

60V DUAL N-CHANNEL SELF PROTECTED ENHANCEMENT MODE INTELLIFET® MOSFET

Product Summary

| | |
|--|-------|
| • Continuous drain source voltage | 60V |
| • On-state resistance | 100mΩ |
| • Nominal load current ($V_{IN} = 5V$) | 2.8A |
| • Clamping Energy | 210mJ |

Description and Applications

The ZXMS6006DT8 is a dual self protected low side MOSFET with logic level input. It integrates over-temperature, over-current, over-voltage (active clamp) and ESD protected logic level functionality. The ZXMS6006DT8 is ideal as a general purpose switch driven from 3.3V or 5V microcontrollers in harsh environments where standard MOSFETs are not rugged enough.

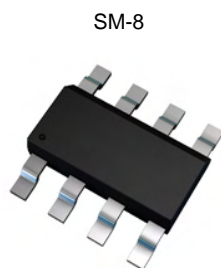
- Lamp Driver
- Motor Driver
- Relay Driver
- Solenoid Driver

Features and Benefits

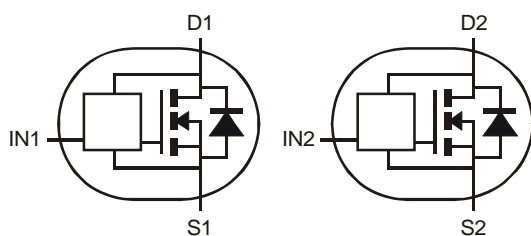
- Compact high power dissipation package
- Low input current
- Logic Level Input (3.3V and 5V)
- Short circuit protection with auto restart
- Over voltage protection (active clamp)
- Thermal shutdown with auto restart
- Over-current protection
- Input Protection (ESD)
- High continuous current rating
- **Green, RoHS Compliant (Note 1)**
- **Halogen and Antimony Free. (Note 2)**
- **Qualified to AEC-Q101 Standards for High Reliability**

Mechanical Data

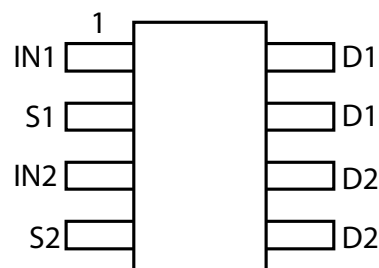
- Case: SM-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish
- Weight: 0.117 grams (approximate)



Top View



Device symbol



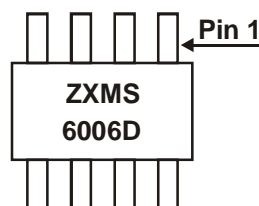
Top view
Pin-Out

Ordering Information (Note 3)

| Product | Marking | Reel size (inches) | Tape width (mm) | Quantity per reel |
|---------------|-----------|--------------------|-----------------|-------------------|
| ZXMS6006DT8TA | ZXMS6006D | 7 | 12 | 1,000 |

- Notes:
1. Contain <900ppm bromine, chlorine (<1500ppm total) and <1000ppm antimony compounds.
 2. Diodes Inc's "Green" Policy can be found on our website at <http://www.diodes.com>
 3. For packaging details, go to our website at <http://www.diodes.com>

