

General Description

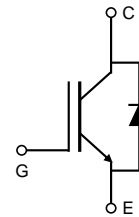
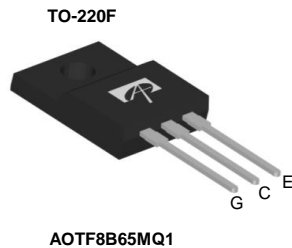
- Latest AlphaIGBT (αIGBT) technology
- 650V breakdown voltage
- Very fast and soft recovery freewheeling diode
- Low $V_{CE(sat)}$ and V_f
- Low turn-off switching loss and softness
- High effective turn-on di/dt
- Low Q_{rr}
- Very good EMI behavior
- High short-circuit ruggedness

Applications

- Motor drives
- Home appliance applications such as refrigerators and washing machines
- Fan, pumps, vacuum cleaner
- Other hard switching applications

Product Summary

V_{CE}	650V
I_C ($T_C=100^\circ\text{C}$)	8A
$V_{CE(sat)}$ ($T_J=25^\circ\text{C}$)	1.8V



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOTF8B65MQ1	TO220F	Tube	1000
Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted			
Parameter	Symbol	AOTF8B65MQ1	Units
Collector-Emitter Voltage	V_{CE}	650	V
Gate-Emitter Voltage	V_{GE}	± 30	V
Continuous Collector Current	I_C	$T_C=25^\circ\text{C}$	$16^{(2)}$
		$T_C=100^\circ\text{C}$	$8^{(2)}$
Pulsed Collector Current, Limited by T_{Jmax}	I_{CM}	24	A
Turn-Off SOA, $V_{CE} \leq 650\text{V}$, Limited by T_{Jmax}	I_{LM}	24	A
Continuous Diode Forward Current	I_F	$T_C=25^\circ\text{C}$	$16^{(2)}$
		$T_C=100^\circ\text{C}$	$8^{(2)}$
Diode Pulsed Current, Limited by T_{Jmax}	I_{FM}	24	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	$T_C=25^\circ\text{C}$	30
		$T_C=100^\circ\text{C}$	12
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	AOTF8B65MQ1	Units
Maximum Junction-to-Ambient	$R_{\theta JA}$	65	$^\circ\text{C/W}$
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	4.2	$^\circ\text{C/W}$
Maximum Diode Junction-to-Case	$R_{\theta JC}$	7	$^\circ\text{C/W}$

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

(2) TO220F I_C follows DPAK(TO-252).

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	650	-	-	V	
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} =15V, I _C =8A	T _J =25°C	-	1.8	2.25	V
			T _J =125°C	-	2.09	-	
			T _J =150°C	-	2.19	-	
V _F	Diode Forward Voltage	V _{GE} =0V, I _F =8A	T _J =25°C	-	1.52	1.9	V
			T _J =125°C	-	1.59	-	
			T _J =150°C	-	1.56	-	
V _{GE(th)}	Gate-Emitter Threshold Voltage	V _{CE} =5V, I _C =1mA	-	4.9	-	V	
I _{CES}	Zero Gate Voltage Collector Current	V _{CE} =650V, 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 =8A	-	5	-	S	
DYNAMIC PARAMETERS							
C _{ies}	Input Capacitance	V _{GE} =0V, V _{CC} =25V, f=1MHz	-	500	-	pF	
C _{oes}	Output Capacitance		-	45	-	pF	
C _{res}	Reverse Transfer Capacitance		-	16	-	pF	
Q _g	Total Gate Charge	V _{GE} =15V, V _{CC} =520V, I _C =8A	-	22	-	nC	
Q _{ge}	Gate to Emitter Charge		-	6.5	-	nC	
Q _{gc}	Gate to Collector Charge		-	10	-	nC	
I _{C(SC)}	Short Circuit Collector Current	V _{GE} =15V, V _{CC} =400V, t _{sc} ≤5μs, T _J ≤150°C	-	50	-	A	
R _g	Gate Resistance	V _{GE} =0V, V _{CC} =0V, f=1MHz	-	7	-	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 =8A, R _G =37.5Ω	-	8.5	-	ns	
t _r	Turn-On Rise Time		-	14	-	ns	
t _{D(off)}	Turn-Off Delay Time		-	102	-	ns	
t _f	Turn-Off Fall Time		-	16	-	ns	
E _{on}	Turn-On Energy		-	0.16	-	mJ	
E _{off}	Turn-Off Energy		-	0.11	-	mJ	
E _{total}	Total Switching Energy		-	0.27	-	mJ	
t _{rr}	Diode Reverse Recovery Time		T _J =25°C	-	94	-	ns
Q _{rr}	Diode Reverse Recovery Charge		I _F =8A, di/dt=200A/μs, V _{CC} =400V	-	0.2	-	μC
I _{rm}	Diode Peak Reverse Recovery Current		-	-	3.49	-	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 =8A, R _G =37.5Ω	-	7.5	-	ns	
t _r	Turn-On Rise Time		-	15	-	ns	
t _{D(off)}	Turn-Off Delay Time		-	122	-	ns	
t _f	Turn-Off Fall Time		-	26	-	ns	
E _{on}	Turn-On Energy		-	0.19	-	mJ	
E _{off}	Turn-Off Energy		-	0.18	-	mJ	
E _{total}	Total Switching Energy		-	0.37	-	mJ	
t _{rr}	Diode Reverse Recovery Time		T _J =150°C	-	133	-	ns
Q _{rr}	Diode Reverse Recovery Charge		I _F =8A, di/dt=200A/μs, V _{CC} =400V	-	0.38	-	μC
I _{rm}	Diode Peak Reverse Recovery Current		-	-	4.39	-	A

