NGTB50N60S1WG

IGBT - Inverter Welding

This Insulated Gate Bipolar Transistor (IGBT) features a robust and cost effective Trench construction, and provides superior performance in demanding switching applications, offering both low on state voltage and minimal switching loss. The IGBT is well suited for welding applications. Incorporated into the device is a soft and fast co−packaged free wheeling diode with a low forward voltage.

Features

- T_{Jmax} = 175°C
- Soft Fast Reverse Recovery Diode
- Optimized for High Speed Switching
- 5 μs Short−Circuit Capability
- This is a Pb−Free Device

Typical Applications

- Welding

ABSOLUTE MAXIMUM RATINGS

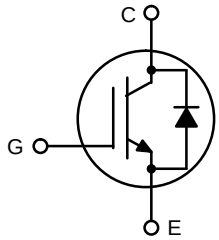
Rating	Symbol	Value	Unit
Collector−emitter voltage	V_{CES}	600	V
Collector current @ Tc = 25°C @ Tc = 100°C	I_C	 100 50	A
Diode Forward Current @ Tc = 25°C @ Tc = 100°C	I_F	 100 50	A
Diode Pulsed Current T_{PULSE} Limited by T_J Max	I_{FM}	200	A
Pulsed collector current, T_{pulse} limited by T_{Jmax}	I_{CM}	200	A
Short−circuit withstand time V_{GE} = 15 V, V_{CE} = 400 V, $T_J \leq$ +150°C	t_{SC}	5	μs
Gate−emitter voltage	V_{GE}	±20	V
Transient gate−emitter voltage (T_{PULSE} = 5 μs, D < 0.10)		±30	V
Power Dissipation @ Tc = 25°C @ Tc = 100°C	P_D	 417 208	W
Operating junction temperature range	T_J	−55 to +175	°C
Storage temperature range	T_{stg}	−55 to +175	°C
Lead temperature for soldering, 1/8” from case for 5 seconds	T_{SLD}	260	°C

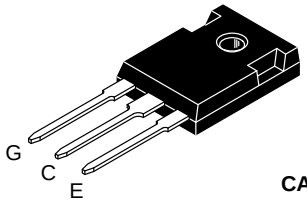
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

ON Semiconductor®

www.onsemi.com

50 A, 600 V
V_{CEsat} = 1.80 V
E_{OFF} = 0.46 mJ





TO−247
CASE 340AL

MARKING DIAGRAM

A = Assembly Location
Y = Year
WW = Work Week
G = Pb−Free Package

ORDERING INFORMATION

Device	Package	Shipping
NGTB50N60S1WG	TO−247 (Pb−Free)	30 Units / Rail

© Semiconductor Components Industries, LLC, 2014

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction−to−case, for IGBT	$R_{\theta JC}$	0.36	°C/W
Thermal resistance junction−to−case, for Diode	$R_{\theta JC}$	0.60	°C/W
Thermal resistance junction−to−ambient	$R_{\theta JA}$	40	°C/W

