

Tagore Technology

Disruptive GaN-on-Si RF Products
July 2016

16L 3x3 - 5x5mm QFN packages

APPLICATIONS

- Cellular Infrastructure
- Military Communications Radio
- Software Defined Radios
- AESA Radar
- Digital Communication Links
- Avionics
- LTE relays, small cells, TDD microcells
- PMR/LMR High Power Radio
- Antenna Tuning Switch
- 3G/4G multi mode multi band switching
- Rx diversity band switching
- High linearity general purpose applications
- Satellite terminals

FEATURES

- Up to 6GHz operation frequency
- Low broadband insertion loss
- Good broadband isolation
- High power handling (CW 10W - 30W, 50W@316W peak)
- Excellent linearity behavior
- Fast wake-up and switching times
- Supports power supply voltages 2.6-5.5V
- Supports control voltages 1.8-5V
- Ultra low power 'sleep mode' with $I_{dd} < 1\mu A$
- Supports 'all RF throws off' mode
- RoHS Compliant

Industry Smallest High Power RF Switch

Features/Value Proposition

- 3x3-5x5 mm QFN with built in controller IC
- Microamps current drain, compared to 10's of Milliamps with PIN Diodes
- High Power & Speed
- Need only + control voltage logic & Vdd
- Good ACLR performance

Competition

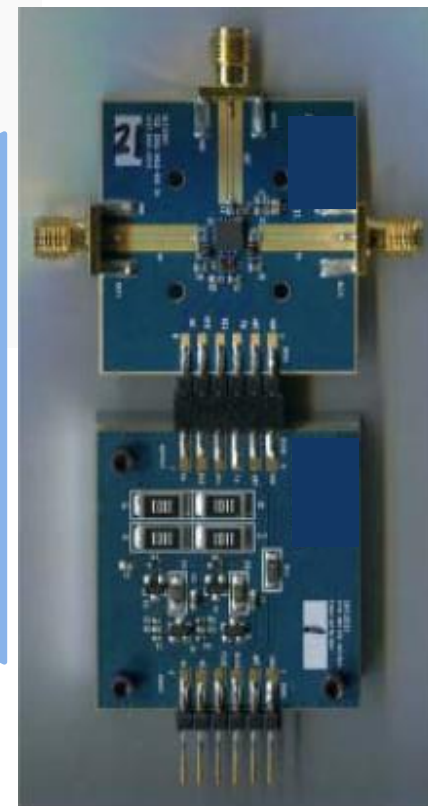
- High power PIN diodes
 - Macom, Skyworks, Microsemi
- Ultra CMOS
 - Peregrine



