CEL

NEC's ½W LOW VOLTAGE L, S-BAND SPDT SWITCH

UPG2214TB

FEATURES

- **SWITCH CONTROL VOLTAGE:**
  $V_{cont\ (H)}$ = 1.8 to 5.3 V (3.0 V TYP.)
  $V_{cont\ (L)}$ = −0.2 to +0.2 V (0 V TYP.)

- **LOW INSERTION LOSS:**
  0.25 dB TYP. @ 0.05 to 0.5 GHz, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V
  0.25 dB TYP. @ 0.5 to 1.0 GHz, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V
  0.30 dB TYP. @ 1.0 to 2.0 GHz, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V
  0.35 dB TYP. @ 2.0 to 2.5 GHz, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V
  0.35 dB TYP. @ 2.5 to 3.0 GHz, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V

- **HIGH ISOLATION:**
  32 dB TYP. @ 0.05 to 0.5 GHz, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V
  28 dB TYP. @ 0.5 to 1.0 GHz, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V
  27 dB TYP. @ 1.0 to 2.0 GHz, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V
  26 dB TYP. @ 2.0 to 2.5 GHz, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V
  24 dB TYP. @ 2.5 to 3.0 GHz, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V

- **POWER HANDLING:**
  $P_{in\ (1\ dB)}$ = +27.0 dBm TYP. @ 0.5 to 3.0 GHz, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V
  $P_{in\ (1\ dB)}$ = +20.0 dBm TYP. @ 0.5 to 3.0 GHz, $V_{cont\ (H)}$ = 1.8 V, $V_{cont\ (L)}$ = 0 V

- **HIGH-DENSITY SURFACE MOUNTING:**
  6-pin super minimold package (2.0 × 1.25 × 0.9 mm)

- **Pb FREE**

DESCRIPTION

NEC's UPG2214TB is a GaAs MMIC L, S-band SPDT (Single Pole Double Throw) switch for mobile phones and other L, S-band applications from 0.05 to 3.0 GHz.

This device can operate from 1.8 to 5.3 V with low insertion loss and high isolation. Performance is specified at both 1.8 V and 3.0 V.

The UPG2214TB is housed in a 6-pin super minimold package suitable for high-density surface mounting.

APPLICATIONS

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

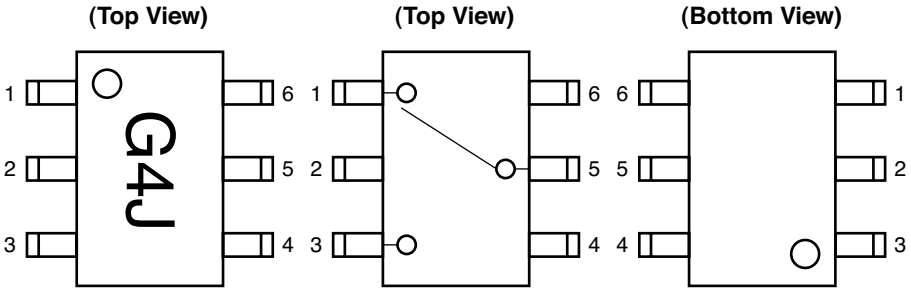
ORDERING INFORMATION

Part Number	Package	Marking	Supplying Form
UPG2214TB-E4-A	6-pin super minimold	G4J	• Embossed tape 8 mm wide • Pin 4, 5, 6 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: UPG2214TB-A

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

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



PIN NO.	PIN NAME
1	OUTPUT1
2	GND
3	OUTPUT2
4	V_{cont2}
5	INPUT
6	V_{cont1}

TRUTH TABLE

V_{cont1}	V_{cont2}	INPUT-OUTPUT1	INPUT-OUTPUT2
Low	High	ON	OFF
High	Low	OFF	ON

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

PARAMETER	SYMBOL	RATINGS	UNIT
Switch Control Voltage	V_{cont}	+6.0 **Note**	V
Input Power	P_{in}	+30	dBm
Operating Ambient Temperature	T_A	–45 to +85	°C
Storage Temperature	T_{stg}	–55 to +150	°C

Note $|V_{cont1}-V_{cont2}| \leq 6.0$ V

RECOMMENDED OPERATING RANGE (T_A = 25°C, unless otherwise specified)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Switch Control Voltage (H)	$V_{cont(H)}$	1.8	3.0	5.3	V
Switch Control Voltage (L)	$V_{cont(L)}$	–0.2	0	0.2	V

