# RClamp1851PQ
## Ultra Small RClamp®
## 1-Line, 18V ESD Protection

**PROTECTION PRODUCTS**

## Description

RClamp® TVS are designed to protect sensitive electronics from damage or latch-up due to ESD. It offers desirable characteristics for board level protection including fast response time, low operating and clamping voltage, and no device degradation.

RClamp1851PQ is specifically designed for protection of Near Field Communications (NFC) interfaces. It features extremely good ESD protection characteristics including a low typical dynamic resistance of 0.18 Ohms, low peak ESD clamping voltage, and high ESD withstand voltage (+/-17kV contact per IEC 61000-4-2). Low typical capacitance (0.37pF at $V_R$=0V) minimizes harmonic distortion on the RF signal. This device is bi-directional and has a working voltage of 18V for use on NFC resonator circuits without signal clipping.

RClamp1851PQ is in a 2-pin DFN package measuring 1.0 x 0.6mm with a nominal height of 0.55mm. The small package gives the designer the flexibility to protect single lines in applications where arrays are not practical. The combination of small size and high ESD surge capability makes them ideal for use in portable applications such as cellular phones, digital cameras, and tablet PC's. This device is qualified to AEC-Q100 and AEC-Q101 for automotive use.

## Features

- High ESD withstand voltage: +/-17kV (contact) and +/-20kV (air) per IEC 61000-4-2
- Protects one high speed data line
- Qualified to AEC-Q100, Grade 1 and AEC-Q101
- Low ESD clamping voltage
- Working voltage: 18V
- Low capacitance: 0.37pF Typical
- Low leakage current
- Low dynamic resistance: 0.18 Ohms Typical
- Solid-state silicon-avalanche technology

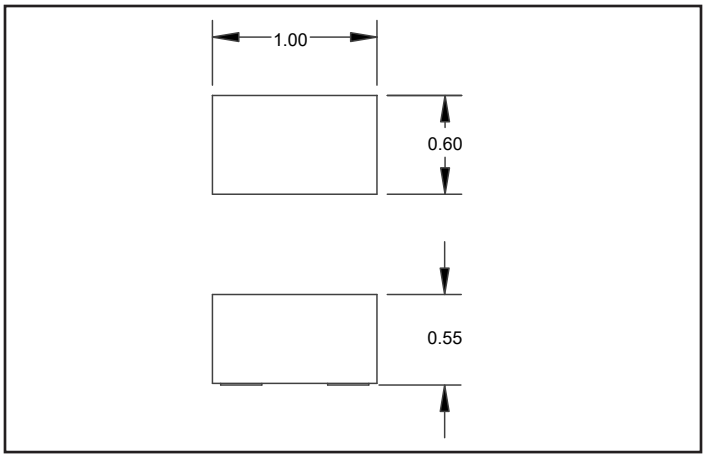
## Mechanical Characteristics

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

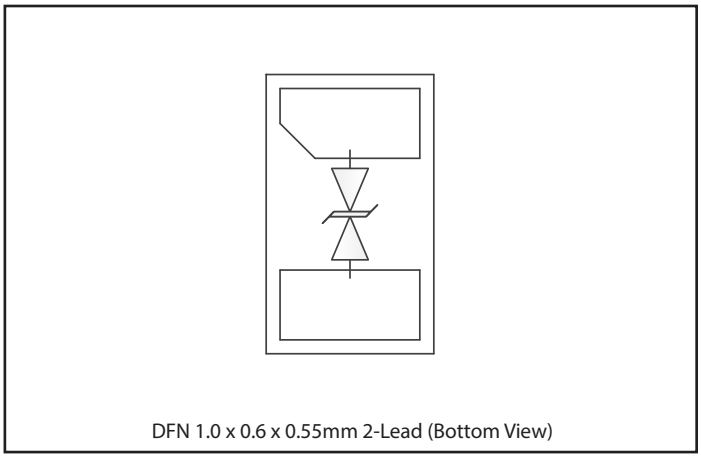
## Applications

- Near Field Communication (NFC) lines
- RF signal lines
- FM/DAB/Telematics/GPS antenna
- Automotive and industrial applications

## Package Dimension (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 = 8/20µs) | $P_{PK}$ | 24 | W |
| Peak Pulse Current (tp = 8/20µs) | $I_{PP}$ | 4 | A |
| ESD per IEC 61000-4-2 (Air)[1]<br>ESD per IEC 61000-4-2 (Contact)[1] | $V_{ESD}$ | ±20<br>±17 | kV |
| Operating Temperature | $T_{OP}$ | -40 to +125 | $^{O}$C |
| Junction Temperature & Storage Temperature | $T_J$ & $T_{STG}$ | -55 to +150 | $^{O}$C |

