



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

## UPG2009TB

### FEATURES

- **LOW INSERTION LOSS:**  
0.25 dB TYP. @  $V_{cont1/2} = 2.8$  V/0 V,  $f = 1.0$  GHz  
0.30 dB TYP. @  $V_{cont1/2} = 2.8$  V/0 V,  $f = 2.0$  GHz
- **HIGH ISOLATION:**  
28 dB TYP. @  $V_{cont1/2} = 2.8$  V/0 V,  $f = 2.0$  GHz
- **POWER HANDLING:**  
 $P_{in (0.1dB)} = 34$  dBm TYP. @  $V_{cont1/2} = 2.8$  V/0 V,  $f = 1.0$  GHz
- **BIDIRECTIONAL, SYMMETRICAL**
- **6-PIN SUPER MINIMOLD PACKAGE (2.0 × 1.25 × 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™, W-LAN and WLL
- Short Range Wireless

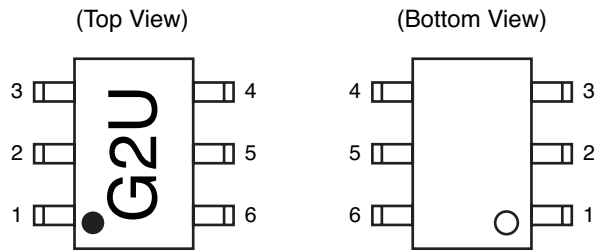
### ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
UPG2009TB-E3-A	6-pin super minimold	G2U	<ul style="list-style-type: none"><li>• Embossed tape 8 mm wide</li><li>• Pin 1, 2, 3 face the perforation side of the tape</li><li>• Qty 3 kpcs/reel</li></ul>

**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	V <sub>Cont2</sub>
5	IN
6	V <sub>Cont1</sub>

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

Parameter	Symbol	Ratings	Unit
Control Voltage 1, 2	V <sub>cont1, 2</sub>	-6.0 to +6.0 <sup>Note1</sup>	V
Input Power	P <sub>in</sub>	+36	dBm
Total Power Dissipation	P <sub>tot</sub>	0.15	W
Operating Ambient Temperature	T <sub>A</sub>	-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** (T<sub>A</sub> = 25°C)

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

## ELECTRICAL CHARACTERISTICS

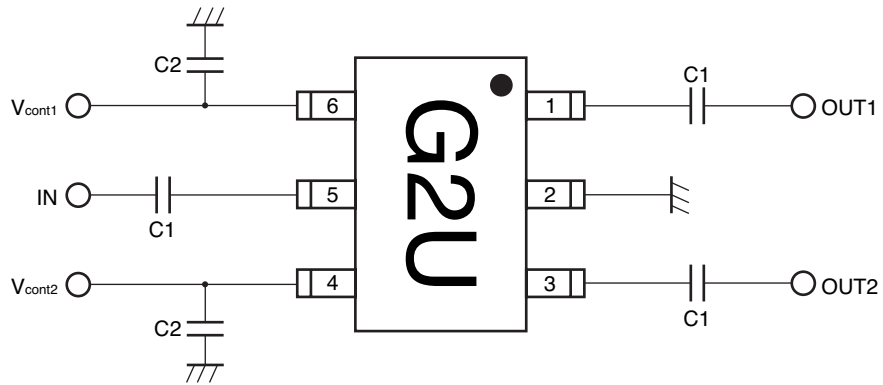
( $T_A = +25^\circ\text{C}$ ,  $V_{\text{cont}1} = 2.8\text{ V}$ ,  $V_{\text{cont}2} = 0\text{ V}$  or  $V_{\text{cont}1} = 0\text{ V}$ ,  $V_{\text{cont}2} = 2.8$ ,  $Z_o = 50\ \Omega$ , off chip DC blocking capacitors value; 56 pF, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss	$L_{\text{INS}}$	$f = 0.5$ to $1.0\text{ GHz}$	–	0.25	0.45	dB
		$f = 2.0\text{ GHz}$	–	0.30	0.50	dB
		$f = 2.5\text{ GHz}$	–	0.40	–	dB
Isolation	ISL	$f = 0.5$ to $2.0\text{ GHz}$	24	28	–	dB
		$f = 2.5\text{ GHz}$	–	25	–	dB
Input Return Loss	$RL_{\text{in}}$	$f = 0.5$ to $2.5\text{ GHz}$	15	20	–	dB
Output Return Loss	$RL_{\text{out}}$	$f = 0.5$ to $2.5\text{ GHz}$	15	20	–	dB
Input Power at 0.1 dB Compression Point <b>Note</b>	$P_{\text{in}(0.1\text{ dB})}$	$f = 1.0\text{ GHz}$ , $V_{\text{cont}} = 2.8\text{ V}/0\text{ V}$	32.5	34	–	dBm
2nd Harmonics	$2f_0$	$f = 1.0\text{ GHz}$ , $V_{\text{cont}} = 2.8\text{ V}/0\text{ V}$ , $P_{\text{in}} = 30.5\text{ dBm}$	65	75	–	dBc
3rd Harmonics	$3f_0$	$f = 1.0\text{ GHz}$ , $V_{\text{cont}} = 2.8\text{ V}/0\text{ V}$ , $P_{\text{in}} = 30.5\text{ dBm}$	65	75	–	dBc
Switching Speed	$t_{\text{sw}}$		–	150	–	ns
Control Current	$I_{\text{cont}}$	$V_{\text{cont}} = 2.8\text{ V}/0\text{ V}$ , RF Non	–	1	50	$\mu\text{A}$

