GaAs INTEGRATED CIRCUIT

μPG2415TK

0.5 to 6.0 GHz SPDT SWITCH

DESCRIPTION

The μPG2415TK is a GaAs MMIC SPDT (Single Pole Double Throw) switch for 0.5 to 6.0 GHz applications, including dual-band wireless LAN.

This device operates with dual control switching voltages of 2.7 to 5.3 V. This device can operate at frequencies from 0.5 to 6.0 GHz, with low insertion loss and high isolation.

This device is housed in a 6-pin lead-less minimold package (1511 PKG) and is suitable for high-density surface mounting.

FEATURES

- Switch control voltage : $V_{cont\ (H)}$ = 3.0 V TYP.
  : $V_{cont\ (L)}$ = 0 V TYP.
- Low insertion loss : L_{ins} = 0.45 dB TYP. @ f = 2.5 GHz
  : L_{ins} = 0.65 dB TYP. @ f = 6.0 GHz
- High isolation : ISL = 28 dB TYP. @ f = 2.5 GHz
  : ISL = 26 dB TYP. @ f = 6.0 GHz
- Handling power : $P_{in\ (0.1\ dB)}$ = +31.0 dBm TYP. @ f = 2.0 to 6.0 GHz
- High-density surface mounting : 6-pin lead-less minimold package (1.5 × 1.1 × 0.55 mm)

APPLICATIONS

- Dual-band wireless LAN etc.

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPG2415TK-E2	μPG2415TK-E2-A	6-pin lead-less minimold (1511 PKG) (Pb-Free)	G6D	• Embossed tape 8 mm wide • Pin 1, 6 face the perforation side of the tape • Qty 5 kpcs/reel

Remark To order evaluation samples, please contact your nearby sales office.
Part number for sample order: μPG2415TK

Caution Although this device is designed to be as robust as possible, ESD (Electrostatic Discharge) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions must be employed at all times.

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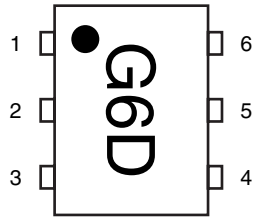
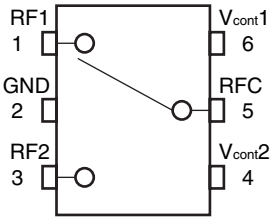
PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM

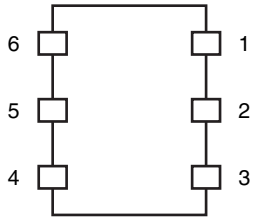
(Top View)



(Top View)



(Bottom View)



Pin No.	Pin Name
1	RF1
2	GND
3	RF2
4	$V_{cont}2$
5	RFC
6	$V_{cont}1$

SW TRUTH TABLE

ON Path	$V_{cont}1$	$V_{cont}2$
RFC-RF1	High	Low
RFC-RF2	Low	High

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 ($V_{cont\ (H)}$ = 3.0 V)	P_{in}	+34.0	dBm
Input Power ($V_{cont\ (H)}$ = 5.0 V)	P_{in}	+35.0	dBm
Power Dissipation (average)	P_D	0.15	W
Operating Ambient Temperature	T_A	–45 to +85	°C
Storage Temperature	T_{stg}	–55 to +150	°C

Note $|V_{cont}1 - V_{cont}2| \leq 6.0$ V

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

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Operating Frequency	f	0.5	–	6.0	GHz
Switch Control Voltage (H)	$V_{cont\ (H)}$	2.7	3.0	5.3	V
Switch Control Voltage (L)	$V_{cont\ (L)}$	–0.2	0	0.2	V
Control Voltage Difference	$\Delta V_{cont\ (H)}$, $\Delta V_{cont\ (L)}$ Note	–0.1	0	0.1	V

