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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DATA SHEET

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3215TB

5 V, SUPER MINIMOLD SILICON MMIC WIDEBAND AMPLIFIER

DESCRIPTION

The μPC3215TB is a silicon monolithic IC designed as wideband amplifier. The μPC3215TB is suitable to systems required wideband operation from HF to L band.

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

The package is 6-pin super minimold suitable for surface mount.

FEATURES

- Wideband response : f_u = 2.9 GHz TYP. @3 dB bandwidth
- Noise figure : NF = 2.3 dB TYP. @f = 1.5 GHz
- Power gain : G_P = 20.5 dB TYP. @f = 1.5 GHz
- Supply voltage : V_{CC} = 4.5 to 5.5 V
- High-density surface mounting: 6-pin super minimold package

APPLICATION

- Systems required wideband operation from HF to L band

ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
μPC3215TB-E3	6-pin super minimold	C3H	Embossed tape 8 mm wide. 1, 2, 3 pins face the perforation side of the tape. Qty 3 kpcs/reel.

Remark To order evaluation samples, please contact your local NEC sales office. (Part number for sample order: μPC3215TB)

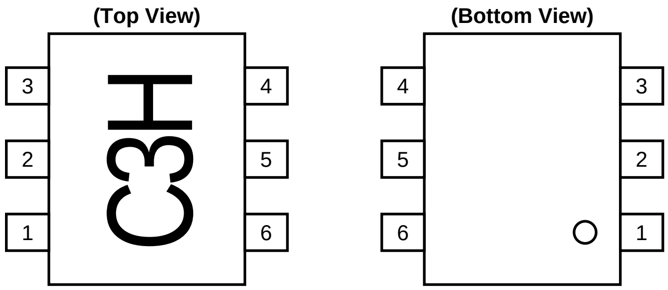
Caution Electro-static sensitive devices

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 representative for availability and additional information.

Document No. P14765EJ2V0DS00 (2nd edition)
Date Published August 2000 N CP(K)
Printed in Japan

The mark ★ shows major revised points.

PIN CONNECTIONS



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

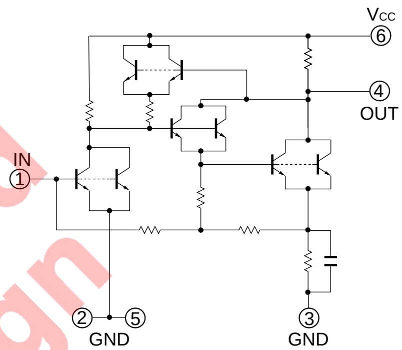
PRODUCT LINE-UP OF 5V-BIAS SILICON MMIC WIDEBAND AMPLIFIERS (T_A = +25°C, V_{CC} = 5.0 V, Z_S = Z_L = 50 Ω)

Part No.	f_u (GHz)	$P_{O\,(sat)}$ (dBm)	G_P (dB)	NF (dB)	I_{CC} (mA)	Package	Marking
μPC2711T	2.9	+1.0	13	5.0 @f = 1 GHz	12	6-pin minimold	C1G
μPC2711TB						6-pin super minimold	
μPC2712T	2.6	+3.0	20	4.5 @f = 1 GHz	12	6-pin minimold	C1H
μPC2712TB						6-pin super minimold	
μPC3210TB	2.3	+3.5	20	3.4 @f = 1.5 GHz	15	6-pin super minimold	C2X
μPC3215TB	2.9	+3.5	20.5	2.3 @f = 1.5 GHz	14	6-pin super minimold	C3H

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

Caution The package size distinguishes between minimold and super minimold.

PIN EXPLANATION

Pin No.	Pin Name	Applied Voltage (V)	Pin Voltage (V)Note	Function and Applications	Internal Equivalent Circuit
1	INPUT	—	0.82	Signal input pin. A internal matching circuit, configured with resistors, enables 50 Ω connection over a wideband. A multi-feedback circuit is designed to cancel the deviations of h_{FE} and resistance. This pin must be coupled to signal source with capacitor for DC cut.	
2 3 5	GND	0	—	Ground pin. This pin should be connected to system ground with minimum inductance. Ground pattern on the board should be formed as wide as possible. All the ground pins must be connected together with wide ground pattern to decrease impedance difference.	
4	OUTPUT	—	3.8	Signal output pin. A internal matching circuit, configured with resistors, enables 50 Ω connection over a wideband. This pin must be coupled to next stage with capacitor for DC cut.	
6	V_{CC}	4.5 to 5.5	—	Power supply pin. This pin should be externally equipped with bypass capacitor to minimize ground impedance.	

Note Pin voltage is measured at V_{CC} = 5.0 V

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C	6.0	V
Circuit Current	I_{CC}	T_A = +25°C	30	mA
Input Power	P_{in}	T_A = +25°C	+10	dBm
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

Note Mounted on 50 × 50 × 1.6-mm epoxy glass PWB, with copper patterning on both sides.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}	4.5	5.0	5.5	V
Operating Ambient Temperature	T_A	–40	+25	+85	°C
Input Power	P_{in}	–	–	0	dBm
Input Frequency	f_{in}	0.1	–	2.9	GHz

