



# **NEC's BROADBAND GaAs MMIC DPDT SWITCH FOR 2.4 GHz AND 5 GHz WLAN**

## **UPG2035T5F**

### FEATURES

- **OPERATING FREQUENCY:**  
2.4 to 2.5 GHz and 4.9 to 6.0 GHz (specified)  
2.0 to 6.0 GHz Broadband Operation (unspecified)
- **LOW INSERTION LOSS:**  
0.8 dB TYP. @ 2.4 to 2.5 GHz  
1.2 dB TYP. @ 4.9 to 6.0 GHz
- **POWER HANDLING:**  
 $P_{in}$  (1 dB) = +31 dBm TYP. @ 2.4 to 2.5 GHz  
+30 dBm TYP. @ 4.9 to 6.0 GHz
- **CONTROL VOLTAGE:**  
+3.0 V / 0 V (Dual control)
- **HIGH ISOLATION:**  
INPUT to OUTPUT = 34 dB TYP. @ 2.4 to 2.5 GHz  
INPUT to OUTPUT = 33 dB TYP. @ 4.9 to 6.0 GHz  
TX to RX, ANT1 to ANT2 = 24 dB TYP. @ 2.4 to 2.5 GHz  
TX to RX, ANT1 to ANT2 = 22 dB TYP. @ 4.9 to 6.0 GHz
- **INPUT/OUTPUT RETURN LOSS:**  
15 dB TYP.
- **SWITCHING SPEED:**  
50 ns @  $t_{RISE}/t_{FALL}$  (10/90% RF)
- **12-PIN PLASTIC QFN PACKAGE:**  
(3.0 × 3.0 × 0.75 mm)
- **Pb FREE**

### DESCRIPTION

NEC's UPG2035T5F is a GaAs MMIC DPDT switch for 2.4 GHz and 5 GHz dualband Wireless LAN.

The UPG2035T5F features low insertion loss, high isolation, and dualband operation.

### APPLICATIONS

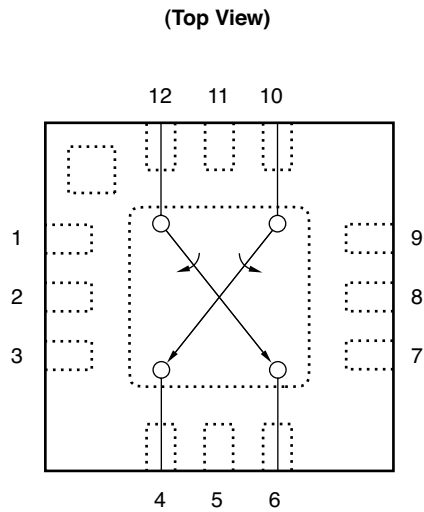
- 802.11a+b/g WIRELESS LAN
- 2.0 TO 6.0 GHz T/R SWITCHING
- 2.0 TO 6.0 GHz ANTENNA DIVERSITY SWITCHING

### ORDERING INFORMATION

| PART NUMBER     | ORDER NUMBER    | PACKAGE                         | MARKING | SUPPLYING FORM                                                                                                                                              |
|-----------------|-----------------|---------------------------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UPG2035T5F-E2-A | UPG2035T5F-E2-A | 12-pin plastic QFN<br>(Pb-Free) | 2035    | <ul style="list-style-type: none"> <li>• Embossed tape 8 mm wide</li> <li>• Pin 1 indicates roll-in direction of tape</li> <li>• Qty 3 kpcs/reel</li> </ul> |

**Remark** To order evaluation samples, contact your nearby sales office.  
Part number for sample order: UPG2035T5F-A

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



| PIN NO.     | PIN NAME           | DESCRIPTION    |
|-------------|--------------------|----------------|
| 1           | NC                 | Ground         |
| 2           | NC                 | Ground         |
| 3           | V <sub>cont1</sub> | Control 1      |
| 4           | ANT1               | Antenna Port 1 |
| 5           | NC                 | Ground         |
| 6           | ANT2               | Antenna Port 2 |
| 7           | V <sub>cont2</sub> | Control 2      |
| 8           | NC                 | Ground         |
| 9           | NC                 | Ground         |
| 10          | RX                 | Receive Port   |
| 11          | NC                 | Ground         |
| 12          | TX                 | Transmit Port  |
| EXPOSED PAD | GND                | Ground         |

**Remark** NC indicates functionally non-connected pins, but actual grounding is recommended.

TRUTH TABLE

| V <sub>cont1</sub> | V <sub>cont2</sub> | ANT1-RX | ANT1-TX | ANT2-TX | ANT2-RX |
|--------------------|--------------------|---------|---------|---------|---------|
| 2.7 to 5.0 V       | 0 ± 0.2 V          | ON      | OFF     | ON      | OFF     |
| 0 ± 0.2 V          | 2.7 to 5.0 V       | OFF     | ON      | OFF     | ON      |

ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = +25°C, unless otherwise specified)

| PARAMETER                     | SYMBOL            | RATINGS                        | UNIT |
|-------------------------------|-------------------|--------------------------------|------|
| Switch Control Voltage        | V <sub>cont</sub> | −6.0 to +6.0 <sup>Note 1</sup> | V    |
| Input Power                   | P <sub>in</sub>   | +36                            | dBm  |
| Total Power Dissipation       | P <sub>tot</sub>  | 0.15 <sup>Note 2</sup>         | W    |
| Operating Ambient Temperature | T <sub>A</sub>    | −45 to +85                     | °C   |
| Storage Temperature           | T <sub>stg</sub>  | −55 to +150                    | °C   |

- Notes**
- 1.  $|V_{cont1} - V_{cont2}| \leq 6.0\text{ V}$
  - 2. Mounted on double-sided copper-clad 50 × 50 × 1.6 mm epoxy glass PWB, T<sub>A</sub> = +85°C

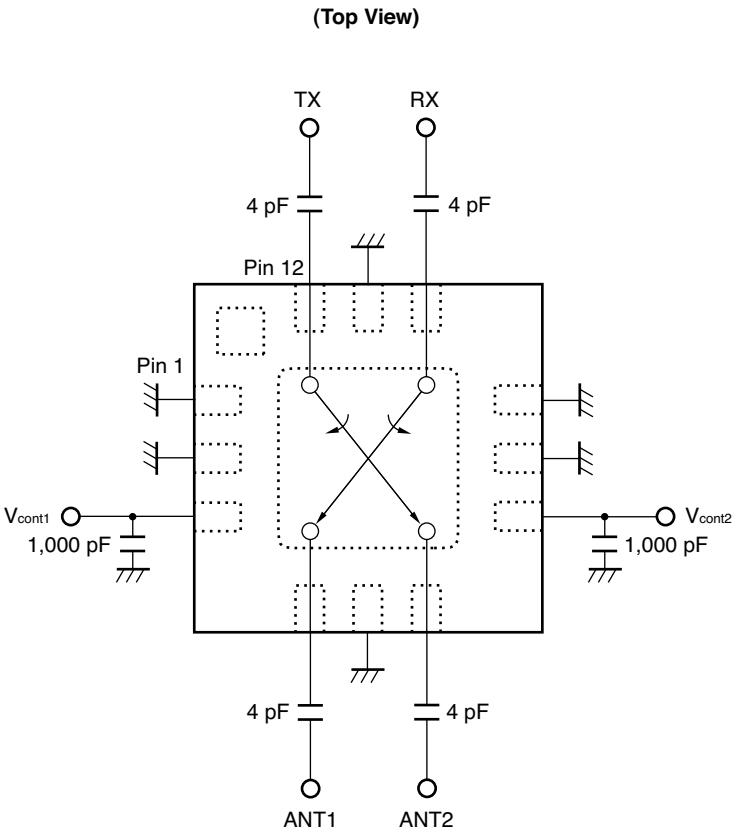
**RECOMMENDED OPERATING RANGE** ( $T_A = +25^\circ\text{C}$ )

| PARAMETER                  | SYMBOL                | MIN. | TYP. | MAX. | UNIT |
|----------------------------|-----------------------|------|------|------|------|
| Operating Frequency 1      | f1                    | 2.4  | –    | 2.5  | GHz  |
| Operating Frequency 2      | f2                    | 4.9  | –    | 6.0  | GHz  |
| Switch Control Voltage (H) | V <sub>cont</sub> (H) | 2.7  | 3.0  | 5.0  | V    |
| Switch Control Voltage (L) | V <sub>cont</sub> (L) | –0.2 | 0    | 0.2  | V    |

**ELECTRICAL CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ , V<sub>cont</sub> = 3.0 V/0 V, Z<sub>0</sub> = 50  $\Omega$ , DC blocking capacitors value: 4 pF,  
 Each port, unless otherwise specified)

