

Field Stop Trench IGBT

650 V, 75 A

FGHL75T65MQDT

Field stop 4th generation mid speed IGBT technology copacked with full rated current diode.

Features

- Maximum Junction Temperature: $T_J = 175^\circ\text{C}$
- Positive Temperature Co-efficient for Easy Parallel Operating
- High Current Capability
- Low Saturation Voltage: $V_{CE(\text{Sat})} = 1.45 \text{ V (Typ.)} @ I_C = 75 \text{ A}$
- 100% of the Parts are Tested for I_{LM} (Note 2)
- Smooth and Optimized Switching
- Tight Parameter Distribution
- RoHS Compliant

Typical Applications

- Solar Inverter
- UPS, ESS
- PFC, Converters

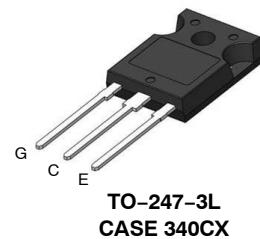
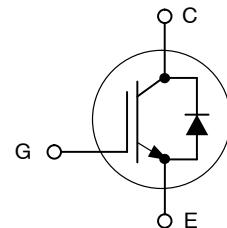
MAXIMUM RATINGS

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) @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	I_C	80 75	A
Pulsed Collector Current (Note 2)	I_{LM}	300	A
Pulsed Collector Current (Note 3)	I_{CM}	300	A
Diode Forward Current (Note 1) @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	I_F	80 75	A
Pulsed Diode Maximum Forward Current	I_{FM}	300	A
Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$ @ $T_C = 100^\circ\text{C}$	P_D	375 188	W
Operating Junction and Storage Temperature Range	T_J , T_{STG}	-55 to +175	°C
Maximum Lead Temp. for Soldering Purposes (1/8" from case for 5 s)	T_L	260	°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. $V_{CC} = 400 \text{ V}$, $V_{GE} = 15 \text{ V}$, $I_C = 300 \text{ A}$, $R_G = 9 \Omega$, Inductive Load, 100% tested
3. Repetitive rating: pulse width limited by max. junction temperature

75 A, 650 V
 $V_{CE(\text{Sat})} = 1.45 \text{ V}$



MARKING DIAGRAM



&Y = ON Semiconductor Logo
&Z = Assembly Plant Code
&3 = 3-Digit Date Code
&K = 2-Digit Lot Traceability Code
FGHL75T65MQDT = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
FGHL75T65MQDT	TO-247-3L	30 Units / Tube

FGHL75T65MQDT

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal resistance junction-to-case, for IGBT	$R_{\theta JC}$	0.40	°C/W
Thermal resistance junction-to-case, for Diode	$R_{\theta JC}$	0.60	°C/W
Thermal resistance junction-to-ambient	$R_{\theta JA}$	40	°C/W

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Collector-emitter breakdown voltage, gate-emitter short-circuited	$V_{GE} = 0 \text{ V}$, $I_C = 1 \text{ mA}$	BV_{CES}	650	–	–	V
Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0 \text{ V}$, $I_C = 1 \text{ mA}$	$\frac{\Delta BV_{CES}}{\Delta T_J}$	–	0.6	–	V/°C
Collector-emitter cut-off current, gate-emitter short-circuited	$V_{GE} = 0 \text{ V}$, $V_{CE} = 650 \text{ V}$	I_{CES}	–	–	250	μA
Gate leakage current, collector-emitter short-circuited	$V_{GE} = 20 \text{ V}$, $V_{CE} = 0 \text{ V}$	I_{GES}	–	–	±400	nA

ON CHARACTERISTICS

Gate-emitter threshold voltage	$V_{GE} = V_{CE}$, $I_C = 75 \text{ mA}$	$V_{GE(\text{th})}$	3.0	4.5	6.0	V
Collector-emitter saturation voltage	$V_{GE} = 15 \text{ V}$, $I_C = 75 \text{ A}$, $T_J = 25^\circ\text{C}$ $V_{GE} = 15 \text{ V}$, $I_C = 75 \text{ A}$, $T_J = 150^\circ\text{C}$	$V_{CE(\text{sat})}$	–	1.45	1.8	V

DYNAMIC CHARACTERISTICS

Input capacitance	$V_{CE} = 30 \text{ V}$, $V_{GE} = 0 \text{ V}$, $f = 1 \text{ MHz}$	C_{ies}	–	4954	–	pF
Output capacitance		C_{oes}	–	163	–	
Reverse transfer capacitance		C_{res}	–	14	–	
Gate charge total	$V_{CE} = 400 \text{ V}$, $I_C = 75 \text{ A}$, $V_{GE} = 15 \text{ V}$	Q_g	–	149	–	nC
Gate-to-emitter charge		Q_{ge}	–	27	–	
Gate-to-collector charge		Q_{gc}	–	34	–	

SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

Turn-on delay time	$T_C = 25^\circ\text{C}$, $V_{CC} = 400 \text{ V}$, $I_C = 37.5 \text{ A}$, $R_G = 4.7 \Omega$, $V_{GE} = 15 \text{ V}$, Inductive Load	$t_{d(on)}$	–	22	–	ns
Rise time		t_r	–	21	–	
Turn-off delay time		$t_{d(off)}$	–	125	–	
Fall time		t_f	–	11	–	
Turn-on switching loss		E_{on}	–	0.86	–	
Turn-off switching loss		E_{off}	–	0.49	–	
Total switching loss		E_{ts}	–	1.35	–	
Turn-on delay time	$T_C = 25^\circ\text{C}$, $V_{CC} = 400 \text{ V}$, $I_C = 75 \text{ A}$, $R_G = 4.7 \Omega$, $V_{GE} = 15 \text{ V}$, Inductive Load	$t_{d(on)}$	–	24	–	ns
Rise time		t_r	–	46	–	
Turn-off delay time		$t_{d(off)}$	–	118	–	
Fall time		t_f	–	66	–	
Turn-on switching loss		E_{on}	–	2.35	–	
Turn-off switching loss		E_{off}	–	1.25	–	
Total switching loss		E_{ts}	–	3.6	–	

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS, INDUCTIVE LOAD						
Turn-on delay time	$T_C = 150^\circ\text{C}$, $V_{CC} = 400 \text{ V}$, $I_C = 37.5 \text{ A}$, $R_G = 4.7 \Omega$, $V_{GE} = 15 \text{ V}$, Inductive Load	$t_{d(on)}$	–	22	–	ns
Rise time		t_r	–	22	–	
Turn-off delay time		$t_{d(off)}$	–	142	–	
Fall time		t_f	–	85	–	
Turn-on switching loss		E_{on}	–	1.43	–	mJ
Turn-off switching loss		E_{off}	–	0.85	–	
Total switching loss		E_{ts}	–	2.28	–	
Turn-on delay time		$t_{d(on)}$	–	24	–	ns
Rise time	$T_C = 150^\circ\text{C}$, $V_{CC} = 400 \text{ V}$, $I_C = 75 \text{ A}$, $R_G = 4.7 \Omega$, $V_{GE} = 15 \text{ V}$, Inductive Load	t_r	–	50	–	
Turn-off delay time		$t_{d(off)}$	–	126	–	
Fall time		t_f	–	80	–	
Turn-on switching loss		E_{on}	–	3.24	–	mJ
Turn-off switching loss		E_{off}	–	1.75	–	
Total switching loss		E_{ts}	–	4.99	–	
DIODE CHARACTERISTICS						
Diode Forward Voltage	$I_F = 75 \text{ A}, T_J = 25^\circ\text{C}$	V _{FM}	–	1.65	2.1	V
	$I_F = 75 \text{ A}, T_J = 150^\circ\text{C}$		–	1.55	–	
DIODE SWITCHING CHARACTERISTICS, INDUCTIVE LOAD						
Reverse Recovery Energy	$T_C = 25^\circ\text{C}$, $V_{CE} = 400 \text{ V}$, $I_F = 37.5 \text{ A}$, $dI_F/dt = 1000 \text{ A}/\mu\text{s}$	E_{rec}	–	105	–	μJ
Diode Reverse Recovery Time		T_{rr}	–	58	–	ns
Diode Reverse Recovery Charge		Q_{rr}	–	591	–	nC
Reverse Recovery Energy	$T_C = 25^\circ\text{C}$, $V_{CE} = 400 \text{ V}$, $I_F = 75 \text{ A}$, $dI_F/dt = 1000 \text{ A}/\mu\text{s}$	E_{rec}	–	235	–	μJ
Diode Reverse Recovery Time		T_{rr}	–	107	–	ns
Diode Reverse Recovery Charge		Q_{rr}	–	1113	–	nC
Reverse Recovery Energy	$T_C = 150^\circ\text{C}$, $V_{CE} = 400 \text{ V}$, $I_F = 37.5 \text{ A}$, $dI_F/dt = 1000 \text{ A}/\mu\text{s}$	E_{rec}	–	747	–	μJ
Diode Reverse Recovery Time		T_{rr}	–	151	–	ns
Diode Reverse Recovery Charge		Q_{rr}	–	2780	–	nC
Reverse Recovery Energy	$T_C = 150^\circ\text{C}$, $V_{CE} = 400 \text{ V}$, $I_F = 75 \text{ A}$, $dI_F/dt = 1000 \text{ A}/\mu\text{s}$	E_{rec}	–	865	–	μJ
Diode Reverse Recovery Time		T_{rr}	–	171	–	ns
Diode Reverse Recovery Charge		Q_{rr}	–	3286	–	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

