# Specification Status: RELEASED

## GENERAL DESCRIPTION

Littelfuse PolyZen devices are polymer enhanced, precision Zener diode. They offer resettable protection against multi-Watt fault events without the need for multi-Watt heat sinks.



PolyZen Zener diode was selected due to its relatively flat voltage vs current response. This helps improve output voltage clamping, even when input voltage is high and diode currents are large.

An advanced feature of the PolyZen devices is that the Zener diode is thermally coupled to a resistively non-linear, polymer PTC (positive temperature coefficient) substrate. The PTC substrate is fully integrated into the device, and is electrically in series between $V_{IN}$ and the diode clamped $V_{OUT}$.

This advanced PTC substrate responds to either extended diode heating or overcurrent events by transitioning from a low to high resistance state, also known as ”tripping”. A tripped PTC will limit current and generate voltage drop. It helps to protect both the Zener diode and the follow-on electronics and effectively increases the diode’s power handling capability.

The polymer enhanced Zener diode helps protect sensitive portable electronics from damage caused by inductive voltage spikes, voltage transients, incorrect power supplies and reverse bias. These devices are particularly suitable for portable electronics and other low-power DC devices.

## BENEFITS

- Stable Zener diode helps shield downstream electronics from overvoltage and reverse bias
- Trip events shut out overvoltage and reverse bias sources
- Analog nature of trip events minimizes upstream inductive spikes
- Integrated protection on over current, over voltage, over temperature and ESD
- Minimal power dissipation requirements
- Single component placement

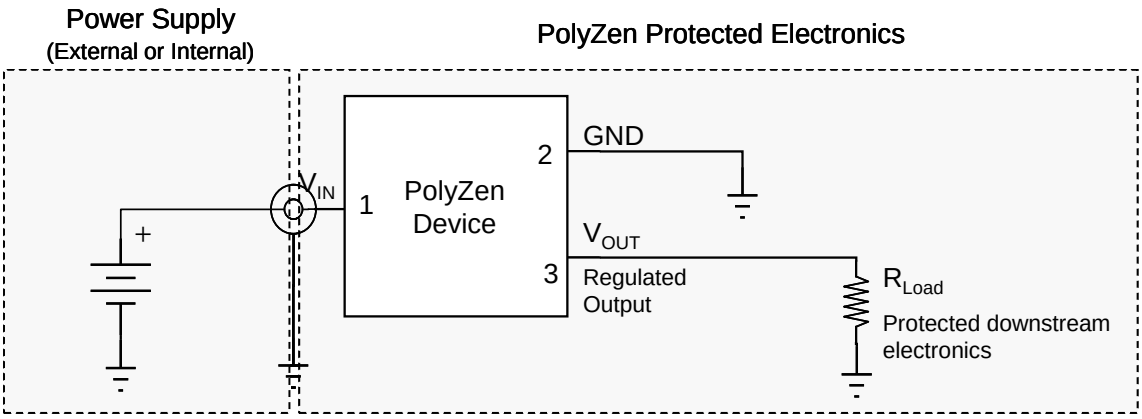
## FEATURES

- Overvoltage transient suppression
- Stable $V_Z$ vs fault current
- Time delayed, overvoltage trip
- Time delayed, reverse bias trip
- Multi-Watt power handling capability
- Integrated device construction
- RoHS Compliant

## TARGET APPLICATIONS

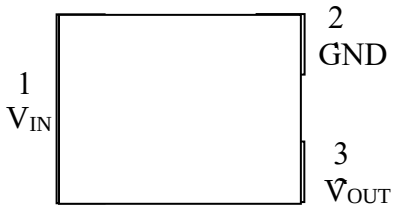
- DC power port protection in portable electronics
- DC power port protection for systems using barrel jacks for power input
- Internal overvoltage & transient suppression
- DC output voltage regulation

## TYPICAL APPLICATION BLOCK DIAGRAM

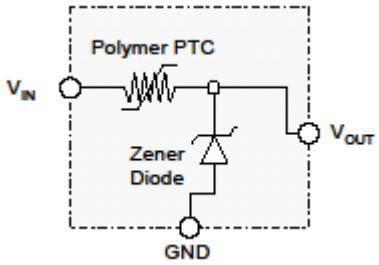


## CONFIGURATION INFORMATION

### Pin Configuration (Top View)



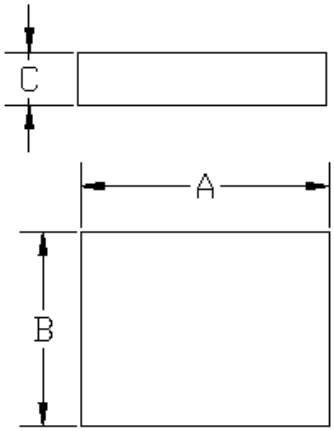

### Block Diagram




## PIN DESCRIPTION

| Pin Number | Pin Name | Pin Function |
|---|---|---|
| 1 | $V_{IN}$ | **$V_{IN}$.** Device input |
| 2 | GND | **GND** |
| 3 | $V_{OUT}$ | **$V_{OUT}$.** Zener regulated voltage output |