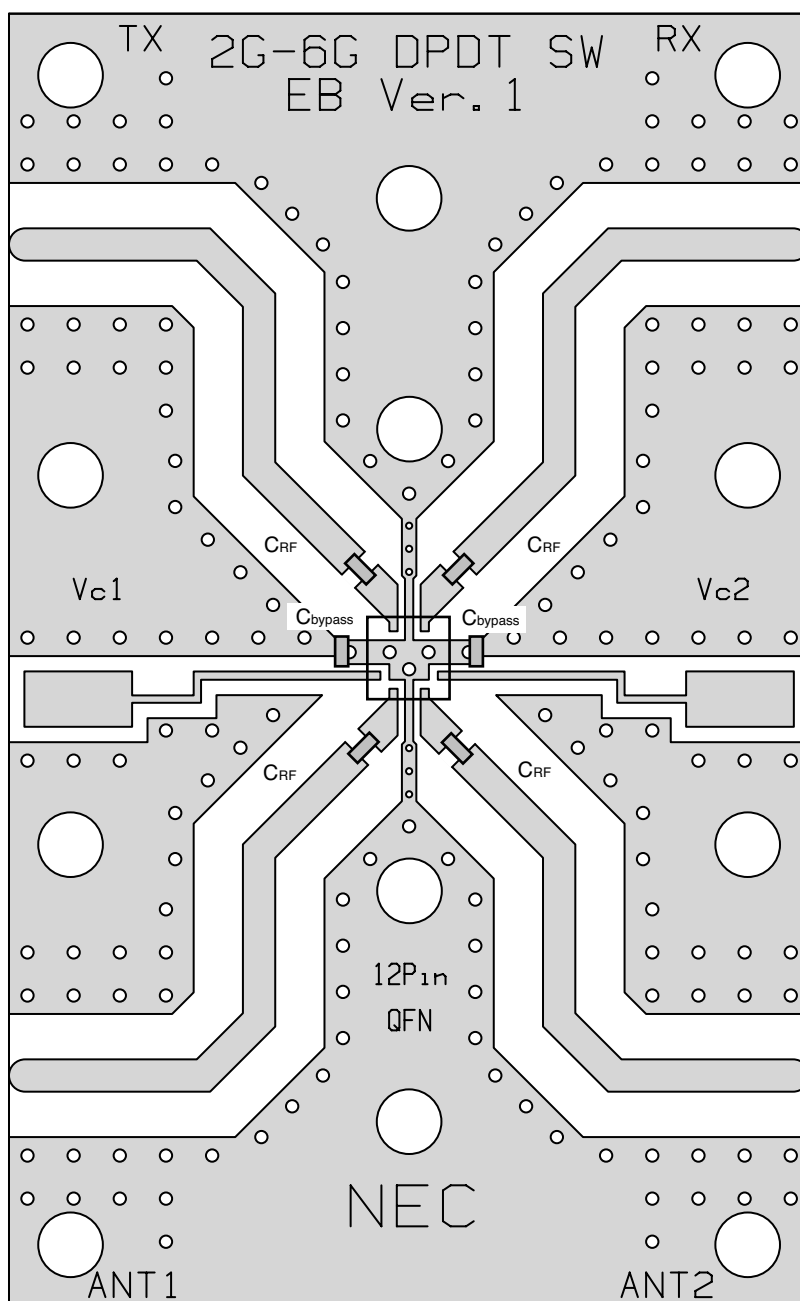
| PARAMETER                                       | SYMBOL                 | TEST CONDITIONS                                                         | MIN. | TYP. | MAX. | UNIT          |
|-------------------------------------------------|------------------------|-------------------------------------------------------------------------|------|------|------|---------------|
| Insertion Loss 1                                | L <sub>INS1</sub>      | f = 2.4 to 2.5 GHz                                                      | –    | 0.8  | 1.0  | dB            |
| Insertion Loss 2                                | L <sub>INS2</sub>      | f = 4.9 to 6.0 GHz                                                      | –    | 1.2  | 1.4  | dB            |
| Isolation 1 (INPUT to OUTPUT)                   | ISL1                   | f = 2.4 to 2.5 GHz                                                      | 25   | 34   | –    | dB            |
| Isolation 2 (INPUT to OUTPUT)                   | ISL2                   | f = 4.9 to 6.0 GHz                                                      | 25   | 33   | –    | dB            |
| Isolation 3 (TX to RX, ANT1 to ANT2)            | ISL3                   | f = 2.4 to 2.5 GHz                                                      | 17   | 24   | –    | dB            |
| Isolation 4 (TX to RX, ANT1 to ANT2)            | ISL4                   | f = 4.9 to 6.0 GHz                                                      | 17   | 22   | –    | dB            |
| Input and Output Return Loss 1                  | RL1                    | f = 2.4 to 2.5 GHz                                                      | –    | 15   | –    | dB            |
| Input and Output Return Loss 2                  | RL2                    | f = 4.9 to 6.0 GHz                                                      | –    | 15   | –    | dB            |
| Switch Control Current 1                        | I <sub>cont</sub> 1    | f = 2.4 to 2.5 GHz                                                      | –    | 0.7  | 1.5  | $\mu\text{A}$ |
| Switch Control Current 2                        | I <sub>cont</sub> 2    | f = 4.9 to 6.0 GHz                                                      | –    | 0.7  | 1.5  | $\mu\text{A}$ |
| 1 dB Gain Compression<br>Input Power            | P <sub>in</sub> (1 dB) | f = 2.4 to 2.5 GHz                                                      | –    | 31   | –    | dBm           |
|                                                 |                        | f = 4.9 to 6.0 GHz                                                      | –    | 30   | –    |               |
| 3rd Order Distortion Input Intercept<br>Point 1 | IIP <sub>3</sub> 1     | f = 2.4 to 2.5 GHz                                                      | –    | 45   | –    | dBm           |
| 3rd Order Distortion Input Intercept<br>Point 2 | IIP <sub>3</sub> 2     | f = 4.9 to 6.0 GHz                                                      | –    | 45   | –    | dBm           |
| Switch Control Speed 1                          | t <sub>sw</sub> 1      | f = 2.4 to 2.5 GHz,<br>t <sub>RISE</sub> /t <sub>FALL</sub> (10/90% RF) | –    | 50   | –    | ns            |
| Switch Control Speed 2                          | t <sub>sw</sub> 2      | f = 4.9 to 6.0 GHz,<br>t <sub>RISE</sub> /t <sub>FALL</sub> (10/90% RF) | –    | 50   | –    | ns            |

EVALUATION CIRCUIT



This application circuit and its parameters are for reference only.

## ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD

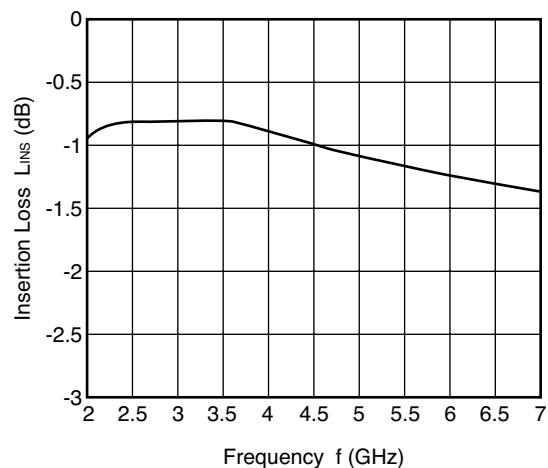


## USING THE NEC EVALUATION BOARD

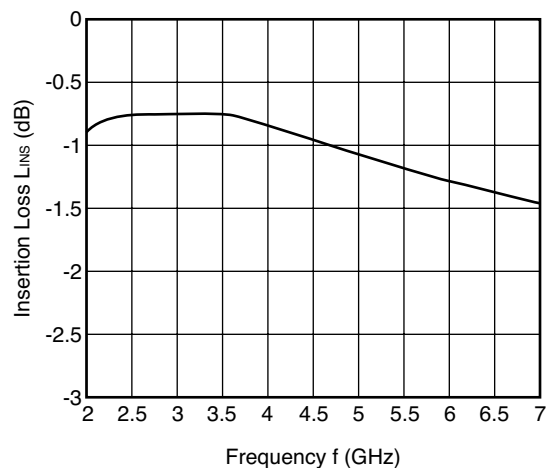
| SYMBOL  | FORM           | RATING   | PART NUMBER          | MANUFACTURER |
|---------|----------------|----------|----------------------|--------------|
| CRF     | Chip Capacitor | 4 pF     | GRM1552C1H4R0CZ01B   | muRata       |
| Cbypass | Chip Capacitor | 1 000 pF | GRM155B11H102KA01B   | muRata       |
| –       | PC Terminal    | –        | A2-2PA-2.54DSA       | Hirose       |
| –       | RF Connector   | –        | 142-0721-821         | Johnson      |
| –       | PWB            | –        | RO4003 (t = 0.51 mm) | Rogers       |

**TYPICAL CHARACTERISTICS** ( $T_A = +25^{\circ}\text{C}$ ,  $V_{\text{cont}} = 3.0 \text{ V/0 V}$ ,  $Z_0 = 50 \Omega$ , DC block capacitor = 4 pF  
using test fixture, unless otherwise specified)

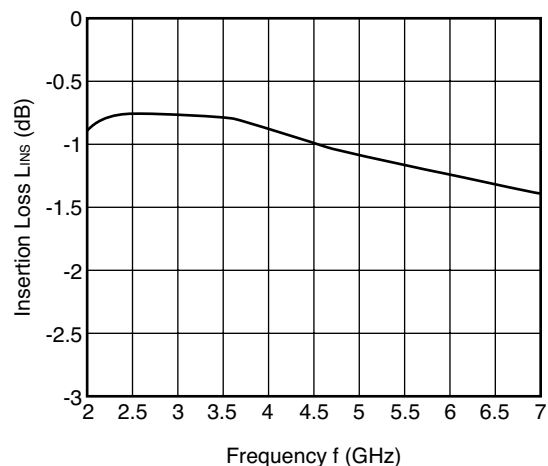
TX-ANT1 INSERTION LOSS vs. FREQUENCY  
(When TX-ANT1 and ANT2-RX are ON)



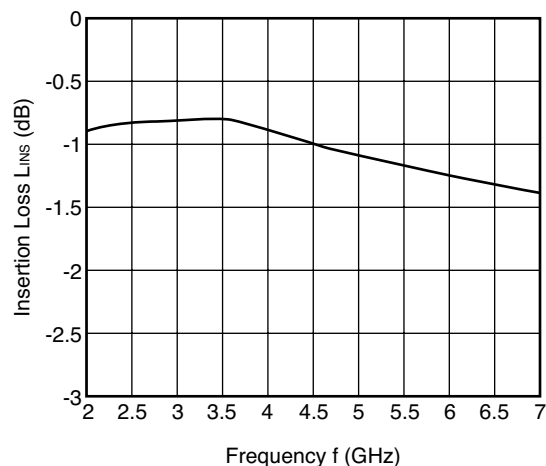
ANT1-RX INSERTION LOSS vs. FREQUENCY  
(When TX-ANT2 and ANT1-RX are ON)



