Description

The ZMR250Q/ZMR330Q/ZMR500Q 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 2.5V or 5V with a drive capability up to 50mA.

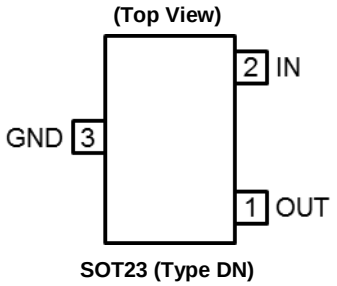
All three devices are designed with space saving in mind and are available in the small outline SOT23 (Type DN) package. All three have an input voltage range of at least 20V plus the output voltage.

The ZMR250Q, ZMR330Q and ZMR500Q have been qualified to AEC-Q100 Grade 1 and are Automotive Compliant 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 (Type DN)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- Automotive Compliant
- **Qualified to AEC-Q100 Standards for High Reliability**
- **PPAP Capable (Note 4)**

Pin Assignments

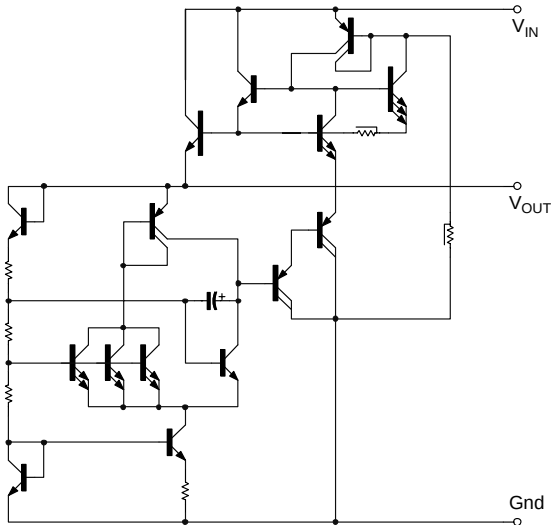


Applications

- Automotive Point of Load Regulation

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. http://www.diodes.com/product_compliance_definitions.html.

Equivalent Circuit



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Absolute Maximum Ratings

Parameter		Rating	Unit
Input Voltage (Note 5) ZMR250Q ZMR330Q ZMR500Q		 22.5 24 25	V
Power Dissipation (T_A = +25°C) (Note 6) SOT23 (Type DN)		 500	mW
Output Current (I_O)		100	mA
Ambient Temperature		-55 to +125	°C
Maximum Junction Temperature		+125	°C
Storage Temperature		-65 to +150	°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:
5. 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°C.
6. Maximum power dissipation for the SOT23 (Type DN) package is calculated assuming that the device is mounted on a ceramic substrate measuring 15mm x 15mm x 0.6mm.

Recommended Operating Conditions

Input Voltage Range	Min	Max	Unit
ZMR250Q	4.2	22.5	V
ZMR330Q	4.8	24	V
ZMR500Q	7.0	25	V
Junction Temperature Range	-40	+125	°C
Ambient Temperature Range	-40	+125	°C

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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} = 4.5V to 22.5V	T_J = -40°C to +125°C	2.360	—	2.640	V
ΔV_O	Line Regulation	V_{IN} = 4.5V 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} = 4.5V to 22.5V		—	2	±10	
V_N	Output Noise Voltage	f = 10Hz to 10kHz		—	65	—	µVrms
$\Delta V_{IN}/\Delta V_O$	Ripple Rejection	V_{IN} = 6.3V to 18V, f = 120Hz		55	75	—	dB
V_{IN}	Input Voltage Required to Maintain Regulation	—		—	3.9	—	V
$\Delta V_O/\Delta_T$	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} = 5V to 24V	T_J = -40°C to +125°C	3.148	—	3.408	V
ΔV_O	Line Regulation	V_{IN} = 5V 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} = 5V to 20V		—	2	±10	
V_N	Output Noise Voltage	f = 10Hz to 10kHz		—	80	—	µVrms
$\Delta V_{IN}/\Delta V_O$	Ripple Rejection	V_{IN} = 6V to 20V, f = 120Hz		55	—	—	dB
V_{IN}	Input Voltage Required to Maintain Regulation	—		—	4.74	—	V

