Quad High Voltage, Auto Damping Device

Features

- Up to ±130V input voltage protection
- 35Ω typical ON resistance
- Fast switching speed
- No external supplies needed

Applications

- Medical ultrasound imaging
- NDT applications
- Fast resettable fuses
- High side switches
- Data acquisition

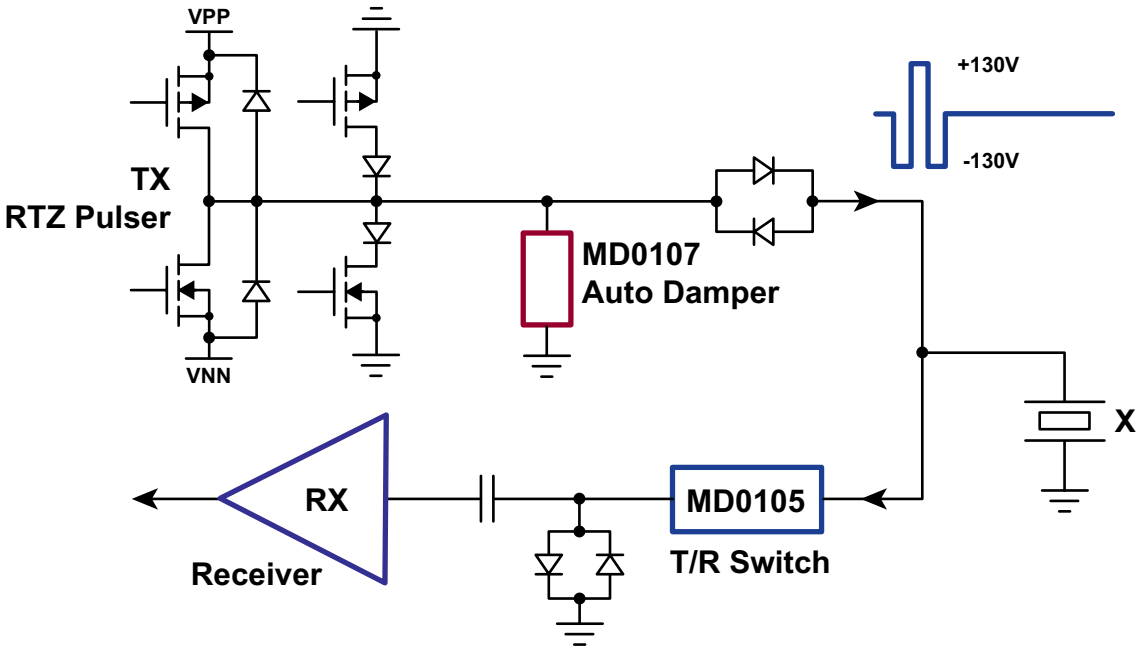
General Description

The MD0107 can be considered as a normally closed switch with a typical switch resistance of 35Ω. In this state, the MD0107 ensures that any leakage currents are shunted to ground, while maintaining a low voltage drop. This low voltage level is beneficial as it ensures that the anti-parallel diodes in the transmit path remain off during the receive cycle of the system. Thus the anti-parallel diodes more effectively block the small signals and prevent transmitter noise from contaminating the receive signal.

During operation of the pulser, the MD0107 switch opens and thus presents a high impedance to the transmitter pulse. The switch opens as soon as the voltage across it exceeds +/-2V and can withstand up to +/-130V. In this off-state, the MD0107 has very little effect on the transmit pulses or the power dissipated by the pulser.

The impedance of the MD0107, when the voltage across it is low, is suitable for terminating transmission lines. Where the line impedance is higher than the nominal 35Ω of the MD0107, a series resistor can be added; for example terminating a ~75Ω line can be effectively achieved by adding a 39Ω resistor. Without correct line termination, reflections can cause higher signal loss and degrade image quality in ultrasound systems.

