

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

# **UPG2015TB**

### **FEATURES**

### · SUPPLY VOLTAGE:

VDD = 2.7 to 3.0 V (2.8 V TYP.)

### · SINGLE SWITCH CONTROL VOLTAGE:

Vcont (H) = 2.7 to 3.0 V (2.8 V TYP.) Vcont (L) = -0.2 to +0.2 V (0 V TYP.)

### · LOW INSERTION LOSS:

 $LINS1 = 0.25 \ dB \ TYP. @ f = 0.5 \ to \ 1.0 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS2 = 0.30 \ dB \ TYP. @ f = 1.0 \ to \ 2.0 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V, Vcont = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. @ f = 2.5 \ GHz, VDD = 2.8 \ V/0 \ V \\ LINS3 = 0.35 \ dB \ TYP. \ MIN \ TYP. \ MIN \ TYP. \ MIN \ TYP. \ MIN \$ 

#### HIGH ISOLATION:

ISL1 = 27 dB TYP. @ f = 0.5 to 2.0 GHz, VDD = 2.8 V, Vcont = 2.8 V/0 V ISL2 = 24 dB TYP. @ f = 2.5 GHz, VDD = 2.8 V, Vcont = 2.8 V/0 V

### POWER HANDLING:

Pin (0.1 dB) = +27.0 dBm TYP. @ f = 2.5 GHz, VDD = 2.8 V, Vcont = 2.8 V/0 V

#### · HIGH-DENSITY SURFACE MOUNTING:

6-pin super minimold package  $(2.0 \times 1.25 \times 0.9 \text{ mm})$ 

### **DESCRIPTION**

NEC's UPG2015TB is a single control single control GaAs MMIC 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 to 2.5 GHz, with low insertion loss and high isolation.

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

### **APPLICATIONS**

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

### ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form	
UPG2015TB-E3-A	6-pin super minimold	G3J	Embossed tape 8 mm wide	
			• Pin 1, 2, 3 face the perforation side of the tape	
			Qty 3 kpcs/reel	

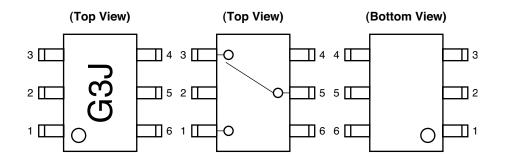
Remark To order evaluation samples, contact your nearby sales office.

Part number for sample order: UPG2015TB

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

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# PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



Pin No.	Pin Name	
1	OUTPUT1	
2	GND	
3	OUTPUT2	
4	VCont	
5	INPUT	
6	Vdd	

### **TRUTH TABLE**

Vcont	INPUT-OUTPUT1	INPUT-OUTPUT2	
Low	OFF	ON	
High	ON	OFF	

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

Parameter	Symbol	Ratings	Unit
Supply Voltage	V <sub>DD</sub>	+6.0	٧
Switch Control Voltage	Vcont	+6.0	٧
Input Power	Pin	+33	dBm
Operating Ambient Temperature	TA	-45 to +85	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C

# **RECOMMENDED OPERATING RANGE** (TA = 25°C, unless otherwise specified)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V <sub>DD</sub>	2.7	2.8	3.0	V
Switch Control Voltage (H)	Vcont (H)	2.7	2.8	3.0	V
Switch Control Voltage (L)	Vcont (L)	-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 Loss 1	LINS1	f = 0.5 to 1.0 GHz	-	0.25	0.45	dB
Insertion Loss 2	LINS2	f = 1.0 to 2.0 GHz	_	0.30	0.50	dB
Insertion Loss 3	Linsa	f = 2.5 GHz	_	0.35	0.55	dB
Isolation 1	ISL <sub>1</sub>	f = 0.5 to 2.0 GHz	23	27	-	dB
Isolation 2	ISL <sub>2</sub>	f = 2.5 GHz	20	24	-	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
0.1 dB Gain Compression	Pin (0.1 dB)	f = 2.0 GHz	+25.5	+27.0	-	dBm
Input Power Note		f = 2.5 GHz	+25.5	+27.0	-	dBm
Supply Current	IDD		-	50	100	μΑ
Switch Control Current	Icont		-	4	20	μΑ
Switch Control Speed	tsw		-	0.3	2.0	μS

**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.

### 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)

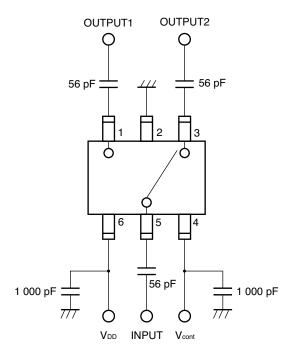
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
1 dB Gain Compression	Pin (1 dB)	f = 2.0 GHz	-	+30.0	-	dBm
Input Power Note						

**Note** Pin (1 dB) 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.

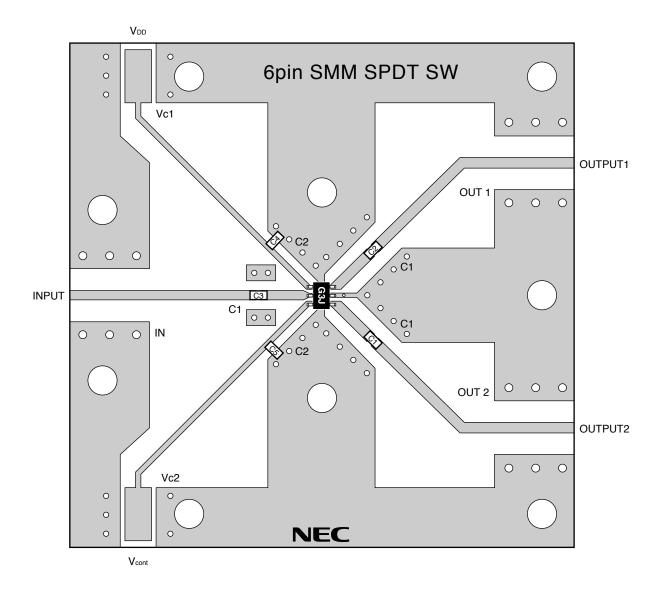
The value of DC blocking capacitors should be chosen to accommodate the frequency of operation, bandwidth, switching speed and the condition with actual board of your system. The range of recommended DC blocking capacitor value is less than 100 pF.

# **EVALUATION CIRCUIT** (VDD = 2.8 V, Vcont = 2.8 V/0 V, DC blocking capacitors = 56 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

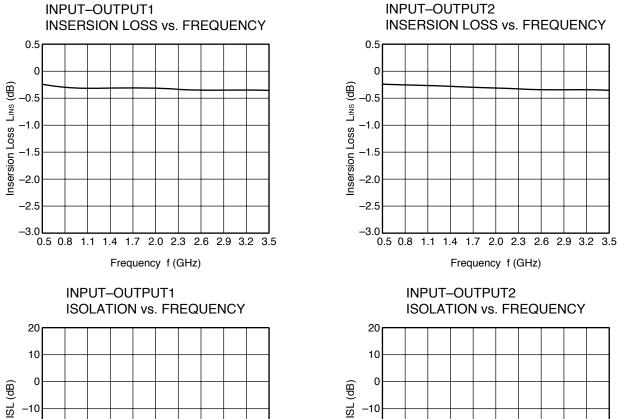


# USING THE NEC EVALUATION BOARD

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

### TYPICAL CHARACTERISTICS

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

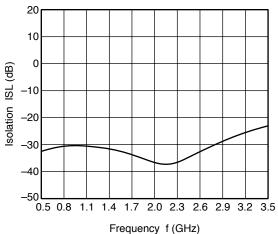


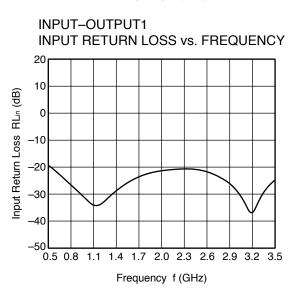
-10

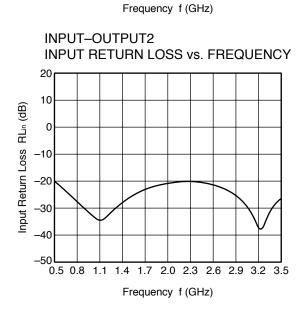
-20

-30

Isolation



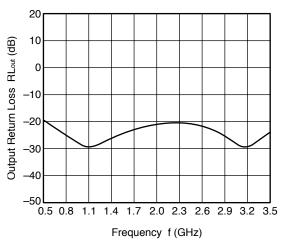




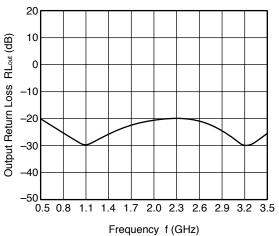
0.5 0.8 1.1 1.4 1.7 2.0 2.3 2.6 2.9 3.2 3.5

Remark The graphs indicate nominal characteristics.

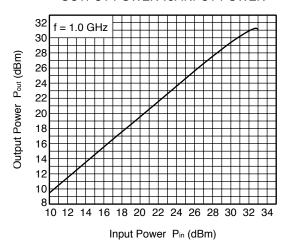
# INPUT-OUTPUT1 OUTPUT RETURN LOSS vs. FREQUENCY



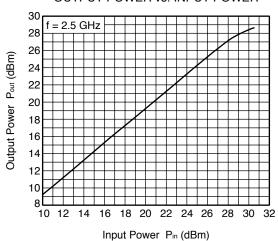
### INPUT-OUTPUT2 OUTPUT RETURN LOSS vs. FREQUENCY



### **OUTPUT POWER vs. INPUT POWER**



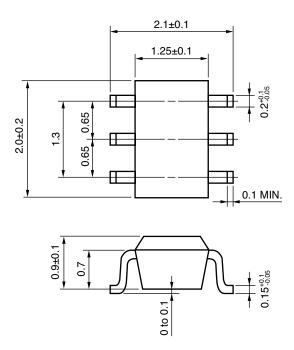
### **OUTPUT POWER vs. INPUT POWER**



**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

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 in CEL	
Lead (Pb)	< 1000 PPM	-A -AZ 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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