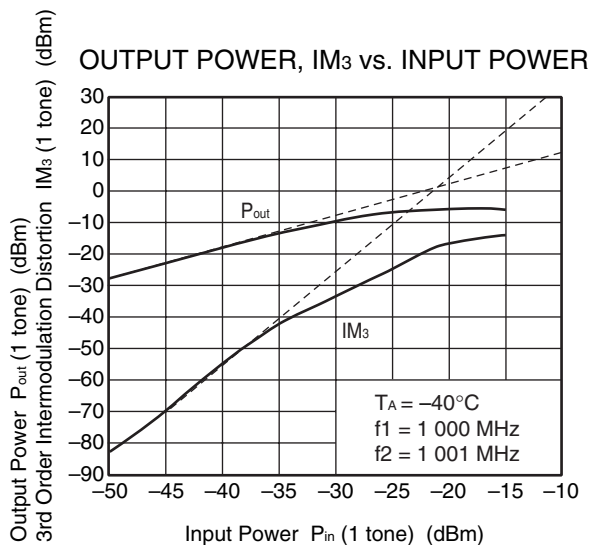
Remark The graphs indicate nominal characteristics.



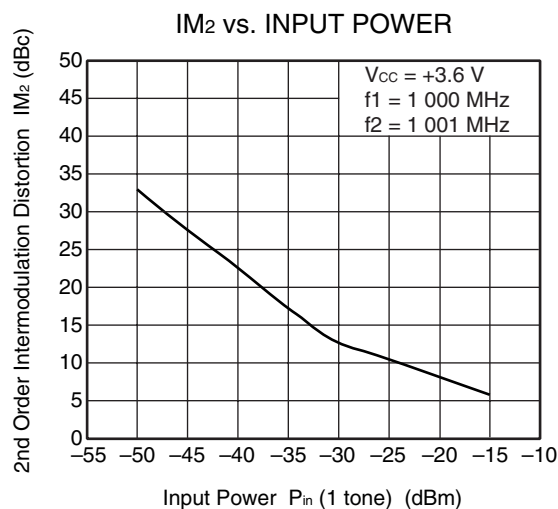
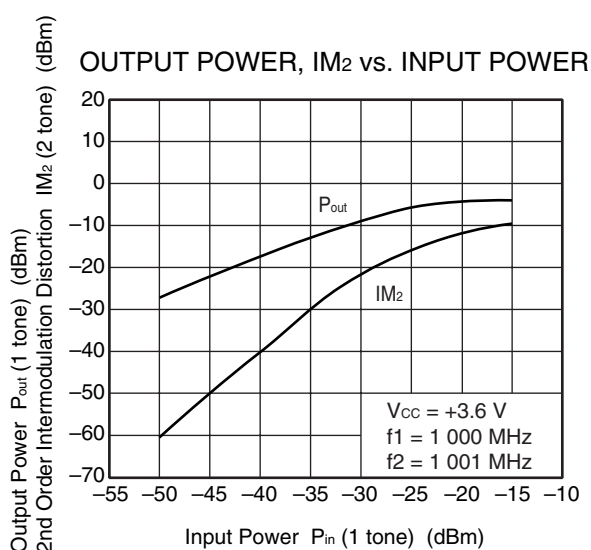
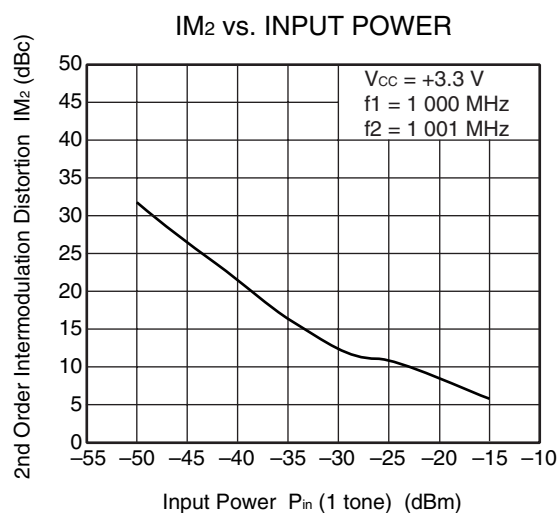
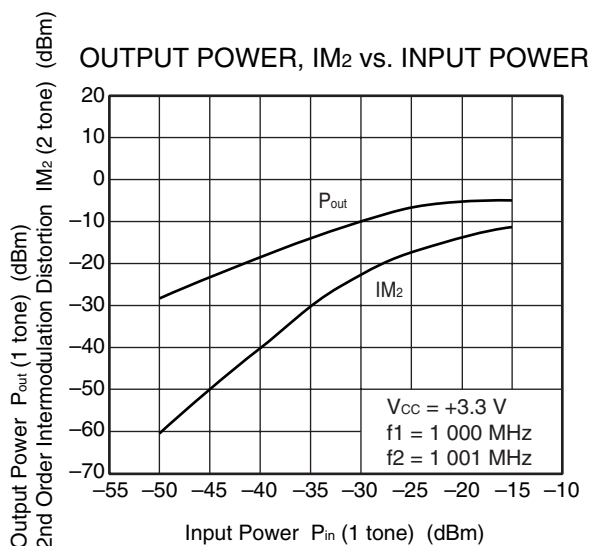
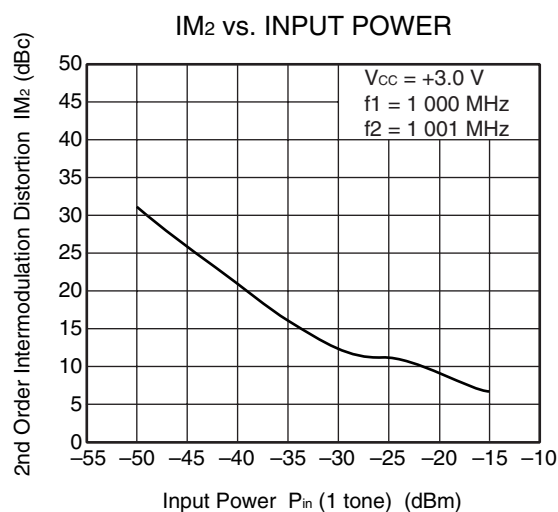
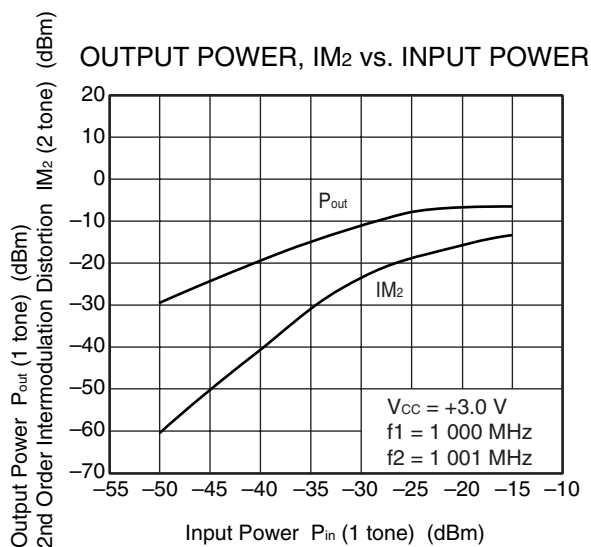
Remark The graphs indicate nominal characteristics.