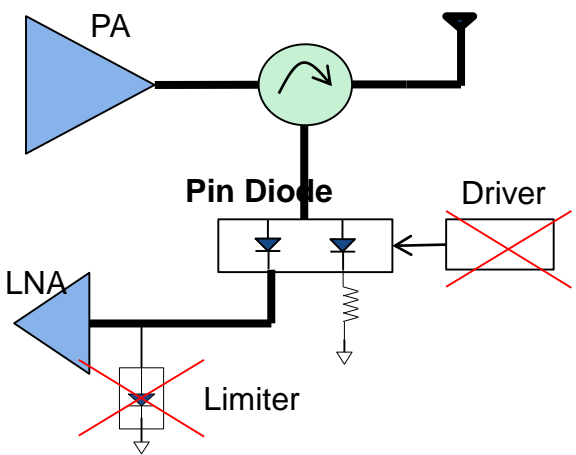
Tagore
3x3mm

50X Smaller
10X Lower Power

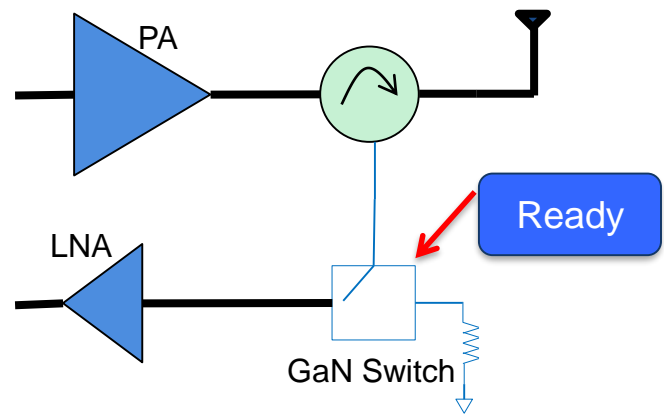
Competitors PIN diode solution



Application- Receiver Protection Switch



Current Solution



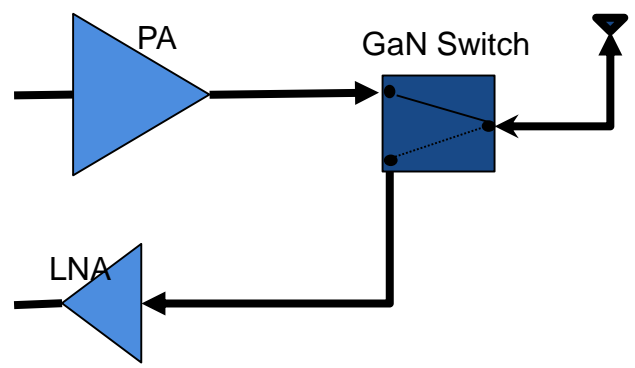
Tagore Solution

Part No	Package QFN	Freq Range	Ins Loss	P0.1dB	Peak Power Short Term	Switching Time
	mm	GHz	dB	Watt	Watt	uSec
TS7322	3x3	0.7-3.8	0.4	20	100	1.5
TS7224	3x3	0.7-3.8	0.4	10	50	1.0

- All switches are controlled by 2.6 – 5.25V VDD and 1.8 – 5V logic signal; No external boost needed
- Peak power ratings are for fail-safe mode operation of TD-LTE receiver front end
- Peak Power is based on 10sec test and very minimal degradation to isolation.

Application - Front End TR Switch for Small Cell

T1

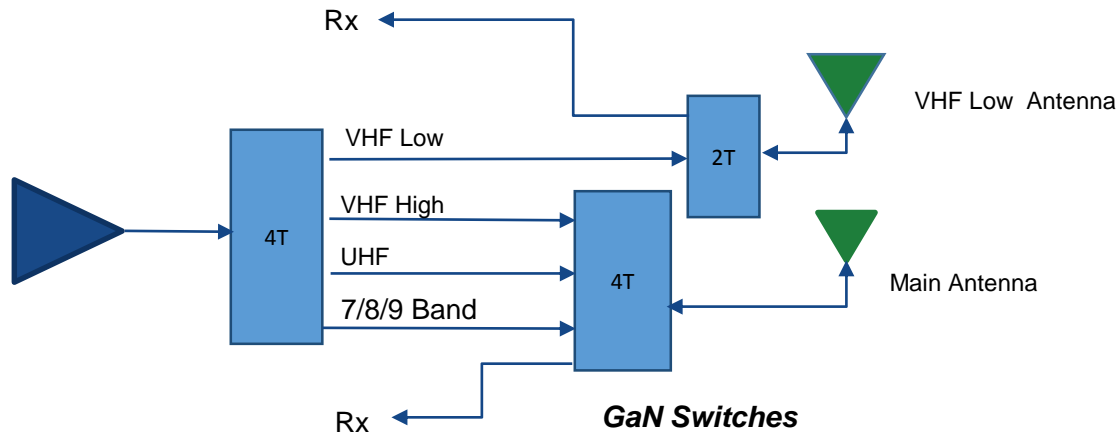


Part No	Package QFN	Freq Range	Ins Loss @ 3.8GHz	Iso @ 3.8GHz	P0.1dB	P0.1dB Peak	IIP3	Enhanced Switching Time
	mm	GHz	dB	dB	Watt	Watt	dBm	uSec
TS7322	3x3	0.01-6	0.5	25	20	100	71	1.5
TS7224	3x3	0.01-6	0.5	25	10	50	71	1.0
TS7225	3x3	0.01-6	0.5	25	10		71	1.0
TS7321	3x3	0.01-6	0.5	25	20		71	1.5

