

IGBT - Power, Co-PAK

N-Channel, Field Stop IV, MQ (Medium Speed), TO247-4L

650 V, 1.45 V, 50 A

FGH4L50T65MQDC50

Using the novel field stop 4th generation IGBT technology and generation 1.5 SiC Schottky Diode technology in TO-247 4-lead package, FGH4L50T65MQDC50 offers the optimum performance with both low conduction and switching losses for high-efficiency operations in various applications, especially totem pole bridgeless PFC and Inverter.

Features

- Positive Temperature Coefficient for Easy Parallel Operation
- High Current Capability
- 100% of the Parts are Tested for I_{LM} (Note 2)
- Smooth and Optimized Switching
- Low Saturation Voltage: $V_{CE(Sat)} = 1.45$ V (Typ.) @ $I_C = 50$ A
- No Reverse Recovery / No Forward Recovery
- Tight Parameter Distribution
- RoHS Compliant

Applications

- Charging Station (EVSE)
- Solar Inverter
- UPS, ESS
- PFC, Converters

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

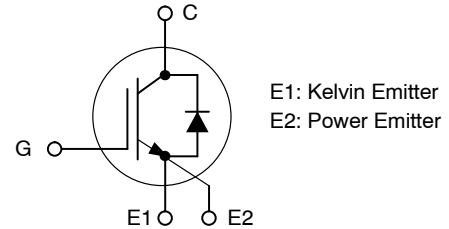
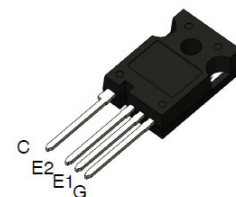
Parameter		Symbol	Value	Unit
Collector-to-Emitter Voltage		V_{CES}	650	V
Gate-to-Emitter Voltage		V_{GES}	± 20	
Transient Gate-to-Emitter Voltage ($t_p < 0.5 \mu s$, $D < 0.001$)			± 30	
Collector Current	$T_C = 25^\circ C$ (Note 1)	I_C	100	A
	$T_C = 100^\circ C$		50	
Power Dissipation	$T_C = 25^\circ C$	P_D	246	W
	$T_C = 100^\circ C$		123	
Pulsed Collector Current	$T_C = 25^\circ C$ (Note 2)	I_{LM}	200	A
	$T_C = 25^\circ C$ (Note 3)	I_{CM}	200	
Diode Forward Current	$T_C = 25^\circ C$ (Note 1)	I_F	60	A
	$T_C = 100^\circ C$		50	
Pulsed Diode Maximum Forward Current	$T_C = 25^\circ C$	I_{FM}	200	A
Operating Junction and Storage Temperature Range		T_J , T_{STG}	-55 to +175	$^\circ C$
Maximum Lead Temp. for Soldering Purposes (1/8" from case for 5 s)		T_L	260	$^\circ C$

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. $V_{CC} = 400$ V, $V_{GE} = 15$ V, $I_C = 200$ A, Inductive Load, 100% tested
3. Repetitive rating: pulse width limited by max. junction temperature

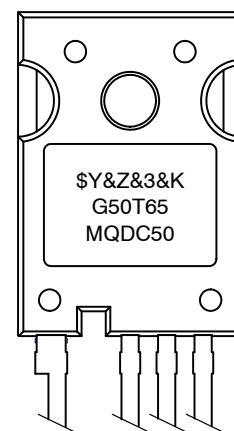
BV_{CES}	$V_{CE(sat)}$	I_C
650 V	1.45 V	50 A

PIN CONNECTIONS



TO-247-4LD
CASE 340CJ

MARKING DIAGRAM



\$Y = onsemi Logo
 &Z = Assembly Plant Code
 &3 = 3-Digit Date Code
 &K = 2-Digit Lot Traceability Code
 G50T65MQDC50 = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
FGH4L50T65MQDC50	TO-247-4LD	30 Units / Tube

FGH4L50T65MQDC50

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance Junction-to-Case, for IGBT	$R_{\theta JC}$	0.61	°C/W
Thermal Resistance Junction-to-Case, for Diode	$R_{\theta JCD}$	0.70	
Thermal Resistance junction-to-Ambient	$R_{\theta JA}$	40	

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	$V_{GE} = 0\text{ V}, I_C = 1\text{ mA}$	$\frac{\Delta BV_{CES}}{\Delta T_J}$	–	0.5	–	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	$V_{GE} = V_{CE}, I_C = 50\text{ mA}$	$V_{GE(th)}$	3.0	4.5	6.0	V
Collector-emitter Saturation Voltage	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 25^\circ\text{C}$	$V_{CE(sat)}$	–	1.45	1.8	V
	$V_{GE} = 15\text{ V}, I_C = 50\text{ A}, T_J = 175^\circ\text{C}$		–	1.65	–	

DYNAMIC CHARACTERISTICS

Input Capacitance	$V_{CE} = 30\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$	C_{ies}	–	3340	–	pF
Output Capacitance		C_{oes}	–	630	–	
Reverse Transfer Capacitance		C_{res}	–	10	–	
Gate Charge Total	$V_{CE} = 400\text{ V}, I_C = 50\text{ A}, V_{GE} = 15\text{ V}$	Q_g	–	102	–	nC
Gate-to-emitter Charge		Q_{ge}	–	19	–	
Gate-to-collector Charge		Q_{gc}	–	25	–	

SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

Turn-on Delay Time	$T_J = 25^\circ\text{C}, V_{CC} = 400\text{ V}, I_C = 25\text{ A}, R_G = 15\ \Omega, V_{GE} = 15\text{ V}, \text{Inductive Load}$	$t_{d(on)}$	–	27	–	ns
Rise Time		t_r	–	10	–	
Turn-off Delay Time		$t_{d(off)}$	–	181	–	
Fall Time		t_f	–	21	–	
Turn-on Switching Loss		E_{on}	–	0.24	–	mJ
Turn-off Switching Loss		E_{off}	–	0.31	–	
Total Switching Loss		E_{ts}	–	0.55	–	
Turn-on Delay Time	$T_J = 25^\circ\text{C}, V_{CC} = 400\text{ V}, I_C = 50\text{ A}, R_G = 15\ \Omega, V_{GE} = 15\text{ V}, \text{Inductive Load}$	$t_{d(on)}$	–	29	–	ns
Rise Time		t_r	–	21	–	
Turn-off Delay Time		$t_{d(off)}$	–	173	–	
Fall Time		t_f	–	18	–	
Turn-on Switching Loss		E_{on}	–	0.54	–	mJ
Turn-off Switching Loss		E_{off}	–	0.59	–	
Total Switching Loss		E_{ts}	–	1.13	–	

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
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SWITCHING CHARACTERISTICS, INDUCTIVE LOAD

Turn-on Delay Time	$T_J = 175^\circ\text{C}$, $V_{CC} = 400\text{ V}$, $I_C = 25\text{ A}$, $R_G = 15\ \Omega$, $V_{GE} = 15\text{ V}$, Inductive Load	$t_{d(on)}$	–	24	–	ns
Rise Time		t_r	–	11	–	
Turn-off Delay Time		$t_{d(off)}$	–	197	–	
Fall Time		t_f	–	24	–	
Turn-on Switching Loss		E_{on}	–	0.31	–	mJ
Turn-off Switching Loss		E_{off}	–	0.51	–	
Total Switching Loss		E_{ts}	–	0.82	–	
Turn-on Delay Time	$T_J = 175^\circ\text{C}$, $V_{CC} = 400\text{ V}$, $I_C = 50\text{ A}$, $R_G = 15\ \Omega$, $V_{GE} = 15\text{ V}$, Inductive Load	$t_{d(on)}$	–	26	–	ns
Rise Time		t_r	–	27	–	
Turn-off Delay Time		$t_{d(off)}$	–	186	–	
Fall Time		t_f	–	26	–	
Turn-on Switching Loss		E_{on}	–	0.74	–	mJ
Turn-off Switching Loss		E_{off}	–	0.97	–	
Total Switching Loss		E_{ts}	–	1.71	–	

DIODE CHARACTERISTICS

Diode Forward Voltage	$I_F = 50\text{ A}$, $T_J = 25^\circ\text{C}$	V_F	–	1.46	1.7	V
	$I_F = 50\text{ A}$, $T_J = 175^\circ\text{C}$		–	1.83	–	
Total Capacitance	$V_R = 400\text{ V}$, $f = 1\text{ MHz}$, $T_J = 25^\circ\text{C}$	C	–	210	–	pF
	$V_R = 600\text{ V}$, $f = 1\text{ MHz}$, $T_J = 25^\circ\text{C}$		–	202	–	

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.

