



YOUSHANG SEMICONDUCTOR

**设计研发新型功率器件**

**各类小信号开关**

**中低压及高压大电流等场效应管**

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## Description

The NK-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.

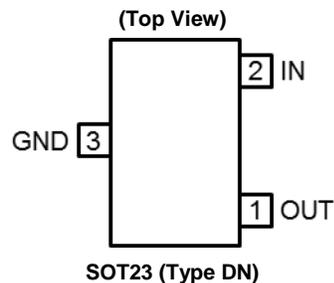
All three devices are designed with space saving in mind and are available in the small outline SOT23 (Type DN) package. All three have an input voltage range of at least 20V plus the output voltage.

The NK-ZMR250Q, NK-ZMR330Q and NK-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)

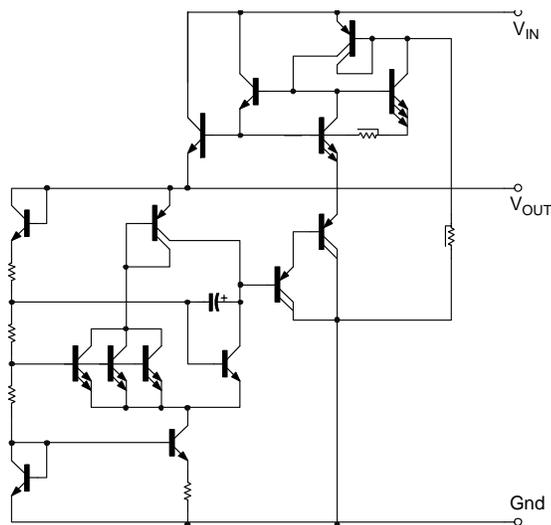
## Pin Assignments



## Applications

- Automotive Point of Load Regulation

## Equivalent Circuit



## Absolute Maximum Ratings

Parameter	Rating	Unit	
Input Voltage (Note 5)			
NK-ZMR250Q	22.5	V	
NK-ZMR330Q	24		
NK-ZMR500Q	25		
Power Dissipation ( $T_A = +25^\circ\text{C}$ ) (Note 6)			
SOT23 (Type DN)	500	mW	
Output Current ( $I_O$ )	100	mA	
Ambient Temperature	-55 to +125	$^\circ\text{C}$	
Maximum Junction Temperature	+125	$^\circ\text{C}$	
Storage Temperature	-65 to +150	$^\circ\text{C}$	
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  $+25^\circ\text{C}$  and must be linearly derated to zero at  $T_A = T_J = +125^\circ\text{C}$ .
  - 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
NK-ZMR250Q	4.2	22.5	V
NK-ZMR330Q	4.8	24	V
NK-ZMR500Q	7.0	25	V
Junction Temperature Range	-40	+125	$^\circ\text{C}$
Ambient Temperature Range	-40	+125	$^\circ\text{C}$

**Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ ,  $I_O = 10\text{mA}$ ,  $V_{IN} = 6.5\text{V}$ , unless otherwise specified.)

**NK-ZMR250Q**

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$V_O$	Output Voltage	—	2.438	2.5	2.563	V
		—	2.360	—	2.640	V
		$V_{IN} = 4.5\text{V to } 22.5\text{V}$ $T_J = -40^\circ\text{C to } +125^\circ\text{C}$	2.360	—	2.640	V
$\Delta V_O$	Line Regulation	$V_{IN} = 4.5\text{V to } 22.5\text{V}$	—	5	15	mV
$\Delta V_O$	Load Regulation	$I_O = 0 \text{ to } 50\text{mA}$	—	20	30	mV
		$I_O = 0 \text{ to } 10\text{mA}$	—	12	—	
$I_S$	Supply Current	$T_J = -40^\circ\text{C to } +125^\circ\text{C}$	—	30	40	$\mu\text{A}$
$\Delta I_S$	Supply Current Change	$I_O = 0 \text{ to } 50\text{mA}$	—	1	$\pm 10$	$\mu\text{A}$
		$V_{IN} = 4.5\text{V to } 22.5\text{V}$	—	2	$\pm 10$	
$V_N$	Output Noise Voltage	$f = 10\text{Hz to } 10\text{kHz}$	—	65	—	$\mu\text{Vrms}$
$\Delta V_{IN}/\Delta V_O$	Ripple Rejection	$V_{IN} = 6.3\text{V to } 18\text{V}$ , $f = 120\text{Hz}$	55	75	—	dB
$V_{IN}$	Input Voltage Required to Maintain Regulation	—	—	3.9	—	V
$\Delta V_O/\Delta T$	Average Temperature Coefficient $V_O$	$I_O = 5.0\text{mA}$ $T_J = -40^\circ\text{C to } +125^\circ\text{C}$	—	0.275	0.700	$\text{mV}/^\circ\text{C}$

**Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ ,  $I_O = 10\text{mA}$ ,  $V_{IN} = 7\text{V}$ , unless otherwise specified.)

**NK-ZMR330Q**

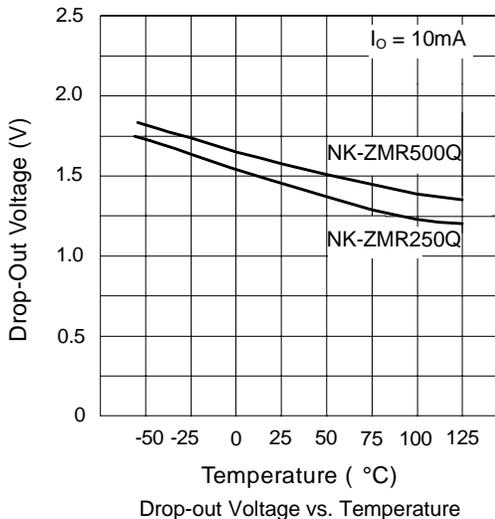
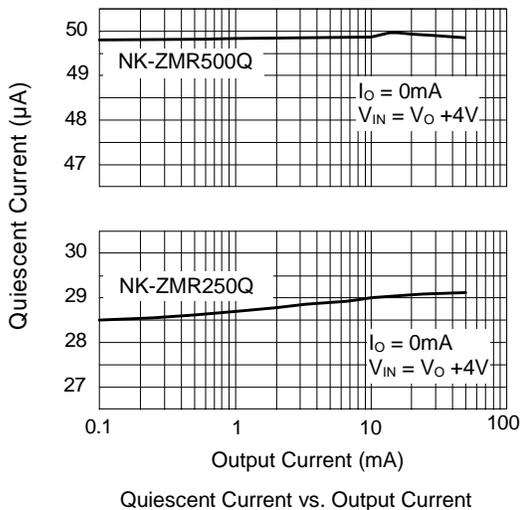
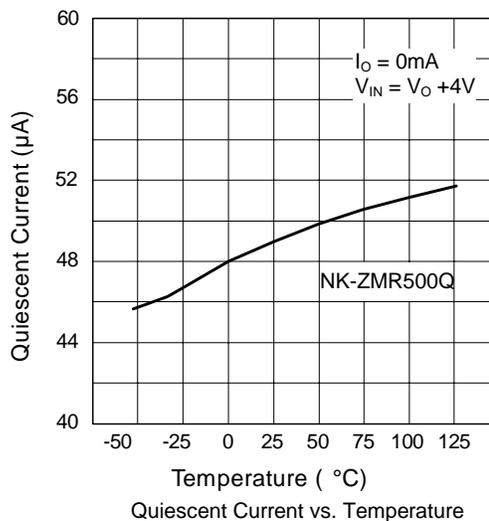
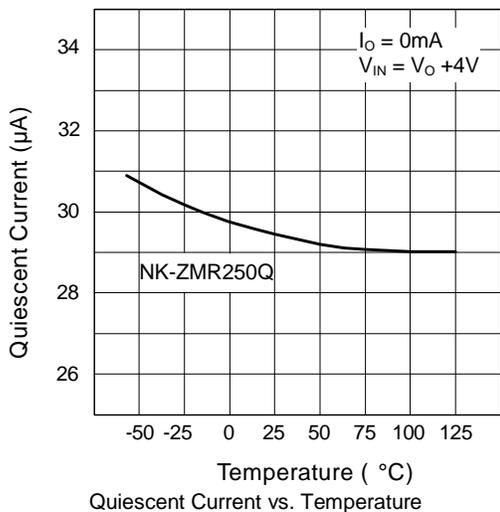
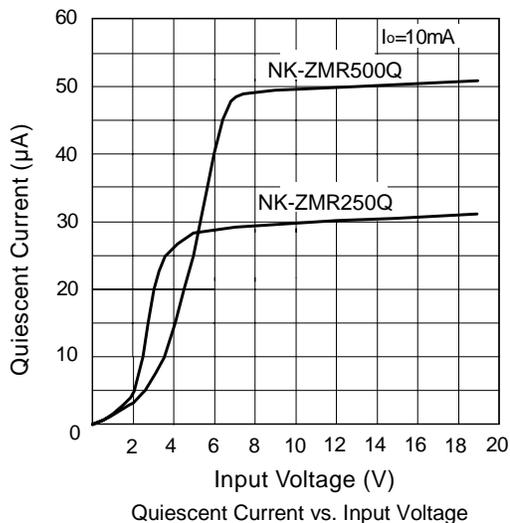
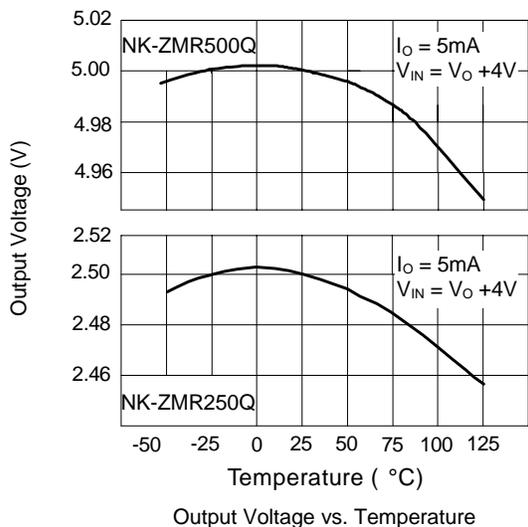
Symbol	Parameter	Condition	Min	Typ	Max	Unit
$V_O$	Output Voltage	—	3.217	3.3	3.383	V
		—	3.148	—	3.393	V
		$V_{IN} = 5\text{V to } 24\text{V}$ $T_J = -40^\circ\text{C to } +125^\circ\text{C}$	3.148	—	3.408	V
$\Delta V_O$	Line Regulation	$V_{IN} = 5\text{V to } 24\text{V}$	—	5	15	mV
$\Delta V_O$	Load Regulation	$I_O = 0 \text{ to } 50\text{mA}$	—	20	50	mV
		$I_O = 0 \text{ to } 10\text{mA}$	—	13	—	
$I_S$	Supply Current	$T_J = -40^\circ\text{C to } +125^\circ\text{C}$	—	120	170	$\mu\text{A}$
$\Delta I_S$	Supply Current Change	$I_O = 0 \text{ to } 50\text{mA}$	—	5	$\pm 10$	$\mu\text{A}$
		$V_{IN} = 5\text{V to } 20\text{V}$	—	2	$\pm 10$	
$V_N$	Output Noise Voltage	$f = 10\text{Hz to } 10\text{kHz}$	—	80	—	$\mu\text{Vrms}$
$\Delta V_{IN}/\Delta V_O$	Ripple Rejection	$V_{IN} = 6\text{V to } 20\text{V}$ , $f = 120\text{Hz}$	55	—	—	dB
$V_{IN}$	Input Voltage Required to Maintain Regulation	—	—	4.74	—	V

**Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ ,  $I_O = 10\text{mA}$ ,  $V_{IN} = 10\text{V}$ , unless otherwise specified.)