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
STATIC CHARACTERISTIC						
Collector−emitter breakdown voltage, gate−emitter short−circuited	V_{GE} = 0 V, I_C = 500 μA	$V_{(BR)CES}$	600	−	−	V
Collector−emitter saturation voltage	V_{GE} = 15 V, I_C = 50 A V_{GE} = 15 V, I_C = 50 A, T_J = 175°C	V_{CEsat}	1.50 −	1.80 2.19	2.00 −	V
Gate−emitter threshold voltage	V_{GE} = V_{CE}, I_C = 350 μA	$V_{GE(th)}$	4.5	5.5	6.5	V
Collector−emitter cut−off current, gate−emitter short−circuited	V_{GE} = 0 V, V_{CE} = 600 V V_{GE} = 0 V, V_{CE} = 600 V, T_J = 150°C	I_{CES}	− −	− −	0.5 4.0	mA
Gate leakage current, collector−emitter short−circuited	V_{GE} = 20 V , V_{CE} = 0 V	I_{GES}	−	−	200	nA
DYNAMIC CHARACTERISTIC						
Input capacitance	V_{CE} = 20 V, V_{GE} = 0 V, f = 1 MHz	C_{ies}	−	5328	−	pF
Output capacitance		C_{oes}	−	252	−	
Reverse transfer capacitance		C_{res}	−	148	−	
Gate charge total	V_{CE} = 480 V, I_C = 50 A, V_{GE} = 15 V	Q_g	−	220	−	nC
Gate to emitter charge		Q_{ge}	−	52	−	
Gate to collector charge		Q_{gc}	−	116	−	
SWITCHING CHARACTERISTIC, INDUCTIVE LOAD						
Turn−on delay time	T_J = 25°C V_{CC} = 400 V, I_C = 50 A R_g = 10 Ω V_{GE} = 0 V/ 15 V	$t_{d(on)}$	−	100	−	ns
Rise time		t_r	−	47	−	
Turn−off delay time		$t_{d(off)}$	−	237	−	
Fall time		t_f	−	67	−	
Turn−on switching loss		E_{on}	−	1.50	−	mJ
Turn−off switching loss		E_{off}	−	0.46	−	
Total switching loss		E_{ts}	−	1.96	−	
Turn−on delay time	T_J = 150°C V_{CC} = 400 V, I_C = 50 A R_g = 10 Ω V_{GE} = 0 V/ 15 V	$t_{d(on)}$	−	90	−	ns
Rise time		t_r	−	49	−	
Turn−off delay time		$t_{d(off)}$	−	245	−	
Fall time		t_f	−	96	−	
Turn−on switching loss		E_{on}	−	1.90	−	mJ
Turn−off switching loss		E_{off}	−	0.83	−	
Total switching loss		E_{ts}	−	2.73	−	
DIODE CHARACTERISTIC						
Forward voltage	V_{GE} = 0 V, I_F = 50 A V_{GE} = 0 V, I_F = 50 A, T_J = 175°C	V_F	− −	2.10 2.20	2.90 −	V
Reverse recovery time	T_J = 25°C I_F = 50 A, V_R = 400 V di_F/dt = 200 A/μs	t_{rr}	−	94	−	ns
Reverse recovery charge		Q_{rr}	−	0.45	−	μC
Reverse recovery current		I_{rrm}	−	8	−	A

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.

