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.
- 10µA typical ADJ current
- Over temperature protection
- Available in 3 different packages

Applications

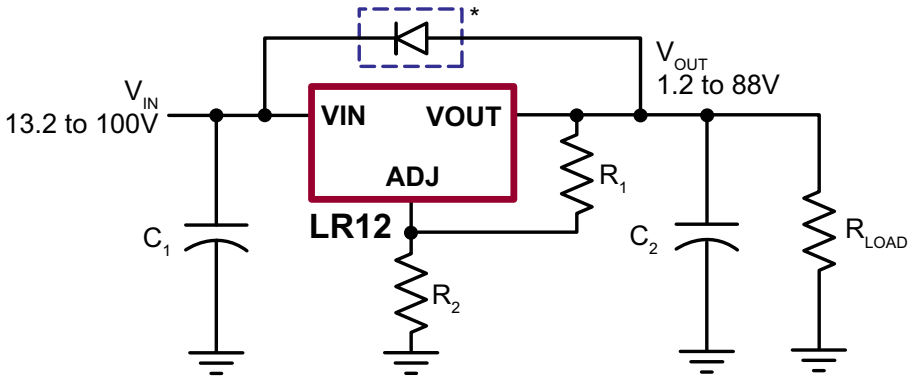
- DC/DC SMPS startup circuits
- Adjustable high voltage constant current sources
- Industrial controls
- Motor controls
- Battery powered systems
- Power supplies
- Telecom applications
- LED drivers
- Automotive applications

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 10µA is connected to the ADJ pin. This increases V_{OUT} by a constant voltage of 10µA 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 500µA are required.

LR12 Typical Application



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

Ordering Information

Part Number	Package Options	Packing
LR12K4-G	TO-252 (D-PAK)	2000/Reel
LR12LG-G	8-Lead SOIC	2500/Reel
LR12N3-G	TO-92	1000/Bag
LR12N3-G P002	TO-92	2000/Reel
LR12N3-G P003	TO-92	2000/Reel
LR12N3-G P005	TO-92	2000/Reel
LR12N3-G P013	TO-92	2000/Reel
LR12N3-G P014	TO-92	2000/Reel

-G denotes a lead (Pb)-free / RoHS compliant package

Absolute Maximum Ratings

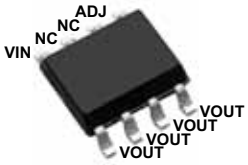
Parameter	Value
V_{IN-ADJ}	-0.5V to +120V
$V_{OUT-ADJ}$	-10V to +10V
V_{IN} - V_{OUT}	-0.5V to +120V
Operating ambient temperature	-40°C to +85°C
Operating junction temperature	-40°C to +125°C
Storage temperature	-65°C to +150°C
Power Dissipation @ T_A = 25°C TO-252 (D-PAK) 8-Lead SOIC TO-92	 2.0W 1.8W 0.6W

Typical Thermal Resistance

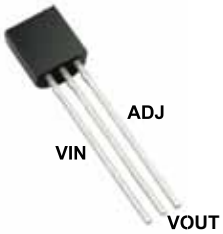
Package	θ_{ja} (°C/W)
TO-252	81°C/W
8-Lead SOIC	101°C/W
TO-92	132°C/W

Pin Configuration

TO-252 (D-PAK)



8-Lead SOIC



TO-92

Product Marking

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

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

TO-252 (D-PAK)

YY = Year Sealed
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8-Lead SOIC

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

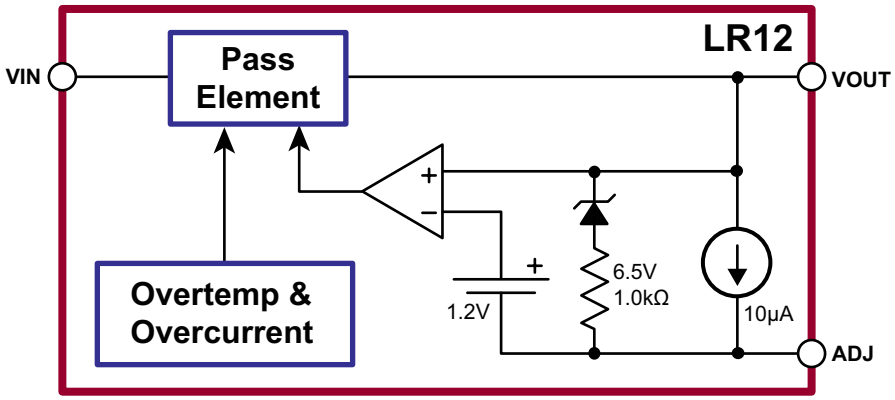
Electrical Characteristics *(Test conditions unless otherwise specified: -40°C < T_A < +85°C)*

