IGBT - Field Stop, Trench 650 V, 50 A

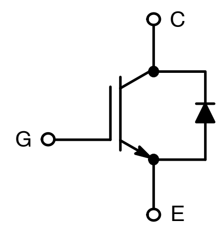
Product Preview

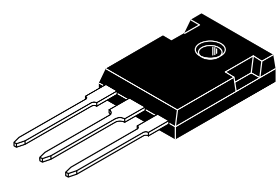
FGHL50T65SQDT

ON Semiconductor®

www.onsemi.com

50 A, 650 V
V_{CESat} = 1.47 V (Typ.)





TO−247−3LD
CASE 340CX

Using novel field stop IGBT technology, ON Semiconductor's new series of field stop 4th generation IGBTs offer the optimum performance for solar inverter, UPS, welder, telecom, ESS and PFC 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: $V_{CE(Sat)}$ = 1.47 V (Typ.) @ I_C = 50 A
- 100% of the Parts tested for I_{LM}(1)
- High Input Impedance
- Fast Switching
- Tighten Parameter Distribution
- This Device is Pb−Free and is RoHS Compliant

Typical Applications

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

Table 1. MAXIMUM RATING

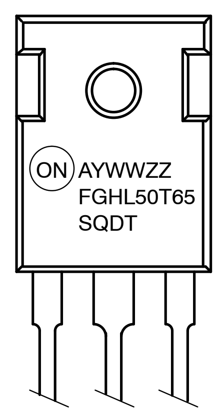
Symbol	Rating	Value	Unit
V_{CES}	Collector to Emitter Voltage	650	V
V_{GES}	Gate to Emitter Voltage Transient Gate to Emitter Voltage	±20 ±30	V
I_C	Collector Current @ T_C = 25°C @ T_C = 100°C	100 50	A
I_{LM}	Pulsed Collector Current (Note 1)	200	A
I_{CM}	Pulsed Collector Current (Note 2)	200	A
I_F	Diode Forward Current @ T_C = 25°C @ T_C = 100°C	75 50	A
I_{FM}	Pulsed Diode Maximum Forward Current	300	A
P_D	Maximum Power Dissipation @ T_C = 25°C @ T_C = 100°C	268 134	W
T_J, T_{STG}	Operating Junction / Storage Temperature Range	−55 to +175	°C
T_L	Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5 seconds	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. VCC = 400 V, VGE = 15 V, IC = 200 A, RG = 3 Ω, Inductive Load, 100% Tested
2. Repetitive rating: pulse width limited by max. Junction temperature

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

MARKING DIAGRAM



FGHL50T65SQDT = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
ZZ = Assembly Lot Number

ORDERING INFORMATION

Device	Package	Shipping
FGHL50T65SQDT	TO−247−3L	30 Units / Rail

THERMAL CHARACTERISTICS

Symbol	Rating	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, for IGBT	0.56	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max for Diode	0.65	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max	40	°C/W