TYPICAL CHARACTERISTICS

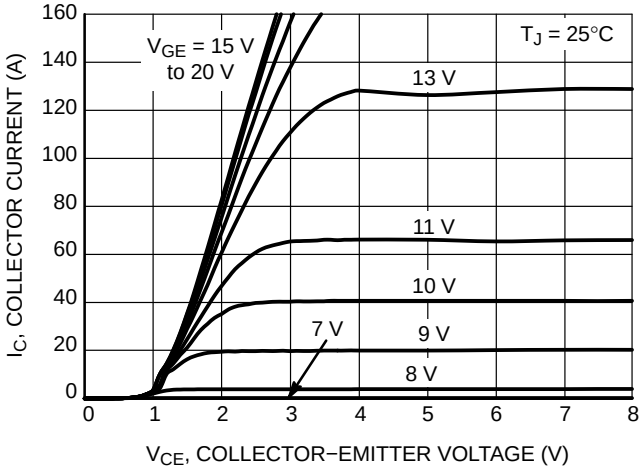


Figure 1. Output Characteristics

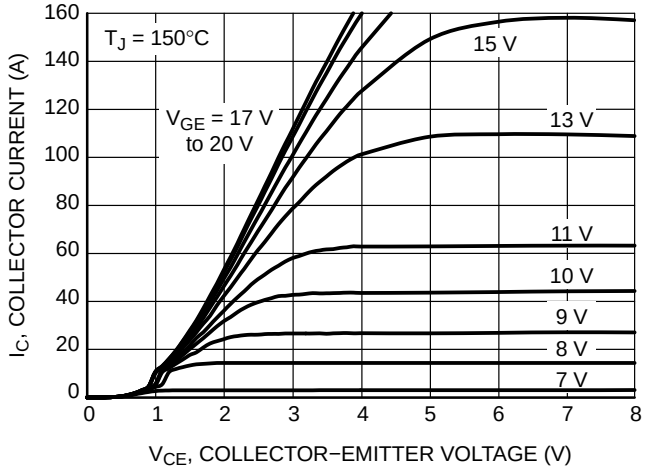


Figure 2. Output Characteristics

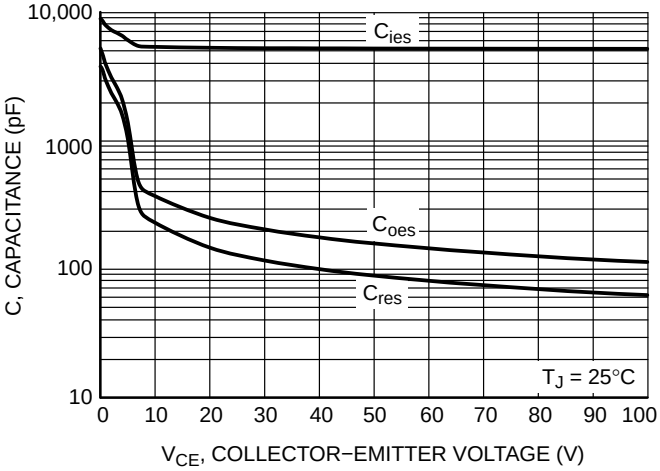


Figure 3. Typical Capacitance

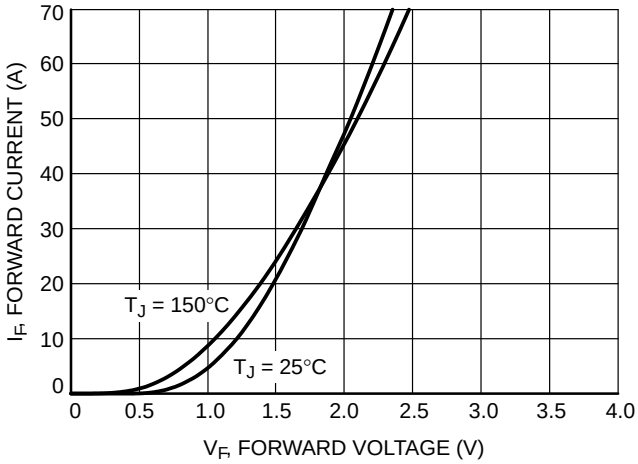


Figure 4. Diode Forward Characteristics

