



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



NCS210, NCV210, NCS211

Current-Shunt Monitor, Voltage Output, Bi-Directional Zero-Drift

The NCS210, NCV210, and NCS211 are voltage output current shunt monitors that can measure voltage across shunts at common-mode voltages from -0.3 V to 26 V , independent of supply voltage. Two fixed gains are available: 200 V/V , or 500 V/V . The low offset of the zero-drift architecture enables current sensing with maximum drops across the shunt as low as 10 mV full-scale.

The devices can operate from a single $+2.7\text{ V}$ to $+26\text{ V}$ power supply, drawing a maximum of $100\text{ }\mu\text{A}$ of supply current. All versions are specified over the extended operating temperature range (-40°C to $+125^{\circ}\text{C}$). Available in SC-70 and thin UQFN space-saving packages.

Features

- Wide Common-Mode Input Range -0.3 V to 26 V
- Supply Voltage Range from 2.7 V to 26 V
- Low Offset Voltage $\pm 60\text{ }\mu\text{V}$ Max
- Low Offset Drift ($0.1\text{ }\mu\text{V}/^{\circ}\text{C}$)
- Low Gain Error (Max 1%)
- Rail-to-Rail Input and Output Capability
- Low Current Consumption (typ $65\text{ }\mu\text{A}$, $100\text{ }\mu\text{A}$ max)
- NCV Prefix for Automotive and Other Applications Requiring Unique Site Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications

- Current Sensing (High-Side/Low-Side)
- Automotive
- Telecom
- Sensors

This document contains information on some products that are still under development. ON Semiconductor reserves the right to change or discontinue these products without notice.



ON Semiconductor®

www.onsemi.com

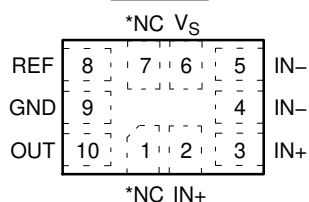
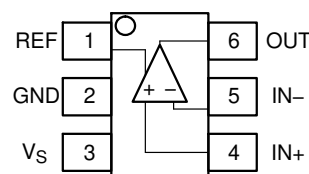


SC70-6
SQ SUFFIX
CASE 419B



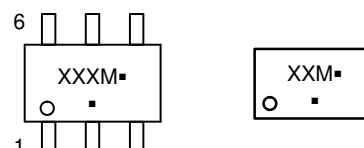
UQFN10
MU SUFFIX
CASE 488AT

PIN CONNECTIONS



*NC denotes no internal connection. These pins can be left floating or connected to any voltage between V_S and GND.

MARKING DIAGRAMS



XXX = Specific Device Code (See page 4)

M = Date Code

■ = Pb-Free Package

(Note: Microdot may be in either location)

Product	Gain	R3-R4	R1-R2
NCS210	200	5 k Ω	1 M Ω
NCV210	200	5 k Ω	1 M Ω
NCS211	500	2 k Ω	1 M Ω

$$V_{OUT} = (I_{LOAD} \times R_{SHUNT})GAIN + V_{REF}$$

ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 4 of this data sheet.