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, $V_{cont\ (H)}$ = 3.0, $V_{cont\ (L)}$ = 0 V, DC blocking capacitors value = 100 pF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Insertion Loss 1	L_{ins1}	f = 0.05 to 0.5 GHz **Note 1**	–	0.25	0.45	dB
Insertion Loss 2	L_{ins2}	f = 0.5 to 1.0 GHz	–	0.25	0.45	dB
Insertion Loss 3	L_{ins3}	f = 1.0 to 2.0 GHz	–	0.30	0.50	dB
Insertion Loss 4	L_{ins4}	f = 2.0 to 2.5 GHz	–	0.35	0.55	dB
Insertion Loss 5	L_{ins5}	f = 2.5 to 3.0 GHz	–	0.35	0.60	dB
Isolation 1	ISL1	f = 0.05 to 0.5 GHz **Note 1**	29	32	–	dB
Isolation 2	ISL2	f = 0.5 to 1.0 GHz	25	28	–	dB
Isolation 3	ISL3	f = 1.0 to 2.0 GHz	24	27	–	dB
Isolation 4	ISL4	f = 2.0 to 2.5 GHz	23	26	–	dB
Isolation 5	ISL5	f = 2.5 to 3.0 GHz	21	24	–	dB
Input Return Loss 1	RL_{in1}	f = 0.05 to 0.5 GHz **Note 1**	15	20	–	dB
Input Return Loss 2	RL_{in2}	f = 0.5 to 3.0 GHz	15	20	–	dB
Output Return Loss 1	RL_{out1}	f = 0.05 to 0.5 GHz **Note 1**	15	20	–	dB
Output Return Loss 2	RL_{out2}	f = 0.5 to 3.0 GHz	15	20	–	dB
0.1 dB Loss Compression Input Power **Note 2**	$P_{in\ (0.1\ dB)}$	f = 2.0/2.5 GHz	+21.0	+23.0	–	dBm
		f = 0.5 to 3.0 GHz	–	+23.0	–	dBm
1 dB Loss Compression Input Power **Note 3**	$P_{in\ (1\ dB)}$	f = 0.5 to 3.0 GHz	–	+27.0	–	dBm
2nd Harmonics	$2f_0$	f = 2.0 GHz, P_{in} = +15 dBm	–	–55	–47	dBc
		f = 2.5 GHz, P_{in} = +15 dBm	–	–55	–47	dBc
3rd Harmonics	$3f_0$	f = 2.0 GHz, P_{in} = +15 dBm	–	–55	–47	dBc
		f = 2.5 GHz, P_{in} = +15 dBm	–	–55	–47	dBc
Intermodulation Intercept Point	IIP_3	f = 0.5 to 3.0 GHz, 2 tone, P_{in} = +16 dBm, 5 MHz spicing	–	+58	–	dBm
Switch Control Current	I_{cont}		–	4	20	μA
Switch Control Speed	t_{SW}	50% CTL to 90/10% RF	–	20	200	ns

Notes 1. DC blocking capacitors = 1,000 pF at f = 0.05 to 0.5 GHz

2. $P_{in\ (0.1\ dB)}$ is the measured input power level when the insertion loss increases 0.1 dB more than that of linear range.

3. $P_{in\ (1\ dB)}$ is the measured input power level when the insertion loss increases 1 dB more than that of linear range.

