

LDO Regulator - Very Low Dropout, CMOS, Bias Rail 700 mA

NCP137

The NCP137 is a 700 mA VLDO equipped with NMOS pass transistor and a separate bias supply voltage (V_{BIAS}). The device provides very stable, accurate output voltage with low noise suitable for space constrained, noise sensitive applications. In order to optimize performance for battery operated portable applications, the NCP137 features low I_Q consumption. The WLCSP6 1.2 mm x 0.8 mm Chip Scale package is optimized for use in space constrained applications.

Features

- Input Voltage Range: V_{OUT} to 5.5 V
- Bias Voltage Range: 2.5 V to 5.5 V
- Adjustable and Fixed Voltage Version Available
- Output Voltage Range: 0.4 V to 1.8 V (Fixed) and 0.5 V to 3.0 V (Adjustable)
- $\pm 1\%$ Accuracy over Temperature, 0.5% V_{OUT} @ 25°C
- Ultra-Low Dropout: Typ. 40 mV at 700 mA
- Very Low Bias Input Current of Typ. 35 μ A
- Very Low Bias Input Current in Disable Mode: Typ. 0.5 μ A
- Logic Level Enable Input for ON/OFF Control
- Output Active Discharge Option Available
- Stable with a 4.7 μ F Ceramic Capacitor
- Available in WLCSP6 – 1.2 mm x 0.8 mm, 0.4 mm pitch Package
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

- Battery-powered Equipment
- Smartphones, Tablets
- Cameras, DVRs, STB and Camcorders



ON Semiconductor™

www.onsemi.com



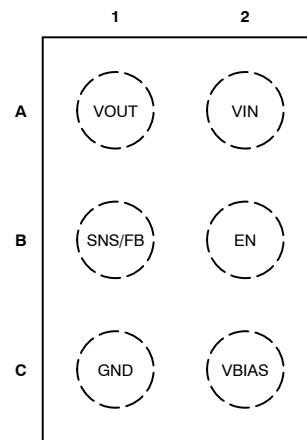
WLCSP6, 1.2x0.8
CASE 567MV

MARKING DIAGRAM



XX = Specific Device Code
M = Month Code

PIN CONNECTIONS



ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 7 of this data sheet.

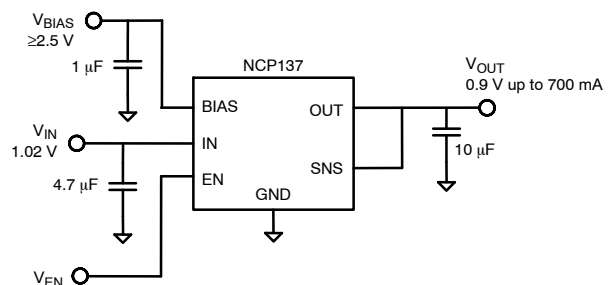
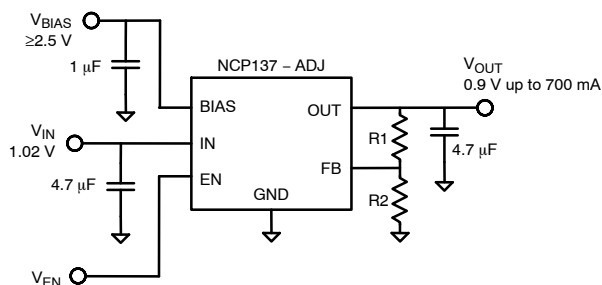
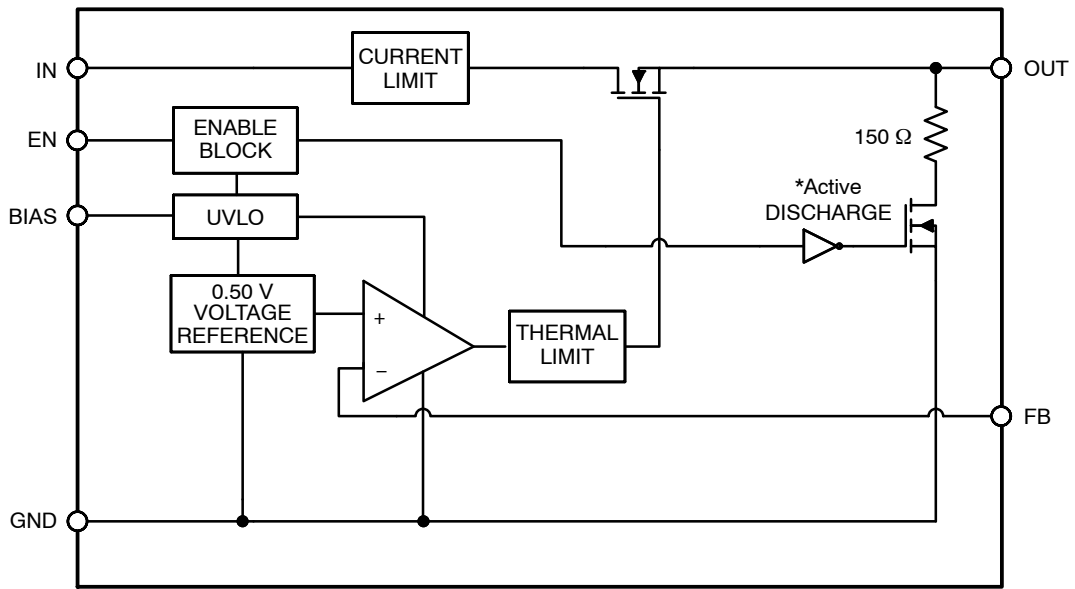


