

# KS206

Switch, SP4T  
0.02–4.0 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: 1.0 dB @ 2 GHz.
- ✓ High Isolation: 48 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 6 for MR HI –REL Ordering Details.

## APPLICATIONS

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



TABLE I: ELECTRICAL CHARACTERISTICS (+25°C)<sup>1</sup>

Parameter	Symbol	Conditions	Min	Typical	Max	Units
Insertion Loss	IL	0.02 – 1.0 GHz		1.0	1.30	dB
		1.0 – 2.0 GHz		1.2	1.65	dB
		2.0 – 2.5 GHz		1.2	1.65	dB
		2.5 – 4.0 GHz		1.6	1.90	dB
Isolation	ISO	0.02 – 1.0 GHz	45	50		dB
		1.0 – 2.0 GHz	40	45		dB
		2.0 – 2.5 GHz	35	40		dB
		2.5 – 4.0 GHz	33	38		dB
RF1/RF2 Return Loss (ON State)	S11 /  S22	0.02 – 2.0 GHz	9	12		dB
		2.0 – 3.0 GHz	10	12		dB
		3.0 – 4.0 GHz	12	17		dB
Return Loss Output (OFF State)	S22	0.02 – 0.1 GHz	0	0		dB
		0.1 – 0.5 GHz	3	5		dB
		0.5 – 2.0 GHz	8	11		dB
		2.0 – 3.0 GHz	12	16		dB
		3.0 – 4.0 GHz	13	17		dB

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

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

Parameter	Symbol	Conditions	Min	Typical	Max	Units
Input Compression Point	IP1dB	0.5 – 4.0 GHz		+30		dBm
3rd order input intercept point (+8 dBm tones, 1 MHz spacing)	IIP3	0.5 – 4.0 GHz		+47		dBm
Rise/Fall Time	$t_{RISE}/t_{FALL}$	10%/90% RF rise/ 90%/10% RF fall time		40		nS
ON/OFF Time	$t_{ON}/t_{OFF}$	50% $V_{CTL}$ to 90%/10% RF		120		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		-4.5	V
Control Voltage Low	$V_{IL}$	Positive Control	-0.25		0.25	V
Digital Input Leakage	$I_{IN}$	$V_{CTL} = -7.0V$		50	200	$\mu A$

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

TABLE 3: ABSOLUTE MAXIMUM RATINGS

Characteristic	Min.	Max.	Units
Positive Control (0/+5)	-0.2	+7.5	V
Negative Control (-5/0)	-7.5	+0.2	V
RF Input power		+30	dBm
Operating temperature	-55	+125	°C
Storage temperature	-65	+150	°C
Thermal resistance		38.9	°C/W
ESD sensitivity (HBM)		200 (Class 0)	V

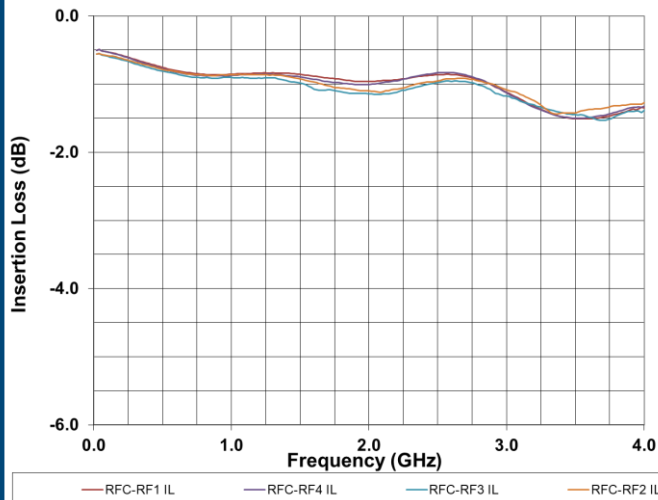


Caution: Class 1A (HBM 250V) Electrostatic Sensitive Device. Proper ESD precaution should be used when handling device.

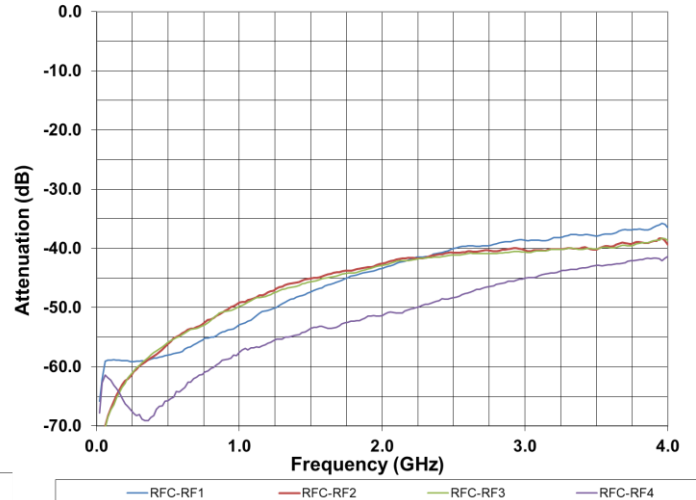
1. Unit shall survive operation without damage over the temperature range but not tested.
2. Exceeding maximum limits may cause damage.

TYPICAL PERFORMANCE (+25 °C)

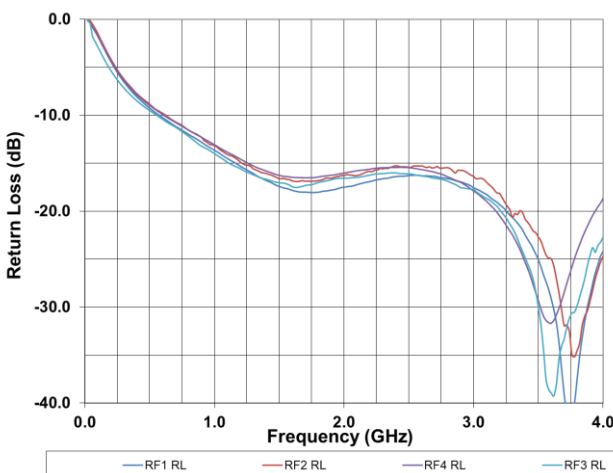
### Insertion Loss vs Frequency



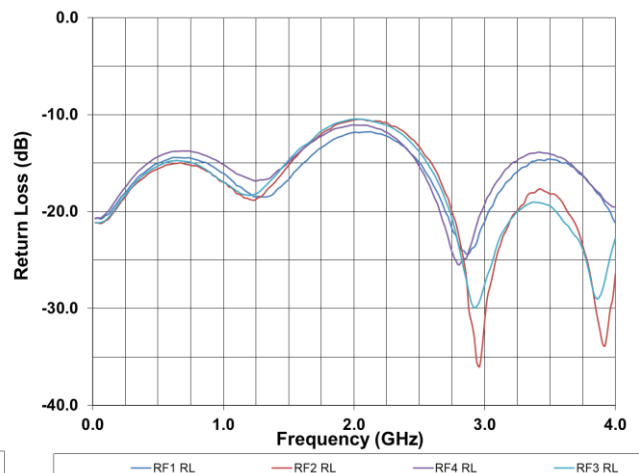
### Isolation vs Frequency



### Return Loss vs Frequency (OFF State)

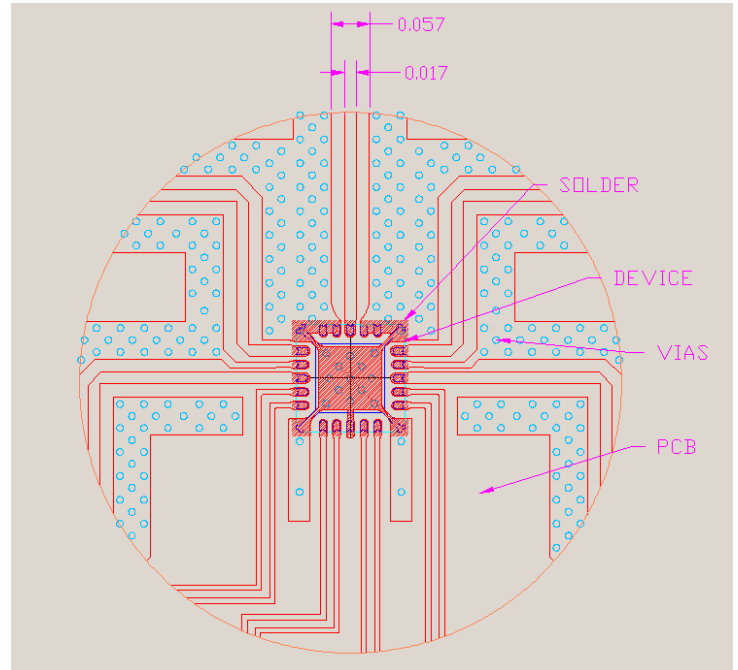
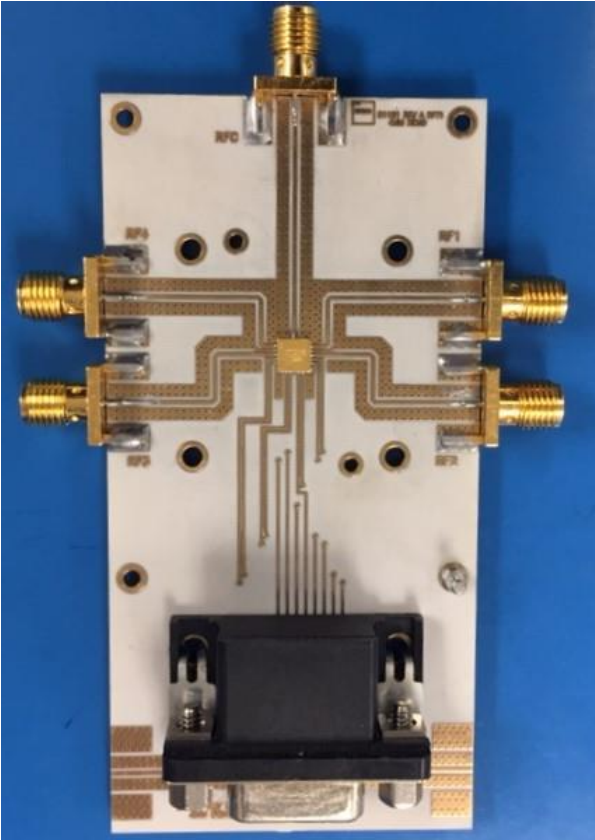


### Return Loss vs Frequency (ON State)



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## EVALUATION BOARD (KS206-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)

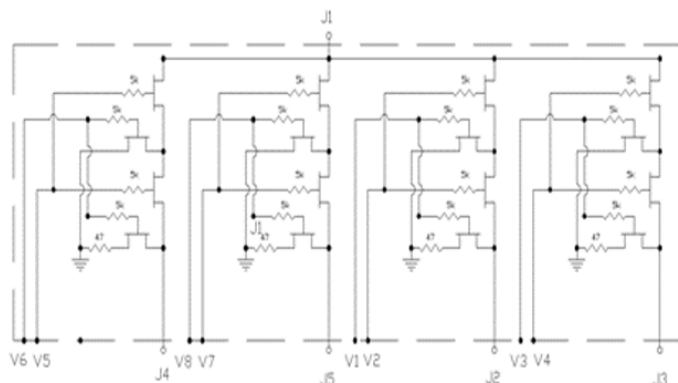
CTL1	CTL2	CTL3	CTL4	CTL5	CTL6	CTL7	CTL8	RF Path
0	-5	-5	0	-5	0	-5	0	RFC—RF1
-5	0	0	-5	-5	0	-5	0	RFC—RF2
-5	0	-5	0	0	-5	-5	0	RFC—RF3
-5	0	-5	0	-5	0	0	-5	RFC—RF4