Note $\Delta V_{cont\ (H)} = V_{cont}1\ (H) - V_{cont}2\ (H)$

$\Delta V_{cont\ (L)} = V_{cont}1\ (L) - V_{cont}2\ (L)$

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V, Z_O = 50 Ω, DC blocking capacitors = 8 pF, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss 1	$L_{ins}1$	f = 0.5 to 2.0 GHz Note 1	–	0.40	0.65	dB
Insertion Loss 2	$L_{ins}2$	f = 2.0 to 2.5 GHz	–	0.45	0.70	dB
Insertion Loss 3	$L_{ins}3$	f = 2.5 to 3.8 GHz	–	0.55	0.80	dB
Insertion Loss 4	$L_{ins}4$	f = 3.8 to 6.0 GHz	–	0.65	0.90	dB
Isolation 1	ISL1	f = 0.5 to 2.0 GHz Note 1	25	28	–	dB
Isolation 2	ISL2	f = 2.0 to 2.5 GHz	25	28	–	dB
Isolation 3	ISL3	f = 2.5 to 3.8 GHz	25	28	–	dB
Isolation 4	ISL4	f = 3.8 to 6.0 GHz	22	26	–	dB
Return Loss 1	RL1	f = 0.5 to 2.0 GHz Note 1	15	20	–	dB
Return Loss 2	RL2	f = 2.0 to 2.5 GHz	15	20	–	dB
Return Loss 3	RL3	f = 2.5 to 6.0 GHz	10	15	–	dB
0.1 dB Loss Compression Input Power Note 2	$P_{in\ (0.1\ dB)}$	f = 0.5 to 2.0 GHz Note 1	–	+32.0	–	dBm
		f = 2.0 to 6.0 GHz	–	+31.0	–	dBm
		f = 0.5 to 6.0 GHz Note 1, $V_{cont\ (H)}$ = 5.0 V	–	+35.0	–	dBm
1 dB Loss Compression Input Power Note 3	$P_{in\ (1\ dB)}$	f = 0.5 to 2.0 GHz Note 1	–	+34.0	–	dBm
		f = 2.0 to 6.0 GHz	–	+34.0	–	dBm
Input 3rd Order Intercept Point	IIP_3	f = 2.5 GHz, P_{in} = +20 dBm	–	+60	–	dBm
2nd Harmonics	$2f_0$	f = 2.5 GHz, P_{in} = +20 dBm	–	80	–	dBc
3rd Harmonics	$3f_0$	f = 2.5 GHz, P_{in} = +20 dBm	–	80	–	dBc
Switch Control Current	I_{cont}	No RF input	–	0.1	10	μA
Switch Control Speed	t_{SW}	50% CTL to 90/10% RF	–	50	250	ns

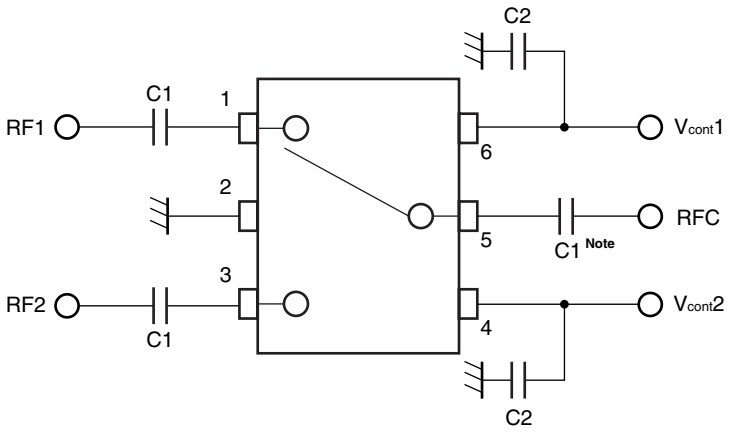
Notes 1. DC blocking capacitors = 56 pF at f = 0.5 to 2.0 GHz