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

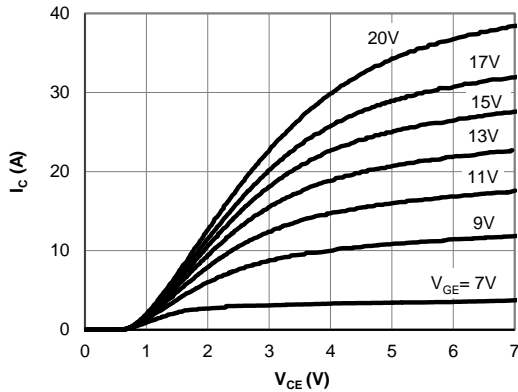


Figure 1: Output Characteristic
($T_j=25^\circ\text{C}$)

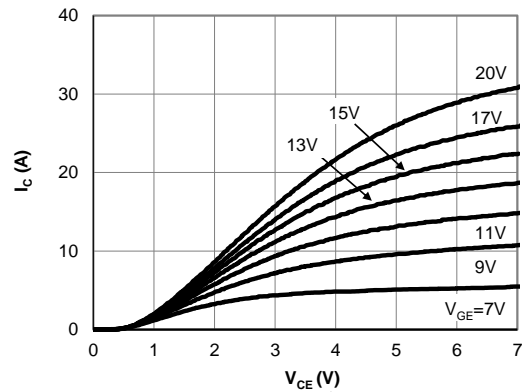


Figure 2: Output Characteristic
($T_j=150^\circ\text{C}$)

