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# EClamp8052P

## EMIClamp®
## 2-Line Common Mode Filter and Low Capacitance ESD Protection

**PROTECTION PRODUCTS**

## Description

EClamp®8052P integrates common mode filtering with low capacitance ESD protection and is designed specifically for MIPI, MHL, and USB interfaces. Each device provides filtering and ESD protection for one high-speed differential pair.

EClamp8052P is an easily implemented solution for replacing discrete common mode chokes and ESD protection devices in a single package. These devices utilize silicon avalanche technology for superior ESD and TLP clamping performance. They feature high maximum ESD withstand voltage of +/- 25kV contact, +/-30kV air discharge per IEC 61000-4-2. The integrated common-mode choke has a typical differential mode cutoff frequency >3GHZ and typical common mode suppression of 10dB at 500MHz and 15dB from 1GHz to 2.8GHz. Each channel series resistance is 1.8 Ohms maximum.

EClamp8052P is in a 7-pin SGP1917N5 package, measuring 1.9 x 1.7mm with a nominal height of 0.55mm. The leads have a nominal pin-to-pin pitch of 0.50mm. Flow- through package design simplifies PCB layout and maintains signal integrity on high-speed lines.

## Features

- Transient Protection to
  - IEC 61000-4-2 (ESD) 30kV (Air), 25kV (Contact)
  - IEC 61000-4-4 (EFT) 4kV (5/50ns)
  - IEC 61000-4-5 (Lightning) 6A (8/20µs)
- Package design optimized for high speed lines
- ESD protection and common mode filtering for two high-speed lines
- High differential bandwidth cutoff frequency
- Low ESD Clamping Voltage
- Dynamic Resistance: 0.50 Ohms (Typ)
- Solid-State Silicon-Avalanche Technology

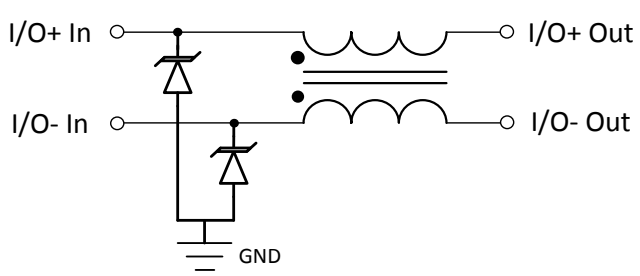
## Mechanical Characteristics

- SGP1917N5 package
- Pb-Free, Halogen Free, RoHS/WEEE Compliant
- Nominal Dimensions: 1.9 x 1.70 x 0.55 mm
- Molding Compound Flammability Rating: UL 94V-0
- Marking : Marking Code + Date Code
- Packaging : Tape and Reel

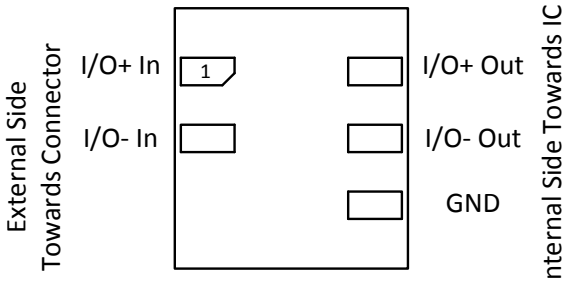
## Applications

- Industrial Equipment
- USB 2.0 / USB 3.0
- HDMI / MHL
- MIPI Camera Serial Interface (CSI)
- MIPI Display Serial Interface (DSI)

## Circuit Diagram




## Pin Configuration



## Absolute Maximum Ratings

| Rating | Symbol | Value | Units |
|---|---|---|---|
| Peak Pulse Current (tp = 8/20µs) | $I_{PP}$ | 6 | A |
| ESD per IEC 61000-4-2 (Contact)(1)<br>ESD per IEC 61000-4-2 (Air)(1) | $V_{ESD}$ | ±25<br>±30 | kV |
| Operating Temperature | $T_J$ | -40 to +125 | °C |
| Storage Temperature | $T_{STG}$ | -55 to +150 | °C |