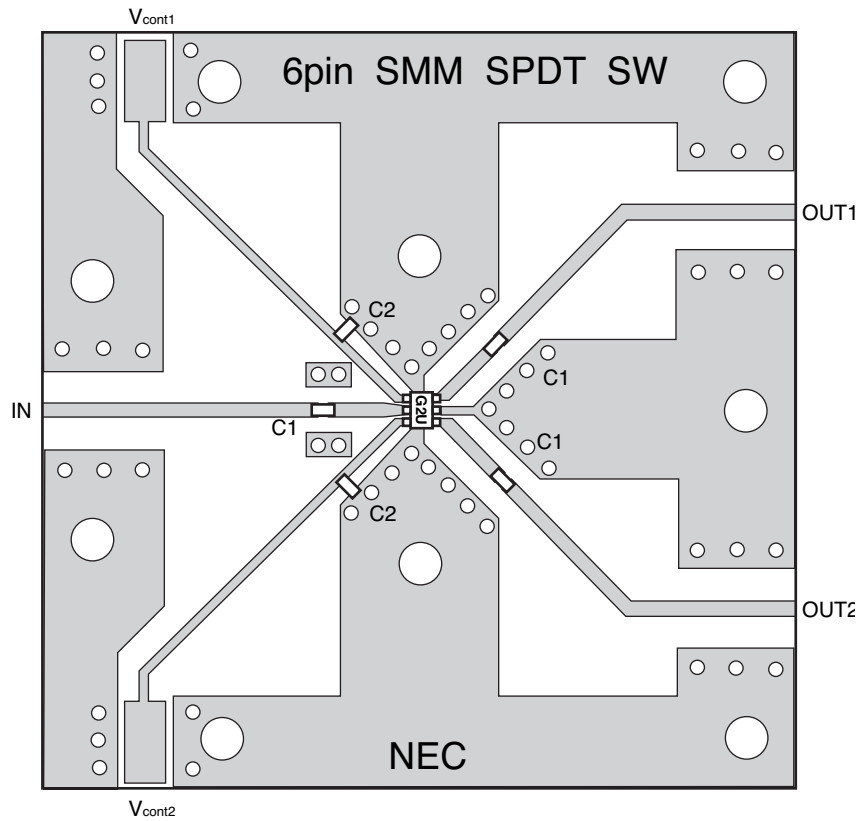
**Note**  $P_{\text{in}(0.1\text{ dB})}$  is the measured input power level when the insertion loss increases 0.1 dB more than that of linear range. All other characteristics are measured in linear range.

