

Description

This regulator transistor is designed to meet the stringent requirements of automotive applications.

The ZXTR2105FFQ 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:

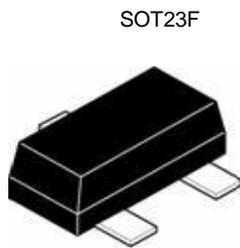
- 12V to 5V Rails
- 24V to 5V Rails
- Other Customized Input Rails

Features

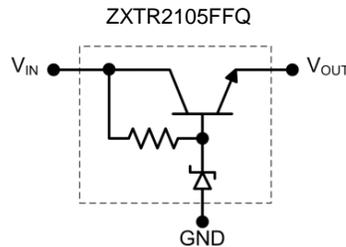
- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 7V to 60V (For Regulated Output Voltage)
- Output Voltage = 5V ± 5%
- Fully Integrated into a SOT23F Package
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

Mechanical Data

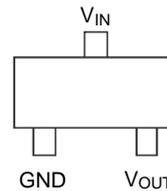
- Case: SOT23F
- Case Material: Molded Plastic "Green" Molding Compound; UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads; Solderable per MIL-STD-202, Method 208
- Weight: 0.008 grams (Approximate)



Top View



Internal Device Schematic



Top View Pin-Out

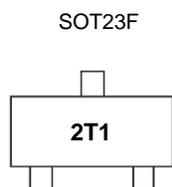
Pin Name	Pin Function
V _{IN}	Input Supply
GND	Power Ground
V _{OUT}	Voltage Output

Ordering Information (Note 5)

Part Number	Compliance	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
ZXTR2105FFQ-7	Automotive	2T1	7	8	3,000

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
 2. See <https://www.diodes.com/quality/lead-free/> 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-Q101 qualified and are PPAP capable. Refer to <https://www.diodes.com/quality/>.
 5. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

Marking Information



2T1 = Product Type Marking Code

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

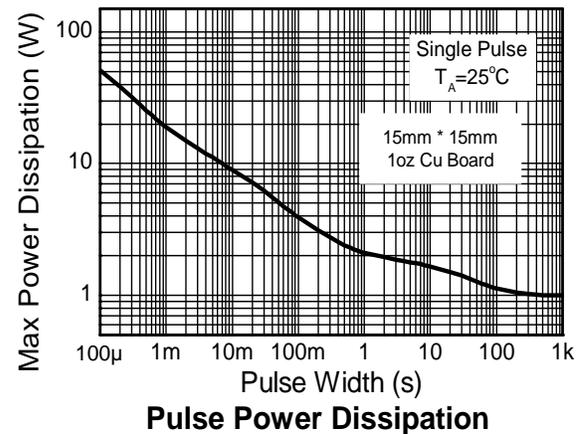
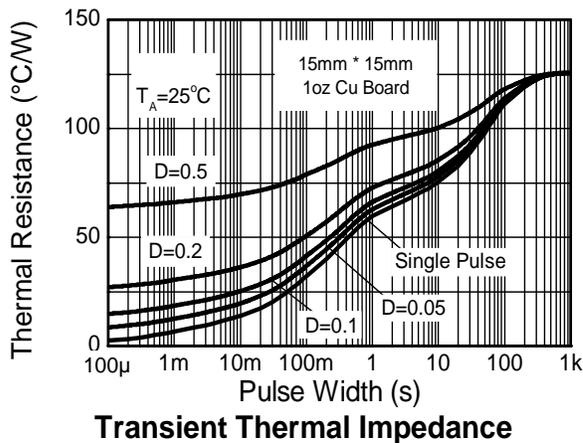
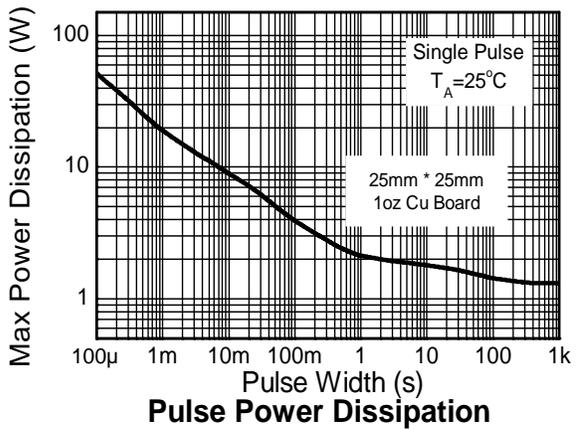
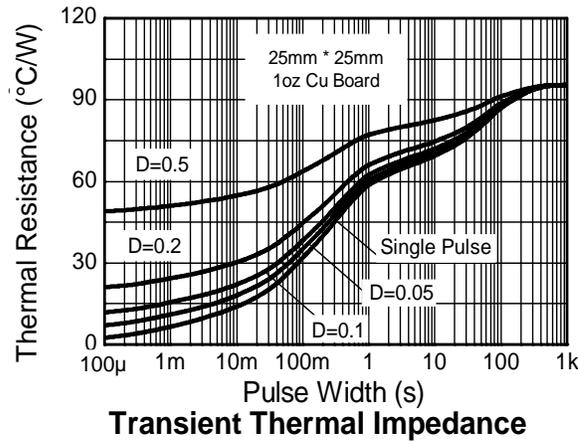
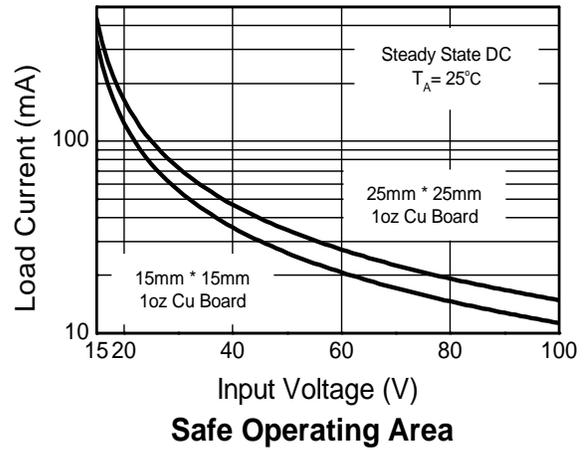
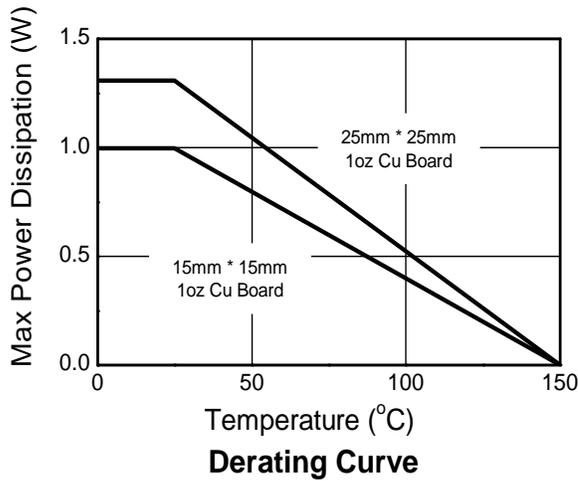
Characteristic	Symbol	Value	Unit	
Power Dissipation	P_D	1.3	W	
		1		
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	95	$^\circ\text{C/W}$	
		126		
Thermal Resistance, Junction to Lead	$R_{\theta JL}$	59		
Thermal Resistance, Junction to Case	$R_{\theta JC}$	38		
Maximum Operating Junction and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

