

General Description

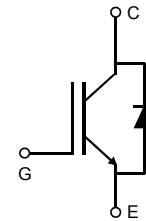
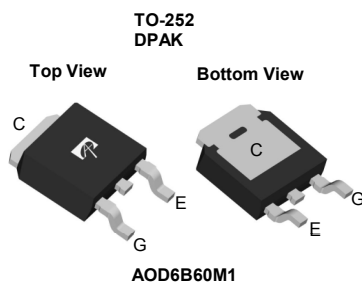
- Latest AlphaIGBT (αIGBT) Technology
- 600V Breakdown Voltage
- Very Fast and Soft Recovery Freewheeling Diode
- High Efficient Turn-On di/dt Controllability
- Low $V_{CE(sat)}$ Enables High Efficiencies
- Low Turn-Off Switching Loss and Softness
- Very Good EMI Behavior
- High Short-Circuit Ruggedness
- Offering $T_J(max)$ of 150C
- Minimal Gate Spike Due to High Input Capacitance

Applications

- Home Appliances
- Motor Drives

Product Summary

V_{CE}	600V
I_C ($T_C=100^\circ\text{C}$)	6A
$V_{CE(sat)}$ ($T_J=25^\circ\text{C}$)	1.7V



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOD6B60M1	TO252	Tape & Reel	2500

Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	AOD6B60M1	Units
Collector-Emitter Voltage	V_{CE}	600	V
Gate-Emitter Voltage	V_{GE}	± 30	V
Continuous Collector Current	I_C	$T_C=25^\circ\text{C}$	12
		$T_C=100^\circ\text{C}$	6
Pulsed Collector Current, Limited by T_{Jmax}	I_{CM}	18	A
Turn off SOA, $V_{CE} \leq 650\text{V}$, Limited by T_{Jmax}	I_{LM}	18	A
Continuous Diode Forward Current	I_F	$T_C=25^\circ\text{C}$	12
		$T_C=100^\circ\text{C}$	6
Diode Pulsed Current, Limited by T_{Jmax}	I_{FM}	18	A
Short circuit withstanding time ¹⁾ $V_{GE}=15\text{V}$, $V_{CC} \leq 400\text{V}$, $T_J \leq 150^\circ\text{C}$	t_{SC}	5	μs
Power Dissipation	P_D	$T_C=25^\circ\text{C}$	69
		$T_C=100^\circ\text{C}$	28
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	T_L	300	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	AOD6B60M1	Units
Maximum Junction-to-Ambient	$R_{\theta JA}$	55	$^\circ\text{C/W}$
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	1.8	$^\circ\text{C/W}$
Maximum Diode Junction-to-Case	$R_{\theta JC}$	3	$^\circ\text{C/W}$

1) Allowed number of short circuits: <1000; time between short circuits: >1s.