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TYPICAL CHARACTERISTICS

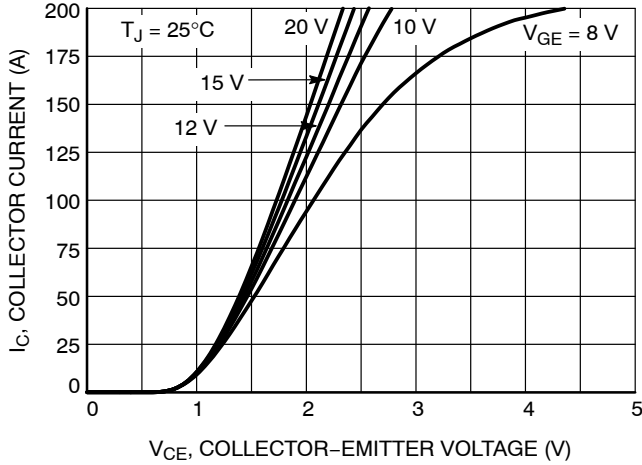


Figure 1. Typical Output Characteristics

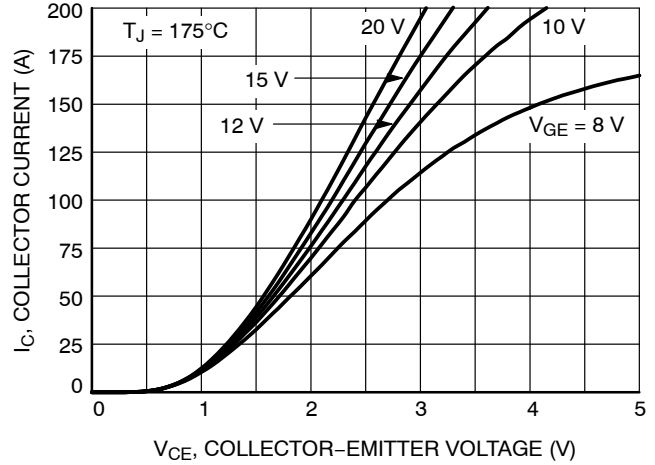


Figure 2. Typical Output Characteristics

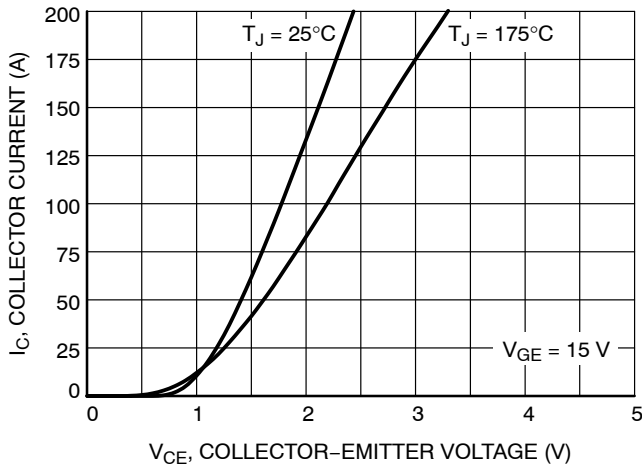


Figure 3. Typical Output Characteristics

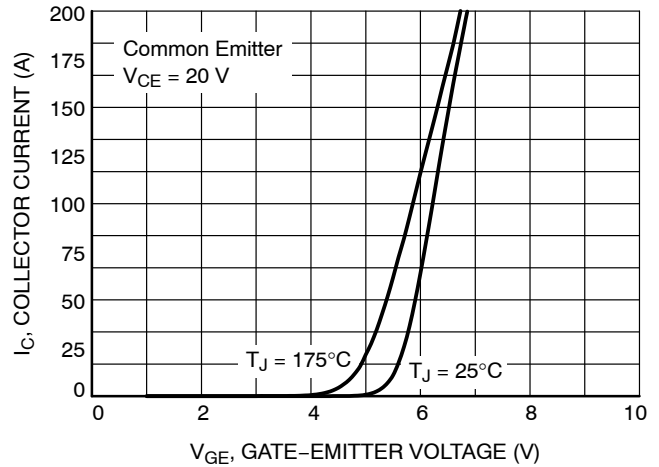