**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** ( $V_{cont1} = 2.8\text{ V}$ ,  $V_{cont2} = 0\text{ V}$  or  $V_{cont2} = 0\text{ V}$ ,  $V_{cont1} = 2.8\text{ V}$ , off chip DC blocking capacitors value  $C1 = 56\text{ pF}$ ,  $C2 = 1\text{ 000 pF}$  (Bypass), using NEC standard evaluation board)



**EVALUATION BOARD**



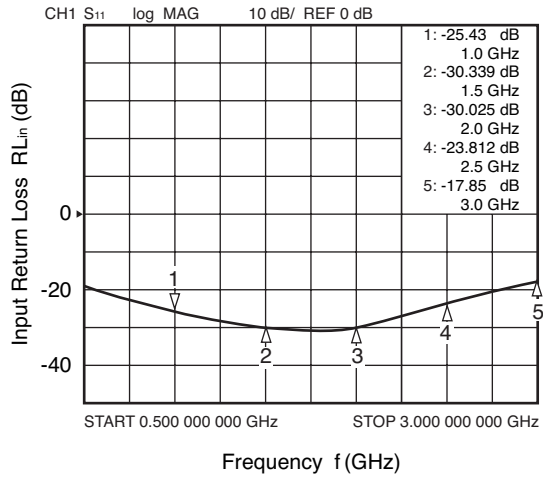
**TRUTH TABLE**

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

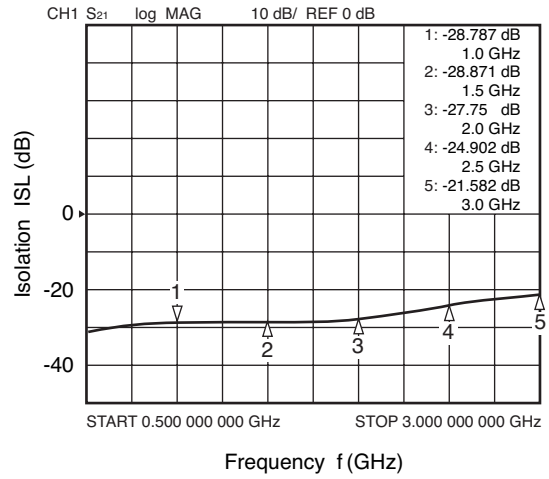
# TYPICAL CHARACTERISTICS

(TA = +25°C Vcont1/2 = 2.8 V/0 V, Pin = 0 dBm, OUT2 side is 50 Ω termination)