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

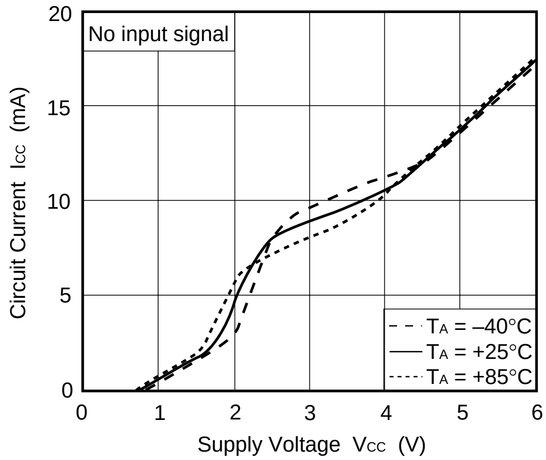
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No input signals	10.5	14.0	17.5	mA
Power Gain	G_P	f = 1.5 GHz, P_{in} = –30 dBm	18.5	20.5	–	dB
Noise Figure	NF	f = 1.5 GHz	–	2.3	3.0	dB
Upper Limit Operating Frequency	f_u	3 dB down below from gain at f = 0.1 GHz	2.5	2.9	–	GHz
Isolation	ISL	f = 1.5 GHz, P_{in} = –30 dBm	39	44	–	dB
Input Return Loss	RL_{in}	f = 1.5 GHz, P_{in} = –30 dBm	10	15	–	dB
Output Return Loss	RL_{out}	f = 1.5 GHz, P_{in} = –30 dBm	6.5	9.5	–	dB
1 dB Compression Point	P-1		–4	–1.5	–	dBm

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

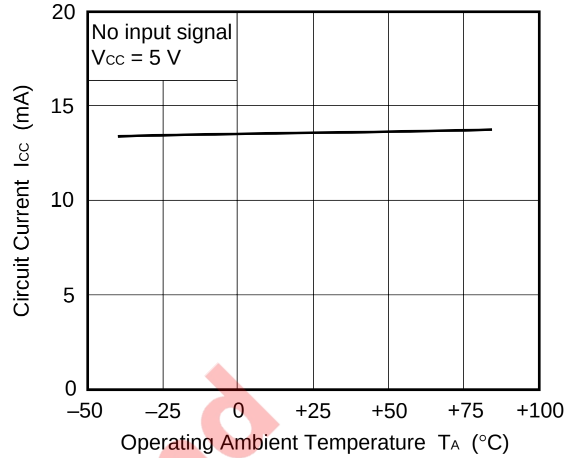
Parameter	Symbol	Test Conditions	Reference Values	Unit
Saturated Output Power	$P_{O(sat)}$	P_{in} = 0 dBm	+3.5	dBm
Output Intercept Point	OIP_3	f_1 = 1.5 GHz, f_2 = 1.501 GHz	+10	dBm
Gain Flatness	ΔG_P	f = 0.1 to 2.15 GHz	1.0	dB

★ **TYPICAL CHARACTERISTICS (Unless otherwise specified, T_A = +25°C)**

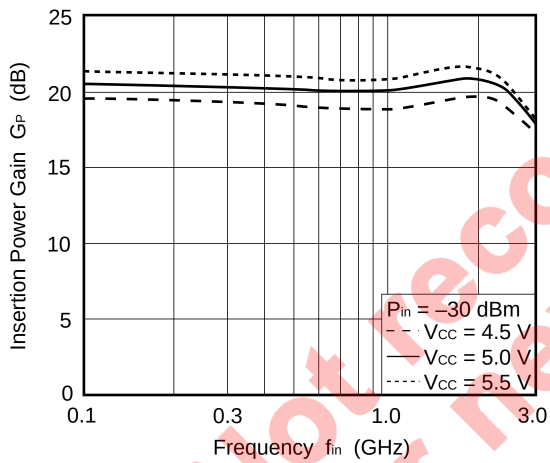
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



INSERTION POWER GAIN vs. FREQUENCY



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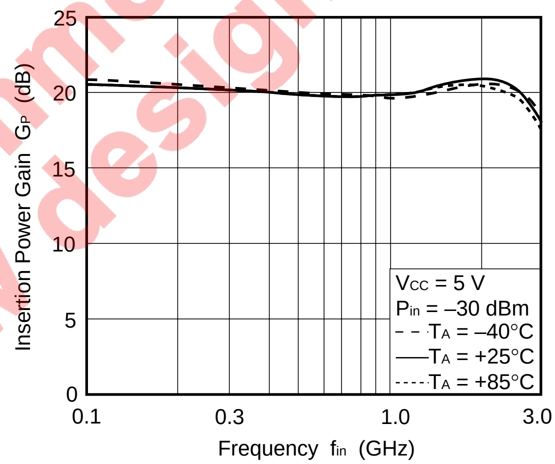
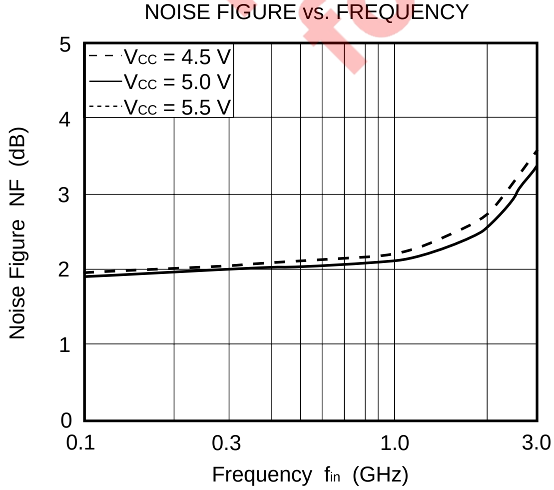
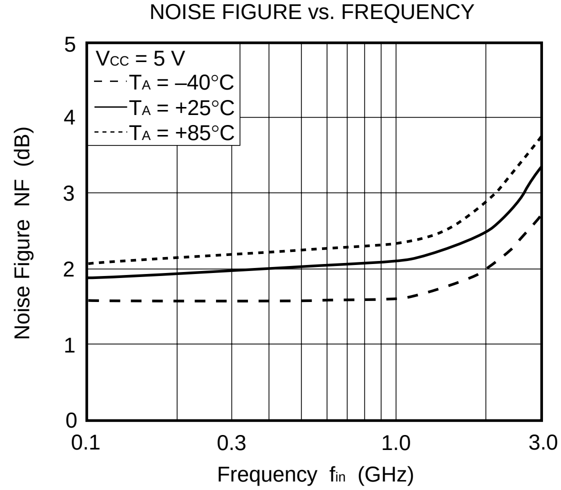