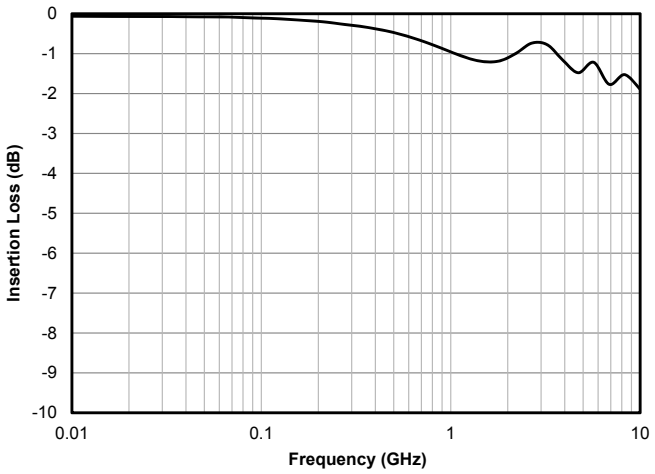
## Electrical Characteristics (T=25°C unless otherwise specified)

| Parameter | Symbol | Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| Reverse Stand-Off Voltage | $V_{RWM}$ | -40°C to 125°C<br>Pin 1 or Pin 2 to Pin 3 | | | | 5 | V |
| Reverse Breakdown Voltage | $V_{BR}$ | $I_t$ = 1mA,<br>Pin 1 or 2 to Pin 3 | -40°C to 125°C | 6.5 | 9 | 11 | V |
| Reverse Leakage Current | $I_R$ | $V_{RWM}$ = 5V | T = 25°C | | 0.005 | 0.100 | µA |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 1A, tp = 8/20µs,<br>Pin 1 or 2 to Pin 3 | | | | 12 | V |
| Clamping Voltage | $V_C$ | $I_{PP}$ = 6A, tp = 8/20µs,<br>Pin 1 or 2 to Pin 3 | | | | 17 | V |
| ESD Clamping Voltage(2) | $V_C$ | $I_{PP}$ = 4A, tp = 0.2/100ns (TLP)<br>Pin 1 or 2 to Pin 3 | | | 11 | | V |
| ESD Clamping Voltage(2) | $V_C$ | $I_{PP}$ = 16A, tp = 0.2/100ns (TLP)<br>Pin 1 or 2 to Pin 3 | | | 17 | | V |
| Dynamic Resistance(2), (3) | $R_{DYN}$ | tp = 0.2/100ns (TLP)<br>Pin 1 or 2 to Pin 3 | | | 0.50 | | Ohms |
| Total Channel Capacitance | $C_{IN}$ | $V_R$ = 0V, f = 1MHz<br>Pin 1 or 2 to Pin 3 | T = 25°C | | 0.95 | 1.2 | pF |
| Differential (SDD21) Cut-Off Frequency | $f_{3dB}$ | 50 Ohm Source and Load Termination | | | 3 | | GHz |
| Common Mode (SCC21) Attenuation | $f_{ATT}$ | f = 75MHz | | | 3 | | dB |
| | | f = 500MHz | | | 10 | | dB |
| | | f = 1GHZ - 2.5GHz | | | 20 | | dB |
| Channel Resistance | $R_{CH}$ | Input to Output | | | 1.3 | 1.8 | Ohms |

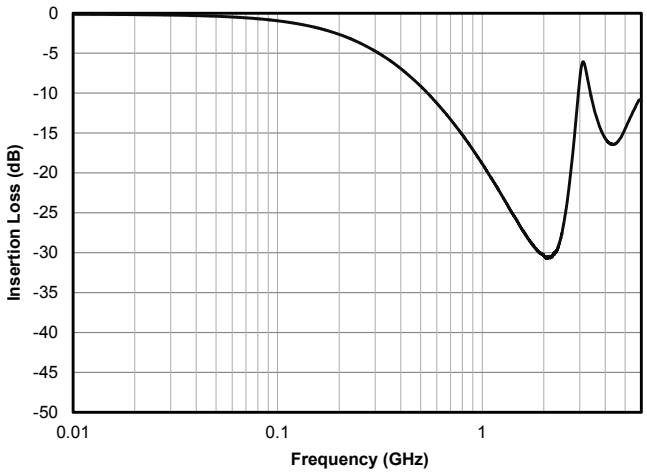
Notes:
(1): ESD Gun return path to Ground Reference Plane (GRP)
(2): Transmission Line Pulse Test (TLP) Settings: tp = 100ns, tr = 0.2ns, $I_{TLP}$ and $V_{TLP}$ averaging window: $t_1$ = 70ns to $t_2$ = 90ns.
(3): Dynamic resistance calculated from $I_{TLP}$ = 4A to $I_{TLP}$ = 16A

# Typical Characteristics

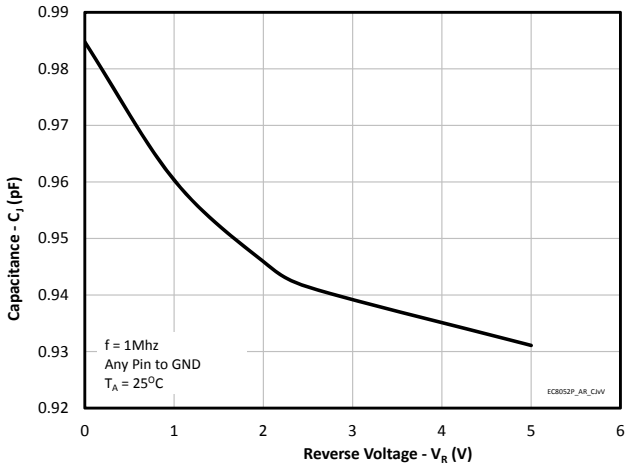
### Differential Mode Attenuation vs. Frequency