Block Diagram



Ordering Information

Part Number	Package Options	Packing
MD0107K6-G	12-Lead (4x4) DFN	3000/Reel

-G denotes a lead (Pb)-free / RoHS compliant package

ESD Sensitive Device

Absolute Maximum Ratings

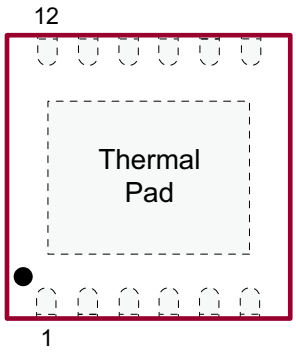
Parameter	Value
V_A - V_B, Differential voltage drop	0 to ±140V
Maximum junction temperature	+125°C
Storage temperature range	-65°C to 150°C
Power dissipation	1.2W

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.

Typical Thermal Resistance

Package	θ_{ja}
12-Lead DFN	42°C/W

Pin Configuration



12-Lead DFN
(top view)
(Pads are at bottom of device)

Product Marking

Y = Last Digit of Year Sealed
W = Code for Week Sealed
L = Lot Number
____ = "Green" Packaging

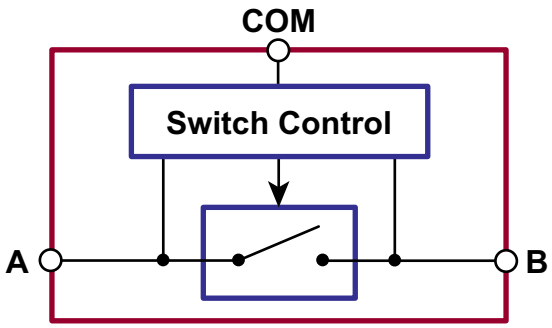
12-Lead DFN

Package may or may not include the following marks: Si or

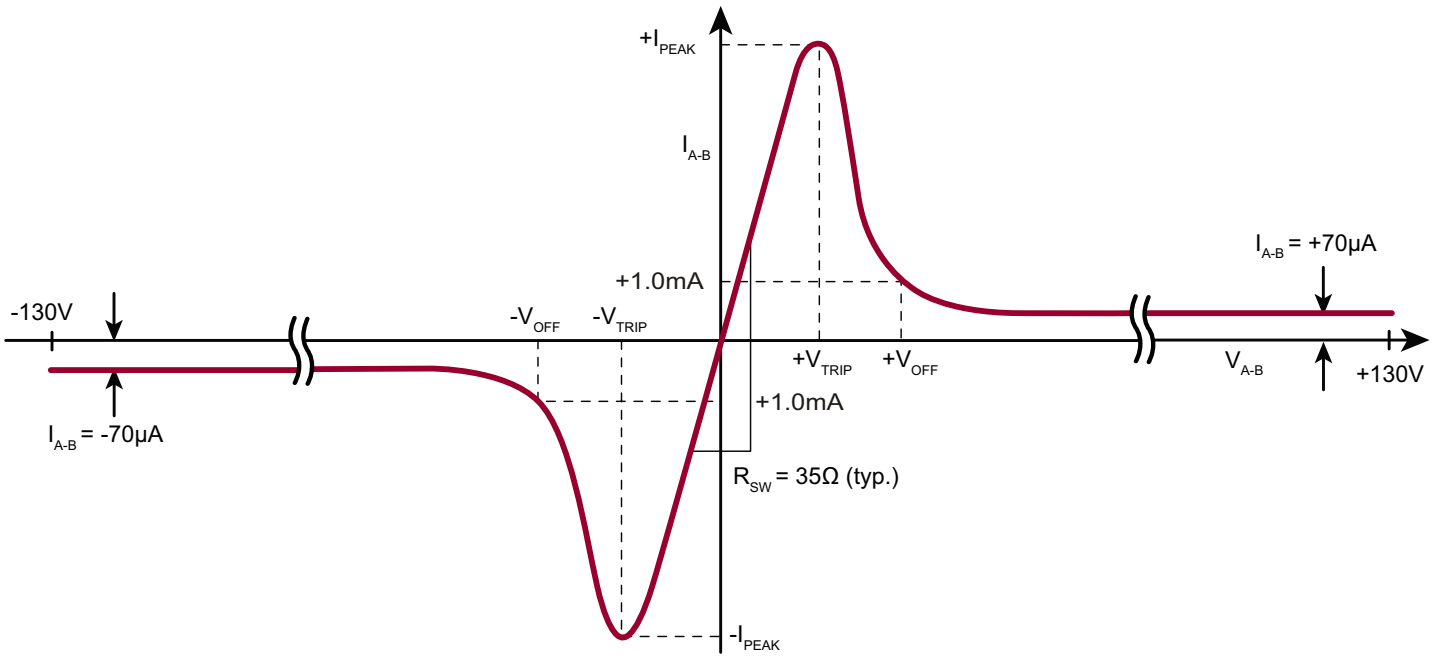
Electrical Characteristics *(T_j = 25°C, unless otherwise specified)*

