

Description

The ZMR-Q series of three terminal fixed positive voltage regulators feature internal current limit and will shut down under thermal overload conditions making the devices difficult to destroy.

The circuit design offers an exceptionally low quiescent current, only 30µA for the 2.5V device, ideal for low power applications. The initial devices in the series regulate to 2.5 or 5V with a drive capability up to 50mA.

All three devices are designed with space saving in mind and are available in the small outline SOT23 package. All three have an input voltage range of at least 20V plus the output voltage.

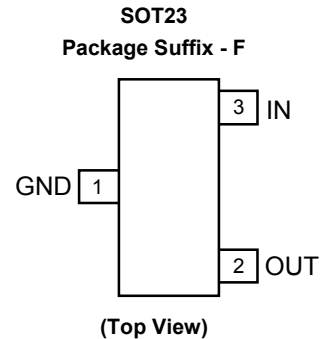
The ZMR250Q, ZMR330Q and ZMR500Q have been qualified to AEC-Q100 Grade 1 and are Automotive Grade supporting PPAPs.

Features

- 2.5V, 3.3V and 5V Output
- Output Current up to 50mA
- Very Low Quiescent Current (30µA)
- Unconditionally Stable
- Internal Short Circuit Current Limit
- Green Molding in SOT23
 - **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
 - **Halogen and Antimony Free. "Green" Device (Note 3)**
- Automotive Grade
 - **Qualified to AEC-Q100 Standards for High Reliability**
 - **PPAP Capable (Note 4)**

- 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.
 4. Automotive products are AEC-Q100 qualified and are PPAP capable. Automotive, AEC-Q100 and standard products are electrically and thermally the same, except where specified. For more information, please refer to http://www.diodes.com/quality/product_compliance_definitions/.

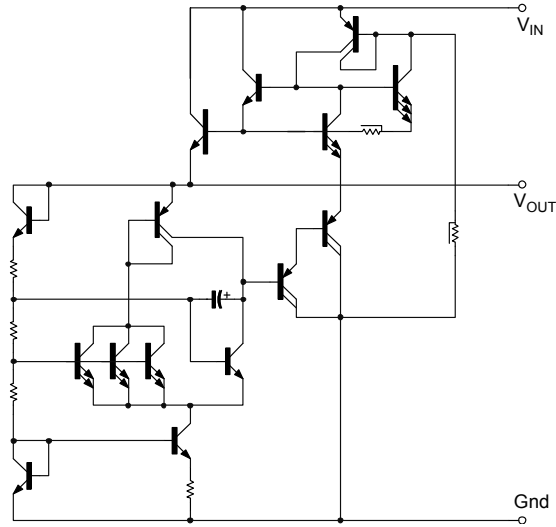
Pin Assignments



Applications

- Automotive Point of Load Regulation

Equivalent Circuit



Absolute Maximum Ratings

Parameter	Rating	Unit
Input Voltage (Note 5) ZMR250 ZMR330 ZMR500	22.5 24 25	V
Power Dissipation ($T_{AMB} = +25^{\circ}C$) (Note 6) SOT23	500	mW
Output Current (I_O)	100	mA
Ambient Temperature	-55 to +125	$^{\circ}C$
Maximum Junction Temperature	125	$^{\circ}C$
Storage Temperature	-65 to +150	$^{\circ}C$
ESD Rating		
HBM	Human Body Model	1.5 kV
MM	Machine Model	350 V
CDM	Charged Device Model	1 kV

Caution: Stresses greater than the 'Absolute Maximum Ratings' specified above, may cause permanent damage to the device. These are stress ratings only; functional operation of the device at conditions between maximum recommended operating conditions and absolute maximum ratings is not implied. Device reliability may be affected by exposure to absolute maximum rating conditions for extended periods of time.

(Semiconductor devices are ESD sensitive and may be damaged by exposure to ESD events. Suitable ESD precautions should be taken when handling and transporting these devices.)

- Notes:
- The maximum operating input voltage and output current of the device will be governed by the maximum power dissipation of the selected package. Maximum package power dissipation is specified at 25°C and must be linearly derated to zero at $T_A = T_J = +125^{\circ}C$.
 - Maximum power dissipation for the SOT23 package is calculated assuming that the device is mounted on a ceramic substrate measuring 15x15x0.6mm.