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, $V_{cont\ (H)}$ = 1.8, $V_{cont\ (L)}$ = 0 V, DC blocking capacitors value = 100 pF, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Insertion Loss 6	L_{ins6}	f = 0.05 to 0.5 GHz **Note 1**	–	0.25	0.50	dB
Insertion Loss 7	L_{ins7}	f = 0.5 to 1.0 GHz	–	0.25	0.50	dB
Insertion Loss 8	L_{ins8}	f = 1.0 to 2.0 GHz	–	0.30	0.55	dB
Insertion Loss 9	L_{ins9}	f = 2.0 to 2.5 GHz	–	0.35	0.60	dB
Insertion Loss 10	L_{ins10}	f = 2.5 to 3.0 GHz	–	0.35	0.65	dB
Isolation 6	ISL6	f = 0.05 to 0.5 GHz **Note 1**	27	30	–	dB
Isolation 7	ISL7	f = 0.5 to 2.0 GHz	23	27	–	dB
Isolation 8	ISL8	f = 2.0 to 2.5 GHz	21	25	–	dB
Isolation 9	ISL9	f = 2.5 to 3.0 GHz	20	24	–	dB
Input Return Loss 3	RL_{in3}	f = 0.05 to 3.0 GHz **Note 1**	15	20	–	dB
Output Return Loss 3	RL_{out3}	f = 0.05 to 3.0 GHz **Note 1**	15	20	–	dB
0.1 dB Loss Compression	$P_{in\ (0.1\ dB)}$	f = 2.0/2.5 GHz	+14.0	+17.0	–	dBm
Input Power **Note 2**		f = 0.5 to 3.0 GHz	–	+17.0	–	dBm
1 dB Loss Compression Input Power **Note 3**	$P_{in\ (1\ dB)}$	f = 0.5 to 3.0 GHz	–	+20.0	–	dBm
Switch Control Current	I_{cont}		–	4	20	μA
Switch Control Speed	t_{SW}	50% CTL to 90/10% RF	–	20	200	ns

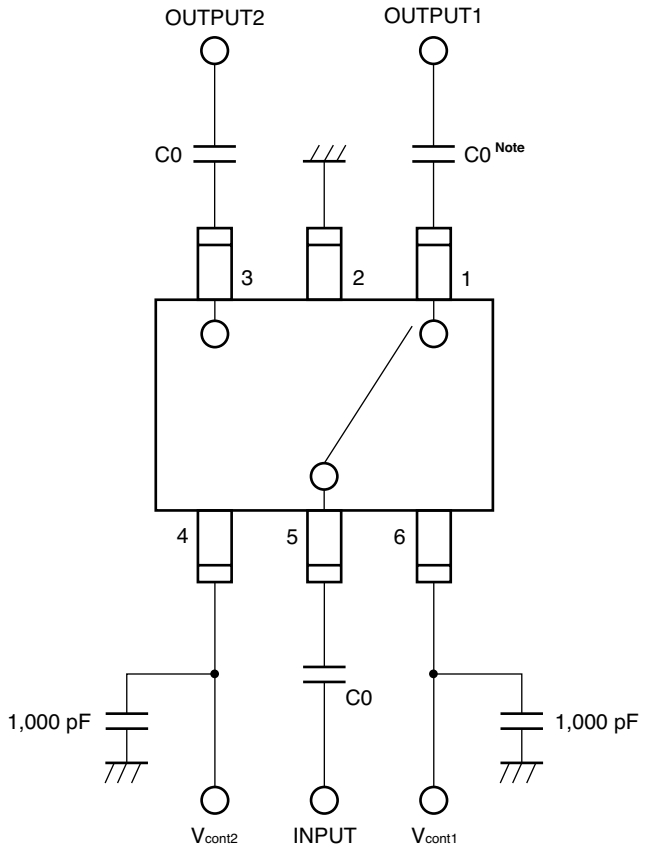
Notes 1. DC blocking capacitors = 1 000 pF at f = 0.05 to 0.5 GHz

2. $P_{in\ (0.1\ dB)}$ is the measured input power level when the insertion loss increases 0.1 dB more than that of linear range.

3. $P_{in\ (1\ dB)}$ 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 this 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 your system. The range of recommended DC blocking capacitor value is less than 100 pF for frequencies above 0.5 GHz, and 1,000 pF for frequencies below 0.5 GHz.