- All switches are controlled by a 2.6 – 5.25V VDD and 1.8 – 5V logic signal
- P0.1dB Peak measured with a 1% Duty Cycle and 10us pulse width

Application - Land Mobile Radio/ TETRA/Switched Bank Filter

Tz



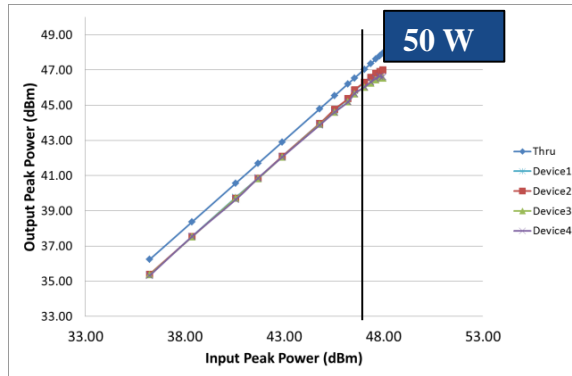
Part No	Description	Package QFN	Freq Range	Ins Loss @ 1GHz	Iso @ 1GHz	P0.1dB	IIP3 at 1GHz	Enhanced Switching Time
		mm	GHz	dB	dB	Watt	dBm	uSec
TS7242K	SP4T	3x3	0.01-6	0.4	35	>10W	70	1.5
TS7341K	SP4T	3x3	0.01-2	0.5	35	>20W	70	1.5
TS7224K	SP2T	3x3	0.01-6	0.3	40	>10W	73	1
TS7321K	SP2T	3x3	0.01-6	0.3	40	>20W	73	1.5
TS7232K	SP3T	3x3	0.01-3	0.4	35	>10W	70	1.5

Higher Power Levels currently in engineering development

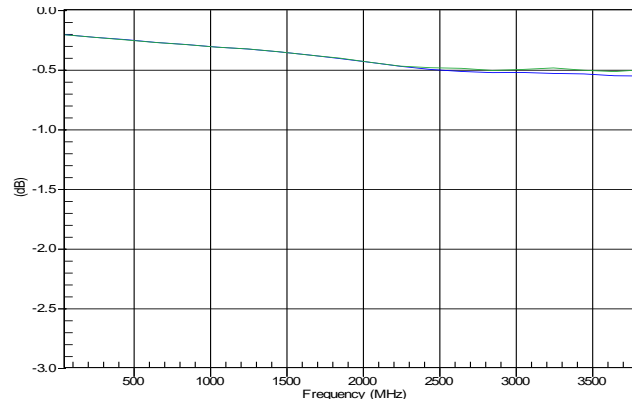
Peak Power/High Isolation Switch Portfolio for RX protection