## Electrical Characteristics (T=25$^{O}$C unless otherwise specified)

| Parameter | Symbol | Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Reverse Stand-Off Voltage | $V_{RWM}$ | | | | | 18 | V |
| Breakdown Voltage | $V_{BR}$ | $I_{BR}$ = 10µA | | 18.5 | 21 | 26.5 | V |
| Reverse Leakage Current | $I_R$ | $V_{RWM}$ = 18V | | | <10 | 50 | nA |
| Clamping Voltage[2] | $V_C$ | $I_{PP}$ = 4A, tp = 1.2/50µs (Voltage), 8/20µs (Current) Combination Waveform | | | 4.5 | 6 | V |
| ESD Clamping Voltage[3] | $V_C$ | tp = 0.2/100ns | I = 4A | | 5 | | V |
| | | | I = 16A | | 7.2 | | |
| Dynamic Resistance[3,4] | $R_{DYN}$ | tp = 0.2/100ns | | | 0.18 | | Ω |
| Junction Capacitance | $C_J$ | $V_R$ = 0V, f = 1MHz | | | 0.37 | 0.45 | pF |

Notes

1) ESD gun return path connected to ESD ground plane

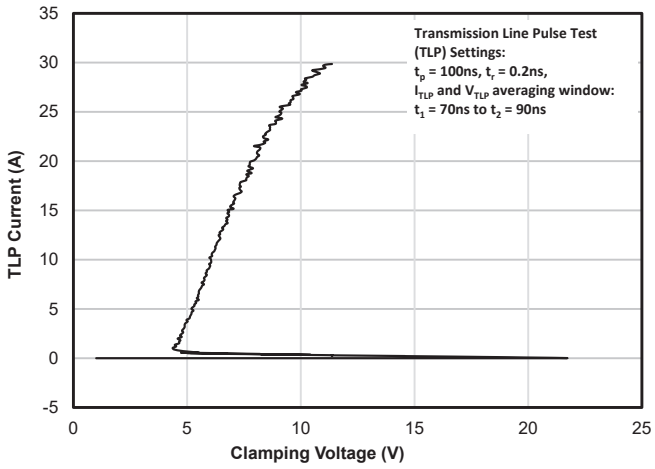
2) Measured using a 1.2/50µs voltage, 8/20µs current combination waveform, $R_S$ = 42Ω. Clamping is defined as the peak voltage across the device after the device snaps back to a conducting state.

3) Transmission Line Pulse Test (TLP) Settings: tp = 100ns, tr = 0.2ns, $I_{TLP}$ and $V_{TLP}$ averaging window: t1 = 70ns to t2 = 90ns.

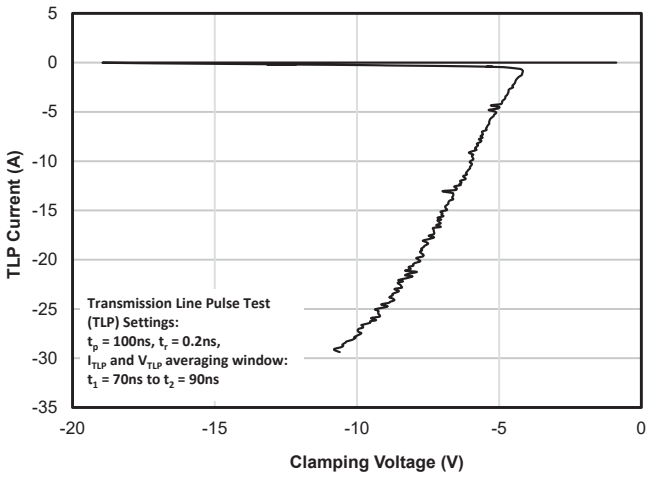
4) Dynamic resistance calculated from $I_{TLP}$ = 4A to $I_{TLP}$ = 16A

# Typical Characteristics

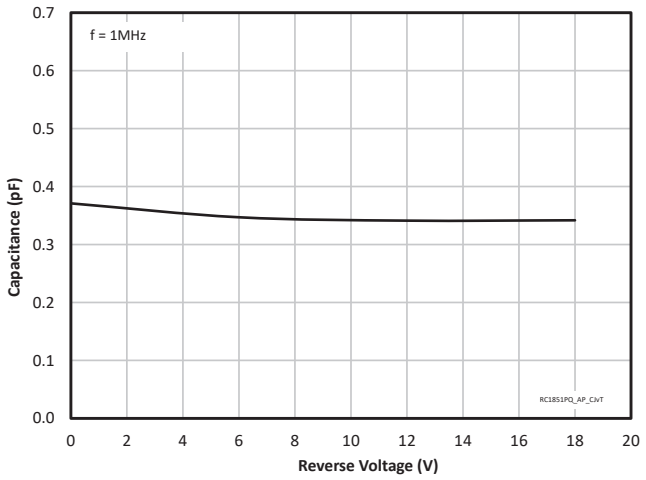
### TLP Characteristic (Positive Pulse)