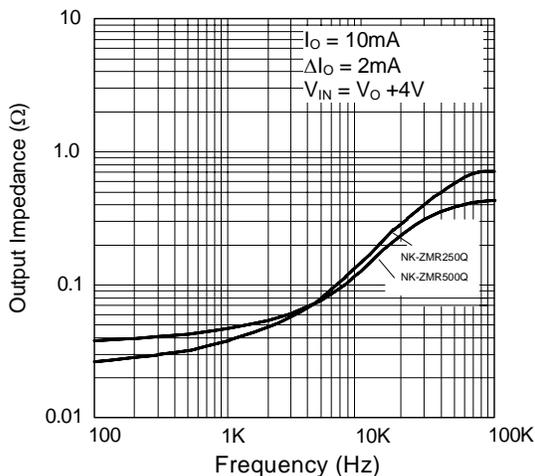
**NK-ZMR500Q**

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$V_O$	Output Voltage	—	4.875	5	5.125	V
		—	4.780	—	5.160	V
		$V_{IN} = 7\text{V to } 25\text{V}$ $T_J = -40^\circ\text{C to } +125^\circ\text{C}$	4.780	—	5.175	V
$\Delta V_O$	Line Regulation	$V_{IN} = 7\text{V to } 25\text{V}$	—	5	15	mV
$\Delta V_O$	Load Regulation	$I_O = 0 \text{ to } 50\text{mA}$	—	25	40	mV
		$I_O = 0 \text{ to } 10\text{mA}$	—	15	—	
$I_S$	Supply Current	$T_J = -40^\circ\text{C to } +125^\circ\text{C}$	—	50	70	$\mu\text{A}$
$\Delta I_S$	Supply Current Change	$I_O = 0 \text{ to } 50\text{mA}$	—	1	$\pm 10$	$\mu\text{A}$
		$V_{IN} = 7\text{V to } 25\text{V}$	—	2	$\pm 10$	
$V_N$	Output Noise Voltage	$f = 10\text{Hz to } 10\text{kHz}$	—	90	—	$\mu\text{Vrms}$
$\Delta V_{IN}/\Delta V_O$	Ripple Rejection	$V_{IN} = 8\text{V to } 18\text{V}$ , $f = 120\text{Hz}$	55	72	—	dB
$V_{IN}$	Input Voltage Required to Maintain Regulation	—	—	6.7	—	V
$\Delta V_O/\Delta T$	Average Temperature Coefficient $V_O$	$I_O = 5.0\text{mA}$ , $T_J = -40^\circ\text{C to } +125^\circ\text{C}$	—	0.275	0.700	$\text{mV}/^\circ\text{C}$

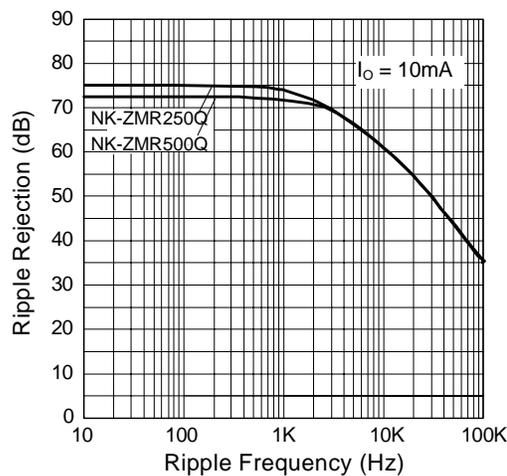
Typical Characteristics



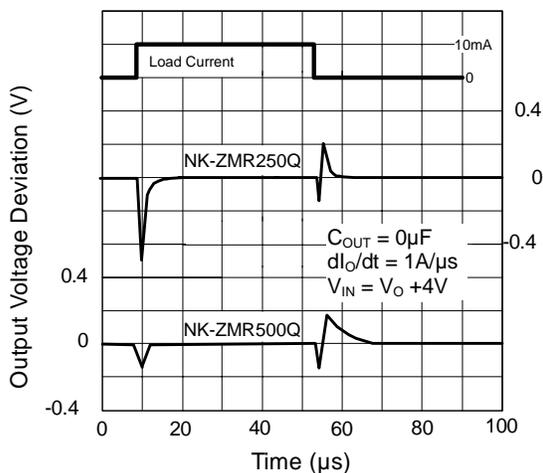
Typical Characteristics (Cont.)



