

**ZXTR1005PD8**

**100V INPUT, 5V 50mA VOLTAGE REGULATOR**

**Description**

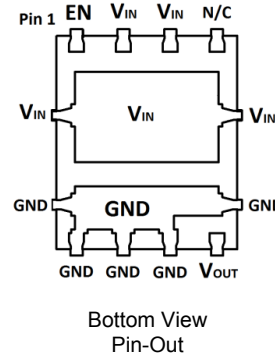
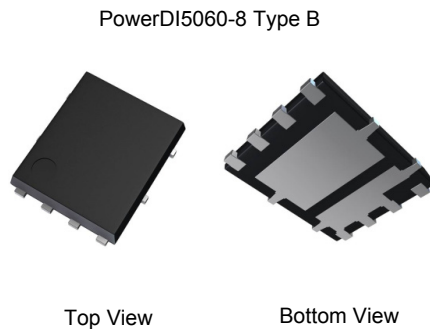
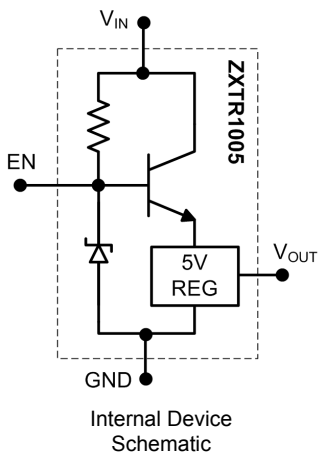
The ZXTR1005PD8 is a high voltage regulator with fixed output voltage of 5V ± 2% and a 50mA drive capability. It is designed for use in high voltage applications where standard linear regulators cannot be used. This function is fully integrated into a PowerDI5060 package, minimizing PCB area and reducing number of components when compared with a multi-chip discrete solution.

The device also features an enable pin which disables the regulator when pulled low.

**Applications**

Supply voltage regulation in:

- Networking
- Telecom
- Power Over Ethernet (PoE)



| Pin Name         | Pin Function   |
|------------------|----------------|
| V <sub>IN</sub>  | Input Supply   |
| GND              | Power Ground   |
| V <sub>OUT</sub> | Voltage Output |
| EN               | Enable         |
| N/C              | Not Connected  |

**Features**

- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 10 to 100V
- Output Voltage = 5V ± 2%
- ± 4% tolerance over -55 to +125°C
- Output Current up to 50mA
- Toggle Output On/Off with Enable pin
- **Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

**Mechanical Data**

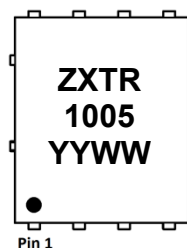
- Case: PowerDI5060-8 Type B
- Case material: Molded Plastic. "Green" Molding Compound.
- UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 ③
- Weight: 0.104 grams (approximate)

**Ordering Information (Note 4)**

| Product        | Package              | Marking   | Reel Size (inches) | Tape Width (mm) | Quantity per Reel |
|----------------|----------------------|-----------|--------------------|-----------------|-------------------|
| ZXTR1005PD8-13 | PowerDI5060-8 Type B | ZXTR 1005 | 13                 | 12              | 2,500             |

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen and Antimony free, "Green" and Lead-Free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  4. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

**Marking Information**



ZXTR1005 = Product Type Marking Code  
YYWW = Date Code Marking  
YY = Year (ex: 13 = 2013)  
WW = Week (01-52)

**Absolute Maximum Ratings** (Voltage relative to GND, @  $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

| Characteristic                       | Symbol            | Value        | Unit |
|--------------------------------------|-------------------|--------------|------|
| Input voltage                        | $V_{IN}$          | -0.3 to +100 | V    |
| Enable current                       | $I_{EN}$          | $\pm 1$      | mA   |
| Continuous Input & Output Current    | $I_{IN}, I_{OUT}$ | 100          | mA   |
| Peak Pulsed Input & Output Current   | $I_{IM}, I_{OM}$  | 100          | mA   |
| Maximum Voltage applied to $V_{OUT}$ | $V_{OUT(max)}$    | 10           | V    |

**Maximum Current** (@  $V_{IN} = 48\text{V}$ ,  $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

| Characteristic            | Symbol    | Value | Unit |
|---------------------------|-----------|-------|------|
| Continuous Output Current | $I_{OUT}$ | 42    | mA   |
| Pulsed Output Current     | $I_{OM}$  | 100   | mA   |
|                           |           | 100   |      |