Figure 4. Transfer Characteristics

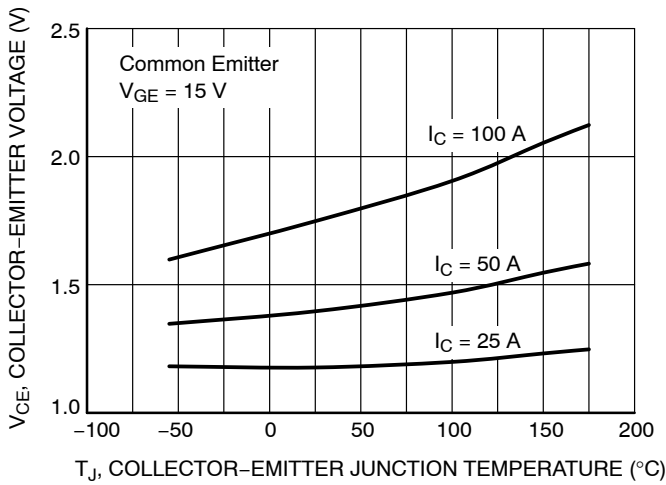


Figure 5. Saturation Voltage vs. Junction Temperature at Variant Current Level

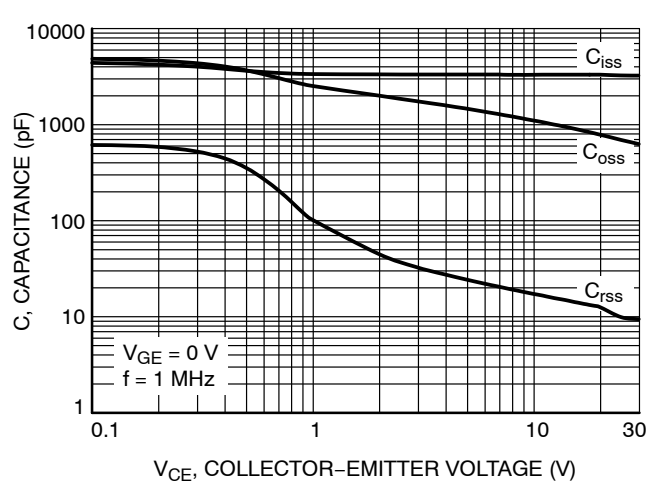


Figure 6. Capacitance Variation

TYPICAL CHARACTERISTICS

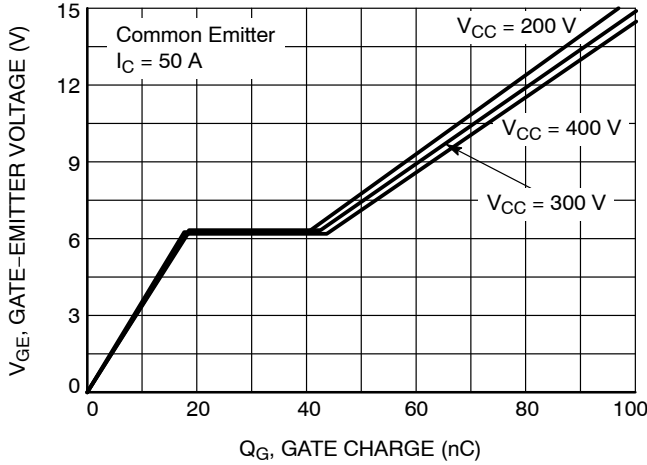


Figure 7. Gate Charge Characteristics