T7

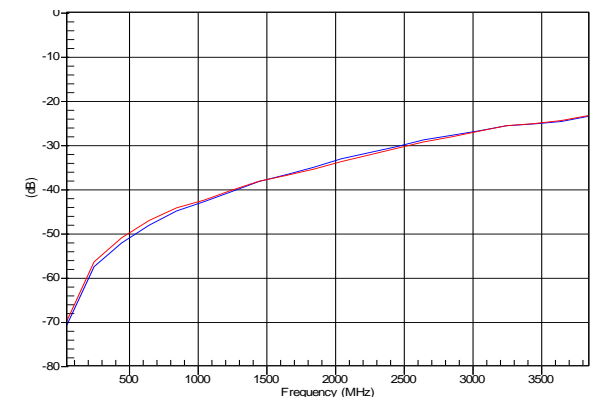
Part Number	SPnT	Type	Freq	P0.1dB	Peak Power	IL TX (1/4GHz)	IL RX (1/4GHz)	Isolation (1/4GHz)	Switching Time	Package	Supply	Logic	Samples
Peak Power Switches													
TS7224K	2T	Reflective	0.01-6GHz	10W	50W		0.3/0.5dB	40dB/25dB	1.0uS	3x3	2.6 - 5.25V	VDD	Now
TS7322K	2T	Reflective	0.01-6GHz	20W	100W		0.3/0.5dB	40dB/25dB	1.5uS	3x3	2.6 - 5.25V	1.8-VDD	Aug'16
High Isolation Switches (Asymmetric)													
TS7129K	2T	Reflective	0.01-6GHz	5W	10W	0.4/0.9dB	0.7/0.9dB	60dB/40dB	0.3uS	3x3	2.6 - 5.25V	1.8-VDD	Aug'16
TS7229K	2T	Reflective	0.01-6GHz	10W	50W	0.4/0.6dB	0.6/1dB	60dB/40dB	1.5uS	3x3	2.6 - 5.25V	1.8-VDD	Aug'16
TS7329K	2T	Reflective	0.01-6GHz	20W	100W	0.4/0.6dB	0.6/1dB	60dB/40dB	1.5uS	3x3	2.6 - 5.25V	1.8-VDD	Aug'16
TS7429L	2T	Reflective	0.01-6GHz	30W	160W	0.4/0.6dB	0.6/1dB	60dB/40dB	1.5uS	4x4	2.6 - 5.25V	1.8-VDD	Aug'16
TS7529L	2T	Reflective	0.01-4GHz	50W	316W	0.4/0.6dB	0.6/1dB	60dB/40dB	2.0uS	4x4	2.6 - 5.25V	1.8-VDD	Sept'16
TS7629N	2T	Reflective	0.01-4GHz	100W	480W	0.4/0.6dB	0.6/1dB	60dB/40dB	2.0uS	5x5	2.6 - 5.25V	1.8-VDD	Sept'16



TS7224K Peak Power compression



TS7232K Insertion loss



TS7232K Isolation

High Power Switch Portfolio

Tz

Part Number	SPnT	Type	Freq	P0.1dB	IL (1/6GHz)	Isolation (1/6GHz)	H3 (35dBm)	Switching Time	Package	VDD Supply	Logic	Samples
10 Watts												
TS7225K	2T	Reflective	0.01-6GHz	>10W	0.3/0.8dB	40/15dB	85dBc	1.5uS	3x3	2.6 - 5.25V	VDD	Now
TS7232K	3T	Reflective	0.01-3GHz	>10W	0.4/0.6dB	35/25dB	82dBc	1.5uS	3x3	2.6 - 5.25V	VDD	Now
TS7242K	4T	Reflective	0.01-3GHz	>10W	0.4/0.8dB	35/23dB	80dBc	1.5uS	3x3	2.6 - 5.25V	VDD	Now
TS7246K	4T	Reflective	0.01-3GHz	>10W	0.4/0.8dB	35/23dB	90dBc	2.5us	3x3	2.6 - 5.25V	1.8-VDD	Aug'16
20 Watts												
TS7321K	2T	Reflective	0.01-6GHz	>20W	0.3/0.8dB	40/15dB	80dBc	1.5uS	3x3	2.6 - 5.25V	VDD	Now
TS7341K	4T	Reflective	0.01-2.5GHz	>20W	0.5/0.7dB	35/25dB	80dBc	1.5uS	3x3	2.6 - 5.25V	VDD	Now
30 Watts												
TS7421L	2T	Reflective	0.01-6GHz	>30W	0.3/0.8dB	40/15dB	85dBc	2.0uS	4x4	2.6 - 5.25V	1.8-VDD	Aug'16
TS7441L	4T	Reflective	0.01-2GHz	>30W	0.5/0.7dB	35/25dB	80dBc	2.0uS	4x4	2.6 - 5.25V	1.8-VDD	Aug'16
50 Watts												
TS7521L	2T	Reflective	0.01-4GHz	>50W	0.4/0.9dB	35/15dB	85dBc	2.5uS	4x4	2.6 - 5.25V	1.8-VDD	Sept'16