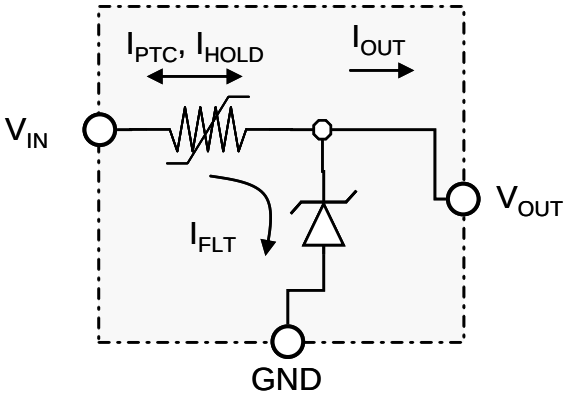
## MECHANICAL DIMMENSIONS




| | | Min | Typ | Max |
|---|---|---|---|---|
| | | mm (in) | | |
| Length | A | 4.80 (0.190) | 5.00 (0.197) | 5.20 (0.206) |
| Width | B | 3.80 (0.150) | 4.00 (0.158) | 4.20 (0.166) |
| Height | C | 1.20 (0.047) | 1.30 (0.051) | 1.40 (0.055) |

## DEFINITION of TERMS

| | |
|---|---|
| $I_{PTC}$ | Current flowing through the PTC portion of the circuit |
| $I_{FLT}$ | RMS fault current flowing through the diode |
| $I_{OUT}$ | Current flowing out the $V_{OUT}$ pin of the device |
| Trip Event | A condition where the PTC transitions to a high resistance state, thereby significantly limiting $I_{PTC}$ and related currents. |
| Trip Endurance | Time the PTC portion of the device remains in a high resistance state. |



## GENERAL SPECIFICATIONS[1-3, 12] (Typical unless otherwise specified)

## ELECTRICAL CHARACTERISTICS

| $V_Z$[4] (V) | | $I_{zt}$[4] (A) | Leakage Current | | $I_{HOLD}$[5] @20ºC (A) | $I_{HOLD}$ @60ºC (A) | $R_{TYP}$[6] (Ohms) | $R_{1Max}$[7] (Ohms) | $V_{INT}$ Max[8] (V) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Min | Max | | Test Voltage (V) | Max Current (mA) | | | | | $V_{INT}$ Max (V) | Test Current (A) |
| 5.35 | 5.85 | 0.1 | 5.25 | 10 | 2.6 | 2 | 0.040 | 0.055 | 16 | 5 |

## MAXIMUM RATINGS

| $V_{IN}$ Max[9] | | $I_{FLT}$ Max[10] | | Peak pulse current | ESD withstand (IEC 61000-4-2) | | Temperature | | Tripped Power Dissipation[11] Max | |
|---|---|---|---|---|---|---|---|---|---|---|
| $V_{IN}$ Max (V) | Test Current (A) | $I_{FLT}$ Max (A) | Test voltage (V) | 8/20 µs pulse (IEC 61000-4-5) (A) | Contact (KV) | Air (KV) | Operating (ºC) | Storage (ºC) | Value (W) | Test Voltage (V) |
| 20 | 3 | 3 | 16 | 150 | +/- 30 | +/- 30 | -40 to +85 | -40 to +85 | 1.0 | 20 |
| -16 | -3 | -40 | -12 | | | | | | | |

Note 1: Electrical characteristics determined at 25ºC unless otherwise specified.

Note 2: This device is intended for limited fault protection. Repeated trip events or extended trip endurance can degrade the device and may affect performance to specifications. Performance impact will depend on multiple factors including, but not limited to, voltage, trip current, trip duration, trip cycles, load condition and circuit design. For details or ratings specific to your application contact Littelfuse Connectivity Circuit Protection Division directly.

Note 3: Specifications developed using 1.0 ounce 0.045" wide copper traces on dedicated FR4 test boards. Performance in your application may vary.