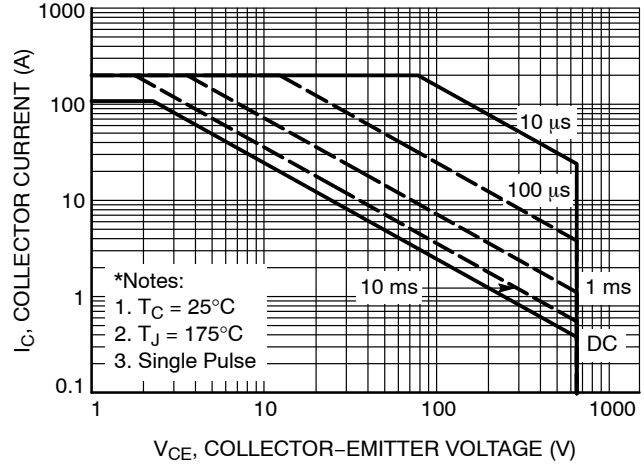


Figure 8. SOA Characteristics

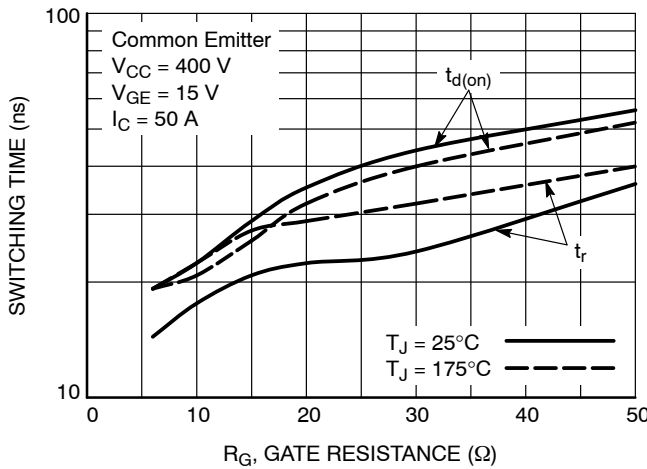


Figure 9. Turn-On Characteristics vs. Gate Resistance

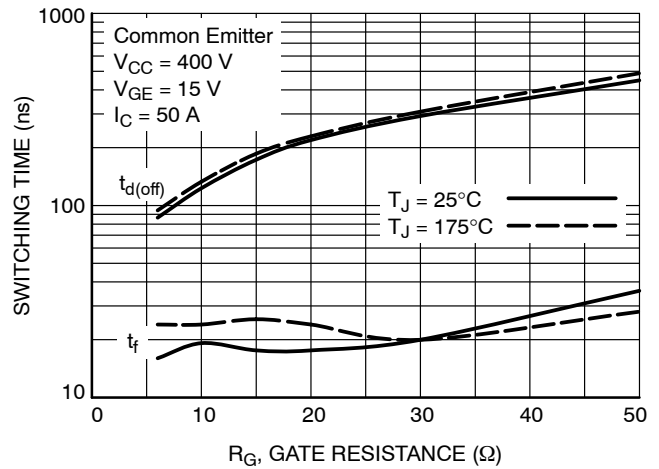


Figure 10. Turn-Off Characteristics vs. Gate Resistance

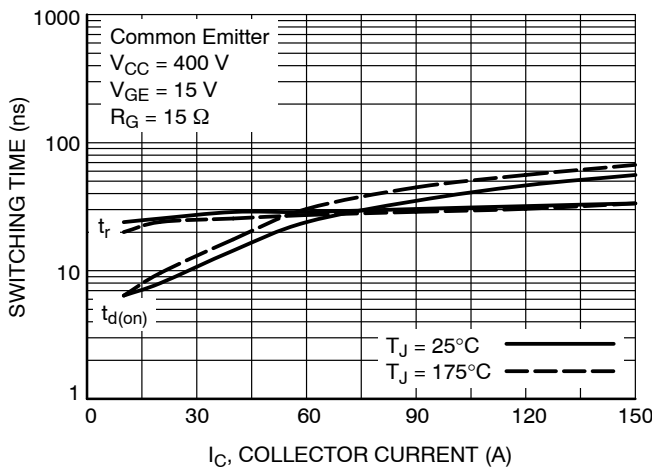


Figure 11. Turn-on Characteristics vs. Collector Current

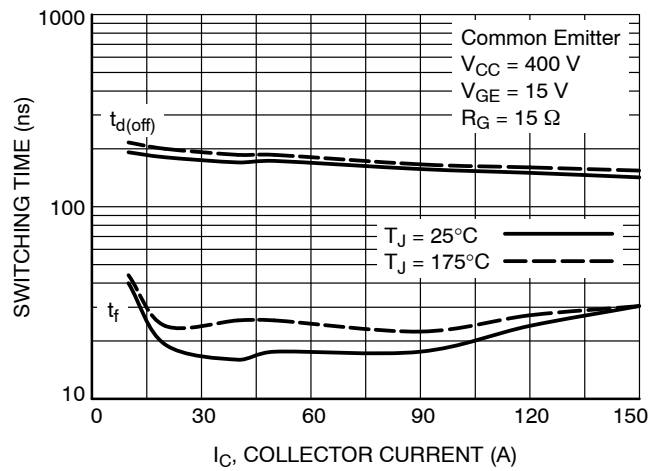


Figure 12. Turn-off Characteristics vs. Collector Current

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TYPICAL CHARACTERISTICS

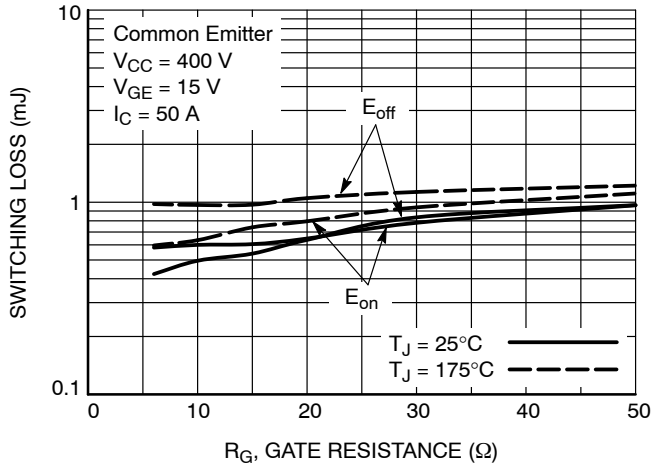


Figure 13. Switching Loss vs. Gate Resistance

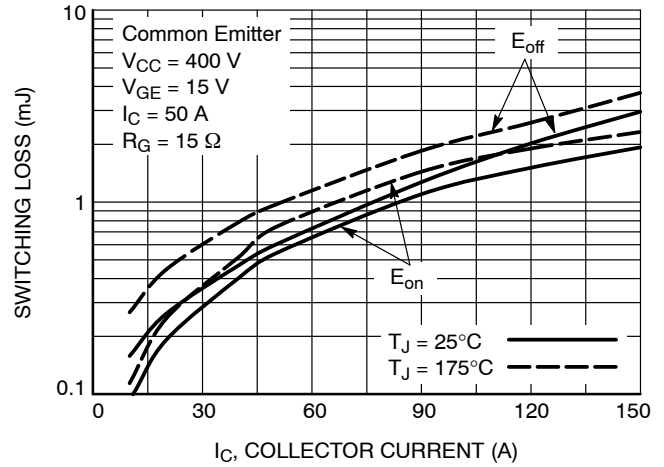


Figure 14. Switching Loss vs. Collector Current

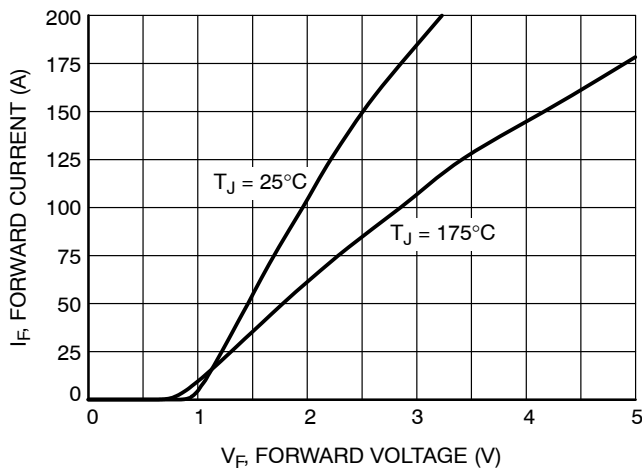


Figure 15. Forward Diode Characteristics

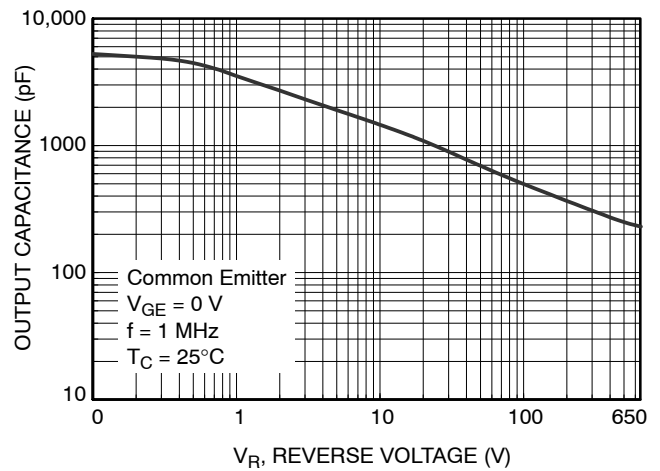


Figure 16. (Diode) Output Capacitance (Coes) vs. Reverse Voltage

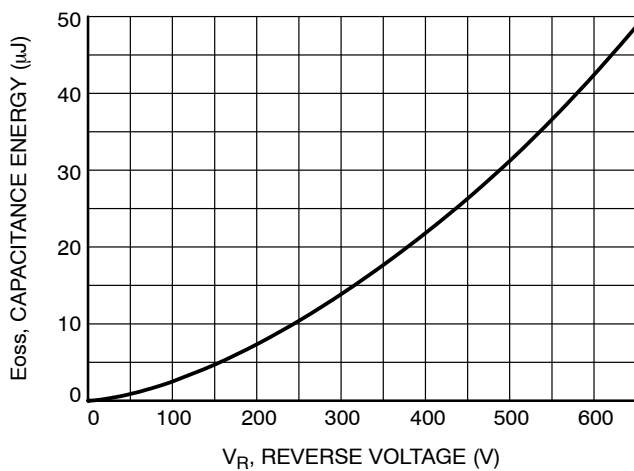


Figure 17. Output Capacitance Stored Energy

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TYPICAL CHARACTERISTICS

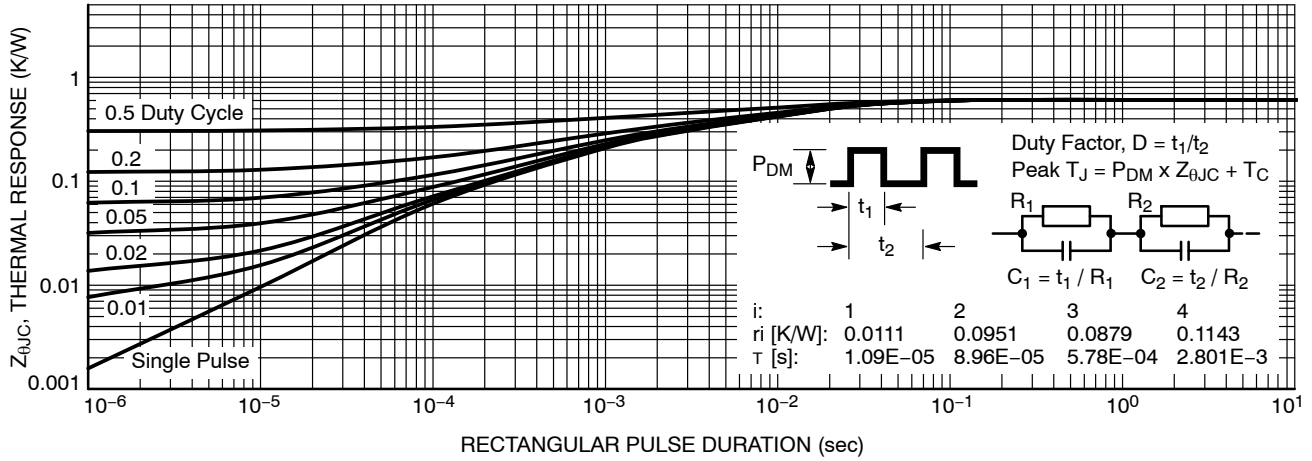


Figure 18. Transient Thermal Impedance of IGBT

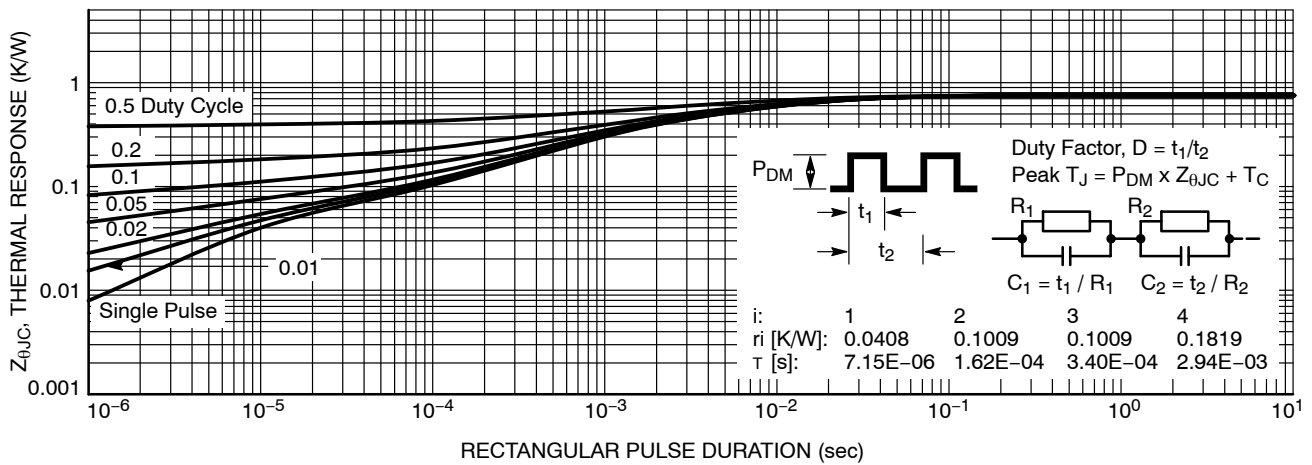
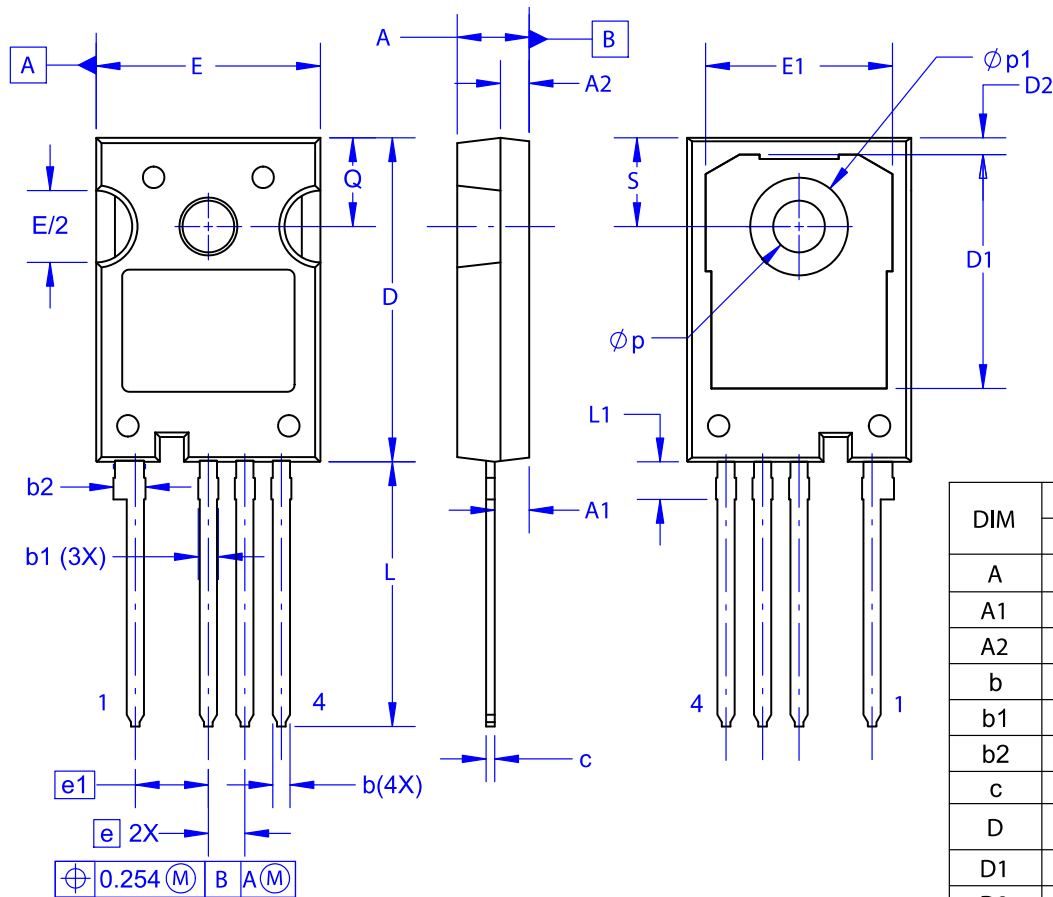


Figure 19. Transient Thermal Impedance of Diode

TO-247-4LD
CASE 340CJ
ISSUE A

DATE 16 SEP 2019


NOTES:

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