



SILICON RFIC LOW CURRENT AMPLIFIER FOR MOBILE COMMUNICATIONS

UPC8179TB

FEATURES

- **HIGH DENSITY SURFACE MOUNTING:**
6 Pin Super Minimold Package (2.0 x 1.25 x 0.9 mm)
- **SUPPLY VOLTAGE:**
Vcc = 2.4 to 3.3 V
- **HIGH EFFICIENCY:**
Po(1dB) = +3.0 dBm TYP at f = 1.0 GHz
Po(1dB) = +1.5 dBm TYP at f = 1.9 GHz
Po(1dB) = +1.0 dBm TYP at f = 2.4 GHz
- **POWER GAIN:**
GP = 13.5 dB TYP at f = 1.0 GHz
GP = 15.5 dB TYP at f = 1.9 GHz
GP = 15.5 dB TYP at f = 2.4 GHz
- **EXCELLENT ISOLATION:**
ISL = 44 dB TYP at f = 1.0 GHz
ISL = 42 dB TYP at f = 1.9 GHz
ISL = 41 dB TYP at f = 2.4 GHz
- **LOW CURRENT CONSUMPTION:**
Icc = 4.0 mA TYP AT VCC = 3.0 V
- **OPERATING FREQUENCY:**
Icc = 4.0 mA TYP AT VCC = 3.0 V
- **LIGHT WEIGHT:**
7 mg (standard Value)

APPLICATION

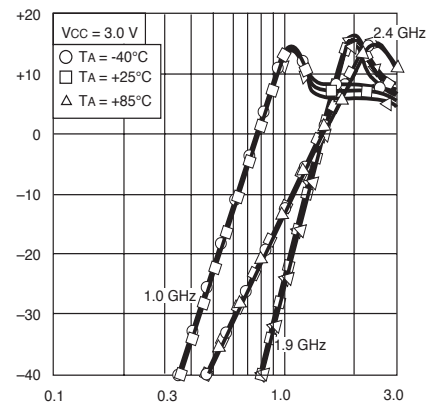
- Buffer amplifiers for 0.1 to 2.4 GHz mobile communications systems.

ELECTRICAL CHARACTERISTICS,

(Unless otherwise specified, TA = +25°C, Vcc = VOUT = 3.0 V, Zs = ZL = 50Ω, at LC matched Frequency)

| PART NUMBER PACKAGE OUTLINE | | | UPC8179TB S06 | | |
|--------------------------------|---|-------|------------------|------|------|
| SYMBOLS | PARAMETERS AND CONDITIONS | UNITS | MIN | TYP | MAX |
| Icc | Circuit Current (no input signal) | mA | 2.9 | 4.0 | 5.4 |
| GP | Power Gain, f = 1.0 GHz, PIN = -30 dBm f = 1.9 GHz, PIN = -30 dBm f = 2.4 GHz, PIN = -30 dBm | dB | 11.0 | 13.5 | 15.5 |
| | | | 13.0 | 15.5 | 17.5 |
| | | | 13.0 | 15.5 | 17.5 |
| ISOL | Isolation, f = 1.0 GHz, PIN = -30 dBm f = 1.9 GHz, PIN = -30 dBm f = 2.4 GHz, PIN = -30 dBm | dB | 39.0 | 44.0 | — |
| | | | 37.0 | 42.0 | — |
| | | | 36.0 | 41.0 | — |
| P1dB | Output Power at 1 dB gain compression, f = 1.0 GHz f = 1.9 GHz f = 2.4 GHz | dB | -0.5 | 3.0 | — |
| | | | -2.0 | 1.5 | — |
| | | | -3.0 | 1.0 | — |
| NF | Noise Figure, f = 1.0 GHz f = 1.9 GHz f = 2.4 GHz | dB | — | 5.0 | 6.5 |
| | | | — | 5.0 | 6.5 |
| | | | — | 5.0 | 6.5 |
| RLIN | Input Return Loss, (without matching circuit) f = 1.0 GHz, PIN = -30 dBm f = 1.9 GHz, PIN = -30 dBm f = 2.4 GHz, PIN = -30 dBm | dB | 4.0 | 7.0 | — |
| | | | 4.0 | 7.0 | — |
| | | | 6.0 | 9.0 | — |

POWER GAIN vs. FREQUENCY



Output match for best performance at each frequency

DESCRIPTION

NEC's UPC8179TB is a silicon monolithic integrated circuit designed as amplifier for mobile communications. This IC can realize low current consumption with external chip inductor which can be realized on internal 50Ω wideband matched IC. This low current amplifier runs on 3.0 V. This IC is manufactured using NEC's 30 GHz fMAX UHS0 (Ultra High Speed Process) silicon bipolar process. This process uses direct silicon nitride passivation film and gold electrodes. These materials can protect the chip surface from pollution and prevent corrosion/migration. Thus this IC has excellent performance uniformity and reliability.

ABSOLUTE MAXIMUM RATINGS¹ (TA = 25°C)

| SYMBOLS | PARAMETERS | UNITS | RATINGS |
|---------|--------------------------------|-------|-------------|
| Vcc | Supply Voltage, Pins 4 & 6 | V | 3.6 |
| Icc | Circuit Current | mA | 15 |
| PD | Power Dissipation ² | mW | 270 |
| TOP | Operating Temperature | °C | -40 to +85 |
| TSTG | Storage Temperature | °C | -55 to +150 |
| PIN | Input Power | dBm | +5 |

Notes:

1. Operation in excess of any one of these parameters may result in permanent damage.
2. Mounted on a 50 x 50 x 1.6 mm epoxy glass PWB (TA = +85°C).

