

KS204

Switch, SPDT
0.02–8.0 GHz

DESCRIPTION

This is a GaAs pHEMT Non-Reflective high performance, low loss switch in a 3x3 mm leadless Hermetic Surface-Mount Technology (SMT) package for Harsh Environments including Defense and Satellite application. This device can be ordered with the 100% screening requirements of MIL-PRF-38535 Class B and S, in addition

FEATURES

- ✓ Low Insertion Loss: 0.8 dB @ 2 GHz.
- ✓ High Isolation: 55 dB @ 2 GHz.
- ✓ Non-Reflective Match in off state (S22).
- ✓ NASA EEE-INST-002 compliant.
- ✓ Successfully Tested to 1MRAD TID.
- ✓ High Reliability Class B and S Screening Available.
- ✓ See Page 5 for MR HI –REL Ordering Details.

APPLICATIONS

- ✓ Microwave Radios
- ✓ Military Radios
- ✓ VSAT
- ✓ Telecom Infrastructure
- ✓ Test Equipment



TABLE I: ELECTRICAL CHARACTERISTICS (+25°C)¹

| Parameter | Symbol | Conditions | Min | Typical | Max | Units |
|--|---------------|----------------|-----|---------|------|-------|
| Insertion Loss | IL | 0.02 – 2.0 GHz | | 0.75 | 1.10 | dB |
| | | 2.0 – 3.0 GHz | | 0.8 | 1.25 | dB |
| | | 3.0 – 4.0 GHz | | 1.0 | 1.35 | dB |
| | | 4.0 – 8.0 GHz | | 1.5 | 1.8 | dB |
| Isolation | ISO | 0.02 – 3.0 GHz | 50 | 55 | | dB |
| | | 3.0 – 4.0 GHz | 45 | 50 | | dB |
| | | 4.0 – 6.0 GHz | 40 | 45 | | dB |
| | | 6.0 – 8.0 GHz | 35 | 40 | | dB |
| Return Loss Input (All States) Output (ON State) | S11 / S22 | 0.02 – 2.0 GHz | 19 | 22 | | dB |
| | | 2.0 – 3.0 GHz | 15 | 22 | | dB |
| | | 3.0 – 4.0 GHz | 12 | 18 | | dB |
| | | 4.0 – 8.0 GHz | 9 | 12 | | dB |
| Return Loss Output (OFF State) | S22 | 0.02 – 0.3 GHz | 0 | 4 | | dB |
| | | 0.3 – 0.5 GHz | 5 | 8 | | dB |
| | | 0.5 – 2.0 GHz | 9 | 11 | | dB |
| | | 2.0 – 4.0 GHz | 12 | 15 | | dB |
| | | 4.0 – 8.0 GHz | 9 | 13 | | dB |

1. All electrical characteristics are measured at +25°C at a minimum.

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TABLE 2: OPERATING CHARACTERISTICS (-40 TO +85°C, $V_{CTL} = 0V/5V$)¹

| Parameter | Symbol | Conditions | Min | Typical | Max | Units |
|---|---------------------|--|-------|---------|------|---------|
| Input Compression Point | IP1dB | 0.02 – 0.5 GHz | | +24 | | dBm |
| | | 0.5 – 8.0 GHz | | +30 | | dBm |
| 3rd order input intercept point (+8 dBm tones, 1 MHz spacing) | IIP3 | 0.02 – 0.5 GHz | | +30 | | dBm |
| | | 0.5 – 8.0 GHz | | +46 | | dBm |
| Rise/Fall Time | t_{RISE}/t_{FALL} | 10%/90% RF rise/ 90%/10% RF fall time | | 5 | | nS |
| ON/OFF Time | t_{ON}/t_{OFF} | 50% V_{CTL} to 90%/10% RF | | 15 | | nS |
| Control Voltage High | V_{IH} | Positive Control | +2.7 | | +7.0 | V |
| Control Voltage Low | V_{IL} | Positive Control | -0.25 | | 0.25 | V |
| Control Voltage High | V_{IH} | Negative Control | -7.0 | | -2.7 | V |
| Control Voltage Low | V_{IL} | Negative Control | -0.25 | | 0.25 | V |
| Digital Input Leakage | I_{IN} | $V_{CTL} = -7.0V$ | -200 | | | μA |