Marking Information



Top View

ZXMS6006D = Product Type Marking Code

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ZXMS6006DT8

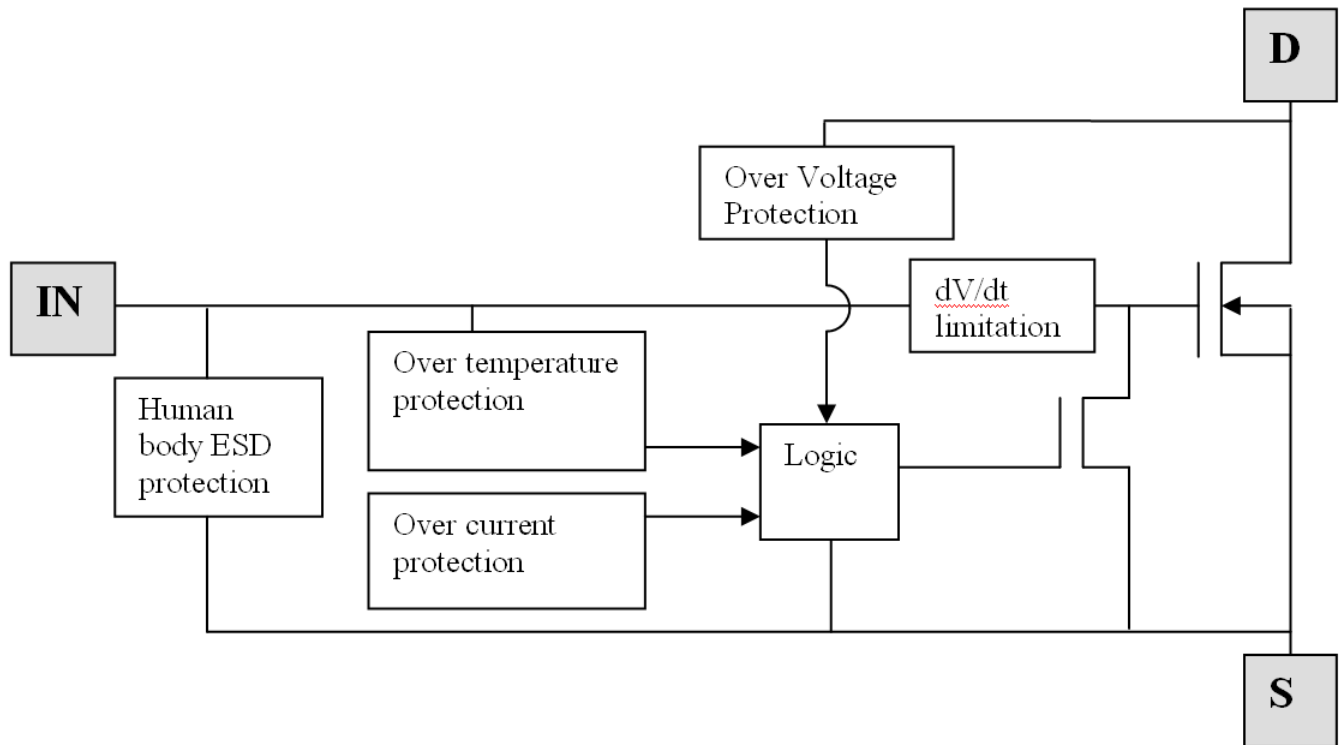
Document number: DS35143 Rev. 1 - 2

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Functional Block Diagram



Maximum Ratings @T_A = 25°C unless otherwise specified

| Characteristic | Symbol | Value | Units |
|---|---------------------|-----------------------|-------|
| Continuous Drain-Source Voltage | V _{DS} | 60 | V |
| Drain-Source Voltage For Short Circuit Protection | V _{DS(SC)} | 16 | V |
| Continuous Input Voltage | V _{IN} | -0.5 ... +6 | V |
| Continuous Input Current @ -0.2V ≤ V _{IN} ≤ 6V | I _{IN} | No limit | mA |
| Continuous Input Current @ V _{IN} < -0.2V or V _{IN} > 6V | | I _{IN} ≤ 2 | |
| Pulsed Drain Current @ V _{IN} = 3.3V (Note 6) | I _{DM} | 11 | A |
| Pulsed Drain Current @ V _{IN} = 5V (Note 6) | I _{DM} | 13 | A |
| Continuous Source Current (Body Diode) (Note 4) | I _S | 2 | A |
| Pulsed Source Current (Body Diode) | I _{SM} | 12 | A |
| Unclamped Single Pulse Inductive Energy, T _J = 25°C, I _D = 0.5A, V _{DD} = 24V | E _{AS} | 210 | mJ |
| Electrostatic Discharge (Human Body Model) | V _{ESD} | 4000 | V |
| Charged Device Model | V _{CDM} | 1000 | V |

Thermal Characteristics @T_A = 25°C unless otherwise specified

| Characteristic | Symbol | Value | Units |
|--|------------------|-------------|-------|
| Power Dissipation at T _A = 25°C (Notes 4 & 7) | P _D | 1.16 | W |
| Linear Derating Factor | | 9.28 | mW/°C |
| Power Dissipation at T _A = 25°C (Notes 4 & 8) | P _D | 1.67 | W |
| Linear Derating Factor | | 13.3 | mW/°C |
| Power Dissipation at T _A = 25°C (Notes 5 & 7) | P _D | 2.13 | W |
| Linear Derating Factor | | 17 | mW/°C |
| Thermal Resistance, Junction to Ambient (Notes 4 & 7) | R _{θJA} | 108 | °C/W |
| Thermal Resistance, Junction to Ambient (Notes 4 & 8) | R _{θJA} | 75 | °C/W |
| Thermal Resistance, Junction to Case (Notes 5 & 7) | R _{θJC} | 58.7 | °C/W |
| Thermal Resistance, Junction to Case (Note 9) | R _{θJC} | 26.5 | °C/W |
| Operating Temperature Range | T _J | -40 to +150 | °C |
| Storage Temperature Range | T _{STG} | -55 to +150 | °C |