**Thermal Characteristics** (@  $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

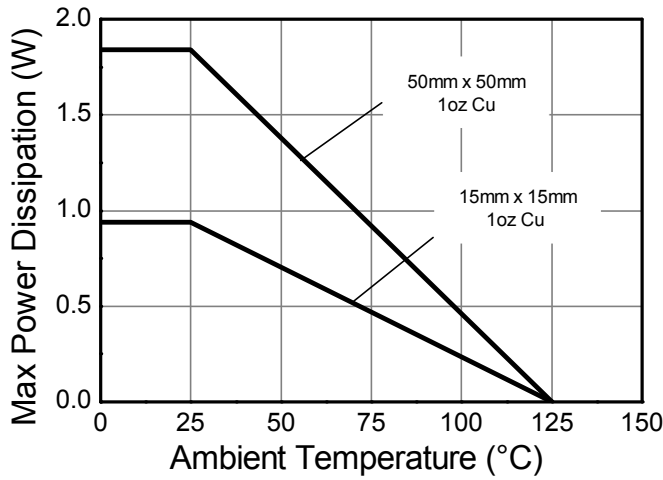
| Characteristic                               | Symbol          | Value       | Unit               |
|--|-----------------|-------------|--------------------|
| Power Dissipation                            | $P_D$           | 1.84        | W                  |
|  |                 | 0.94        |                    |
| Thermal Resistance, Junction to Ambient      | $R_{\theta JA}$ | 54.3        | $^\circ\text{C/W}$ |
|  |                 | 106.4       |                    |
| Thermal Resistance, Junction to Lead         | $R_{\theta JL}$ | 13          |                    |
| Thermal Resistance, Junction to Case         | $R_{\theta JC}$ | 13.9        |                    |
| Maximum Operating Junction Temperature Range | $T_J$           | -55 to +125 |                    |
| Storage Temperature Range                    | $T_{STG}$       | -65 to +150 | $^\circ\text{C}$   |

**ESD Ratings** (Note 11)

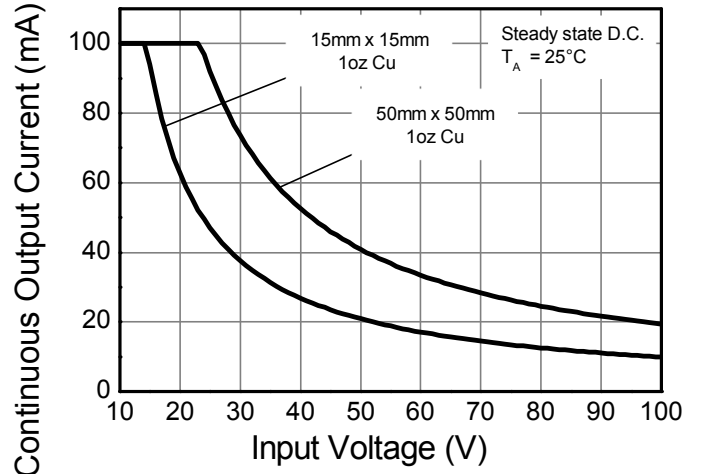
| Characteristics                            | Symbols | Value | Unit | JEDEC Class |
|--|---------|-------|------|-------------|
| Electrostatic Discharge – Human Body Model | ESD HBM | 4,000 | V    | 3A          |
| Electrostatic Discharge – Machine Model    | ESD MM  | 400   | V    | C           |

- Notes:
- For a device mounted with the exposed  $V_{IN}$  pad on 50mm x 50mm 1oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in steady-state.
  - Same as note 5, except mounted on 15mm x 15mm 1oz copper.
  - Same as note 5, whilst operating at  $V_{IN} = 48\text{V}$  this is thermally limited. Refer to Safe Operating Area for other Input Voltages.
  - Same as note 5, except measured with a single pulse width = 100 $\mu\text{s}$  and  $V_{IN} = 48\text{V}$ . This is limited by the absolute maximum  $I_{OM}$  rating.
  - Same as note 5, except measured with a single pulse width = 10ms and  $V_{IN} = 48\text{V}$ . This is limited by the absolute maximum  $I_{OM}$  rating.
  - $R_{\theta JL}$  = Thermal resistance from junction to solder-point (on the exposed  $V_{IN}$  pad).
  - $R_{\theta JC}$  = Thermal resistance from junction to the top of case.
  - Refer to JEDEC specification JESD22-A114 and JESD22-A115.

