RTC5601H : 0.1 GHz – 6.0 GHz SPDT Switch

Description

The RTC5601H is a SPDT antenna switch in GaAs pHEMT technology operating from 0.1 GHz up to 6.0 GHz frequency range. This device exhibits low insertion loss, high isolation and low DC power consumption characteristics over broadband range. Due to the excellent performance, RTC5601H undertakes the wonderful choice of transmit/receive function in wireless applications such as mobile phone, Bluetooth®, WLAN, and IEEE 802.11 a/b/g/n/ac.

Feature

- Frequency Range : 0.1 – 6.0 GHz
- Low Control Voltage : 3.0 V
- Low Insertion Loss : 0.55 dB@ 2.5 GHz
  : 0.75 dB@ 5.9 GHz
- High Isolation : 28 dB@2.5 GHz
  : 28 dB@5.9 GHz
- High Handling Power : P1dB = +37 dBm@2.5 GHz, +36 dBm@5.8GHz
- 6L QFN-1.5x1.5x0.55 mm^3 Plastic Package
- RoHS, Pb-free, Halogen Free Compliant
- Moisture Sensitivity Level : MSL 3

Application

- IEEE 802.11a/b/g/n/ac WLAN networks
- WiMAX 802.16
- Bluetooth®
- L, S band digital cellular or cordless telephone

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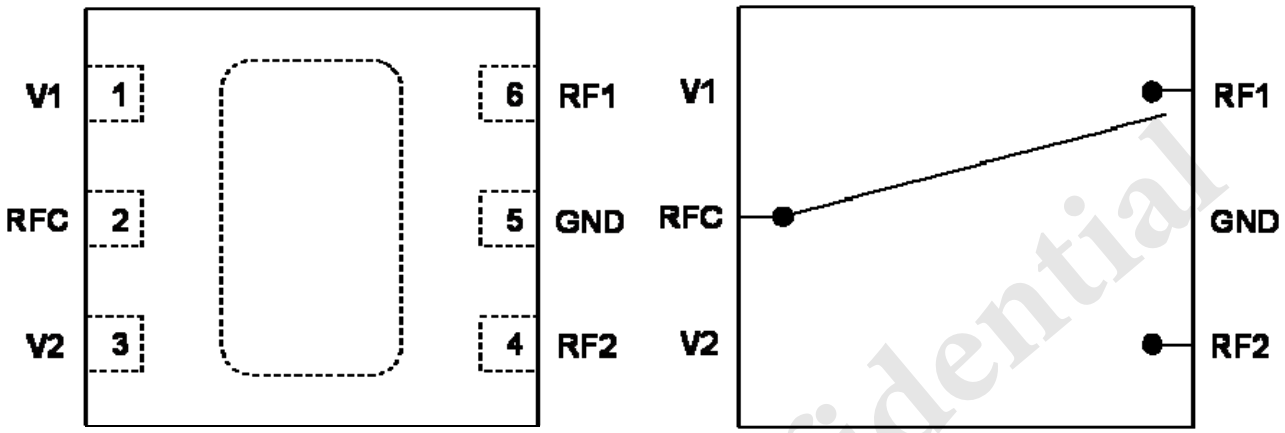
Pin Out (Top View through package) & Functional Block Diagram



Pin Function Description

Pin No.	Name	Description	Pin No.	Name	Description
1	V1	DC control voltage	4	RF2	RF Signal, DC blocking needed
2	RFC	RF Signal, DC blocking needed	5	GND	Ground
3	V2	DC control voltage	6	RF1	RF Signal, DC blocking needed
Exposed Pad		Must be connected to GND for best performance			

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Recommended Operation Range

Parameter	Symbol	Min	Typ	Max	Unit
Operation Frequency	f1	0.1	–	6.0	GHz
Control Voltage High (H)	V1, V2	2.5	3.0	5.0	V
Control Voltage Low (L)	V1, V2	0	0	0.25	V

Absolute Maximum Rating

Parameter	Symbol	Rating	Unit
Control voltage	V1, V2	+6.0	V
Input power	P_{IN}	+38	dBm
Operating temperature	T_A	-30 ~ +85	℃
Storage temperature	T_{ST}	-30 ~ +125	℃

Note : Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only, functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation between operation range maximum and absolute maximum for extended periods may affect device reliability.

Truth Table

V1	V2	RFC – RF1	RFC – RF2
High	Low	ON	OFF
Low	High	OFF	ON

Note : High =2.5 ~ 5.0 V, Low = 0 ~ 0.25 V

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Electrical Specifications

T_A = 25℃, 50Ω system with control voltage V = 3 V / 0 V, P_{IN} = 0 dBm, C_{Block} = 47 pF, unless otherwise noted

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Insertion Loss RFC to RF1 or RF2	IL_1	0.1 – 0.5 GHz	–	0.65	–	dB
	IL_2	0.5 – 2.0 GHz	–	0.60	0.75	dB
	IL_3	2.0 – 2.5 GHz	–	0.55	0.75	dB
	IL_4	2.5 – 3.5 GHz	–	0.55	0.75	dB
	IL_5	3.5 – 6.0 GHz	–	0.75	0.95	dB
Isolation RFC to RF1 or RF2	Iso_1	0.1 – 0.5 GHz	–	33	–	dB
	Iso_2	0.5 – 2.0 GHz	27	30	–	dB
	Iso_3	2.0 – 2.5 GHz	25	28	–	dB
	Iso_4	2.5 – 3.5 GHz	24	27	–	dB
	Iso_5	3.5 – 6.0 GHz	24	28	–	dB
Isolation RF1 to RF2	Iso_1	0.1 – 0.5 GHz	–	35	–	dB
	Iso_2	0.5 – 2.0 GHz	28	31	–	dB
	Iso_3	2.0 – 2.5 GHz	26	29	–	dB
	Iso_4	2.5 – 3.5 GHz	26	29	–	dB
	Iso_5	3.5 – 6.0 GHz	27	31	–	dB
Return loss (Insertion loss state)	RL_1	0.1 – 0.5 GHz	15	25	–	dB
	RL_2	0.5 – 2.0 GHz	15	25	–	dB
	RL_3	2.0 – 2.5 GHz	15	28	–	dB
	RL_4	2.5 – 3.5 GHz	15	29	–	dB
	RL_5	3.5 – 6.0 GHz	13	17	–	dB
Input power for 1dB compression	P1dB	2.5 GHz	–	+37	–	dBm
		5.9 GHz	–	+36	–	

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2nd harmonic	2fo	f = 2.5 GHz Pin = +25 dBm	–	71	–	dBc
3rd harmonic	3fo	f = 2.5 GHz Pin = +25 dBm	–	71	–	dBc
Error Vector Magnitude, WLAN	EVM_2.5%	f = 2.45 GHz, WLAN,802.11g,OFDM, 54Mbps, 64QAM, P_{in} for 2.5% error	–	24	–	dBm
Switch Rise/Fall Time	tr, tf	Rise, Fall (10%/90% RF to 90%/10% RF)	–	100	–	ns
Switch On/Off Time	ton, toff	On, Off (50% V to 90%/10% RF)	–	100	–	ns
Control Current	Ictl	No RF	–	3	–	μA

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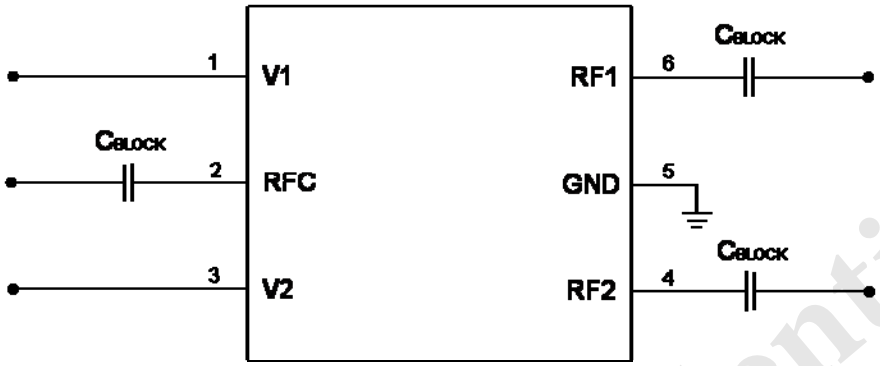
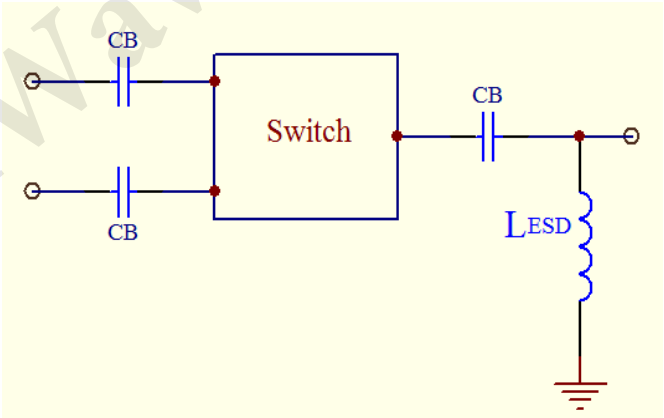
Application Circuit



Note:

1. C_{BLOCK} = 47 pF for operation 0.1 ~ 6.0 GHz are required on all RF ports.
2. Larger Capacitance recommended for lower frequency operation.
3. Exposed paddle in the bottom must be grounded.

Application Information



1. Recommend to add L_{ESD} to provide a good approach for increasing the ESD protection on a specific RF port, typically the port attached to the antenna.
2. The L_{ESD} value may be tailored to provide specific electrical responses.
3. The RF ground connections should be kept as short as possible and directly connected to a good RF ground for best performance.

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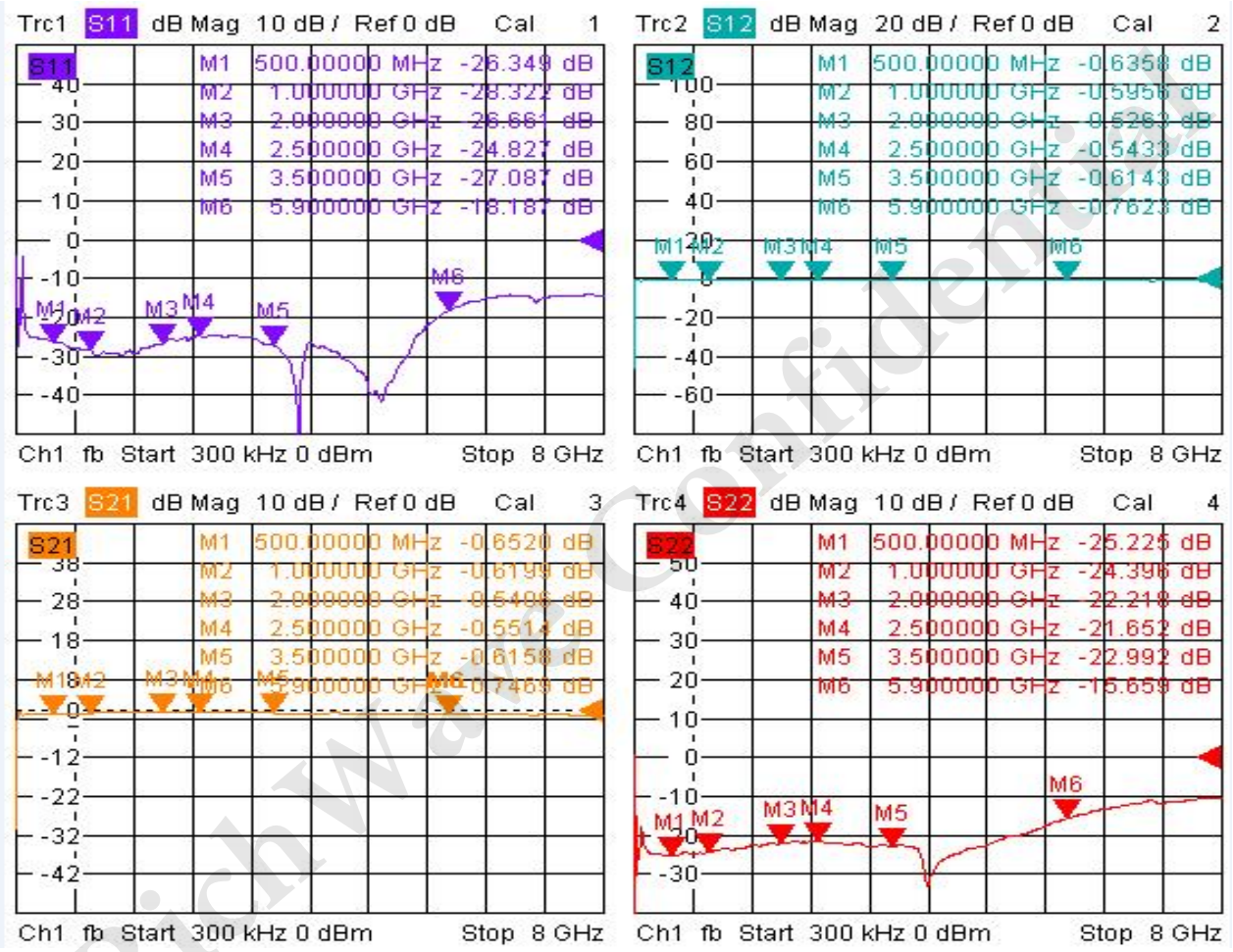
Typical Performance Characteristics

T_A = 25℃, 50 Ω system with control voltage = 0/3 V, P_{IN} = 0 dBm, unless otherwise noted.