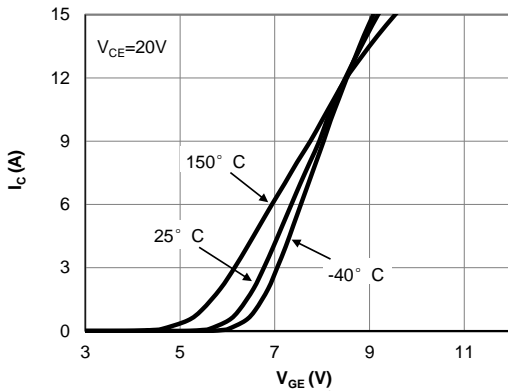


Figure 3: Transfer Characteristic

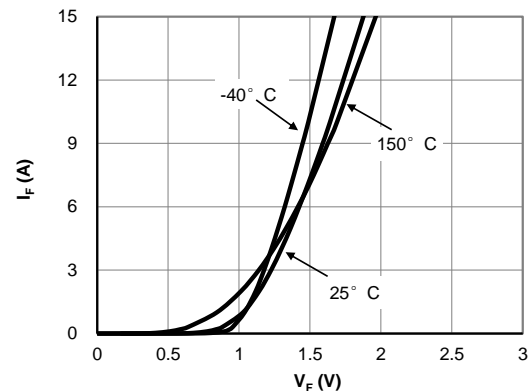


Figure 4: Diode Characteristic

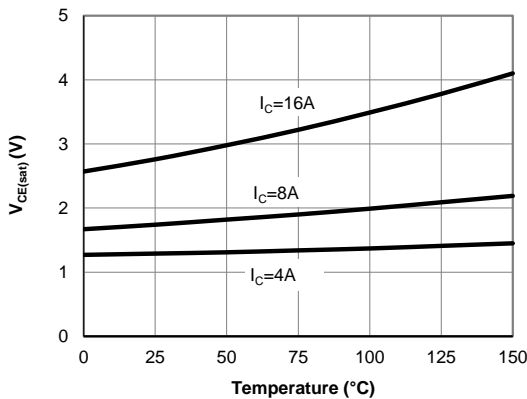


Figure 5: Collector-Emitter Saturation Voltage vs. Junction Temperature

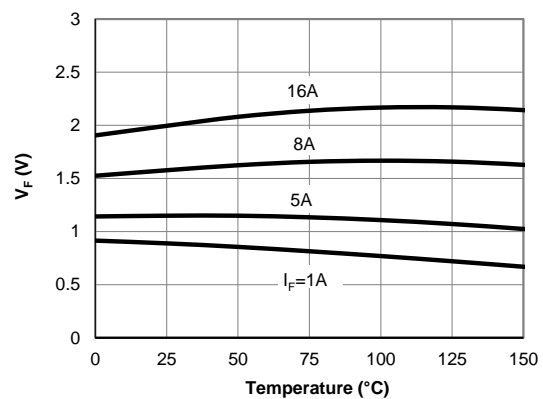


Figure 6: Diode Forward voltage vs. Junction Temperature

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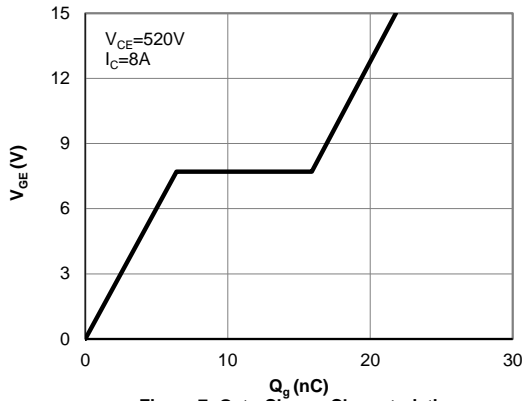


Figure 7: Gate-Charge Characteristics

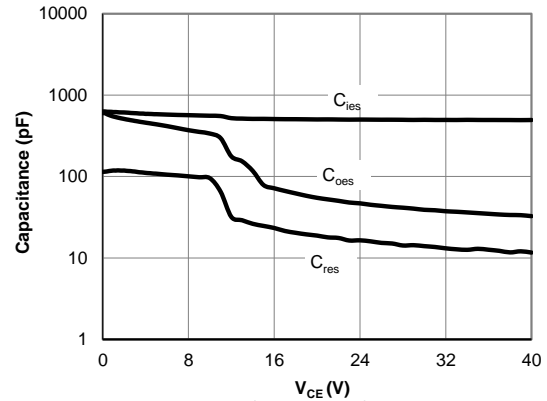


Figure 8: Capacitance Characteristic

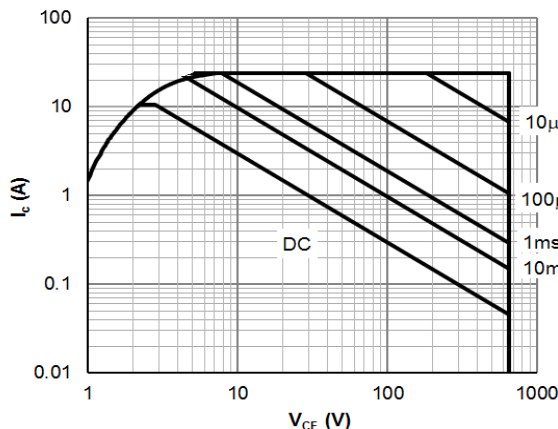


Figure 9: Forward Bias Safe Operating Area
($T_C=25^\circ\text{C}$, $V_{GE}=15\text{V}$)

