



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

0755-83047638

ysbdt@szyoushang.cn

www.szyoushang.cn



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企业QQ二维码

Description

The NK-ZXTR2112F monolithically integrates a transistor, zener diode and resistor to function as a linear regulator. The device regulates with a 12V nominal output at 15mA. It is designed for use in high voltage applications where standard linear regulators cannot be used. This function is fully integrated into a SOT23 package, minimizing PCB area and reducing number of components when compared with a multi-chip discrete solution.

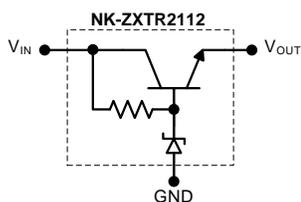
Applications

Supply voltage regulation for:

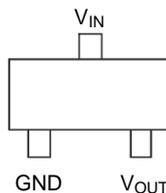
- 24V to 12V Rails
- Other Customized Input Rails



Top View



Internal Device Schematic



Top View Pin-Out

Pin Name	Pin Function
V_{IN}	Input Supply
GND	Power Ground
V_{OUT}	Voltage Output

Features

- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 15 to 60V (For regulated output voltage)
- Output Voltage = $12V \pm 10\%$
- Fully integrated into a SOT23 package

Mechanical Data

- Case: SOT23
- Case Material: Molded Plastic. "Green" Molding Compound. UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 @3
- Weight: 0.008 grams (Approximate)

Absolute Maximum Ratings

(Voltage relative to GND, @ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Input Voltage	V_{IN}	-0.3 to 60	V
Continuous Input & Output Current	I_{IN}, I_{OUT}	320	mA
Peak Pulsed Input & Output Current	I_{IM}, I_{OM}	2	A
Maximum Voltage applied to V_{OUT}	$V_{OUT(max)}$	Smaller of $V_{IN}+5V$ or 17V	V

Maximum Current at $V_{IN} = 24V$

(@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Continuous Output Current	I_{OUT}	50	mA
Pulsed Output Current	I_{OM}	2,000	mA
		500	

Thermal Characteristics

Characteristic	Symbol	Value	Unit	
Power Dissipation	P_D	625	mW	
		500		
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	200	$^\circ\text{C/W}$	
		250		
Thermal Resistance, Junction to Lead	$R_{\theta JL}$	197		
Thermal Resistance, Junction to Case	$R_{\theta JC}$	17		
Maximum Operating Junction and Storage Temperature Range	T_J, T_{STG}	-65 to +150		$^\circ\text{C}$

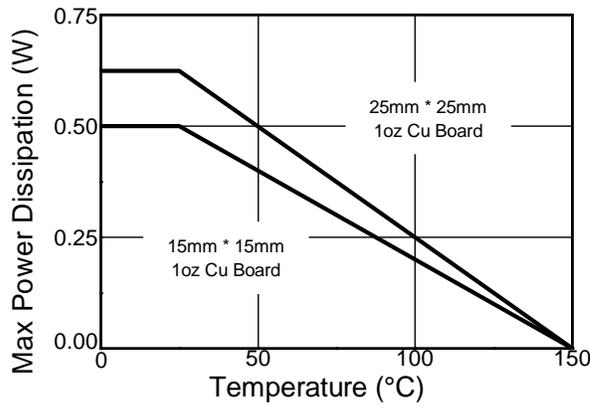
ESD Ratings

(Note 11)

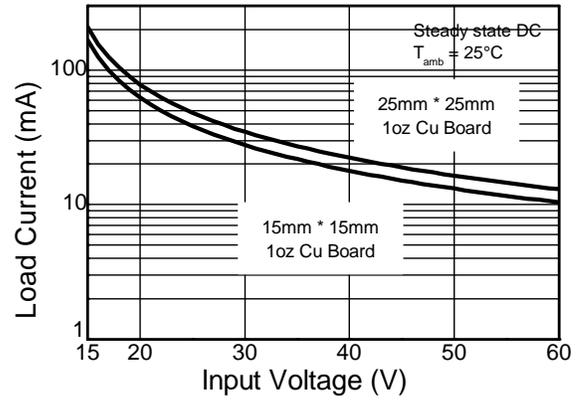
Characteristics	Symbols	Value	Unit	JEDEC Class
Electrostatic Discharge – Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge – Machine Model	ESD MM	400	V	C

