

SCP51460

LDO Regulator - High Accuracy, Low Noise

20 mA

The SCP51460 is a low cost, low power, high accuracy LDO voltage regulator. This device will supply output current up to 20 mA at fixed output voltage 3.3 V with excellent regulation characteristics, making it ideal for precision regulator applications. It is designed to be stable without output capacitor. This is an important feature, when fast rise times and PCB space are in concern. The protective features include Short Circuit Current and Reverse Voltage Protection. The SCP51460 is packaged in 3 leads surface mount SOT-23 package.

Features

- Fixed Output Voltage 3.3 V
- V_{OUT} Accuracy 1% over 0 to +100°C
- Wide Input Voltage Range up to 28 V
- Low Quiescent Current
- Low Noise
- Reverse Battery Protection
- Stable Without Output Capacitor
- Available in 3 leads SOT-23 Package
- This Device is Pb-Free and is RoHS Compliant

Typical Applications

- Handheld Instruments
- Precision Regulators
- Data Acquisition Systems
- High Accuracy Micropower Supplies

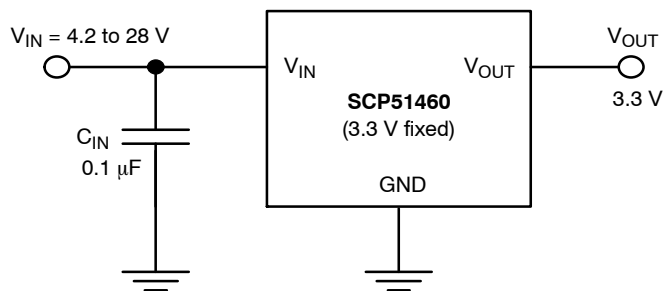
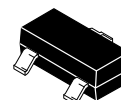


Figure 1. Typical Application Schematics



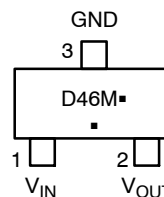
ON Semiconductor®

www.onsemi.com



**SOT-23-3
SN1 SUFFIX
CASE 318**

MARKING DIAGRAM AND PIN ASSIGNMENT



(Top View)

D46 = Specific Device Code
M = Date Code
▪ = Pb-Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

SCP51460

Table 1. PIN FUNCTION DESCRIPTION

Pin No.	Pin Name	Description
1	V _{IN}	Positive Input Voltage
2	V _{OUT}	Regulated Output Voltage
3	GND	Power Supply Ground; Device Substrate

Table 2. ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Voltage (Note 1)	V _{IN}	30	V
Reverse Input Voltage	V _{IN}	-15	V
Output Short Circuit Duration (Note 2)	I _{OUT}	∞	sec
Maximum Junction Temperature	T _{J(max)}	150	°C
Storage Temperature	T _{STG}	-65 to 150	°C
ESD Capability, Human Body Model (Note 3)	ESD _{HBM}	1000	V
ESD Capability, Machine Model (Note 3)	ESD _{MM}	100	V

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.
2. With the Input Voltage ≤ 28 V the SCP51460 is able to withstand an infinitely long time under Short Circuit Condition.
3. This device series incorporates ESD protection and is tested by the following methods:
 ESD Human Body Model tested per AEC-Q100-002 (EIA/JESD22-A114)
 ESD Machine Model tested per AEC-Q100-003 (EIA/JESD22-A115)
 Latch up Current Maximum Rating: tested per JEDEC standard: JESD78.

