# Surface Mount PTC

## 0ZCN Series

HF Pb 0ZCN Series – 2016 Chip RoHS Compliant

### Product Features

- 2016 Dimension, Surface mountable, Solid state, Faster time to trip than standard SMD devices.
- Full compliance with EU Directive 2011/65/EU and amending directive 2015/863
- AEC-Q Compliant
- Meets Bel automotive qualification*
  * - Largely based on internal AEC-Q test plan

### Operating (Hold Current) Range

300mA - 2A

### Maximum Voltage

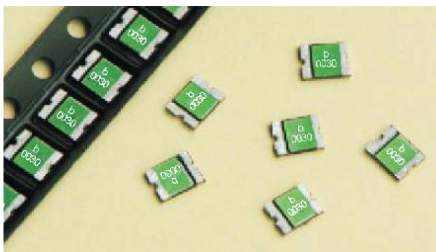
6 - 60V (per table)

### Temperature Range

-40°C to 85°C

### Agency Approval

TUV (Std. EN/IEC 60738-1-1 and EN/IEC 60730-1, Cert. R50102117)
UL Recognized Component (Std. UL1434, File E305051)



UK CA CE TÜV c UL us

**AEC-Q Compliant**

LEAD FREE = Pb
HALOGEN FREE = HF

### Electrical Characteristics (23°C)

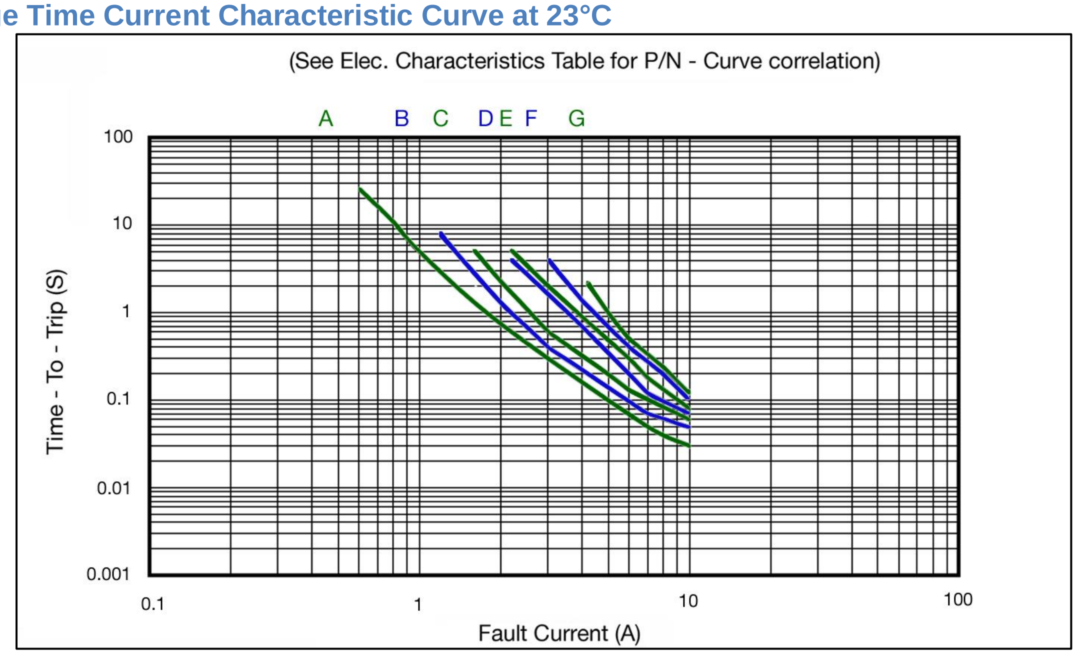
| | Part Number | Hold Current | Trip Current | Rated Voltage | Maximum Current | Typical Power | Max Time to Trip | | Resistance Tolerance | | Agency Approvals | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Current | Time | Rmin | R1max | cULus | TÜV |
| | | $I_H$, A | $I_T$, A | $V_{max}$, Vdc | $I_{max}$, A | $P_d$, W | A | Sec | Ohms | Ohms | | |
| A | 0ZCN0030FF2C | 0.30 | 0.60 | 60 | 100 | 1.4 | 1.5 | 3.0 | 0.500 | 2.300 | Y | Y |
| B | 0ZCN0055FF2A | 0.55 | 1.10 | 60 | 100 | 1.4 | 2.5 | 5.0 | 0.200 | 1.000 | Y | Y |
| C | 0ZCN0075FF2A | 0.75 | 1.50 | 60 | 100 | 1.4 | 8.0 | 0.5 | 0.130 | 0.900 | Y | Y |
| D | 0ZCN0110FF2C | 1.10 | 2.20 | 15 | 100 | 1.4 | 8.0 | 0.5 | 0.100 | 0.400 | Y | Y |
| | 0ZCN0110AF2C | 1.10 | 2.20 | 33 | 100 | 1.4 | 8.0 | 0.5 | 0.100 | 0.400 | Y | Y |
| E | 0ZCN0150FF2C | 1.50 | 3.00 | 15 | 100 | 1.4 | 8.0 | 0.8 | 0.070 | 0.180 | Y | Y |
| F | 0ZCN0200FF2C | 2.00 | 4.20 | 6 | 100 | 1.4 | 8.0 | 3.0 | 0.048 | 0.100 | Y | Y |