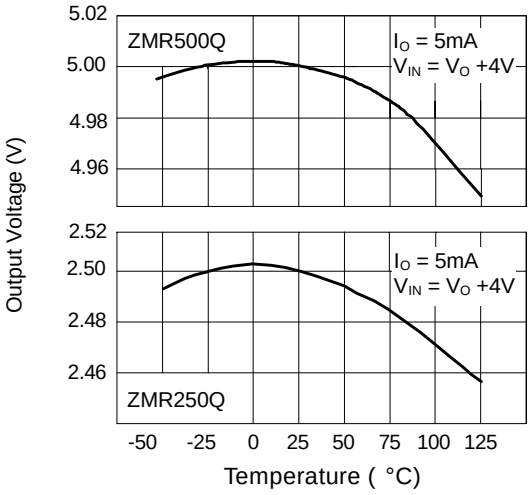
Electrical Characteristics (@T_A = +25°C, I_O = 10mA, V_{IN} = 10V, unless otherwise specified.)

ZMR500Q

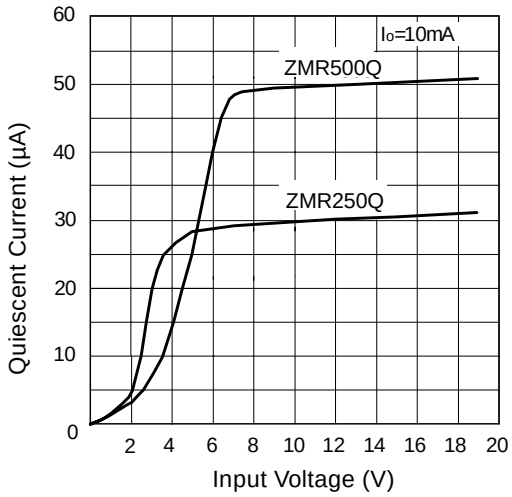
Symbol	Parameter	Condition		Min	Typ	Max	Unit
V_O	Output Voltage	—		4.875	5	5.125	V
		—	I_O = 0 to 50mA	4.780	—	5.160	V
		V_{IN} = 7V to 25V	T_J = -40°C to +125°C	4.780	—	5.175	V
ΔV_O	Line Regulation	V_{IN} = 7V to 25V		—	5	15	mV
ΔV_O	Load Regulation	I_O = 0 to 50mA		—	25	40	mV
		I_O = 0 to 10mA		—	15	—	
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} = 7V to 25V		—	2	±10	
V_N	Output Noise Voltage	f = 10Hz to 10kHz		—	90	—	µVrms
$\Delta V_{IN}/\Delta V_O$	Ripple Rejection	V_{IN} = 8V to 18V, f = 120Hz		55	72	—	dB
V_{IN}	Input Voltage Required to Maintain Regulation	—		—	6.7	—	V
$\Delta V_O/\Delta_T$	Average Temperature Coefficient V_O	I_O = 5.0mA, T_J = -40°C to +125°C		—	0.275	0.700	mV/°C

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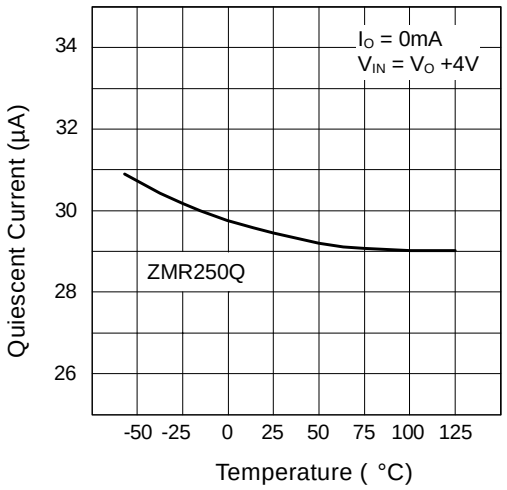
Typical Characteristics



