PolyZen Device Helps Protect Portable Electronics from Charger-Induced Failure

The widespread availability of external and universal power supplies has made charger-induced system failure a leading cause of device warranty returns. Designing in additional safeguards to help prevent damage that may be caused by the use of unauthorized charging systems is complicated by the fact that the solution itself must accommodate smaller electronic packages.

The most cost-effective way to implement a power bus for portable electronics is with a standard DC barrel jack. However, because this connector is so commonly used, the user may accidentally connect the incorrect power supply to electronic equipment at home or while traveling. Faults may also occur when using commercially available universal power supplies that come with a variety of connectors. These devices allow the user to dial in the voltage to levels as high as 24V, as well as switch polarity.

Transient protection is especially critical when designing peripherals that may be powered off computer buses and automotive power buses. Automotive power buses are notoriously dirty. Although they are nominally 12V, they can range in normal operation from 8V to 16V. Still, battery currents can exceed 100 Amps and be stopped instantly via a relay or fuse, generating large inductive spikes on the bus and increasing voltage by five times or more.

Although typical computer power supplies provide regulated lines at 5V +/-5%, and 12V +/-5%, under certain circumstances the voltage at these lines may exceed 5.25V and 12.6V, causing damage to the system or unprotected peripherals. Voltage spikes can occur when there is inductance in the power bus and a rapid change in current occurs. This change can result from a hot disconnect of a peripheral, an internal system shutdown, or other internal power fluctuations.

Under the new USB 3.0 specification, high-powered devices will be able to source up 0.9A of current, and new types of powering devices, such as Powered-B connector devices, may provide up to 1A, as opposed to 0.5A in the USB 2.0 specification. These higher current applications require more reliable and robust circuit protection to help prevent damage caused by overvoltage transients and overcurrent conditions.

PolyZen devices are designed to help lock out inappropriate power supplies. The device is particularly effective at clamping and smoothing inductive voltage spikes. In response to an inductive spike, the device's Zener diode element shunts current to ground until the voltage is reduced to the normal operating range. In the case of a wrong-voltage power supply, the device clamps the voltage, shunts excess power to ground, and eventually locks out the wrong supply.

The relatively flat voltage vs. current response of the PolyZen device helps clamp the output voltage, even when input voltage and source currents vary. It helps provide coordinated protection with a component that protects like a Zener diode, but is capable of withstanding very-high-power fault conditions – without requiring any special heat-sinking structures beyond normal PCB traces.

PolyZen Device Helps Protect Portable Electronics from Charger-Induced Failure

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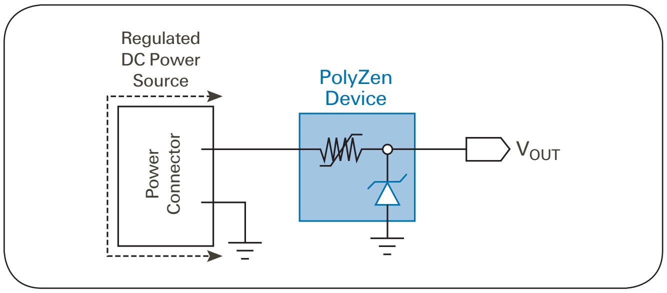
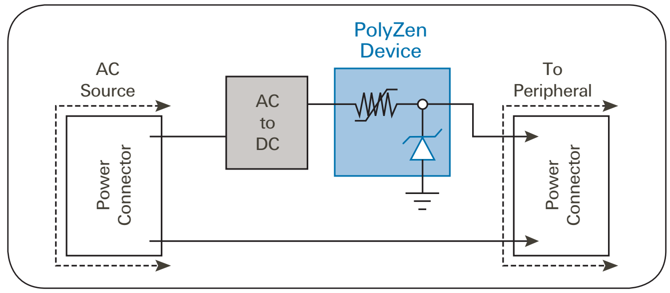
Typical Circuit— "On Board" Protection



Power Conditioning (AC to DC converter output)



Electrical Characteristics (Performance ratings @ 25°C unless otherwise specified)

Part Number	V_Z(V) Min	V_Z(V) Typ	V_Z(V) Max	I_{Zt} (A)	I_{HOLD} @ 20°C (A)	R_{Typ} (Ω)	R_{1MAX} (Ω)	$V_{INT\ MAX}$: $V_{INT\ MAX}$ (V)	$V_{INT\ MAX}$: Test Current (A)	$I_{FLT\ MAX}$: $I_{FLT\ MAX}$ (A)	$I_{FLT\ MAX}$: Test Voltage (V)
ZEN056V130A24LS	5.45	5.60	5.75	0.10	1.30	0.12	0.16	24	3	+10/-40	+24/-16
ZEN059V130A24LS†	5.80	5.90	6.00	0.10	1.30	0.12	0.15	24	3	+6/-40	+24/-16
ZEN065V130A24LS	6.35	6.50	6.65	0.10	1.30	0.12	0.16	24	3	+6/-40	+24/-16
ZEN098V130A24LS	9.60	9.80	10.00	0.10	1.30	0.12	0.16	24	3	+3.5/-40	+24/-16
ZEN132V130A24LS	13.20	13.40	13.60	0.10	1.30	0.12	0.16	24	3	+2/-40	+24/-16
ZEN164V130A24LS	16.10	16.40	16.60	0.10	1.30	0.12	0.16	24	3	+1.25/-40	+24/-16
ZEN056V230A16LS	5.45	5.60	5.75	0.10	2.30	0.04	0.06	16	5	+5/-40	+16/-12
ZEN065V230A16LS	6.35	6.50	6.65	0.10	2.30	0.04	0.06	16	5	+3.5/-40	+16/-12
ZEN098V230A16LS	9.60	9.80	10.00	0.10	2.30	0.04	0.06	16	5	+3.5/-40	+16/-12
ZEN132V230A16LS	13.20	13.40	13.60	0.10	2.30	0.04	0.06	16	5	+2/-40	+20/-12
ZEN056V075A48LS	5.45	5.60	5.75	0.10	0.75	0.28	0.45	48	3	+10/-40	+48/-16
ZEN132V075A48LS	13.20	13.40	13.60	0.10	0.75	0.28	0.45	48	3	+2/-40	+48/-16
ZEN056V115A24LS	5.45	5.60	5.75	0.10	1.15	0.15	0.18	24	3	+10/-40	+24/-16
NEW ZEN056V130A16YM	5.35	5.60	5.85	0.10	1.30	0.110	0.160	14	3	+3/-40	+16/-12
NEW ZEN056V175A12YM	5.35	5.60	5.85	0.10	1.75	0.050	0.095	12	4	+3/-40	+12/-12
NEW ZEN132V130A16YM	13.20	13.40	13.80	0.10	1.30	0.110	0.160	14	3	+1/-40	+20/-12
NEW ZEN132V175A12YM	13.20	13.40	13.80	0.10	1.75	0.050	0.095	12	4	+1/-40	+20/-12
NEW ZEN056V130A24YC	5.35	5.60	5.85	0.10	1.30	0.110	0.170	24	3	+4/-40	+24/-16
NEW ZEN056V230A16YC	5.35	5.60	5.85	0.10	2.30	0.040	0.070	16	5	+3/-40	+16/-12
NEW ZEN056V260A16YC	5.35	5.60	5.85	0.10	2.60	0.040	0.055	16	5	+3/-40	+16/-12
NEW ZEN132V130A24YC	13.20	13.40	13.80	0.10	1.30	0.110	0.170	24	3	+1/-40	+24/-16
NEW ZEN132V230A16YC	13.20	13.40	13.80	0.10	2.30	0.040	0.070	16	5	+1/-40	+20/-12
NEW ZEN132V260A16YC	13.20	13.40	13.80	0.10	2.60	0.040	0.055	16	5	+1/-40	+20/-12

