

Features

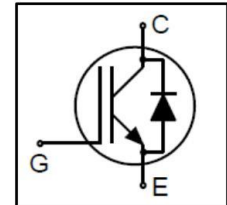
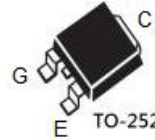
- ◆ Trench epi-Fs Technology
- ◆ High efficient turn-on di/dt controllability
- ◆ Low $V_{CE(sat)}$ enable high efficiencies
- ◆ Low Turn-off switching loss and softness
- ◆ Very Good EMI and High Short-Circuit Ruggedness

Application

- ◆ Fan、Pumps
- ◆ Motor Drives
- ◆ Vacuum Cleaner
- ◆ Home Appliance Applications

Product Summary

V_{CE}	650	V
I_C	6	A
$V_{CE(sat),typ}$	1.63	V



Key Performance and Package Parameters

Type	V_{CE}	I_C	$V_{CE(sat)}, T_J = 25^\circ\text{C}$	$T_{J\max}$	Package
MID06T065DFS	650V	6A	1.63V	175°C	TO-252

Maximum Ratings (@ $T_a = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage	650	V
I_C	DC collector current, $T_C = 25^\circ\text{C}$	12	A
	DC collector current, $T_C = 100^\circ\text{C}$	6	
I_{CM}	Pulsed Collector Current, Limited by $T_{J\max}$	18	A
I_{FM}	Diode pulsed current, tp limited by $T_{J\max}$	18	A
I_F	Diode forward current, $T_C = 25^\circ\text{C}$	12	A
	Diode forward current, $T_C = 100^\circ\text{C}$	6	
V_{GES}	Gate-emitter voltage	± 30	V
P_D	Power dissipation, $T_C = 25^\circ\text{C}$	83	W
T_J, T_{STG}	Operating and Storage Temperature Range	-55...+150	°C
T_L	Maximum lead temperature for soldering purpose, 1/8" from case for 5s	300	°C
t_{SC}	Short circuit withstand time $V_{GE} = 15V, V_{CC} \leq 400V, T_J \leq 175^\circ\text{C}$	15	μs

Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal resistance, junction - ambient	-	70	-	°C/W
$R_{\theta JC}$	IGBT thermal resistance, junction - case	-	1.8	-	
$R_{\theta JC}$	Diode thermal resistance, junction - case	-	2.2	-	

■ Static Characteristic(@Ta = 25° C unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-emitter breakdown voltage	$V_{GE} = 0V, I_C = 1mA$	650	-	-	V
V_{CEsat}	Collector-emitter saturation voltage	$V_{GE} = 15V, I_C = 6A, T_J = 25^\circ C$	-	1.63	1.95	V
		$V_{GE} = 15V, I_C = 6A, T_J = 125^\circ C$	-	1.95	-	
		$V_{GE} = 15V, I_C = 6A, T_J = 175^\circ C$	-	2.10	-	
$V_{GE(th)}$	Gate-emitter threshold voltage	$V_{CE} = V_{GE}, I_C = 1mA$	4.5	5.5	6.5	V
I_{CES}	Zero gate voltage collector current	$V_{CE} = 650V, V_{GE} = 0V, T_J = 25^\circ C$	-	-	10	μA
I_{GES}	Gate-emitter leakage current	$V_{CE} = 0V, V_{GE} = \pm 20V$	-	-	± 100	nA

■ Dynamic Characteristics(@Ta = 25° C unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CC} = 25V, V_{GE} = 0V, F = 1MHz$	-	246	-	pF
C_{oes}	Output Capacitance		-	33	-	
C_{res}	Reverse transfer capacitance		-	3.0	-	
Q_G	Gate charge	$V_{GE} = 15V, V_{CC} = 520V, I_C = 6A$	-	9.0	-	nC
Q_{GE}	Gate to Emitter Charge		-	3.0	-	
Q_{GC}	Gate to Collector Charge		-	3.2	-	
$I_{C(SC)}$	Short circuit collector current	$V_{GE} = 15V, V_{CC} \leq 400V, t_{sc} \leq 15\mu s, T_J \leq 175^\circ C$	-	32	-	A

■ Switching Characteristics (@TJ = 25° C unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	$V_{GE} = 15V, V_{CC} = 400V, I_C = 6A, R_g = 5\Omega$ Inductive Load	-	9	-	ns
t_r	Turn-On Rise Time		-	12	-	
$t_{d(off)}$	Turn-Off Delay Time		-	39	-	
t_f	Turn-Off Fall Time		-	135	-	
E_{on}	Turn-on energy		-	0.08	-	mJ
E_{off}	Turn-off energy		-	0.16	-	
E_{total}	Total Switching Energy		-	0.24	-	
t_{rr}	Diode reverse recovery time	$I_F = 6A, V_{CC} = 400V, di/dt = 200A/\mu s$	-	91	-	ns
Q_{rr}	Diode reverse recovery charge		-	0.25	-	μC
I_{rm}	Diode Peak Reverse Recovery Current		-	4.9	-	A

■ Switching Characteristics(@T_J = 175° C unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
t _{d(on)}	Turn-On Delay Time	V _{GE} = 15V, V _{CC} = 400V, I _C = 6A, R _g = 5Ω Inductive Load	-	10	-	ns
t _r	Turn-On Rise Time		-	33	-	
t _{d(off)}	Turn-Off Delay Time		-	57	-	
t _f	Turn-Off Fall Time		-	180	-	
E _{on}	Turn-on energy		-	0.11	-	mJ
E _{off}	Turn-off energy		-	0.23	-	
E _{total}	Total Switching Energy		-	0.34	-	
t _{rr}	Diode reverse recovery time	I _F = 6A, V _{CC} = 400V, di/dt = 200A/μs	-	122	-	ns
Q _{rr}	Diode reverse recovery charge		-	0.44	-	μC
I _{rm}	Diode Peak Reverse Recovery Current		-	6.5	-	A

■ Characteristic Curve

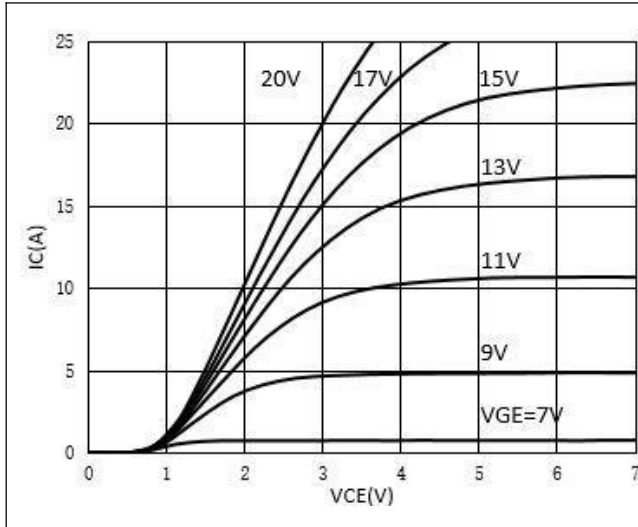


Figure 1. Typical Output Characteristics $T_{vj} = 25^{\circ}\text{C}$

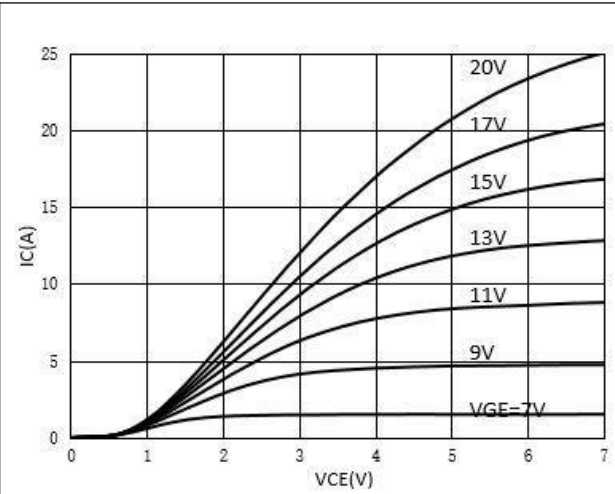


Figure 2. Typical Output Characteristics $T_{vj} = 175^{\circ}\text{C}$

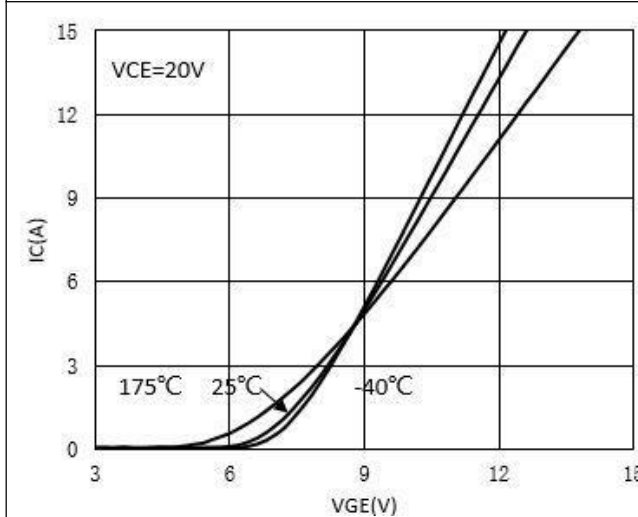


Figure 3. Typical Transfer Characteristic

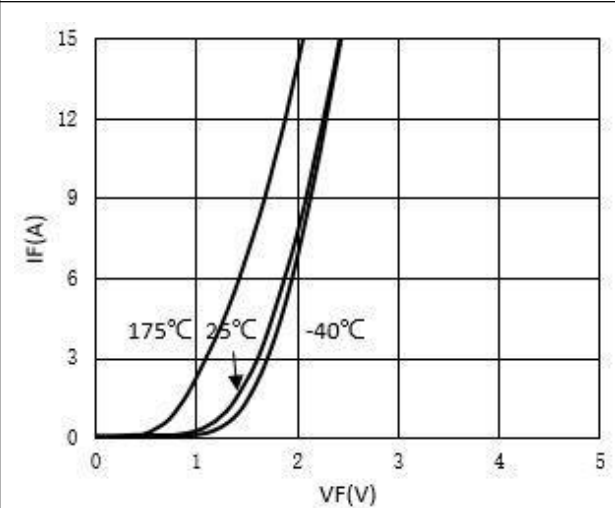


Figure 4. Typical Diode Characteristic

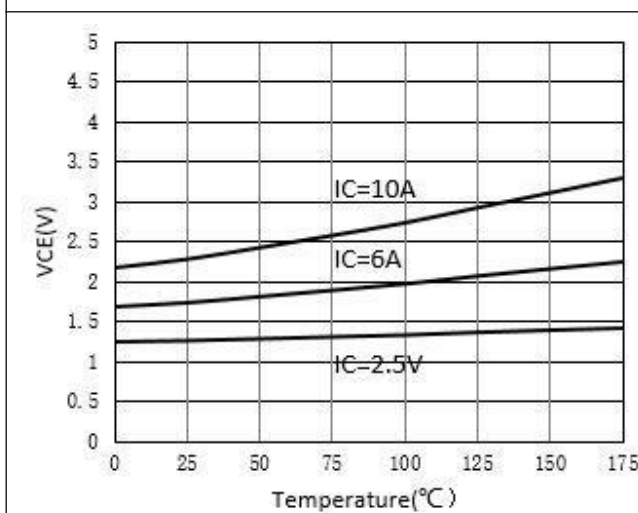


Figure 5. Collector-Emitter Saturation Voltage vs. Junction Temperature

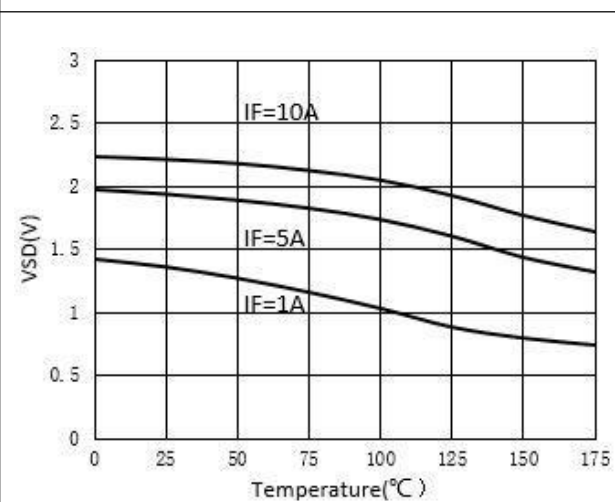


Figure 6. Diode Forward Voltage vs. Junction Temperature

■ Characteristic Curve

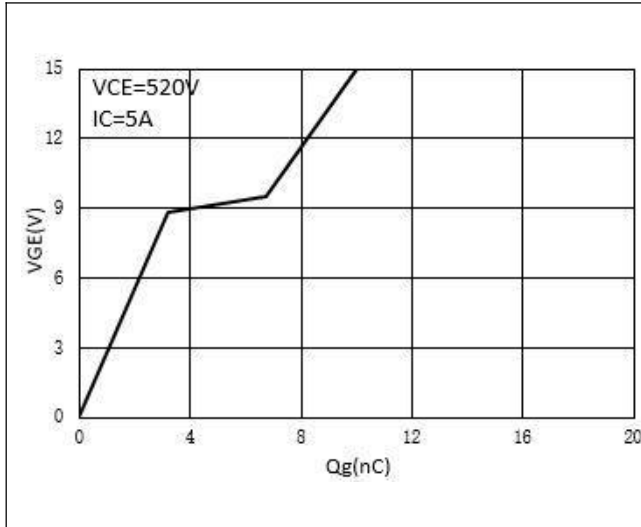


Figure 7. Gate-Charge Characteristics

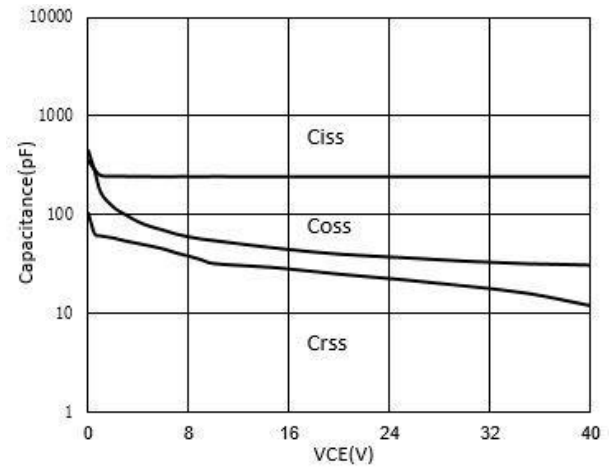


Figure 8. Capacitance Characteristics

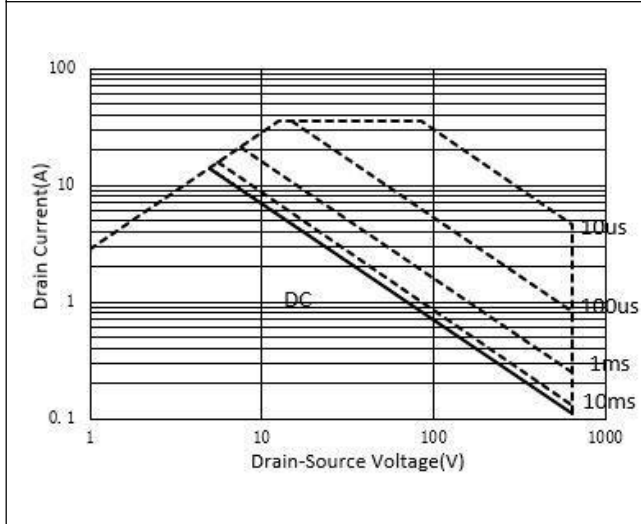


Figure 9. Forward Bias Safe Operating Area

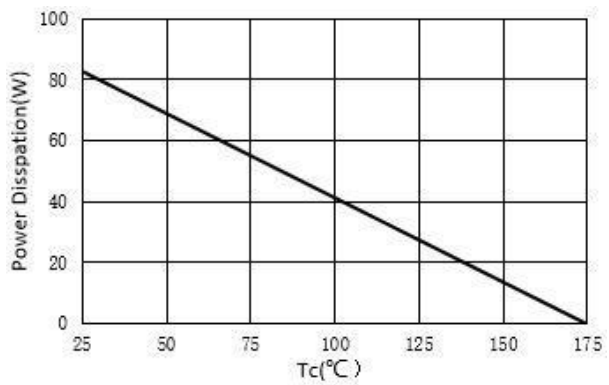


Figure 10. Power Dissipation as Function of Case

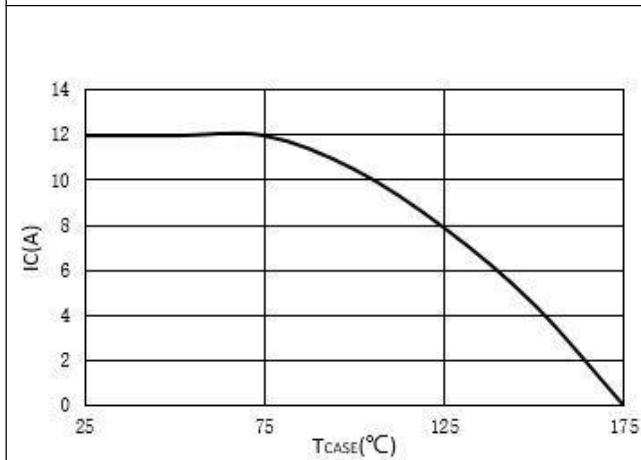


Figure 11. Current De-rating

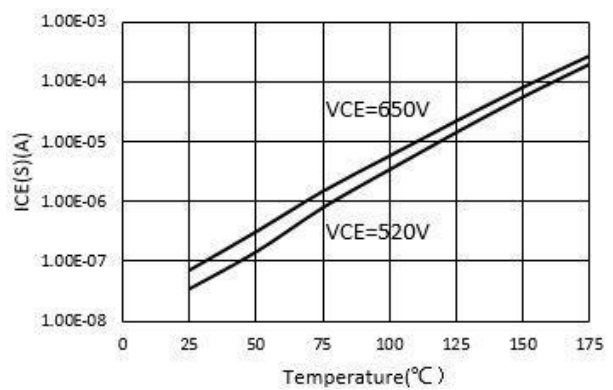


Figure 12. Diode Reverse Leakage Current vs. Junction Temperature

■ Characteristic Curve

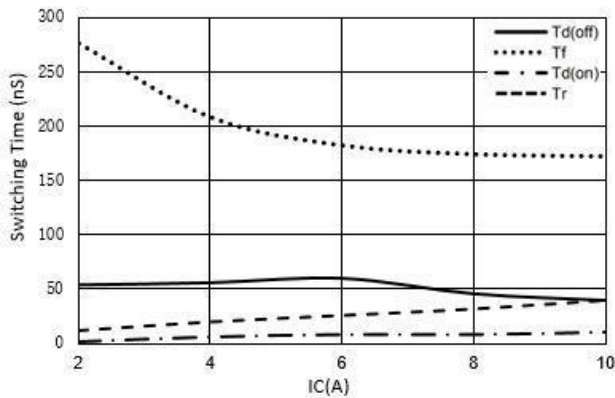


Figure 13. Switching Time vs. I_c
 $T_{vj} = 175^\circ\text{C}$, $V_{GE} = 15\text{V}$, $V_{CE} = 400\text{V}$, $R_g = 60\Omega$

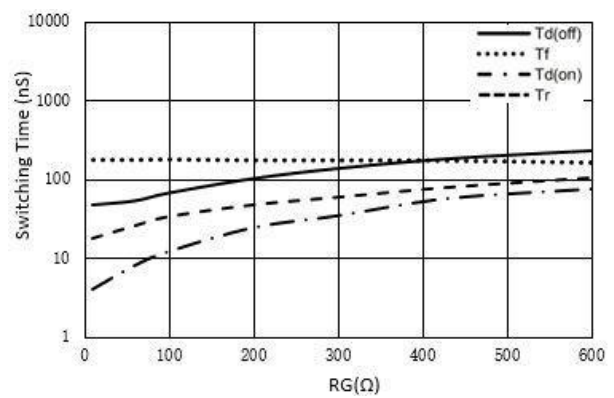


Figure 14. Switching Time vs. R_g
 $T_{vj} = 175^\circ\text{C}$, $V_{GE} = 15\text{V}$, $V_{CE} = 400\text{V}$, $I_c = 6\text{A}$

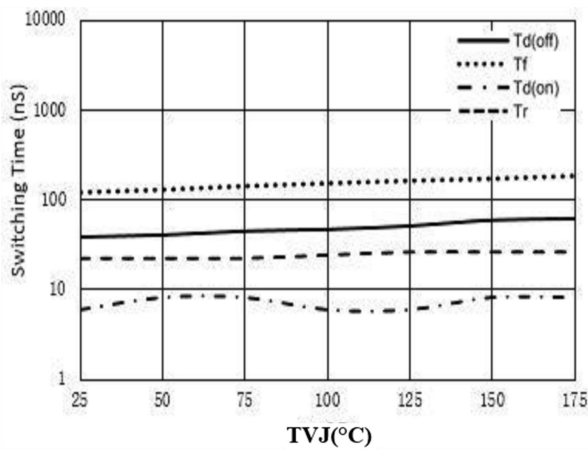


Figure 15. Switching Time vs. T_{vj}
 $V_{GE} = 15\text{V}$, $V_{CE} = 400\text{V}$, $I_c = 6\text{A}$, $R_g = 60\Omega$

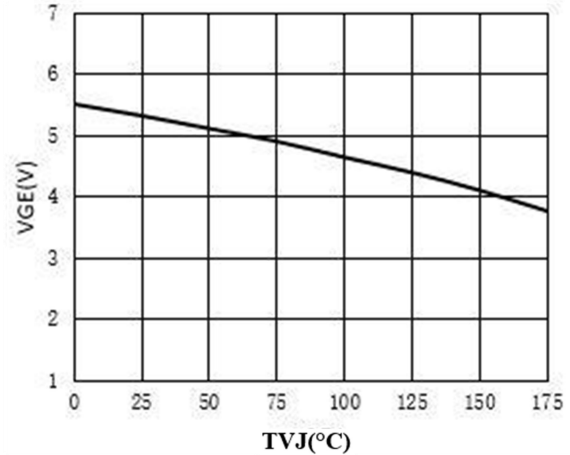


Figure 16. V_{GE} vs. T_{vj}

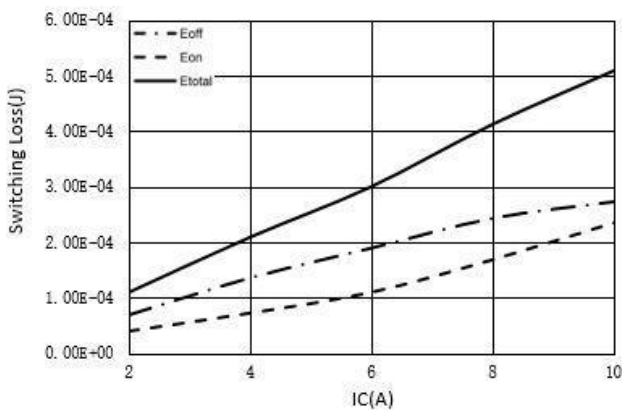


Figure 17. Switching Loss vs. I_c
 $T_{vj} = 175^\circ\text{C}$, $V_{GE} = 15\text{V}$, $V_{CE} = 400\text{V}$, $R_g = 60\Omega$

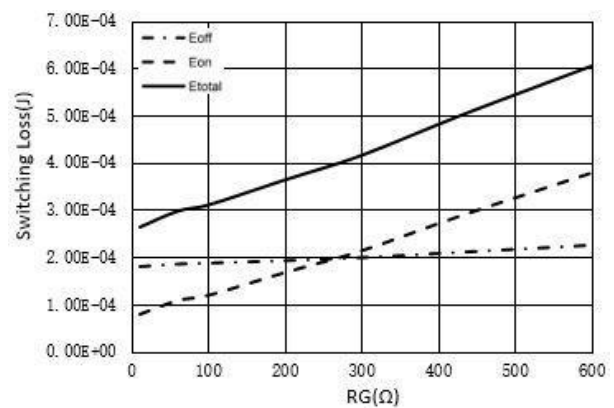


Figure 18. Switching Loss vs. R_g
 $T_{vj} = 175^\circ\text{C}$, $V_{GE} = 15\text{V}$, $V_{CE} = 400\text{V}$, $I_c = 6\text{A}$

■ Characteristic Curve

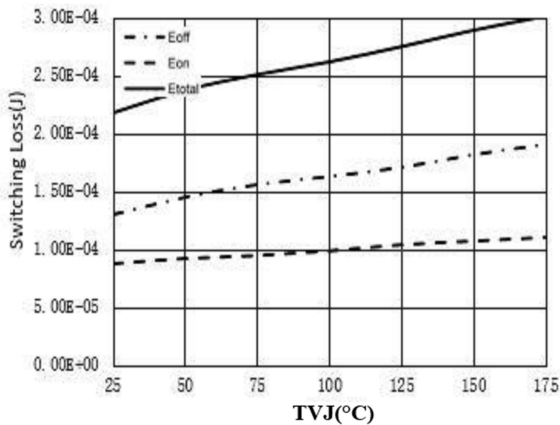


Figure 19. Switching Loss vs. T_{vj}
 $V_{GE} = 15V$, $V_{CE} = 400V$, $I_C = 6A$, $R_g = 60\Omega$

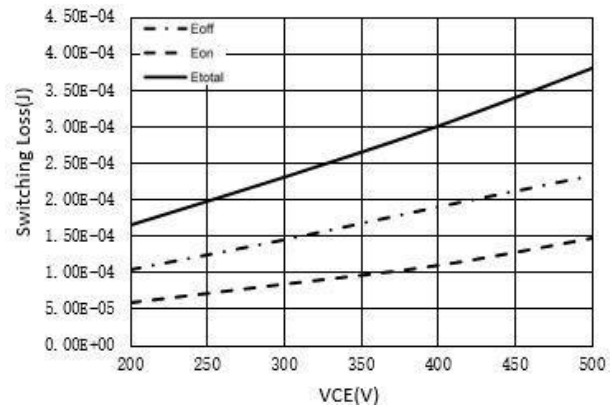


Figure 20. Switching Loss vs. V_{CE}
 $T_{vj} = 175^\circ C$, $V_{GE} = 15V$, $I_C = 6A$, $R_g = 60\Omega$

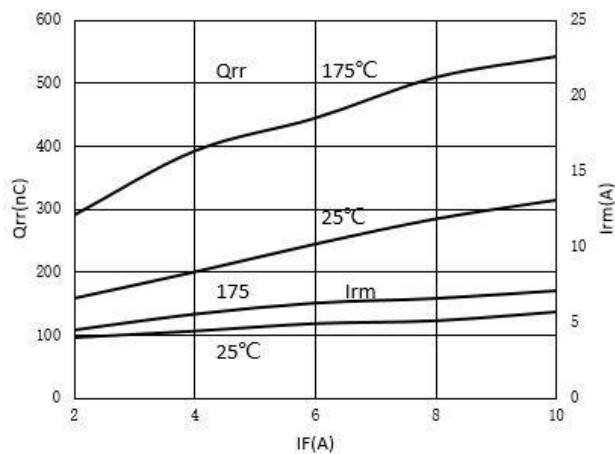


Figure 21. Diode Reverse Recovery Charge and Peak Current vs. Conduction Current
 $V_{GE} = 15V$, $V_{CE} = 400V$, $d_i/d_t = 200A/\mu s$

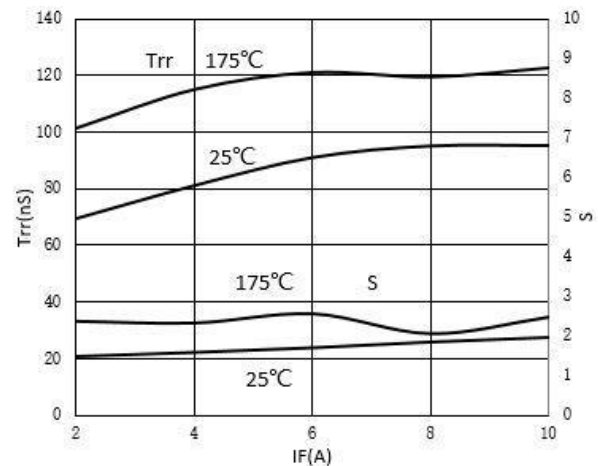


Figure 22. Diode Reverse Recovery Time and Softness Factor vs. Conduction Current
 $V_{GE} = 15V$, $V_{CE} = 400V$, $d_i/d_t = 200A/\mu s$

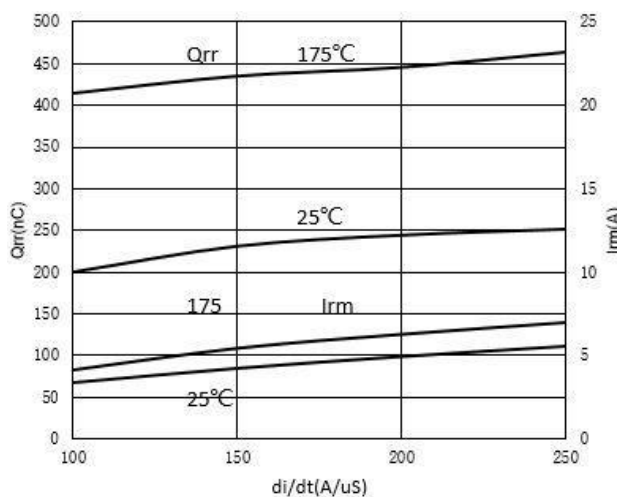


Figure 23. Diode Reverse Recovery Charge and Peak Current vs. d_i/d_t
 $V_{GE} = 15V$, $V_{CE} = 400V$, $d_i/d_t = 200A/\mu s$

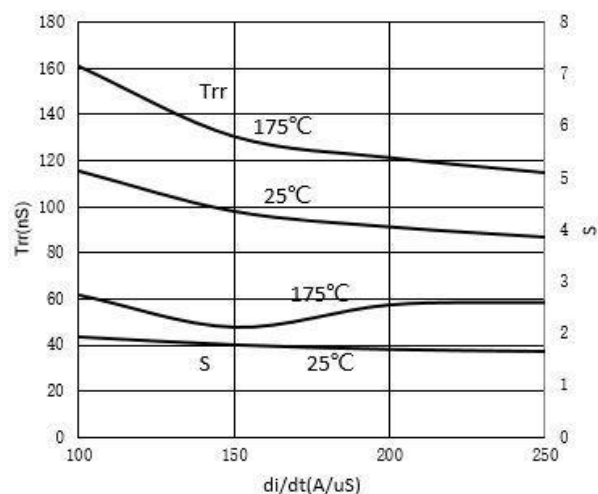


Figure 24. Diode Reverse Recovery Time and Softness Factor vs. d_i/d_t
 $V_{GE} = 15V$, $V_{CE} = 400V$, $d_i/d_t = 200A/\mu s$

■ Characteristic Curve

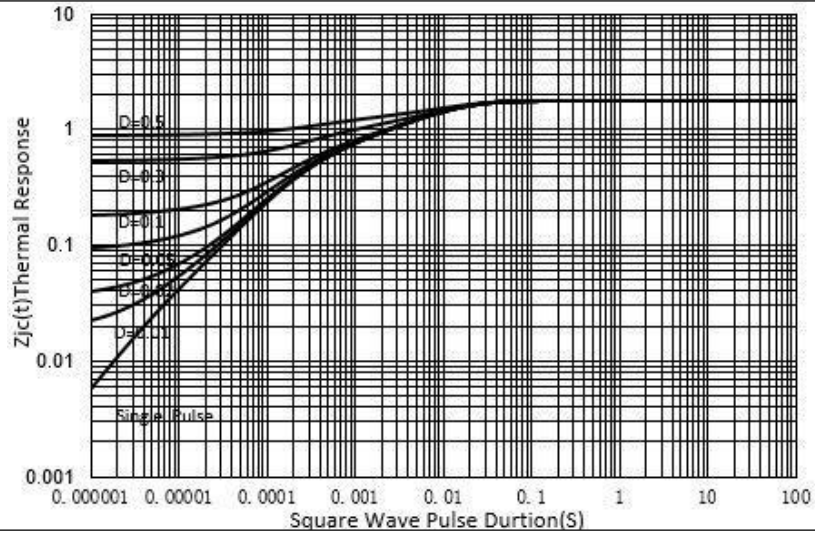


Figure 25. Normalized Maximum Transient Thermal Impedance for IGBT

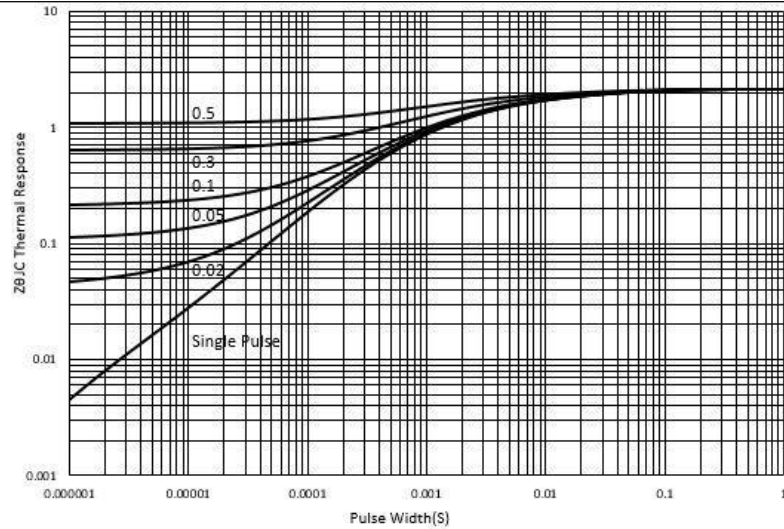


Figure 26. Normalized Maximum Transient Thermal Impedance for Diode

■ Package Information

TO-252

