Description

The ZXTR1005K4 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 TO252 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)

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: TO252-4
- 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
- Weight: 0.34 grams (approximate)

Ordering Information (Note 4)

<table>
<thead>
<tr>
<th>Product</th>
<th>Package</th>
<th>Marking</th>
<th>Reel Size (inches)</th>
<th>Tape Width (mm)</th>
<th>Quantity per Reel</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZXTR1005K4-13</td>
<td>TO252-4</td>
<td>ZXR 1005</td>
<td>13</td>
<td>16</td>
<td>2,500</td>
</tr>
</tbody>
</table>

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 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.

Marking Information

ZXTR 1005 = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 13 = 2013)
WW = Week (01-52)
## Absolute Maximum Ratings

(Voltage relative to GND, \(TA = +25°C\), unless otherwise specified.)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage</td>
<td>(V_{IN})</td>
<td>-0.3 to 100</td>
<td>V</td>
</tr>
<tr>
<td>Enable Current</td>
<td>(I_{EN})</td>
<td>±1</td>
<td>mA</td>
</tr>
<tr>
<td>Continuous Input &amp; Output Current</td>
<td>(I_{IN}, I_{OUT})</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Peak Pulsed Input &amp; Output Current</td>
<td>(I_{IM}, I_{OM})</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Maximum Voltage applied to (V_{OUT})</td>
<td>(V_{OUT(\text{max})})</td>
<td>10</td>
<td>V</td>
</tr>
</tbody>
</table>

## Maximum Current

(\(V_{IN} = 48\,\text{V}, \ TA = +25°C\), unless otherwise specified.)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Output Current</td>
<td>(I_{OUT})</td>
<td>50</td>
<td>mA</td>
</tr>
<tr>
<td>Pulsed Output Current</td>
<td>(I_{OM})</td>
<td>100</td>
<td>mA</td>
</tr>
</tbody>
</table>

## Thermal Characteristics

(\(TA = +25°C\), unless otherwise specified.)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Dissipation</td>
<td>(P_D)</td>
<td>2.3</td>
<td>W</td>
</tr>
<tr>
<td>Thermal Resistance, Junction to Ambient</td>
<td>(R_{JA})</td>
<td>44</td>
<td>°C/W</td>
</tr>
<tr>
<td>Thermal Resistance, Junction to Lead</td>
<td>(R_{JL})</td>
<td>90</td>
<td>°C/W</td>
</tr>
<tr>
<td>Thermal Resistance, Junction to Case</td>
<td>(R_{JC})</td>
<td>8.39</td>
<td>°C/W</td>
</tr>
<tr>
<td>Maximum Operating Junction Temperature Range</td>
<td>(T_J)</td>
<td>-55 to +125</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>(T_{STG})</td>
<td>-65 to +150</td>
<td>°C</td>
</tr>
</tbody>
</table>

## ESD Ratings

(Note 11)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbols</th>
<th>Value</th>
<th>Unit</th>
<th>JEDEC Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrostatic Discharge – Human Body Model</td>
<td>ESD HBM</td>
<td>4,000</td>
<td>V</td>
<td>3A</td>
</tr>
<tr>
<td>Electrostatic Discharge – Machine Model</td>
<td>ESD MM</td>
<td>400</td>
<td>V</td>
<td>C</td>
</tr>
</tbody>
</table>

Notes:
5. 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.
6. Same as note 5, except mounted on 15mm x 15mm 1oz copper.
7. 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.
8. Same as note 5, except measured with a single pulse width = 100\,\mu s and \(V_{IN}=48\,\text{V}\). This is limited by the absolute maximum \(I_{OM}\) rating.
9. 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.
10. \(R_{JL}\) = Thermal resistance from junction to solder-point (on the exposed \(V_{IN}\) pad).
11. \(R_{JC}\) = Thermal resistance from junction to the top of case.
12. Refer to JEDEC specification JESD22-A114 and JESD22-A115.
Thermal Characteristics and Derating Information

Derating Curve

Continuous Output Current (mA)

Input Voltage (V)

Max Power Dissipation (W)

Steady state D.C. $T_A = 25°C$

Safe Operating Area

Safe Operating Area

15mm x 15mm 1oz Cu

50mm x 50mm 1oz Cu

100µ 1m 10m 100m 1 10 100 1k 10k

0 10 20 30 40 50 60 70 80 90 100

10 20 30 40 50 60 70 80 90 100

0 0.5 1 1.5 2 2.5 3

0 0.5 1 1.5 2 2.5 3

Max Power Dissipation (W)

Max Power Dissipation (W)

Ambient Temperature (°C)

50mm x 50mm 1oz Cu

50mm x 50mm 1oz Cu

50mm x 50mm 1oz Cu

50mm x 50mm 1oz Cu

50mm x 50mm 1oz Cu

D=0.5

D=0.2

D=0.1

D=0.05

Pulse Width (s)

Pulse Width (s)

