

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.

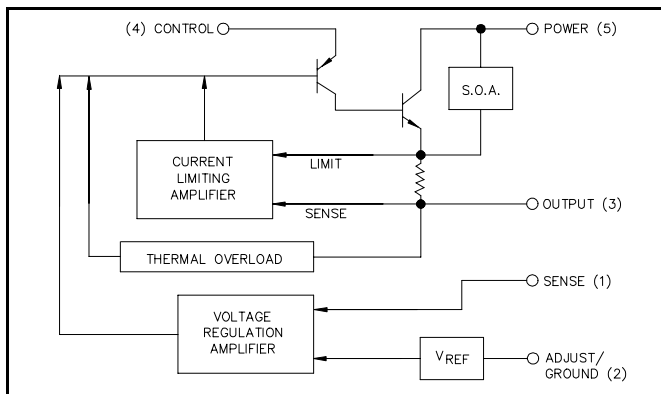
## FEATURES

- 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>K</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, 5-pin	7	See Note (1)
EZ1581CT-X.X		5	
EZ1582CT-X.X		3	
EZ1583CT-X.X		1.5	
EZ1580CM-X.X	TO-263, 5-pin <sup>(2)</sup>	7	See Note (1)
EZ1581CM-X.X		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>CONTROL</sub>	V <sub>P</sub> V <sub>C</sub>	7 13.2	V
Power Dissipation	P <sub>D</sub>	Internally Limited	W
Thermal Resistance Junction to Case EZ1580/1 TO-220 EZ1580/1 TO-263 EZ1582/3 TO-220 EZ1582/3 TO-263	θ <sub>JC</sub>	2 2 3 3	°C/W
Thermal Resistance Junction to Ambient EZ158X TO-220 EZ158X TO-263	θ <sub>JA</sub>	50 60	°C/W
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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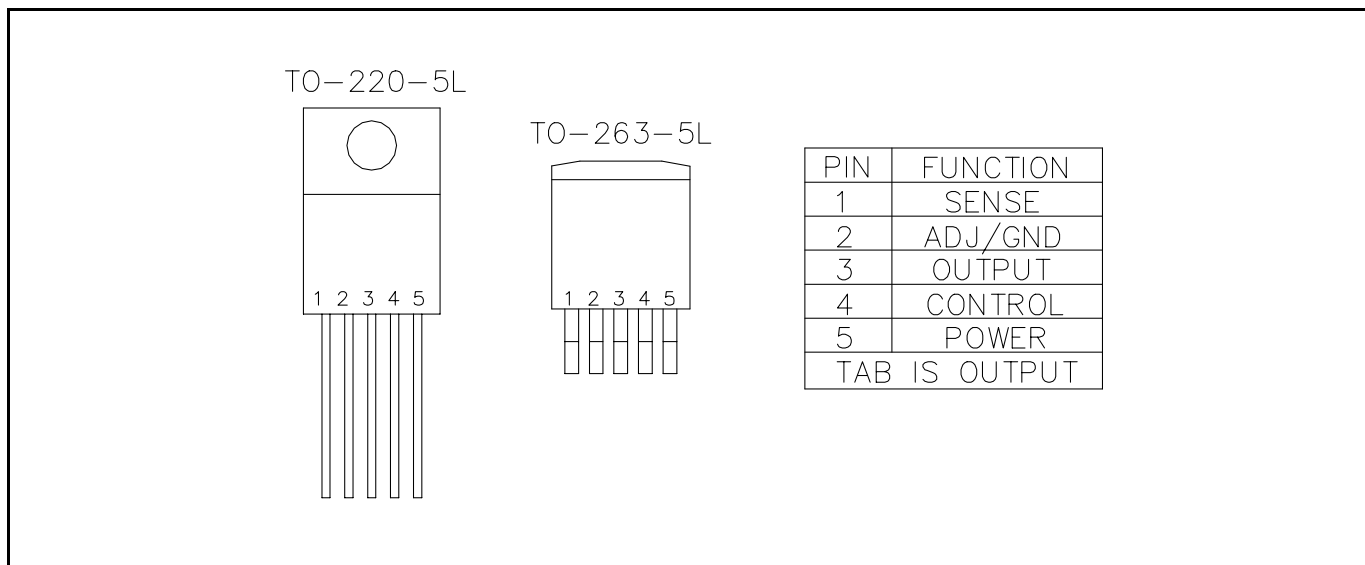
PowerPC is a trademark of IBM.

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

1

February 26, 1999

## 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 / 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.  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).

February 26, 1999

**ELECTRICAL CHARACTERISTICS**

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

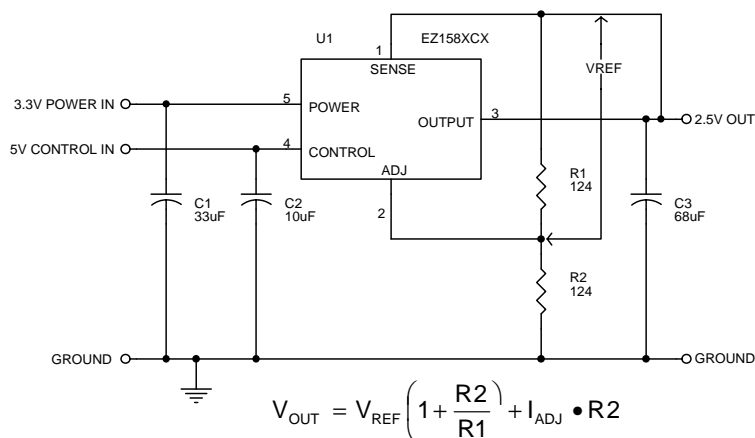
**NOTES**

- (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.

