



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-ZXTR2105FF monolithically integrates a transistor, zener diode and resistor to function as a linear regulator. The device regulates with a 5V 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 SOT23F package, minimizing PCB area and reducing the number of components when compared with a multi-chip discrete solution.

## Applications

Supply Voltage Regulation for:

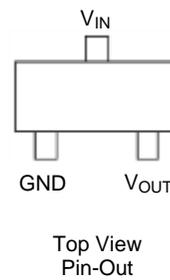
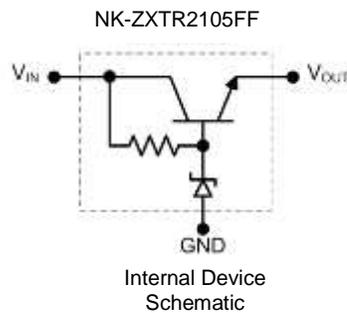
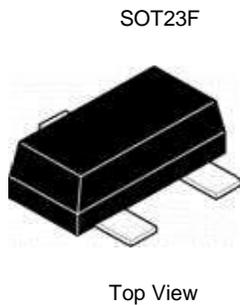
- 12V to 5V Rails
- 24V to 5V Rails
- Other Customized Input Rails

## Features

- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 7 to 60V (For Regulated Output Voltage)
- Output Voltage =  $5V \pm 5\%$
- Fully Integrated into a SOT23F Package

## Mechanical Data

- Case: SOT23F
- 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 
- Weight: 0.008 grams (Approximate)



Pin Name	Pin Function
V <sub>IN</sub>	Input Supply
GND	Power Ground
V <sub>OUT</sub>	Voltage Output

**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 and Output Current	$I_{IN}, I_{OUT}$	320	mA
Peak Pulsed Input and Output Current	$I_{IM}, I_{OM}$	2	A
Maximum Voltage Applied to $V_{OUT}$	$V_{OUT(MAX)}$	Smaller of $V_{IN}+5V$ or 10V	V

**Maximum Current at  $V_{IN} = 12V$**  (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Continuous Output Current	$I_{OUT}$	89	mA
Pulsed Output Current	$I_{OM}$	2,000	mA
		890	

**Thermal Characteristics**

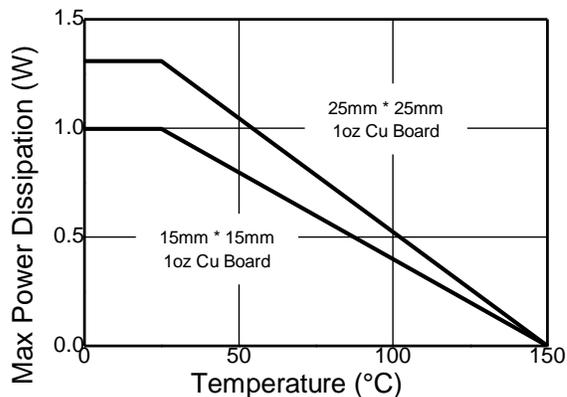
Characteristic	Symbol	Value	Unit
Power Dissipation	$P_D$	1.3	W
		1	
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	95	$^\circ\text{C/W}$
		126	
Thermal Resistance, Junction to Lead	$R_{\theta JL}$	59	
Thermal Resistance, Junction to Case	$R_{\theta JC}$	38	
Maximum Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-65 to +150	$^\circ\text{C}$

**ESD Ratings** (Note 11)

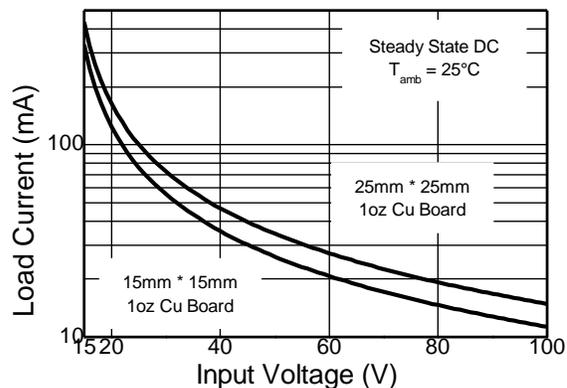
Characteristics	Symbols	Value	Unit	JEDEC Class
Electrostatic Discharge – Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge – Machine Model	ESD MM	400	V	C

- 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  $V_{IN}=12V$ . Refer to Safe Operating Area for other Input Voltages.
  - Same as Note 5, except measured with a single pulse width = 100 $\mu\text{s}$  and  $V_{IN}=12V$ .
  - Same as Note 5, except measured with a single pulse width = 10ms and  $V_{IN}=12V$ .
  - $R_{\theta JL}$  = 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.