Recommended Operating Conditions

Input Voltage Range	Min	Max	Unit
ZMR250	4.2	22.5	V
ZMR330	4.8	24	V
ZMR500	7.0	25	V
Junction Temperature Range	-40	+125	$^{\circ}C$
Ambient Temperature Range	-40	+125	$^{\circ}C$

Electrical Characteristics (@T_A = +25°C, I_O = 10mA, V_{IN} = 6.5V, unless otherwise specified.)

ZMR250Q

Symbol	Parameter	Condition	Min	Typ	Max	Unit	
V _O	Output Voltage		2.438	2.5	2.563	V	
			I _O = 0 to 50mA	2.360		2.640	V
		V _{IN} = 4.5 to 22.5V T _J = -40°C to +125°C	2.360		2.640	V	
ΔV _O	Line Regulation	V _{IN} = 4.5 to 22.5V		5	15	mV	
ΔV _O	Load Regulation	I _O = 0 to 50mA		20	30	mV	
		I _O = 0 to 10mA		12			
I _S	Supply Current	T _J = -40°C to +125°C		30	40	μA	
ΔI _S	Supply Current Change	I _O = 0 to 50mA		1	±10	μA	
		V _{IN} = 4.5 to 22.5V		2	±10		
V _N	Output Noise Voltage	f = 10Hz to 10kHz		65		μVrms	
ΔV _{IN} /ΔV _O	Ripple Rejection	V _{IN} = 6.3 to 18V f = 120Hz	55	75		dB	
V _{IN}	Input Voltage Required to Maintain Regulation			3.9		V	
ΔV _O /ΔT	Average Temperature Coefficient V _O	I _O = 5.0mA T _J = -40°C to +125°C		0.275	0.700	mV/°C	

Electrical Characteristics (@T_A = +25°C, I_O = 10mA, V_{IN} = 7V, unless otherwise specified.)

ZMR330Q

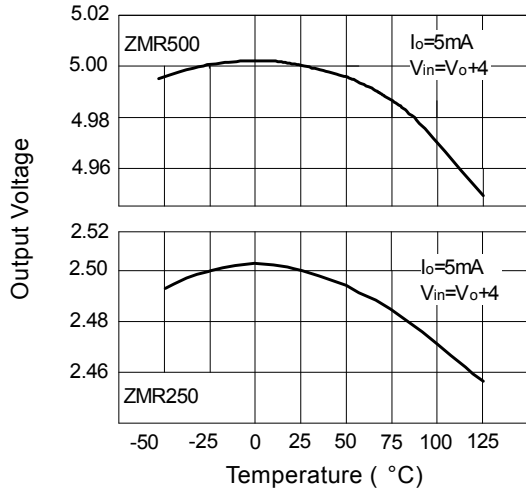
Symbol	Parameter	Condition	Min	Typ	Max	Unit	
V _O	Output Voltage		3.217	3.3	3.383	V	
			I _O = 0 to 50mA	3.148		3.393	V
		V _{IN} = 5 to 24V T _J = -40°C to +125°C	3.148		3.408	V	
ΔV _O	Line Regulation	V _{IN} = 5 to 24V		5	15	mV	
ΔV _O	Load Regulation	I _O = 0 to 50mA		20	50	mV	
		I _O = 0 to 10mA		13			
I _S	Supply Current	T _J = -40°C to +125°C		120	170	μA	
ΔI _S	Supply Current Change	I _O = 0 to 50mA		5	±10	μA	
		V _{IN} = 5 to 20V		2	±10		
V _N	Output Noise Voltage	f = 10Hz to 10kHz		80		μVrms	
ΔV _{IN} /ΔV _O	Ripple Rejection	V _{IN} = 6 to 20V f = 120Hz	55			dB	
V _{IN}	Input Voltage Required to Maintain Regulation			4.74		V	

Electrical Characteristics (@T_A = +25°C, I_O = 10mA, V_{IN} = 10V, unless otherwise specified.)