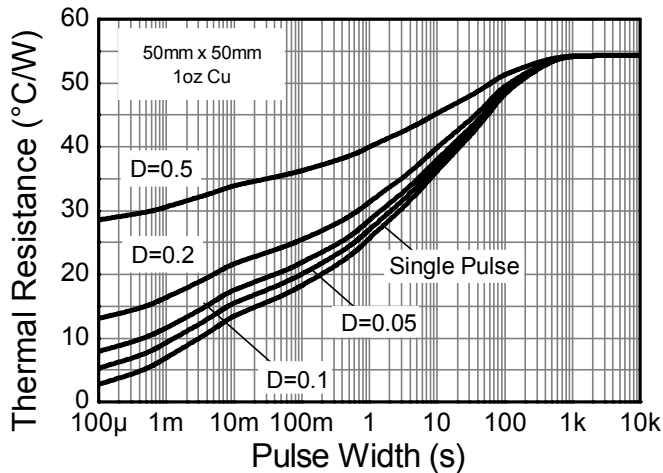
**Thermal Characteristics and Derating Information**



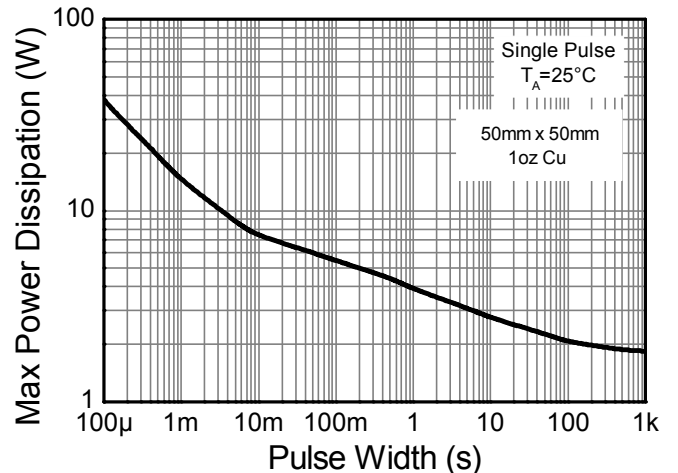
**Derating Curve**



**Safe Operating Area**



**Transient Thermal Impedance**



**Pulse Power Dissipation**

**Electrical Characteristics** (Voltage relative to GND, @T<sub>A</sub> = +25°C, unless otherwise specified.)

**Enable Output with EN = OPEN (i.e. -100nA < I<sub>EN</sub> < 100nA)**

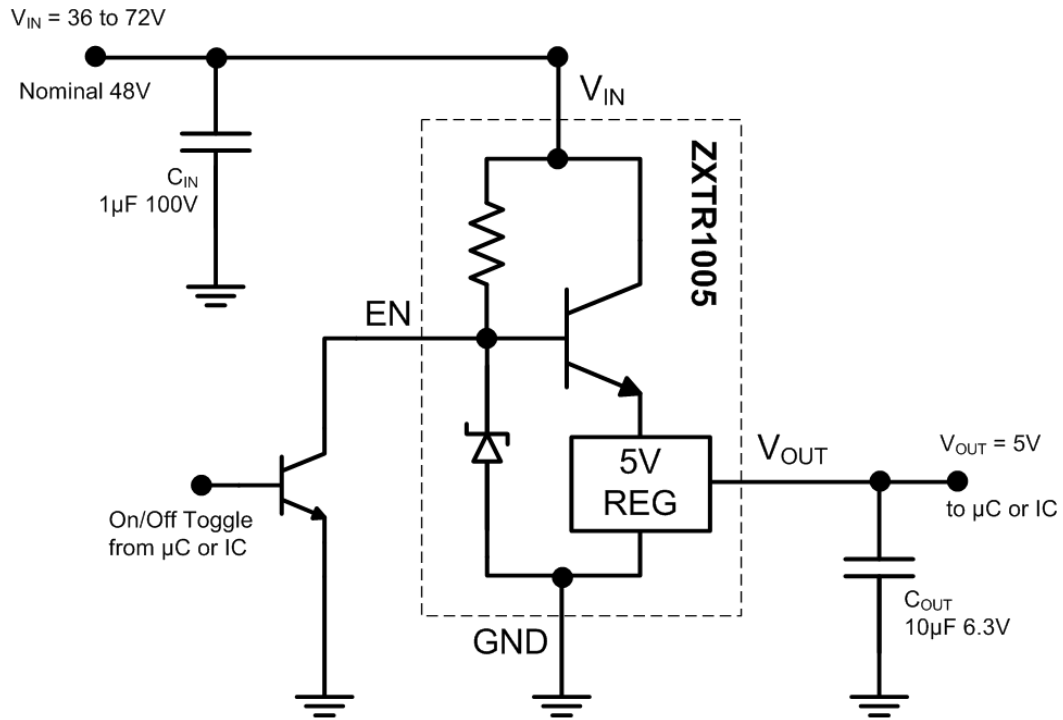
| Characteristic  | Symbol                              | Min | Typ        | Max        | Unit  | Test Condition   |
|---|-------------------------------------|-----|------------|------------|-------|--|
| Output Voltage (Note 12)  | V <sub>OUT</sub>                    | 4.9 | 5.0        | 5.1        | V     | V <sub>IN</sub> = 48V, I <sub>OUT</sub> = 15mA   |
| Line Regulation (Note 12 & 13)                                      | ΔV <sub>OUT</sub>                   | -10 | 2          | 10         | mV    | V <sub>IN</sub> = 10 to 100V, I <sub>OUT</sub> = 15mA  |
| Average Temperature Coefficient                                     | ΔV <sub>OUT</sub> /ΔT               | —   | 0.44       | 0.7        | mV/°C | T <sub>J</sub> = -55°C to +125°C<br>V <sub>IN</sub> = 48V, I <sub>OUT</sub> = 15mA                                   |
| Load Regulation (Note 12 & 14)                                      | ΔV <sub>OUT</sub>                   | —   | 20         | 50         | mV    | I <sub>OUT</sub> = 0.1 to 50mA, V <sub>IN</sub> = 48V  |
| Minimum Value of Input Voltage Required to Maintain Line Regulation | V <sub>IN(MIN)</sub>                | 10  | —          | —          | V     | —  |
| Power Supply Rejection Ratio  | ΔV <sub>IN</sub> /ΔV <sub>OUT</sub> | —   | 57         | —          | dB    | C <sub>OUT</sub> = 100nF, I <sub>OUT</sub> = 15mA,<br>V <sub>OUT</sub> = 5V, V <sub>IN</sub> = 10 to 100V, f = 100Hz |
| <b>Toggle Output On/Off</b>   |                                     |     |            |            |       |  |
| Enable Output   | V <sub>OUT</sub>                    | 4.9 | 5.0        | 5.1        | V     | EN = OPEN, -100nA < I <sub>EN</sub> < 100nA,<br>V <sub>IN</sub> = 48V, I <sub>OUT</sub> = 15mA                       |
| Disable Output  | V <sub>OUT</sub>                    | —   | 0          | 1          | V     | EN = GND, -0.3V < V <sub>EN</sub> < 1V,<br>V <sub>IN</sub> = 48V, I <sub>OUT</sub> = 100nA                           |
| Quiescent Current (Note 12) with Enable Output                      | I <sub>Q</sub>                      | —   | 300<br>650 | 500<br>900 | μA    | EN = OPEN, V <sub>IN</sub> = 48V<br>EN = OPEN, V <sub>IN</sub> = 100V  |
| Quiescent Current (Note 12) with Disable Output                     | I <sub>Q</sub>                      | —   | 300<br>650 | 500<br>900 | μA    | EN = GND, V <sub>IN</sub> = 48V<br>EN = GND, V <sub>IN</sub> = 100V  |

- Notes: 12. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.  
 13. Line regulation ΔV<sub>OUT</sub> = V<sub>OUT</sub>(@ V<sub>IN</sub> = 100V) – V<sub>OUT</sub>(@ V<sub>IN</sub> = 10V)  
 14. Load regulation ΔV<sub>OUT</sub> = V<sub>OUT</sub>(@ I<sub>OUT</sub> = 50mA) – V<sub>OUT</sub>(@ I<sub>OUT</sub> = 0mA)

