

FGHL75T65MQD Datasheet



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DiGi Electronics Part Number	FGHL75T65MQD-DG
Manufacturer	onsemi
Manufacturer Product Number	FGHL75T65MQD
Description	IGBT 650V 75A TO247
Detailed Description	IGBT Trench Field Stop 650 V 80 A 375 W Through Hole TO-247-3

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Purchase and inquiry

Manufacturer Product Number:

FGHL75T65MQD

Series:

-

IGBT Type:

Trench Field Stop

Current - Collector (Ic) (Max):

80 A

Vce(on) (Max) @ Vge, Ic:

1.8V @ 15V, 75A

Switching Energy:

1.94mj (on), 1.55mj (off)

Gate Charge:

145 nC

Test Condition:

400V, 75A, 100hm, 15V

Operating Temperature:

-55°C ~ 175°C (Tj)

Package / Case:

TO-247-3

Base Product Number:

FGHL75

Manufacturer:

onsemi

Product Status:

Active

Voltage - Collector Emitter Breakdown (Max):

650 V

Current - Collector Pulsed (Icm):

300 A

Power - Max:

375 W

Input Type:

Standard

Td (on/off) @ 25°C:

33ns/176ns

Reverse Recovery Time (trr):

36 ns

Mounting Type:

Through Hole

Supplier Device Package:

TO-247-3

Environmental & Export classification

RoHS Status:

ROHS3 Compliant

REACH Status:

REACH Unaffected

HTSUS:

8541.29.0095

Moisture Sensitivity Level (MSL):

Not Applicable

ECCN:

EAR99

Field Stop Trench IGBT

650 V, 75 A

FGHL75T65MQD

Field stop 4th generation mid speed IGBT technology and Full current rated copak Diode technology.

Features

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

Typical Applications

- Solar Inverter
- UPS, ESS
- PFC, Converters

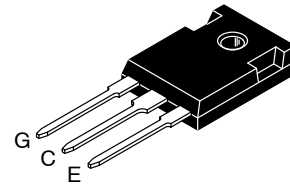
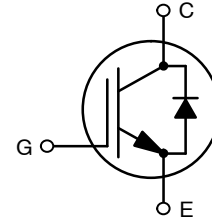
MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Collector-to-Emitter Voltage	V_{CES}	650	V
Gate-to-Emitter Voltage	V_{GES}	± 20	V
Transient Gate-to-Emitter Voltage	V_{GES}	± 30	V
Collector Current (Note 1)	I_C	$T_C = 25^{\circ}\text{C}$	80
		$T_C = 100^{\circ}\text{C}$	75
Pulsed Collector Current (Note 2)	I_{LM}	300	A
Pulsed Collector Current (Note 3)	I_{CM}	300	A
Diode Forward Current (Note 1)	I_F	$T_C = 25^{\circ}\text{C}$	80
		$T_C = 65^{\circ}\text{C}$	75
Pulsed Diode Maximum Forward Current	$I_{FM(2)}$	300	A
Non-Repetitive Forward Surge Current (Half-Sine Pulse, $t_p = 8.3\text{ ms}$, $T_C = 25^{\circ}\text{C}$) (Half-Sine Pulse, $t_p = 8.3\text{ ms}$, $T_C = 150^{\circ}\text{C}$)	$I_{F,SM}$	255 225	A
Maximum Power Dissipation	P_D	$T_C = 25^{\circ}\text{C}$	375
		$T_C = 100^{\circ}\text{C}$	188
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +175	$^{\circ}\text{C}$
Maximum Lead Temperature for Soldering Purposes (1/8" from case for 5 s)	T_L	260	$^{\circ}\text{C}$

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.

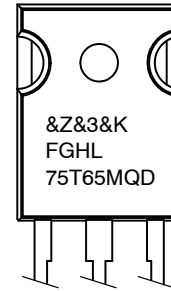
1. Value limit by bond wire
2. $V_{CC} = 400\text{ V}$, $V_{GE} = 15\text{ V}$, $I_C = 300\text{ A}$, $R_G = 14\ \Omega$, Inductive Load, 100% Tested
3. Repetitive rating: Pulse width limited by max. junction temperature

BV_{CES}	$V_{CE(sat)}$ TYP	I_C MAX
650 V	1.45 V	75 A



TO-247 LONG LEADS
CASE 340CX

MARKING DIAGRAM



&Z = Assembly Plant Code
 &3 = 3-Digit Date Code
 &K = 2-Digit Lot Traceability Code
 FGHL75T65MQD = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
FGHL75T65MQD	TO-247-3L	30 Units / Rail

FGHL75T65MQD**Table 1. THERMAL CHARACTERISTICS**

Parameter	Symbol	Value	Unit
Thermal Resistance Junction-to-Case, for IGBT	$R_{\theta JC}$	0.40	°C/W
Thermal Resistance Junction-to-Case, for Diode	$R_{\theta JC}$	0.6	
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	40	

Table 2. ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTIC						
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	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	$\Delta BV_{CES} / \Delta T_J$	-	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 CHARACTERISTIC						
Gate-emitter threshold voltage	$V_{GE} = V_{CE}, I_C = 75\text{ mA}$	$V_{GE(th)}$	3.0	4.5	6.0	V
Collector-emitter saturation voltage	$V_{GE} = 15\text{ V}, I_C = 75\text{ A}$ $V_{GE} = 15\text{ V}, I_C = 75\text{ A}, T_J = 175^\circ\text{C}$	$V_{CE(sat)}$	-	1.45 1.65	1.8 -	V
DYNAMIC CHARACTERISTIC						
Input capacitance	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	C_{ies}	-	4913	-	pF
Output capacitance		C_{oes}	-	131	-	
Reverse transfer capacitance		C_{res}	-	15	-	
Gate charge total	$V_{CE} = 400\text{ V}, I_C = 75\text{ A}, V_{GE} = 15\text{ V}$	Q_g	-	145	-	nC
Gate-to-Emitter charge		Q_{ge}	-	25	-	
Gate-to-Collector charge		Q_{gc}	-	33	-	
SWITCHING CHARACTERISTIC, INDUCTIVE LOAD						
Turn-on delay time	$T_C = 25^\circ\text{C}$ $V_{CC} = 400\text{ V}, I_C = 37.5\text{ A}$ $R_G = 10\ \Omega$ $V_{GE} = 15\text{ V}$ Inductive Load	$t_{d(on)}$	-	29	-	ns
Rise time		t_r	-	29	-	
Turn-off delay time		$t_{d(off)}$	-	193	-	
Fall time		t_f	-	47	-	
Turn-on switching loss		E_{on}	-	0.75	-	mJ
Turn-off switching loss		E_{off}	-	0.48	-	
Total switching loss		E_{ts}	-	1.22	-	
Turn-on delay time	$T_C = 25^\circ\text{C}$ $V_{CC} = 400\text{ V}, I_C = 75\text{ A}$ $R_G = 10\ \Omega$ $V_{GE} = 15\text{ V}$ Inductive Load	$t_{d(on)}$	-	33	-	ns
Rise time		t_r	-	60	-	
Turn-off delay time		$t_{d(off)}$	-	176	-	
Fall time		t_f	-	76	-	
Turn-on switching loss		E_{on}	-	1.94	-	mJ
Turn-off switching loss		E_{off}	-	1.55	-	
Total switching loss		E_{ts}	-	3.49	-	

FGHL75T65MQD**Table 2. ELECTRICAL CHARACTERISTICS** ($T_J = 25^\circ\text{C}$ unless otherwise specified) (continued)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
SWITCHING CHARACTERISTIC, INDUCTIVE LOAD						
Turn-on delay time	$T_C = 175^\circ\text{C}$ $V_{CC} = 400\text{ V}$, $I_C = 37.5\text{ A}$ $R_G = 10\ \Omega$ $V_{GE} = 15\text{ V}$ Inductive Load	$t_{d(on)}$	–	27	–	ns
Rise time		t_r	–	31	–	
Turn-off delay time		$t_{d(off)}$	–	214	–	
Fall time		t_f	–	66	–	
Turn-on switching loss		E_{on}	–	1.49	–	mJ
Turn-off switching loss		E_{off}	–	0.72	–	
Total switching loss		E_{ts}	–	2.21	–	
Turn-on delay time	$T_C = 175^\circ\text{C}$ $V_{CC} = 400\text{ V}$, $I_C = 75\text{ A}$ $R_G = 10\ \Omega$ $V_{GE} = 15\text{ V}$ Inductive Load	$t_{d(on)}$	–	31	–	ns
Rise time		t_r	–	61	–	
Turn-off delay time		$t_{d(off)}$	–	191	–	
Fall time		t_f	–	85	–	
Turn-on switching loss		E_{on}	–	3.23	–	mJ
Turn-off switching loss		E_{off}	–	1.90	–	
Total switching loss		E_{ts}	–	5.12	–	
DIODE CHARACTERISTIC						
Diode Forward Voltage	$I_F = 75\text{ A}$, $T_C = 25^\circ\text{C}$ $I_F = 75\text{ A}$, $T_C = 175^\circ\text{C}$	V_{FM}	– –	2.3 1.9	2.6 –	V
Reverse Recovery Energy	$I_F = 75\text{ A}$, $di_F/dt = 200\text{ A}/\mu\text{s}$, $T_C = 175^\circ\text{C}$	E_{rec}	–	49	–	μJ
Diode Reverse Recovery Time	$I_F = 75\text{ A}$, $di_F/dt = 200\text{ A}/\mu\text{s}$, $T_C = 25^\circ\text{C}$ $I_F = 75\text{ A}$, $di_F/dt = 200\text{ A}/\mu\text{s}$, $T_C = 175^\circ\text{C}$	T_{rr}	–	36 204	–	ns
Diode Reverse Recovery Charge	$I_F = 75\text{ A}$, $di_F/dt = 200\text{ A}/\mu\text{s}$, $T_C = 25^\circ\text{C}$ $I_F = 75\text{ A}$, $di_F/dt = 200\text{ A}/\mu\text{s}$, $T_C = 175^\circ\text{C}$	Q_{rr}	–	51 990	–	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.

FGHL75T65MQD

TYPICAL CHARACTERISTICS

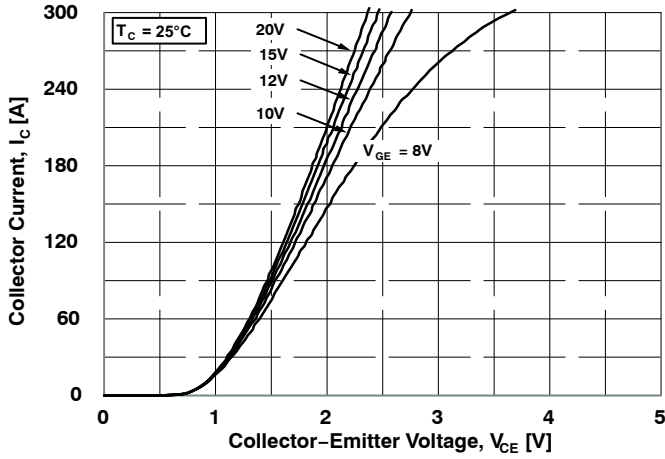


Figure 1. Typical Output Characteristics (25°C)

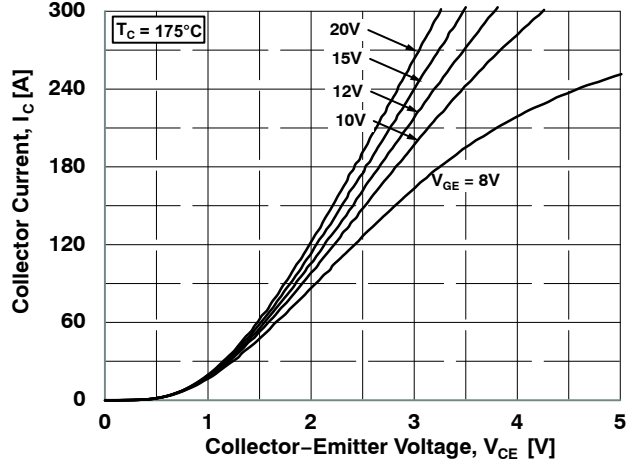


Figure 2. Typical Output Characteristics (175°C)

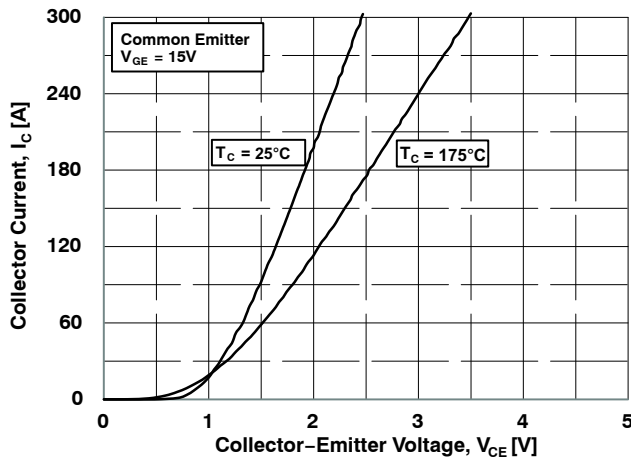


Figure 3. Typical Saturation Voltage Characteristics

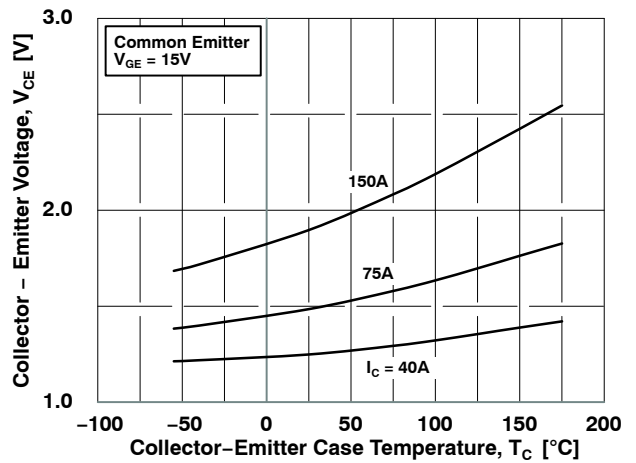


Figure 4. Saturation Voltage vs. Case Temperature at Variant Current Level

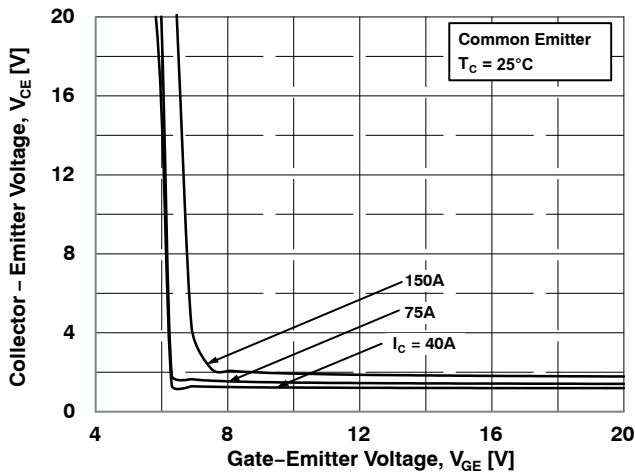


Figure 5. Saturation Voltage vs. V_{GE} (25°C)

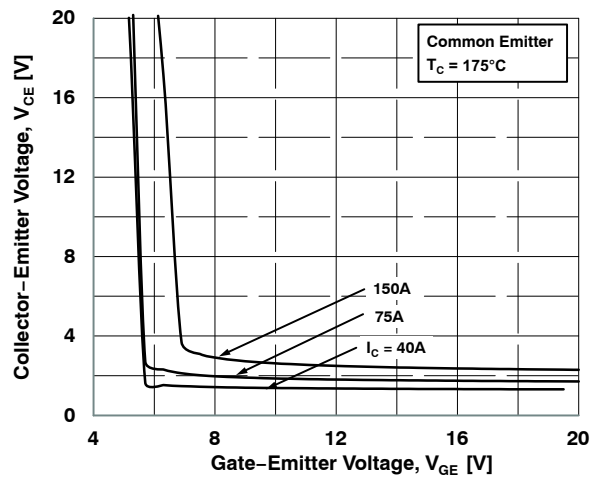


Figure 6. Saturation Voltage vs. V_{GE} (175°C)

FGHL75T65MQD

TYPICAL CHARACTERISTICS

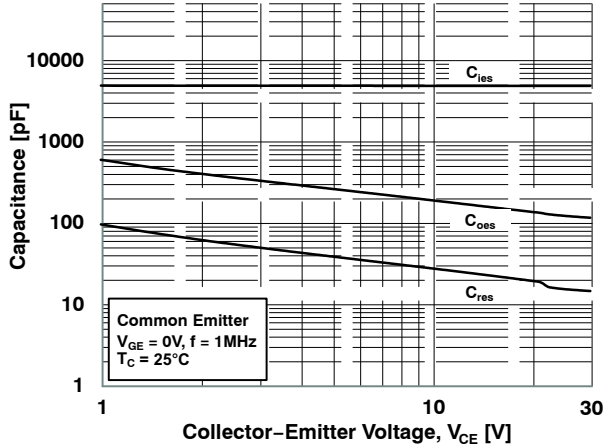


Figure 7. Capacitance Characteristics

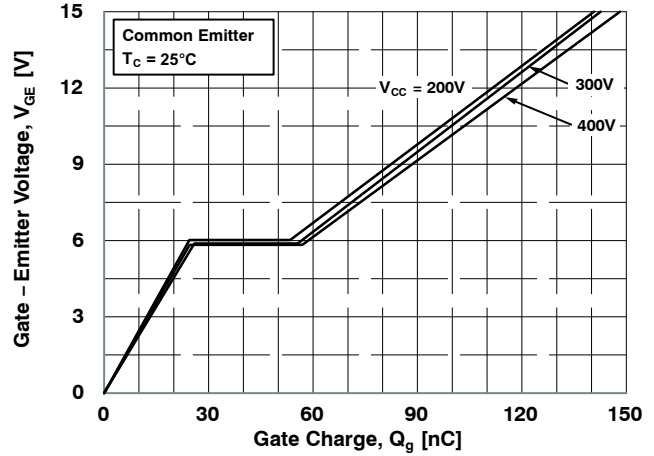


Figure 8. Gate Charge Characteristics

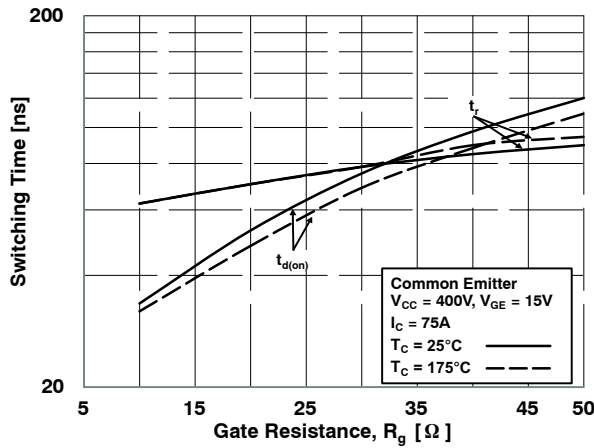


Figure 9. Turn-On Characteristics vs. Gate Resistance

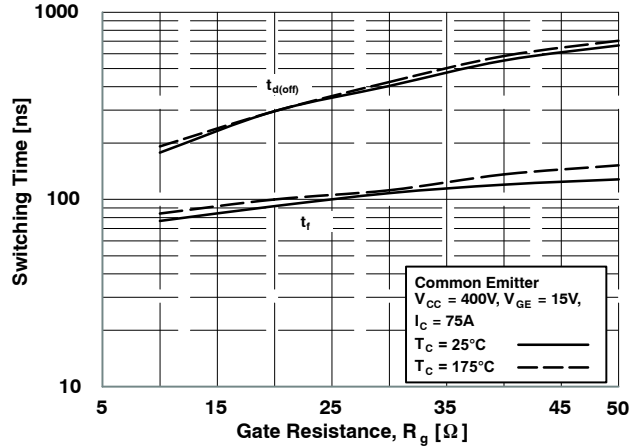


Figure 10. Turn-Off Characteristics vs. Gate Resistance

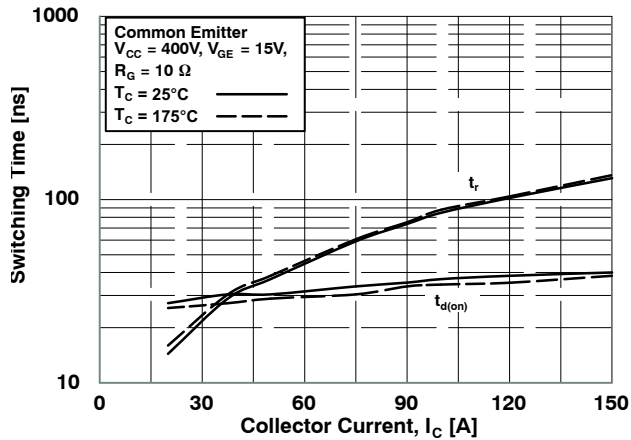


Figure 11. Turn-On Characteristics vs. Collector Current

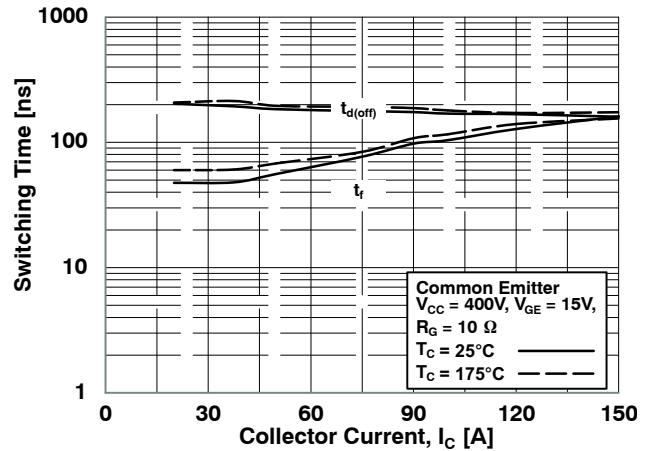


Figure 12. Turn-Off Characteristics vs. Collector Current

FGHL75T65MQD

TYPICAL CHARACTERISTICS

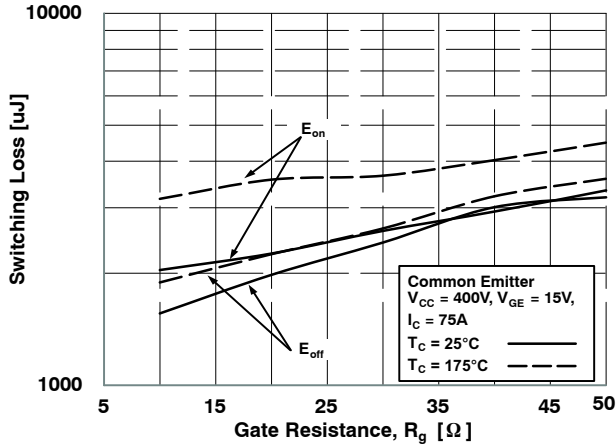


Figure 13. Switching Loss vs. Gate Resistance

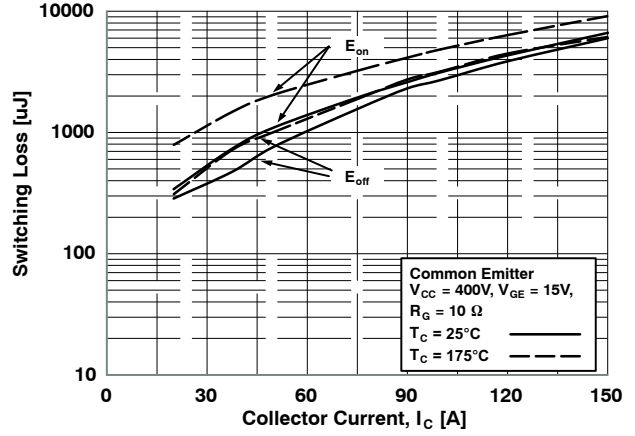


Figure 14. Switching Loss vs. Collector Current

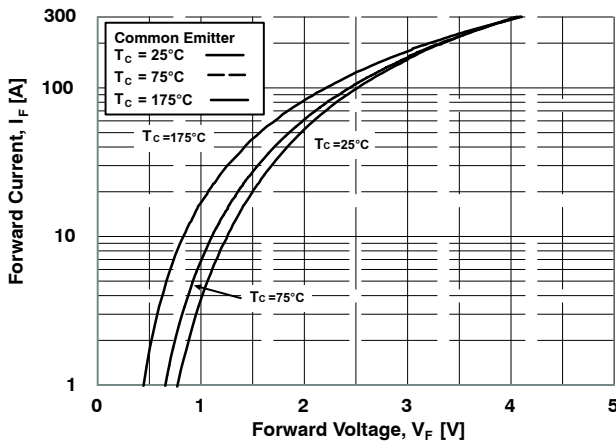


Figure 15. Forward Characteristics

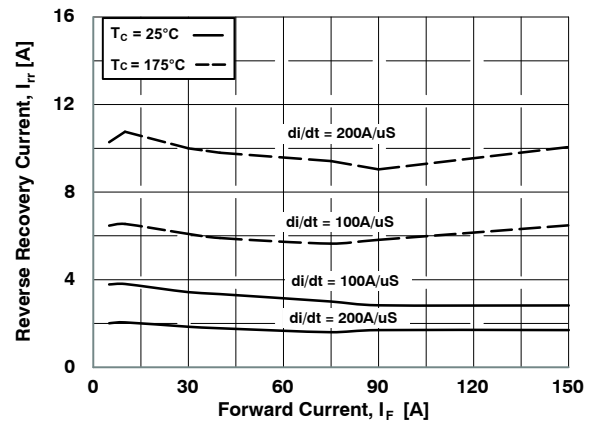


Figure 16. Reverse Recovery Current

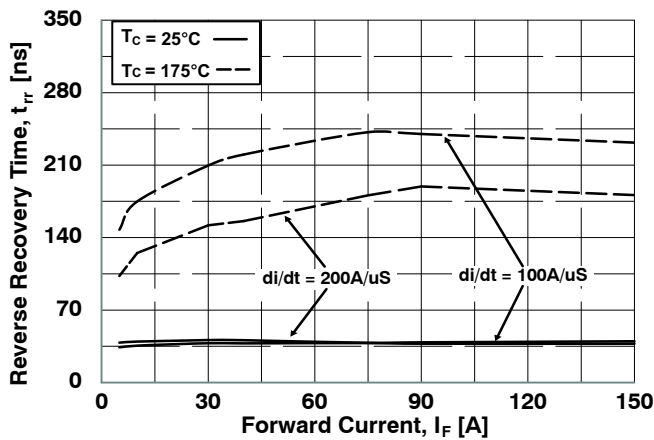


Figure 17. Reverse Recovery Time

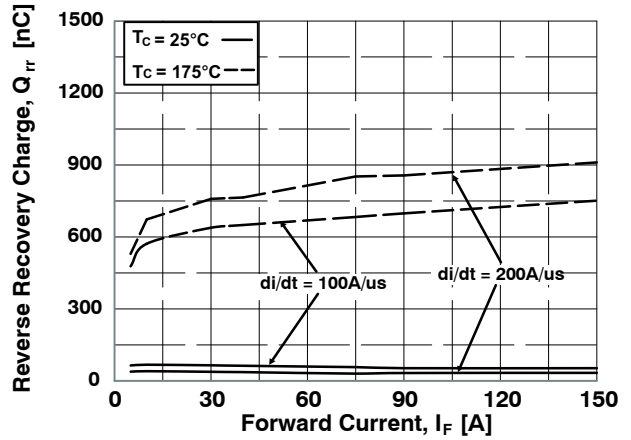


Figure 18. Stored Charge

FGHL75T65MQD

TYPICAL CHARACTERISTICS

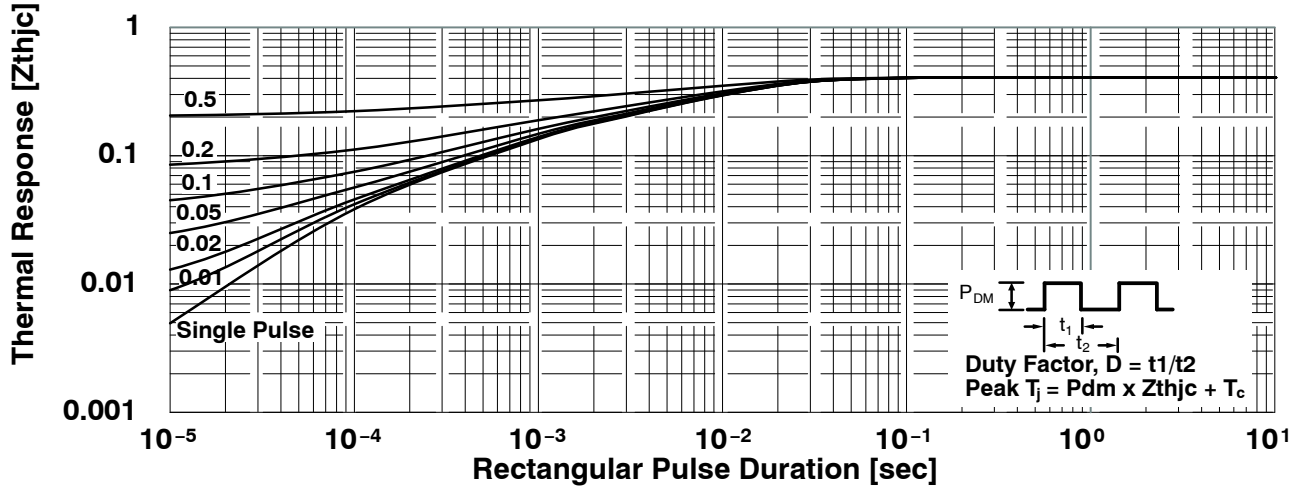


Figure 19. Transient Thermal Impedance of IGBT

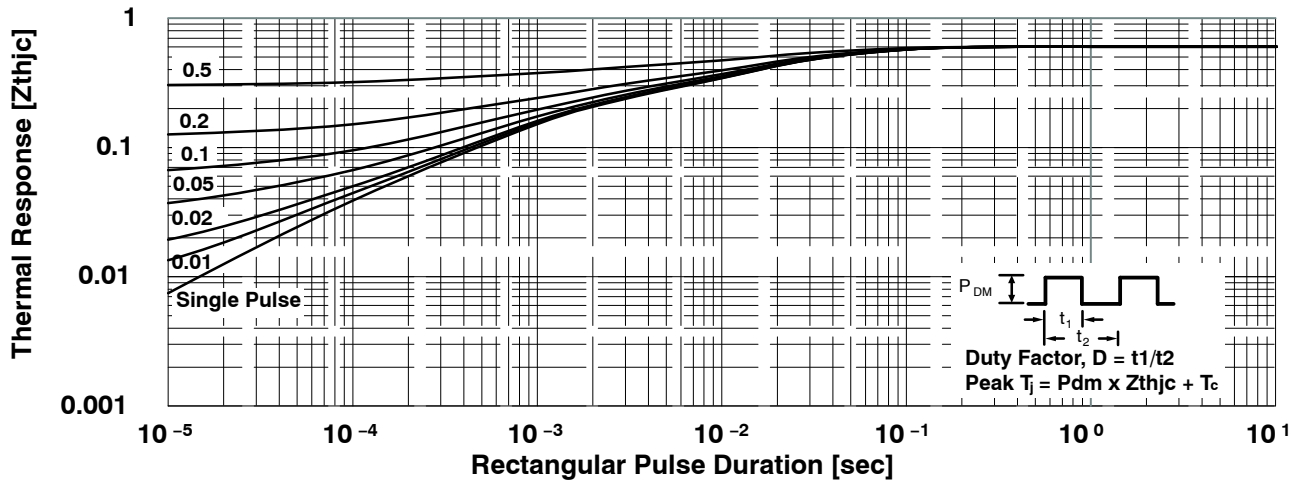


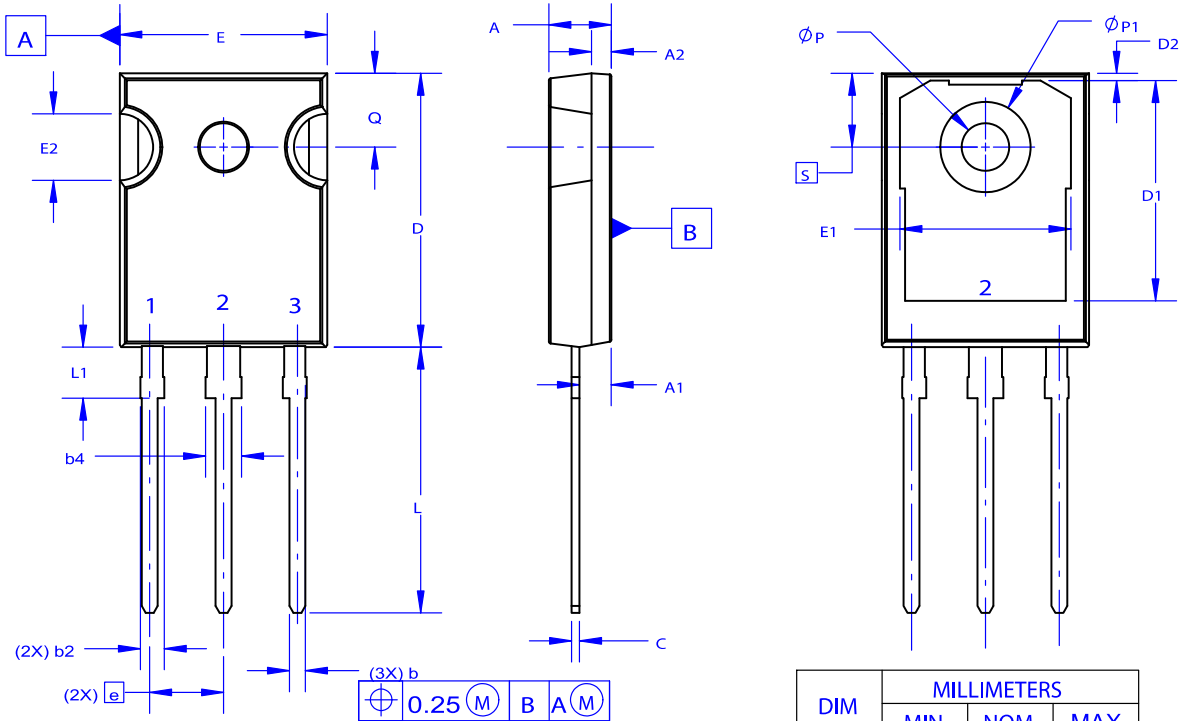
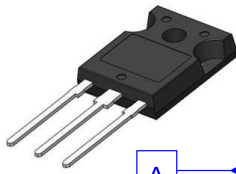
Figure 20. Transient Thermal Impedance of Diode



**MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS**

**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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