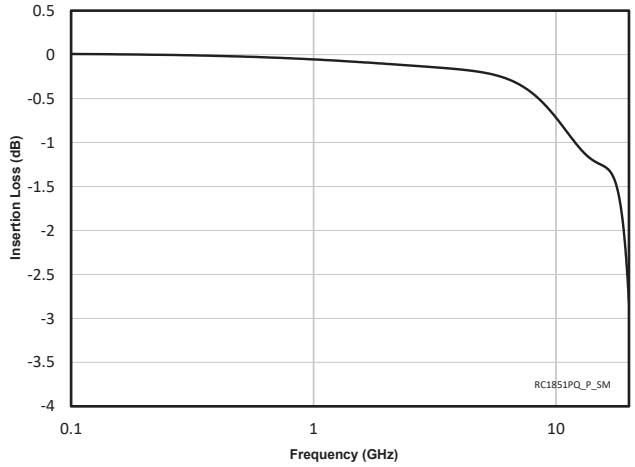

### TLP Characteristic (Negative Pulse)



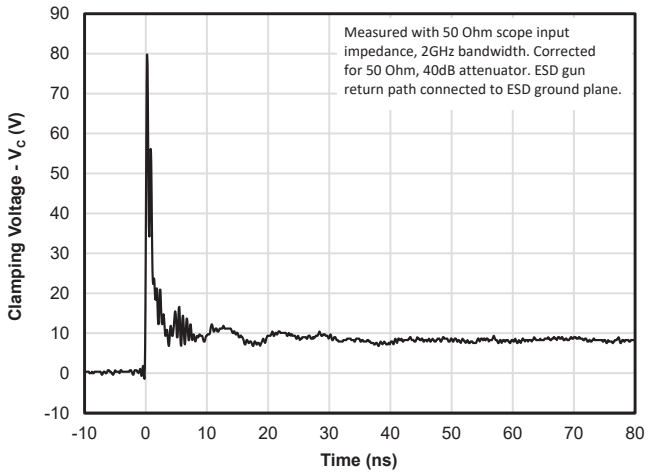

### Junction Capacitance vs. Reverse Voltage



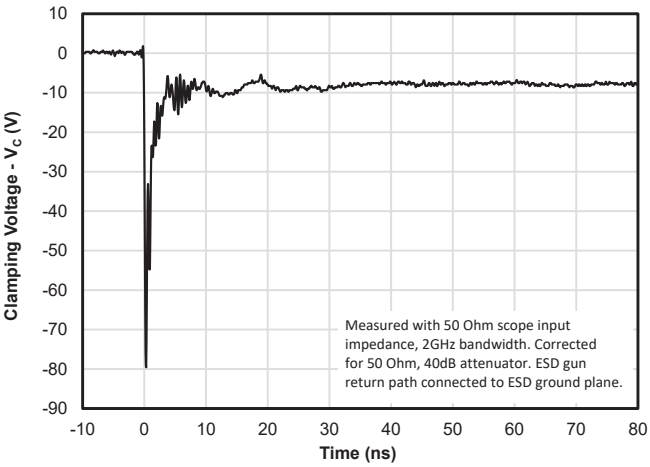

### Insertion Loss




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

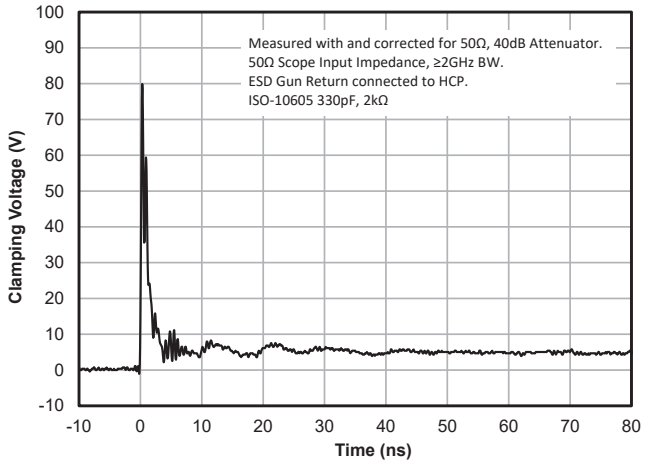



### ESD Clamping (-8kV Contact per IEC 61000-4-2)

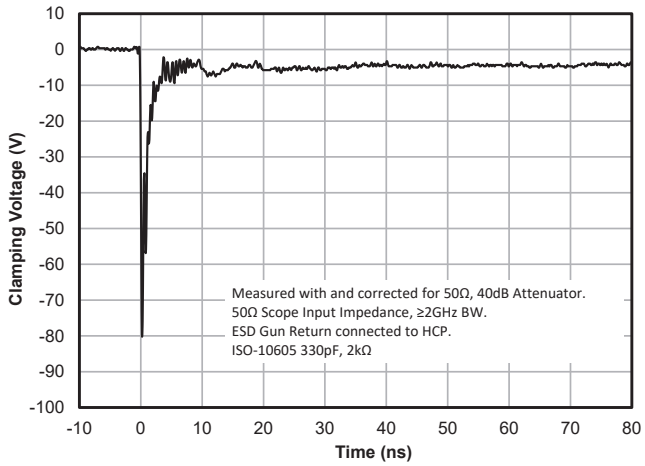


# Typical Characteristics

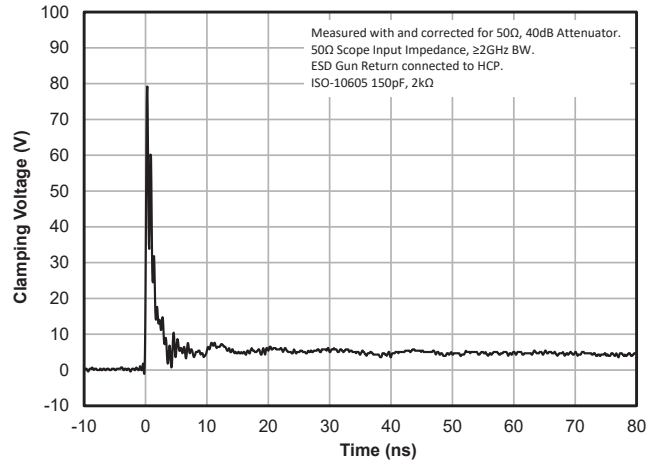
### ESD Clamping (+8kV Contact per ISO-10605 330pF, 2kΩ)



