

High Input Voltage, Adjustable 3-Terminal Linear Regulator

Features

- ▶ 13.2 to 100V input voltage range
- ▶ Stable with 100nF output capacitor
- ▶ Adjustable 1.20 to 88V output regulation
- ▶ 5% reference voltage tolerance
- ▶ Output current limiting, 50mA min.
- ▶ 10 μ A typical ADJ current
- ▶ Over temperature protection
- ▶ Available in 3 different packages

Applications

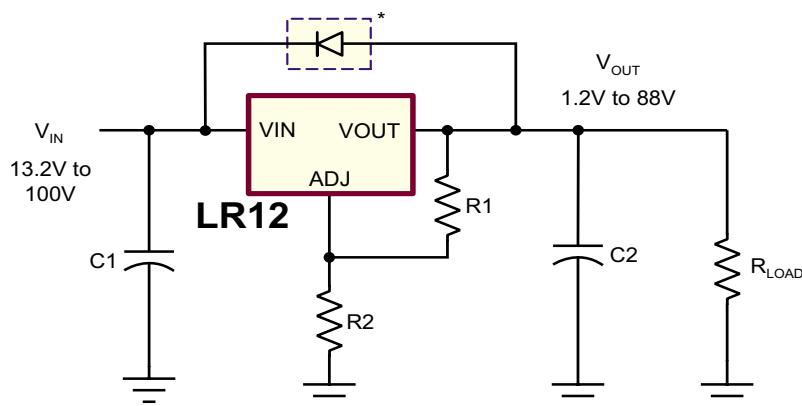
- ▶ DC/DC SMPS startup circuits
- ▶ Adjustable high voltage constant current sources
- ▶ Industrial controls
- ▶ Motor controls
- ▶ Battery powered systems
- ▶ Power supplies
- ▶ Telecom applications
- ▶ LED drivers
- ▶ Automotive applications

General Description

The Supertex LR12 is a high voltage, low output current, adjustable linear regulator. It has a wide operating input voltage range of 13.2 - 100V. The output voltage can be adjusted from 1.20 - 88V, provided that the input voltage is at least 12V greater than the output voltage. The output voltage can be adjusted by means of two external resistors R_1 and R_2 as shown in the typical application circuits. The LR12 regulates the voltage difference between VOUT and ADJ pins to a nominal value of 1.20V. The 1.20V is amplified by the external resistor ratio R_1 and R_2 . An internal constant bias current of typically 10 μ A is connected to the ADJ pin. This increases V_{OUT} by a constant voltage of 10 μ A times R_2 .

The LR12 has current limiting and temperature limiting. The output current limit is 100mA maximum and the minimum temperature limit is 125°C. An output short circuit current will therefore be limited to 100mA maximum. When the junction temperature reaches its temperature limit, the output current and/or output voltage will decrease to keep the junction temperature from exceeding its temperature limit. For SMPS start-up circuit applications, the LR12 turns off when an external voltage greater than the output voltage of the LR12 is applied to VOUT of the LR12. To maintain stability, a bypass capacitor of 100nF or larger and a minimum DC output current of 500 μ A are required.

LR12 Typical Application



*Required for conditions where V_{IN} is less than V_{OUT} .

Ordering Information

Package Options			
Device	8-Lead SOIC	TO-252 (D-PAK)	TO-92
LR12	LR12LG-G	LR12K4-G	LR12N3-G

-G indicates package is RoHS compliant ('Green')



Absolute Maximum Ratings

Parameter	Value
V_{IN-ADJ}	-0.5V to +120V
$V_{OUT-ADJ}$	-10V to +10V
$V_{IN} - V_{OUT}$	-0.5V to +120V
Operating ambient temperature	-40°C to +85°C
Operating junction temperature	-40°C to +125°C
Storage temperature	-65°C to +150°C

Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.

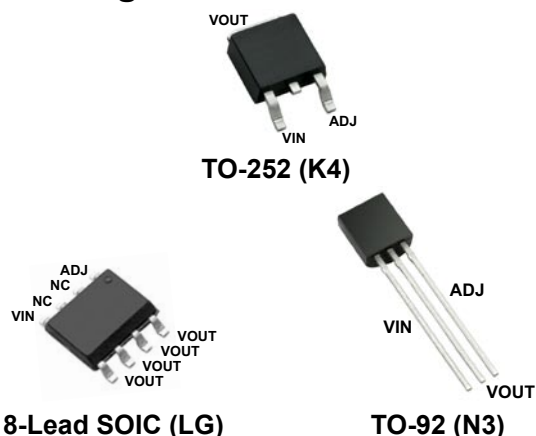
Thermal Characteristics

Package	Power Dissipation @ $T_A = 25^\circ\text{C}$	θ_{jc} (°C/W)	θ_{ja} (°C/W)
TO-252	2.0W	6.25	50
8-Lead SOIC	1.8W	-	55*
TO-92	0.6W	125	170

Notes:

* Mounted on FR4 board, 25mm x 25mm x 1.57mm

Pin Configurations



Product Marking

Si YYWW
LR12K4
LLLLLLL

YY = Year Sealed
WW = Week Sealed
L = Lot Number
_____ = "Green" Packaging

Package may or may not include the following marks: Si or

TO-252 (K4)

