NCP5426

LDO Regulator/Vibration Motor Driver

The NCP5426 series of fixed output, 150 mA low dropout linear regulators are designed to be an economical solution for a variety of applications. Each device contains a voltage reference unit, an error amplifier, a PNP power transistor, resistors for setting output voltage, an under voltage lockout on the input, an enable pin, and current limit and temperature limit protection circuits.

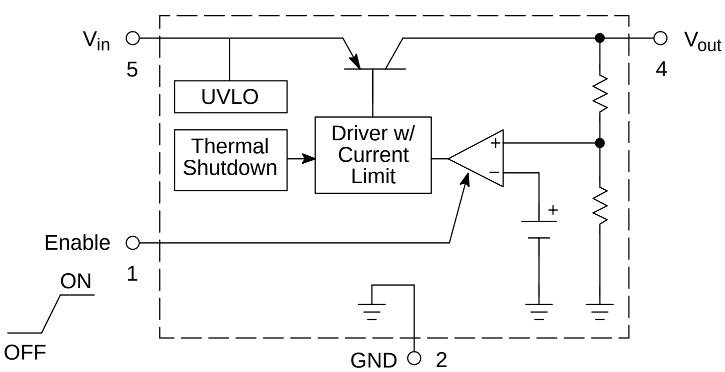
The NCP5426 is designed for driving a vibration motor using ceramic capacitors on the output. The device is housed in the micro−miniature TSOP−5 surface mount package. The NCP5426 is available in output voltages of 1.2 V to 2.0 V in 0.1 V increments.

Features

- Wide Operating Voltage Range to 12 V
- Internally Set Output Voltages
- Enable Pin for On/Off Control
- UVLO on the Input Voltage with Hysteresis
- Current and Thermal Protection
- Compatible with Ceramic, Tantalum or Aluminum Electrolytic Capacitors
- Pb−Free Package is Available

Typical Applications

- Vibration Motor Driver

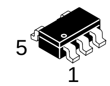


This device contains 47 active transistors.

Figure 1. Internal Schematic

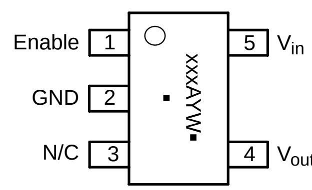
ON Semiconductor®

http://onsemi.com



TSOP−5
SN SUFFIX
CASE 483

PIN CONNECTIONS AND MARKING DIAGRAM



(Top View)

xxx = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = 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 7 of this data sheet.

DETAILED PIN DESCRIPTION

Pin	Name	Description
1	Enable	The enable pin allows the user to control the output. A low signal disables the output and places the device into a low current standby mode.
2	GND	Ground pin.
3	N/C	This pin is not connected to the device.
4	V_{out}	Regulated output voltage.
5	V_{in}	Input voltage.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Max Voltage, All Pins	V_{MAX}	12	V
Power Dissipation to Air	P_A	150	mW
Power Dissipation, Board Mounted	P	600	mW
Operating and Storage Temperature	T_A	−40 to 85	°C
Thermal Resistance	T_{JA}	300	°C/W
Junction Temperature	T_J	125	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

ELECTRICAL CHARACTERISTICS (T_A = 25°C, for min/max values T_A is the operating junction temperature that applies, V_{CC} = 3.5 V, unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Operating Voltage	V_{CC}	–	–	12	V
Operating Voltage Turn On, I_{out} = 30 mA, Increasing V_{CC}	V_{CCON}	–	2.6	2.8	V
Operating Voltage Turn Off, I_{out} = 30 mA, Decreasing V_{CC}	V_{CCOFF}	2.0	2.1	2.2	V
Operating Voltage Hysteresis, I_{out} = 30 mA	$V_{CC(hyst)}$	400	500	600	mV
Operating Current No Load	I_{CC}	–	120	240	µA
Operating Current, V_{CC} = 1.8 V, Enable High	$I_{CC(uvlo)}$	–	80	160	µA
Operating Current, Enable Low	$I_{CC(off)}$	–	–	0.1	µA
Maximum Output Current, V_{out} = 0.95 *V_{nom}	$I_{out(max)}$	150	–	–	mA
Overcurrent Protection, V_{out} = 0 V	$I_{out(limit)}$	–	270	–	mA
Load Regulation, V_{in} = 3.5 V, I_{out} 1.0 to 100 mA	Reg_{load}	–	30	60	mV
Line Regulation, I_{out} = 30 mA, V_{in} 3.0 to 5.0 V	Reg_{line}	–	10	20	mV
Ripple Rejection, V_{in} 3.5 V, f 120 Hz, V_{pp} 1.0 V, I_{out} 30 mA	RR	55	70	–	dB
Temperature Shutdown	T_{std}	–	150	–	°C
V_{CC} Low Detector Temperature Coefficient, I_{out} = 30 mA, T = −40 to 85°C	ΔV_{CC} H to L/ΔT	–	200	–	ppm/°C
V_{out} Temperature Coefficient	$\Delta V_o/\Delta T$	–	100	–	ppm/°C
Enable Pin High Threshold	V_{eh}	1.6	–	–	V
Enable Pin Low Threshold	V_{el}	–	–	0.4	V
Enable Pin Current, V_e = 1.6 V	I_e	–	5.0	10	µA
−1.3 V					
Output Voltage, I_{out} = 30 mA	V_{out}	1.261	1.3	1.339	V