Sym	Parameter	Min	Typ	Max	Units	Conditions
V_{A-B}	Max. differential input voltage from A to B	±130	-	-	V	I_{A-B} = ±1.0mA
R_{SW}	Switch ON resistance from A to B or B to A	-	35	50	Ω	I_{A-B} = ±5.0mA
V_{TRIP}	V_{A-B} trip point to turn-off	-	±1.0	±2.0	V	---
V_{OFF}	Switch turn-off voltage	-	±2.0	-	V	I_{A-B} = ±1.0mA
$I_{A-B(OFF)}$	Switch off current	-	±70	±150	µA	V_{A-B} = ±130V
I_{PEAK}	Peak switching current	-	±30	-	mA	---
T_{OFF}	Turn-off time	-	-	20	ns	---
T_{ON}	Turn-on time	-	-	20	ns	---
$C_{SW(ON)}$	Switch ON capacitance from A to B or B to A	-	7.0	-	pF	SW = ON
$C_{SW(OFF)}$	Switch OFF capacitance from A to B or B to A	-	5.0	-	pF	V_{SW} = 25V
BW	Small signal bandwidth from DC to	-	100	-	MHz	R_{LOAD} = 50Ω
T_J	Operating junction temperature	-40	-	+125	°C	---

Block Diagram *(one of four)*



Typical I-V Characteristics



Functional Description

The Supertex MD0107 can be considered as a normally closed switch controlled by a switch control (please refer to the block diagram). The switch control monitors the voltage drop across terminals A and B. If the voltage difference is greater than ±2.0V, the T/R switch will start to open. Once in the open state, there is a small amount of current flowing through the T/R switch, 70µA, to detect if the high voltage is still present or not.

The T/R switch will not close until the voltage across terminal A and B drops below ±2.0V. A pair of back-to-back diodes from the receive side of the switch to ground is needed to complete the circuit and to allow the initial peak current (about 60mA) to flow through the switch so it can drop ±2.0V. If the diodes are not present, then there is no current path and the voltage drop across terminal A and B will be less than ±2.0V, so the switch will remain in the closed position.

The MD0107 does not require a power supply. There are only two active pins; one connects to the transmitter side, one connects to the receiver side.

ON Resistance

When the voltage across terminals A and B are below ±2.0V, the switch is in the receive mode and the R_{ON} is typically 35Ω. Once the voltage across the terminals A and B is greater than ±2.0V, the switch is in the transmit mode and blocking the high voltage pulses from passing through to the receiver and damaging it.

Switch Capacitance

The typical switch ON capacitance ($C_{SW(ON)}$) is 7.0pF. This is measured from A to B when the switch is ON. The switch OFF capacitance is a function of the voltage across the T/R switch. The $C_{SW(OFF)}$ is about 5.0pF for 10V to 130V of the transmit voltage.

T_{ON} and T_{OFF} Time

The T_{ON} and T_{OFF} of the MD0107 are less than 20ns, which provide a fast switch between the transmit mode and the receive mode. The T_{ON} and T_{OFF} are input rise/fall time dependent. The T/R switch turns ON and OFF faster when the rise and fall times of the transmit pulse are faster. On the other hand, the switch turns ON and OFF slower if the rise and fall times of the transmit pulse are slower.