- Notes:
- For a device mounted with the V_{IN} lead on 25mm x 25mm 1oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in steady-state.
 - Same as note 5, except mounted on 15mm x 15mm 1oz copper.
 - Same as note 5, whilst operating at $V_{IN}=24V$. Refer to Safe Operating Area for other Input Voltages.
 - Same as note 5, except measured with a single pulse width = 100 μs and $V_{IN}=24V$.
 - Same as note 5, except measured with a single pulse width = 10ms and $V_{IN}=24V$.
 - $R_{\theta JL}$ = Thermal resistance from junction to solder-point (at the end of the V_{IN} lead).
 - $R_{\theta JC}$ = Thermal resistance from junction to the top of case.
 - Refer to JEDEC specification JESD22-A114 and JESD22-A115.

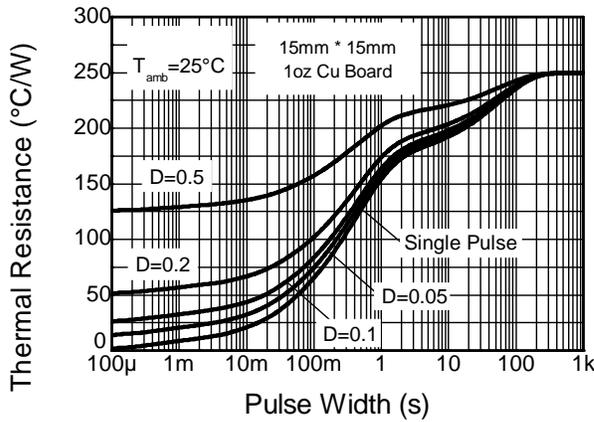
Thermal Characteristics and Derating Information