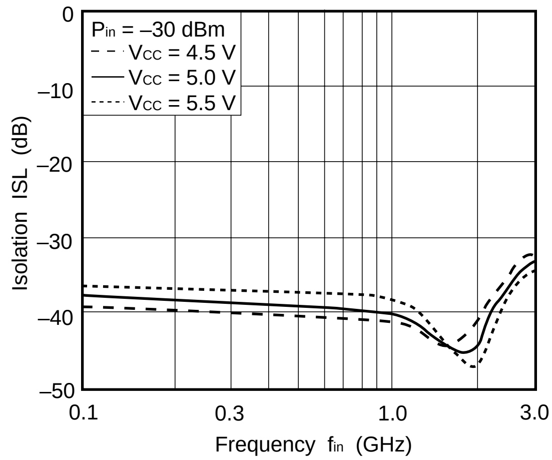
NOISE FIGURE vs. FREQUENCY



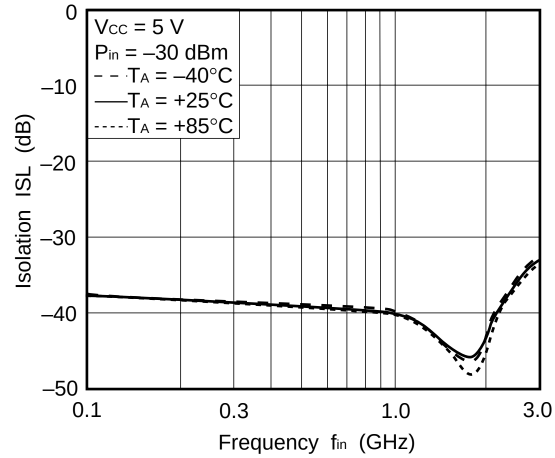
NOISE FIGURE vs. FREQUENCY



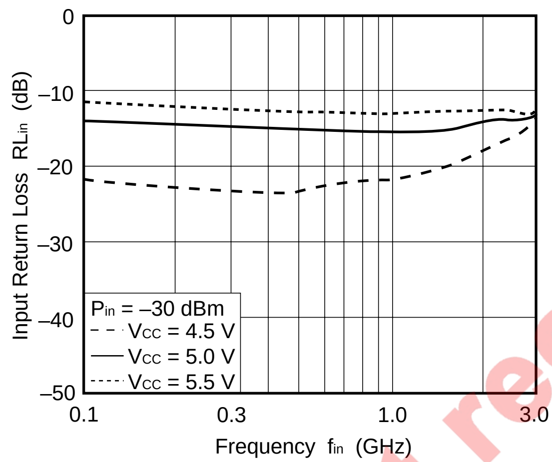
ISOLATION vs. FREQUENCY



ISOLATION vs. FREQUENCY



INPUT RETURN LOSS vs. FREQUENCY



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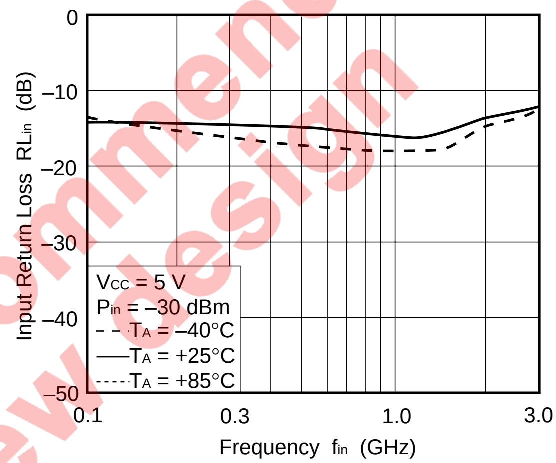
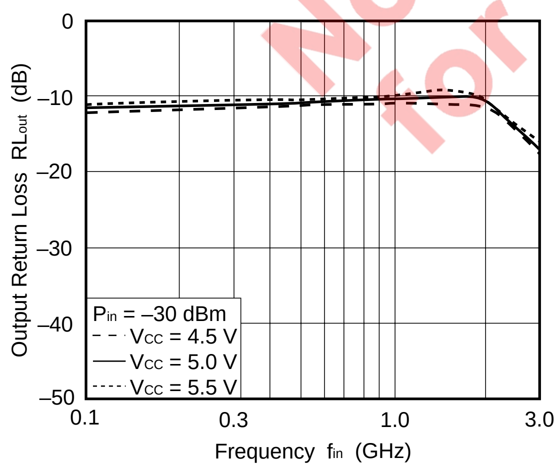