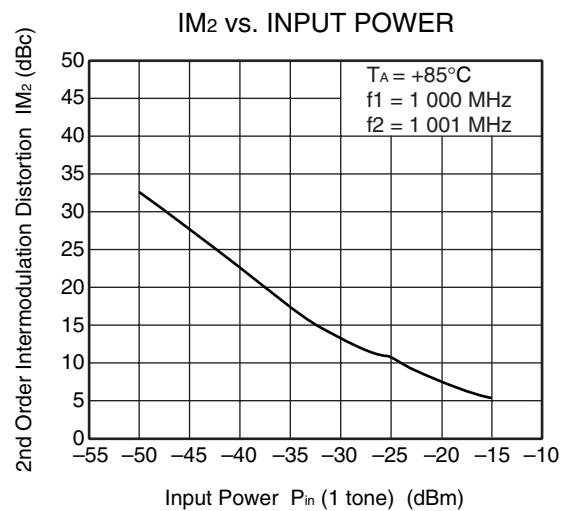
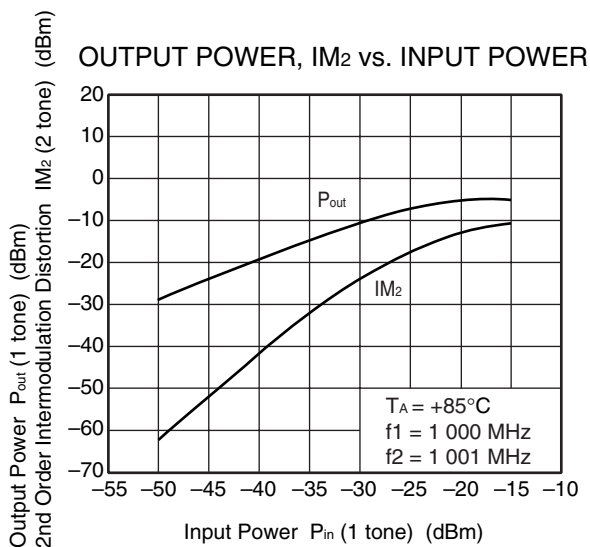
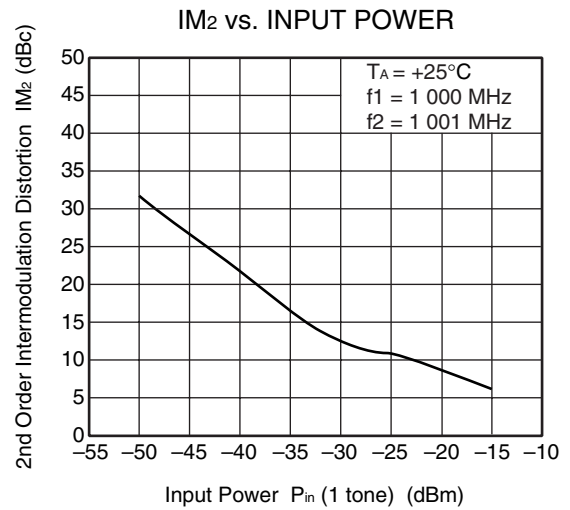
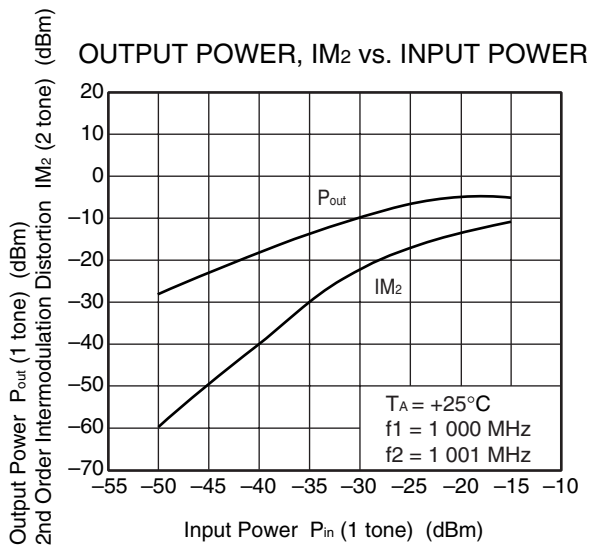
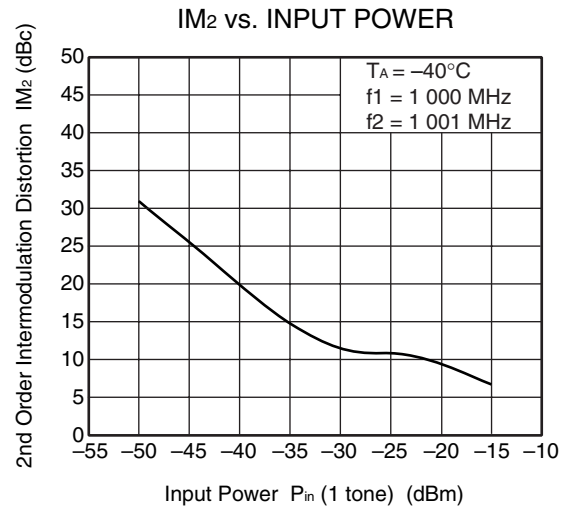
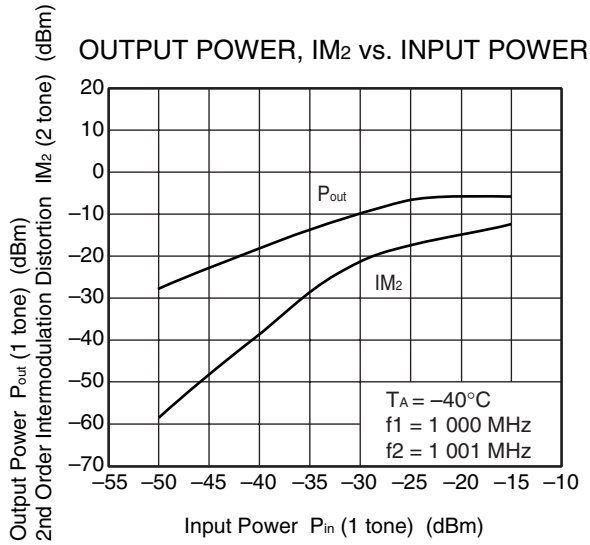
Remark The graphs indicate nominal characteristics.