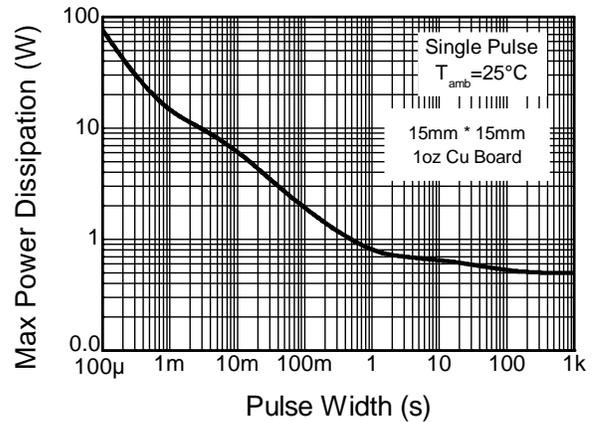
Derating Curve



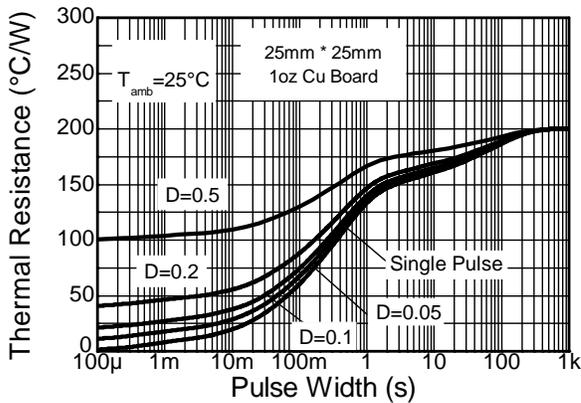
Safe Operating Area



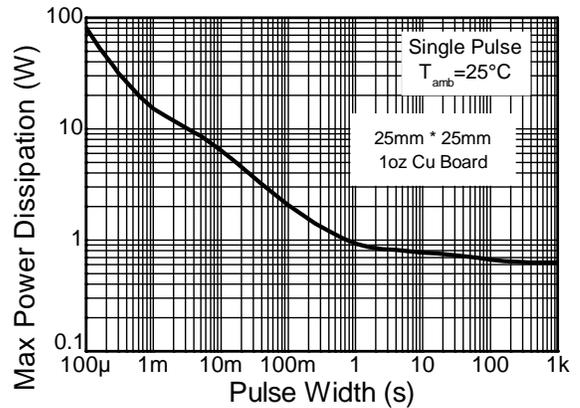
Transient Thermal Impedance



Pulse Power Dissipation



Transient Thermal Impedance



Pulse Power Dissipation

Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Output Voltage (Note 12)	V_{OUT}	10.8	12	13.2	V	$V_{IN} = 24\text{V}$, $I_{OUT} = 15\text{mA}$
Line Regulation (Notes 12 & 13)	ΔV_{OUT}	—	20	50	mV	$V_{IN} = 18$ to 24V , $I_{OUT} = 15\text{mA}$
		—	130	-		$V_{IN} = 18$ to 60V , $I_{OUT} = 15\text{mA}$
		—	150	-		$V_{IN} = 15$ to 60V , $I_{OUT} = 15\text{mA}$
Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	—	10.4	—	mV/ $^\circ\text{C}$	$T_J = -40^\circ\text{C}$ to $+125^\circ\text{C}$ $V_{IN} = 24\text{V}$, $I_{OUT} = 15\text{mA}$
Load Regulation (Notes 12 & 14)	ΔV_{OUT}	—	-30 -190	-100 -300	mV	$I_{OUT} = 10$ to 20mA , $V_{IN} = 24\text{V}$ $I_{OUT} = 0.1$ to 50mA , $V_{IN} = 24\text{V}$
Minimum Value of Input Voltage Required to Maintain Line Regulation	$V_{IN(MIN)}$	15	—	—	V	—
Quiescent Current	I_Q	—	160	360	μA	$V_{IN} = 15\text{V}$, $I_{OUT} = 10\mu\text{A}$
		—	3,500	6,000		$V_{IN} = 60\text{V}$, $I_{OUT} = 10\mu\text{A}$
Power Supply Rejection Ratio	$\Delta V_{in}/\Delta V_{out}$	—	50	—	dB	$C_{OUT} = 100\text{nF}$, $I_{OUT} = 15\text{mA}$, $V_{OUT} = 12\text{V}$, $V_{IN} = 15$ to 60V , $f = 100\text{Hz}$

Notes: 12. Measured under pulsed conditions. Pulse width $\leq 300\mu\text{s}$. Duty cycle $\leq 2\%$.

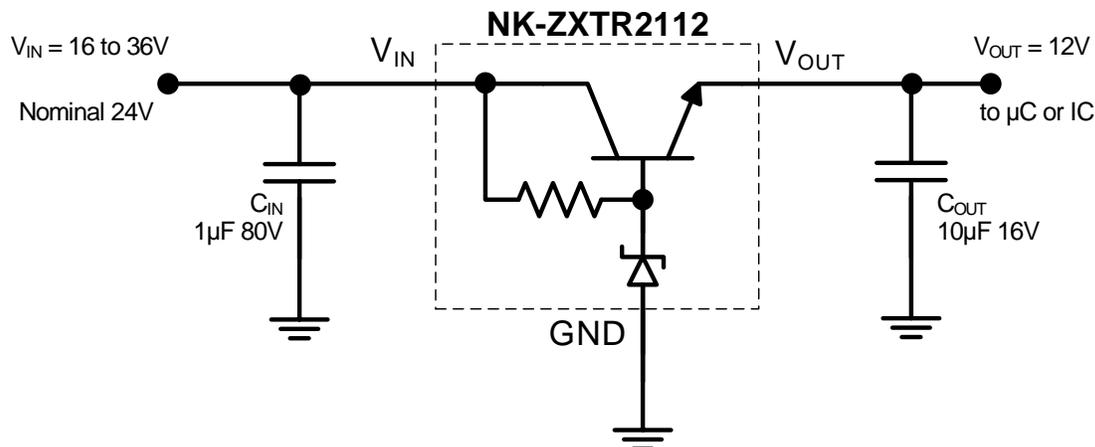
13. Line regulation $\Delta V_{OUT} = V_{OUT}(@V_{IN}=24\text{V}) - V_{OUT}(@V_{IN} = 18\text{V})$