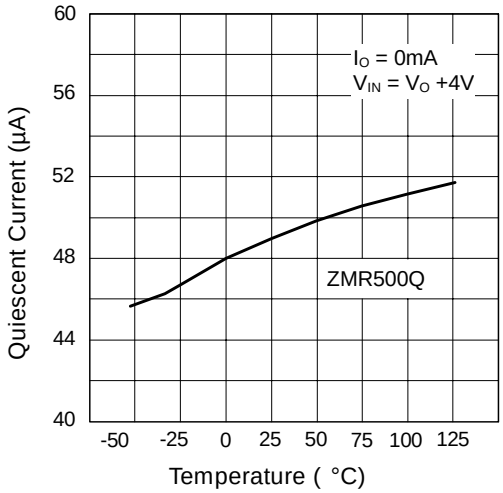
Output Voltage vs. Temperature



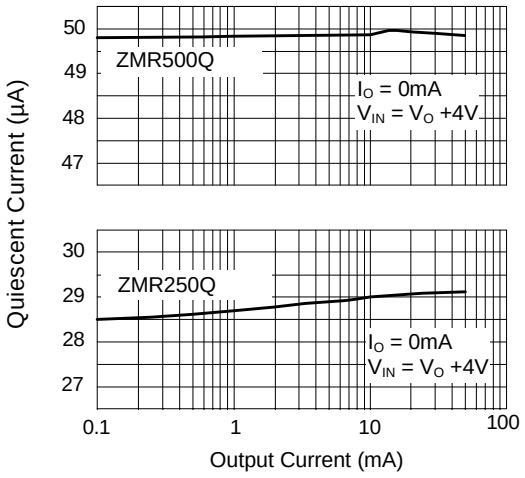
Quiescent Current vs. Input Voltage



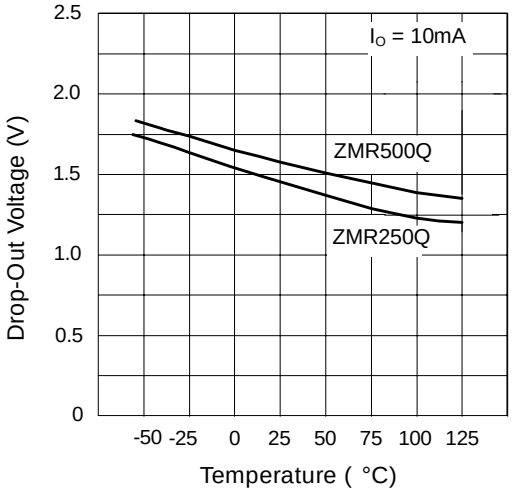
Quiescent Current vs. Temperature



Quiescent Current vs. Temperature



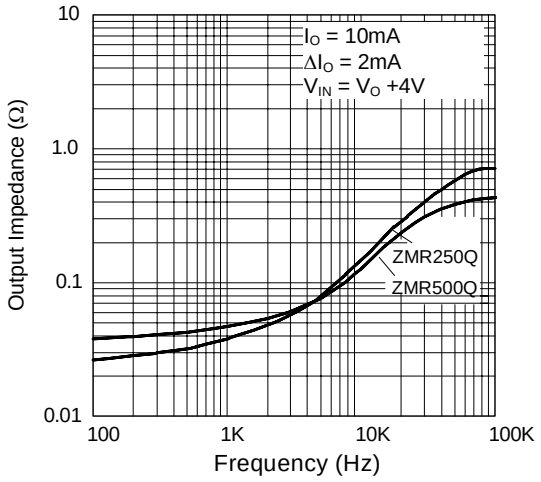
Quiescent Current vs. Output Current



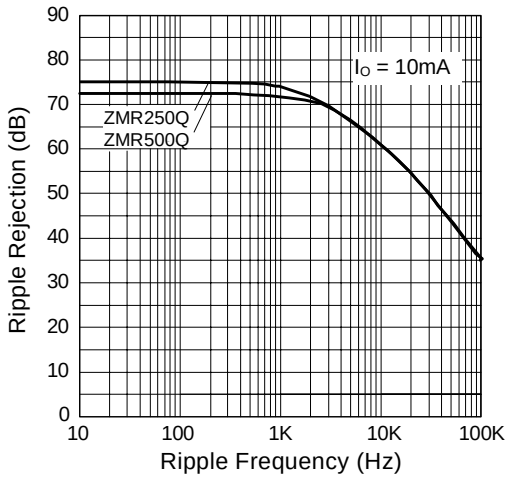
Drop-out Voltage vs. Temperature

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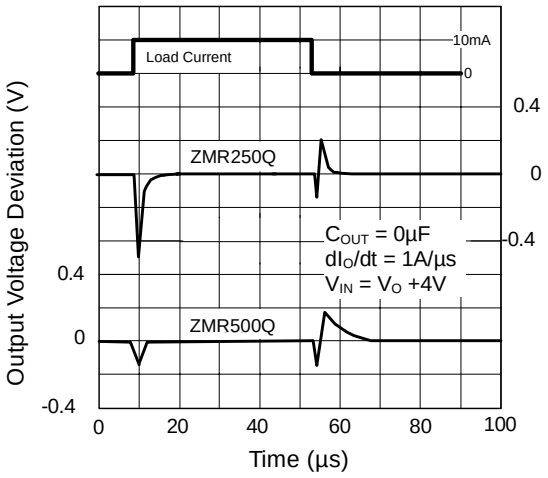
Typical Characteristics (Cont.)



