# EClamp2367NQ

## EMIClamp®
## EMI Filter and ESD Protection For SD Card Interfaces

**PROTECTION PRODUCTS**

## Description

EClamp®2367NQ integrates low capacitance ESD protection, low pass filters, and pull up resistors designed specifically for secure digital card interfaces in automotive applications. It is compliant with SD3.01 UHS-1 SDR 104 standard.

EClamp2367NQ is an easily implemented solution for replacing discrete resistors and ESD protection devices in a single package. These devices utilize silicon avalanche technology for superior ESD and TLP clamping performance. They feature maximum ESD withstand voltage of ±12kV contact, ±15kV air discharge per IEC 61000-4-2. They are qualified to AEC-Q100 for use in automotive applications.

EClamp2367NQ is in a SLP3030P16 package, measuring 3.0 x 3.0mm with a nominal height of 0.60mm. The leads have a nominal pin-to-pin pitch of 0.50mm.

## Features

- Transient Protection to
  - IEC 61000-4-2 (ESD): 15kV (Air), 12kV (Contact)
  - IEC 61000-4-4 (EFT) 4kV (5/50ns)
  - ISO-10605 (ESD): 15kV (Air), 12kV (Contact)
- Qualified to AEC-Q100, Grade 1
- Compliant with SD3.01 UHS-1 SDR 104 Standard
- Low capacitance to accommodate long PCB traces
- Low ESD Clamping Voltage
- Solid-State Silicon-Avalanche Technology

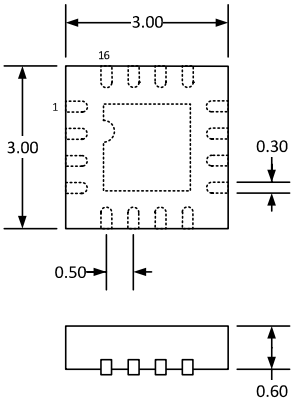
## Mechanical Characteristics

- SLP3030P16 package
- Pb-Free, Halogen Free, RoHS/WEEE Compliant
- Nominal Dimensions: 3.0 x 3.0 x 0.6 mm
- Lead Finish: NiPdAu
- Molding Compound Flammability Rating: UL 94V-0
- Marking : Marking Code + Date Code
- Packaging : Tape and Reel

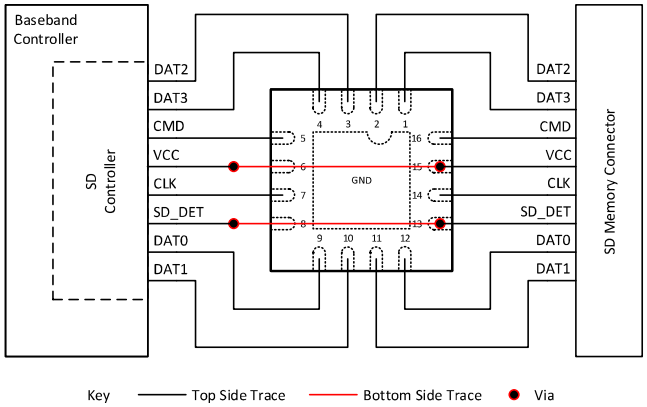
## Applications

- Automotive Applications
- Secure Digital (SD) Memory Card Interfaces
- Multimedia Card Interfaces (MCI)