ESD Ratings (Note 12)

Characteristics	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge – Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge – Charge Device Model	ESD CDM	1,000	V	IV

- Notes:
6. For a device mounted with the V_{IN} lead on 25mm x 25mm 1oz copper that is on a single-sided 1.6mm FR-4 PCB; device is measured under still air conditions whilst operating in steady-state.
 7. Same as Note 6, except mounted on 15mm x 15mm 1oz copper.
 8. Same as Note 6, whilst operating at $V_{IN}=12V$. Refer to Safe Operating Area for other Input Voltages.
 9. Same as Note 6, except measured with a single pulse width = 100 μs and $V_{IN}=12V$.
 10. Same as Note 6, except measured with a single pulse width = 10ms and $V_{IN}=12V$.
 11. $R_{\theta JL}$ = 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.
 12. Refer to JEDEC specification JESD22-A114 and JESD22-C101.

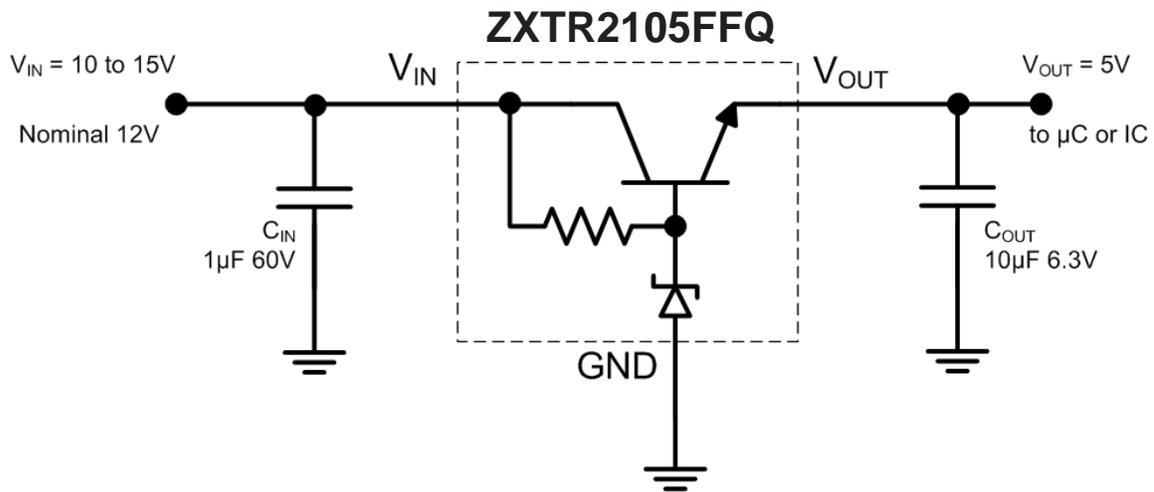
Thermal Characteristics and Derating Information



Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

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

- Notes:
- 13. Measured Under Pulsed Conditions; Pulse Width ≤ 300μs. Duty cycle ≤ 2%.
 - 14. Line Regulation
 $\Delta V_{OUT} = V_{OUT}@V_{IN} = 15V - V_{OUT}@V_{IN} = 10V$
 $\Delta V_{OUT} = V_{OUT}@V_{IN} = 60V - V_{OUT}@V_{IN} = 7V$
 $\Delta V_{OUT} = V_{OUT}@V_{IN} = 60V - V_{OUT}@V_{IN} = 10V$
 - 15. Load Regulation
 $\Delta V_{OUT} = V_{OUT}@I_{OUT} = 20mA - V_{OUT}@I_{OUT} = 10mA$
 $\Delta V_{OUT} = V_{OUT}@I_{OUT} = 50mA - V_{OUT}@I_{OUT} = 0.1mA$

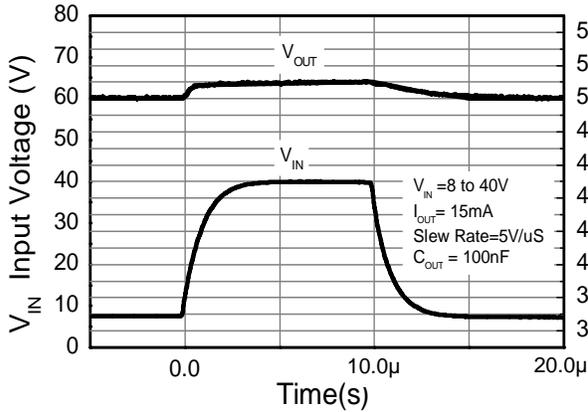
Typical Application Circuit


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

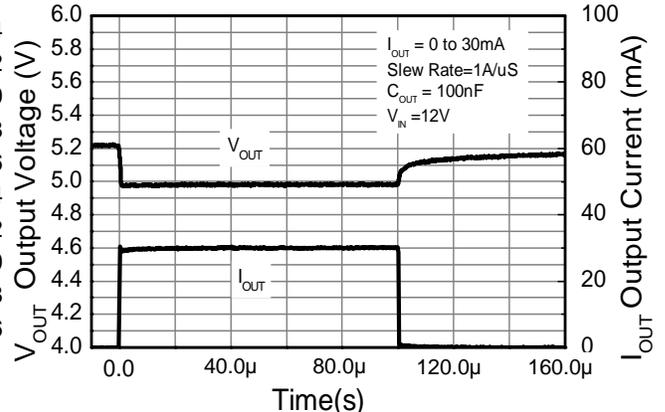
Pin Functions

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

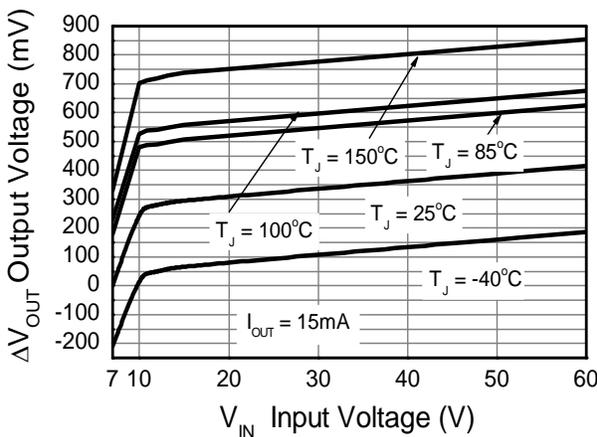
Typical Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)



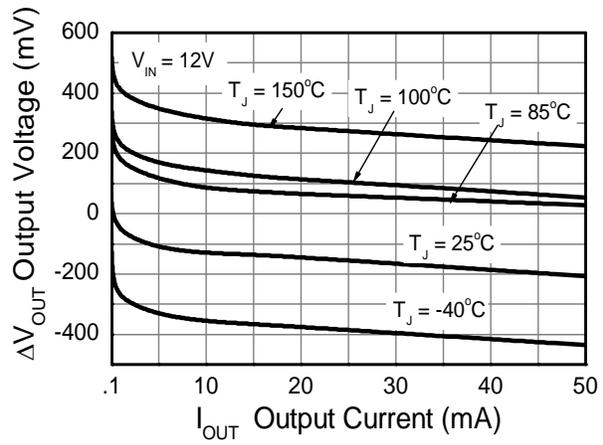
Line Transient Response



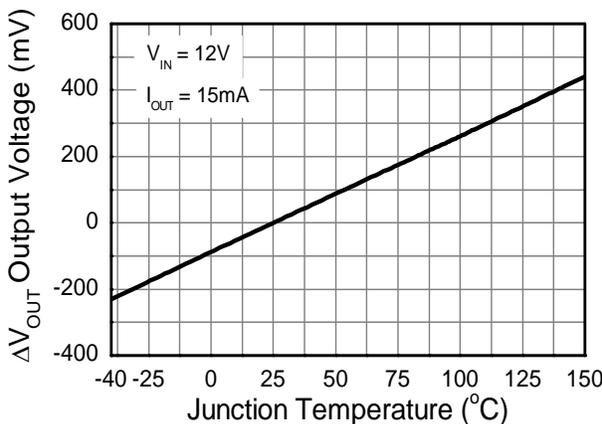
Load Transient Response



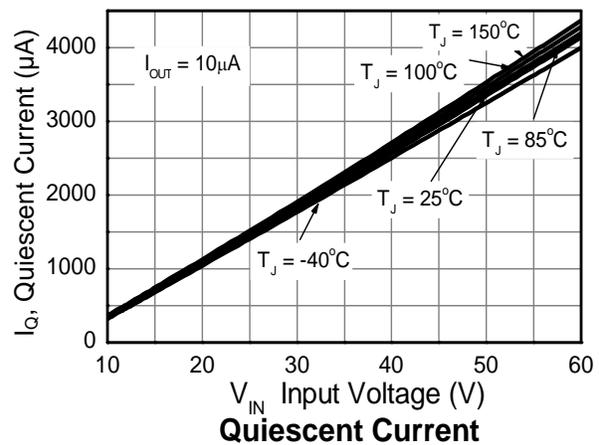
Line Regulation (Note 16)



Load Regulation (Note 17)



Temperature Coefficient (Note 18)



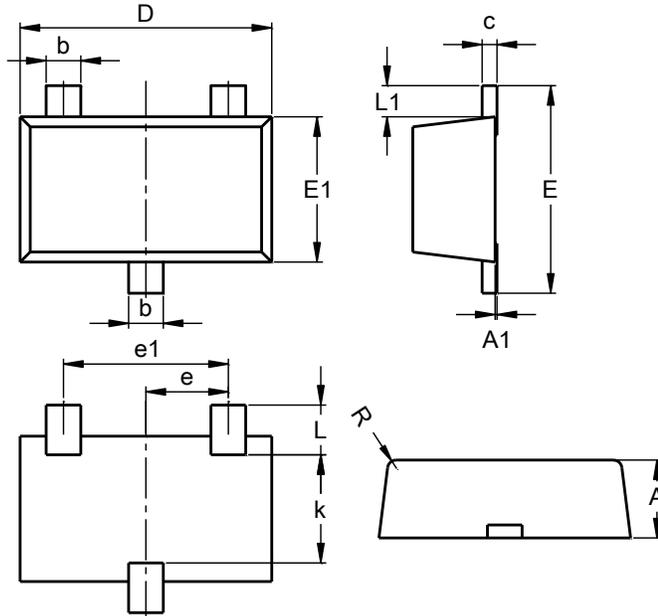
Quiescent Current

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

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

SOT23F

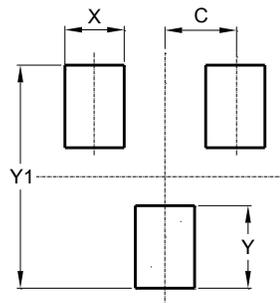


SOT23F			
Dim	Min	Max	Typ
A	0.80	1.00	0.90
A1	0.00	0.10	0.01
b	0.35	0.50	0.44
c	0.10	0.20	0.16
D	2.80	3.00	2.90
e	0.95 REF		
e1	1.90 REF		
E	2.30	2.50	2.40
E1	1.50	1.70	1.65
k	1.20	-	-
L	0.30	0.65	0.50
L1	0.30	0.50	0.40
R	0.05	0.15	-
All Dimensions in mm			

Suggested Pad Layout

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

SOT23F



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

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