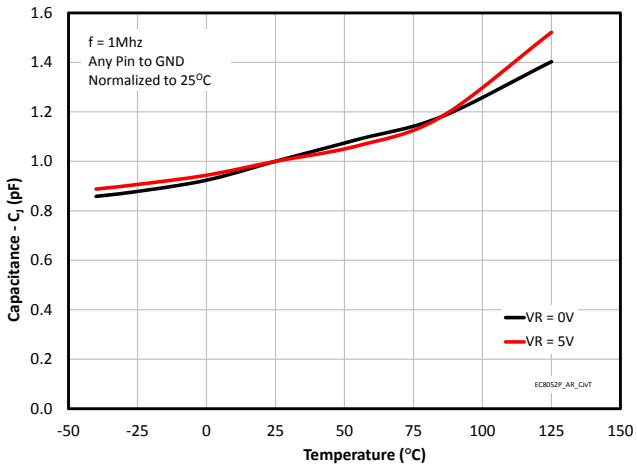

### Common Mode Attenuation vs. Frequency



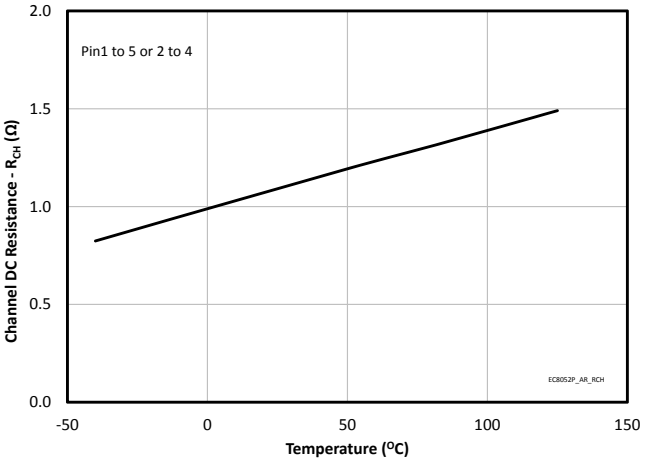

### Junction Capacitance vs. Reverse Voltage



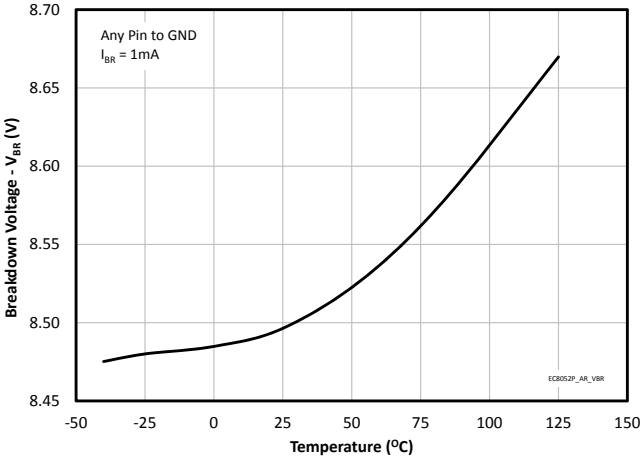

### Junction Capacitance vs. Temperature




### Channel DC Resistance vs. Temperature

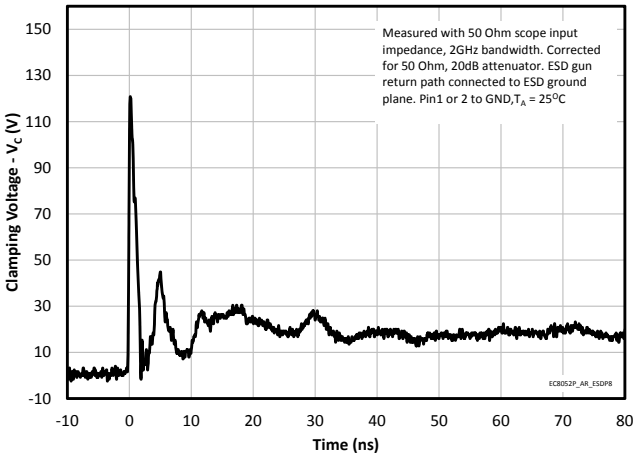



### Breakdown Voltage ($V_{BR}$) vs. Temperature

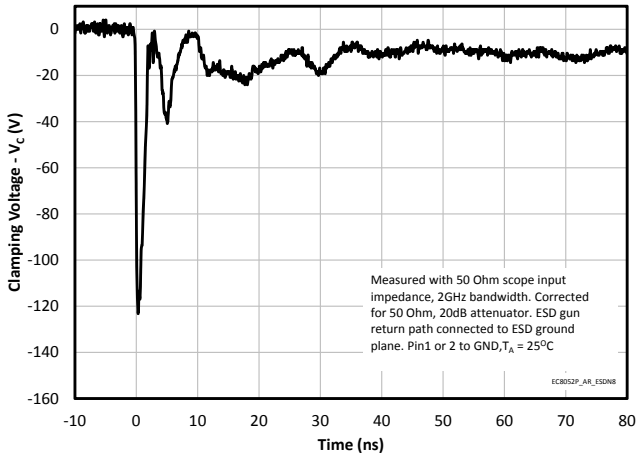


# Typical Characteristics

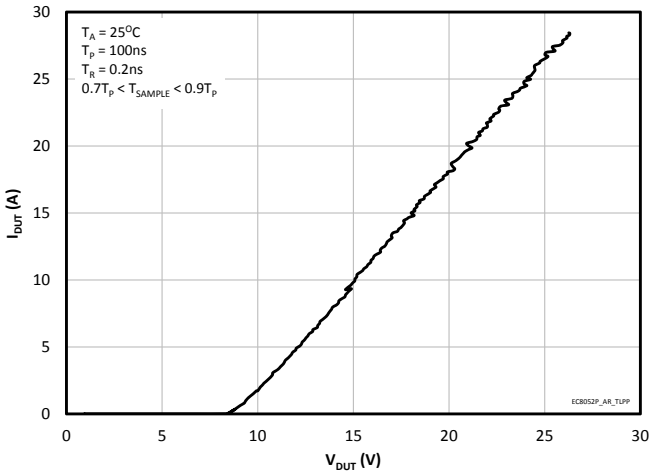
### ESD Clamping (+8kV Contact per IEC 61000-4-2)