## Nominal Dimensions

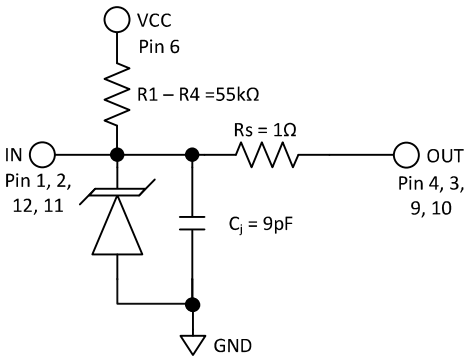



## Application Diagram

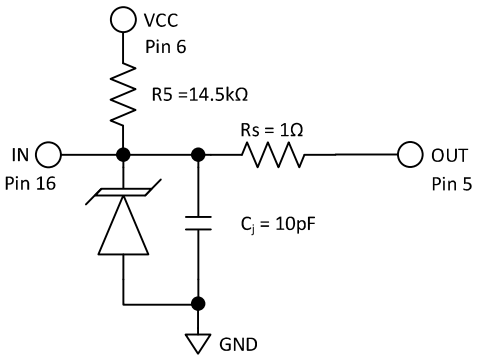



**SD Card Protection Example**

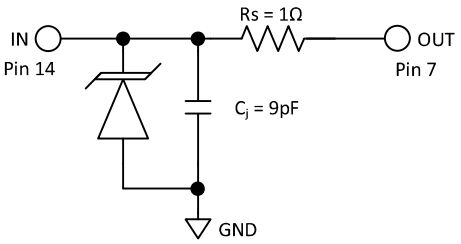
## Schematic and Pin Identification



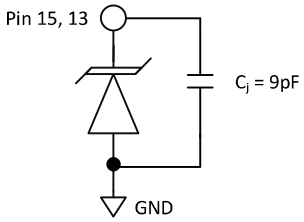

4x DAT 0 – DAT3




1x CMD




1x CLK




VCC, SD_DET

Note:
All values are typical and measured at T = 25°C

## Absolute Maximum Ratings

| Rating | Symbol | Value | Units |
|---|---|---|---|
| ESD per IEC 61000-4-2 (Contact)(1)<br>ESD per IEC 61000-4-2 (Air)(1) | $V_{ESD}$ | ±12<br>±15 | kV |
| ESD per ISO-10605 (Contact)(2)<br>ESD per ISO-10605 (Air)(2) | $V_{ESD}$ | ±12<br>±15 | kV |
| Operating Temperature | $T_{OP}$ | -40 to +125 | °C |
| Storage Temperature | $T_{STG}$ | -55 to +150 | °C |

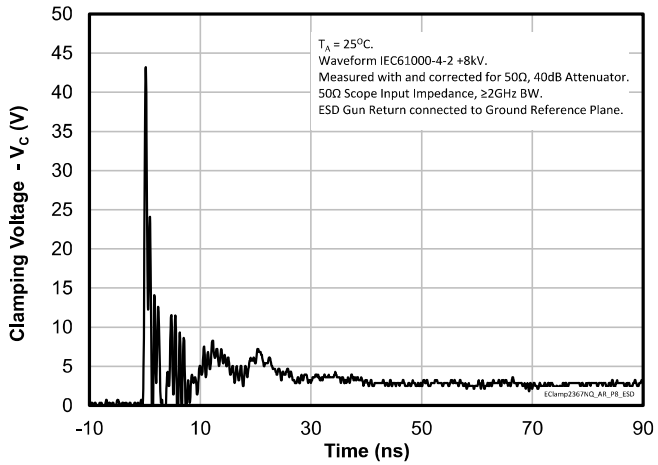
## Electrical Characteristics (T=25°C unless otherwise specified)

| Parameter | Symbol | Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Reverse Stand-Off Voltage | $V_{RWM}$ | -40°C to 125°C, Any I/O Pin to GND Tab | | | | 5 | V |
| Reverse Breakdown Voltage | $V_{BR}$ | $I_t$ = 1mA,<br>Any I/O Pin to GND Tab | -40°C to 125°C | 6 | 7.5 | 10 | V |
| Reverse Leakage Current | $I_R$ | $V_{RWM}$ = 5V<br>Any I/O Pin to GND Tab | T = 25°C | | 0.01 | 0.100 | µA |
| | | | T = 125°C | | 0.06 | 0.200 | µA |
| ESD Clamping Voltage(3) | $V_C$ | $I_{PP}$ = 4A, tp = 0.2/100ns (TLP) | | | 10 | | V |
| | $V_C$ | $I_{PP}$ = 16A, tp = 0.2/100ns (TLP) | | | 15.5 | | V |
| Capacitance | $C_J$ | Pin1, 2, 3, 4, 7, 9, 10, 11, 12,13, 14, or 15 to GND | $V_R$ = 0V, f = 1MHz | | 9 | 11 | pF |
| | | Pin 5 or16 to GND | | | 10 | 12 | |
| Pull-Up Resistors (DAT0 - DAT3) | $R_1, R_2, R_3, R_4$ | Pins 1, 2, 11, 12 to Pin 6 | | 40 | 55 | 60 | kΩ |
| Pull-Up Resistor (CMD) | $R_5$ | Pin 16 to Pin 6 | | 12 | 14.5 | 18 | |
| Series Resistors | $R_S$ | -40°C to 125°C | | 0.5 | 1 | 2 | Ω |

