MADL-0110 Series

M/A-COM Technology Solutions

Silicon PIN Limiter Diodes

V1

Features

- Low Insertion Loss and Noise Figure
- High Peak and Average Operating Power
- Various P1dB Compression Powers
- Low Flat Leakage Power
- Proven Reliable, Silicon Nitride Passivation
- RoHS Compliant
- 3 mil Anode Contact Area

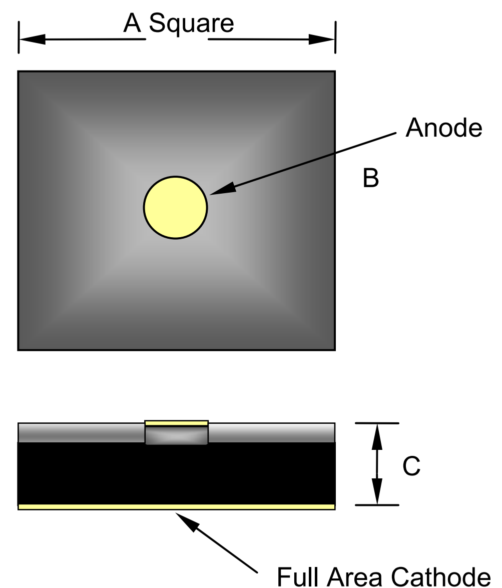
Description

M/A-COM Technology Solutions manufactures a series of silicon PIN limiter diodes with small and medium I-region lengths which are specifically designed for high signal applications. The devices are designed to provide low insertion loss, at zero bias, as well as low flat leakage power with fast signal response/recovery times.

Applications

The MADL-0110 Series of PIN limiter diodes are designed for use in passive limiter control circuits to protect sensitive receiver components such as low noise amplifiers (LNA), detectors, and mixers covering the 10 MHz to 18 GHz frequency range.

Chip Outline



ODS	Dimension	mils	mm
134	A	15 ± 2	.381 ± .51
	B	3	0.076
	C	7 ±1*	.178 ± .025

Absolute Maximum Ratings[1] T_{AMB} = 25°C

(Unless otherwise specified)

Parameter	Absolute Maximum
Forward Current	100mA
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +150°C
Junction Temperature	+175°C
RF Peak & C.W. Incident Power	Per Performance Table
Mounting Temperature	+320°C for 10 sec.

Note:
1. Exceeding any of the above ratings may cause permanent damage.

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Un-Packaged Die Electrical Specifications at T_{AMB} = 25°C

Part Number[1]	*Minimum V_{REV} 10 µA*	*Maximum V_{REV} 10 µA*	*Minimum C_{jov} 1 MHz*	*Maximum C_{jov} 1 MHz*	*Maximum $R_{S\ 10mA}$ 500 MHz*	Nominal Characteristics			
						Carrier Lifetime I_{FOR} =10mA I_{REV} = -6mA	*I-Region Thickness*	*Contact Diameter*	*Thermal Resistance*
	V_R	V_R	pF	pF	Ohms[2]	nS[2]	µm	mils	°C/W[1]
MADL-011009-01340W	20	35	0.16	0.23	1.50	10	2	3.0	175
MADL-011010-01340W	30	50	0.17	0.24	1.50	15	3	3.0	150
MADL-011011-01340W	60	75	0.05	0.17	2.30	10	4	3.0	150

Note:
1. For other available limiter devices consult the MA4L Series limiter datasheet.
2. Test performed with the chip mounted in an ODS-30 package.

*Nominal High Signal Performance at T_{AMB} = 25°C

Part Number	*Incident Peak Power for 1dB Limiting* *Freq. = 9.4GHz*	*Incident Peak Power for 10dB Limiting* *Freq. = 9.4GHz*	*Incident Peak Power for 15dB Limiting* *Freq. = 9.4GHz*	*Recovery Time 3 dB* *Peak Power = 50W*	*Maximum Incident* *Peak Power*	*Maximum CW* *Input Power*
	dBm	dBm	dBm	nS	Watts	Watts
MADL-011009-01340W	8	31	41	10	90	3
MADL-011010-01340W	11	34	44	25	125	4
MADL-011011-01340W	15	38	50	75	200	5