**Pin Functions**

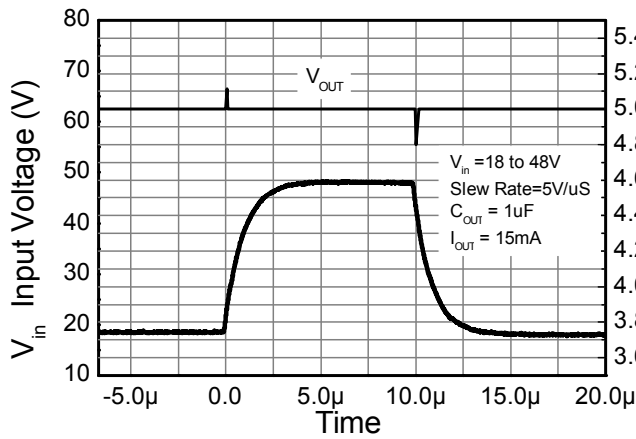
| Pin Name         | Pin Function   | Notes   |
|------------------|----------------|---|
| V <sub>IN</sub>  | Input Supply   | To maintain output regulation the input voltage can vary from 10V to 100V with respect to the GND pin. It is recommended to connect a 1μF capacitor to GND.   |
| GND              | Power Ground   | This pin should be tied to the system ground.   |
| V <sub>OUT</sub> | Voltage Output | Outputs a regulated 5V when drawing between 0.1 to 50mA current. It is recommended to connect a ≥100nF capacitor to GND to minimize the noise on the regulated output. The pin can be pulled high to a maximum of 10V with respect to ground.   |
| EN               | Enable Output  | <p><b>Output Always On</b></p> <p>When the output state is required to be permanently on, then the EN pin should be left floating in an OPEN state.</p> <p><b>Toggle Output On/Off</b></p> <p>Toggle the regulator's output state between on (5V) and off (0V).</p> <p><b>Enable Output</b></p> <p>Leave the EN pin floating in an OPEN state.</p> <p><b>Disable Output</b></p> <p>Pull the EN pin to GND in a SHORT state.</p> <p>For example, see the Typical Application Circuit showing a transistor toggling the EN pin.</p> |
|                  |                | <p>EN pin = Do not connect</p> <p><b>Enable Output</b></p> <p>EN pin = -100nA &lt; I<sub>EN</sub> &lt; 100nA</p> <p><b>Disable Output</b></p> <p>EN pin = -0.3V &lt; V<sub>EN</sub> &lt; 1V</p>   |

**Typical Application Circuit**

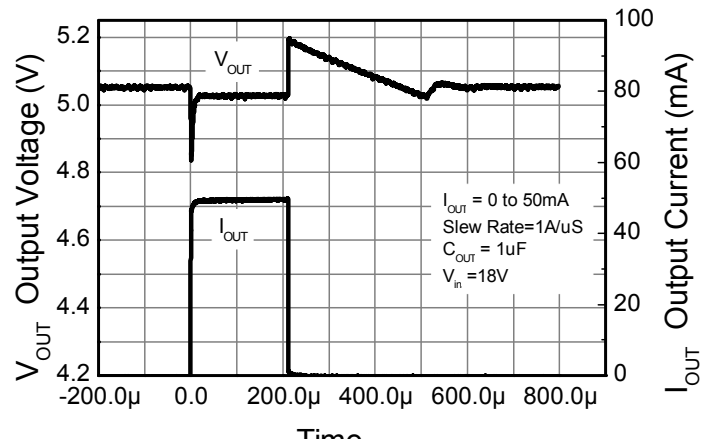


Example of a 5V regulated supply from a nominal 48V for powering a Controller IC.

