KT103

Digital Attenuator 0.02–4.0 GHz

KCB SOLUTIONS
THE HIGHEST STANDARD IN RF

DESCRIPTION

The KT103 is a GaAs pHEMT broadband seven bit digital attenuator in a hermetic Surface-Mount Technology (SMT) package for high reliability applications. This attenuator offers low insertion loss and excellent attenuation accuracy. It can be supplied and tested to the screening requirements of MIL-PRF-38534 Class B and S in addition to the required QCI.

FEATURES

- ✓ 7 Bit Fixed attenuator, LSB .25dB, MSB 16dB.
- ✓ NASA EEE-INST-002 compliant.
- ✓ Successfully Tested to 1M RAD 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

ELECTRICAL CHARACTERISTICS (+25 °C)[1]

Parameter	Symbol	Conditions	Min	Typical	Max	Units
Insertion Loss	IL	0.02 – 1.0 GHz 1.0 – 2.0 GHz 2.0 – 3.0 GHz 3.0 – 4.0 GHz		1.5 1.7 2.2 3.2	2.0 2.5 3.0 4.0	dB dB dB dB
Attenuation Range	Attn	0.02 – 4.0 GHz	0	0.25	31.75	dB
Return Loss (Any State)	IRL/ORL	0.02 – 1.0 GHz 1.0 – 2.0 GHz 2.0 – 3.0 GHz 3.0 – 4.0 GHz	15 14 12 6	20 18 14 10		dB dB dB dB
Attenuation Accuracy		0.02 – 2.0 GHz 0 dB—7.75 dB 8 dB—31.75 dB 2.0—4.0 GHz 0dB—31.75 dB			 ±(0.2+1.5%) ±(0.15+5%) ±(0.25+4.5%)	 dB dB dB

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

OPERATING CHARACTERISTICS (+25 °C)[1]

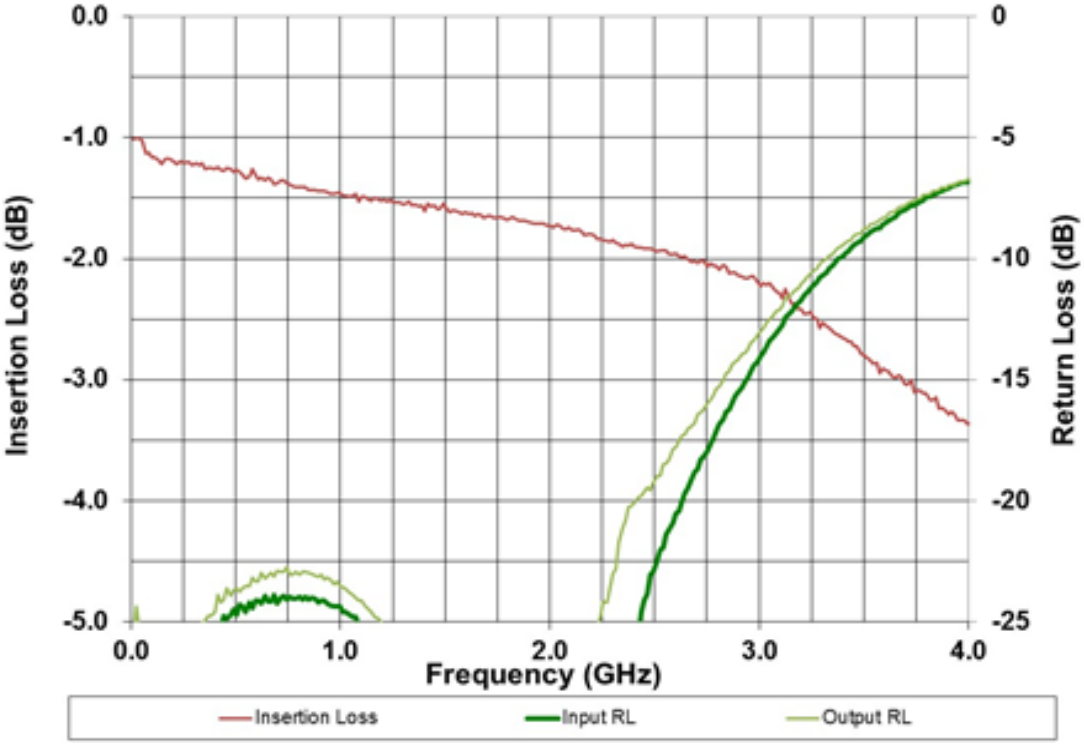
Parameter	Symbol	Conditions	Min	Typical	Max	Units
Input Compression Point	IP1dB	0.02 – 0.1 GHz: IL state		+27		dBm
		Attn states		+16		dBm
		0.1 – 0.5 GHz: IL state		+35		dBm
		Attn states		+27		dBm
		0.5 – 2.0 GHz: IL state		+35		dBm
		Attn states		+27		dBm
		2.0 – 3.2 GHz: IL state		+35		dBm
		Attn states		+27		dBm
3rd order input intercept point (+18 dBm tones, +/- 1% spacing, any state)	IIP3	0.02 – 0.1 GHz	+35	+40		dBm
		0.1 – 0.5 GHz	+35	+40		dBm
		0.5 – 2.0 GHz	+40	+50		dBm
		2.0 – 4.0 GHz	+40	+50		dBm
2nd order input intercept point (+18 dBm tones, +/- 1% spacing, any state)	IIP2	0.02 – 0.1 GHz		+45		dBm
		0.1 – 0.5 GHz		+70		dBm
		0.5 – 2.0 GHz		+70		dBm
		2.0 – 4.0 GHz		+70		dBm
Gain Flatness/Slope		0 to 16 dB Atten.				
		0.02 – 0.2 GHz		0.5		dB
		0.2 – 0.5 GHz		0.5		dB
		0.5 – 1.0 GHz		1.0		dB
		1.0 – 2.0 GHz		1.0		dB
		2.0 – 3.2 GHz		2.0		dB
		16.25 to 31.75 dB Atten.				
		0.02 – 0.2 GHz		2.0		dB
		0.2 – 0.5 GHz		1.0		dB
		0.5 – 1.0 GHz		1.0		dB
		1.0 – 2.0 GHz		1.0		dB
		2.0 – 3.2 GHz		2.5		dB
Rise/Fall Time	T_{RISE}/T_{FALL}	50% V_{CTL} to 90%/10% RF			400	nS
Settling time	t_{SETTLE}	50% VCTL to RF settled to within 0.1 dB		0.2	1	µS
Control Voltage High	V_{IH}		-0.8	0	+0.2	V
Control Voltage Low	V_{IL}		-8.0	-5.0	-3.0	V