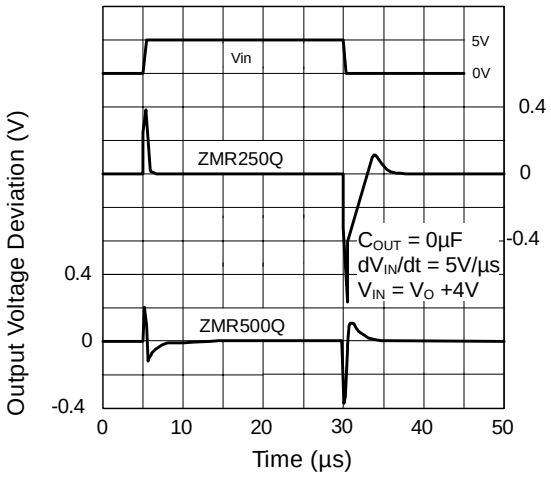
Output Impedance v Frequency



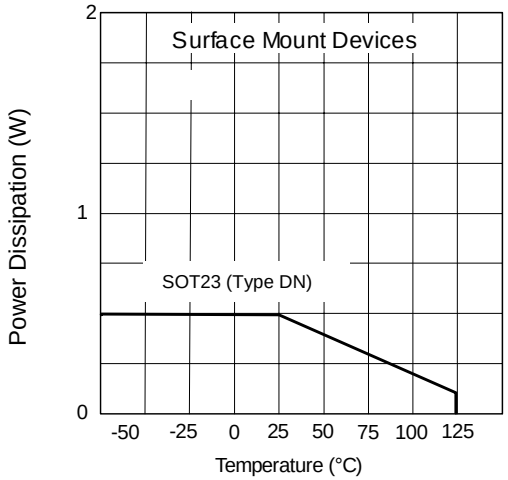
Ripple Rejection v Ripple Frequency



Load Transient Response



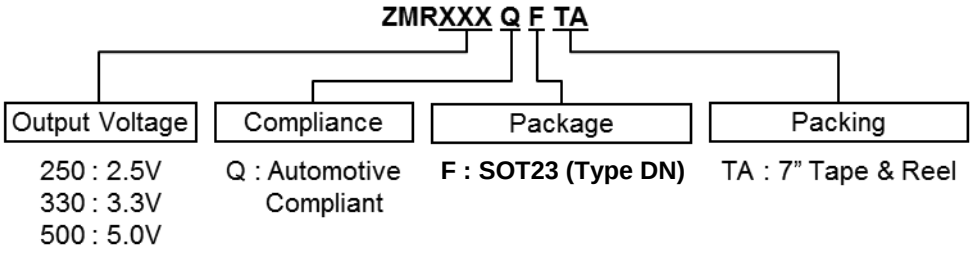
Line Transient Response



Power Derating

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Ordering Information

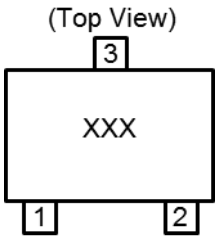


Part Number	Package	Package Code	Identification Code	Packing: 7" Tape and Reel			Qualification Grade (Note 7)
				Quantity	Tape Width	Part Number Suffix	
ZMR250QFTA	SOT23 (Type DN)	F	25K	3000	8mm	TA	Automotive Compliant
ZMR330QFTA	SOT23 (Type DN)	F	330	3000	8mm	TA	Automotive Compliant
ZMR500QFTA	SOT23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

