Revision History

Rev.	History	Issue Date	Remark
0.1	Initial version	20010107	Preliminary Version created by Randall
1.0	Add Revision History	20150711	Rick Hsiao
1.1	Add ESD specifcation	20250831	Randall Lan
1.2	Marking 31A	20260413	Randall Lan
2	Application circuit, R=10K ohm	20260526	Randall Lan

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TM3001A ~3GHz RF Switch, SPDT MMIC with ESD 2000V HBM

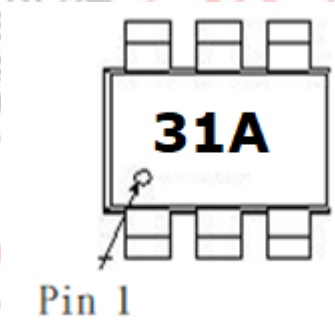
General Description

The TM3001A is a GaAs MMIC SPDT switch with ESD in a SOT-363 6 lead plastic package. The SPDT MMIC build in ESD +/2000V/-2000V HBM protection. It is good to sued in RF Front circuit. The TM3001A features low insertion loss and positive voltage operation with low DC power consumption. Typical applications are for the variety of analog and digital wireless communication systems.

Features

- Insertion Loss: 0.325dB @ 2.5GHz
- P_{-1dB}: +32dBm Typical @+3.3V
- Isolation >23 dB
- IIP3: 55dBm @ Input Power up to 20dBm
- ESD HBM mode +2000/-2000V
- Good Reliability Performance
- SOT-363-6 Lead Plastic Package
- T/R Switches in 802.11b, g WLAN Systems

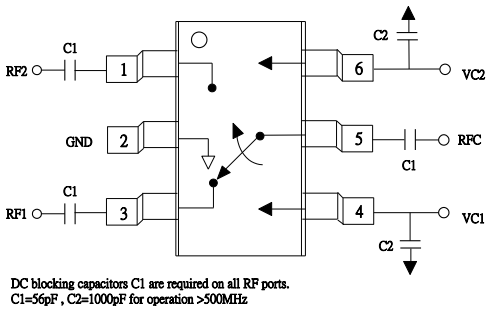
Product Photo



Application

- WLAN
- Mobile Phone
- Bluetooth
- DECT
- PHS
- GPS

Functional Block Diagram



DC blocking capacitors C1 are required on all RF ports.
C1=56pF , C2=1000pF for operation >500MHz

Absolute Maximum Ratings

Parameter	Value	Unit
Switch Control VC1 , VC2	-6.0 to +6.0 Note	V
RF input Power (>500MHz)	33	dBm
Operating Temperature	-40 to +85	℃
Storage Temperature	-65 to +150	℃

Note $|VC1-VC2| \leqq 6.0V$

Notes:

1. Operation of this device in excess of any maximum rating as specified above may cause permanent damage to the device.
2. Caution! ESD Sensitive Device.

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Electrical Specifications at 25°C with 0, +3V Control Voltages

Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Insertion Loss	Input Power +25dBm DC–1.0GHz 1.0 -2.0GHz 2.0 -3.0GHz	-	 0.3 0.35 0.35	 0.4 0.5 0.6	 dB dB dB
Isolation	Input Power +25dBm DC–1.0GHz 1.0 -2.0GHz 2.0 -3.0GHz	 24 23 22	 26 24 23	 - -	 dB dB dB
VSWR	DC–1.0GHz 1.0 -2.0GHz 2.0 -3.0GHz	-	1.2 1.2 1.2	1.4 1.4 1.6	-
Input Power for 1 dB compression	2.45GHz	-	32	-	dBm
Second Harmonics	f=2.5GHz, Pin=25dBm	-	-75	-	dBc
Third Harmonics	f=2.5GHz, Pin=25dBm	-	-80	-	dBc
Intermodulation Intercept Point (IIP3)	For two tones (f=2.5GHz, 2.501GHz) @ Input power +20dBm	-	55	-	dBm
Switch Time		-	50	-	ns
Control Current	Input Power +25dBm	-	4	100	μA
ESD	At Vc1, Vc2 PINS		+/- 2000		V
VC1, Vc2		2.8	5	6	V

