

## 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 °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

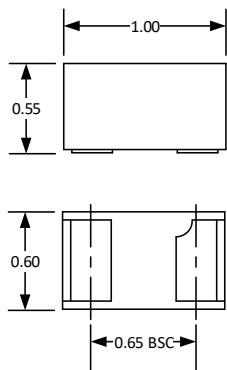
### Mechanical Characteristics

- 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

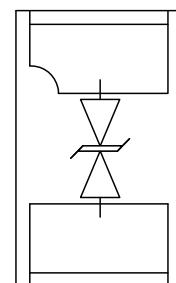
- Antenna
- USB 3.2
- LVDS
- Automotive Applications
- Industrial Equipment

### Package Dimension



Nominal Dimensions (mm)

### Schematic & Pin Configuration



DFN 1.0 x 0.6 x 0.55mm 2-Lead (Bottom View)

## Absolute Maximum Rating

| Rating   | Symbol            | Value                | Units |
|--|-------------------|----------------------|-------|
| Peak Pulse Power ( $tp = 8/20\mu s$ )  | $P_{PK}$          | 80                   | W     |
| Peak Pulse Current ( $tp = 8/20\mu s$ )  | $I_{PP}$          | 10                   | A     |
| ESD per IEC 61000-4-2 (Air) <sup>(1)</sup><br>ESD per IEC 61000-4-2 (Contact) <sup>(1)</sup> | $V_{ESD}$         | $\pm 30$<br>$\pm 25$ | kV    |
| ESD per ISO-10605 (Air) <sup>(2)</sup><br>ESD per ISO-10605 (Contact) <sup>(2)</sup>         | $V_{ESD}$         | $\pm 30$<br>$\pm 30$ | kV    |
| ESD per ISO-10605 (Air) <sup>(3)</sup><br>ESD per ISO-10605 (Contact) <sup>(3)</sup>         | $V_{ESD}$         | $\pm 30$<br>$\pm 25$ | kV    |
| ESD per ISO-10605 (Air) <sup>(4)</sup><br>ESD per ISO-10605 (Contact) <sup>(4)</sup>         | $V_{ESD}$         | $\pm 23$<br>$\pm 21$ | 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)

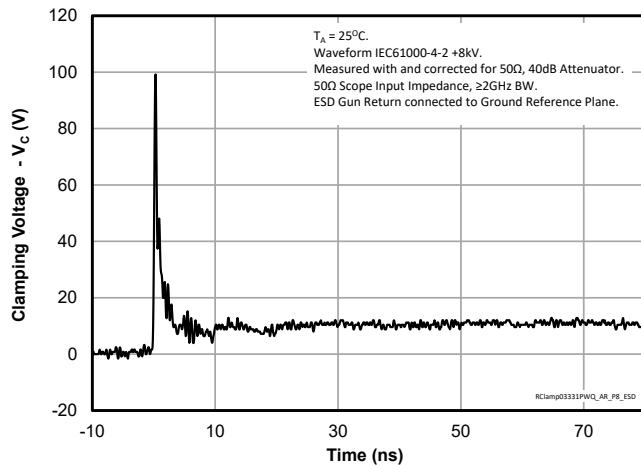
| Parameter                             | Symbol    | Conditions  | Min. | Typ. | Max. | Units |
|---------------------------------------|-----------|---|------|------|------|-------|
| Reverse Stand-Off Voltage             | $V_{RWM}$ | T = -40 °C to +125 °C, Pin 1 to 2 or 2 to 1   |      |      | 3.3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

Notes:

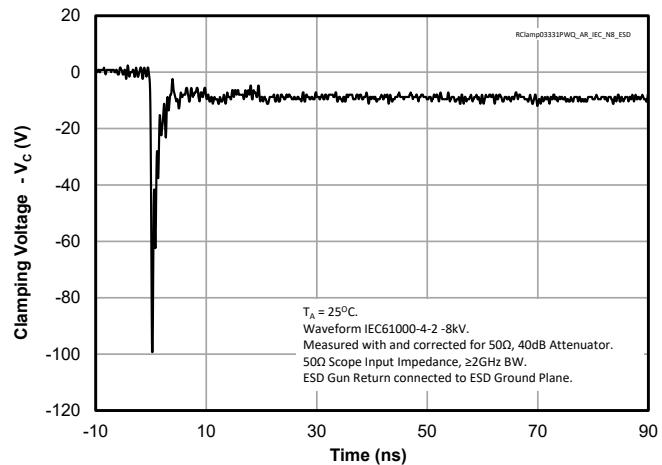
- 1) ESD gun return path connected to ESD ground plane
- 2) ESD gun return path to Horizontal Coupling Plane (HCP); Test conditions: 150pF/330pF, 2kΩ
- 3) ESD gun return path to Horizontal Coupling Plane (HCP); Test conditions: 150pF, 330Ω
- 4) ESD gun return path to Horizontal Coupling Plane (HCP); Test conditions: 330pF, 330Ω
- 5) Measured using a 1.2/50μs voltage, 8/20μs 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:  $tp = 100\text{ns}$ ,  $tr = 0.2\text{ns}$ ,  $I_{TLP}$  and  $V_{TLP}$  averaging window:  $t1 = 70\text{ns}$  to  $t2 = 90\text{ns}$ .
- 7) Dynamic resistance calculated from  $I_{TLP} = 4A$  to  $I_{TLP} = 16A$

# Typical Characteristics

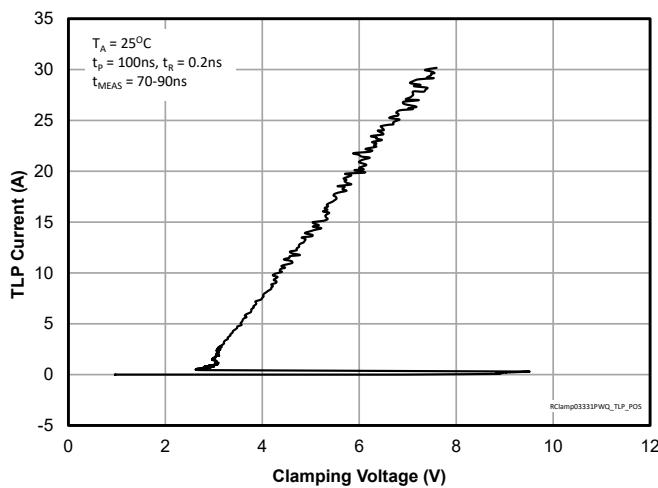
**ESD Clamping (8kV Contact per IEC 61000-4-2)**



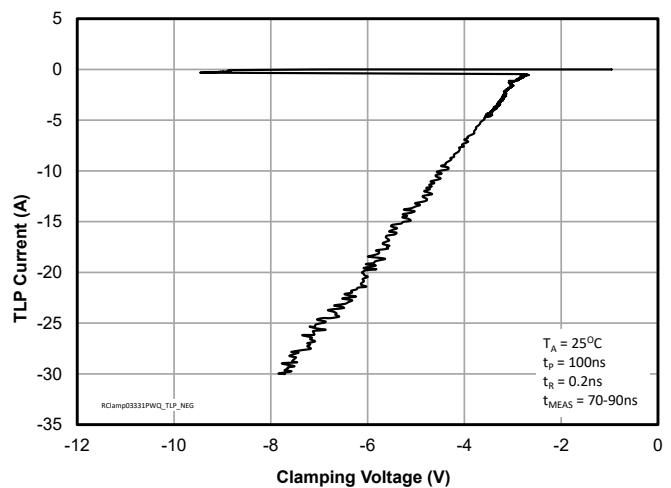
**ESD Clamping (-8kV Contact per IEC 61000-4-2)**