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

Marking Information

SOT23 (Type DN)



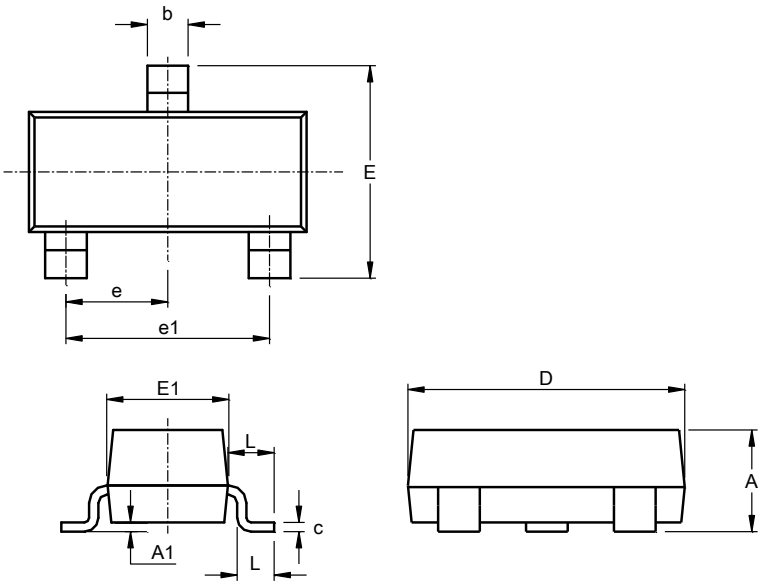
XXX : Identification Code

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Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

SOT23 (Type DN)

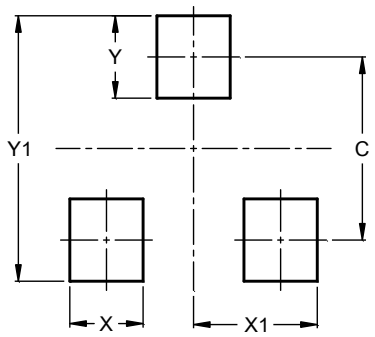


SOT23 (Type DN)			
Dim	**Min**	**Max**	**Typ**
A	0.89	1.12	1.00
A1	0.01	0.10	0.05
b	0.30	0.51	0.45
c	0.08	0.20	0.10
D	2.80	3.04	3.00
E	2.10	2.64	2.42
E1	1.20	1.40	1.37
e	0.95 REF		
e1	1.90 REF		
L	0.25	0.60	0.30
L1	0.45	0.62	0.54
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

SOT23 (Type DN)



Dimensions	Value (in mm)
C	2.0
X	0.8
X1	1.35
Y	0.9
Y1	2.9

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