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May 2016

FGY160T65SPD_F085

650V, 160A Field Stop Trench IGBT With Soft Fast Recovery Diode

Features

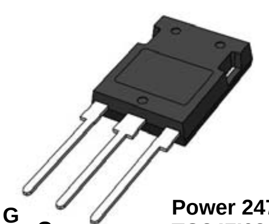
- Automotive Qualified
- Very low saturation voltage : $V_{CE(sat)}$ = 1.6 V(Typ.) @ I_C = 160 A
- Maximum junction temperature : T_J = 175 ^oC
- Positive temperature Co-efficient
- Tight parameter distribution
- High input impedance
- 100% of the parts are dynamically tested
- Short circuit ruggedness > 6 μs @ 25 ^oC
- Copacked with soft, fast recovery Extremefast diode

Benefits

- Very Low conduction and switching losses for a high efficiency operation in various applications
- Rugged transient reliability
- Outstanding parallel operation performance with balance current sharing
- Low EMI

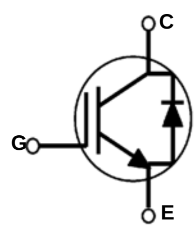
Applications

- Traction inverter for HEV/EV
- Auxiliary DC/AC converter
- Motor drives
- Other power-train applications requiring high power switch



G C E

Power 247
TO247I03



Absolute Maximum Ratings

Symbol	Description		Ratings	Units
V_{CES}	Collector to Emitter Voltage		650	V
V_{GES}	Gate to Emitter Voltage		± 20	V
I_C	Collector Current (Note1)	@ T_C = 25 ^oC	240	A
	Collector Current	@ T_C = 100 ^oC	220	A
$I_{Nominal}$	Nominal Current		160	A
I_{CM}	Pulsed Collector Current		480	A
I_F	Diode Forward Current (Note1)	@ T_C = 25 ^oC	240	A
	Diode Forward Current	@ T_C = 100 ^oC	188	A
P_D	Maximum Power Dissipation	@ T_C = 25 ^oC	882	W
	Maximum Power Dissipation	@ T_C = 100 ^oC	441	W
SCWT	Short Circuit Withstand Time	@ T_C = 25 ^oC	6	μs
dV/dt	Voltage Transient Ruggedness (Note2)		10	V/ns
T_J	Operating Junction Temperature		-55 to +175	^oC
T_{stg}	Storage Temperature Range		-55 to +175	^oC
T_L	Maximum Lead Temp. for soldering Purposes, 1/8” from case for 5 seconds		300	^oC

Notes:
1: Limited by bondwire
2: V_{CC} = 400 V, V_{GE} = 15 V, I_{CE} = 480 A, Inductive Load

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$(IGBT)	Thermal Resistance, Junction to Case	-	0.17	$^oC/W$
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case	-	0.32	$^oC/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	$^oC/W$

Package Marking and Ordering Information

Device Marking	Device	Package	Packing Type	Qty per Tube
FGY160T65SPD	FGY160T65SPD_F085	TP-247	Tube	30ea

For Fairchild's definition of "green" Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html.

