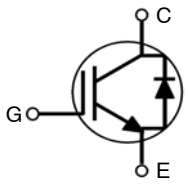
IGBT – Field Stop, Trench

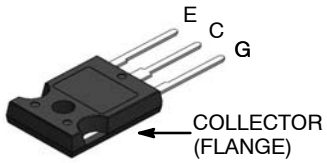
650 V, 40 A

FGH40T65SHDF



Description

Using novel field stop IGBT technology, **onsemi**'s new series of field stop 3rd generation IGBTs offer superior conduction and switching performance and easy parallel operation. This device is well suited for the resonant or soft switching application such as induction heating and MWO.



TO-247-3LD
CASE 340CH

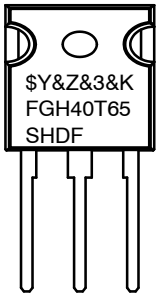
Features

- Maximum Junction Temperature: T_J = 175 °C
- Positive Temperature Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.45 V(Typ.) @ I_C = 40 A
- 100% of the Parts Tested for I_{LM} (Note 1)
- High Input Impedance
- Fast Switching
- Tighten Parameter Distribution
- This Device is Pb-Free and is RoHS Compliant

Applications

- Induction Heating, MWO

MARKING DIAGRAM



$Y	= **onsemi** Logo
&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FGH40T65SHDF	= Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

© Semiconductor Components Industries, LLC, 2014

ABSOLUTE MAXIMUM RATINGS

Description		Symbol	FGH40T65SHDF-F155	Unit
Collector to Emitter Voltage		V_{CES}	650	V
Gate to Emitter Voltage		V_{GES}	±20	V
Transient Gate to Emitter Voltage			±30	V
Collector Current	T_C = 25 °C	I_C	80	A
Collector Current	T_C = 100 °C		40	A
Pulsed Collector Current (Note 1)	T_C = 25 °C	I_{LM}	120	A
Pulsed Collector Current (Note 2)		I_{CM}	120	A
Diode Forward Current	T_C = 25 °C	I_F	40	A
Diode Forward Current	T_C = 100 °C		20	A
Pulsed Diode Maximum Forward Current		I_{FM}	60	A
Maximum Power Dissipation	T_C = 25 °C	P_D	268	W
Maximum Power Dissipation	T_C = 100 °C		134	W
Operating Junction Temperature		T_J	−55 to +175	°C
Storage Temperature Range		T_{stg}	−55 to +175	°C
Maximum Lead Temp. for Soldering Purposes, 1/8” from Case for 5 Seconds		T_L	300	°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 V, V_{GE} = 15 V, I_C = 120 A, R_G = 30 Ω, Inductive Load
2. Repetitive Rating: Pulse width limited by max. junction temperature.

THERMAL CHARACTERISTICS

Parameter	Symbol	FGH40T65SHDF-F155	Unit
Thermal Resistance, Junction to Case (IGBT)	$R_{\theta JC}$	0.56	°C/W
Thermal Resistance, Junction to Case (Diode)	$R_{\theta JC}$	1.75	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	40	°C/W

PACKAGE MARKING AND ORDERING INFORMATION

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FGH40T65SHDF	FGH40T65SHDF-F155	TO-247-3LD	–	–	30

Share Feedback
Your Opinion Matters

ELECTRICAL CHARACTERISTICS OF THE IGBT (T_C = 25 °C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector to Emitter Breakdown Voltage	BV_{CES}	V_{GE} = 0 V, I_C = 1 mA	650	–	–	V
Temperature Coefficient of Breakdown Voltage	$\Delta BV_{CES}/\Delta T_J$	V_{GE} = 0 V, I_C = 1 mA		0.6		V/°C
Collector Cut-Off Current	I_{CES}	V_{CE} = V_{CES}, V_{GE} = 0 V	–	–	250	μA
G-E Leakage Current	I_{GES}	V_{GE} = V_{GES}, V_{CE} = 0 V	–	–	±400	nA
ON CHARACTERISTICS						
G-E Threshold Voltage	$V_{GE(th)}$	I_C = 40 mA, V_{CE} = V_{GE}	3.5	5.5	7.5	V
Collector to Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 40 A, V_{GE} = 15 V	–	1.45	1.85	V
		I_C = 40 A, V_{GE} = 15 V, T_C = 175 °C	–	1.8	–	V
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ies}	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	–	1982	–	pF
Output Capacitance	C_{oes}		–	70	–	pF
Reverse Transfer Capacitance	C_{res}		–	25	–	pF
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$T_{d(on)}$	V_{CC} = 400 V, I_C = 40 A, R_G = 6 Ω, V_{GE} = 15 V, Inductive Load, T_C = 25 °C	–	18	–	ns
Rise Time	T_r		–	27	–	ns
Turn-Off Delay Time	$T_{d(off)}$		–	64	–	ns
Fall Time	T_f		–	3	–	ns
Turn-On Switching Loss	E_{on}		–	1.22	–	mJ
Turn-Off Switching Loss	E_{off}		–	0.44	–	mJ
Total Switching Loss	E_{ts}		–	1.66	–	mJ
Turn-On Delay Time	$T_{d(on)}$	V_{CC} = 400 V, I_C = 40 A, R_G = 6 Ω, V_{GE} = 15 V, Inductive Load, T_C = 175 °C	–	18	–	ns
Rise Time	T_r		–	31	–	ns
Turn-Off Delay Time	$T_{d(off)}$		–	70	–	ns
Fall Time	T_f		–	56	–	ns
Turn-On Switching Loss	E_{on}		–	1.78	–	mJ
Turn-Off Switching Loss	E_{off}		–	0.78	–	mJ
Total Switching Loss	E_{ts}		–	2.56	–	mJ
Total Gate Charge	Q_g	V_{CC} = 400 V, I_C = 40 A, V_{GE} = 15 V	–	68	–	nC
Gate to Emitter Charge	Q_{ge}		–	12	–	nC
Gate to Collector Charge	Q_{gc}		–	25	–	nC

ELECTRICAL CHARACTERISTICS OF THE DIODE (T_J = 25 °C unless otherwise noted)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Diode Forward Voltage	V_{FM}	I_F = 20 A	T_C = 25 °C	–	1.5	1.95	V
			T_C = 175 °C	–	1.37	–	
Reverse Recovery Energy	E_{rec}	I_F = 20 A, dI_F/dt = 200 A/μs	T_C = 175 °C	–	153	–	μJ
Diode Reverse Recovery Time	T_{rr}		T_C = 25 °C	–	101	–	ns
			T_C = 175 °C	–	238	–	
Diode Reverse Recovery Charge	Q_{rr}		T_C = 25 °C	–	343	–	nC
			T_C = 175 °C	–	1493	–	

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.

Share Feedback
Your Opinion Matters

TYPICAL PERFORMANCE CHARACTERISTICS

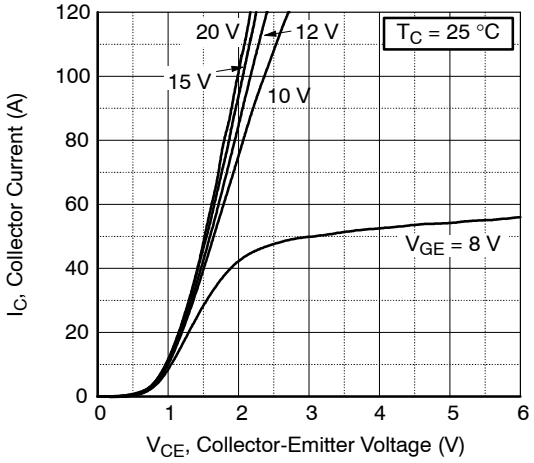


Figure 1. Typical Output Characteristics

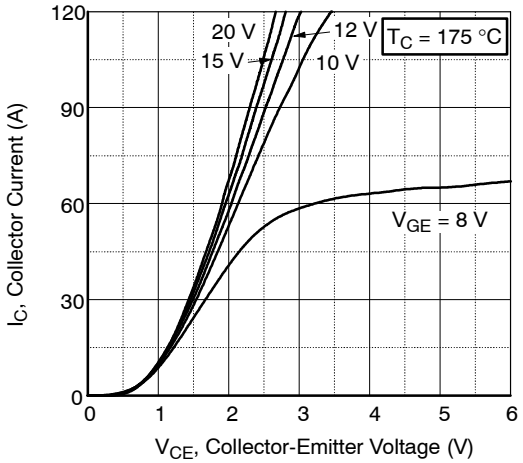


Figure 2. Typical Output Characteristics

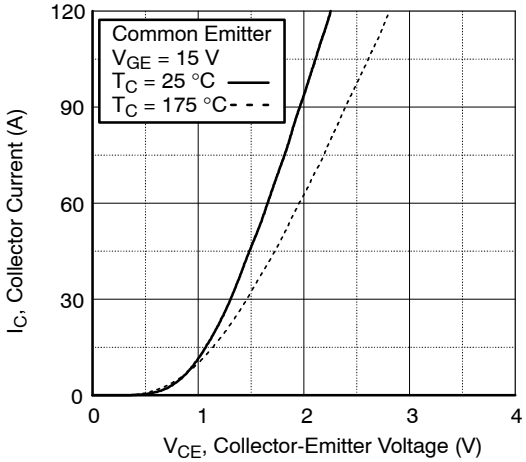


Figure 3. Typical Saturation Voltage Characteristics

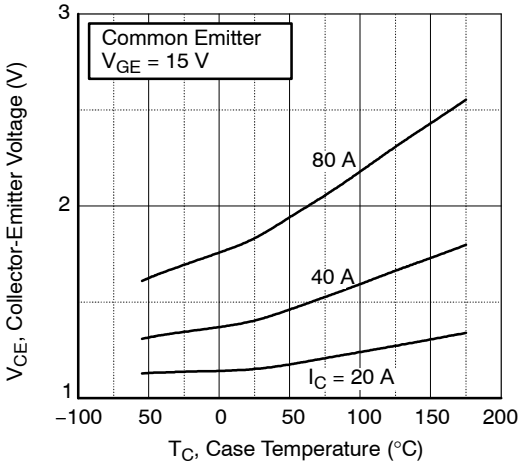


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

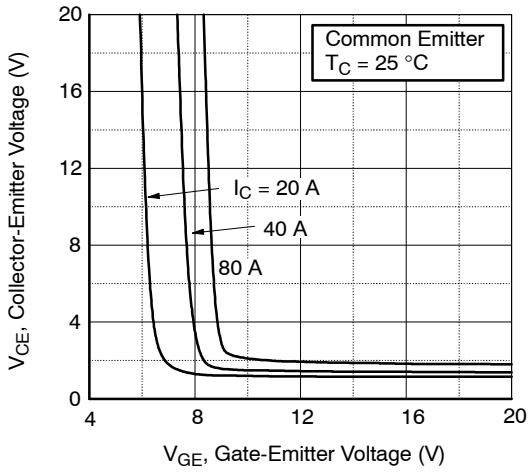


Figure 5. Saturation Voltage vs V_{GE}

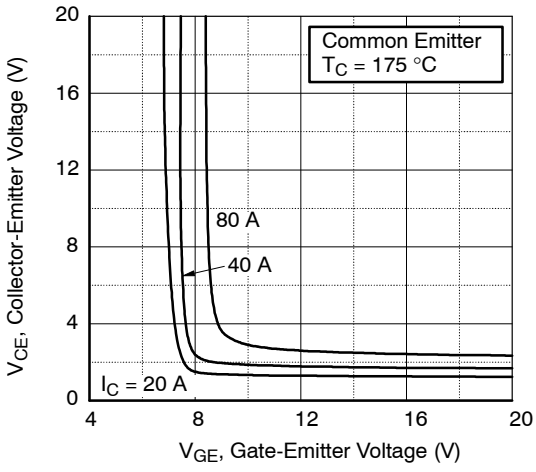


Figure 6. Saturation Voltage vs V_{GE}

Share Feedback
Your Opinion Matters

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

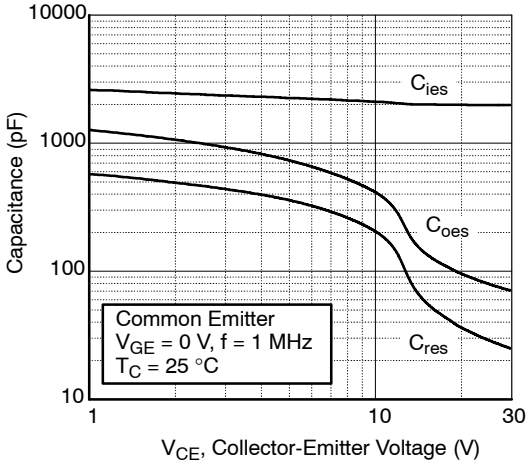


Figure 7. Capacitance Characteristics

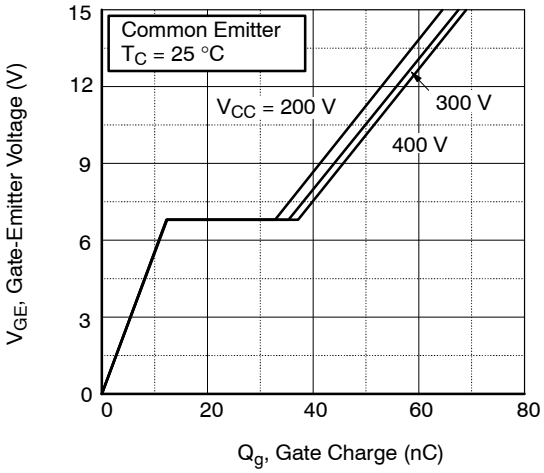


Figure 8. Gate Charge Characteristics

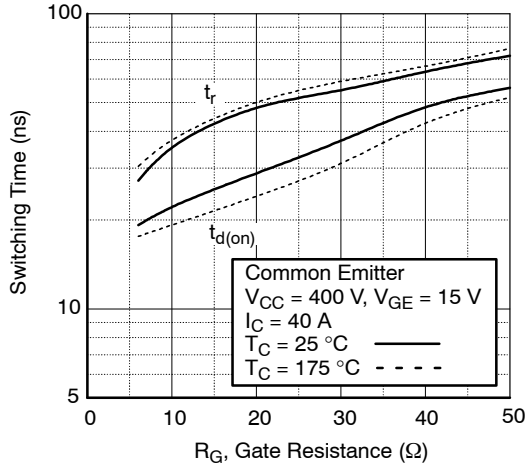


Figure 9. Turn-On Characteristics vs. Gate Resistance

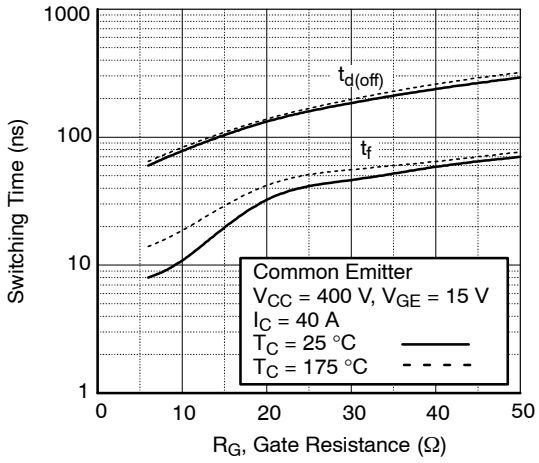


Figure 10. Turn-Off Characteristics vs. Gate Resistance

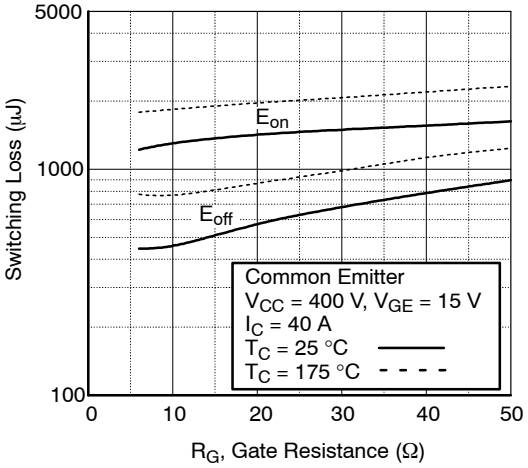


Figure 11. Switching Loss vs. Gate Resistance

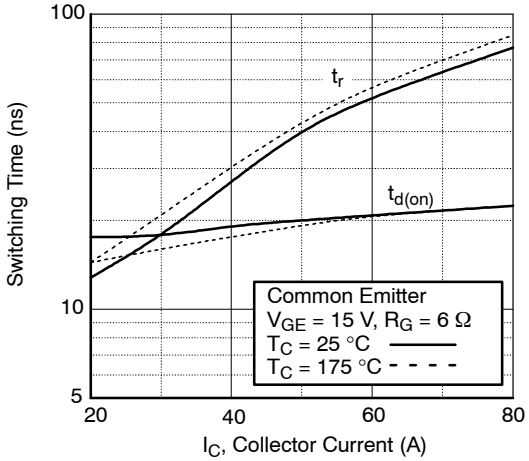


Figure 12. Turn-On Characteristics vs. Collector Current

Share Feedback
Your Opinion Matters

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

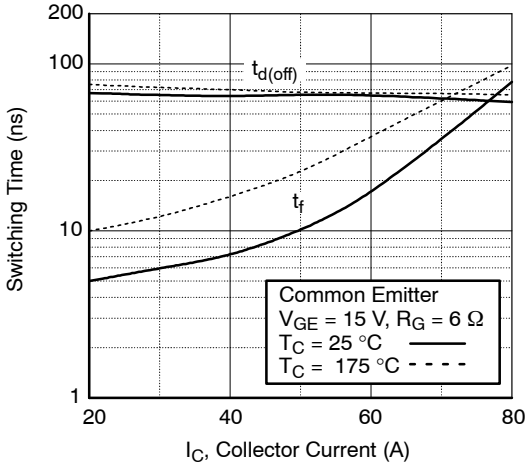


Figure 13. Turn-Off Characteristics vs. Collector Current

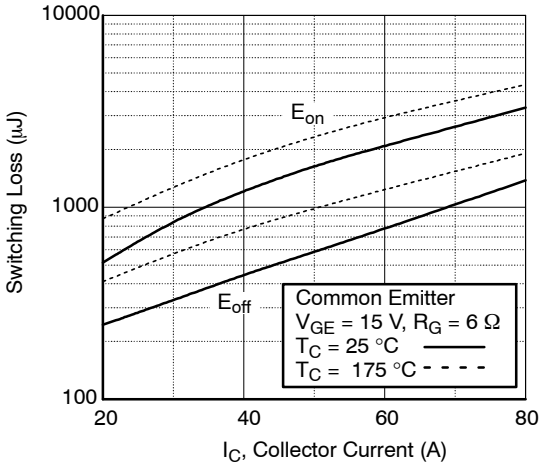


Figure 14. Switching Loss vs. Collector Current

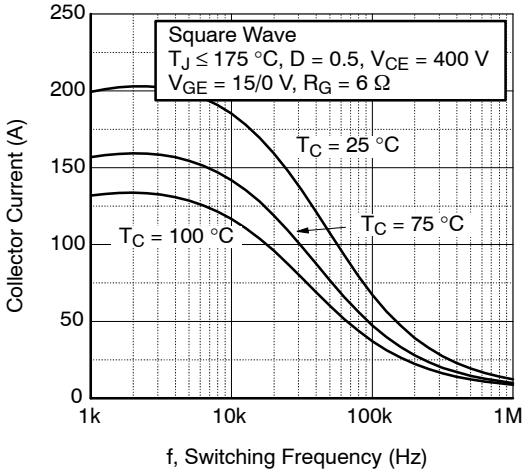


Figure 15. Load Current vs. Frequency

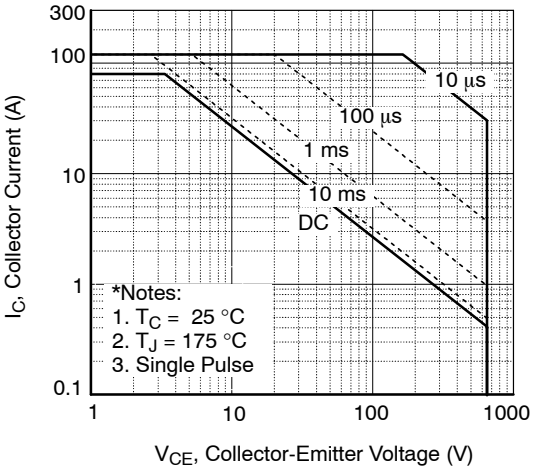


Figure 16. SOA Characteristics

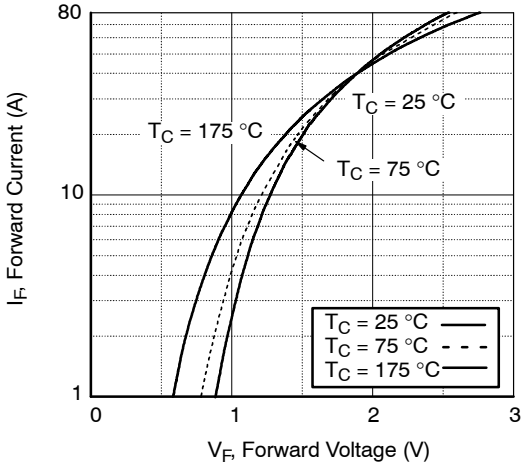


Figure 17. Forward Characteristics

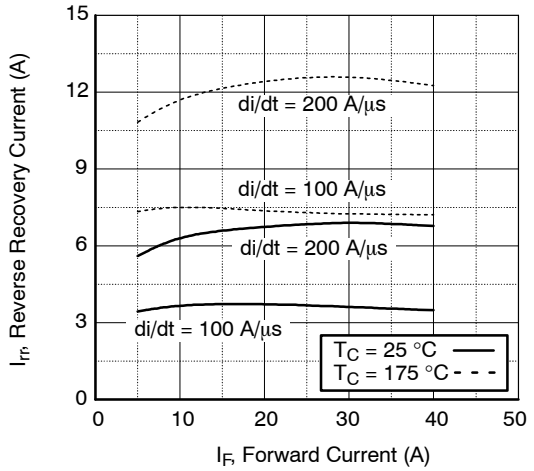


Figure 18. Reverse Recovery Current

Share Feedback
Your Opinion Matters

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

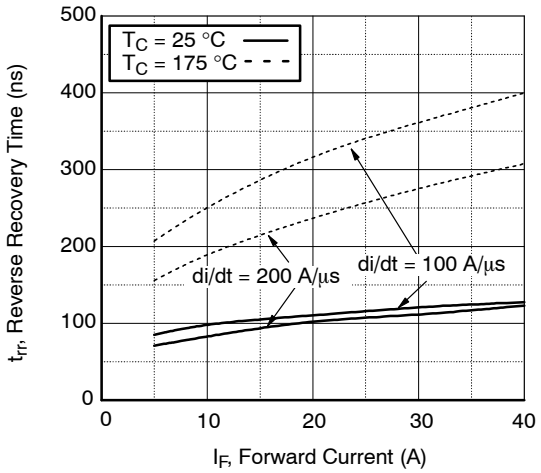


Figure 19. Reverse Recovery Time

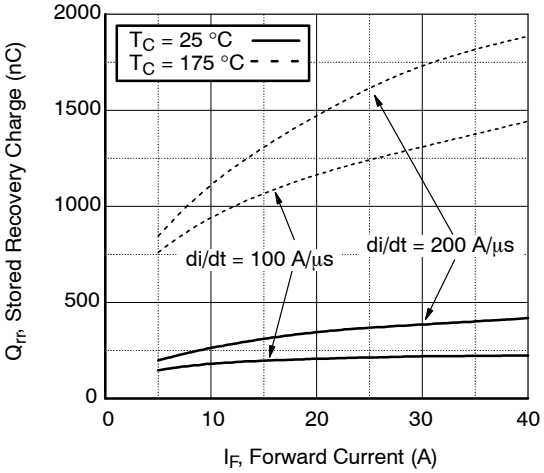


Figure 20. Stored Charge

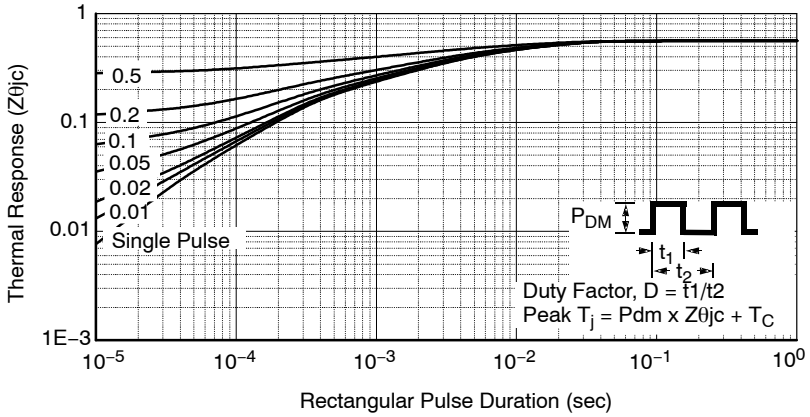


Figure 21. Transient Thermal Impedance of IGBT

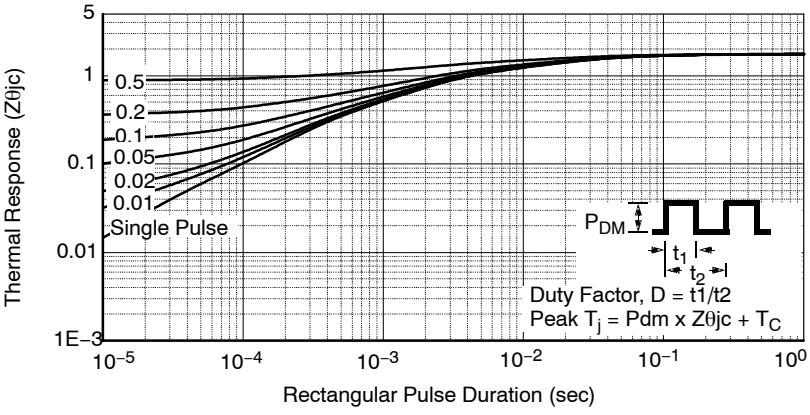


Figure 22. Transient Thermal Impedance of Diode

Share Feedback
Your Opinion Matters

REVISION HISTORY

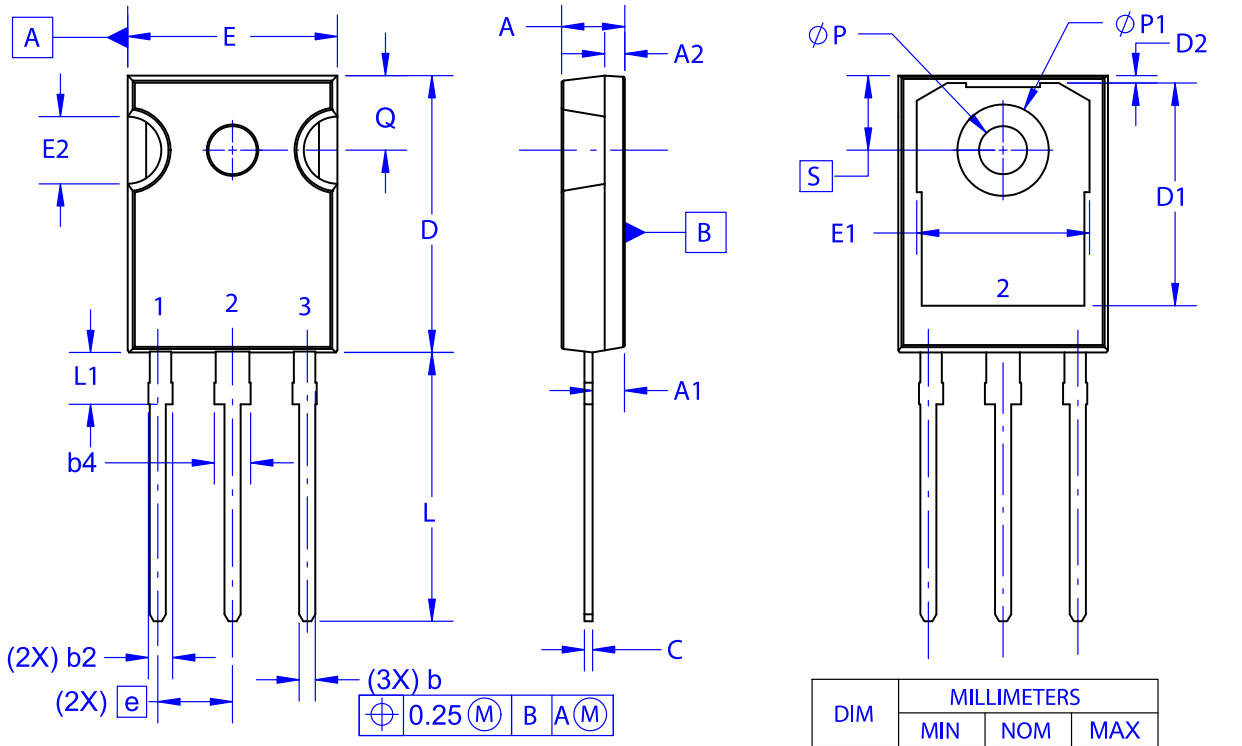
Revision	Description of Changes	Date
5	Document rebranded to **onsemi** format.	3/27/2026

This document has undergone updates prior to the inclusion of this revision history table. The changes tracked here only reflect updates made on the noted approval dates.

Share Feedback
Your Opinion Matters

TO−247−3LD
CASE 340CH
ISSUE A

DATE 09 OCT 2019

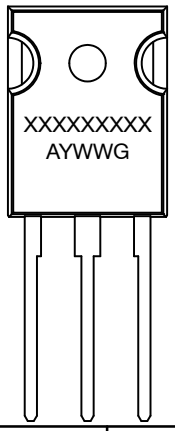


NOTES: UNLESS OTHERWISE SPECIFIED.

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	2.29	2.475	2.66
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	6.61	6.73	6.85

GENERIC
MARKING DIAGRAM*



XXXX = 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:	**98AON13853G**	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**

onsemi and onsemi are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the 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. **onsemi** 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.

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