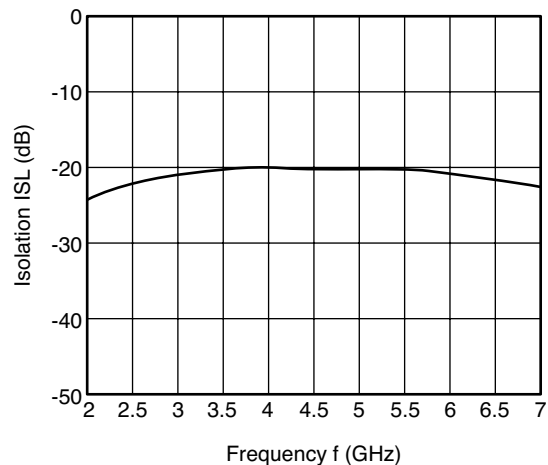
TX-ANT2 INSERTION LOSS vs. FREQUENCY  
(When TX-ANT2 and ANT1-RX are ON)



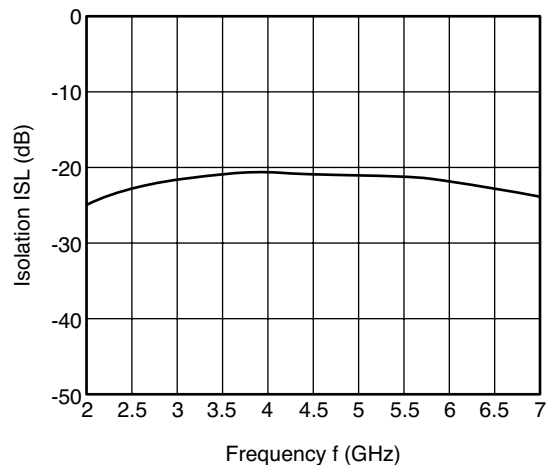
ANT2-RX INSERTION LOSS vs. FREQUENCY  
(When TX-ANT1 and ANT2-RX are ON)



TX-RX ISOLATION vs. FREQUENCY  
(When TX-ANT2 and ANT1-RX are ON)

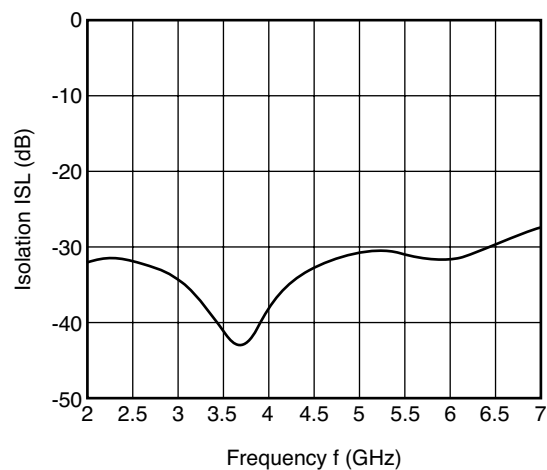


TX-RX ISOLATION vs. FREQUENCY  
(When TX-ANT1 and ANT2-RX are ON)

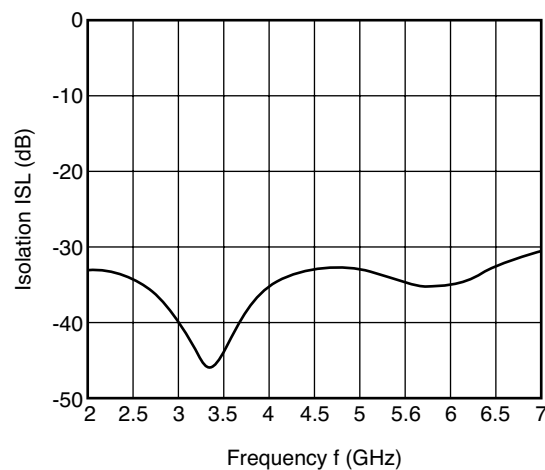


**Remark** The graphs indicate nominal characteristics.

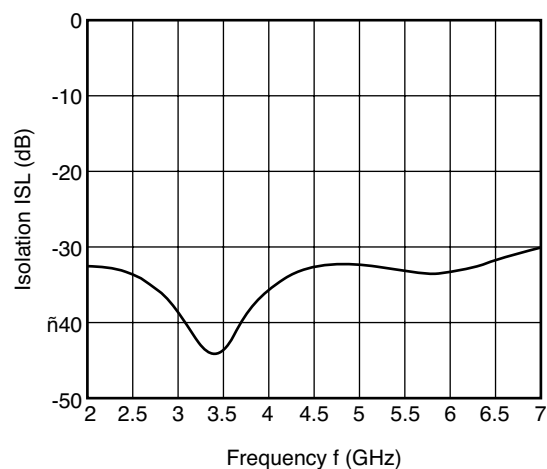
TX-ANT1 ISOLATION vs. FREQUENCY  
(When TX-ANT2 and ANT1-RX are ON)



