

ENGAFGHL50T65SQDC

Product Preview

Field Stop Trench IGBT 650 V, 50 A, TO-247

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit	
Collector-to-Emitter Voltage	V_{CES}	650	V	
Gate-to-Emitter Voltage	V_{GES}	± 20	V	
Continuous Collector Current $R_{\theta JC}$	I_{CC}	$T_C = 25^\circ\text{C}$	88.7	A
		$T_C = 100^\circ\text{C}$	62.7	
Power Dissipation $R_{\theta JC}$	P_{DC}	$T_C = 25^\circ\text{C}$	467	W
		$T_C = 100^\circ\text{C}$	233	
Continuous Collector Current $R_{\theta JA}$	I_{CA}	$T_A = 25^\circ\text{C}$	TBD	A
		$T_A = 100^\circ\text{C}$	TBD	
Power Dissipation $R_{\theta JA}$	P_{DA}	$T_A = 25^\circ\text{C}$	TBD	W
		$T_A = 100^\circ\text{C}$	TBD	
Pulsed Collector Current $R_{\theta JC}$	I_{LM}	1170	A	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +175	$^\circ\text{C}$	
Continuous Diode Forward Current $R_{\theta JC}$	I_F	$T_C = 25^\circ\text{C}$	102	A
		$T_C = 100^\circ\text{C}$	40.7	
Pulsed Diode Forward Current $R_{\theta JC}$	I_{fmc}	405	A	
Single Pulse Avalanche Energy ($T_J = 25^\circ\text{C}$, $V_G = 20\text{ V}$, $I_{L(pk)} = 1\text{ A}$, $L = 0.1\text{ mH}$, $R_G = 25\ \Omega$)	E_{AS}	TBD	mJ	
Lead Temperature for Soldering Purposes	T_L	TBD	$^\circ\text{C}$	

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.

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case	$R_{\theta JC}$	0.32	$^\circ\text{C/W}$
Junction-to-Case	$R_{\theta JCD}$	0.75	
Junction-to-Ambient	$R_{\theta JA}$	TBD	

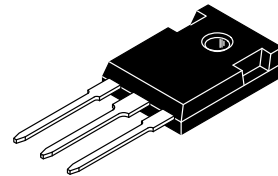
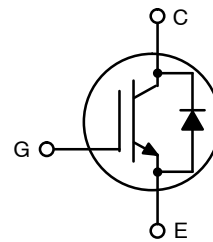
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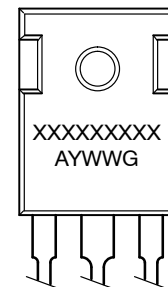
www.onsemi.com

BV_{CES}	$V_{CE(sat)}$	I_C
650 V	1.7 V	50 A



TO-247
COPACK IGBT
CASE 340L

MARKING DIAGRAM



XXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
G = Pb-Free Package

ORDERING INFORMATION

Device	Package	Shipping†
ENGAFGHL50T65SQDC	TO-247	30 Units / Rail

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

ENGAFGHL50T65SQDC

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-to-Emitter Breakdown Voltage	BVCES	$V_G = 0\text{ V}, I_C = 0.18\text{ A}, T_C = 25^\circ\text{C}$	650	-	-	V
Collector-to-Emitter Breakdown Voltage Temperature Coefficient	BVCES _{TCV}	$V_G = 0\text{ V}, I_C = 0.18\text{ A}, T_{J(\text{max})} = 175^\circ\text{C}$	-	0.56	-	V/°C
Zero Gate Voltage Collector Current	I _{CES}	$T_C = 25^\circ\text{C}$	-	-	TBD	μA
		$T_C = 175^\circ\text{C}$	-	-	TBD	
Gate-to-Emitter Leakage Current	I _{GES}	$V_G = 20\text{ V}, V_C = 0\text{ V}$	-	-	TBD	

ON CHARACTERISTICS

Gate Threshold Voltage	V _{GS(TH)}	$V_G = V_C, I_C = 0.05\text{ A}$	-	4.39	-	V
Gate Threshold Voltage Temperature Coefficient	V _{GS(TH)/T_J}		-	-6.79	-	mV/°C
Collector-to-Emitter Saturation Voltage	V _{CE(sat)}	$V_G = 15.0\text{ V}, I_C = 49.7\text{ A}, T_J = 25^\circ\text{C}$	-	1.70	-	V
		$V_G = 15.0\text{ V}, I_C = 49.7\text{ A}, T_J = 175^\circ\text{C}$	-	2.04	-	