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	13.2V < V_{IN} <100V, R_1 = 2.4KΩ, R_2 = 0
ΔV_{OUT}	Line regulation	-	0.003	0.03	%/V	15V < V_{IN} <100V, V_{OUT} = 5.0V, I_{OUT} = 0.5A
	Load regulation	-	1.4	3.0	%	V_{IN} = 15V, V_{OUT} = 5.0V, 0.5mA< I_{OUT}<50mA
	Temperature regulation	-1.0	-	+1.0	%	V_{IN} = 15V, V_{OUT} = 5.0V, I_{OUT} = 10mA, -40°C < T_A < 85°C

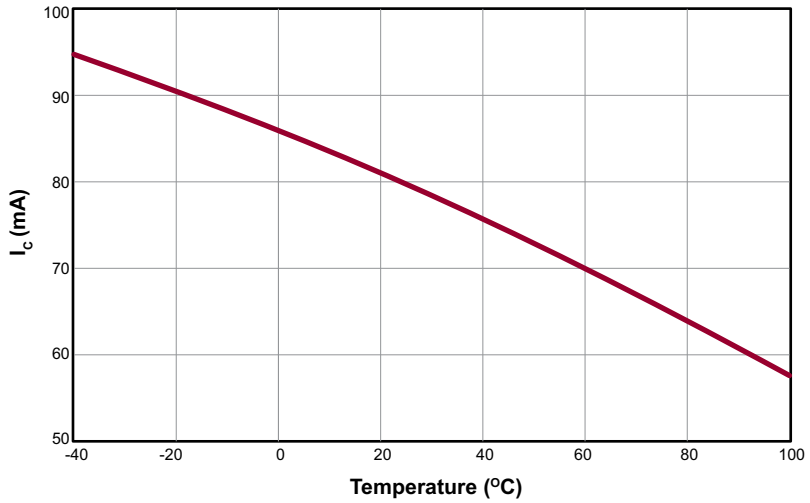
Electrical Characteristics *(cont.)*

Sym	Parameter	Min	Typ	Max	Units	Conditions
I_{OUT}	Output current limit	50	-	100	ma	$T_J < 85^oC$, $V_{IN} - V_{OUT} < 12V$
		-	-	-0.5		$T_J < 125^oC$, $V_{IN} - V_{OUT} < 100V$
	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} = 5.0V
T_{LIMIT}	Junction temperature limit	125	-	-	^oC	---