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV_{CES}	Collector−emitter breakdown voltage, gate−emitter short−circuited	V_{GE} = 0 V, I_C = 1 mA	650	–	–	V
$\frac{\Delta BV_{CES}}{\Delta T_j}$	Temperature Coefficient of Breakdown Voltage	V_{GE} = 0 V, I_C = 1 mA	–	0.6	–	V/°C
I_{CES}	Collector−emitter cut−off current, gate−emitter short−circuited	V_{GE} = 0 V, V_{CE} = V_{CES}	–	–	250	μA
I_{GES}	Gate leakage current, collector−emitter short−circuited	V_{GE} = V_{GES}, V_{CE} = 0 V	–	–	±400	nA
ON CHARACTERISTICS						
$V_{GE(th)}$	Gate−emitter threshold voltage	V_{GE} = V_{CE}, I_C = 50 mA	2.6	4.5	6.4	V
$V_{CE(sat)}$	Collector−emitter saturation voltage	V_{GE} = 15 V, I_C = 50 A V_{GE} = 15 V, I_C = 50 A, T_c = 175°C	– –	1.47 1.7	2.1 –	V
DYNAMIC CHARACTERISTICS						
C_{ies}	Input capacitance	V_{CE} = 30 V, V_{GE} = 0 V, f = 1 MHz	–	3081	–	pF
C_{oes}	Output capacitance		–	136	–	
C_{res}	Reverse transfer capacitance		–	10.8	–	
SWITCHING CHARACTERISTICS, INDUCTIVE LOAD						
$t_{d(on)}$	Turn−on delay time	T_C = 25°C VCC = 400 V, IC = 12.5 A Rg = 4.7 Ω V_{GE} = 15 V Inductive Load	–	22.8	–	ns
t_r	Rise time		–	5.20	–	
$t_{d(off)}$	Turn−off delay time		–	70	–	
t_f	Fall time		–	27.20	–	
E_{on}	Turn−on switching loss		–	223	–	μJ
E_{off}	Turn−off switching loss		–	91.13	–	
E_{ts}	Total switching loss		–	314.13	–	
$t_{d(on)}$	Turn−on delay time	T_C = 25°C VCC = 400 V, IC = 25 A Rg = 4.7 Ω V_{GE} = 15 V Inductive Load	–	23.60	–	ns
t_r	Rise time		–	10.40	–	
$t_{d(off)}$	Turn−off delay time		–	66.40	–	
t_f	Fall time		–	10.20	–	
E_{on}	Turn−on switching loss		–	515.60	–	μJ
E_{off}	Turn−off switching loss		–	133	–	
E_{ts}	Total switching loss		–	648.60	–	

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS, INDUCTIVE LOAD						
$t_{d(on)}$	Turn−on delay time	T_C = 175°C VCC = 400 V, IC = 12.5 A Rg = 4.7 Ω V_{GE} = 15 V Inductive Load	–	23.60	–	ns
t_r	Rise time		–	7.20	–	
$t_{d(off)}$	Turn−off delay time		–	87	–	
t_f	Fall time		–	72	–	
E_{on}	Turn−on switching loss		–	259.20	–	μJ
E_{off}	Turn−off switching loss		–	221	–	
E_{ts}	Total switching loss		–	480.20	–	
$t_{d(on)}$	Turn−on delay time	T_C = 175°C VCC = 400 V, IC = 25 A Rg = 4.7 Ω V_{GE} = 15 V Inductive Load	–	25.60	–	ns
t_r	Rise time		–	14.80	–	
$t_{d(off)}$	Turn−off delay time		–	78	–	
t_f	Fall time		–	42	–	
E_{on}	Turn−on switching loss		–	578.90	–	μJ
E_{off}	Turn−off switching loss		–	406.80	–	
E_{ts}	Total switching loss		–	985.70	–	
Qg	Total Gate Charge	VCE = 400 V, IC = 50 A, VGE = 15 V	–	99.7	–	nC
Qge	Gate to Emitter Charge		–	18.3	–	nC
Qgc	Gate to collector Charge		–	25.90	–	nC
DIODE CHARACTERISTICS						
V_F	Forward voltage	I_F = 50 A, T_c = 25°C I_F = 50 A, T_c = 175°C	– –	2 1.6	2.6 –	V
Erec	Reverse Recovery Energy	I_F = 50 A, dI_F/dt = 200 A/μs, Tc=175°C	–	80.14	–	μJ
Trr	Diode Reverse Recovery Time	IF = 50 A, dI_F/dt = 200 A/μs IF = 50 A, dI_F/dt = 200 A/μs, Tc = 175°C	–	35.60 201	–	nS
Qrr	Diode Reverse Recovery Charge	IF = 50 A, dI_F/dt = 200 A/μs IF = 50 A, dI_F/dt = 200 A/μs, Tc = 175°C	–	66.22 1135.65	–	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.

TYPICAL CHARACTERISTICS

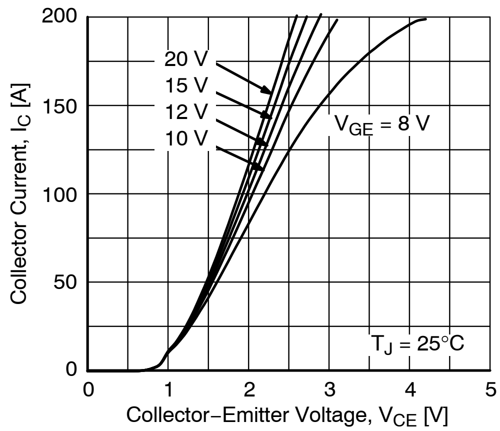


Figure 1. Typical Output Characteristics (T_J = 25°C)

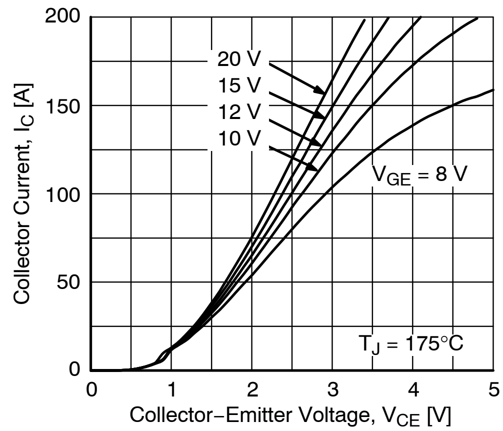


Figure 2. Typical Output Characteristics (T_J = 175°C)

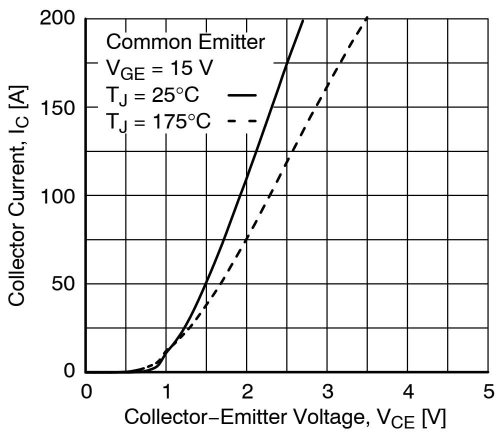


Figure 3. Typical Saturation Voltage Characteristics

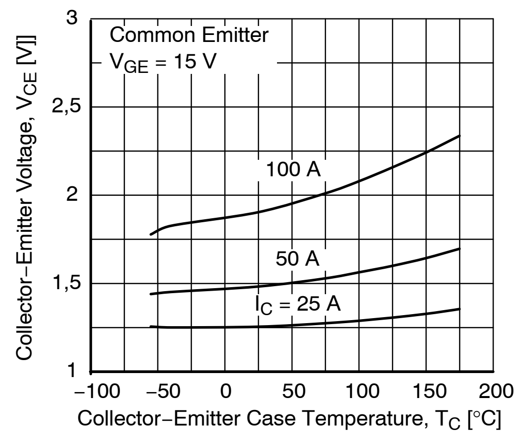


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

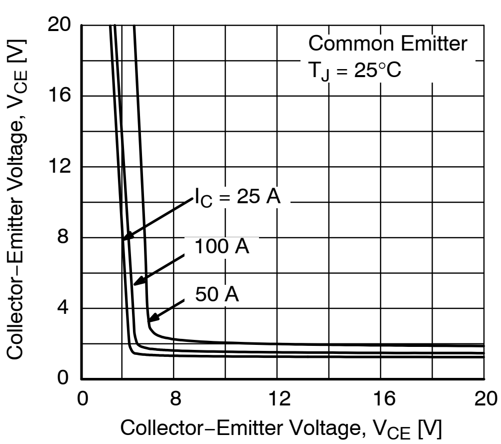


Figure 5. Saturation Voltage vs. V_{GE} (T_J = 25°C)

