

February 26, 1999

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## DESCRIPTION

The EZ158X family of high performance positive voltage regulators are designed for use in applications requiring very low dropout voltage at 7, 5, 3 and 1.5 amps. When supplying 2.5V on motherboards where both 5V and 3.3V supplies are available, the superior dropout characteristics of the EZ158X result in reduced heat dissipation compared to regular LDOs, thus allowing heat sink size reduction. Additionally, the EZ158X provides excellent regulation over variations in line, load and temperature. Remote sense operation allows compensating for trace, connector and other resistive losses.

Outstanding features include very low dropout performance at rated current, fast transient response, remote sense, internal current limiting, thermal shutdown and safe operating area protection of the output device. The EZ158X is a five terminal adjustable voltage regulator available in the popular 5 pin TO-220 and TO-263 plastic packages.

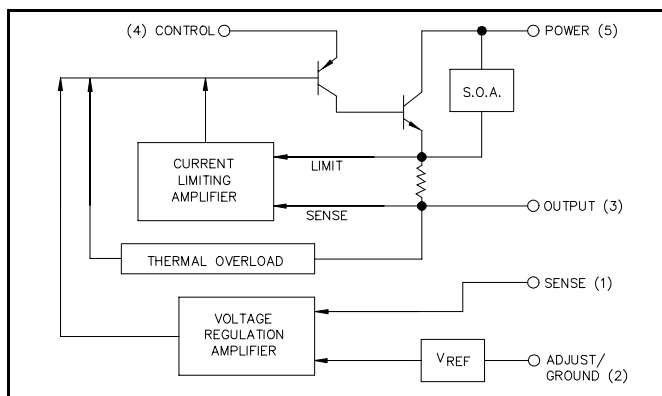
## FEATURES

- 540mV dropout @ 7A in dual supply mode (EZ1580)
- Remote sense operation
- Fast transient response
- 0.5% initial accuracy
- 5 Pin TO-220 and TO-263 packages

## APPLICATIONS

- Microprocessor supplies
- Split plane microprocessor supplies
- Pentium® Processor P54C and P55C
- PowerPC™ 603/604EV
- AMD5<sub>x</sub>86™, AMD K6

## BLOCK DIAGRAM



## ORDERING INFORMATION

| DEVICE       | PACKAGE              | I <sub>OUT</sub> (A) | V <sub>OUT</sub> (V) |
|--------------|----------------------|----------------------|----------------------|
| EZ1580CT-X.X | TO-220,              | 7                    | See Note (1)         |
| EZ1581CT-X.X | 5-pin                | 5                    |                      |
| EZ1582CT-X.X |                      | 3                    |                      |
| EZ1583CT-X.X |                      | 1.5                  |                      |
| EZ1580CM-X.X | TO-263,              | 7                    | See Note (1)         |
| EZ1581CM-X.X | 5-pin <sup>(2)</sup> | 5                    |                      |
| EZ1582CM-X.X |                      | 3                    |                      |
| EZ1583CM-X.X |                      | 1.5                  |                      |

Notes:

(1) Where -X.X denotes voltage options. Available voltages are: 1.5V and 2.5V. Leave blank for adjustable version (1.3 to 5.7V).

(2) Add suffix 'TR' for tape and reel (TO-263).

## ABSOLUTE MAXIMUM RATINGS

| Parameter                              | Symbol            | Maximum            | Units |
|--|-------------------|--------------------|-------|
| Input Voltage                          |                   |                    |       |
| V <sub>POWER</sub>                     | V <sub>P</sub>    | 7                  | V     |
| V <sub>CONTROL</sub>                   | V <sub>C</sub>    | 13.2               | V     |
| Power Dissipation                      | P <sub>D</sub>    | Internally Limited | W     |
| Thermal Resistance Junction to Case    |                   |                    |       |
| EZ1580/1 TO-220                        | θ <sub>JC</sub>   | 2                  | °C/W  |
| EZ1580/1 TO-263                        |                   | 2                  |       |
| EZ1582/3 TO-220                        |                   | 3                  |       |
| EZ1582/3 TO-263                        |                   | 3                  |       |
| Thermal Resistance Junction to Ambient |                   |                    |       |
| EZ158X TO-220                          | θ <sub>JA</sub>   | 50                 | °C/W  |
| EZ158X TO-263                          |                   | 60                 |       |
| Operating Junction Temperature Range   | T <sub>J</sub>    | 0 to 125           | °C    |
| Storage Temperature Range              | T <sub>STG</sub>  | -65 to 125         | °C    |
| Lead Temperature (Soldering) 10 Sec.   | T <sub>LEAD</sub> | 260                | °C    |