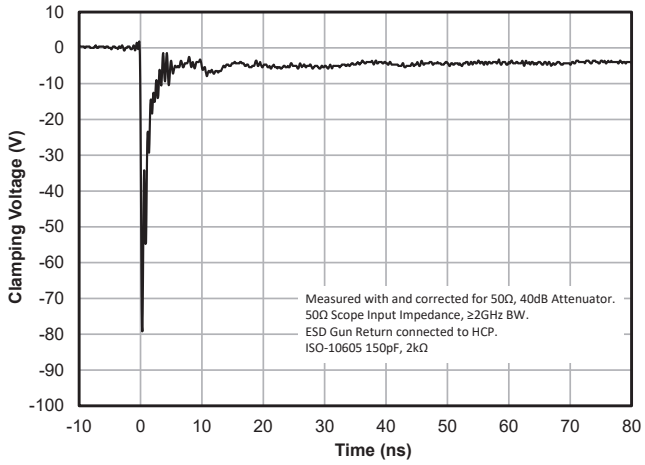

### ESD Clamping (-8kV Contact per ISO-10605 330pF, 2kΩ)



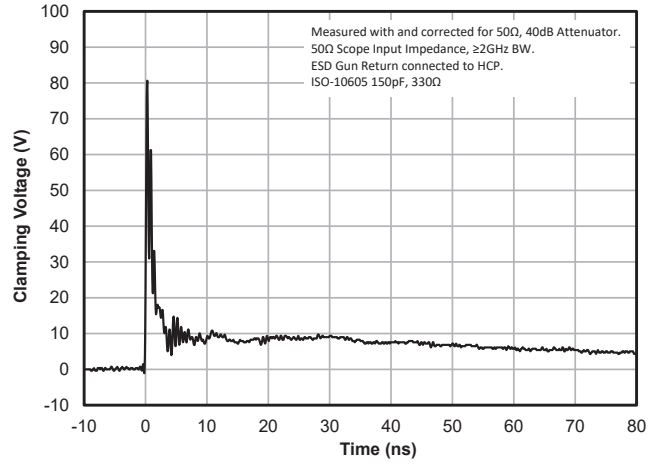

### ESD Clamping (+8kV Contact per ISO-10605 150pF, 2kΩ)



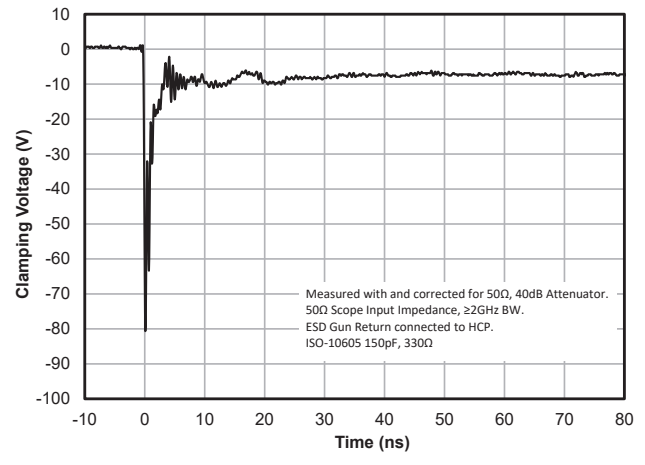

### ESD Clamping (-8kV Contact per ISO-10605 150pF, 2kΩ)




### ESD Clamping (+8kV Contact per ISO-10605 150pF, 330Ω)

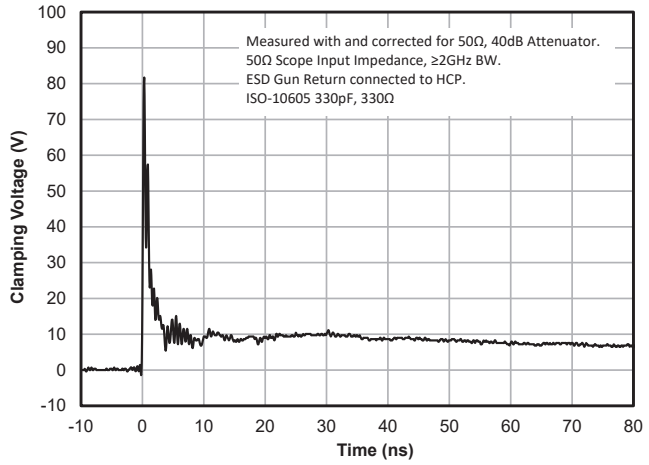



### ESD Clamping (-8kV Contact per ISO-10605 150pF, 330Ω)

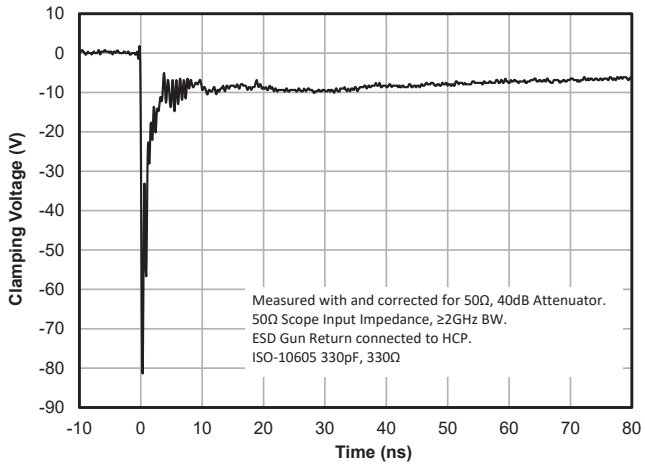


# Typical Characteristics

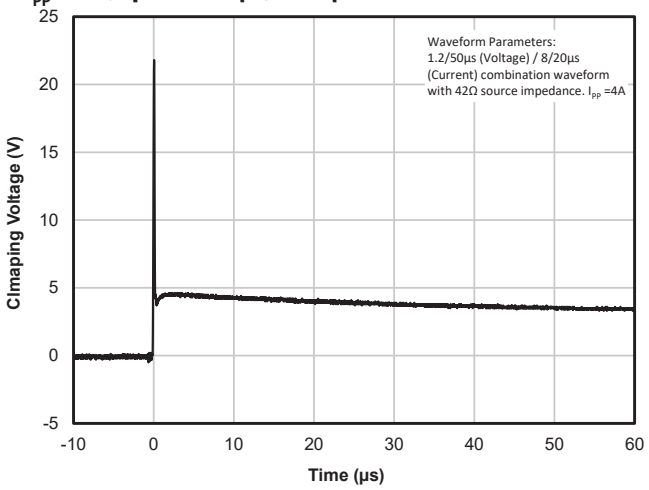
### ESD Clamping (+8kV Contact per ISO-10605 330pF, 330Ω)




### ESD Clamping (-8kV Contact per ISO-10605 330pF, 330Ω)




### Clamping Characteristic
### $I_{PP}$ = 4A, tp=1.2/50µs, 8/20µs Combination Waveform



# Application Information

### ESD Protection of NFC Interfaces

The Near Field Communication (NFC) antenna is usually connected to the NFC controller IC via contact points on the phone. These contact points are user accessible and therefore may be subjected to ESD strikes. External protection (TVS) devices should be placed between the antenna and the NFC chip interface. The working voltage of the TVS should be high enough, so it does not clip the NFC signal. Additionally, the capacitance of the device should be minimized in order to avoid harmonic distortion of the RF signal. RClamp1851PQ meets these requirements and also features extremely low dynamic resistance resulting in low ESD clamping voltage. The low dynamic resistance also helps ensure protection for Schottky diodes that may be used in the NFC circuit. RClamp1851PQ is designed to work on NFC circuits with AC signals as high as 18V. An example protection circuit is shown below in Figure 1.

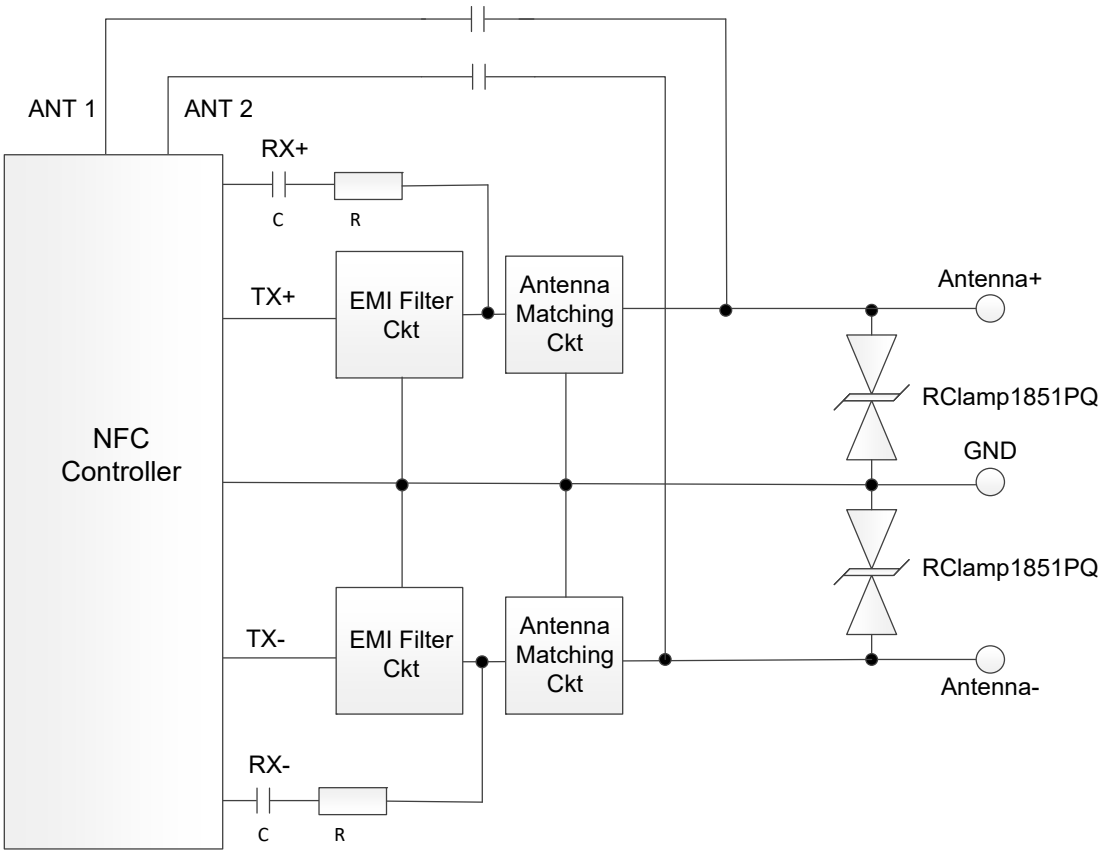
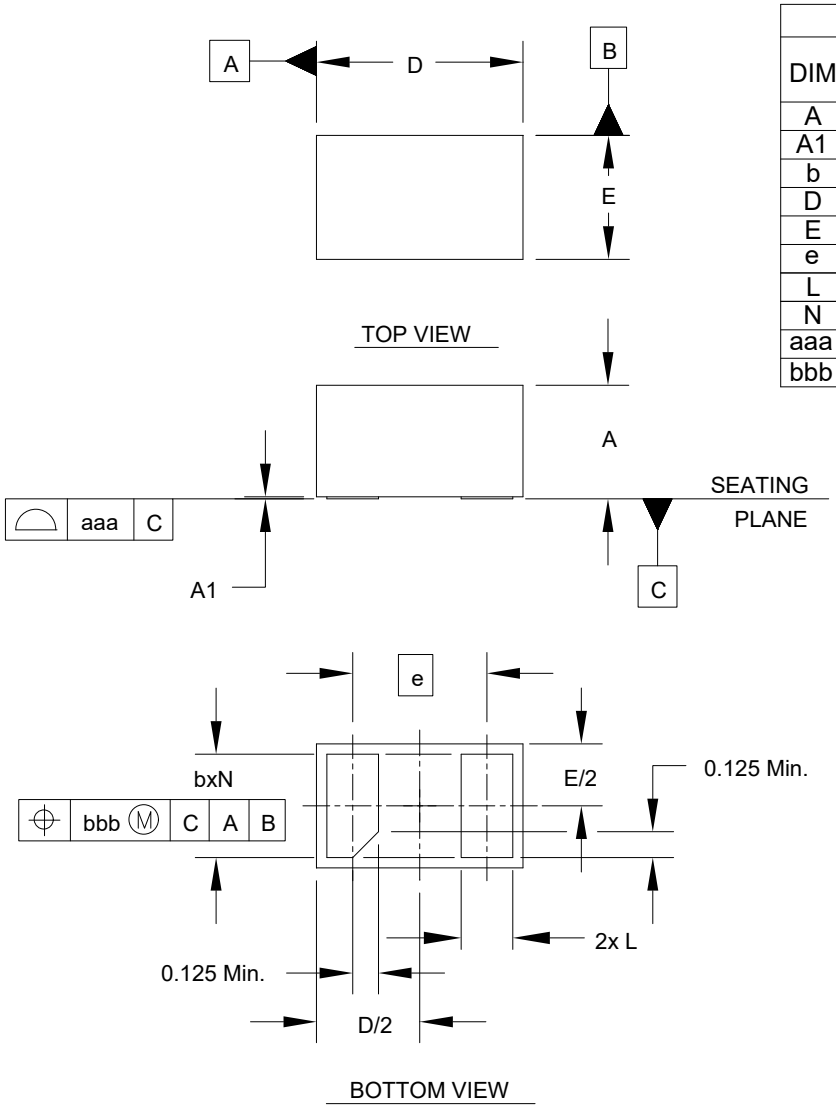



**Figure 1 - NFC Protection Example**

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




| DIMENSIONS | | | |
|---|---|---|---|
| DIM | MILLIMETERS | | |
| | MIN | NOM | MAX |
| A | 0.50 | 0.55 | 0.60 |
| A1 | 0.00 | 0.02 | 0.05 |
| b | 0.45 | 0.50 | 0.55 |
| D | 0.95 | 1.00 | 1.05 |
| E | 0.55 | 0.60 | 0.65 |
| e | 0.65 BSC | | |
| L | 0.20 | 0.25 | 0.30 |
| N | 2 | | |
| aaa | 0.08 | | |
| bbb | 0.10 | | |

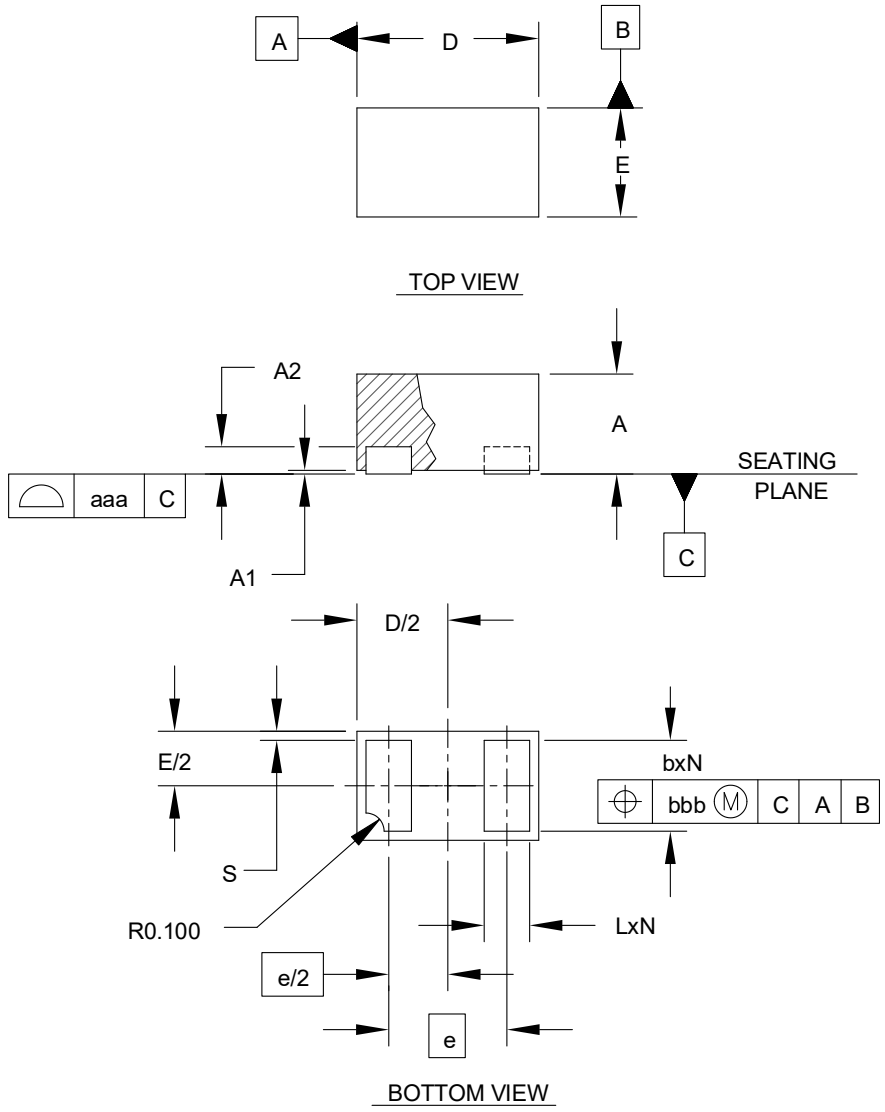
NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).

Note:

The device is available with two package outline drawings with identical dimensions and two chamfer options. Chamfer difference does not affect functionality. Both are compatible with the recommended land pattern. Semtech reserves the right to ship either POD.

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




| DIMENSIONS | | | |
|---|---|---|---|
| DIM | MILLIMETERS | | |
| | MIN | NOM | MAX |
| A | 0.50 | 0.55 | 0.60 |
| A1 | 0.00 | 0.02 | 0.05 |
| A2 | | (0.150) | |
| b | 0.45 | 0.50 | 0.55 |
| D | 0.95 | 1.00 | 1.05 |
| E | 0.55 | 0.60 | 0.65 |
| e | | 0.65 BSC | |
| L | 0.20 | 0.25 | 0.30 |
| S | | (0.05) | |
| N | | 2 | |
| aaa | | 0.08 | |
| bbb | | 0.10 | |

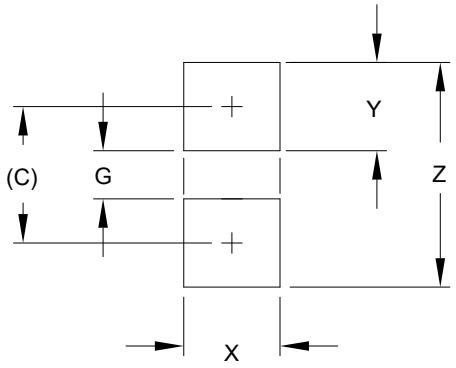
NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).

Note:

The device is available with two package outline drawings with identical dimensions and two chamfer options. Chamfer difference does not affect functionality. Both are compatible with the recommended land pattern. Semtech reserves the right to ship either POD.

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

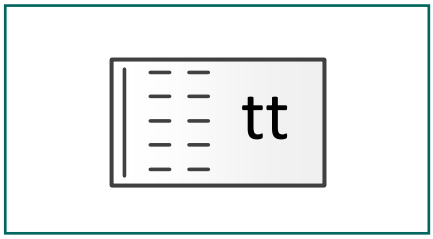



| DIMENSIONS | |
|---|---|
| DIM | MILLIMETERS |
| C | (0.85) |
| G | 0.30 |
| X | 0.60 |
| Y | 0.55 |
| Z | 1.40 |

NOTES:

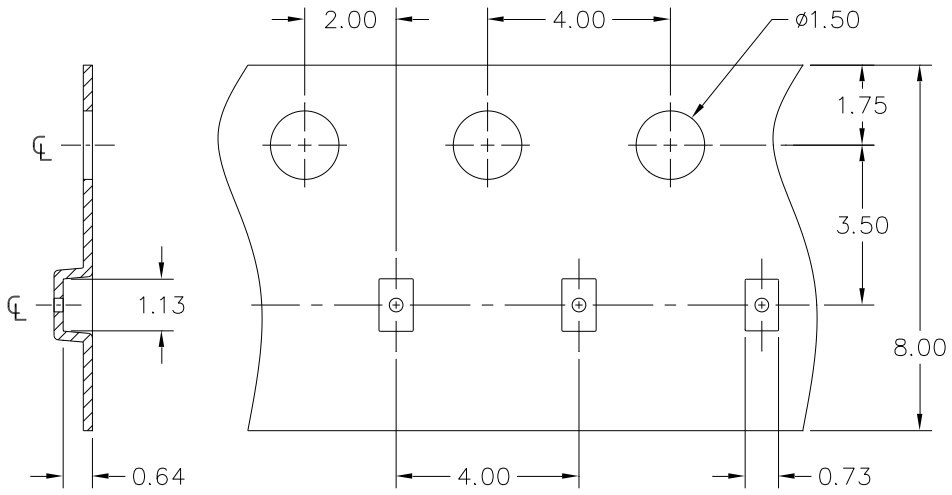
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.

## Marking Code

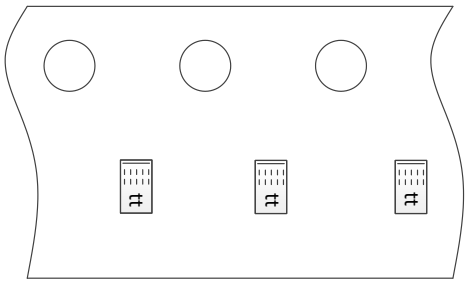



Notes: Device is electrically symmetrical.

## Tape and Reel Specification




Note: All dimensions are nominal dimensions in mm.



## Ordering Information

| Part Number | Qty per Reel | Reel Size |
|---|---|---|
| RClamp1851PQ.C | 3,000 | 7” |
| RailClamp and RClamp are registered trademarks of Semtech Corporation. | | |

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