

FGHL50T65SQ

IGBT for PFC Applications 650 V, 50 A, TO-247-3L

Features

- Maximum Junction Temperature: $T_J = 175^\circ\text{C}$
- Positive Temperature Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)} = 1.6\text{ V (Typ.) @ } I_C = 50\text{ A}$
- 100% of the Parts Tested for ILM (Note 1)
- High Input Impedance
- Fast Switching
- Tighten Parameter Distribution
- RoHS Compliant

Typical Applications

- Solar Inverter, UPS, Welder, Telecom, ESS, PFC

MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit	
Collector-to-Emitter Voltage	V_{CES}	650	V	
Gate-to-Emitter Voltage	V_{GES}	± 20	V	
Transient Gate-to-Emitter Voltage	V_{GES}	± 30	V	
Collector Current	I_C	$T_C = 25^\circ\text{C}$	100	A
		$T_C = 100^\circ\text{C}$	50	
Pulsed Collector Current (Note 2)	I_{CM}	200	A	
Maximum Power Dissipation	P_D	$T_C = 25^\circ\text{C}$	268	W
		$T_C = 100^\circ\text{C}$	134	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +175	$^\circ\text{C}$	
Maximum Lead Temperature for Soldering Purposes (1/8" from case for 5 s)	T_L	260	$^\circ\text{C}$	

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.

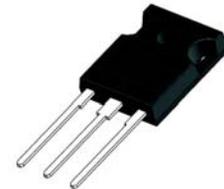
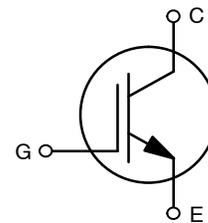
1. $V_{CC} = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 200\text{ A}$, Inductive Load
2. Repetitive rating: Pulse width limited by max. Junction temperature
3. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted



ON Semiconductor®

www.onsemi.com

BV_{CES}	$V_{CE(sat)}$ TYP	I_C MAX
650 V	1.6 V	200 A



TO-247 LONG LEADS
CASE 340CX

MARKING DIAGRAM



$\$Y$ = ON Semiconductor Logo
 $\&Z$ = Assembly Plant Code
 $\&3$ = 3-Digit Date Code
 $\&K$ = 2-Digit Lot Traceability Code
 FGHL50T65SQ = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
FGHL50T65SQ	TO-247-3L	30 Units / Rail

FGHL50T65SQ

Table 1. THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Case – Steady State	$R_{\theta JC}$	0.56	°C/W
Junction-to-Ambient – Steady State (Note 4)	$R_{\theta JA}$	40	

4. Repetitive rating: Pulse width limited by max. Junction temperature

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise stated)

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

OFF CHARACTERISTICS

Collector to Emitter Breakdown Voltage	BV_{CES}	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	650			V
Temperature Coefficient of Breakdown Voltage	$\Delta V_{CES} / \Delta T_J$	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$		0.6		V/°C
Collector Cut-Off Current	I_{CES}	$V_{CE} = V_{CES}, V_{GE} = 0\text{ V}$			250	μA
G-E Leakage Current	I_{GES}	$V_{GE} = V_{GES}, V_{CE} = 0\text{ V}$			± 400	nA

ON CHARACTERISTICS

Gate Threshold Voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}, I_C = 50\text{ mA}$	2.6	4.5	6.4	V
Collector to Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 50\text{ A}, V_{GE} = 15\text{ V}, T_C = 25^\circ\text{C}$		1.6	2.1	V
		$I_C = 50\text{ A}, V_{GE} = 15\text{ V}, T_C = 175^\circ\text{C}$		1.92		V

DYNAMIC CHARACTERISTIC

Input Capacitance	C_{ies}	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$		3209		pF
Output Capacitance	C_{oes}			42		
Reverse Transfer Capacitance	C_{res}			12		

SWITCHING CHARACTERISTIC

Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 400\text{ V}, I_C = 25\text{ A}, R_G = 4.7\ \Omega, V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 25^\circ\text{C}$ FWD: FGHL50T65SQD		19		ns	
Rise Time	t_r			13		ns	
Turn-Off Delay Time	$t_{d(off)}$				93		ns
Fall Time	t_f				6.4		ns
Turn-On Switching Loss	E_{on}				410		μJ
Turn-Off Switching Loss	E_{off}				88		μJ
Total Switching Loss	E_{ts}			498		μJ	
Turn-On Delay Time	$t_{d(on)}$	$V_{CC} = 400\text{ V}, I_C = 25\text{ A}, R_G = 4.7\ \Omega, V_{GE} = 15\text{ V},$ Inductive Load, $T_C = 175^\circ\text{C}$ FWD: FGHL50T65SQD		18		ns	
Rise Time	t_r			15		ns	
Turn-Off Delay Time	$t_{d(off)}$				102		ns
Fall Time	t_f				8		ns
Turn-On Switching Loss	E_{on}				641		μJ
Turn-Off Switching Loss	E_{off}				203		μJ
Total Switching Loss	E_{ts}			844		μJ	
Total Gate Charge	Q_g	$V_{CE} = 400\text{ V}, I_C = 50\text{ A}, V_{GE} = 15\text{ V}$		99		nC	
Gate-to-Emitter Charge	Q_{ge}			17		nC	
Gate-to-Collector Charge	Q_{gc}			23		nC	

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.

FGHL50T65SQ

TYPICAL CHARACTERISTICS

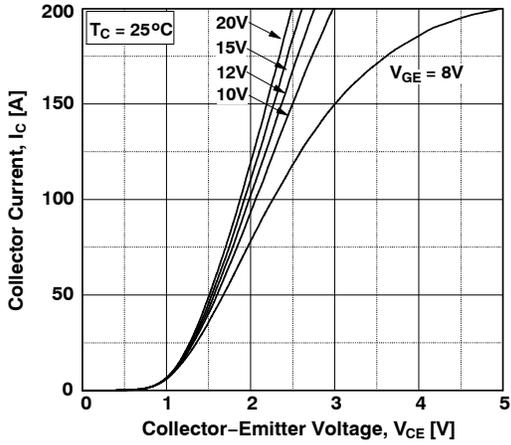


Figure 1. Typical Output Characteristics

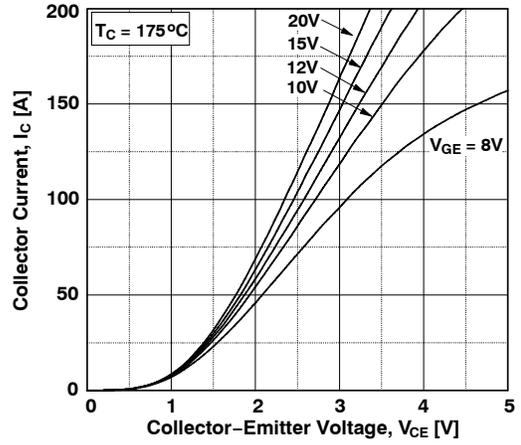


Figure 2. Typical Output Characteristics

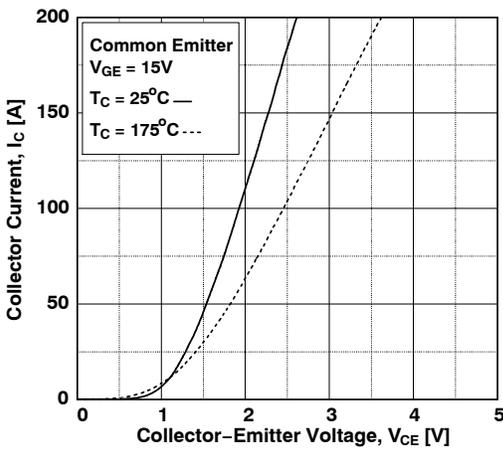


Figure 3. Typical Saturation Voltage Characteristics

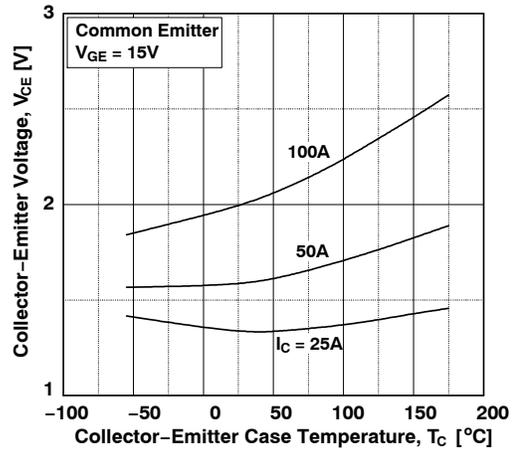


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

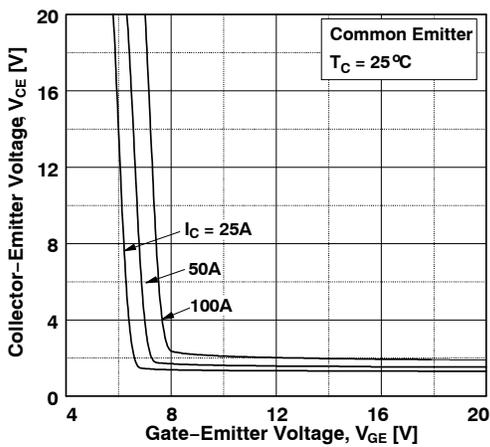


Figure 5. Saturation Voltage vs. V_{GE}

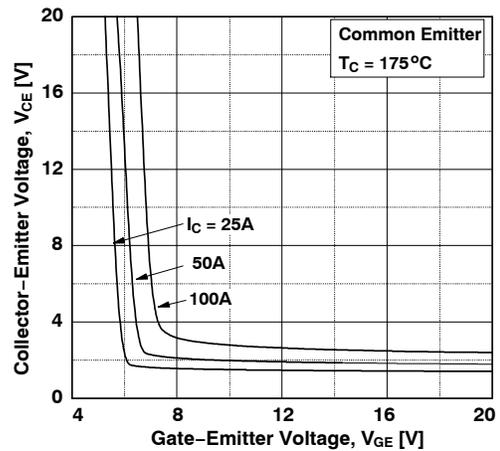


Figure 6. Saturation Voltage vs. V_{GE}

FGHL50T65SQ

TYPICAL CHARACTERISTICS

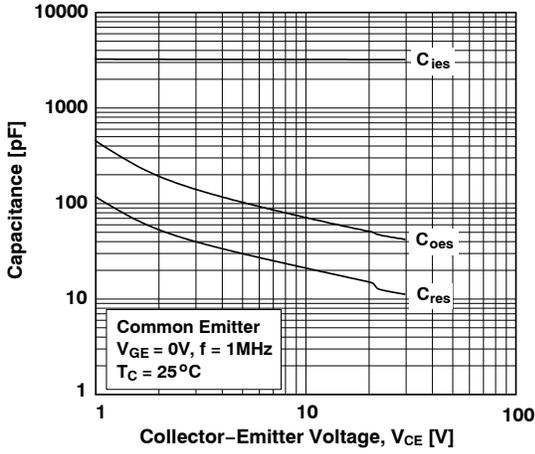


Figure 7. Capacitance Characteristics

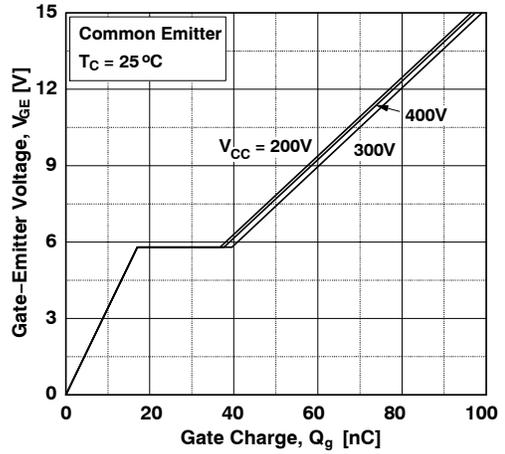


Figure 8. Gate Charge Characteristics

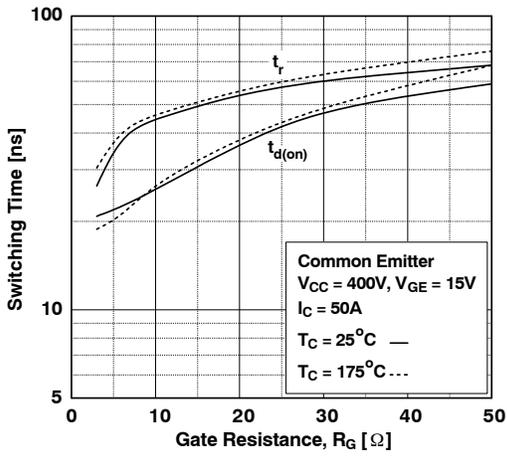


Figure 9. Turn-on Characteristics vs. Gate Resistance

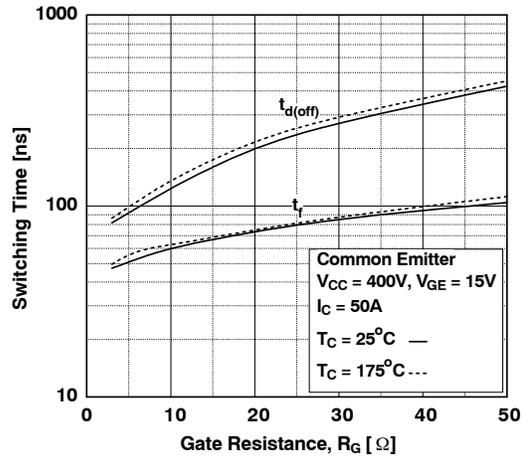


Figure 10. Turn-off Characteristics vs. Gate Resistance

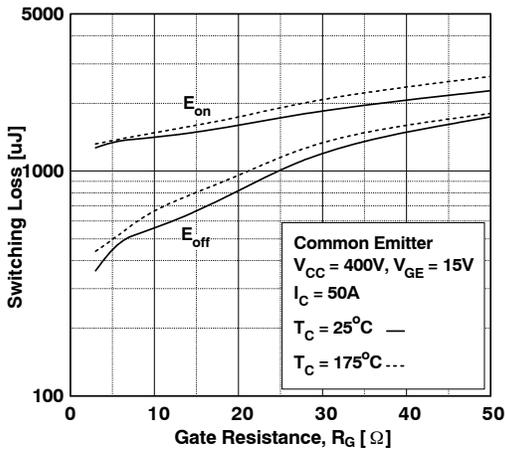


Figure 11. Switching Loss vs. Gate Resistance

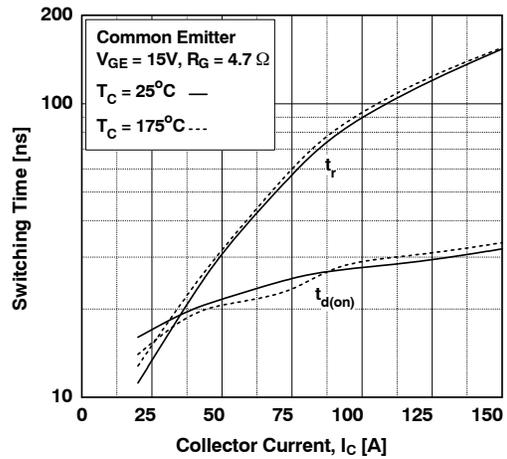


Figure 12. Turn-on Characteristics vs. Collector Current

FGHL50T65SQ

TYPICAL CHARACTERISTICS

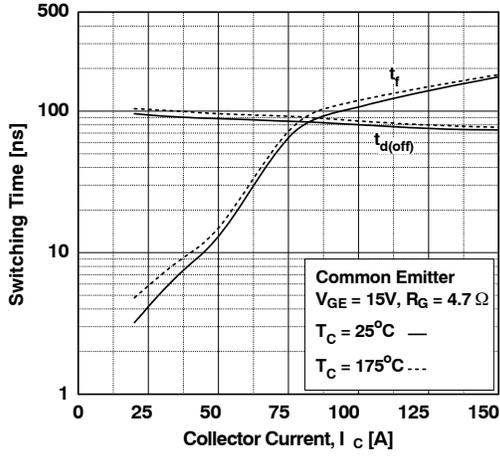


Figure 13. Turn-off Characteristics vs. Collector Current

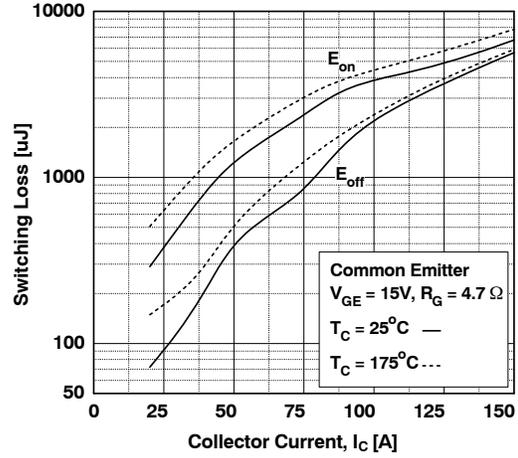


Figure 14. Switching Loss vs. Collector Current

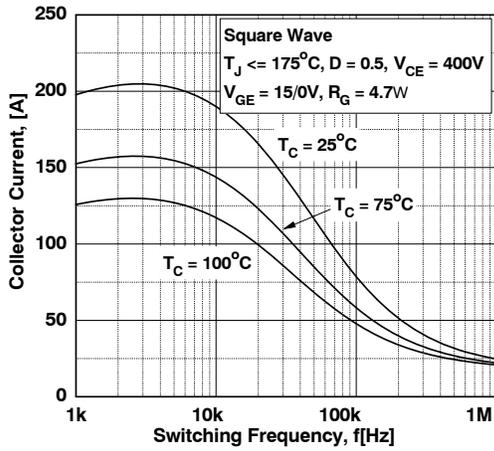


Figure 15. Load Current vs. Frequency

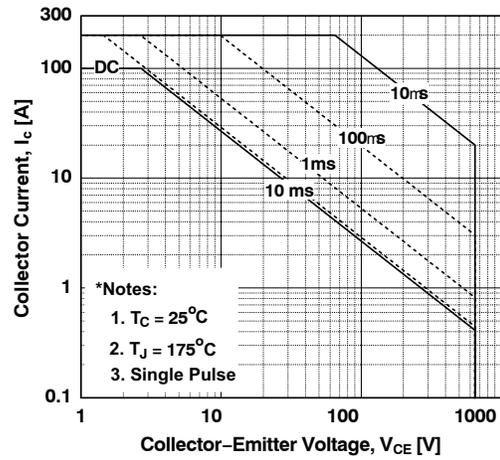


Figure 16. SOA Characteristics

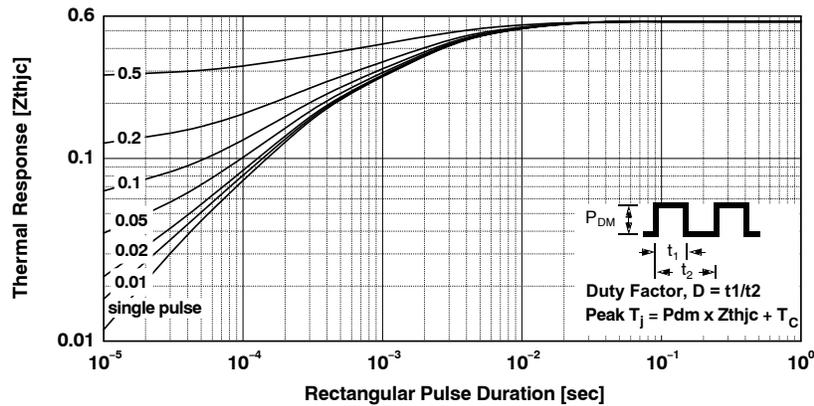


Figure 17. Transient Thermal Impedance of IGBT

MECHANICAL CASE OUTLINE

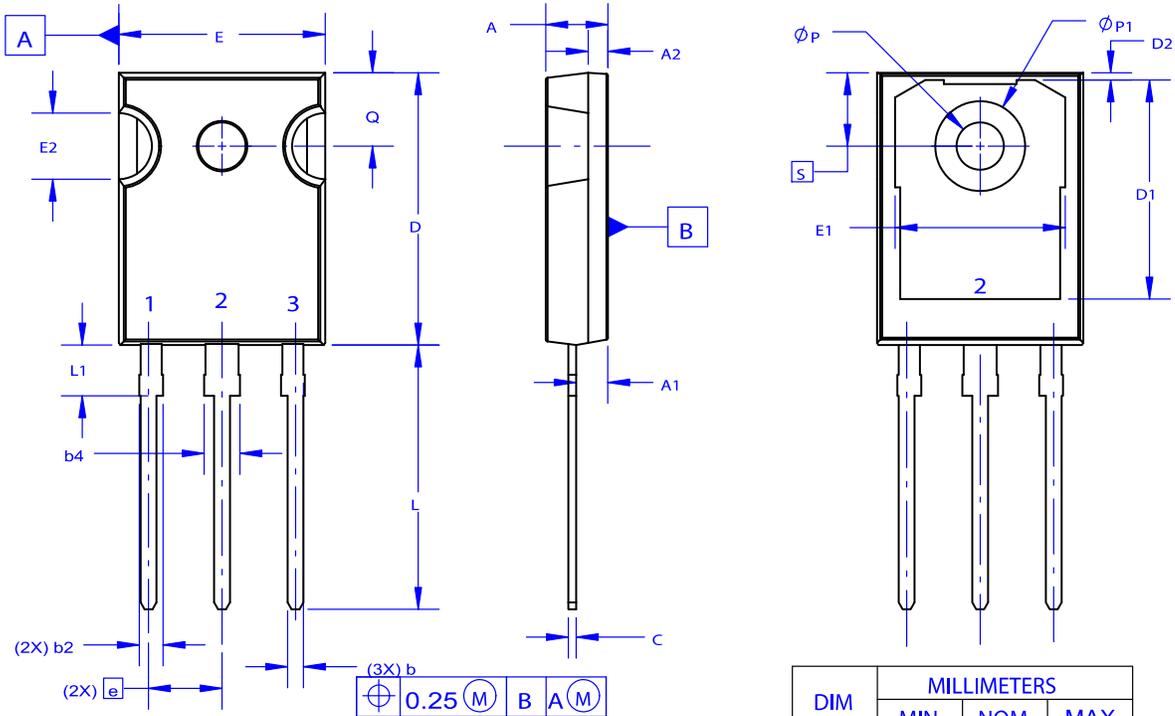
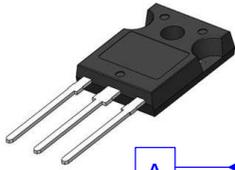
PACKAGE DIMENSIONS

ON Semiconductor®



TO-247-3LD
CASE 340CX
ISSUE A

DATE 06 JUL 2020



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
D	20.32	20.57	20.82
E	15.37	15.62	15.87
E2	4.96	5.08	5.20
e	~	5.56	~
L	19.75	20.00	20.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
Q	5.34	5.46	5.58
S	5.34	5.46	5.58
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D1	13.08	~	~
D2	0.51	0.93	1.35
E1	12.81	~	~
ØP1	6.60	6.80	7.00

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. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:	98AON93302G	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-247-3LD	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.

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

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[onsemi:](#)

[FGHL50T65SQ](#)