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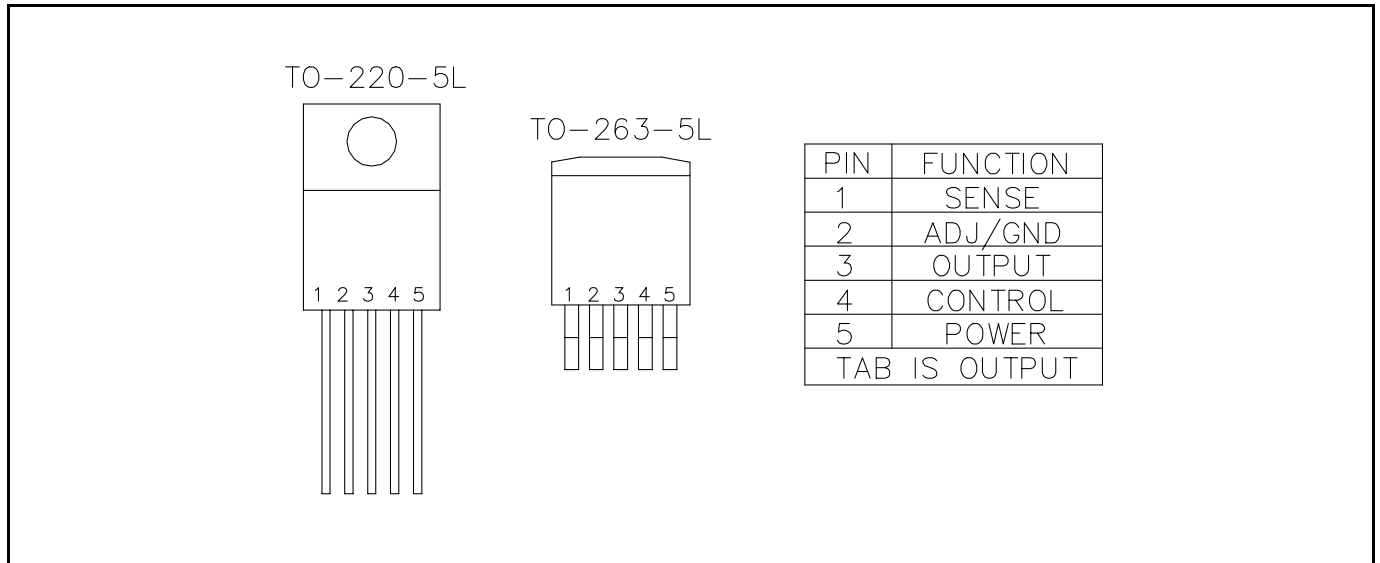
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AMD5<sub>x</sub>86 and K6 are trademarks of Advanced Micro Devices.

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**PIN CONFIGURATION**



**PIN DESCRIPTION**

| Pin | Pin Name           | Pin Function   |
|-----|--------------------|--|
| 1   | SENSE              | This pin is the positive side of the reference voltage for this device. With this pin it is possible to Kelvin sense the output voltage at the load.   |
| 2   | ADJUST /<br>GROUND | This pin is the negative side of the reference voltage for the device. Transient response can be improved by adding a small bypass capacitor from the adjust pin to ground.<br><br>This pin is the bottom end of the internal resistor feedback chain for fixed output voltage parts, and should be connected to ground. |
| 3   | OUTPUT             | This is the power output of the device, and is electrically connected to the TAB.  |
| 4   | CONTROL            | This pin is the supply pin for the control circuitry for the device. The current flow into this pin will be approximately 1% of the output current. For the device to regulate, the voltage at this pin must be between 1.0V and 1.3V greater than the output voltage (see dropout specifications).                      |
| 5   | POWER              | This is the collector input to the power device of the EZ158X. The output load current is supplied through this pin. For the device to regulate, the voltage on this pin must be between 0.1V and 0.7V greater than the output voltage, depending upon load current (see dropout specifications).                        |