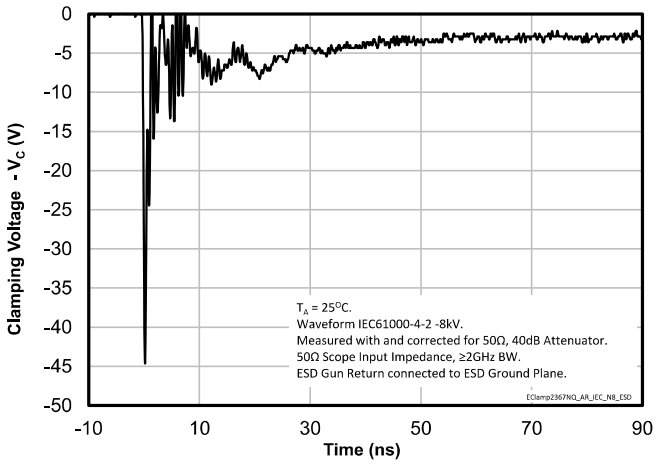
Notes:
(1): ESD Gun return path to Ground Reference Plane (GRP)
(2): ESD Gun return path to Horizontal Coupling Plane (HCP); Test conditions: a)150pF/330pF, 330Ω
(3): Transmission Line Pulse Test (TLP) Settings: tp = 100ns, tr = 0.2ns, $I_{TLP}$ and $V_{TLP}$ averaging window: $t_1$ = 70ns to $t_2$ = 90ns
(4): Dynamic resistance calculated from $I_{TLP}$ = 4A to $I_{TLP}$ = 16A

# Typical Characteristics

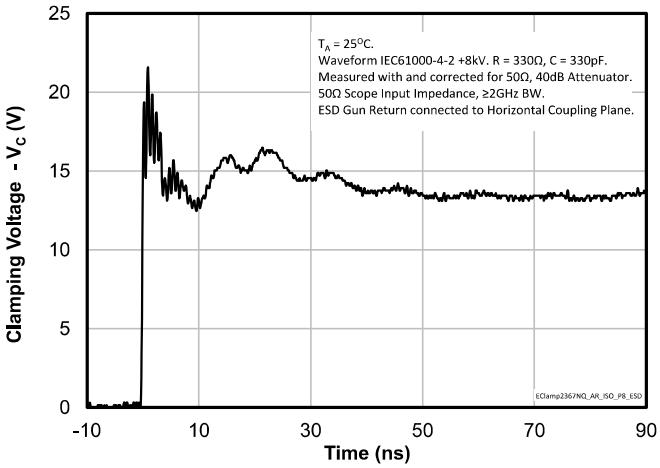
### ESD Clamping (+8kV Contact per IEC 61000-4-2)



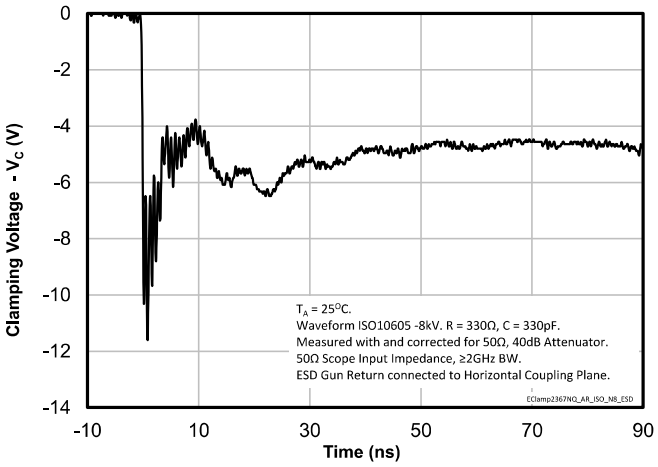

### ESD Clamping (-8kV Contact per IEC 61000-4-2)



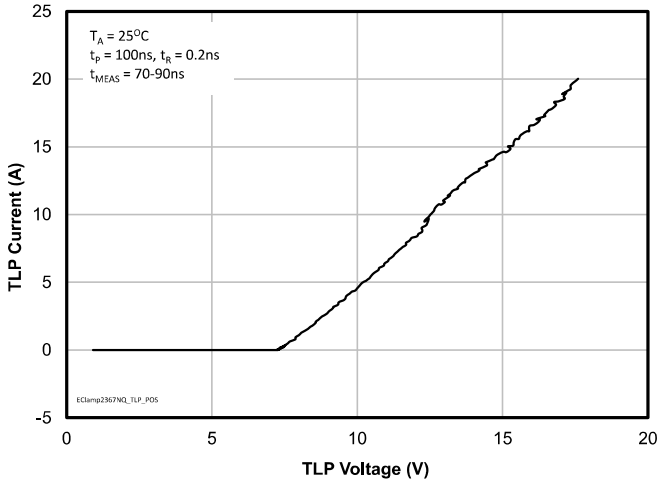

### ESD Clamping (+8kV Contact per ISO-10605 330pF, 330Ω)



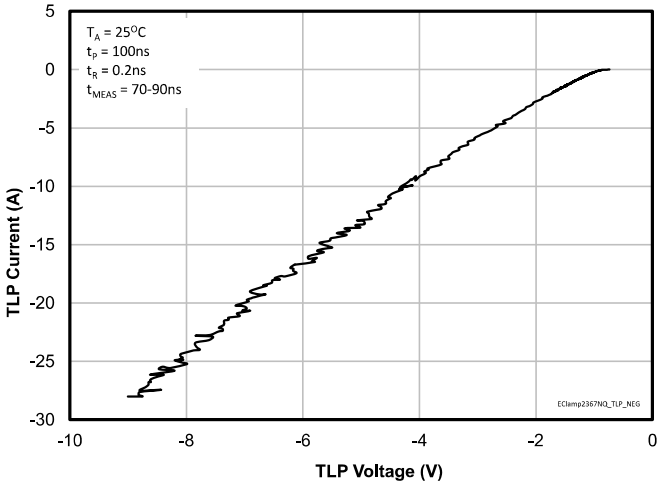

### ESD Clamping (-8kV Contact per ISO-10605 330pF, 330Ω)




