IGBT - Field Stop, Trench 650 V, 75 A

FGH75T65UPD-F085

Description

Using Novel Field Stop Trench IGBT Technology, ON Semiconductor's new series of Field Stop Trench IGBTs offer the optimum performance for Automotive chargers, Solar Inverter, UPS and Digital Power Generator where low conduction and switching losses are essential.

Features

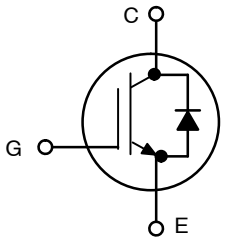
- Maximum Junction Temperature : T_J = 175°C
- Positive Temperature Co−efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(sat)}$ = 1.65 V (Typ.) @ I_C = 75 A
- High Input Impedance
- Tightened Parameter Distribution
- AEC−Q101Qualified and PPAP Capable
- This Device is Pb−Free and is RoHS Compliant

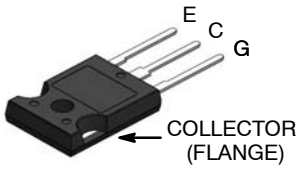
Applications

- Automotive Chargers, Converters, High Voltage Auxiliaries
- Solar Inverters, UPS, Digital Power Generator

ON Semiconductor®

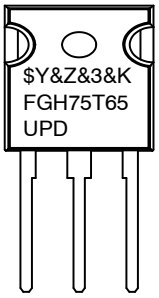
www.onsemi.com





TO−247−3LD
CASE 340CK

MARKING DIAGRAM



$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FGH75T65UPD	= Specific Device Code

ORDERING INFORMATION

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

ABSOLUTE MAXIMUM RATINGS

Description		Symbol	Ratings	Unit
Collector to Emitter Voltage		V_{CES}	650	V
Gate to Emitter Voltage		V_{GES}	±20	V
Collector Current	T_C = 25°C	I_C	150	A
	T_C = 100°C		75	A
Pulsed Collector Current		I_{CM} (Note 1)	225	A
Diode Forward Current	T_C = 25°C	I_F	75	A
	T_C = 100°C		50	A
Pulsed Diode Maximum Forward Current		I_{FM} (Note 1)	225	A
Maximum Power Dissipation	T_C = 25°C	P_D	375	W
	T_C = 100°C		187	W
Short Circuit Withstand Time	T_C = 25°C	SCWT	5	μs
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.

THERMAL CHARACTERISTICS

Parameter	Symbol	Ratings	Unit
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$ (IGBT) (Note 2)	0.4	°C/W
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$ (Diode)	0.86	°C/W
Parameter	**Symbol**	**Typ**	
Thermal Resistance, Junction−to−Ambient (PCB Mount) (Note 2)	$R_{\theta JA}$	40	°C/W

PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Mark	Package	Package Method	Reel Size	Tape Width	Quantity
FGH75T65UPD−F085	FGH75T65UPD	TO−247	Tube	−	−	30

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	−	0.65	−	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	−	−	3600	
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 = 75 mA, V_{CE} = V_{GE}	4.0	6.0	7.5	V
Collector to Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 75 A, V_{GE} = 15 V	−	1.69	2.3	V
		I_C = 75 A, V_{GE} = 15 V, T_C = 175°C	−	2.21	−	V

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ies}	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	–	5665	–	pF
Output Capacitance	C_{oes}		–	205	–	pF
Reverse Transfer Capacitance	C_{res}		–	100	–	pF
SWITCHING CHARACTERISTICS						
Turn−On Delay Time	$t_{d(on)}$	V_{CC} = 400 V, I_C = 75 A, R_G = 3 Ω, V_{GE} = 15 V, Inductive Load, T_C = 25°C	–	32	48	ns
Rise Time	t_r		–	43	71	ns
Turn−Off Delay Time	$t_{d(off)}$		–	166	216	ns
Fall Time	t_f		–	24	33	ns
Turn−On Switching Loss	E_{on}		–	2.85	4.80	mJ
Turn−Off Switching Loss	E_{off}		–	1.20	1.60	mJ
Total Switching Loss	E_{ts}		–	4.05	5.30	mJ
Turn−On Delay Time	$t_{d(on)}$	V_{CC} = 400 V, I_C = 75 A, R_G = 3 Ω, V_{GE} = 15 V, Inductive Load, T_C = 175°C	–	30	–	ns
Rise Time	t_r		–	57	–	ns
Turn−Off Delay Time	$t_{d(off)}$		–	176	–	ns
Fall Time	t_f		–	21	–	ns
Turn−On Switching Loss	E_{on}		–	4.45	–	mJ
Turn−Off Switching Loss	E_{off}		–	1.60	–	mJ
Total Switching Loss	E_{ts}		–	6.05	–	mJ
Short Circuit Withstand Time	Tsc	V_{GE} = 15 V, V_{CC} ≤ 400V, R_G = 10 Ω	5	–	–	μs
Total Gate Charge	Q_g	V_{CE} = 400 V, I_C = 75 A, V_{GE} = 15 V	–	385	578	nC
Gate to Emitter Charge	Q_{ge}		–	45	68	nC
Gate to Collector Charge	Q_{gc}		–	210	315	nC

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

Parametr	Symbol	Test Conditions		Min	Typ	Max	Unit
Diode Forward Voltage	V_{FM}	I_F = 50 A	T_C = 25°C	–	2.1	2.6	V
			T_C = 175°C	–	1.7	–	
Reverse Recovery Energy	E_{rec}	I_F = 50 A, dI_F/dt = 200 A/μs	T_C = 175°C	–	40	–	μJ
Diode Reverse Recovery Time	t_{rr}		T_C = 25°C	–	43	85	ns
			T_C = 175°C	–	162	–	
Diode Reverse Recovery Charge	Q_{rr}		T_C = 25°C	–	83	170	nC
			T_C = 175°C	–	805	–	

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.

2. Rθjc for TO−247 : according to Mil standard 883−1012 test method. Rθja 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.

TYPICAL PERFORMANCE CHARACTERISTICS

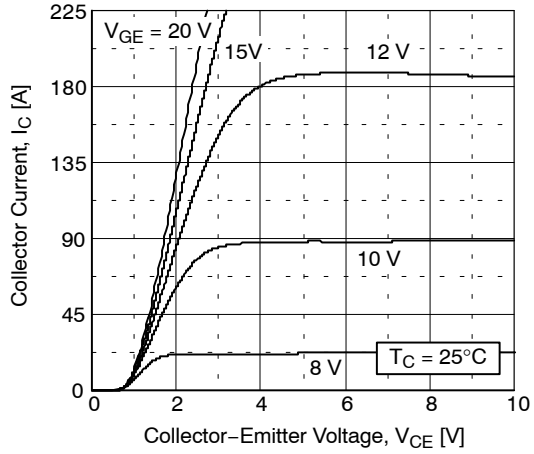


Figure 1. Typical Output Characteristics

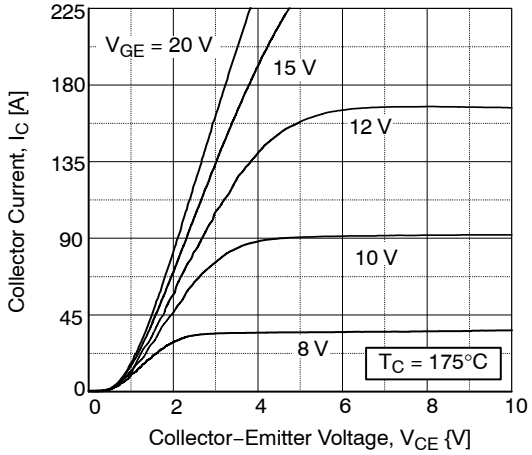


Figure 2. Typical Output Characteristics

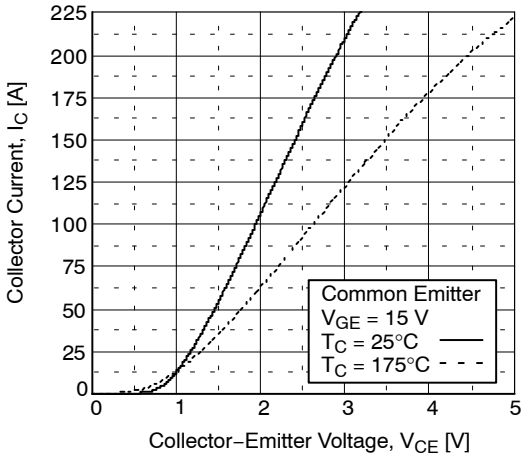


Figure 3. Typical Saturation Voltage Characteristics

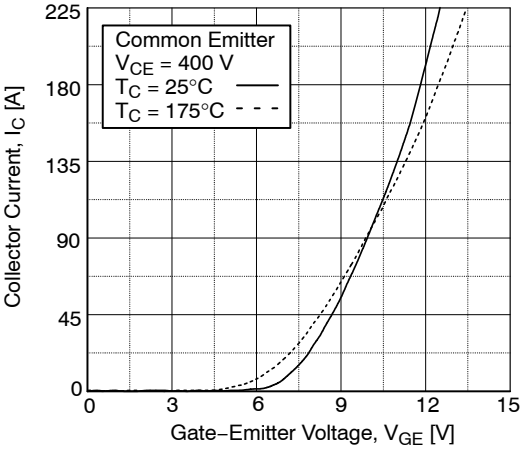


Figure 4. Transfer Characteristics

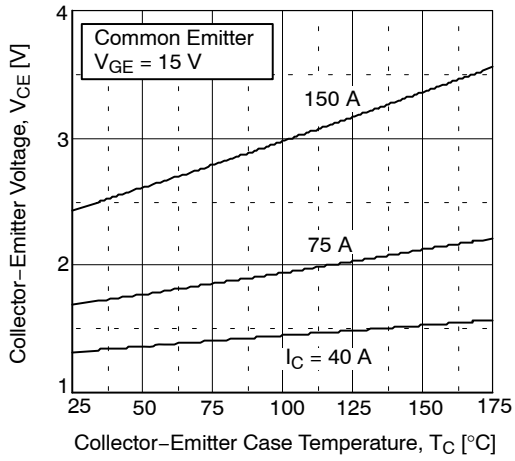


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

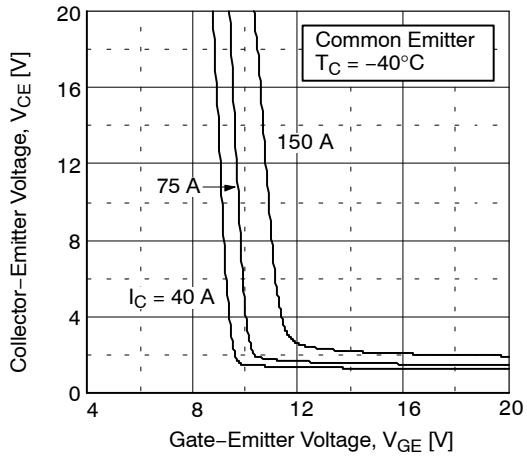


Figure 6. Saturation Voltage vs. V_{GE}

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

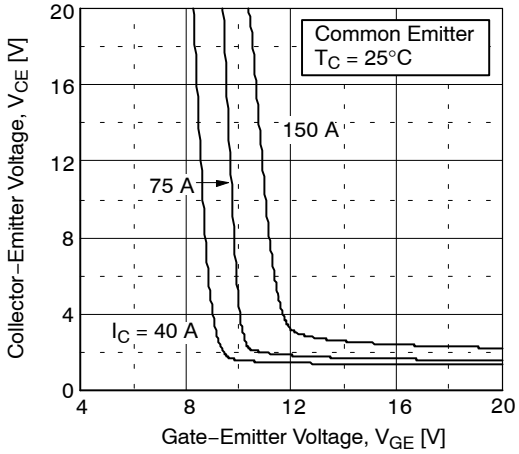


Figure 7. Saturation Voltage vs. V_{GE}

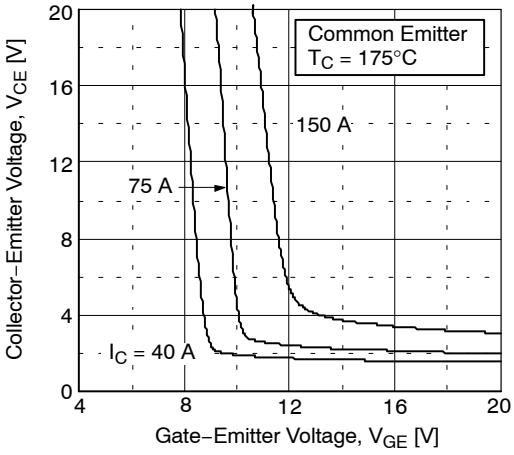


Figure 8. Saturation Voltage vs. V_{GE}

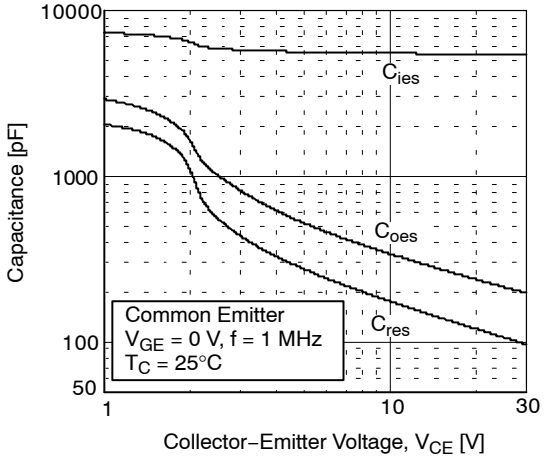


Figure 9. Capacitance Characteristics

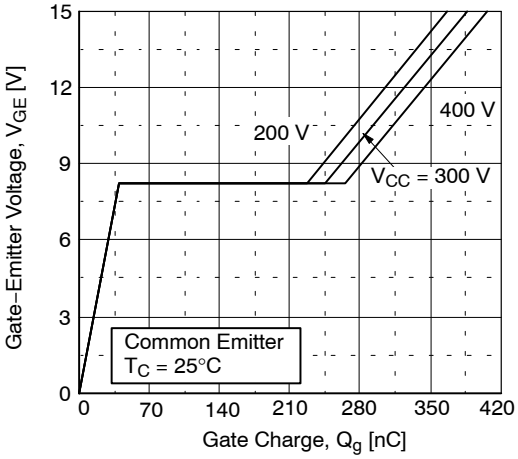


Figure 10. Gate Charge Characteristics

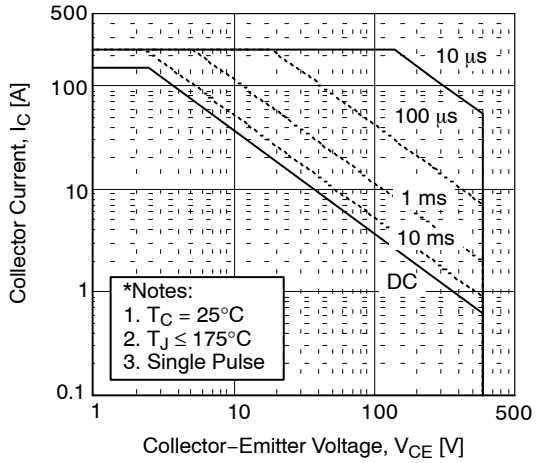


Figure 11. SOA Characteristics

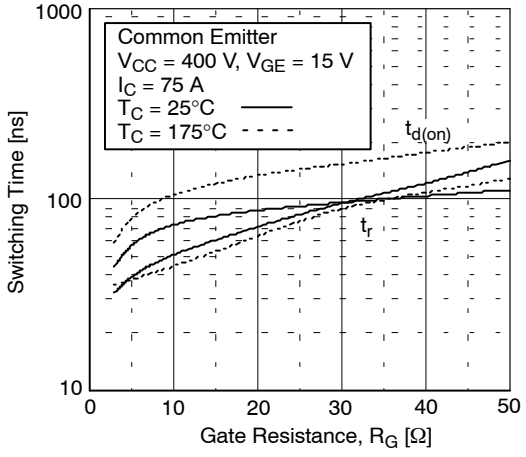


Figure 12. Turn−on Characteristics vs. Gate Resistance

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

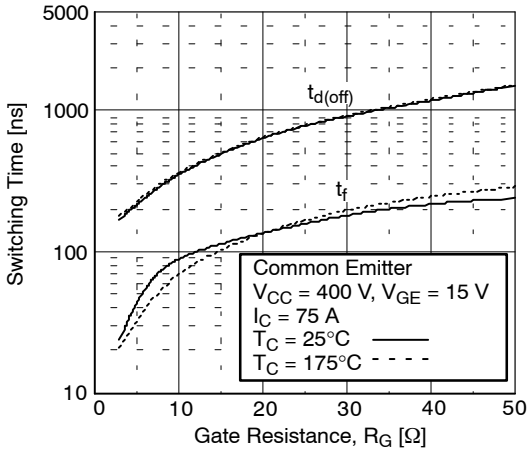


Figure 13. Turn−off Characteristics vs. Gate Resistance

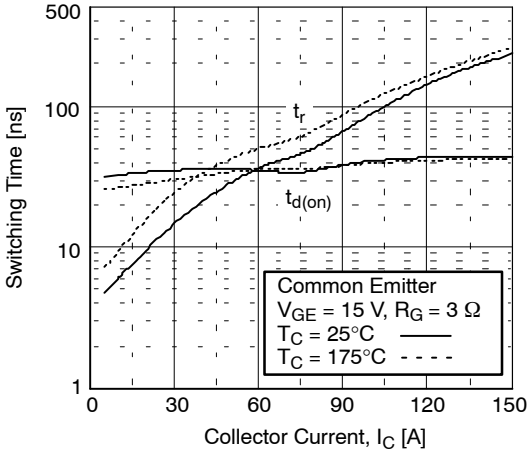


Figure 14. Turn−on Characteristics vs. Collector Current

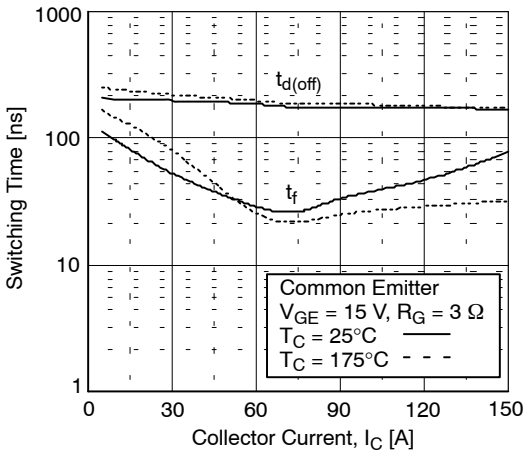


Figure 15. Turn−off Characteristics vs. Collector Current

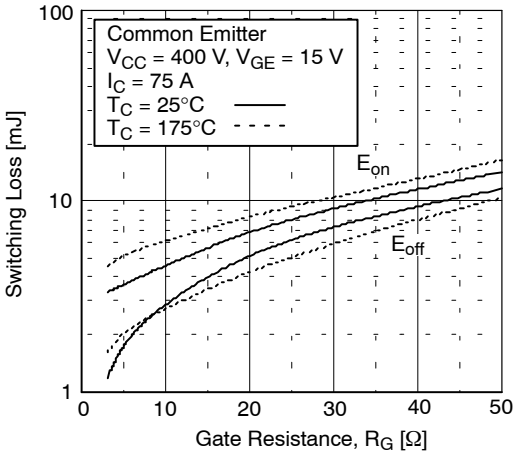


Figure 16. Switching Loss vs. Gate Resistance

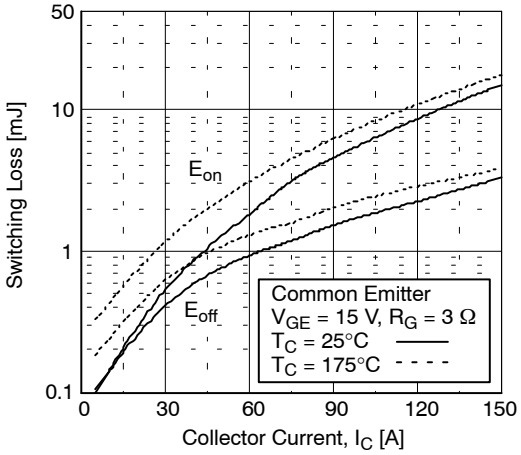


Figure 17. Switching Loss vs. Collector Current

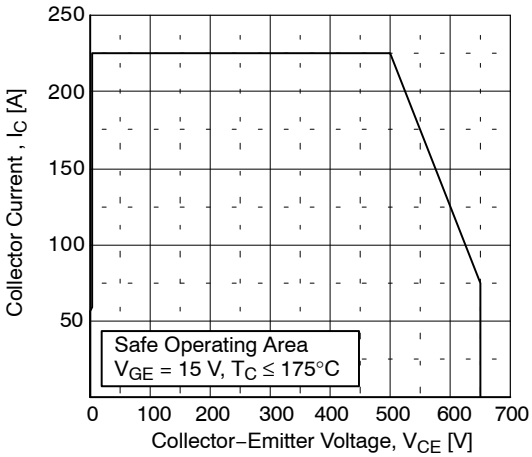


Figure 18. Turn−off Switching SOA Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

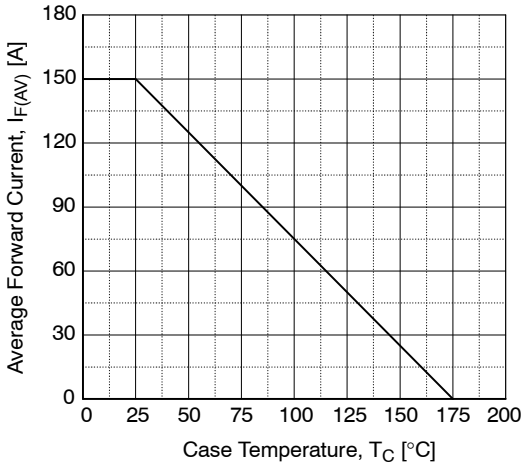


Figure 19. Current Derating

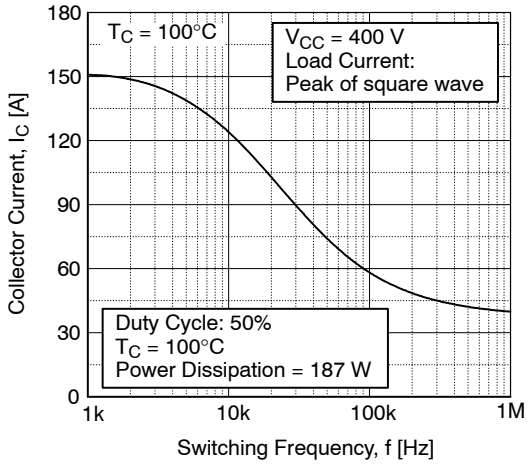


Figure 20. Load Current vs. Frequence

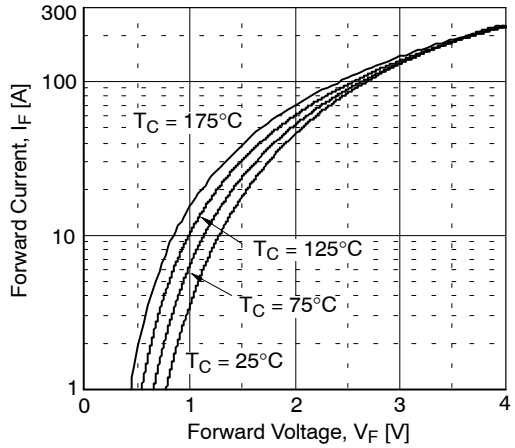


Figure 21. Forward Characteristics

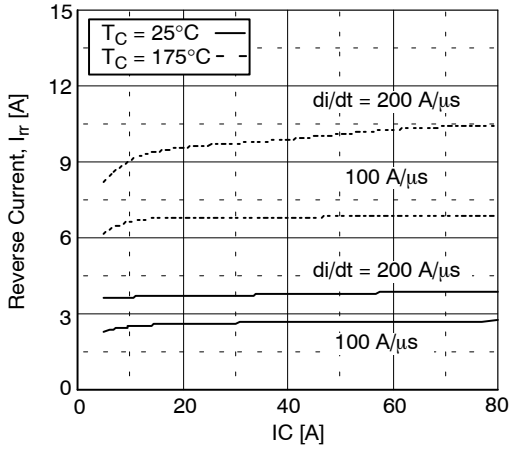


Figure 22. Reverse Recovery Time

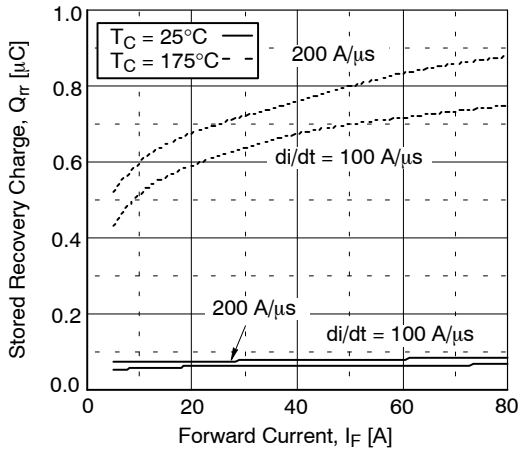


Figure 23. Stored Charge

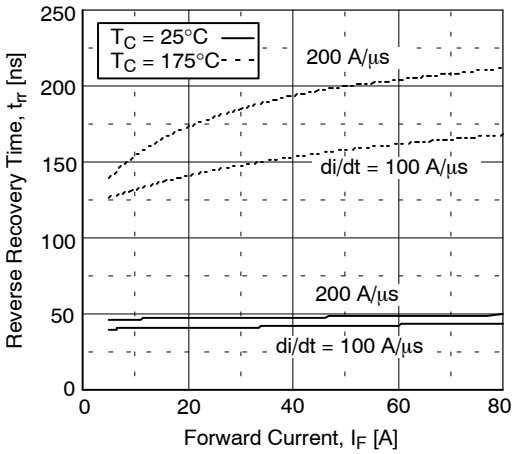


Figure 24. Reverse Recovery Time

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

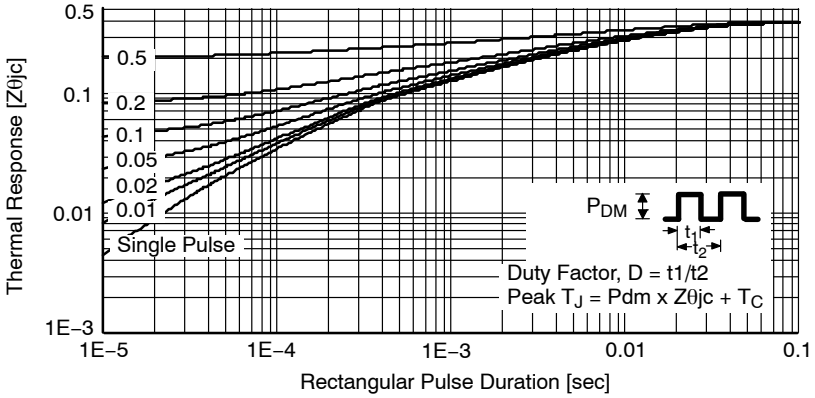