CHARGES, CAPACITANCES & GATE RESISTANCE

Gate Resistance	R _G	$V_G = 0\text{ V}, V_C = 325\text{ V}$	-	1.64	-	Ω
Input Capacitance	C _{IES}		-	3154	-	pF
Reverse Transfer Capacitance	C _{RES}		-	9.19	-	
Output Capacitance	C _{OES}		-	156	-	
Total Gate Charge	Q _{G(TOT)}	$V_C = 520\text{ V}, I_C = 24.9\text{ A}, V_G = 20\text{ V}$	-	132	-	nC
Gate-to-Emitter Charge	Q _{GE}		-	17.6	-	
Gate-to-Collector Charge	Q _{GC}		-	19.5	-	

SWITCHING CHARACTERISTICS

Turn-On Delay Time	t _{d(on)}	$V_G = 0/20\text{ V}, I_D = 49.8\text{ A}, V_D = 520\text{ V}, R_G = 4.7\text{ }\Omega, T_C = 25^\circ\text{C}$	-	29.5	-	ns
Turn-Off Delay Time	t _{d(off)}		-	73.2	-	
Rise Time	t _r		-	7.04	-	
Fall Time	t _f		-	12.8	-	mJ
Turn-On Switching Loss	E _{on}		-	0.46	-	
Turn-Off Switching Loss	E _{off}		-	0.51	-	
Total Switching Loss	E _{tot}		-	0.97	-	
Turn-On Delay Time	t _{d(on)}	$V_G = 0/20\text{ V}, I_D = 49.8\text{ A}, V_D = 520\text{ V}, R_G = 4.7\text{ }\Omega, T_C = 175^\circ\text{C}$	-	29.3	-	ns
Turn-Off Delay Time	t _{d(off)}		-	85.8	-	
Rise Time	t _r		-	7.46	-	
Fall Time	t _f		-	14.7	-	mJ
Turn-On Switching Loss	E _{on}		-	0.47	-	
Turn-Off Switching Loss	E _{off}		-	0.60	-	
Total Switching Loss	E _{tot}		-	1.07	-	

ENGAFGHL50T65SQDC

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(on)}$	$V_G = 0/20\text{ V}, I_D = 24.9\text{ A},$ $V_D = 520\text{ V}, R_G = 4.7\ \Omega,$ $T_C = 25^\circ\text{C}$	-	19.9	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	77.5	-	
Rise Time	t_r		-	7.04	-	
Fall Time	t_f		-	13.9	-	
Turn-On Switching Loss	E_{on}		-	0.19	-	mJ
Turn-Off Switching Loss	E_{off}		-	0.12	-	
Total Switching Loss	E_{tot}		-	0.31	-	
Turn-On Delay Time	$t_{d(on)}$	$V_G = 0/20\text{ V}, I_D = 24.9\text{ A},$ $V_D = 520\text{ V}, R_G = 4.7\ \Omega,$ $T_C = 175^\circ\text{C}$	-	19.9	-	ns
Turn-Off Delay Time	$t_{d(off)}$		-	92.4	-	
Rise Time	t_r		-	7.42	-	
Fall Time	t_f		-	16.2	-	
Turn-On Switching Loss	E_{on}		-	0.19	-	mJ
Turn-Off Switching Loss	E_{off}		-	0.15	-	
Total Switching Loss	E_{tot}		-	0.34	-	

SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Reverse Recovery Time	t_{RR}	$I_D = 49.8\text{ A}, di/dt = 200\text{ A}/\mu\text{s},$ $V_{DS} = 520\text{ V}, V_{GS} = 0/20\text{ V},$ $T_C = 25^\circ\text{C}$	-	253	-	ns
Reverse Recovery Charge	Q_{RR}		-	60.8	-	nC
Reverse Recovery Energy	E_{REC}		-	4.06	-	μJ
Peak Reverse Recovery Current	I_{RRM}		-	1.44	-	A
Reverse Recovery Time	t_{RR}	$I_D = 49.8\text{ A}, di/dt = 200\text{ A}/\mu\text{s},$ $V_{DS} = 520\text{ V}, V_{GS} = 0/20\text{ V},$ $T_C = 175^\circ\text{C}$	-	474	-	ns
Reverse Recovery Charge	Q_{RR}		-	103	-	nC
Reverse Recovery Energy	E_{REC}		-	14.9	-	μJ
Peak Reverse Recovery Current	I_{RRM}		-	1.41	-	A

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.