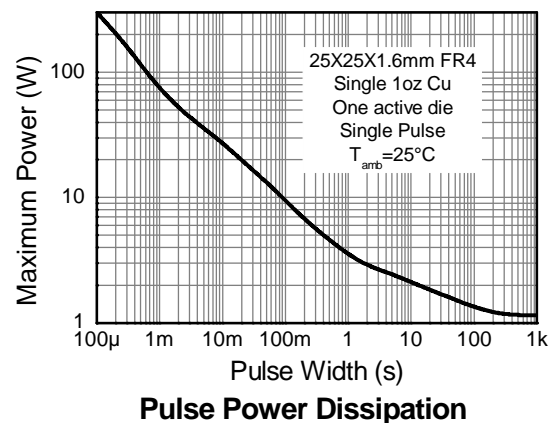
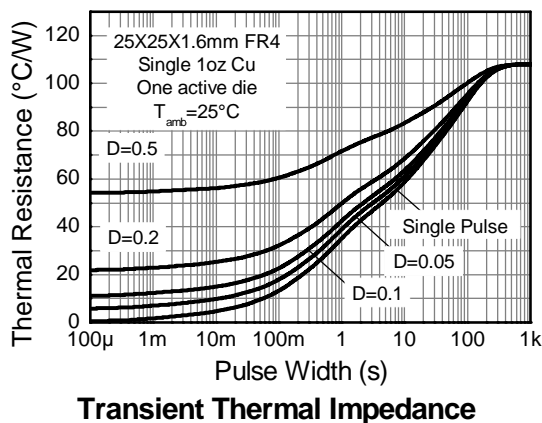
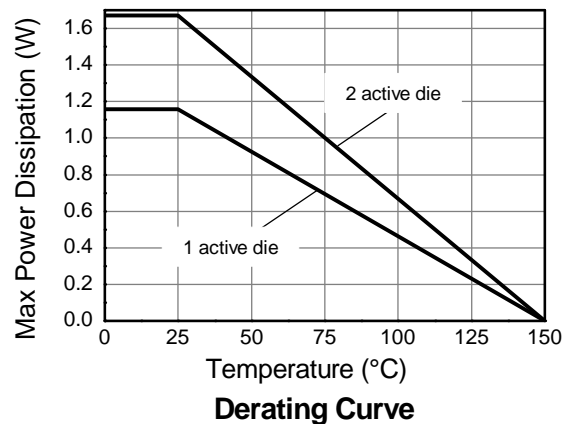
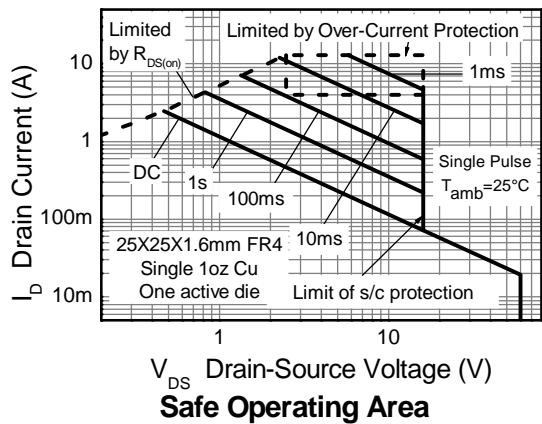
- Notes:
4. For a dual device surface mounted on a 25mm x 25mm single sided 1oz weight copper split down the middle on 1.6mm FR4 board, in still air conditions.
 5. For a dual device surface mounted on FR4 PCB measured at t_s ≤ 10sec
 6. Repetitive rating 25mm x 25mm FR4 PCB, D = 0.02, Pulse width = 300μs – pulse width limited by junction temperature. Refer to transient thermal impedance graph.
 7. For a dual device with one active die.
 8. For a dual device with 2 active die running at equal power.
 9. Thermal resistance from junction to the mounting surface of the drain pin.