Note 4: $I_{zt}$ is the current at which $V_z$ is measured ($V_Z = V_{OUT}$). Additional $V_Z$ values are available on request.

Note 5: $I_{HOLD}$: Maximum steady state current (current entering or exiting the $V_{IN}$ pin of the device) that will not generate a trip event at the specified temperature. Specification assumes $I_{FLT}$ (current flowing through the Zener diode) is sufficiently low so as to prevent the diode from acting as a heat source. Testing is conducted with an "open" Zener.

Note 6: $R_{TYP}$: Resistance between $V_{IN}$ and $V_{OUT}$ pins during normal operation at room temperature.

Note 7: $R_{1Max}$: The maximum resistance between $V_{IN}$ and $V_{OUT}$ pins at room temperature, one hour after first tripped event or after reflow soldering.

Note 8: $V_{INT}$ Max: $V_{INT}$ Max is defined as the maximum voltage at which devices can be survived according to typical qualification process at the specified voltage and current. $V_{INT}$ Max testing is conducted using a "shorted" load ($V_{OUT}$ = 0 V). $V_{INT}$ Max is a survivability rating, not a performance rating. For performance ratings, see Note 2.

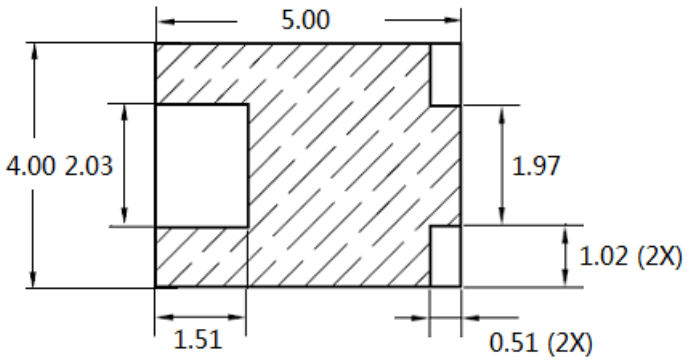
Note 9: $V_{IN}$ Max: For practical application, Polyzen devices are polymer enhanced diode, it use the Polymer PTC technology to offer the diode resettable protection against continuous overvoltage fault events. $V_{IN}$ Max is defined as the maximum voltage rating of the whole device at which devices can be survived according to typical qualification process at specified voltage and current. Testing conducted with no load connected to $V_{OUT}$. $V_{IN}$ Max is a survivability rating, not a performance rating. For performance ratings, see Note 2.

Note 10: $I_{FLT}$ Max: Maximum RMS fault current the device can withstand and remain resettable. Specification is dependent on the direction of current flow through the device. RMS fault currents above $I_{FLT}$ Max may permanently damage the PolyZen device. Specification assumes $I_{OUT}$ = 0. Testing conducted with no load connected to $V_{OUT}$.

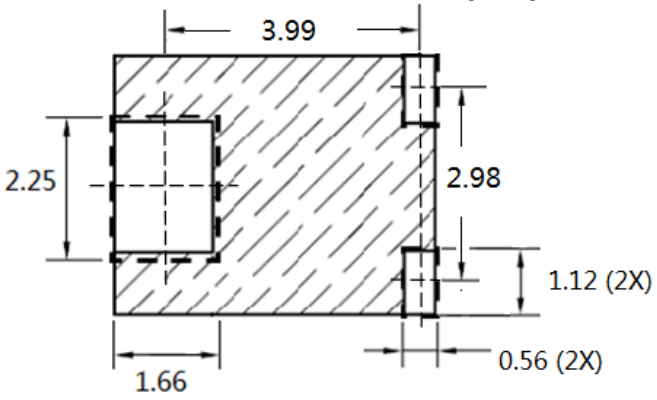
Note 11: The power dissipated by the device when in the "tripped" state, as measured on Littelfuse test boards (see note 3).

Note 12: Specifications based on limited qualification data and subject to change.

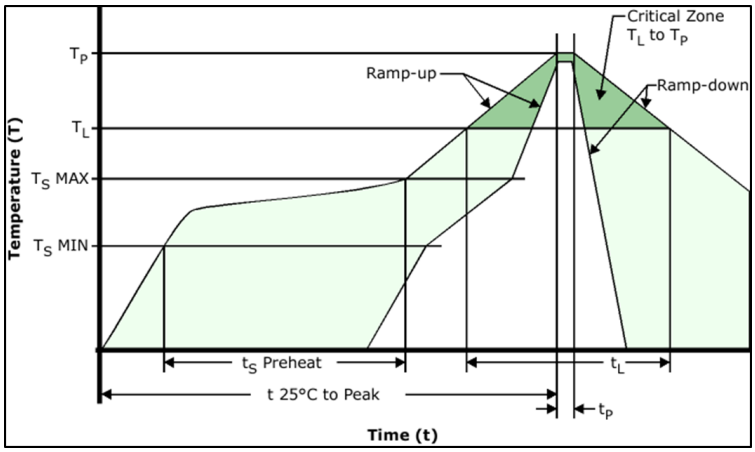
## RECOMMENDED PAD DIMENSIONS (mm)




## RECOMMENDED PAD LAYOUT (mm)




## RECOMMENDED SOLDER REFLOW PROFILE

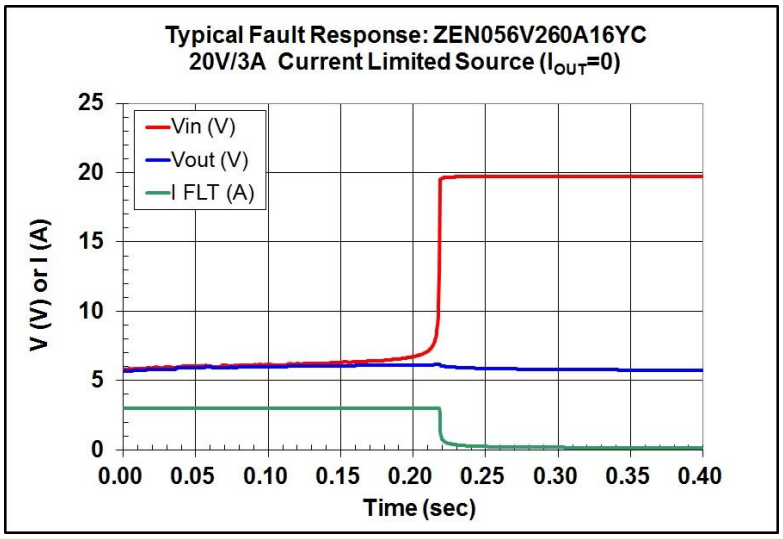


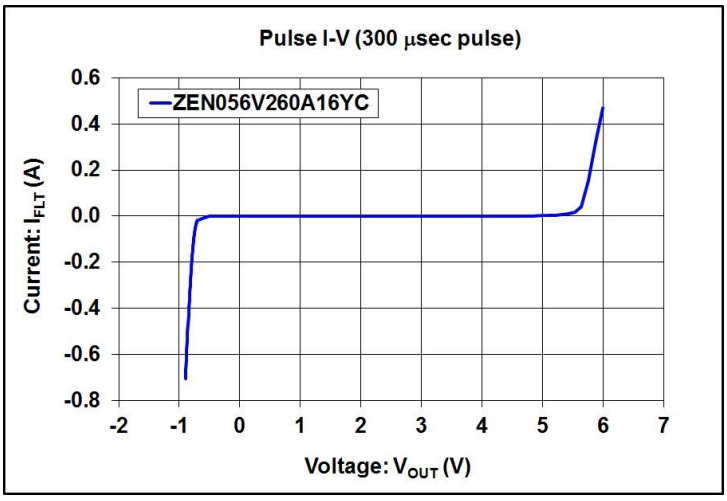

| Classification Reflow Profiles | |
|---|---|
| **Profile Feature** | **Pb-Free Assembly** |
| Average Ramp-up Rate (Ts Max to Tp) | 3° C/second max |
| Average Ramp-down Rate (Tp to $T_L$) | 3° C/second max |
| **Preheat** | |
| • Temperature Min (Ts Min) | 150° C |
| • Temperature Max (Ts Max) | 200° C |
| • Time (ts Preheat) | 60-180 seconds |
| **Time maintained above:** | |
| • Temperature ($T_L$) | 217° C |
| • Time ($t_L$) | 60-150 seconds |
| **Peak / Classification Temperature** | |
| • Temperature ($T_P$) | 250 ° C |
| **Time within 5° C of actual peak** | |
| • Time ($t_P$) | 20-40 seconds |
| **Time 25° C to peak Temperature** | 8 minutes max |

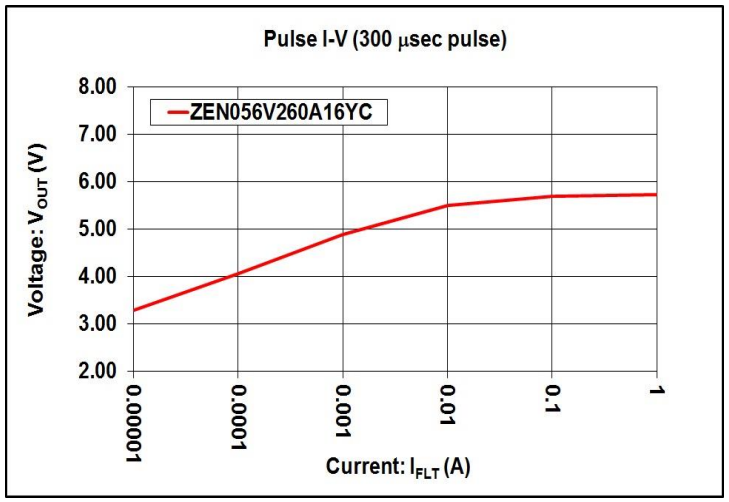
250

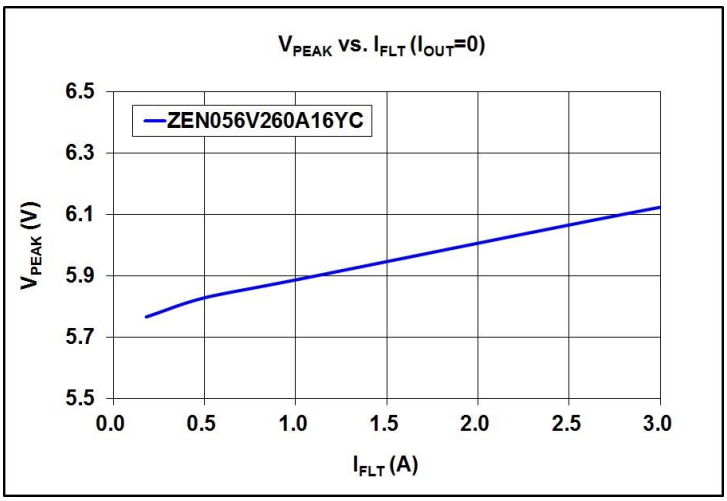
Avoid scratching the package when the device surface temperature is great than 85 °C

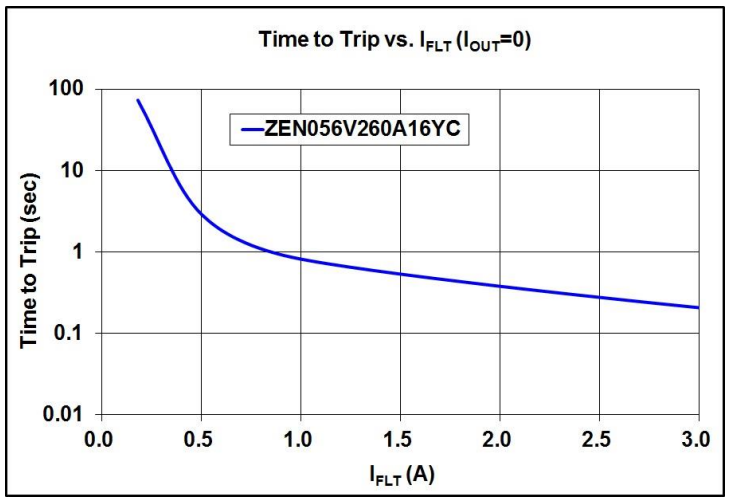
## TYPICAL DEVICE CHARACTERISTICS

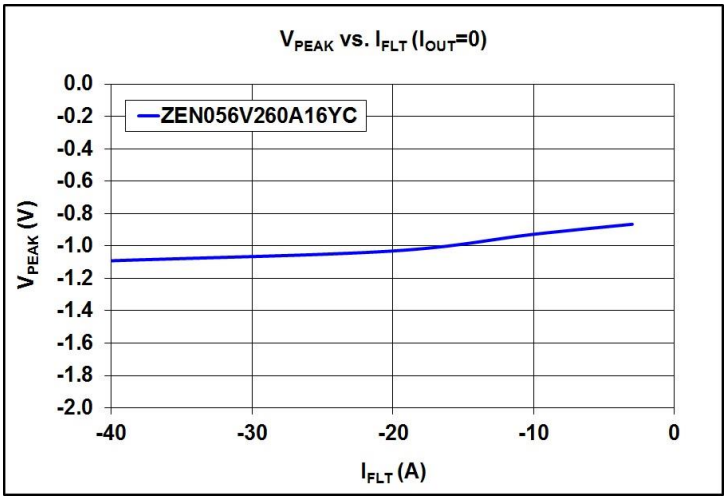


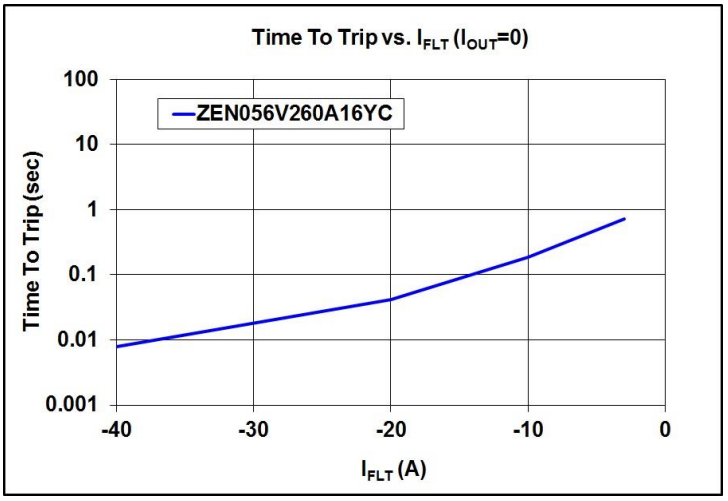



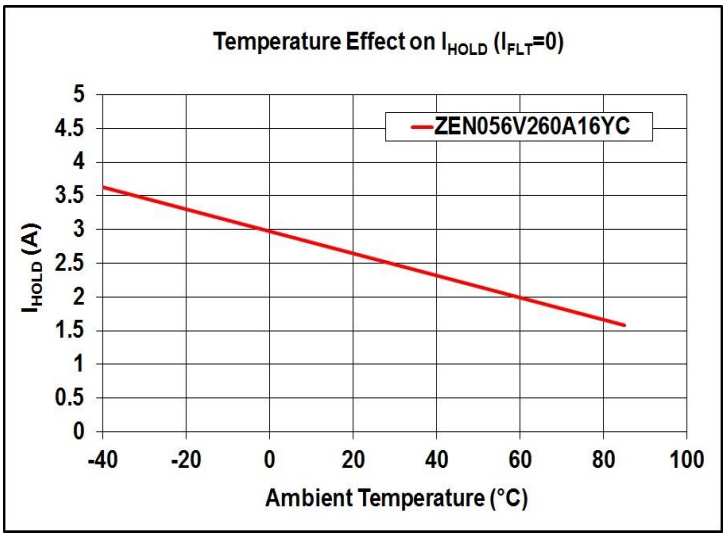



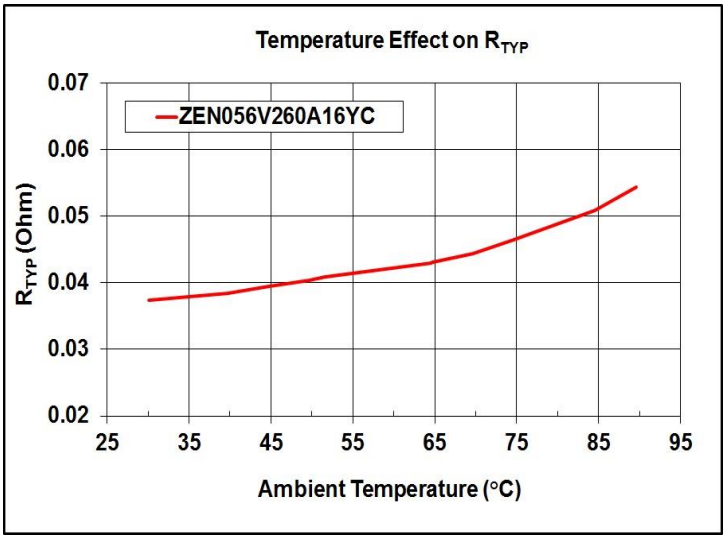



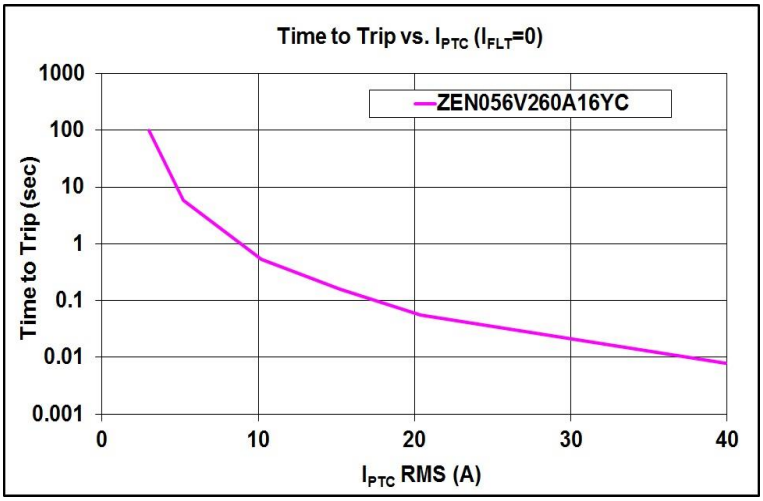




$V_{PEAK}$ vs. $I_{FLT}$ ($I_{OUT}$=0)
ZEN056V260A16YC
$V_{PEAK}$ (V)
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
-1.8
-2.0
-40
-30
-20
-10
0
$I_{FLT}$ (A)


Time To Trip vs. $I_{FLT}$ ($I_{OUT}$=0)
ZEN056V260A16YC
Time To Trip (sec)
100
10
1
0.1
0.01
0.001
-40
-30
-20
-10
0
$I_{FLT}$ (A)


Temperature Effect on $I_{HOLD}$ ($I_{FLT}$=0)
ZEN056V260A16YC
$I_{HOLD}$ (A)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-40
-20
0
20
40
60
80
100
Ambient Temperature (°C)

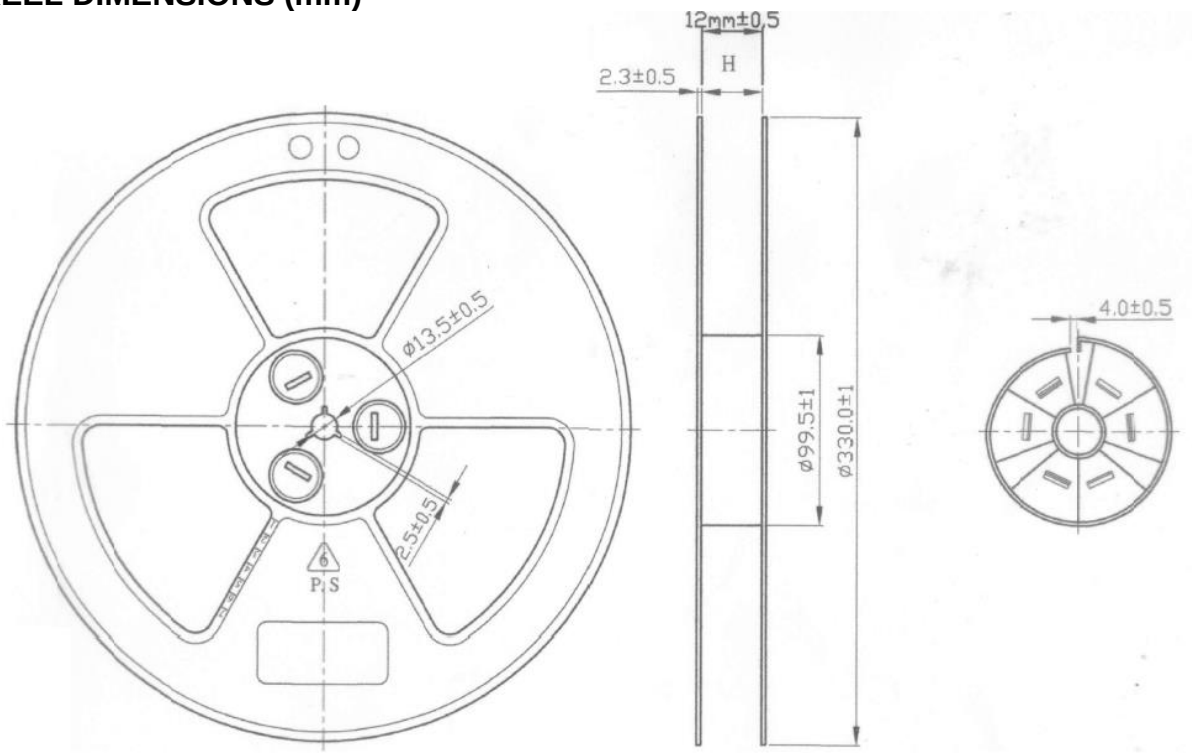

Temperature Effect on $R_{TYP}$
ZEN056V260A16YC
$R_{TYP}$ (Ohm)
0.07
0.06
0.05
0.04
0.03
0.02
25
35
45
55
65
75
85
95
Ambient Temperature (°C)


Time to Trip vs. $I_{PTC}$ ($I_{FLT}$=0)
ZEN056V260A16YC
Time to Trip (sec)
1000
100
10
1
0.1
0.01
0.001
0
10
20
30
40
$I_{PTC}$ RMS (A)

## PACKAGING

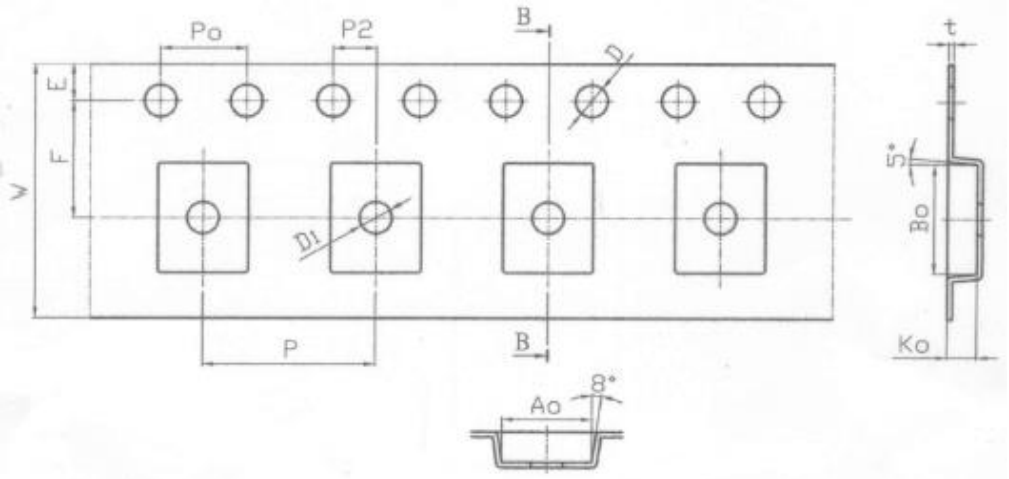
| Packaging | Tape & Reel | Standard Box |
|---|---|---|
| ZEN056V260A16YC | 4000 | 20000 |

## REEL DIMENSIONS (mm)

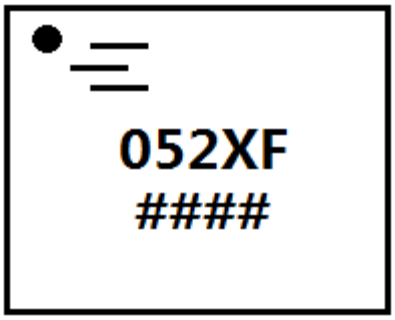


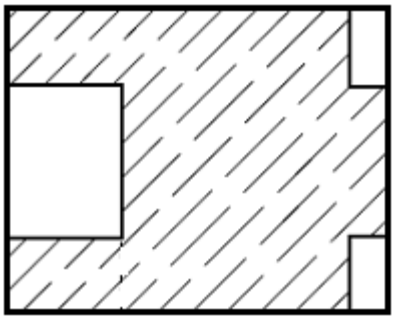

## TAPE DIMENSIONS (mm)

| Item | Dimension | tolerance |
|---|---|---|
| W | 12.00 | ±0.10 |
| P | 8.00 | ±0.10 |
| E | 1.75 | ±0.10 |
| F | 5.50 | ±0.10 |
| P2 | 2.00 | ±0.10 |
| D | 1.50 | +0.10 −0.00 |
| D1 | 1.50 | ±0.10 |
| Po | 4.00 | ±0.10 |
| 10Po | 40.00 | ±0.20 |
| Ao | 4.20 | ±0.10 |
| Bo | 5.25 | ±0.10 |
| Ko | 1.40 | ±0.10 |
| t | 0.24 | ±0.05 |



## DEVICE MARKINGS INFORMATION



| Markings | Vz | Hold current | Special code |
|---|---|---|---|
| 052XF | 5.6V | 2.6A | F |
| #### | Last 4 digits of batch number | | |

## MATERIALS INFORMATION

**ROHS Compliant**

Directive 2002/95/EC Compliant

**ELV Compliant**

Directive 2000/53/EC Compliant

**Pb-Free**

**Halogen Free***

HF

* Halogen Free refers to: Br≤900ppm, Cl≤900ppm, Br+Cl≤1500ppm.

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