1. All operating characteristics are guaranteed over full performance temperature range but not tested.

TABLE 3: ABSOLUTE MAXIMUM RATINGS

| Characteristic | Min. | Max. | Units |
|-----------------------|------|----------------|-------|
| Control voltage (A+B) | -0.5 | +9.0 | V |
| RF Input power | | +30 | dBm |
| Operating temperature | -55 | +125 | °C |
| Storage temperature | -65 | +150 | °C |
| Thermal resistance | | 53.5 | °C/W |
| ESD sensitivity (HBM) | | 250 (Class 1A) | V |

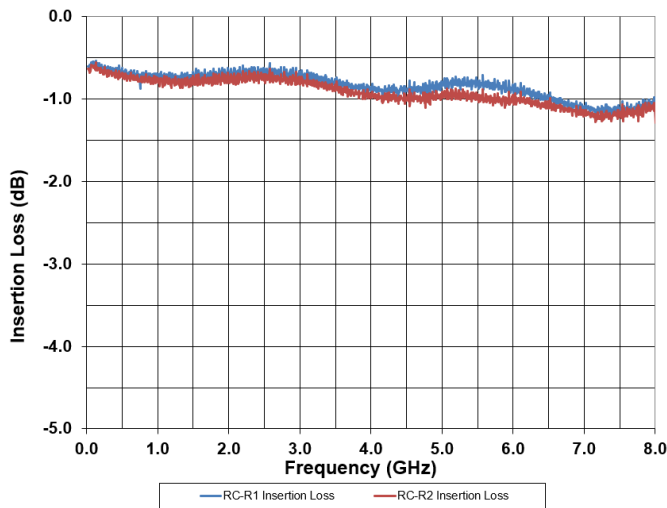


Caution: Class 1A (HBM 250V) Electrostatic Sensitive Device. Proper ESD precaution should be used when handling device.

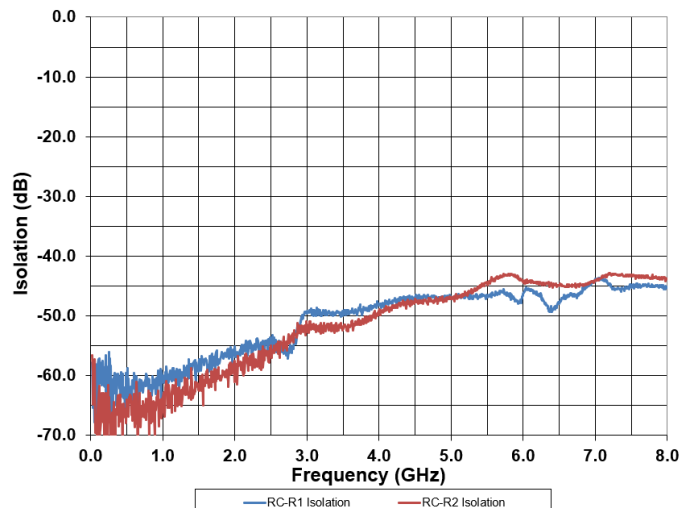
1. Unit shall survive operation without damage over the temperature range but not tested.

TYPICAL PERFORMANCE (+25 °C)