### TLP Characteristic (Any Pin to GND)

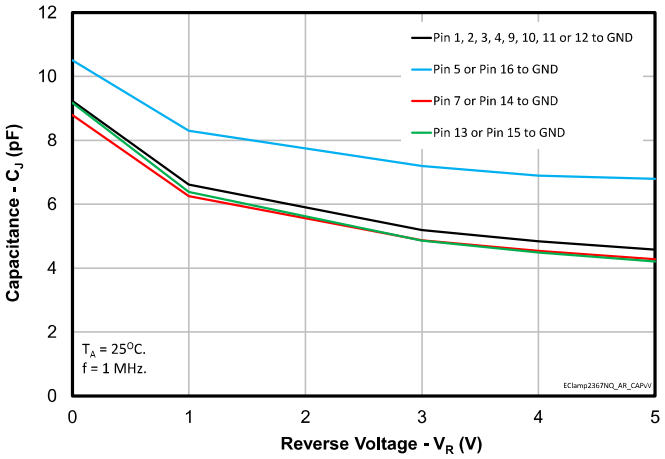



### TLP Characteristic (GND to Any Pin)

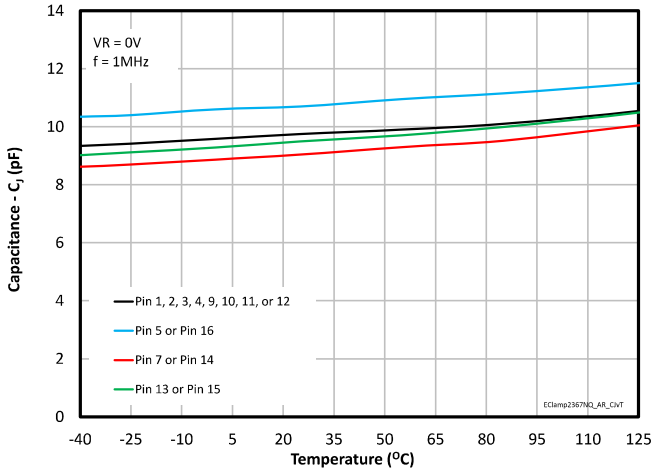


# Typical Characteristics

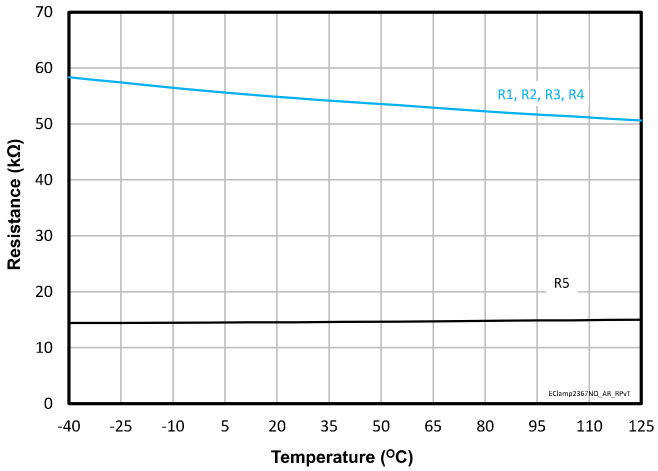
### Junction Capacitance (Line to GND) vs. Reverse Voltage



