

# MLM2060-300 & MLM2060-301



## PIN Diode Limiter 2 - 6 GHz

Rev. V1

### Features

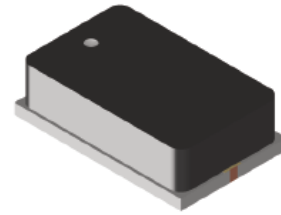
- Surface Mount Limiter in 8 mm x 5 mm x 2.5 mm Package
- Incorporates PIN Limiter Diodes, DC Blocks and DC Return
- Higher Peak Power Handling than Plastic: 100 W Peak Power
- Lower Insertion Loss: 0.85 dB
- Lower Flat Leakage Power: 19 dB
- RoHS\* Compliant

### Description

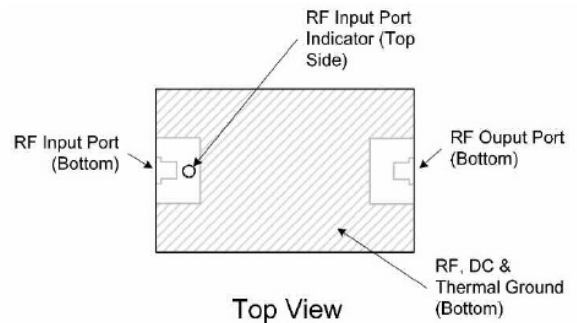
The MLM2060-300 and MLM2060-301 Series of surface mount silicon PIN diode limiters is manufactured using a proven hybrid manufacturing process incorporating PIN diodes and passive devices integrated within a ceramic substrate. This low profile, compact surface mount component offers superior low and high signal performance to comparable MMIC devices in QFN packages. The limiter modules are designed to optimize small signal insertion loss, noise figure and high signal flat leakage performance in a compact surface mount package.

The MLM2060-300 has shunt PIN limiter diodes and a shunt coil with no DC blocks, whereas the MLM2060-301 incorporates shunt PIN limiter diodes, a shunt coil, and DC blocks for versatility of design preference. Using PIN diodes with lower thermal resistance (<40 °C/W), RF CW incident power levels of +6 dBm and RF peak incident power levels of 50 dBm @ 1 μs RF pulse width, 0.001 duty cycle are very achievable in broadband limiter applications. The lower PIN diode series resistance, (<1.5 Ω), coupled with the smaller minority carrier lifetime, (<20 ns), provides lower flat leakage power (<20 dBm) and lower spike leakage energy (<0.1 Ergs ) for superior LNA protection.

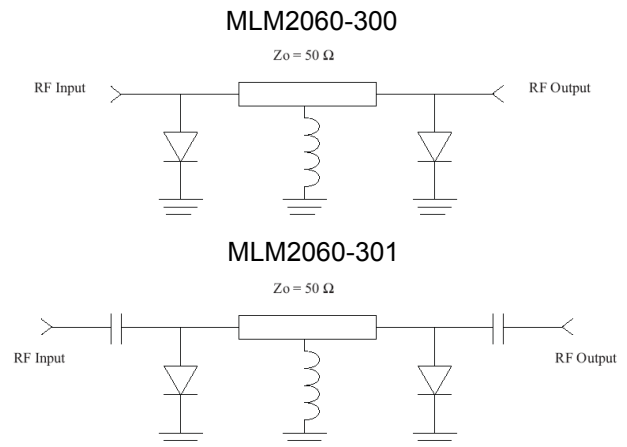
These MLM2060-300 and MLM2060-301 Limiter Series are ideal for 2 to 6 GHz Radar, IED, and WiMax applications, requiring high volume, surface mount, solder re-flow manufacturing. These products are durable, reliable, and capable of meeting all military, commercial, and industrial environments. The devices are fully RoHS compliant and are available in tube or tape & reel.