$\Delta V_{OUT} = V_{OUT}(@V_{IN}=60\text{V}) - V_{OUT}(@V_{IN} = 15\text{V})$

$\Delta V_{OUT} = V_{OUT}(@V_{IN}=60\text{V}) - V_{OUT}(@V_{IN} = 18\text{V})$

14. Load regulation $\Delta V_{OUT} = V_{OUT}(@I_{OUT} = 20\text{mA}) - V_{OUT}(@I_{OUT} = 10\text{mA})$

$\Delta V_{OUT} = V_{OUT}(@I_{OUT} = 50\text{mA}) - V_{OUT}(@I_{OUT} = 0.1\text{mA})$

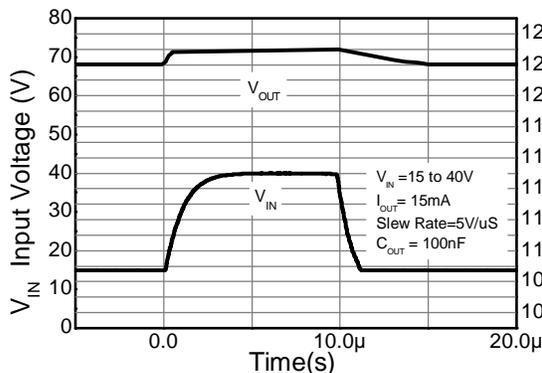
Typical Application Circuit


Example of a 12V regulated supply from a nominal 24V for powering a Controller IC.

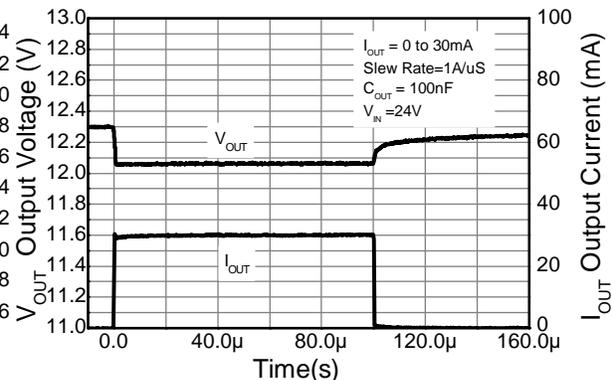
Pin Functions

Pin Name	Pin Function	Notes
V_{IN}	Input Supply	Input voltage can vary from -0.3V to 60V with respect to GND; for V_{OUT} regulated then $15\text{V} \leq V_{IN} \leq 60\text{V}$. It is recommended to connect a $1\mu\text{F}$ capacitor to GND.
GND	Power Ground	This pin should be tied to the system ground.
V_{OUT}	Voltage Output	Outputs a regulated 12V when $15\text{V} \leq V_{IN} \leq 60\text{V}$. When $V_{IN} < 15\text{V}$, then V_{OUT} maximum = $V_{IN} - 1\text{V}$. The pin can be pulled high to a maximum of $+17\text{V}$ with respect to GND, or $+5\text{V}$ with respect to V_{IN} , whichever is lower. It is recommended to connect a $10\mu\text{F}$ capacitor to GND and a minimum of $10\mu\text{A}$ to be drawn from V_{OUT} to maintain regulation.

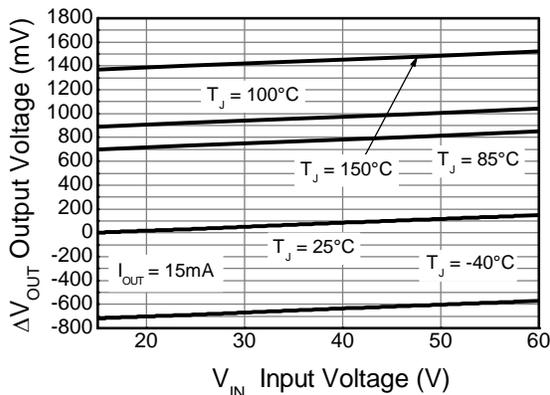
Typical Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)