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units	
STATIC PARAMETERS							
BV _{CES}	Collector-Emitter Breakdown Voltage	I _C =1mA, V _{GE} =0V, T _J =25°C	600	-	-	V	
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} =15V, I _C =6A	T _J =25°C	-	1.7	2.15	V
			T _J =125°C	-	2	-	
			T _J =150°C	-	2.1	-	
V _F	Diode Forward Voltage	V _{GE} =0V, I _F =6A	T _J =25°C	-	1.45	1.85	V
			T _J =125°C	-	1.41	-	
			T _J =150°C	-	1.37	-	
V _{GE(th)}	Gate-Emitter Threshold Voltage	V _{CE} =5V, I _C =1mA	-	5.1	-	V	
I _{CES}	Zero Gate Voltage Collector Current	V _{CE} =600V, V _{GE} =0V	T _J =25°C	-	-	10	μA
			T _J =125°C	-	-	500	
			T _J =150°C	-	-	1000	
I _{GES}	Gate-Emitter leakage current	V _{CE} =0V, V _{GE} =±30V	-	-	±100	nA	
g _{FS}	Forward Transconductance	V _{CE} =20V, I _C =6A	-	5	-	S	
DYNAMIC PARAMETERS							
C _{ies}	Input Capacitance	V _{GE} =0V, V _{CC} =25V, f=1MHz	-	345	-	pF	
C _{oes}	Output Capacitance		-	36	-	pF	
C _{res}	Reverse Transfer Capacitance		-	13	-	pF	
Q _g	Total Gate Charge	V _{GE} =15V, V _{CC} =480V, I _C =6A	-	14	-	nC	
Q _{ge}	Gate to Emitter Charge		-	3.4	-	nC	
Q _{gc}	Gate to Collector Charge		-	7.3	-	nC	
I _{C(SC)}	Short circuit collector current	V _{GE} =15V, V _{CC} =400V, t _{sc} ≤ 5us, T _J ≤ 150°C	-	30	-	A	
R _g	Gate resistance	V _{GE} =0V, V _{CC} =0V, f=1MHz	-	6.5	-	Ω	
SWITCHING PARAMETERS, (Load Inductive, T_J=25°C)							
T _{d(on)}	Turn-On Delay Time	T _J =25°C V _{GE} =15V, V _{CC} =400V, I _C =6A, R _G =50Ω	-	7	-	ns	
T _r	Turn-On Rise Time		-	13	-	ns	
T _{d(off)}	Turn-Off Delay Time		-	94	-	ns	
T _f	Turn-Off Fall Time		-	16	-	ns	
E _{on}	Turn-On Energy		-	0.12	-	mJ	
E _{off}	Turn-Off Energy		-	0.09	-	mJ	
E _{total}	Total Switching Energy		-	0.21	-	mJ	
T _{rr}	Diode Reverse Recovery Time	T _J =25°C I _F =6A, dI/dt=200A/μs, V _{CC} =400V	-	74	-	ns	
Q _{rr}	Diode Reverse Recovery Charge		-	0.15	-	μC	
I _{rm}	Diode Peak Reverse Recovery Current		-	3.5	-	A	
SWITCHING PARAMETERS, (Load Inductive, T_J=150°C)							
T _{d(on)}	Turn-On Delay Time	T _J =150°C V _{GE} =15V, V _{CC} =400V, I _C =6A, R _G =50Ω	-	6	-	ns	
T _r	Turn-On Rise Time		-	14	-	ns	
T _{d(off)}	Turn-Off Delay Time		-	114	-	ns	
T _f	Turn-Off Fall Time		-	44	-	ns	
E _{on}	Turn-On Energy		-	0.15	-	mJ	
E _{off}	Turn-Off Energy		-	0.14	-	mJ	
E _{total}	Total Switching Energy		-	0.29	-	mJ	
T _{rr}	Diode Reverse Recovery Time	T _J =150°C I _F =6A, dI/dt=200A/μs, V _{CC} =400V	-	181	-	ns	
Q _{rr}	Diode Reverse Recovery Charge		-	0.37	-	μC	
I _{rm}	Diode Peak Reverse Recovery Current		-	4.7	-	A	

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

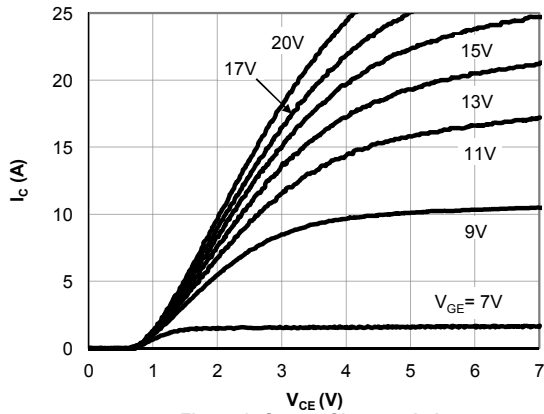


Figure 1: Output Characteristic
($T_j=25^\circ\text{C}$)

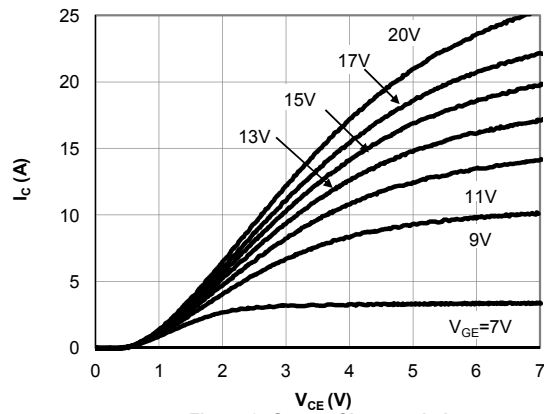


Figure 2: Output Characteristic
($T_j=150^\circ\text{C}$)