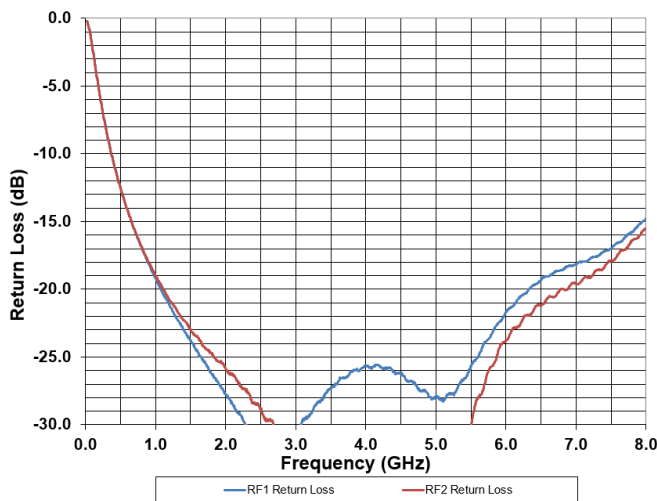
Insertion Loss vs Frequency



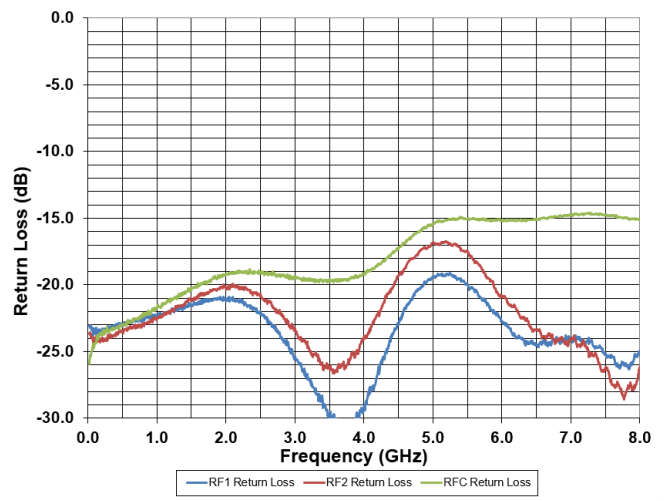
Isolation vs Frequency



Return Loss vs Frequency (OFF State)



Return Loss vs Frequency (ON State)

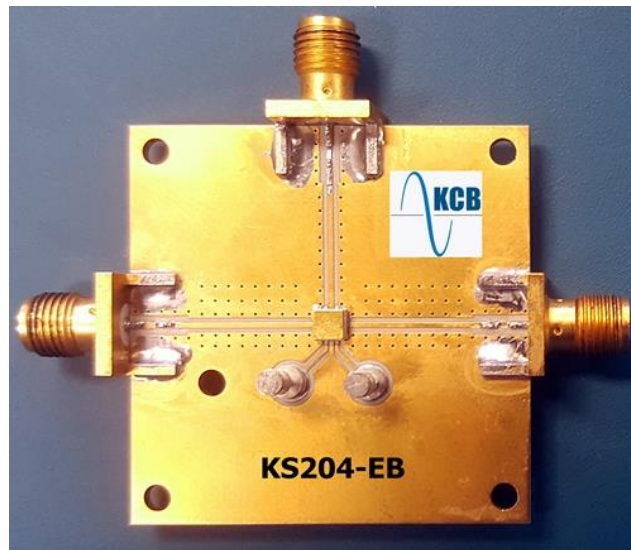


Note: Scatter plot data was gathered using modified evaluation board with 2.4 mm Southwest connectors.

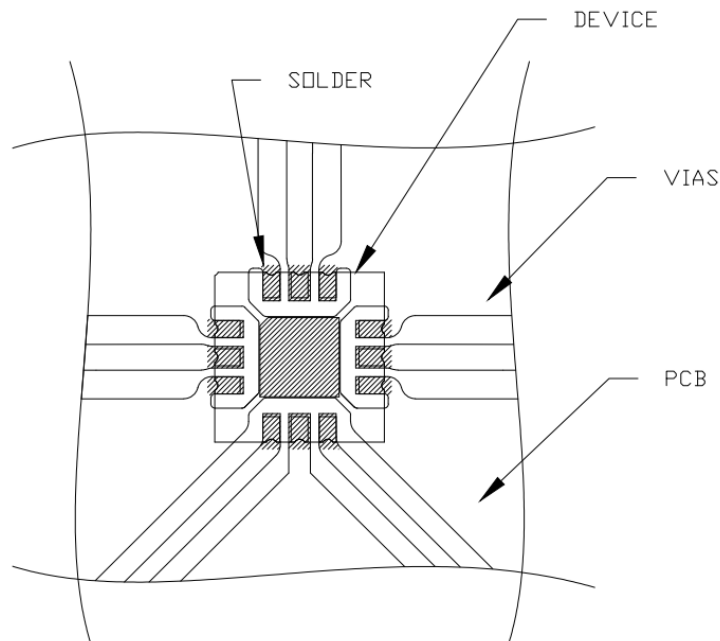


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EVALUATION BOARD (KS204-EB)