Table 3. THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Characteristics, SOT23-3 package Thermal Resistance, Junction-to-Ambient (Note 4)	R _{θJA}	246	°C/W

4. Soldered on 1 oz 50 mm² FR4 copper area.

Table 4. OPERATING RANGES

Rating	Symbol	Min	Max	Unit
Operating Input Voltage (Note 5)	V _{IN}	V _{OUT} + 0.9	28	V
Operating Ambient Temperature Range	T _A	0	100	°C

5. Refer to ELECTRICAL CHARACTERISTICS and APPLICATION INFORMATION for Safe Operating Area.

Table 5. ELECTRICAL CHARACTERISTICS ($V_{IN} = V_{OUT} + 2.5\text{ V}$, $I_{OUT} = 0$, $C_{IN} = 0.1\text{ }\mu\text{F}$, $C_{OUT} = 0\text{ }\mu\text{F}$; For typical values $T_A = 25^\circ\text{C}$, for min/max values $0^\circ\text{C} \leq T_A \leq 100^\circ\text{C}$ unless otherwise noted.) (Note 6).

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Output Voltage		V_{OUT}	3.267 (-1 %)	3.3	3.333 (+1 %)	V
Line Regulation	$V_{IN} = V_{OUT} + 0.9\text{ V}$ to 2.5 V $V_{IN} = V_{OUT} + 2.5\text{ V}$ to 20 V	Reg_{LINE}	– –	120 75	1000 130	ppm/V
Load Regulation	$I_{OUT} = 100\text{ }\mu\text{A}$, $T_A = 25^\circ\text{C}$ $I_{OUT} = 10\text{ mA}$, $T_A = 25^\circ\text{C}$ $I_{OUT} = 20\text{ mA}$, $T_A = 25^\circ\text{C}$	Reg_{LOAD}	– – –	1200 210 180	3000 300 300	ppm/mA
Load Regulation	$I_{OUT} = 100\text{ }\mu\text{A}$, $0^\circ\text{C} \leq T_A \leq 100^\circ\text{C}$ $I_{OUT} = 10\text{ mA}$, $0^\circ\text{C} \leq T_A \leq 100^\circ\text{C}$	Reg_{LOAD}	– –	1500 260	4000 300	ppm/mA
Dropout Voltage	Measured at $V_{OUT} - 2\%$ $I_{OUT} = 0\text{ mA}$ $I_{OUT} = 10\text{ mA}$	V_{DO}	– –	0.65 0.94	0.9 1.4	V
Quiescent Current	$I_{OUT} = 0\text{ mA}$, $T_A = 25^\circ\text{C}$ $I_{OUT} = 0\text{ mA}$, $0^\circ\text{C} \leq T_A \leq 100^\circ\text{C}$	I_Q	– –	150	180 220	μA
Output Short Circuit Current	$V_{OUT} = 0\text{ V}$, $T_A = 25^\circ\text{C}$	I_{SC}	–	40	–	mA
Reverse Leakage	$V_{IN} = -15\text{ V}$, $T_A = 25^\circ\text{C}$	I_{LEAK}	–	0.1	10	μA
Output Noise Voltage (Note 7)	$f = 0.1\text{ Hz}$ to 10 Hz $f = 10\text{ Hz}$ to 1 kHz	V_N	–	13.2 13.2	–	μV_{PP} μV_{rms}

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

6. Performance guaranteed over the indicated operating temperature range by design and/or characterization tested at $T_J = T_A = 25^\circ\text{C}$. Low duty cycle pulse techniques are used during testing to maintain the junction temperature as close to ambient as possible.
7. Peak-to-peak noise is measured with a single pole high pass filter at 0.1 Hz and 2-pole low pass filter at 10 Hz. The unit is enclosed into still-air environment to eliminate thermocouple effects. The test time is set to 10 sec.