## TRUTH TABLE (POSITIVE CONTROL)

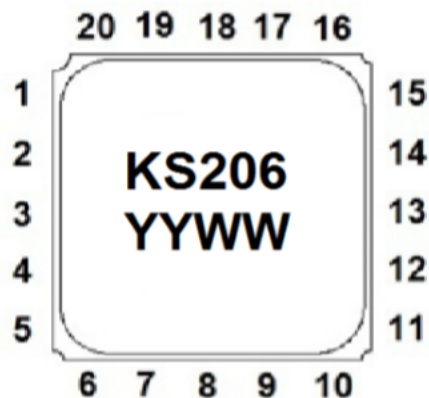
CTL1	CTL2	CTL3	CTL4	CTL5	CTL6	CTL7	CTL8	RF Path
+5	0	0	+5	0	+5	0	+5	RFC—RF1
0	+5	+5	0	0	+5	0	+5	RFC—RF2
0	+5	0	+5	+5	0	0	+5	RFC—RF3
0	+5	0	+5	0	+5	+5	0	RFC—RF4

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	Designation	Designation
1	RF4	11	CTL2
2	GND	12	CTL1
3	RF3	13	RF2
4	CTL8	14	GND
5	CTL7	15	RF1
6	CTL6	16	GND
7	CTL5	17	GND
8	GND	18	RFC
9	CTL4	19	GND
10	CTL3	20	GND

## PACKAGE NOTES:

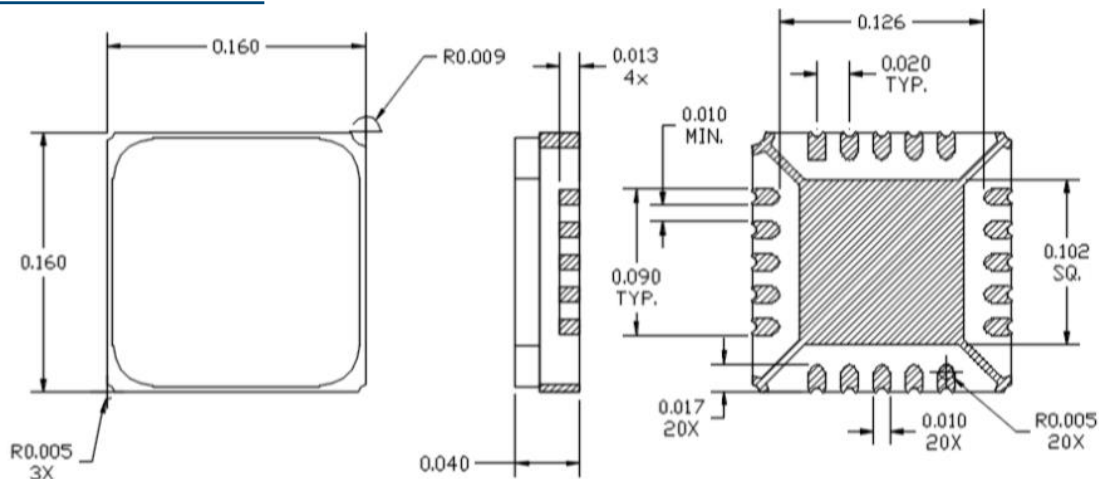
- Lid: ASTM F-15 Alloy
- Base/Walls: Alumina
- Lid/Bottom Finish: Gold over Nickel

## 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 <sub>CC</sub>	5%	5%/3% Functional
Group A Electrical <sup>5</sup>	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	KS206C	KS206B	KS206S