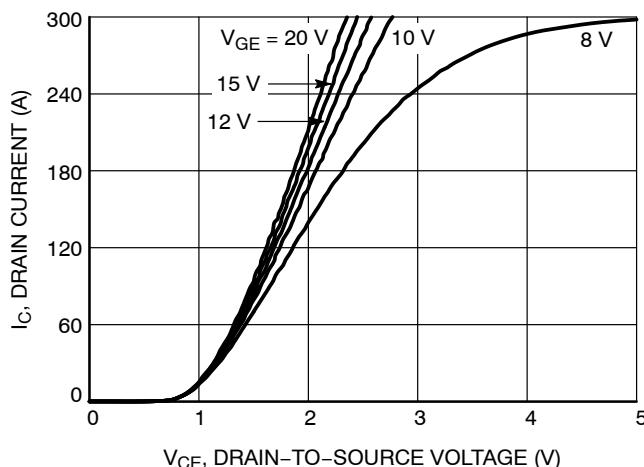


Figure 1. Typical Output Characteristics (25°C)

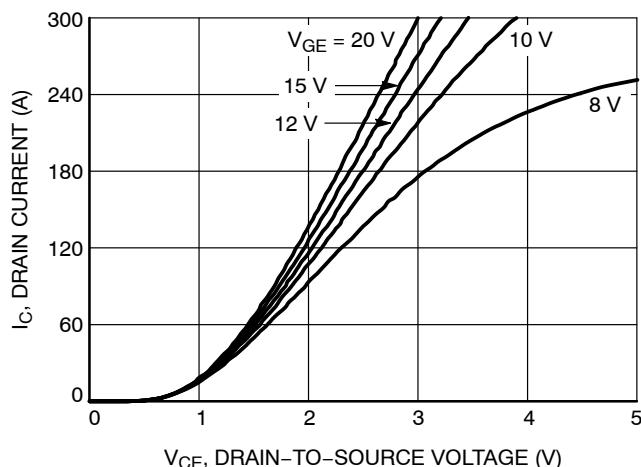


Figure 2. Typical Output Characteristics (150°C)

