

## PROTECTION PRODUCTS

### Description

RClamp®03331PWQ is specifically designed to provide secondary surge and ESD protection on antennas and high-speed data ports. RClamp03331PWQ utilizes snap-back or "crow-bar" technology to minimize device clamping voltage. It features high surge current capability of 10A ( $t_p=8/20\mu s$ ). ESD characteristics are highlighted by high ESD withstand voltage  $\pm 30kV$  (Air) and  $\pm 25kV$  (Contact) per IEC 61000-4-2. RClamp03331PWQ has extremely low dynamic resistance ( $0.16\Omega$ ). Each device will protect one lines operating up to 3.3V. RClamp03331PWQ is qualified to AEC-Q100 and AEC-Q101, Grade 1 ( $-40$  to  $+125^\circ C$ ) for automotive applications.

RClamp03331PWQ is in a DFN 1.0 x 0.6 x 0.55mm 2-Lead package. The combination of small size, low capacitance, and high ESD surge capability makes them ideal for use in industrial, automotive, and consumer applications.

### Features

- High ESD withstand Voltage:
  - IEC 61000-4-2 (ESD):  $\pm 30kV$  (Air),  $\pm 25kV$  (Contact)
- Ultra-small package
- Protects one line
- Low ESD clamping voltage
- Working voltage:  $\pm 3.3V$
- Low capacitance: 0.35pF Typical
- Low leakage current
- Low dynamic resistance
- Side wettable flanks
- Qualified to AEC-Q100 and AEC-Q101, Grade 1
- Solid-state silicon-avalanche technology

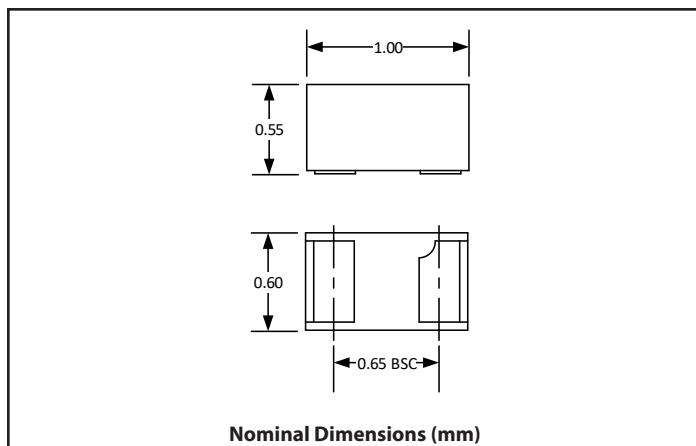
### Mechanical Characteristics

- Package: DFN 1.0 x 0.6 x 0.55mm 2-Lead
- Pb-Free, Halogen Free, RoHS/WEEE compliant
- Lead Finish: Pb-Free
- Marking: Marking code
- Packaging: Tape and Reel

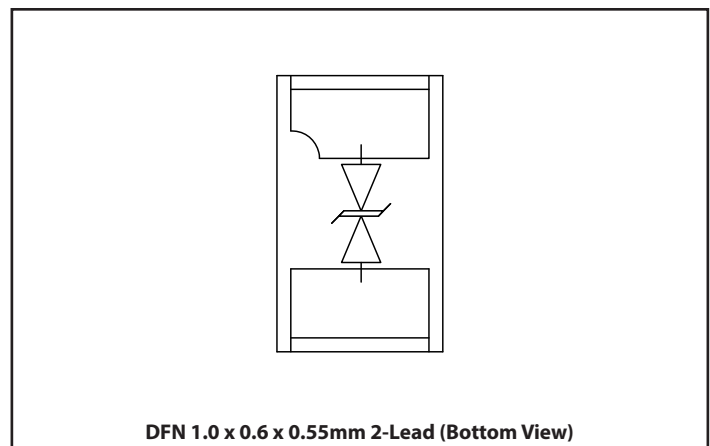
### Applications

- Antenna
- USB 3.2
- LVDS
- Automotive Applications
- Industrial Equipment

### Package Dimension



### Schematic & Pin Configuration



## Absolute Maximum Rating

Rating	Symbol	Value	Units
Peak Pulse Power ( $t_p = 8/20\mu s$ )	$P_{PK}$	80	W
Peak Pulse Current ( $t_p = 8/20\mu s$ )	$I_{PP}$	10	A
ESD per IEC 61000-4-2 (Air) <sup>(1)</sup> ESD per IEC 61000-4-2 (Contact) <sup>(1)</sup>	$V_{ESD}$	$\pm 30$ $\pm 25$	kV
ESD per ISO-10605 (Air) <sup>(2)</sup> ESD per ISO-10605 (Contact) <sup>(2)</sup>	$V_{ESD}$	$\pm 30$ $\pm 30$	kV
ESD per ISO-10605 (Air) <sup>(3)</sup> ESD per ISO-10605 (Contact) <sup>(3)</sup>	$V_{ESD}$	$\pm 30$ $\pm 25$	kV
ESD per ISO-10605 (Air) <sup>(4)</sup> ESD per ISO-10605 (Contact) <sup>(4)</sup>	$V_{ESD}$	$\pm 23$ $\pm 21$	kV
Operating Temperature	$T_{OP}$	-40 to +125	°C
Junction Temperature and Storage Temperature	$T_J$ & $T_{STG}$	-55 to +150	°C

## Electrical Characteristics (T=25°C unless otherwise specified)

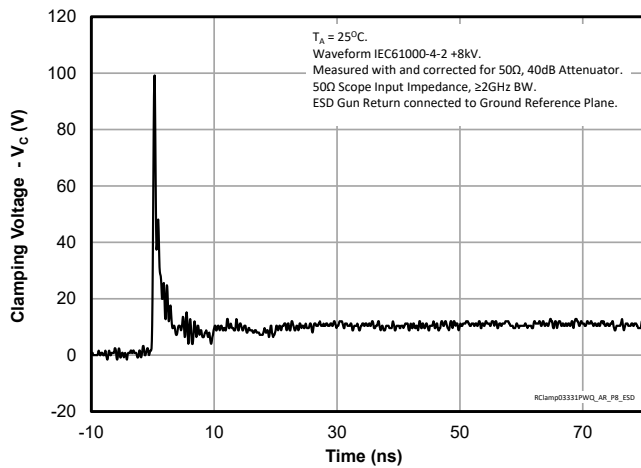
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Reverse Stand-Off Voltage	$V_{RWM}$	T = -40 °C to +125 °C, Pin 1 to 2 or 2 to 1			3.3	V
Reverse Breakdown Voltage	$V_{BR}$	$I_t = 1mA$ , Pin 1 to 2 or 2 to 1	6	7	11	V
Reverse Leakage Current	$I_R$	$V_{RWM} = 3.3V$ , Pin 1 to 2 or 2 to 1			50	nA
Clamping Voltage <sup>(5)</sup>	$V_C$	$I_{PP} = 10A$ , $t_p = 1.2/50 \mu s$ (Voltage), 8/20 $\mu s$ (Current) Combination Waveform		5	8	V
ESD Clamping Voltage <sup>(6)</sup>	$V_C$	$I_{TLP} = 4A$ , $t_p = 0.2/100ns$ (TLP)		3.3		V
		$I_{TLP} = 16A$ , $t_p = 0.2/100ns$ (TLP)		5.3		
Dynamic Resistance <sup>(6),(7)</sup>	$R_{DYN}$	$t_p = 0.2/100ns$		0.16		$\Omega$
Junction Capacitance	$C_J$	$V_R = 0V$ , $f = 1MHz$		0.35	0.39	pF

Notes:

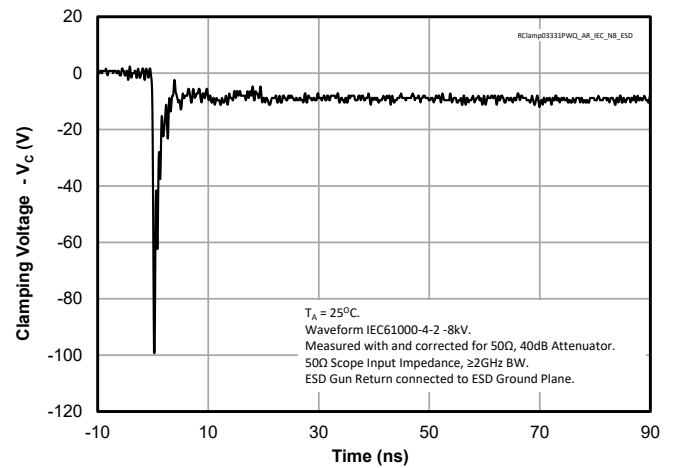
- 1) ESD gun return path connected to ESD ground plane
- 2) ESD gun return path to Horizontal Coupling Plane (HCP); Test conditions: 150pF/330pF, 2k $\Omega$
- 3) ESD gun return path to Horizontal Coupling Plane (HCP); Test conditions: 150pF, 330 $\Omega$
- 4) ESD gun return path to Horizontal Coupling Plane (HCP); Test conditions: 330pF, 330 $\Omega$
- 5) Measured using a 1.2/50 $\mu s$  voltage, 8/20 $\mu s$  current combination waveform,  $R_s = 2\Omega$ . Clamping is defined as the peak voltage across the device after the device snaps back to a conducting state.
- 6) Transmission Line Pulse Test (TLP) Settings:  $t_p = 100ns$ ,  $t_r = 0.2ns$ ,  $I_{TLP}$  and  $V_{TLP}$  averaging window:  $t_1 = 70ns$  to  $t_2 = 90ns$ .
- 7) Dynamic resistance calculated from  $I_{TLP} = 4A$  to  $I_{TLP} = 16A$

# Typical Characteristics

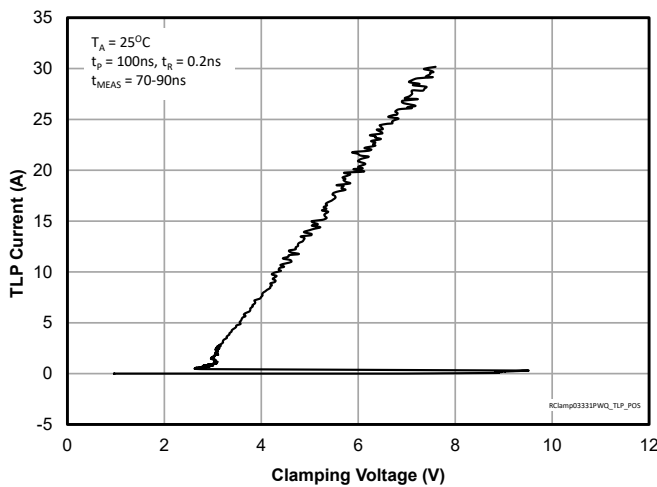
## ESD Clamping (8kV Contact per IEC 61000-4-2)



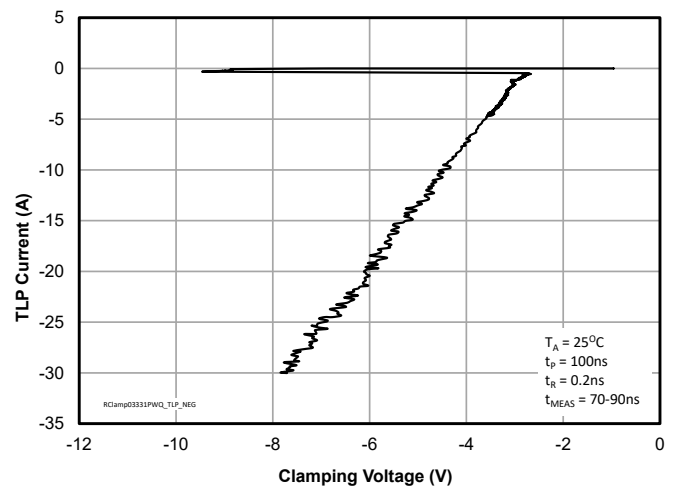
## ESD Clamping (-8kV Contact per IEC 61000-4-2)



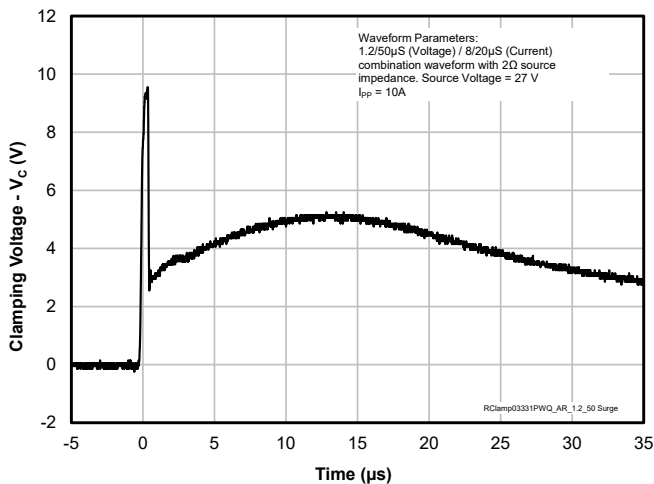
## TLP Characteristic (Positive Pulse)