***See page 3 for high signal performance parameter notes.**

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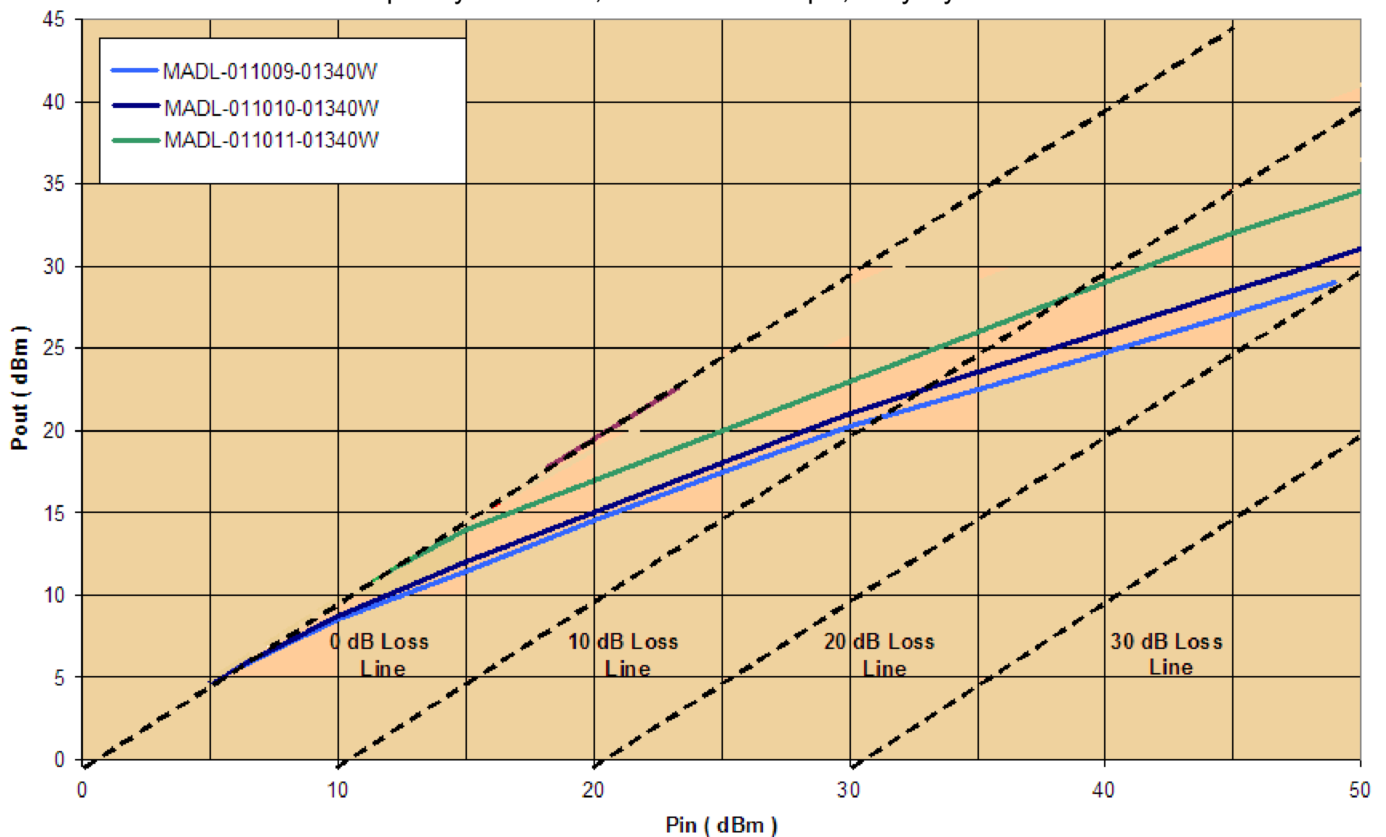
Typical High Signal Peak Power Performance in a Single Shunt 50Ω Circuit



High Signal Performance: Measured in a single shunt diode (die) configuration attached directly to the gold plated RF ground of a 50Ω, SMA connectorized, test fixture using 2 mil thick conductive silver epoxy . Chip anode contact is thermo-compression wire bonded using a 1 mil. diameter gold wire onto a 7.2 mil thick Rogers 5880 Duroid microstrip trace. A shunt coil provides the D.C. return.

Test frequency = 9.4 GHz
RF pulse width = 1.0 µS, 0.001% duty cycle.

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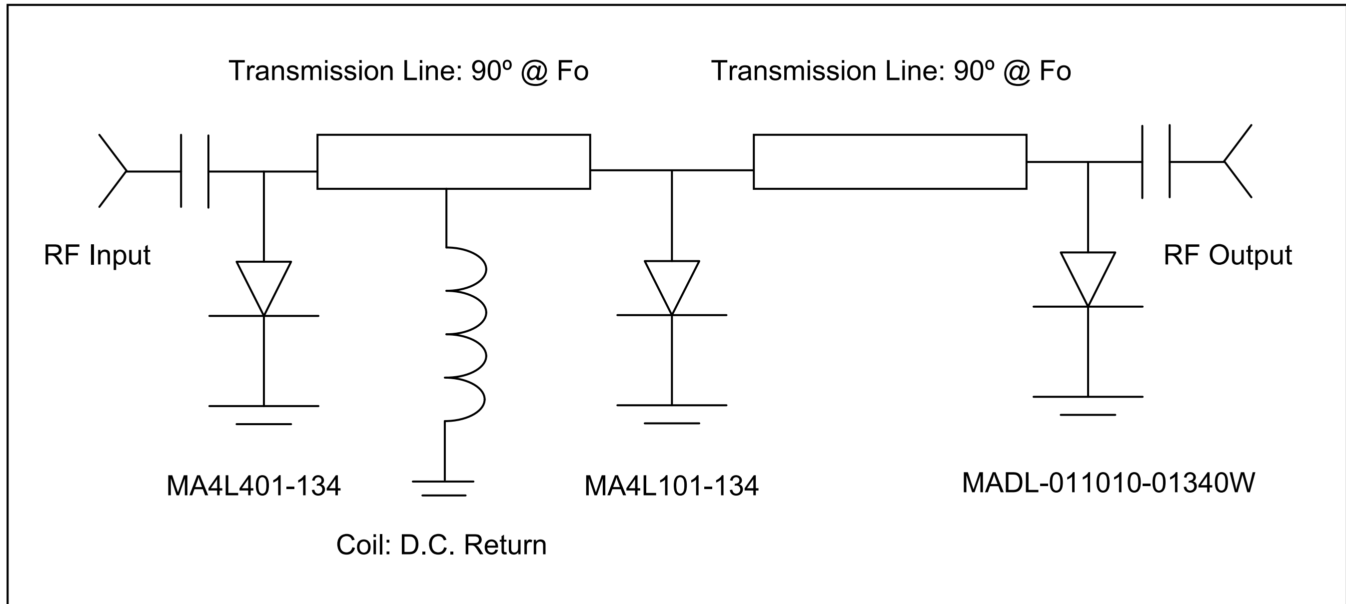
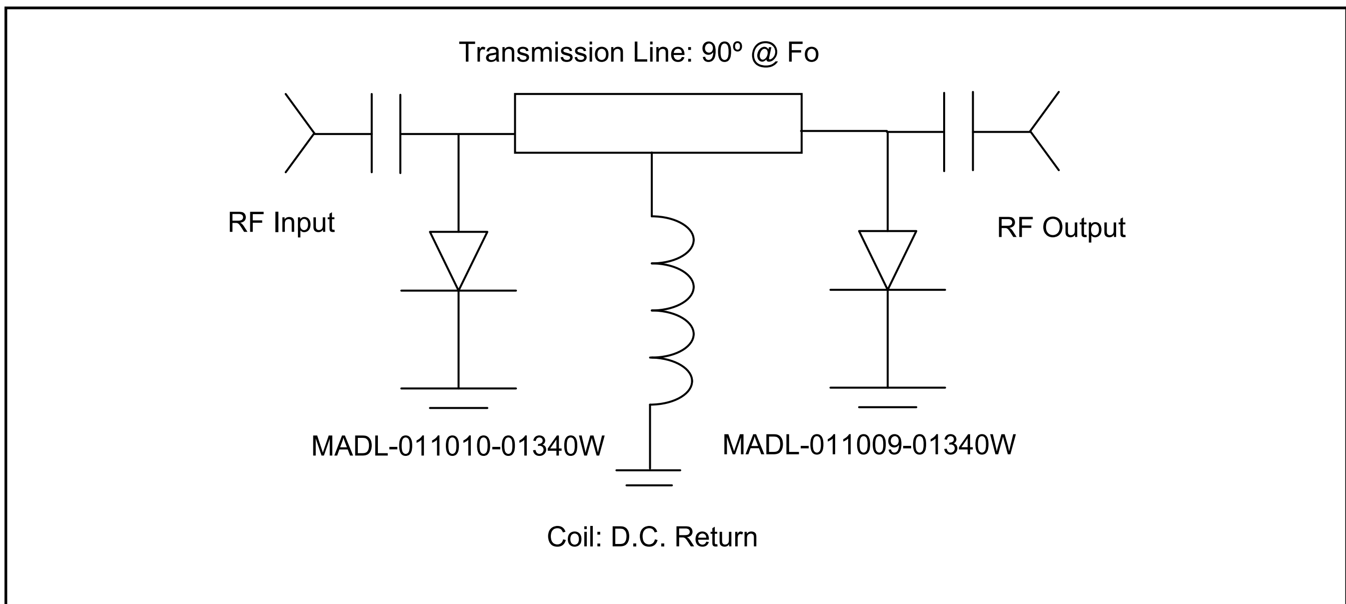
Application Circuits

Typical +60dBm Peak Power, 1µS P.W., 0.001% Duty Cycle, +20dBm Flat Leakage Limiter Circuit



Typical +50dBm Peak Power, 1µS P.W., 0.001% Duty Cycle, +20dBm Flat Leakage Limiter Circuit



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Notes for Specification and Nominal High Signal Performance Tables:

1) ***Maximum Series Resistance***: R_S, is measured at 500 MHz in the ODS-30 package and is equivalent to the total diode resistance: R_S = Rj (Chip Junction Resistance) + R_O (Package Ohmic Resistance)
2) ***Nominal C.W. Thermal Resistance***: Θ_{TH} is measured in a ceramic pill package, ODS-30, mounted to a metal (infinite) heatsink. Chip only thermal resistance values are approximately 2°C/W less than the ODS-30 listed package values in the specifications table.
3) ***Maximum High Signal Performance***: Measured with a single shunt diode (die) attached directly to the gold plated RF housing ground with 2 mil thick conductive silver epoxy in a 50Ω, SMA, connectorized test fixture. Chip anode contact is thermo-compression wire bonded using a 1 mil. diameter gold wire onto a 7.2 mil thick Rogers 5880 Duroid microstrip trace. A shunt coil provides the D.C. return. Test frequency = 9.4 GHz, RF pulse width = 1.0 µS, Duty Cycle = 0.001%.
4) ***Maximum C.W. Incident Power***: Measured in a 50Ω, SMA, connectorized housing @ 4GHz utilizing a TWT amplifier and the same single diode assembly configuration as stated in Note 3 above.

Die Handling and Mounting Information

Handling: All semiconductor chips should be handled with care in order to avoid damage or contamination from perspiration, salts, and skin oils. For individual die, the use of plastic tipped tweezers or vacuum pick up tools is strongly recommended. Bulk handling should ensure that abrasion and mechanical shock are minimized.

Die Attach: The die have Ti-Pt-Au back and anode metal, with a final gold thickness of 1.0µm. Die can be mounted with a gold-tin, eutectic solder perform or conductive silver epoxy. The metal RF and D.C. ground plane mounting surface must be free of contamination and should have a surface flatness or < ± 0.002".

- ***Eutectic Die Attachment Using Hot Gas Die Bonder:*** An 80/20, gold / tin eutectic solder perform is recommended with a work surface temperature of 255°C and a tool tip temperature of 220°C. When the hot gas is applied, the temperature at the tool tip should be approximately 290°C. The chip should not be exposed to a temperatures in excess of 320°C for more than 10 seconds.

- ***Eutectic Die Attachment Using Reflow Oven:*** Refer to Application Note M538, "Surface Mounting Instructions".

- ***Epoxy Die Attachment:*** A thin, controlled amount of electrically conductive silver epoxy should be applied, approximately 1-2 mils thick to minimize ohmic and thermal resistances. A small epoxy fillet should be visible around the outer perimeter of the chip after placement to ensure full area coverage. Cure the conductive silver epoxy per the manufacturer's schedule, typically 150˚C for 1 hour.

Wire Bonding: The chip's anode metallization stack is comprised of Ti/Pt/Au with a final gold thickness of 1.0µm. Thermo-compression wedge bonding using a .7 to 1 mil diameter gold wire is recommended. The heat stage temperature should be set to approximately 200°C with a bonding tip temperature of 125˚C and a force of 18 to 40 grams. Use of ultrasonic energy is not advised but if necessary it should be adjusted to the minimum required to achieve a good bond. Excessive energy or force applied to the top contact will cause the metallization to dislodge and lift off. Automatic ball bonding may also be used.

See Application Note M541, "Bonding and Handling Procedures for Chip Diode Devices" for more detailed handling and assembly information.

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