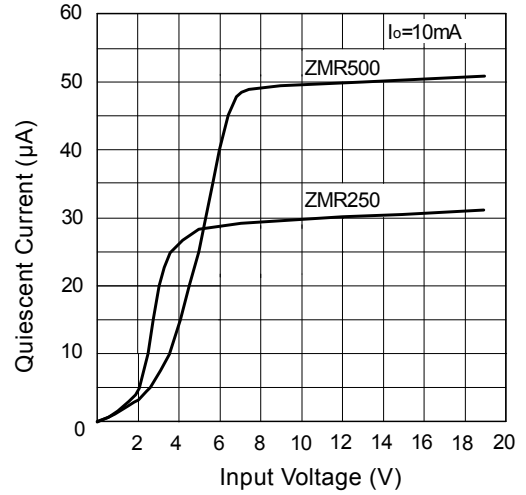
ZMR500Q

Symbol	Parameter	Condition	Min	Typ	Max	Unit	
V _O	Output Voltage		4.875	5	5.125	V	
			I _O = 0 to 50mA	4.780		5.160	V
		V _{IN} = 7 to 25V T _J = -40°C to +125°C	4.780		5.175	V	
ΔV _O	Line Regulation	V _{IN} = 7 to 25V		5	15	mV	
ΔV _O	Load Regulation	I _O = 0 to 50mA		25	40	mV	
		I _O = 0 to 10mA		15			
I _S	Supply Current	T _J = -40°C to +125°C		50	70	μA	
ΔI _S	Supply Current Change	I _O = 0 to 50mA		1	±10	μA	
		V _{IN} = 7 to 25V		2	±10		
V _N	Output Noise Voltage	f = 10Hz to 10kHz		90		μVrms	
ΔV _{IN} /ΔV _O	Ripple Rejection	V _{IN} = 8 to 18V f = 120Hz	55	72		dB	
V _{IN}	Input Voltage Required to Maintain Regulation			6.7		V	
ΔV _O /ΔT	Average Temperature Coefficient V _O	I _O = 5.0mA, T _J = -40°C to +125°C		0.275	0.700	mV/°C	