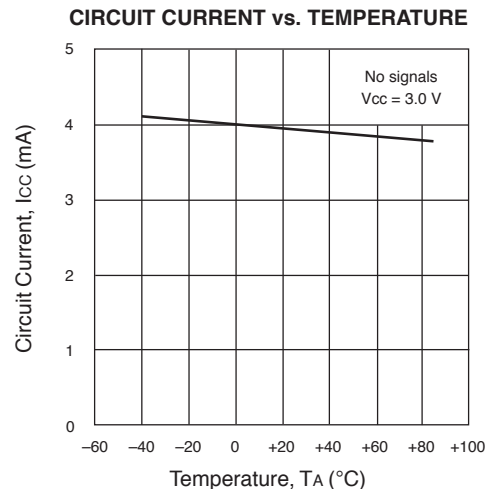
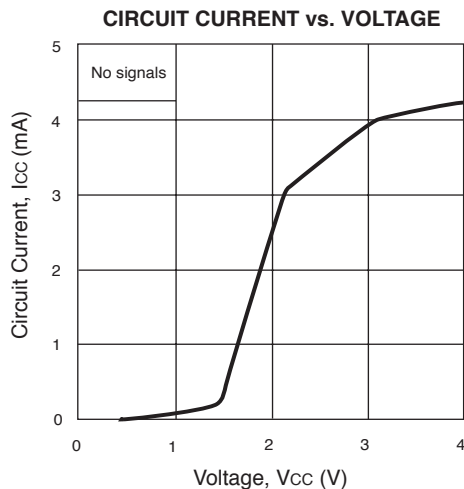
RECOMMENDED OPERATING CONDITIONS

| SYMBOLS | PARAMETERS | UNITS | MIN | TYP | MAX |
|---------|-------------------------------|-------|-----|-----|-----|
| Vcc | Supply Voltage | V | 2.7 | 3.0 | 3.3 |
| TA | Operating Ambient Temperature | °C | -40 | +25 | +85 |

PIN FUNCTIONS

| Pin No. | Symbol | Pin Voltage | Description | Internal Equivalent Circuit |
|-------------|--------|---------------------------|--|-----------------------------|
| 1 | INPUT | 1.09 V | Signal Input Pin. A internal matching circuit, configured with resistors, enable 50 W connection over a wide band. This pin must be coupled to signal source with capacitor for DC cut. | |
| 2 3 5 | GND | through external inductor | Ground pin. This pin should be connected to the 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 | Same as Vcc voltage | Signal output pin. This pin is designed as collector output. Due to the high impedance output, this pin should be externally equipped with matching LC matching circuit to next stage. For L, a size 1005 chip inductor can be chosen. | |
| 6 | Vcc | 2.4 to 3.3 | Power supply pin. This pin should be externally equipped with bypass capacitor to minimize its impedance. | |

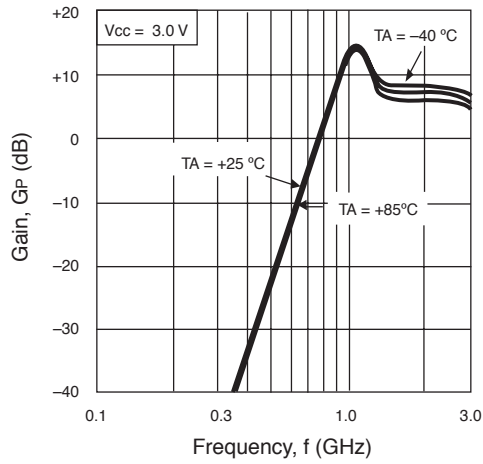
TYPICAL PERFORMANCE CURVES (Unless otherwise specified, TA = 25°C)



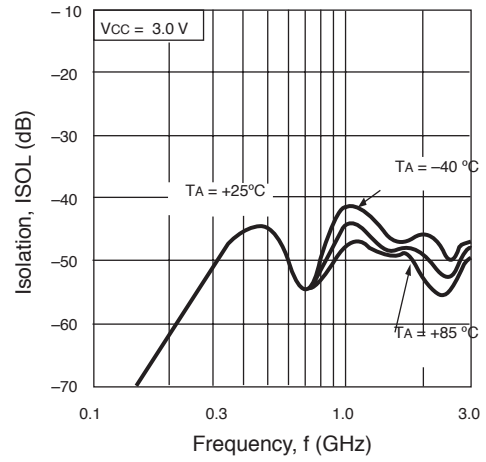
TYPICAL PERFORMANCE CURVES (Unless otherwise specified, $T_A = 25^\circ\text{C}$)