### Pin Out



### Limiter Schematic



### Ordering Information

Part Number	Package
MLM2060-300-T	tube packaging
MLM2060-300-R	250 or 500 piece reel
MLM2060-301-T	tube packaging
MLM2060-301-R	250 or 500 piece reel

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\* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

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DC-0014353

**Electrical Specifications: Freq. = 2 - 6 GHz, T<sub>A</sub> = +25°C, Z<sub>0</sub> = 50 Ω**

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss	Swept Frequency, P <sub>OUT</sub> = 0 dBm	dB	—	-0.85	-1.1
Return Loss	Swept Frequency, P <sub>OUT</sub> = 0 dBm	dB	-13	-14	—
Input 1 dB Compression Point	Swept Frequency	dBm	7	8	10
2 <sup>ND</sup> Harmonic	P <sub>OUT</sub> = 0 dBm F <sub>0</sub> = 4 GHz	dBc	45	50	—
Peak Incident Power	RF Pulse Width = 1 μs, duty cycle = 0.001%	dBm	—	50	51
CW Incident Power	Swept Frequency	dBm	—	35	36
Flat Leakage Power	+50 dBm, RF pulse width = 1 μs, duty cycle = 0.001%	dBm	—	18	20
Spike Leakage Energy	+50 dBm, RF pulse width = 1 μs, duty cycle = 0.001%	erg	—	0.1	0.2
Recovery Time	50% trailing RF pulse to 1 dB IL	ns	—	100	150

**Absolute Maximum Ratings<sup>1,2</sup>**

Parameter	Absolute Maximum
RF CW Incident Power @ +85°C, Source & Load VSWR <1.2:1	35 dBm
RF Peak Incident Power @ +85°C, Source & Load VSWR <1.2:1 RF Pulse Width = 1 μs, 0.1% Duty Cycle	50 dBm
Insertion Loss Rate of Change with Operating Temperature	-0.0025 dB / °C
Junction Temperature	+175°C
Operating Temperature	-65°C to +125°C
Storage Temperature	-65°C to +150°C
Assembly Temperature	260°C for 10 seconds

1. Exceeding any one or combination of these limits may cause permanent damage to this device.
2. MACOM does not recommend sustained operation near these survivability limits.

## Handling Procedures

Please observe the following precautions to avoid damage:

## Static and Moisture Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these Class 0 (HBM) devices.

## Environmental Capabilities

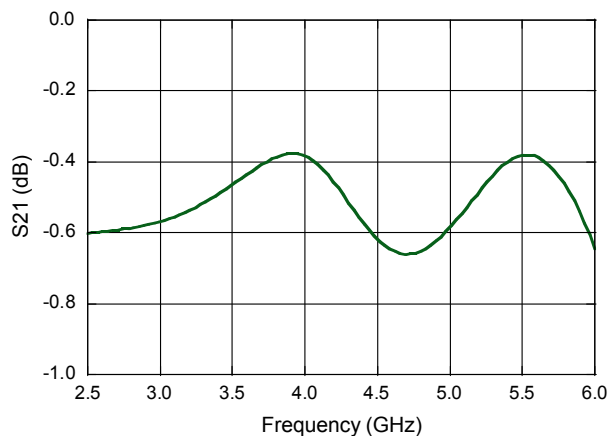
This limiter is capable of meeting the environmental requirements of MIL-STD-750, MIL-STD-202 and MIL-STD-883.

## Assembly Instructions

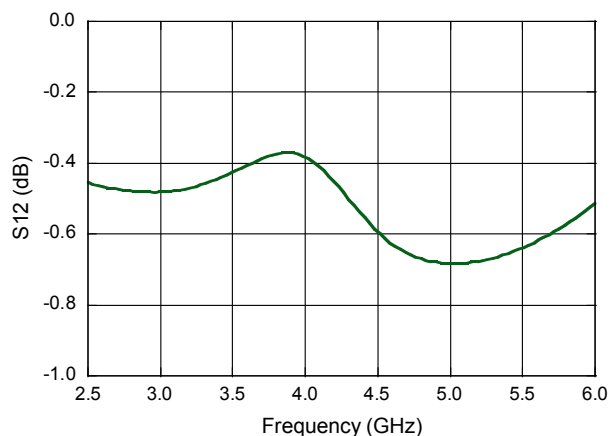
The MLM2060-300 & MLM2060-301 limiter diodes may be placed onto circuit boards with pick and place manufacturing equipment from tube or tape-reel dispensing. The devices are attached to the circuit board using conventional solder re-flow or wave soldering procedures with RoHS type or Sn63/Pb37 type solders.