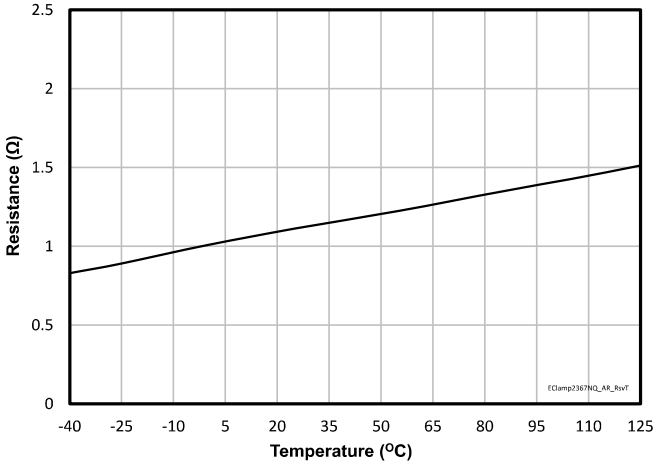

### Junction Capacitance to GND vs. Temperature



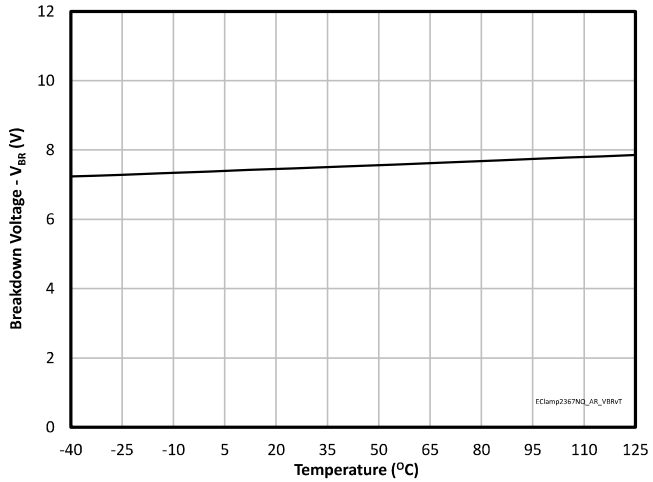

### Resistance (Pull up Resistors) vs. Temperature



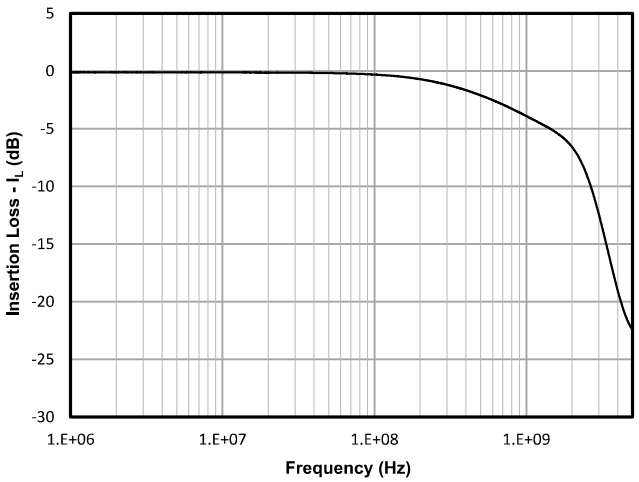

### Resistance (Series Resistors) vs. Temperature




### Breakdown Voltage ($V_{BR}$) vs. Temperature




### Insertion Loss (S21)



# Application Information

**Secure Digital Interface Protection**

EClamp2367NQ is specifically designed for secure digital card interfaces in automotive applications. It is compliant with SD3.01 UHS-1 SDR 104 standard. Each device integrates TVS diodes, series resistors, and bus pull up resistors. The device has been tested and qualified to AEC-Q100, Grade 1 for use in automotive applications.

**Device Connection**

A typical application circuit is shown below. Since the device contains series resistors, lines enter and exit separate pins as shown. The center tab serves as the ground connection. As such, connection to the VCC pins (and SD_DET if used) requires vias to a different board layer. All other connections can be made on the same layer where the device is located.

**Device Placement**

Placement of the protection component is a critical element for effective ESD suppression. EClamp2367NQ should be placed as close to the connector as possible. Ground connection should be made directly to the ground plane using micro-vias. This reduces parasitic inductance in the ground path and minimizes the clamping voltage seen by the protected device.