OUTPUT RETURN LOSS vs. FREQUENCY



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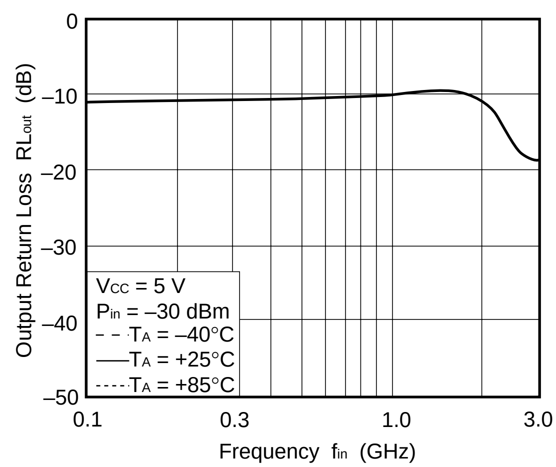
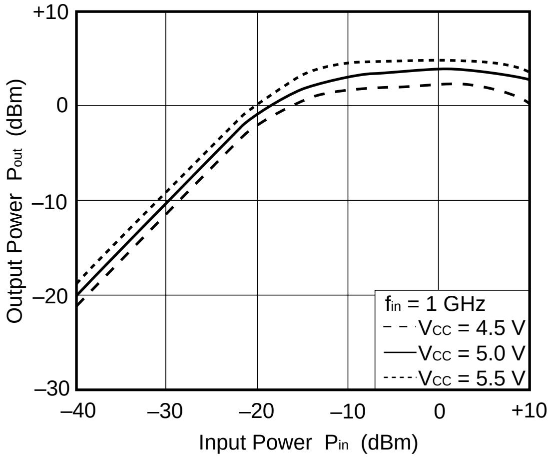
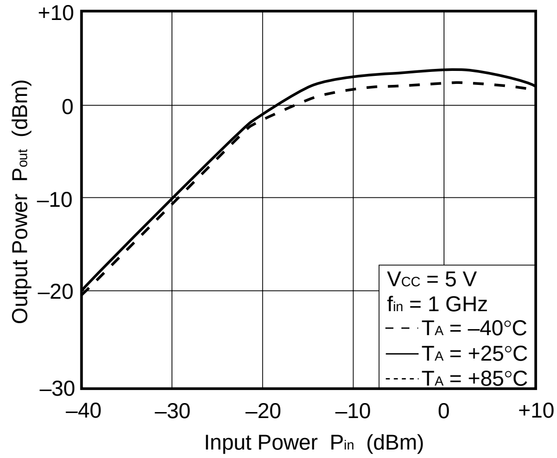


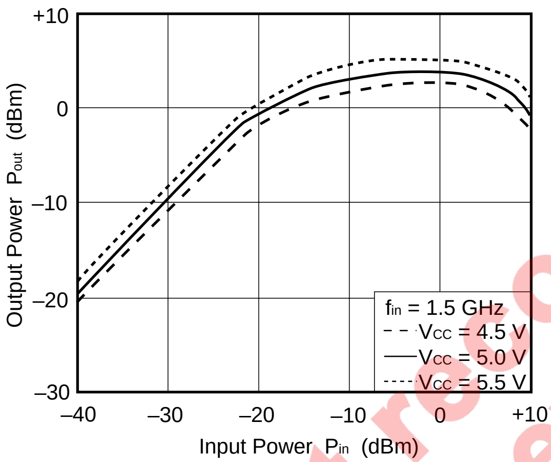
OUTPUT POWER vs. INPUT POWER



OUTPUT POWER vs. INPUT POWER



OUTPUT POWER vs. INPUT POWER



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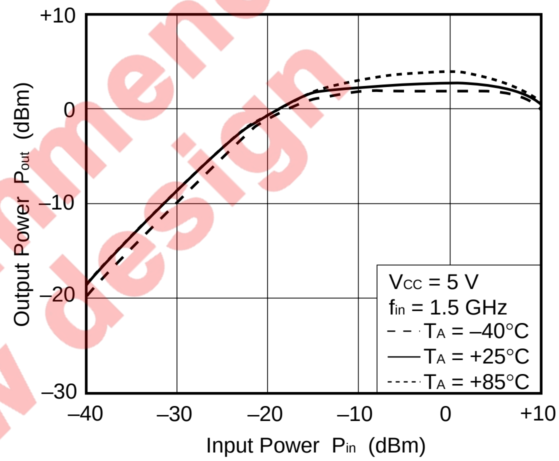

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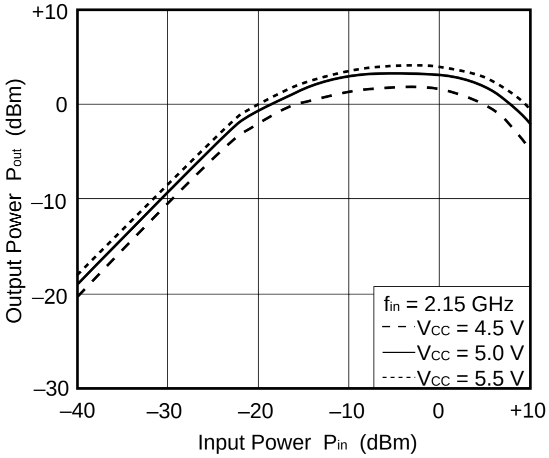