## TLP Characteristic (Negative Pulse)

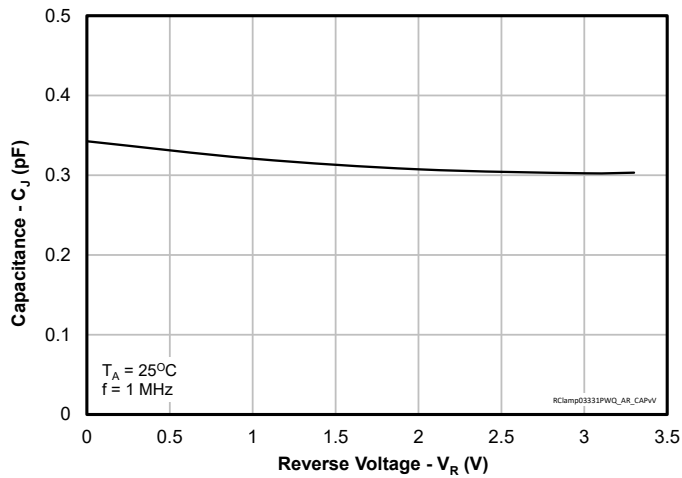


## Clamping Characteristic (10A, Combination Waveform)

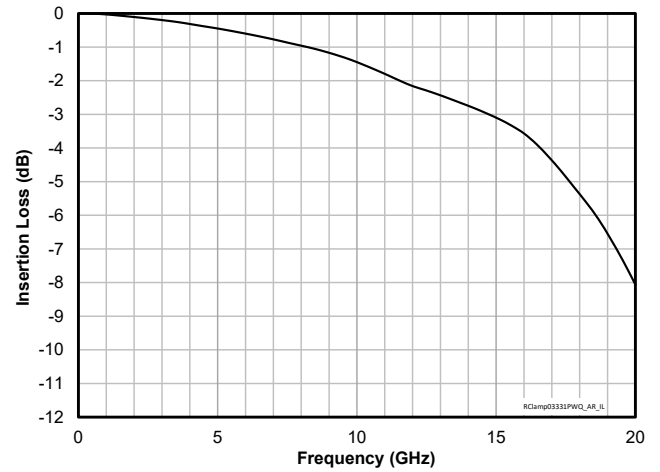


## Typical Characteristics (Continued)

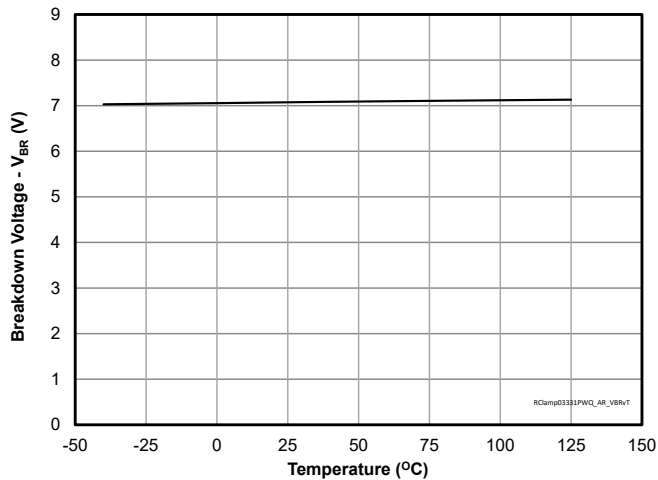