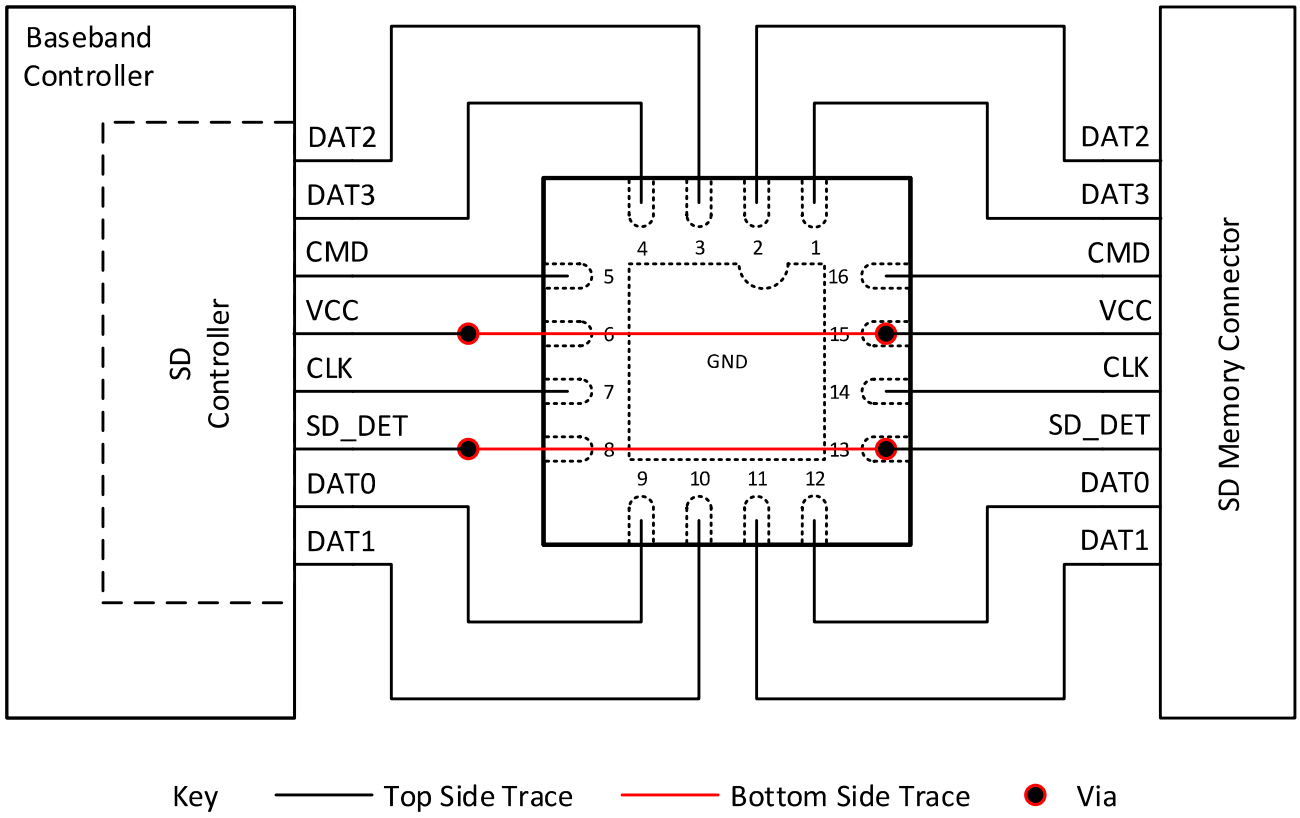
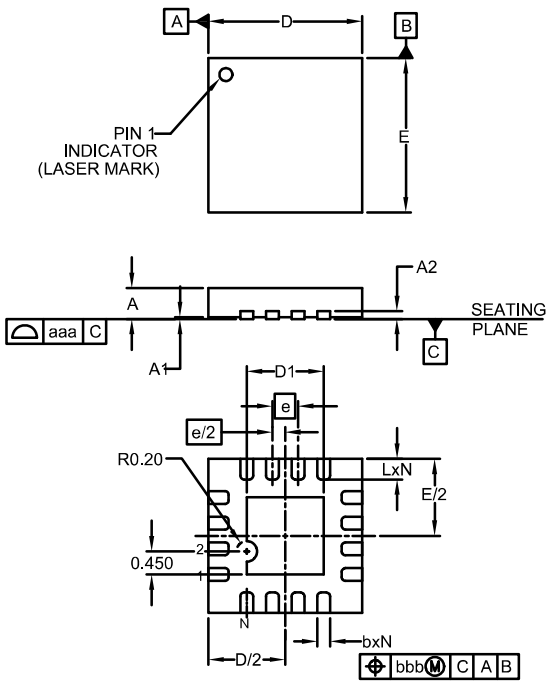



**Figure 1 - SD Interface Protection Example**

# Outline Drawing - SLP3030P16

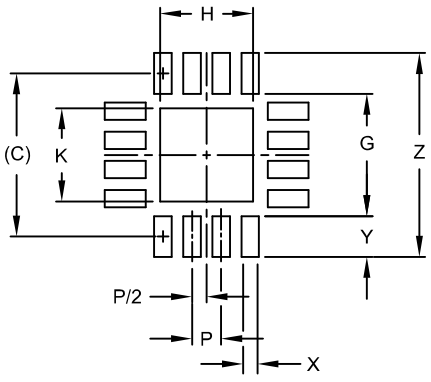



| DIMENSIONS | | | |
|---|---|---|---|
| DIM | MILLIMETERS | | |
| | MIN | NOM | MAX |
| A | 0.55 | 0.60 | 0.65 |
| A1 | 0.00 | 0.02 | 0.05 |
| A2 | - | (0.15) | - |
| b | 0.20 | 0.25 | 0.30 |
| D | 2.90 | 3.00 | 3.10 |
| D1 | 1.40 | 1.50 | 1.60 |
| E | 2.90 | 3.00 | 3.10 |
| E1 | 1.40 | 1.50 | 1.60 |
| e | 0.50 BSC | | |
| L | 0.35 | 0.40 | 0.45 |
| N | 16 | | |
| aaa | 0.08 | | |
| bbb | 0.10 | | |