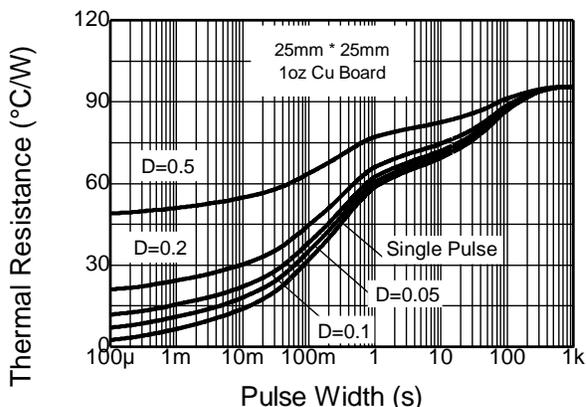
**Thermal Characteristics and Derating Information**



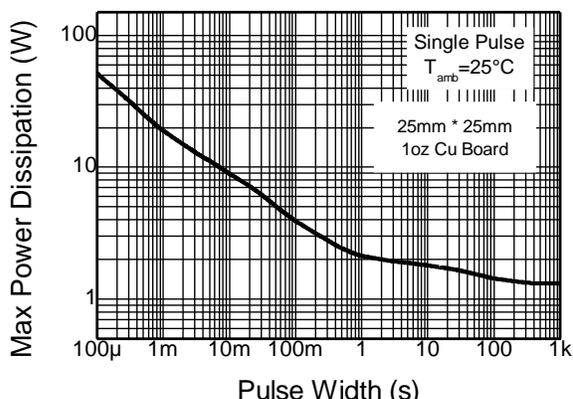
**Derating Curve**



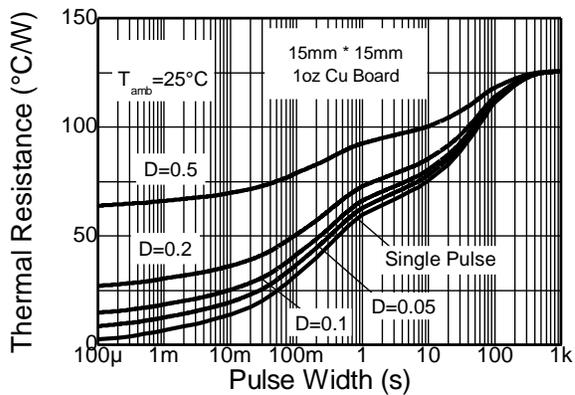
**Safe Operating Area**



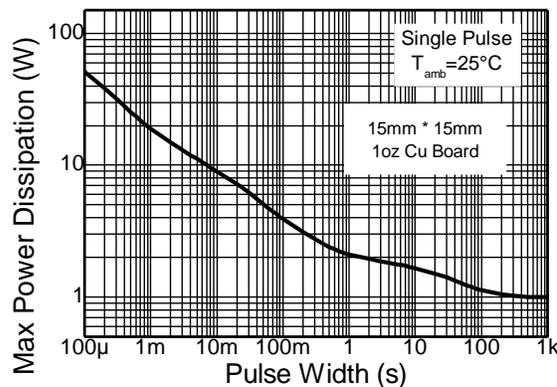
**Transient Thermal Impedance**



**Pulse Power Dissipation**



**Transient Thermal Impedance**



**Pulse Power Dissipation**

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Output Voltage (Note 12)	V <sub>OUT</sub>	4.75	5.0	5.25	V	V <sub>IN</sub> = 12V, I <sub>OUT</sub> = 15mA
Line Regulation (Notes 12 & 13)	ΔV <sub>OUT</sub>	—	33	220	mV	V <sub>IN</sub> = 10 to 15V, I <sub>OUT</sub> = 15mA
		—	400	700		V <sub>IN</sub> = 7 to 60V, I <sub>OUT</sub> = 15mA
		—	145	400		V <sub>IN</sub> = 10 to 60V, I <sub>OUT</sub> = 15mA
Temperature Coefficient	ΔV <sub>OUT</sub> /ΔT	—	3.52	—	mV/°C	T <sub>J</sub> = -40°C to +150°C V <sub>IN</sub> = 12V, I <sub>OUT</sub> = 15mA
Load Regulation (Notes 12 & 14)	ΔV <sub>OUT</sub>	—	-20 -166	-130 -300	mV	I <sub>OUT</sub> = 10 to 20mA, V <sub>IN</sub> = 12V I <sub>OUT</sub> = 0.1 to 50mA, V <sub>IN</sub> = 12V