RECOMMENDED SOLDER LAYOUT



NOTES:

1. TRANSMISSION LINES SCALED FOR ROGERS RO4003, 0.008 INCHES THICK
2. GROUND ALL UNUSED PORTS
3. MAXIMUM REFLOW TEMPERATURE: 265C.
4. DXF FILE AVAILABLE UPON REQUEST.
5. CONTACT KCB SOLUTIONS FOR FURTHER GUIDANCE ON DEVICE PLACEMENT AND ATTACHMENT

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TRUTH TABLE (NEGATIVE CONTROL)

| A | B | RF Path |
|----|----|---------|
| 0 | -5 | RFC—RF1 |
| -5 | 0 | RFC—RF2 |

TRUTH TABLE (POSITIVE CONTROL)

| A | B | RF Path |
|----|----|---------|
| +5 | 0 | RFC—RF1 |
| 0 | +5 | RFC—RF2 |

Note: External blocking capacitors are required on all RF ports. Capacitor should be selected to allow for low frequency operation.

SCHEMATIC

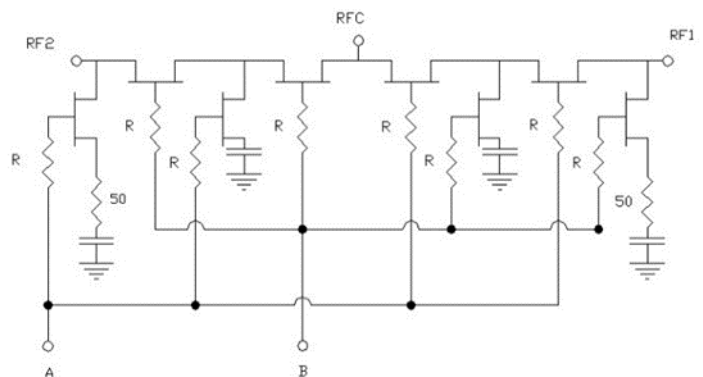
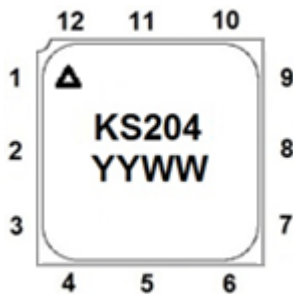


FIGURE 1: DEVICE MARKING/PIN OUT



XXX = Serial # will be added for Class B and S Part #

| PIN | Designation | PIN | Designation |
|-----|-------------|-----|-------------|
| 1 | GND | 7 | GND |
| 2 | RF1 | 8 | RF2 |
| 3 | GND | 9 | GND |
| 4 | A | 10 | GND |
| 5 | GND | 11 | RFC |
| 6 | B | 12 | GND |

PACKAGE NOTES:

- Lid: ASTM F-15 Alloy
- Base/Walls: Alumina
- Lid/Bottom Finish: Gold over Nickel

ADDITIONAL NOTES:

- Maximum reflow temperature: 265°C for 90 seconds maximum
- Package base is RF ground
- External blocking capacitors required on all RF ports