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

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

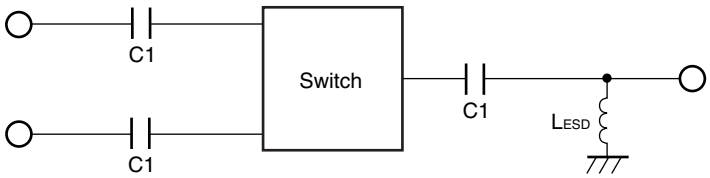
EVALUATION CIRCUIT



Note C1 : 0.5 to 2.0 GHz 56 pF
: 2.0 to 6.0 GHz 8 pF
C2 : 1 000 pF

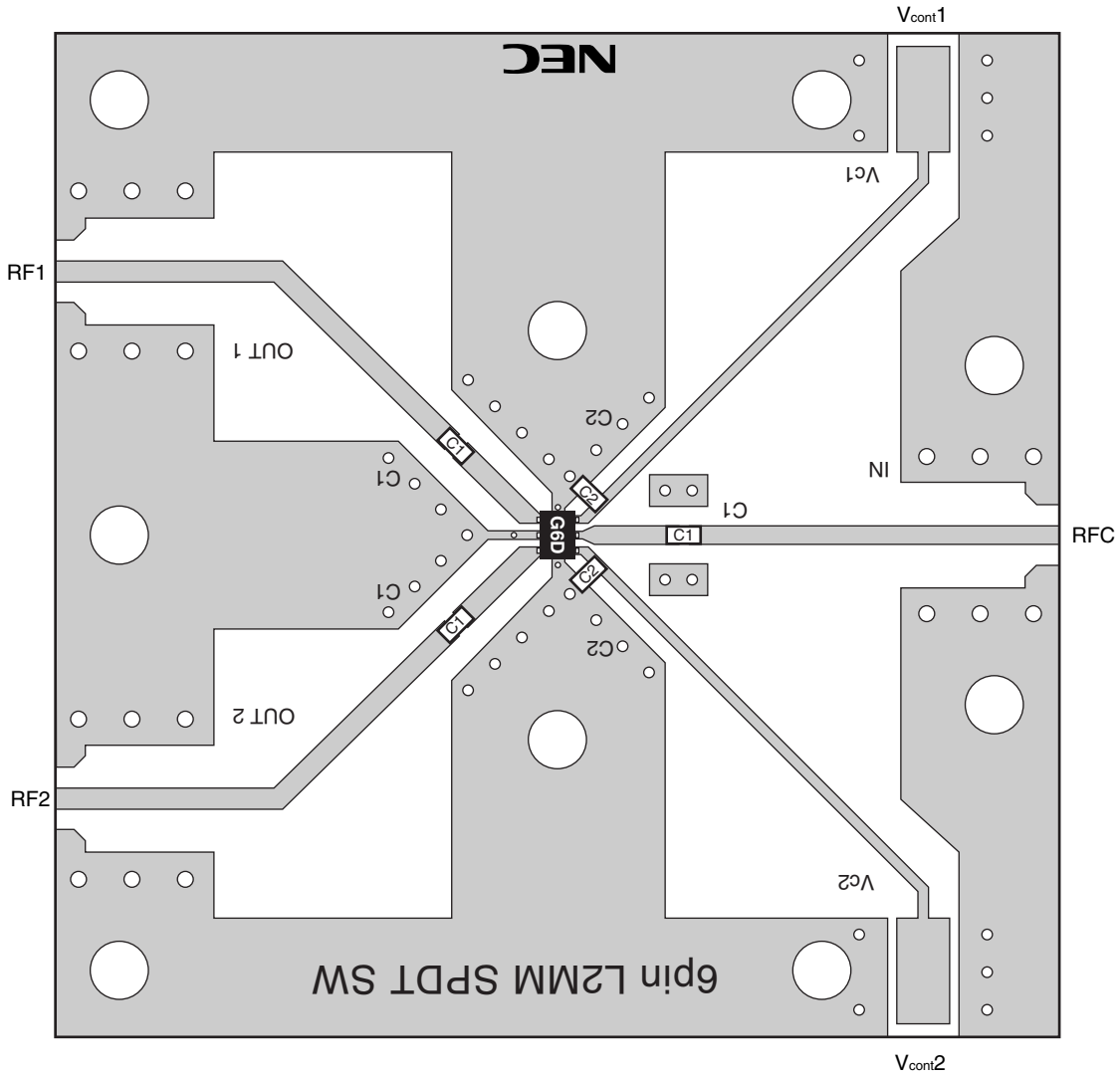
The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

APPLICATION INFORMATION



- L_{ESD} provides a means to increase the ESD protection on a specific RF port, typically the port attached to the antenna.
- The value may be tailored to provide specific electrical responses.
- The RF ground connections should be kept as short as possible and connected to directly to a good RF ground for best performance.

