

50W Peak Power Broadband SPDT

FEATURES

- Low insertion loss
 - 0.35dB @ 1GHz
- High isolation
 - 42dB @ 1GHz
- High Peak Power Handling
- No external DC blocking capacitors on RF lines
- 26dBm CW hot switching capable
- Versatile 2.6-5.25V power supply
- All RF Ports OFF state

APPLICATIONS

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

DESCRIPTION

The TS7224K is a symmetrical reflective Single Pole Dual Throw (SPDT) switch designed for broadband, high peak power switching applications. Its broadband behavior from DC to 6GHz frequencies makes the TS7224K an excellent switch for all the applications requiring low insertion loss, high isolation and high linearity within a small package size.

The TS7224K is packaged into a compact Quad Flat No lead (QFN) 3x3mm 16 leads plastic package.

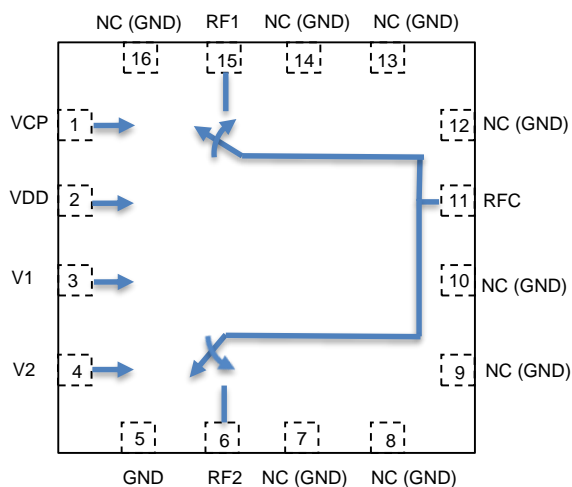


Figure 1: Functional Block Diagram (top view)

ORDERING INFORMATION

Base Part Number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
TS7223K	QFN 3 mm x 3 mm	Tape and Reel	3000	TS7224KMTRPBF

PIN DESCRIPTION

PIN NUMBER	PIN NAME	DESCRIPTION
1	VCP	Input Pin. Connecting a SMD Capacitor (or capacitor in parallel with high value resistor) between this pin and ground enable faster switching time
2	VDD	DC power supply
3	V1	Switch control input 1
4	V2	Switch control input 2
5	GND	Ground
6	RF2	RF throw 2
7	NC	This pin is not connected to internal circuit. Connect to PCB ground plane if needed (e.g. coplanar access line)
8	NC	This pin is not connected to internal circuit. Connect to PCB ground plane if needed (e.g. coplanar access line)
9	NC	This pin is not connected to internal circuit. Connect to PCB ground plane if needed (e.g. coplanar access line)
10	NC	This pin is not connected to internal circuit. Connect to PCB ground plane if needed (e.g. coplanar access line)
11	RFC	RF Common port
12	NC	This pin is not connected to internal circuit. Connect to PCB ground plane if needed (e.g. coplanar access line)
13	NC	This pin is not connected to internal circuit. Connect to PCB ground plane if needed (e.g. coplanar access line)
14	NC	This pin is not connected to internal circuit. Connect to PCB ground plane if needed (e.g. coplanar access line)
15	RF1	RF throw 1
16	NC	This pin is not connected to internal circuit. Connect to PCB ground plane if needed (e.g. coplanar access line)

The backside ground slug of the package must be grounded directly to the ground plane to ensure proper operation

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNITS
Power supply voltage	VDD	2.6 to 5.5	V
Storage temperature Range	T _{st}	-55 to +125	°C
Operating Temperature Range	T _{op}	-40 to +105	°C

Exceeding one or a combination of the Absolute Maximum Ratings conditions may cause permanent damage to the device.

SWITCH TRUTH TABLE

V2	V1	RF PATH
1	0	All OFF state
0	0	RFC-RF1
0	1	RFC-RF2

There is an internal pull-down to ground on the V2 control pin: this pin can be left floating when the all OFF state is not used.

If All OFF state is not used, then the switch can be operated with single control line V1.

There is an internal pull-down to ground on the V1 control pin: default switch state at start-up without any control voltage applied will be RFC-RF1 on.