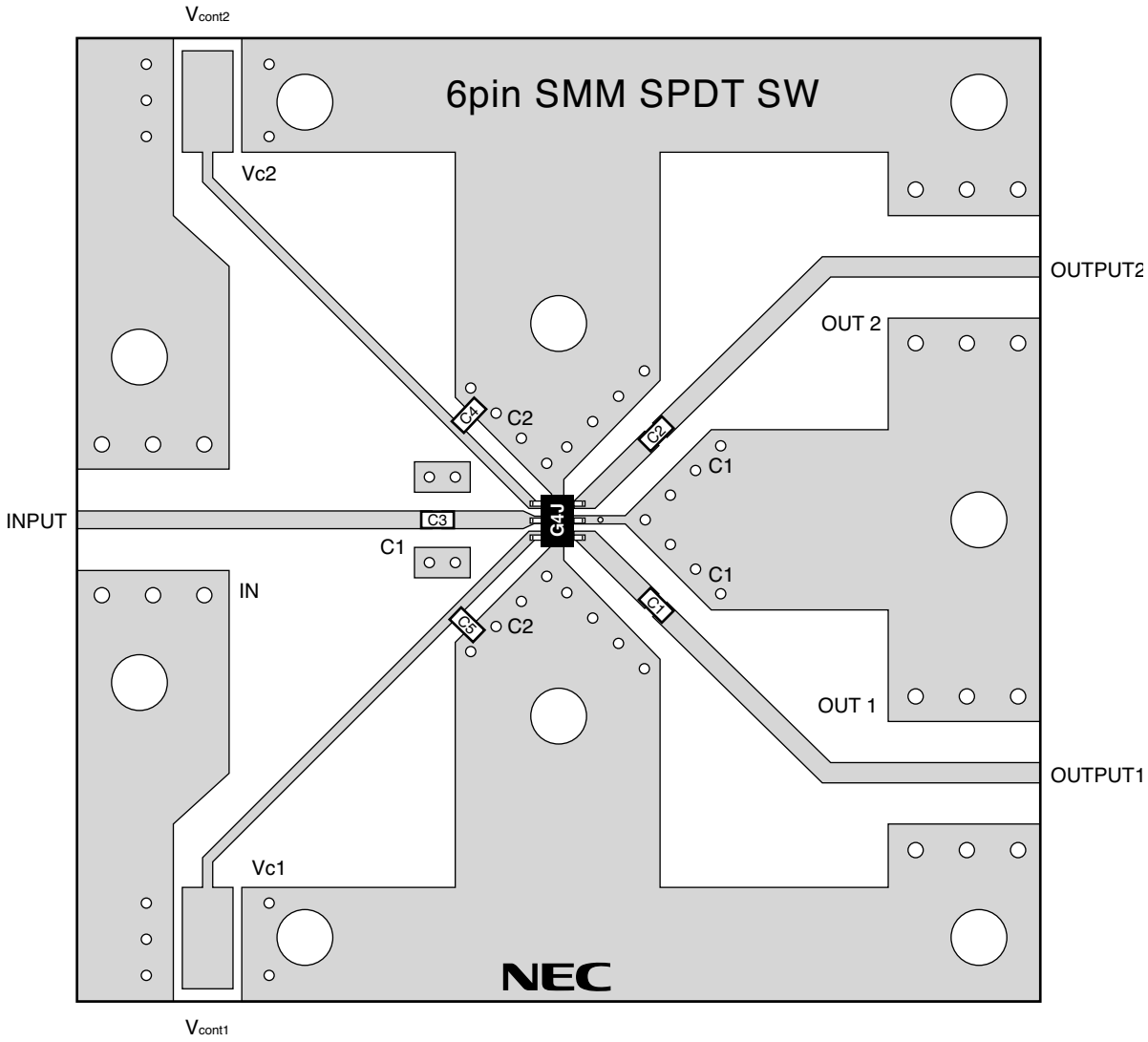
EVALUATION CIRCUIT



Note C0 : 0.05 to 0.5 GHz 1,000 pF
: 0.5 to 3.0 GHz 100 pF

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

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



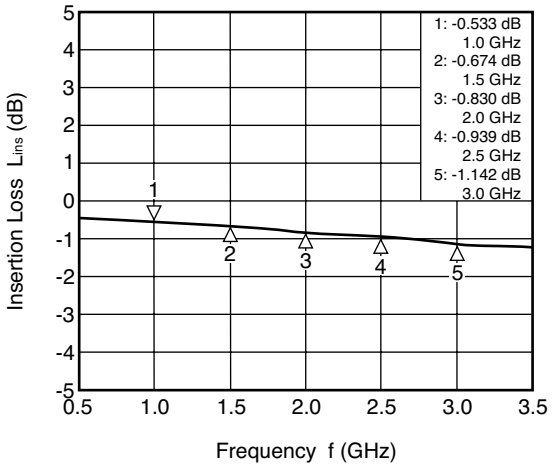
USING THE NEC EVALUATION BOARD

SYMBOL	VALUES
C1, C2, C3	100 pF
C4, C5	1,000 pF

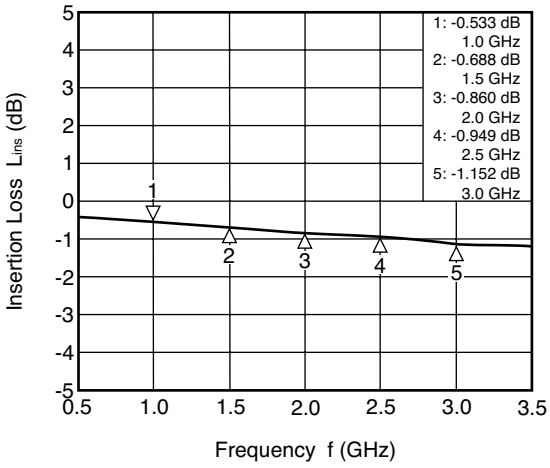