IH Hold Current- The maximum current at which the device will not trip in still air at 23°C.
IT Trip current- The minimum current at which the device will trip in still air at 23°C.
Vmax Maximum voltage device can withstand at its rated current without suffering damage.
Imax Maximum fault current device can withstand at rated voltage (Vmax) without damage.
Pd Typical power dissipated by device when in tripped state in 23°C still air environment.
Rmin Minimum device resistance at 23°C in initial un-soldered state.
R1max Maximum device resistance at 23°C, 1 hour after initial device trip, or after being soldered to PCB in end application.

## PTC's – Basic Theory of Operation / "Tripped" Resistance Explanation

A Bel PTC consists of a block of polymeric material containing conductive carbon granules which is sandwiched between two conductive metal plates. When this polymer block reaches approximately 125C, either due to current passing through it via conductive chains of carbon particles or due to an external heat source; it swells volumetrically. This expansion breaks apart a majority of the chains of carbon granules that run randomly between the two conductive plates. This behavior results in a sharp increase in resistance across the two plates which all but eliminates current flow through the device, allowing just enough residual current flow to maintain the block's internal temperature at 125C. Once this "tripped" state current is cut off, the polymer brick cools and shrinks to its original size, thereby allowing its broken carbon chains to reestablish themselves and permit the part to return to its low resistance state. Once cooled to room ambient, the PTC will once again exhibit a resistance less than its "R1max" rating.
At currents below the device IHOLD rating, AND at temperatures below 100C, the PTC maintains a resistance value below its R1 MAX rating.
The catalog data for each device specifies a "Typical Power" value. This is the power required to exactly match the heat lost by the tripped device to its ambient surroundings at 23C. By Ohm's Law, power can be stated as: $W = E^2/R$. Thus the approximate resistance of a "Tripped" PTC can be determined by: $R = E^2/W$, where "E" is the voltage appearing across the PTC (usually the supply's open circuit voltage), and "W" is the Typical Power value for the particular PTC.
Since the PPTC acts to maintain a constant internal temperature, its apparent resistance will change based upon applied voltage and, to a lesser degree, ambient conditions. Consider the following example....
A PTC with a Typical Power of 1 watt protecting a circuit using a 60V supply will demonstrate an apparent, tripped resistance "R" of:
$R = 60^2/1 = 3{,}600$ ohms
This same tripped device when used to protect a 12V circuit would now present an apparent resistance of:
$R = 12^2/1 = 144$ ohms
The value for Typical Power is "typical" because any physical factors that affect heat loss (such as ambient temperature or air convection) will somewhat alter the level of power that the PTC needs to maintain its internal temperature. In short, PTCs do not exhibit a constant, quantifiable tripped resistance value.

## Average Time Current Characteristic Curve at 23°C




The Average Time Current Characteristic Curve and Temperature Rerating Curve are affected by a number of variables and these curves are provided for guidance only.



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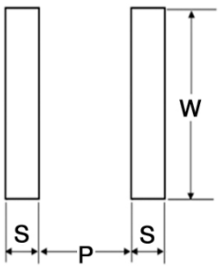
## Pad Layout

The dimensions in the table below provide the recommended pad layout.

