

## 20W Avg Broadband SPDT

### FEATURES

- Low insertion loss
  - 0.35dB @ 800MHz
- High isolation
  - 45dB @ 800MHz
- High Peak Power Handling
- No external DC blocking capacitors on RF lines
- 41dBm CW hot switching capable
- Versatile 2.6-5.25V power supply
- All RF Ports OFF state

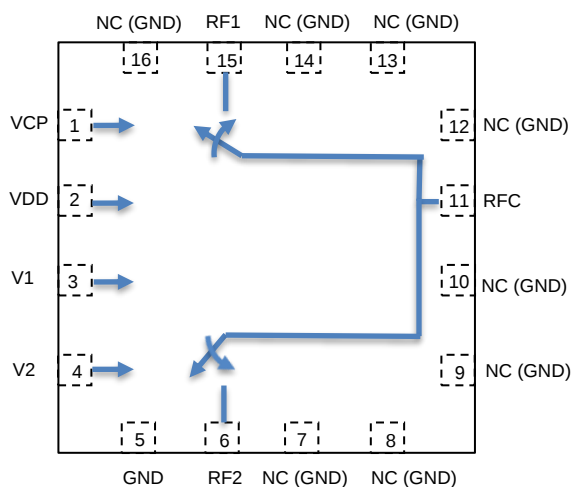
### APPLICATIONS

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

### DESCRIPTION

The TS7321K 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 TS7321K an excellent switch for all the applications requiring low insertion loss, high isolation and high linearity within a small package size.

The TS7321K 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 |                       |
| TS7321K          | QFN 3 mm x 3 mm | Tape and Reel | 3000     | TS7321KMTRPBF         |

## 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 <sub>st</sub> | -55 to +125 | °C    |
| Operating Temperature Range               | T <sub>op</sub> | -40 to +85  | °C    |
| RF Input power CW, 25degC                 | RFx             | 43          | dBm   |
| Thermal Resistance (junction to GND slug) | Rtheta          | 25          | °C/W  |
| Junction Temp                             | T <sub>j</sub>  | 140         | °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       |

**Note: VDD should be applied first before V1 and V2.**

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                   | 400MHz                                                                             |      | 0.25 |      | dB    |
|                                  | 800MHz                                                                             |      | 0.35 | 0.45 |       |
|                                  | 1.95GHz                                                                            |      | 0.45 | 0.6  |       |
|                                  | 2.6GHz                                                                             |      | 0.55 | 0.7  |       |
|                                  | 6.0GHz                                                                             |      | 0.9  |      |       |
| Isolation RFC-RFx                | 400MHz                                                                             |      | 50   |      | dB    |
|                                  | 800MHz                                                                             | 40   | 45   |      |       |
|                                  | 1.95GHz                                                                            | 34   | 35   |      |       |
|                                  | 2.6GHz                                                                             | 27   | 32   |      |       |
|                                  | 6.0GHz                                                                             |      | 17   |      |       |
| Return Loss RFC, RFX             | 400MHz                                                                             |      | 25   |      | dB    |
|                                  | 800MHz                                                                             |      | 22   |      |       |
|                                  | 1.95GHz                                                                            |      | 23   |      |       |
|                                  | 2.6GHz                                                                             |      | 18   |      |       |
|                                  | 6.0GHz                                                                             |      | 13   |      |       |
| Harmonic distortion              |                                                                                    |      |      |      |       |
| H2                               | 800MHz, Pin=35dBm                                                                  |      | -46  |      | dBm   |
| H3                               | 800MHz, Pin=35dBm                                                                  |      | -46  |      | dBm   |
| IIP3                             | 800MHz                                                                             |      | 73   |      | dBm   |
| Switching time                   | 50% ctrl to 10/90% of the RF value is settled. VCP pin let unconnected             |      | 3.0  |      | μs    |
| Enhanced Switching Time          | 50% ctrl to 10/90% of the RF value is settled. C1=1nF(refer to figure 5 schematic) |      | 1.2  |      | μs    |
| P0.1dB <sup>2</sup>              | 0.1dB Compression Point. 800MHz                                                    | 43   | 44   |      | dBm   |
| Peak Power Handling <sup>1</sup> | 800MHz, Pulsed Power                                                               |      | 47   |      | dBm   |
| Control voltage                  | Power Supply VDD                                                                   | 2.6  | 3.3  | 5.25 | V     |
|                                  | V1, V2 ctrl pins Vih                                                               | 1.0  | VDD  | 5.25 | V     |
|                                  | All control pins Vil                                                               | -0.3 |      | 0.5  | V     |
| Control current                  | Iil, V1 or V2                                                                      |      | 0    |      | μA    |
|                                  | Iih, V1 or V2                                                                      |      |      | 7.5  | μA    |
| Current consumption              | Active mode (VDD On)                                                               |      | 225  | 260  | μA    |