### Capacitance vs. Reverse Voltage



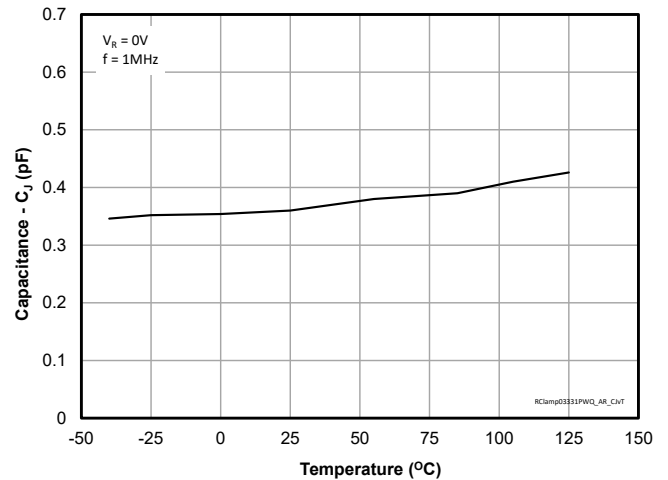
### Insertion Loss - S21



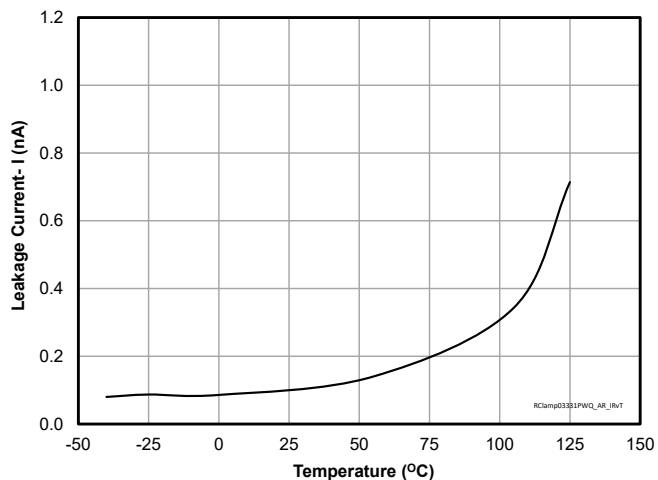
### Breakdown Voltage vs. Temperature



### Capacitance vs. Temperature

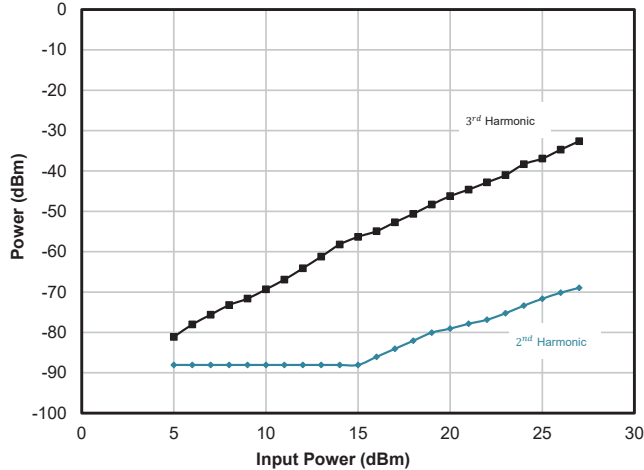


### Leakage vs. Temperature

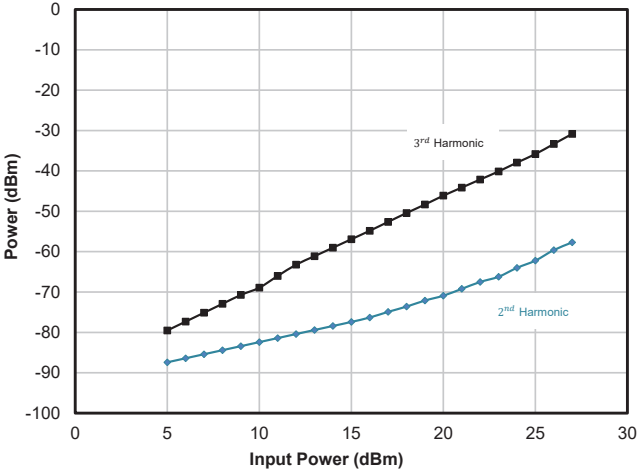


# Typical Characteristics (Continued)

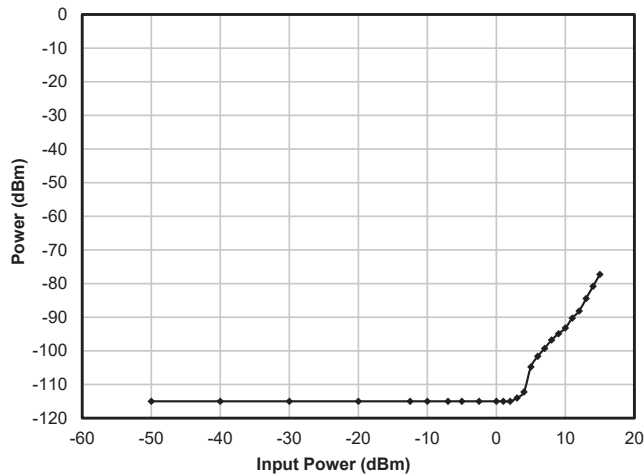
Harmonic Generation - GSM Low Band  
 $f_{\text{in}} = 897.4\text{MHz}$



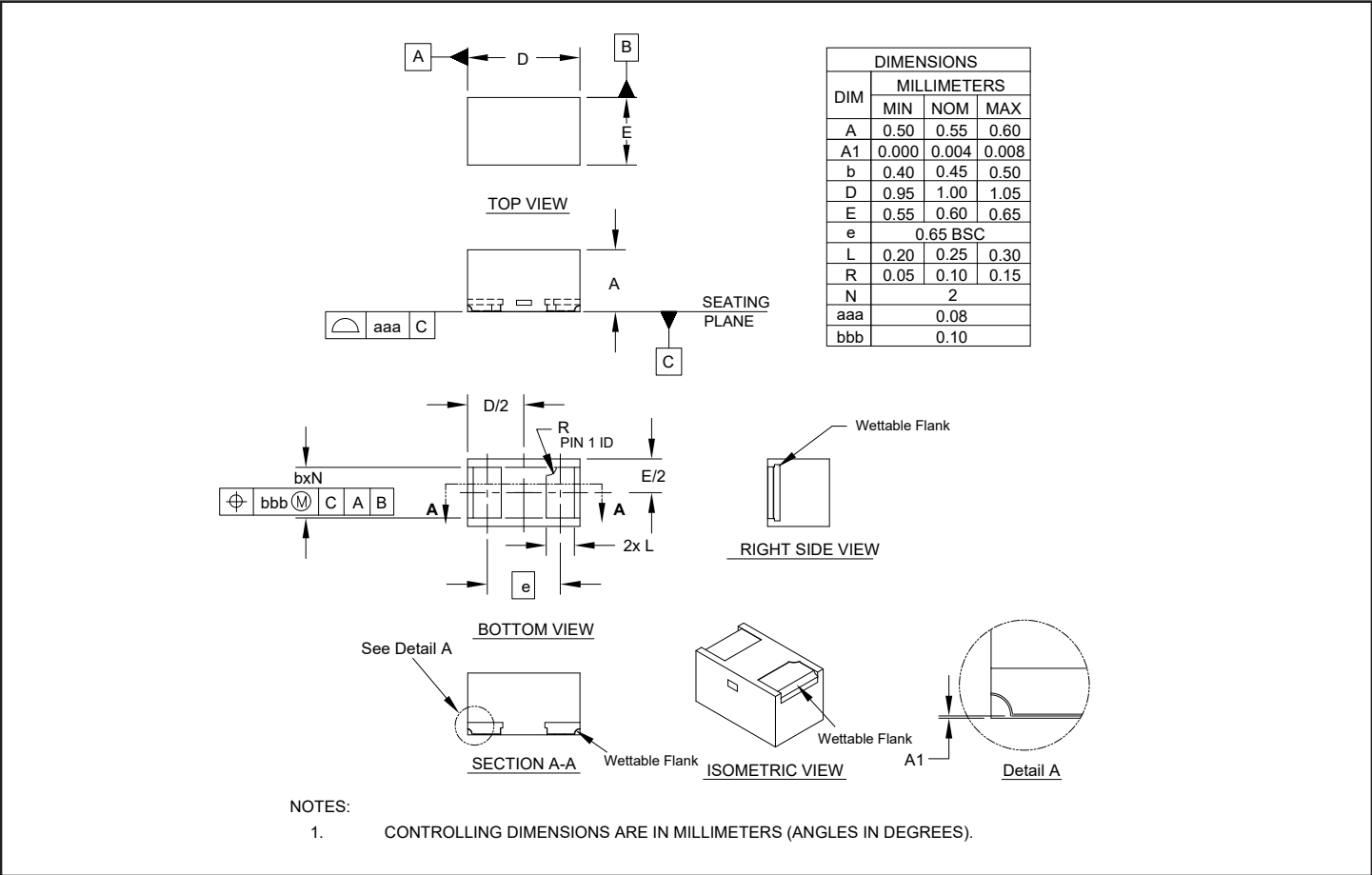
Harmonic Generation - GSM High Band  
 $f_{\text{in}} = 1747.4\text{MHz}$