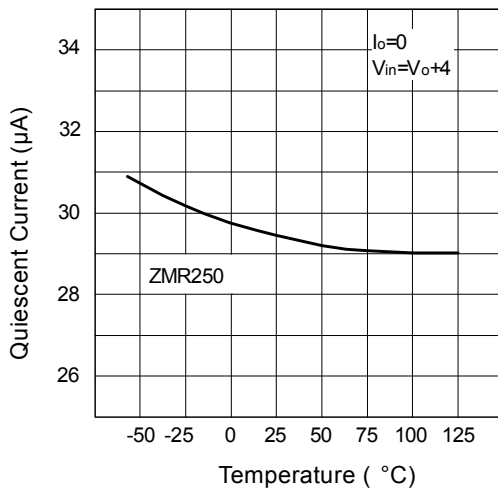
Typical Characteristics



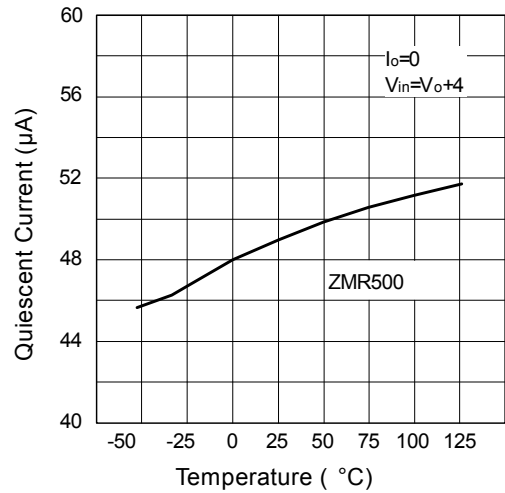
Output Voltage vs. Temperature



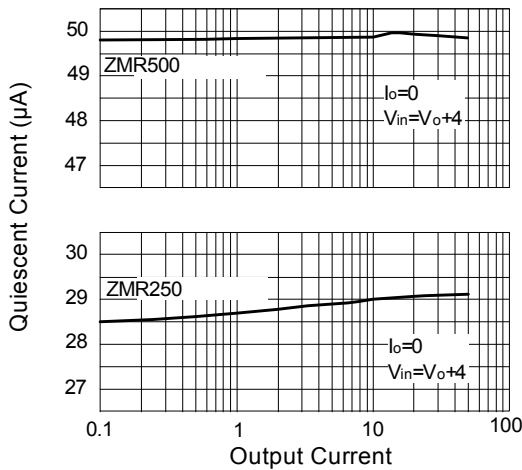
Quiescent Current vs. Input Voltage



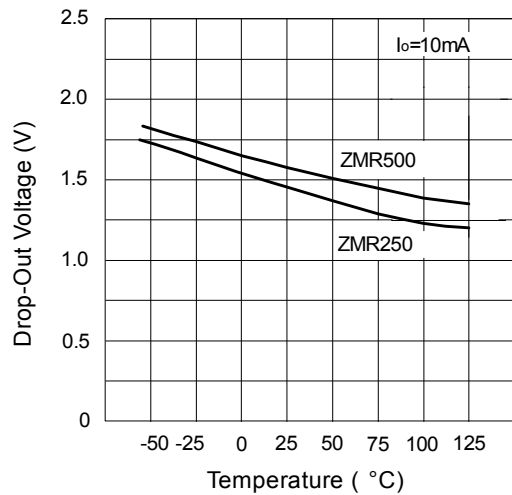
Quiescent Current vs. Temperature



Quiescent Current vs. Temperature

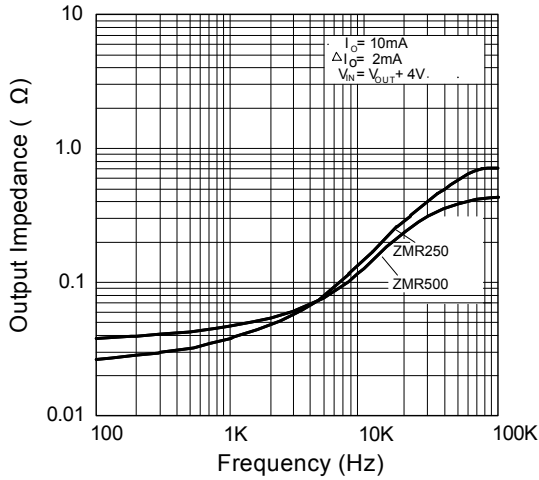


Quiescent Current vs. Output Current

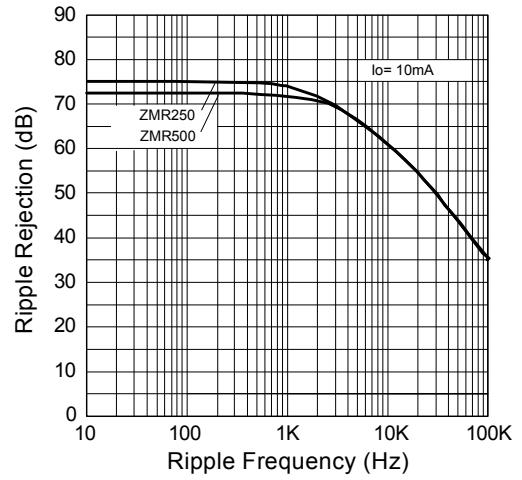


Drop-out Voltage vs. Temperature

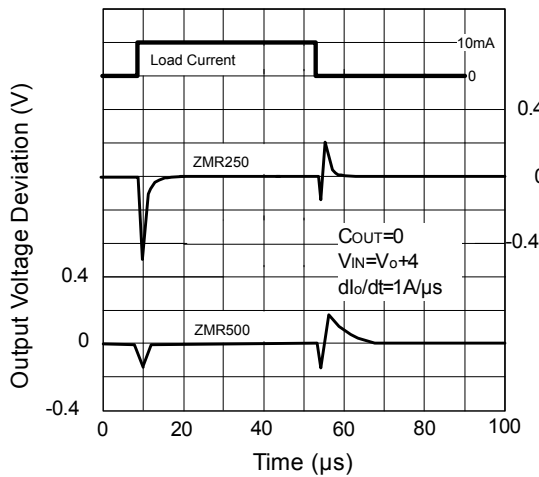
Typical Characteristics (cont.)