TYPICAL CHARACTERISTICS

(T_A = +25°C, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V, DC blocking capacitors = 100 pF, unless otherwise specified)

INPUT-OUTPUT1
INSERTION LOSS vs. FREQUENCY



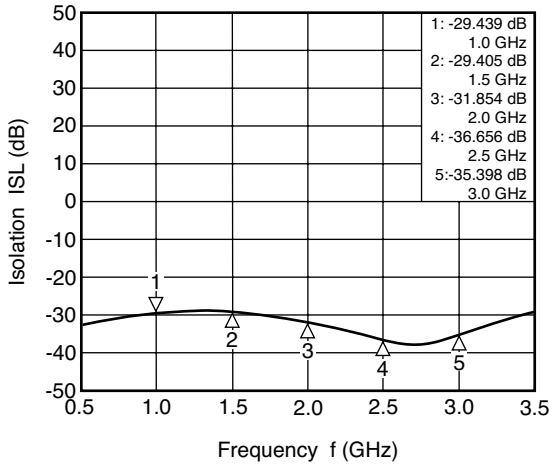
INPUT-OUTPUT2
INSERTION LOSS vs. FREQUENCY



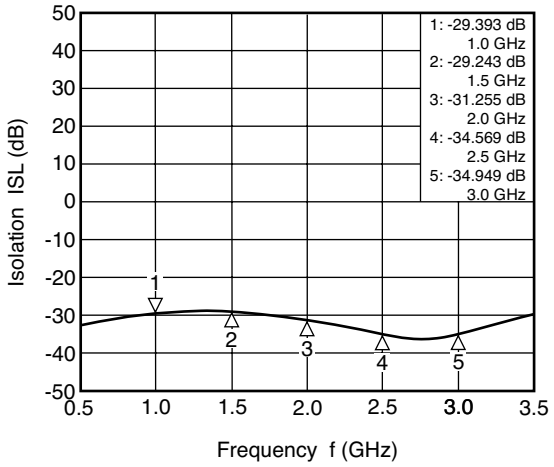
Remark The graphs indicate nominal characteristics.