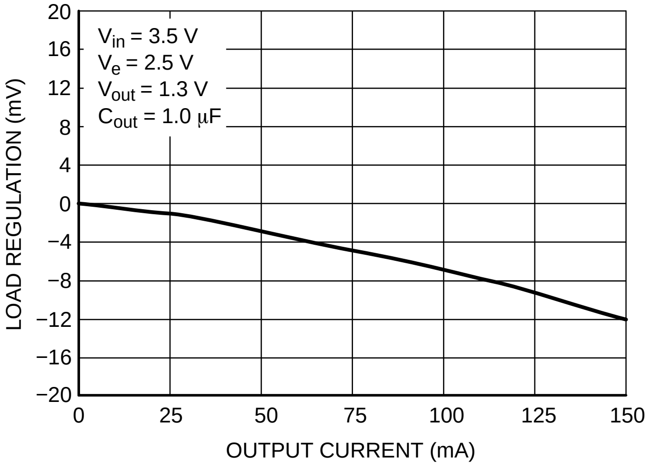


Figure 2. Load Regulation NCP5426

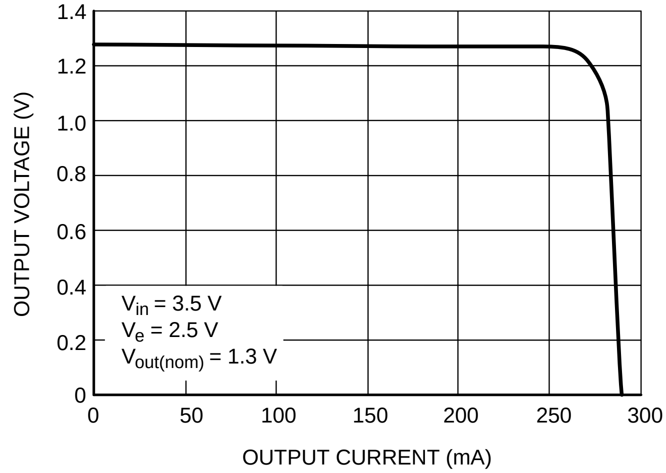


Figure 3. Current Limit NCP5426

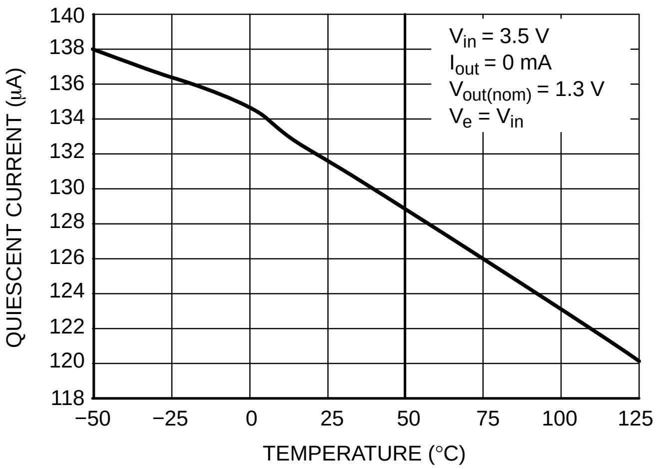


Figure 4. Quiescent Current vs. Temperature

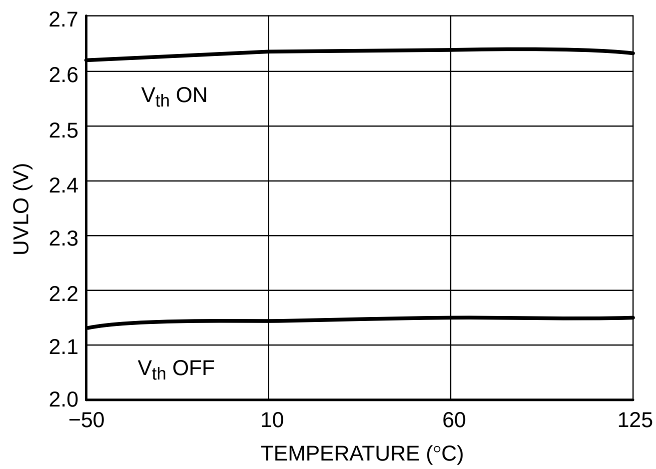


Figure 5. Undervoltage Lockout vs. Temperature

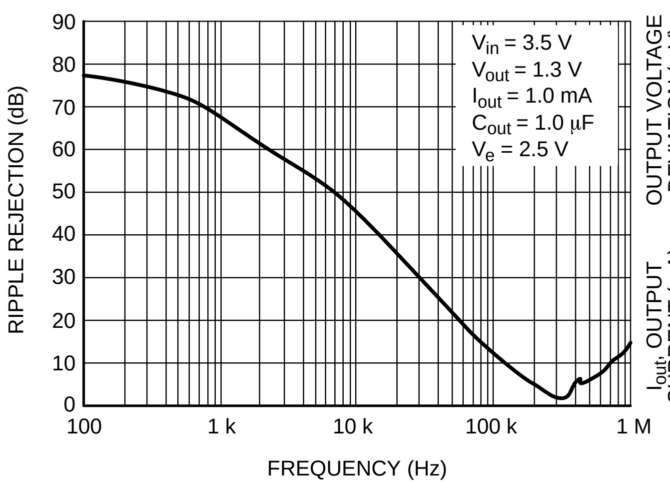


Figure 6. Ripple Rejection vs. Frequency