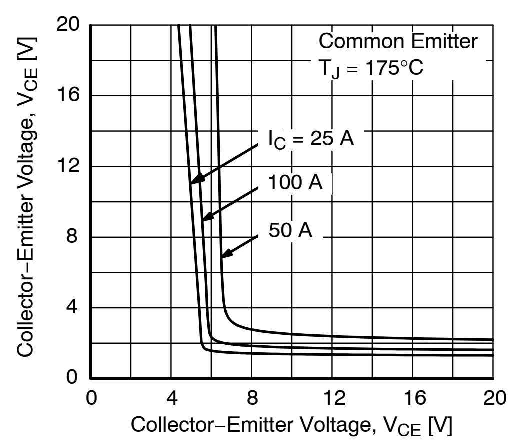


Figure 6. Saturation Voltage vs. V_{GE} (T_J = 175°C)

TYPICAL CHARACTERISTICS (continued)

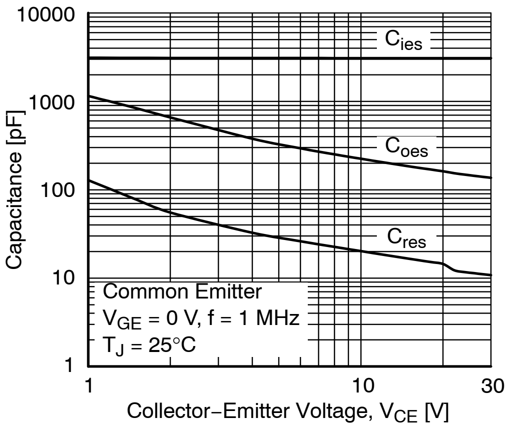


Figure 7. Capacitance Characteristics

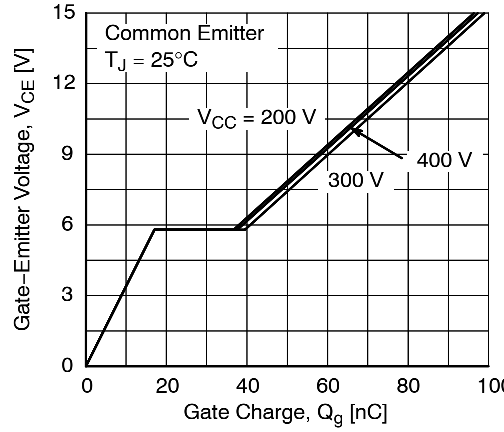


Figure 8. Gate Charge Characteristic

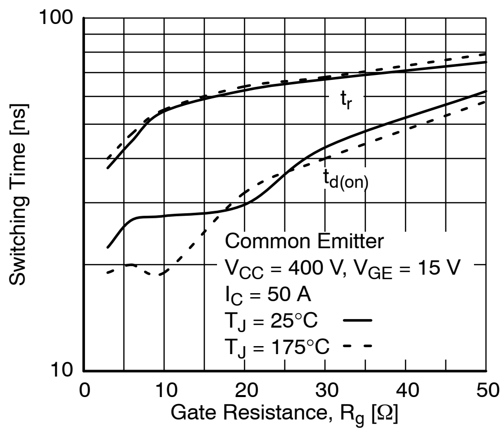