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

# Land Pattern - SLP3030P16

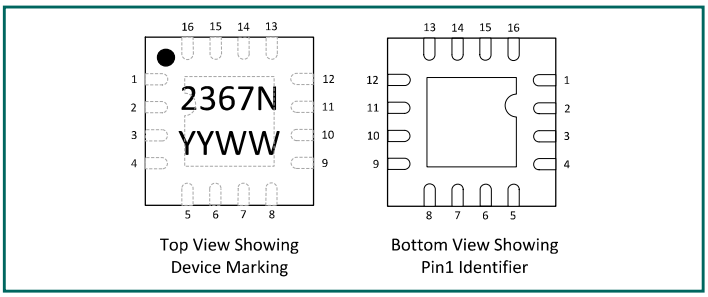



| DIMENSIONS | |
|---|---|
| DIM | MILLIMETERS |
| C | (2.80) |
| G | 2.10 |
| H | 1.60 |
| K | 1.60 |
| P | 0.50 |
| X | 0.30 |
| Y | 0.70 |
| Z | 3.50 |

NOTES:

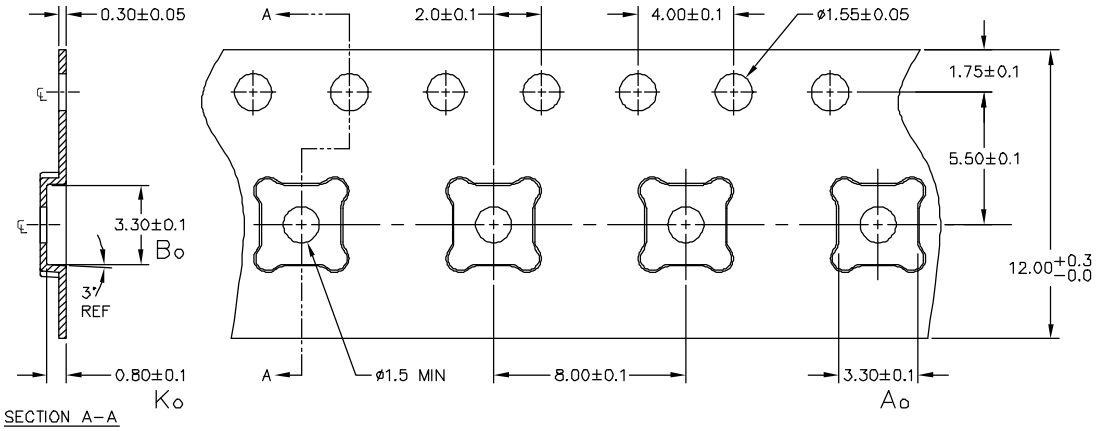
1. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY. CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S MANUFACTURING GUIDELINES ARE MET.
2. DO NOT PLACE VIAS BETWEEN THE CORNER LEADS INSIDE THE 3X3MM PACKAGE FOOTPRINT.
3. THERMAL VIAS IN THE LAND PATTERN OF THE EXPOSED PAD SHALL BE CONNECTED TO A SYSTEM GROUND PLANE. FAILURE TO DO SO MAY COMPROMISE THE THERMAL AND/OR FUNCTIONAL PERFORMANCE OF THE DEVICE.

## Marking Code

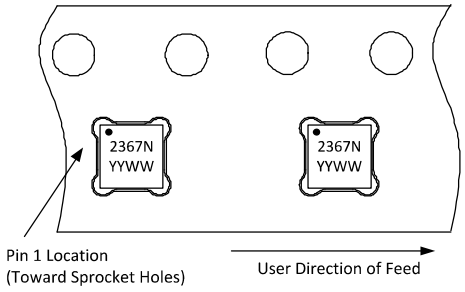



YYWW = Alphanumeric character Date Code

## Tape and Reel Specification - Plastic Tape, 4mm Pitch




NOTE: ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.




## Ordering Information

| Part Number | Qty per Reel | Reel Size |
|---|---|---|
| EClamp2367NQTLT | 3000 | 13 Inch |
| EMIClamp and EClamp are trademarks of Semtech Corporation. | | |

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