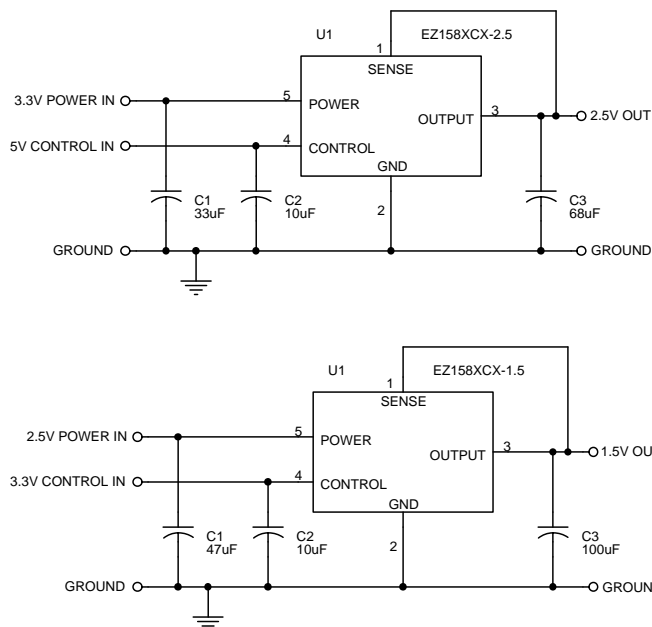
February 26, 1999

## 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.

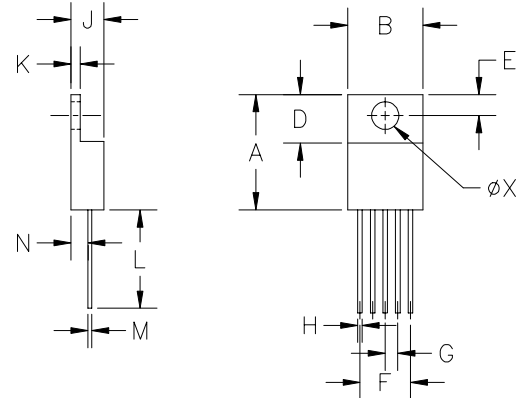
February 26, 1999

## 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,  $V_{\text{CONTROL}}$ , which should exceed  $V_{\text{OUT}}$  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.

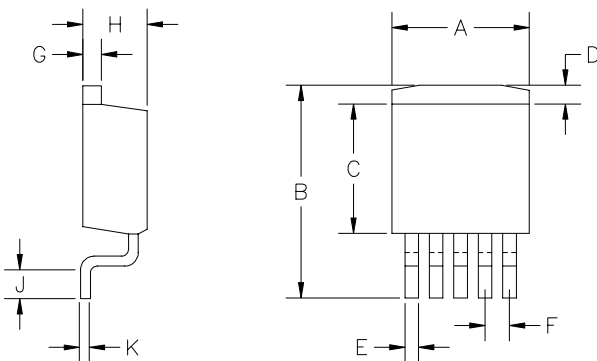
## DEVICE OUTLINE - TO-220, 5 PIN



DIM <sup>N</sup>	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.560	.650	14.22	16.51	—
B	.380	.420	9.65	10.67	—
D	.230	.260	5.84	6.60	—
E	.100	.135	2.54	3.43	—
F	.263	.273	6.68	6.94	—
G	.062	.072	1.57	1.83	—
H	.025	.040	.63	1.02	—
J	.140	.190	3.55	4.83	—
K	.045	.055	1.14	1.40	—
L	.540	.560	13.72	14.22	—
M	.014	.022	.35	.56	—
N	.080	.120	2.03	3.05	—
ØX	.139	.161	3.53	4.09	—

JEDEC TO-220

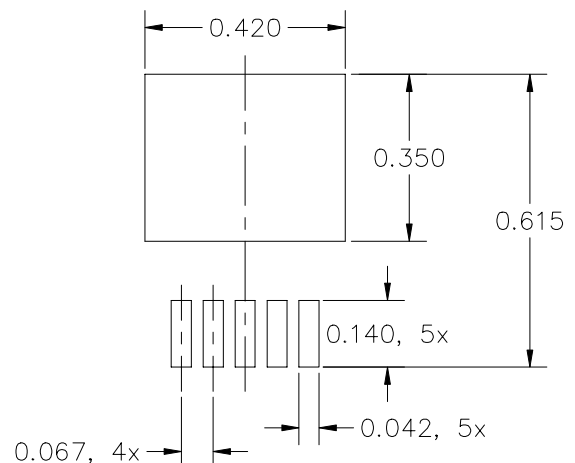
## DEVICE OUTLINE - TO-263, 5 PIN



DIM <sup>N</sup>	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.380	.405	9.65	10.29	—
B	.575	.625	14.60	15.88	—
C	.325	.380	8.25	9.66	—
D	—	.055	—	1.40	—
E	.020	.039	.50	.99	—
F	.060	.072	1.52	1.83	—
G	.045	.055	1.14	1.40	—
H	.160	.190	4.06	4.83	—
J	.090	.110	2.28	2.80	—
K	.018	.029	1.457	1.736	—

JEDEC TO-263

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



NOTE: ALL DIMENSIONS ARE IN INCHES