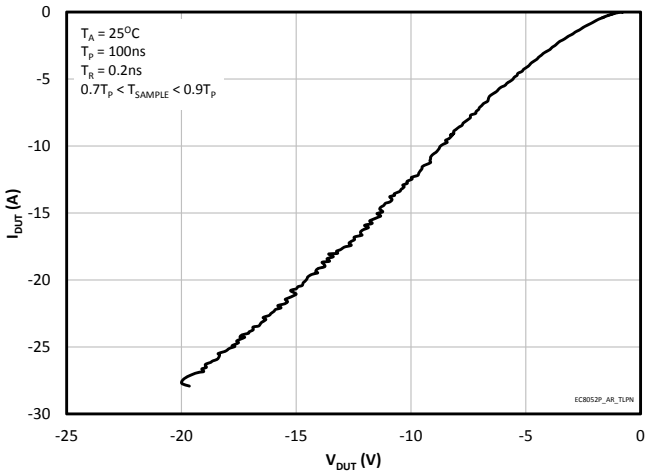

### ESD Clamping (-8kV Contact per IEC 61000-4-2)



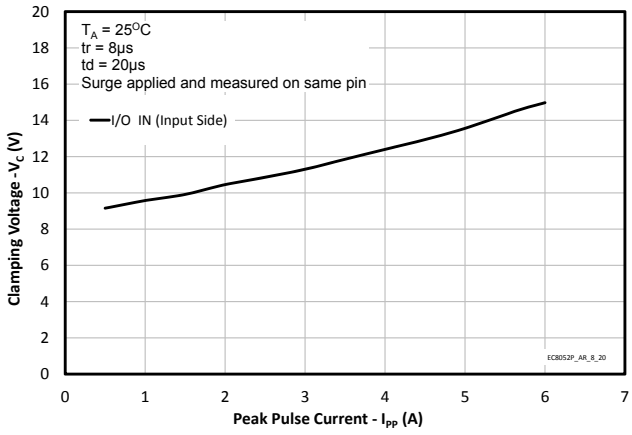

### TLP Characteristic (Positive)



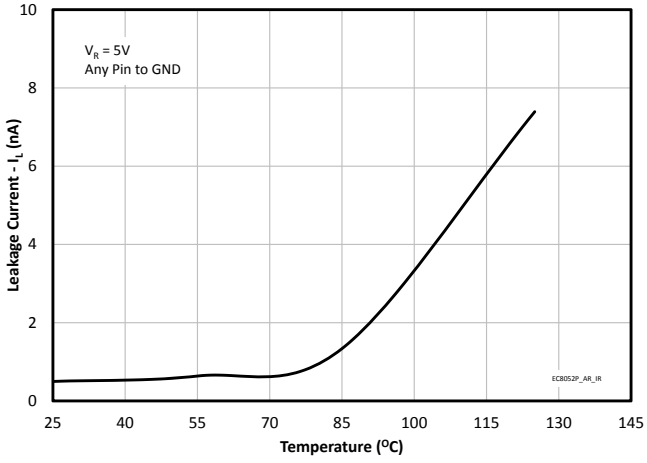

### TLP Characteristic (Negative)




### Clamping Voltage vs. Peak Pulse Current (tp=8/20us)




### Reverse Leakage vs. Temperature



# Application Information

**USB Interface Protection**

EClamp8052P may be used to protect D+ and D- lines against ESD and EMI in USB 2.0, USB 3.0, and USB 3.1 applications. USB D+ and D- lines enter at pins 1 and 2 (connector side) and exit at pins 4 and 5. The TVS diodes are internally connected at pins 1 and 2 and therfore must be located towards the connector on the PCB. Pin 3 is connected to the ground plane. Figures 1 is an example of protecting a USB 3.0 Type-A interface (host side shown).

For USB 3.0 applications, RClamp3324T is recommended for protecting the 5Gb/s SuperSpeed line pairs. Lines are routed through the device at pins 1-4. Traces should be kept the same length to avoid impedance mismatch. Ground is connected at pins 5 and 6. The differential impedance of each pair can be controlled for USB 3.0 (85 Ohms +/-15%) while maintaining a minimum trace-to-trace and trace-to-pad spacing. Individual PCB design constraints may necessitate different spacing or trace width. Both ground pads should be connected for optimal performance. Ground connection is made using filled via-in-pad. Additional information may be found on the device data sheet.

Single line devices such as uClamp0571P are recommended for surge and ESD protection of the VBus line. This device features high surge and ESD capability and may be used on 5V power rails.

**Device Placement**

Placement of the protection component is a critical element for effective ESD suppression. TVS diodes should be placed as close to the connector as possible. This helps reduce transient coupling to nearby traces. Ground connections 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.