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

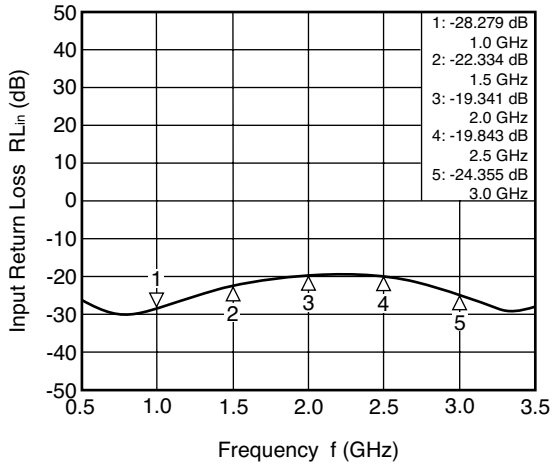
INPUT-OUTPUT1
ISOLATION vs. FREQUENCY



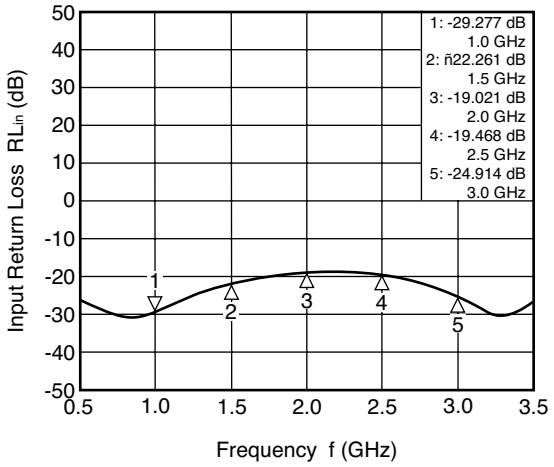
INPUT-OUTPUT2
ISOLATION vs. FREQUENCY



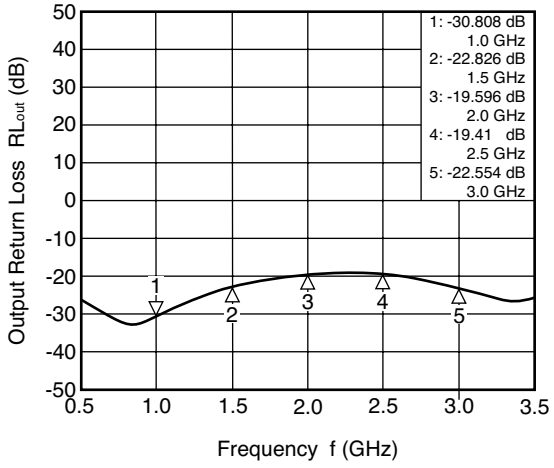
INPUT-OUTPUT1
INPUT RETURN LOSS vs. FREQUENCY



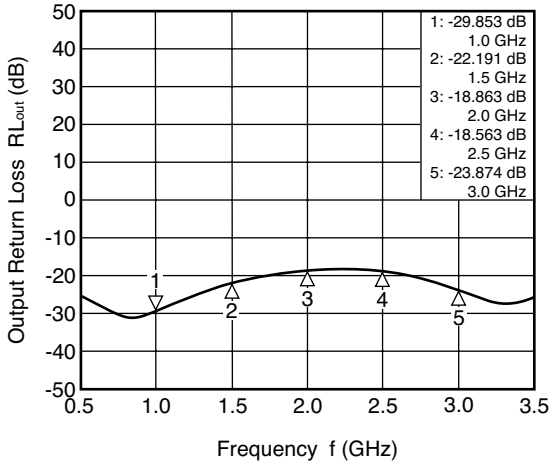
INPUT-OUTPUT2
INPUT RETURN LOSS vs. FREQUENCY



INPUT-OUTPUT1
OUTPUT RETURN LOSS vs. FREQUENCY

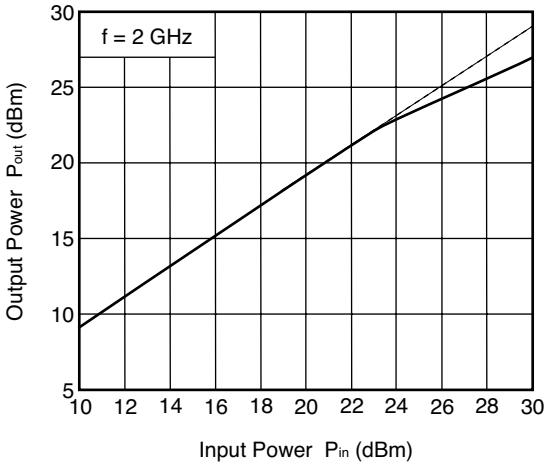


INPUT-OUTPUT2
OUTPUT RETURN LOSS vs. FREQUENCY



Remark The graphs indicate nominal characteristics.

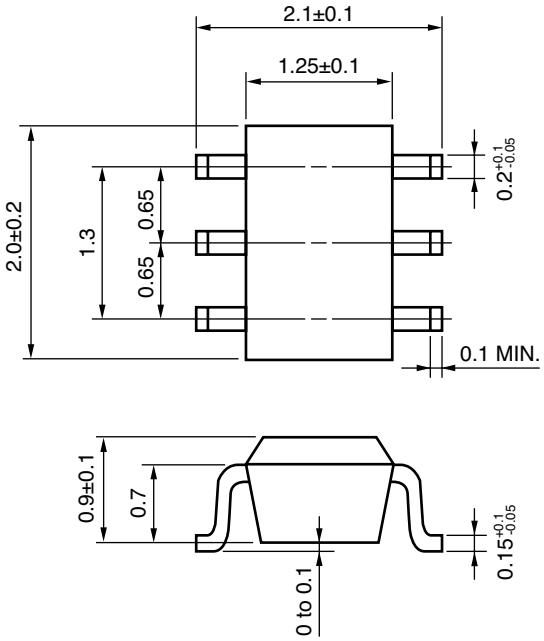
OUTPUT POWER vs. INPUT POWER



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).**

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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 contained in CEL devices	
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.