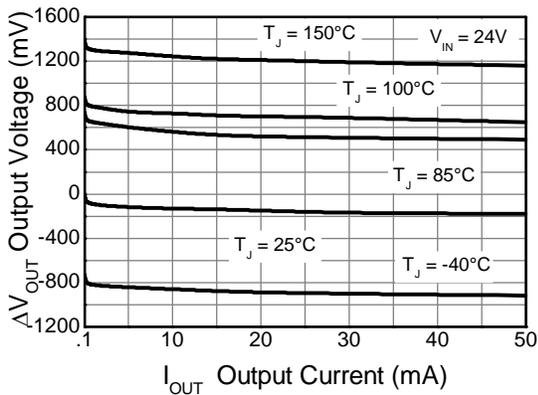
Line transient response



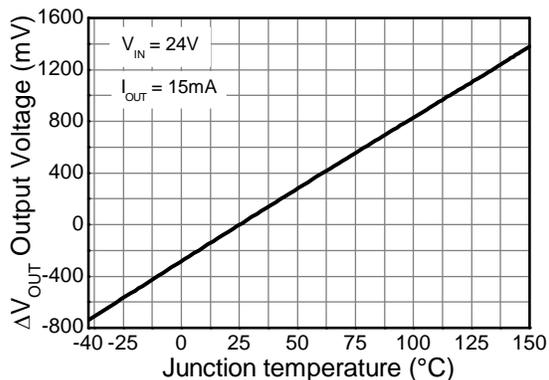
Load transient response



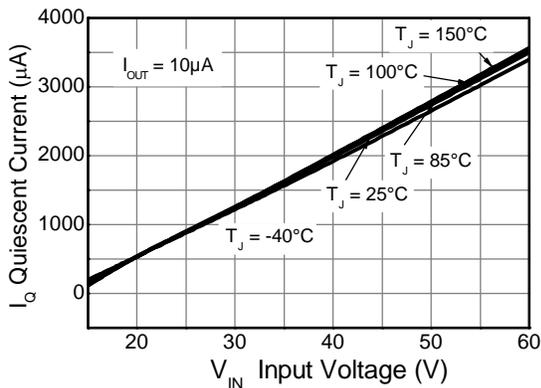
Line Regulation (Note 15)



Load Regulation (Note 16)



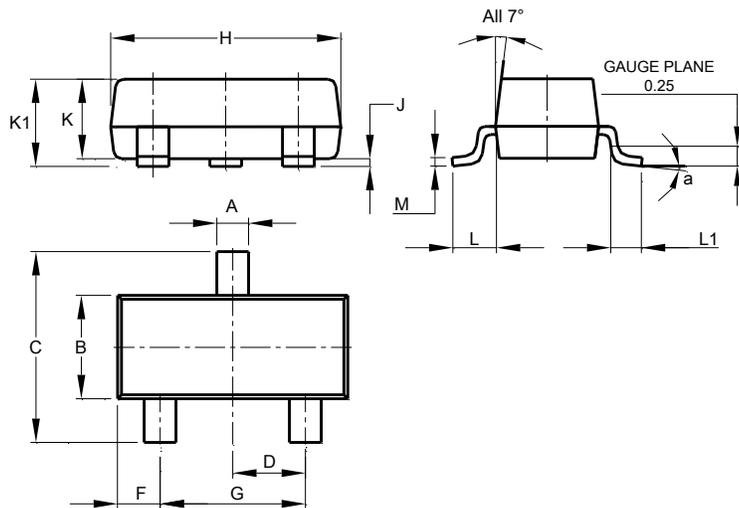
Temperature Coefficient (Note 17)



Quiescent Current

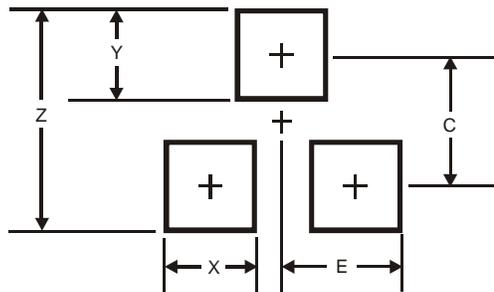
- Notes:
- 15. Line Regulation $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 15\text{V}, I_{OUT} = 15\text{mA}, T_J = +25^\circ\text{C})$.
 - 16. Load Regulation $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 24\text{V}, I_{OUT} = 0.1\text{mA}, T_J = +25^\circ\text{C})$.
 - 17. Temperature Coefficient $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 24\text{V}, I_{OUT} = 15\text{mA}, T_J = +25^\circ\text{C})$.

Package Outline Dimensions



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	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	8°		
All Dimensions in mm			

Suggested Pad Layout



Dimensions	Value (in mm)
Z	2.9
X	0.8
Y	0.9
C	2.0
E	1.35