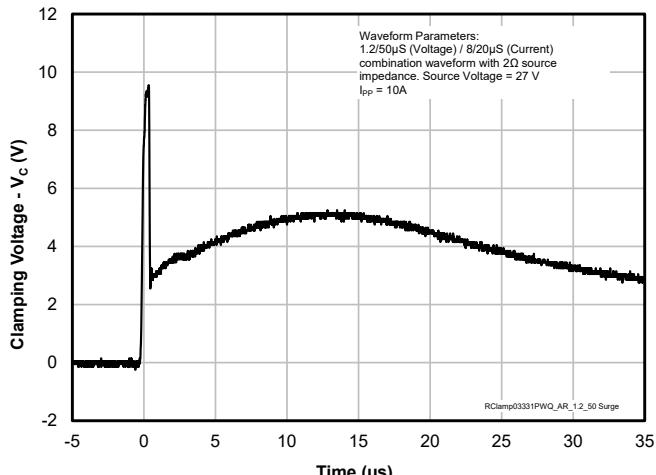
**TLP Characteristic (Positive Pulse)**



**TLP Characteristic (Negative Pulse)**

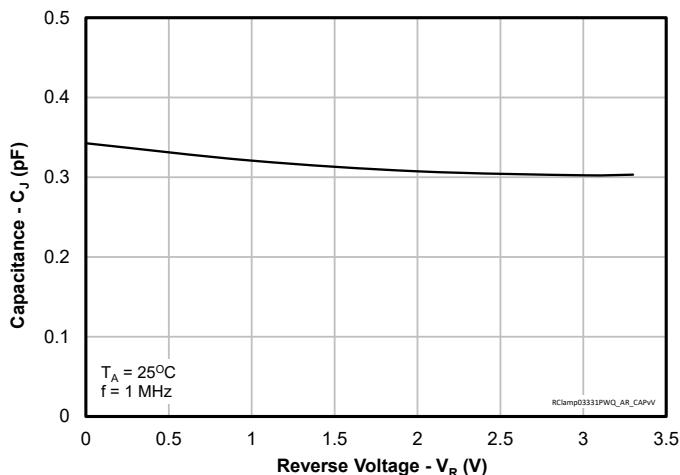


**Clamping Characteristic (10A, Combination Waveform)**

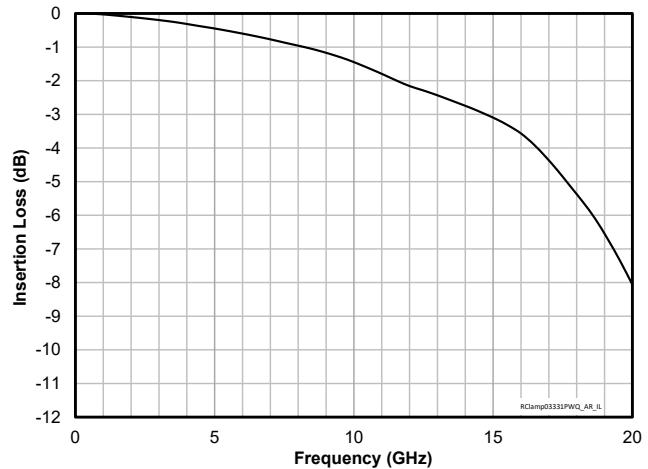