Electrical Characteristics of the IGBT

T_J = 25 °C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{CES}	Collector to Emitter Breakdown Voltage	V_{GE} = 0V, I_C = 1mA	650	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	V_{GE} = 0V, I_C = 1mA	-	0.6	-	$V/^oC$
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}$, V_{GE} = 0V	-	-	40	µA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}$, V_{CE} = 0V	-	-	± 250	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	I_C = 160mA, $V_{CE} = V_{GE}$	4.3	5.3	6.3	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C = 160A, V_{GE} = 15V	-	1.6	2.05	V
		I_C = 160A, V_{GE} = 15V, T_J = 175 ^oC	-	2.15	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	V_{CE} = 30V, V_{GE} = 0V, f = 1MHz	-	6710	-	pF
C_{oes}	Output Capacitance		-	450	-	pF
C_{res}	Reverse Transfer Capacitance		-	55	-	pF
R_G	Internal Gate Resistance	f = 1MHz	-	3	-	Ω
Switching Characteristics						
$T_{d(on)}$	Turn-On Delay Time	V_{CC} = 400V, I_C = 160A, R_G = 5Ω, V_{GE} = 15V, Inductive Load, T_J = 25 ^oC	-	53	-	ns
T_r	Rise Time		-	197	-	ns
$T_{d(off)}$	Turn-Off Delay Time		-	98	-	ns
T_f	Fall Time		-	141	-	ns
E_{on}	Turn-On Switching Loss		-	12.4	-	mJ
E_{off}	Turn-Off Switching Loss		-	5.7	-	mJ
E_{ts}	Total Switching Loss		-	18.1	-	mJ
$T_{d(on)}$	Turn-On Delay Time	V_{CC} = 400V, I_C = 160A, R_G = 5Ω, V_{GE} = 15V, Inductive Load, T_J = 175 ^oC	-	52	-	ns
T_r	Rise Time		-	236	-	ns
$T_{d(off)}$	Turn-Off Delay Time		-	104	-	ns
T_f	Fall Time		-	204	-	ns
E_{on}	Turn-On Switching Loss		-	21	-	mJ
E_{off}	Turn-Off Switching Loss		-	8.5	-	mJ
E_{ts}	Total Switching Loss		-	29.5	-	mJ

Electrical Characteristics of the IGBT (Continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Units
Q_g	Total Gate Charge	V_{CE} = 400V, I_C = 160A, V_{GE} = 15V	-	163	245	nC
Q_{ge}	Gate to Emitter Charge		-	50	-	nC
Q_{gc}	Gate to Collector Charge		-	49	-	nC

Electrical Characteristics of the Diode T_J = 25 °C unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max	Units
V_{FM}	Diode Forward Voltage	I_F = 160A	T_J = 25 ^oC	-	1.4	1.7	V
			T_J = 175 ^oC	-	1.35	-	
E_{rec}	Reverse Recovery Energy	V_{CE} = 400V, I_F = 160A, dI_F/dt = 1000A/μs	T_J = 25 ^oC	-	598	-	μJ
			T_J = 175 ^oC	-	4000	-	
T_{rr}	Diode Reverse Recovery Time		T_J = 25 ^oC	-	132	-	ns
			T_J = 175 ^oC	-	245	-	
Q_{rr}	Diode Reverse Recovery Charge		T_J = 25 ^oC	-	3.3	-	μC
			T_J = 175 ^oC	-	12.5	-	