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD

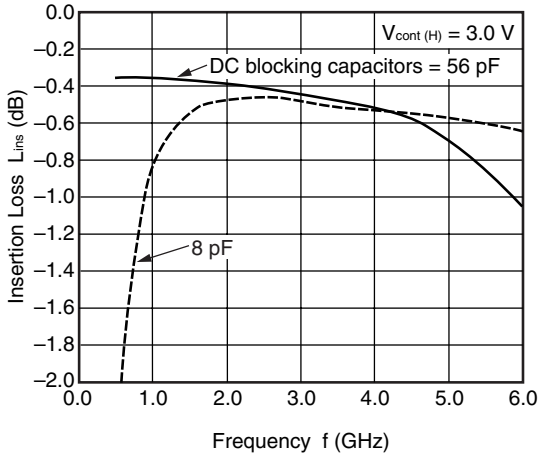


USING THE NEC EVALUATION BOARD

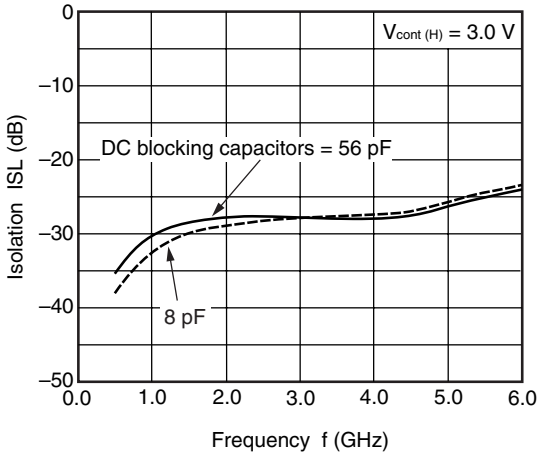
Symbol	Test Conditions	Values
C1	f = 0.5 to 2.0 GHz	56 pF
	f = 2.0 to 6.0 GHz	8 pF
C2		1 000 pF

TYPICAL CHARACTERISTICS (T_A = +25°C, $V_{cont\ (H)}$ = 3.0 V, $V_{cont\ (L)}$ = 0 V, Z_O = 50 Ω, DC blocking capacitors = 8 pF, unless otherwise specified)

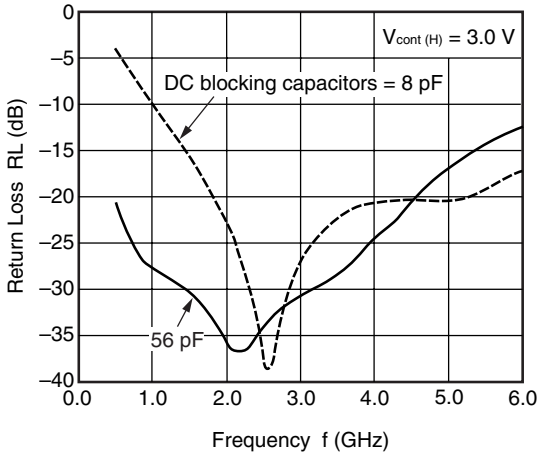
RFC-RF1/RF2
INSERTION LOSS vs. FREQUENCY