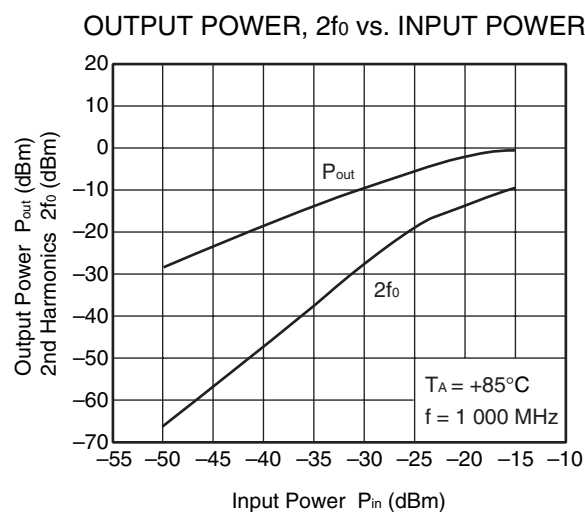
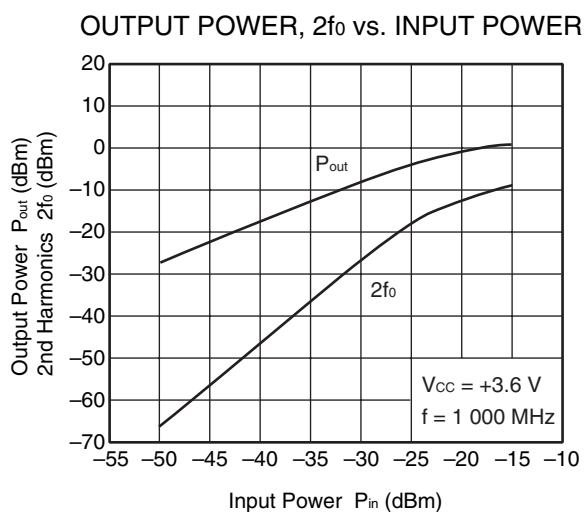
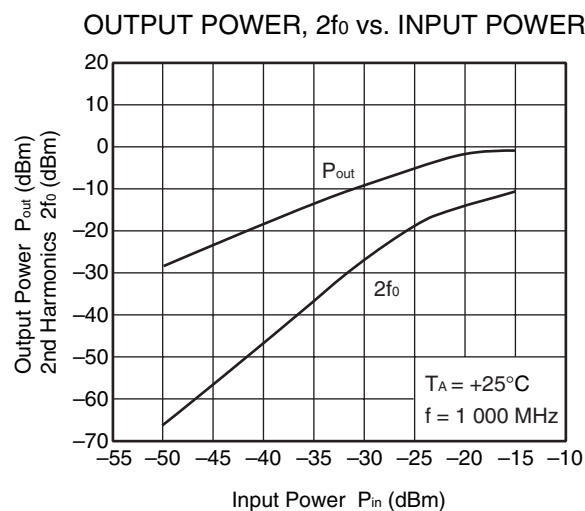
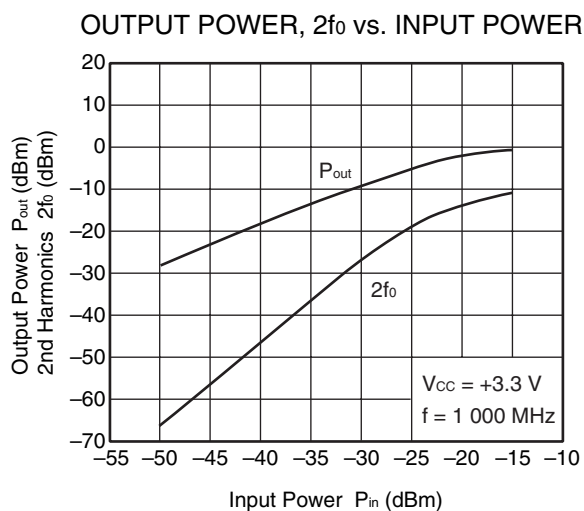
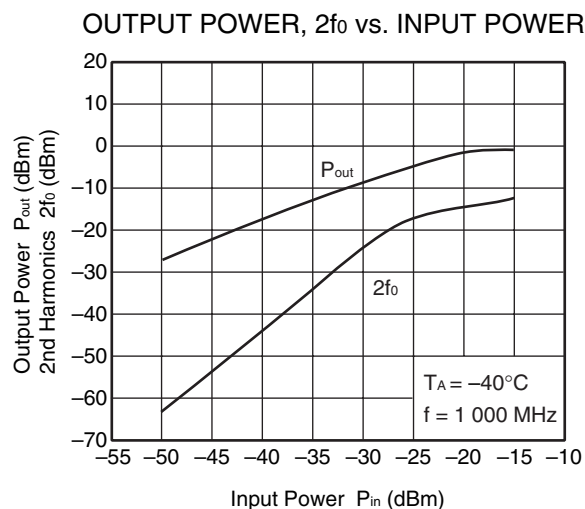
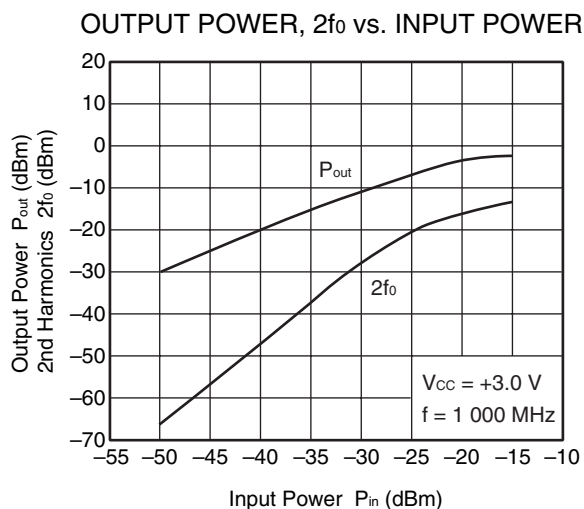
Remark The graphs indicate nominal characteristics.