ELECTRICAL SPECIFICATIONS

Temperature=25°C, VDD=2.7V, 50Ω source and load conditions

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Operating frequency		10		6000	MHz
Insertion loss	1GHz		0.35		dB
	3GHz		0.5		
	6GHz		0.8		
Isolation RFC-RFx	1GHz, RFC-RF1 or RFC-RF2 ON		43		dB
	3GHz, RFC-RF1 or RFC-RF2 ON		27		
	6GHz, RFC-RF1 or RFC-RF2 ON		15		
Return Loss RFC, RFX	1GHz		25		dB
	3GHz		18		
	6GHz		18		
Harmonic distortion					
H2	900MHz, Pin=35dBm		-46		dBm
H3	900MHz, Pin=35dBm		-50		dBm
IIP3	1GHz		73		dBm
Peak Power Handling ¹	700-3800MHz. TD-LTE signal. 8dB PAR		47		dBm
Switching time	50% ctrl to 10/90% of the RF value is settled. VCP pin let unconnected		2.8		μs
Enhanced Switching Time	50% ctrl to 10/90% of the RF value is settled. C1=1nF R1=5MΩ (refer to figure 5 schematic)		1.5		μs
P0.1dB ²	0.1dB Compression Point. 1GHz	40			dBm
Control voltage	Power Supply VDD	2.6	3.3	5.25	V
	V1, V2 ctrl pins Vih	0.67*VDD	VDD	VDD+0.3	V
	All control pins Vil	-0.3		0.3*VDD	V
Control current	Iil, V1 or V2 ctrl voltage =0.3*VDD		0		μA
	Iih, V1 or V2 ctrl voltage = VDD			7.5	μA
Current consumption	Active mode (VDD On)		225		μA

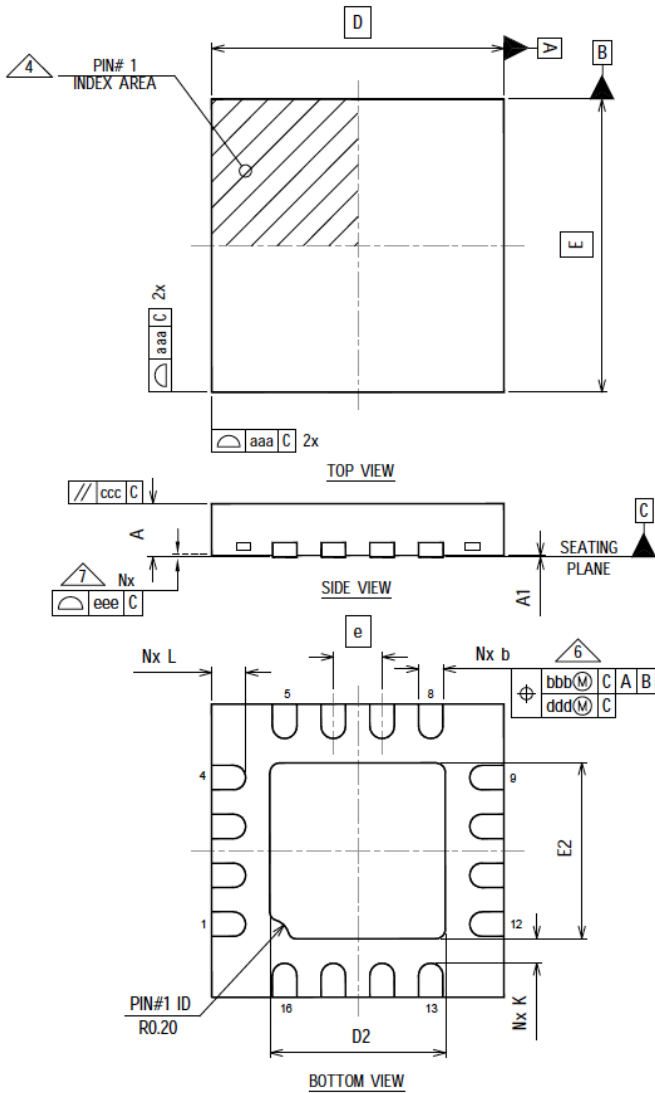
Note 1: No performance degradation after 10 minutes exposure to +39dBm TD-LTE signal with 8dB PAR at 105degC

Note 2: P0.1dB is a Figure Of Merit. Although the switch can be operated safely at this level of power, reliability in time is not guaranteed in P0.1dB operating condition.

