

# KT104

Digital  
Attenuator  
0.02–4.0 GHz

## DESCRIPTION

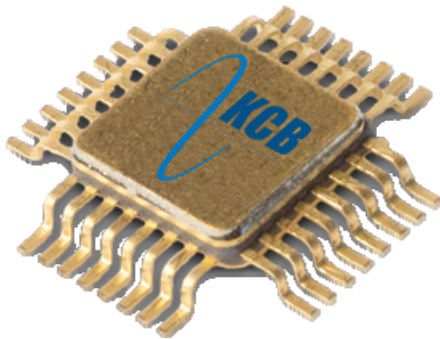
The KT104 is a GaAs pHEMT broadband seven bit digital attenuator in a hermetic Surface-Mount Technology (SMT) package for high reliability applications. This attenuator offers low insertion loss and excellent attenuation accuracy. It can be supplied and tested to the screening requirements of MIL-PRF-38534 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)<sup>1</sup>**

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

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

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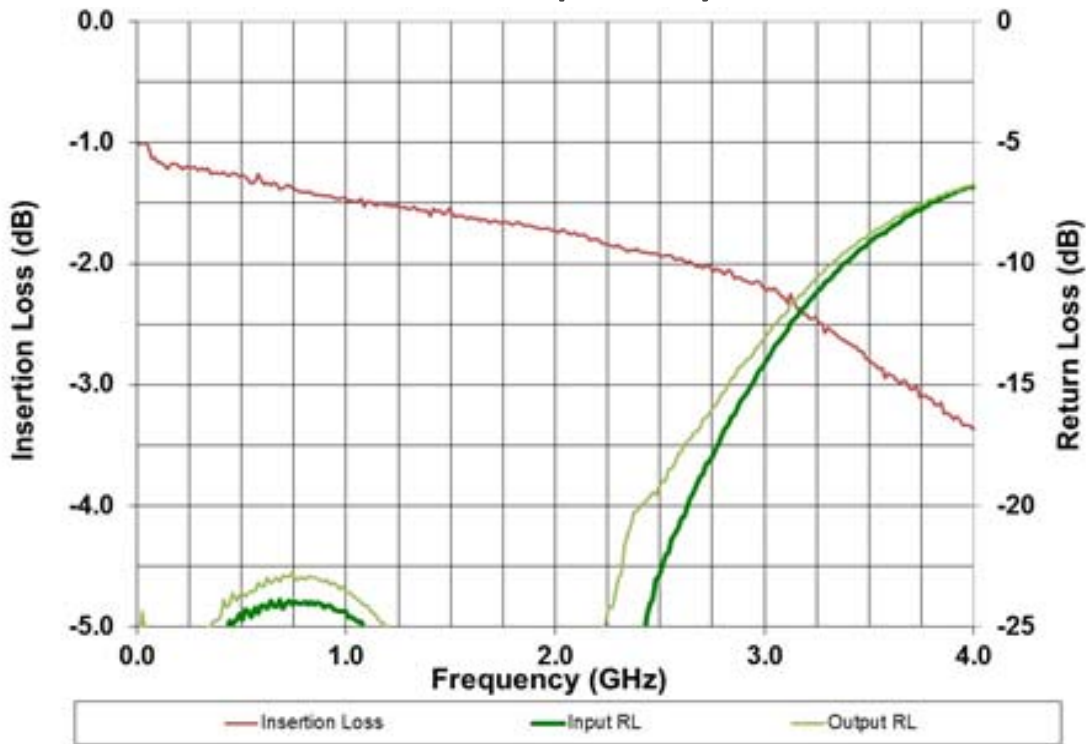
## OPERATING CHARACTERISTICS (+25 °C, $V_{IL} = -5V$ )<sup>1</sup>

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	+29	+35		dBm
		0.1 – 0.5 GHz	+45	+50		dBm
		0.5 – 2.0 GHz	+50	+55		dBm
		2.0 – 4.0 GHz	+50	+55		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% $V_{CTL}$ to RF settled to within 0.1 dB		0.2	1	$\mu$ S
Control Voltage High	$V_{IH}$		-0.8	0	+0.2	V
Control Voltage Low	$V_{IL}$		-7.0	-5.0	-3.0	V