Figure 25. Transient Thermal Impedance of IGBT

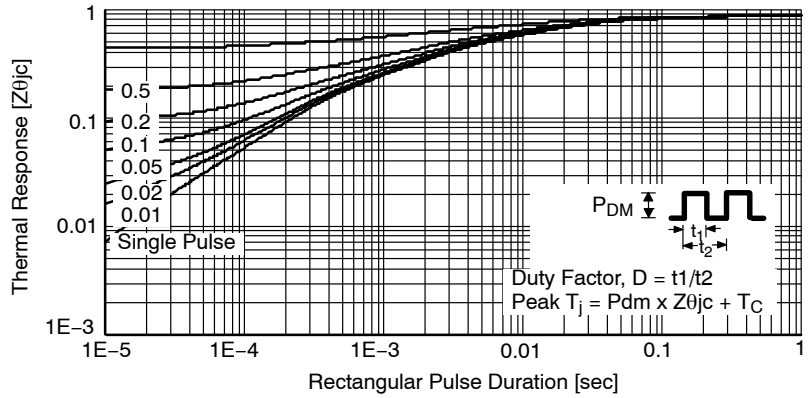


Figure 26. Transient Thermal Impedance of Diode

TO−247−3LD SHORT LEAD
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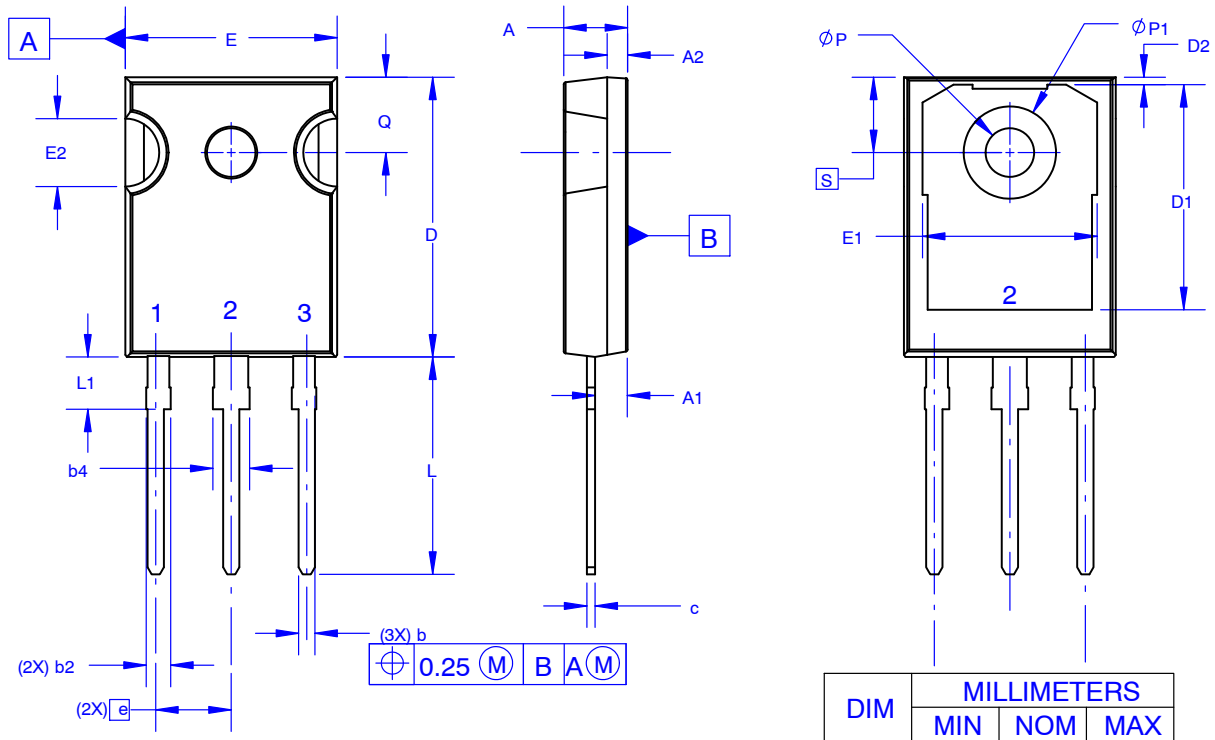
ISSUE A

DATE 31 JAN 2019

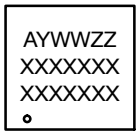


DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93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

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
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