YYWW
LR12
LLLL

YY = Year Sealed
WW = Week Sealed
L = Lot Number
_____ = "Green" Packaging

Package may or may not include the following marks: Si or

8-Lead SOIC (LG)

SiLR
1 2
YWLL

Y = Last Digit of Year Sealed
W = Code for Week Sealed
L = Lot Number
_____ = "Green" Packaging

Package may or may not include the following marks: Si or

TO-92 (N3)

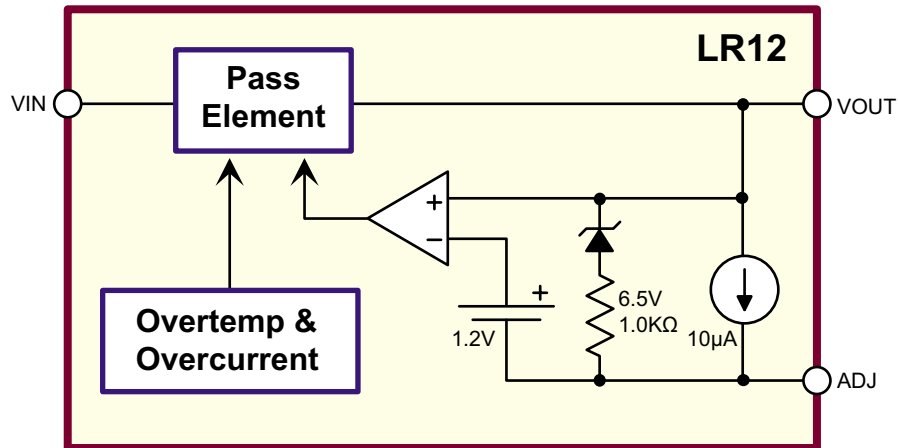
Electrical Characteristics (Test conditions unless otherwise specified: $-40^\circ\text{C} < T_A < +85^\circ\text{C}$)

Sym	Parameter	Min	Typ	Max	Units	Conditions
$V_{IN} - V_{OUT}$	Input to output voltage difference	12	-	98.8	V	---
V_{OUT}	Overall output voltage regulation	1.14	1.20	1.26	V	$13.2\text{V} < V_{IN} < 100\text{V}$, $R_1 = 2.4\text{K}\Omega$, $R_2 = 0$
ΔV_{OUT}	Line regulation	-	0.003	0.03	%/V	$15\text{V} < V_{IN} < 100\text{V}$, $V_{OUT} = 5.0\text{V}$, $I_{OUT} = 0.5\text{A}$
	Load regulation	-	1.4	3.0	%	$V_{IN} = 15\text{V}$, $V_{OUT} = 5.0\text{V}$, $0.5\text{mA} < I_{OUT} < 50\text{mA}$
	Temperature regulation	-1.0	-	+1.0	%	$V_{IN} = 15\text{V}$, $V_{OUT} = 5.0\text{V}$, $I_{OUT} = 10\text{mA}$, $-40^\circ\text{C} < T_A < 85^\circ\text{C}$

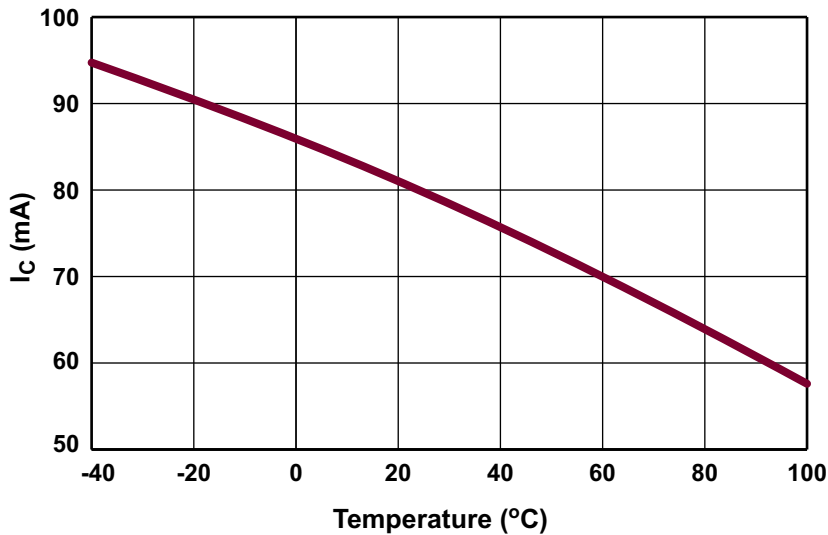
Electrical Characteristics *(cont.)*

Sym	Parameter	Min	Typ	Max	Units	Conditions
I_{OUT}	Output current limit	50	-	100	ma	$T_J < 85^\circ\text{C}, V_{IN} - V_{OUT} < 12\text{V}$
		-	-	-0.5		$T_J < 125^\circ\text{C}, V_{IN} - V_{OUT} < 100\text{V}$
	Minimum output current	0.5	-	-	mA	Includes R_1 and load current
I_{ADJ}	Adjust output current	5.0	10	15	μA	---
C2	Minimum output load capacitance	100	-	-	nF	---
DV_{OUT}/D_{VIN}	Ripple rejection ratio	50	60	-	dB	120Hz, $V_{OUT} = 5.0\text{V}$
T_{LIMIT}	Junction temperature limit	125	-	-	$^\circ\text{C}$	---