Pre Production of 10,20W by Aug 2016

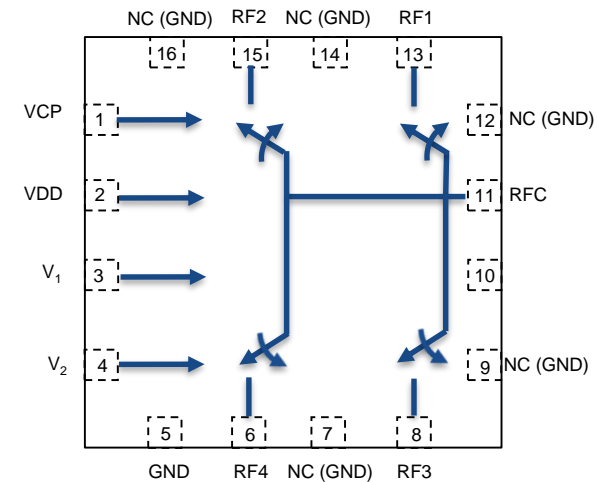
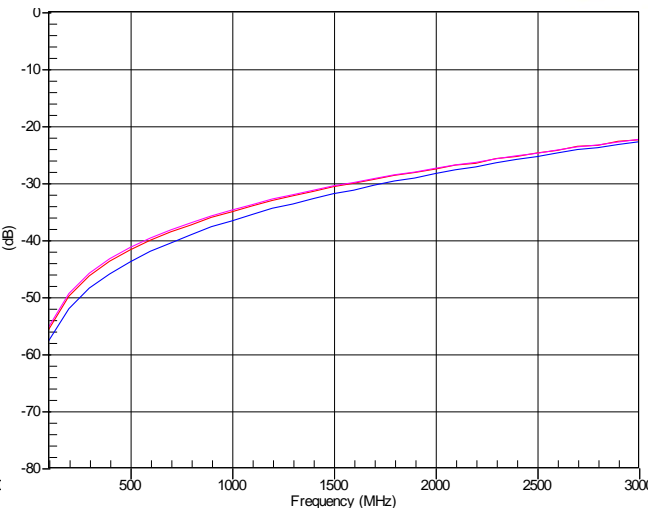
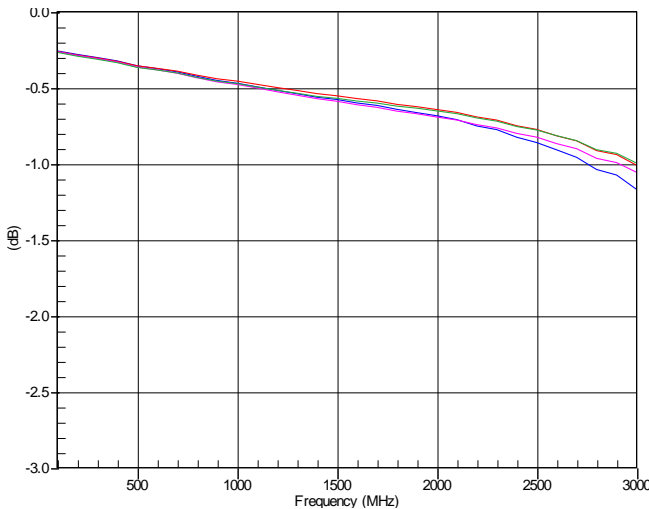
TS7341K – 20W SP4T RF Switch