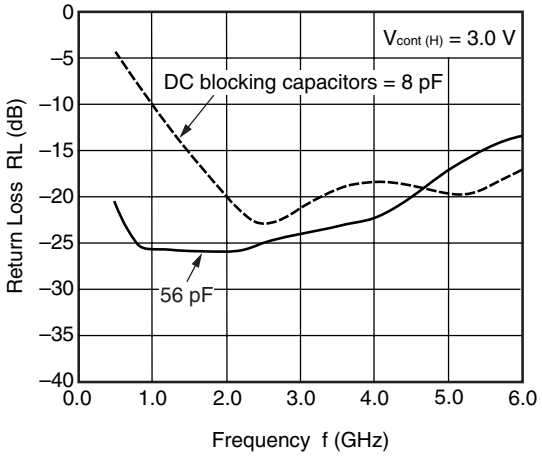
RFC-RF1/RF2
ISOLATION vs. FREQUENCY



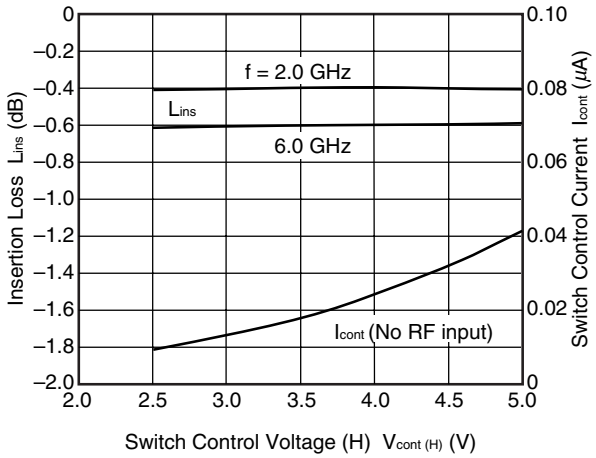
RFC RETURN LOSS vs. FREQUENCY



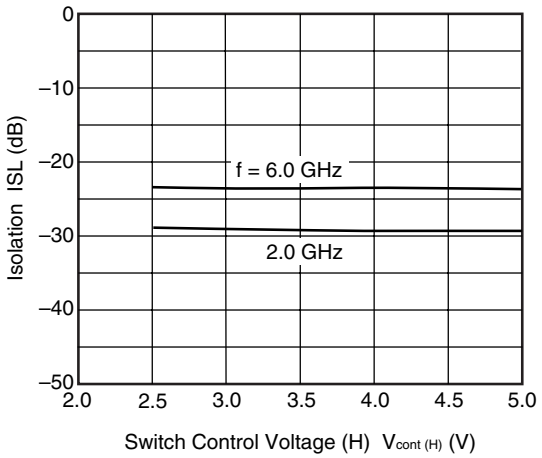
RF1/RF2 RETURN LOSS vs. FREQUENCY



RFC-RF1/RF2 INSERTION LOSS,
I_{cont} vs. SWITCH CONTROL VOLTAGE (H)

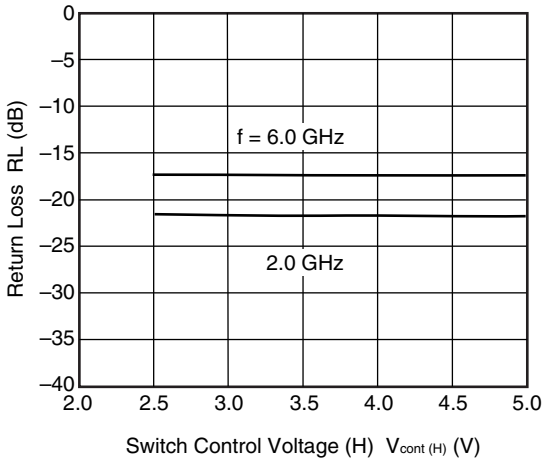


RFC-RF1/RF2 ISOLATION vs.
SWITCH CONTROL VOLTAGE (H)