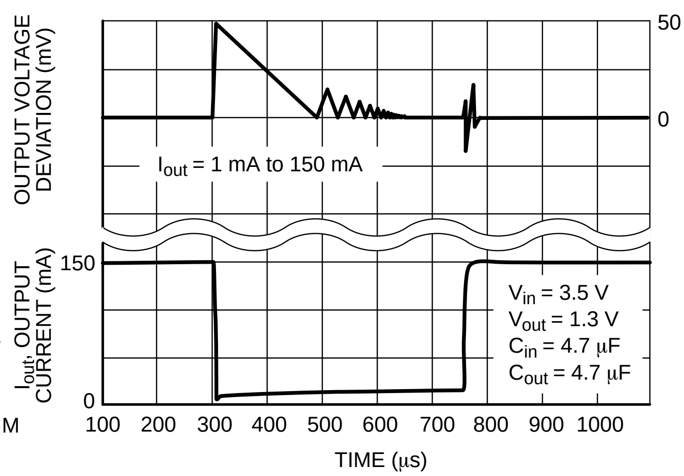


Figure 7. Load Transient Response

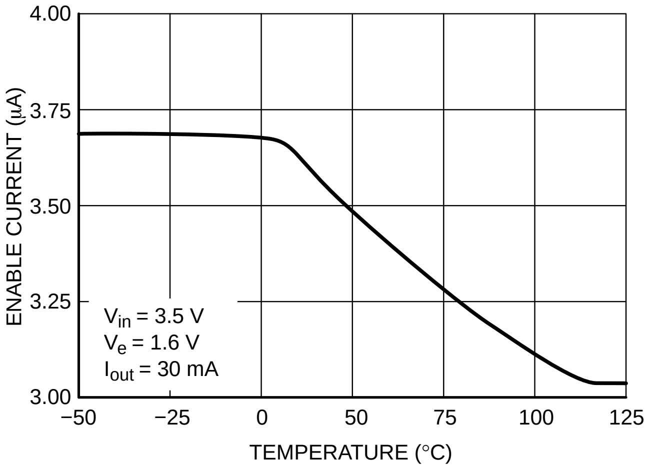


Figure 8. Enable Current vs. Temperature

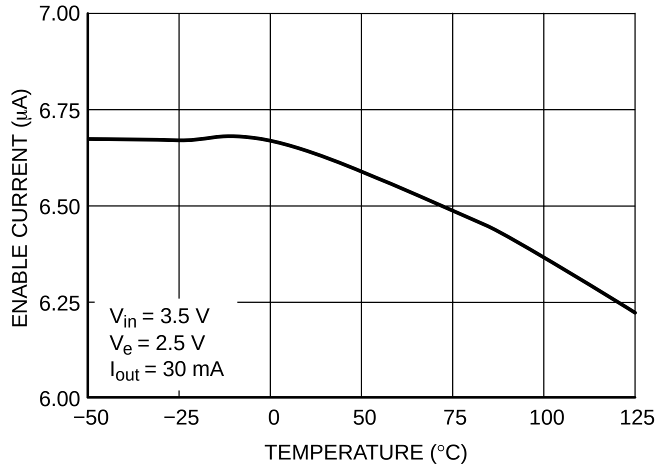


Figure 9. Enable Current vs. Temperature

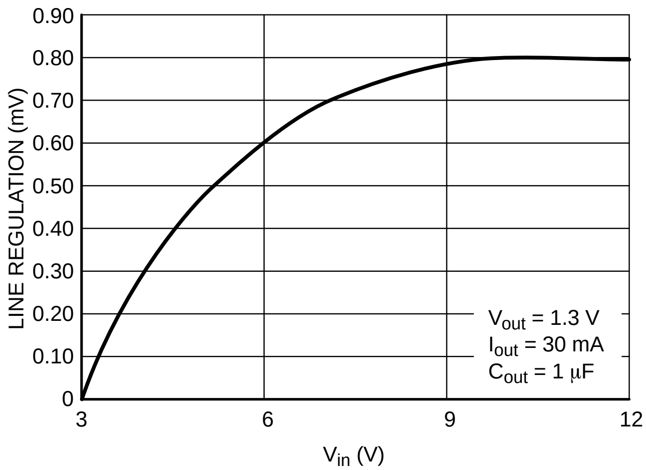
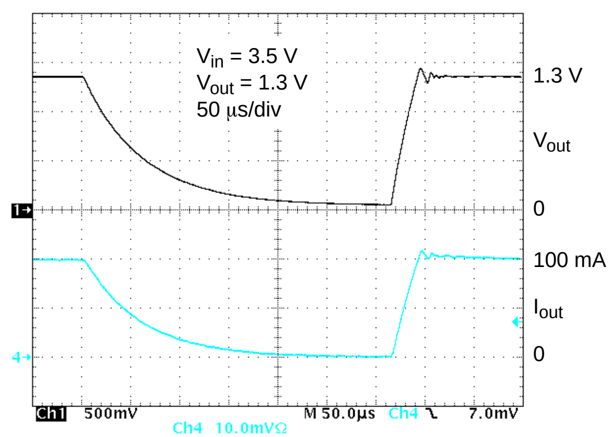
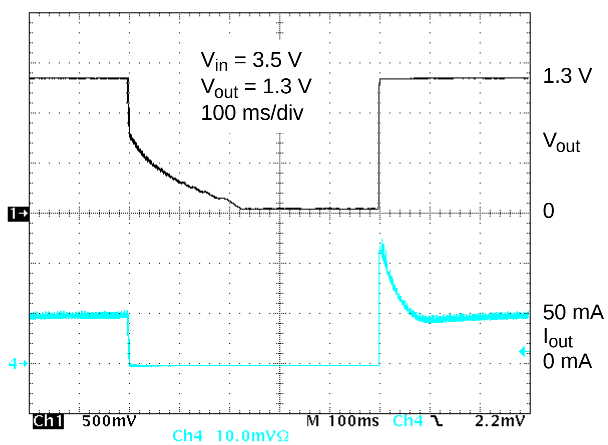


Figure 10. Line Regulation



$C_{in} = C_{out}$ = 4.7 μF

Figure 11. Resistive Transient Response for Switching the Enable Pin, R_{out} − 13 Ohms



$C_{in} = C_{out}$ = 4.7 μF

Figure 12. Transient Response for Switching the Enable Pin, Vibration Motor Load

DEFINITIONS

Load Regulation

The change in output voltage for a change in output load current at a constant temperature and input voltage.