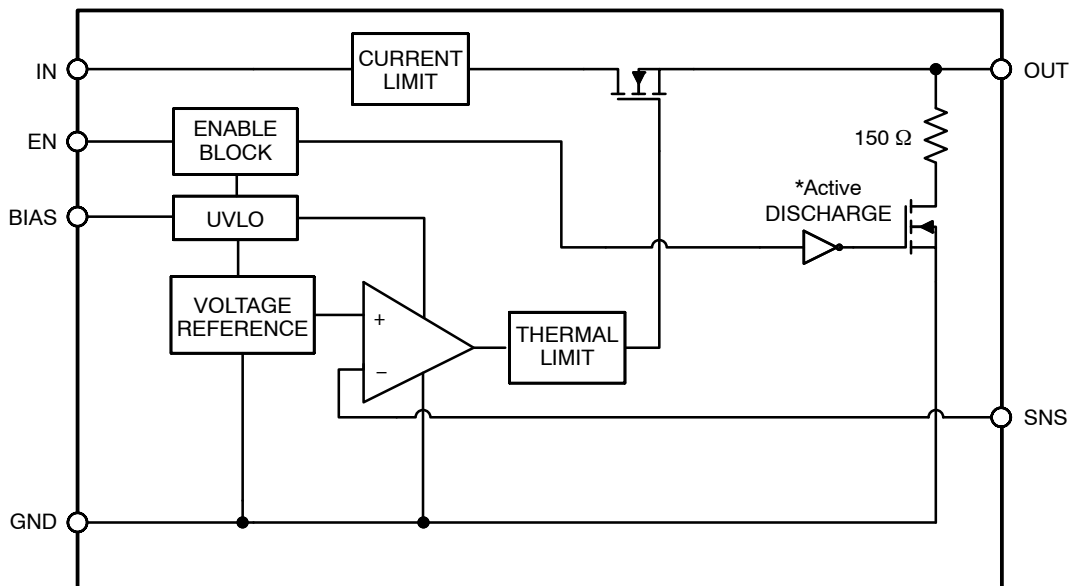
Figure 1. Typical Application Schematics

NCP137



*Active output discharge function is present only in NCP137A option devices.

Figure 2. Simplified Schematic Block Diagram – Adjustable Version



*Active output discharge function is present only in NCP137A option devices.

Figure 3. Simplified Schematic Block Diagram – Fixed Version

NCP137

PIN FUNCTION DESCRIPTION

Pin No. WLCSP6	Pin Name	Description
A1	VOUT	Regulated Output Voltage pin
A2	VIN	Input Voltage Supply pin
B1 (ADJ devices)	FB	Adjustable Regulator Feedback Input. Connect to output voltage resistor divider central node.
B1 (Fix Volt devices)	SNS	Output voltage Sensing Input. Connect to Output on the PCB to output the voltage corresponding to the part version.
B2	EN	Enable pin. Driving this pin high enables the regulator. Driving this pin low puts the regulator into shutdown mode.
C1	GND	Ground pin
C2	VBIAS	Bias voltage supply for internal control circuits. This pin is monitored by internal Under-Voltage Lockout Circuit.