Figure 9. Turn−on Characteristics vs. Gate Resistance

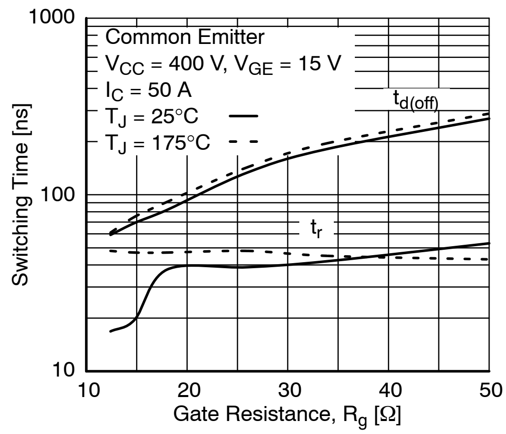


Figure 10. Turn−Off Characteristics vs. Gate Resistance

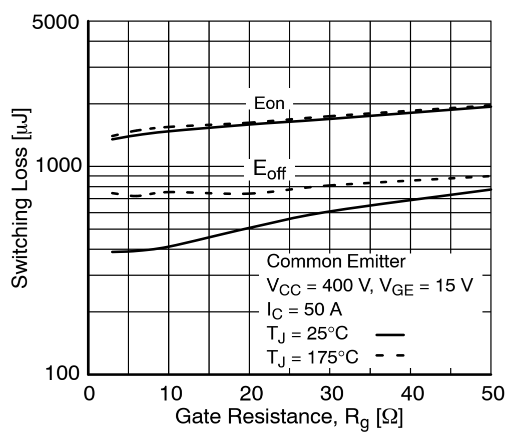


Figure 11. Switching Loss vs Gate Resistance

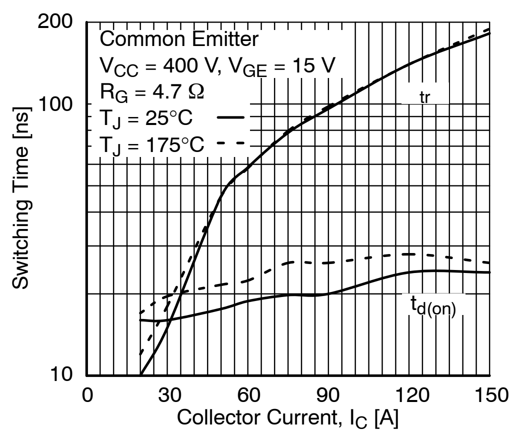


Figure 12. Turn−On Characteristics vs. Collector Current

TYPICAL CHARACTERISTICS (continued)

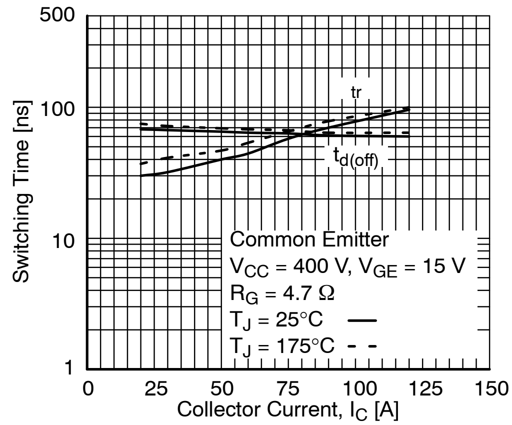


Figure 13. Turn−Off Characteristics vs. Collector Current

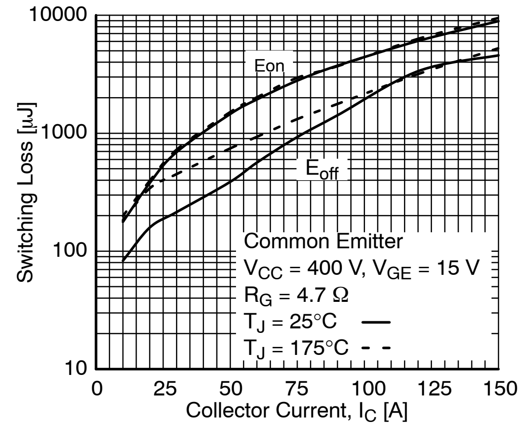


Figure 14. Switching Loss vs. Collector Current

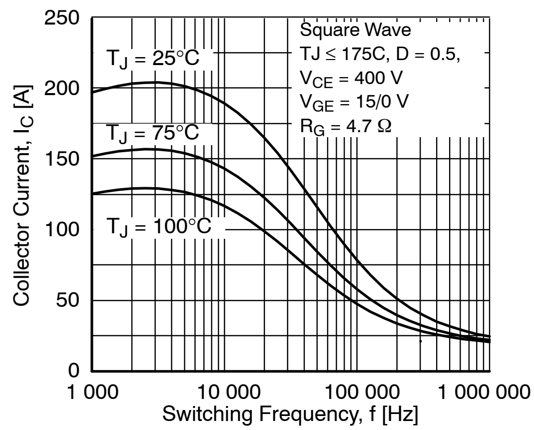


Figure 15. Load Current vs. Frequency

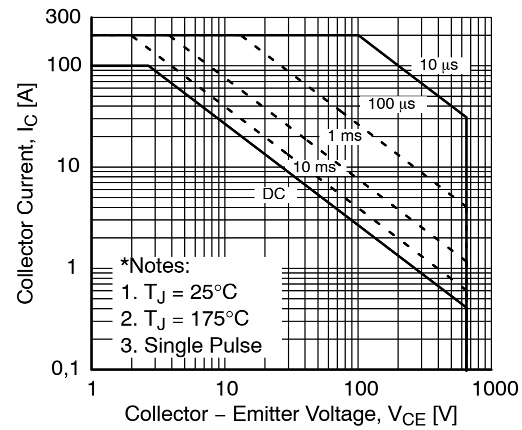


Figure 16. SOA Characteristics (FBSOA)

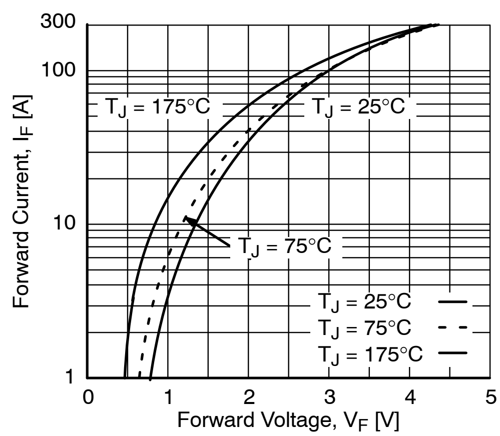


Figure 17. Forward Characteristics

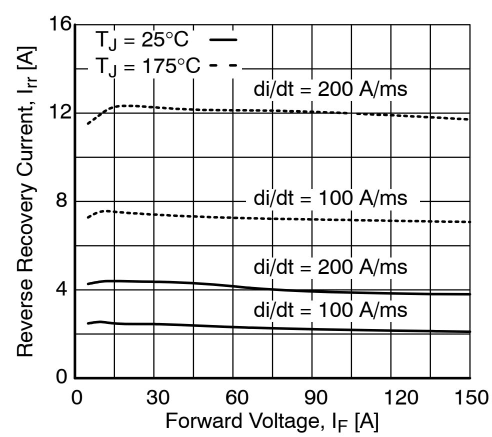


Figure 18. Reverse Recover Current

TYPICAL CHARACTERISTICS (continued)

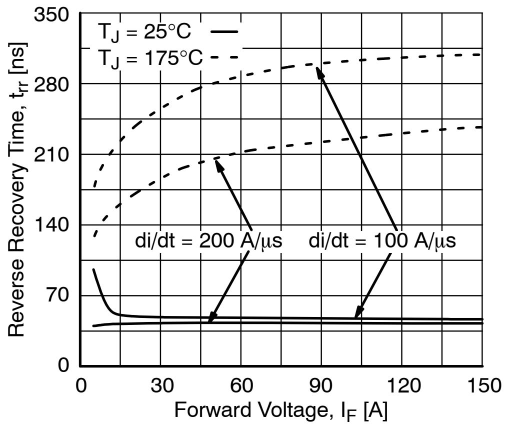


Figure 19. Reverse Recovery Time

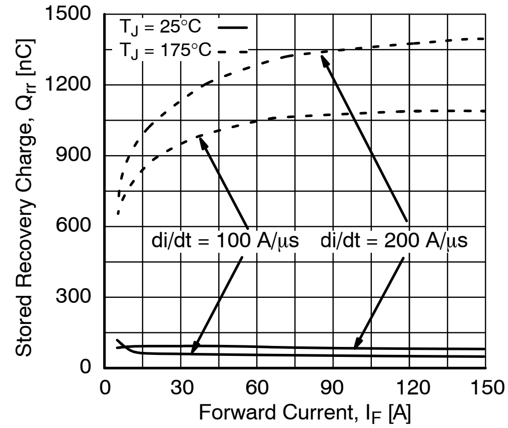


Figure 20. Stored Charge

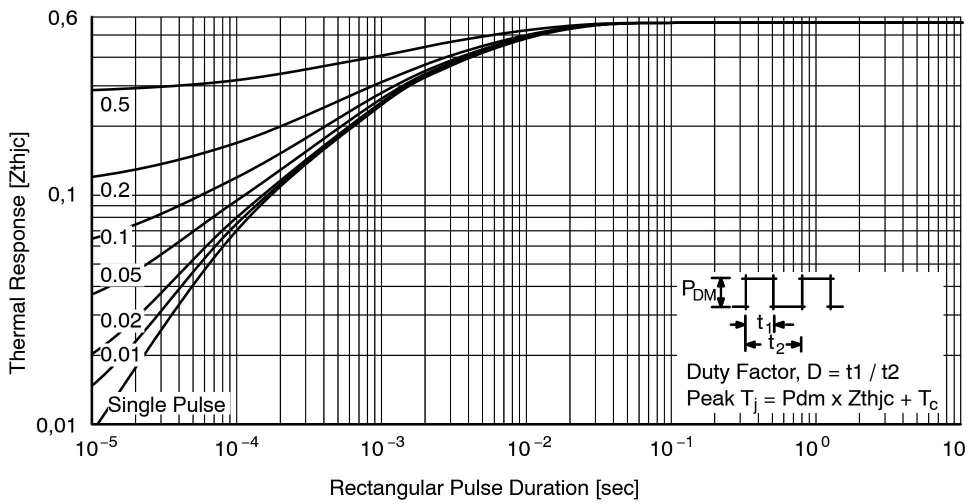


Figure 21. Transient Thermal Impedance of IGBT

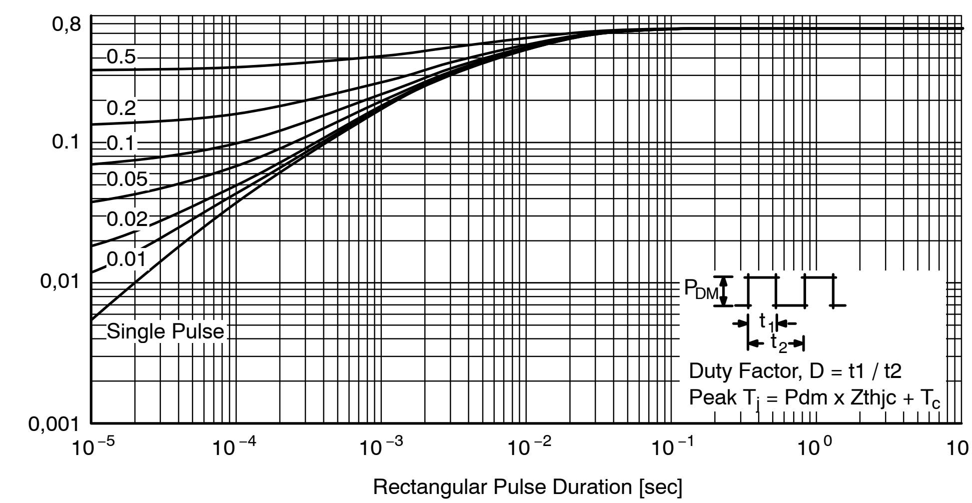
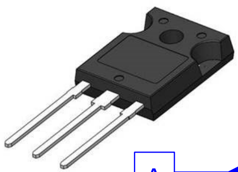
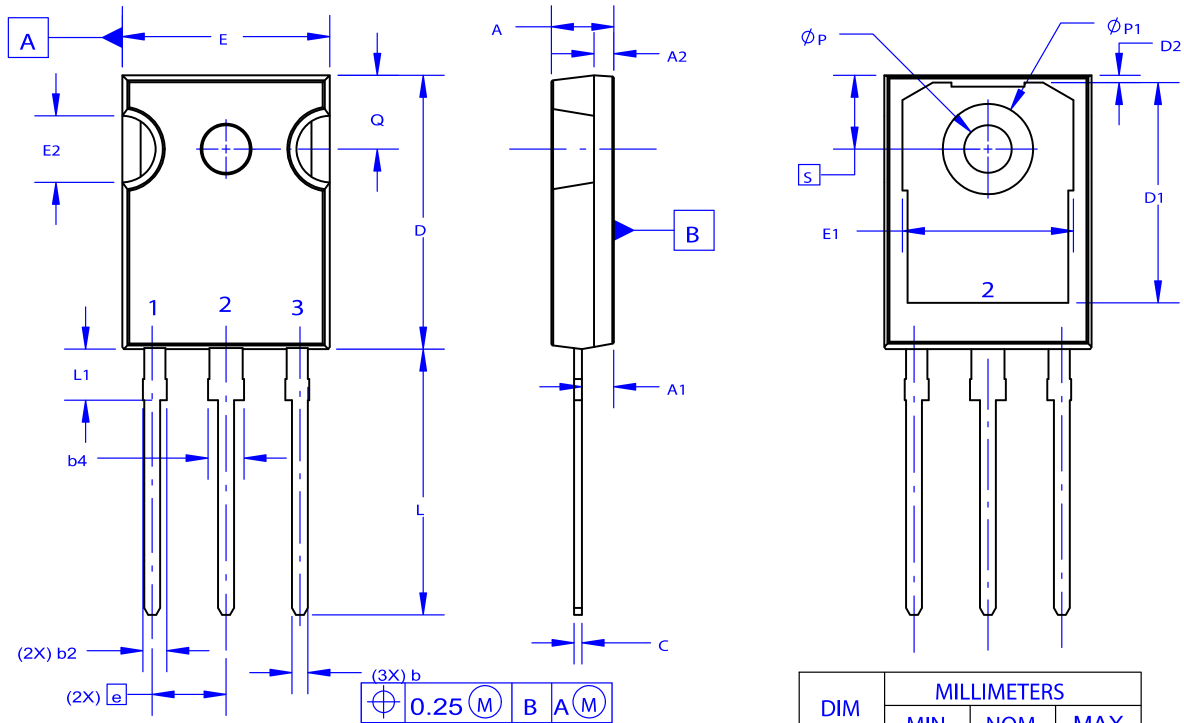


Figure 22. Transient Thermal Impedance of Diode



TO−247−3LD
CASE 340CX
ISSUE A

DATE 06 JUL 2020

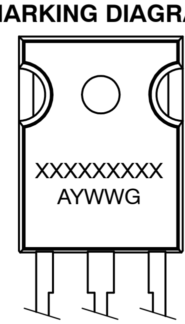


NOTES: UNLESS OTHERWISE SPECIFIED.

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.

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