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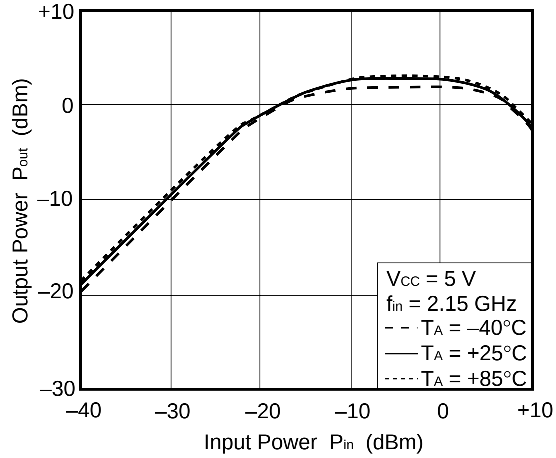

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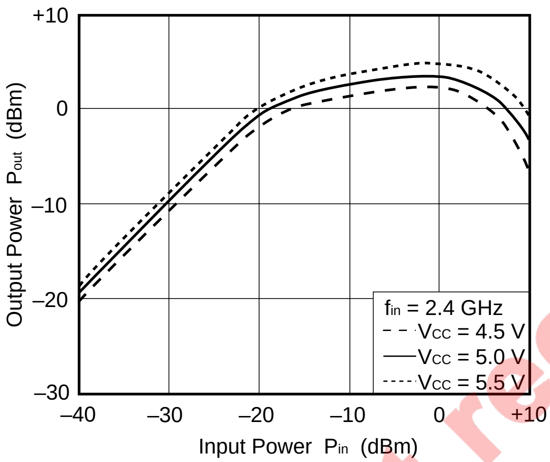
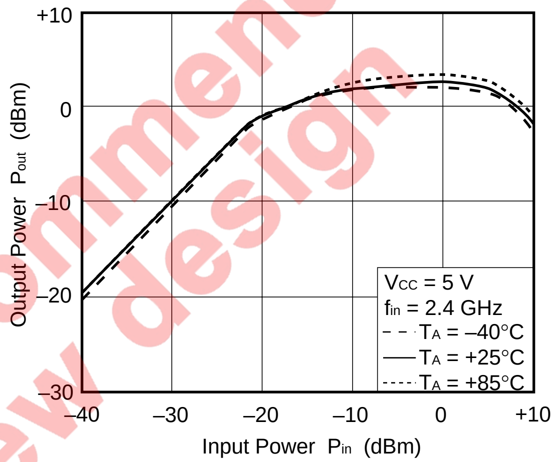
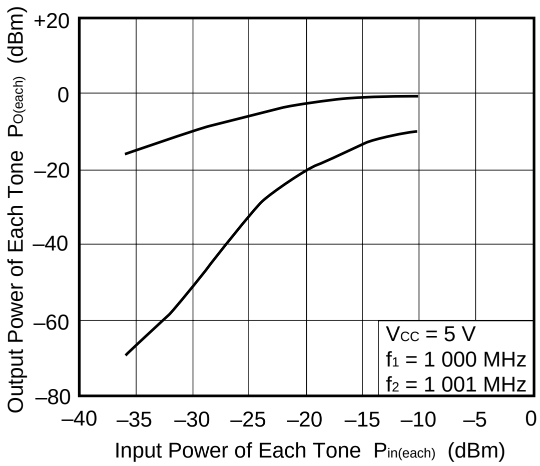


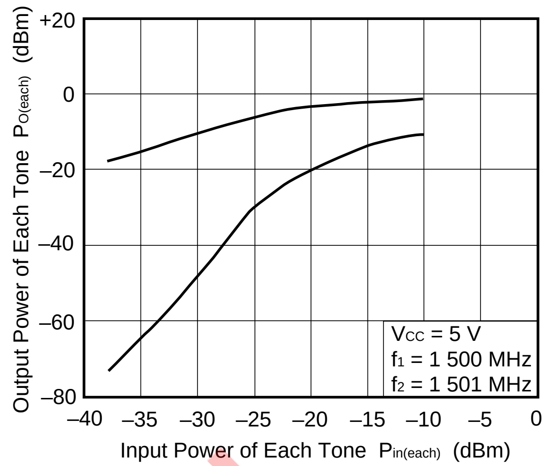
OUTPUT POWER vs. INPUT POWER



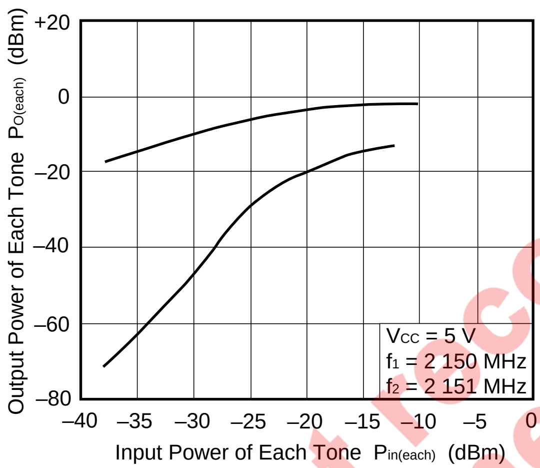
OUTPUT POWER OF EACH TONE vs. INPUT POWER OF EACH TONE