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Voltage (Note 1)	V_{IN}	-0.3 to 6	V
Output Voltage	V_{OUT}	-0.3 to $(V_{IN}+0.3) \leq 6$	V
Chip Enable, Bias, FB and SNS Input	$V_{EN}, V_{BIAS}, V_{FB}, V_{SNS}$	-0.3 to 6	V
Output Short Circuit Duration	t_{SC}	unlimited	s
Maximum Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	-55 to 150	°C
ESD Capability, Human Body Model (Note 2)	ESD_{HBM}	2000	V
ESD Capability, Machine Model (Note 2)	ESD_{MM}	200	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. This device series incorporates ESD protection (except OUT pin) and is tested by the following methods:
 ESD Human Body Model tested per EIA/JESD22-A114
 ESD Machine Model tested per EIA/JESD22-A115
 Latchup Current Maximum Rating tested per JEDEC standard: JESD78.

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Characteristics, WLCSP6 1.2 mm x 0.8 mm Thermal Resistance, Junction-to-Air (Note 3)	$R_{\theta JA}$	69	°C/W

3. This junction-to-ambient thermal resistance under natural convection was derived by thermal simulations based on the JEDEC JESD51 series standards methodology. Only a single device mounted at the center of a high_K (2s2p) 80 mm x 80 mm multilayer board with 1-ounce internal planes and 2-ounce copper on top and bottom. Top copper layer has a dedicated 1.6 sqmm copper area.