TYPICAL CHARACTERISTICS

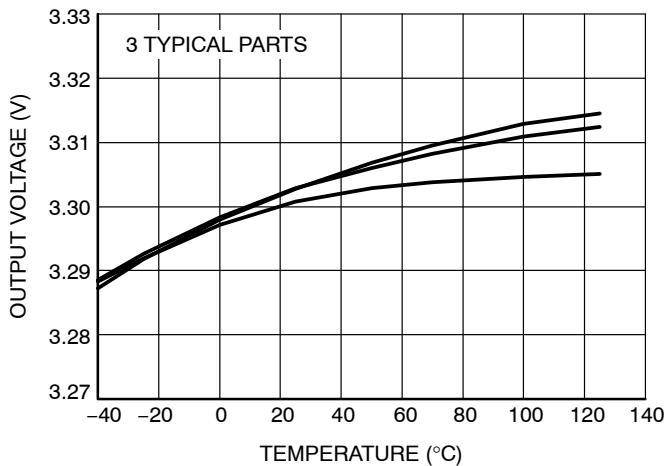


Figure 2. Output Voltage vs. Temperature

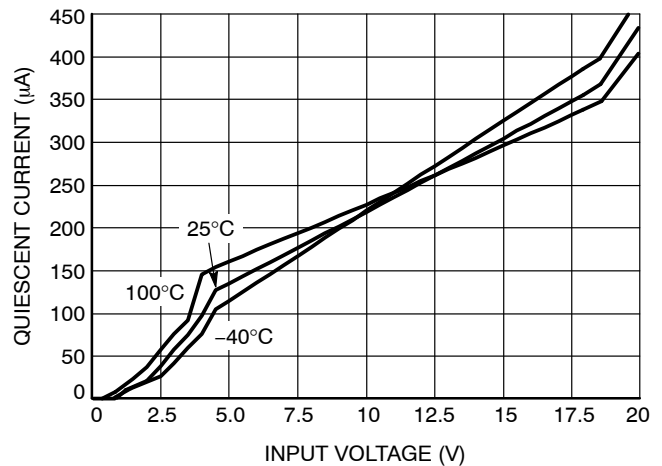


Figure 3. Quiescent Current vs. Input Voltage

TYPICAL CHARACTERISTICS

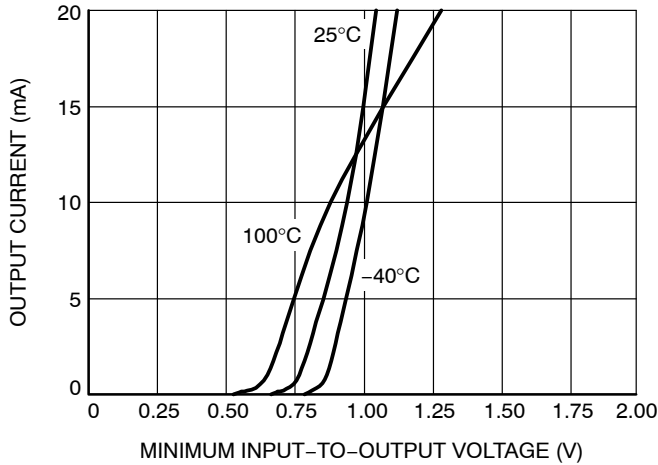


Figure 4. Dropout Voltage vs. Output Current

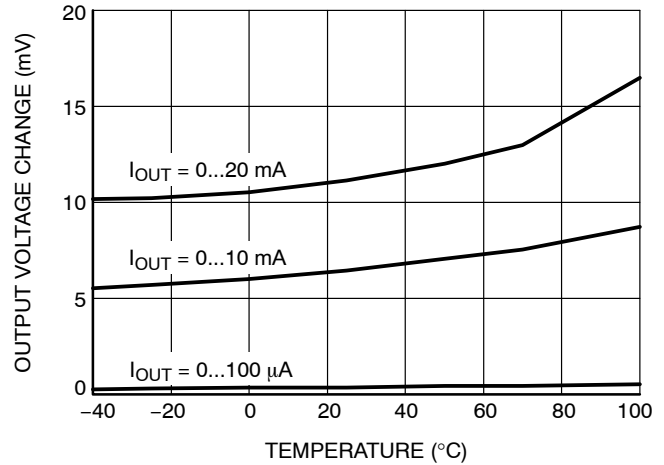


Figure 5. Output Voltage Change vs. Temperature

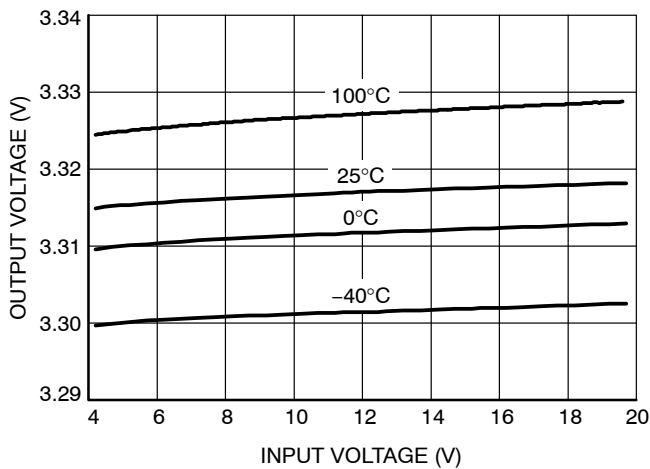


Figure 6. Output Voltage vs. Input Voltage