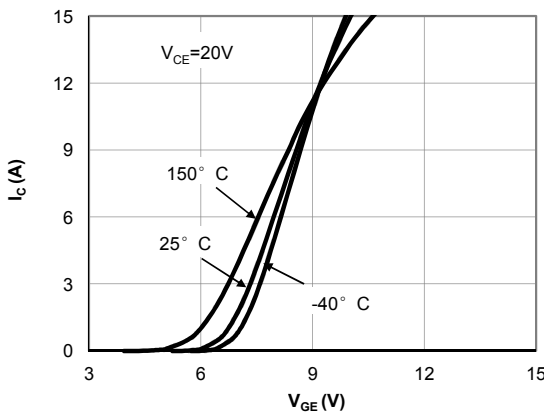


Figure 3: Transfer Characteristic

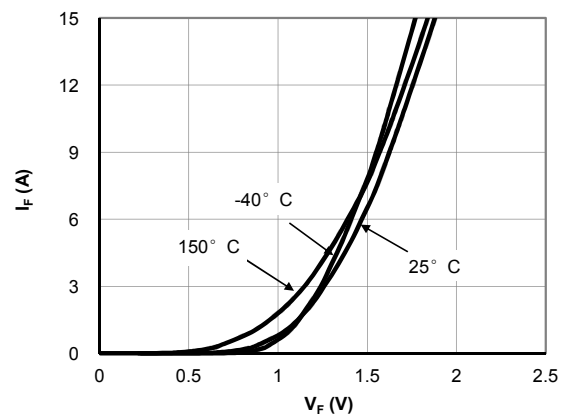


Figure 4: Diode Characteristic

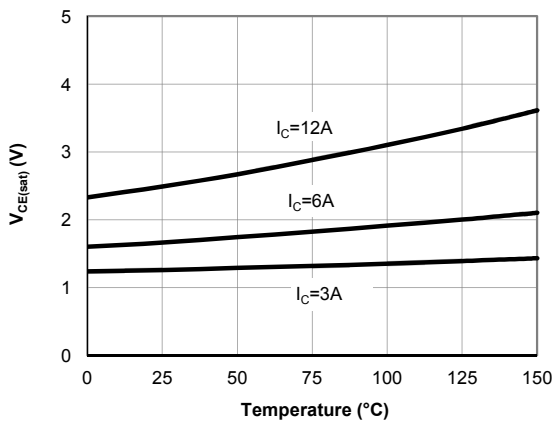


Figure 5: Collector-Emitter Saturation Voltage vs. Junction Temperature

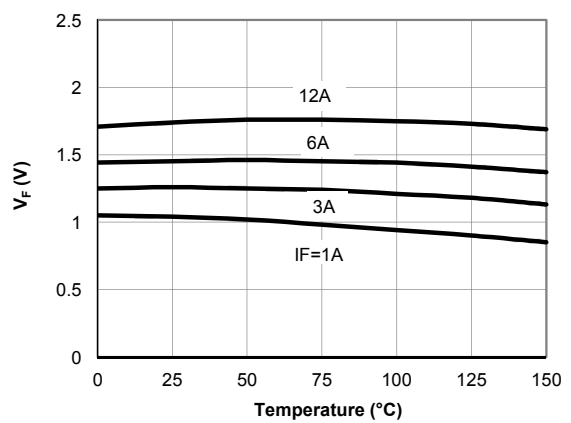


Figure 6: Diode Forward voltage vs. Junction Temperature

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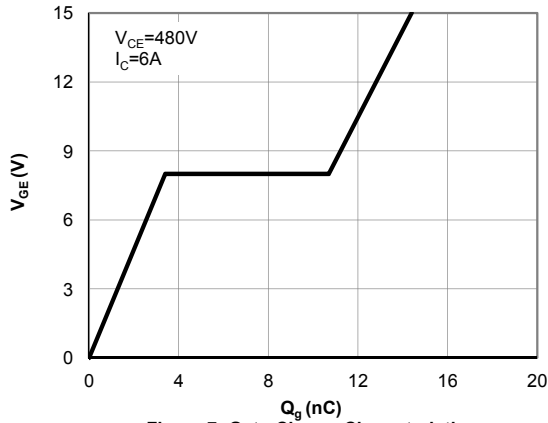


Figure 7: Gate-Charge Characteristics

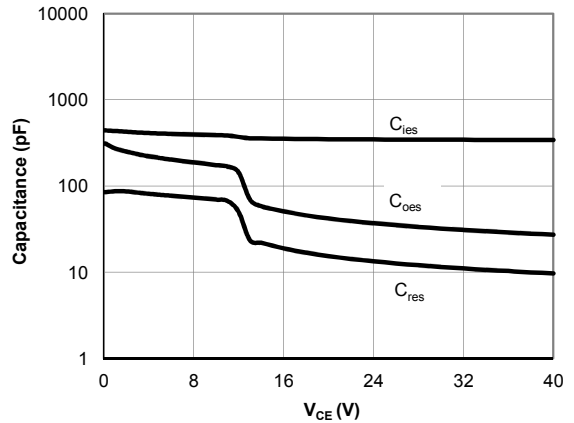


Figure 8: Capacitance Characteristic

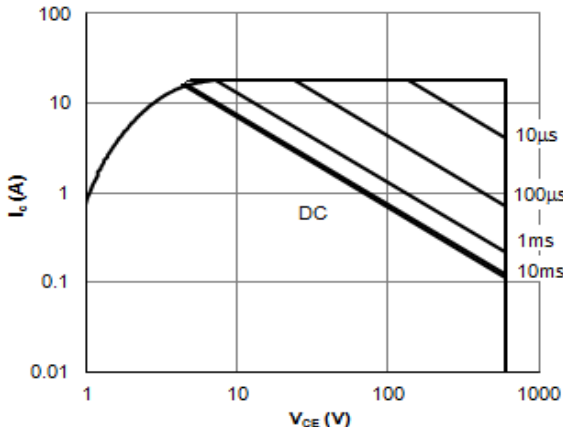


Figure 9: Forward Bias Safe Operating Area
($T_C=25^{\circ}\text{C}$, $V_{GE}=15\text{V}$)

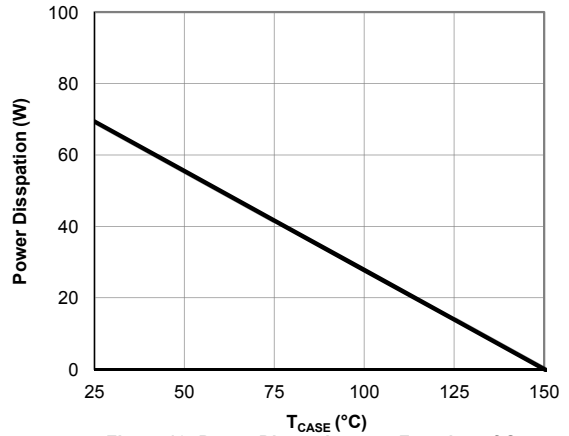


Figure 10: Power Dissipation as a Function of Case

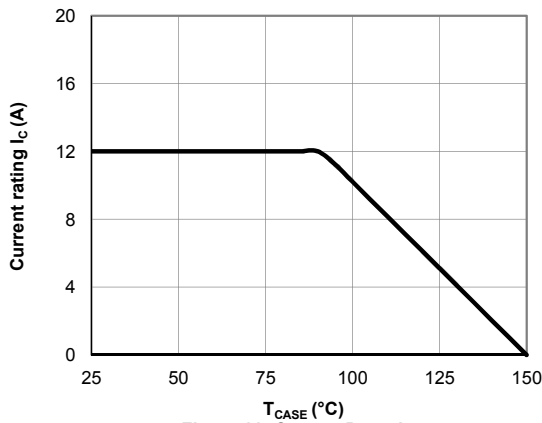


Figure 11: Current De-rating

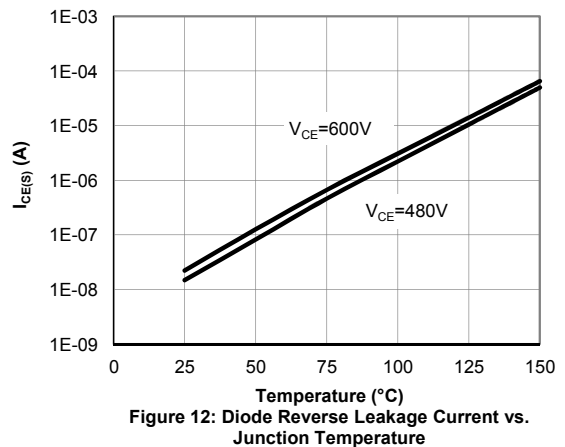


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

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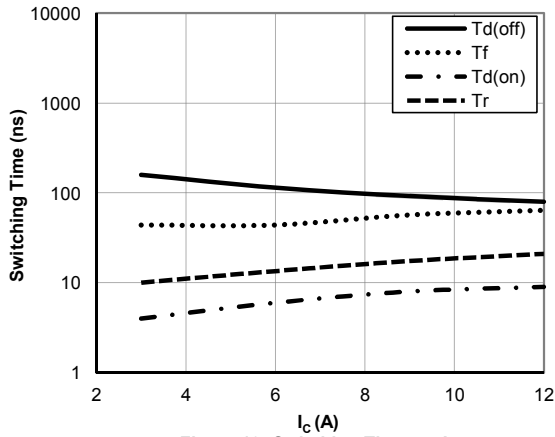


Figure 13: Switching Time vs. I_C
($T_J=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $R_g=50\Omega$)

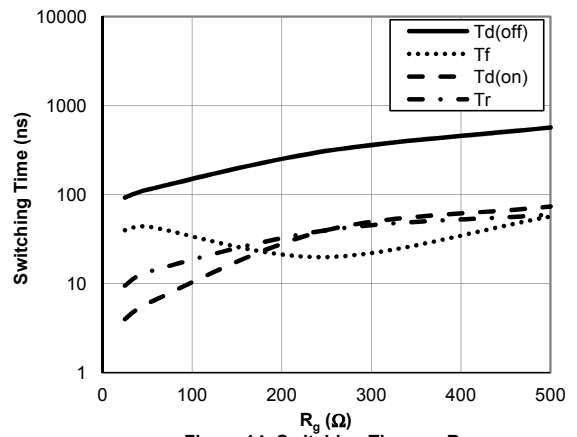


Figure 14: Switching Time vs. R_g
($T_J=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_C=6\text{A}$)

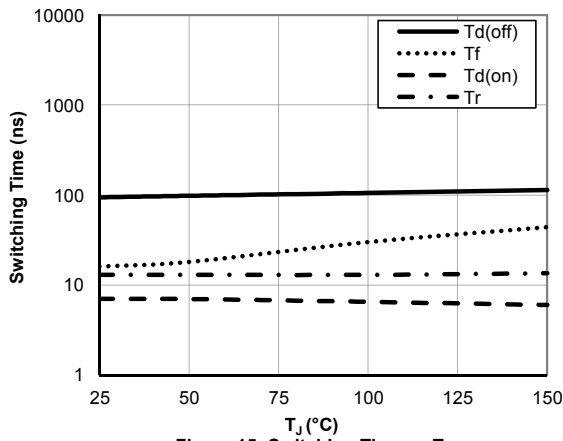


Figure 15: Switching Time vs. T_J
($V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_C=6\text{A}$, $R_g=50\Omega$)

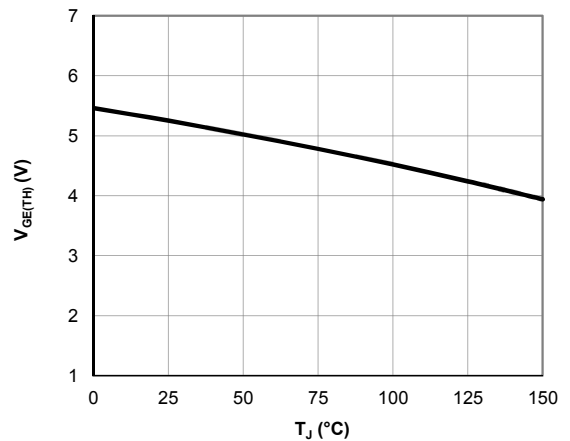


Figure 16: $V_{GE(\text{TH})}$ vs. T_J

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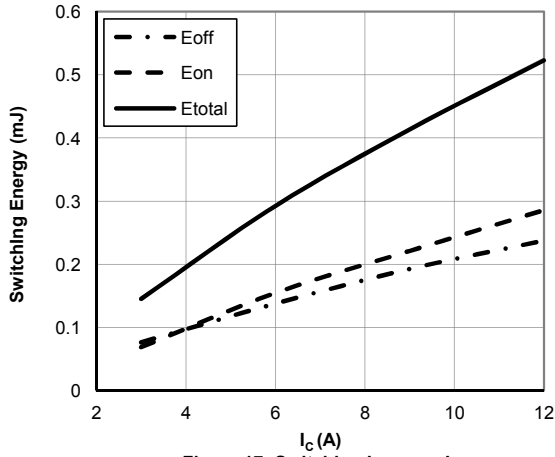


Figure 17: Switching Loss vs. I_C
($T_J=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $R_g=50\Omega$)

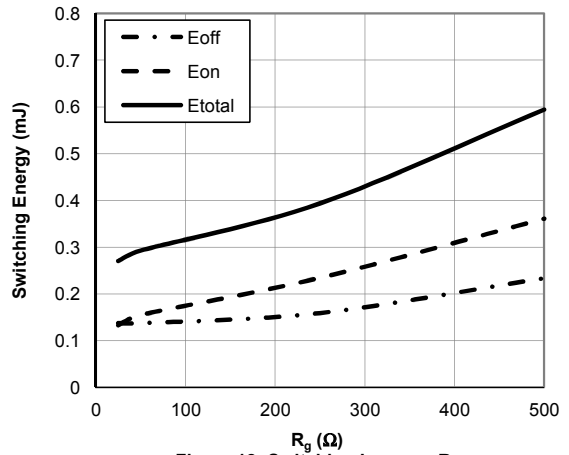


Figure 18: Switching Loss vs. R_g
($T_J=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_C=6\text{A}$)

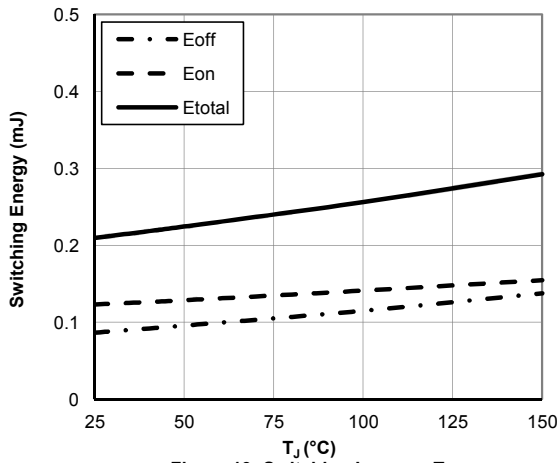


Figure 19: Switching Loss vs. T_J
($V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_C=6\text{A}$, $R_g=50\Omega$)

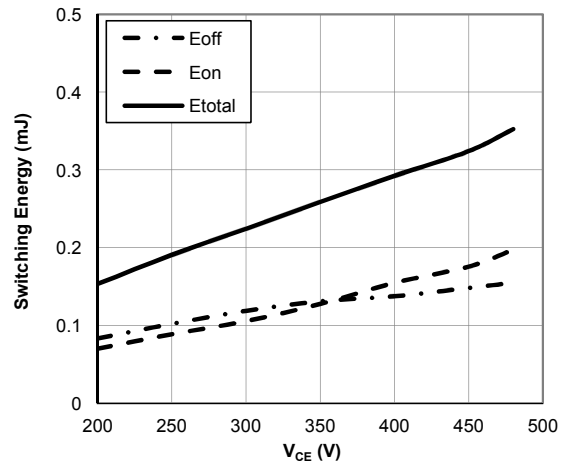


Figure 20: Switching Loss vs. V_{CE}
($T_J=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $I_C=6\text{A}$, $R_g=50\Omega$)

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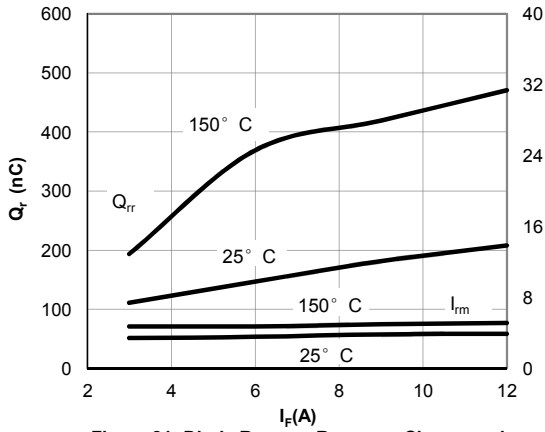


Figure 21: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current
 ($V_{GE}=15V, V_{CE}=400V, di/dt=200A/\mu s$)

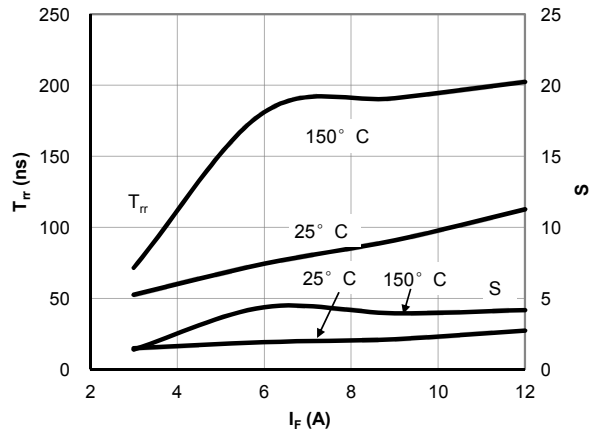


Figure 22: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current
 ($V_{GE}=15V, V_{CE}=400V, di/dt=200A/\mu s$)

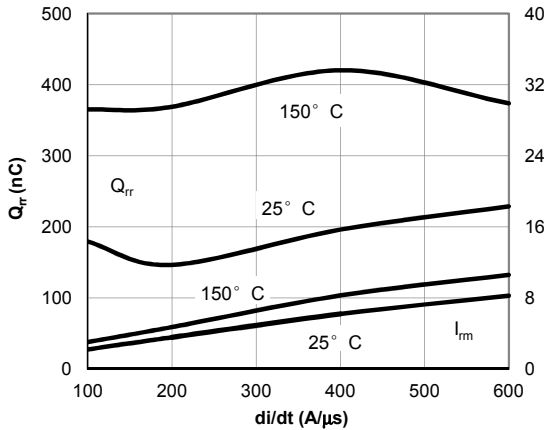


Figure 23: Diode Reverse Recovery Charge and Peak Current vs. di/dt
 ($V_{GE}=15V, V_{CE}=400V, I_F=6A$)

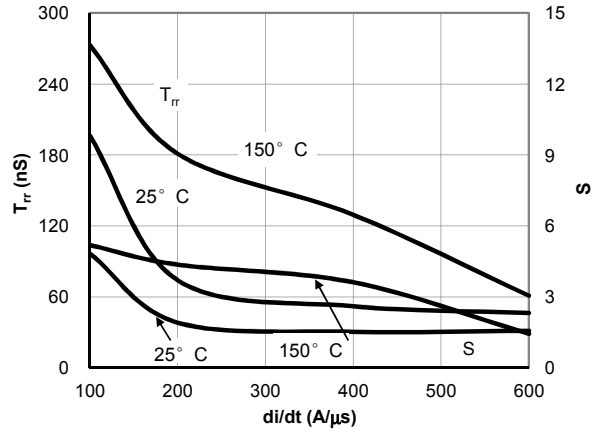


Figure 24: Diode Reverse Recovery Time and Softness Factor vs. di/dt
 ($V_{GE}=15V, V_{CE}=400V, I_F=6A$)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

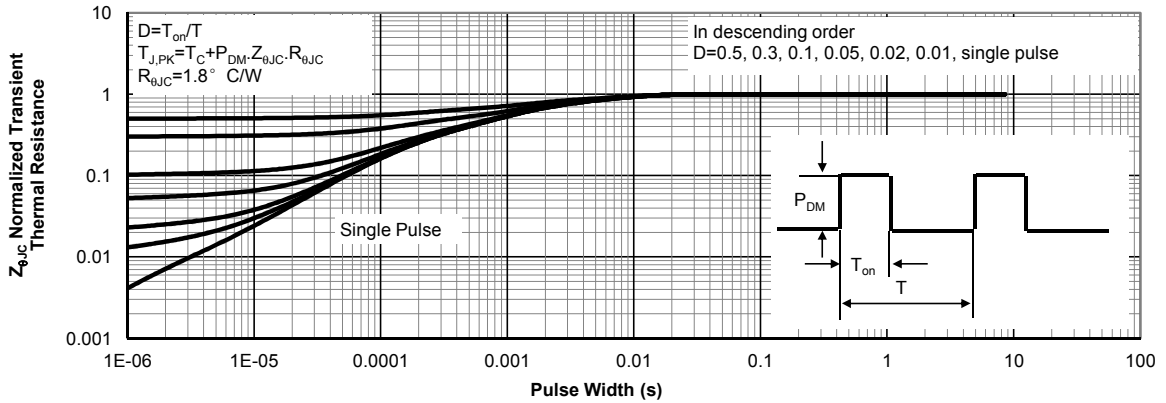


Figure 25: Normalized Maximum Transient Thermal Impedance for IGBT

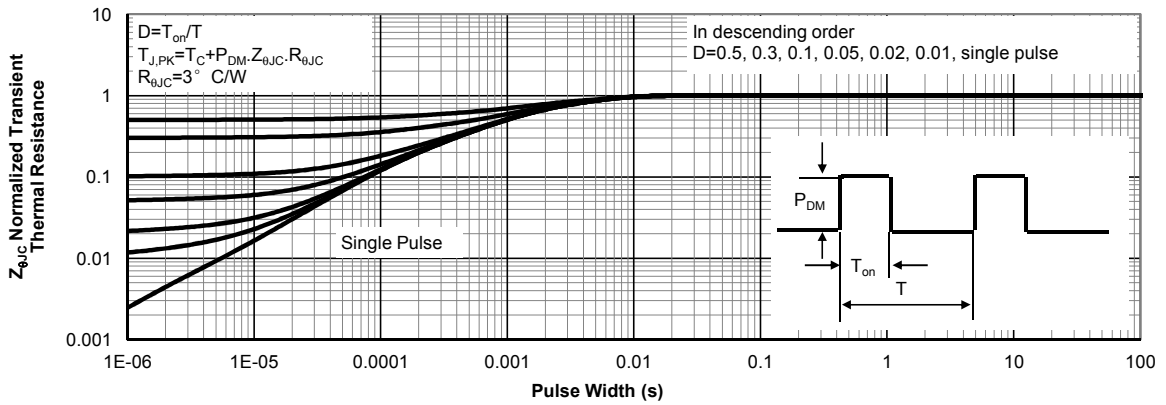


Figure 26: Normalized Maximum Transient Thermal Impedance for Diode

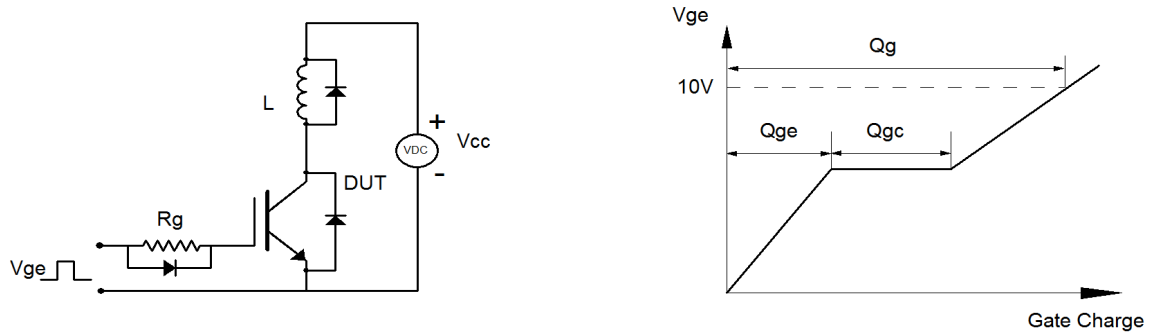


Figure A: Gate Charge Test Circuit & Waveforms

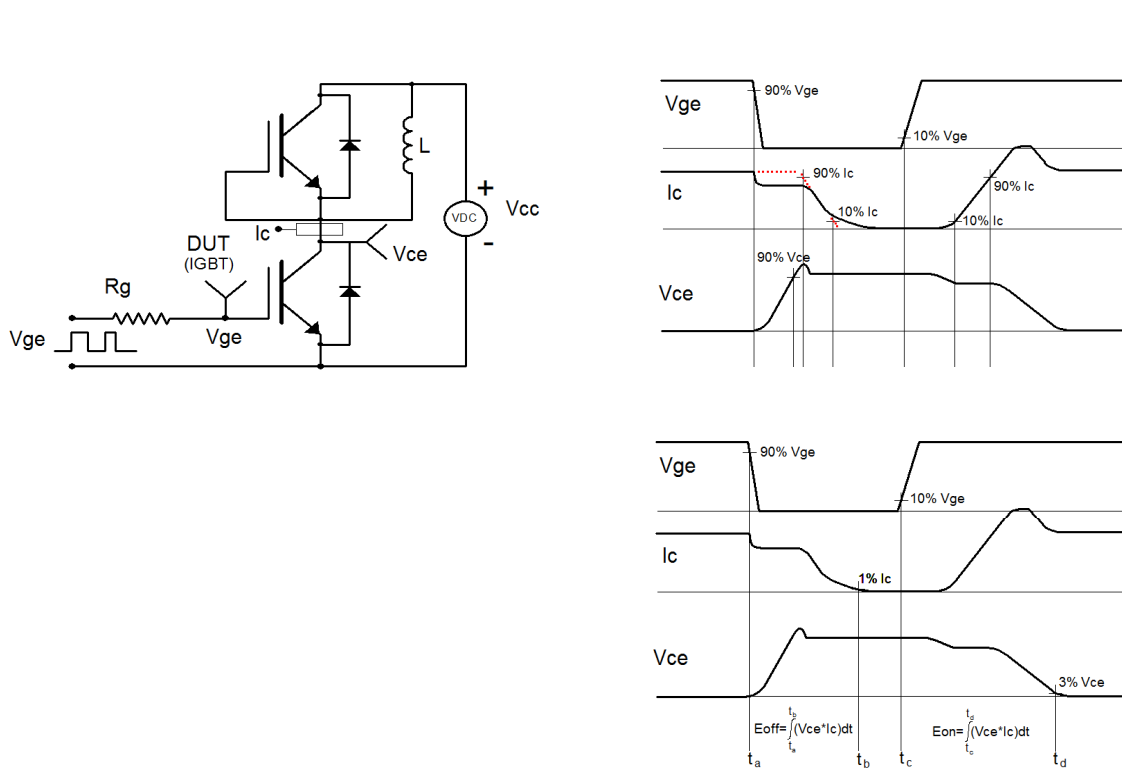


Figure B: Inductive Switching Test Circuit & Waveforms

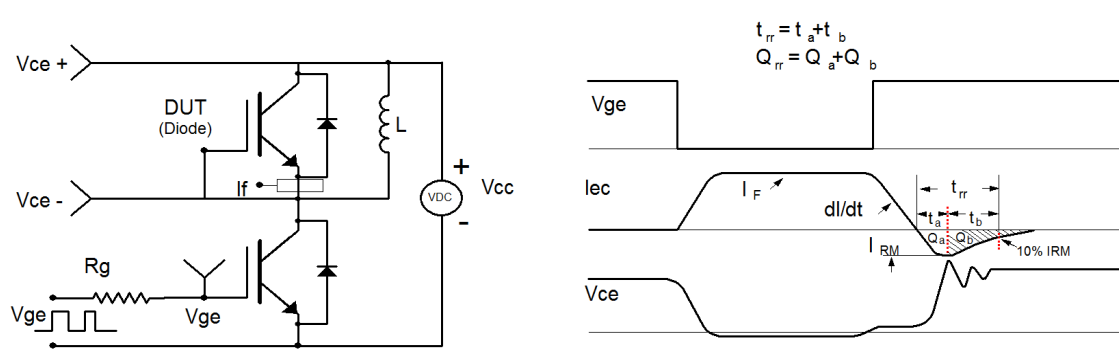


Figure C: Diode Recovery Test Circuit & Waveforms