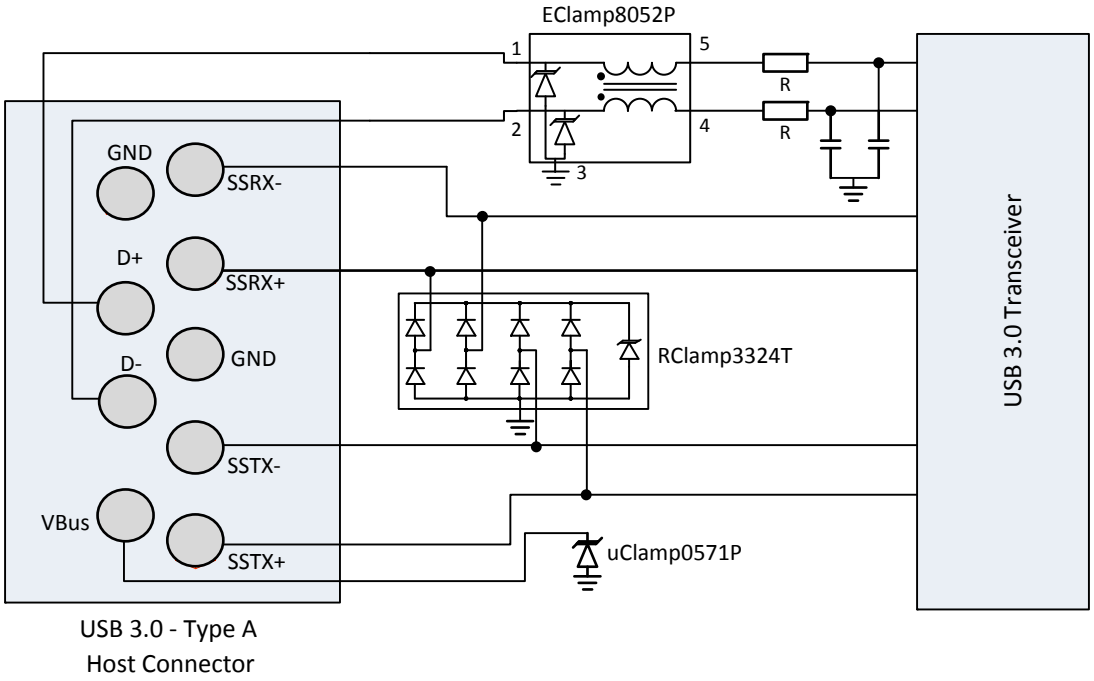



**Figure 1 - USB 3.0 Type-A Protection Example**

## Application Information

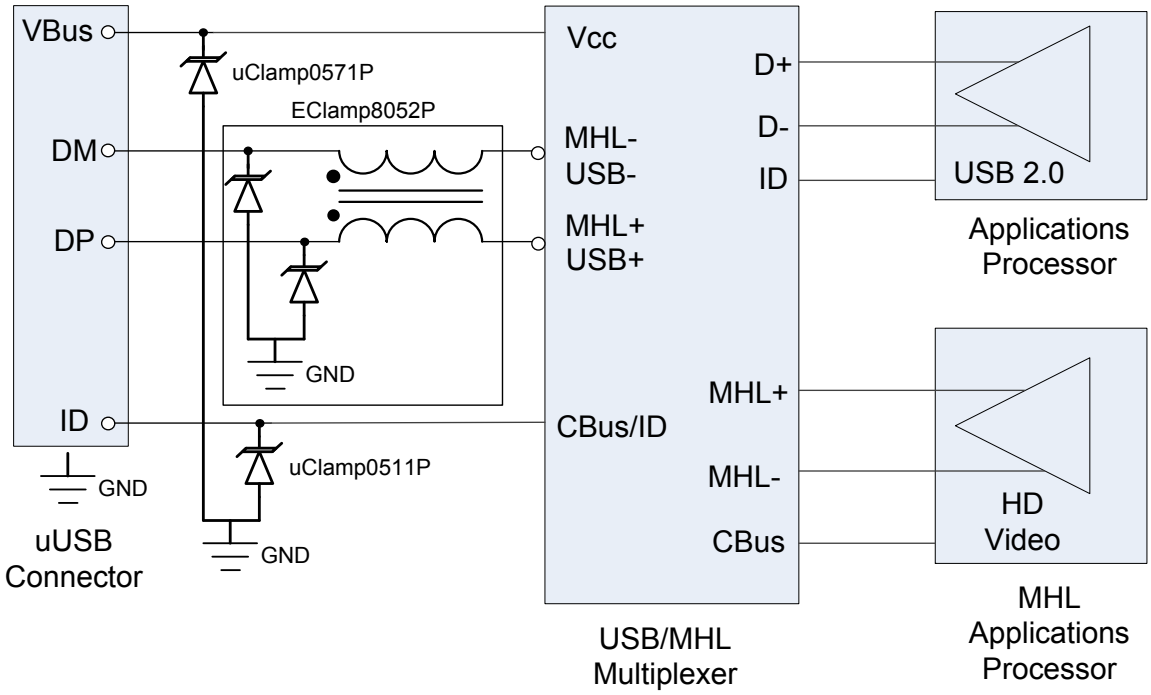



**Figure 2 - USB2.0 / MHL Interface Protection**

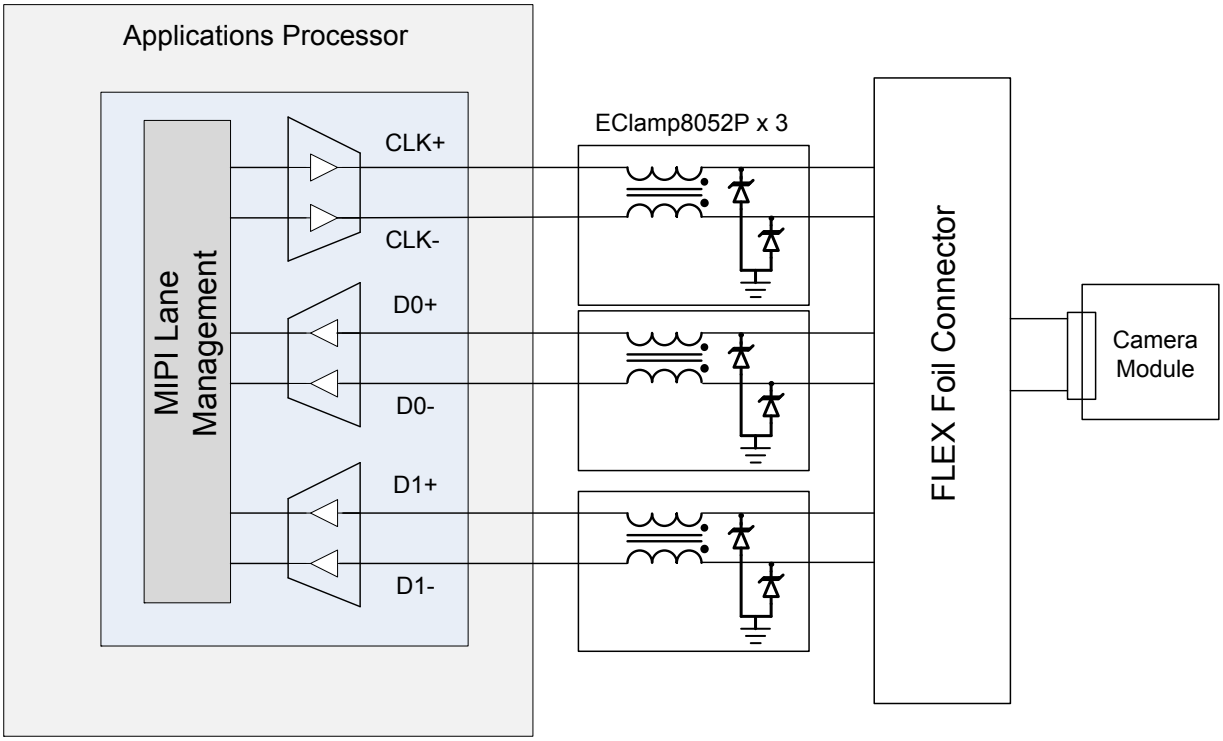
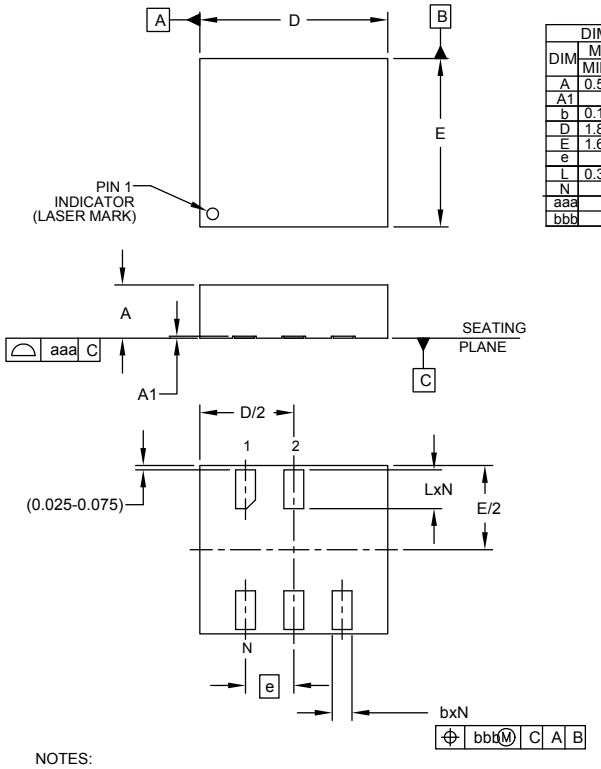



**Figure 3 - MIPI Camera Serial Interface Protection**

# Outline