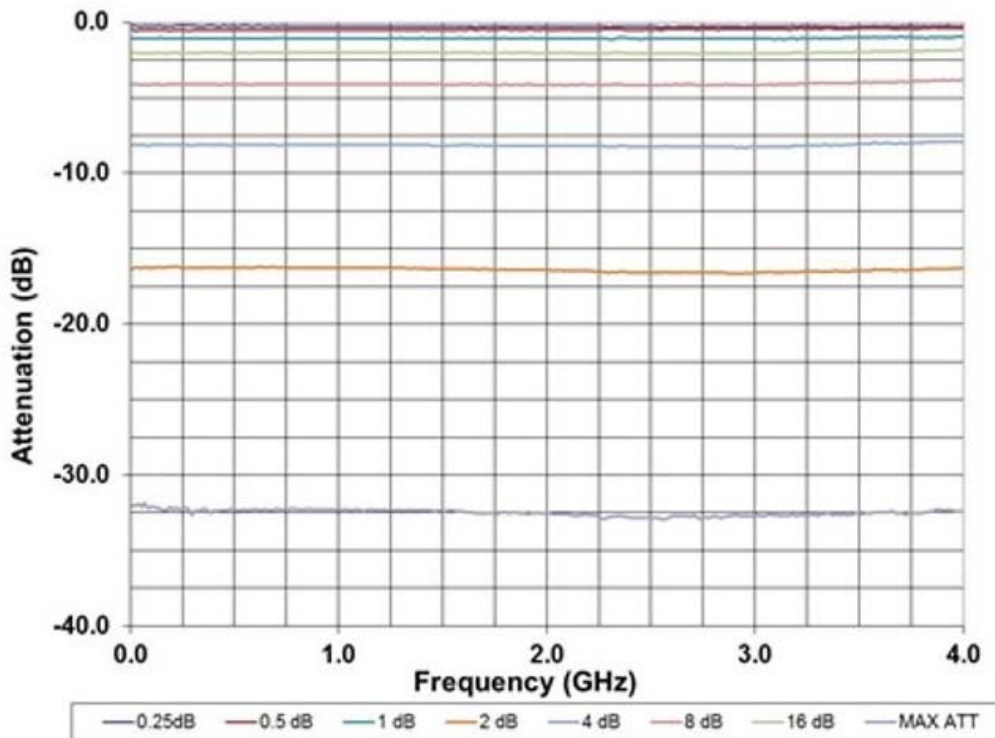
1. All operating characteristics are guaranteed over full performance temperature range but not tested.

TYPICAL PERFORMANCE (+25 °C)

### Insertion Loss vs Frequency:



### Attenuation vs Frequency

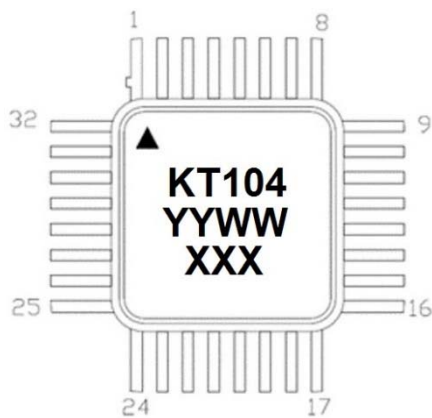


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## TRUTH TABLE/CONTROL CONDITIONS

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

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

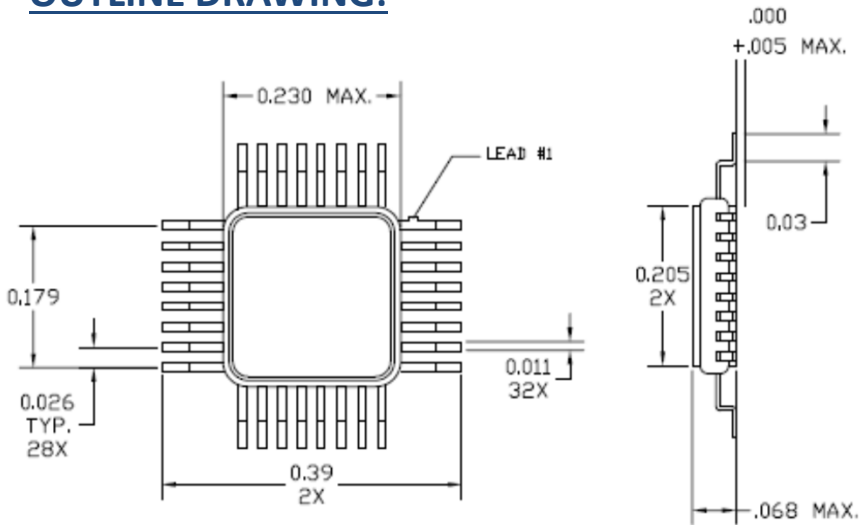
Characteristic	Min.	Max.	Units
Control voltage	-7	+0.2	V
RF Input power <sup>1</sup>		+25	dBm
Operating temperature	-55	+125	°C
Storage temperature	-65	+150	°C
Maximum Junction Temp		+150	°C
ESD sensitivity (HBM)		500 (Class 1B)	V

1. Exceeding maximum or minimum limits may cause damage.



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## OUTLINE DRAWING:



### Package Notes:

- Lid/Leads: ASTM F-15 Alloy
- Base/Walls: Alumina
- Lid Finish: Gold over Nickel
- Leads/Seal Ring/Bottom: 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		100%	100%
Burn In	1015	A	100%/160 Hours/ 125°C	100%/320 Hours/ 125°C
Final Electrical	Small Signal Testing		100%	100%
PDA Calculation	5004	25% Δ IL / 100% Δ Icc	5%	5%/3% functional
Group A Electrical /5	Per Product Specification		45/0	45/0
Leak Test	1014 A and C	1 x 10 <sup>-8</sup> 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	KT104C	KT104B	KT104S