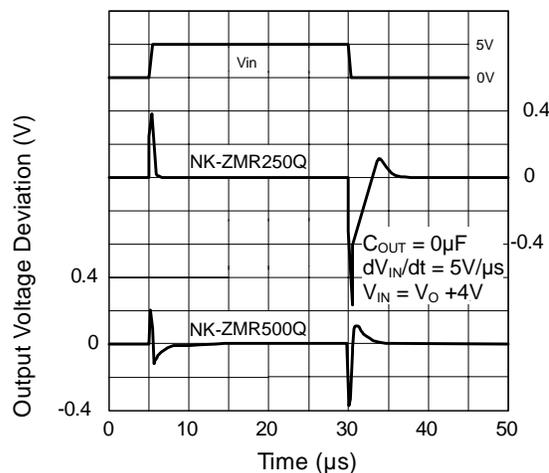
Output Impedance v Frequency



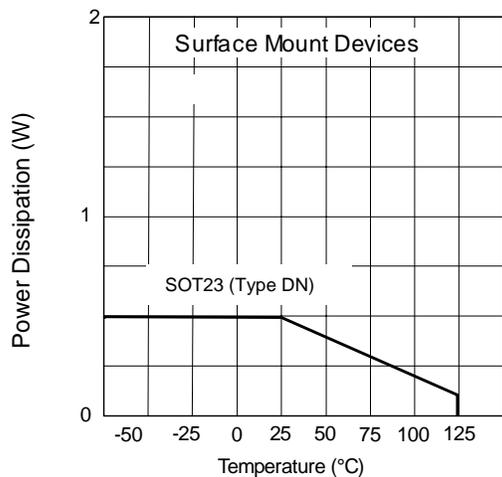
Ripple Rejection v Ripple Frequency



Load Transient Response

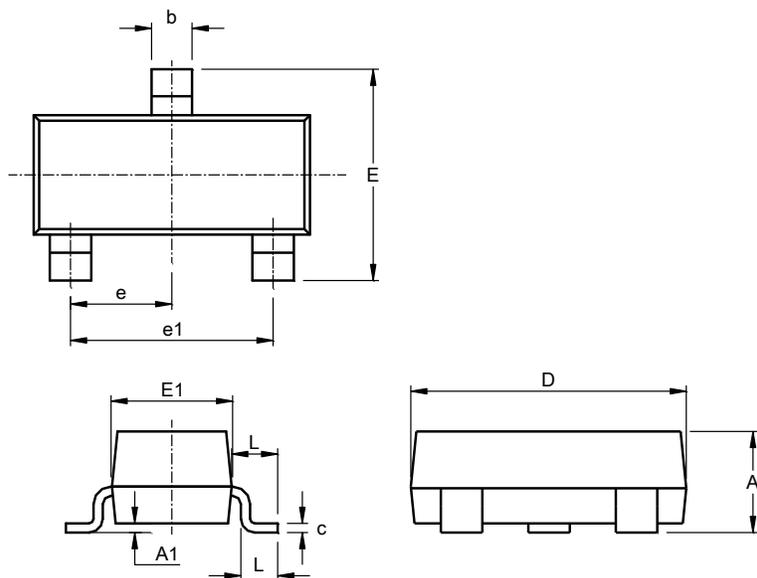


Line Transient Response



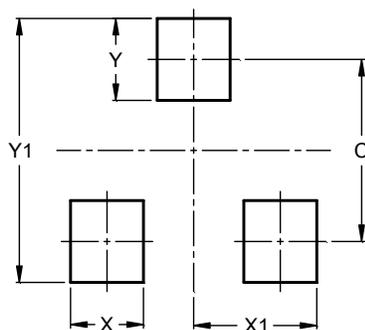
Power Derating

## Package Outline Dimensions

**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

**SOT23 (Type DN)**


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