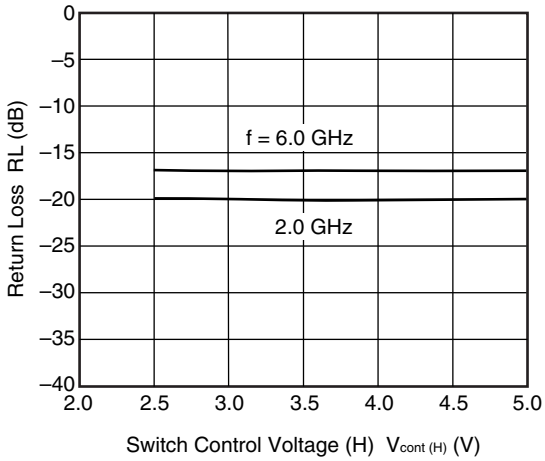


Remark The graphs indicate nominal characteristics.

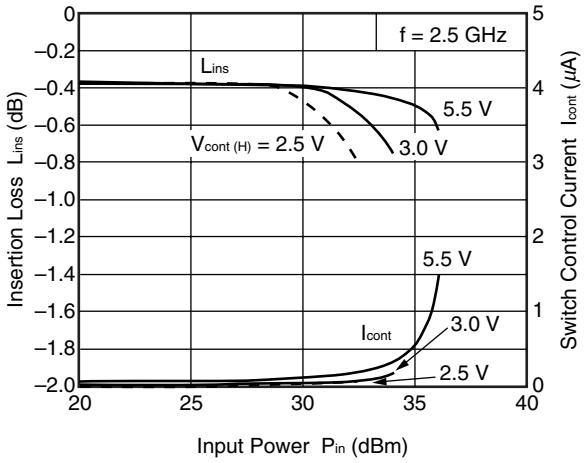
RFC RETURN LOSS vs.
SWITCH CONTROL VOLTAGE (H)



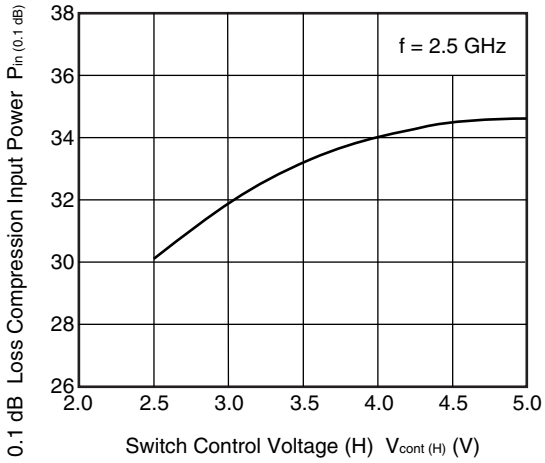
RF1/RF2 RETURN LOSS vs.
SWITCH CONTROL VOLTAGE (H)



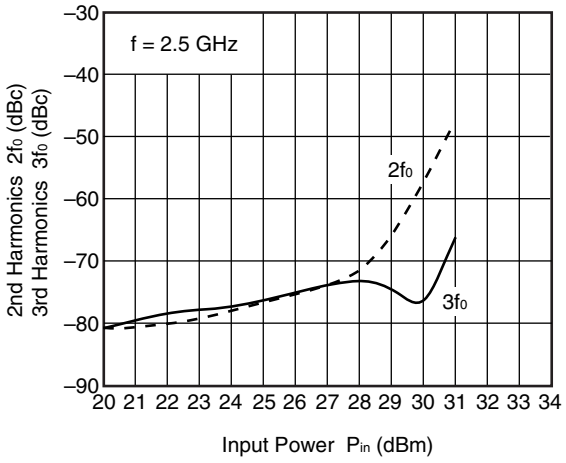
RFC-RF1/RF2 INSERTION LOSS,
I_{cont} vs. INPUT POWER