LS module height is 1.7mm typical. YM module height is 1.2mm typical. YC module height is 1.3mm typical.

† Typical operating current is 500µA @ 5.0V which meets USB suspend mode requirement.

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Typical Performance Curves

Figure PZ2

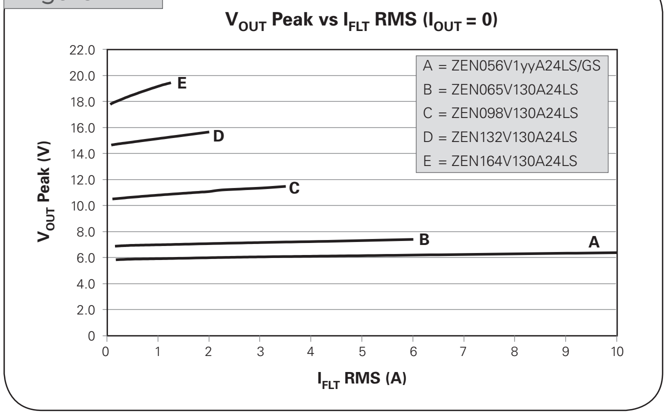


Figure PZ3

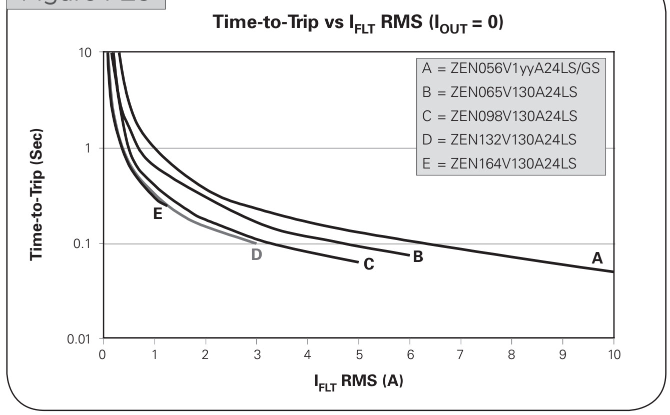


Figure PZ4

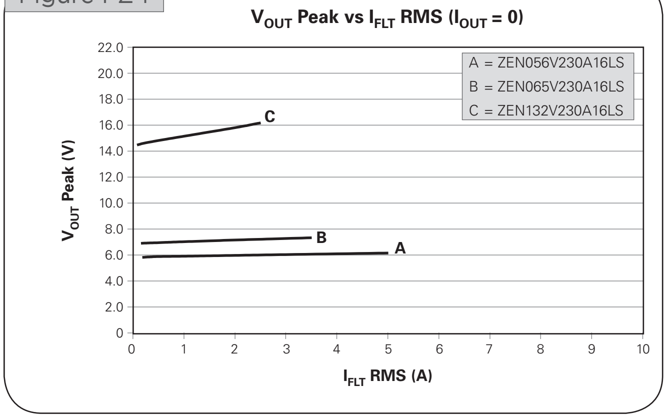


Figure PZ5

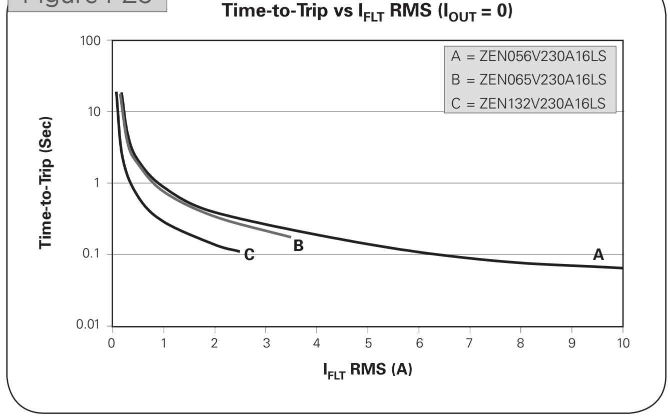


Figure PZ6

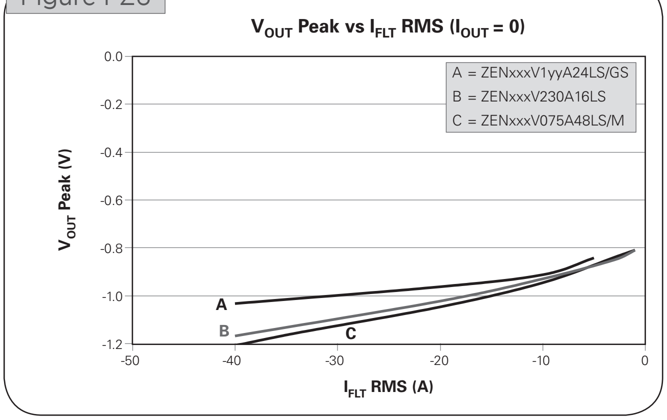
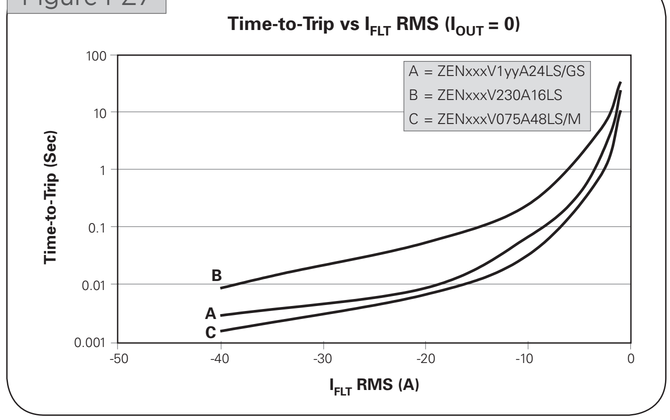


Figure PZ7



PolyZen Device Helps Protect Portable Electronics from Charger-Induced Failure

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Typical Performance Curves

Figure PZ8

Temperature Effect on I_{HOLD} (I_{FLT} = 0)

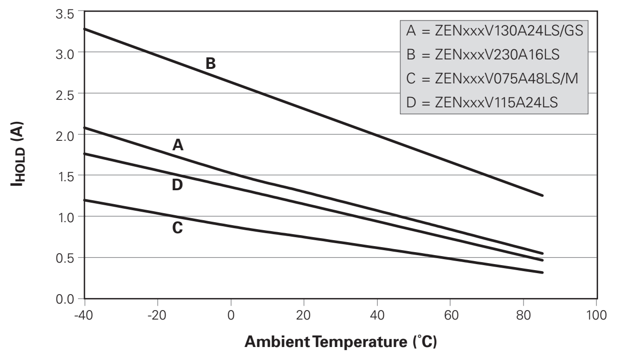


Figure PZ9

Time-to-Trip vs I_{PTC} RMS (I_{FLT} = 0)

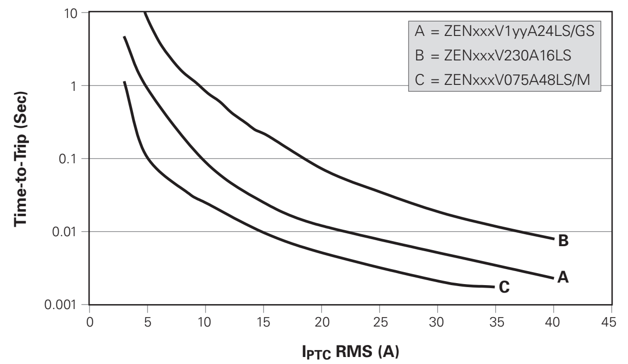


Figure PZ10

V_{OUT} Peak vs. I_{FLT} RMS (I_{OUT} = 0)

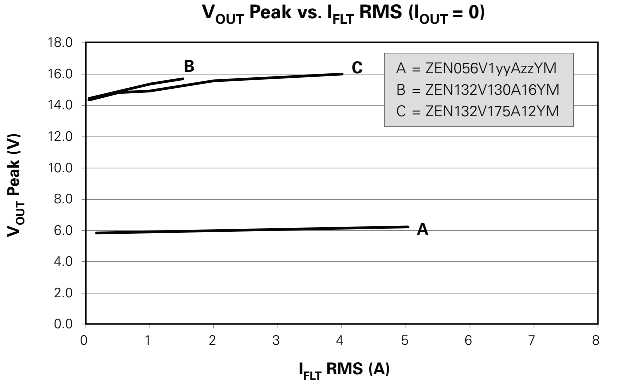


Figure PZ11

Time-to-Trip vs. I_{FLT} RMS (I_{OUT} = 0)

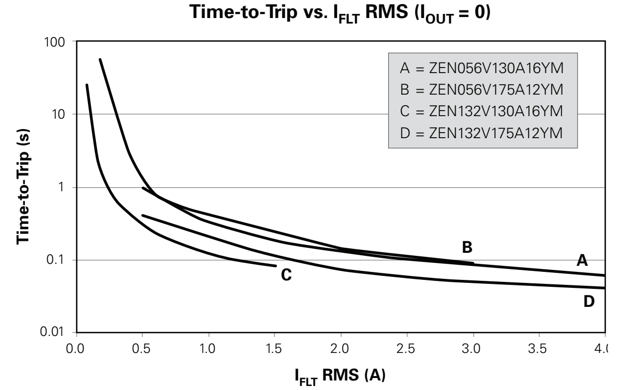


Figure PZ12

V_{OUT} Peak vs. I_{FLT} RMS (I_{OUT} = 0)