## Typical Performance Curves

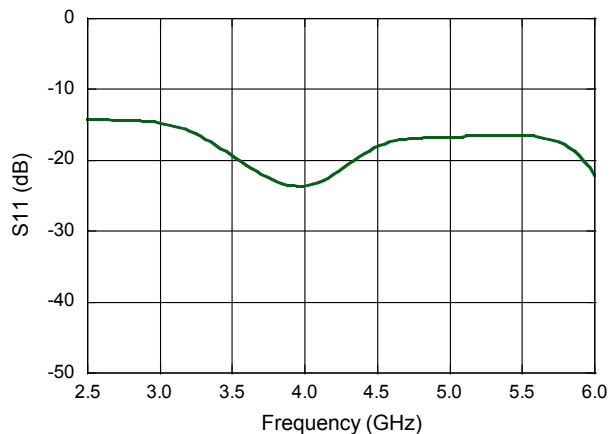
**Gain**



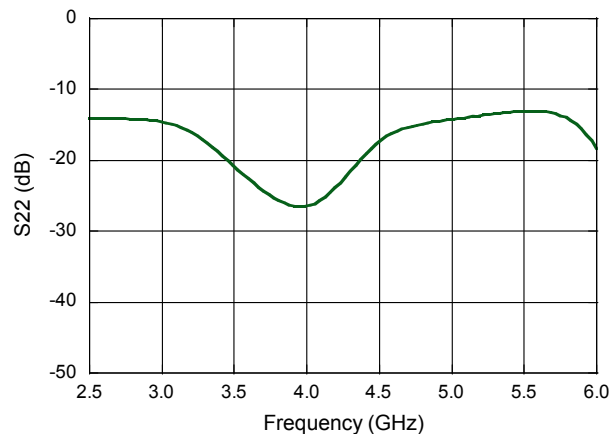
**Insertion Loss**



**Input Return Loss**

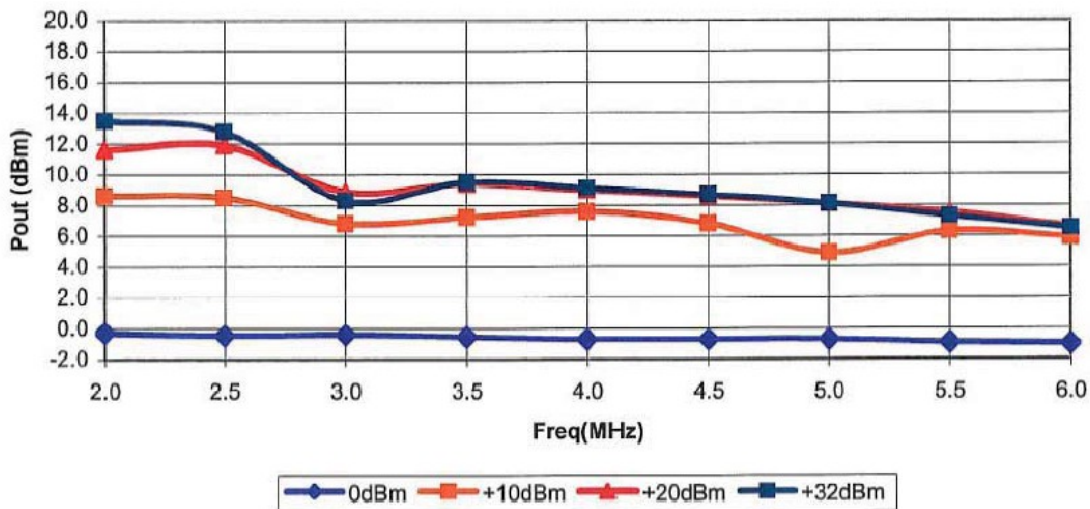


**Output Return Loss**

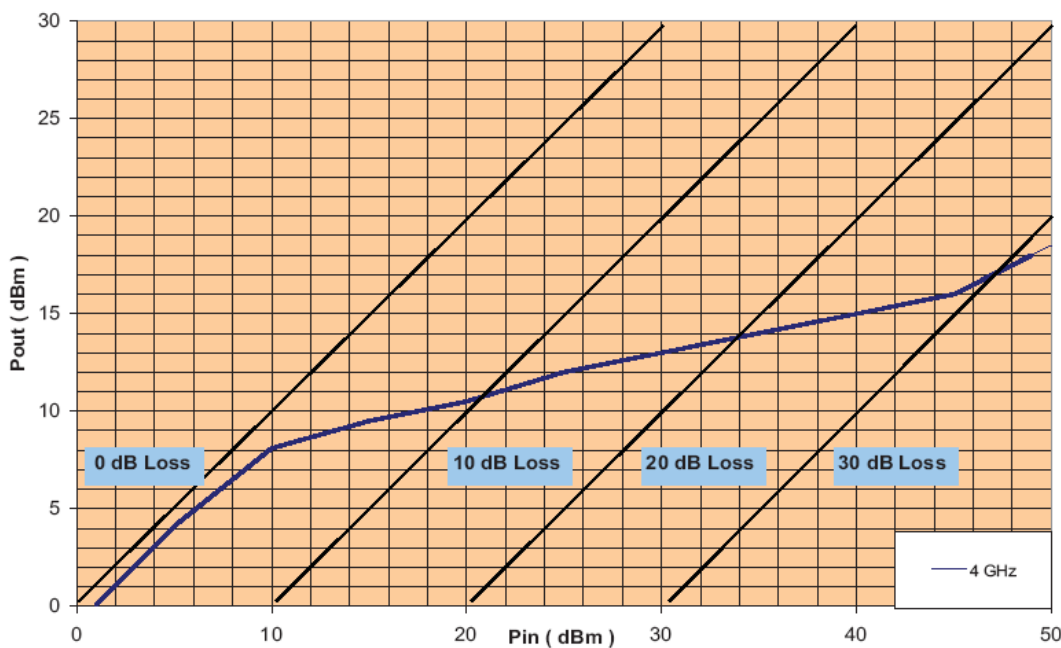


## Typical Performance Curves

**MLM2060-300 RF CW Incident Performance**  
Output Power vs. Input Power



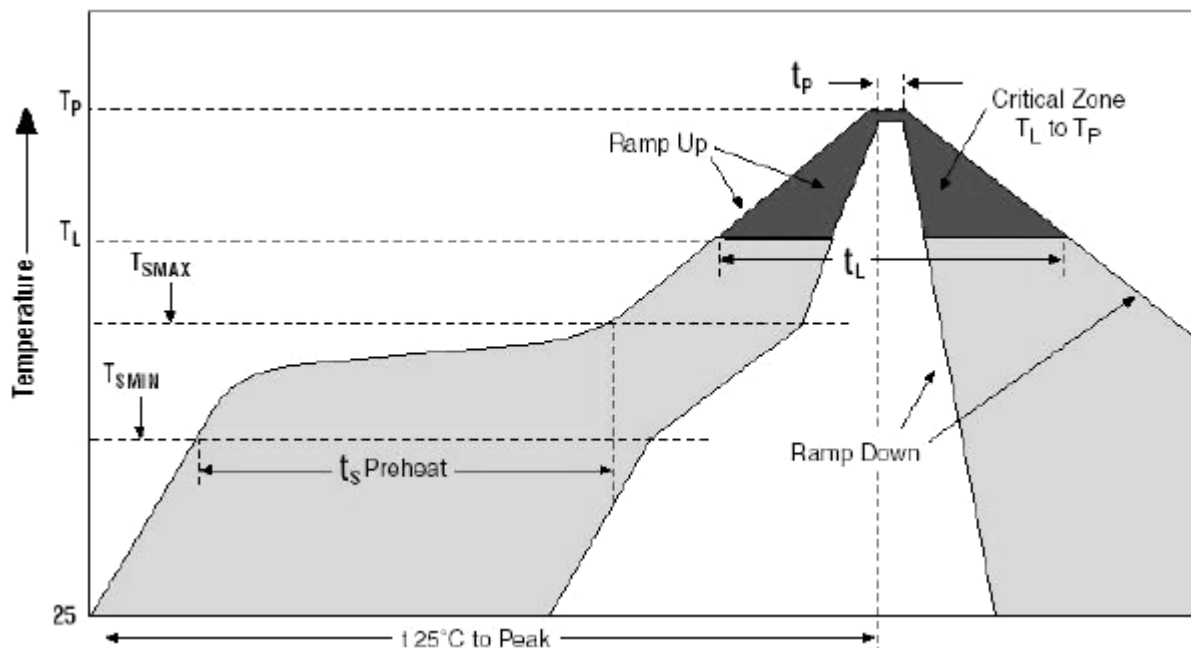
**MLM2060-301 RF Peak Incident Performance**  
Output Power vs. Input Power



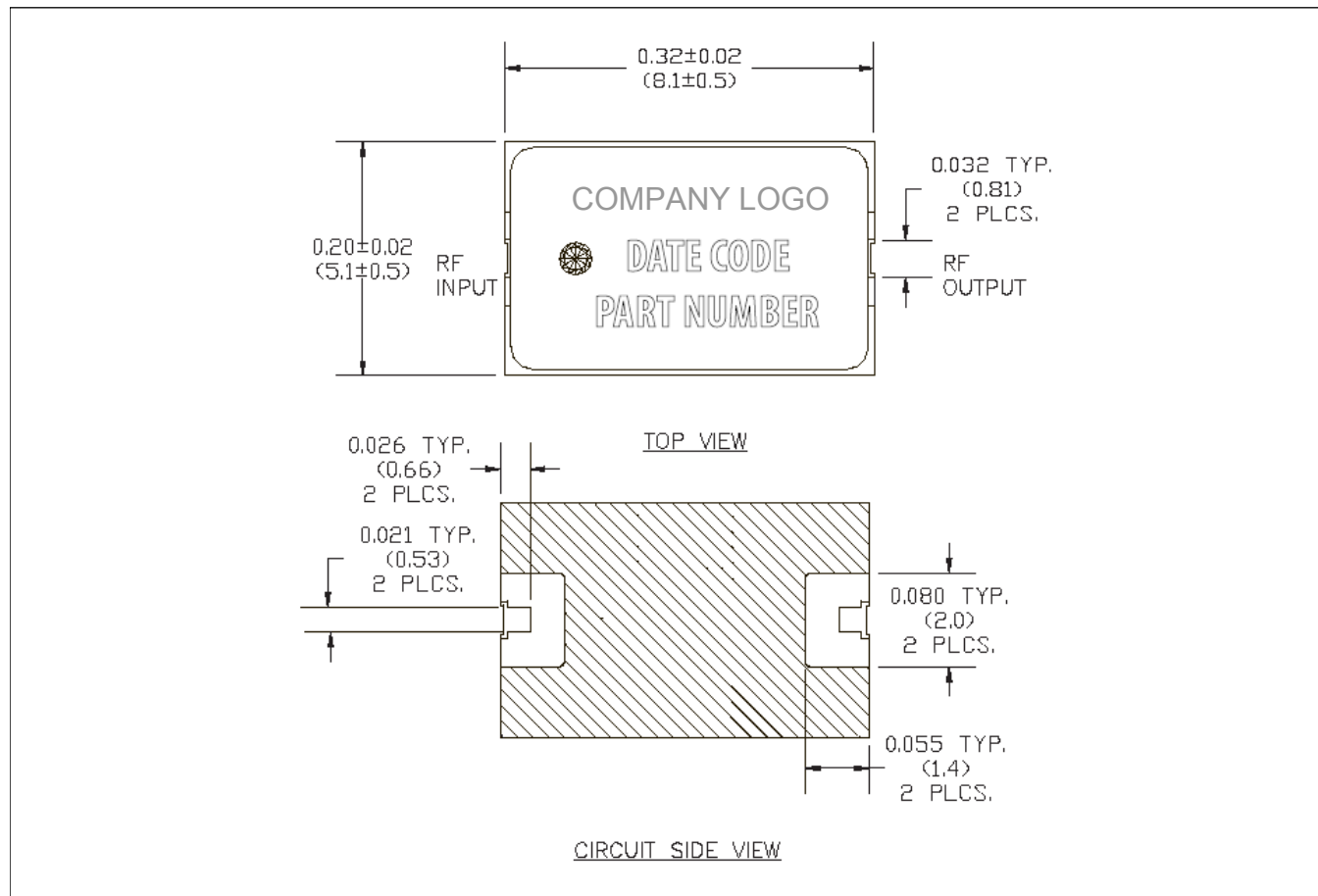
**Table 1: Time-Temperature Profile for Sn 60 / Pb 40 or RoHS Type Solders**

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (TL to TP)	3°C/second maximum	3°C/second maximum
Preheat - Temperature Minimum (TSMIN) - Temperature Maximum (TSMAX) - Time (Minimum to maximum) (ts)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
TSMAX to TL - Ramp-up Rate	—	3°C/second maximum
Time Maintained above: - Temperature (TL) - Time (tL)	183°C 60-150 seconds	217°C 60-150 seconds
Peak Temperature (TP)	225 +0 / -5°C	245 +0 / -5°C
Time within 5°C of actual Peak Temperature (TP)	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second maximum	6°C/second maximum
Time 25°C to Peak Temperature	6 minutes maximum	8 minutes maximum

**Graph1: Solder Re-Flow Time-Temperature Function**



## Outline Drawing, Case Style 300 (CS300)



The hatched metal area on circuit side of device is RF, DC and thermal grounded.

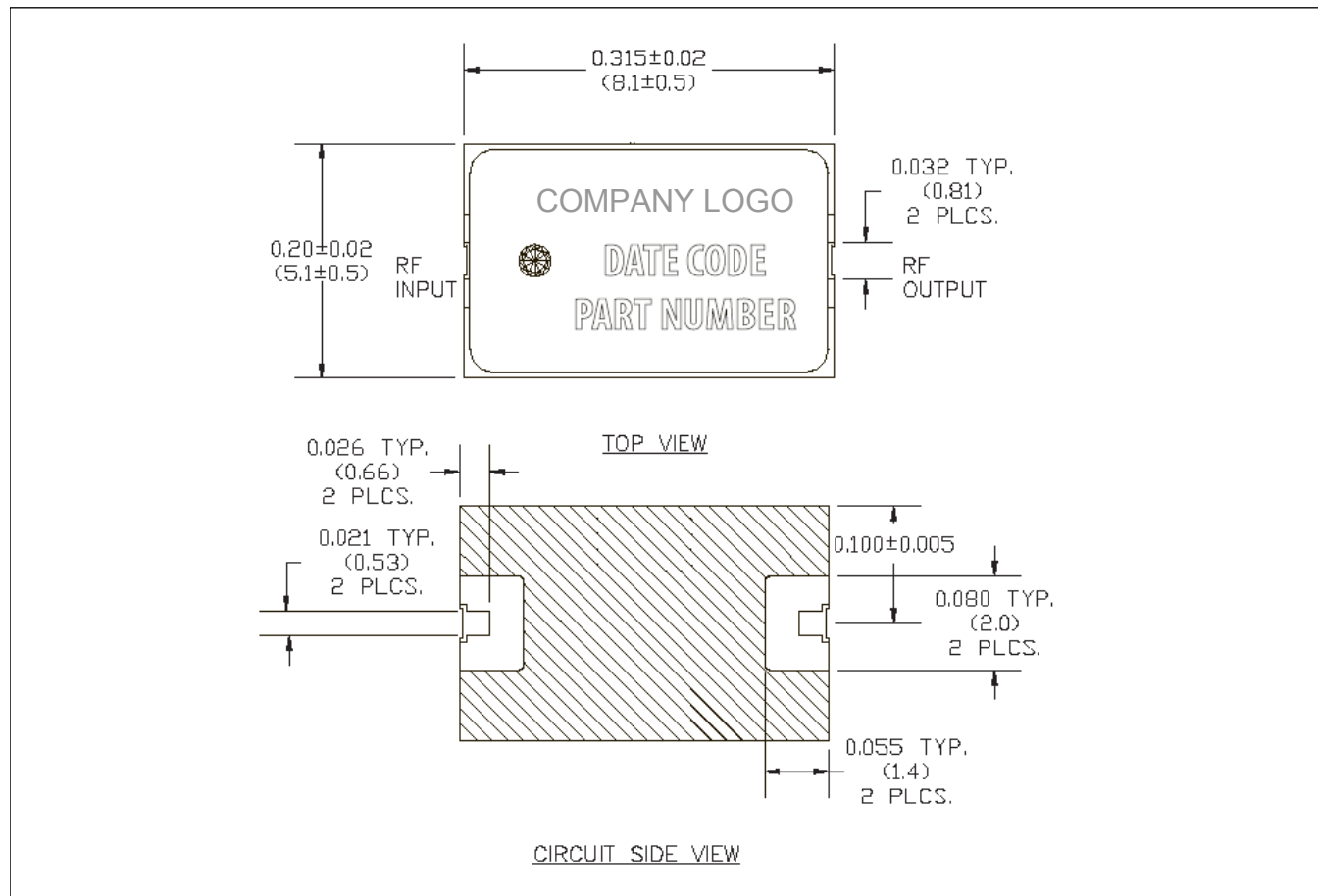
Dimensions are in inches (mm)

Substrate Material: 20 mil thick Alumina Nitride (ALN)

RF Cover: Black Ceramic

Top Side and Backside Metallization: 100  $\mu$  IN. typical plated over Ti-Pd.

## Outline Drawing, Case Style 301 (CS301)



The hatched metal area on circuit side of device is RF, DC and thermal grounded.

Dimensions are in inches (mm)

Substrate Material: 20 mil thick Alumina Nitride (ALN)

RF Cover: Black Ceramic

Top Side and Backside Metallization: 100  $\mu$  IN. typical plated over Ti-Pd.

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