Notes: All measurements made in 50Ω system, unless otherwise specified.
DC=500MHz

Pin Assignment

Pin No.	Pin Name
1	RF2
2	GND
3	RF1
4	VC1
5	RFC
6	VC2

SW Truth Table

VC1	VC2	RFC-RF1	RFC-RF2
High	Low	Isolation	Insertion Loss
Low	High	Insertion Loss	Isolation

High: 3V to 5V, Low: -0.2V to 0.2V

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Reliability Testing Items and Specification

No.	Testing Items
1	Temperature Cycling Testing + IR Reflow
2	Pressure Cooker Testing + IR Reflow
3	Thermal Humidity Testing
4	Working Life
5	Electro-Static Discharge
6	Over Voltage
7	Over Power

All sample passed reliability testing

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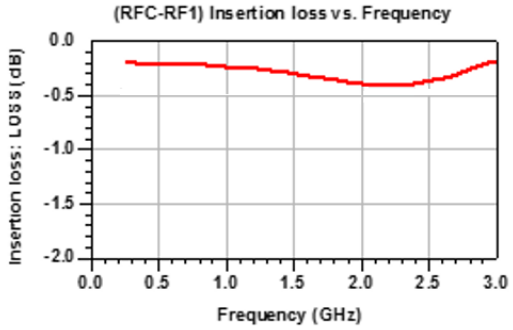
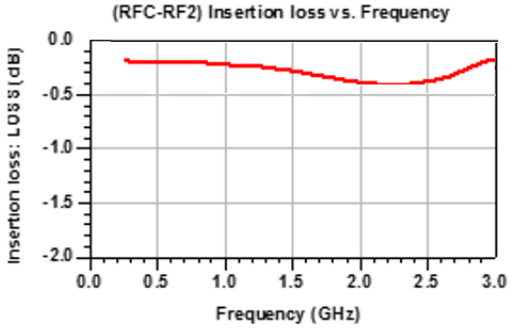
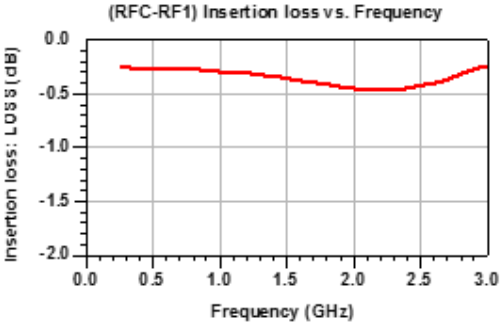
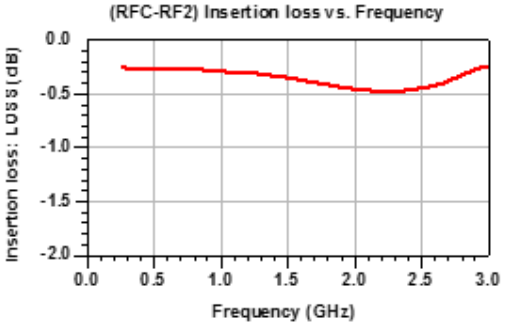
Typical Characteristics

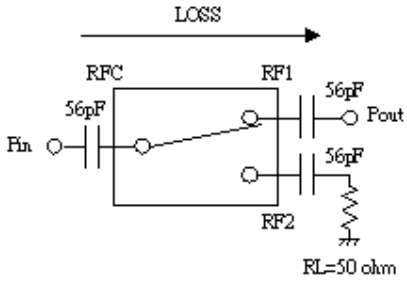
(V_{cc}=0V/3.0V , P_{in}=0dBm)

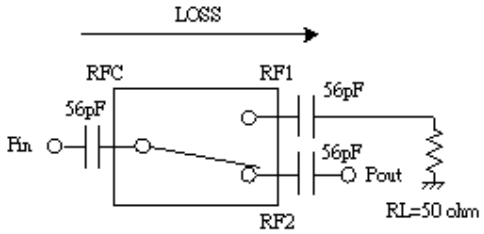












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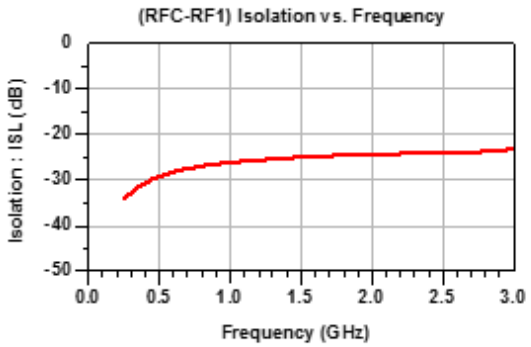