T1



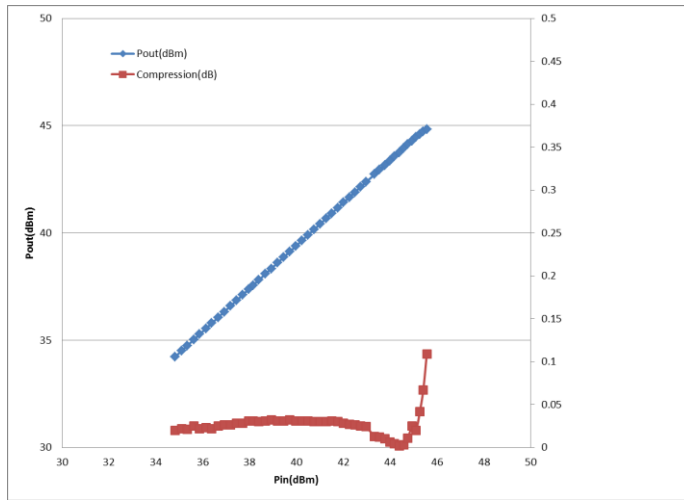
Applications:

- Cellular infrastructure
- Private Mobile Radio handsets
- Public safety handsets
- Small cells
- LTE relays and microcells
- Satellite terminals

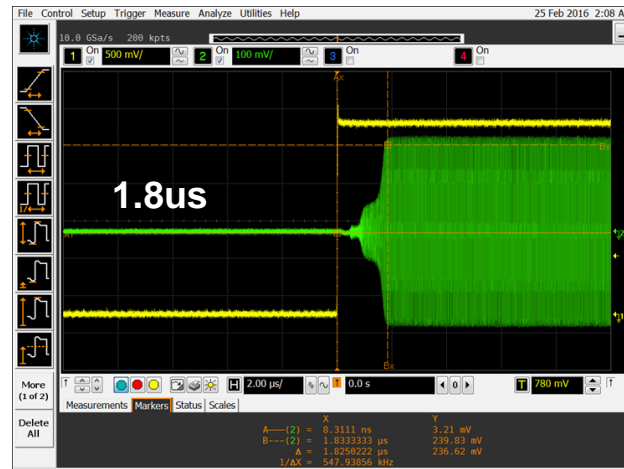


TS7341K – Peak Power Performance

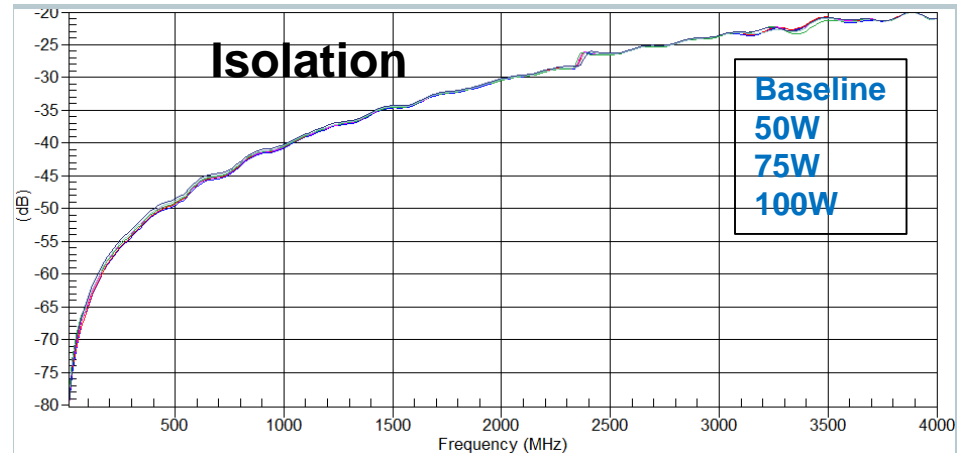
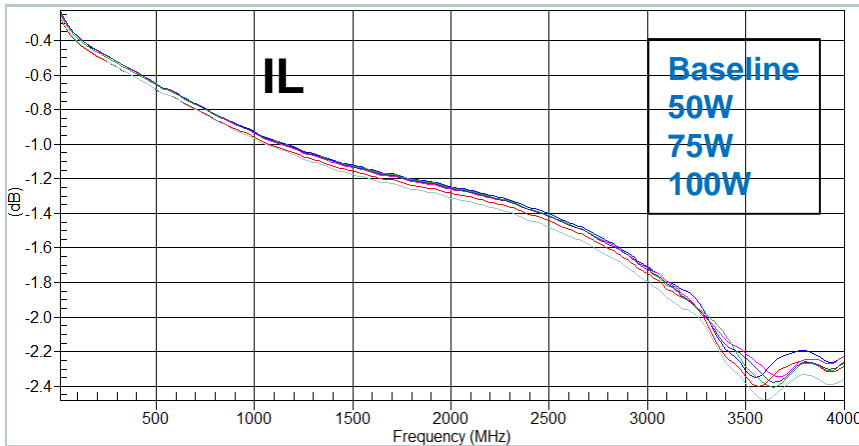
T1