Functional Block Diagram



Current Limit



Typical Application Circuits

Figure 1: High Input Voltage, 5.0V Output Linear Regulator

* Required for conditions where V_{IN} is less than V_{OUT}

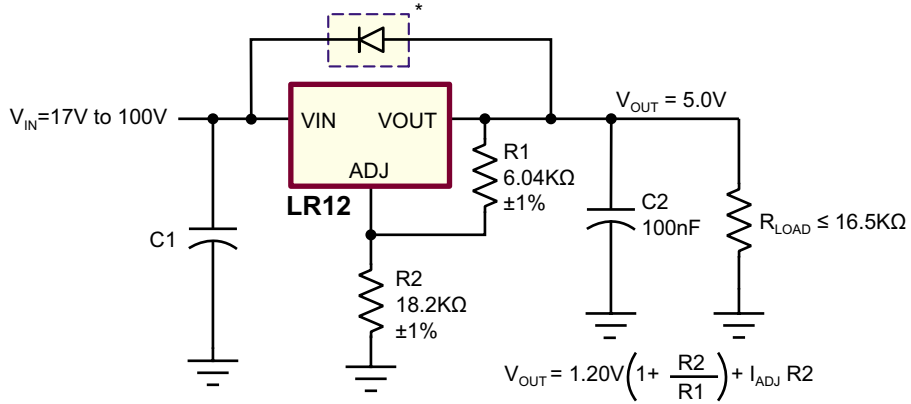


Figure 2: SMPS Start-Up Circuit

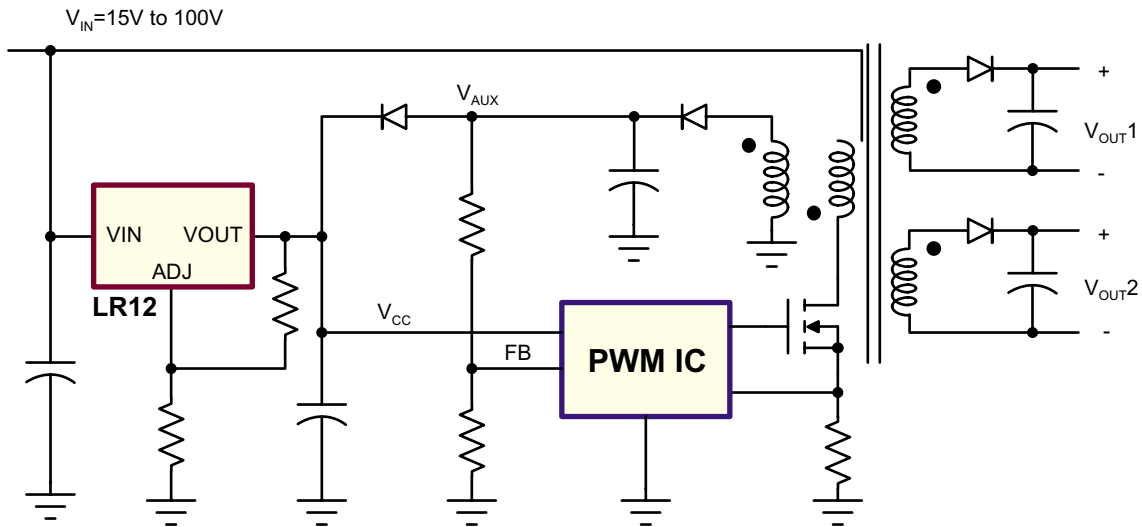
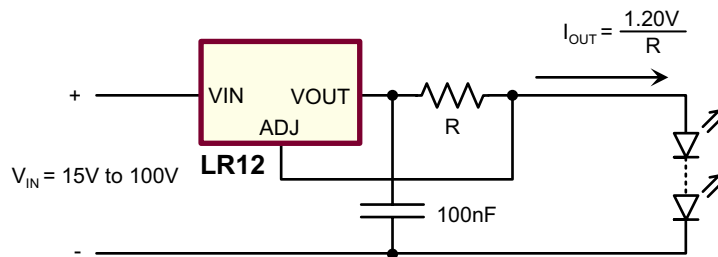
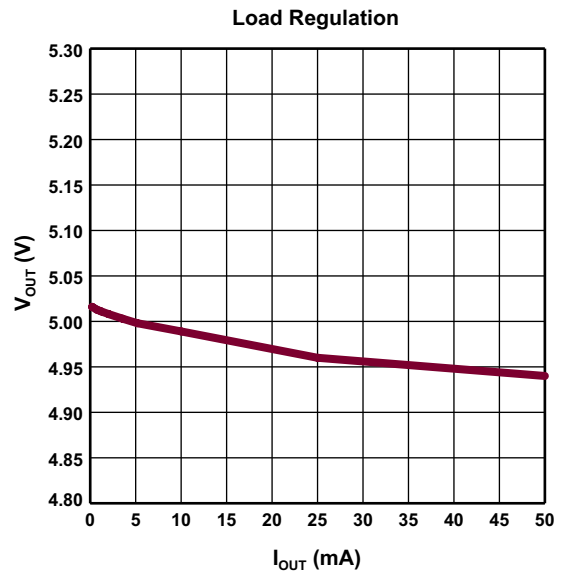
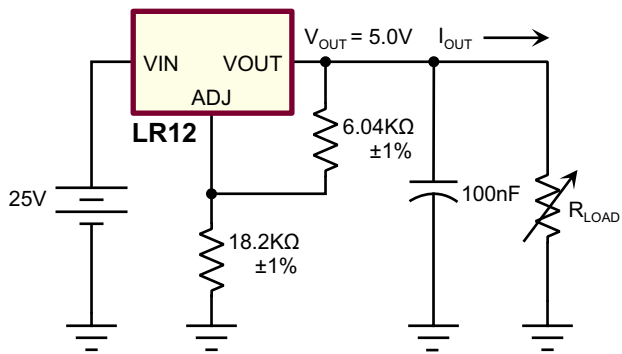
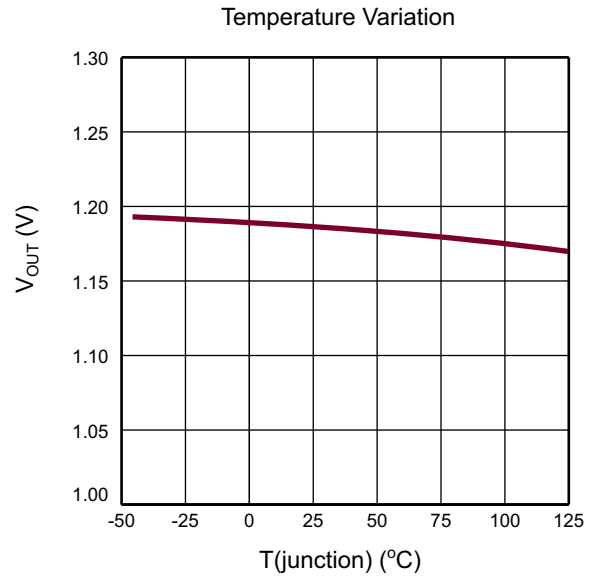
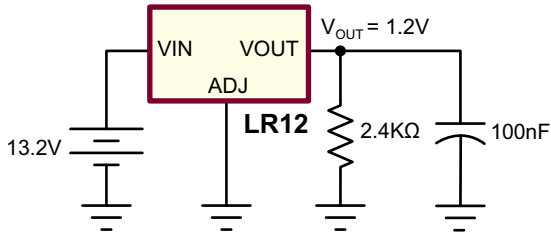