100µ 1m 10m 100m 1 10 100 1k 10k

100µ 1m 10m 100m 1 10 100 1k 10k

0 0.5 1 1.5 2 2.5 3

0 0.5 1 1.5 2 2.5 3

Thermal Resistance (°C/W)

Transient Thermal Impedance

Transient Thermal Impedance

0 10 20 30 40 50 60 70 80 90 100

0 10 20 30 40 50 60 70 80 90 100

100µ 1m 10m 100m 1 10 100 1k 10k

100µ 1m 10m 100m 1 10 100 1k 10k

Thermal Resistance (°C/W)

Pulse Power Dissipation

Pulse Power Dissipation

0 10 20 30 40 50 60 70 80 90 100

0 10 20 30 40 50 60 70 80 90 100

100µ 1m 10m 100m 1 10 100 1k 10k

100µ 1m 10m 100m 1 10 100 1k 10k

Max Power Dissipation (W)

Max Power Dissipation (W)


**Electrical Characteristics** (Voltage relative to GND, @TA = +25°C, unless otherwise specified.)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
<th>Test Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage (Note 12)</td>
<td>VOUT</td>
<td>4.9</td>
<td>5.0</td>
<td>5.1</td>
<td>V</td>
<td>VIN = 48V, IOUT = 15mA</td>
</tr>
<tr>
<td>Line Regulation (Note 12 &amp; 13)</td>
<td>ΔVOUT</td>
<td>-10</td>
<td>2</td>
<td>10</td>
<td>mV</td>
<td>VIN = 10 to 100V, IOUT = 15mA</td>
</tr>
<tr>
<td>Average Temperature Coefficient</td>
<td>ΔVOUT/ΔT</td>
<td>—</td>
<td>0.44</td>
<td>0.7</td>
<td>mV/°C</td>
<td>TJ = -55°C to +125°C</td>
</tr>
<tr>
<td>Load Regulation (Note 12 &amp; 14)</td>
<td>ΔVOUT</td>
<td>—</td>
<td>20</td>
<td>50</td>
<td>mV</td>
<td>IOUT = 0.1 to 50mA, VIN = 48V</td>
</tr>
<tr>
<td>Minimum Value of Input Voltage Required to Maintain Line Regulation</td>
<td>V_MINMIN</td>
<td>10</td>
<td>—</td>
<td>—</td>
<td>V</td>
<td>—</td>
</tr>
<tr>
<td>Power Supply Rejection Ratio</td>
<td>ΔVIN/ΔVOUT</td>
<td>—</td>
<td>57</td>
<td>—</td>
<td>dB</td>
<td>COUT = 100nF, IOUT = 15mA, VIN = 10 to 100V, f = 100Hz</td>
</tr>
</tbody>
</table>

### Enable Output with EN = OPEN (i.e. -100nA < IEN < 100nA)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
<th>Test Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable Output</td>
<td>VOUT</td>
<td>4.9</td>
<td>5.0</td>
<td>5.1</td>
<td>V</td>
<td>EN = OPEN, -100nA &lt; IEN &lt; 100nA, VIN = 48V, IOUT = 15mA</td>
</tr>
<tr>
<td>Disable Output</td>
<td>VOUT</td>
<td>—</td>
<td>0</td>
<td>1</td>
<td>V</td>
<td>EN = GND, -0.3V &lt; VEN &lt; 1V, VIN = 48V, IOUT = 100nA</td>
</tr>
<tr>
<td>Quiescent Current (Note 12) with Enable Output</td>
<td>IQ</td>
<td>—</td>
<td>300</td>
<td>500</td>
<td>µA</td>
<td>EN = OPEN, VIN = 48V</td>
</tr>
<tr>
<td>Quiescent Current (Note 12) with Disable Output</td>
<td>IQ</td>
<td>—</td>
<td>300</td>
<td>500</td>
<td>µA</td>
<td>EN = GND, VIN = 48V</td>
</tr>
</tbody>
</table>

Notes:  
12. Measured under pulsed conditions. Pulse width ≤ 300µs. Duty cycle ≤ 2%.  
13. Line regulation ΔVOUT = VOUT(@VIN = 100V) – VOUT(@VIN = 10V)  
14. Load regulation ΔVOUT = VOUT(@IOUT = 50mA) – VOUT(@IOUT = 0mA)  

### Pin Functions

<table>
<thead>
<tr>
<th>Pin Name</th>
<th>Pin Function</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIN</td>
<td>Input Supply</td>
<td>To maintain output regulation the input voltage can vary from 10 to 100V with respect to the GND pin. It is recommended to connect a 1µF capacitor to GND.</td>
</tr>
<tr>
<td>GND</td>
<td>Power Ground</td>
<td>This pin should be tied to the system ground.</td>
</tr>
<tr>
<td>VOUT</td>
<td>Voltage Output</td>
<td>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.</td>
</tr>
</tbody>
</table>
| EN        | Enable Output         | Output Always On  
When the output state is required to be permanently on, then the EN pin should be left floating in an OPEN state. EN pin = Do not connect  
Toggle Output On/Off  
Toggle the regulator's output state between on (5V) and off (0V).  
Enable Output  
Leave the EN pin floating in an OPEN state. Enable Output  
EN pin = -100nA < IEN < 100nA  
Disable Output  
Pull the EN pin to GND in a SHORT state. Disable Output  
EN pin = -0.3V < VEN < 1V |

ZXTR1005K4  
Datasheet number: DS36315 Rev. 1–2  
www.diodes.com  
January 2014  
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Typical Application Circuit

Example of a 5V regulated supply from a nominal 48V for powering a Controller IC.
Typical Electrical Characteristics (@Ta = +25°C, unless otherwise specified.)

**Line transient response**

- Input Voltage (V) vs. Time
- Output Voltage (V) vs. Time
- V_out = 18 to 48V
- Slew Rate = 5V/μs
- C_out = 1μF
- I_out = 15mA

**Load transient response**

- Output Voltage (mV) vs. Current (mA)
- I_out = 0 to 50mA
- Slew Rate = 1A/μs
- C_out = 1μF
- V_in = 18V

**Line Regulation (Note 15)**

- Output Voltage (mV) vs. Input Voltage (V)
- Temperature Coefficient (°C)
- V_out = 18 to 48V
- I_out = 15mA
- T_J = -55°C to 125°C

**Load Regulation (Note 16)**

- Output Voltage (mV) vs. Output Current (mA)
- Temperature Coefficient (°C)
- V_in = 48V
- I_out = 15mA
- T_J = -55°C to 125°C

**Temperature Coefficient (Note 17)**

- Quiescent Current (μA) vs. Junction temperature (°C)
- Temperature Coefficient (°C)
- V_in = 48V
- I_out = 15mA

Notes:
15. Line regulation ΔV_OUT = V_OUT – V_OUT(@ V_IN = 10V, I_OUT = 15mA, T_J = +25°C)
16. Load regulation ΔV_OUT = V_OUT – V_OUT(@ V_IN = 48V, I_OUT = 0A, T_J = +25°C)
17. Temperature Coefficient ΔV_OUT = V_OUT – V_OUT(@ V_IN = 48V, I_OUT = 30mA, T_J = +25°C)
### Package Outline Dimensions

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

<table>
<thead>
<tr>
<th>Dim</th>
<th>Min</th>
<th>Max</th>
<th>Typ</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.19</td>
<td>2.39</td>
<td>2.29</td>
</tr>
<tr>
<td>A1</td>
<td>0.00</td>
<td>0.13</td>
<td>0.08</td>
</tr>
<tr>
<td>A2</td>
<td>0.97</td>
<td>1.17</td>
<td>1.07</td>
</tr>
<tr>
<td>b</td>
<td>0.51</td>
<td>0.71</td>
<td>0.583</td>
</tr>
<tr>
<td>b1</td>
<td>0.61</td>
<td>0.79</td>
<td>0.70</td>
</tr>
<tr>
<td>b2</td>
<td>5.21</td>
<td>5.46</td>
<td>5.33</td>
</tr>
<tr>
<td>c2</td>
<td>0.45</td>
<td>0.58</td>
<td>0.531</td>
</tr>
<tr>
<td>D</td>
<td>6.00</td>
<td>6.20</td>
<td>6.10</td>
</tr>
<tr>
<td>D1</td>
<td>5.21</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>E</td>
<td>6.45</td>
<td>6.70</td>
<td>6.58</td>
</tr>
<tr>
<td>E1</td>
<td>4.32</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>H</td>
<td>9.40</td>
<td>10.41</td>
<td>9.91</td>
</tr>
<tr>
<td>L</td>
<td>1.40</td>
<td>1.78</td>
<td>1.59</td>
</tr>
<tr>
<td>L3</td>
<td>0.88</td>
<td>1.27</td>
<td>1.08</td>
</tr>
<tr>
<td>L4</td>
<td>0.64</td>
<td>1.02</td>
<td>0.83</td>
</tr>
<tr>
<td>a</td>
<td>0°</td>
<td>10°</td>
<td>-</td>
</tr>
</tbody>
</table>

All Dimensions in mm

### Suggested Pad Layout

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

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Value (in mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td>1.27</td>
</tr>
<tr>
<td>c1</td>
<td>2.54</td>
</tr>
<tr>
<td>X</td>
<td>1.00</td>
</tr>
<tr>
<td>X1</td>
<td>5.73</td>
</tr>
<tr>
<td>Y</td>
<td>2.00</td>
</tr>
<tr>
<td>Y1</td>
<td>6.17</td>
</tr>
<tr>
<td>Y2</td>
<td>1.64</td>
</tr>
<tr>
<td>Y3</td>
<td>2.66</td>
</tr>
</tbody>
</table>
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