



General Description

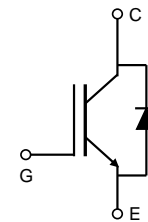
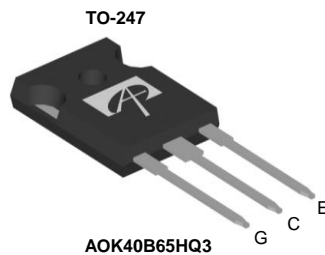
- 650V breakdown voltage
- High switching speed
- Low Qrr
- Low turn-off switching loss and softness
- Very good EMI behavior
- Latest AlphaIGBT technology

Applications

- PFC application for air-conditioners
- Solar inverter
- Welding machines

Product Summary

V_{CE}	650V
I_C ($T_C=100^\circ\text{C}$)	40A
$V_{CE(sat)}$ ($T_J=25^\circ\text{C}$)	2.05V



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOK40B65HQ3	TO247	Tube	240

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

Parameter	Symbol	AOK40B65HQ3	Units
Collector-Emitter Voltage	V_{CE}	650	V
Gate-Emitter Voltage	V_{GE}	± 30	V
Continuous Collector Current	I_C	$T_C=25^\circ\text{C}$	80
		$T_C=100^\circ\text{C}$	40
Pulsed Collector Current, Limited by T_{Jmax}	I_{CM}	120	A
Turn off SOA, $V_{CE} \leq 650\text{V}$, Limited by T_{Jmax}	I_{LM}	120	A
Continuous Diode Forward Current	I_F	$T_C=25^\circ\text{C}$	20
		$T_C=100^\circ\text{C}$	10
Diode Pulsed Current, Limited by T_{Jmax}	I_{FM}	30	A
Power Dissipation	P_D	$T_C=25^\circ\text{C}$	312
		$T_C=100^\circ\text{C}$	156
Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 175	$^\circ\text{C}$
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	T_L	300	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Typical	Units
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	$^\circ\text{C/W}$
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	0.48	$^\circ\text{C/W}$
Maximum Diode Junction-to-Case	$R_{\theta JC}$	2.78	$^\circ\text{C/W}$

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 =40A	T _J =25°C	-	2.05	2.6	V
			T _J =125°C	-	2.57	-	
			T _J =175°C	-	2.82	-	
V _F	Diode Forward Voltage	V _{GE} =0V, I _F =10A	T _J =25°C	-	1.65	2.1	V
			T _J =125°C	-	1.76	-	
			T _J =175°C	-	1.7	-	
V _{GE(th)}	Gate-Emitter Threshold Voltage	V _{CE} =5V, I _C =1mA	-	4.7	-	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 =175°C	-	-	5000	
I _{GES}	Gate-Emitter leakage current	V _{CE} =0V, V _{GE} =±30V	-	-	±100	nA	
g _{FS}	Forward Transconductance	V _{CE} =20V, I _C =40A	-	24	-	S	
DYNAMIC PARAMETERS							
C _{ies}	Input Capacitance	V _{GE} =0V, V _{CC} =25V, f=1MHz	-	1230	-	pF	
C _{oes}	Output Capacitance		-	100	-	pF	
C _{res}	Reverse Transfer Capacitance		-	44	-	pF	
Q _g	Total Gate Charge	V _{GE} =15V, V _{CC} =520V, I _C =40A	-	61	-	nC	
Q _{ge}	Gate to Emitter Charge		-	18	-	nC	
Q _{gc}	Gate to Collector Charge		-	27	-	nC	
R _g	Gate Resistance	V _{GE} =0V, V _{CC} =0V, f=1MHz	-	11	-	Ω	
SWITCHING PARAMETERS, (Load Inductive, T_J=25°C)							
t _{D(on)}	Turn-On DelayTime	T _J =25°C V _{GE} =15V, V _{CC} =400V, I _C =40A, R _G =7.5Ω	-	31	-	ns	
t _r	Turn-On Rise Time		-	29	-	ns	
t _{D(off)}	Turn-Off Delay Time		-	110	-	ns	
t _f	Turn-Off Fall Time		-	13	-	ns	
E _{on}	Turn-On Energy		-	1.19	-	mJ	
E _{off}	Turn-Off Energy		-	0.38	-	mJ	
E _{total}	Total Switching Energy		-	1.57	-	mJ	
t _{rr}	Diode Reverse Recovery Time	T _J =25°C I _F =10A, di/dt=200A/μs, V _{CC} =400V	-	106	-	ns	
Q _{rr}	Diode Reverse Recovery Charge		-	0.24	-	μC	
I _{rm}	Diode Peak Reverse Recovery Current		-	3.7	-	A	
SWITCHING PARAMETERS, (Load Inductive, T_J=175°C)							
t _{D(on)}	Turn-On DelayTime	T _J =175°C V _{GE} =15V, V _{CC} =400V, I _C =40A, R _G =7.5Ω	-	30	-	ns	
t _r	Turn-On Rise Time		-	33	-	ns	
t _{D(off)}	Turn-Off Delay Time		-	127	-	ns	
t _f	Turn-Off Fall Time		-	16	-	ns	
E _{on}	Turn-On Energy		-	1.36	-	mJ	
E _{off}	Turn-Off Energy		-	0.68	-	mJ	
E _{total}	Total Switching Energy		-	2.04	-	mJ	
t _{rr}	Diode Reverse Recovery Time	T _J =175°C I _F =10A, di/dt=200A/μs, V _{CC} =400V	-	168	-	ns	
Q _{rr}	Diode Reverse Recovery Charge		-	0.51	-	μC	
I _{rm}	Diode Peak Reverse Recovery Current		-	5.0	-	A	