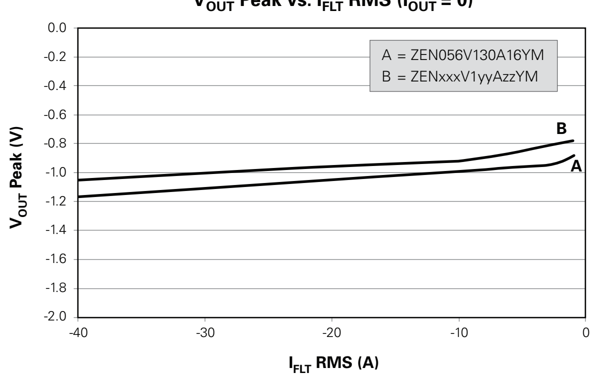
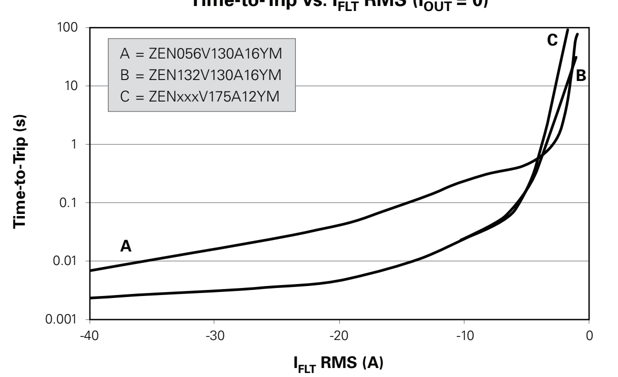


Figure PZ13

Time-to-Trip vs. I_{FLT} RMS (I_{OUT} = 0)



PolyZen Device Helps Protect Portable Electronics from Charger-Induced Failure

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Typical Performance Curves

Figure PZ14

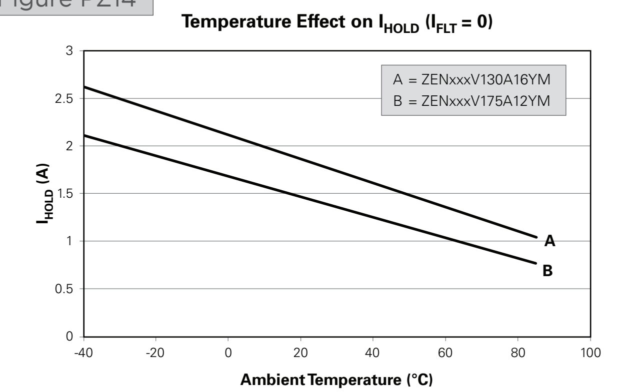


Figure PZ15

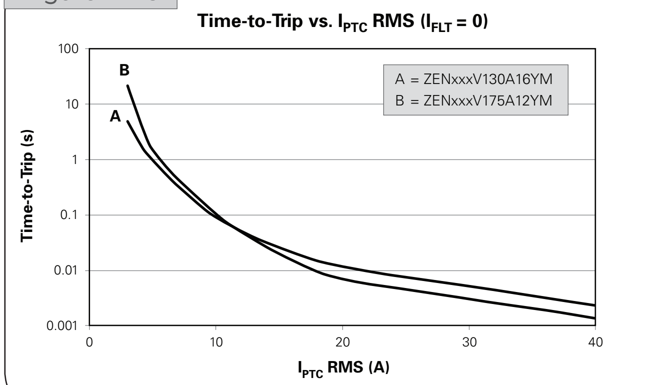


Figure PZ16

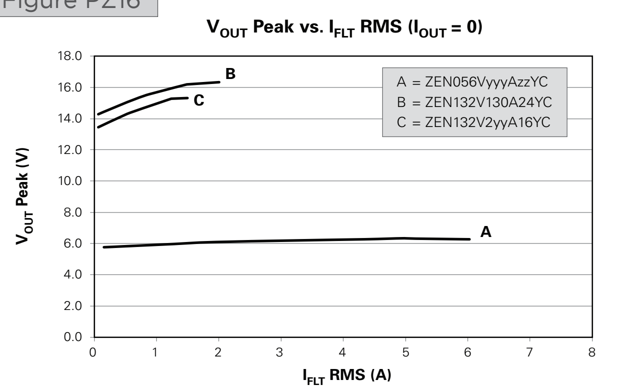


Figure PZ17

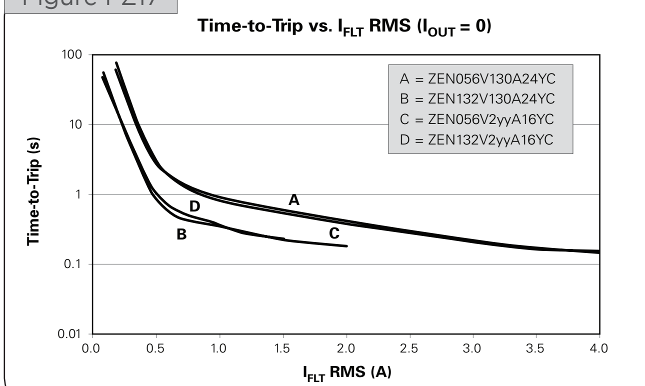


Figure PZ18

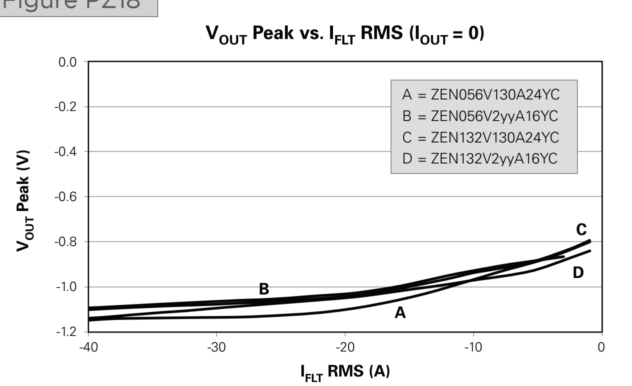
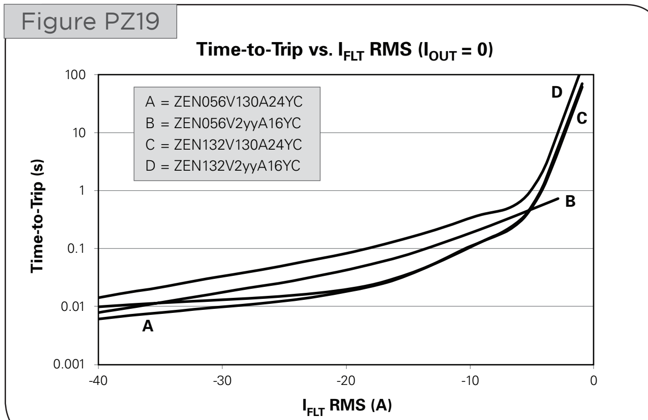


Figure PZ19



PolyZen Device Helps Protect Portable Electronics from Charger-Induced Failure

Typical Performance Curves

Figure PZ20

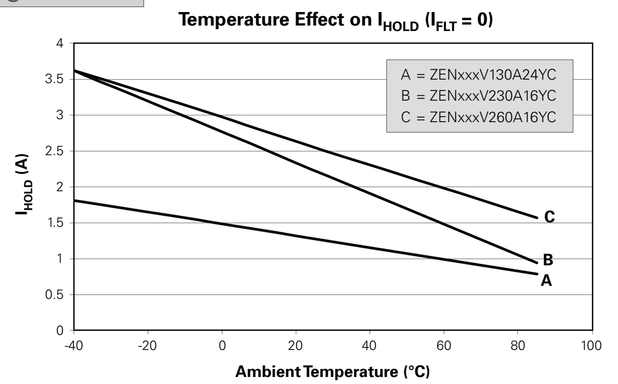
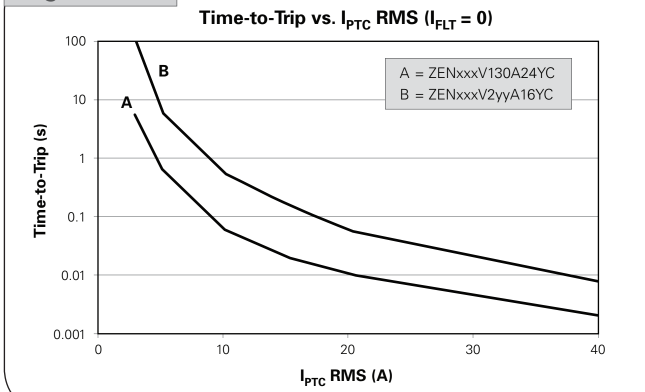
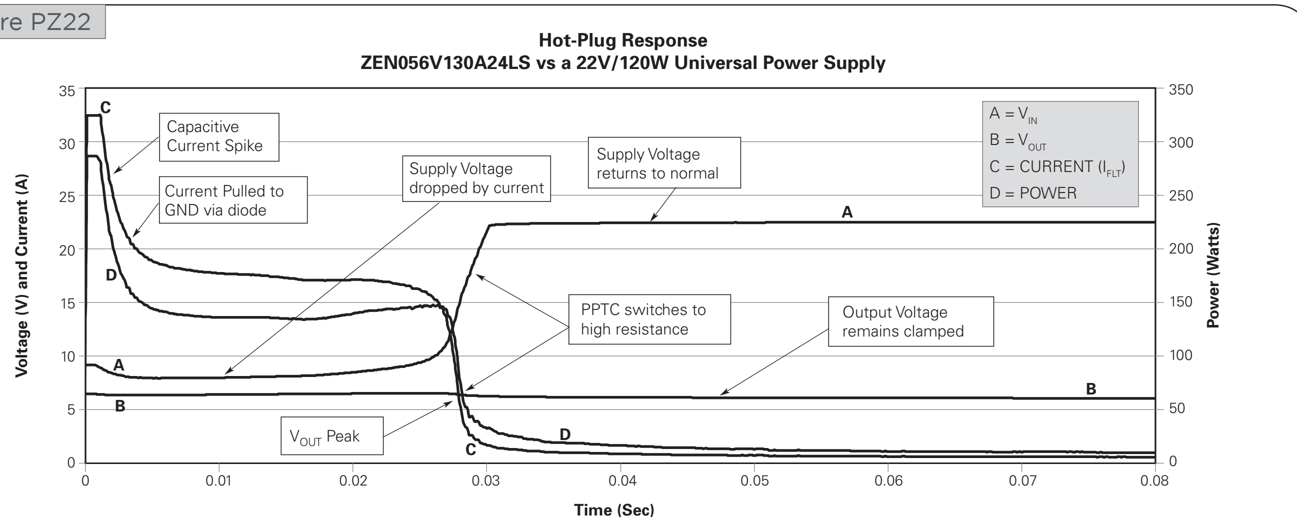


Figure PZ21



Basic Operation Examples

Figure PZ22



PolyZen Device Helps Protect Portable Electronics from Charger-Induced Failure

Expertise Applied | Answers Delivered

Basic Operation Examples

Figure PZ23

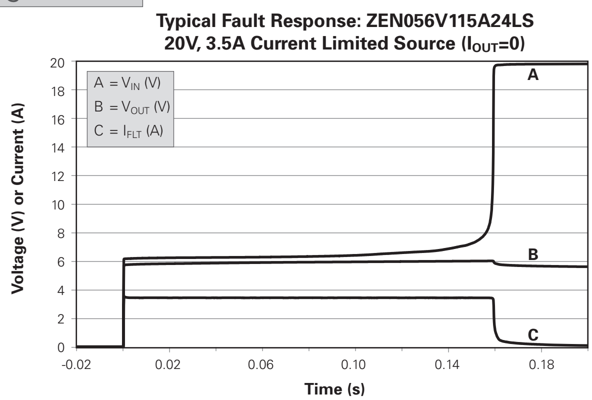


Figure PZ24

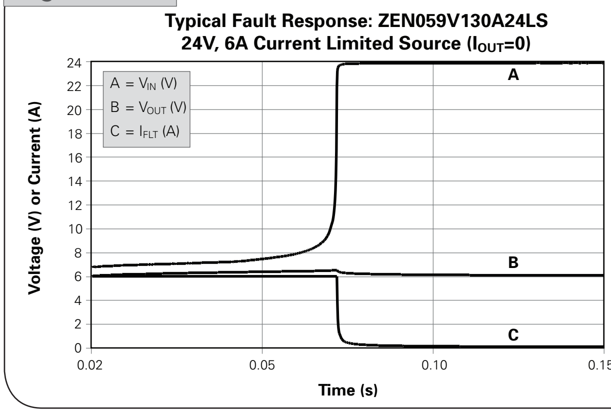


Figure PZ25

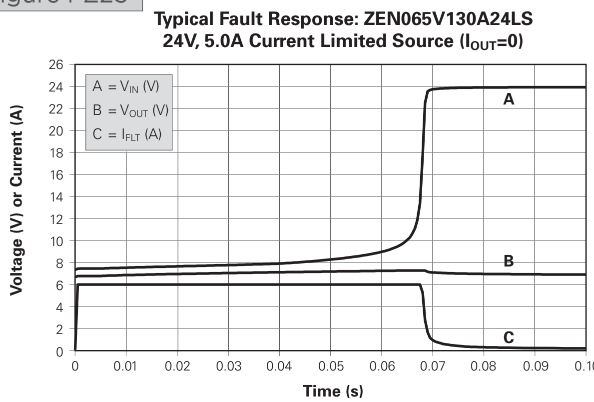


Figure PZ26

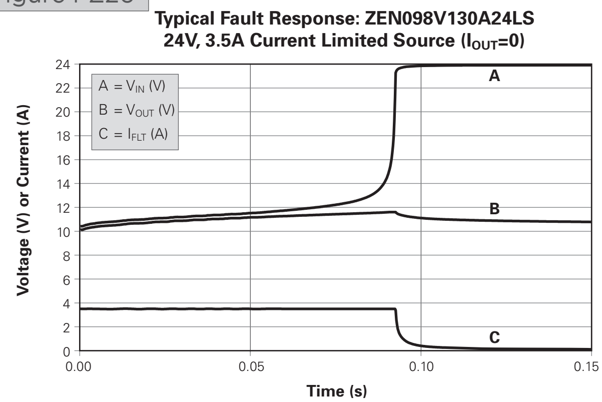


Figure PZ27

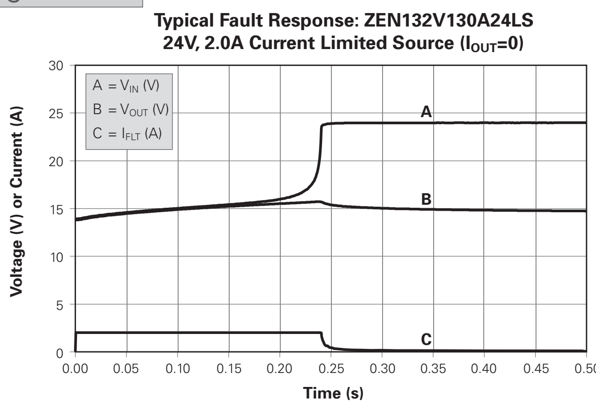
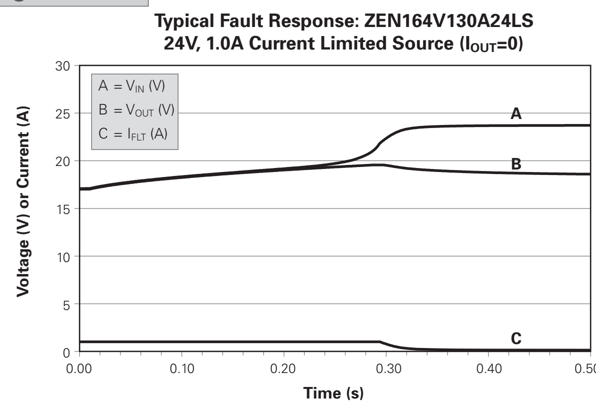


Figure PZ28



PolyZen Device Helps Protect Portable Electronics from Charger-Induced Failure

Basic Operation Examples

Figure PZ29

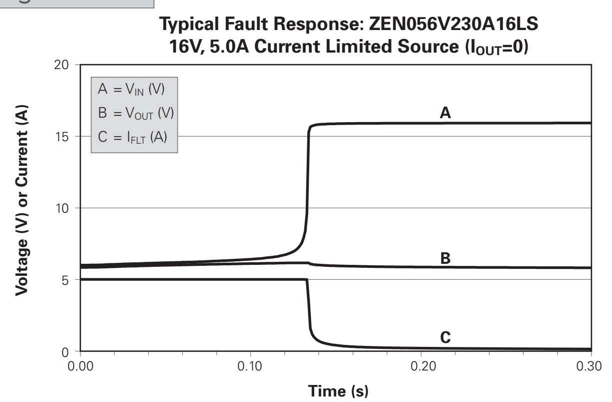
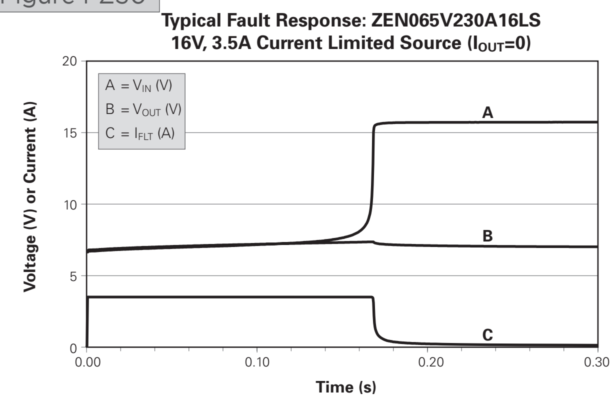


Figure PZ30



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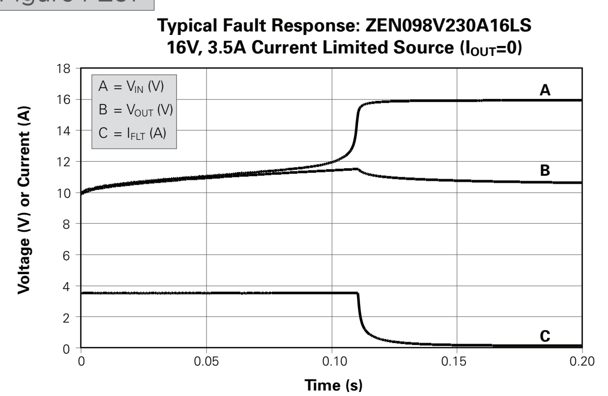