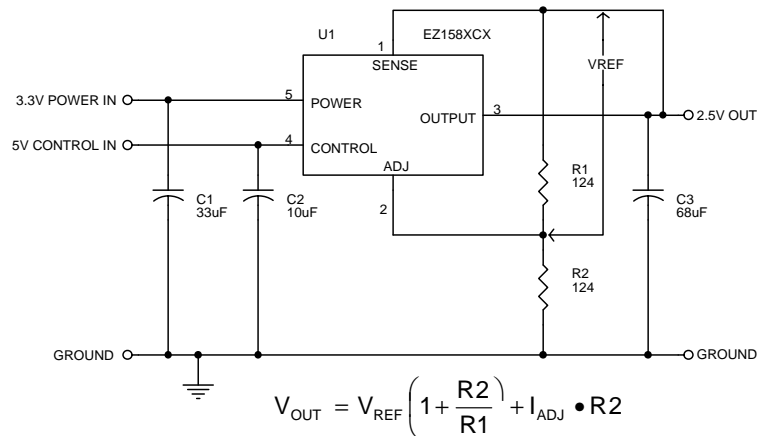
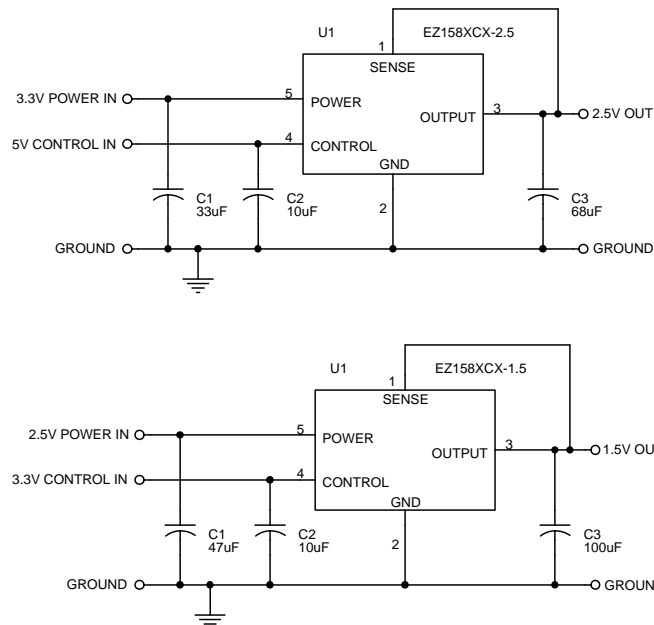
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**ELECTRICAL CHARACTERISTICS**