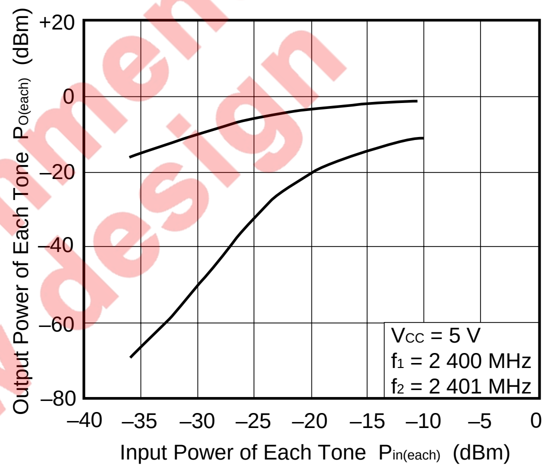
OUTPUT POWER OF EACH TONE vs. INPUT POWER OF EACH TONE



OUTPUT POWER OF EACH TONE vs. INPUT POWER OF EACH TONE



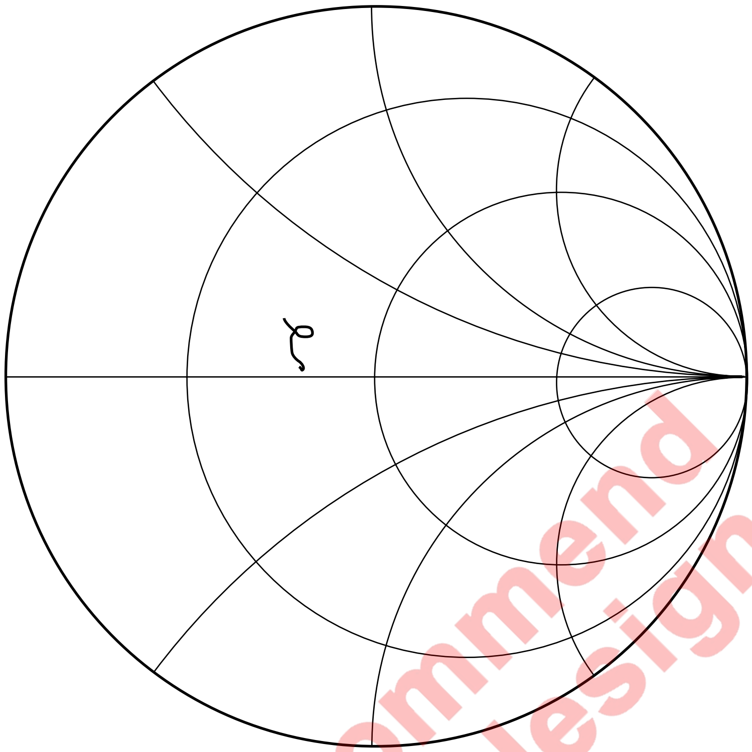
OUTPUT POWER OF EACH TONE vs. INPUT POWER OF EACH TONE



Remark The graphs indicate nominal characteristics.

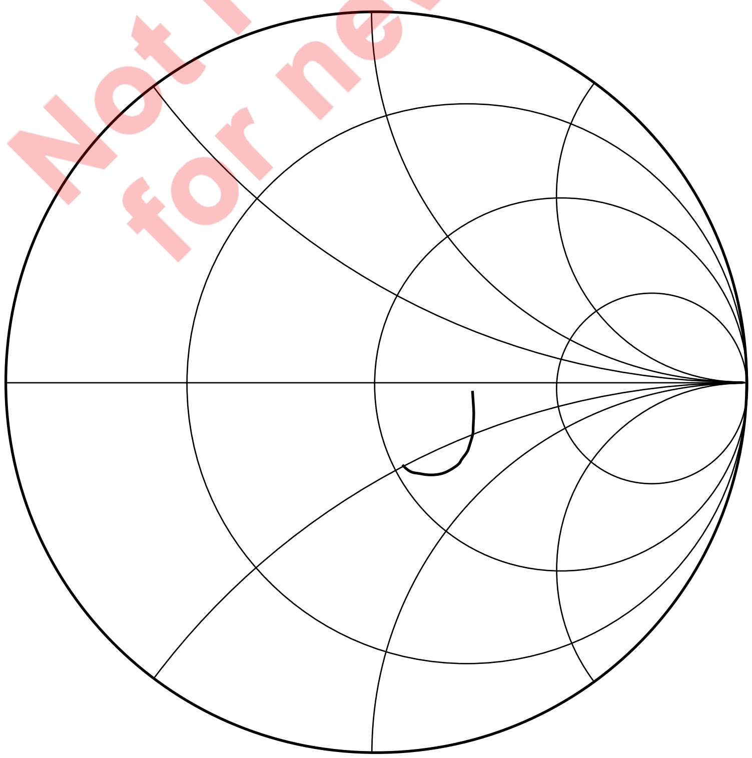
★ S-PARAMETERS (T$_A$ = +25°C, V$_{CC}$ = 5 V)