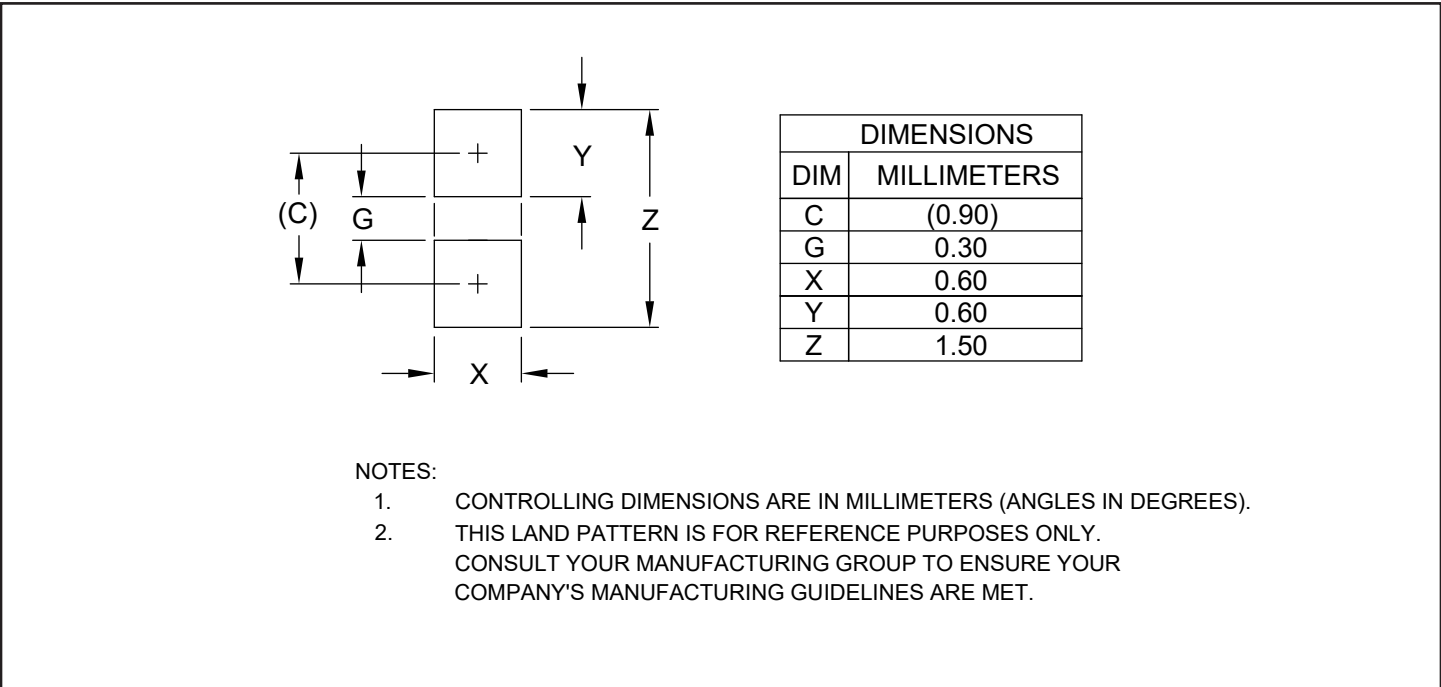
Intermodulation Distortion (Input: 760MHz + 815MHz)



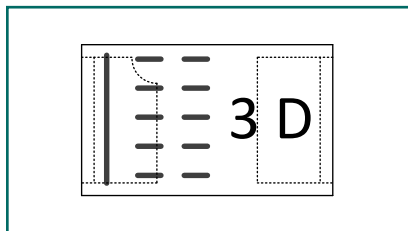
# Outline Drawing - DFN 1.0 x 0.6 x 0.55mm 2-Lead



# Land Pattern - DFN 1.0 x 0.6 x 0.55mm 2-Lead



## Marking

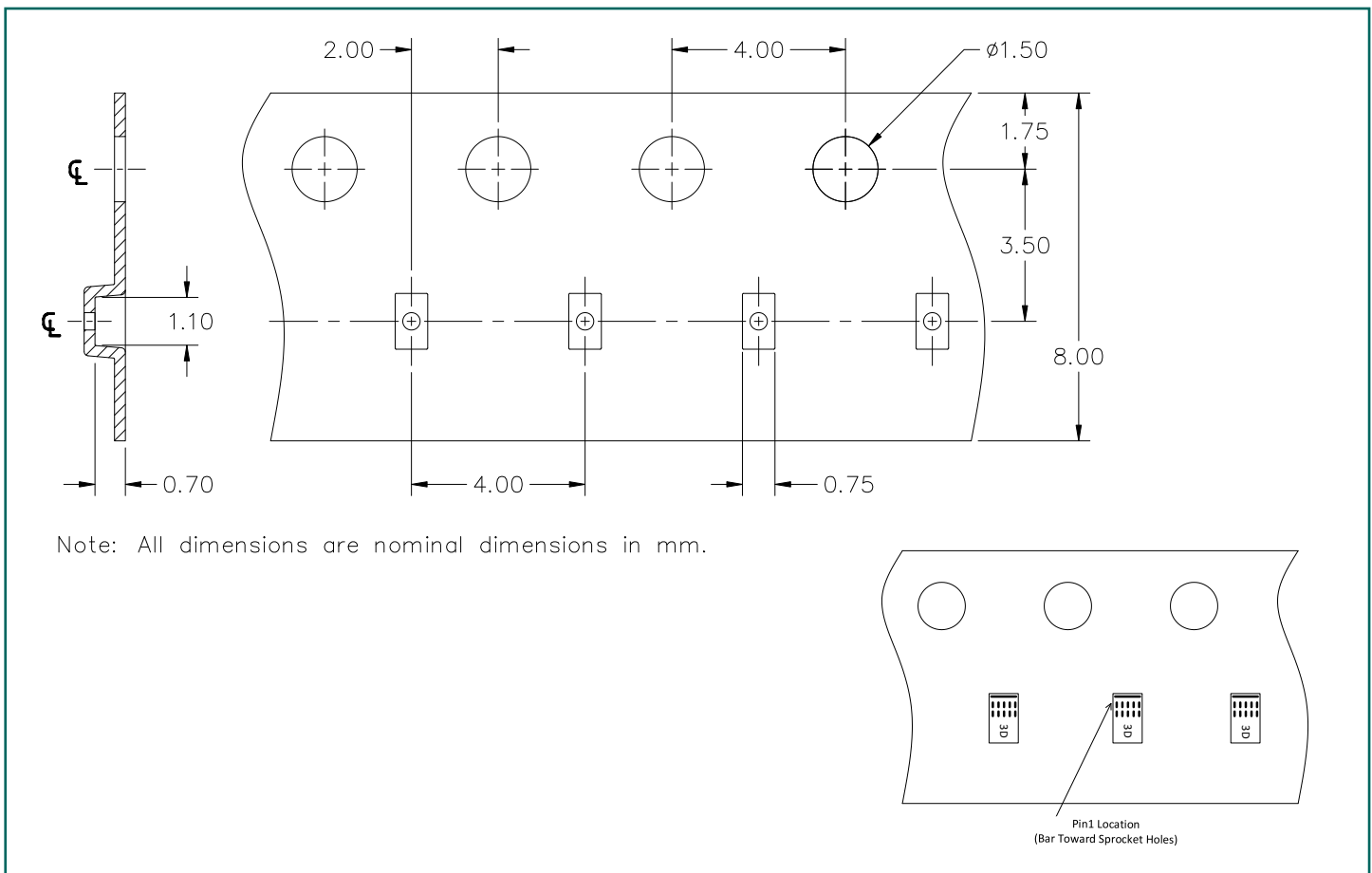


Notes:

1. Device is electrically symmetrical
2. Marking will also include line matrix date code
3. Bar indicates Pin 1 location

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2. Marking will also include line matrix date code
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## Tape and Reel Specification



## Ordering Information

Part Number	Qty per Reel	Reel Size
RClamp03331PWQC	3,000	7"
RClamp is trademark of Semtech Corporation		



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