| Parameter  | Symbol                         | Test Conditions <sup>(1)</sup> |                           |  |  | Test Limits              |  |  | Units |    |
|--|--------------------------------|--------------------------------|---------------------------|--|--|--------------------------|--|--|-------|----|
|  |                                | V <sub>CNTL</sub><br>Volts     | V <sub>PWR</sub><br>Volts | Amps   | T <sub>J</sub> <sup>(6)</sup>                                | Min                      | Typ  | Max  |       |    |
| Reference Voltage  | V <sub>REF</sub>               | 2.75                           | 2.00                      | 0.01   | 25°C   | 1.243                    | 1.250  | 1.257  | V     |    |
| EZ1583<br>EZ1582<br>EZ1581<br>EZ1580   |                                | 2.7 - 12                       | 2.05 - 5.5                | 0.01 - 1.5<br>0.01 - 3.0<br>0.01 - 5.0<br>0.01 - 7.0 | O.T.   | 1.237                    | 1.250  | 1.263  |       |    |
| Line Regulation  | REG <sub>(LINE)</sub>          | 2.5 - 12                       | 1.75 - 5.5                | 0.01   | O.T.   |                          | 1.0  | 3.0  |       | mV |
| Load Regulation<br>EZ1583<br>EZ1582<br>EZ1581<br>EZ1580  | REG <sub>(LOAD)</sub>          | 2.75                           | 2.1                       | 0.01 - 1.5<br>0.01 - 3.0<br>0.01 - 5.0<br>0.01 - 7.0 | O.T.   |                          | 1.0  | 5.0  |       | mV |
| Minimum Load Current <sup>(2)</sup>  | I <sub>O</sub>                 | 5                              | 3.3                       |  | O.T.   |                          | 5.0  | 10   | mA    |    |
| Control Pin Current <sup>(3)</sup><br>EZ1583<br>EZ1582<br>EZ1581<br>EZ1580                           | I <sub>C</sub>                 | 2.75                           | 2.05                      | 1.5<br>3.0<br>5.0<br>7.0                             | O.T.   |                          | 6.0<br>30<br>33<br>60  | 120  | mA    |    |
| Adjust Pin Current   | I <sub>ADJ</sub>               | 2.75                           | 2.05                      | 0.01   | O.T.   |                          | 50   | 120  | µA    |    |
| Current Limit<br>EZ1583<br>EZ1582<br>EZ1581<br>EZ1580  | I <sub>CL</sub>                | 2.75                           | 2.05                      |  | O.T.   | 1.6<br>3.1<br>5.1<br>7.1 |  |  | A     |    |
| Ripple Rejection <sup>(4)</sup><br>EZ1583<br>EZ1582<br>EZ1581<br>EZ1580                              | R <sub>A</sub>                 | 3.75                           | 3.75                      | 0.75<br>1.5<br>2.5<br>3.5                            | 25°C   | 60                       | 80   |  | dB    |    |
| Thermal Regulation <sup>(5)</sup>  | REG <sub>(THERMAL)</sub>       |                                |                           |  |  |                          | 0.002  | 0.02   | %/W   |    |
| Dropout Voltage <sup>(7)</sup><br>Minimum V <sub>CNTL</sub><br>EZ1583<br>EZ1582<br>EZ1581<br>EZ1580  | V <sub>C</sub> -V <sub>O</sub> |                                | 2.05                      | 1.5<br>3.0<br>5.0<br>7.0                             | O.T.   |                          | 1.00<br>1.05<br>1.10<br>1.15                                 | 1.15<br>1.18<br>1.25<br>1.30                                 | V     |    |
| Dropout Voltage <sup>(7)</sup><br>Minimum V <sub>POWER</sub><br>EZ1583<br>EZ1582<br>EZ1581<br>EZ1580 | V <sub>P</sub> -V <sub>O</sub> | 2.75                           |                           | 1.5<br>3.0<br>5.0<br>7.0                             | 25°C<br>O.T.<br>25°C<br>O.T.<br>25°C<br>O.T.<br>25°C<br>O.T. |                          | 0.40<br>0.50<br>0.40<br>0.50<br>0.40<br>0.50<br>0.54<br>0.70 | 0.50<br>0.60<br>0.50<br>0.60<br>0.50<br>0.60<br>0.62<br>0.80 | V     |    |

- NOTES**
- (1) Unless otherwise specified, V<sub>OUT</sub> = V<sub>SENSE</sub>; V<sub>ADJ</sub> = 0V.
  - (2) Required to maintain regulation. Voltage set resistors R1, R2 are usually utilized for minimum load current.
  - (3) Current used to drive the output section; minimum value equals the standby current of the device.
  - (4) V<sub>C</sub> = V<sub>P</sub> = 3.75V Avg; V<sub>RIPPLE</sub> = 1V<sub>PK-PK</sub>.
  - (5) 30ms.
  - (6) Over Temp (O.T.) = over specified operating junction temperature range.
  - (7) Minimum input/output voltage required to maintain 1% regulation.

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**TYPICAL APPLICATIONS<sup>(1)(2)</sup>**
**Adjustable Output Parts<sup>(3)</sup>**

**Fixed Output Parts**

**NOTES:**

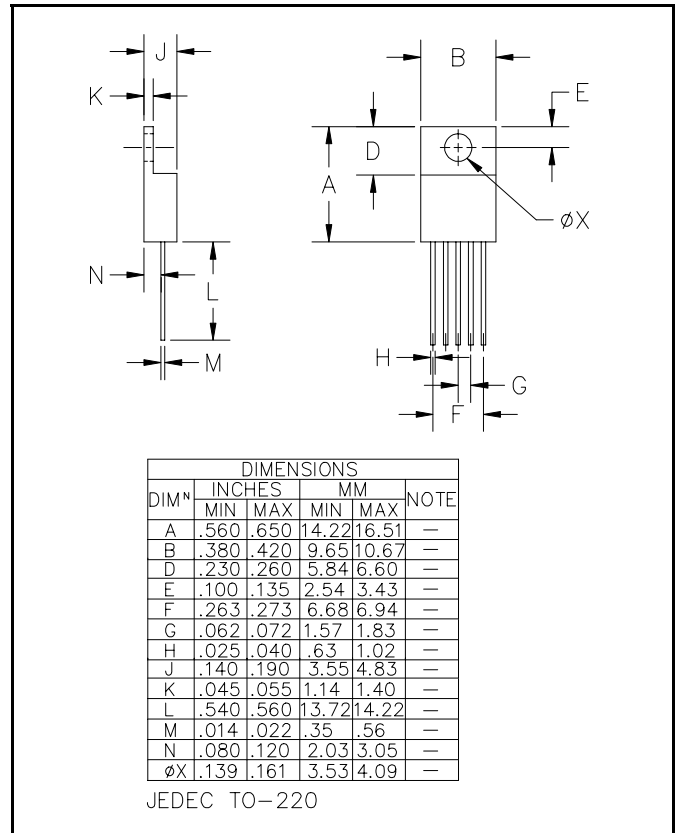
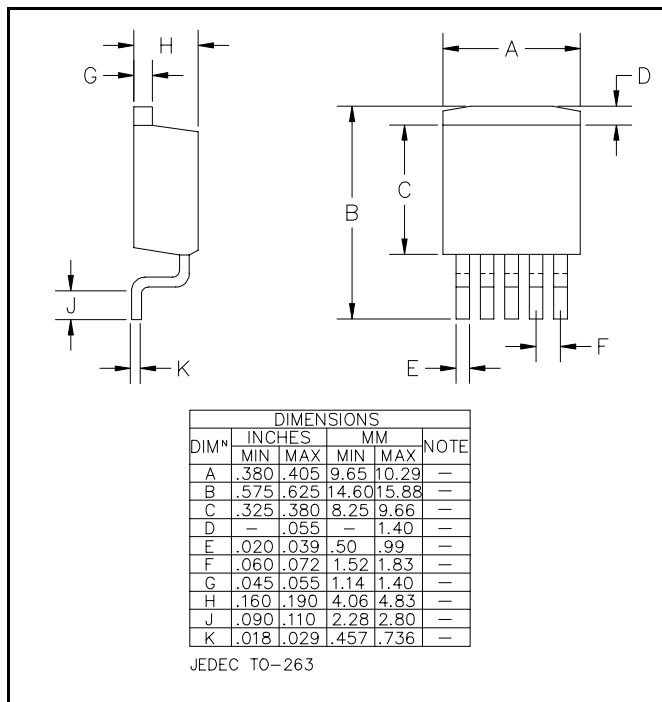
- (1) Capacitor values are for reference only. Good quality, low ESR tantalum or aluminum electrolytic capacitors should be used. Increasing the value of the output capacitor will improve the overall transient response.
- (2) If the same voltage is input to both POWER and CONTROL, then the dropout voltage will become 1.3V maximum.
- (3) A small (~0.033μF) capacitor can be used to bypass the ADJUST pin to improve transient response, if needed.

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**APPLICATION INFORMATION**

The EZ158X is a low dropout regulator designed to power the next generation of low voltage, split voltage plane processors, such as the Pentium® Processor P55C, the IBM PowerPC™ 603EV and 604EV and the AMD5<sub>K</sub>86™ and K6 Processors.

The dropout voltage is minimized by utilizing a separate input voltage,  $V_{CONTROL}$ , which should exceed  $V_{OUT}$  by at least 1.3V. The 2.5V power for the load (microprocessor core) can be derived from a 3.3V system supply. Since the efficiency of a linear regulator is the ratio of the output to the input voltage, heat dissipation is reduced by using a 3.3 input, thereby lowering heatsink and cooling fan costs. For a load of 7A at 2.5V, the regulator would dissipate 17.5W when converting from 5V, but only 5.6W from a 3.3V input. Remote Kelvin sensing of the output voltage can be achieved by connecting the sense pin to the output at the load. Remote sensing will reduce errors associated with resistive trace losses between regulator and processor.

**DEVICE OUTLINE - TO-220, 5 PIN**

**DEVICE OUTLINE - TO-263, 5 PIN**

**MINIMUM LAND PATTERN - TO-263, 5 PIN**