Recommended Operating Conditions

The ZXMS6006DT8 is optimized for use with μC operating from 3.3V and 5V supplies.

| Characteristic | Symbol | Min | Max | Unit |
|---|-----------------|-----|-----|--------------------|
| Input Voltage Range | V_{IN} | 0 | 5.5 | V |
| Ambient Temperature Range | T_{A} | -40 | 125 | $^{\circ}\text{C}$ |
| High Level Input Voltage for MOSFET to be on | V_{IH} | 3 | 5.5 | V |
| Low Level Input Voltage for MOSFET to be off | V_{IL} | 0 | 0.7 | V |
| Peripheral Supply Voltage (voltage to which load is referred) | V_{P} | 0 | 16 | V |

Thermal Characteristics

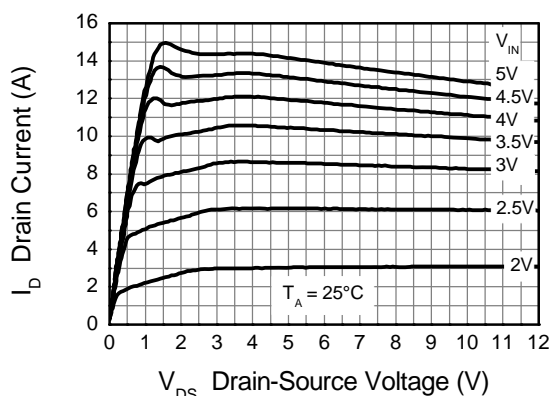


Electrical Characteristics @T_A = 25°C unless otherwise specified

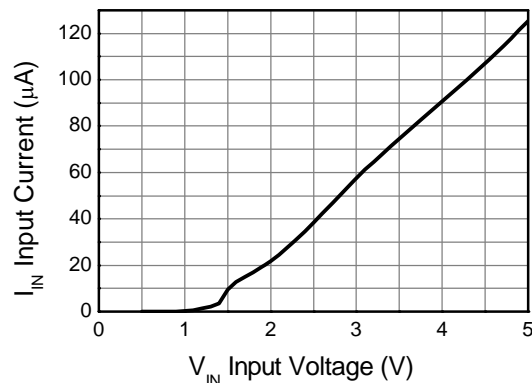
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---------------------|-----|-----|-----|------|--|
| Static Characteristics | | | | | | |
| Drain-Source Clamp Voltage | V _{DS(AZ)} | 60 | 65 | 70 | V | I _D = 10mA |
| Off State Drain Current | I _{DSS} | - | - | 1 | μA | V _{DS} = 12V, V _{IN} = 0V |
| | | - | - | 2 | | V _{DS} = 36V, V _{IN} = 0V |
| Input Threshold Voltage | V _{IN(th)} | 0.7 | 1 | 1.5 | V | V _{DS} = V _{GS} , I _D = 1mA |
| Input Current | I _{IN} | - | 60 | 100 | μA | V _{IN} = +3V |
| | | - | 120 | 200 | | V _{IN} = +5V |
| Input Current while Over Temperature Active | - | - | - | 400 | μA | V _{IN} = +5V |
| Static Drain-Source On-State Resistance | R _{DS(on)} | - | 85 | 125 | mΩ | V _{IN} = +3V, I _D = 1A |
| | | - | 75 | 100 | | V _{IN} = +5V, I _D = 1A |
| Continuous Drain Current (Notes 4 & 8) | I _D | 2.0 | - | - | A | V _{IN} = 3V; T _A = 25°C |
| | | 2.2 | - | - | | V _{IN} = 5V; T _A = 25°C |
| Continuous Drain Current (Notes 4 & 7) | | 2.6 | - | - | | V _{IN} = 3V; T _A = 25°C |
| | | 2.8 | - | - | | V _{IN} = 5V; T _A = 25°C |
| Current Limit (Note 10) | I _{D(LIM)} | 4 | 8 | - | A | V _{IN} = +3V |
| | | 6 | 13 | - | | V _{IN} = +5V |
| Dynamic Characteristics | | | | | | |
| Turn On Delay Time | t _{d(on)} | - | 8.6 | - | μs | V _{DD} = 12V, I _D = 1A, V _{GS} = 5V |
| Rise Time | t _r | - | 18 | - | μs | |
| Turn Off Delay Time | t _{d(off)} | - | 34 | - | μs | |
| Fall Time | t _f | - | 15 | - | μs | |
| Over-Temperature Protection | | | | | | |
| Thermal Overload Trip Temperature (Note 11) | T _{JT} | 150 | 175 | - | °C | - |
| Thermal Hysteresis (Note 11) | f _f | - | 10 | - | °C | - |

- Notes:
- The drain current is restricted only when the device is in saturation (see graph 'typical output characteristic'). This allows the device to be used in the fully on state without interference from the current limit. The device is fully protected at all drain currents, as the low power dissipation generated outside saturation makes current limit unnecessary.
 - Over-temperature protection is designed to prevent device destruction under fault conditions. Fault conditions are considered as "outside" normal operating range, so this part is not designed to withstand over-temperature for extended periods..