ENGAFGHL50T65SQDC

TYPICAL CHARACTERISTICS

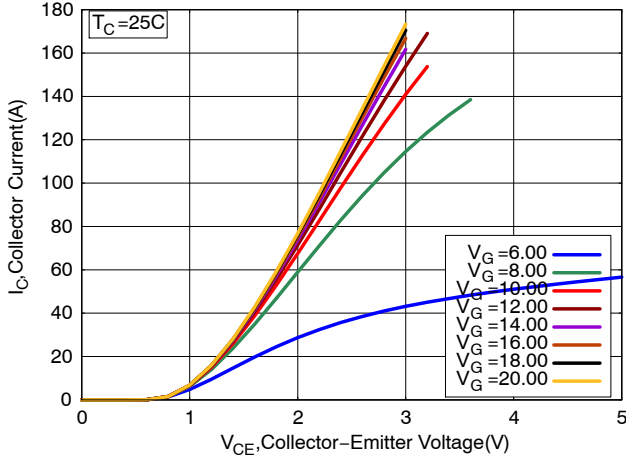


Figure 1. Typical Output Characteristics

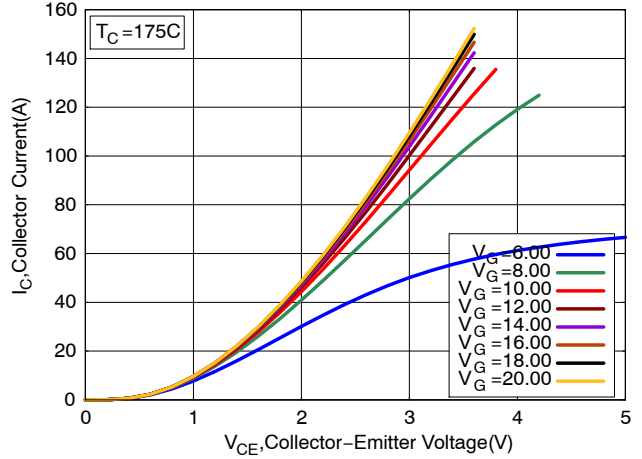


Figure 2. Typical Output Characteristics

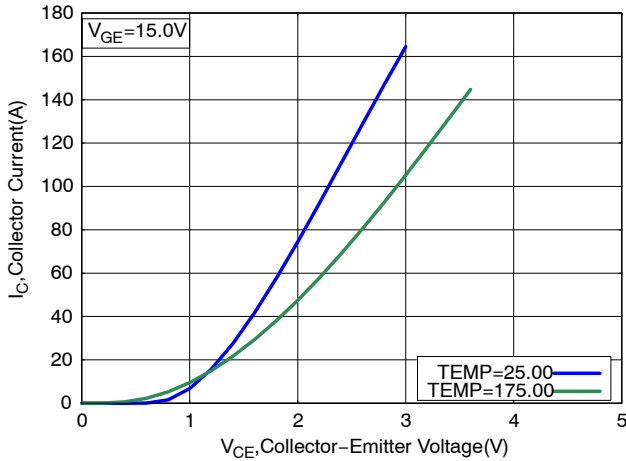


Figure 3. Typical Saturation Voltage Characteristics

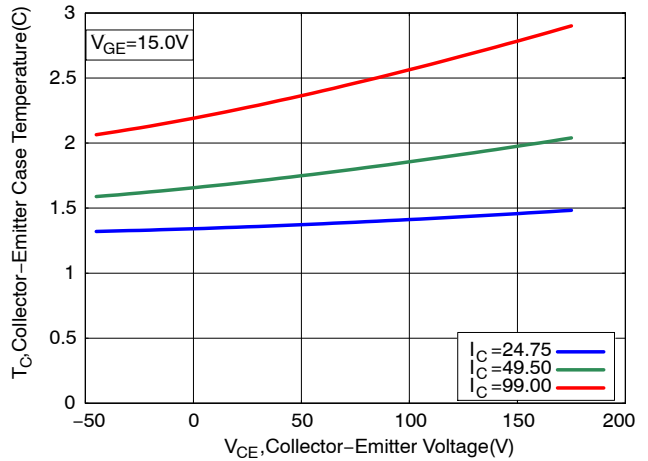


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

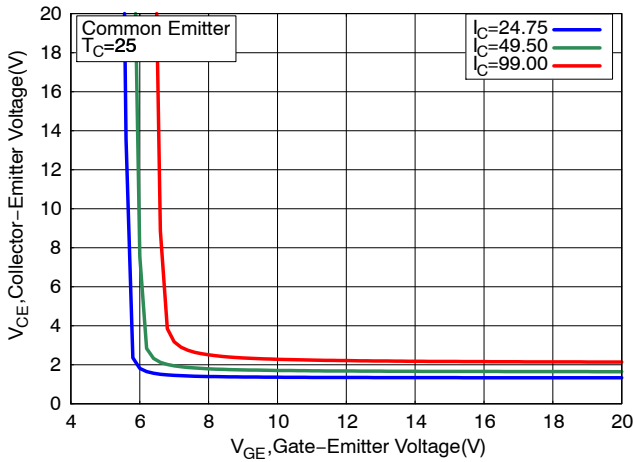


Figure 5. Saturation Voltage vs. V_{GE}

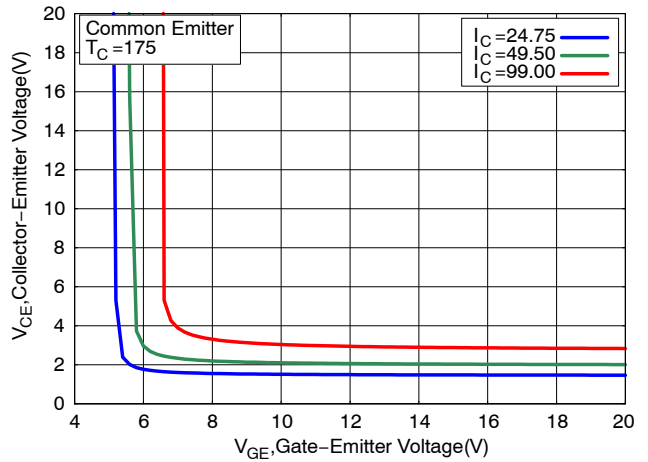


Figure 6. Saturation Voltage vs. V_{GE}

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TYPICAL CHARACTERISTICS

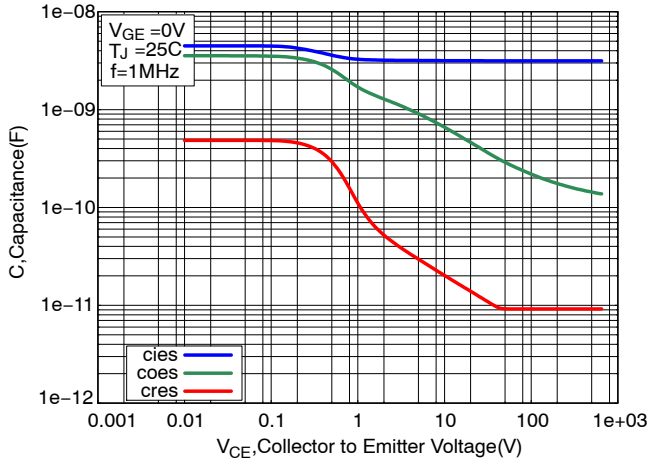


Figure 7. Capacitance Characteristics

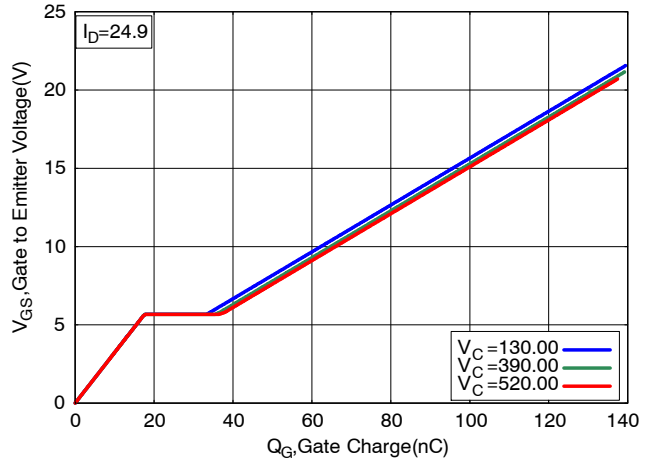


Figure 8. Gate Charge Characteristics

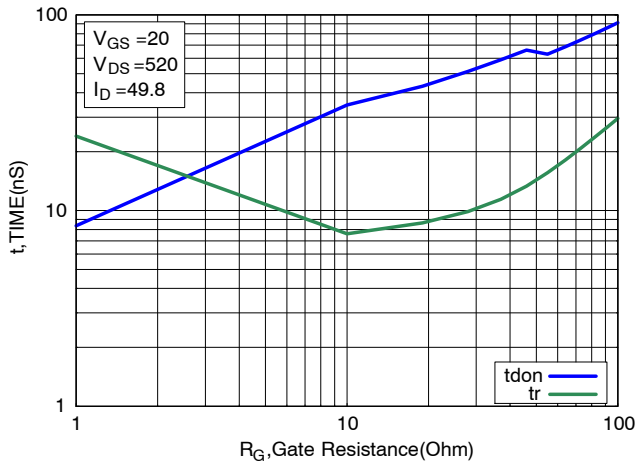


Figure 9. Turn-on Characteristics vs. Gate Resistance

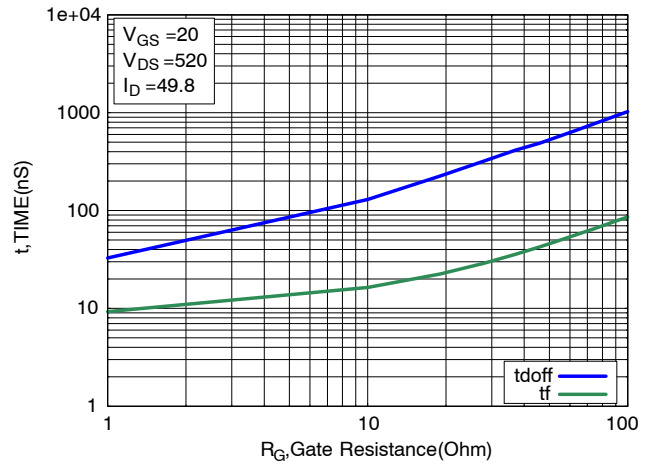


Figure 10. Turn-off Characteristics vs. Gate Resistance

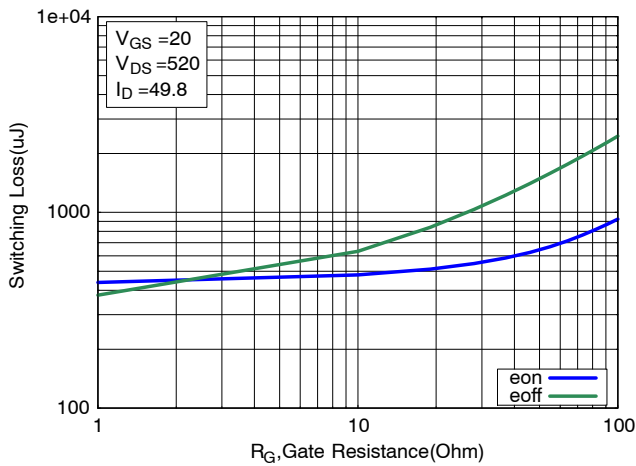


Figure 11. Switching Loss vs. Gate Resistance

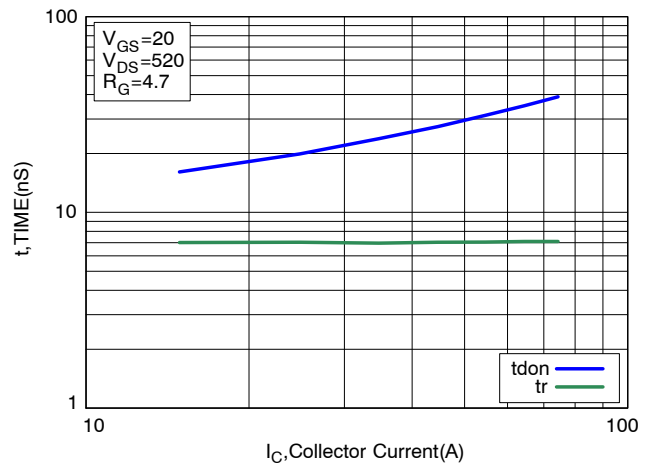


Figure 12. Turn-on Characteristics vs. Collector Current

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TYPICAL CHARACTERISTICS

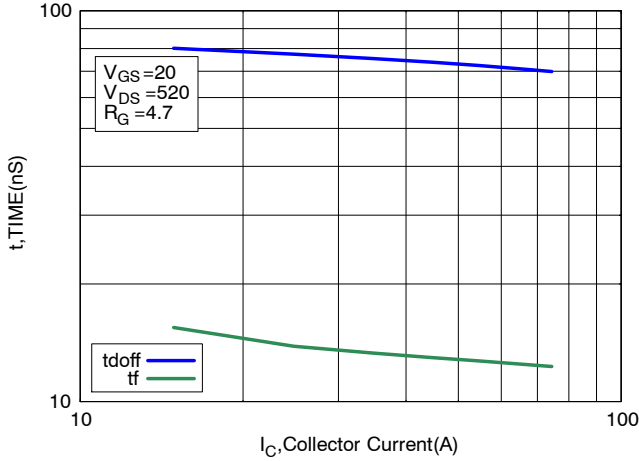


Figure 13. Turn-off Characteristics vs. Collector Current

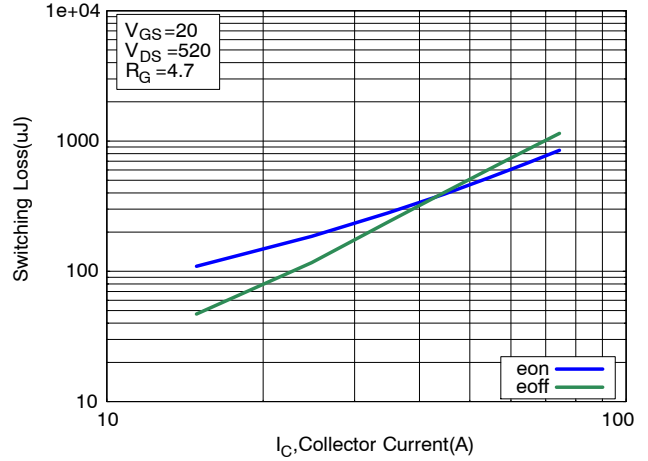


Figure 14. Switching Loss vs. Collector Current

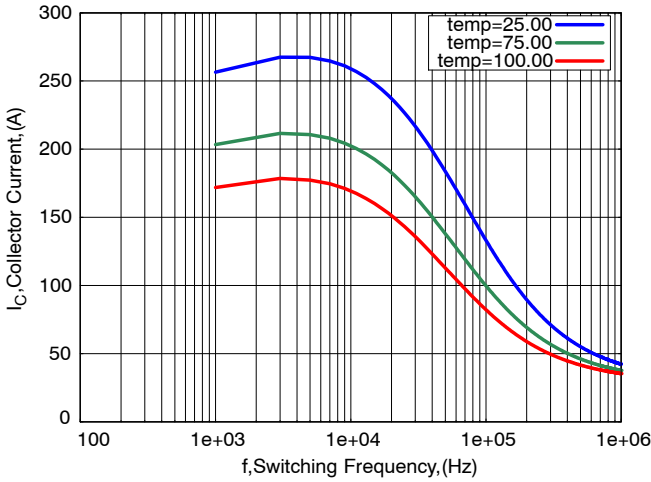


Figure 15. Load Current vs. Frequency

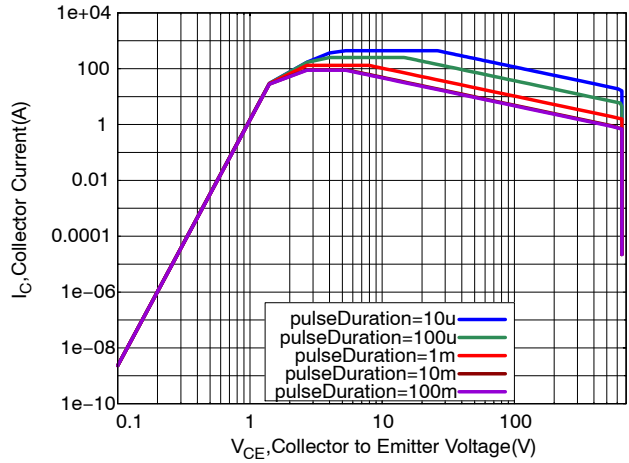


Figure 16. SOA Characteristics

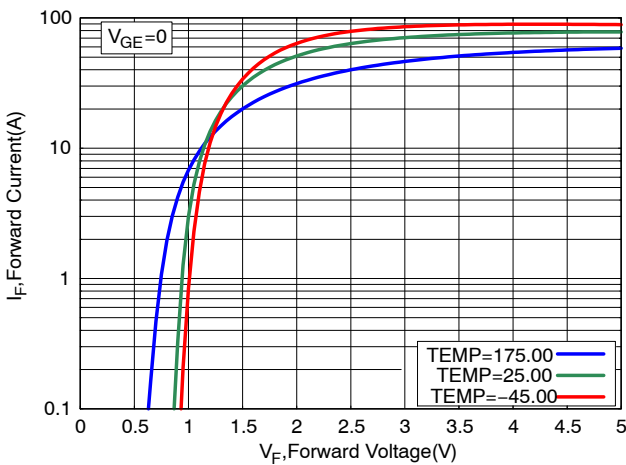


Figure 17. Forward Characteristics

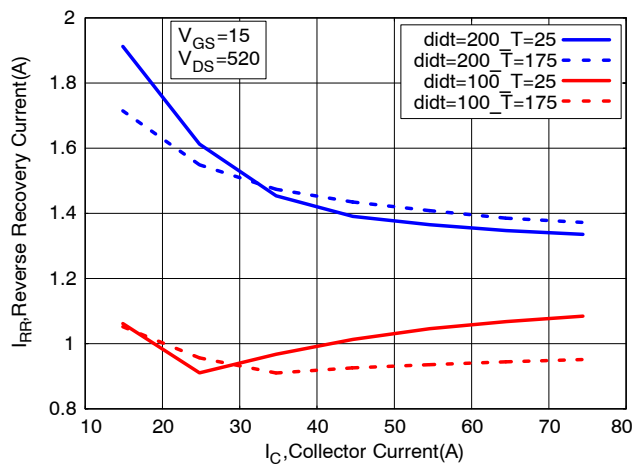


Figure 18. Reverse Recovery Current

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TYPICAL CHARACTERISTICS

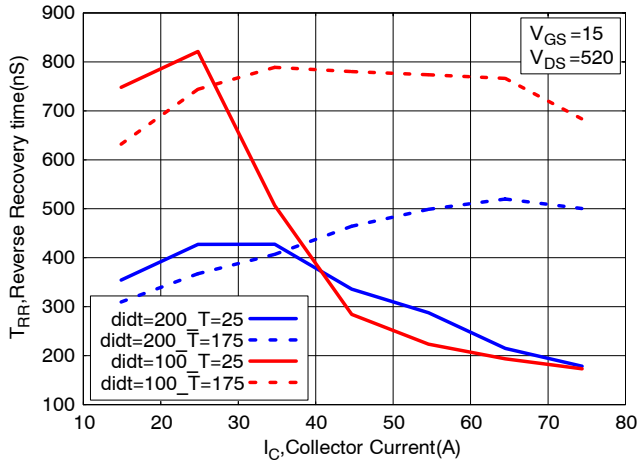


Figure 19. Reverse Recovery Time

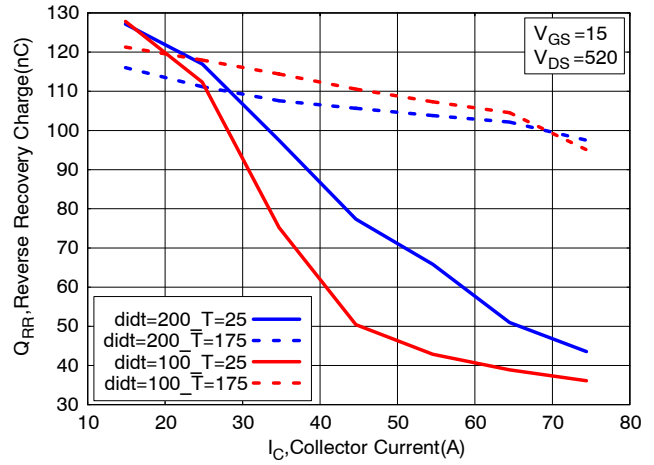


Figure 20. Stored Charge

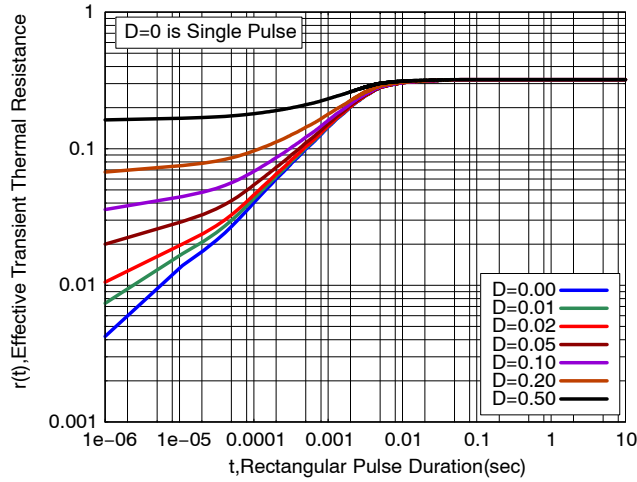


Figure 21. Transient Thermal Impedance of IGBT

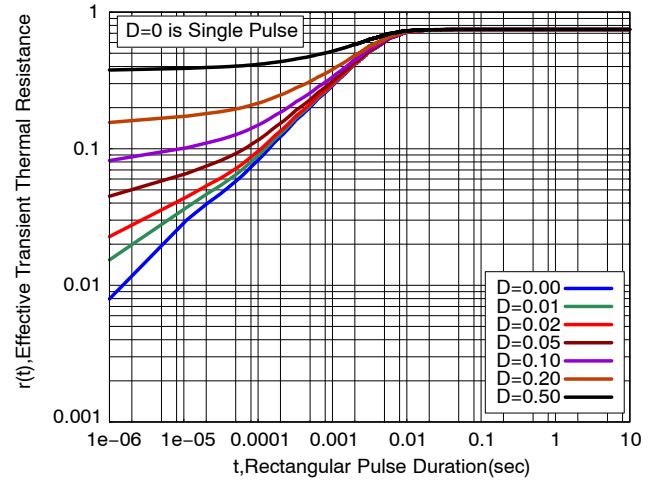
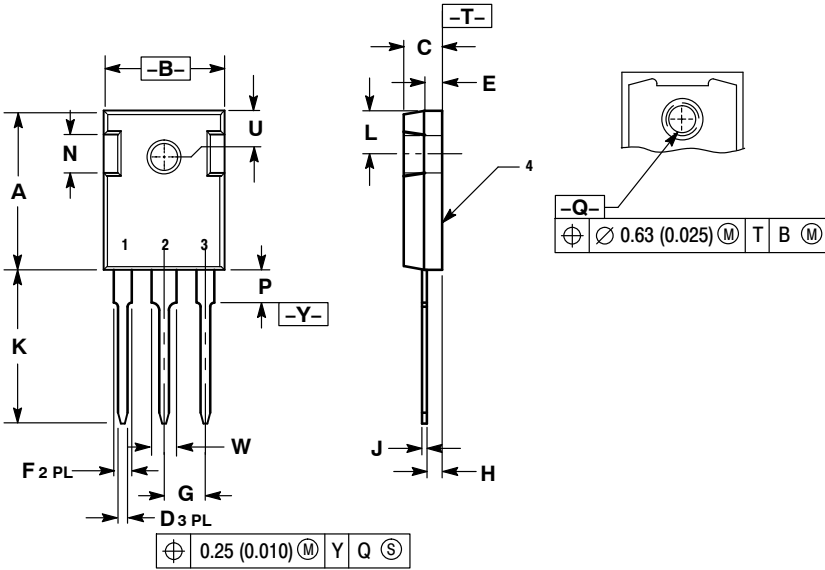


Figure 22. Transient Thermal Impedance of Diode

ENGAFGHL50T65SQDC

PACKAGE DIMENSIONS

TO-247
CASE 340L-02
ISSUE F



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	20.32	21.08	0.800	0.830
B	15.75	16.26	0.620	0.640
C	4.70	5.30	0.185	0.209
D	1.00	1.40	0.040	0.055
E	1.90	2.60	0.075	0.102
F	1.65	2.13	0.065	0.084
G	5.45 BSC		0.215 BSC	
H	1.50	2.49	0.059	0.098
J	0.40	0.80	0.016	0.031
K	19.81	20.83	0.780	0.820
L	5.40	6.20	0.212	0.244
N	4.32	5.49	0.170	0.216
P	---	4.50	---	0.177
Q	3.55	3.65	0.140	0.144
U	6.15 BSC		0.242 BSC	
W	2.87	3.12	0.113	0.123

- STYLE 4:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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