S$_{11}$-FREQUENCY



START 0.100000000 GHz
STOP 3.100000000 GHz

S$_{22}$-FREQUENCY



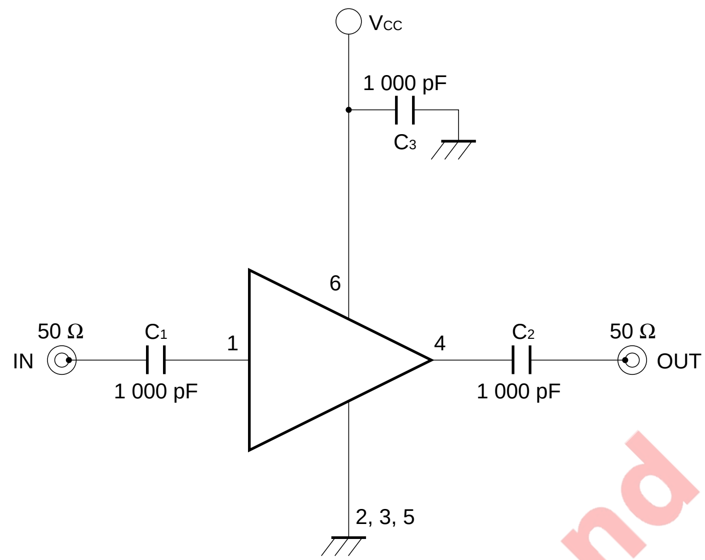
START 0.100000000 GHz
STOP 3.100000000 GHz

★ TYPICAL S-PARAMETER VALUES (T_A = +25°C)

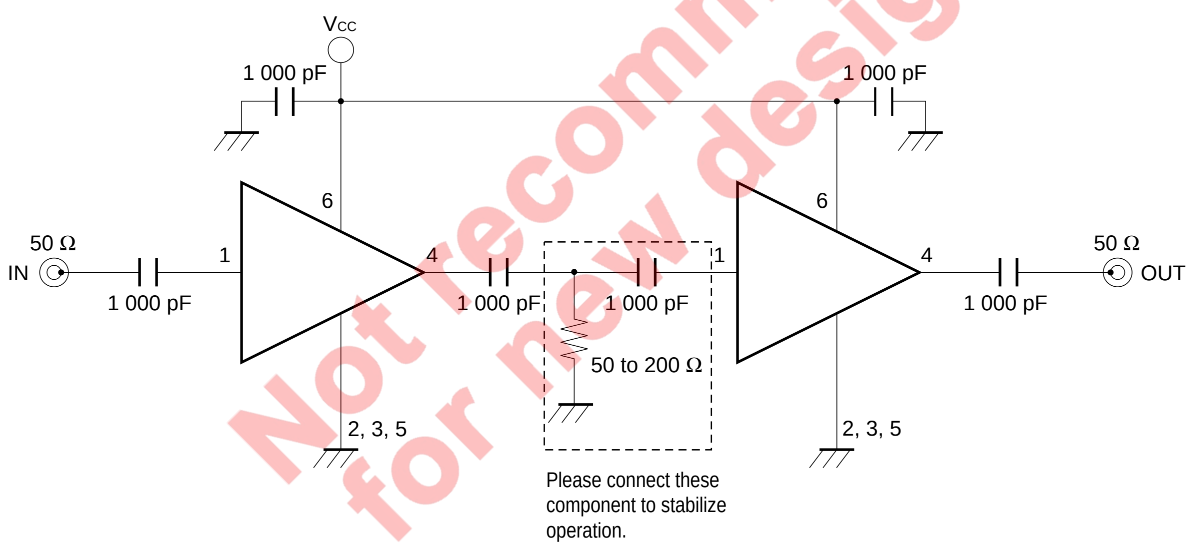
V_{CC} = 5.0 V, I_{CC} = 16 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}		K
MHz	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	
100.0000	0.207	174.1	10.788	–4.6	0.013	6.3	0.285	–3.3	3.38
200.0000	0.190	173.1	10.714	–9.8	0.013	–0.5	0.282	–3.7	3.39
300.0000	0.186	174.3	10.565	–14.3	0.013	2.7	0.283	–4.6	3.37
400.0000	0.192	173.8	10.359	–18.3	0.014	4.7	0.285	–6.2	3.92
500.0000	0.200	174.5	10.225	–21.7	0.013	5.3	0.286	–7.6	3.96
600.0000	0.201	173.0	10.116	–24.9	0.013	2.1	0.286	–8.8	3.69
700.0000	0.204	173.0	10.116	–28.0	0.011	1.6	0.288	–10.4	3.91
800.0000	0.206	172.4	10.122	–31.1	0.011	12.9	0.289	–11.7	4.17
900.0000	0.210	172.7	10.186	–34.5	0.011	5.1	0.290	–13.5	3.99
1000.0000	0.212	171.4	10.182	–37.7	0.009	4.1	0.295	–14.9	4.28
1100.0000	0.218	169.4	10.208	–41.6	0.011	4.9	0.299	–16.8	4.19
1200.0000	0.217	168.4	10.296	–45.6	0.009	11.0	0.300	–18.0	4.65
1300.0000	0.221	165.9	10.248	–49.7	0.006	20.5	0.299	–20.2	5.78
1400.0000	0.228	164.7	10.438	–53.9	0.008	1.6	0.307	–23.1	6.97
1500.0000	0.233	162.3	10.369	–58.0	0.006	25.7	0.310	–24.8	6.80
1600.0000	0.238	159.5	10.554	–62.7	0.005	31.6	0.316	–27.5	11.54
1700.0000	0.244	157.2	10.492	–67.2	0.004	48.5	0.317	–30.5	11.75
1800.0000	0.246	153.9	10.483	–72.2	0.003	87.2	0.318	–33.3	13.52
1900.0000	0.248	150.6	10.408	–76.9	0.004	93.4	0.323	–36.9	8.46
2000.0000	0.246	147.4	10.405	–82.2	0.007	114.5	0.323	–40.6	7.46
2100.0000	0.241	144.9	10.267	–87.2	0.008	115.4	0.319	–44.9	6.20
2200.0000	0.236	142.2	10.039	–92.7	0.011	124.0	0.312	–48.9	4.50
2300.0000	0.229	142.2	9.896	–97.7	0.012	121.6	0.306	–52.6	4.12
2400.0000	0.219	143.5	9.684	–102.4	0.014	124.9	0.292	–56.3	3.40
2500.0000	0.215	145.7	9.348	–107.5	0.015	117.8	0.279	–59.3	3.42
2600.0000	0.213	149.3	9.068	–112.0	0.018	117.3	0.270	–61.7	3.02
2700.0000	0.221	150.1	8.673	–116.6	0.017	114.4	0.256	–63.7	3.17
2800.0000	0.234	151.3	8.437	–121.1	0.020	114.0	0.248	–65.1	2.85
2900.0000	0.253	152.1	8.080	–124.9	0.021	111.6	0.237	–67.3	2.98
3000.0000	0.264	150.7	7.791	–129.4	0.020	112.5	0.232	–68.0	2.90
3100.0000	0.283	148.7	7.458	–132.7	0.022	113.7	0.229	–70.2	3.02