## Typical Characteristics (Continued)

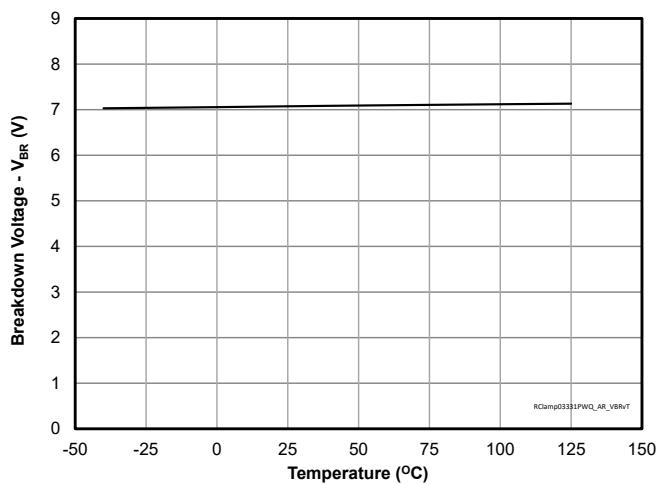
Capacitance vs. Reverse Voltage



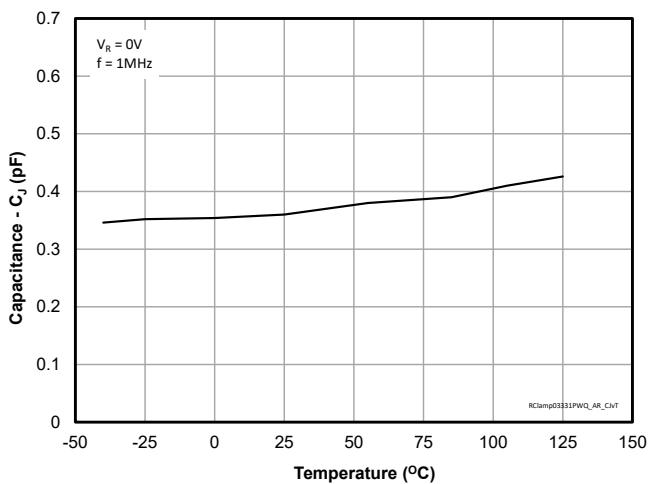
Insertion Loss - S21



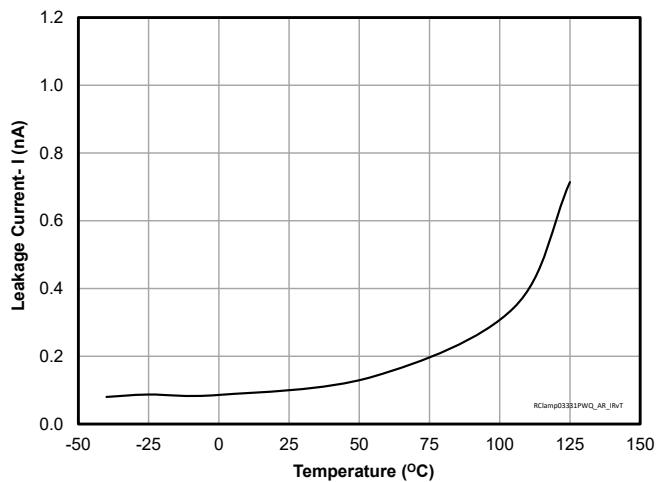
Breakdown Voltage vs. Temperature



Capacitance vs. Temperature

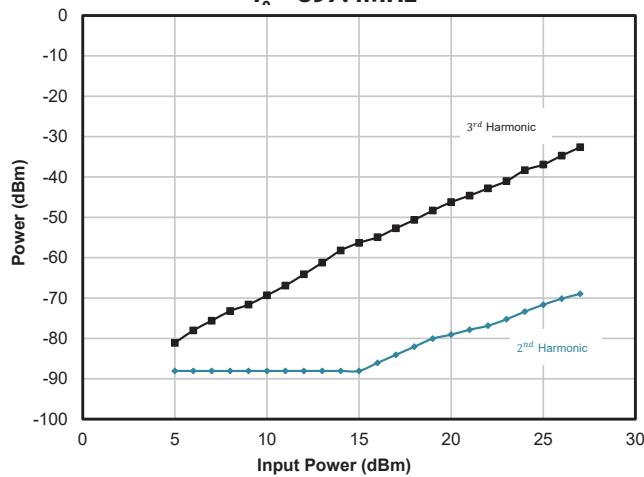


Leakage vs. Temperature

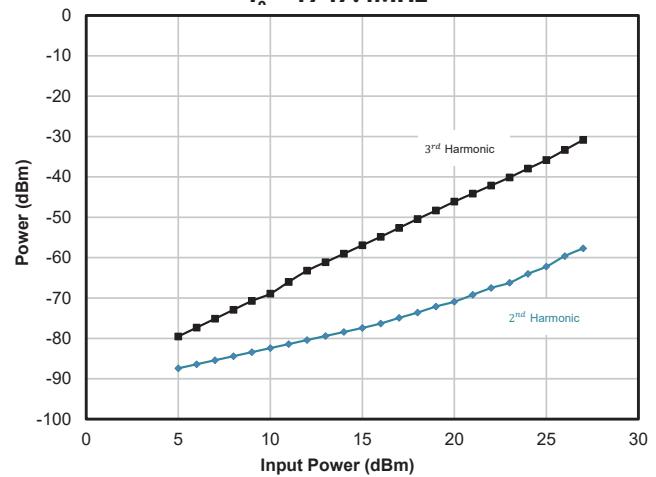


## Typical Characteristics (Continued)

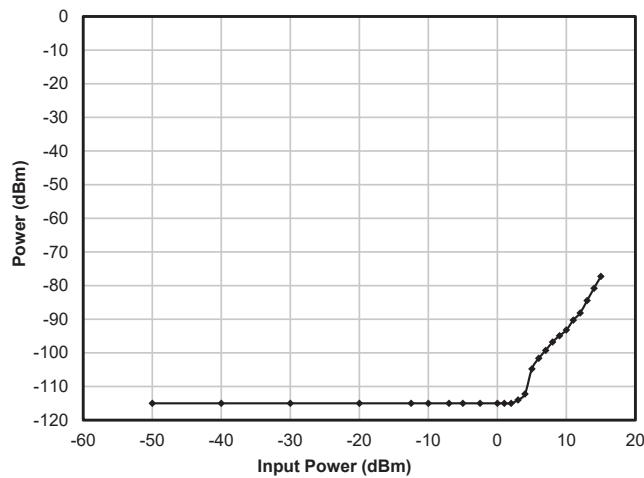
Harmonic Generation - GSM Low Band  
 $f_a = 897.4\text{MHz}$



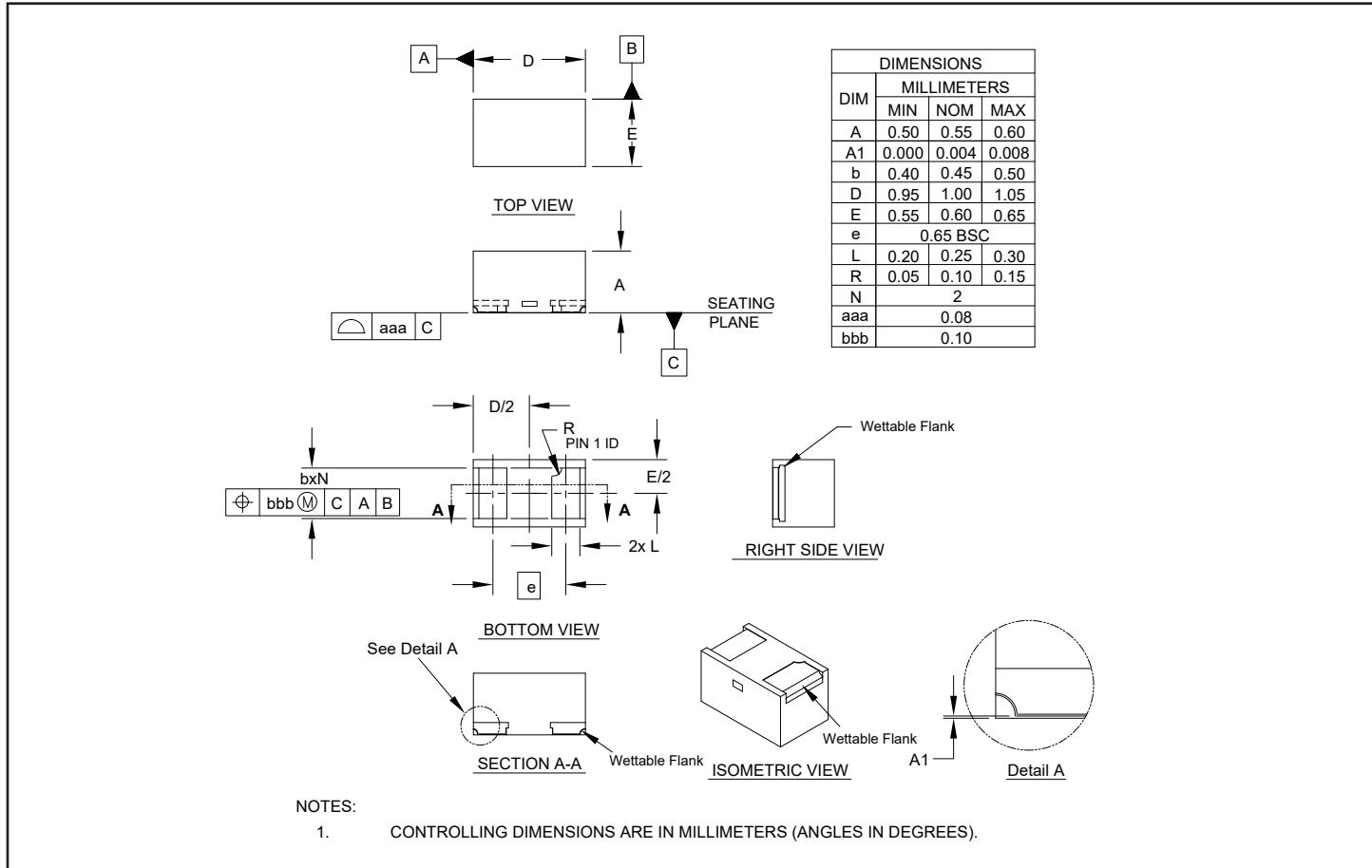
Harmonic Generation - GSM High Band  
 $f_a = 1747.4\text{MHz}$



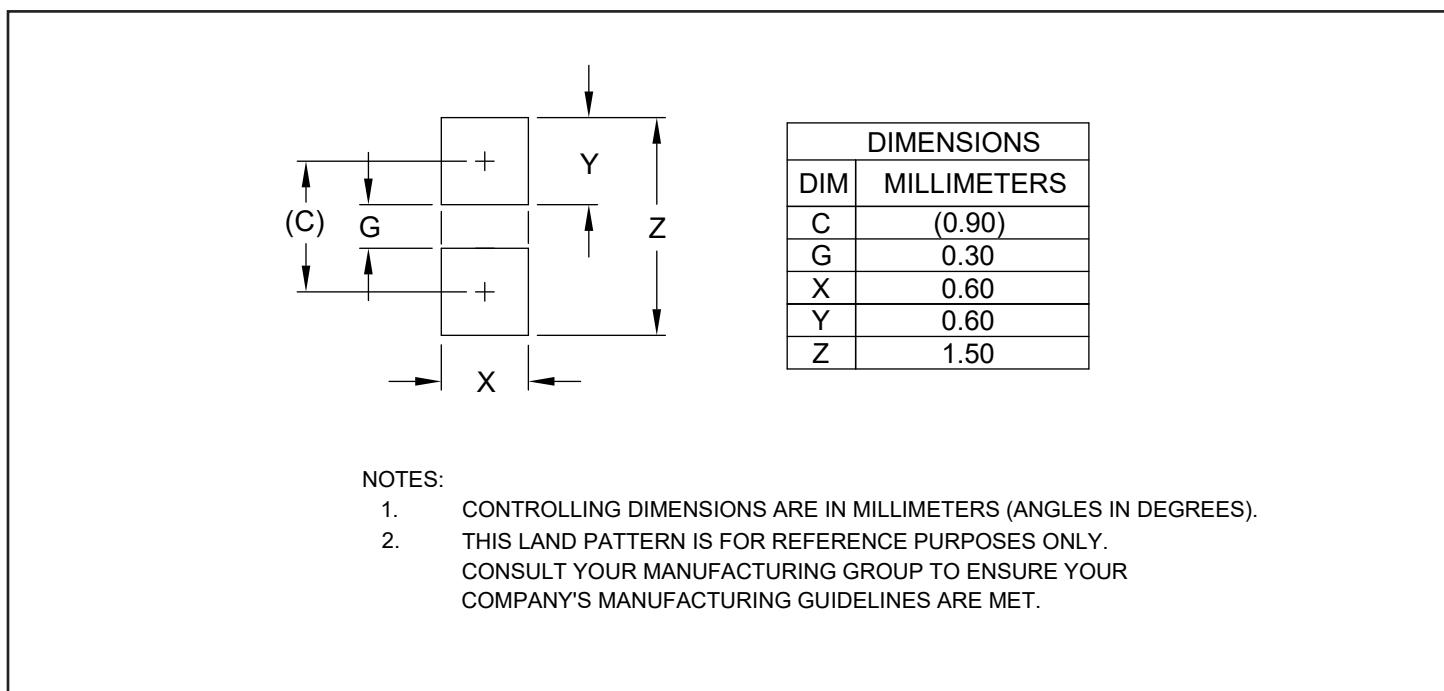
Intermodulation Distortion (Input: 760MHz + 815MHz)



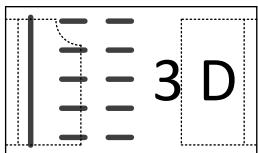
## Outline Drawing - DFN 1.0 x 0.6 x 0.55mm 2-Lead



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



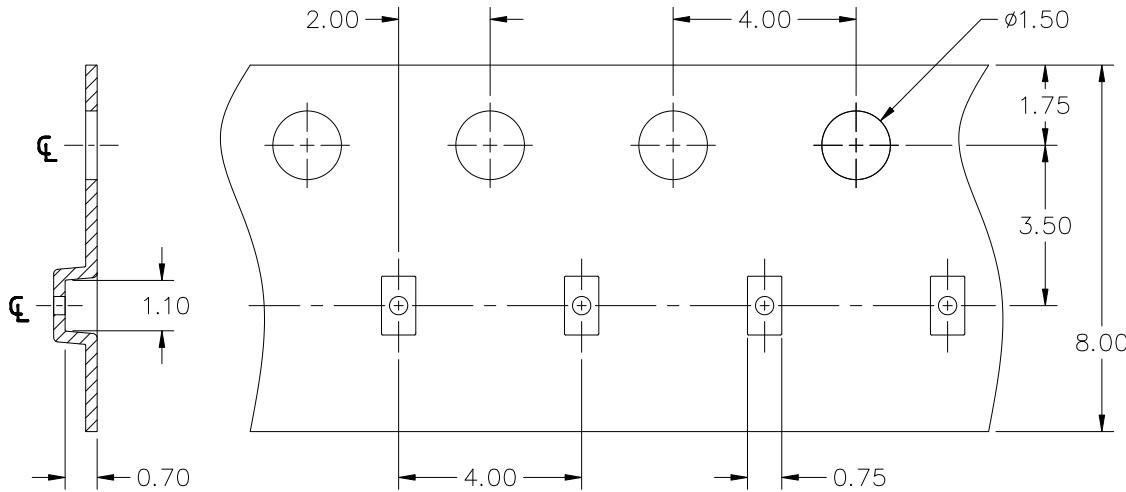
## Marking



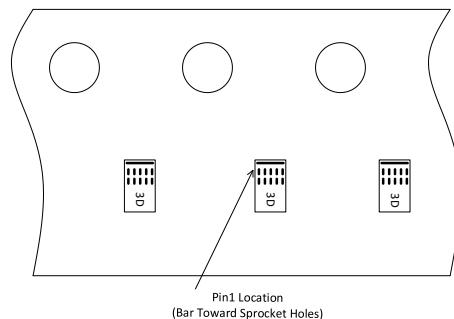
Notes:

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

## Tape and Reel Specification



Note: All dimensions are nominal dimensions in mm.



Pin1 Location  
(Bar Toward Sprocket Holes)

## Ordering Information

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



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## Important Notice

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