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FGD3N60UNDF

600 V, 3 A

Short Circuit Rated IGBT

Features

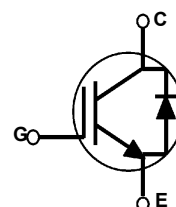
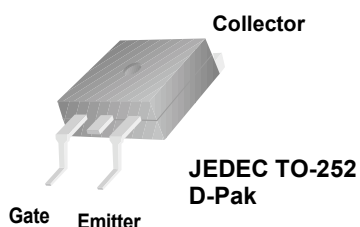
- Short Circuit Rated 10us
- High Current Capability
- High Input Impedance
- Fast Switching
- RoHS Compliant

Applications

- Sewing Machine, CNC, Home Appliances, Motor Control

General Description

Using advanced NPT IGBT technology, Fairchild®'s the NPT IGBTs offer the optimum performance for low-power inverter-driven applications where low-losses and short-circuit ruggedness features are essential.



Absolute Maximum Ratings

Symbol	Description	Ratings	Unit
V_{CES}	Collector to Emitter Voltage	600	V
V_{GES}	Gate to Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C = 25^\circ\text{C}$	6	A
	Collector Current @ $T_C = 100^\circ\text{C}$	3	A
$I_{CM(1)}$	Pulsed Collector Current @ $T_C = 25^\circ\text{C}$	9	A
I_F	Diode Forward Current @ $T_C = 25^\circ\text{C}$	3	A
P_D	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	60	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	24	W
T_J	Operating Junction Temperature	-55 to +150	$^\circ\text{C}$
T_{stg}	Storage Temperature Range	-55 to +150	$^\circ\text{C}$
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

Notes:

1: Repetitive rating: Pulse width limited by max. junction temperature

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}(\text{IGBT})$	Thermal Resistance, Junction to Case		2.08	$^\circ\text{C/W}$
$R_{\theta JC}(\text{Diode})$	Thermal Resistance, Junction to Case		5.0	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (PCB Mount)(2)		150	$^\circ\text{C/W}$

Notes:

2: Mounted on 1" square PCB (FR4 or G-10 material)

Package Marking and Ordering Information

Device Marking	Device	Package	Rel Size	Tape Width	Quantity
FGD3N60UNDF	FGD3N60UNDF	TO252	330mm	16mm	2500 units

Electrical Characteristics of the IGBT T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV _{CES}	Collector to Emitter Breakdown Voltage	V _{GE} = 0V, I _C = 250μA	600	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25°C	-	0.3	-	V/°C
I _{CES}	Collector Cut-Off Current	V _{CE} = V _{CES} , V _{GE} = 0V	-	-	1	mA
I _{GES}	G-E Leakage Current	V _{GE} = V _{GES} , V _{CE} = 0V	-	-	±10	uA
On Characteristics						
V _{GE(th)}	G-E Threshold Voltage	I _C = 3mA, V _{CE} = V _{GE}	5.5	6.8	8.5	V
V _{CE(sat)}	Collector to Emitter Saturation Voltage	I _C = 3A, V _{GE} = 15V	-	2.0	2.52	V
		I _C = 3A, V _{GE} = 15V, T _C = 125°C	-	2.4	-	V
Dynamic Characteristics						
C _{ies}	Input Capacitance	V _{CE} = 30V, V _{GE} = 0V, f = 1MHz	-	165		pF
C _{oes}	Output Capacitance		-	28		pF
C _{res}	Reverse Transfer Capacitance		-	8.5		pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{CC} = 400V, I _C = 3A, R _G = 10Ω, V _{GE} = 15V, Inductive Load, T _C = 25°C	-	5.5		ns
t _r	Rise Time		-	1.8		ns
t _{d(off)}	Turn-Off Delay Time		-	22		ns
t _f	Fall Time		-	91		ns
E _{on}	Turn-On Switching Loss		-	52		uJ
E _{off}	Turn-Off Switching Loss		-	30		uJ
E _{ts}	Total Switching Loss		-	82		uJ
t _{d(on)}	Turn-On Delay Time	V _{CC} = 400V, I _C = 3A, R _G = 10Ω, V _{GE} = 15V, Inductive Load, T _C = 125°C	-	4.8		ns
t _r	Rise Time		-	2.6		ns
t _{d(off)}	Turn-Off Delay Time		-	24		ns
t _f	Fall Time		-	122		ns
E _{on}	Turn-On Switching Loss		-	65		uJ
E _{off}	Turn-Off Switching Loss		-	44		uJ
E _{ts}	Total Switching Loss		-	109		uJ
T _{sc}	Short Circuit Withstand Time	V _{CC} = 350V, R _G = 100Ω, V _{GE} = 15V, T _C = 150°C	10			us

Electrical Characteristics of the IGBT $T_C = 25^\circ\text{C}$ unless otherwise noted

Q_g	Total Gate Charge	$V_{CE} = 400\text{V}, I_C = 3\text{A},$ $V_{GE} = 15\text{V}$	-	1.6	-	nC
Q_{ge}	Gate to Emitter Charge		-	6.6	-	nC
Q_{gc}	Gate to Collector Charge		-	11.3	-	nC

Electrical Characteristics of the Diode $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions		Min.	Typ.	Max	Unit
V _{FM}	Diode Forward Voltage	I _F = 3A	T _C = 25°C	-	1.7	2.2	V
			T _C = 125°C	-	1.6	-	
t _{rr}	Diode Reverse Recovery Time	I _F =3A, dI _F /dt = 200A/μs	T _C = 25°C	-	21	-	ns
			T _C = 125°C	-	31	-	
Q _{rr}	Diode Reverse Recovery Charge		T _C = 25°C	-	23	-	nC
			T _C = 125°C	-	49	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

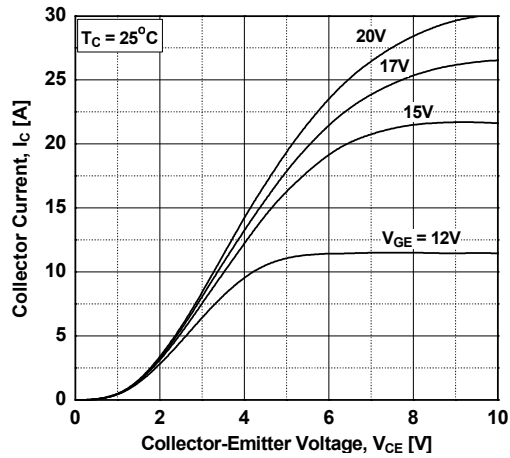


Figure 2. Typical Output Characteristics

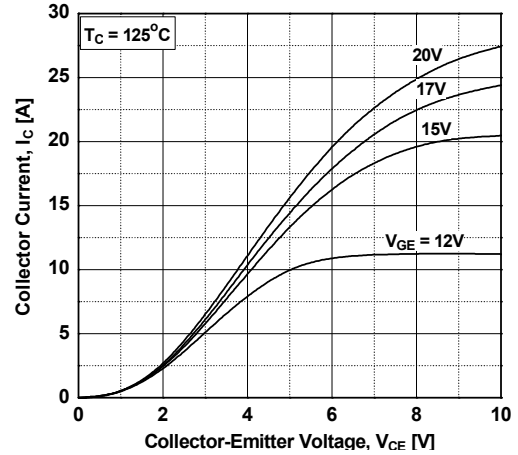


Figure 3. Typical Saturation Voltage Characteristics

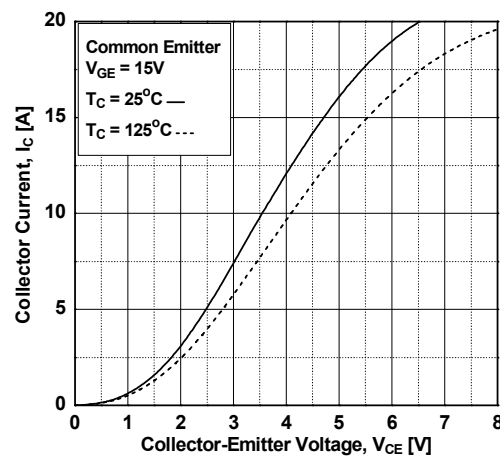


Figure 4. Transfer Characteristics

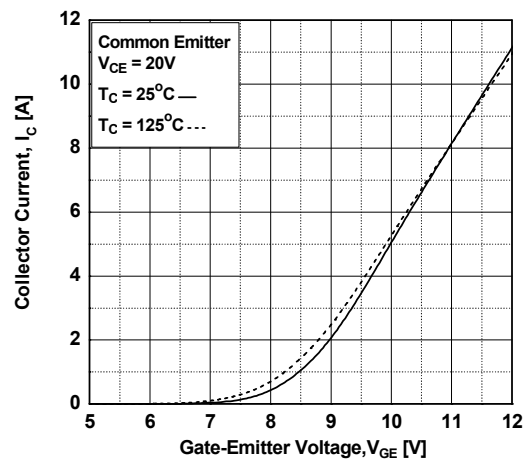


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

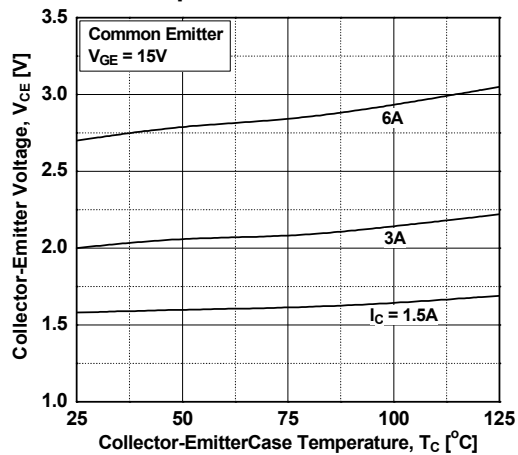
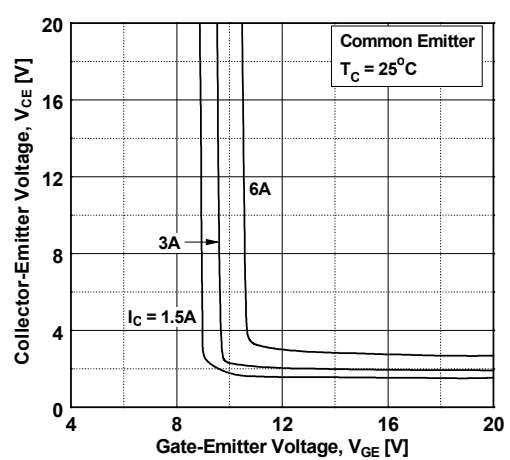


Figure 6. Saturation Voltage vs. Vge



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

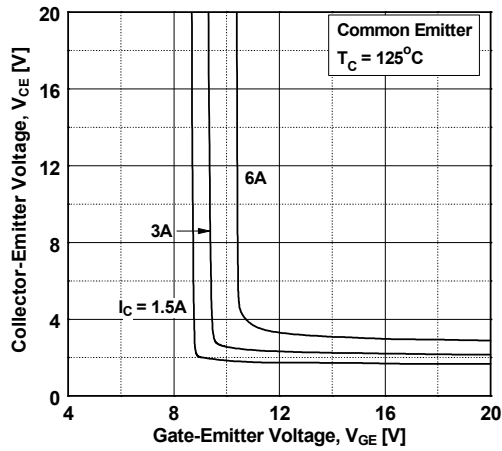


Figure 8. Capacitance Characteristics

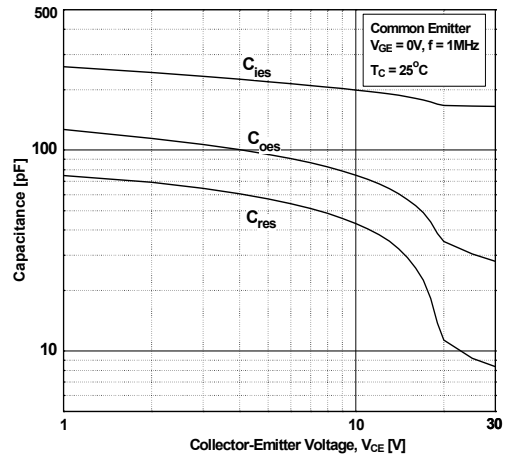


Figure 9. Gate charge Characteristics

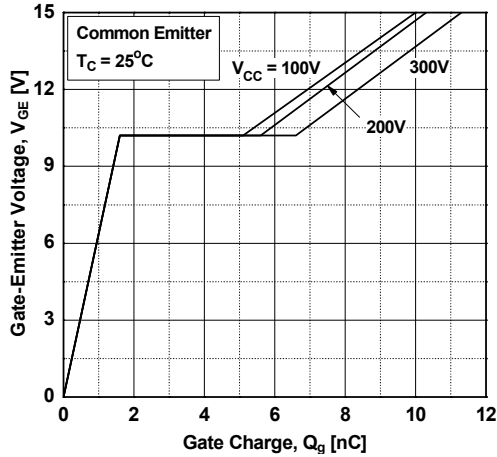


Figure 10. SOA Characteristics

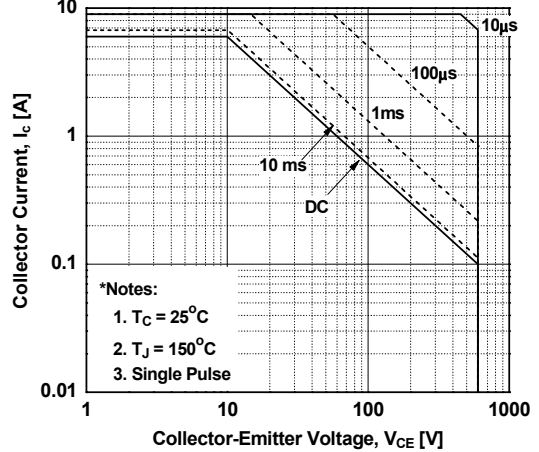


Figure 11. Turn-on Characteristics vs. Gate Resistance

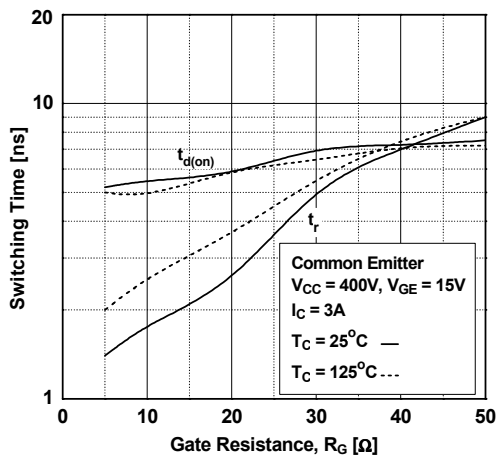
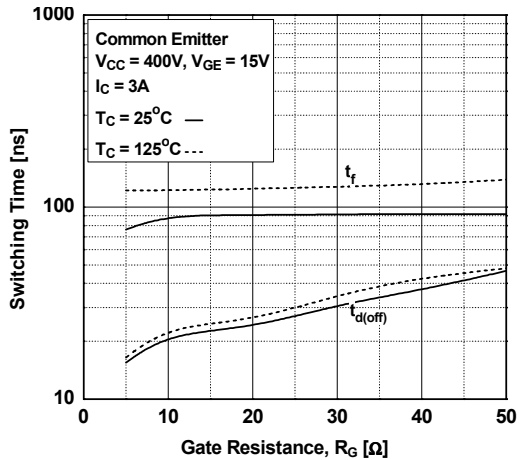


Figure 12. Turn-off Characteristics vs. Gate Resistance



Typical Performance Characteristics

Figure 13. Turn-on Characteristics vs. Collector Current

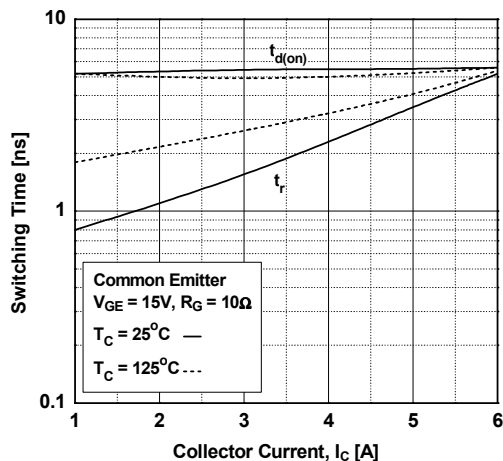


Figure 14. Turn-off Characteristics vs. Collector Current

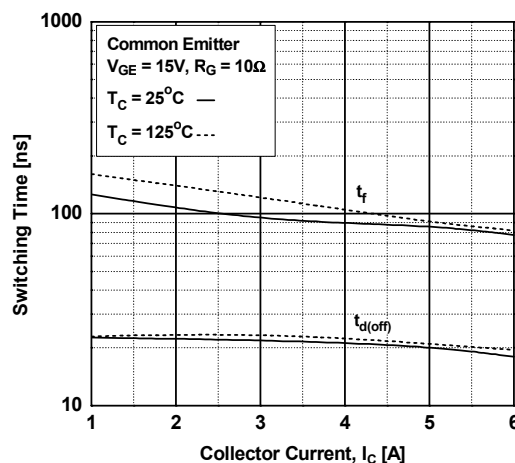


Figure 15. Switching Loss vs. Gate Resistance

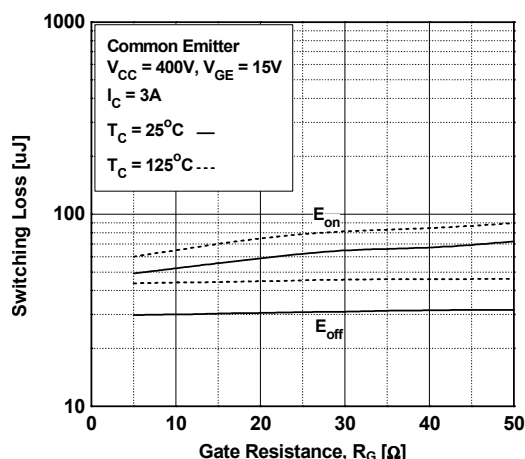


Figure 16. Switching Loss vs Collector Current

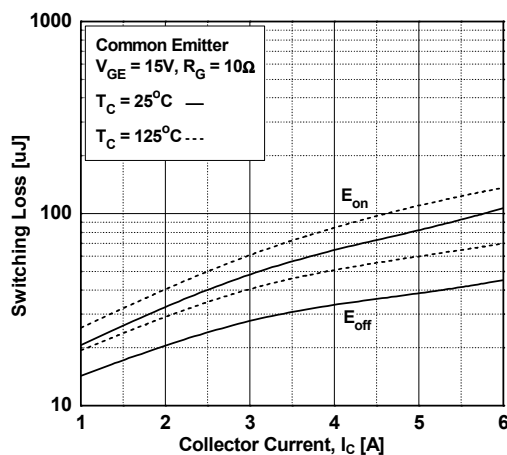


Figure 17. Turn off Switching SOA Characteristics

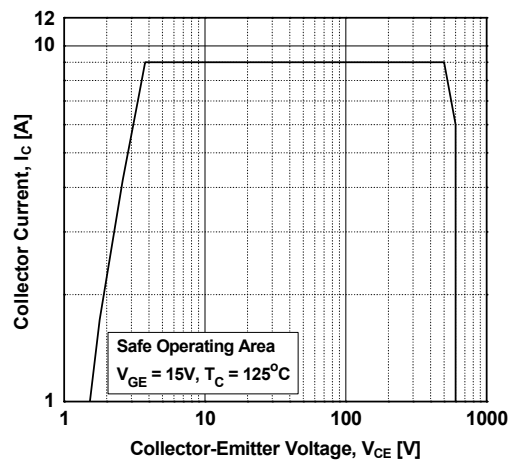
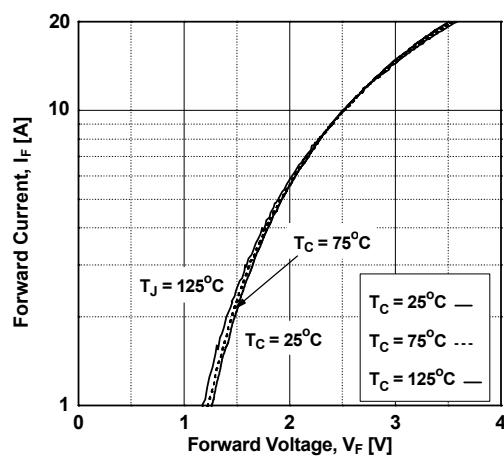


Figure 18. Forward Characteristics



Typical Performance Characteristics

Figure 19. Reverse Recovery Current

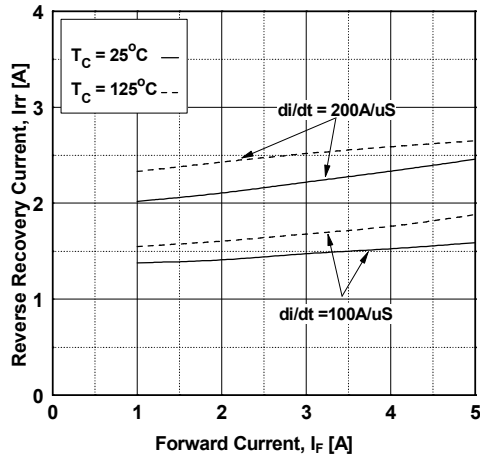


Figure 20. Stored Charge

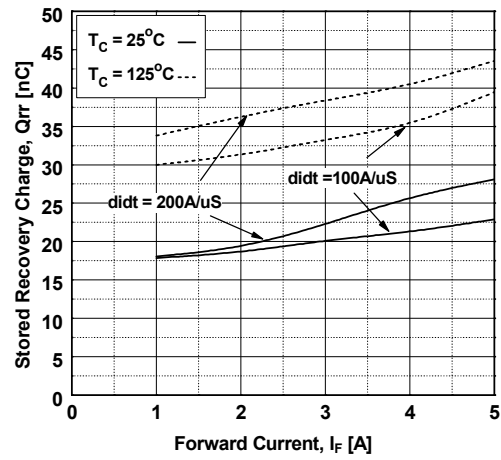


Figure 21. Reverse Recovery Time

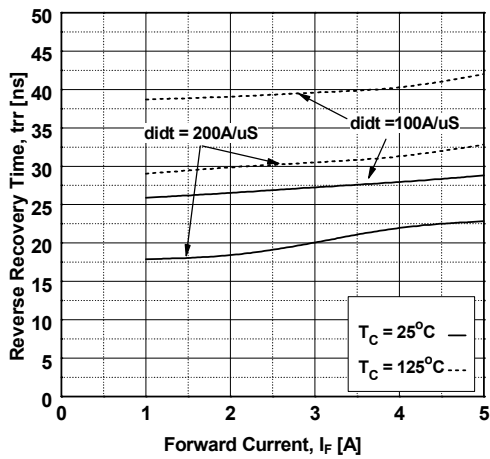
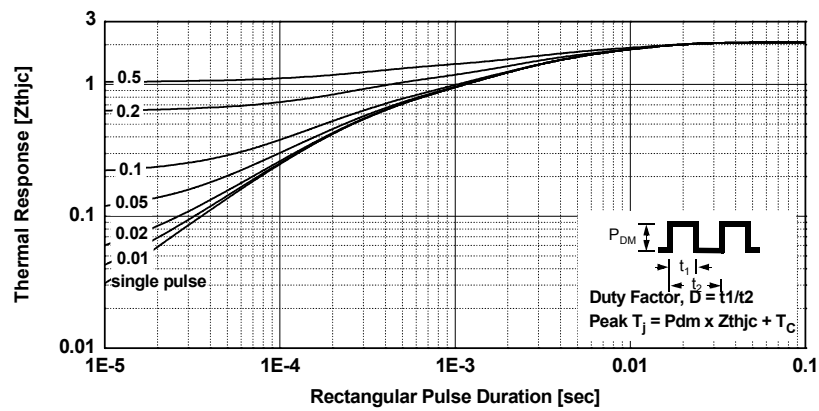
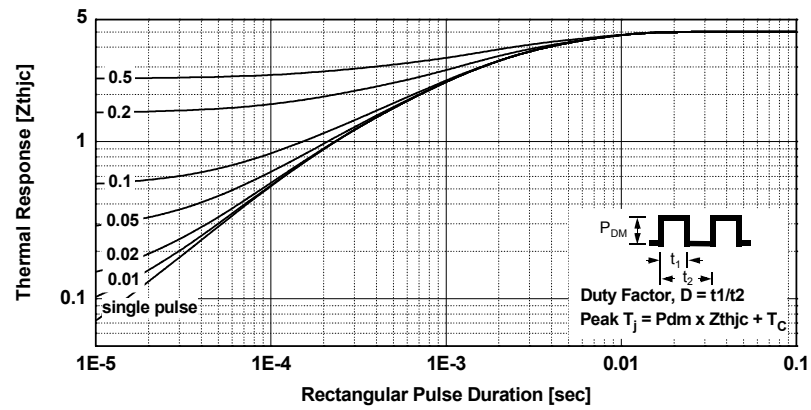


Figure 22. Transient Thermal Impedance of IGBT



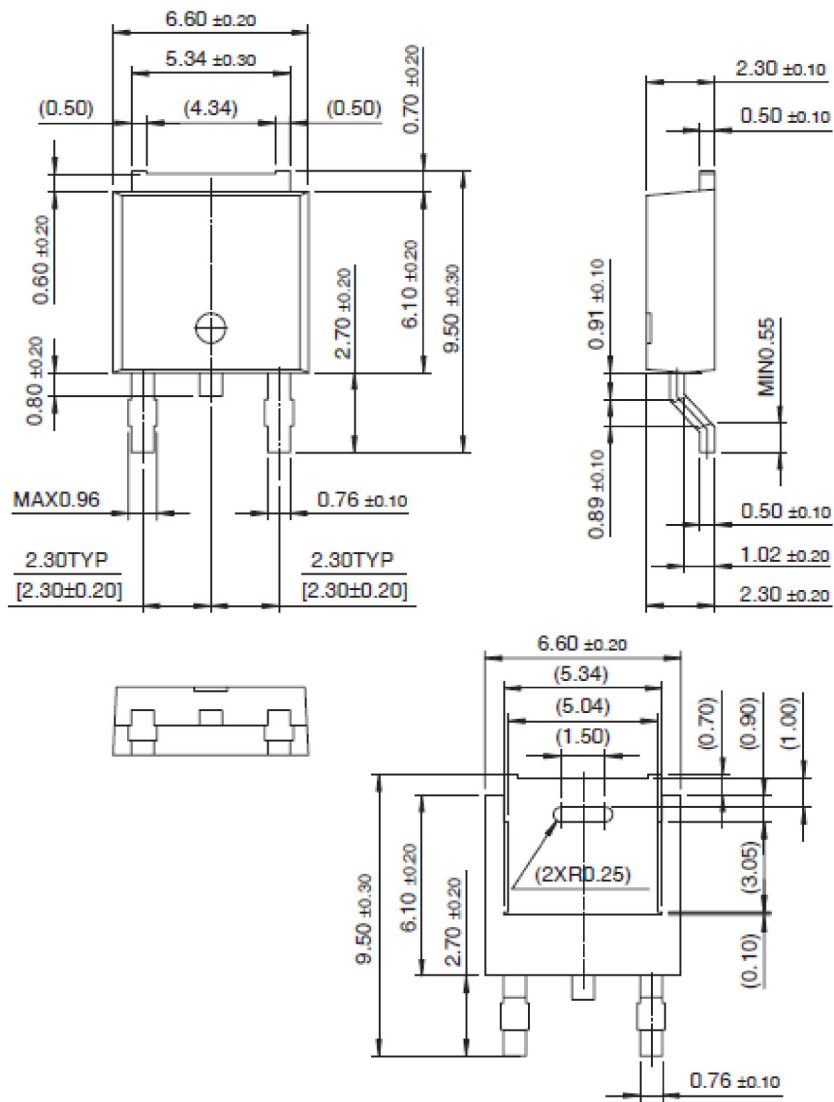
Typical Performance Characteristics

Figure 23. Transient Thermal Impedance of FRD



Mechanical Dimensions

D-PAK



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