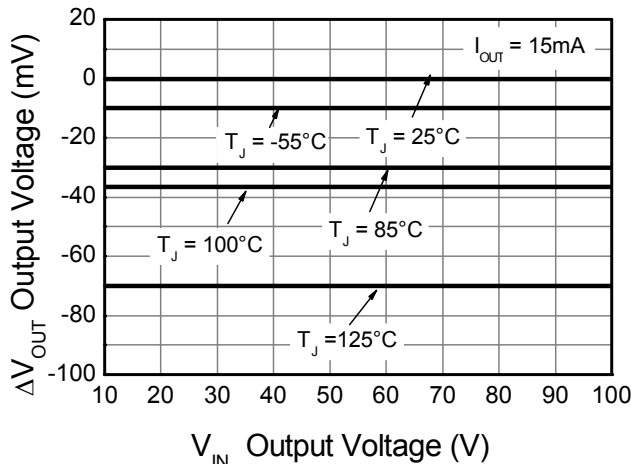
**Typical Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)



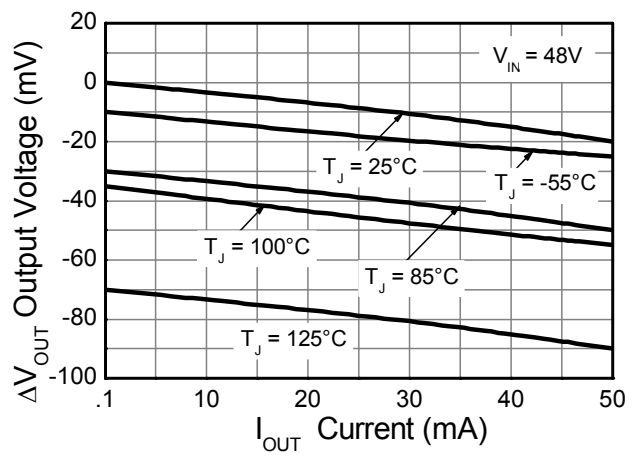
**Line transient response**



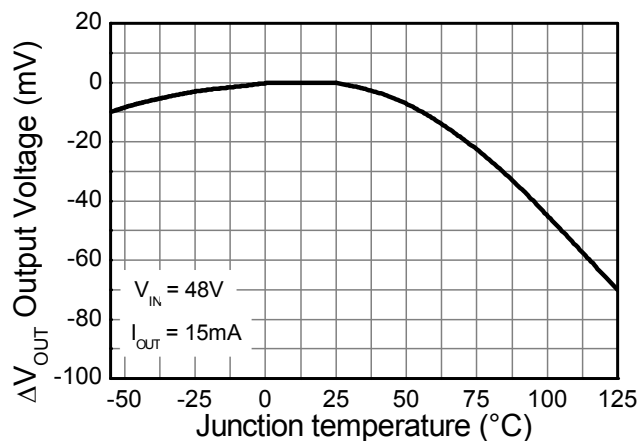
**Load transient response**



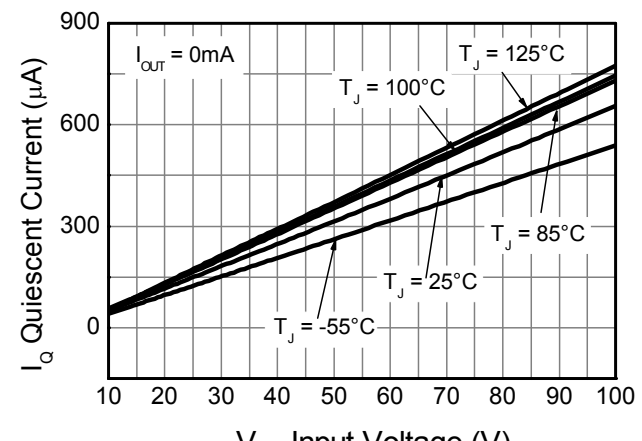
**Line Regulation (Note 15)**



**Load Regulation (Note 16)**



**Temperature Coefficient (Note 17)**

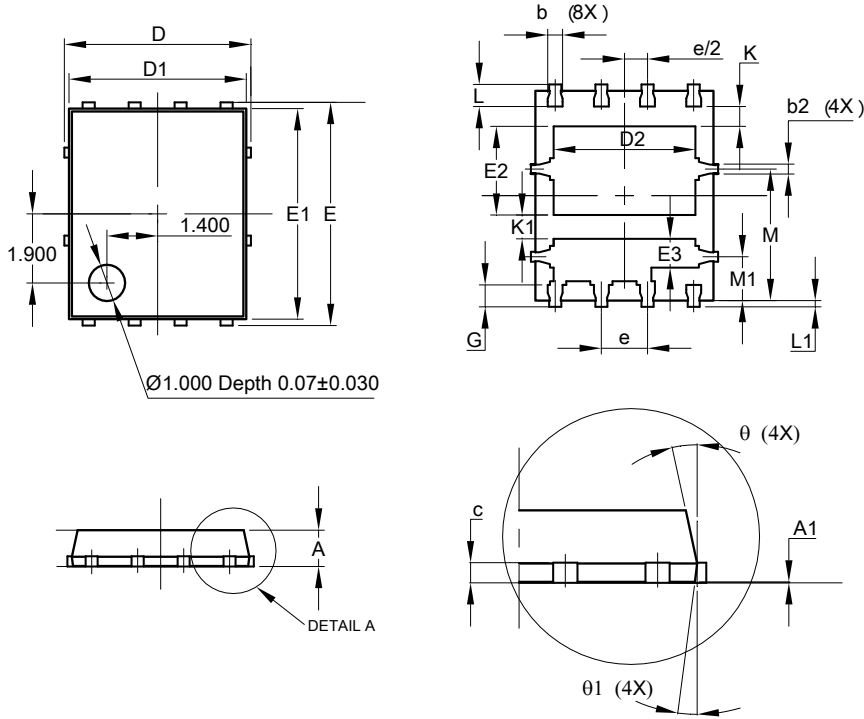


**Quiescent Current**

- Notes:
- 15. Line regulation  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 10V, I_{OUT} = 15mA, T_J = +25^\circ C)$
  - 16. Load regulation  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 48V, I_{OUT} = 0A, T_J = +25^\circ C)$
  - 17. Temperature Coefficient  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 48V, I_{OUT} = 30mA, T_J = +25^\circ C)$

**Package Outline Dimensions**

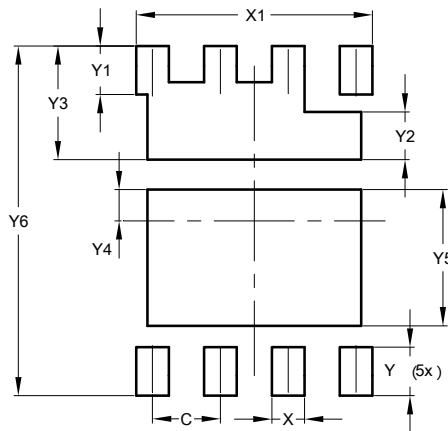
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



| POWERDI <sup>®</sup> 5060-8<br>TYPE B |          |       |       |
|---------------------------------------|----------|-------|-------|
| Dim                                   | Min      | Max   | Typ   |
| A                                     | 0.90     | 1.10  | 1.00  |
| A1                                    | 0.00     | 0.05  | —     |
| b                                     | 0.33     | 0.51  | 0.41  |
| b2                                    | 0.20     | 0.40  | 0.273 |
| c                                     | 0.230    | 0.330 | 0.273 |
| D                                     | 5.15 BSC |       |       |