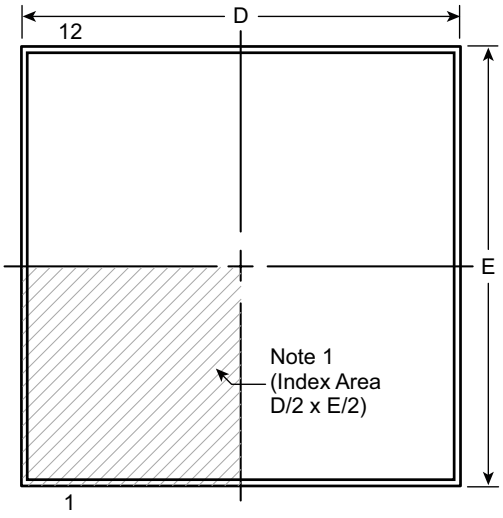
Pin Description - 12-Lead DFN

Pad	Name	Description
1	A1	Switch terminal A1
2	NC	No internal connection
3	A2	Switch terminal A2
4	A3	Switch terminal A3
5	NC	No internal connection
6	A4	Switch terminal A4

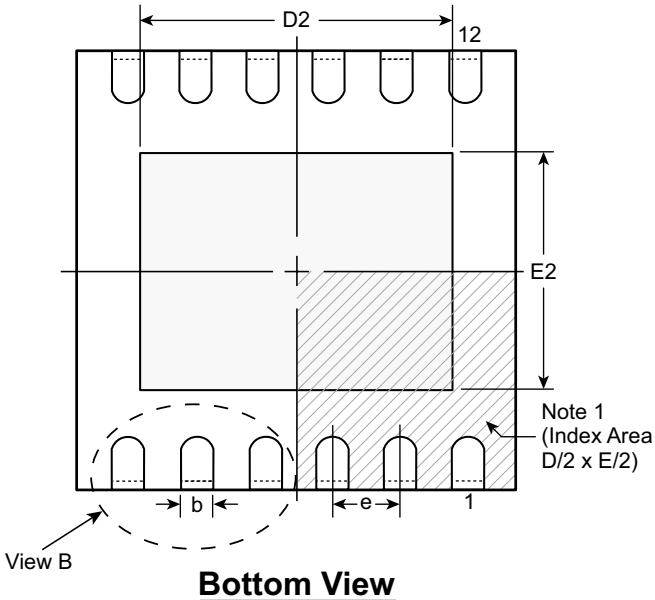
Pad	Name	Description
7	B4	Switch terminal B4
8	NC	No internal connection
9	B3	Switch terminal B3
10	B2	Switch terminal B2
11	NC	No internal connection
12	B1	Switch terminal B1
Center Tab	---	Connect to ground

12-Lead DFN Package Outline (K6)

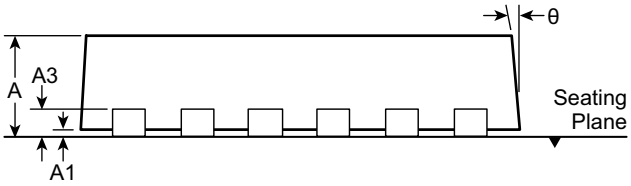
4.00x4.00mm body, 1.00mm height (max), 0.50mm pitch



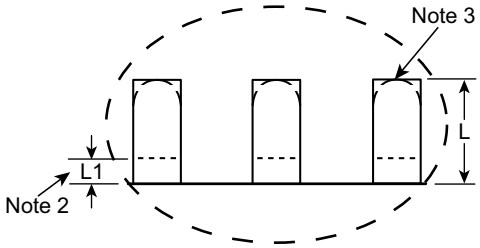
Top View



Bottom View



Side View



View B

Notes:

1. *A Pin 1 identifier must be located in the index area indicated. The Pin 1 identifier can be: a molded mark/identifier; an embedded metal marker; or a printed indicator.*
2. *Depending on the method of manufacturing, a maximum of 0.15mm pullback (L1) may be present.*
3. *The inner tip of the lead may be either rounded or square.*

Symbol		A	A1	A3	b	D	D2	E	E2	e	L	L1	θ
Dimension (mm)	MIN	0.80	0.00	0.20 REF	0.18	3.85	3.19	3.85	2.29	0.50 BSC	0.30	0.00	0°
	NOM	0.90	0.02		0.25	4.00	3.34	4.00	2.44		0.40	-	-
	MAX	1.00	0.05		0.30	4.15	3.44	4.15	2.54		0.50	0.15	14°

Drawings not to scale.
Supertex Doc.#: *DSPD-12DFNK64X4P050, Version A030210.*

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to http://www.supertex.com/packaging.html.)

Supertex inc.
1235 Bordeaux Drive, Sunnyvale, CA 94089
Tel: 408-222-8888
www.supertex.com