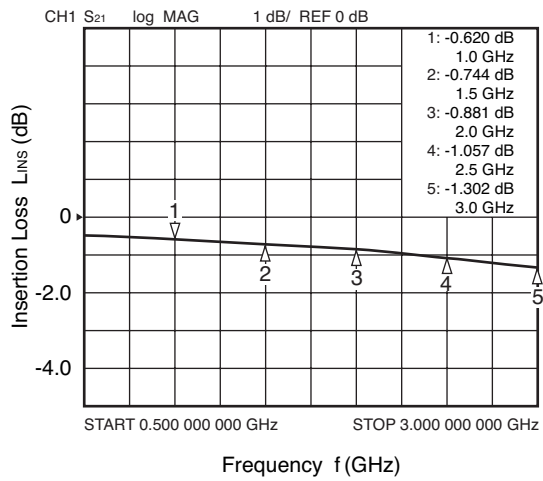
### INPUT RETURN LOSS vs. FREQUENCY



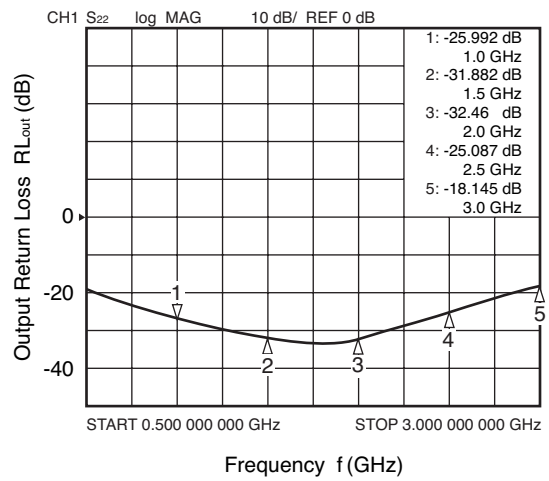
### ISOLATION vs. FREQUENCY



### INSERTION LOSS vs. FREQUENCY



### OUTPUT RETURN LOSS vs. FREQUENCY



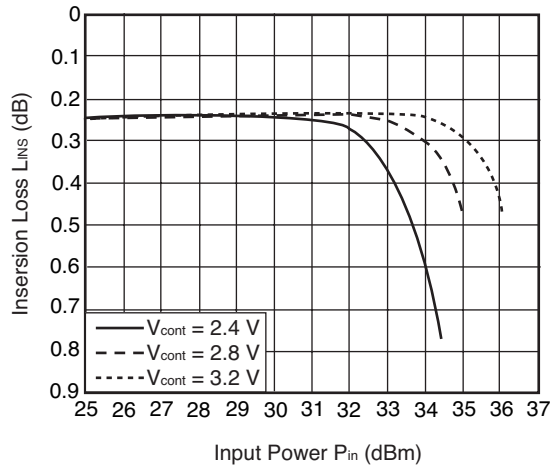
**Caution** These characteristics values include the losses of the NEC evaluation board.

**Remark** The graphs indicate nominal characteristics.

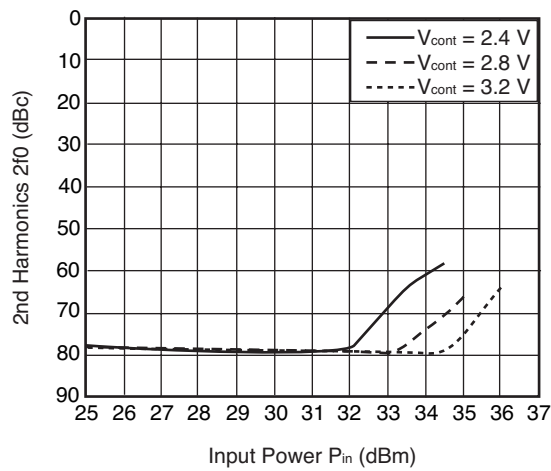
### TYPICAL CHARACTERISTICS

(f = 2 GHz, OUT2 side is 50 Ω termination)

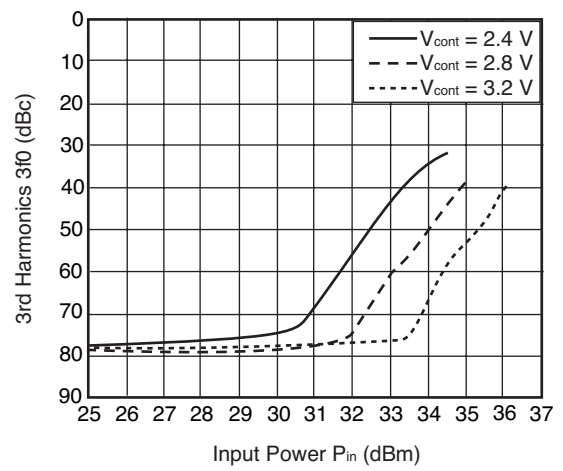
RELATION BETWEEN CONTROL VOLTAGE OF INSERSION LOSS



RELATION BETWEEN CONTROL VOLTAGE OF 2nd HARMONICS



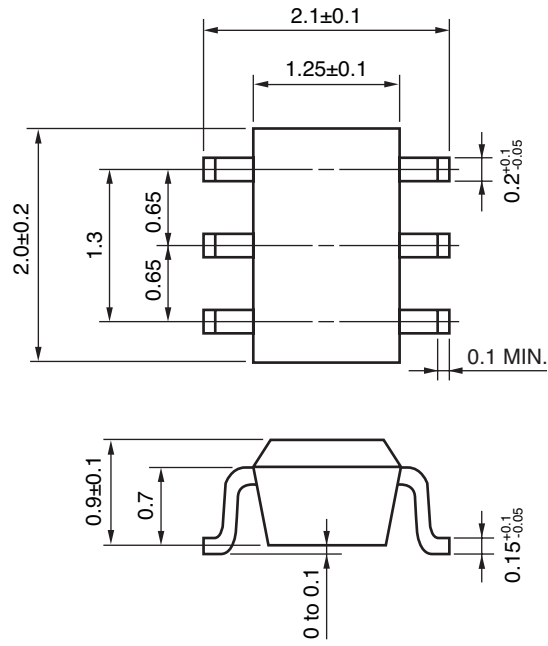
RELATION BETWEEN CONTROL VOLTAGE OF 3rd HARMONICS



**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 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
VPS	Peak temperature (package surface temperature) : 215°C or below 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	VP215
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 (pin 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).

### 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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02/14/2007



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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