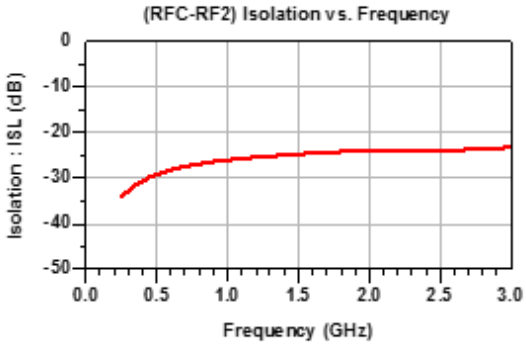

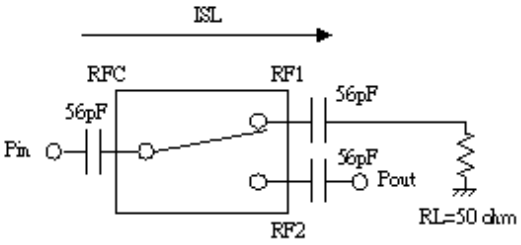

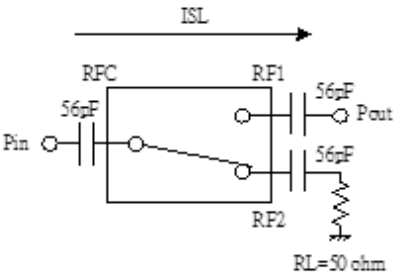

Typical Characteristics (continued)

(V_{cc}=0V/3.0V , P_{in}=0dBm)

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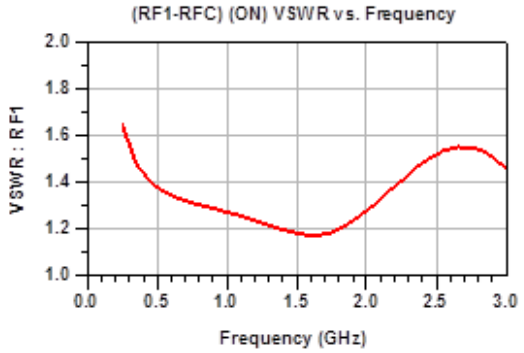