NCP137

ELECTRICAL CHARACTERISTICS $-40^{\circ}\text{C} \leq T_J \leq 85^{\circ}\text{C}$; $V_{\text{BIAS}} = 2.7\text{ V}$ or $(V_{\text{OUT}} + 1.6\text{ V})$, whichever is greater, $V_{\text{IN}} = V_{\text{OUT(NOM)}} + 0.3\text{ V}$, $I_{\text{OUT}} = 1\text{ mA}$, $V_{\text{EN}} = 1\text{ V}$, $C_{\text{IN}} = 4.7\text{ }\mu\text{F}$, $C_{\text{OUT}} = 10\text{ }\mu\text{F}$, $C_{\text{BIAS}} = 1\text{ }\mu\text{F}$, unless otherwise noted. Typical values are at $T_J = +25^{\circ}\text{C}$. Min/Max values are for $-40^{\circ}\text{C} \leq T_J \leq 85^{\circ}\text{C}$ unless otherwise noted. (Notes 4, 5)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage Range		V_{IN}	$V_{\text{OUT}} + V_{\text{DO}}$		5.5	V
Operating Bias Voltage Range		V_{BIAS}	$(V_{\text{OUT}} + 1.50) \geq 2.5$		5.5	V
Undervoltage Lock-out	V_{BIAS} Rising Hysteresis	UVLO		1.6 0.2		V
Reference Voltage (Adj devices)	$T_J = +25^{\circ}\text{C}$	V_{REF}		0.500		V
Output Voltage Accuracy		V_{OUT}		± 0.5		%
Output Voltage Accuracy	$-40^{\circ}\text{C} \leq T_J \leq 85^{\circ}\text{C}$, $V_{\text{OUT(NOM)}} + 0.3\text{ V} \leq V_{\text{IN}} \leq V_{\text{OUT(NOM)}} + 1.0\text{ V}$, 2.7 V or $(V_{\text{OUT(NOM)}} + 1.6\text{ V})$, whichever is greater < $V_{\text{BIAS}} < 5.5\text{ V}$, $1\text{ mA} < I_{\text{OUT}} < 700\text{ mA}$	V_{OUT}	-1.0		+1.0	%
V_{IN} Line Regulation	$V_{\text{OUT(NOM)}} + 0.3\text{ V} \leq V_{\text{IN}} \leq 5.0\text{ V}$	LineReg		0.01		%/V
V_{BIAS} Line Regulation	2.7 V or $(V_{\text{OUT(NOM)}} + 1.6\text{ V})$, whichever is greater < $V_{\text{BIAS}} < 5.5\text{ V}$	LineReg		0.01		%/V
Load Regulation	$I_{\text{OUT}} = 1\text{ mA}$ to 700 mA	LoadReg		1.5		mV
V_{IN} Dropout Voltage	$I_{\text{OUT}} = 700\text{ mA}$ (Notes 6, 7)	V_{DO}		40	60	mV
V_{BIAS} Dropout Voltage	$I_{\text{OUT}} = 700\text{ mA}$, $V_{\text{IN}} = V_{\text{BIAS}}$ (Notes 6, 8, 9)	V_{DO}		1.1	1.5	V
Output Current Limit	$V_{\text{OUT}} = 90\% V_{\text{OUT(NOM)}}$	I_{CL}	800	1200	1500	mA
FB/SNS Pin Operating Current		I_{FB} , I_{SNS}		0.1	0.5	μA
Bias Pin Quiescent Current	$V_{\text{BIAS}} = 2.7\text{ V}$, $I_{\text{OUT}} = 0\text{ mA}$	I_{BIASQ}		35	50	μA
Bias Pin Disable Current	$V_{\text{EN}} \leq 0.4\text{ V}$	$I_{\text{BIAS(DIS)}}$		0.5	1	μA
Vinput Pin Disable Current	$V_{\text{EN}} \leq 0.4\text{ V}$	$I_{\text{VIN(DIS)}}$		0.5	1	μA
EN Pin Threshold Voltage	EN Input Voltage "H"	$V_{\text{EN(H)}}$	0.9			V
	EN Input Voltage "L"	$V_{\text{EN(L)}}$			0.4	
EN Pull Down Current	$V_{\text{EN}} = 5.5\text{ V}$	I_{EN}		0.3	1	μA
Turn-On Time	From assertion of V_{EN} to $V_{\text{OUT}} = 98\% V_{\text{OUT(NOM)}}$, $V_{\text{OUT(NOM)}} = 1.0\text{ V}$, $C_{\text{OUT}} = 4.7\text{ }\mu\text{F}$	t_{ON}		150		μs
Power Supply Rejection Ratio (Adj devices)	V_{IN} to V_{OUT} , $f = 1\text{ kHz}$, $I_{\text{OUT}} = 10\text{ mA}$, $V_{\text{IN}} \geq V_{\text{OUT}} + 0.5\text{ V}$, $V_{\text{OUT(NOM)}} = 1.0\text{ V}$, $C_{\text{OUT}} = 4.7\text{ }\mu\text{F}$	PSRR(V_{IN})		75		dB
	V_{BIAS} to V_{OUT} , $f = 1\text{ kHz}$, $I_{\text{OUT}} = 10\text{ mA}$, $V_{\text{IN}} \geq V_{\text{OUT}} + 0.5\text{ V}$, $V_{\text{OUT(NOM)}} = 1.0\text{ V}$, $V_{\text{BIAS}} = 3.0\text{ V}$, $C_{\text{OUT}} = 4.7\text{ }\mu\text{F}$	PSRR(V_{BIAS})		85		
Output Noise Voltage (Adj devices)	$V_{\text{IN}} = V_{\text{OUT}} + 0.5\text{ V}$, $f = 10\text{ Hz}$ to 100 kHz , $V_{\text{OUT(NOM)}} = 1.0\text{ V}$, $C_{\text{OUT}} = 4.7\text{ }\mu\text{F}$	V_{N}		$35 \times V_{\text{OUT}}/V_{\text{REF}}$		μV_{RMS}
Thermal Shutdown Threshold	Temperature increasing			160		$^{\circ}\text{C}$
	Temperature decreasing			140		

4. Performance guaranteed over the indicated operating temperature range by design and/or characterization. Production tested at $T_A = 25^{\circ}\text{C}$. Low duty cycle pulse techniques are used during the testing to maintain the junction temperature as close to ambient as possible.
5. Adjustable devices tested at $V_{\text{OUT}} = V_{\text{REF}}$ unless otherwise noted; external resistor tolerance is not taken into account.
6. Dropout voltage is characterized when V_{OUT} falls 3% below $V_{\text{OUT(NOM)}}$.
7. For adjustable devices, V_{IN} dropout voltage tested at $V_{\text{OUT(NOM)}} = 2 \times V_{\text{REF}}$.
8. For adjustable devices, V_{BIAS} dropout voltage tested at $V_{\text{OUT(NOM)}} = 3 \times V_{\text{REF}}$ due to a minimum Bias operating voltage of 2.5 V.
9. For fixed output voltages below 1.5 V, V_{BIAS} dropout does not apply due to a minimum Bias operating voltage of 2.5 V.