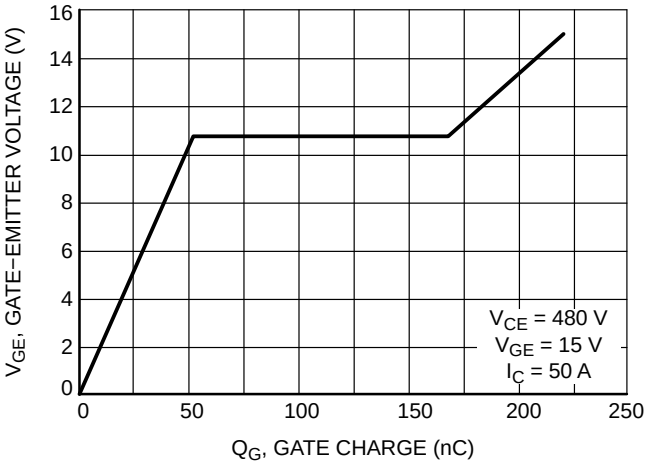


Figure 5. Typical Gate Charge

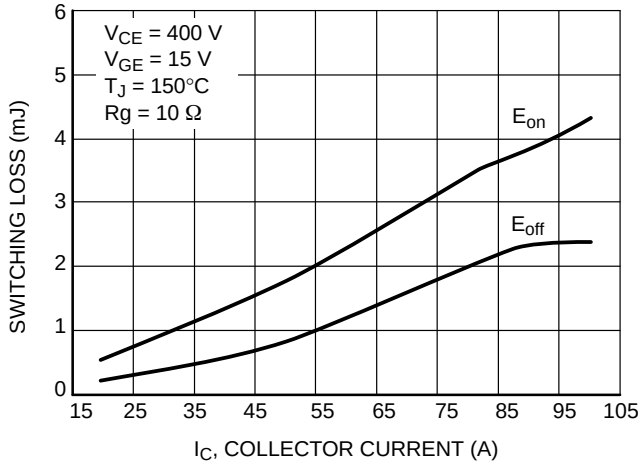


Figure 6. Switching Loss vs. I_C

TYPICAL CHARACTERISTICS

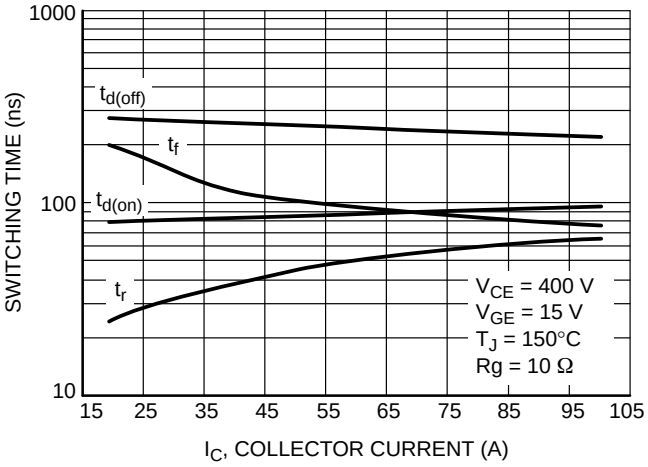


Figure 7. Switching Time vs. I_C

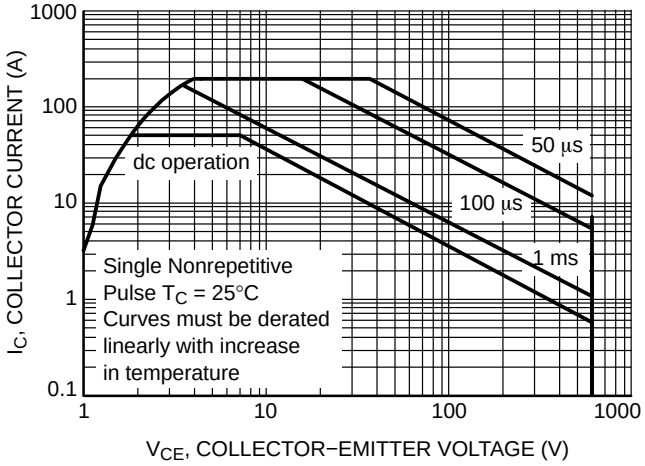
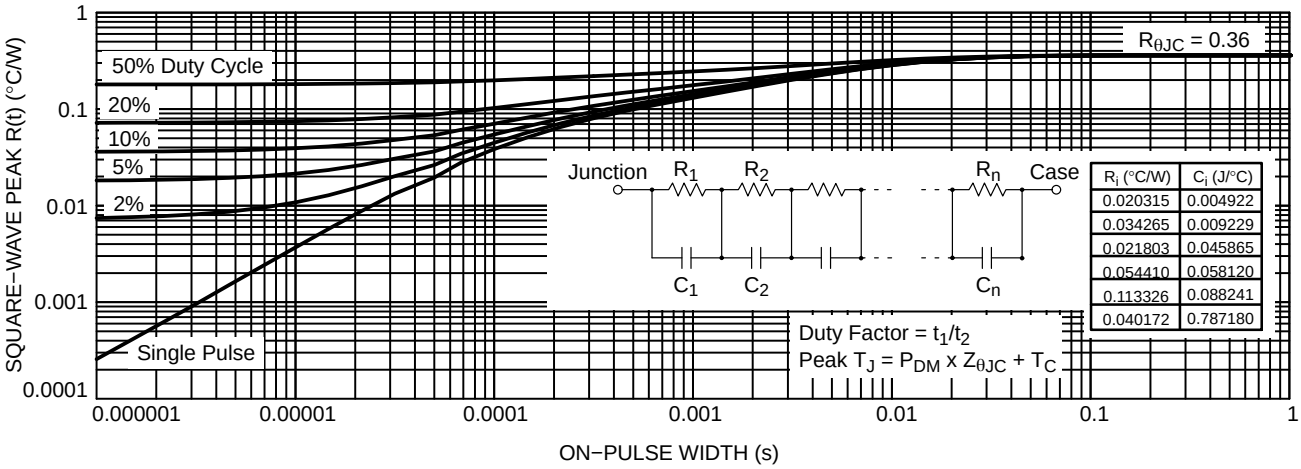
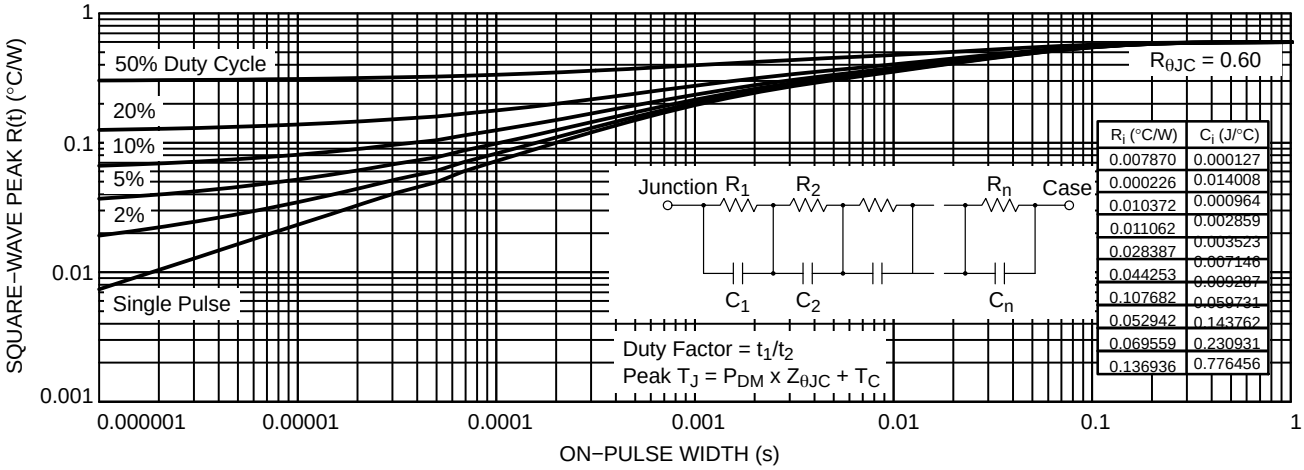