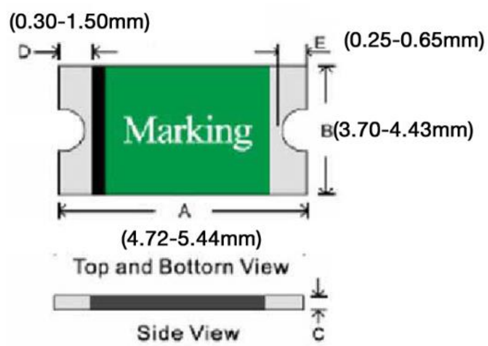



| P | | S | | W | |
|---|---|---|---|---|---|
| Nominal | | Nominal | | Nominal | |
| mm | Inch | mm | Inch | mm | Inch |
| 3.40 | 0.133 | 1.50 | 0.059 | 4.60 | 0.181 |

## Termination Pad Materials

Matte Tin – Plated Copper

## Mechanical Dimensions and Marking



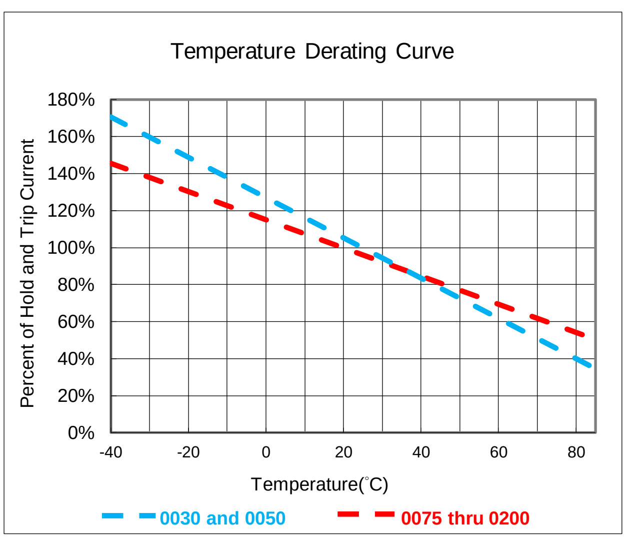

All dimensions in mm.

| Part Number | Dimensions | | Marking Code | |
|---|---|---|---|---|
| | C | | "b", IH code | |
| | Min | Max | b xxxx | b xxx xx |
| 0ZCN0030FF2C | 0.40 | 1.15 | 0030 | |
| 0ZCN0055FF2A | 0.40 | 1.70 | 0055 | |
| 0ZCN0075FF2A | 0.40 | 1.70 | 0075 | |
| 0ZCN0110FF2C | 0.30 | 0.70 | 0110 | |
| 0ZCN0110AF2C | 0.30 | 0.70 | | 110<br>33 |
| 0ZCN0150FF2C | 0.25 | 0.65 | 0150 | |
| 0ZCN0200FF2C | 0.25 | 0.65 | 0200 | |

## Temperature Derating Table

| | Temperature Derating | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **I Hold Value** | **-40** | **-20** | **0** | **23** | **30** | **40** | **50** | **60** | **70** | **85** |
| 0030 and 0050 | 167% | 150% | 133% | 100% | 93% | 83% | 73% | 63% | 51% | 33% |
| 0075 thru 0200 | 143% | 129% | 116% | 100% | 94% | 86% | 77% | 69% | 61% | 48% |

## Thermal Derating Curve




**Cautionary Notes**

1. Operation beyond the specified maximum ratings or improper use may result in damage and possible electrical arcing and/or flame.
2. These Polymer PTC (PPTC) devices are intended for protection against occasional overcurrent/overtemperature fault conditions and may not be suitable for use in applications where repeated and/or prolonged fault conditions are anticipated.
3. Avoid contact of PTC device with chemical solvent. Prolonged contact may adversely impact the PTC performance.
4. These PTC devices may not be suitable for use in circuits with a large inductance, as the PTC trip can generate circuit voltage spikes above the PTC rated voltage.
5. These devices may be used in both DC and AC circuits provided that peak-to-peak line voltage when carrying AC does not exceed the PTC's Vmax rating. As PTCs are essentially thermal devices, the RMS value of AC current carried by a PTC will produce tripping parameters and times-to-trip similar to those of a DC voltage of the same magnitude.
6. If potting is mandated, avoid rigid potting compounds as they will encase the PTC and prevent it from volumetrically expanding to properly respond to a trip event.
7. MSL: 2a (According to IPC J-Std-020).



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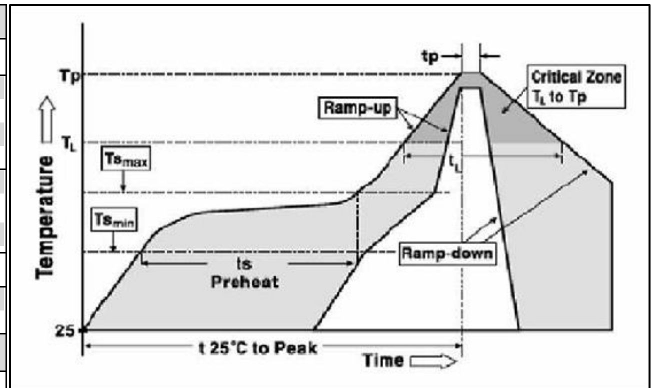
## Environmental Specifications

| | |
|---|---|
| Temperature cycling | JESD22 Method JA-104 |
| Biased humidity | MIL-STD-202 Method 103 |
| Operational life | MIL-STD-202 Method 108 |
| Resistance to solvents | MIL-STD-202 Method 215 |
| Mechanical shock | MIL-STD-202 Method 213 |
| Vibration | MIL-STD-202 Method 204 |
| Resistance to soldering heat | MIL-STD-202 Method 210 |
| Thermal shock | MIL-STD-202 Method 107 |
| Solderability | ANSI/J-STD-002 |
| Board flex(SMD) | AEC-Q200-005 |
| Terminal strength | AEC-Q200-006 |

## Solder Reflow and Rework Recommendations

| Profile Feature | Pb-Free Assembly |
|---|---|
| Average Ramp-Up Rate (Tsmax to Tp) | 3°C/second max |
| Preheat : | |
| Temperature Min (Tsmin) | 150°C |
| Temperature Max (Tsmax) | 200°C |
| Time (tsmin to tsmax) | 60-180 seconds |
| Time maintained above: | |
| Temperature(TL) | 217°C |
| Time (tL) | 60-150 seconds |
| Peak/Classification Temperature(Tp) : | 260°C |
| Time within 5°C of actual Peak : | |
| Temperature (tp) | 20-40 seconds |
| Ramp-Down Rate : | 6°C/second max. |
| Time 25°C to Peak Temperature : | 8 minutes max |




### Solder Reflow

Due to "lead free / RoHS Compliant " construction of these PTC devices , the required Temperature and Dwell Time in the " Soldering " zone of the reflow profile are greater than those used for non-RoHS devices.

1. Recommended reflow methods; IR, vapor phase oven, hot air oven.
2. Not Recommended For Wave Solder / Direct Immersion.
3. Recommended paste thickness range – 0.20 – 0.25mm.
4. Devices are compatible with standard industry cleaning solvents and methods.
5. MSL: 2a (According to IPC J-Std-020).

### Caution

If reflow temperature / dwell times exceed the recommended profile, the electrical performance of the PTC may be affected.

Rework: MIL-STD-202G Method 210F, Test Condition A.

## Standard Packaging

| Part Number | Tape/Reel Qty |
|---|---|
| 0ZCN0030FF2C | 2,000 |
| 0ZCN0055FF2A | 1,000 |
| 0ZCN0075FF2A | 1,000 |
| 0ZCN0110FF2C Thru 0ZCN0200FF2C | 2,000 |

2000 or 1000 fuses in 7 inches dia. Reel, 8mm wide tape, 4mm pitch, per EIA-481(equivalent IEC-286 part 3).

## P/N Explanation and Ordering Information

0ZCN 0XXX X X XX

PTC series
0ZCN,2016 Size

I HOLD Rating
Refer to Part Number and IH Rating in Electrical Characteristics Table on P.1.

Electrical Characteristics
F = Standard Design
A to Z (except F) = Special, customer spec, DCR sort, etc.

Mechanical Features
F = Standard Design
A to Z (except F) = Special, customer spec, lead forming, etc.

Tape & Reel Qty
See standard packaging



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