Dropout Voltage

The input/output differential at which the regulator output no longer maintains regulation against further reductions in input voltage. Measured when the output drops 2.0% below its nominal. The junction temperature, load current, and minimum input supply requirements affect the dropout level.

Output Noise Voltage

This is the integrated value of the output noise over a specified frequency range. Input voltage and output load current are kept constant during the measurement. Results are expressed in μVRMS or nV$\sqrt{Hz}$.

Quiescent Current

The current which flows through the ground pin when the regulator operates without a load on its output: internal IC operation, bias, etc. When the LDO becomes loaded, this term is called the Ground current. It is actually the difference between the input current (measured through the LDO input pin) and the output current.

Line Regulation

The change in output voltage for a change in input voltage. The measurement is made under conditions of low dissipation or by using pulse technique such that the average chip temperature is not significantly affected.

Line Transient Response

Typical over and undershoot response when input voltage is excited with a given slope.

Thermal Protection

Internal thermal shutdown circuitry is provided to protect the integrated circuit in the event that the maximum junction temperature is exceeded. When activated at typically 150°C, the regulator turns off. This feature is provided to prevent failures from accidental overheating.

Maximum Package Power Dissipation

The power dissipation level at which the junction temperature reaches its maximum operating value, i.e. 125°C.

APPLICATIONS INFORMATION

The following description will assist the system designer to correctly use the NCP5426 in an application. The NCP5426 is designed specifically for use with inductive loads, typically Vibration Motors. The LDO is capable of using ceramic and tantalum capacitors. Please refer to Figure 13 for a typical system schematic.

Input Decoupling

A capacitor, C1, is necessary on the input for normal operation. A ceramic or tantalum capacitor with a minimum value of 1.0 μF is required. Higher values of capacitance and lower ESR will improve the overall line and load transient response.

Output Decoupling

A capacitor, C2, is required for the NCP5426 to operate normally. A ceramic or tantalum capacitor will suffice. The selection of the output capacitor is dependant upon several factors: output current, power up and down delays, inductive kickback during power up and down. It is recommended the output capacitor be as close to the output pin and ground pin for the best system response.

Enable Pin

The enable pin will turn on or off the regulator. The enable pin is active high. The internal input resistance of the enable pin is high which will keep the current very low when the pin is pulled high. A low threshold voltage permits the NCP5426 to operate directly from microprocessors or controllers.

Thermal

As power across the NCP5426 increases, it might become necessary to provide some thermal relief. The maximum power dissipation supported by the device is dependent upon board design and layout. Mounting pad configuration on the PCB, the board material and the ambient temperature effect the rate of junction temperature rise for the part. This is stating that when the NCP5426 has good thermal conductivity through the PCB, the junction temperature will be relatively low with high power dissipation applications.

The maximum dissipation the package can handle is given by:

$$PD = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

T_J is not recommended to exceed 125°C. The NCP5426 can dissipate up to 400 mW @ 25°C. The power dissipated by the NCP5426 can be calculated from the following equation:

$$P_{tot} = [V_{in} * I_{GND}(I_{out})] + [V_{in} - V_{out}] * I_{out}$$

or

$$V_{inMAX} = \frac{P_{tot} + V_{out} * I_{out}}{I_{GND} + I_{out}}$$

If a 150 mA output current is needed then the ground current is extracted from the data sheet curves: 200 μA @ 150 mA. For an NCP5426SN18T1 (1.8 V), the maximum input voltage will then be 4.4 V, good for a 1 Cell Li−ion battery.

Hints

Please be sure the V_{in} and GND lines are sufficiently wide. When the impedance of these lines is high, there is a chance to pick up noise or cause the regulator to malfunction. Set external components, especially the output capacitor, as close as possible to the circuit, and make leads as short as possible.