Typical Performance Characteristics

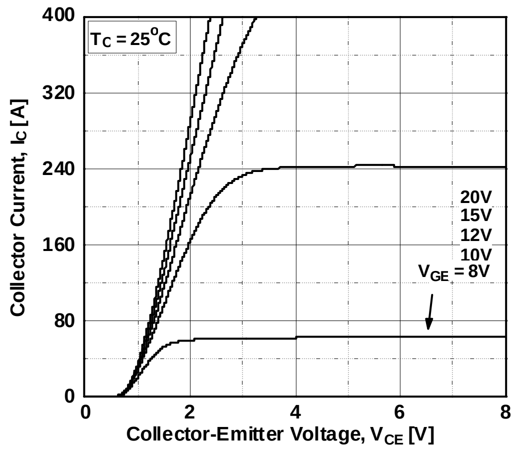


Figure 1. Typical Output Characteristics

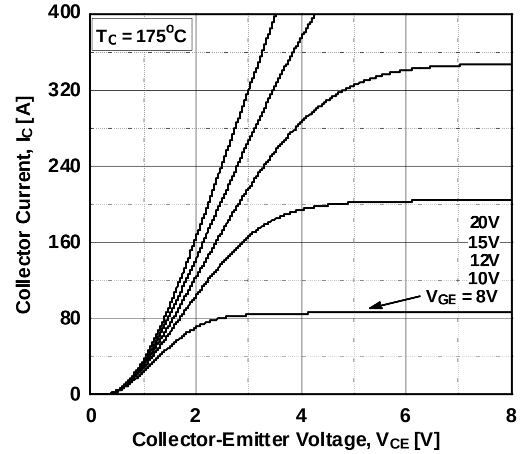


Figure 2. Typical Output Characteristics

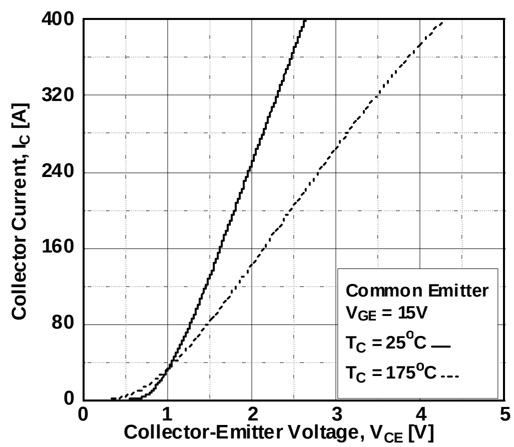


Figure 3. Typical SaturationVoltage

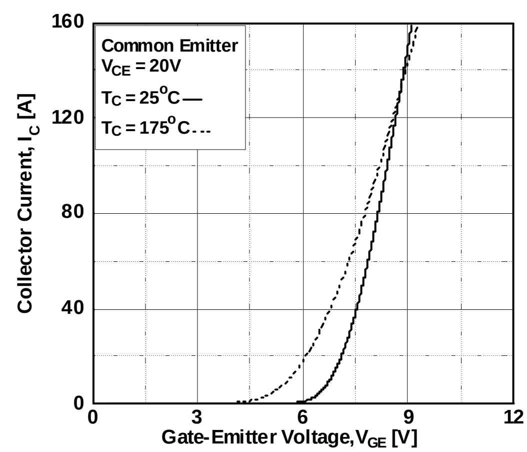


Figure 4. Transfer Charactersistics

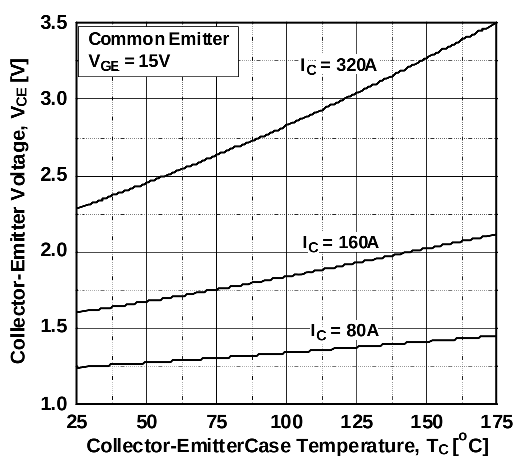


Figure 5. Saturation Voltage vs. Case Temperature at Varient Current Level

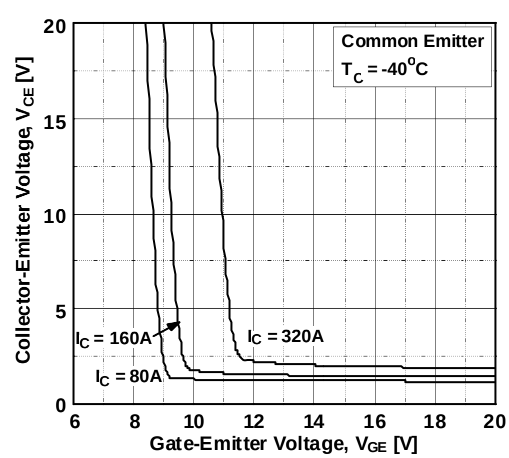


Figure 6. Saturation Voltage vs. VGE

Typical Performance Characteristics

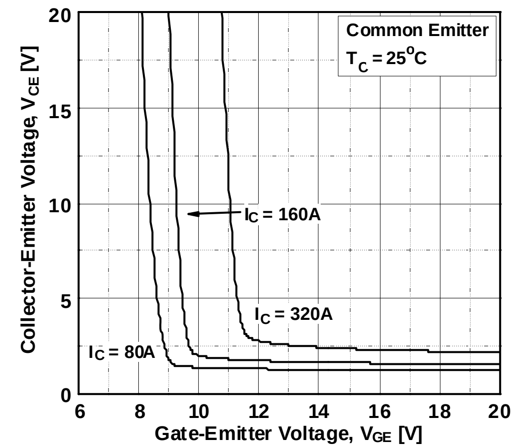


Figure 7. Saturation Voltage vs. VGE

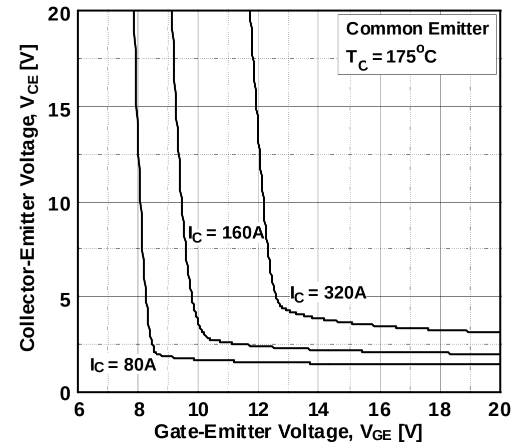


Figure 8. Saturation Voltage vs. VGE

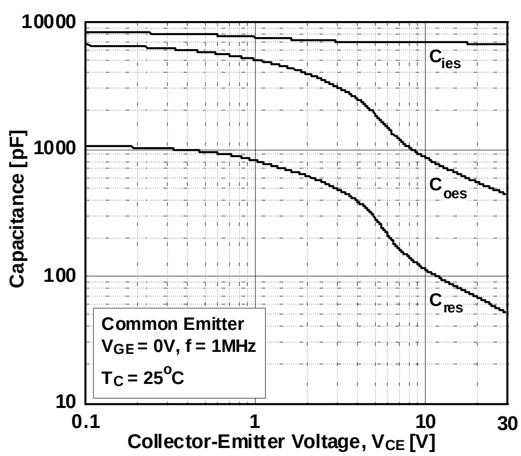