1.0 GHz Output Port Matching

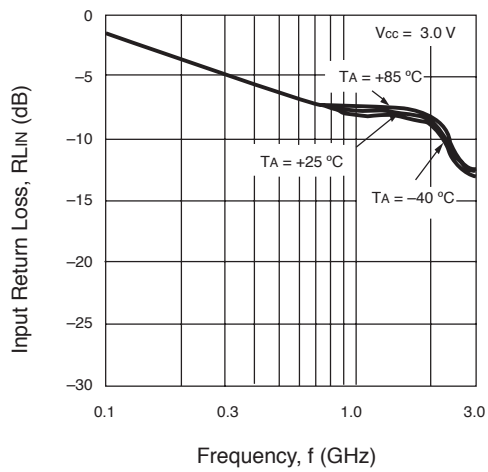
GAIN vs. FREQUENCY



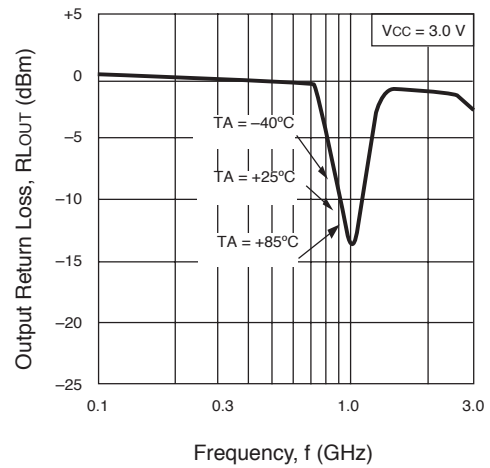
ISOLATION vs. FREQUENCY



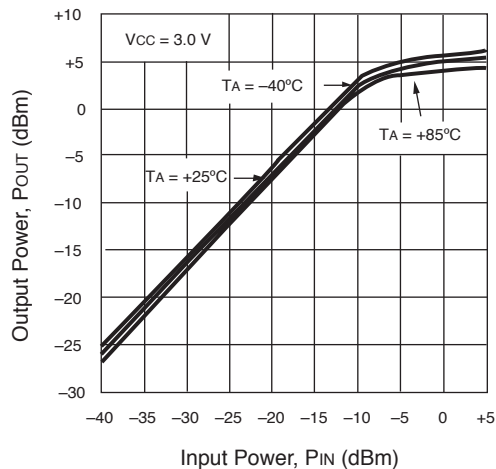
INPUT RETURN LOSS vs. FREQUENCY



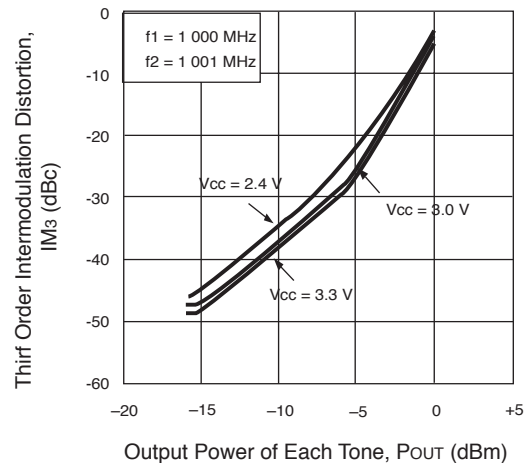
OUTPUT RETURN LOSS vs. FREQUENCY



OUTPUT POWER vs. INPUT POWER



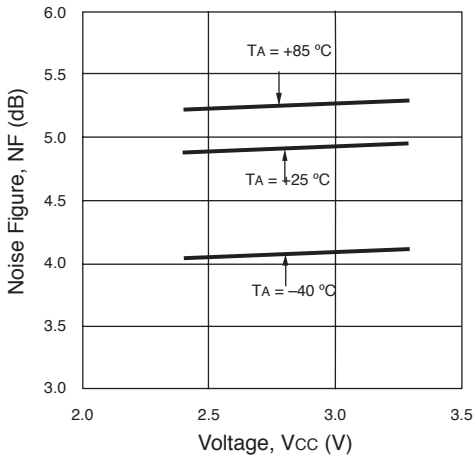
THIRD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER OF EACH TONE



TYPICAL PERFORMANCE CURVES (Unless otherwise specified, $T_A = 25^\circ\text{C}$)

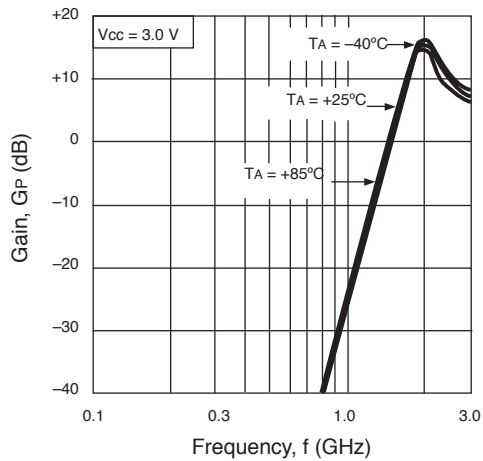
1.0 GHz Output Port Matching

NOISE FIGURE vs. VOLTAGE

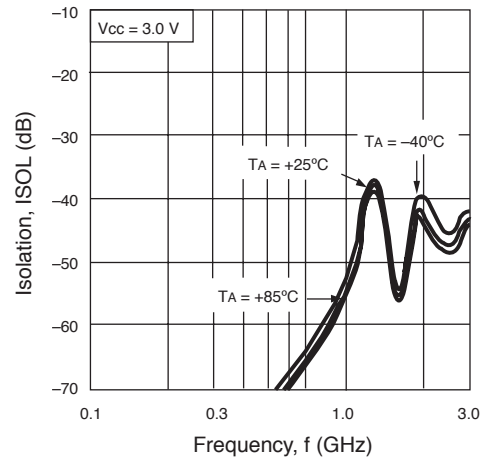


1.9 GHz Output Port Matching

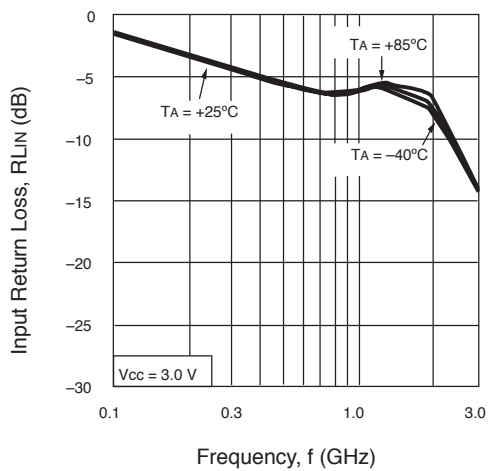
GAIN vs. FREQUENCY



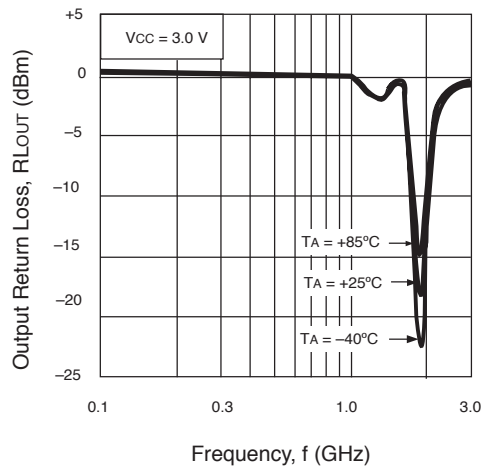
ISOLATION vs. FREQUENCY



INPUT RETURN LOSS vs. FREQUENCY

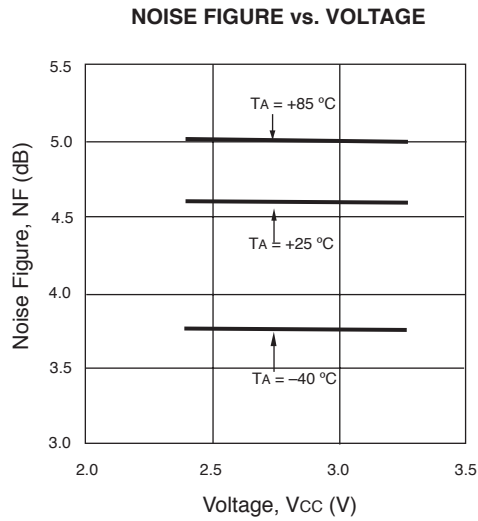
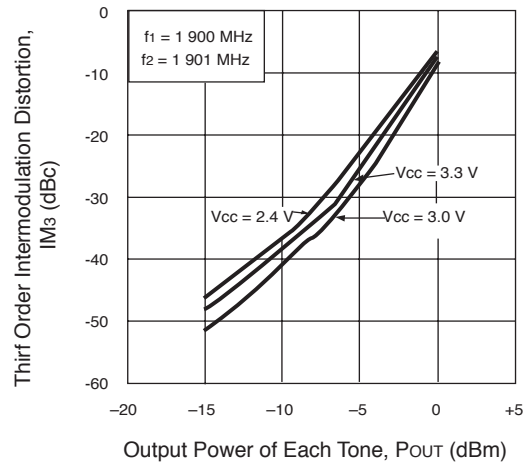
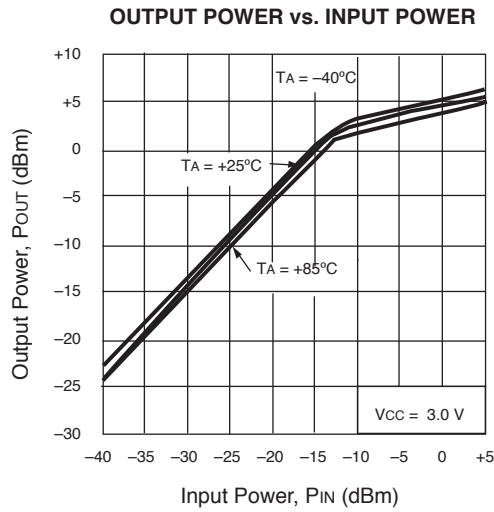


OUTPUT RETURN LOSS vs. FREQUENCY

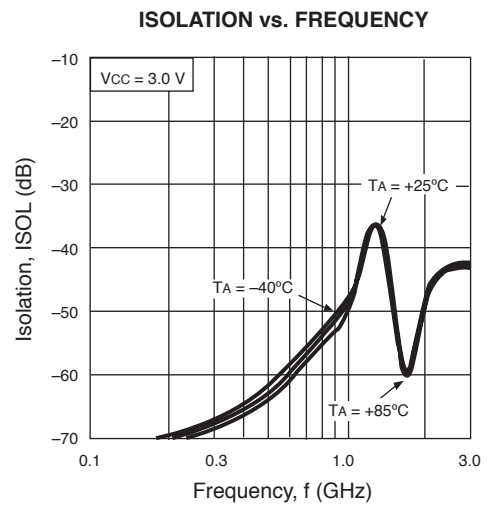
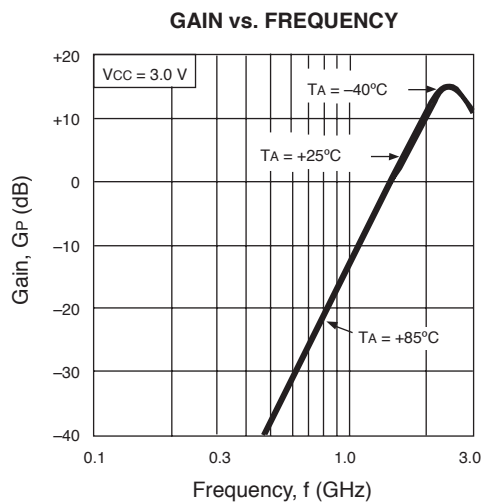


TYPICAL PERFORMANCE CURVES (Unless otherwise specified, $T_A = 25^\circ\text{C}$)

1.9 GHz Output Port Matching



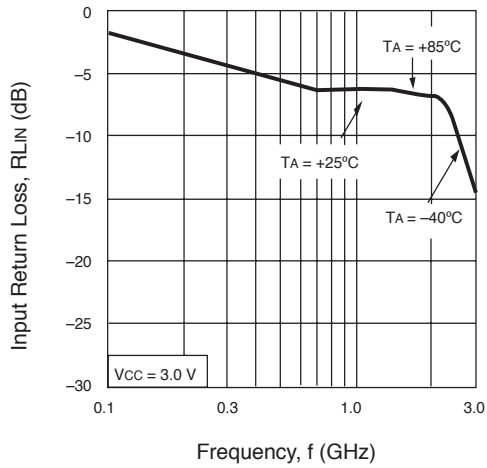
2.4 GHz Output Port Matching



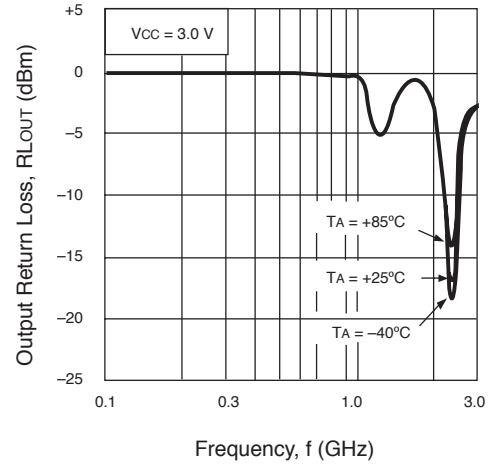
TYPICAL PERFORMANCE CURVES (Unless otherwise specified, $T_A = 25^\circ\text{C}$)

2.4 GHz Output Port Matching

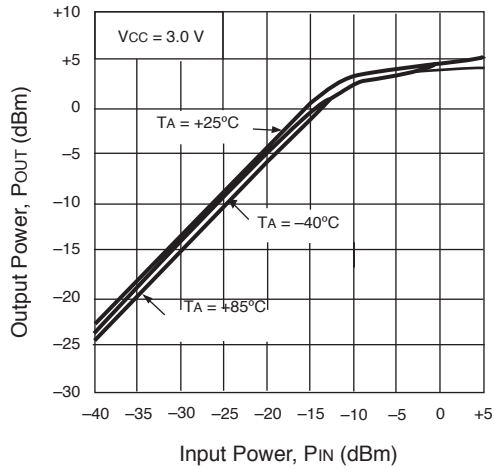
INPUT RETURN LOSS vs. FREQUENCY



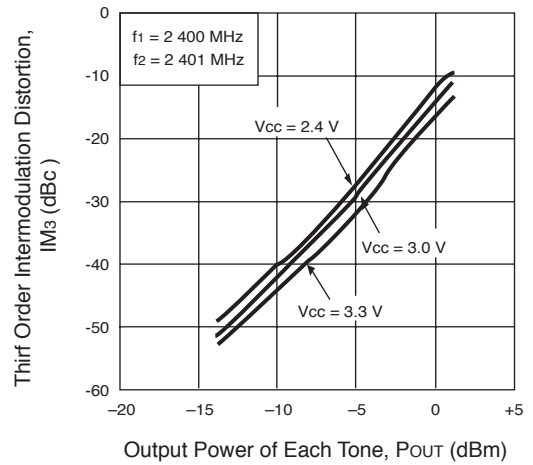
OUTPUT RETURN LOSS vs. FREQUENCY



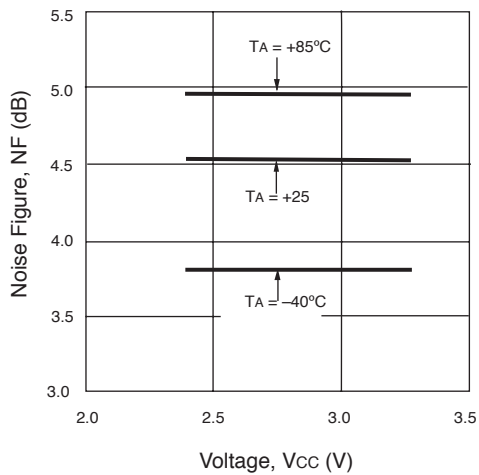
OUTPUT POWER vs. INPUT POWER



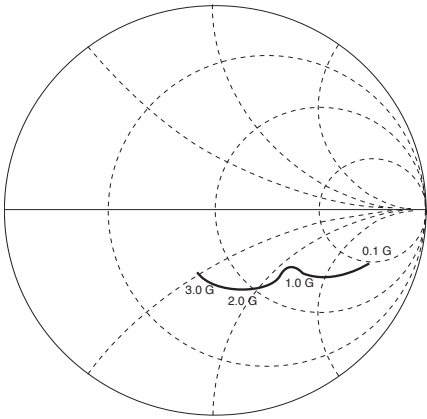
THIRD ORDER INTERMODULATION DISTORTION vs. OUTPUT POWER OF EACH TONE



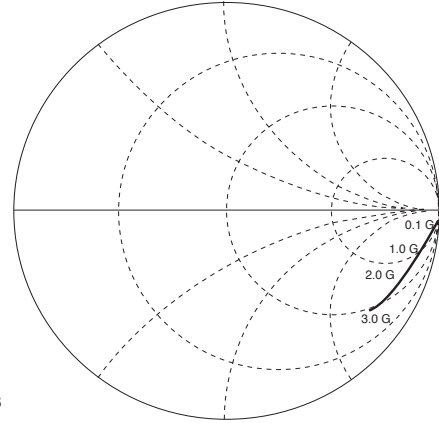
NOISE FIGURE vs. VOLTAGE



TYPICAL SCATTERING PARAMETERS (TA = 25°C)



S11



S22

Coordinates in Ohms
Frequency in GHz
 Vcc = Vout = 3.0 V, Icc = 4.0 mA

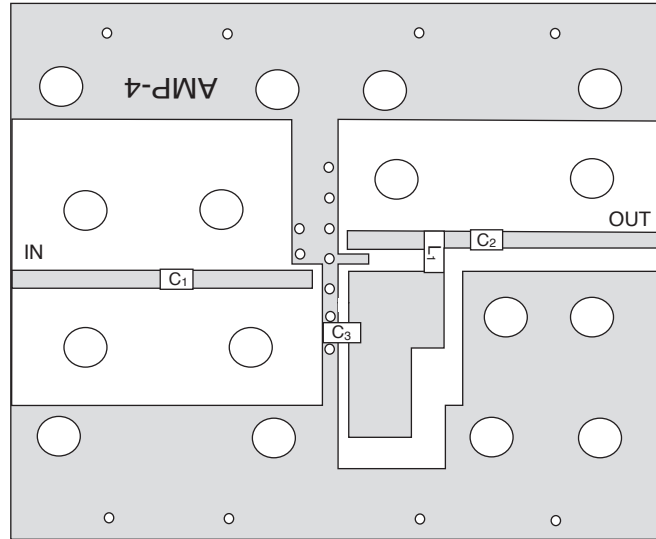
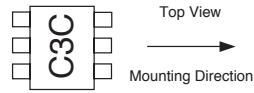
Vcc = Vout = 3.0 V, Icc = 4.0 mA

| FREQUENCY GHz | S11 | | S21 | | S12 | | S22 | |
|------------------|-------|--------|-------|--------|-------|-------|-------|-------|
| | MAG | ANG | MAG | ANG | MAG | ANG | MAG | ANG |
| 0.1 | 0.824 | -17.1 | 1.181 | -177.7 | 0.002 | 108.8 | 0.996 | -2.4 |
| 0.2 | 0.692 | -25.9 | 1.181 | -172.4 | 0.003 | 64.7 | 0.986 | -4.0 |
| 0.3 | 0.594 | -29.2 | 1.247 | -167.4 | 0.004 | 51.3 | 0.980 | -5.8 |
| 0.4 | 0.533 | -30.7 | 1.370 | -164.1 | 0.005 | 55.8 | 0.965 | -7.5 |
| 0.5 | 0.499 | -31.1 | 1.514 | -162.4 | 0.005 | 60.6 | 0.958 | -8.6 |
| 0.6 | 0.474 | -32.0 | 1.677 | -162.9 | 0.006 | 46.6 | 0.950 | -10.1 |
| 0.7 | 0.460 | -32.7 | 1.885 | -163.8 | 0.006 | 42.9 | 0.941 | -11.2 |
| 0.8 | 0.450 | -34.0 | 2.050 | -166.3 | 0.006 | 45.9 | 0.935 | -12.4 |
| 0.9 | 0.441 | -35.6 | 2.237 | -169.2 | 0.005 | 42.1 | 0.929 | -13.8 |
| 1.0 | 0.438 | -37.7 | 2.460 | -173.1 | 0.007 | 34.0 | 0.918 | -14.9 |
| 1.1 | 0.431 | -39.8 | 2.627 | -177.3 | 0.007 | 46.9 | 0.914 | -16.0 |
| 1.2 | 0.426 | -42.0 | 2.772 | 178.4 | 0.005 | 27.7 | 0.903 | -17.0 |
| 1.3 | 0.427 | -44.8 | 2.965 | 173.2 | 0.005 | 40.2 | 0.895 | -18.3 |
| 1.4 | 0.417 | -48.1 | 3.123 | 168.0 | 0.004 | 24.4 | 0.891 | -19.5 |
| 1.5 | 0.413 | -50.6 | 3.199 | 161.8 | 0.006 | 45.5 | 0.884 | -20.4 |
| 1.6 | 0.408 | -54.6 | 3.351 | 156.8 | 0.005 | 44.6 | 0.877 | -21.1 |
| 1.7 | 0.398 | -57.6 | 3.345 | 151.2 | 0.003 | 42.4 | 0.867 | -22.1 |
| 1.8 | 0.387 | -61.6 | 3.103 | 145.5 | 0.005 | 44.6 | 0.877 | -21.1 |
| 1.9 | 0.380 | -64.9 | 3.361 | 140.9 | 0.005 | 59.5 | 0.859 | -24.4 |
| 2.0 | 0.366 | -69.1 | 3.375 | 136.3 | 0.004 | 45.4 | 0.852 | -25.1 |
| 2.1 | 0.352 | -72.1 | 3.350 | 132.3 | 0.003 | 58.3 | 0.846 | -25.9 |
| 2.2 | 0.341 | -75.6 | 3.304 | 127.9 | 0.003 | 73.9 | 0.847 | -26.4 |
| 2.3 | 0.330 | -79.4 | 3.347 | 124.8 | 0.006 | 81.1 | 0.839 | -27.4 |
| 2.4 | 0.320 | -82.4 | 3.325 | 121.2 | 0.006 | 98.3 | 0.839 | -28.2 |
| 2.5 | 0.304 | -85.6 | 3.275 | 117.3 | 0.006 | 100.5 | 0.838 | -29.1 |
| 2.6 | 0.296 | -88.2 | 3.284 | 113.7 | 0.004 | 114.6 | 0.834 | -29.7 |
| 2.7 | 0.285 | -91.7 | 3.283 | 111.0 | 0.005 | 104.8 | 0.830 | -30.6 |
| 2.8 | 0.272 | -94.3 | 3.224 | 106.5 | 0.005 | 114.1 | 0.831 | -31.4 |
| 2.9 | 0.267 | -96.9 | 3.333 | 104.3 | 0.008 | 127.8 | 0.837 | -32.0 |
| 3.0 | 0.256 | -99.5 | 3.251 | 101.1 | 0.009 | 126.3 | 0.831 | -33.4 |
| 3.1 | 0.248 | -101.9 | 3.381 | 96.0 | 0.008 | 134.1 | 0.833 | -34.0 |

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD

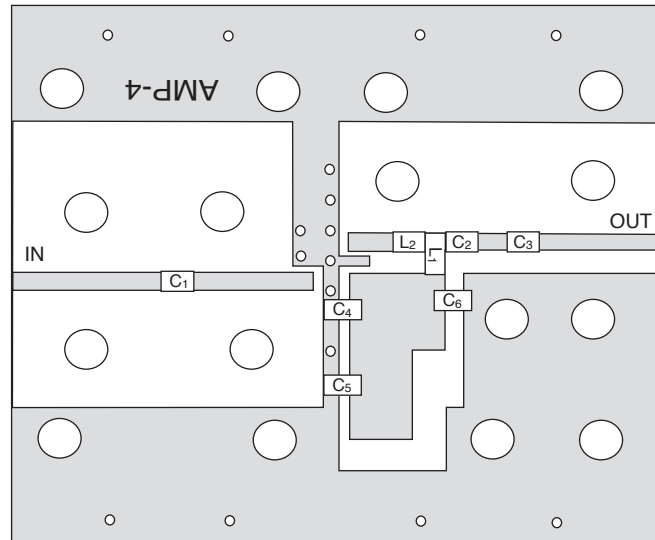
COMPONENT LIST

| 1.0 GHz Output Port Matching | |
|------------------------------|---------|
| C1 | 1000 pF |
| C2 | 0.75 pF |
| C3 | 10 pF |
| L1 | 12 nH |



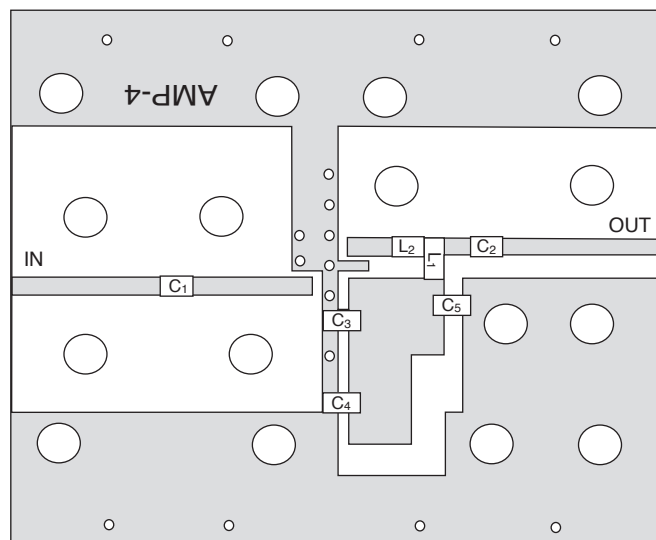
COMPONENT LIST

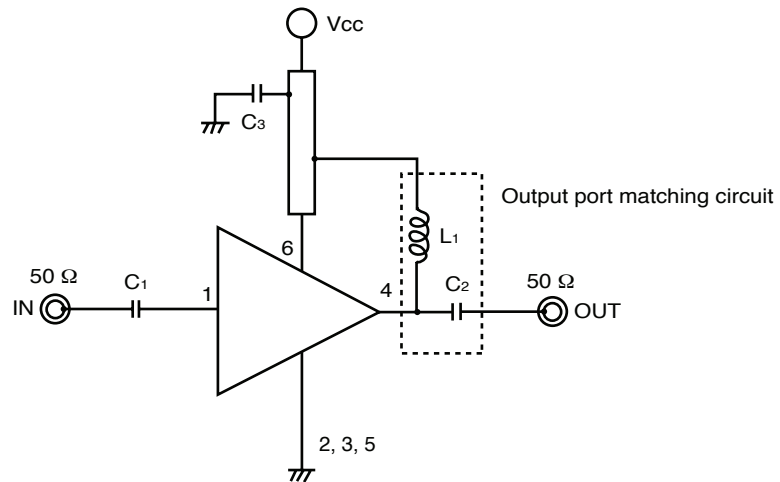
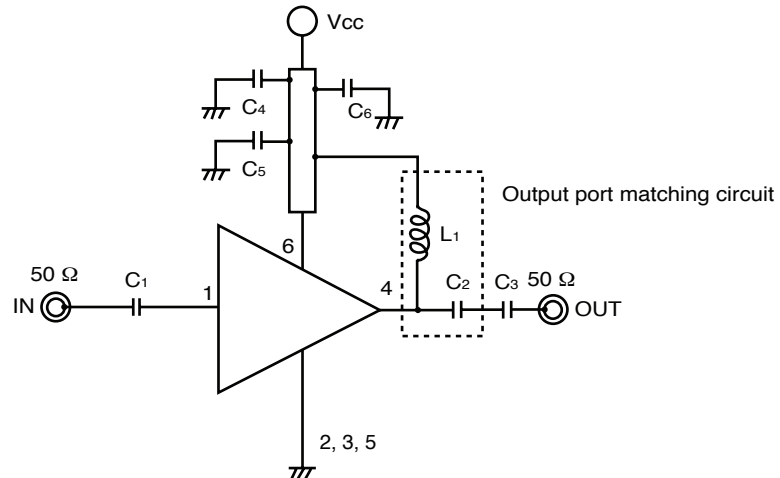
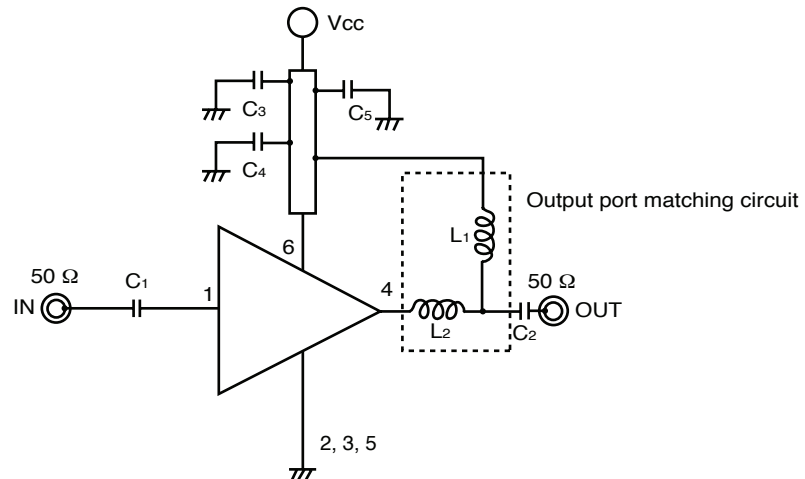
| 1.9GHz Output Port Matching | |
|-----------------------------|---------|
| C1, C3, C5, C6 | 1000 pF |
| C2 | 0.75 pF |
| C4 | 10 pF |
| L1 | 3.3 nH |



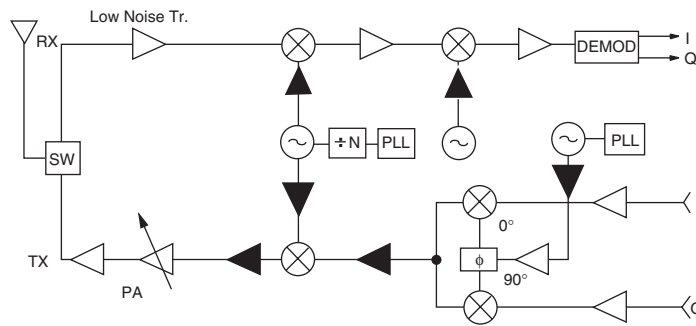
COMPONENT LIST

| 2.4 GHz Output Port Matching | |
|------------------------------|---------|
| C1, C2, C4, C5 | 1000 pF |
| C3 | 10 pF |
| L1 | 1.8 nH |
| L2 | 2.7 nH |

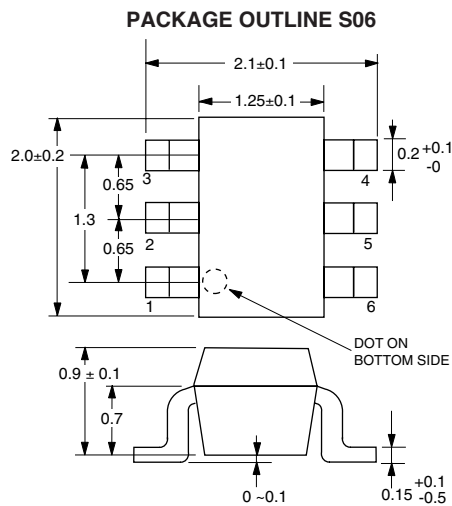


TEST CIRCUITS<1> $f = 1.0 \text{ GHz}$ <2> $f = 1.9 \text{ GHz}$ <3> $f = 2.4 \text{ GHz}$ 

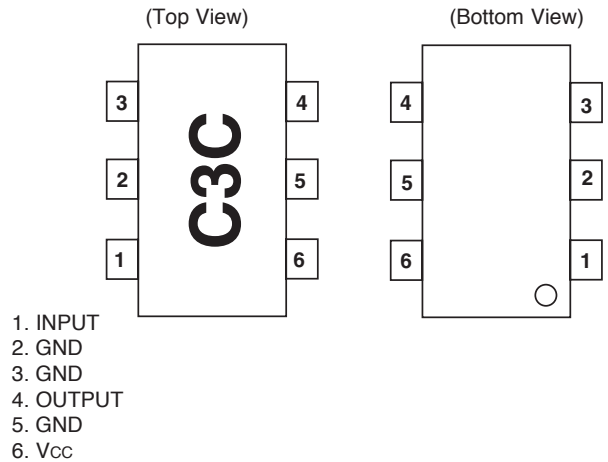
SYSTEM APPLICATION EXAMPLE



OUTLINE DIMENSIONS (Units in mm)

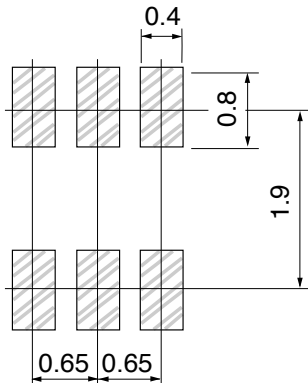


LEAD CONNECTIONS



RECOMMENDED P.C.B. LAYOUT (Units in mm)

Note:
All dimensions are typical unless otherwise specified.



ORDERING INFORMATION

| PART NUMBER | QTY |
|----------------|---------|
| UPC8179TB-E3-A | 3K/Reel |

Note:
Embossed tape, 8 mm wide. Pins 1, 2, 3 are in tape pull-out direction.

Life Support Applications

These NEC products are not intended for use in life support devices, appliances, or systems where the malfunction of these products can reasonably be expected to result in personal injury. The customers of CEL using or selling these products for use in such applications do so at their own risk and agree to fully indemnify CEL for all damages resulting from such improper use or sale.

EXCLUSIVE NORTH AMERICAN AGENT FOR NEC RF, MICROWAVE & OPTOELECTRONIC SEMICONDUCTORS

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05/03/2006

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

| Restricted Substance per RoHS | Concentration Limit per RoHS (values are not yet fixed) | Concentration contained in CEL devices | |
|-------------------------------|---|--|-----|
| | | -A | -AZ |
| Lead (Pb) | < 1000 PPM | Not Detected | (*) |
| Mercury | < 1000 PPM | Not Detected | |
| Cadmium | < 100 PPM | Not Detected | |
| Hexavalent Chromium | < 1000 PPM | Not Detected | |
| PBB | < 1000 PPM | Not Detected | |
| PBDE | < 1000 PPM | Not Detected | |

If you should have any additional questions regarding our devices and compliance to environmental standards, please do not hesitate to contact your local representative.

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Данный компонент на территории Российской Федерации

Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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