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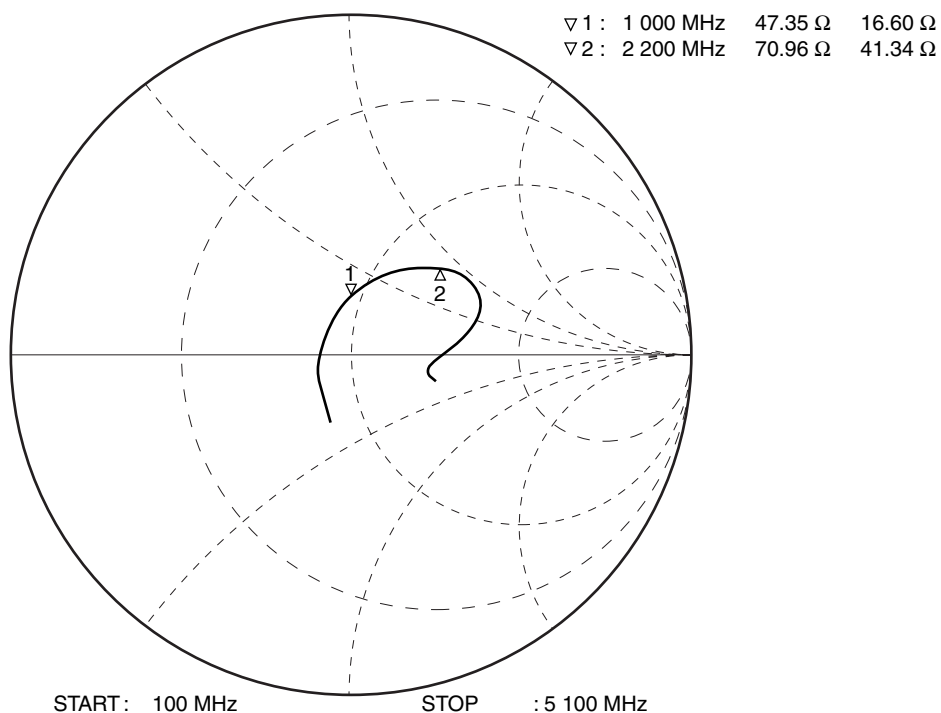
Remark The graphs indicate nominal characteristics.