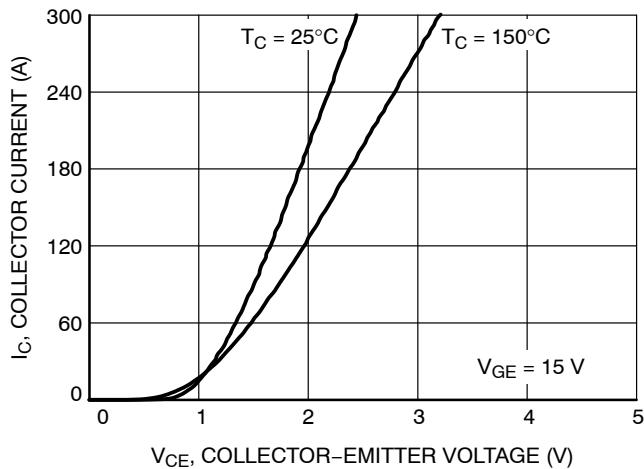


Figure 3. Typical Saturation Voltage Characteristics

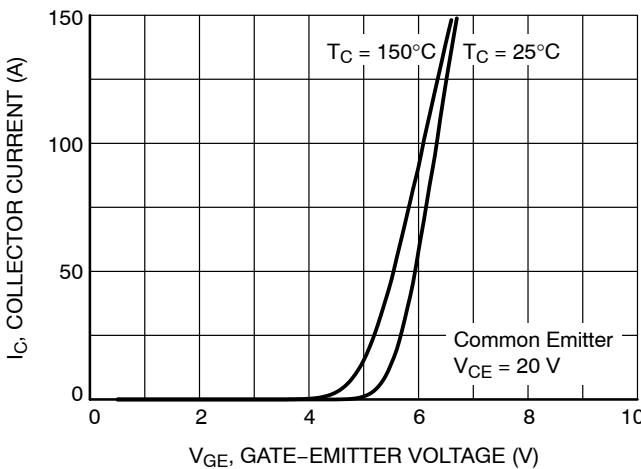


Figure 4. Typical Transfer Characteristics

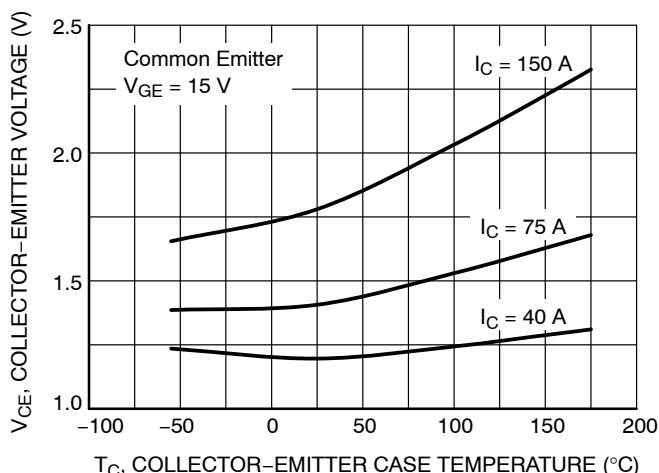


Figure 5. Saturation Voltage vs. Case Temperature

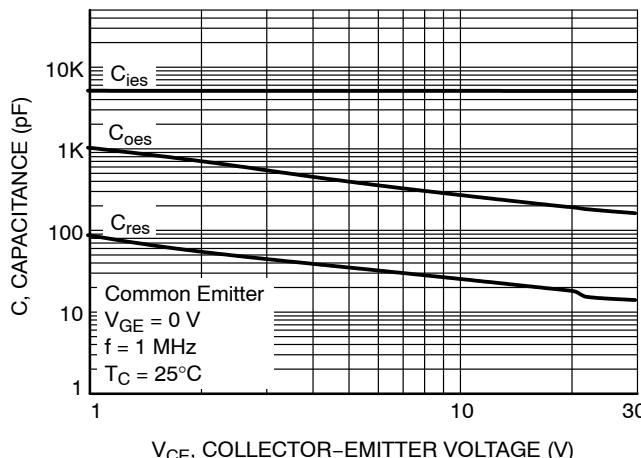
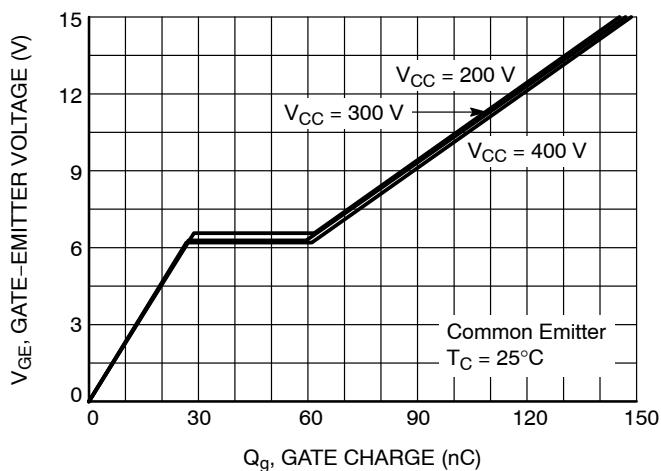
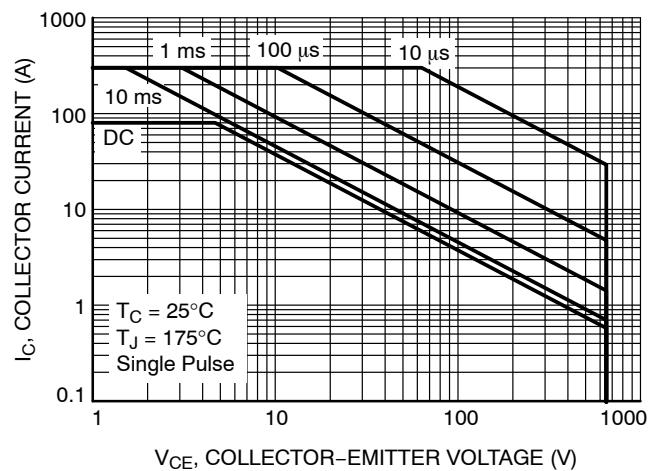
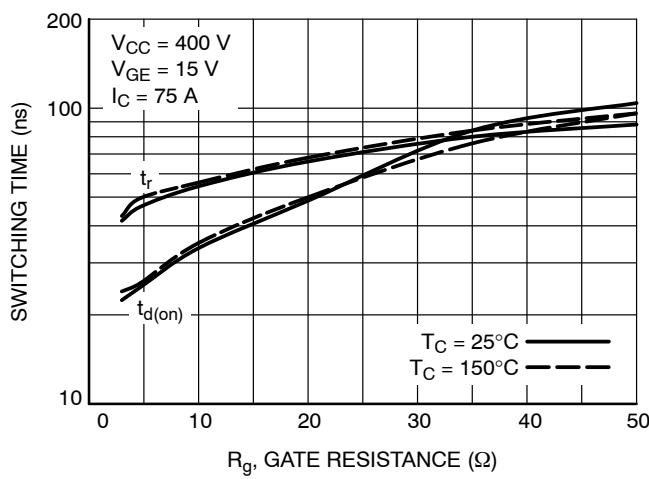
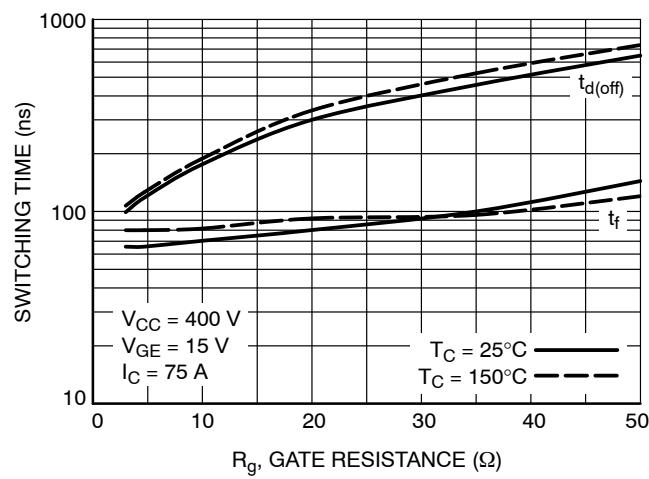
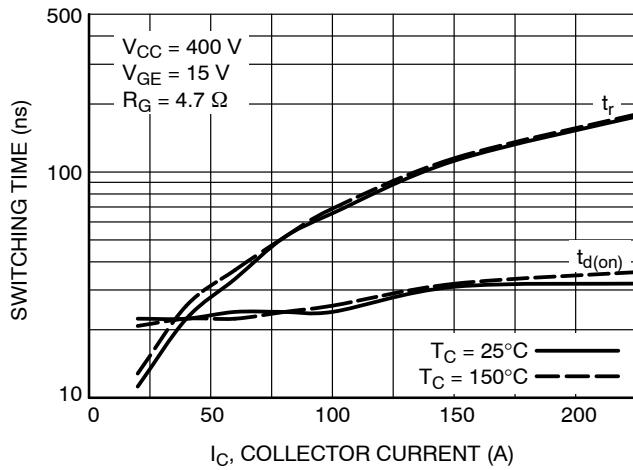
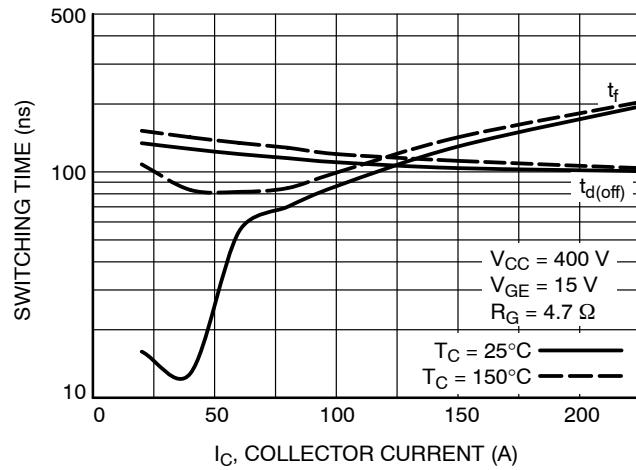
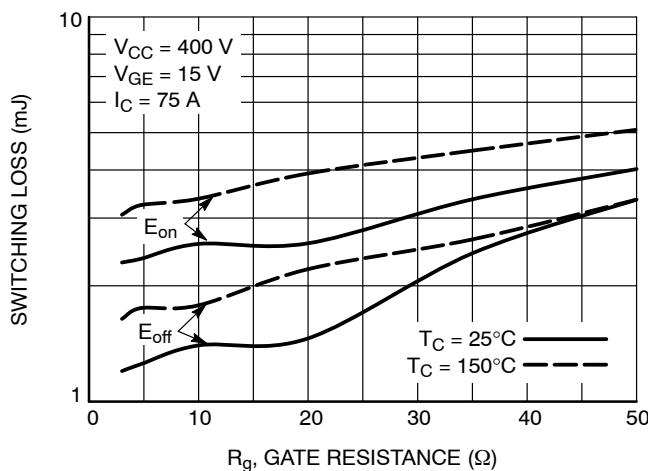
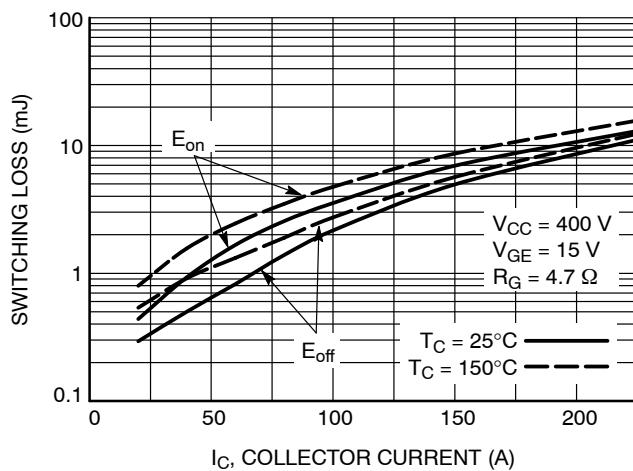
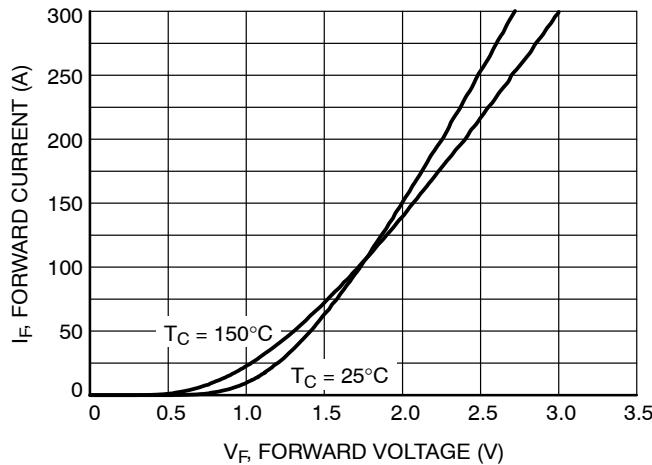
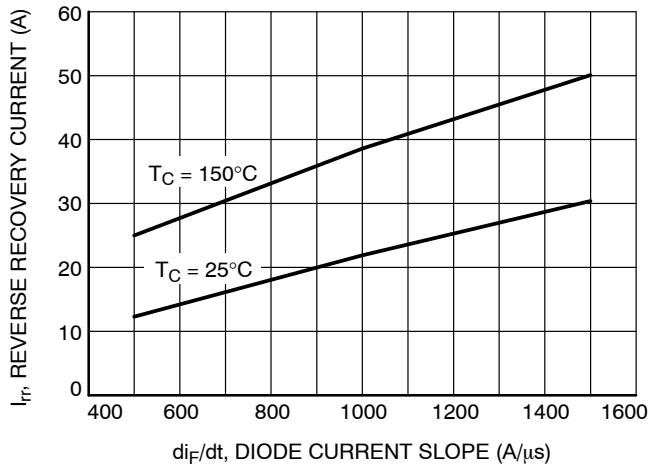
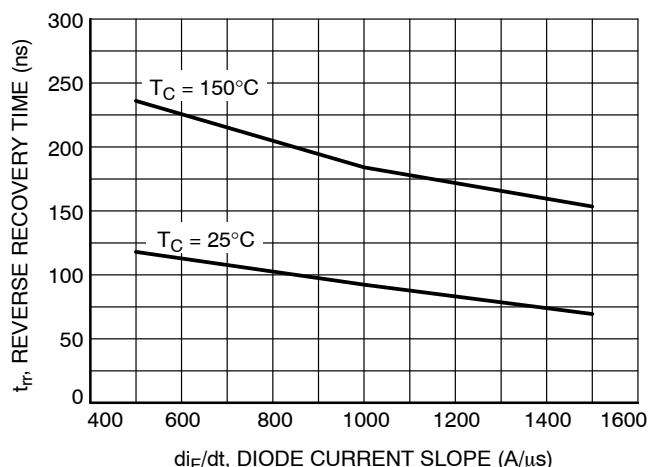
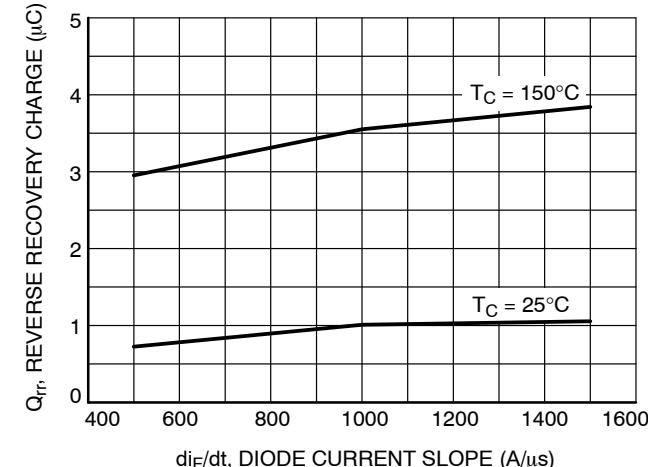


Figure 6. Capacitance Characteristics

TYPICAL CHARACTERISTICS

Figure 7. Gate Charge Characteristics

Figure 8. SOA Characteristics

Figure 9. Turn-On Characteristics vs. Gate Resistance

Figure 10. Turn-Off Characteristics vs. Gate Resistance

Figure 11. Turn-On Characteristics vs. Collector Current

Figure 12. Turn-Off Characteristics vs. Collector Current

TYPICAL CHARACTERISTICS

Figure 13. Switching Loss vs. Gate Resistance

Figure 14. Switching Loss vs. Collector Current

Figure 15. Forward Characteristics

Figure 16. Reverse Recovery Current

Figure 17. Reverse Recovery Time

Figure 18. Stored Charge

TYPICAL CHARACTERISTICS

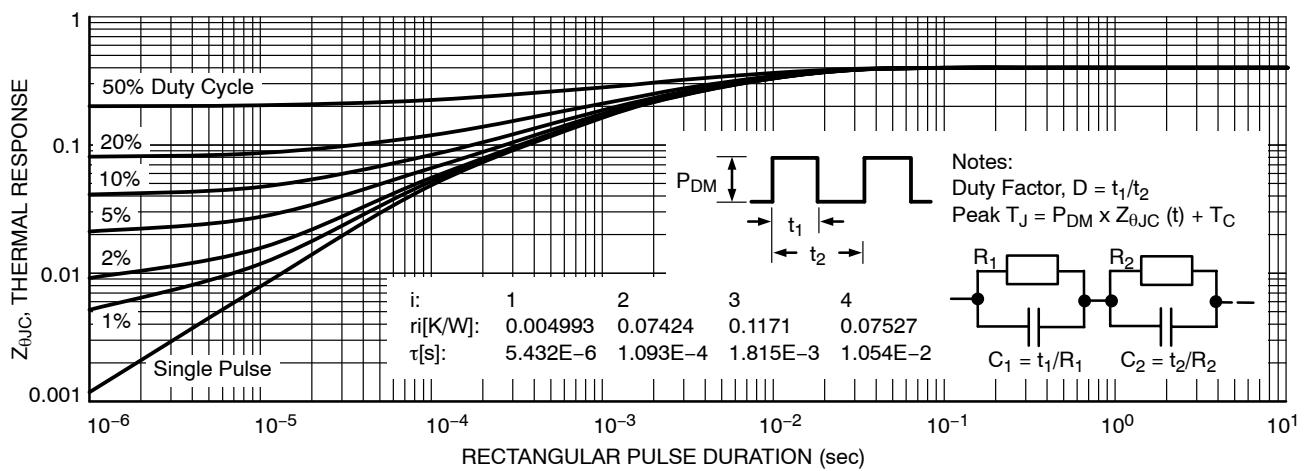


Figure 19. Transient Thermal Impedance of IGBT

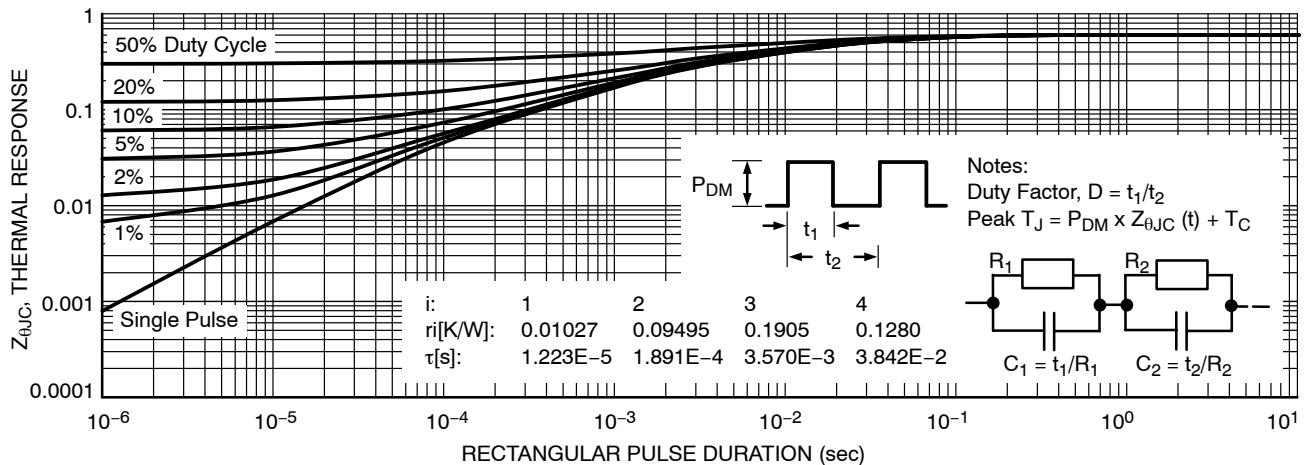
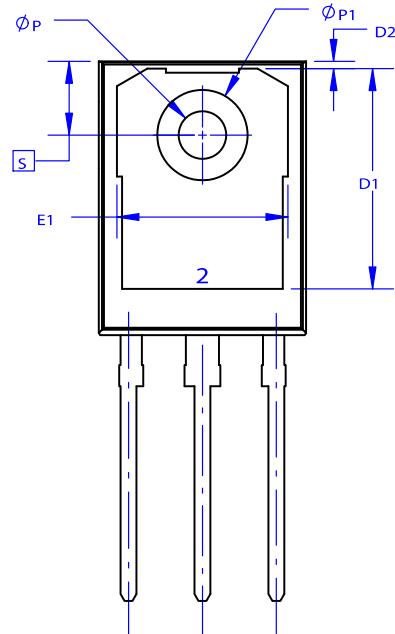
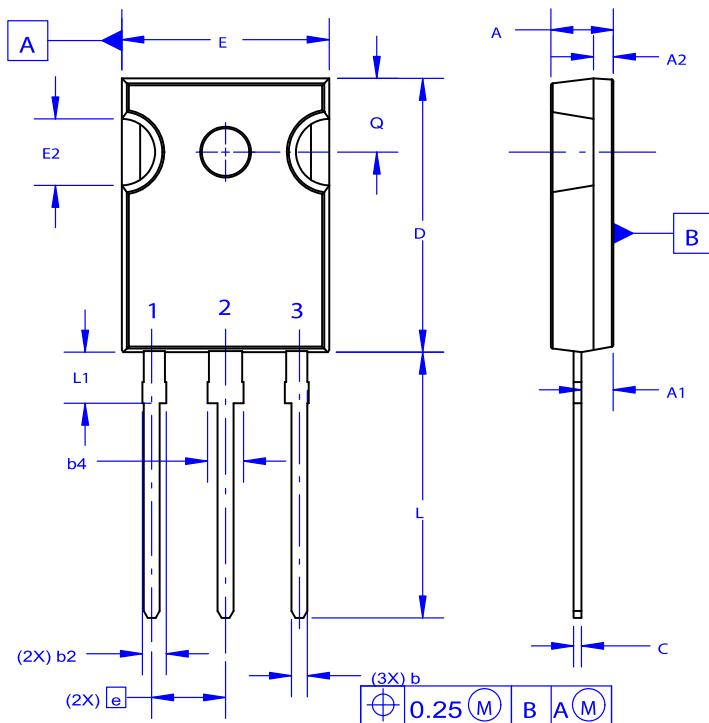


Figure 20. Transient Thermal Impedance of Diode

FGHL75T65MQDT

PACKAGE DIMENSIONS

TO-247-3LD
CASE 340CX
ISSUE A



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
ϕ_P	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	~	~
ϕ_{P1}	6.60	6.80	7.00

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