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

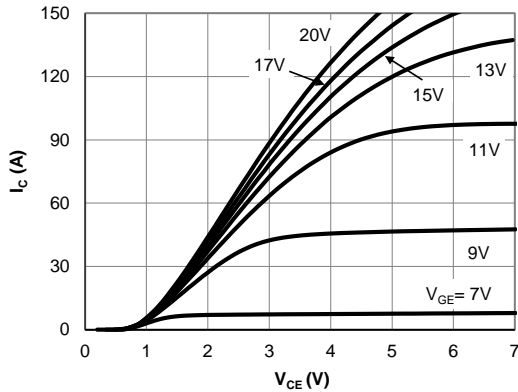


Figure 1: Output Characteristic
($T_j=25^\circ\text{C}$)

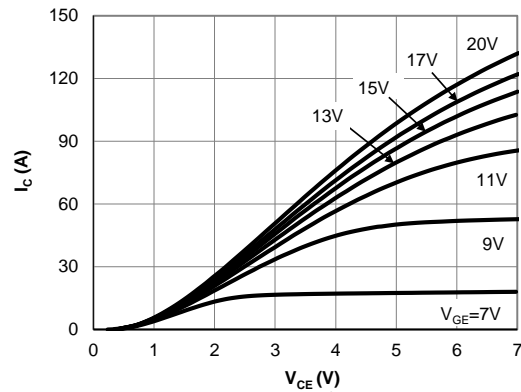


Figure 2: Output Characteristic
($T_j=175^\circ\text{C}$)