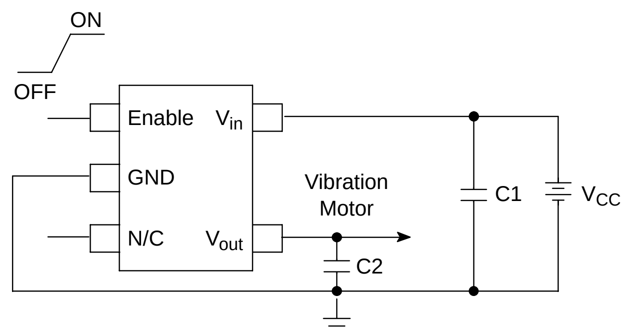


Figure 13. Typical Applications Circuit for Driving a Vibration Motor

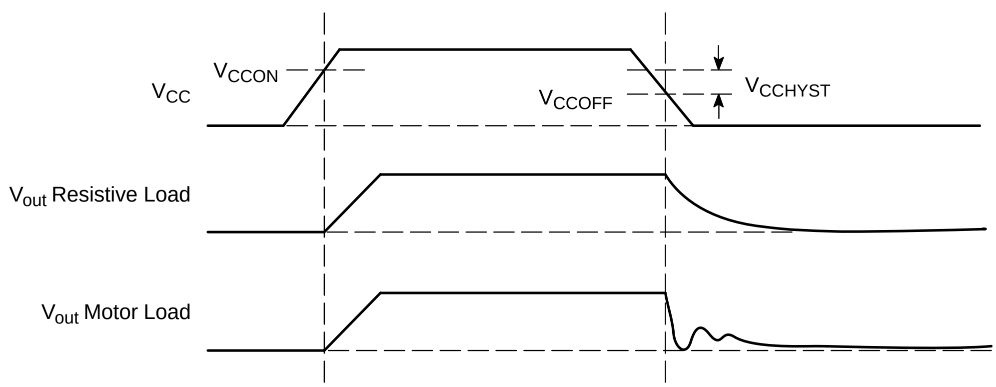


Figure 14. Timing Diagram

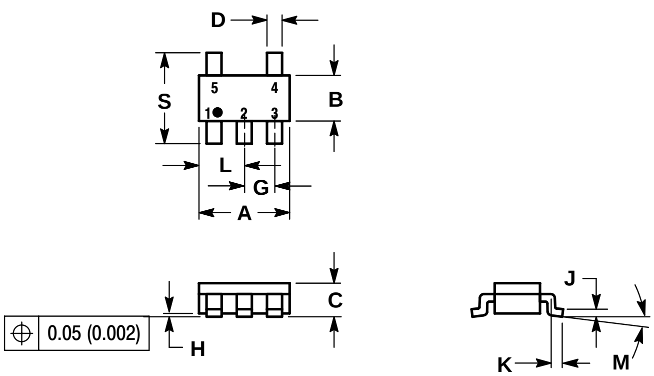
ORDERING INFORMATION

Device	Nominal Output Voltage*	Marking	Package	Shipping†
NCP5426SN13T1	1.3	LDZ	TSOP−5	3000 / Tape & Reel
NCP5426SN13T1G			TSOP−5 (Pb−Free)	
NCP5426SN13T2			TSOP−5	
NCP5426SN13T2G			TSOP−5 (Pb−Free)	

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.
*Contact your ON Semiconductor sales representative for other Output Voltage options.

PACKAGE DIMENSIONS

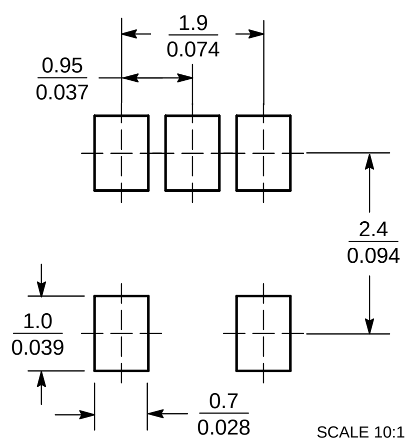
THIN SOT−23−5/TSOP−5/SC59−5
SN SUFFIX
CASE 483−02
ISSUE E



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. A AND B DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	2.90	3.10	0.1142	0.1220
B	1.30	1.70	0.0512	0.0669
C	0.90	1.10	0.0354	0.0433
D	0.25	0.50	0.0098	0.0197
G	0.85	1.05	0.0335	0.0413
H	0.013	0.100	0.0005	0.0040
J	0.10	0.26	0.0040	0.0102
K	0.20	0.60	0.0079	0.0236
L	1.25	1.55	0.0493	0.0610
M	0 °	10 °	0 °	10 °
S	2.50	3.00	0.0985	0.1181

SOLDERING FOOTPRINT*



SCALE 10:1 $\left(\frac{mm}{inches}\right)$

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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082−1312 USA
Phone: 480−829−7710 or 800−344−3860 Toll Free USA/Canada
Fax: 480−829−7709 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

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2−9−1 Kamimeguro, Meguro−ku, Tokyo, Japan 153−0051
Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

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