| D1                                    | 4.70     | 5.10  | 4.90  |
| D2                                    | 3.50     | 4.40  | 3.90  |
| E                                     | 6.15 BSC |       |       |
| E1                                    | 5.60     | 6.00  | 5.80  |
| E2                                    | 2.25     | 2.65  | 2.45  |
| E3                                    | 0.595    | 0.995 | 0.795 |
| e                                     | 1.27 BSC |       |       |
| G                                     | 0.51     | 0.71  | 0.61  |
| K                                     | 0.51     | —     | —     |
| K1                                    | 0.51     | —     | —     |
| L                                     | 0.51     | 0.71  | 0.61  |
| L1                                    | 0.05     | 0.20  | 0.175 |
| M                                     | 3.235    | 4.035 | 3.635 |
| M1                                    | 1.00     | 1.40  | 1.21  |
| θ1                                    | 10°      | 12°   | 11°   |
| θ2                                    | 6°       | 8°    | 7°    |
| All Dimensions in mm                  |          |       |       |

**Suggested Pad Layout**

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 1.270         |
| X          | 0.610         |
| X1         | 4.420         |
| Y          | 0.910         |
| Y1         | 0.910         |
| Y2         | 0.895         |
| Y3         | 2.130         |
| Y4         | 0.585         |
| Y5         | 2.550         |
| Y6         | 6.550         |

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