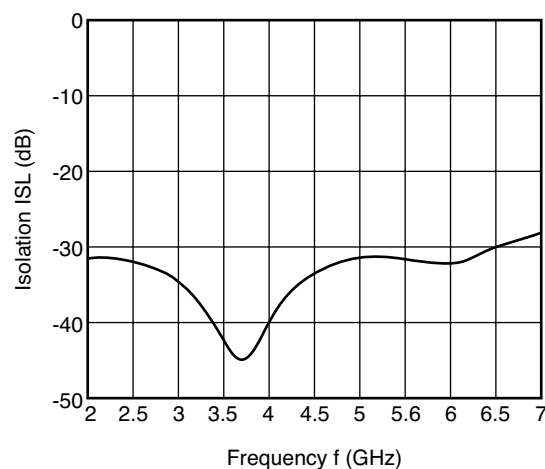
ANT1-RX ISOLATION vs. FREQUENCY  
(When TX-ANT1 and ANT2-RX are ON)



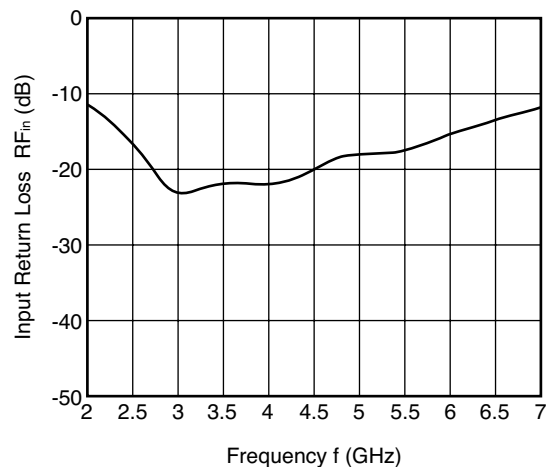
TX-ANT2 ISOLATION vs. FREQUENCY  
(When TX-ANT1 and ANT2-RX are ON)



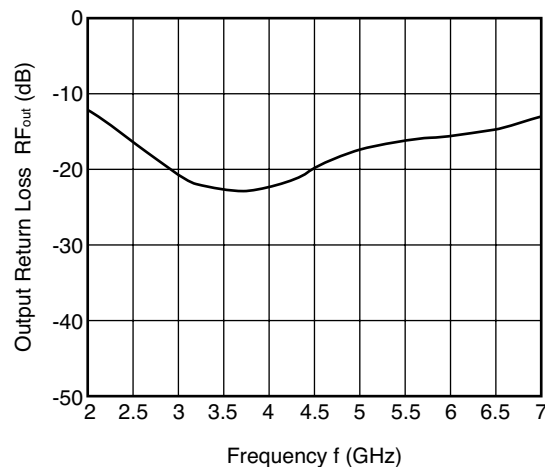
ANT2-RX ISOLATION vs. FREQUENCY  
(When TX-ANT2 and ANT1-RX are ON)



TX-ANT1 INPUT RETURN LOSS vs. FREQUENCY  
(When TX-ANT1 and ANT2-RX are ON)

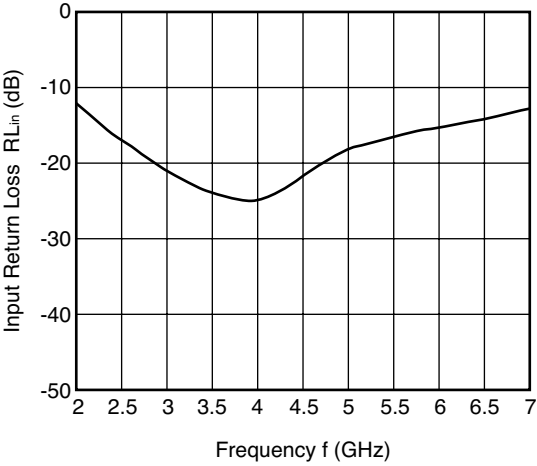


ANT1-RX OUTPUT RETURN LOSS vs. FREQUENCY  
(When TX-ANT2 and ANT1-RX are ON)