TEST CIRCUIT



EXAMPLE OF APPLICATION CIRCUIT



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

Capacitors for V_{CC}, input and output pins

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

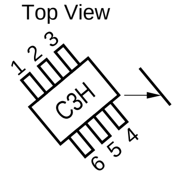
Bypass capacitor for V_{CC} pin is intended to minimize V_{CC} pin's ground impedance. Therefore, stable bias can be supplied against V_{CC} fluctuation.

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

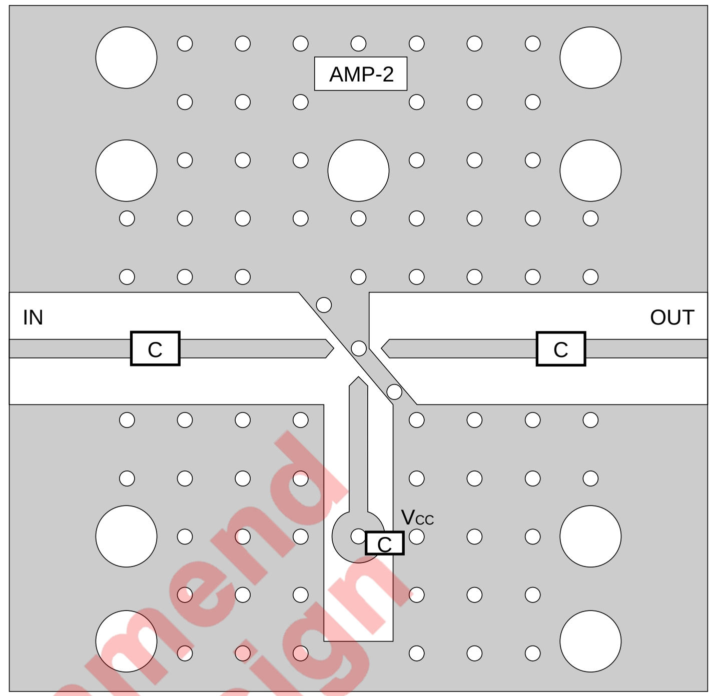
To get flat gain from 100 MHz up, 1 000 pF capacitors are assembled on the test circuit. [Actually, 1 000 pF capacitors give flat gain at least 10 MHz. In the case of under 10 MHz operation, increase the value of coupling capacitor such as 2 200 pF. Because the coupling capacitors are determined by the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

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD

Top View



Mounting direction



COMPONENT LIST

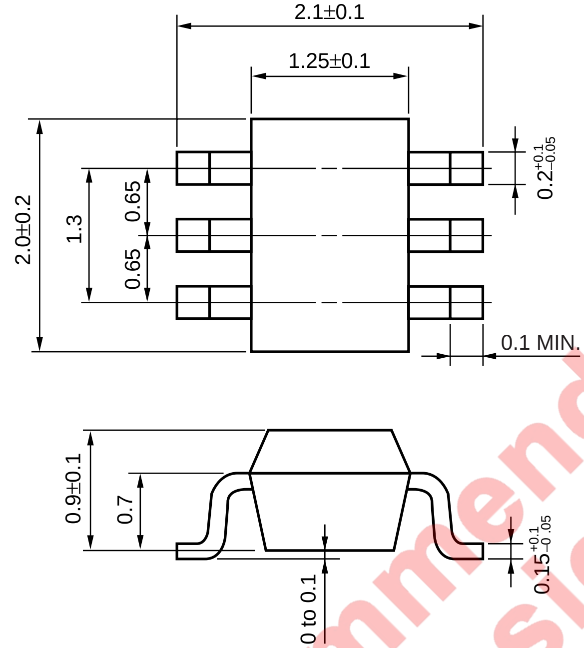
	Value
C	1 000 pF

Notes

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

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).
(3) Keep the track length of the ground pins as short as possible.
(4) A low pass filter must be attached to V_{CC} line.

RECOMMENDED SOLDERING CONDITIONS

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

Soldering Method	Soldering Conditions	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).