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

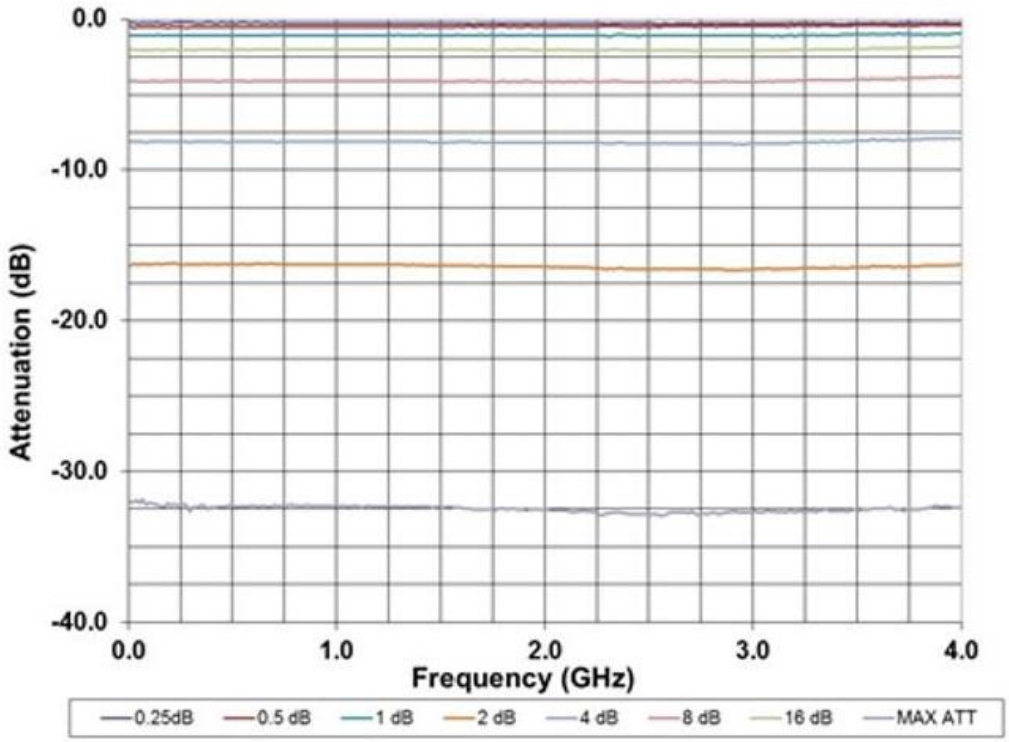
1. Unit shall survive operation without damage over the temperature range but not tested.

TYPICAL PERFORMANCE (+25 °C)

Insertion Loss vs Frequency:



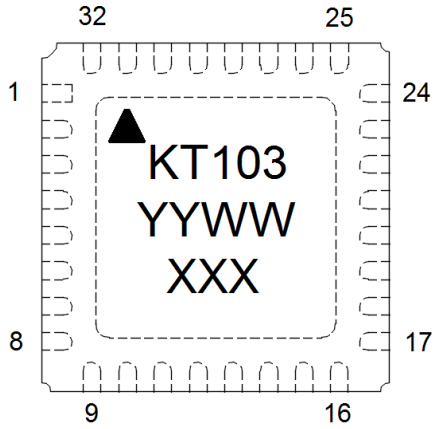
Attenuation vs Frequency



TRUTH TABLE/CONTROL CONDITIONS

V1A	V1B	V2A	V2B	V3A	V3B	V4A	V4B	V5A	V5B	V6A	V6B	V7A	V7B	State
-5	0	-5	0	-5	0	-5	0	-5	0	-5	0	-5	0	I.L.
0	-5	-5	0	-5	0	-5	0	-5	0	-5	0	-5	0	0.25 dB
-5	0	0	-5	-5	0	-5	0	-5	0	-5	0	-5	0	0.50 dB
-5	0	-5	0	0	-5	-5	0	-5	0	-5	0	-5	0	1.00 dB
-5	0	-5	0	-5	0	-5	0	-5	0	-5	0	0	-5	2.00 dB
-5	0	-5	0	-5	0	-5	0	-5	0	0	-5	-5	0	4.00 dB
-5	0	-5	0	-5	0	-5	0	0	-5	-5	0	-5	0	8.00 dB
-5	0	-5	0	-5	0	0	-5	-5	0	-5	0	-5	0	16.00 dB
0	-5	0	-5	0	-5	0	-5	0	-5	0	-5	0	-5	31.75 dB

DEVICE MARKING/PIN OUT:



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

PIN	Designation	PIN	Designation
1	V2A	17	GND
2	V1B	18	GND
3	V1A	19	GND
4	GND	20	RF1
5	RF2	21	GND
6	GND	22	V7B
7	GND	23	V7A
8	GND	24	V6B
9	GND	25	V6A
10	GND	26	V5B
11	GND	27	V5A
12	GND	28	V4B
13	GND	29	V4A
14	GND	30	V3B
15	GND	31	V3A
16	GND	32	V2B

ABSOLUTE MAXIMUM RATINGS[1]

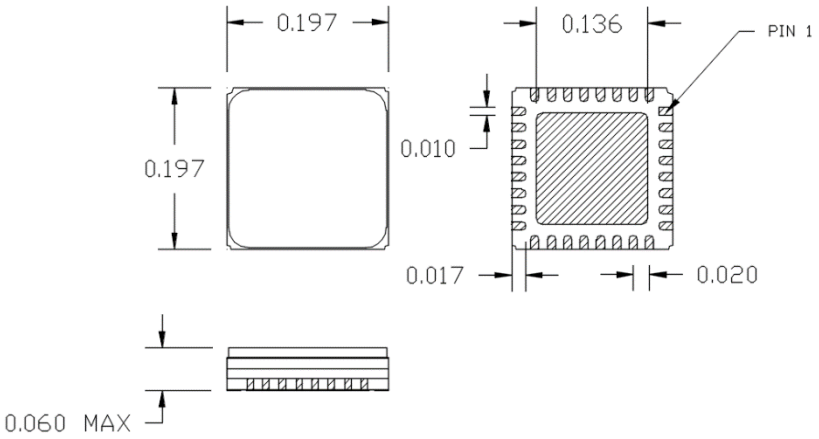
Characteristic	Min.	Max.	Units
Control voltage	-7	+0.2	V
RF Input power		+25	dBm
Operating temperature	-55	+125	˚C
Storage temperature	-65	+150	˚C
Maximum Junction Temp		+150	˚C
ESD sensitivity (HBM)		2000 (Class 2)	V

1. Exceeding maximum or minimum limits may cause damage.

Caution: Class 2 (HBM 2000V) Electrostatic Sensitive Device. Proper ESD precaution should be used when handling device.

KCB SOLUTIONS
THE HIGHEST STANDARD IN RF

OUTLINE DRAWING:



Package Notes:

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

Additional Notes:

- Maximum reflow temperature: 265°C
- Package base if RF ground
- External blocking capacitors required on all RF ports

SCREENING FLOW:

Test Inspection	MIL – STD -883		Requirement	
	Method	Condition	Class B	Class S
Wafer Lot Acceptance /1	5007		N/A	Per Wafer Lot
Non-Destructive Bond Pull	2023		SPC	SPC
Internal Visual	2010	A= Class S, B = Class B	100%	100%
Temperature Cycle	1010	C	100%	100%
Acceleration	2001	E (Y1 only)	100%	100%
PIND	2020	A (5 Cycles)	N/A	100%
Serialization	Per Product Specification		100%	100%
Radiographic	2012	2 views	N/A	100%
Electrical Test	Small Signal Testing	+25˚C	100%	100%
Burn In	1015	A	100%/160 Hours/ 125˚C	100%/240 Hours/ 125˚C
Final Electrical	Small Signal Testing	+25˚C	100%	100%
PDA Calculation	5004	25% Δ IL / 100% Δ Icc	5%	5%/3% functional
Group A Electrical /5	Per Product Specification	-55˚C + 125˚C	45/0	45/0
Leak Test	1014 A and C	1 x 10^{-8} Max	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.
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	KT103C	KT103B	KT103S