NCP137

ELECTRICAL CHARACTERISTICS $-40^{\circ}\text{C} \leq T_J \leq 85^{\circ}\text{C}$; $V_{\text{BIAS}} = 2.7\text{ V}$ or $(V_{\text{OUT}} + 1.6\text{ V})$, whichever is greater, $V_{\text{IN}} = V_{\text{OUT(NOM)}} + 0.3\text{ V}$, $I_{\text{OUT}} = 1\text{ mA}$, $V_{\text{EN}} = 1\text{ V}$, $C_{\text{IN}} = 4.7\text{ }\mu\text{F}$, $C_{\text{OUT}} = 10\text{ }\mu\text{F}$, $C_{\text{BIAS}} = 1\text{ }\mu\text{F}$, unless otherwise noted. Typical values are at $T_J = +25^{\circ}\text{C}$. Min/Max values are for $-40^{\circ}\text{C} \leq T_J \leq 85^{\circ}\text{C}$ unless otherwise noted. (Notes 4, 5)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Output Discharge Pull-Down	$V_{\text{EN}} \leq 0.4\text{ V}$, $V_{\text{OUT}} = 0.5\text{ V}$, NCP137A options only	R_{DISCH}		150		Ω
Power Supply Rejection Ratio (Fixed Voltage devices)	V_{IN} to V_{OUT} , $f = 1\text{ kHz}$, $I_{\text{OUT}} = 10\text{ mA}$, $V_{\text{IN}} \geq V_{\text{OUT}} + 0.5\text{ V}$, $V_{\text{OUT(NOM)}} = 1.05\text{ V}$, $C_{\text{OUT}} = 10\text{ }\mu\text{F}$	$\text{PSRR}(V_{\text{IN}})$		75		dB
	V_{BIAS} to V_{OUT} , $f = 1\text{ kHz}$, $I_{\text{OUT}} = 10\text{ mA}$, $V_{\text{IN}} \geq V_{\text{OUT}} + 0.5\text{ V}$, $V_{\text{OUT(NOM)}} = 1.05\text{ V}$, $V_{\text{BIAS}} = 3.0\text{ V}$, $C_{\text{OUT}} = 10\text{ }\mu\text{F}$	$\text{PSRR}(V_{\text{BIAS}})$		85		dB
Output Noise Voltage (Fixed Voltage devices)	$V_{\text{IN}} = V_{\text{OUT}} + 0.5\text{ V}$, $f = 10\text{ Hz to } 100\text{ kHz}$, $V_{\text{OUT(NOM)}} = 1.05\text{ V}$, $C_{\text{OUT}} = 10\text{ }\mu\text{F}$	V_{N}		40		μVRMS

4. Performance guaranteed over the indicated operating temperature range by design and/or characterization. Production tested at $T_A = 25^{\circ}\text{C}$. Low duty cycle pulse techniques are used during the testing to maintain the junction temperature as close to ambient as possible.
5. Adjustable devices tested at $V_{\text{OUT}} = V_{\text{REF}}$ unless otherwise noted; external resistor tolerance is not taken into account.
6. Dropout voltage is characterized when V_{OUT} falls 3% below $V_{\text{OUT(NOM)}}$.
7. For adjustable devices, V_{IN} dropout voltage tested at $V_{\text{OUT(NOM)}} = 2 \times V_{\text{REF}}$.
8. For adjustable devices, V_{BIAS} dropout voltage tested at $V_{\text{OUT(NOM)}} = 3 \times V_{\text{REF}}$ due to a minimum Bias operating voltage of 2.5 V.
9. For fixed output voltages below 1.5 V, V_{BIAS} dropout does not apply due to a minimum Bias operating voltage of 2.5 V.

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.

