



# NEC's 1/4 W SINGLE CONTROL L, S-BAND SPDT SWITCH

## UPG2012TK

### FEATURES

- **SUPPLY VOLTAGE:**  
 $V_{DD} = 2.7$  to  $3.0$  V (2.8 V TYP.)
- **SINGLE SWITCH CONTROL VOLTAGE:**  
 $V_{cont} (H) = 2.7$  to  $3.0$  V (2.8 V TYP.)  
 $V_{cont} (L) = -0.2$  to  $+0.2$  V (0 V TYP.)
- **LOW INSERTION LOSS:**  
 $L_{INS1} = 0.27$  dB TYP. @  $f = 0.5$  to  $1.0$  GHz,  $V_{DD} = 2.8$  V,  $V_{cont} = 2.8$  V/0 V  
 $L_{INS2} = 0.30$  dB TYP. @  $f = 2.0$  GHz,  $V_{DD} = 2.8$  V,  $V_{cont} = 2.8$  V/0 V  
 $L_{INS3} = 0.30$  dB TYP. @  $f = 2.5$  GHz,  $V_{DD} = 2.8$  V,  $V_{cont} = 2.8$  V/0 V  
(Reference value)
- **HIGH ISOLATION:**  
 $ISL1 = 30$  dB TYP. @  $f = 0.5$  to  $2.0$  GHz,  $V_{DD} = 2.8$  V,  $V_{cont} = 2.8$  V/0 V  
 $ISL2 = 30$  dB TYP. @  $f = 2.5$  GHz,  $V_{DD} = 2.8$  V,  $V_{cont} = 2.8$  V/0 V  
(Reference value)
- **HIGH-DENSITY SURFACE MOUNTING:**  
6-pin lead-less minimold package

### DESCRIPTION

NEC's UPG2012TK is a single control GaAs MMIC for L, S-band SPDT (Single Pole Double Throw) switch for mobile phone and L, S-band applications.

This device can operate frequency from 0.5 GHz to 2.5 GHz, with low insertion loss and high isolation.

This device is housed in a 6-pin lead-less minimold package suitable for high-density surface mounting.

### APPLICATIONS

- L, S-band digital cellular or cordless handsets
- Bluetooth™, W-LAN and WLL
- Short Range Wireless

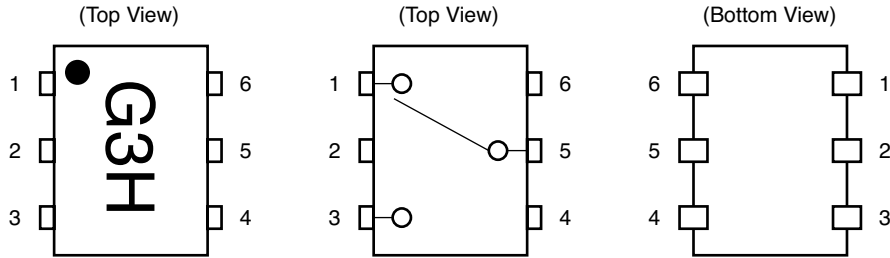
### ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
UPG2012TK-E2-A	6-pin lead-less minimold (1511)	G3H	<ul style="list-style-type: none"><li>• Embossed tape 8 mm wide</li><li>• Pin 1, 6 face the perforation side of the tape</li><li>• Qty 5 kpcs/reel</li></ul>

**Remark** To order evaluation samples, contact your nearby sales office.  
Part number for sample order: UPG2012TK

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

**PIN CONNECTIONS**



Pin No.	Pin Name
1	OUTPUT1
2	GND
3	OUTPUT2
4	V <sub>cont</sub>
5	INPUT
6	V <sub>DD</sub>

**TRUTH TABLE**

V <sub>cont</sub>	INPUT-OUTPUT1	INPUT-OUTPUT2
Low	OFF	ON
High	ON	OFF

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

Parameter	Symbol	Ratings	Unit
Supply Voltage	V <sub>DD</sub>	+6.0	V
Switch Control Voltage	V <sub>cont</sub>	+6.0	V
Input Power	P <sub>in</sub>	+26	dBm
Power Dissipation	P <sub>D</sub>	150 <b>Note</b>	mW
Operating Ambient Temperature	T <sub>A</sub>	-45 to +85	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C

**Note** Mounted on double-sided copper-clad 50 × 50 × 1.6 mm epoxy glass PWB, T<sub>A</sub> = +85°C

**RECOMMENDED OPERATING RANGE** (T<sub>A</sub> = 25°C)

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

## ELECTRICAL CHARACTERISTICS

(TA = +25°C, VDD = 2.8 V, Vcont = 2.8 V/0 V, DC blocking capacitors = 56 pF, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss1	L <sub>INS1</sub>	f = 0.5 to 1.0 GHz	-	0.27	0.50	dB
Insertion Loss2	L <sub>INS2</sub>	f = 2.0 GHz	-	0.30	0.50	dB
Isolation1	ISL1	f = 0.5 to 2.0 GHz	24	30	-	dB
Input Return Loss	RL <sub>in</sub>	f = 0.5 to 2.5 GHz	15	20	-	dB
Output Return Loss	RL <sub>out</sub>	f = 0.5 to 2.5 GHz	15	20	-	dB
0.1 dB Gain Compression Input Power <b>Note</b>	P <sub>in(0.1 dB)</sub>	f = 2.0 GHz	+17.5	+20.5	-	dBm
Supply Current	I <sub>DD</sub>		-	50	100	μA
Switching Control Current	I <sub>cont</sub>		-	4	20	μA

**Note** P<sub>in</sub> (0.1 dB) is the measured input power level when the insertion loss increases 0.1 dB more than that of linear range.

## STANDARD CHARACTERISTICS FOR REFERENCE

(TA = +25°C, VDD = 2.8 V, Vcont = 2.8 V/0 V, DC blocking capacitors = 56 pF, unless otherwise specified)

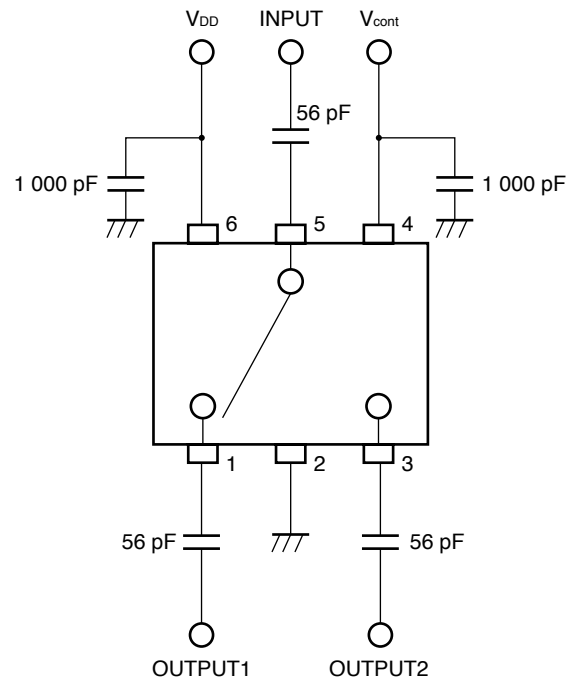
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss3	L <sub>INS3</sub>	f = 2.5 GHz	-	0.30	-	dB
Isolation2	ISL2	f = 2.5 GHz	-	30	-	dB
1 dB Gain Compression Input Power <b>Note</b>	P <sub>in(1 dB)</sub>	f = 2.0 GHz	-	+24.0	-	dBm
Switching Control Speed	t <sub>sw</sub>		-	300	-	ns

**Note** P<sub>in</sub> (1dB) is the measured input power level when the insertion loss increases 1 dB more than that of 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 the actual board of the system. The range of recommended DC blocking capacitor value is less than 100 pF.

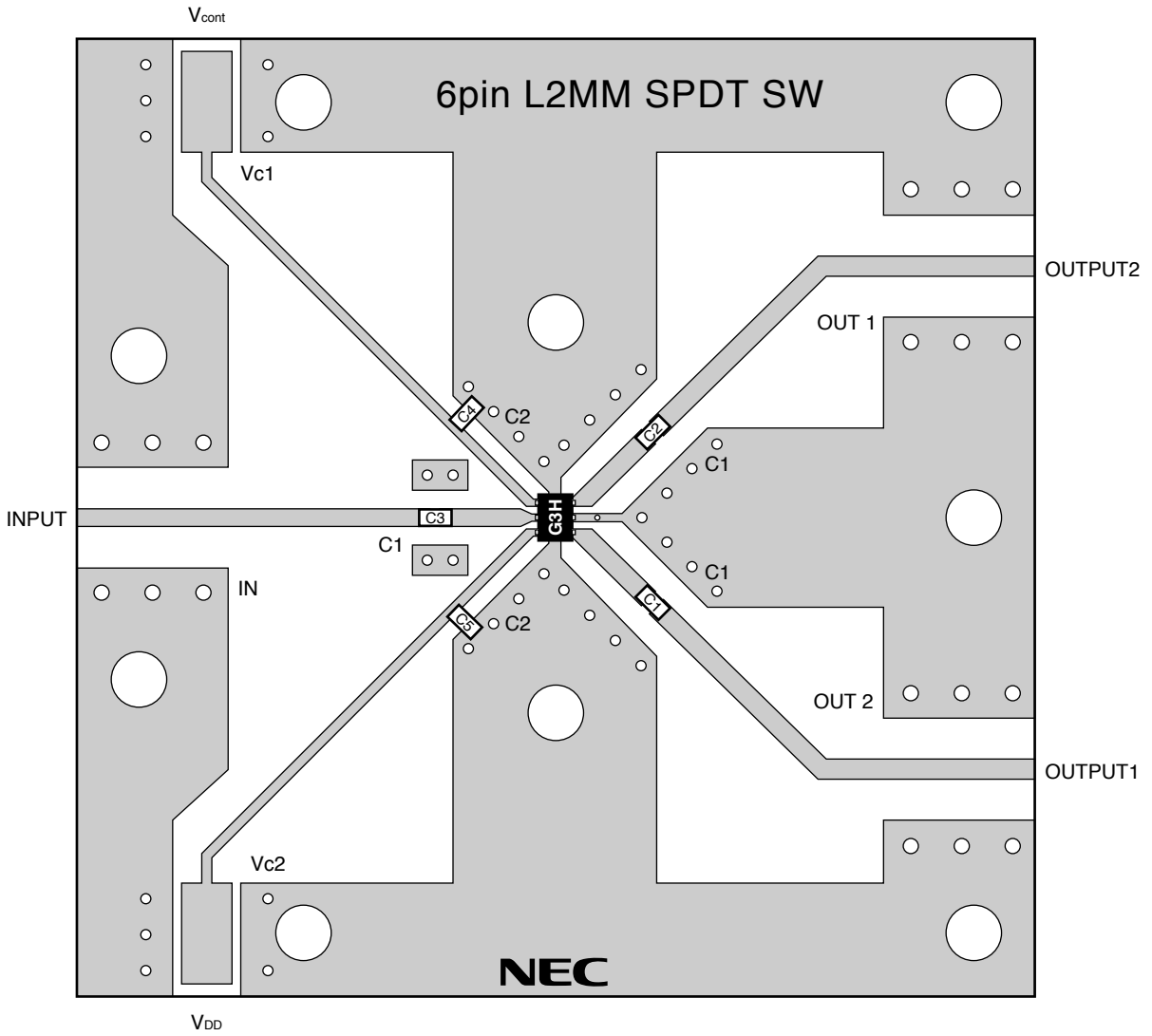
**EVALUATION CIRCUIT**

( $V_{DD} = 2.8\text{ V}$ ,  $V_{cont} = 2.8\text{ V}/0\text{ V}$ , DC blocking capacitors =  $56\text{ pF}$ )



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

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD

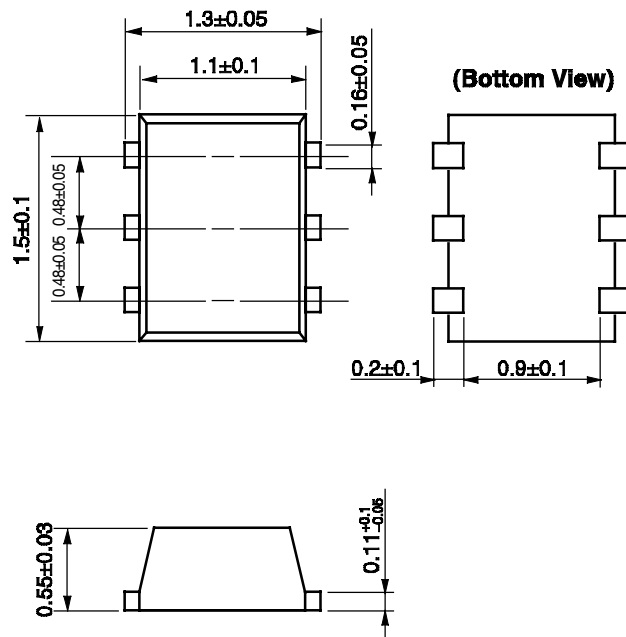


USING THE NEC EVALUATION BOARD

Symbol	Values
C1, C2, C3	56 pF
C4, C5	1 000 pF

**PACKAGE DIMENSIONS**

6-PIN LEAD-LESS MINIMOLD (1511) (UNIT: mm)

**Remark ( ):** Reference value

**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.

**CEL California Eastern Laboratories**, Your source for NEC RF, Microwave, Optoelectronic, and Fiber Optic Semiconductor Devices.

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DATA SUBJECT TO CHANGE WITHOUT NOTICE

08/30/2004

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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