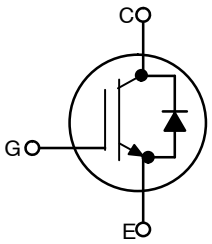
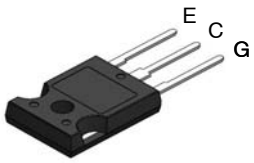
IGBT - Field Stop 600 V, 40 A

FGH40N60SMD-F085





TO−247−3LD
CASE 340CK

Description

Using Novel Field Stop IGBT Technology, **onsemi**'s new series of Field Stop IGBTs offer the optimum performance for Automotive Chargers, Inverter, and other applications where low conduction and switching losses are essential.

Features

- Maximum Junction Temperature: T_J = 175°C
- Positive Temperature Co−efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.9 V(Typ.) @ I_C = 40 A
- High Input Impedance
- Tightened Parameter Distribution
- AEC Qualified and PPAP Capable
  IGBT: AEC−Q101
- This Device is Pb−Free and is RoHS Compliant

Applications

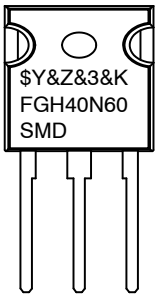
- Automotive Chargers, Converters, High Voltage Auxiliaries
- Inverters, SMPS, PFC, UPS

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	Ratings	Unit
Collector to Emitter Voltage	V_{CES}	600	V
Gate to Emitter Voltage	V_{GES}	±20	V
Collector Current @ T_C = 25°C @ T_C = 100°C	I_C	 80 40	A
Pulsed Collector Current	I_{CM} (Note 1)	120	A
Diode Forward Current @ T_C = 25°C @ T_C = 100°C	I_F	 40 20	A
Pulsed Diode Maximum Forward Current	I_{FM} (Note 1)	120	A
Maximum Power Dissipation @ T_C = 25°C @ T_C = 100°C	P_D	 349 174	W
Operating Junction Temperature	T_J	−55 to +175	°C
Storage Temperature Range	T_{stg}	−55 to +175	°C
Maximum Lead Temperature for Soldering, 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. Repetitive rating: Pulse width limited by max. junction temperature.

MARKING DIAGRAM



$Y	= **onsemi** Logo
&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FGH40N60SMD	= Specific Device Code

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

© Semiconductor Components Industries, LLC, 2013

THERMAL CHARACTERISTICS

Parameter	Symbol	Ratings	Unit
Thermal Resistance Junction−to−Case, for IGBT	$R_{\theta JC}$ (Note 2)	0.43	°C/W
Thermal Resistance Junction−to−Case, for Diode	$R_{\theta JC}$	1.8	°C/W
Parameter	**Symbol**	**Typ.**	
Thermal Resistance Junction−to−Ambient (PCB Mount) (Note 2)	$R_{\theta JA}$	45	°C/W

2. $R_{\theta JC}$ for TO−247: according to Mil standard 883−1012 test method. $R_{\theta JA}$ for TO−247 : according to JESD51−2, test method environmental condition and JESD51−10, test boards for through hole perimeter leaded package thermal measurements. JESD51−3 : Low Effective Thermal Conductivity Test Board for Leaded Surface Mount Package.

PACKAGE MARKING AND ORDERING INFORMATION

Device Marking	Device	Package	Package Type	Quantity
FGH40N60SMD	FGH40N60SMD−F085	TO−247−3	Tube	30 Units

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 = 250 μA	600	–	–	V
Temperature Coefficient of Breakdown Voltage	$\Delta BV_{CES}/\Delta T_J$	V_{GE} = 0 V, I_C = 250 μA	–	0.6	–	V/°C
Collector Cut−Off Current	I_{CES}	V_{CE} = V_{CES}, V_{GE} = 0 V	–	–	250	μA
		I_{CES} at 80% * B_{VCES}, 175°C	–	–	800	
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 = 250 μA, V_{CE} = V_{GE}	3.5	4.5	6.0	V
Collector to Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 40 A, V_{GE} = 15 V	–	1.9	2.5	V
		I_C = 40 A, V_{GE} = 15 V, T_C = 175°C	–	2.1	–	V
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ies}	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	–	1880	2500	pF
Output Capacitance	C_{oes}		–	180	240	pF
Reverse Transfer Capacitance	C_{res}		–	50	65	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	24	ns
Rise Time	t_r		–	28	36.4	ns
Turn−Off Delay Time	$t_{d(off)}$		–	110	143	ns
Fall Time	t_f		–	13.2	18.5	ns
Turn−On Switching Loss	E_{on}		–	0.92	1.2	mJ
Turn−Off Switching Loss	E_{off}		–	0.3	0.39	mJ
Total Switching Loss	E_{ts}		–	1.22	1.59	mJ

Share Feedback
Your Opinion Matters

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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	−	16.7	23.8	ns
Rise Time	t_r		−	27	35.1	ns
Turn−Off Delay Time	$t_{d(off)}$		−	116	151	ns
Fall Time	t_f		−	56.5	81	ns
Turn−On Switching Loss	E_{on}		−	1.47	1.91	mJ
Turn−Off Switching Loss	E_{off}		−	0.73	0.95	mJ
Total Switching Loss	E_{ts}		−	2.20	2.86	mJ
Total Gate Charge	Q_g	V_{CE} = 400 V, I_C = 40 A, V_{GE} = 15 V	−	119	180	nC
Gate to Emitter Charge	Q_{ge}		−	13	20	nC
Gate to Collector Charge	Q_{gc}		−	58	90	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	−	2.3	2.8	V
			T_C = 175°C	−	1.67	−	
Reverse Recovery Energy	E_{rec}	I_F = 20 A, di_F/dt = 200 A/μs	T_C = 175°C	−	48.9	−	μJ
Diode Reverse Recovery Time	t_{rr}		T_C = 25°C	−	36	47	ns
			T_C = 175°C	−	110	−	
Diode Reverse Recovery Charge	Q_{rr}		T_C = 25°C	−	46.8	61	nC
			T_C = 175°C	−	470	−	

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 CHARACTERISTICS

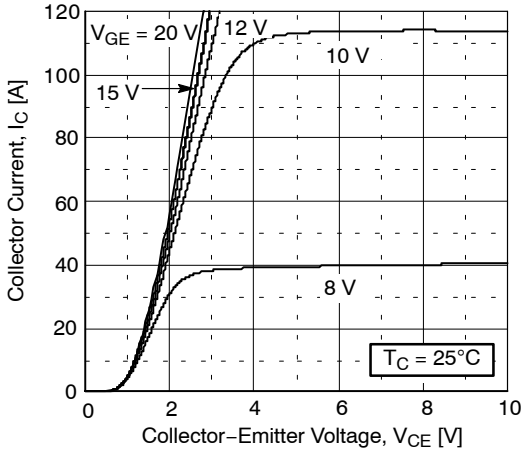


Figure 1. Typical Output Characteristics

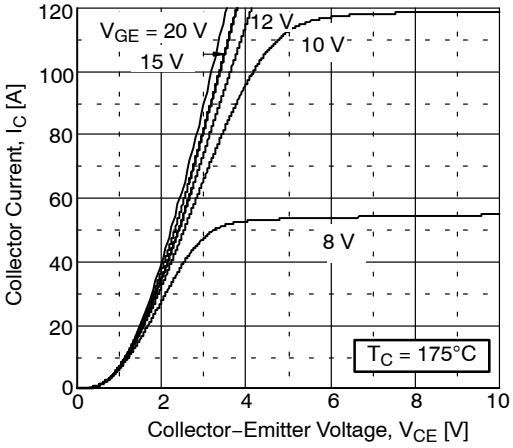


Figure 2. Typical Output Characteristics

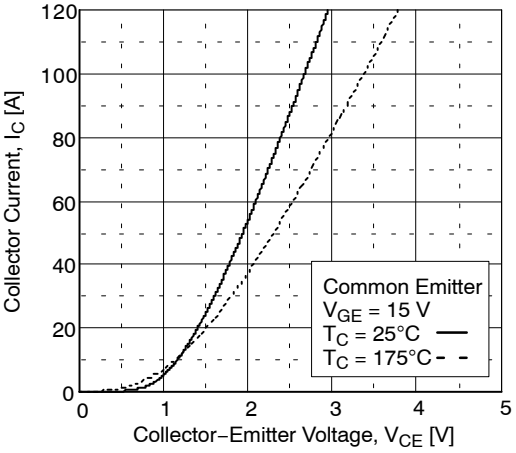


Figure 3. Typical Saturation Voltage Characteristics

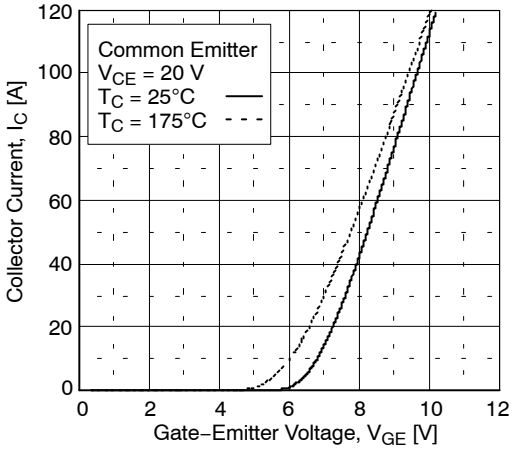


Figure 4. Transfer Characteristics

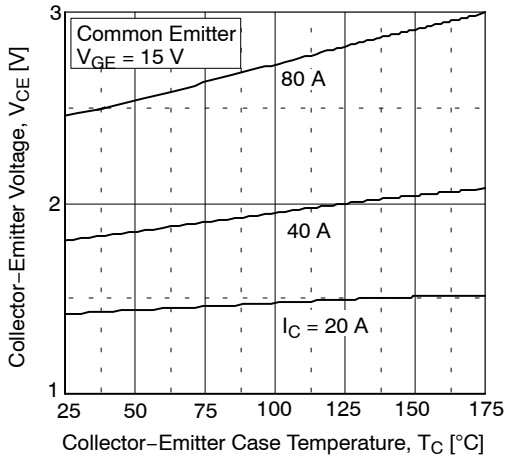


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

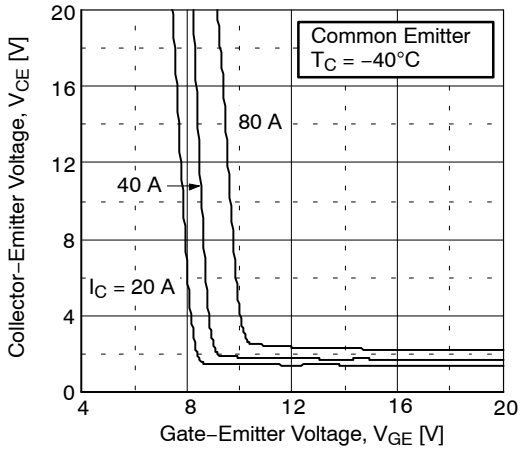


Figure 6. Saturation Voltage vs. V_{GE}

Share Feedback
Your Opinion Matters

TYPICAL CHARACTERISTICS

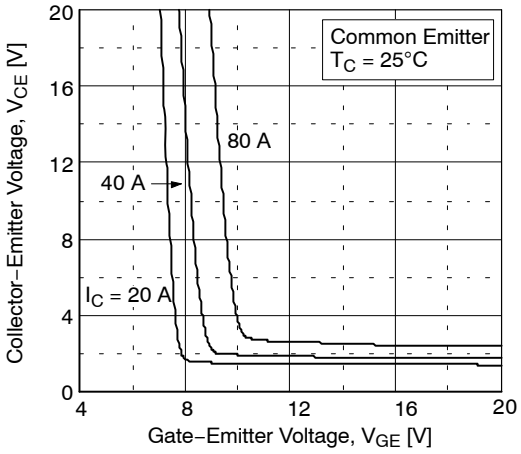


Figure 7. Saturation Voltage vs. V_{GE}

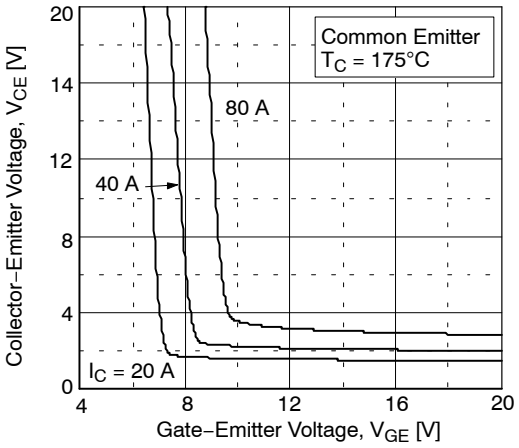


Figure 8. Saturation Voltage vs. V_{GE}

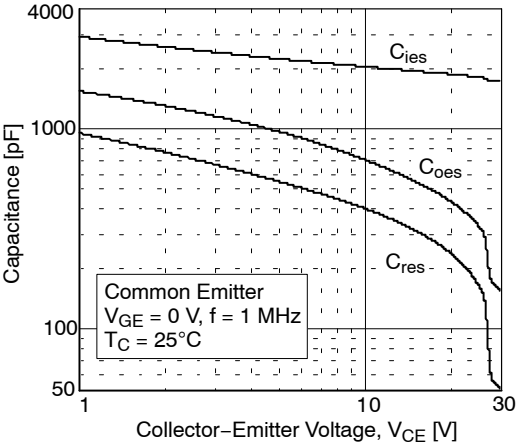


Figure 9. Capacitance Characteristics

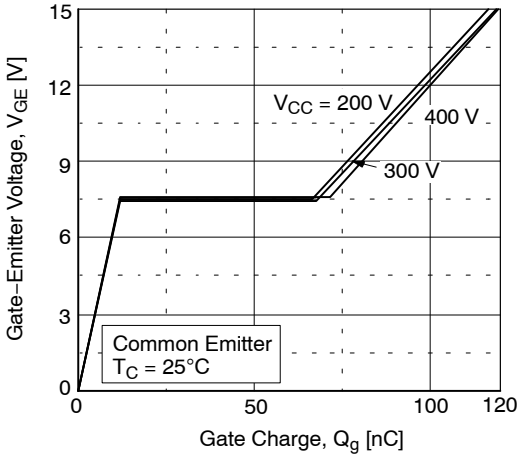


Figure 10. Gate Charge Characteristics

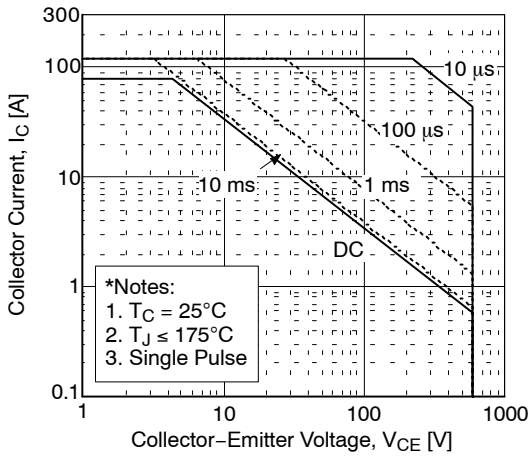


Figure 11. SOA Characteristics

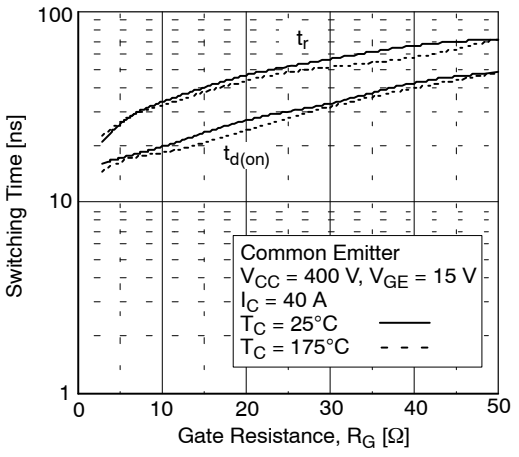


Figure 12. Turn−on Characteristics vs. Gate Resistance

Share Feedback
Your Opinion Matters

TYPICAL CHARACTERISTICS

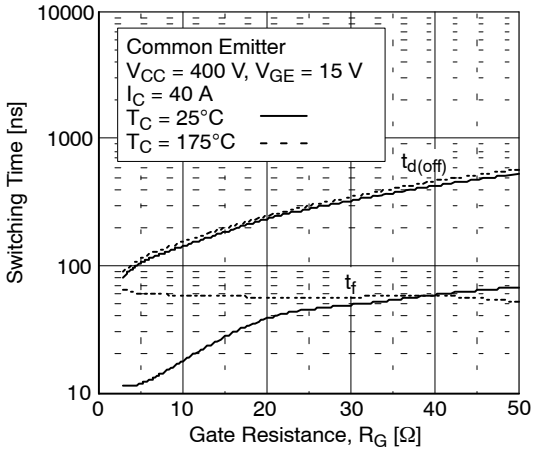


Figure 13. Turn−off Characteristics vs. Gate Resistance

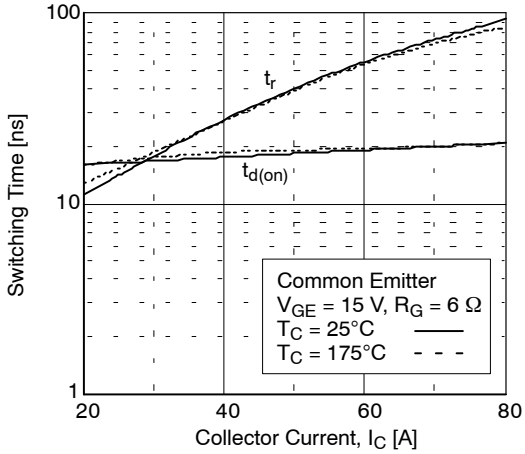


Figure 14. Turn−on Characteristics vs. Collector Current

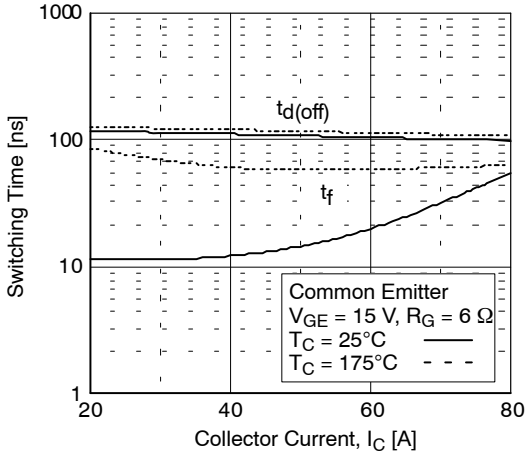


Figure 15. Turn−off Characteristics vs. Collector Current

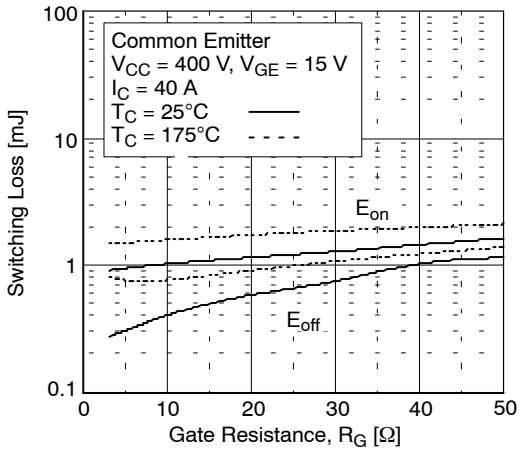


Figure 16. Switching Loss vs. Gate Resistance

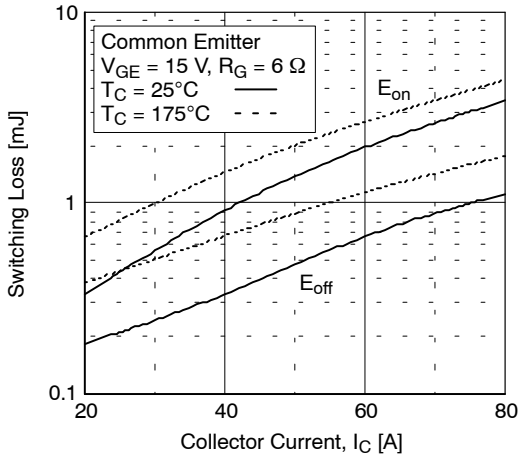


Figure 17. Switching Loss vs. Collector Current

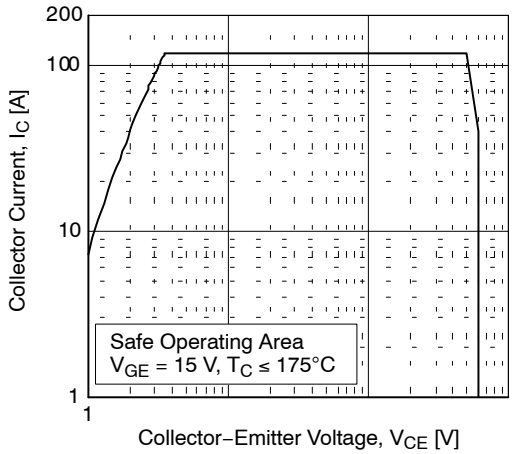


Figure 18. Turn−off Switching SOA Characteristics

Share Feedback
Your Opinion Matters

TYPICAL CHARACTERISTICS

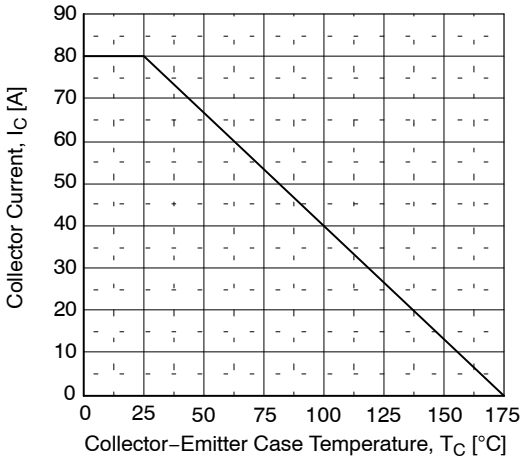


Figure 19. Current Derating

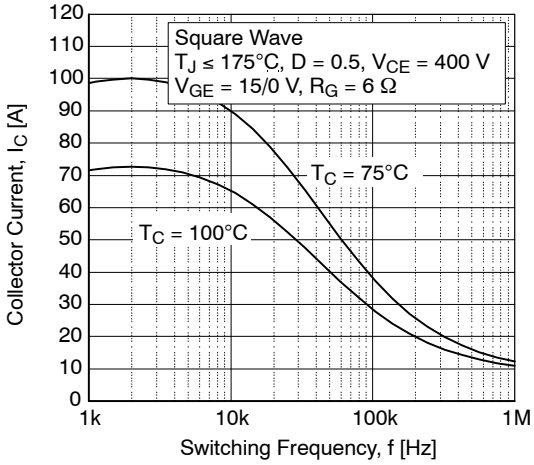


Figure 20. Load Current vs. Frequency

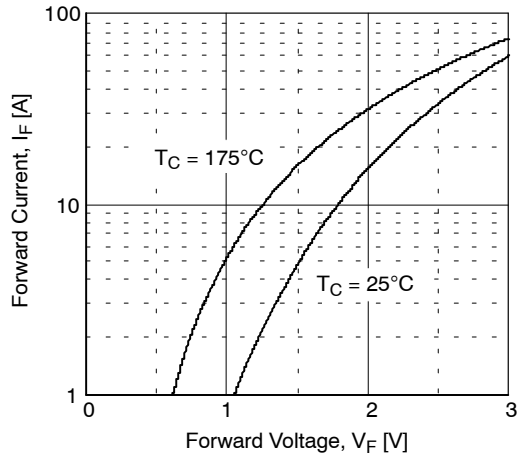


Figure 21. Forward Characteristics

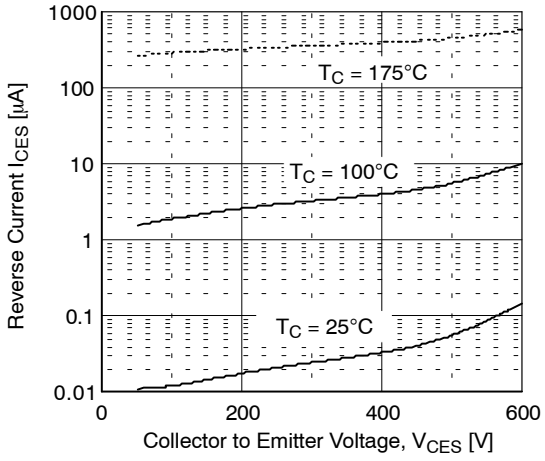


Figure 22. Reverse Current

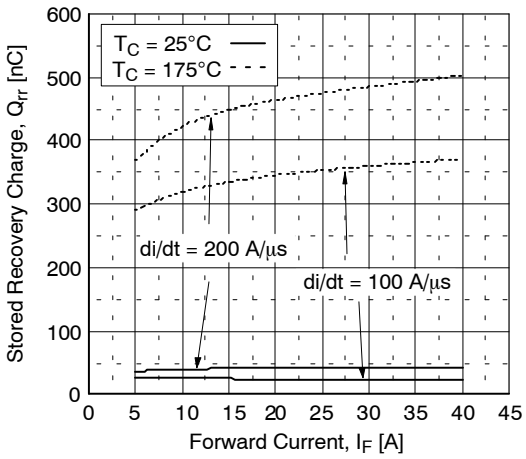


Figure 23. Stored Charge

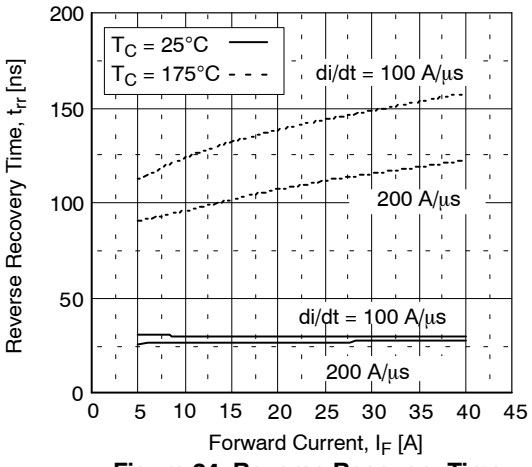


Figure 24. Reverse Recovery Time

Share Feedback
Your Opinion Matters

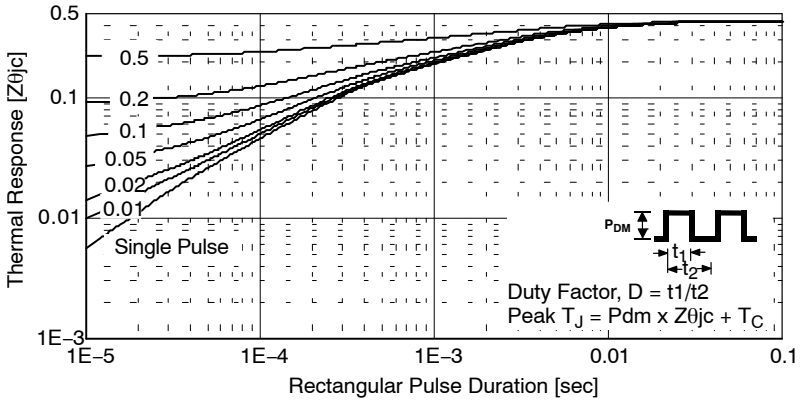


Figure 25. Transient Thermal Impedance of IGBT

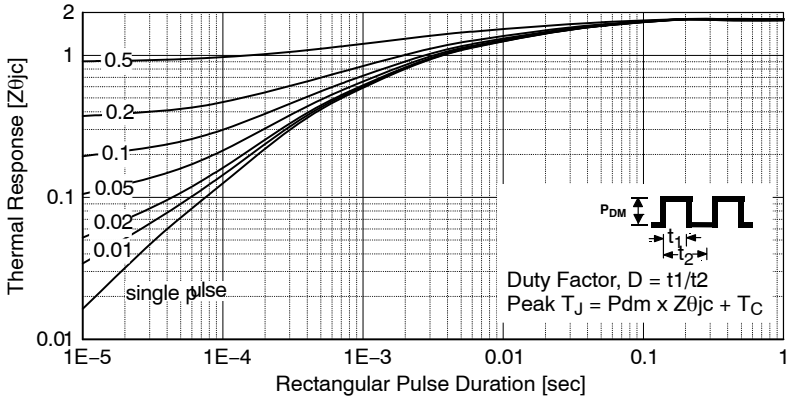
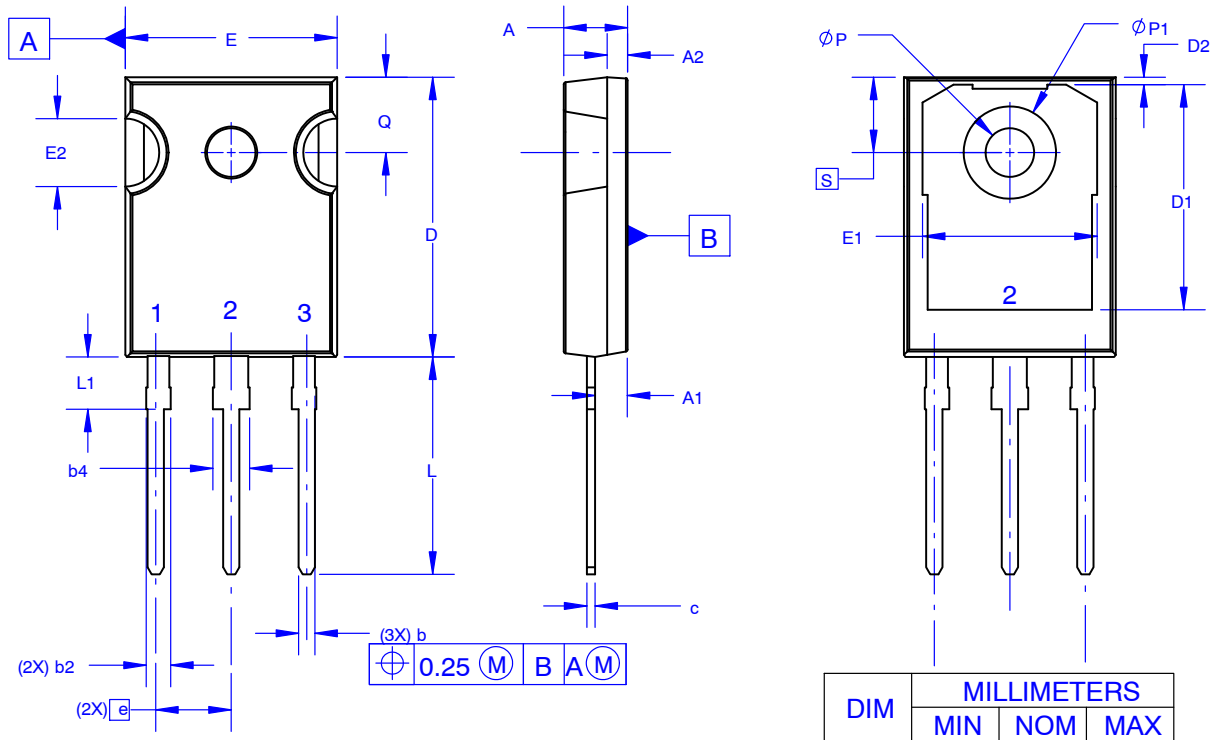


Figure 26. Transient Thermal Impedance of Diode

Share Feedback
Your Opinion Matters

TO−247−3LD SHORT LEAD
CASE 340CK
ISSUE A

DATE 31 JAN 2019

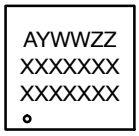


DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
ØP1	6.60	6.80	7.00
Q	5.34	5.46	5.58
S	5.34	5.46	5.58

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.

GENERIC MARKING DIAGRAM*



XXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Assembly Lot 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. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:	**98AON13851G**	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 SHORT LEAD**	**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.

© Semiconductor Components Industries, LLC, 2016

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

ENTEGRECİ

Bu belge www.entegreci.com üzerinden sunulmaktadır.

Elektronik komponent tedarikinde Entegreci

Entegreci, Eskişehir merkezli, Türkiye geneline satış yapan bir elektronik komponent mağazasıdır. Entegreler (IC), mikrodenetleyiciler, transistörler, diyotlar, pasif elemanlar, konnektörler, modüller ve geliştirme kartları tek adetten seri üretim adetlerine kadar satılır. Ürün sayfalarında güncel stok durumunu, fiyatı ve datasheet bağlantısını bulabilirsiniz.

Parça koduyla arama

Üretici parça numarasını yazın; stok ve fiyatı hemen görün.

www.entegreci.com

Ürün kategorileri

Entegreden kapasitöre tüm elektronik komponent kategorileri.

Kategorilere göz atın

Üreticiler

Aradığınız üreticinin ürünlerini tek sayfada inceleyin.

Üreticileri görün

Toplu alım ve teklif

Listede olmayan ya da yüksek adetli parçalar için teklif isteyin.

Teklif isteyin

www.entegreci.com | **destek@entegreci.com** | **0850 305 90 34**

Entegreci is an online electronic components store based in Türkiye. Search by manufacturer part number to see stock, prices and datasheets for integrated circuits, microcontrollers, transistors, passive components and connectors, or request a quote for parts that are not listed.

Bu sayfa Entegreci tarafından eklenmiştir. Belgenin önceki sayfaları asıl yayıncısına aittir ve içeriği değiştirilmemiştir; en güncel sürüm için belgenin yayıncısına başvurun.