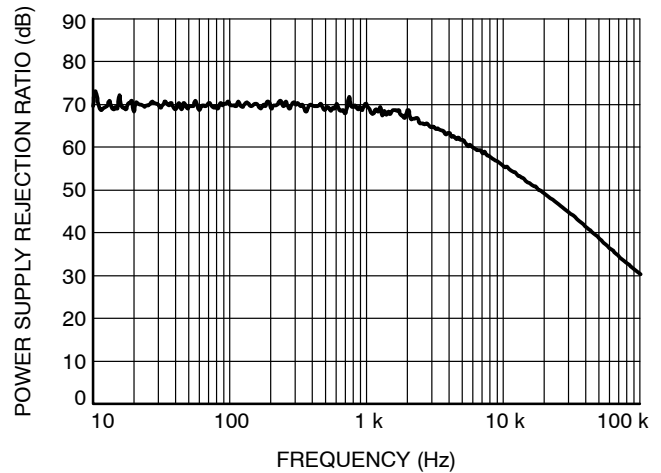


Figure 7. PSRR vs. Frequency

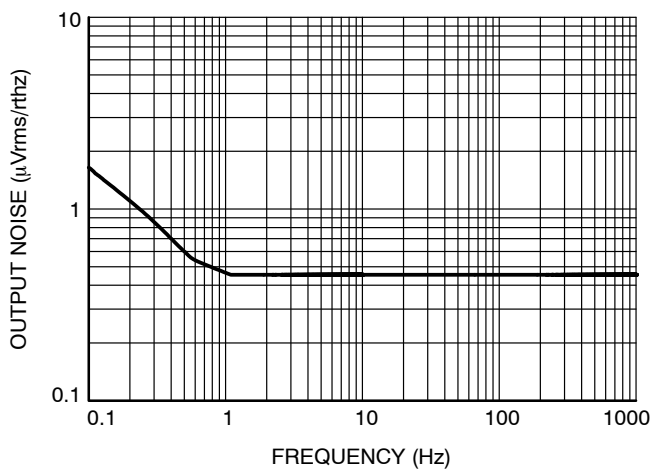
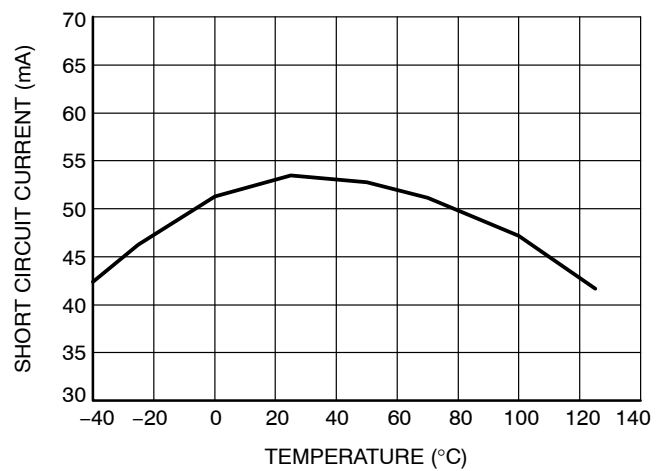
Figure 8. Output Voltage Noise
0.1 Hz – 1 kHz

Figure 9. Short Circuit Current vs. Temperature

APPLICATIONS INFORMATION

Input Decoupling Capacitor (C_{IN})

A ceramic or tantalum 0.1 μF capacitor is recommended and should be connected close to the SCP51460 package. Higher capacitance and lower ESR will improve the overall line transient response.

Output Decoupling Capacitor (C_{OUT})

The SCP51460 does not require any output capacitance to be stable. With no capacitor at the output the device will have faster V_{OUT} rise time and will occupy less PCB space. In some applications however the output capacitor could be added. This will improve the overall transient response. During the transients capacitors with low ESR (e.g. Ceramic capacitors) will cause more ringing than the Tantalum or Aluminum Capacitors.

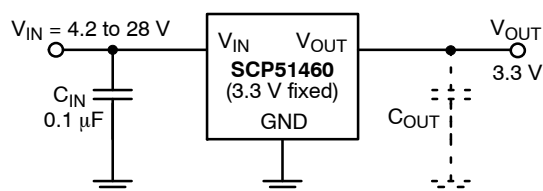


Table 6 shows the maximum capacitance of C_{OUT} for various load currents to avoid instability.

Table 6.

$I_{\text{OUT}} = 100 \mu\text{A}$	$I_{\text{OUT}} = 1 \text{ mA}$	$I_{\text{OUT}} = 10 \text{ mA}$	$I_{\text{OUT}} = 20 \text{ mA}$
$>10 \mu\text{F}$	$>10 \mu\text{F}$	$1 \mu\text{F}$	$0.68 \mu\text{F}$

Thermal Characteristics

As power dissipation in the SCP51460 increases, it may become necessary to provide some thermal relief. The maximum power dissipation supported by the device is dependent upon board design and layout. The board material and the ambient temperature affect the rate of junction temperature rise for the part. The maximum power dissipation the SCP51460 can handle is given by:

$$P_{\text{D(MAX)}} = \frac{[T_{\text{J(MAX)}} - T_{\text{A}}]}{R_{\theta\text{JA}}} \quad (\text{eq. 1})$$

Since T_{J} is not recommended to exceed 100°C ($T_{\text{J(MAX)}}$), then the SCP51460 can dissipate up to 305 mW when the ambient temperature (T_{A}) is 25°C .

The power dissipated by the SCP51460 can be calculated from the following equations:

$$P_{\text{D}} \approx V_{\text{in}}(I_{\text{GND}}@I_{\text{out}}) + I_{\text{out}}(V_{\text{in}} - V_{\text{out}}) \quad (\text{eq. 2})$$

or

$$V_{\text{in(MAX)}} \approx \frac{P_{\text{D(MAX)}} + (V_{\text{out}} \cdot I_{\text{out}})}{I_{\text{out}} + I_{\text{GND}}} \quad (\text{eq. 3})$$

Hints

V_{in} and GND printed circuit board traces should be as wide as possible. When the impedance of these traces is high, there is a chance to pick up noise or cause the regulator to malfunction. Place external components, especially the output capacitor, as close as possible to the SCP51460, and make traces as short as possible.

ORDERING INFORMATION

Device	Device Code	Package	Shipping [†]
SCP51460SN33T1G	D46	SOT23-3 (Pb-Free)	3,000 / Tape & Reel

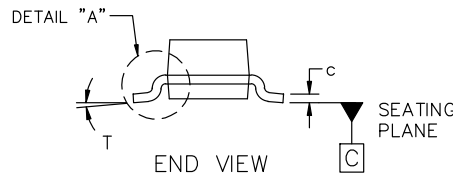
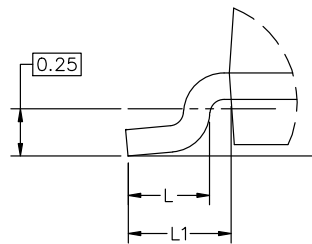
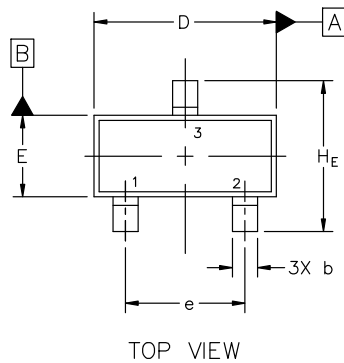
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.



SCALE 4:1

SOT-23 (TO-236) 2.90x1.30x1.00 1.90P
CASE 318
ISSUE AU

DATE 14 AUG 2024

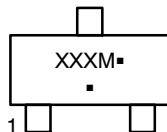


MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.89	1.00	1.11
A1	0.01	0.06	0.10
b	0.37	0.44	0.50
c	0.08	0.14	0.20
D	2.80	2.90	3.04
E	1.20	1.30	1.40
e	1.78	1.90	2.04
L	0.30	0.43	0.55
L1	0.35	0.54	0.69
HE	2.10	2.40	2.64
T	0°	---	10°

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

GENERIC
MARKING DIAGRAM*



XXX = Specific Device Code
M = Date Code
▪ = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



RECOMMENDED
MOUNTING FOOTPRINT

* For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

DOCUMENT NUMBER:	98ASB42226B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOT-23 (TO-236) 2.90x1.30x1.00 1.90P	PAGE 1 OF 2

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

SOT-23 (TO-236) 2.90x1.30x1.00 1.90P
CASE 318
ISSUE AU

DATE 14 AUG 2024

STYLE 1 THRU 5: CANCELLED	STYLE 6: PIN 1. BASE 2. EMITTER 3. COLLECTOR	STYLE 7: PIN 1. EMITTER 2. BASE 3. COLLECTOR	STYLE 8: PIN 1. ANODE 2. NO CONNECTION 3. CATHODE		
STYLE 9: PIN 1. ANODE 2. ANODE 3. CATHODE	STYLE 10: PIN 1. DRAIN 2. SOURCE 3. GATE	STYLE 11: PIN 1. ANODE 2. CATHODE 3. CATHODE-ANODE	STYLE 12: PIN 1. CATHODE 2. CATHODE 3. ANODE	STYLE 13: PIN 1. SOURCE 2. DRAIN 3. GATE	STYLE 14: PIN 1. CATHODE 2. GATE 3. ANODE
STYLE 15: PIN 1. GATE 2. CATHODE 3. ANODE	STYLE 16: PIN 1. ANODE 2. CATHODE 3. CATHODE	STYLE 17: PIN 1. NO CONNECTION 2. ANODE 3. CATHODE	STYLE 18: PIN 1. NO CONNECTION 2. CATHODE 3. ANODE	STYLE 19: PIN 1. CATHODE 2. ANODE 3. CATHODE-ANODE	STYLE 20: PIN 1. CATHODE 2. ANODE 3. GATE
STYLE 21: PIN 1. GATE 2. SOURCE 3. DRAIN	STYLE 22: PIN 1. RETURN 2. OUTPUT 3. INPUT	STYLE 23: PIN 1. ANODE 2. ANODE 3. CATHODE	STYLE 24: PIN 1. GATE 2. DRAIN 3. SOURCE	STYLE 25: PIN 1. ANODE 2. CATHODE 3. GATE	STYLE 26: PIN 1. CATHODE 2. ANODE 3. NO CONNECTION
STYLE 27: PIN 1. CATHODE 2. CATHODE 3. CATHODE	STYLE 28: PIN 1. ANODE 2. ANODE 3. ANODE				

DOCUMENT NUMBER:	98ASB42226B	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	SOT-23 (TO-236) 2.90x1.30x1.00 1.90P	PAGE 2 OF 2

onsemi and **onsemi** are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. **onsemi** does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at
www.onsemi.com/support/sales