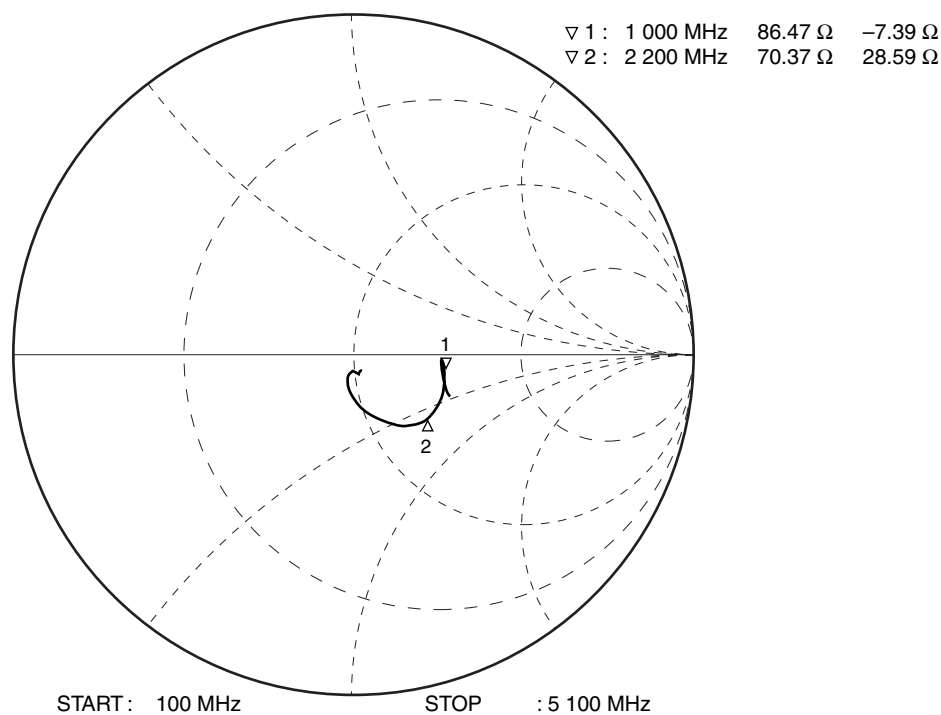
Remark The graphs indicate nominal characteristics.