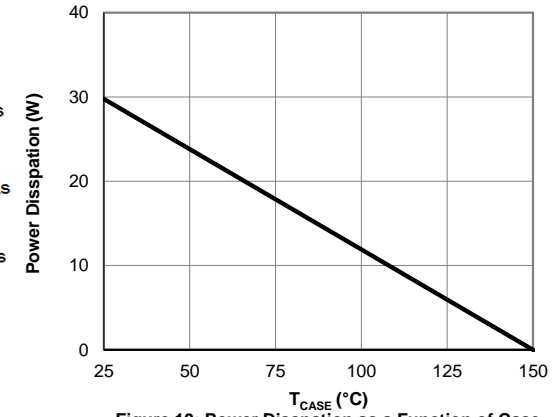


Figure 10: Power Dissipation as a Function of Case

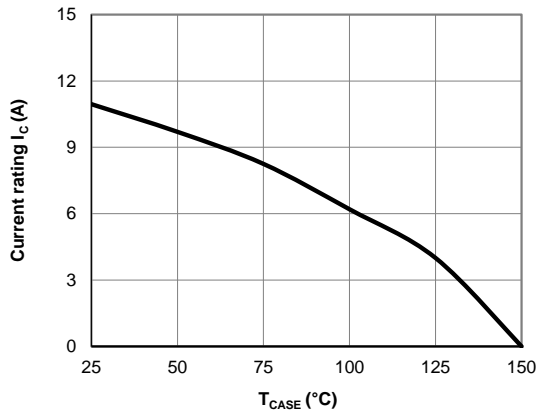


Figure 11: Current De-rating

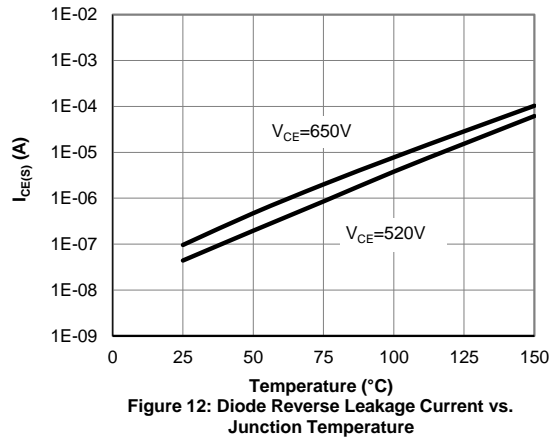


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

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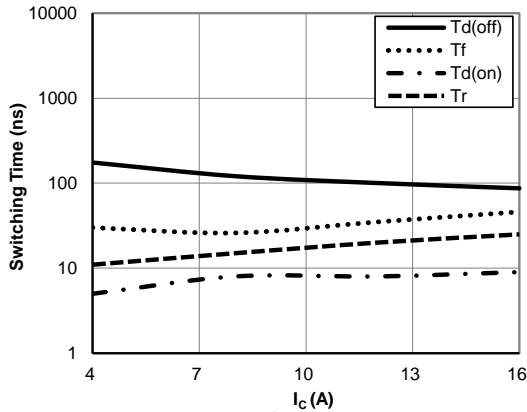


Figure 13: Switching Time vs. I_C
($T_J=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $R_g=37.5\Omega$)

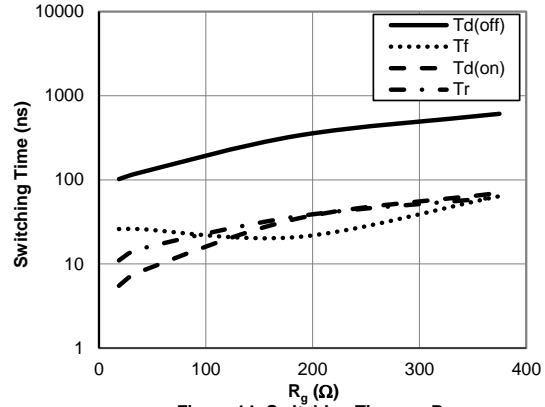


Figure 14: Switching Time vs. R_g
($T_J=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_C=8\text{A}$)

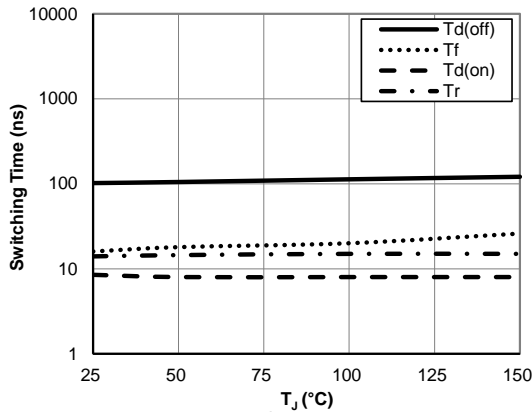


Figure 15: Switching Time vs. T_J
($V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_C=8\text{A}$, $R_g=37.5\Omega$)

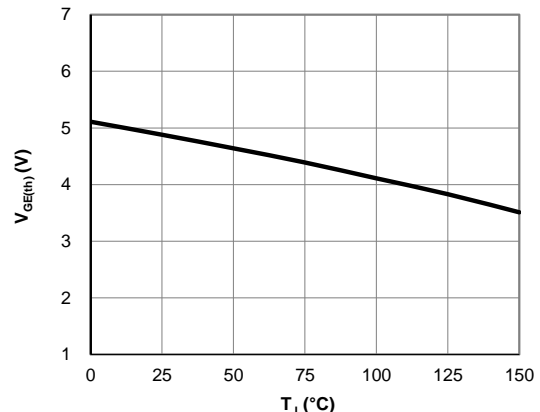


Figure 16: $V_{GE(th)}$ vs. T_J

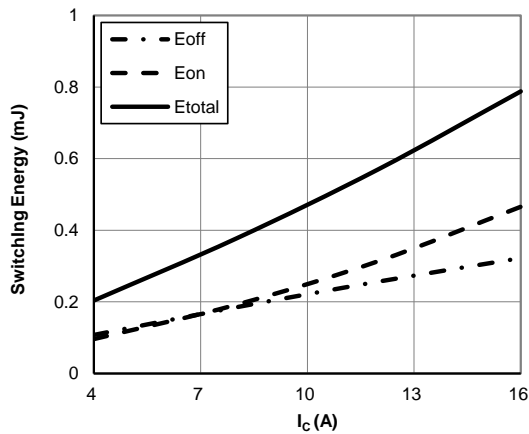


Figure 17: Switching Loss vs. I_C
($T_J=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $R_g=37.5\Omega$)

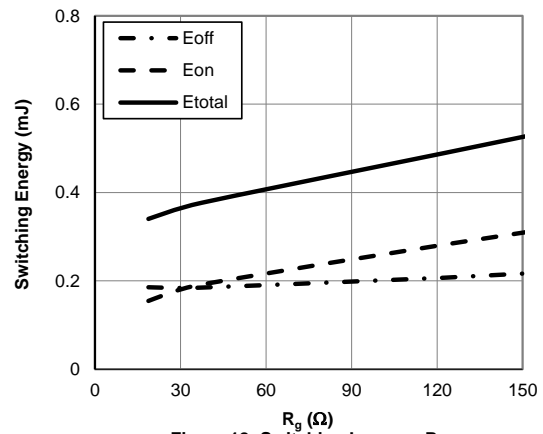


Figure 18: Switching Loss vs. R_g
($T_J=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_C=8\text{A}$)

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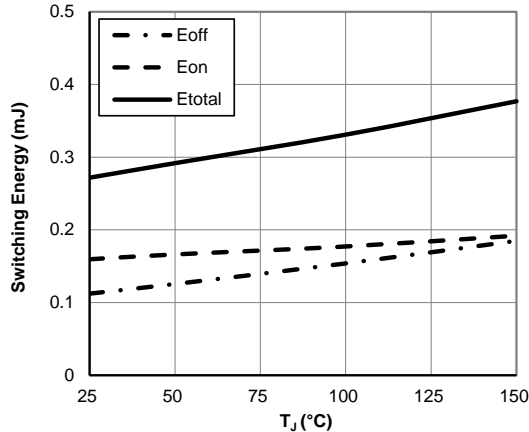


Figure 19: Switching Loss vs. T_j
($V_{GE}=15V, V_{CE}=400V, I_C=8A, R_{\theta}=37.5\Omega$)

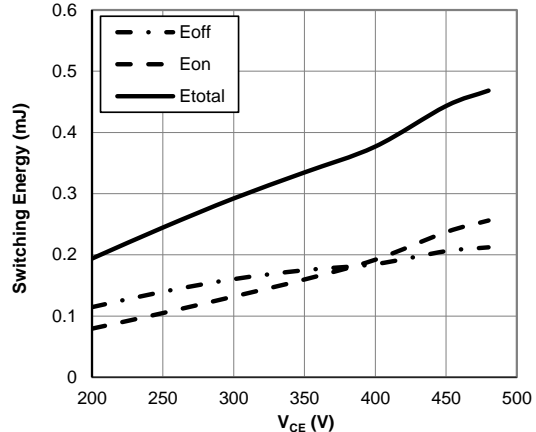


Figure 20: Switching Loss vs. V_{CE}
($T_j=150^\circ C, V_{GE}=15V, I_C=8A, R_{\theta}=37.5\Omega$)

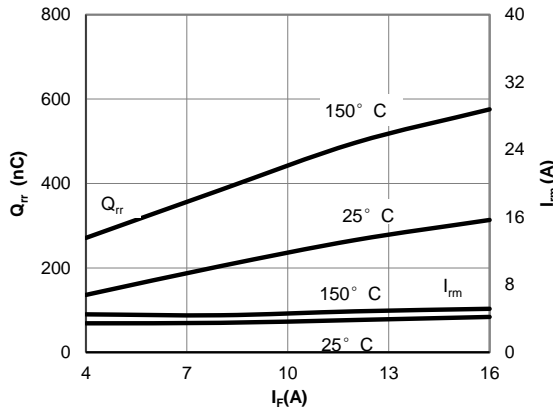


Figure 21: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current
($V_{GE}=15V, V_{CE}=400V, di/dt=200A/\mu s$)

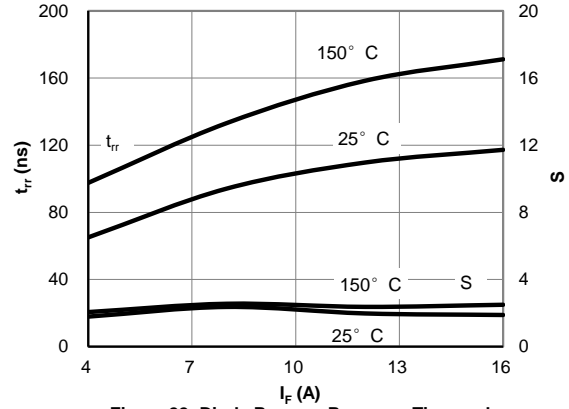


Figure 22: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current
($V_{GE}=15V, V_{CE}=400V, di/dt=200A/\mu s$)

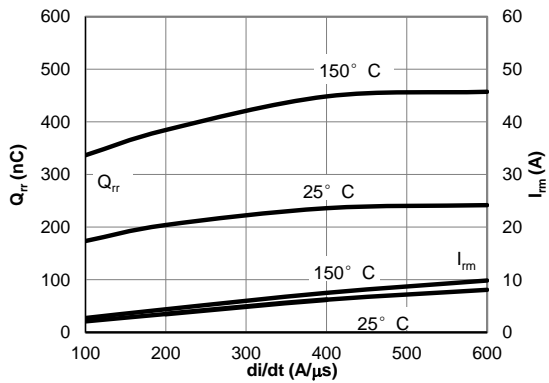


Figure 23: Diode Reverse Recovery Charge and Peak Current vs. di/dt
($V_{GE}=15V, V_{CE}=400V, I_F=8A$)

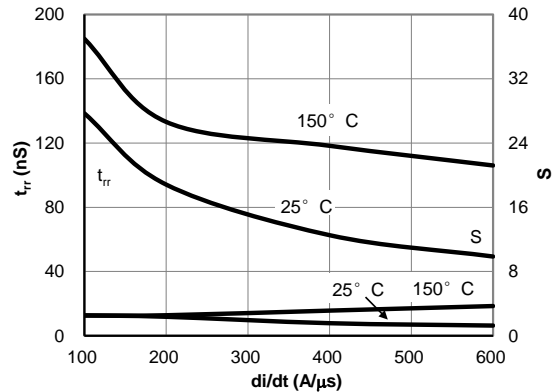


Figure 24: Diode Reverse Recovery Time and Softness Factor vs. di/dt
($V_{GE}=15V, V_{CE}=400V, I_F=8A$)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

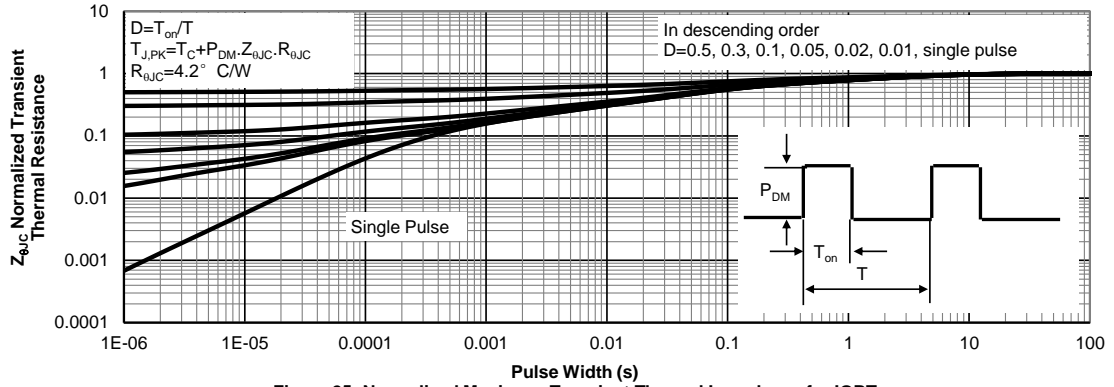


Figure 25: Normalized Maximum Transient Thermal Impedance for IGBT

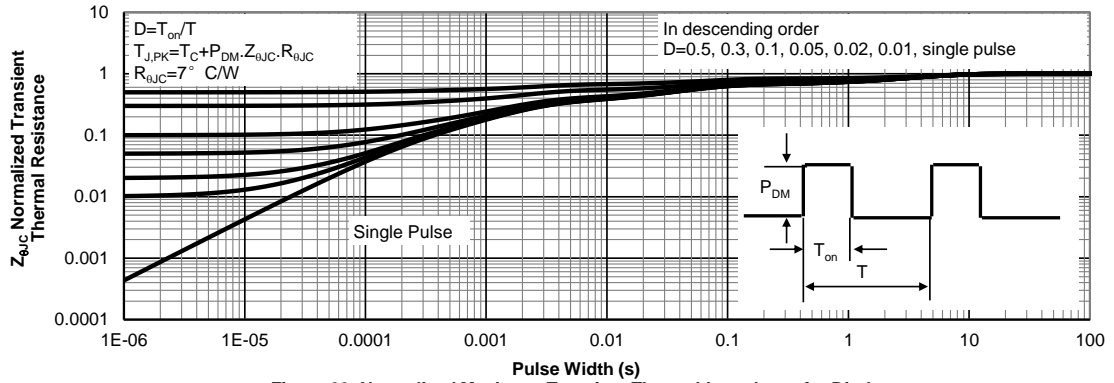


Figure 26: Normalized Maximum Transient Thermal Impedance for Diode

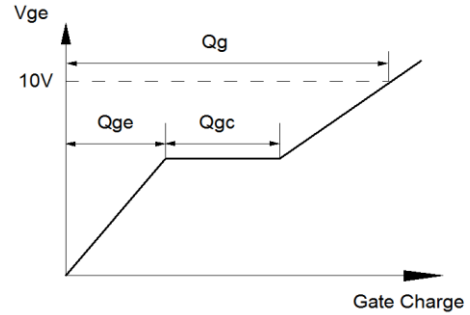
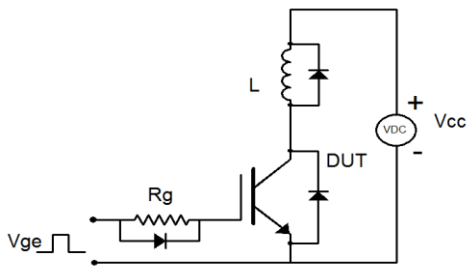


Figure A: Gate Charge Test Circuit & Waveforms

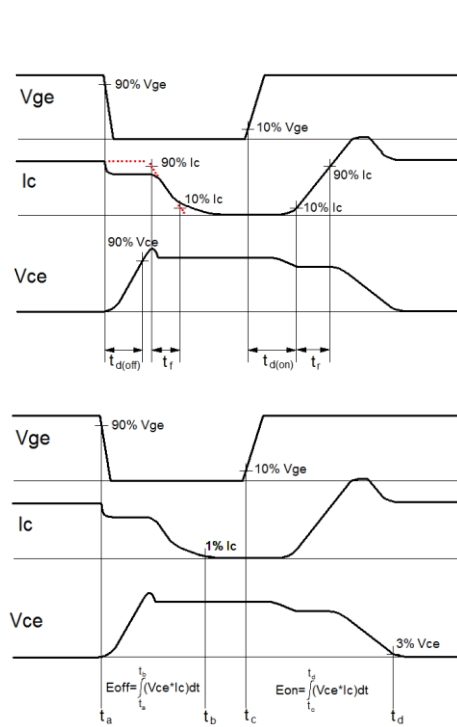
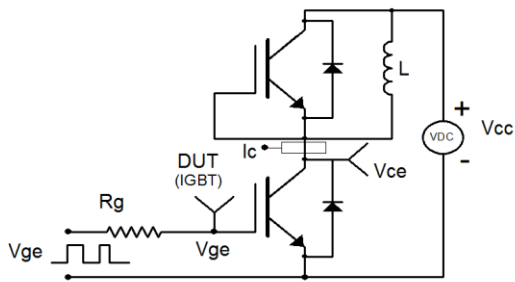


Figure B: Inductive Switching Test Circuit & Waveforms

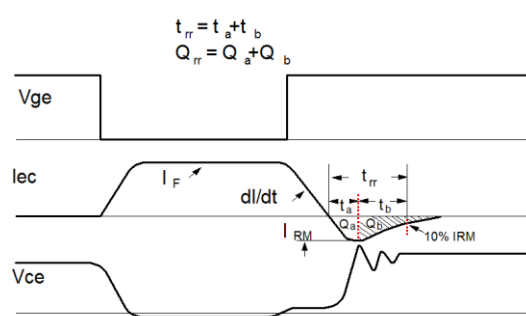
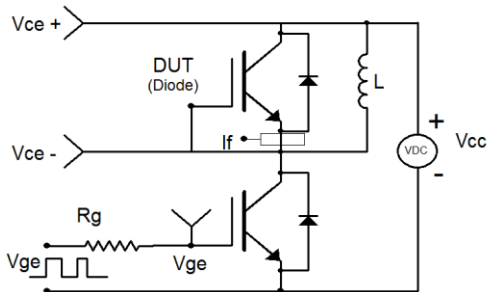


Figure C: Diode Recovery Test Circuit & Waveforms