Note 3: No external DC blocking capacitors required on the RF terminals unless DC voltage is applied on an RF terminal.2

Note 4: This switch supports RF signal hot switching with +26dBm CW input power

PACKAGE INFORMATION



Dimension Table				NOTE
Thickness Symbol	V			
	MINIMUM	NOMINAL	MAXIMUM	
A	0.80	0.90	1.00	
A1	0.00	0.02	0.05	
b	0.20	0.25	0.30	6
D	3.00 BSC			
E	3.00 BSC			
e	0.50 BSC			
D2	1.65	1.80	1.90	
E2	1.65	1.80	1.90	
K	0.20	---	---	
L	0.30	0.35	0.40	
aaa	0.05			
bbb	0.10			
ccc	0.10			
ddd	0.05			
eee	0.08			
N	16			3
ND	4			5
NE	4			5
NOTES	1, 2			
LF DWG NO.	B-3490			
REV.	1			

Figure 2: Package drawings

EVALUATION KIT

The board consists of a 4 layer stack with 2 outer layers made of Rogers 4350B ($\epsilon_r = 3.48$) and 2 inner layers of FR4 ($\epsilon_r = 4.80$). The total thickness of the board is 62 mils (1.57mm). The inner layers provide a ground plane for the 50 Ω transmission lines. The thickness between signal and ground plane is 16mils. Each transmission line is designed using coplanar waveguide with ground plane (CPWG) model using a trace width of 32 mils (0.813mm), gap of 15 mils (0.381mm), and a metal thickness of 1.4mils (0.051mm).

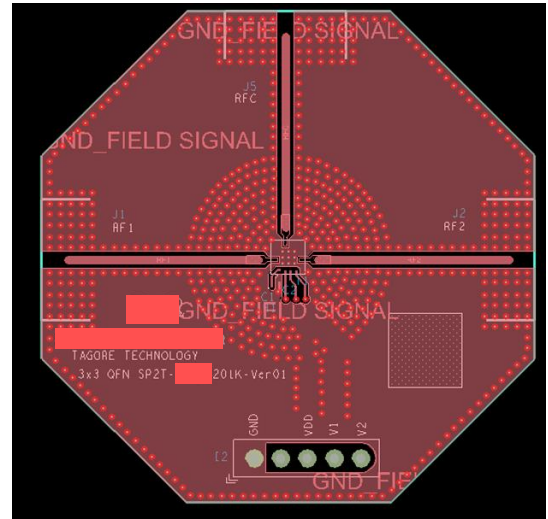


Figure3: Evaluation board Picture (Top layer)

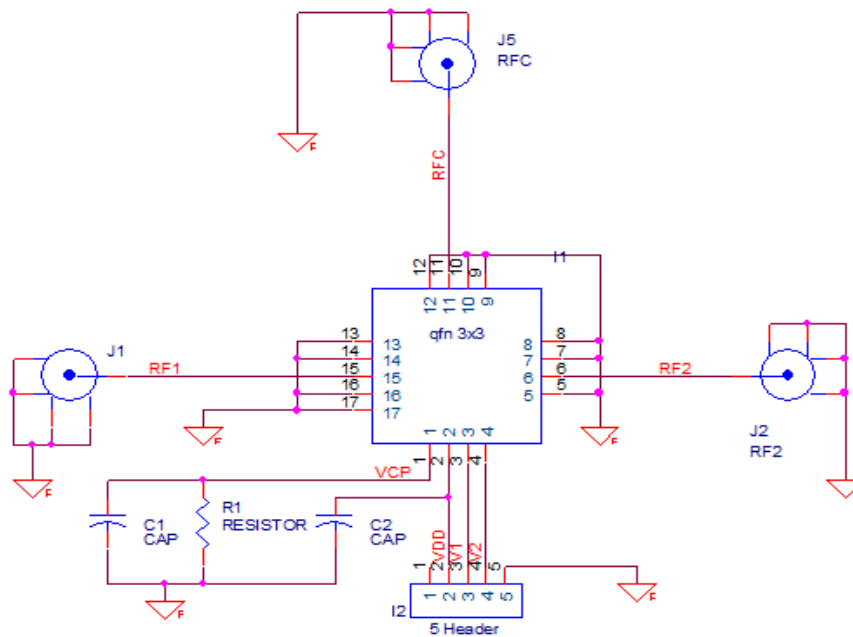


Figure 5: Evaluation board schematic

QUALIFICATION INFORMATION†

Qualification Level		Consumer	
Moisture Sensitivity Level		3x3 QFN	MSL1
	Human Body Model	Class TBD	
	Charged Device Model	+/-1kV	
RoHS Compliant		Yes	

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