Figure 8. Safe Operating Area



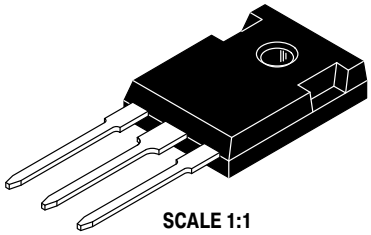
R_i (°C/W)	C_i (J/°C)
0.020315	0.004922
0.034265	0.009229
0.021803	0.045865
0.054410	0.058120
0.113326	0.088241
0.040172	0.787180

Figure 9. IGBT Transient Thermal Impedance



R_i (°C/W)	C_i (J/°C)
0.007870	0.000127
0.000226	0.014008
0.010372	0.000964
0.011062	0.002859
0.028387	0.003523
0.044253	0.007146
0.107682	0.009287
0.052942	0.059731
0.069559	0.143762
0.136936	0.230931
	0.776456

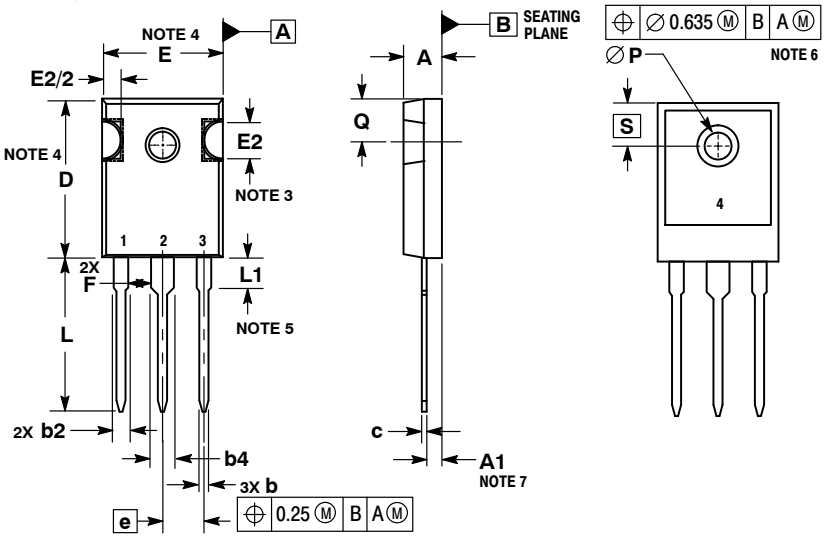
Figure 10. Diode Transient Thermal Impedance



TO−247
CASE 340AL
ISSUE D

DATE 17 MAR 2017

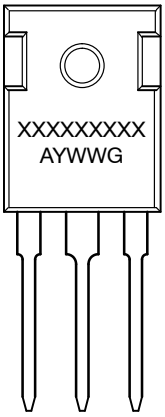
SCALE 1:1



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. SLOT REQUIRED, NOTCH MAY BE ROUNDED.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.13 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREME OF THE PLASTIC BODY.
5. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.
6. ∅P SHALL HAVE A MAXIMUM DRAFT ANGLE OF 1.5° TO THE TOP OF THE PART WITH A MAXIMUM DIAMETER OF 3.91.
7. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.

	MILLIMETERS	
DIM	MIN	MAX
A	4.70	5.30
A1	2.20	2.60
b	1.07	1.33
b2	1.65	2.35
b4	2.60	3.40
c	0.45	0.68
D	20.80	21.34
E	15.50	16.25
E2	4.32	5.49
e	5.45 BSC	
F	2.655	---
L	19.80	20.80
L1	3.81	4.32
P	3.55	3.65
Q	5.40	6.20
S	6.15 BSC	

GENERIC MARKING DIAGRAM*



XXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
G = 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.

DOCUMENT NUMBER:	**98AON16119F**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	**TO−247**	**PAGE 1 OF 1**

ON Semiconductor and ON 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.

© Semiconductor Components Industries, LLC, 2019

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