RFC – RF1 IL & RL at V1 = High



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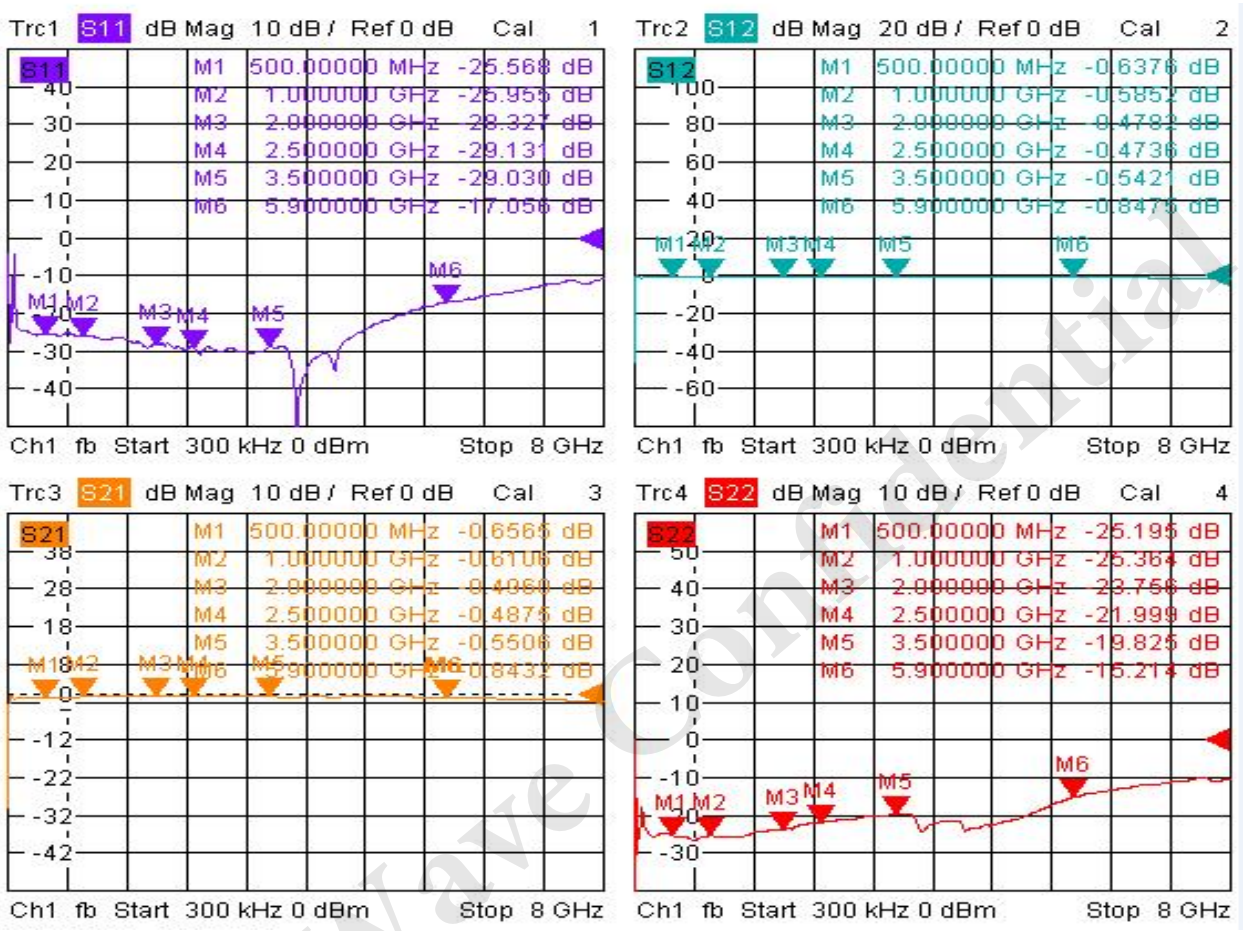
RFC – RF2 IL & RL at V2 = High



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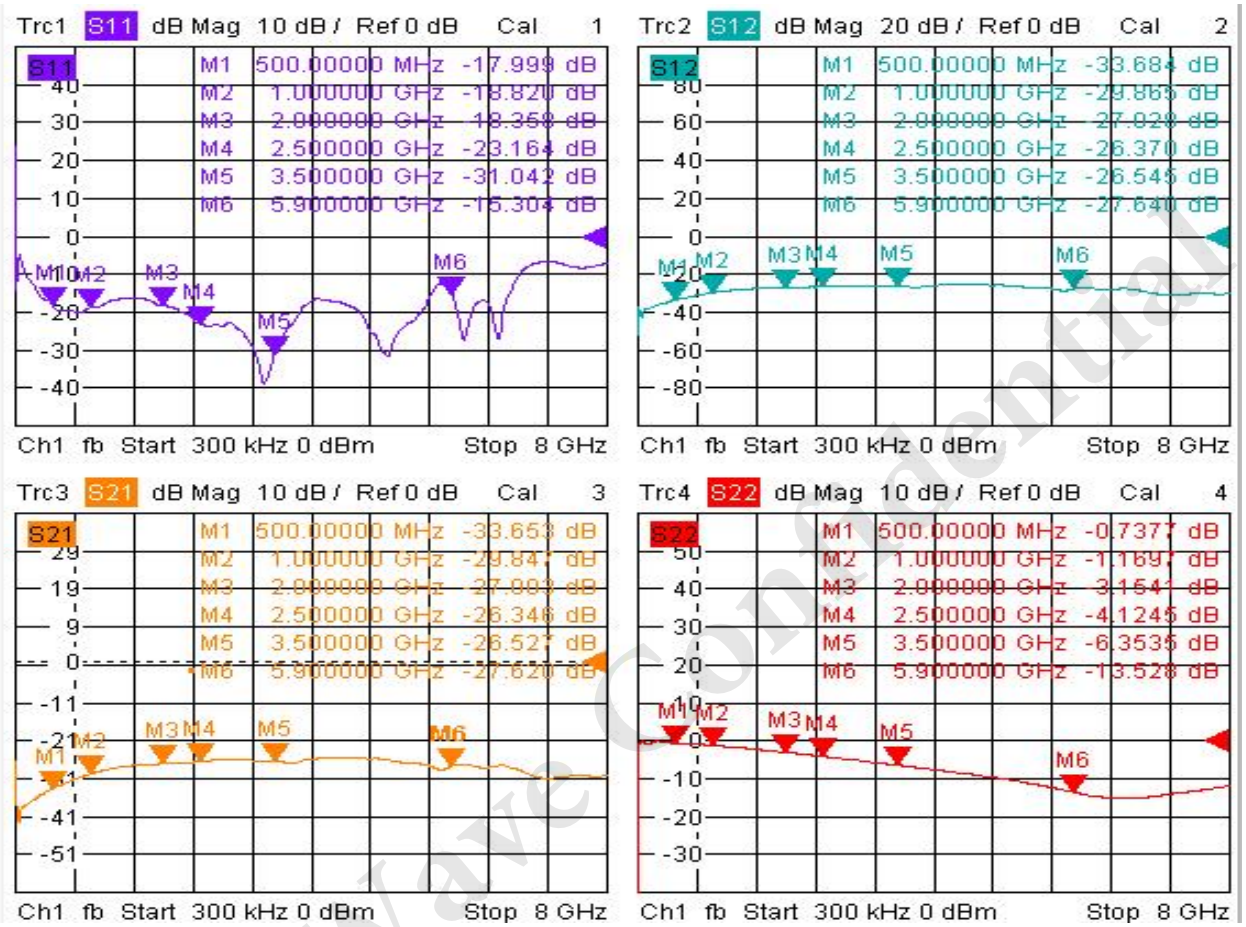
RFC – RF2 Isolation at V1 = High



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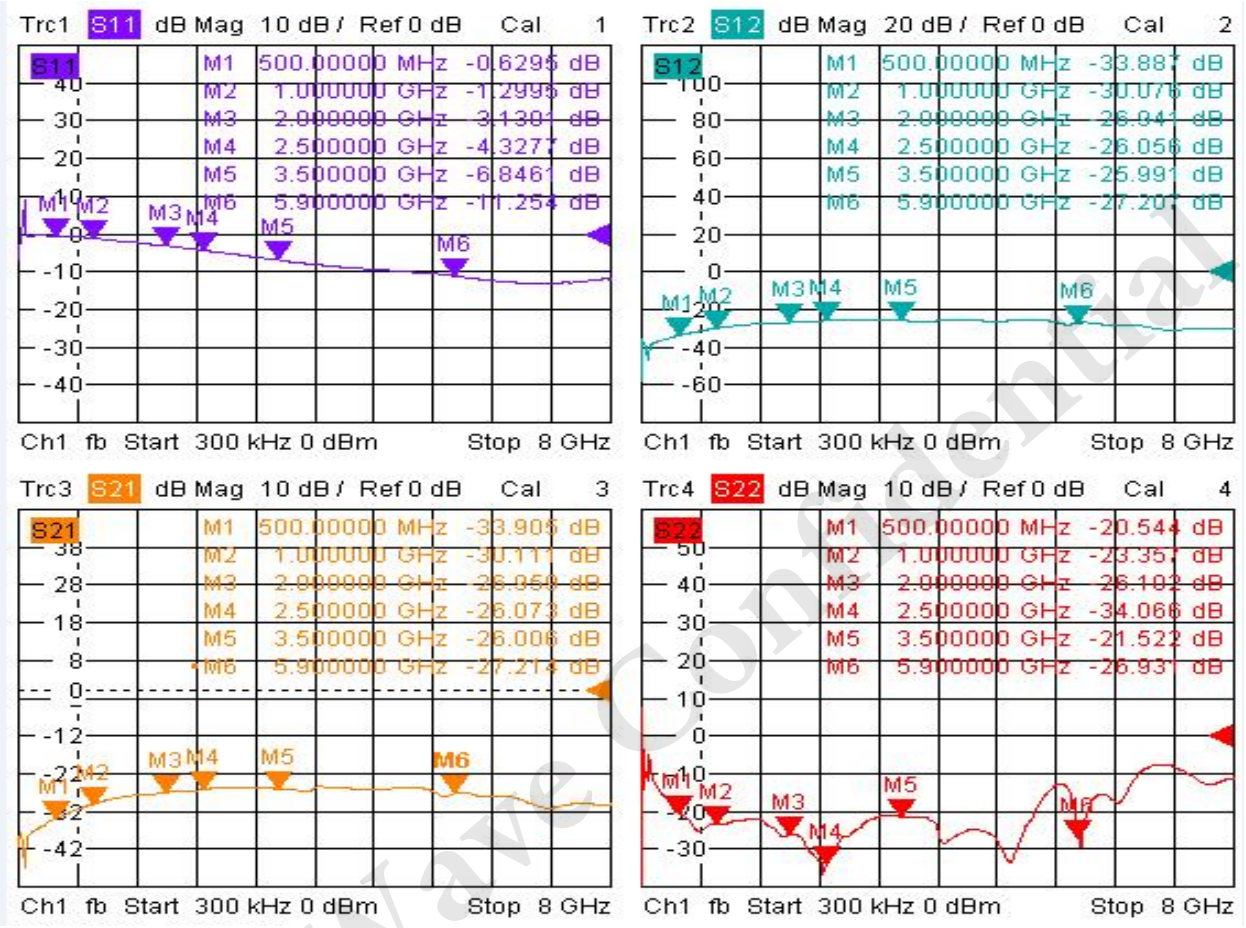
RFC – RF1/RF2 Isolation at V2 = High



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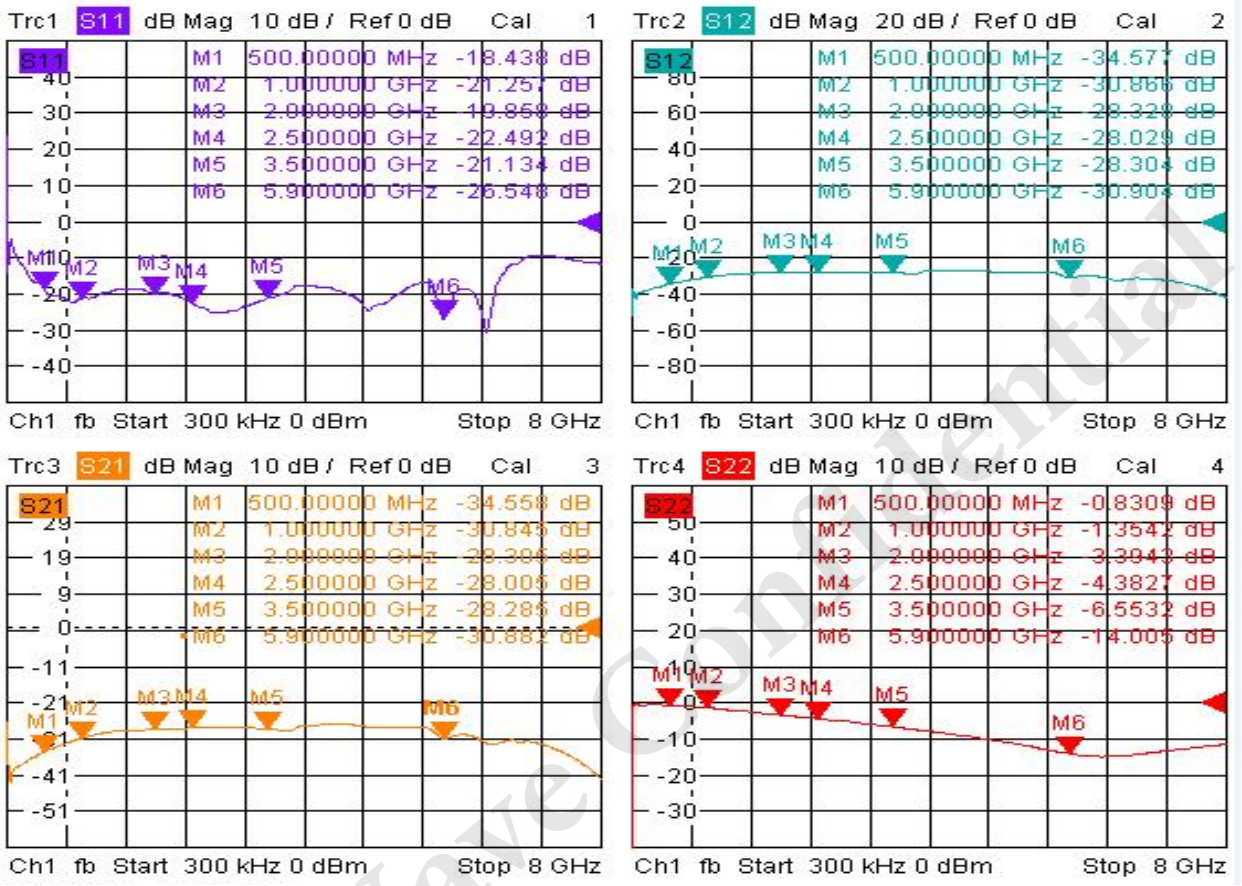
RF1 – RF2 Isolation at V1 = High