NCP137

Enable Operation

The enable pin will turn the regulator on or off. The threshold limits are covered in the electrical characteristics table in this data sheet. If the enable function is not to be used then the pin should be connected to V_{IN} or V_{BIAS} .

Current Limitation

The internal Current Limitation circuitry allows the device to supply the full nominal current and surges but protects the device against Current Overload or Short.

Thermal Protection

Internal thermal shutdown (TSD) circuitry is provided to protect the integrated circuit in the event that the maximum junction temperature is exceeded. When TSD activated, the regulator output turns off. When cooling down under the low temperature threshold, device output is activated again. This TSD feature is provided to prevent failures from accidental overheating.

Activation of the thermal protection circuit indicates excessive power dissipation or inadequate heatsinking. For reliable operation, junction temperature should be limited to +105°C maximum.

ORDERING INFORMATION

Device	Nominal Output Voltage	Marking	Option	Package	Shipping†
NCP137AFCTADJT2G	ADJ	A7	Output Active Discharge	WLCSP6 (Pb-Free)	5000 / Tape & Reel
NCP137AFCTCADJT2G	ADJ	A7	Output Active Discharge, Back Side Coating		
NCP137BFCTADJT2G	ADJ	D7	Non-Active Discharge		
NCP137AFCT045T2G	0.45 V	AT	Output Active Discharge		
NCP137AFCT105T2G	1.05 V	AA	Output Active Discharge		
NCP137AFCT110T2G	1.10 V	AH	Output Active Discharge		
NCP137AFCTC110T2G	1.10 V	AH	Output Active Discharge, Back Side Coating		
NCP137AFCT120T2G	1.20 V	AD	Output Active Discharge		

†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.

To order other package and voltage variants, please contact your ON Semiconductor sales representative

MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

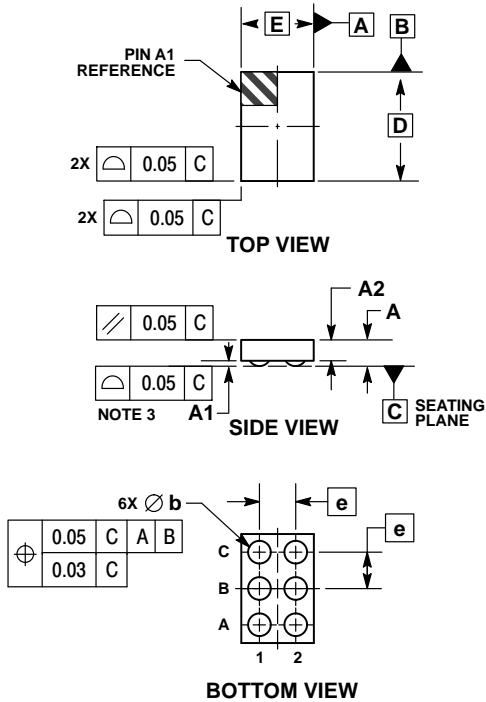
ON Semiconductor®




SCALE 4:1

WLCSP6, 1.20x0.80
CASE 567MV
ISSUE B

DATE 05 JUN 2018



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 2. CONTROLLING DIMENSION: MILLIMETERS.
 3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.

DIM	MILLIMETERS	
	MIN	MAX
A	—	0.33
A1	0.04	0.08
A2	0.23	REF
b	0.24	0.30
D	1.20	BSC
E	0.80	BSC
e	0.40	BSC

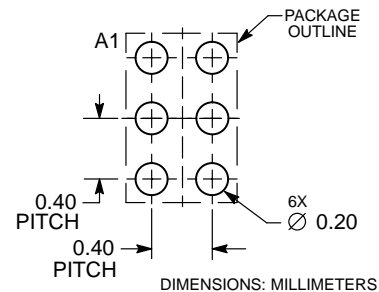
GENERIC MARKING DIAGRAM*



XX = Specific Device Code
M = Month Code


*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.

RECOMMENDED SOLDERING FOOTPRINT*



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

DOCUMENT NUMBER:	98AON06670G	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.
DESCRIPTION:	WLCSP6, 1.20x0.80	PAGE 1 OF 1

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. ON Semiconductor 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.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

TECHNICAL SUPPORT

North American Technical Support:

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative