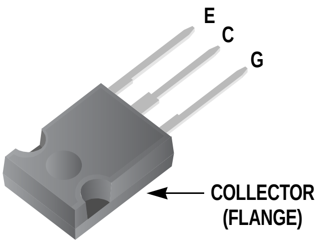
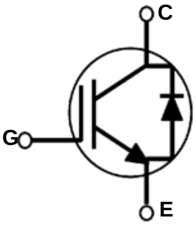
FGH40N60SFD

600V, 40A Field Stop IGBT

Features

- High current capability
- Low saturation voltage: $V_{CE(sat)}$ =2.3V @ I_C = 40A
- High input impedance
- Fast switching
- RoHS compliant





Absolute Maximum Ratings

Symbol	Description	Ratings	Units
V_{CES}	Collector to Emitter Voltage	600	V
V_{GES}	Gate to Emitter Voltage	± 20	V
I_C	Collector Current @ T_C = 25^{o}C	80	A
	Collector Current @ T_C = 100^{o}C	40	A
$I_{CM\ (1)}$	Pulsed Collector Current @ T_C = 25^{o}C	120	A
P_D	Maximum Power Dissipation @ T_C = 25^{o}C	290	W
	Maximum Power Dissipation @ T_C = 100^{o}C	116	W
T_J	Operating Junction Temperature	-55 to +150	^{o}C
T_{stg}	Storage Temperature Range	-55 to +150	^{o}C
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	^{o}C

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$(IGBT)	Thermal Resistance, Junction to Case	-	0.43	^{o}C/W
$R_{\theta JC}$(Diode)	Thermal Resistance, Junction to Case	-	1.45	^{o}C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	-	40	^{o}C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Packaging Type	Qty per Tube	Max Qty per Box
FGH40N60SFD	FGH40N60SFDTU	TO-247	Tube	30ea	-

Electrical Characteristics of the IGBT

T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{CES}	Collector to Emitter Breakdown Voltage	$V_{GE} = 0V$, $I_C = 250\mu A$	600	-	-	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0V$, $I_C = 250\mu A$	-	0.6	-	$V/^oC$
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}$, $V_{GE} = 0V$	-	-	250	μA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}$, $V_{CE} = 0V$	-	-	±400	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 250\mu A$, $V_{CE} = V_{GE}$	4.0	5.0	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 40A$, $V_{GE} = 15V$	-	2.3	2.9	V
		$I_C = 40A$, $V_{GE} = 15V$, $T_C = 125^oC$	-	2.5	-	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE} = 30V$, $V_{GE} = 0V$, f = 1MHz	-	2110	-	pF
C_{oes}	Output Capacitance		-	200	-	pF
C_{res}	Reverse Transfer Capacitance		-	60	-	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400V$, $I_C = 40A$, $R_G = 10\Omega$, $V_{GE} = 15V$, Inductive Load, $T_C = 25^oC$	-	25	-	ns
t_r	Rise Time		-	42	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	115	-	ns
t_f	Fall Time		-	27	54	ns
E_{on}	Turn-On Switching Loss		-	1.13	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.31	-	mJ
E_{ts}	Total Switching Loss		-	1.44	-	mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 400V$, $I_C = 40A$, $R_G = 10\Omega$, $V_{GE} = 15V$, Inductive Load, $T_C = 125^oC$	-	24	-	ns
t_r	Rise Time		-	43	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	120	-	ns
t_f	Fall Time		-	30	-	ns
E_{on}	Turn-On Switching Loss		-	1.14	-	mJ
E_{off}	Turn-Off Switching Loss		-	0.48	-	mJ
E_{ts}	Total Switching Loss		-	1.62	-	mJ
Q_g	Total Gate Charge	$V_{CE} = 400V$, $I_C = 40A$, $V_{GE} = 15V$	-	120	-	nC
Q_{ge}	Gate to Emitter Charge		-	14	-	nC
Q_{gc}	Gate to Collector Charge		-	58	-	nC

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

Symbol	Parameter	Test Conditions		Min.	Typ.	Max	Units
V_{FM}	Diode Forward Voltage	I_F = 20A	$T_C = 25^oC$	-	1.95	2.6	V
			$T_C = 125^oC$	-	1.85	-	
t_{rr}	Diode Reverse Recovery Time	I_{ES} =20A, dI_{ES}/dt = 200A/µs	$T_C = 25^oC$	-	45	-	ns
			$T_C = 125^oC$	-	140	-	
Q_{rr}	Diode Reverse Recovery Charge		$T_C = 25^oC$	-	75	-	nC
			$T_C = 125^oC$	-	375	-	

Typical Performance Characteristics

Figure 1. Typical Output Characteristics

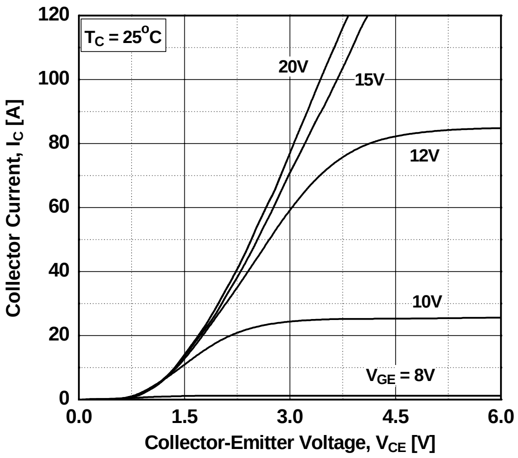


Figure 2. Typical Output Characteristics

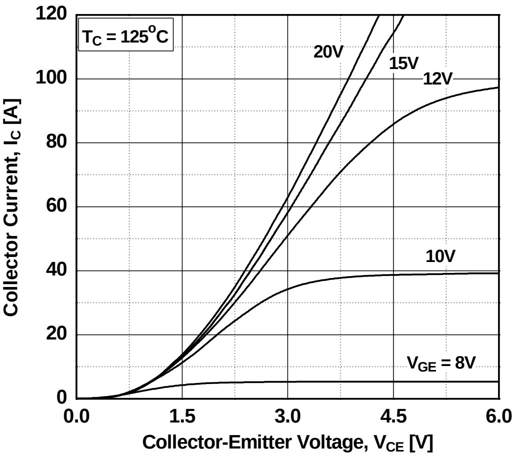


Figure 3. Typical Saturation Voltage Characteristics

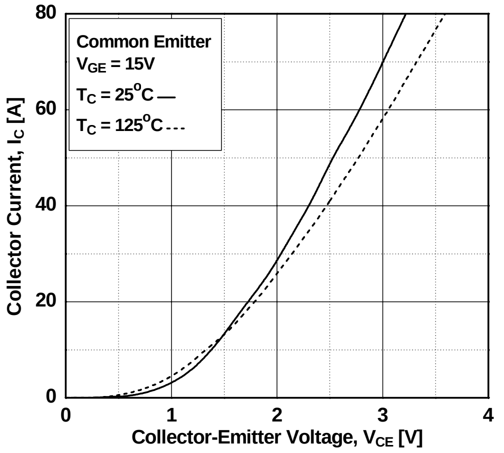


Figure 4. Transfer Characteristics

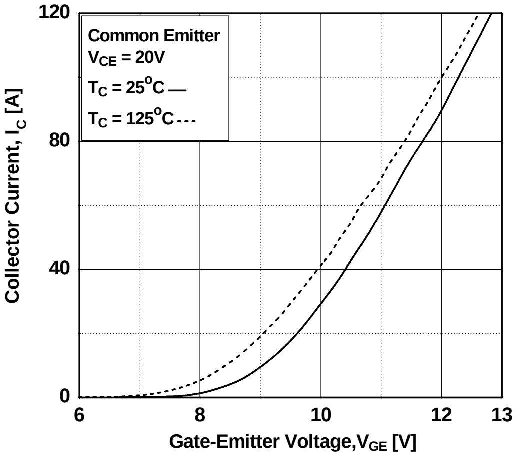


Figure 5. Saturation Voltage vs. Case Temperature at Variant Current Level

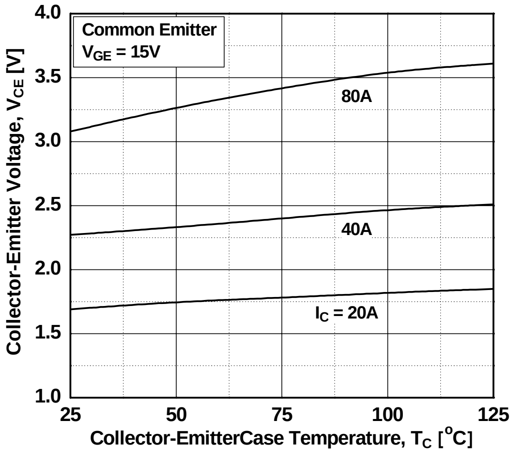
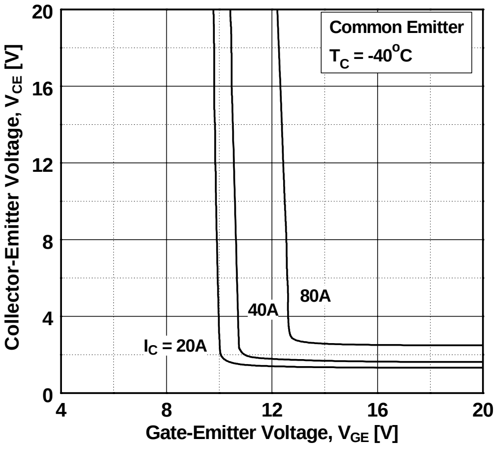


Figure 6. Saturation Voltage vs. V_{GE}



Typical Performance Characteristics

Figure 7. Saturation Voltage vs. V_{GE}

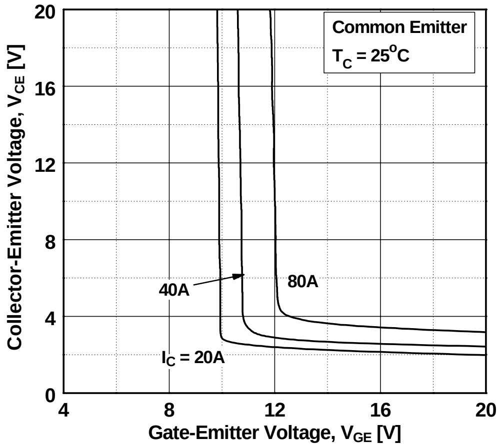


Figure 8. Saturation Voltage vs. V_{GE}

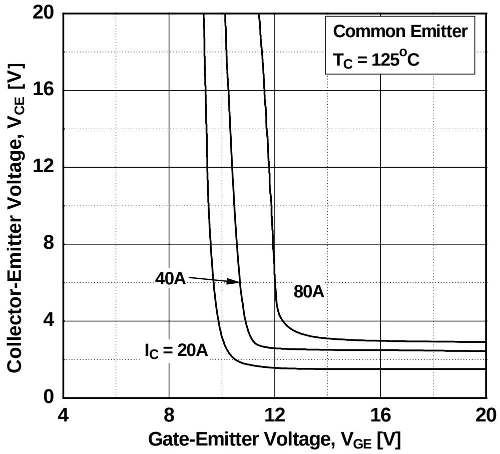


Figure 9. Capacitance Characteristics

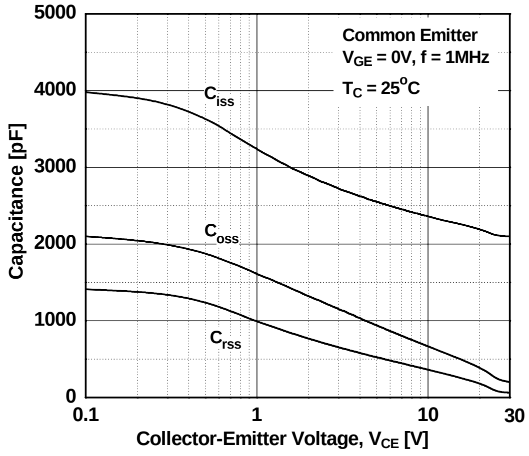


Figure 10. Gate charge Characteristics

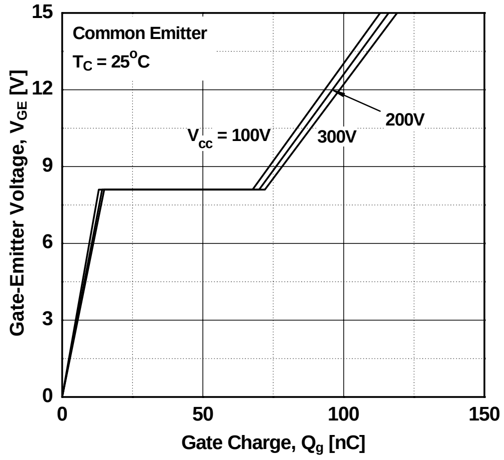


Figure 11. SOA Characteristics

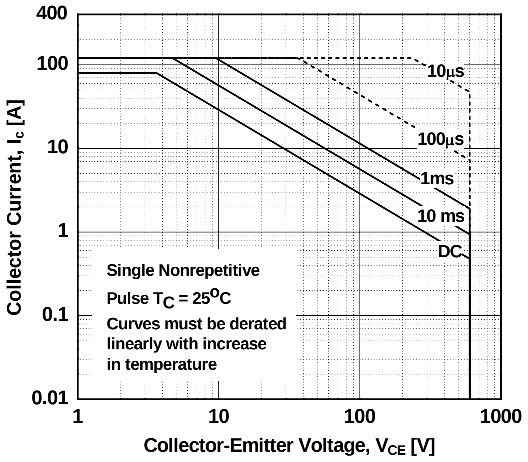
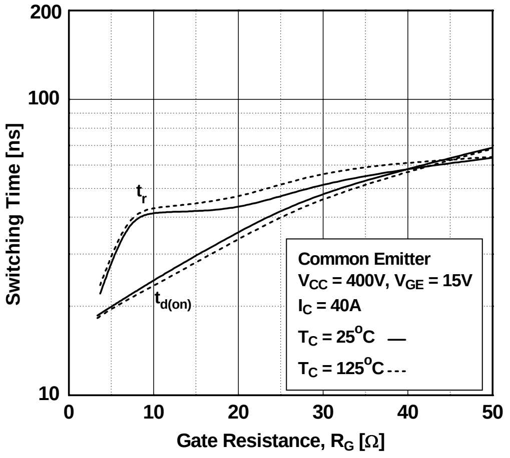


Figure 12. Turn-on Characteristics vs. Gate Resistance



Typical Performance Characteristics

Figure 13. Turn-off Characteristics vs. Gate Resistance

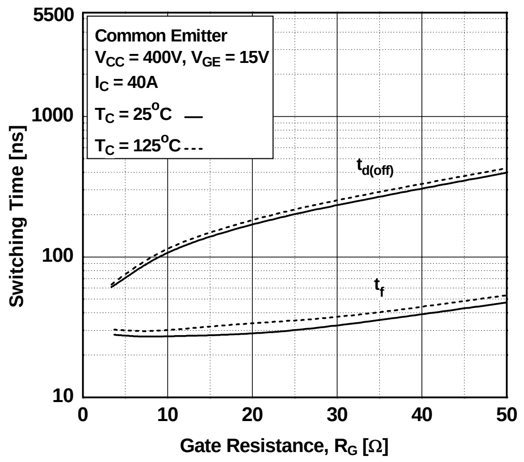


Figure 14. Turn-on Characteristics vs. Collector Current

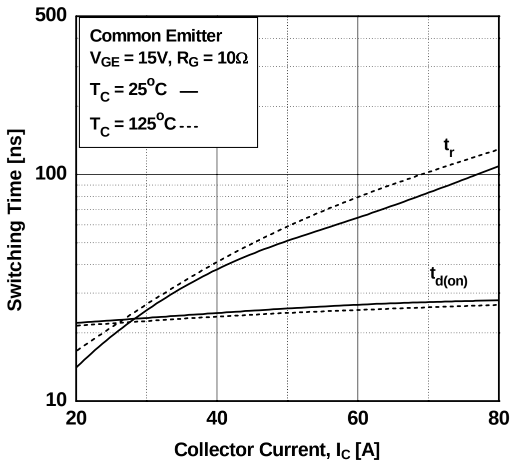


Figure 15. Turn-off Characteristics vs. Collector Current

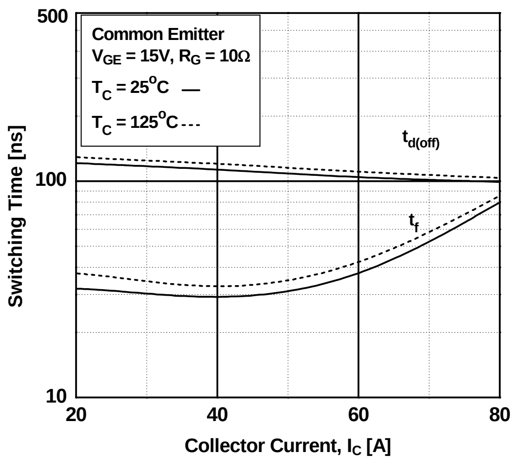


Figure 16. Switching Loss vs. Gate Resistance

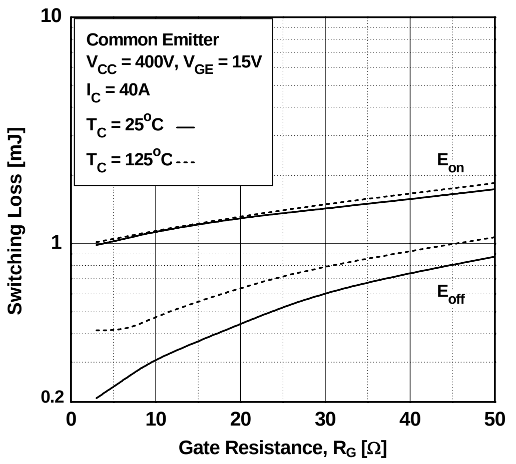


Figure 17. Switching Loss vs. Collector Current

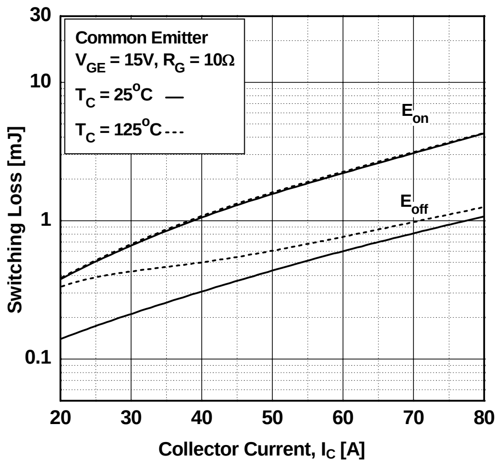
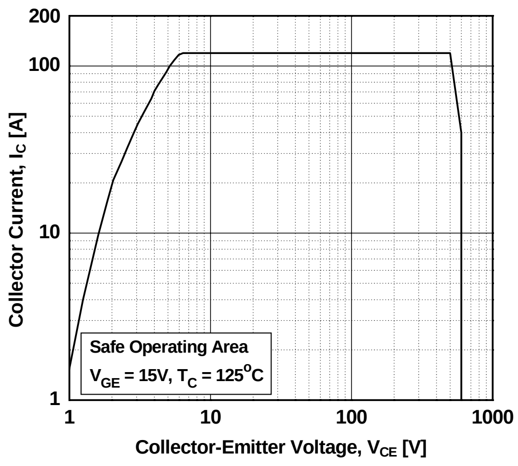


Figure 18. Turn off Switching SOA Characteristics



Typical Performance Characteristics

Figure 19. Forward Characteristics

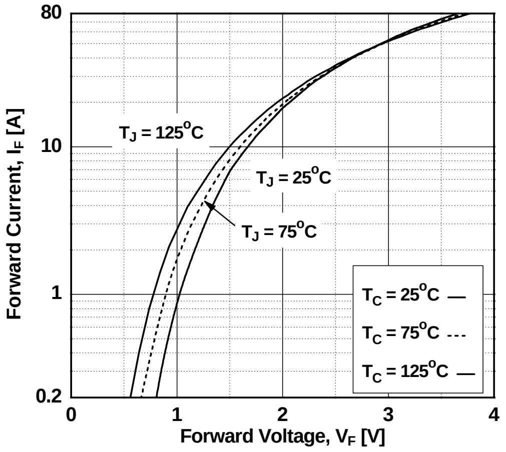


Figure 20. Typical Reverse Current vs. Reverse Voltage

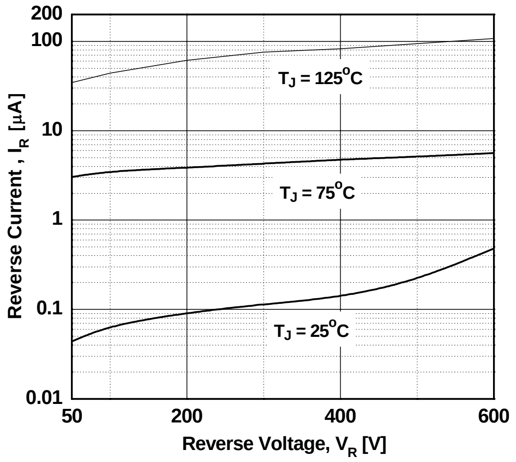


Figure 21. Stored Charge

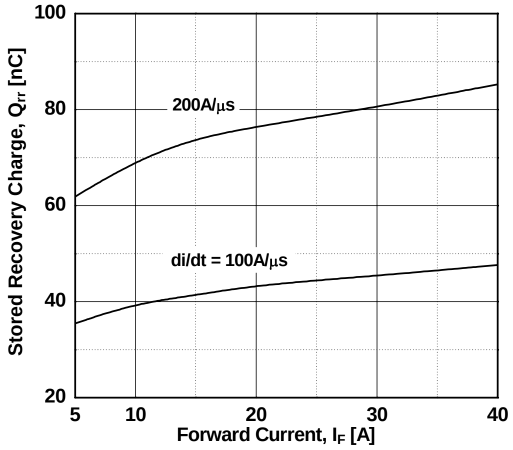


Figure 22. Reverse Recovery Time

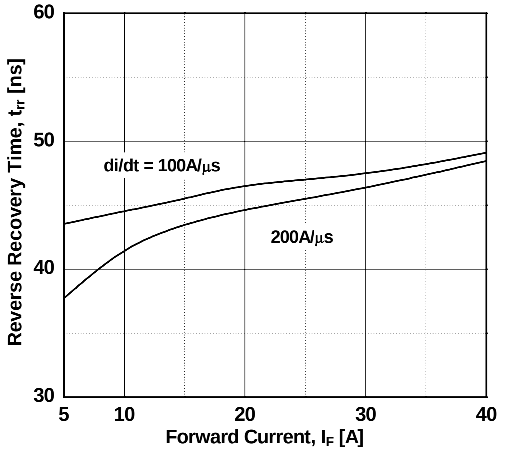
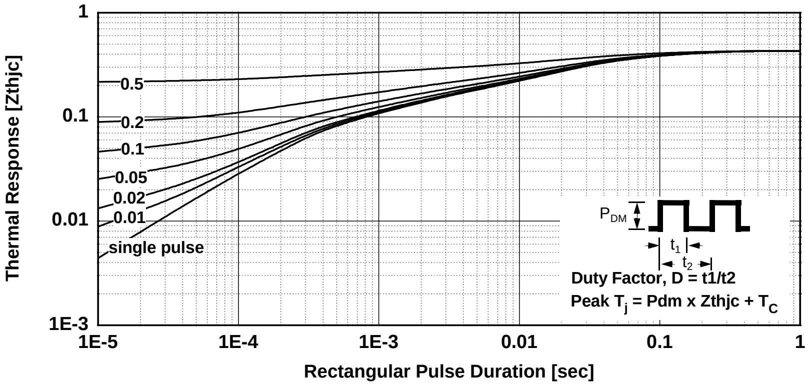


Figure 23.Transient Thermal Impedance of IGBT



Mechanical Dimensions

TO-247AB (FKS PKG CODE 001)