NCS210, NCV210, NCS211

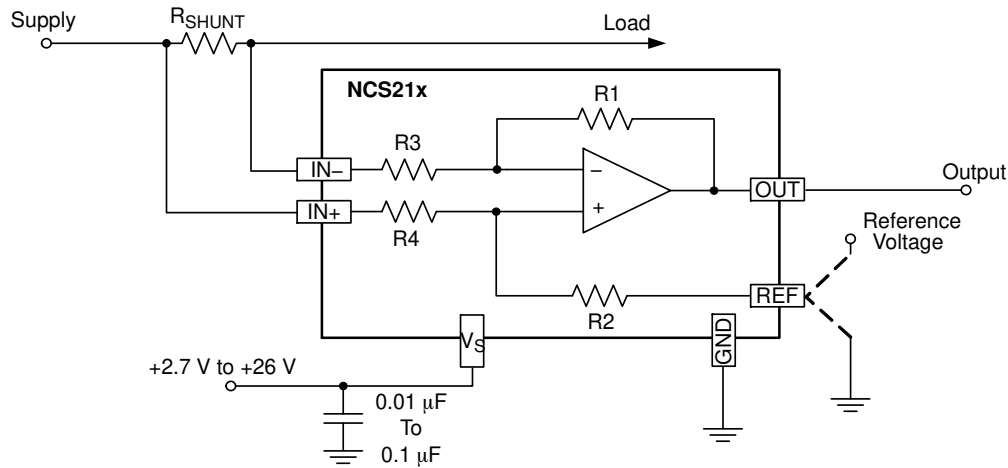


Figure 1. Application Schematic

Table 1. MAXIMUM RATINGS

Rating		Symbol	Value	Unit
Supply Voltage (Note 1)		V_S	+26 +28	V
Analog Inputs	Differential ($V_{IN+} - V_{IN-}$)	V_{IN+}, V_{IN-}	-26 to +26	V
	Common-Mode (Note 2)	V_{IN+}, V_{IN-}	GND-0.3 to +26 GND-0.3 to +28	V
REF Input		V_{REF}	GND-0.3 to (V_S) +0.3	V
Output (Note 2)		V_{OUT}	GND-0.3 to (V_S) +0.3	V
Input Current into Any Pin (Note 2)			5	mA
Maximum Junction Temperature		$T_{J(max)}$	+150	°C
Storage Temperature Range		TSTG	-65 to +150	°C
ESD Capability, Human Body Model (Note 3)		HBM	±3000	V
ESD Capability, Machine Model (Note 3)		MM	±100	V
Charged Device Model (Note 3)		CDM	±1000	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, RECOMMENDED OPERATING RANGES and/or APPLICATION INFORMATION for safe operating parameters.
2. Input voltage at any pin may exceed the voltage shown if current at that pin is limited to 5 mA.
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)
 ESD Charged Device Model tested per AEC-Q100-011.
 Latchup Current Maximum Rating: 50 mA per JEDEC standard: JESD78

Table 2. THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Characteristics (Note 4)	R _{θJA}		°C/W
Thermal Resistance, Junction-to-Air (Note 5)		250	
SC-70 UQFN10		300	

4. Refer to ELECTRICAL CHARACTERISTICS, RECOMMENDED OPERATING RANGES and/or APPLICATION INFORMATION for safe operating parameters.
5. Values based on copper area of 645 mm² (or 1 in²) of 1 oz copper thickness and FR4 PCB substrate.

Table 3. RECOMMENDED OPERATING RANGES

Rating	Symbol	Min	Max	Unit
Supply Voltage	V_S	2.7	26	V
Ambient Temperature	T_A	-40	125	°C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

NCS210, NCV210, NCS211

Table 4. ELECTRICAL CHARACTERISTICS

Boldface limits apply over the specified temperature range, $T_A = -40^{\circ}\text{C}$ to 125°C , guaranteed by characterization and/or design.

At $T_A = +25^{\circ}\text{C}$, $V_{\text{SENSE}} = V_{\text{IN}+} - V_{\text{IN}-}$.

NCS210, NCV210: $V_S = +5\text{ V}$, $V_{\text{IN}+} = 12\text{ V}$, and $V_{\text{REF}} = V_S/2$, unless otherwise noted.

NCS211: $V_S = +12\text{ V}$, $V_{\text{IN}+} = 12\text{ V}$, and $V_{\text{REF}} = V_S/2$, unless otherwise noted.

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
-----------	-----------------	--------	-----	-----	-----	------

GAIN

NCS210, NCV210 NCS211		G		200 500		V/V
Gain Error	NCS210, NCS211	$V_{\text{SENSE}} = -5\text{ mV to } 5\text{ mV}$	G_e	± 0.2	± 1	%
	NCV210	$V_{\text{SENSE}} = -5\text{ mV to } 5\text{ mV}$	G_e	± 0.2	± 1.5	%
Gain Error vs. Temp.	NCS210, NCS211	$T_A = -10^{\circ}\text{C to } 125^{\circ}\text{C}$		7	14	ppm/ $^{\circ}\text{C}$
	NCV210	$T_A = -40^{\circ}\text{C to } 125^{\circ}\text{C}$		7	70	ppm/ $^{\circ}\text{C}$
Nonlinearity Error		$V_{\text{SENSE}} = -5\text{ mV to } 5\text{ mV}$		± 0.01		%
Maximum Capacitive Load		No sustained oscillation		1		nF

VOLTAGE OFFSET

Offset Voltage (RTI Note 6)	NCS210, NCS211	$V_{\text{SENSE}} = 0\text{ mV}$	V_{OS}		± 0.55	± 60	μV
	NCV210				± 0.55	± 90	μV
Offset Drift	NCS210, NCS211		$\delta V/\delta T$		0.1	0.6	$\mu\text{V}/^{\circ}\text{C}$
	NCV210		$\delta V/\delta T$		0.1	1.0	$\mu\text{V}/^{\circ}\text{C}$