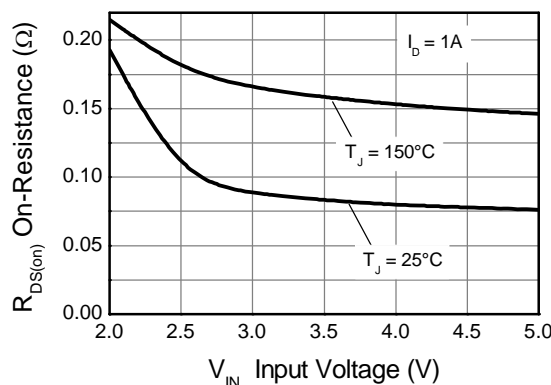
Typical Characteristics



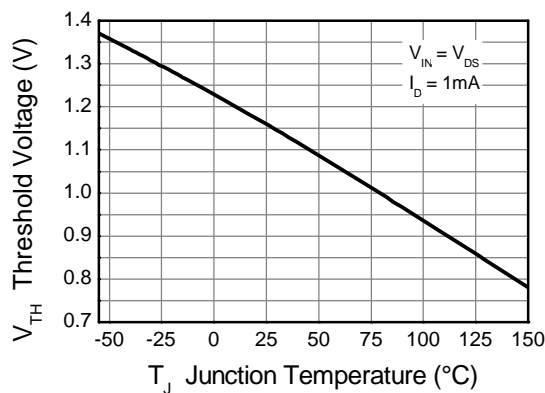
Typical Output Characteristic



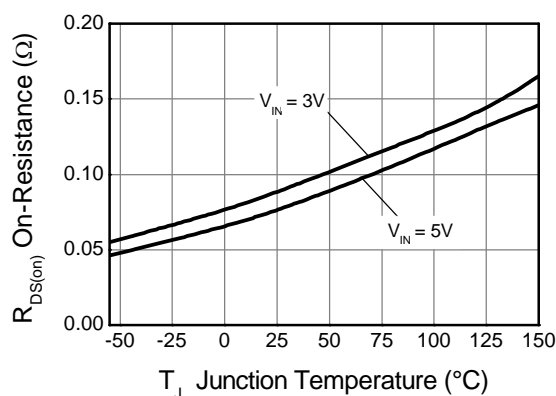
Input Current vs Input Voltage



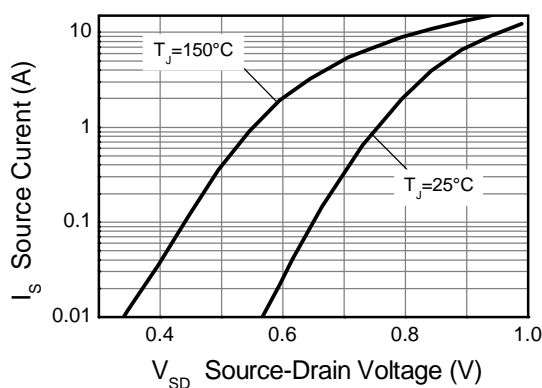
On-Resistance vs Input Voltage



Threshold Voltage vs Temperature

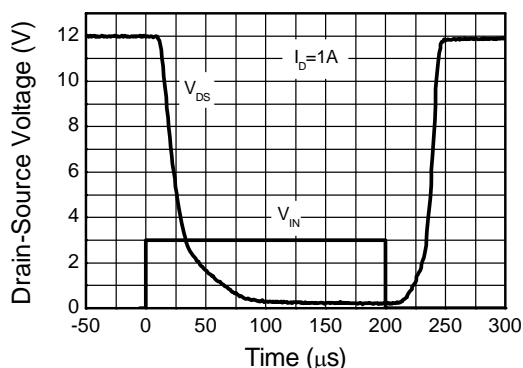


On-Resistance vs Temperature

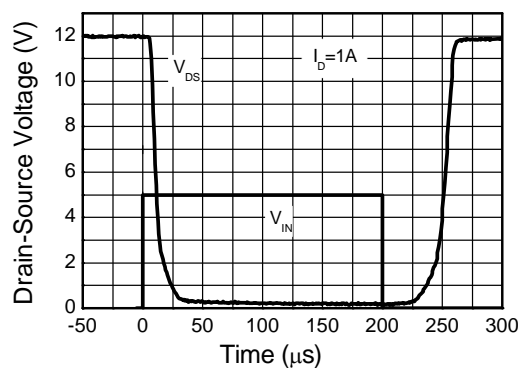


Reverse Diode Characteristic

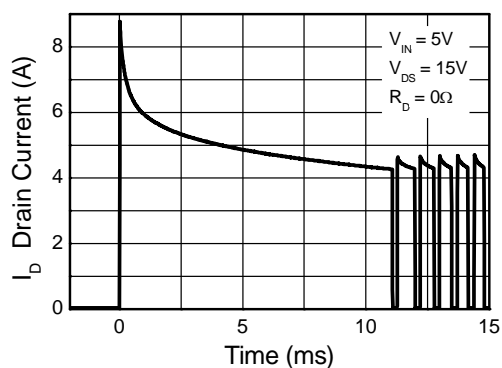
Typical Characteristics - Continued



Switching Speed

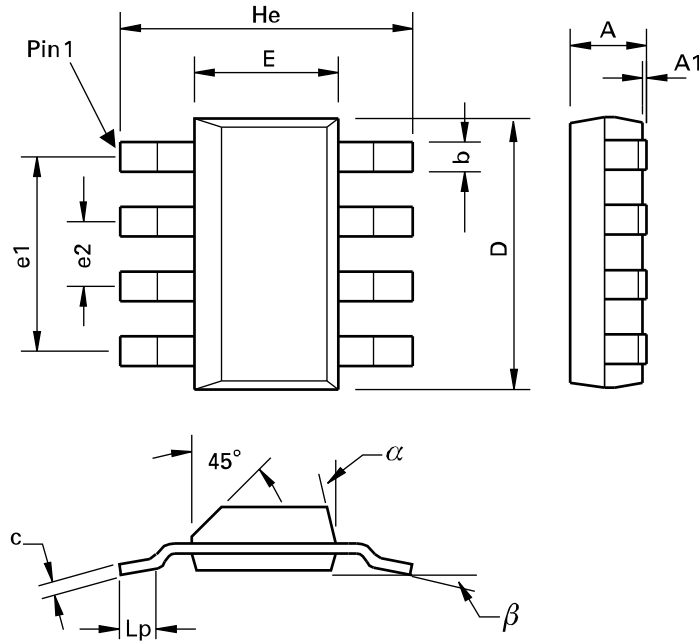


Switching Speed



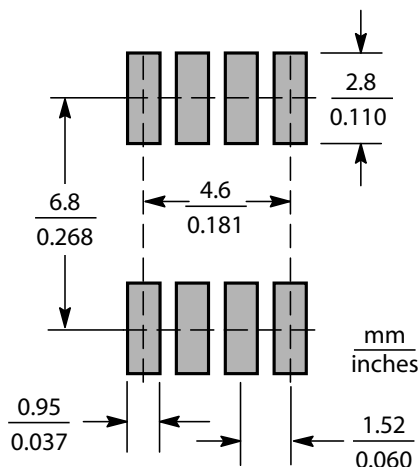
Typical Short Circuit Protection

Package Outline Dimensions



| DIM | Millimeters | | | Inches | | | DIM | Millimeters | | | Inches | | |
|-----|-------------|------|------|--------|-------|--------|----------|-------------|-----|------|--------|-------|--------|
| | Min | Max | Typ. | Min | Max | Typ. | | Min | Max | Typ. | Min | Max | Typ. |
| A | - | 1.7 | - | - | 0.067 | - | e1 | - | - | 4.59 | - | - | 0.1807 |
| A1 | 0.02 | 0.1 | - | 0.008 | 0.004 | - | e2 | - | - | 1.53 | - | - | 0.0602 |
| b | - | - | 0.7 | - | - | 0.0275 | He | 6.7 | 7.3 | - | 0.264 | 0.287 | - |
| c | 0.24 | 0.32 | - | 0.009 | 0.013 | - | Lp | 0.9 | - | - | 0.035 | - | - |
| D | 6.3 | 6.7 | - | 0.248 | 0.264 | - | α | - | 15° | - | - | 15° | - |
| E | 3.3 | 3.7 | - | 0.130 | 0.145 | - | β | - | - | 10° | - | - | 10° |

Suggested Pad Layout



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