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}*

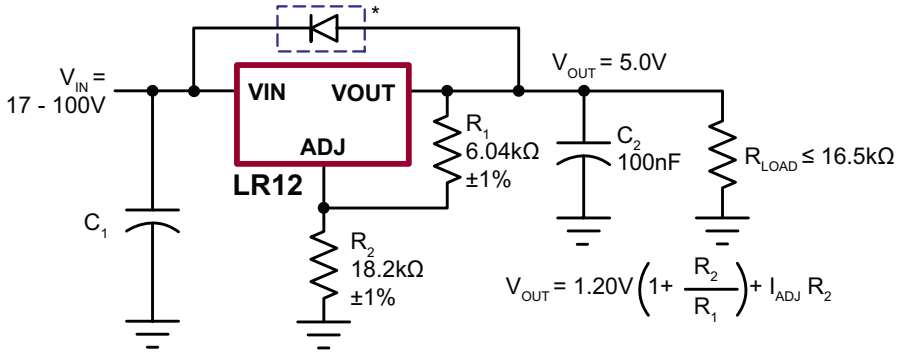


Figure 2: SMPS Start-Up Circuit

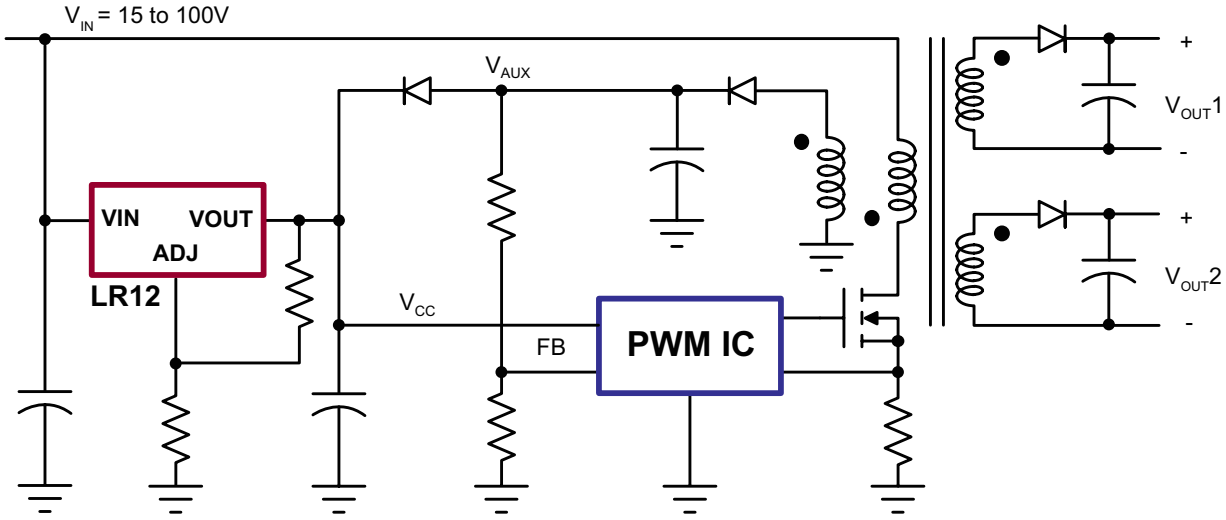
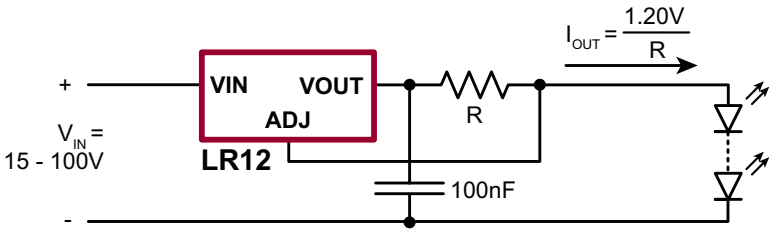
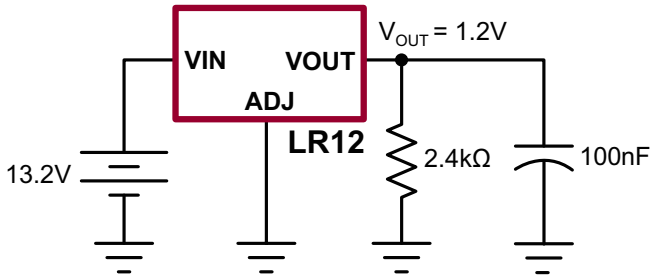
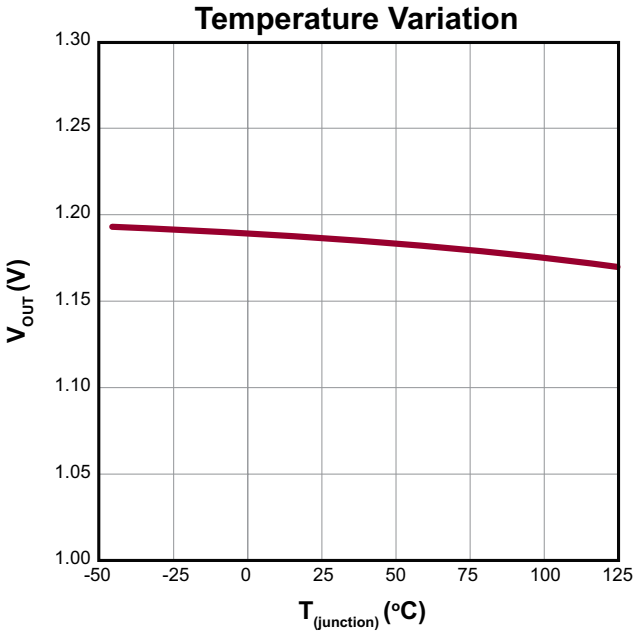


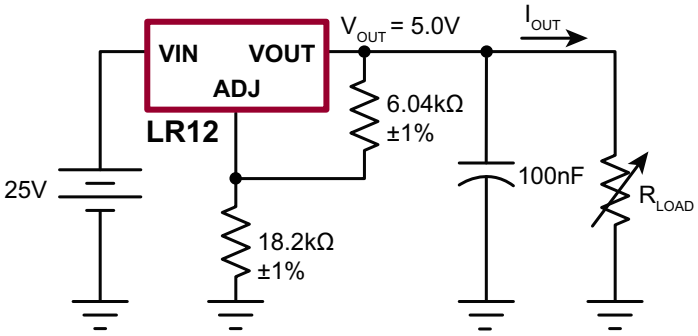
Figure 3: High Voltage Adjustable Constant Current Source

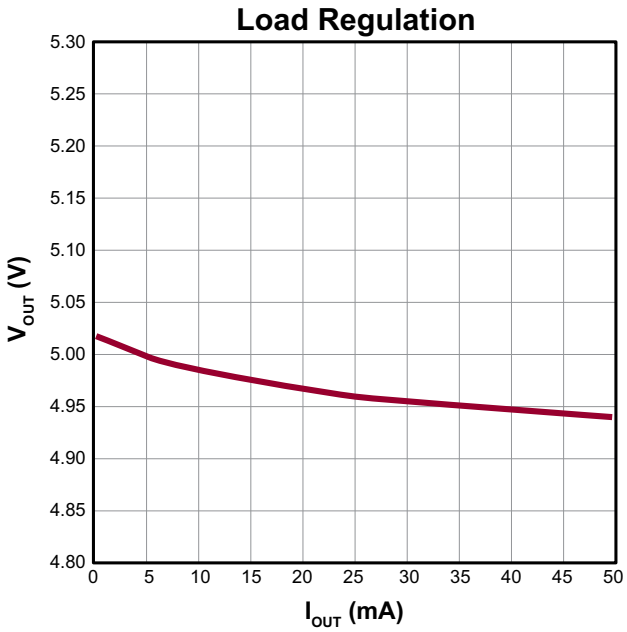


Typical Performance Curves

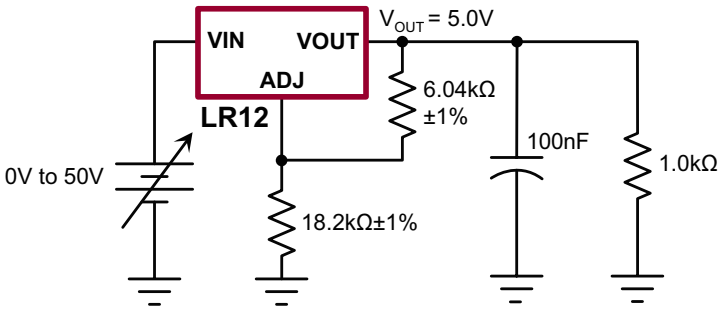


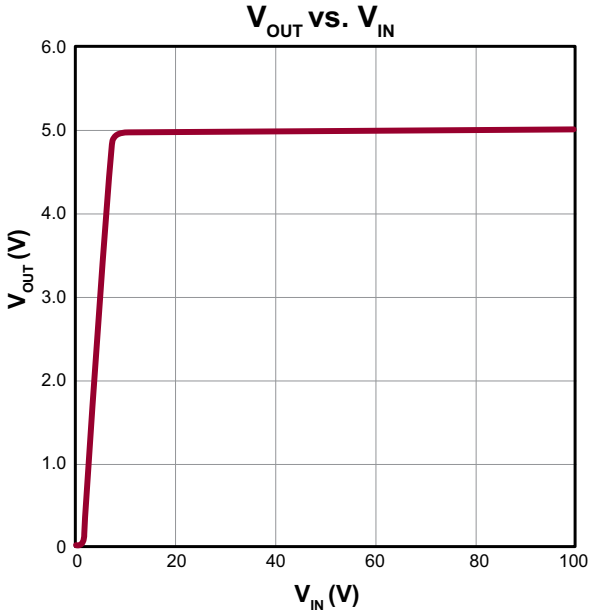


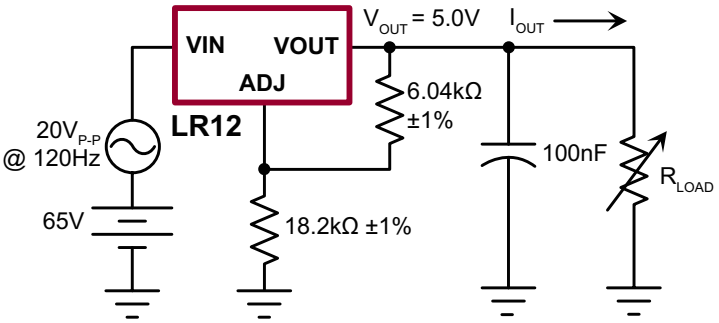


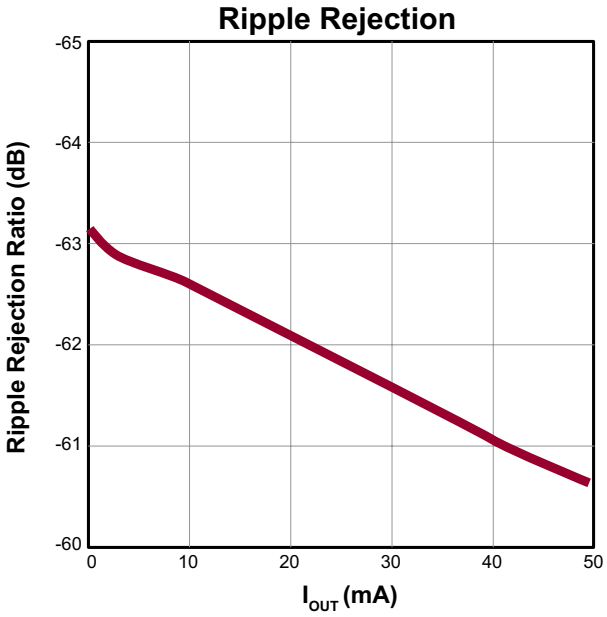


Typical Performance Curves *(cont.)*



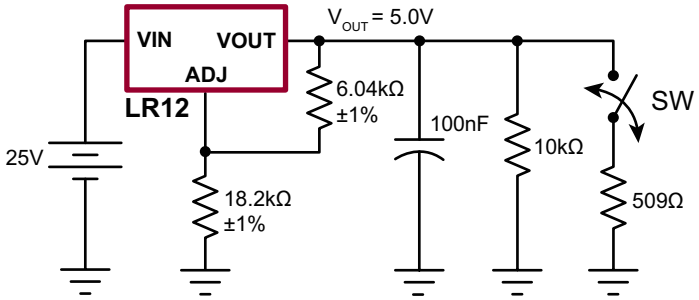




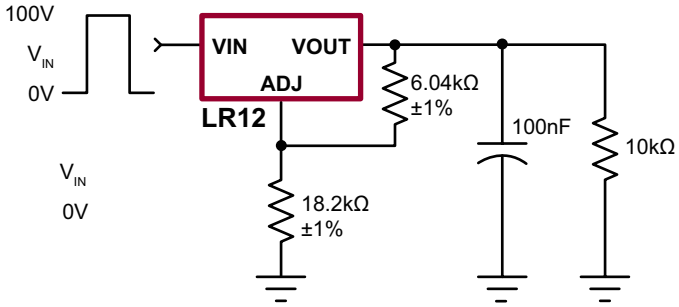


Typical Performance Curves *(cont)*

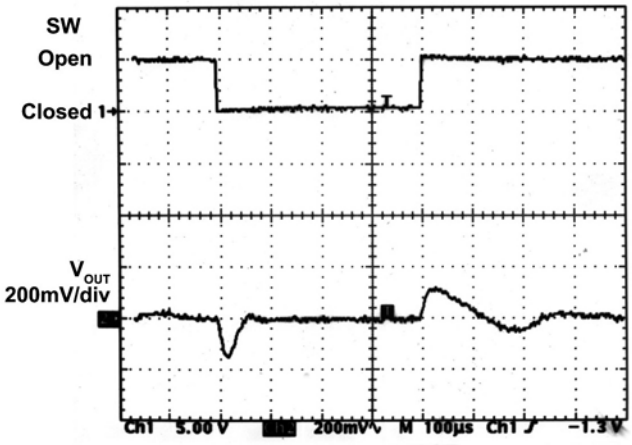
Load Transient Response



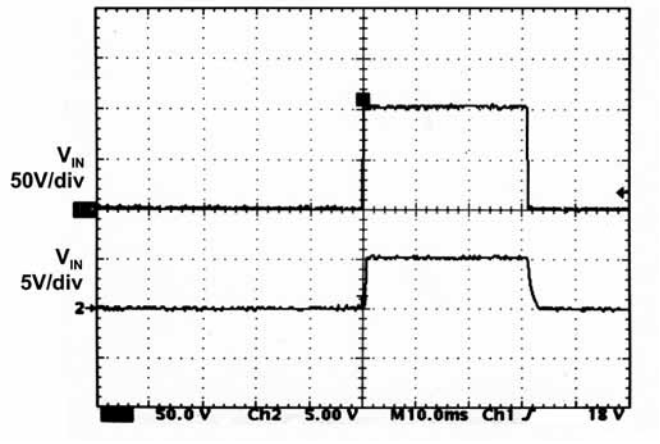
Line Transient Response



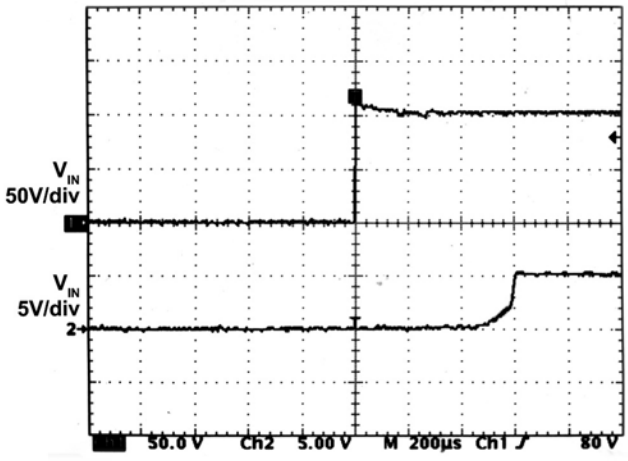
Load Transient Response, Load = 509Ω



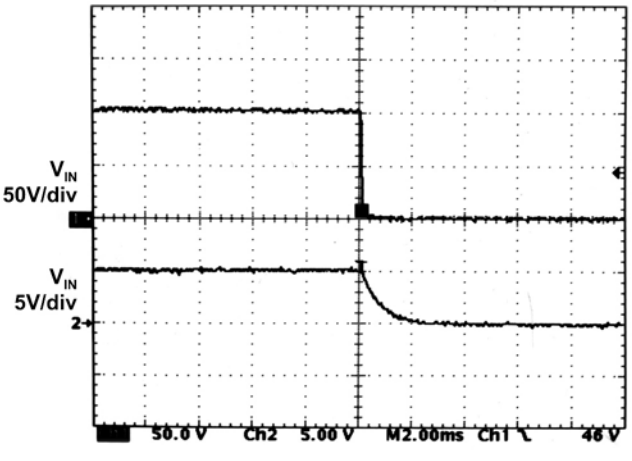
Line Turn On/Off Response



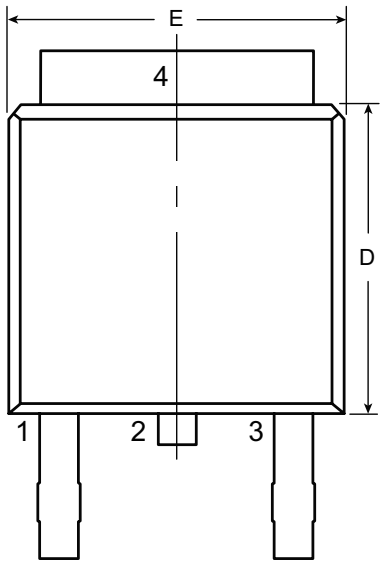
Line Power Up Transient



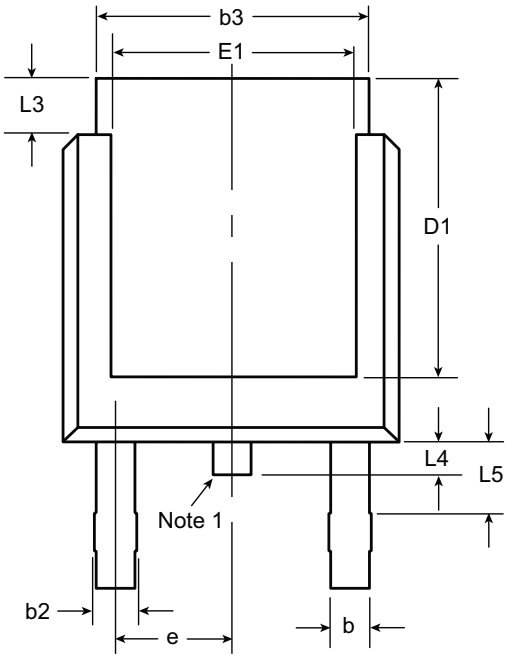
Line Power Down Transient



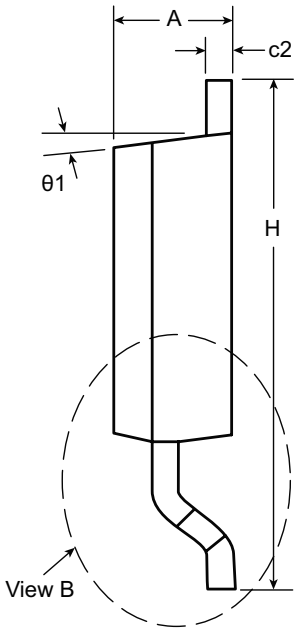
3-Lead TO-252 (D-PAK) Package Outline (K4)



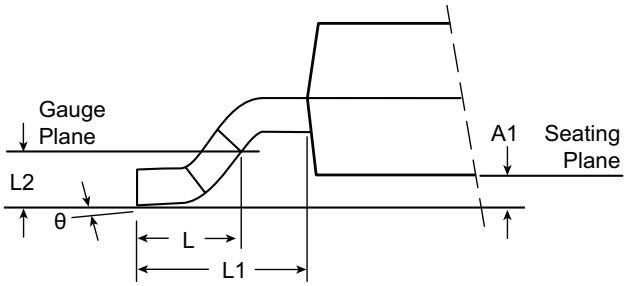
Front View



Rear View



Side View



View B

Note:

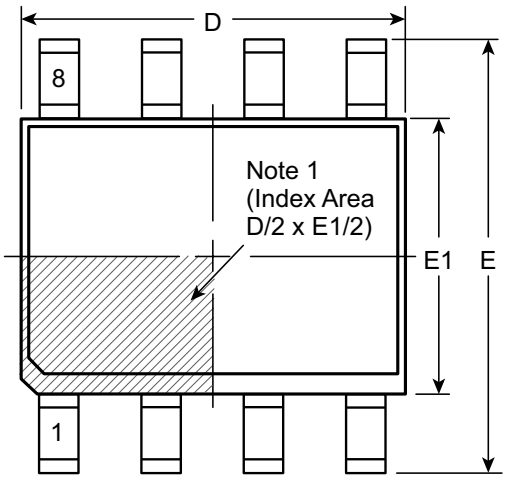
1. *Although 4 terminal locations are shown, only 3 are functional. Lead number 2 was removed.*

Symbol		A	A1	b	b2	b3	c2	D	D1	E	E1	e	H	L	L1	L2	L3	L4	L5	θ	θ1
Dimen-sion (inches)	MIN	.086	.000*	.025	.030	.195	.018	.235	.205	.250	.170	.090 BSC	.370	.055	.108 REF	.020 BSC	.035	.025*	.045	0^0	0^0
	NOM	-	-	-	-	-	-	.240	-	-	-		-	.060			-	-	-	-	-
	MAX	.094	.005	.035	.045	.215	.035	.245	.217*	.265	.182*		.410	.070			.050	.040	.060	10^0	15^0

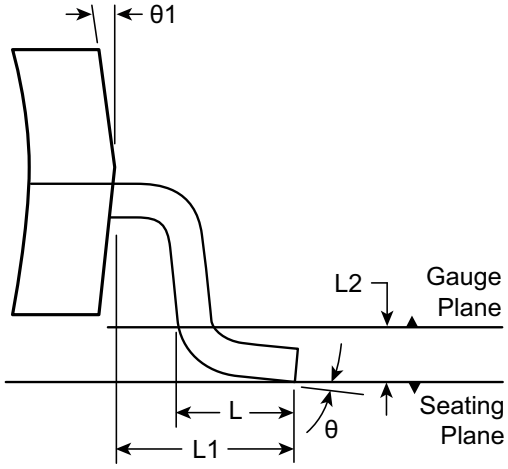
JEDEC Registration TO-252, Variation AA, Issue E, June 2004.
** This dimension is not specified in the JEDEC drawing.*
Drawings not to scale.
Supertex Doc. #: *DSPD-3TO252K4, Version E091009.*

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

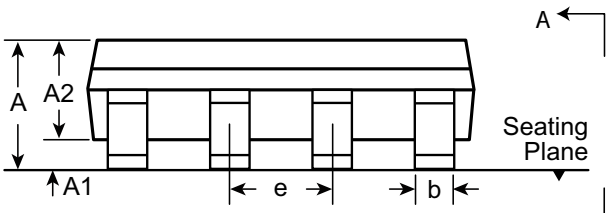
4.90x3.90mm body, 1.75mm height (max), 1.27mm pitch



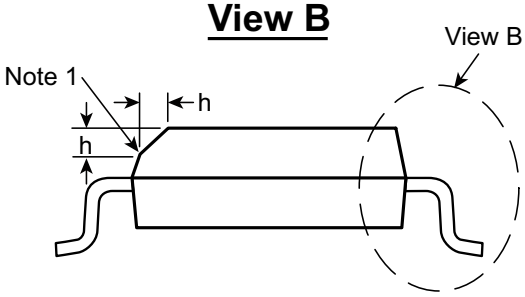
Top View



View B



Side View



View A-A

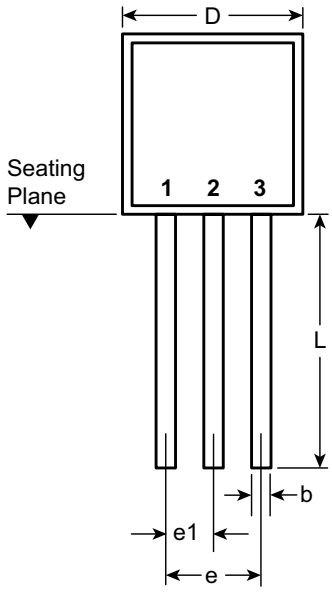
Note:

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.*

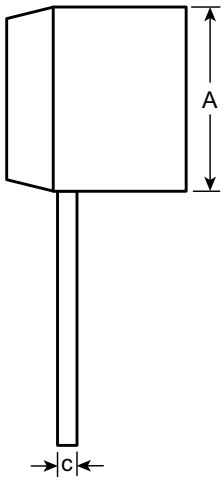
Symbol		A	A1	A2	b	D	E	E1	e	h	L	L1	L2	θ	θ1
Dimension (mm)	MIN	1.35*	0.10	1.25	0.31	4.80*	5.80*	3.80*	1.27 BSC	0.25	0.40	1.04 REF	0.25 BSC	0°	5°
	NOM	-	-	-	-	4.90	6.00	3.90		-	-			-	-
	MAX	1.75	0.25	1.65*	0.51	5.00*	6.20*	4.00*		0.50	1.27			8°	15°

JEDEC Registration MS-012, Variation AA, Issue E, Sept. 2005.
** This dimension is not specified in the JEDEC drawing.*
Drawings are not to scale.
Supertex Doc. #: *DSPD-8SOLGTG, Version I041309.*

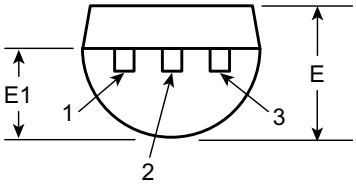
3-Lead TO-92 Package Outline (N3)



Front View



Side View



Bottom View

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 JEDEC drawing.*
† This dimension differs from the JEDEC drawing.
Drawings not to scale.
***Supertex Doc.#:** DSPD-3TO92N3, Version E041009.*

(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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