Performance verified with SP4T



1 minute, 1% Duty cycle CW Peak Power Test

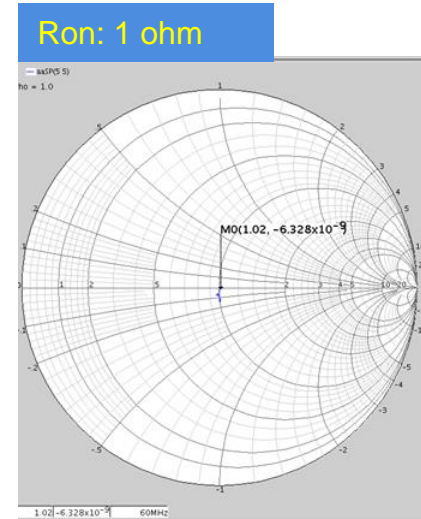
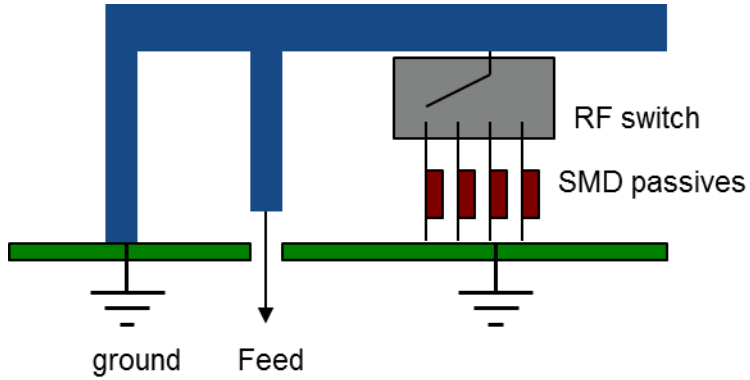


Note: Tests are done in socket.

No change in RF performance after peak power stress up to 100W

Antenna/Filter Tuning Switch

T1



High Peak Voltage Handling

	Part number (2x2x0.75mm)	Reflective Off Ports	Ron (Ω)	Peak RF Voltage (V)	Switching time (us)
SPST	TS6411F	Open	1.5	60	2.0
	TS6311F	Open	1.0	60	2.5
	TS6211F	Open	0.5	60	2.5
SP2T	TS6421F	Open	1.5	60	3.0
	TS6321F	Open	1.0	60	4.0
	TS6221F	Open	0.5	60	7.0
SP4T	TS6440F / 6441F	Short / Open	1.5	60	2.5
	TS6340F / 6341F	Short / Open	1.0	60	3.5

Thank You