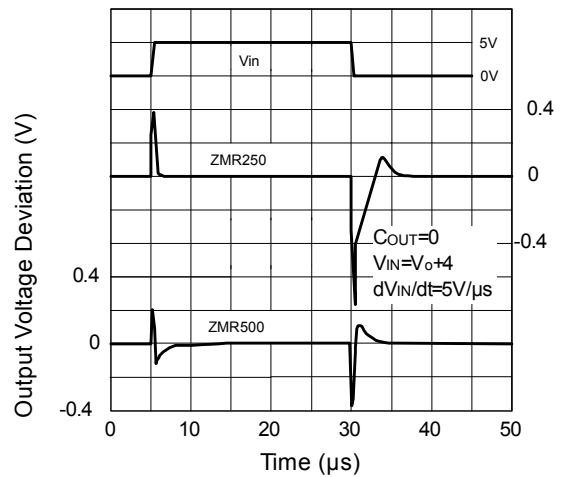
Output Impedance v Frequency



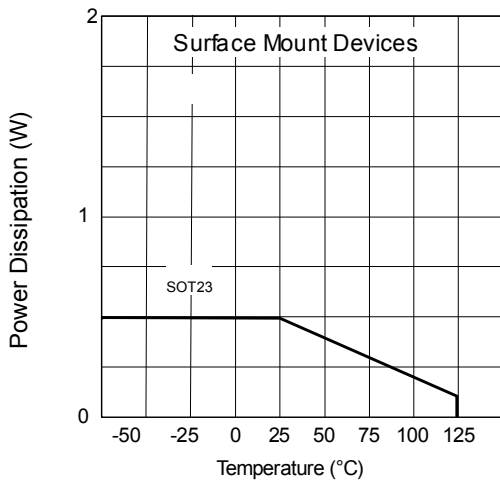
Ripple Rejection v Ripple Frequency



Load Transient Response

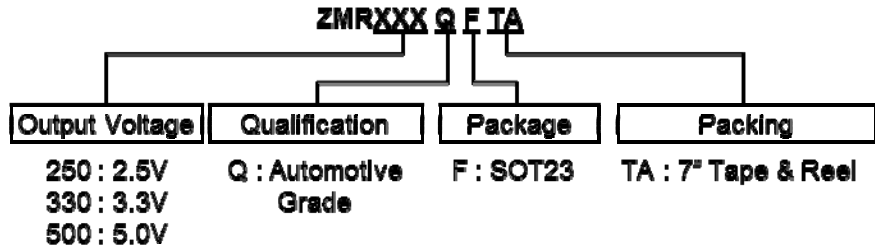


Line Transient Response



Power Derating

Ordering Information

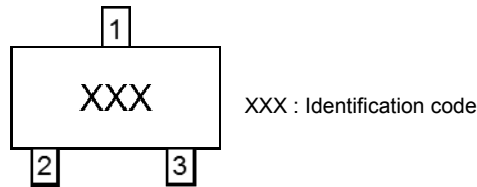


Part Number	Package	Package Code	Identification Code	Packing: 7" Tape and Reel			Qualification Grade (Note 7)
				Quantity	Tape Width	Part Number Suffix	
ZMR250QFTA	SOT23	F	25K	3000	8mm	TA	Automotive Grade
ZMR330QFTA	SOT23	F	330	3000	8mm	TA	Automotive Grade
ZMR500QFTA	SOT23	F	50K	3000	8mm	TA	Automotive Grade

Notes: 7. ZMR250Q, ZMR330Q and ZMR500Q have been qualified to AEC-Q100 grade 1 and are classified as "Automotive Grade" which supports PPAP documentation. See ZMR250/330/500 datasheet for commercial qualified versions.

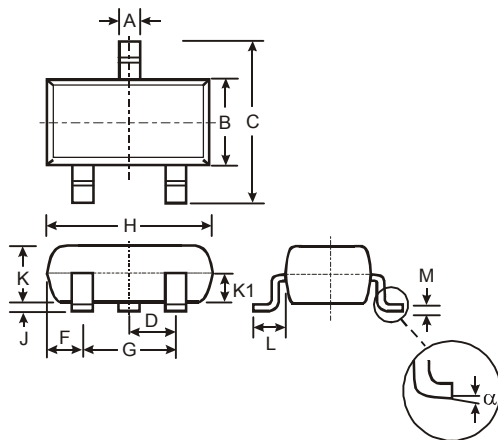
Marking Information

Package type: SOT23



Package Outline Dimensions (All dimensions in mm.)

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

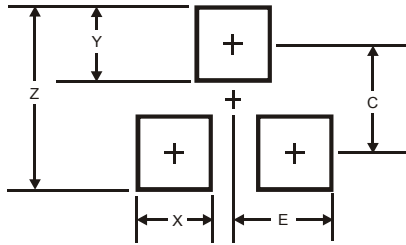


SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.903	1.10	1.00
K1	-	-	0.400
L	0.45	0.61	0.55
M	0.085	0.18	0.11
α	0°	8°	-

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)
Z	2.9
X	0.8
Y	0.9
C	2.0
E	1.35

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