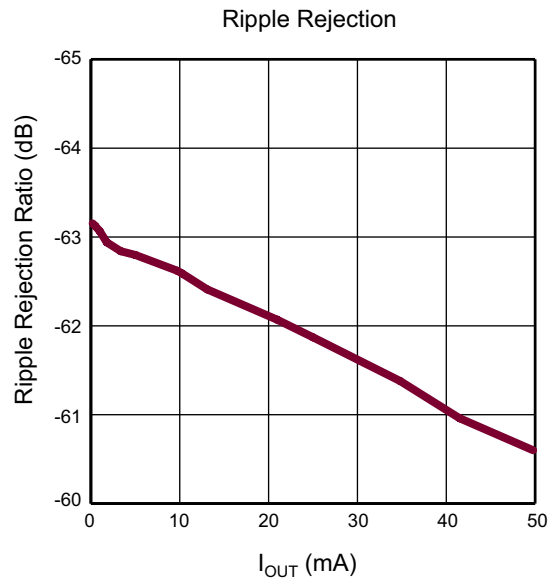
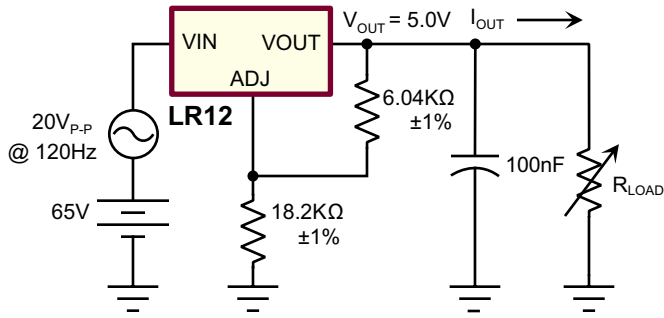
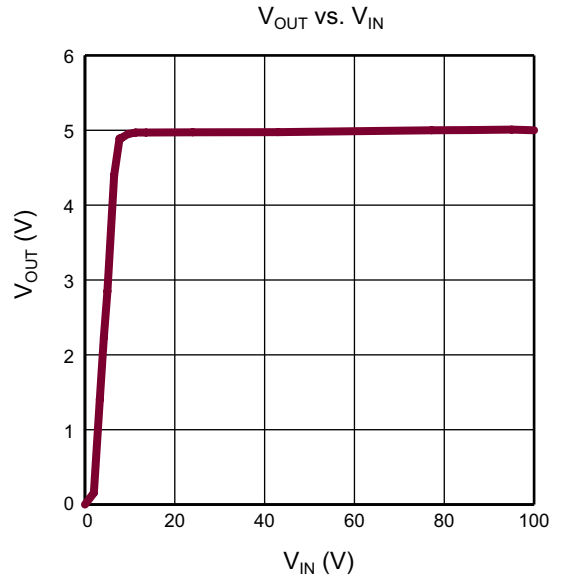
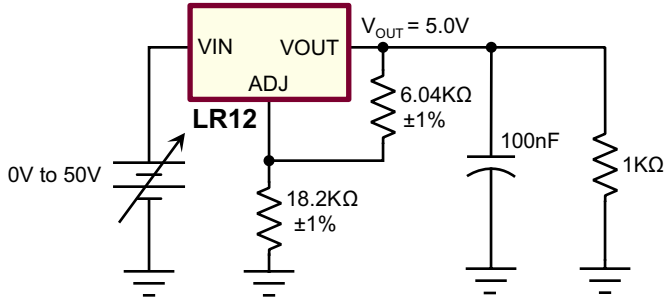
Figure 3: High Voltage Adjustable Constant Current Source



Typical Performance Curves

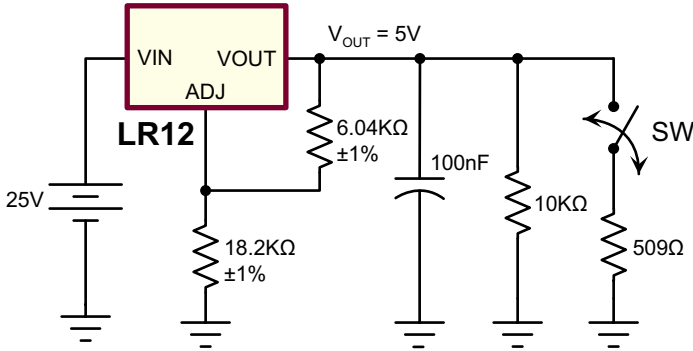


Typical Performance Curves (cont.)

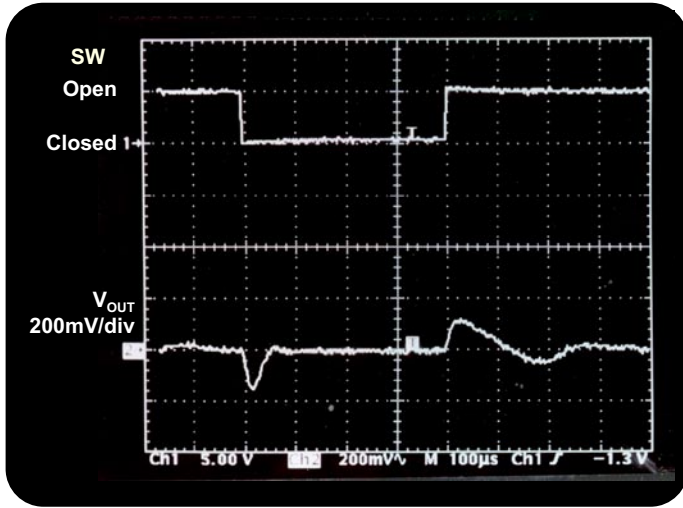
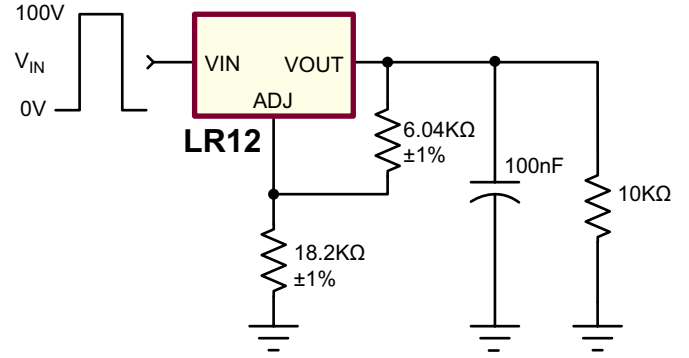


Typical Performance Curves (cont)

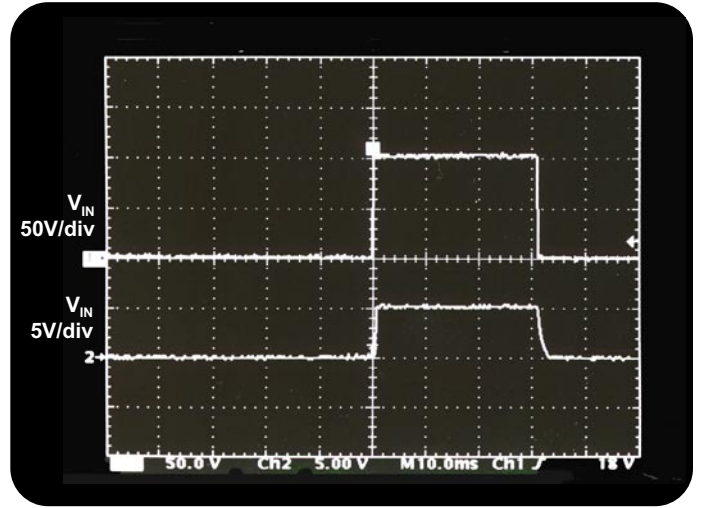
Load Transient Response



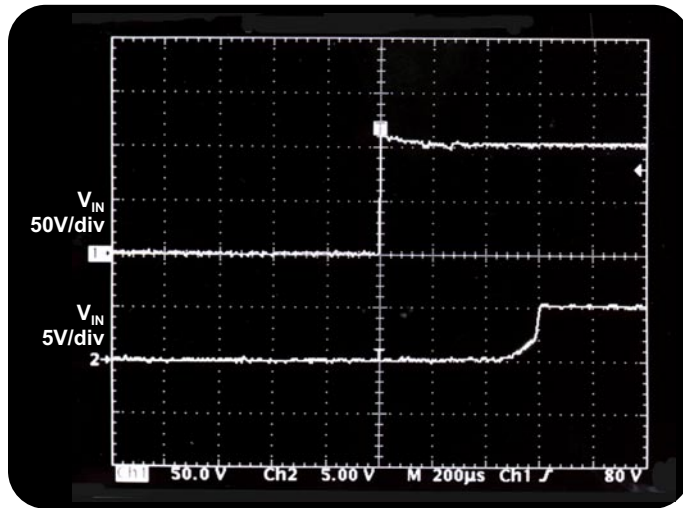
Line Transient Response



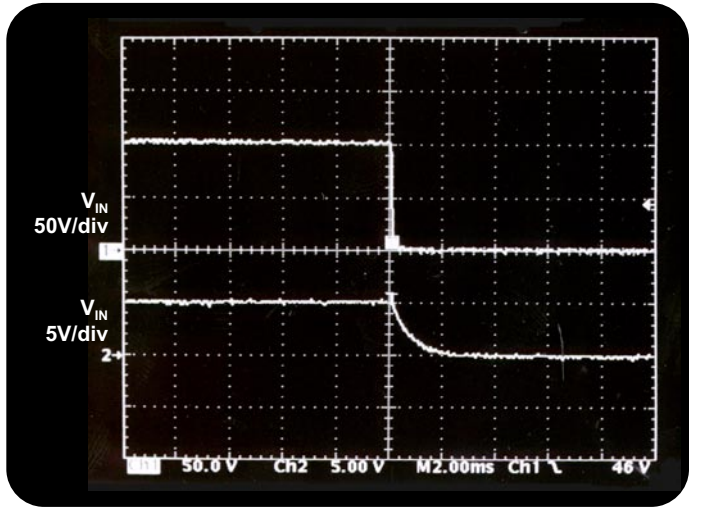
Load Transient Response, Load = 509Ω



Line Turn On/Off Response

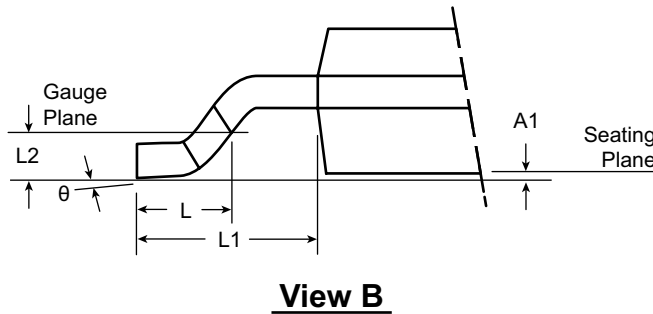
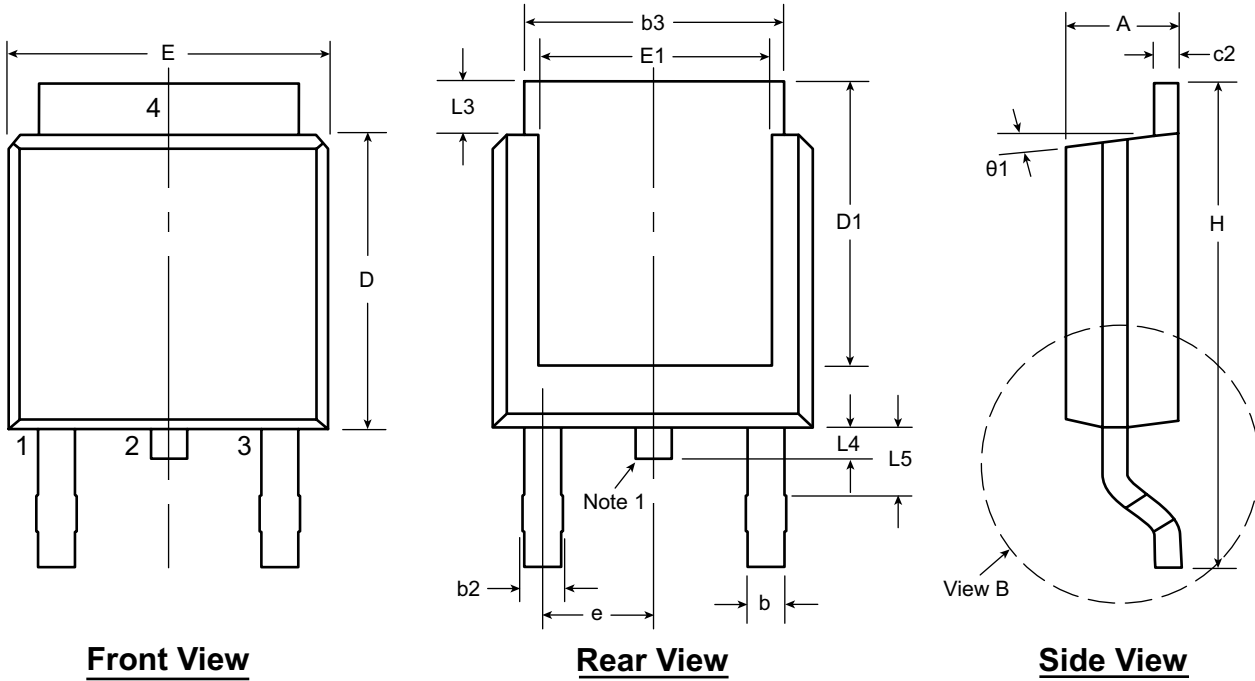


Line Power Up Transient



Line Power Down Transient

3-Lead TO-252 D-PAK Package Outline (K4)



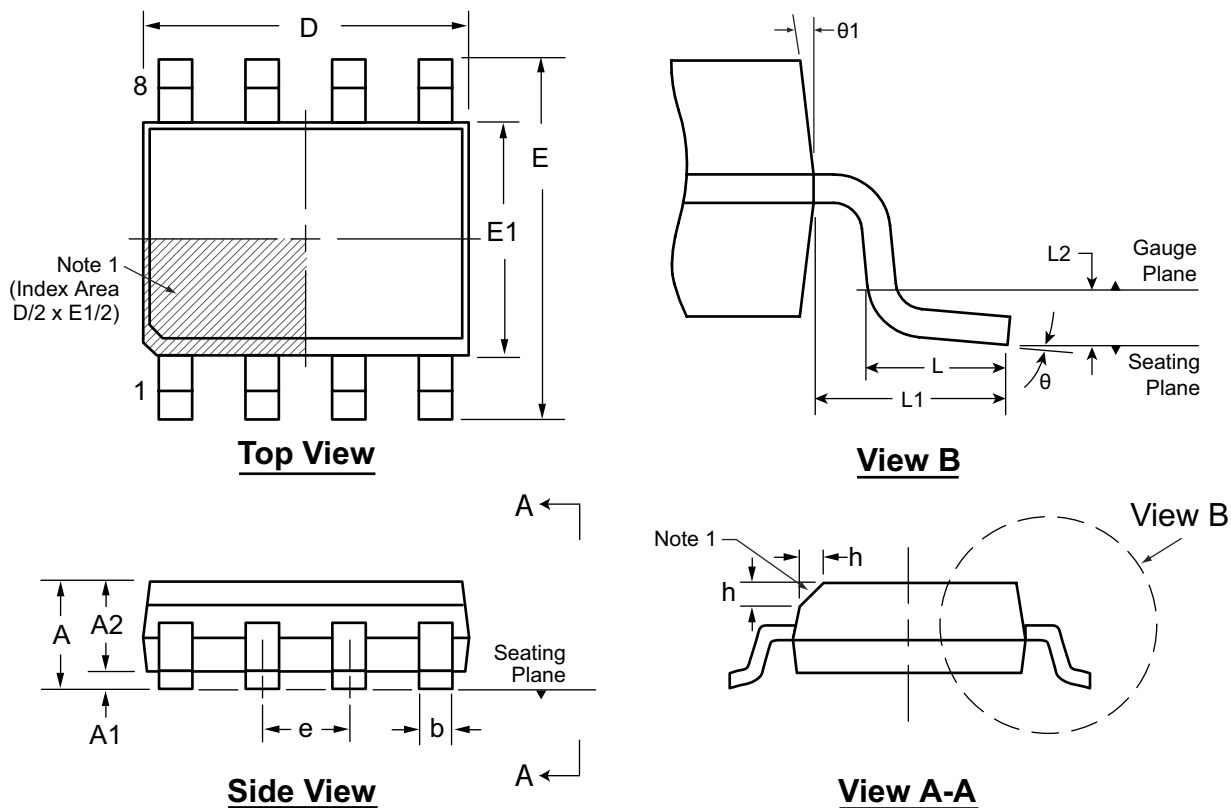
Note:
 1. Although 4 terminal locations are shown, only 3 are functional. Lead number 2 was removed.

Symbol	A	A1	b	b2	b3	c2	D	D1	E	E1	e	H	L	L1	L2	L3	L4	L5	θ	θ_1	
Dimension (inches)	MIN	.086	.000*	.025	.030	.195	.018	.235	.205	.250	.170	.370	.055	.108 REF	.020 BSC	.035	.025*	.045	0°	0°	
	NOM	-	-	-	-	-	-	.240	-	-	.090 BSC	-	.060			-	-	-	-	-	-
	MAX	.094	.005	.035	.045	.215	.035	.245	.217*	.265	.182*	.410	.070			.050	.040	.060	10°	15°	

JEDEC Registration TO-252, Variation AA, Issue E, June 2004.
 * This dimension is not specified in the original JEDEC drawing. The value listed is for reference only.
Drawings not to scale.
 Supertex Doc. #: DSPD-3TO252K4, Version D081408.

8-Lead SOIC (Narrow Body) Package Outline (LG)

4.90x3.90mm body, 1.75mm height (max), 1.27mm pitch

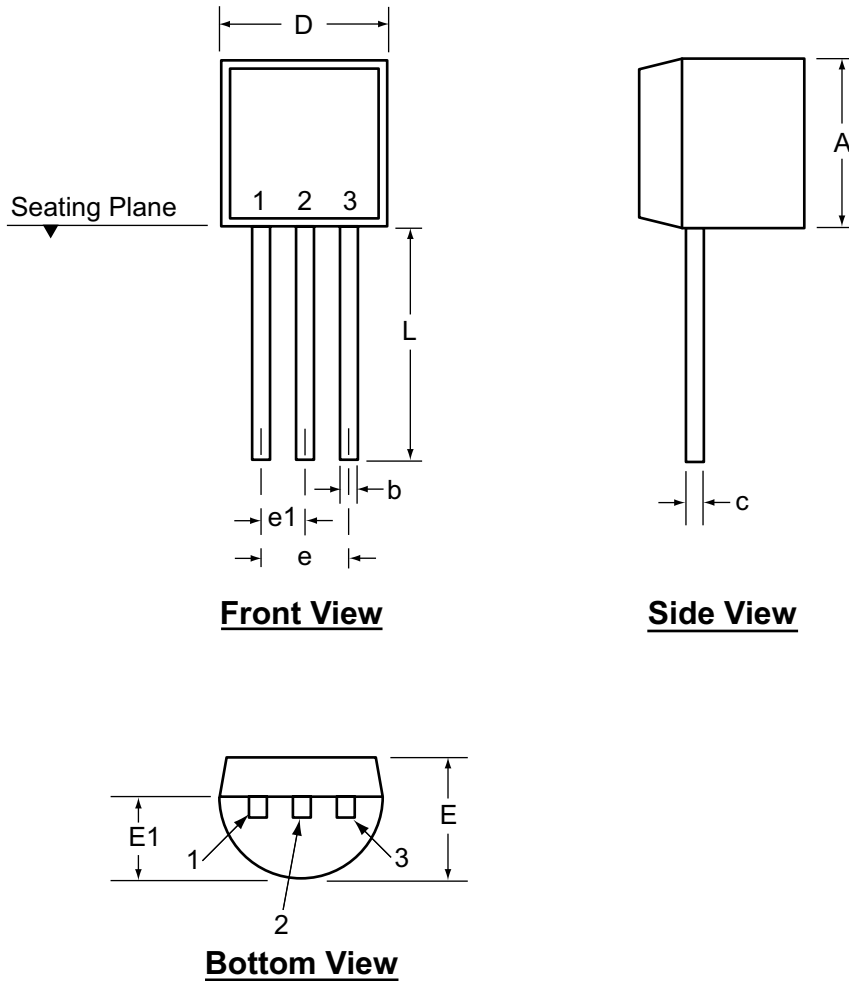


Note:
 1. This chamfer feature is optional. A Pin 1 identifier must be located in the index area indicated. The Pin 1 identifier can be: a molded mark/identifier; an embedded metal marker; or a printed indicator.

Symbol	A	A1	A2	b	D	E	E1	e	h	L	L1	L2	θ	θ1		
Dimension (mm)	MIN	1.35*	0.10	1.25	0.31	4.80*	5.80*	3.80*	1.27 BSC	0.25	0.40	1.04 REF	0.25	0°	5°	
	NOM	-	-	-	-	4.90	6.00	3.90		-	-		0.25 BSC			-
	MAX	1.75	0.25	1.65*	0.51	5.00*	6.20*	4.00*		0.50	1.27		8°			15°

JEDEC Registration MS-012, Variation AA, Issue E, Sept. 2005.
 * This dimension is not specified in the original JEDEC drawing. The value listed is for reference only.
 Drawings are not to scale.
 Supertex Doc. #: DSPD-8SOLGTG, Version H101708.

3-Lead TO-92 Package Outline (N3)



Symbol	A	b	c	D	E	E1	e	e1	L	
Dimensions (inches)	MIN	.170	.014†	.014†	.175	.125	.080	.095	.045	.500
	NOM	-	-	-	-	-	-	-	-	-
	MAX	.210	.022†	.022†	.205	.165	.105	.105	.055	.610*

JEDEC Registration TO-92.

* This dimension is not specified in the original JEDEC drawing. The value listed is for reference only.

† This dimension is a non-JEDEC dimension.

Drawings not to scale.

Supertex Doc.#: DSPD-3TO92N3, Version D080408.

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to <http://www.supertex.com/packaging.html>.)

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