

# NEC's L, S-BAND HIGH POWER SPDT SWITCH

# **UPG2009TB**

#### **FEATURES**

#### · LOW INSERTION LOSS:

0.25 dB TYP. @ Vcont1/2 = 2.8 V/0 V, f = 1.0 GHz 0.30 dB TYP. @ Vcont1/2 = 2.8 V/0 V, f = 2.0 GHz

#### · HIGH ISOLATION:

28 dB TYP. @  $V_{cont1/2} = 2.8 \text{ V/0 V}$ , f = 2.0 GHz

#### POWER HANDLING:

Pin (0.1dB) = 34 dBm TYP. @ Vcont1/2 = 2.8 V/0 V, f = 1.0 GHz

- · BIDIRECTIONAL, SYMMETRICAL
- 6-PIN SUPER MINIMOLD PACKAGE ( $2.0 \times 1.25 \times 0.9$  mm)

#### DESCRIPTION

NEC's UPG2009TB is a L, S-band SPDT (Single Pole Double Throw) GaAs FET switch for digital cellular or cordless telephone application. The device can operate from 500 MHz to 2.5 GHz, with low insertion loss and high isolation.

#### **APPLICATIONS**

- · L-band digital cellular or cordless telephone
- Bluetooth<sup>TM</sup>, W-LAN and WLL
- · Short Range Wireless

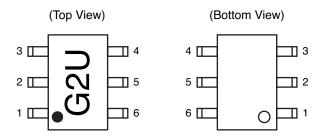
#### ORDERING INFORMATION

| Part Number    | Package              | Marking | Supplying Form  |
|----------------|----------------------|---------|---|
| UPG2009TB-E3-A | 6-pin super minimold | G2U     | 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, contact your nearby sales office. Part number for sample order: UPG2009TB-A

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

## **PIN CONNECTIONS**



| Pin No. | Pin Name |  |
|---------|----------|--|
| 1       | OUT1     |  |
| 2       | GND      |  |
| 3       | OUT2     |  |
| 4       | VCont2   |  |
| 5       | IN       |  |
| 6       | VCont1   |  |

### ABSOLUTE MAXIMUM RATINGS (TA = 25°C, unless otherwise specified)

| Parameter                     | Symbol           | Ratings            | Unit |
|-------------------------------|------------------|--------------------|------|
| Control Voltage 1, 2          | Vcont1, 2        | -6.0 to +6.0 Note1 | V    |
| Input Power                   | Pin              | +36                | dBm  |
| Total Power Dissipation       | P <sub>tot</sub> | 0.15               | W    |
| Operating Ambient Temperature | TA               | -45 to +85         | °C   |
| Storage Temperature           | T <sub>stg</sub> | -55 to +150        | °C   |

Note | V<sub>cont1</sub> - V<sub>cont2</sub> | ≤ 6.0 V

## **RECOMMENDED OPERATING RANGE** (TA = 25°C)

| Parameter              | Symbol                | MIN. | TYP. | MAX. | Unit |
|------------------------|-----------------------|------|------|------|------|
| Control Voltage (High) | Vcont (H)             | +2.7 | +2.8 | +3.0 | V    |
| Control Voltage (Low)  | V <sub>cont (L)</sub> | -0.2 | 0    | +0.2 | V    |

#### **ELECTRICAL CHARACTERISTICS**

(TA = +25°C, Vcont1 = 2.8 V, Vcont2 = 0 V or Vcont1 = 0 V, Vcont2 = 2.8,  $Z_0 = 50 \Omega$ , off chip DC blocking capacitors value; 56 pF, unless otherwise specified)