**Note 1:** 1% Duty Cycle and 10us frame width. Peak P0.1dB**Note 2:** P0.1dB is a Figure Of Merit**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 +41dBm CW input power

## PACKAGE INFORMATION

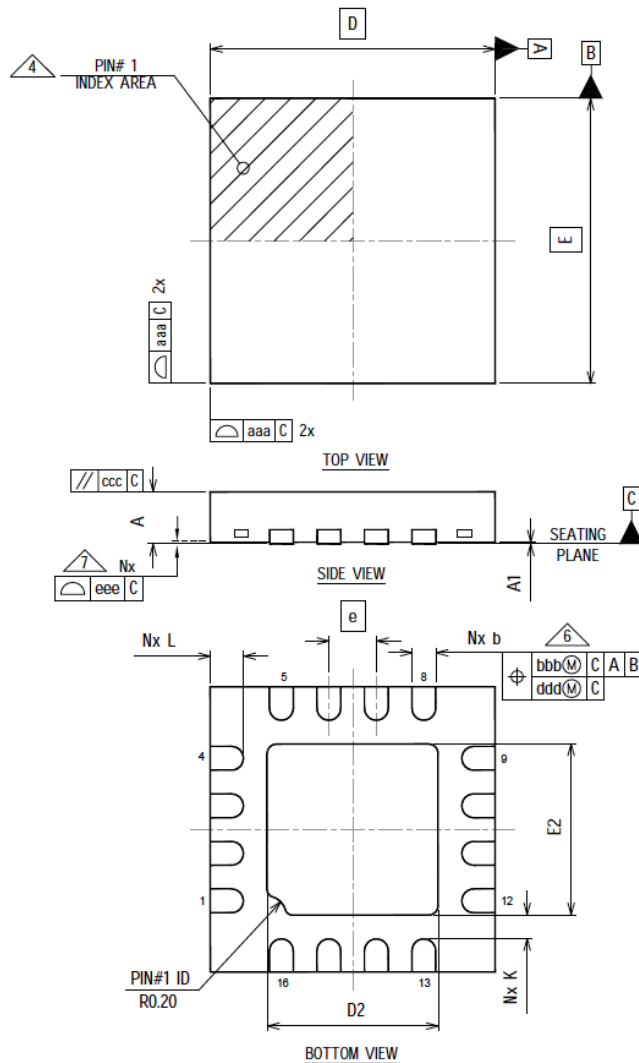


Figure 2: Package drawings

| Dimension Table     |          |         |         |      |
|---------------------|----------|---------|---------|------|
| Thickness<br>Symbol | V        |         |         | NOTE |
|                     | 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        |         |         |      |