Minimum Value of Input Voltage Required to Maintain Line Regulation	V <sub>IN(MIN)</sub>	7	—	—	V	—
Quiescent Current	I <sub>Q</sub>	—	450	800	μA	V <sub>IN</sub> = 12V, I <sub>OUT</sub> = 10μA
		—	4,000	6,700		V <sub>IN</sub> = 60V, I <sub>OUT</sub> = 10μA
Power Supply Rejection Ratio	ΔV <sub>IN</sub> /ΔV <sub>OUT</sub>	—	46	—	dB	C <sub>OUT</sub> = 100nF, I <sub>OUT</sub> = 15mA, V <sub>OUT</sub> = 5V, V <sub>IN</sub> = 7 to 60V, f = 100Hz

Notes: 12. Measured Under Pulsed Conditions; Pulse Width ≤ 300μs. Duty cycle ≤ 2%.

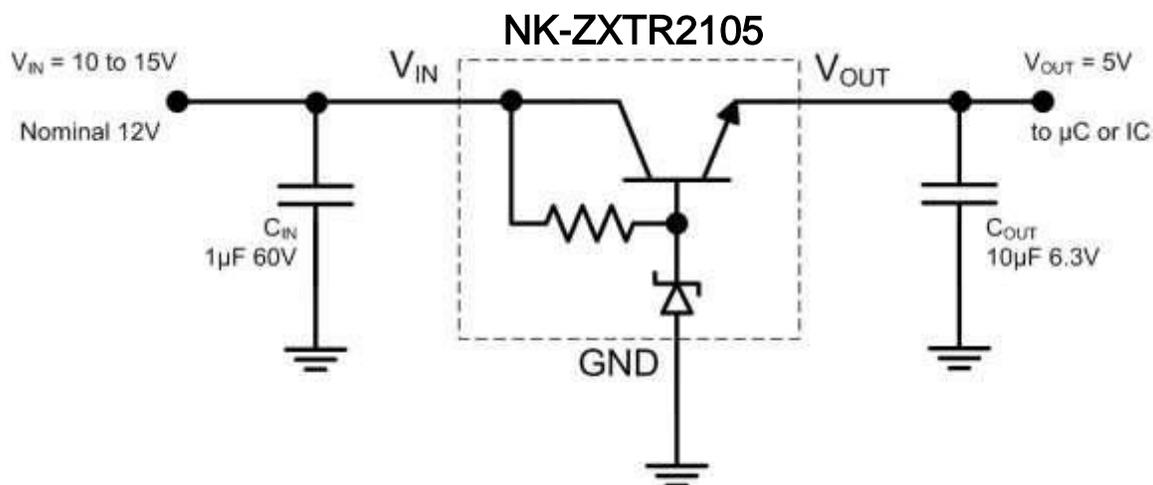
13. Line Regulation ΔV<sub>OUT</sub> = V<sub>OUT</sub>(@V<sub>IN</sub> = 15V) – V<sub>OUT</sub>(@V<sub>IN</sub> = 10V)

ΔV<sub>OUT</sub> = V<sub>OUT</sub>(@V<sub>IN</sub> = 60V) – V<sub>OUT</sub>(@V<sub>IN</sub> = 7V)

ΔV<sub>OUT</sub> = V<sub>OUT</sub>(@V<sub>IN</sub> = 60V) – V<sub>OUT</sub>(@V<sub>IN</sub> = 10V)

14. Load Regulation ΔV<sub>OUT</sub> = V<sub>OUT</sub>(@I<sub>OUT</sub> = 20mA) – V<sub>OUT</sub>(@I<sub>OUT</sub> = 10mA)

ΔV<sub>OUT</sub> = V<sub>OUT</sub>(@I<sub>OUT</sub> = 50mA) – V<sub>OUT</sub>(@I<sub>OUT</sub> = 0.1mA)