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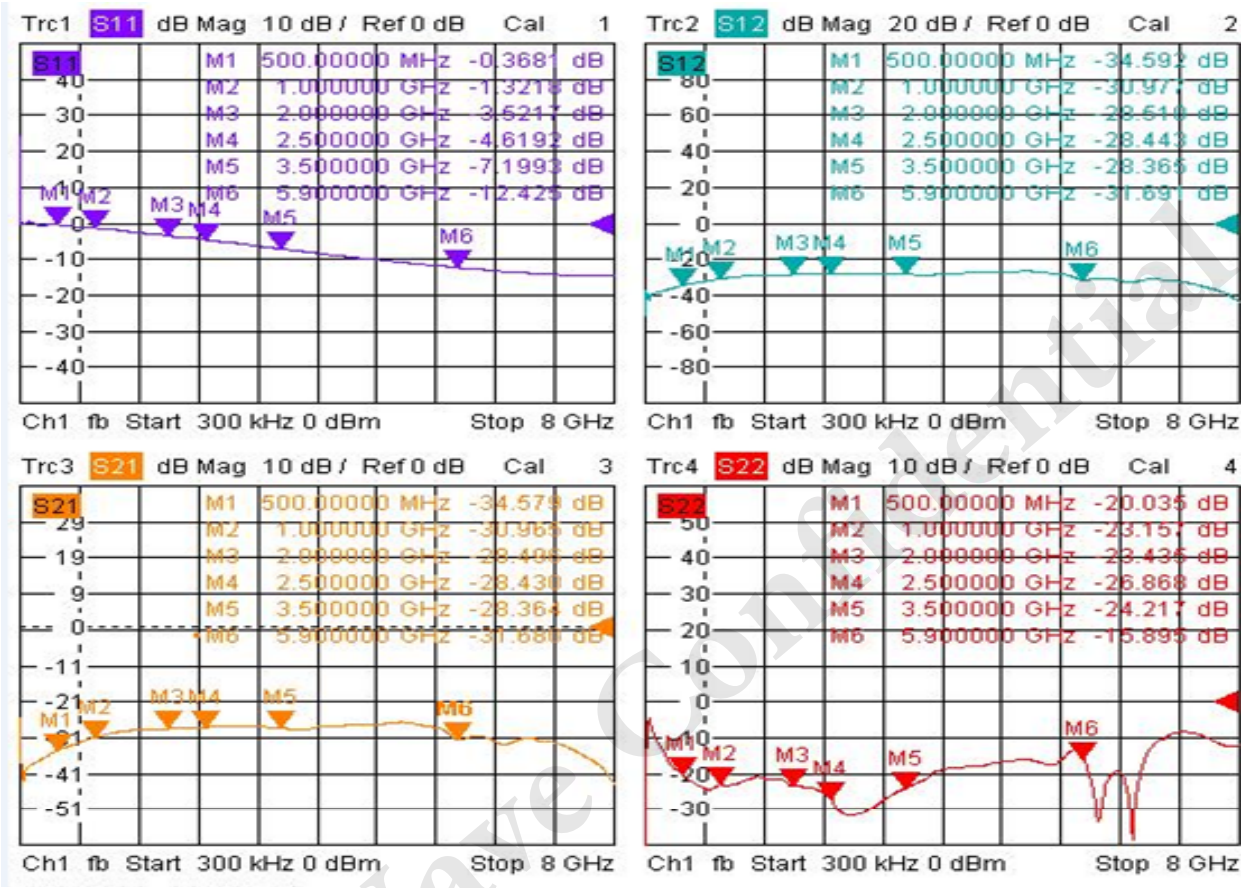
RF1 – RF2 Isolation at V2 = High



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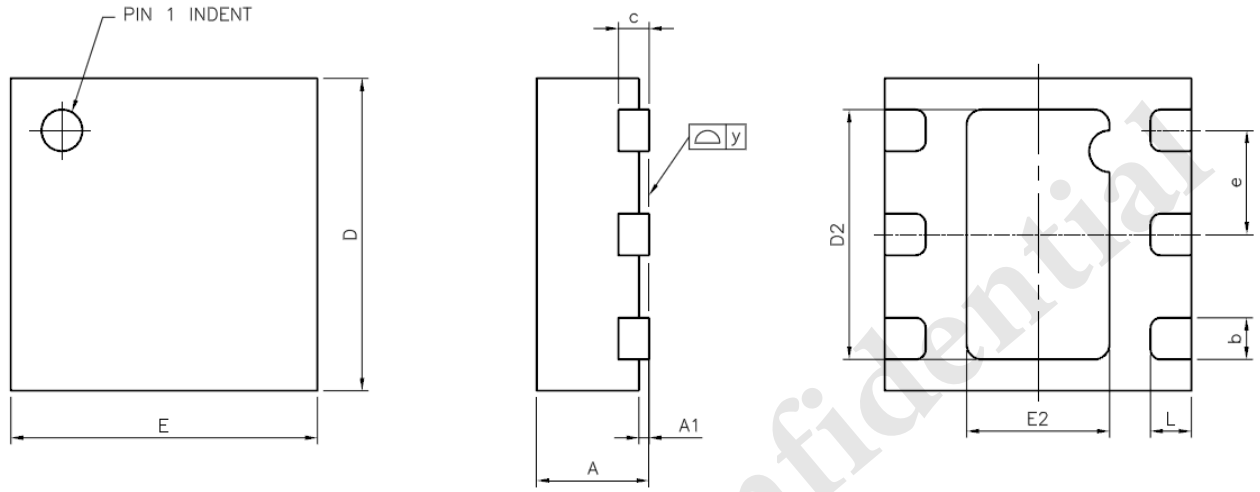
Package Outline Dimension



SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
c	——	0.15 REF.	——
b	0.15	0.20	0.25
D	1.40	1.50	1.60
D2	1.15	1.20	1.25
E	1.40	1.50	1.60
E2	0.65	0.70	0.75
e	——	0.50	——
L	0.15	0.20	0.25
y	0.00	——	0.075

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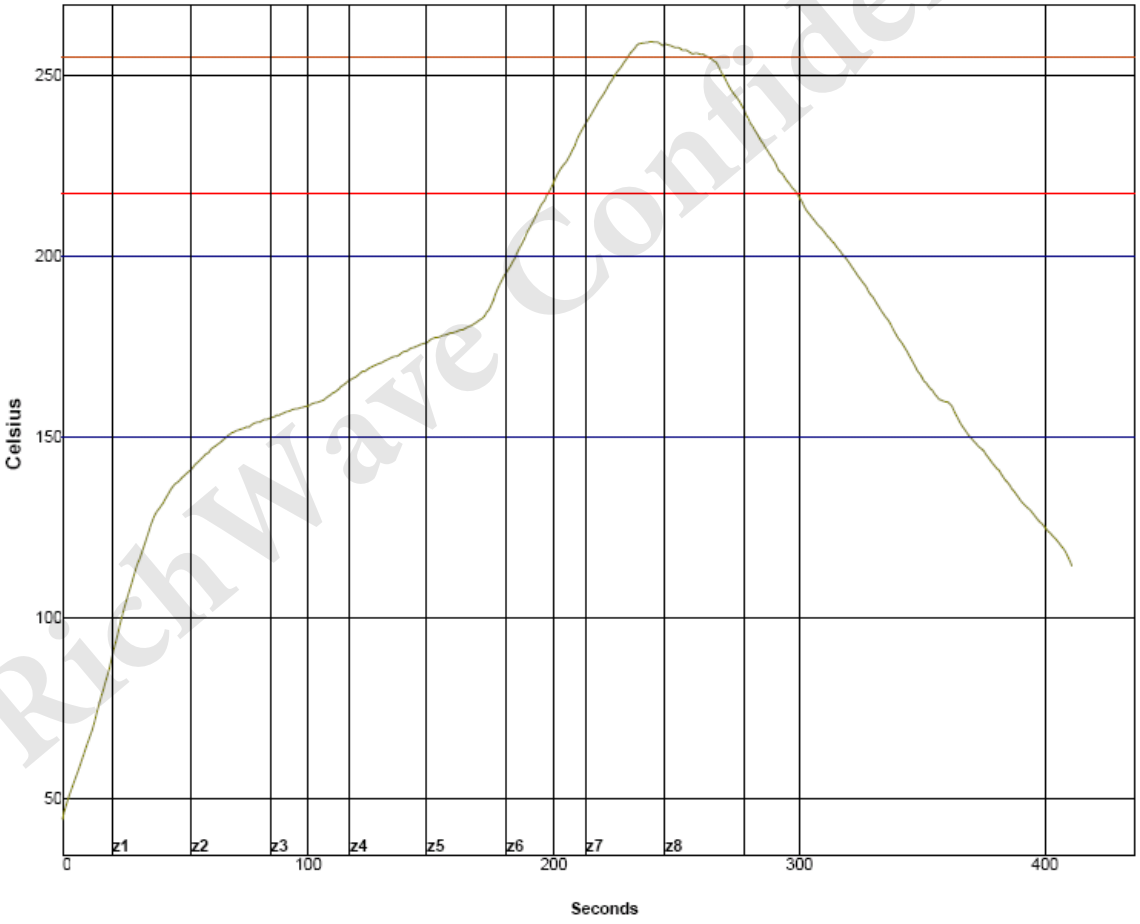
Recommended Solder Reflow Profiles

Average ramp-up rate (200˚C to peak)	3˚C/second max.
Preheat temperature 175 (+/-25) ˚C	60~120secs
Temperature maintained above 217˚C	60~150secs
Time within 5˚C of actual peak temperature	30 seconds min.
Peak temperature range	(260 +2/-2)˚C
Ramp down rate	6˚C/second max.
Time 25˚C to peak temperature	8 minutes max.

* Follow JEDEC spec J-STD-020D



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