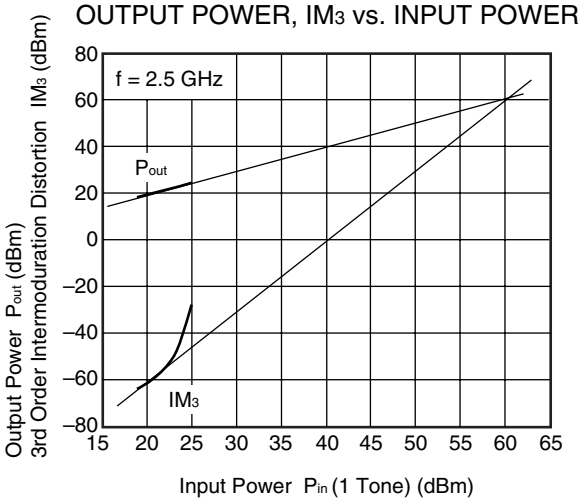
RFC-RF1/RF2 $P_{in\ (0.1\ dB)}$ vs.
SWITCH CONTROL VOLTAGE (H)



RFC-RF1/RF2
$2f_0$, $3f_0$ vs. INPUT POWER



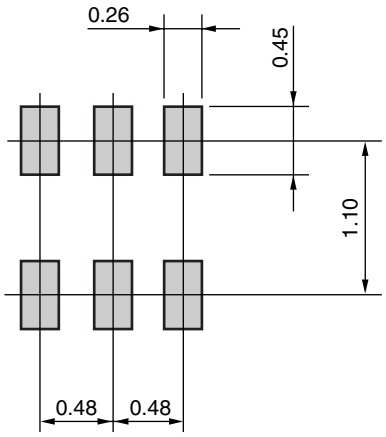
RFC-RF1/RF2
OUTPUT POWER, IM_3 vs. INPUT POWER



Remark The graphs indicate nominal characteristics.

MOUNTING PAD LAYOUT DIMENSIONS

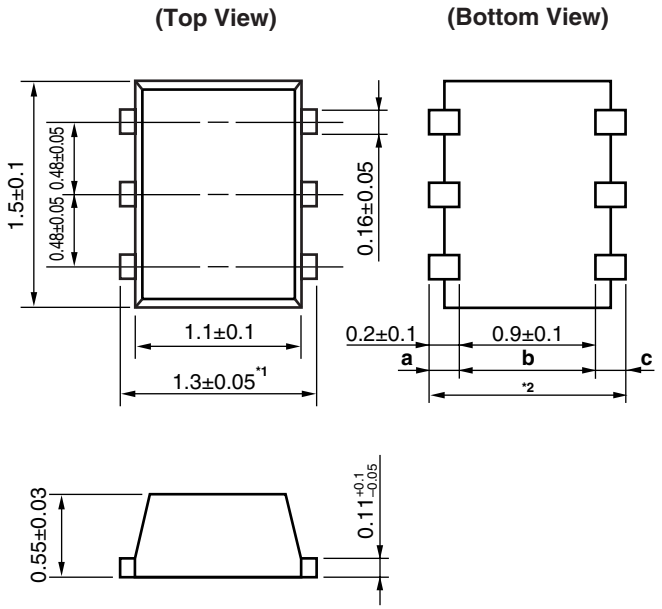
6-PIN LEAD-LESS MINIMOLD (1511 PKG) (UNIT: mm)



Remark The mounting pad layout in this document is for reference only.

PACKAGE DIMENSIONS

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



Remark Dimension*1 is bigger than dimension*2 (dimension*2 = **a** + **b** + **c**).

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) Time at peak temperature Time at temperature of 220°C or higher Preheating time at 120 to 180°C Maximum number of reflow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 60 seconds or less : 120±30 seconds : 3 times : 0.2%(Wt.) or below	IR260
Wave Soldering	Peak temperature (molten solder temperature) Time at peak temperature Preheating temperature (package surface temperature) Maximum number of flow processes Maximum chlorine content of rosin flux (% mass)	: 260°C or below : 10 seconds or less : 120°C or below : 1 time : 0.2%(Wt.) or below	WS260
Partial Heating	Peak temperature (terminal temperature) Soldering time (per side of device) Maximum chlorine content of rosin flux (% mass)	: 350°C or below : 3 seconds or less : 0.2%(Wt.) or below	HS350

Caution Do not use different soldering methods together (except for partial heating).

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M8E0904E

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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