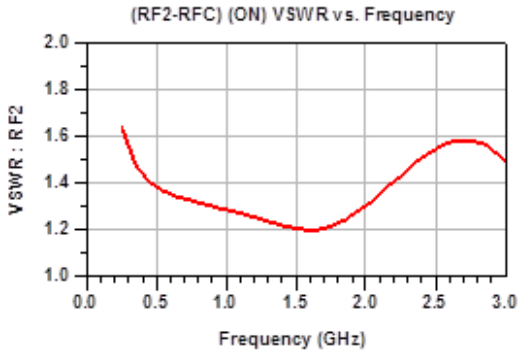

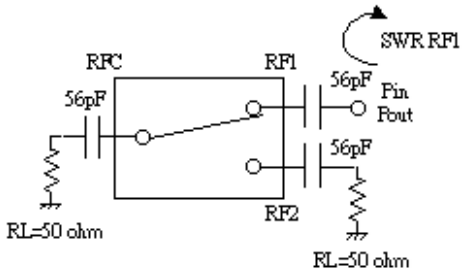

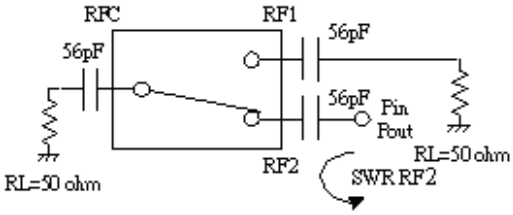

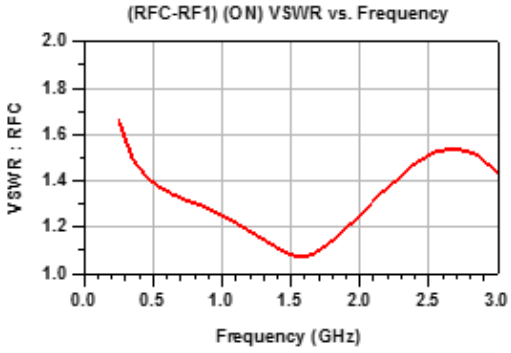

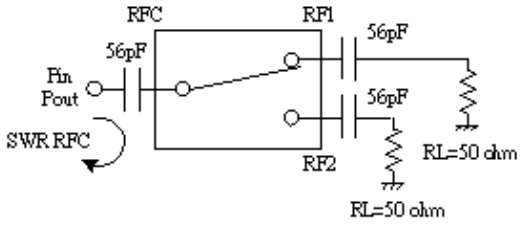

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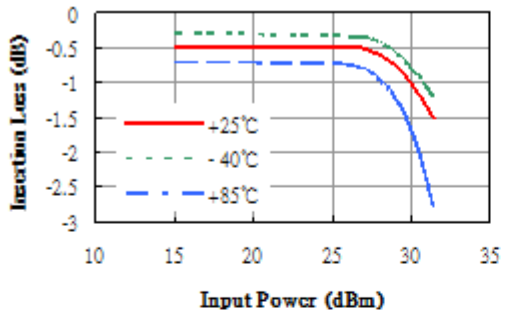
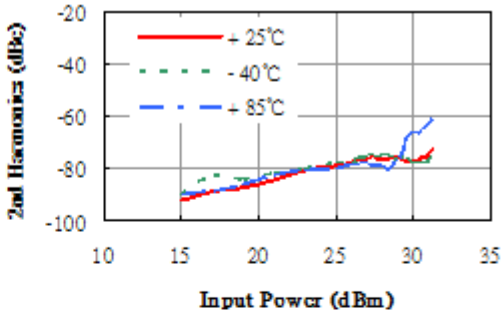
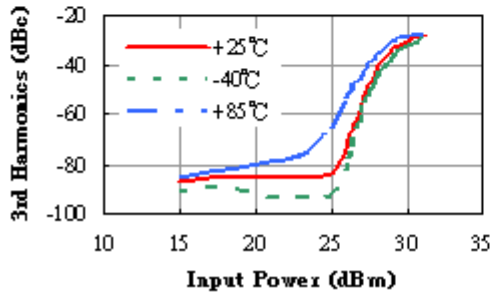
Typical Characteristics (continued)

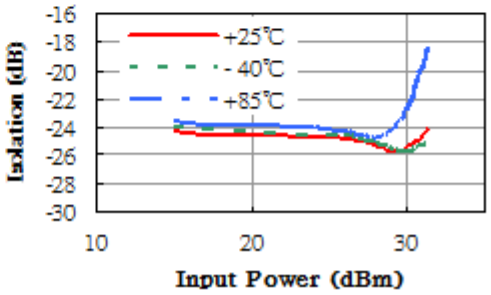




3rd Harmonics vs. Ambient Temperature
(Vcc=0V/3.0V , 2.5GHz@-40℃,+25℃,+80℃)



Isolation vs. Input Power
(Vcc=0V/3.0V , 2.5GHz@-40℃,+25℃,+80℃)



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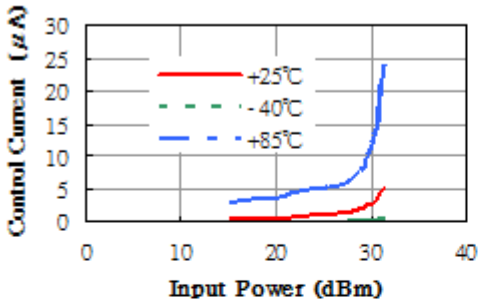
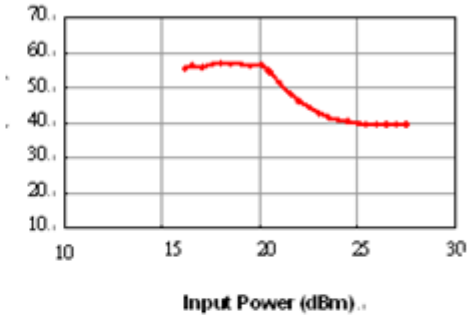
Typical Characteristics (continued)