INPUT

Input Bias Current		$V_{\text{SENSE}} = 0\text{ mV}$	I_{IB}			60	μA
Common-Mode Input Voltage Range			V_{CM}	-0.3		26	V
Common-Mode Rejection Ratio	NCS210, NCS211	$V_S = 5\text{ V}$, $V_{\text{IN}+} = 2\text{ V to } +26\text{ V}$, $V_{\text{SENSE}} = 0\text{ mV}$	CMRR	103	115		dB
		$V_S = 3.3\text{ V}$, $V_{\text{IN}+} = 3\text{ V to } +26\text{ V}$, $V_{\text{SENSE}} = 0\text{ mV}$		103	115		dB
		$V_S = 3.3\text{ V}$, $V_{\text{IN}+} = 0\text{ V to } +26\text{ V}$, $V_{\text{SENSE}} = 0\text{ mV}$ ($T_A = -10^{\circ}\text{C to } 85^{\circ}\text{C}$)		103	120		dB
Common-Mode Rejection Ratio	NCV210	$V_S = 5\text{ V}$, $V_{\text{IN}+} = 2\text{ V to } +26\text{ V}$, $V_{\text{SENSE}} = 0\text{ mV}$	CMRR	100	115		dB
		$V_S = 3.3\text{ V}$, $V_{\text{IN}+} = 3\text{ V to } +26\text{ V}$, $V_{\text{SENSE}} = 0\text{ mV}$		100	115		dB

OUTPUT

Output Voltage Low	Referenced from GND $R_L = 10\text{ k}\Omega$ to Ground	V_{OL}		5	50	mV
Output Voltage High	Referenced from V_S $R_L = 10\text{ k}\Omega$ to Ground	V_{OH}		0.05	0.2	V

DYNAMIC PERFORMANCE

Bandwidth ($f_{-3\text{dB}}$)	$C_{\text{LOAD}} = 10\text{ pF}$, NCS210, NCV210 $C_{\text{LOAD}} = 10\text{ pF}$, NCS211	BW		40 25		kHz
Slew Rate		SR		0.4		V/ μs

NOISE

Spectral Density, 1 kHz (RTI Note 6)		e_n		35		nV/ $\sqrt{\text{Hz}}$
--------------------------------------	--	-------	--	----	--	------------------------

POWER SUPPLY

Operating Voltage Range	$V_{\text{SENSE}} = 0\text{ mV}$	V_S	2.7		26	V
Quiescent Current	$V_{\text{SENSE}} = 0\text{ mV}$	I_{DD}		65	100	μA
Quiescent Current over Temperature	$V_{\text{SENSE}} = 0\text{ mV}$				115	μA
Power Supply Rejection Ratio	$V_S = +2.7\text{ V to } +26\text{ V}$, $V_{\text{IN}+} = 18\text{ V}$, $V_{\text{SENSE}} = 0\text{ mV}$	PSRR		± 0.1	± 10	$\mu\text{V/V}$

6. RTI = referenced-to-input.

NCS210, NCV210, NCS211

ORDERING INFORMATION

Device	Gain	Marking	Package	Shipping †
NCS210SQT2G	200	AAP	SC70-6 (Pb-Free)	3000 / Tape and Reel
NCS211SQT2G	500	AAM		
NCV210SQT2G *	200	VAP		
NCS210MUTAG (In Development)**	200	TBD	UQFN10 (Pb-Free)	3000 / Tape and Reel