Figure 9. Capacitance Charateristics

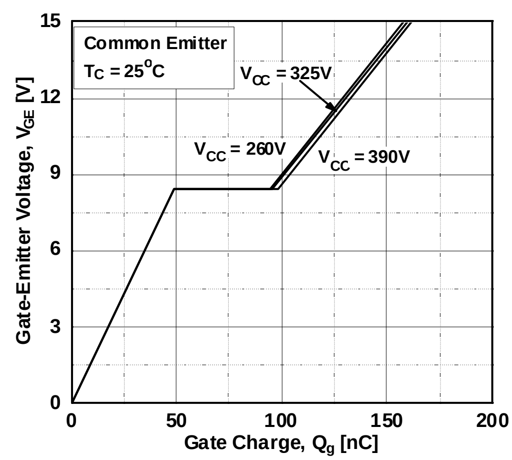


Figure 10. Gate Charge Charateristics

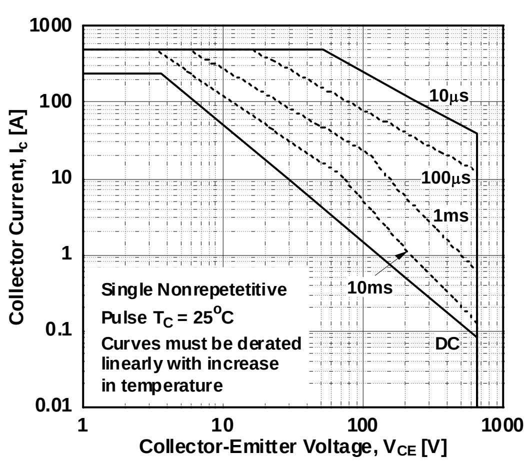


Figure 11. SOA Charateristics

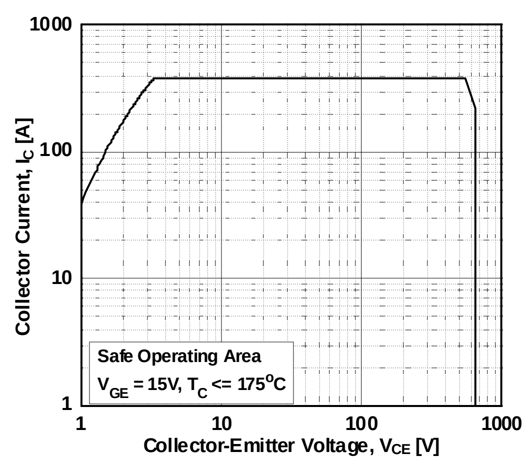


Figure 12. Turn off Switching SOA Charateristics

Typical Performance Characteristics

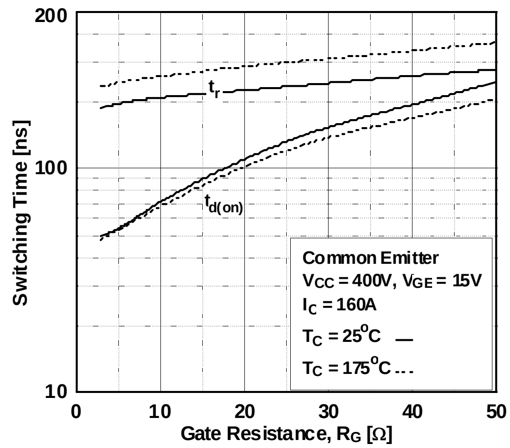


Figure 13. Turn-on Charaterizatics vs. Gate

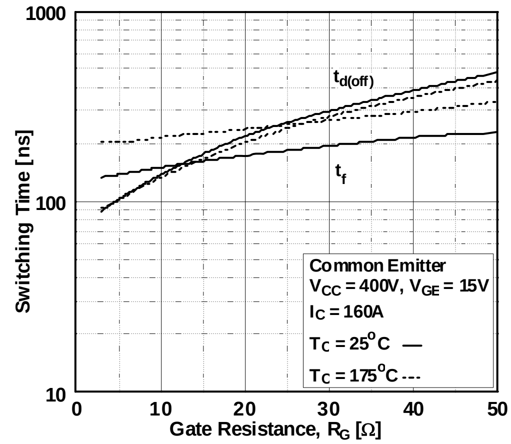


Figure 14. Turn-off Charaterizatics vs. Gate

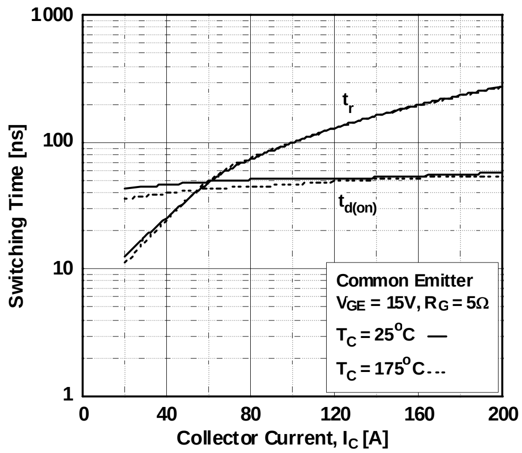


Figure 15. Turn-on Charaterizatics vs. Collector Current

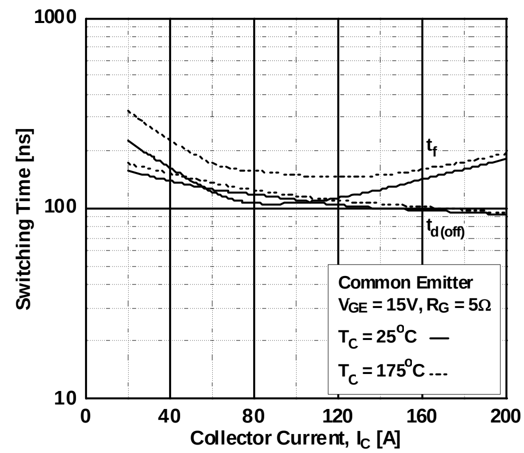


Figure 16. Turn-off Charaterizatics vs. Collector Current

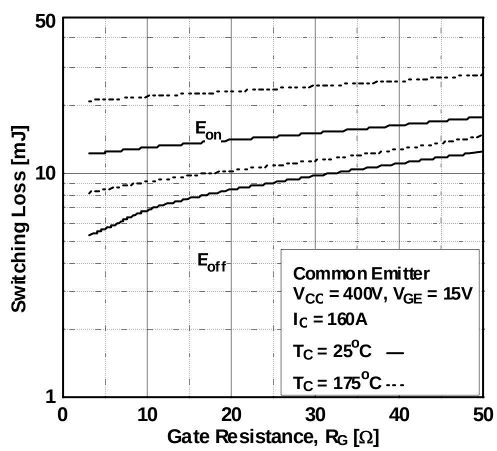


Figure 17. Switching Loss vs. Gate Resistance

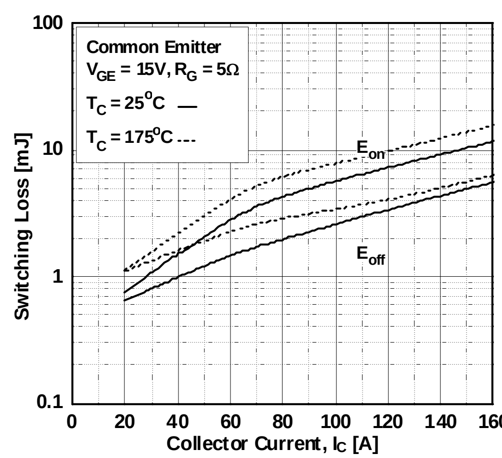


Figure 18. Switching Loss vs. Collector Current

Typical Performance Characteristics

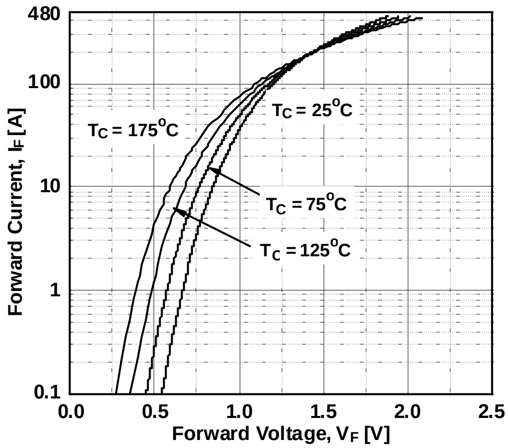


Figure 19. Forward Charateristics

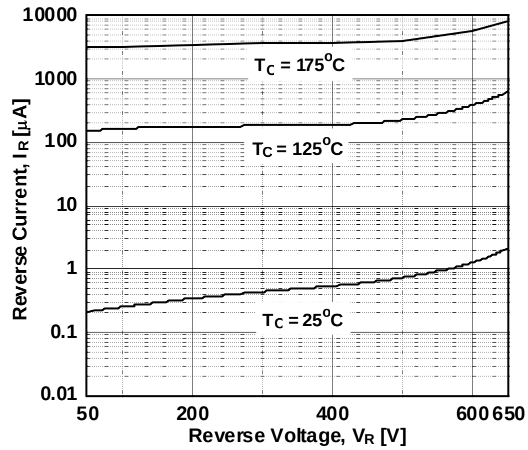


Figure 20. Reverse Current

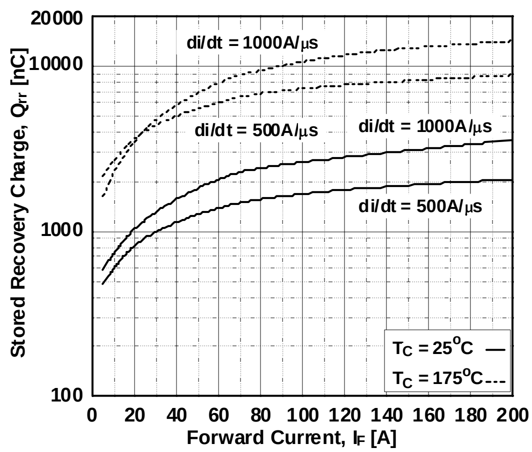


Figure 21. Stored Charge

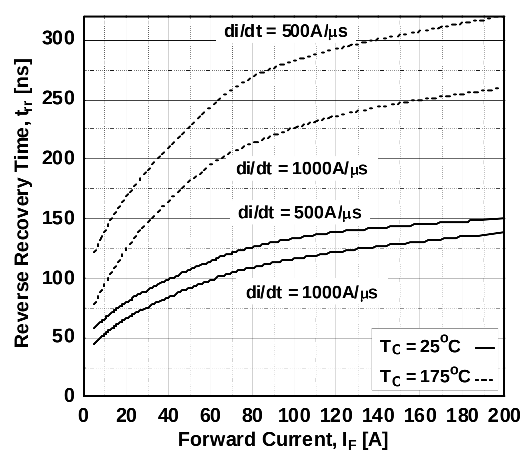


Figure 22. Reverse Recovery Time

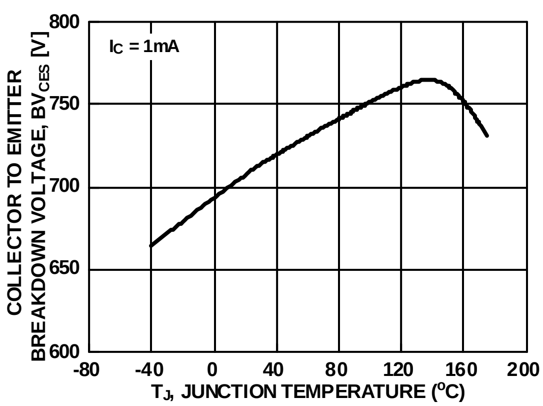


Figure 23. Collector to Emitter Breakdown Voltage vs. Junction Temperature

Typical Performance Characteristics

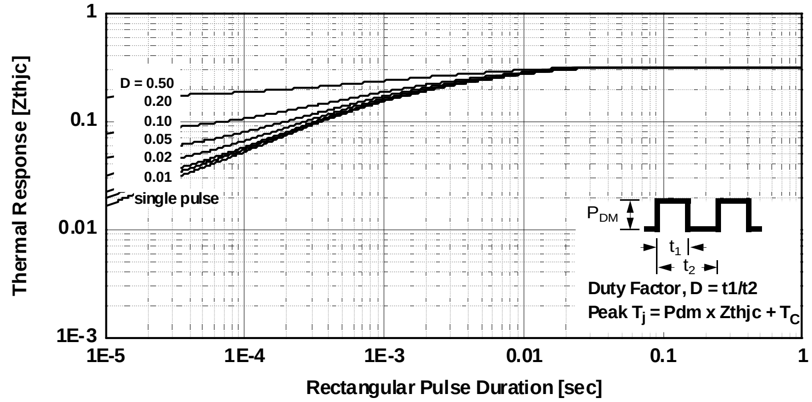


Figure 24. Transient Termal Impedance of Diode

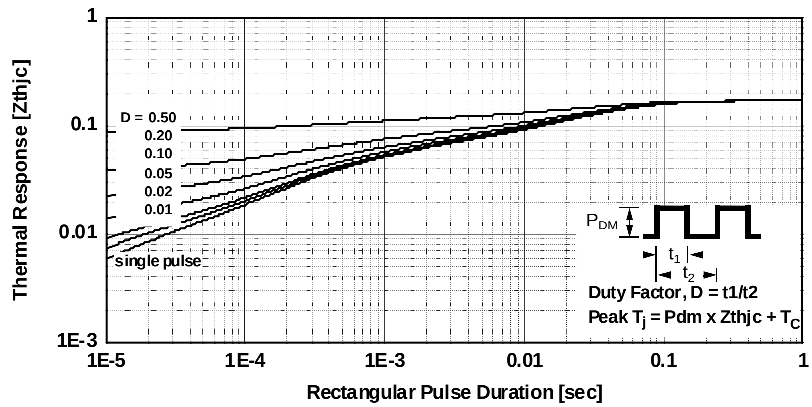
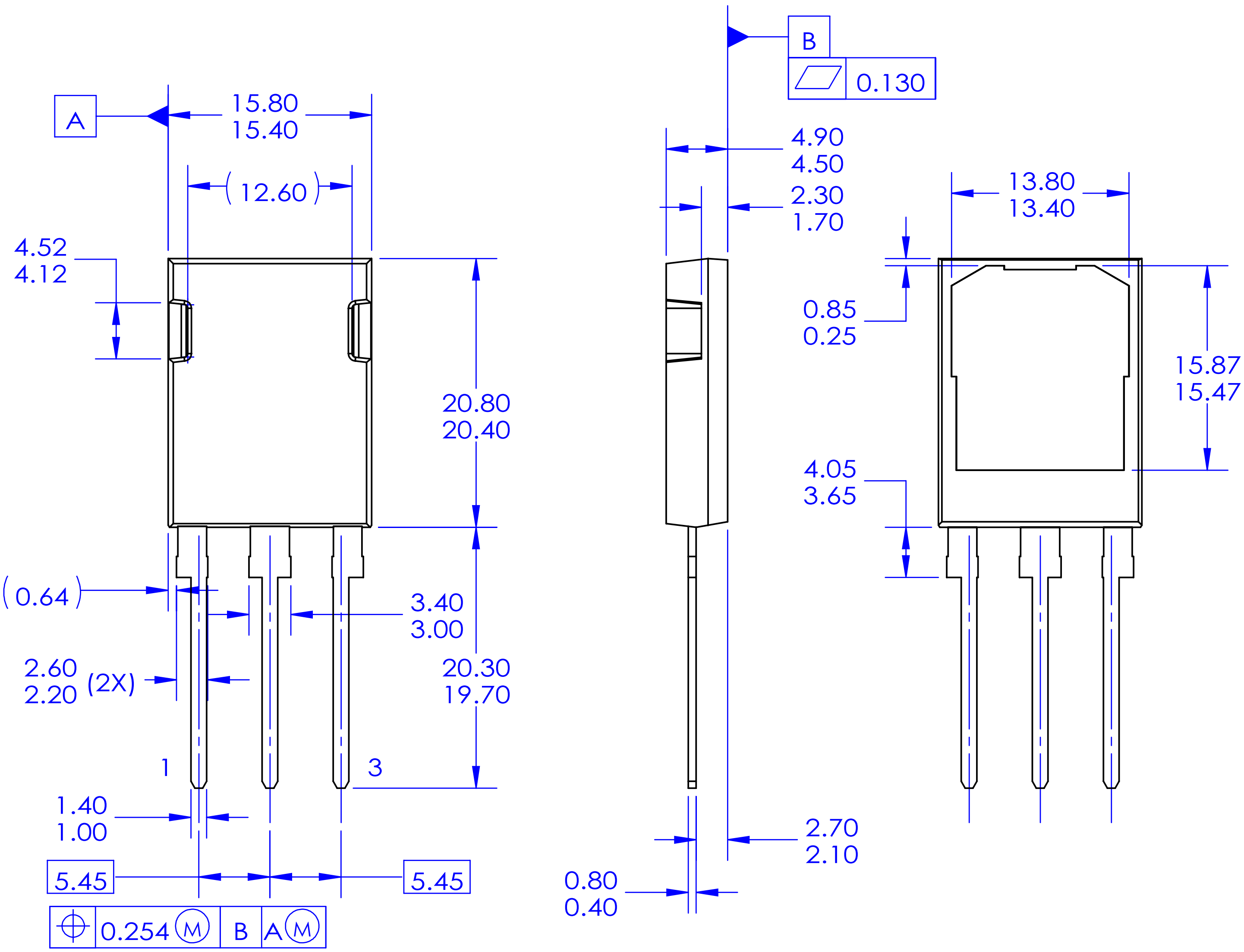


Figure 25. Transient Termal Impedance of IGBT



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