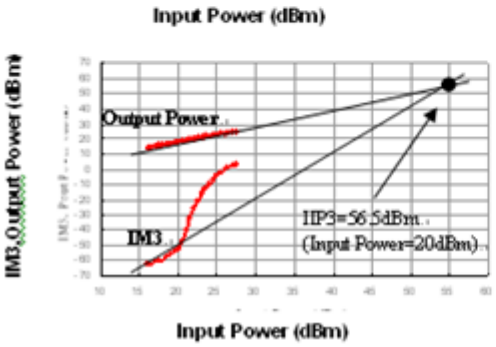
Control Current vs. Input Power
(Vcc=0V/3.0V , 2.5GHz@-40℃,+25℃,+80℃)



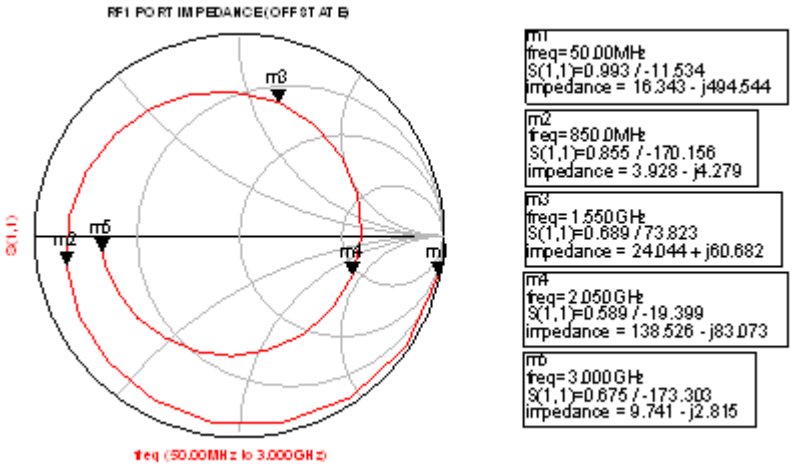
IIP3 vs. Input Power
(Vcc=0 V/3.0V , 2.5 GHz)

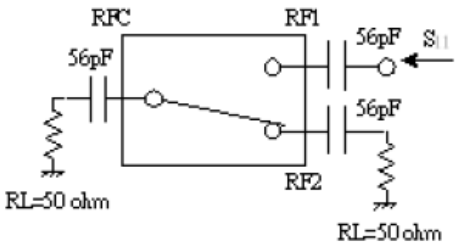


Output Power,IM3 vs. Input Power
(Vcc=0 V/3.0V , 2.5 GHz@ Input Power 20dBm)



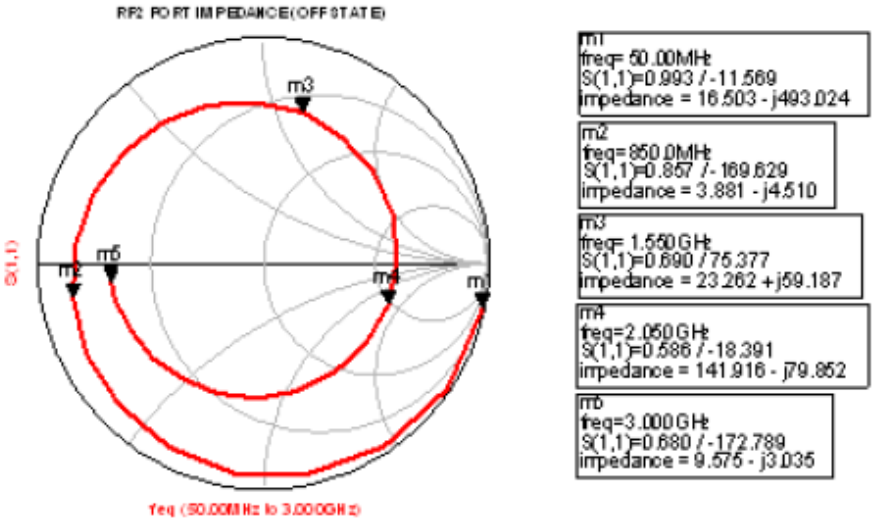
RF1 Port Impedance (Off State)