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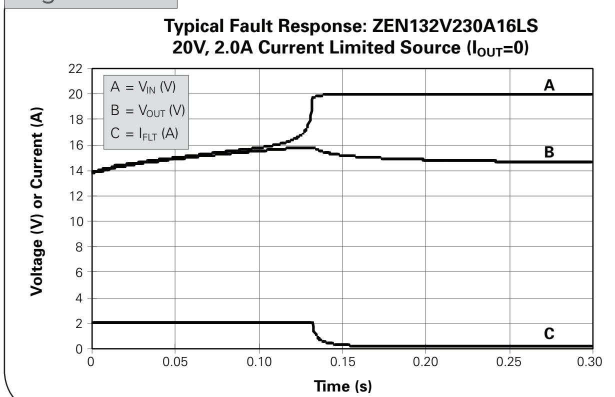

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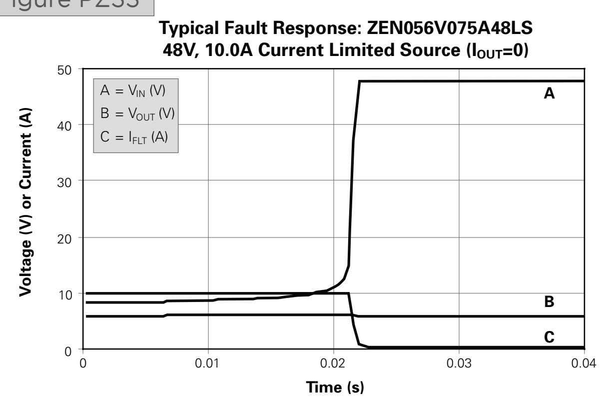
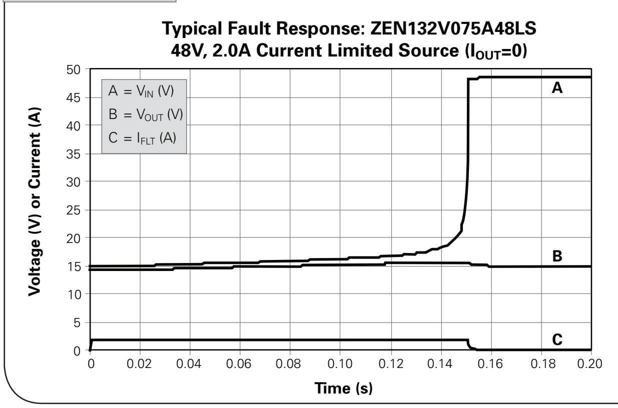


Figure PZ34



PolyZen Device Helps Protect Portable Electronics from Charger-Induced Failure

Expertise Applied | Answers Delivered

Basic Operation Examples

Figure PZ35

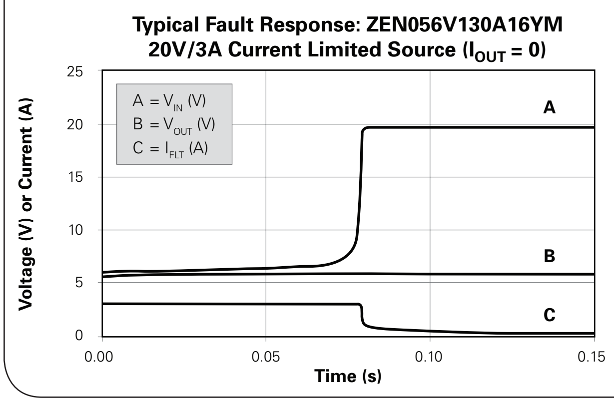


Figure PZ36

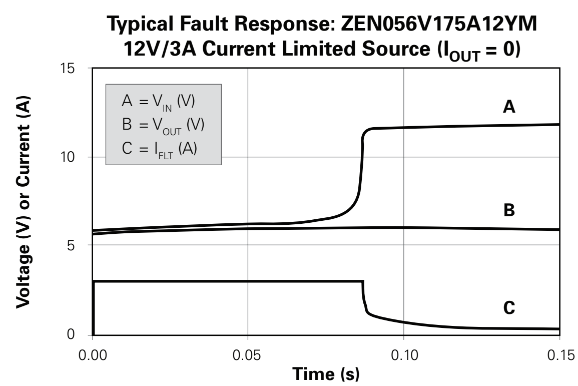


Figure PZ37

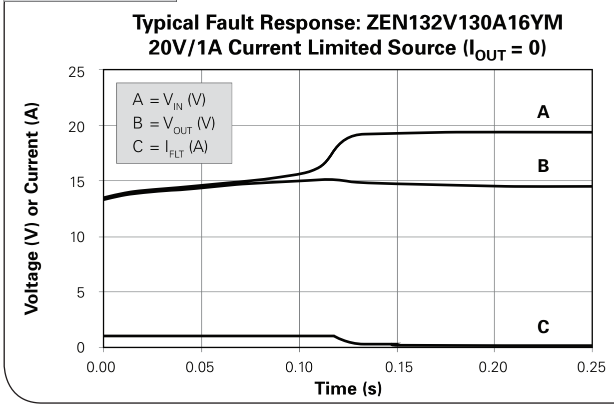


Figure PZ38

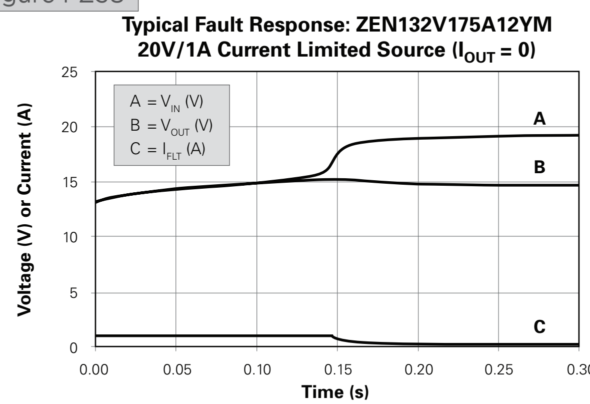


Figure PZ39

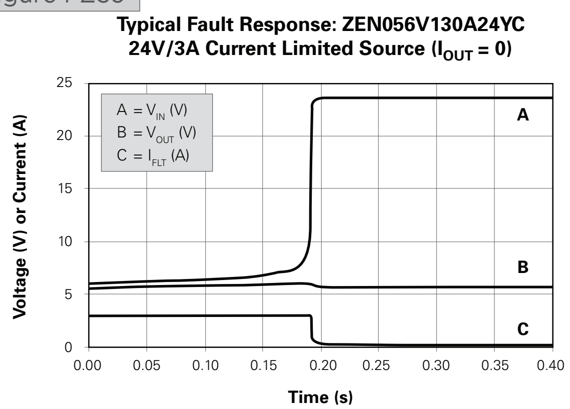
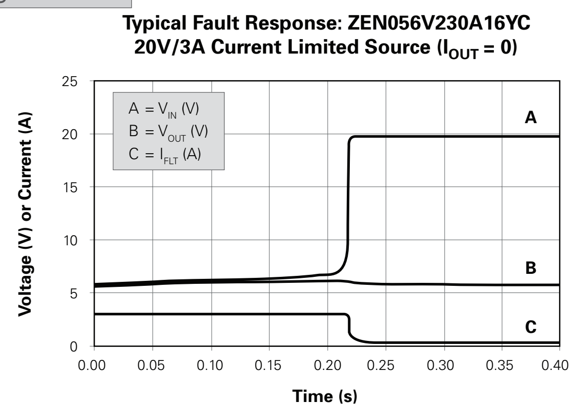


Figure PZ40

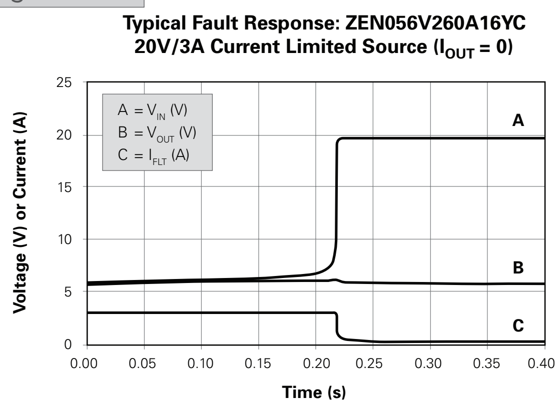


PolyZen Device Helps Protect Portable Electronics from Charger-Induced Failure

Expertise Applied | Answers Delivered

Basic Operation Examples

Figure PZ41



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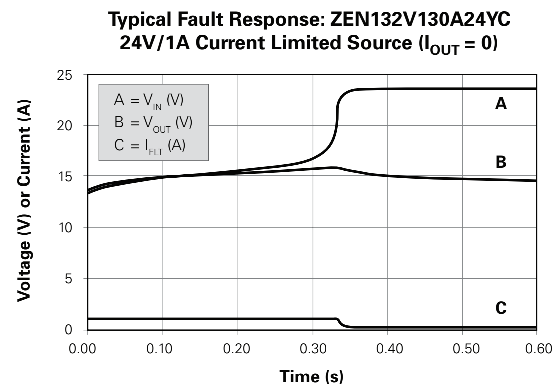


Figure PZ43

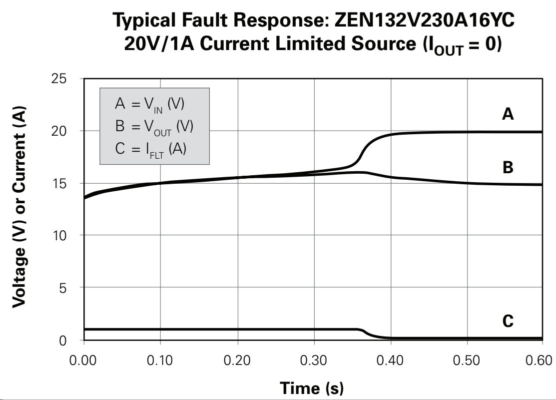
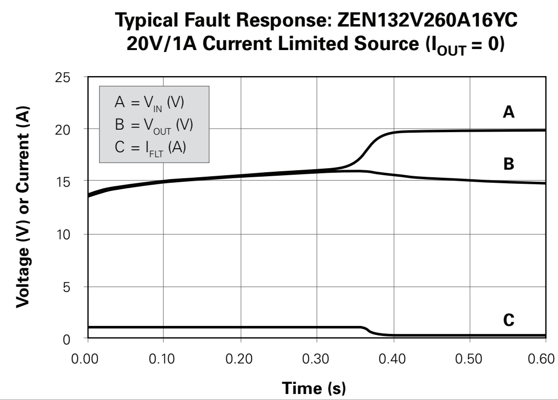


Figure PZ44



Littelfuse
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PolyZen Device Helps Protect Portable Electronics from Charger-Induced Failure

Benefits

- Helps shield downstream electronics from overvoltage and reverse bias
- Trip events shut out overvoltage and reverse bias sources
- Analog nature of trip events minimize upstream inductive spikes
- Helps reduce design costs with single component placement and minimal heat sinking requirements

Applications

- Cell phones
- PDAs
- Personal Navigation Devices
- MP3 players
- DVD players
- Digital cameras
- USB hubs
- Printers
- Scanners
- Hard Disk Drives
- Desk phones
- PBX phones

Features

- Hold currents up to 2.6A
- Power handling on the order of 30 watts
- Stable Vz vs. fault current
- Time delayed, overvoltage trip
- Time delayed, reverse-bias trip
- Power handling on the order of 100 watts
- Integrated device construction
- RoHS compliant

Summary

The PolyZen device's unique ability to withstand high inrush currents make it suitable to help protect portable electronics and other lowpower DC devices such as cell phones, PDAs, MP3 players, digital cameras and USB hubs. Transient protection is particularly important for peripherals that can be powered off computer buses and automotive power buses. PolyZen devices are designed to help lock out inappropriate power supplies and are especially effective at clamping and smoothing inductive voltage spikes.