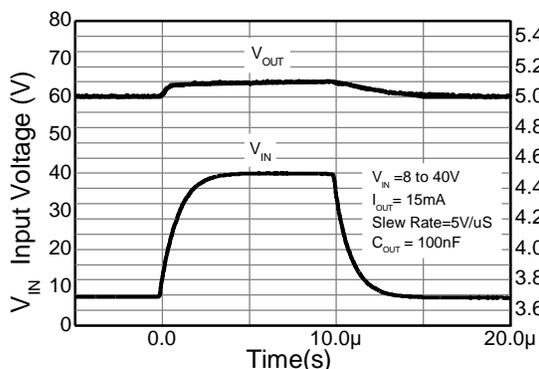
**Typical Application Circuit**


Example of a 5V regulated supply from a nominal 12V for powering a Controller IC.

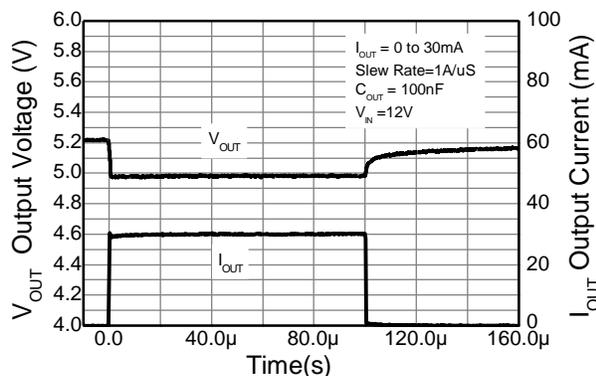
**Pin Functions**

Pin Name	Pin Function	Notes
V <sub>IN</sub>	Input Supply	Input voltage can vary from -0.3V to 60V with respect to GND; for V <sub>OUT</sub> regulated then 7V ≤ V <sub>IN</sub> ≤ 60V. It is recommended to connect a 1μF capacitor to GND.
GND	Power Ground	This pin should be tied to the system ground.
V <sub>OUT</sub>	Voltage Output	Outputs a regulated 5V when 7V ≤ V <sub>IN</sub> ≤ 60V. When V <sub>IN</sub> < 7V, then V <sub>OUT</sub> maximum = V <sub>IN</sub> – 1V. The pin can be pulled high to a maximum of +10V with respect to GND, or +5V with respect to V <sub>IN</sub> , whichever is lower. It is recommended to connect a 10μF capacitor to GND and a minimum of 10μA to be drawn from V <sub>OUT</sub> to maintain regulation.

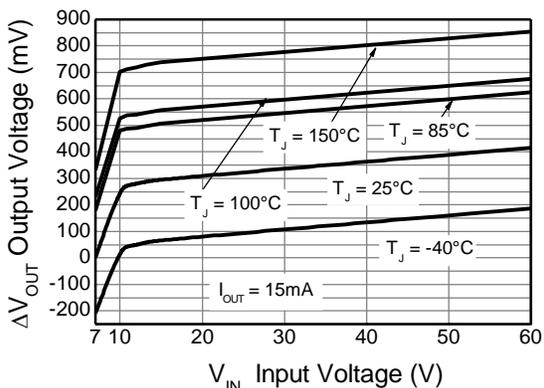
**Typical Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



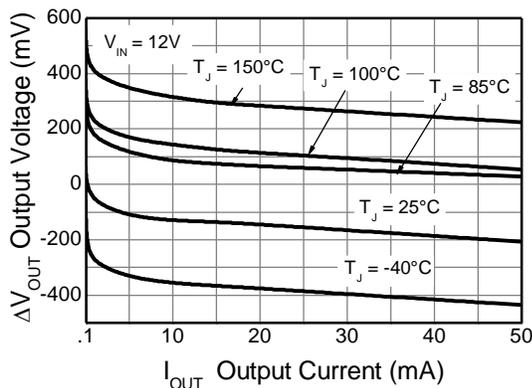
**Line transient response**



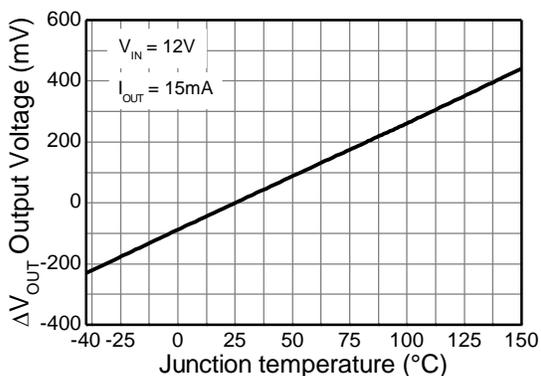
**Load transient response**



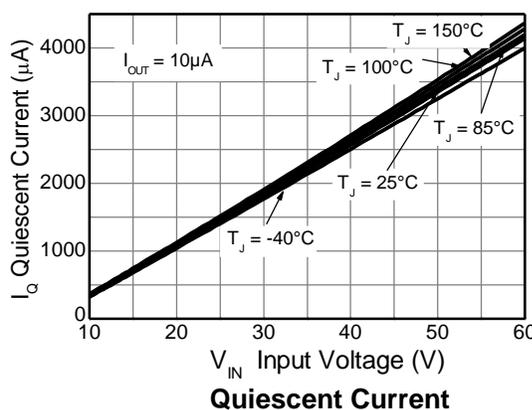
**Line Regulation (Note 15)**



**Load Regulation (Note 16)**



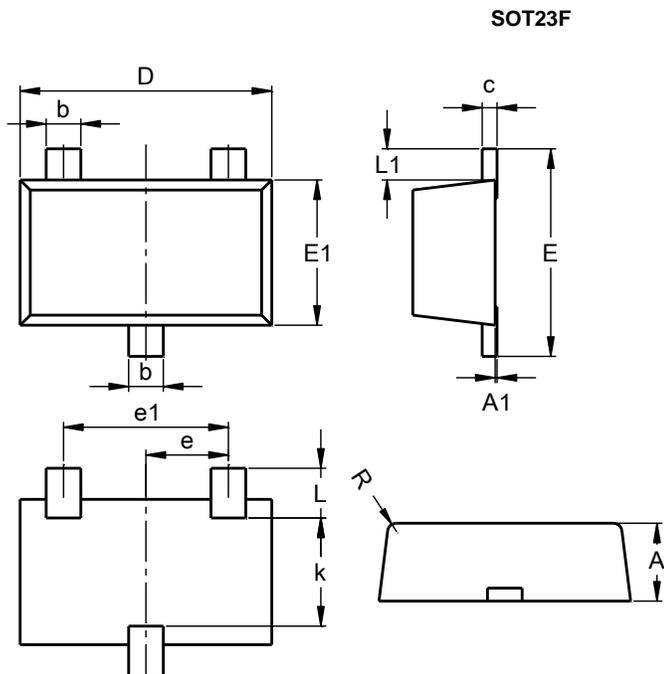
**Temperature Coefficient (Note 17)**



**Quiescent Current**

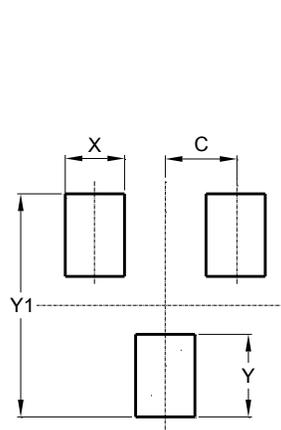
- Notes:
- 15. Line Regulation  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 7\text{V}, I_{OUT} = 15\text{mA}, T_J = +25^\circ\text{C})$ .
  - 16. Load Regulation  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 12\text{V}, I_{OUT} = 0.1\text{mA}, T_J = +25^\circ\text{C})$ .
  - 17. Temperature Coefficient  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 12\text{V}, I_{OUT} = 15\text{mA}, T_J = +25^\circ\text{C})$ .

## Package Outline



SOT23F			
Dim	Min	Max	Typ
A	0.80	1.00	0.90
A1	0.00	0.10	0.01
b	0.35	0.50	0.44
c	0.10	0.20	0.16
D	2.80	3.00	2.90
e	0.95 REF		
e1	1.90 REF		
E	2.30	2.50	2.40
E1	1.50	1.70	1.65
k	1.20	-	-
L	0.30	0.65	0.50
L1	0.30	0.50	0.40
R	0.05	0.15	-
All Dimensions in mm			

## Suggested Pad Layout



Dimensions	Value (in mm)
C	0.95
X	0.80
Y	1.110
Y1	3.000