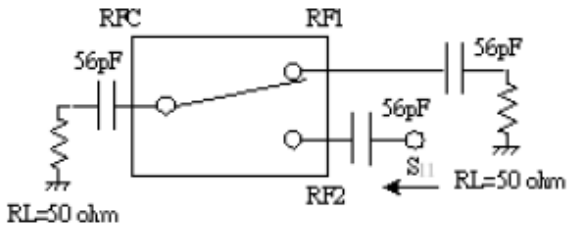




Marker	f (MHz)	Mag.	Ang.(∠°)
1	50	0.933	-11.53
2	850	0.855	-170.15
3	1550	0.689	73.82
4	2050	0.589	-19.39
5	3000	0.675	-173.30

RF2 Port Impedance (Off State)





Marker	f (MHz)	Mag.	Ang.(∠°)
1	50	0.933	-11.53
2	850	0.855	-170.15
3	1550	0.689	73.82
4	2050	0.589	-19.39
5	3000	0.675	-173.30

Typical Characteristics(continued)

Scattering Parameters: S11 (Off State), (Vcc=0/3.0V, 50Ω System)

	RF1 Port		RF2 Port	
f(MHz)	Mag.	Ang.(∠°)	Mag.	Ang.(∠°)
50	0.933	-11.53	0.993	-11.56
100	0.990	-22.83	0.989	-22.91
200	0.978	-46.15	0.978	-46.27
300	0.963	-67.13	0.963	-67.27
400	0.946	-87.31	0.946	-87.42
500	0.925	-108.04	0.925	-108.06
600	0.905	-126.24	0.906	-126.13
700	0.887	-143.95	0.888	-143.69
800	0.865	-162.07	0.866	-161.62
900	0.845	-178.31	0.847	-177.68
1000	0.823	165.44	0.826	166.26
1100	0.800	148.60	0.803	149.59
1200	0.778	132.60	0.780	133.77
1300	0.751	115.52	0.753	116.87
1400	0.727	99.50	0.729	100.95
1500	0.701	82.79	0.702	84.33
1600	0.674	64.82	0.674	66.37
1700	0.652	47.04	0.650	48.57
1800	0.627	29.32	0.625	30.77
1900	0.608	9.55	0.606	10.83
2000	0.592	-9.46	0.589	-8.35
2100	0.583	-29.42	0.580	-28.56
2200	0.581	-48.34	0.578	-47.72
2300	0.583	-66.31	0.580	-65.85
2400	0.593	-84.95	0.592	-84.64
2500	0.603	-101.82	0.602	-101.59
2600	0.618	-118.17	0.619	-117.96
2700	0.633	-133.18	0.635	-133.02
2800	0.647	-147.75	0.650	-147.48
2900	0.664	-160.75	0.668	-160.39
3000	0.675	-173.30	0.680	-172.78

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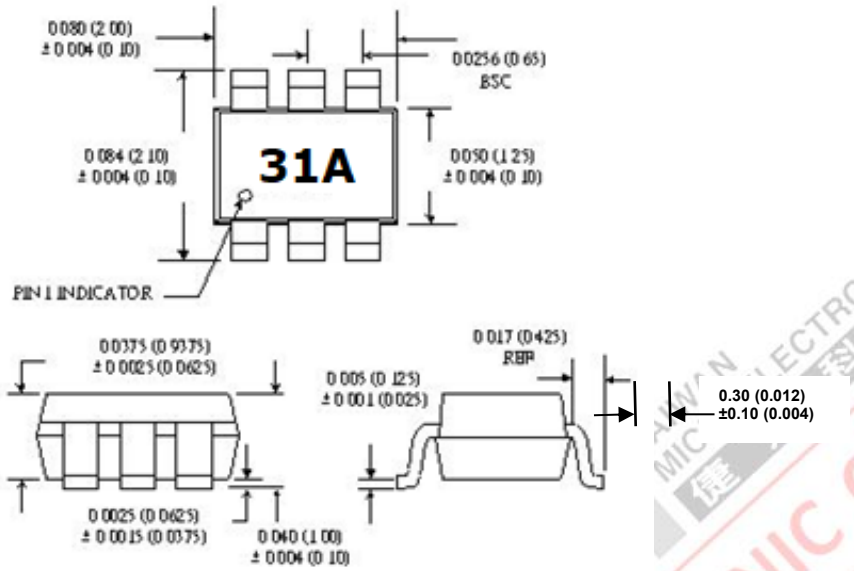
Package Information

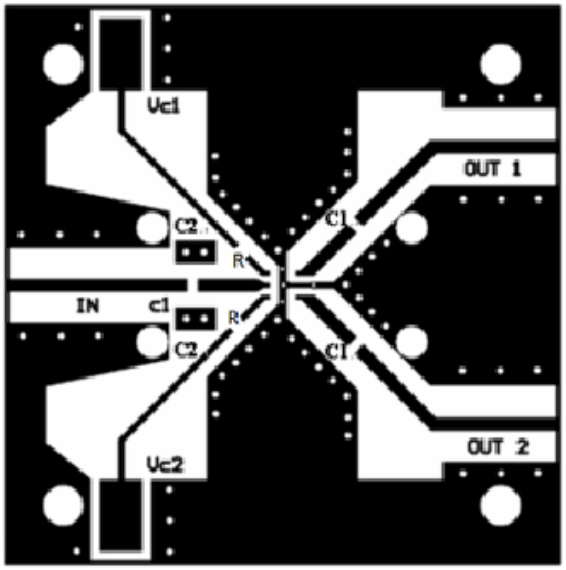
SOT-363 Package Dimensions (Unit: inch (mm))



(f=250MHz~3.0GHz, with application circuit, losses of external circuit are excluded)

Recommended PCB Design

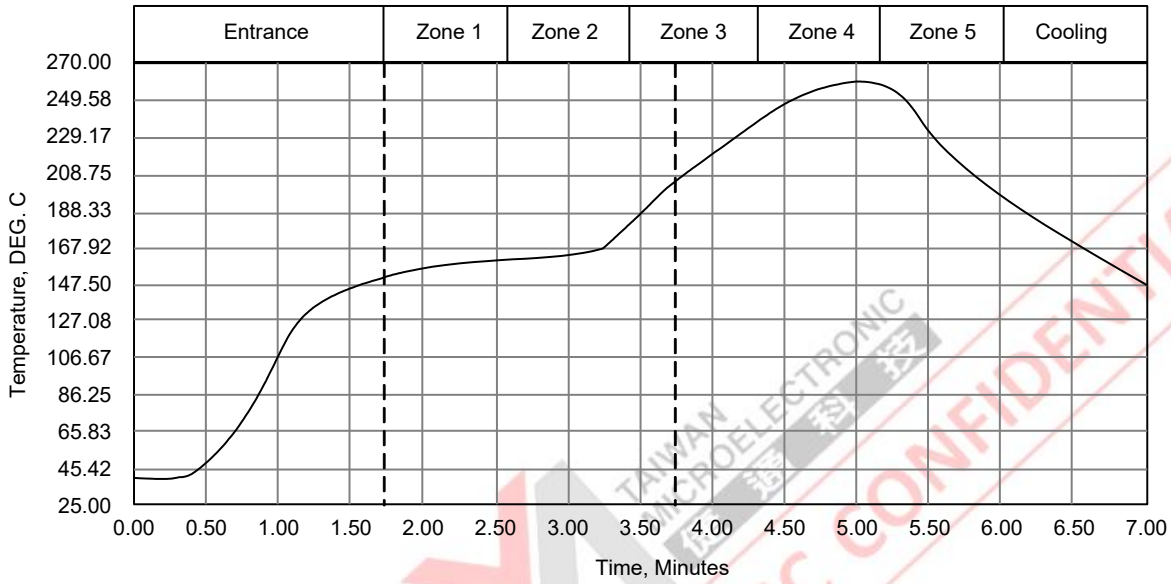
(TOP VIEW)



PCB SIZE : 1350mil x 1350mil
PCB : FR-4 , Thickness=0.4mm
Capacitor: size 0402
Microstrip Line Width = 30mil (Zo=50Ω)
C1=56pF
C2=1000pF

R=10k ohm

SMT Reflow Profile



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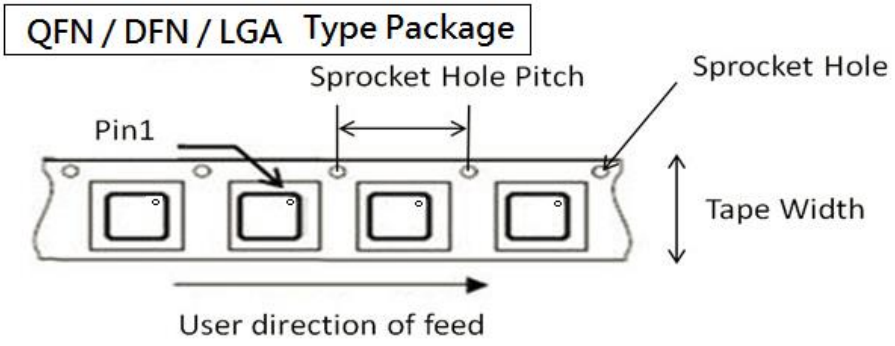
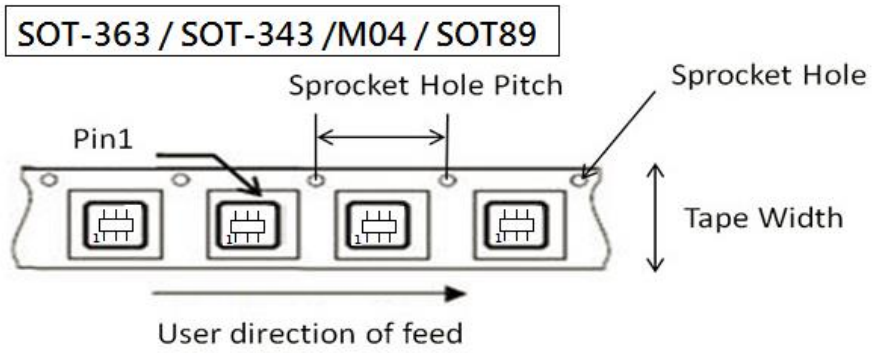
Tape and Reel





Package Type	Reel Size	Tape width (mm)	Sprocket Hole	Sprocket Hole Pitch (mm)	Leader Qty	Trailer Qty	Desiccant (g)
WLCSP 0.69x0.44mm	14"	12±0.03	Φ1.5 +0.1, -0	4.0±0.1	50	50	10
DFN 1.5x1.5mm	7"	12±0.03	Φ1.5 +0.1, -0	4.0±0.1	50	50	10
DFN 2x2mm	7"	12±0.03	Φ1.5 +0.1, -0	4.0±0.1	50	50	10
QFN 2x2mm	7"	12±0.03	Φ1.5 +0.1, -0	4.0±0.1	50	50	10
QFN 3x3mm	7"	12±0.03	Φ1.5 +0.1, -0	4.0±0.1	50	50	10
SOT 343 (M04)	7"	12±0.03	Φ1.5 +0.1, -0	4.0±0.1	50	50	10
SOT 363	7"	12±0.03	Φ1.5 +0.1, -0	4.0±0.1	50	50	10
SOT 89	7"	12±0.03	Φ1.5 +0.1, -0	4.0±0.1	50	50	10

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Handling Precaution

SAFETY INFORMATION ON THIS PRODUCT

Cautions on using this product	The product contains Gallium-Arsenide (GaAs). GsAs vapor and power are hazardous to human health if inhaled or ingested. ● Do not destroy or burn the product. ● Do not cut or cleave off any part of the product. ● Do not crush or chemically dissolve the product. Follow related laws and ordinances for disposal. The product should be excluded from general industrial waste or household garbage.

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