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FIGURE 2: OUTLINE

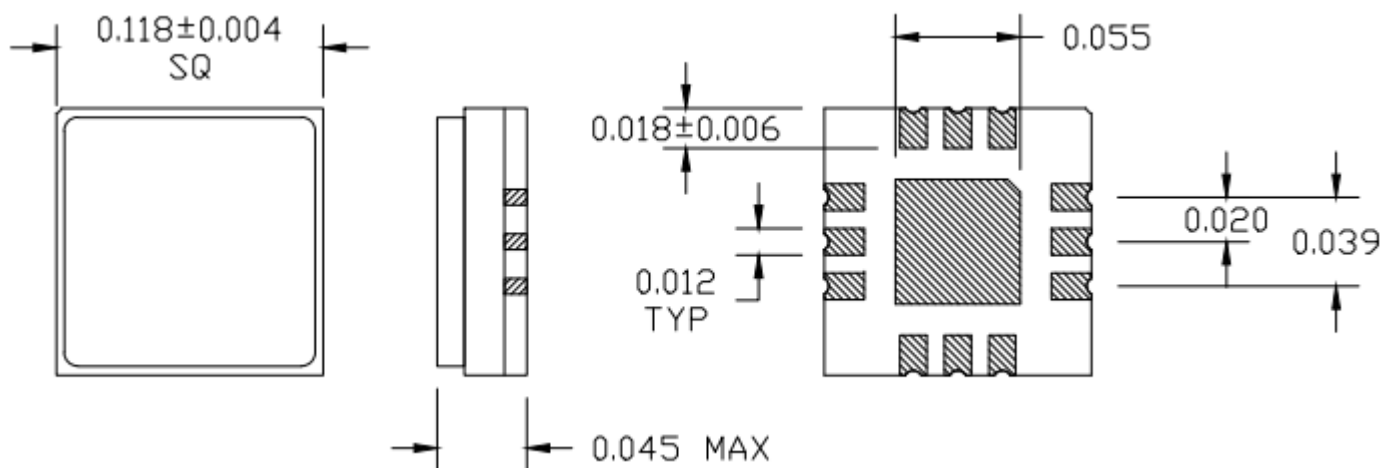


TABLE 4: SCREENING FLOW:

| Test Inspection | MIL – STD -883 | | Requirement | |
|---------------------------------|--------------------|--|--------------------|--------------------|
| | Method | Condition | Class B | Class S |
| Wafer Lot Acceptance | 5007 | | Per Table | Per Wafer Lot |
| Non-Destructive Bond Pull | 2023 | | Process under SPC | Process under SPC |
| Internal Visual | 2010 | A = Class S, B = Class B | 100% | 100% |
| Temperature Cycle | 1010 | C, 10 Cycles | 100% | 100% |
| Acceleration | 2001 | E (Y1 only) | 100% | 100% |
| PIND | 2020 | A (5 Cycles) | N/A | 100% |
| Serialization | IAW Figure 1 | | 100% | 100% |
| Radiographic | 2012 | 2 Views | N/A | 100% |
| Electrical Test | Table 1 | +25°C | 100% | 100% |
| Burn In | 1015 | A | 100%/160 Hrs/125OC | 100%/320 Hrs/125OC |
| Final Electrical | Table 1 | +25°C | 100% | 100% |
| PDA Calculation | 5004 | 25% Δ IL / 100% Δ I_{CC} | 5% | 5%/3% Functional |
| Group A Electrical ⁵ | Table 1 Table 2 | -55°C and +125°C +25°C only | 45/0 | 45/0 |
| Seal: Fine Leak | | A | | |
| Gross Leak | 1014 | C | 100% | 100% |
| External Visual | 2009 | | 100% | 100% |

Notes:

1. Product under configuration control per KCB QAP 015.
2. Customer will be notified of all class 1 changes for Class B and S part numbers.
3. Wafer Lot Acceptance will include 100% die visual, SEM analysis and Lot Traceability.
4. Electrical Test Data will be recorded for each serial number and included in Final Test Report for all Class S part numbers.
5. Group A Electrical testing will include the Small Signal at the Min/Max operating condition. The Dynamic test (P1dB, IP3, SS) will be tested at +25c only.

ORDERING INFORMATION:

| | Unscreened | Class B | Class S |
|---------------------------|------------|---------|---------|
| KCB Solutions Part Number | KS204C | KS204B | KS204S |