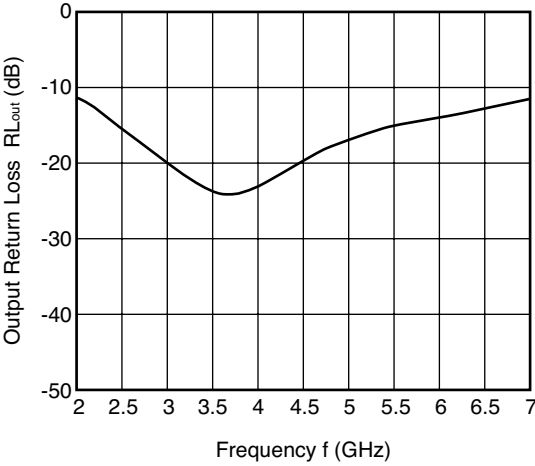


**Remark** The graphs indicate nominal characteristics.

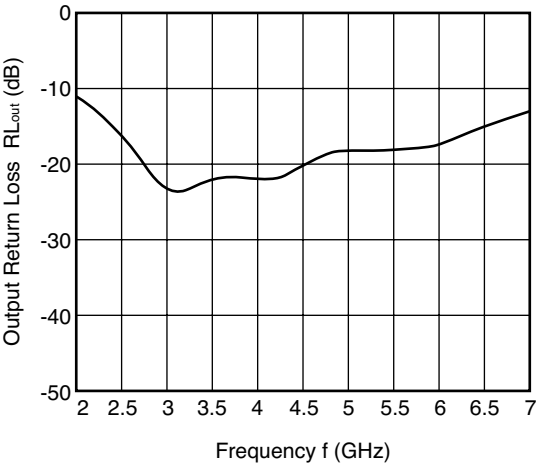
TX-ANT2 INPUT RETURN LOSS vs. FREQUENCY  
(When TX-ANT2 and ANT1-RX are ON)



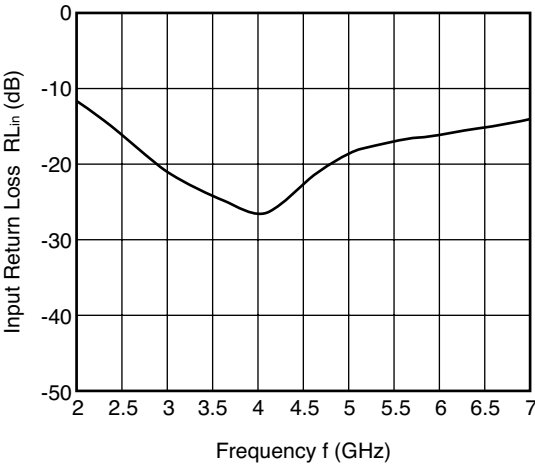
ANT2-RX OUTPUT RETURN LOSS vs. FREQUENCY  
(When TX-ANT1 and ANT2-RX are ON)



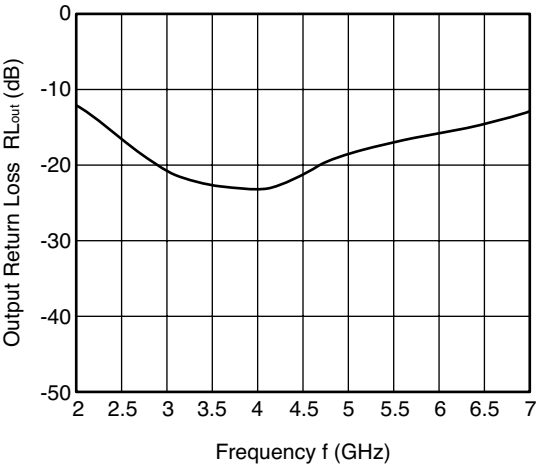
TX-ANT1 OUTPUT RETURN LOSS vs. FREQUENCY  
(When TX-ANT1 and ANT2-RX are ON)



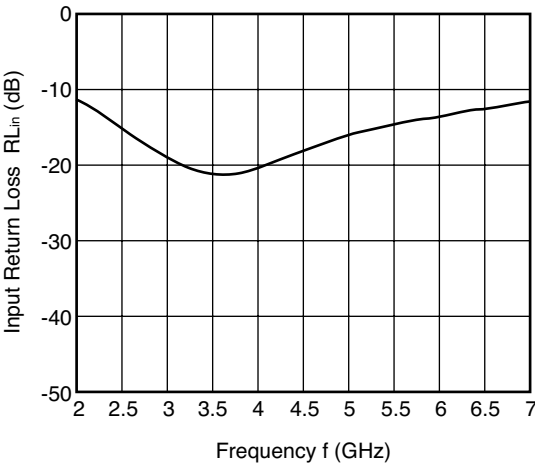
ANT1-RX INPUT RETURN LOSS vs. FREQUENCY  
(When TX-ANT2 and ANT1-RX are ON)



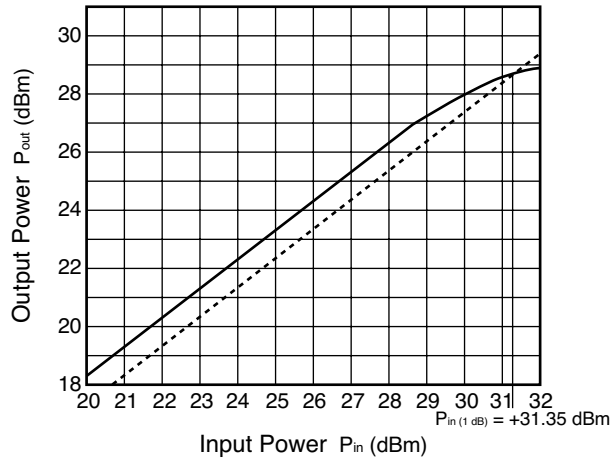
TX-ANT2 OUTPUT RETURN LOSS vs. FREQUENCY  
(When TX-ANT2 and ANT1-RX are ON)



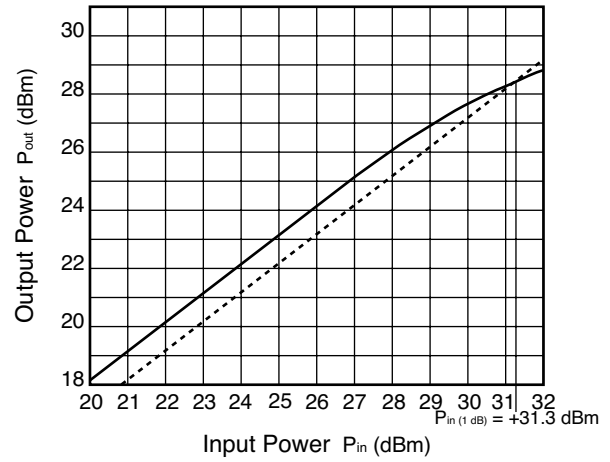
ANT2-RX INPUT RETURN LOSS vs. FREQUENCY  
(When TX-ANT1 and ANT2-RX are ON)



OUTPUT POWER vs. INPUT POWER  
(f = 2.4 GHz)

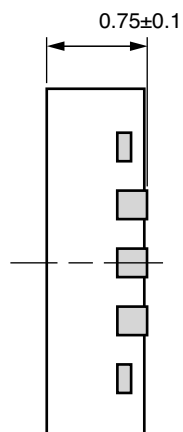
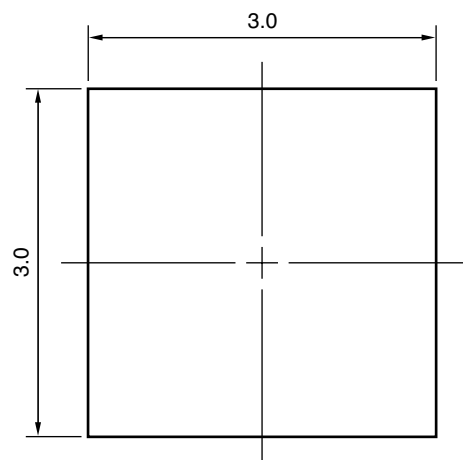


OUTPUT POWER vs. INPUT POWER  
(f = 5.8 GHz)

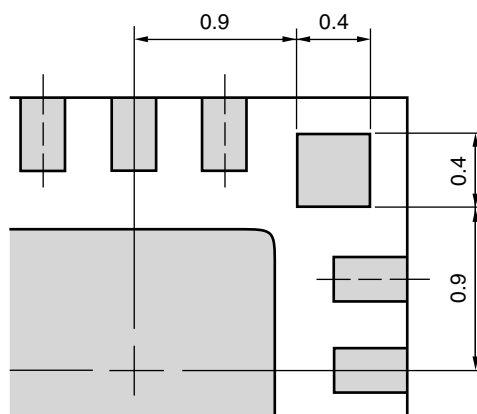
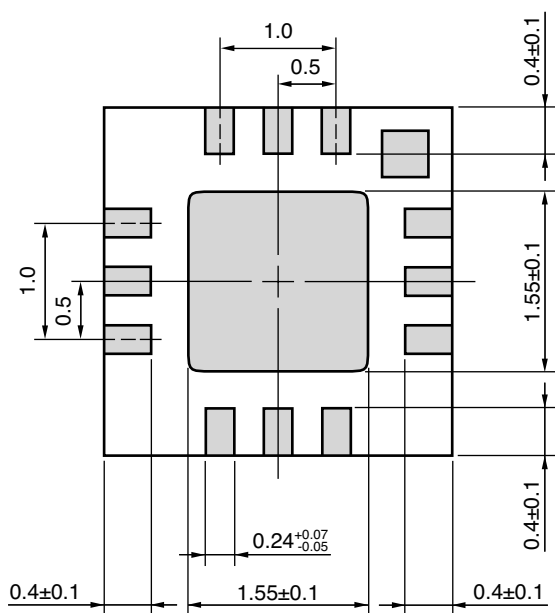


## PACKAGE DIMENSIONS

## 12-PIN QFN (UNIT:mm)



(Bottom View)



Dimensions of pin No.1 indication

## 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<br>Time at peak temperature : 10 seconds or less<br>Time at temperature of 220°C or higher : 60 seconds or less<br>Preheating time at 120 to 180°C : 120±30 seconds<br>Maximum number of reflow processes : 3 times<br>Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below | IR260            |
| Wave Soldering   | Peak temperature (molten solder temperature) : 260°C or below<br>Time at peak temperature : 10 seconds or less<br>Preheating temperature (package surface temperature) : 120°C or below<br>Maximum number of flow processes : 1 time<br>Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below                                                | WS260            |
| Partial Heating  | Peak temperature (pin temperature) : 350°C or below<br>Soldering time (per side of device) : 3 seconds or less<br>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).

### 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.

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DATA SUBJECT TO CHANGE WITHOUT NOTICE

05/04/2005

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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<br>per RoHS | Concentration Limit per RoHS<br>(values are not yet fixed) | Concentration contained<br>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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- Поставка сложных, дефицитных, либо снятых с производства позиций;
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- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.