S-PARAMETERS ($T_A = +25^\circ\text{C}$, $V_{CC} = 3.3\text{ V}$, $P_{in} = -40\text{ dBm}$)

S₁₁—FREQUENCY



S₂₂—FREQUENCY



Remarks 1. Measured on the test circuit of evaluation board.

2. The graphs indicate nominal characteristics.

S-PARAMETERS

S-parameters and noise parameters are provided on our Web site in a format (S2P) that enables the direct import of the parameters to microwave circuit simulators without the need for keyboard inputs.

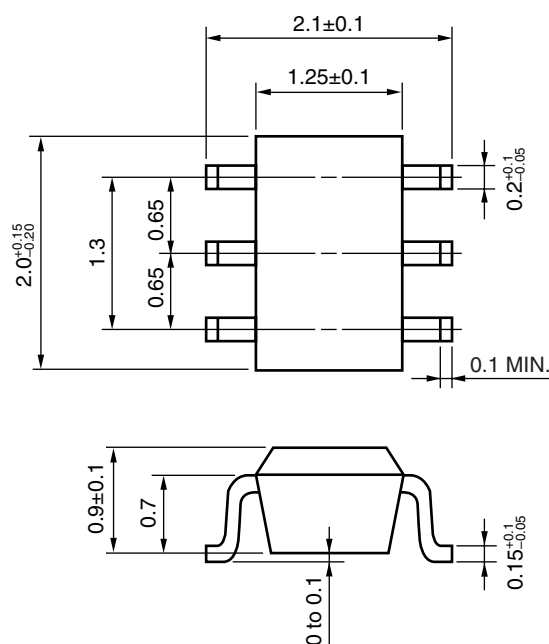
Click here to download S-parameters.

[RF and Microwave] → [Device Parameters]

URL <http://www.necel.com/microwave/en/>

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 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).

- **The information in this document is current as of March, 2010. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.**
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"Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support).

"Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC Electronics products is "Standard" unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact an NEC Electronics sales representative in advance to determine NEC Electronics' willingness to support a given application.

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