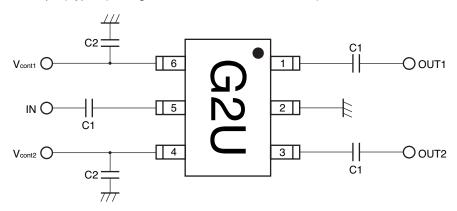
| Parameter              | Symbol      | Test Conditions                             | MIN. | TYP. | MAX. | Unit |
|------------------------|-------------|---|------|------|------|------|
| Insertion Loss         | Lins        | f = 0.5 to 1.0 GHz                          | -    | 0.25 | 0.45 | dB   |
|                        |             | f = 2.0 GHz                                 | -    | 0.30 | 0.50 | dB   |
|                        |             | f = 2.5 GHz                                 | -    | 0.40 | -    | dB   |
| Isolation              | ISL         | f = 0.5 to 2.0 GHz                          | 24   | 28   | -    | dB   |
|                        |             | f = 2.5 GHz                                 | -    | 25   | -    | dB   |
| Input Return Loss      | RLin        | f = 0.5 to 2.5 GHz                          | 15   | 20   | -    | dB   |
| Output Return Loss     | RLout       | f = 0.5 to 2.5 GHz                          | 15   | 20   | -    | dB   |
| Input Power at 0.1 dB  | Pin(0.1 dB) | f = 1.0 GHz,                                | 32.5 | 34   | -    | dBm  |
| Compression Point Note |             | V <sub>cont</sub> = 2.8 V/0 V               |      |      |      |      |
| 2nd Harmonics          | 2f0         | f = 1.0 GHz, V <sub>cont</sub> = 2.8 V/0 V, | 65   | 75   | -    | dBc  |
|                        |             | P <sub>in</sub> = 30.5 dBm                  |      |      |      |      |
| 3rd Harmonics          | 3f0         | f = 1.0 GHz, V <sub>cont</sub> = 2.8 V/0 V, | 65   | 75   | -    | dBc  |
|                        |             | P <sub>in</sub> = 30.5 dBm                  |      |      |      |      |
| Switching Speed        | tsw         |   | -    | 150  | -    | ns   |
| Control Current        | Icont       | V <sub>cont</sub> = 2.8 V/0 V, RF Non       | -    | 1    | 50   | μΑ   |

**Note** Pin (0.1 dB) is the measured input power level when the insertion loss increases 0.1 dB more than that of linear range. All other characteristics are measured in linear range.

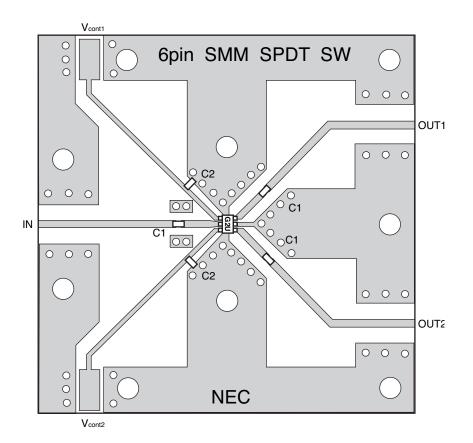
Caution It is necessary to use DC blocking capacitors with the device.

The value of DC blocking capacitors should be chosen to accommodate the frequency of operation, bandwidth, switching speed and the condition with actual board of your system. The range of recommended DC blocking capacitor value is less than 100 pF.

**EVALUATION CIRCUIT** (Vcont1 = 2.8 V, Vcont2 = 0 V or Vcont2 = 0 V, Vcont1 = 2.8 V, off chip DC blocking capacitors value C1 = 56 pF, C2 = 1 000 pF (Bypass), using NEC standard evaluation board)



#### **EVALUATION BOARD**



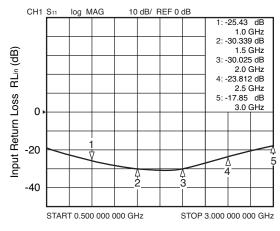
#### **TRUTH TABLE**

| Vcont1 | Vcont2 | IN-OUT1 | IN-OUT2 |
|--------|--------|---------|---------|
| Low    | High   | OFF     | ON      |
| High   | Low    | ON      | OFF     |

#### **TYPICAL CHARACTERISTICS**

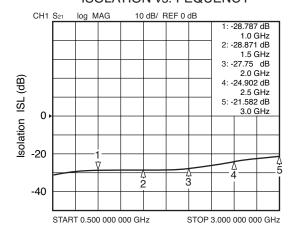
(TA =  $+25^{\circ}$ C Vcont1/2 = 2.8 V/0 V, Pin = 0 dBm, OUT2 side is 50  $\Omega$  termination)

#### INPUT RETURN LOSS vs. FREQUENCY



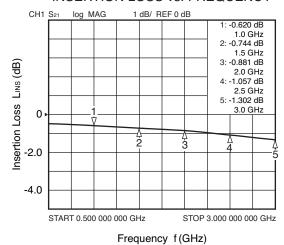
Frequency f(GHz)

#### ISOLATION vs. FEQUENCY

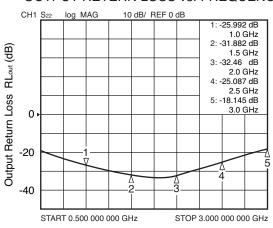


Frequency f(GHz)

#### INSERTION LOSS vs. FREQUENCY



**OUTPUT RETERN LOSS vs. FREQUENCY** 



Frequency f(GHz)

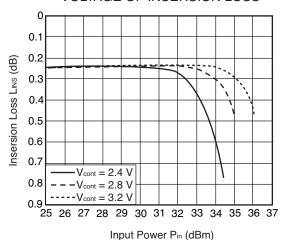
Caution These characteristics values include the losses of the NEC evaluation board.

Remark The graphs indicate nominal characteristics.

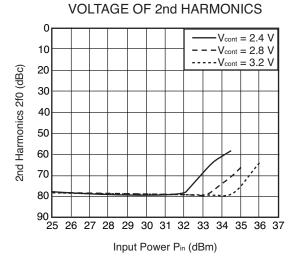
#### **TYPICAL CHARACTERISTICS**

(f = 2 GHz, OUT2 side is 50  $\Omega$  termination)

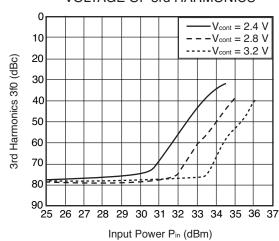
# RELATION BETWEEN CONTROL VOLTAGE OF INSERSION LOSS



# RELATION BETWEEN CONTROL



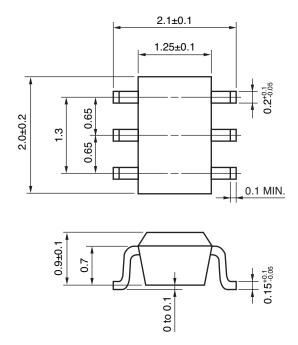
# RELATION BETWEEN CONTROL VOLTAGE OF 3rd HARMONICS



Remark The graphs indicate nominal characteristics.

# PACKAGE DIMENSIONS

6-PIN SUPER MINIMOLD (UNIT: mm)



#### 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 |                  |
| VPS              | Peak temperature (package surface temperature)       | : 215°C or below     | VP215            |
|                  | Time at temperature of 200°C or higher               | : 25 to 40 seconds   |                  |
|                  | Preheating time at 120 to 150°C                      | : 30 to 60 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 (pin 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).

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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Subject: Compliance with EU Directives

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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 per RoHS | Concentration Limit per RoHS (values are not yet fixed) | Concentration in CEL | on contained<br>devices |
|-------------------------------|---|----------------------|-------------------------|
| Lead (Pb)                     | < 1000 PPM  | -A<br>Not Detected   | -AZ<br>(*)              |
| 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 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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- Консультации по применению компонента;
- Поставка образцов и прототипов;
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#### Как с нами связаться

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