†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

*NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

** Contact local sales office for availability.

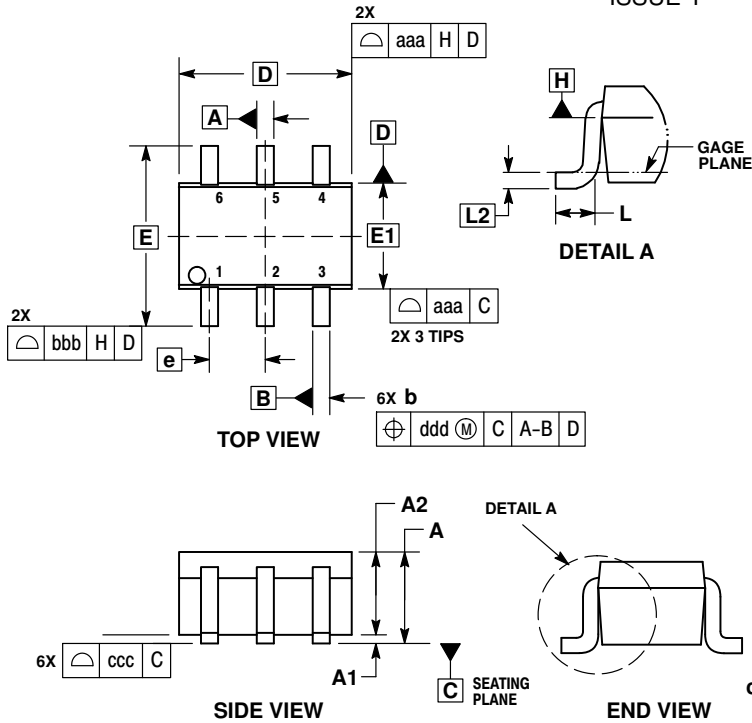
NCS210, NCV210, NCS211

PACKAGE DIMENSIONS

SC-88/SC70-6/SOT-363

CASE 419B-02

ISSUE Y

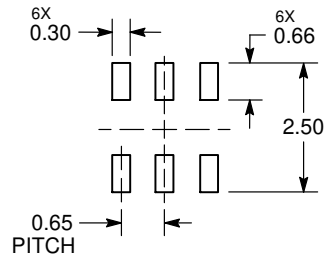


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
5. DATUMS A AND B ARE DETERMINED AT DATUM H.
6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	—	—	1.10	—	—	0.043
A1	0.00	—	0.10	0.000	—	0.004
A2	0.70	0.90	1.00	0.027	0.035	0.039
b	0.15	0.20	0.25	0.006	0.008	0.010
C	0.08	0.15	0.22	0.003	0.006	0.009
D	1.80	2.00	2.20	0.070	0.078	0.086
E	2.00	2.10	2.20	0.078	0.082	0.086
E1	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65 BSC			0.026 BSC		
L	0.26	0.36	0.46	0.010	0.014	0.018
L2	0.15 BSC			0.006 BSC		
aaa	0.15			0.006		
bbb	0.30			0.012		
ccc	0.10			0.004		
ddd	0.10			0.004		

RECOMMENDED SOLDERING FOOTPRINT*



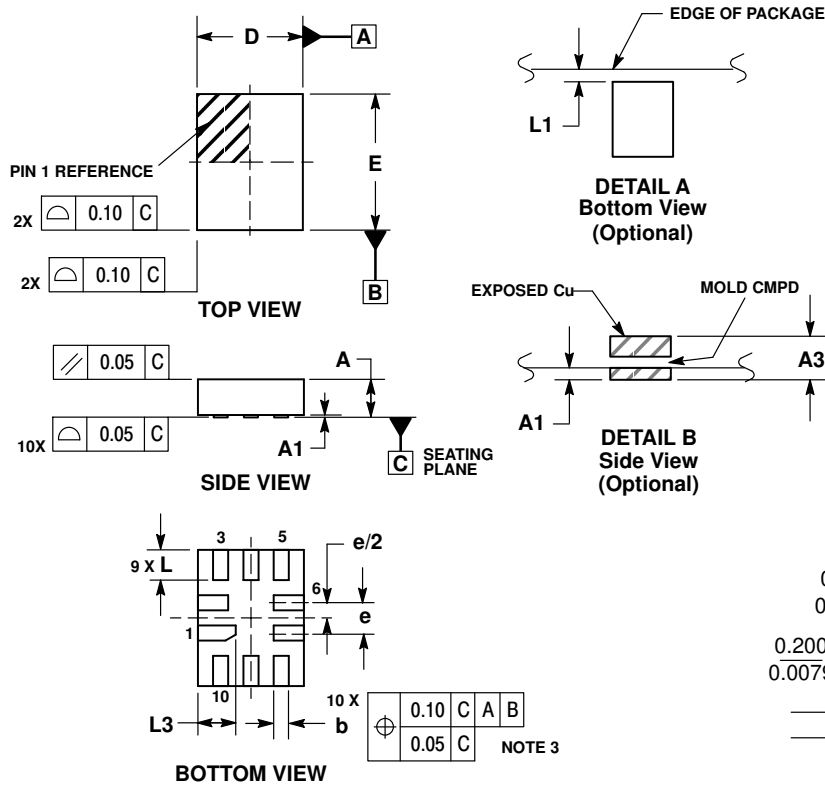
DIMENSIONS: MILLIMETERS

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

NCS210, NCV210, NCS211

PACKAGE DIMENSIONS

UQFN10 1.4x1.8, 0.4P CASE 488AT ISSUE A

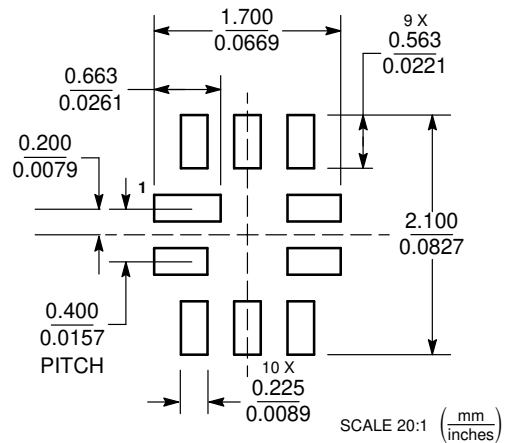


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

MILLIMETERS		
DIM	MIN	MAX
A	0.45	0.60
A1	0.00	0.05
A3	0.127 REF	
b	0.15	0.25
D	1.40 BSC	
E	1.80 BSC	
e	0.40 BSC	
L	0.30	0.50
L1	0.00	0.15
L3	0.40	0.60

MOUNTING FOOTPRINT



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 owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marketing.pdf. 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. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor 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 ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor 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 ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor 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:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative