Field Stop Trench IGBT with Soft Fast Recovery Diode

100 A, 650 V

AFGY100T65SPD

AFGY100T65SPD which is AEC Q101 qualified offers very low conduction and switch losses for a high efficiency operation in various applications, rugged transient reliability and low EMI.

Meanwhile, this part also offers an advantage of outstanding parallel operation performance with balance current sharing.

Features

- AEC−Q101 Qualified
- Very Low Saturation Voltage: $V_{CE(Sat)}$ = 1.6 V (Typ.) @ I_C = 100 A
- Maximum Junction Temperature: T_J = 175°C
- Positive Temperature Co−efficient for Easy Parallel Operating
- Tight Parameter Distribution
- High Input Impedance
- 100% of the Parts are Tested for I_{LM}
- Short Circuit Ruggedness
- Co−packed with Soft Fast Recovery Diode

Typical Applications

- Traction Inverter for HEV/EV
- Auxiliary DC/AC Converters
- Motor Drives
- Other Power−Train Applications Requiring High Power Switch

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector−to−Emitter Voltage	V_{CES}	650	V
Gate−to−Emitter Voltage Transient Gate−to−Emitter Voltage	V_{GES}	±20 ±30	V
Collector Current (Note 1) @ T_C = 25°C @ T_C = 100°C	I_C	120 100	A
Pulsed Collector Current	I_{LM}	300	A
Pulsed Collector Current	I_{CM}	300	A
Diode Forward Current (Note 1) @ T_C = 25°C @ T_C = 100°C	I_F	120 100	A
Maximum Power Dissipation @ T_C = 25°C @ T_C = 100°C	P_D	660 330	W
Short Circuit Withstand Time @ T_C = 25°C	SCWT	6	μs
Voltage Transient Ruggedness (Note 2)	dV/dt	10	V/ns
Operating Junction / Storage Temperature Range	T_J, T_{STG}	−55 to +175	°C
Maximum Lead Temp. for Soldering Purposes, 1/8″ from case for 5 seconds	T_L	265	°C

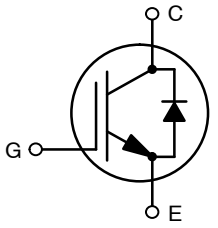
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

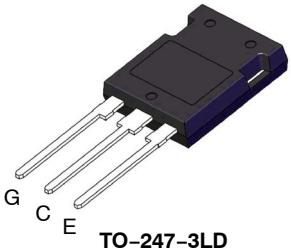
1. Value limit by bond wire
2. V_{CC} = 400 V, V_{GE} = 15 V, I_C = 300 A, Inductive Load

ON Semiconductor®

www.onsemi.com

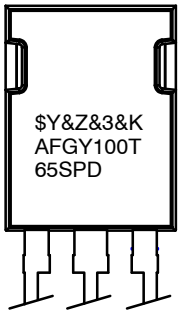
100 A, 650 V,
V_{CESat} = 1.6 V





TO−247−3LD
CASE 340CU

MARKING DIAGRAM



$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Date Code (Year & Week)
&K	= Lot Traceability Code
AFGY100T65SPD	= Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
AFGY100T65SPD	TO−247−3LD	30 Units / Tube

© Semiconductor Components Industries, LLC, 2020

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction−to−case, for IGBT	$R_{\theta JC}$	0.23	°C/W
Thermal resistance junction−to−case, for Diode	$R_{\theta JC}$	0.40	
Thermal resistance junction−to−ambient	$R_{\theta JA}$	40	

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector−emitter breakdown voltage, gate−emitter short−circuited	V_{GE} = 0 V, I_C = 1 mA	BV_{CES}	650	–	–	V
Temperature Coefficient of Breakdown Voltage	V_{GE} = 0 V, I_C = 1 mA	$\frac{\Delta BV_{CES}}{\Delta T_J}$	–	0.6	–	V/°C
Collector−emitter cut−off current, gate−emitter short−circuited	V_{GE} = 0 V, V_{CE} = 650 V	I_{CES}	–	–	40	μA
Gate leakage current, collector−emitter short−circuited	V_{GE} = 20 V, V_{CE} = 0 V	I_{GES}	–	–	±250	nA
ON CHARACTERISTICS						
Gate−emitter threshold voltage	V_{GE} = V_{CE}, I_C = 100 mA	$V_{GE(th)}$	4.3	5.3	6.3	V
Collector−emitter saturation voltage	V_{GE} = 15 V, I_C = 100 A V_{GE} = 15 V, I_C = 100 A, T_J = 175°C	$V_{CE(sat)}$	– –	1.6 2.15	2.05 –	V
DYNAMIC CHARACTERISTICS						
Input capacitance	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	C_{ies}	–	4220	–	pF
Output capacitance		C_{oes}	–	302	–	
Reverse transfer capacitance		C_{res}	–	38	–	
Internal Gate Resistance	f = 1 MHz	R_G	–	3	–	Ω
Gate charge total	V_{CE} = 400 V, I_C = 100 A, V_{GE} = 15 V	Q_g	–	109	164	nC
Gate−to−emitter charge		Q_{ge}	–	34	–	
Gate−to−collector charge		Q_{gc}	–	36	–	
SWITCHING CHARACTERISTICS, INDUCTIVE LOAD						
Turn−on delay time	T_J = 25°C, V_{CC} = 400 V, I_C = 100 A, R_G = 5.0 Ω, V_{GE} = 15 V, Inductive Load	$t_{d(on)}$	–	36	–	ns
Rise time		t_r	–	92	–	
Turn−off delay time		$t_{d(off)}$	–	78	–	
Fall time		t_f	–	106	–	
Turn−on switching loss		E_{on}	–	5.1	–	mJ
Turn−off switching loss		E_{off}	–	2.7	–	
Total switching loss		E_{ts}	–	7.8	–	
Turn−on delay time	T_J = 175°C, V_{CC} = 400 V, I_C = 100 A, R_G = 5.0 Ω, V_{GE} = 15 V, Inductive Load	$t_{d(on)}$	–	32	–	ns
Rise time		t_r	–	96	–	
Turn−off delay time		$t_{d(off)}$	–	84	–	
Fall time		t_f	–	156	–	
Turn−on switching loss		E_{on}	–	7.9	–	mJ
Turn−off switching loss		E_{off}	–	4.0	–	
Total switching loss		E_{ts}	–	11.9	–	

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted) (Continued)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
DIODE CHARACTERISTIC						
Diode Forward Voltage	I_F = 100 A, T_J = 25°C	V_{FM}	–	1.3	1.6	V
	I_F = 100 A, T_J = 175°C		–	1.25	–	
Reverse Recovery Energy	I_F = 100 A, dI_F/dt = 1000 A/μs, V_{CE} = 400 V, T_J = 25°C	E_{rec}	–	383	–	μJ
	I_F = 100 A, dI_F/dt = 1000 A/μs, V_{CE} = 400 V, T_J = 175°C		–	1668	–	
Diode Reverse Recovery Time	I_F = 100 A, dI_F/dt = 1000 A/μs, V_{CE} = 400 V, T_J = 25°C	T_{rr}	–	105	–	ns
	I_F = 100 A, dI_F/dt = 1000 A/μs, V_{CE} = 400 V, T_J = 175°C		–	208	–	
Diode Reverse Recovery Charge	I_F = 100 A, dI_F/dt = 1000 A/μs, V_{CE} = 400 V, T_J = 25°C	Q_{rr}	–	2090	–	nC
	I_F = 100 A, dI_F/dt = 1000 A/μs, V_{CE} = 400 V, T_J = 175°C		–	6974	–	

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

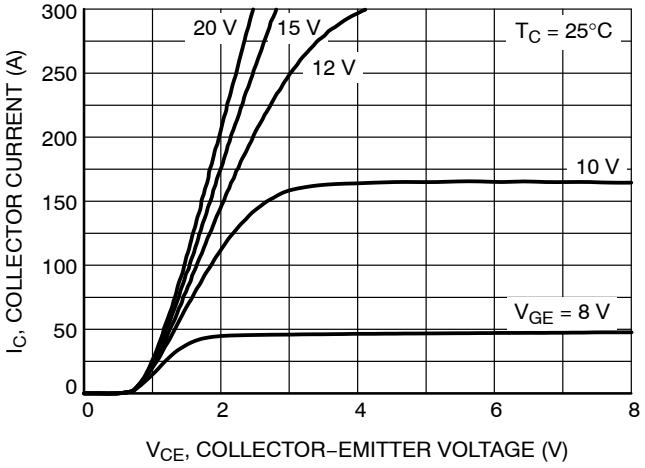


Figure 1. Typical Output Characteristics

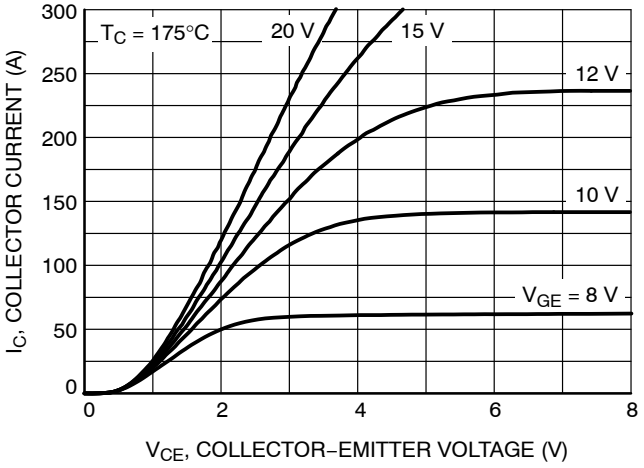


Figure 2. Typical Output Characteristics

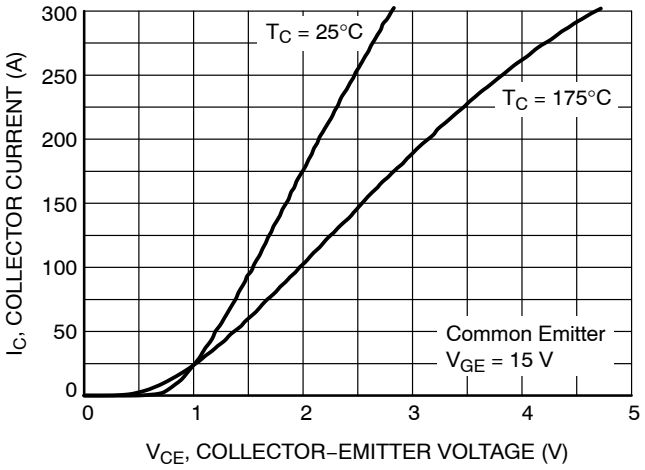


Figure 3. Typical Saturation Voltage

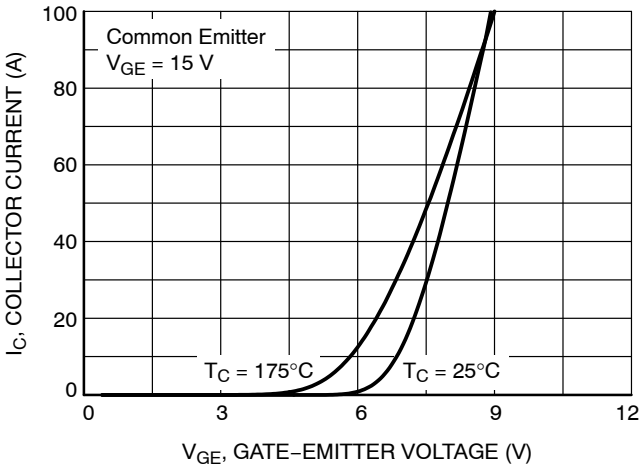


Figure 4. Transfer Characteristics

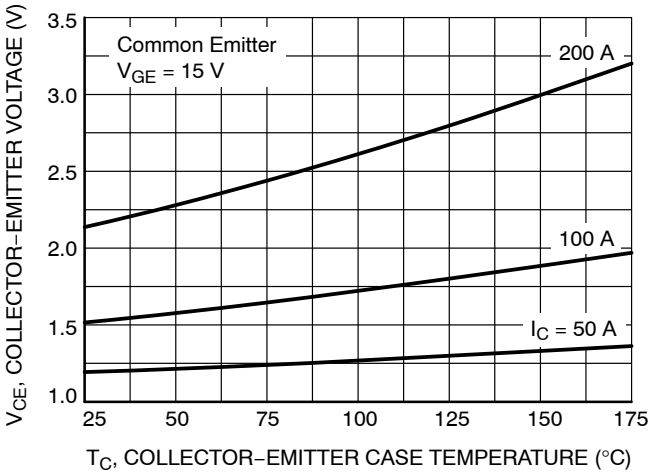


Figure 5. Saturation Voltage vs. Case Temperature

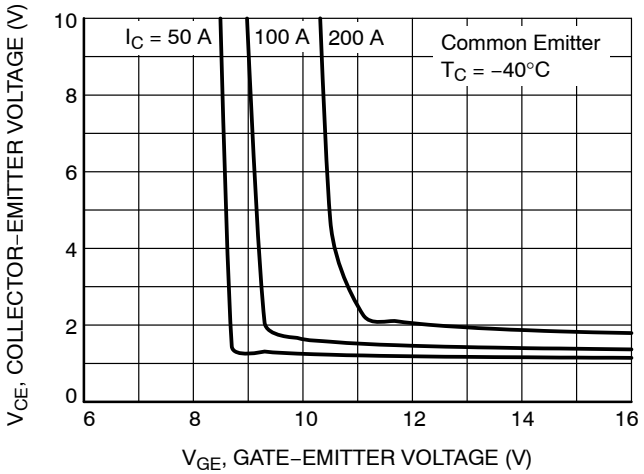


Figure 6. Saturation Voltage vs. V_{GE}

TYPICAL CHARACTERISTICS

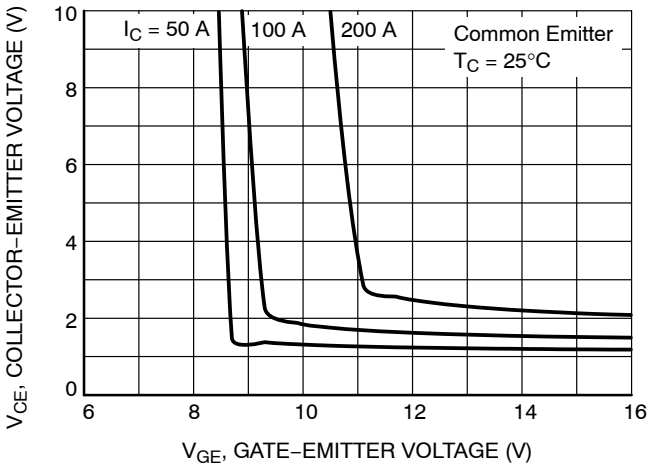


Figure 7. Saturation Voltage vs. V_{CE}

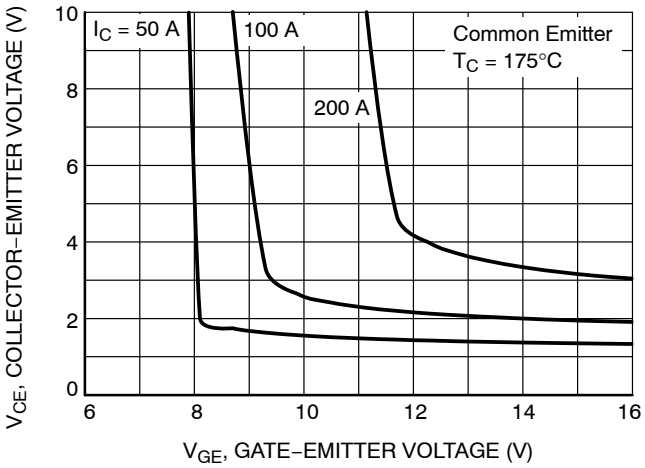


Figure 8. Saturation Voltage vs. V_{CE}

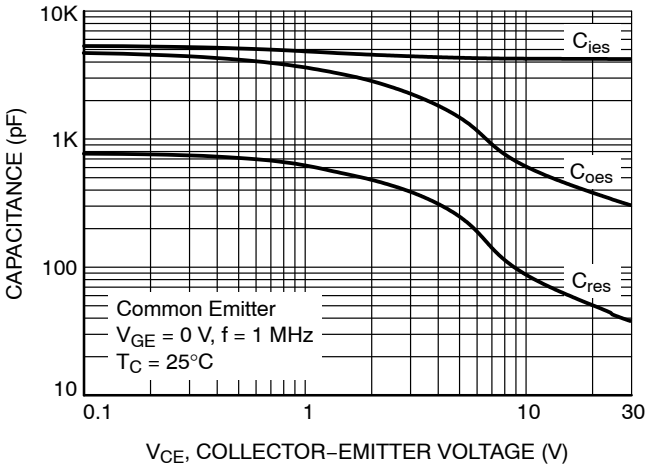


Figure 9. Capacitance Characteristics

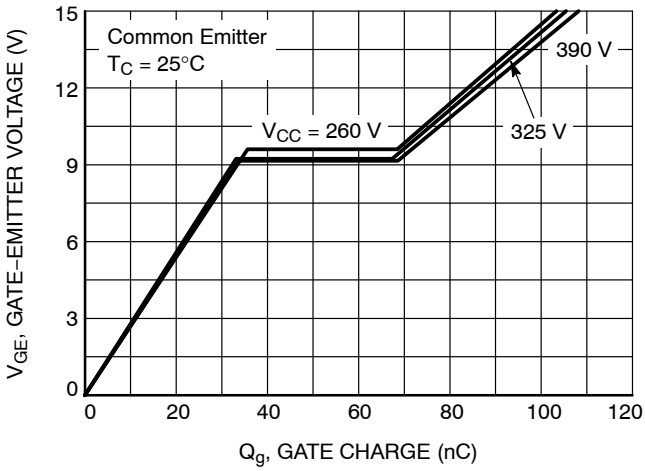


Figure 10. Gate Charge Characteristics

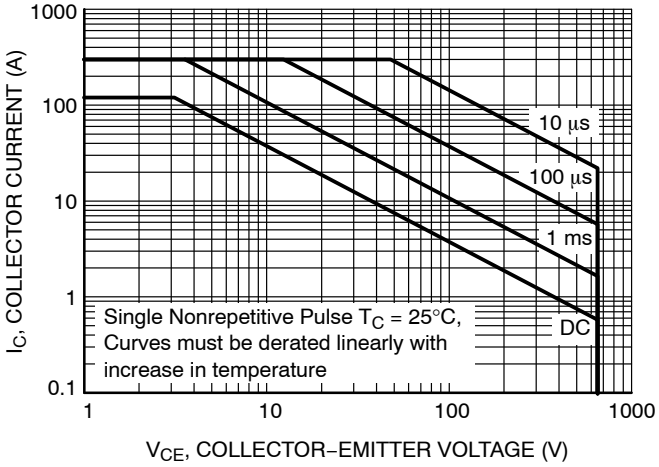


Figure 11. SOA Characteristics

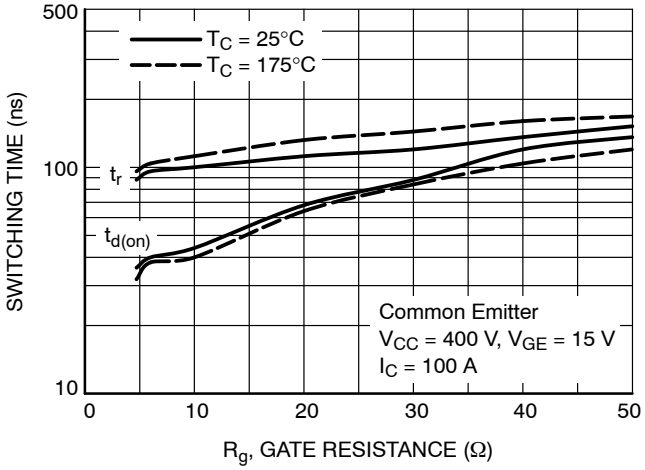


Figure 12. Turn−On Characteristics vs. Gate Resistance

TYPICAL CHARACTERISTICS

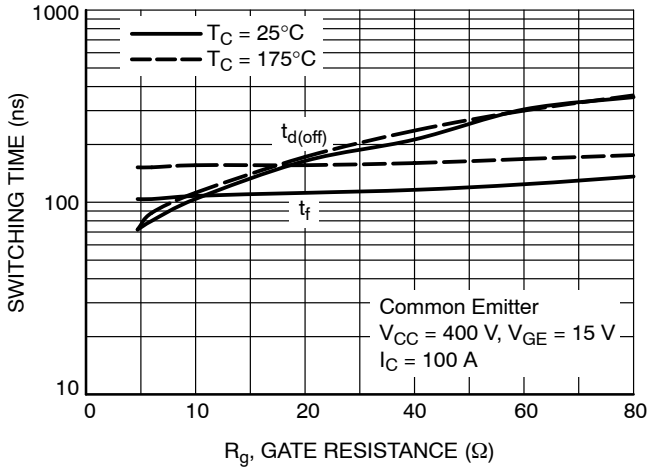


Figure 13. Turn−Off Characteristics vs. Gate Resistance

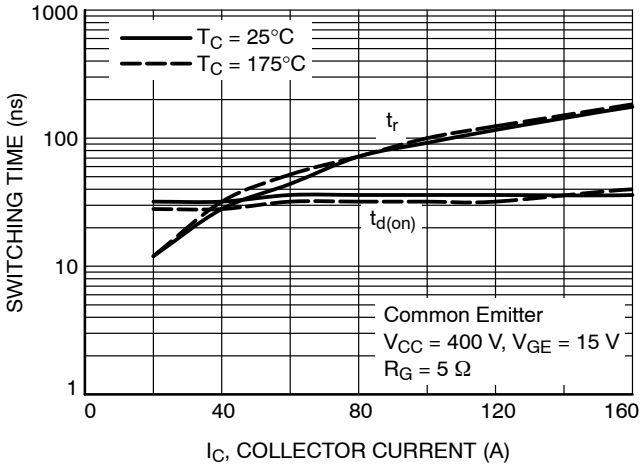


Figure 14. Turn−On Characteristics vs. Collector Current

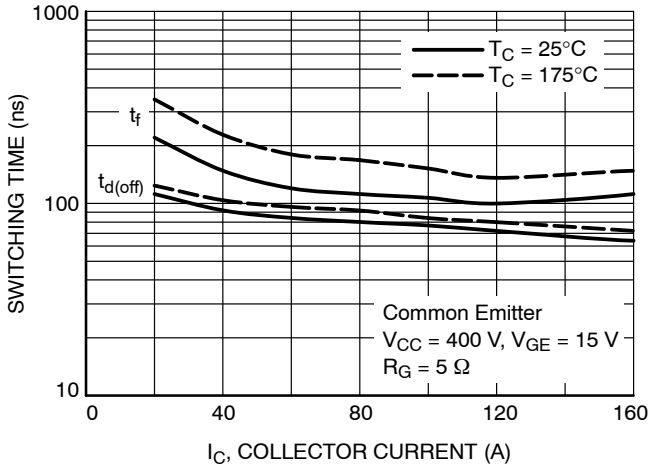


Figure 15. Turn−Off Characteristics vs. Collector Current

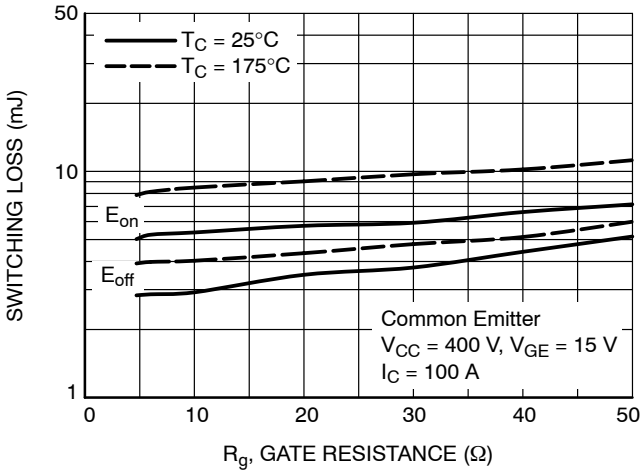


Figure 16. Switching Loss vs. Gate Resistance

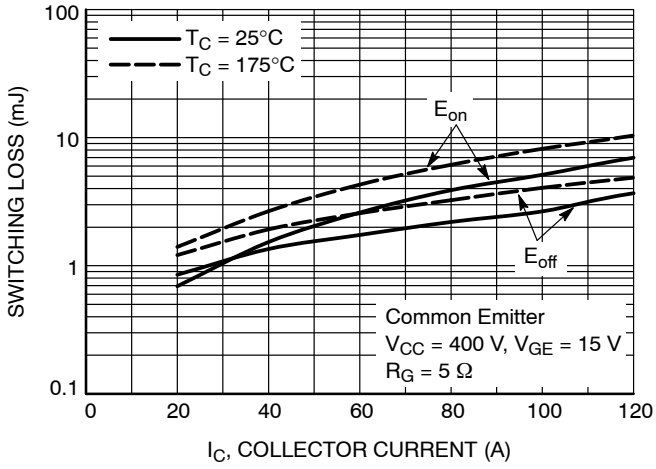


Figure 17. Switching Loss vs. Collector Current

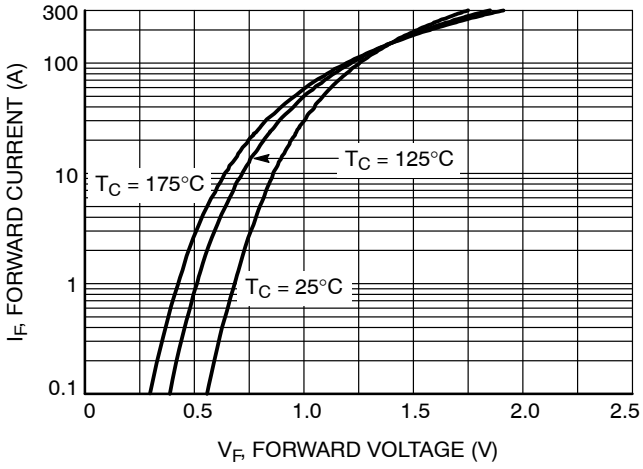


Figure 18. Forward Characteristics

TYPICAL CHARACTERISTICS

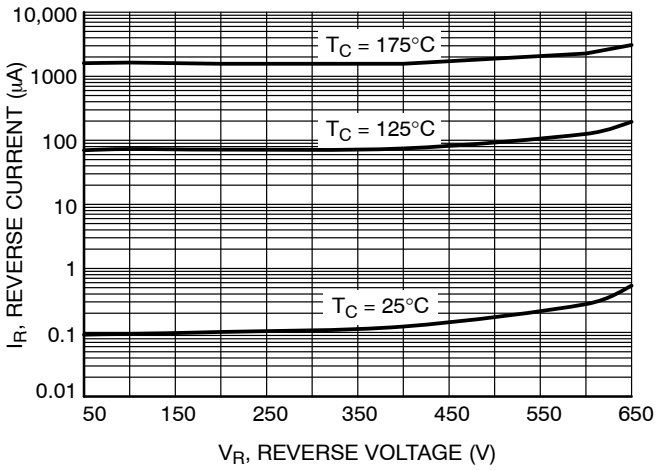


Figure 19. Reverse Current

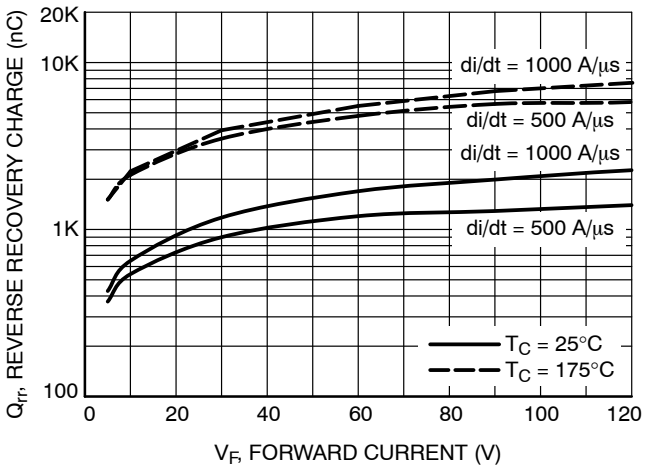


Figure 20. Stored Charge

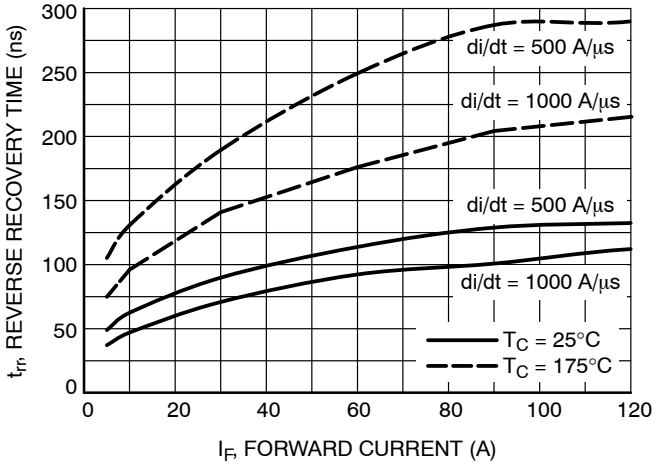


Figure 21. Reverse Recovery Time

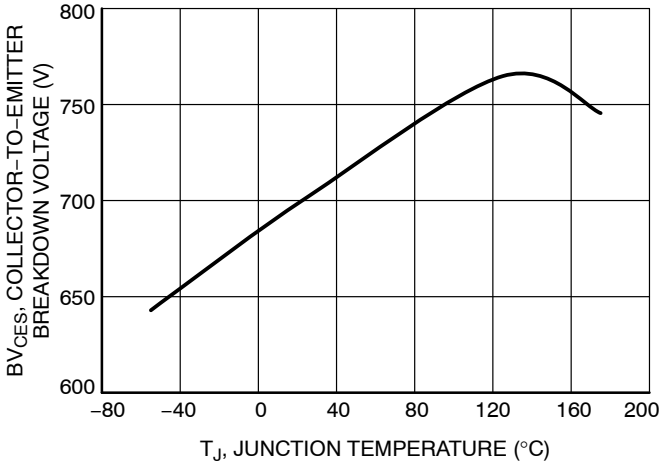


Figure 22. Collector−to−Emitter Breakdown Voltage vs. Junction Temperature

TYPICAL CHARACTERISTICS

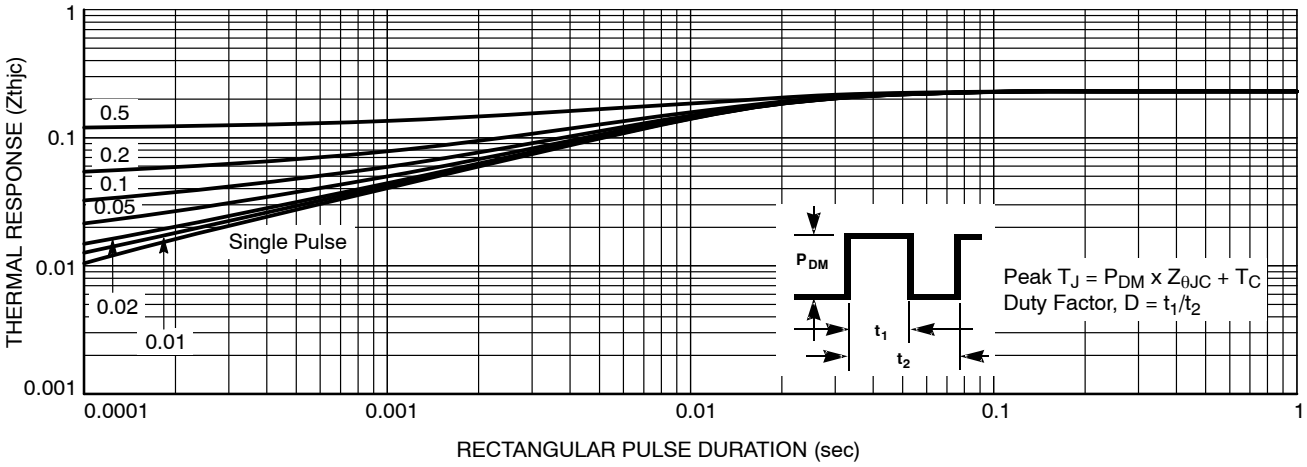


Figure 23. Transient Thermal Impedance of IGBT

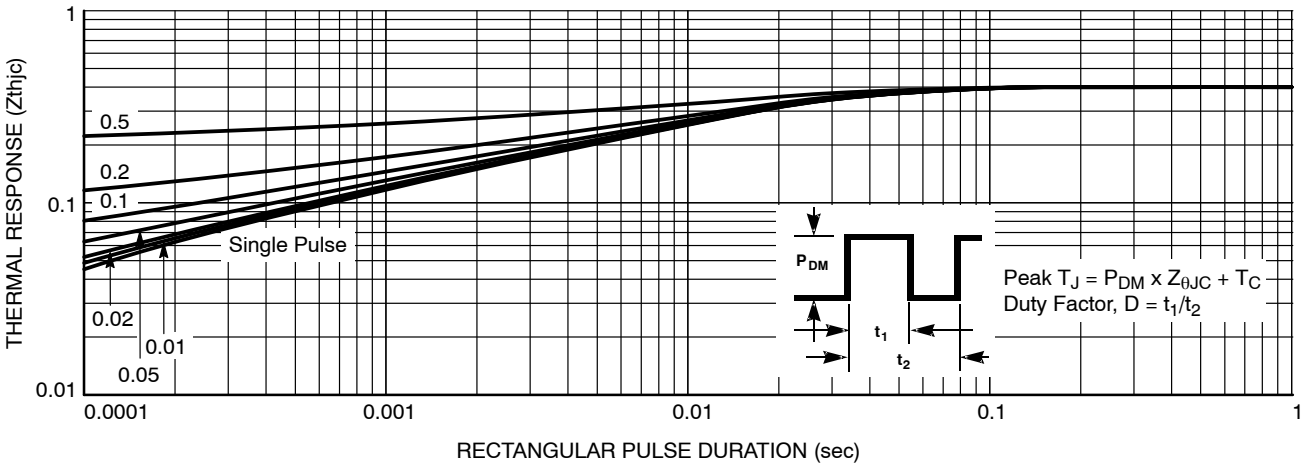
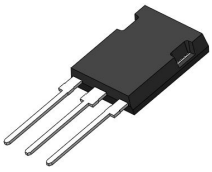


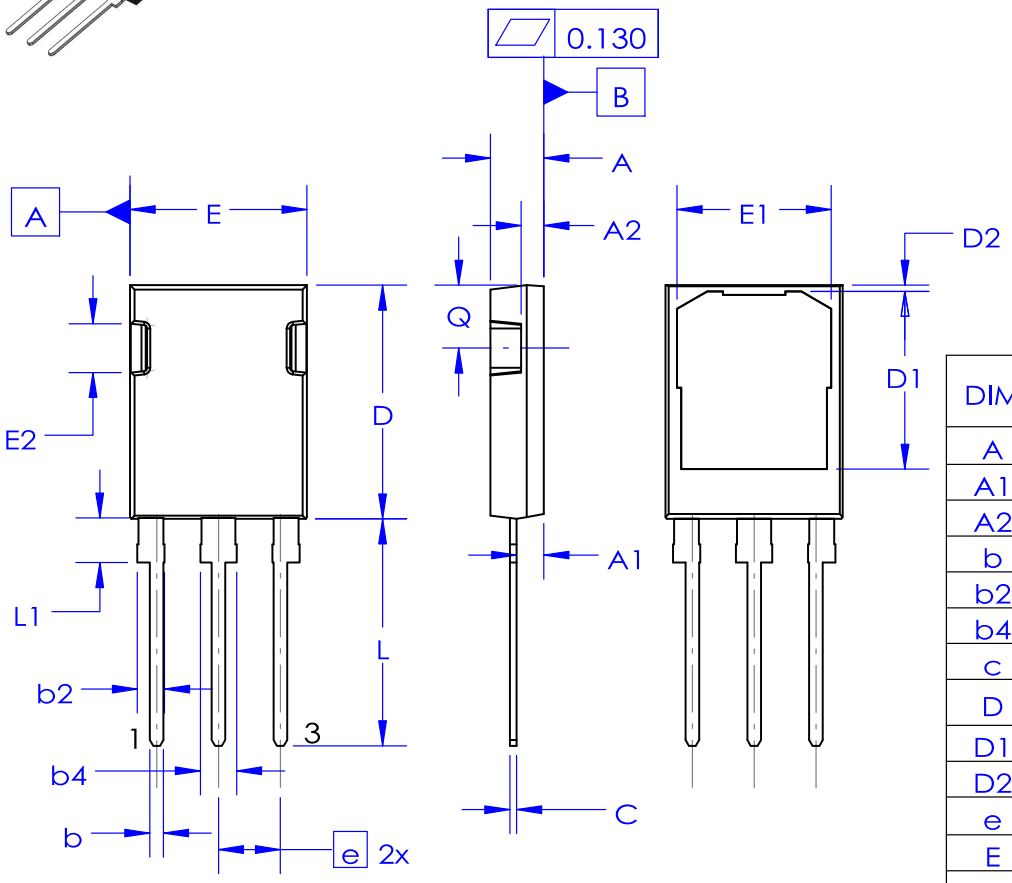
Figure 24. Transient Thermal Impedance of Diode

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS



TO−247−3LD
CASE 340CU
ISSUE B

DATE 28 OCT 2021

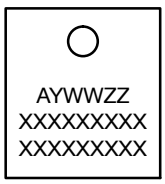


DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.60	4.70	4.80
A1	2.10	2.40	2.70
A2	1.70	2.00	2.30
b	1.16	1.20	1.26
b2	2.20	2.40	2.60
b4	3.00	3.20	3.40
c	0.59	0.60	0.66
D	20.40	20.60	20.80
D1	15.47	15.67	15.87
D2	0.25	0.55	0.85
e	5.45 BSC		
E	15.40	15.60	15.80
E1	13.40	13.60	13.80
E2	4.12	4.30	4.52
L	19.70	20.00	20.30
L1	3.65	3.85	4.05
Q	5.35	5.55	5.75

NOTES:

A. NO INDUSTRY STANDARS APPLIES TO THIS PACKAGE.
B. ALL DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
D. DRAWING CONFORMS TO ASME Y14.5-2009.

GENERIC MARKING DIAGRAM*



XXXX = Specific Device Code
A = Assembly Site Code
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:	**98AON13773G**	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.

© Semiconductor Components Industries, LLC, 2018

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

◊