Drawing - SGP1917N5

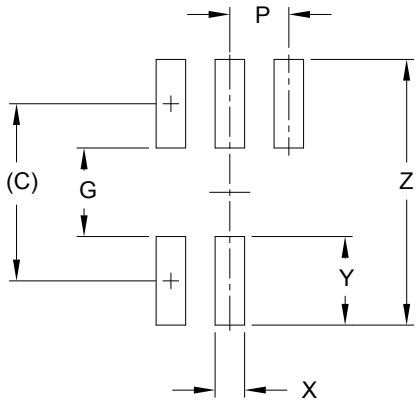



| DIMENSIONS | | | |
|---|---|---|---|
| DIM | MILLIMETERS | | |
| | MIN | NOM | MAX |
| A | 0.50 | 0.55 | 0.60 |
| A1 | See Note 2 | | |
| b | 0.15 | 0.20 | 0.25 |
| D | 1.85 | 1.90 | 1.95 |
| E | 1.65 | 1.70 | 1.75 |
| e | 0.50 BSC | | |
| L | 0.35 | 0.40 | 0.45 |
| N | 5 | | |
| aaa | 0.08 | | |
| bbb | 0.10 | | |

NOTES:

1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. A1 BOTTOM SOLDER MASK ( 0.020+/-0.007 )
   SOLDER PAD ( 0.018+/-0.005)

# Land Pattern - SGP1917N5

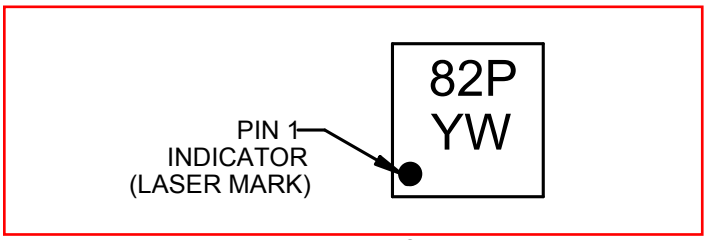



| DIMENSIONS | |
|---|---|
| DIM | MILLIMETERS |
| C | (1.50) |
| G | 0.75 |
| P | 0.50 |
| X | 0.25 |
| Y | 0.75 |
| Z | 2.25 |

NOTES:

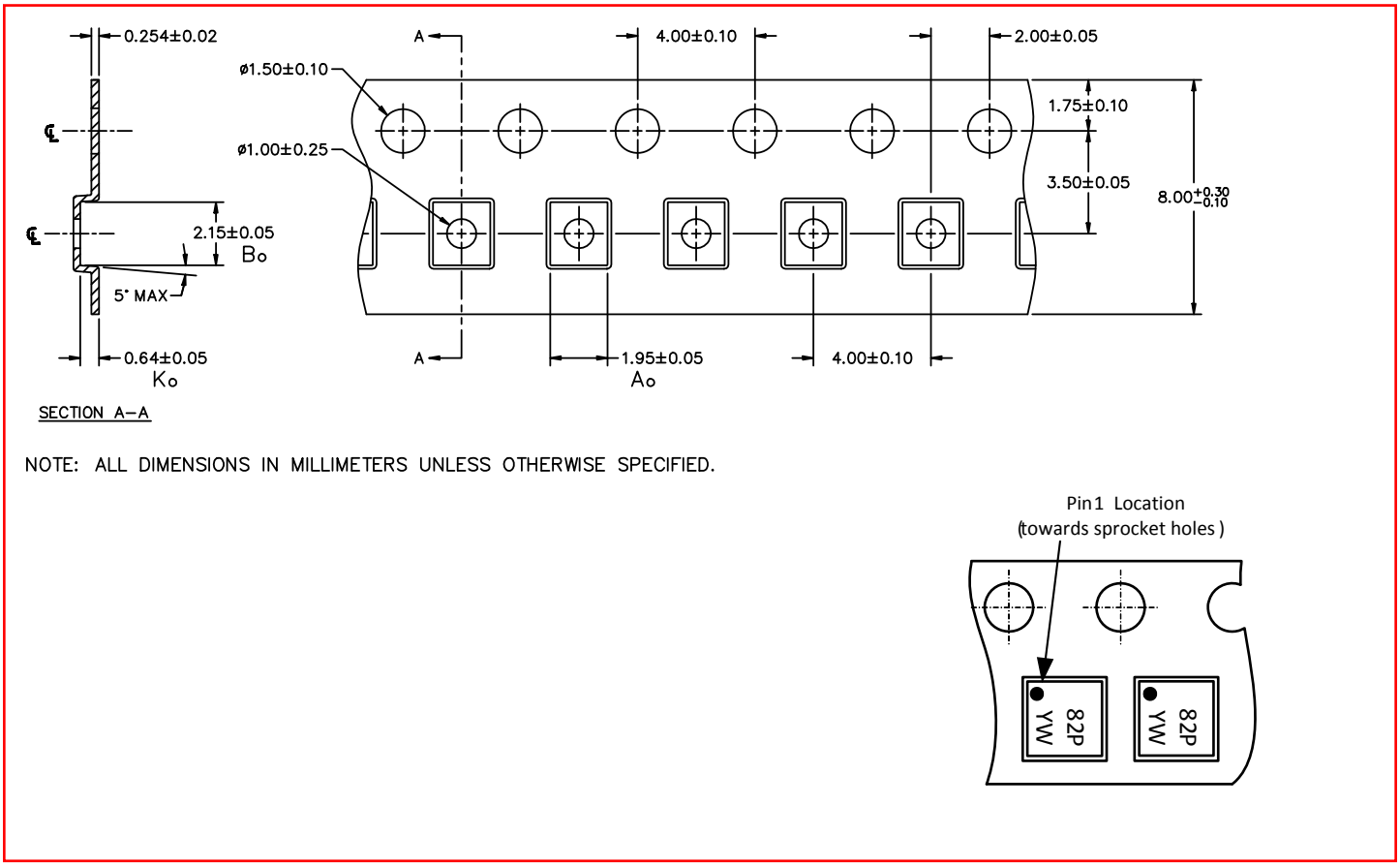
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. THIS LAND PATTERN IS FOR REFERENCE PURPOSES ONLY.
   CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR
   COMPANY'S MANUFACTURING GUIDELINES ARE MET.

## Marking Code




YW = Alphanumeric character Date Code

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




## Ordering Information

| Part Number | Qty per Reel | Reel Size | Carrier Tape | Pitch |
|---|---|---|---|---|
| EClamp8052P.TCT | 3000 | 7 Inch | Plastic | 4mm |
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## Contact Information

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