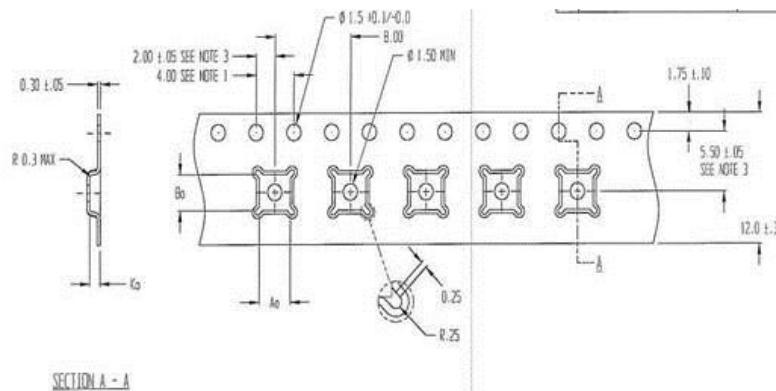


Figure 3: Tape drawing for 3x3mm packages A0=3.30, B0=3.30, K0=1.10

## 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 $\Omega$  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).

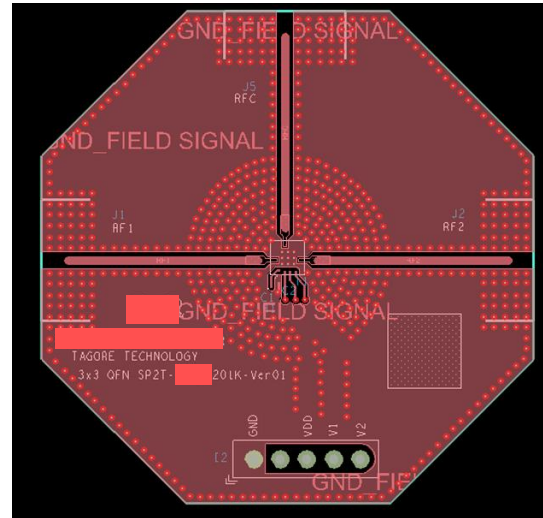


Figure3: Evaluation board Picture (Top layer)

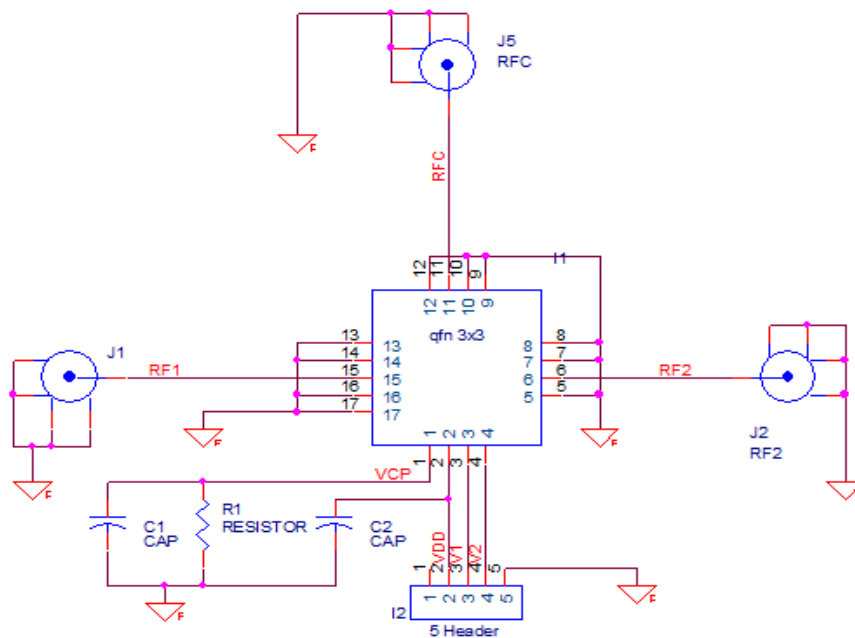


Figure 5: Evaluation board schematic

**QUALIFICATION INFORMATION†**

|                            |                      |          |      |
|----------------------------|----------------------|----------|------|
| Qualification Level        |                      | Consumer |      |
| Moisture Sensitivity Level |                      | 3x3 QFN  | MSL1 |
|                            | Human Body Model     | Class 1A |      |
|                            | Charged Device Model | NA       |      |
| RoHS Compliant             |                      | Yes      |      |

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