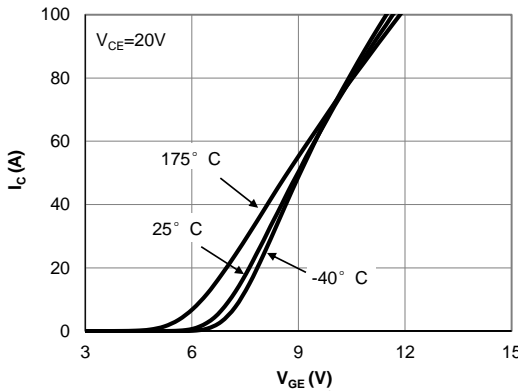


Figure 3: Transfer Characteristic

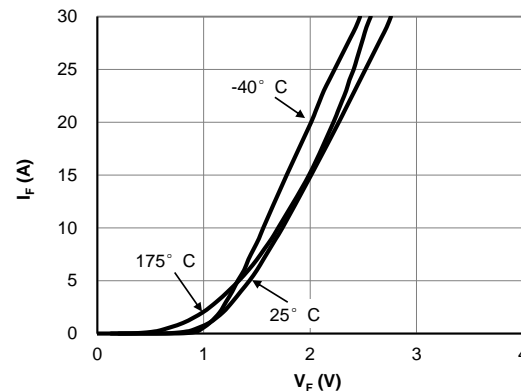


Figure 4: Diode Characteristic

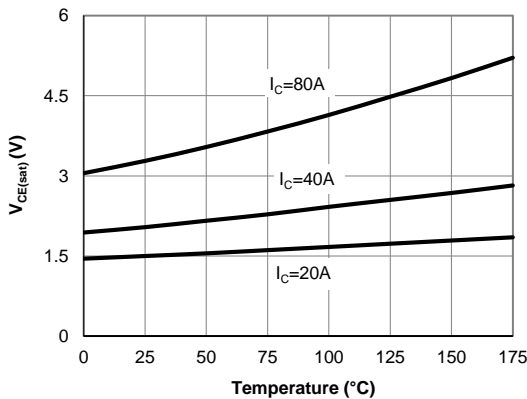


Figure 5: Collector-Emitter Saturation Voltage vs. Junction Temperature

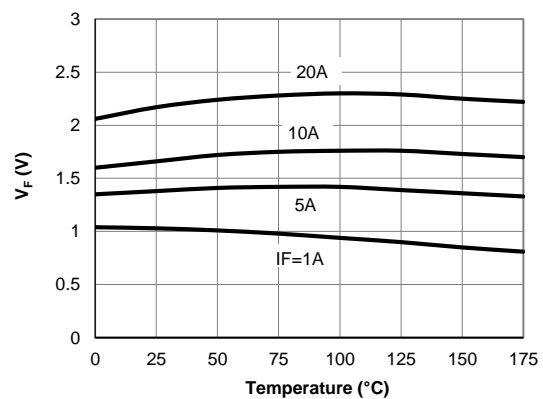


Figure 6: Diode Forward voltage vs. Junction Temperature

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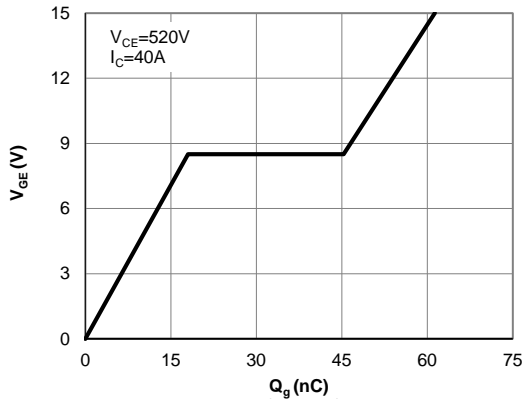


Figure 7: Gate-Charge Characteristics

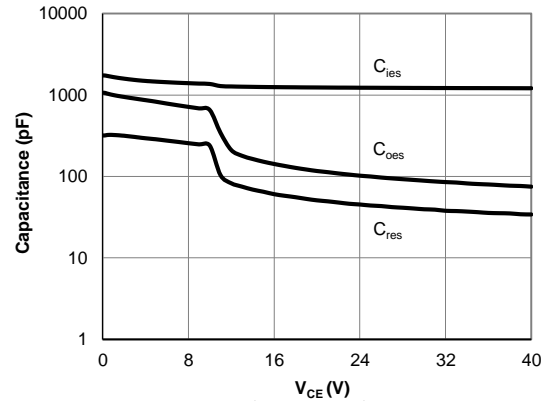


Figure 8: Capacitance Characteristic

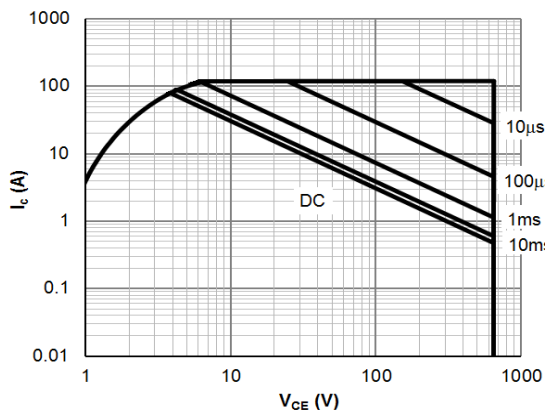


Figure 9: Forward Bias Safe Operating Area
($T_C=25^\circ\text{C}$, $V_{GE}=15\text{V}$)

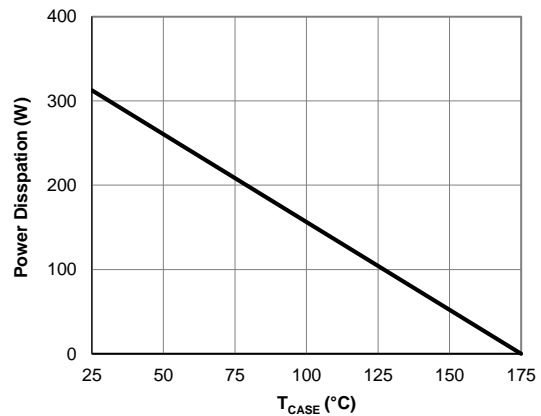


Figure 10: Power Dissipation as a Function of Case

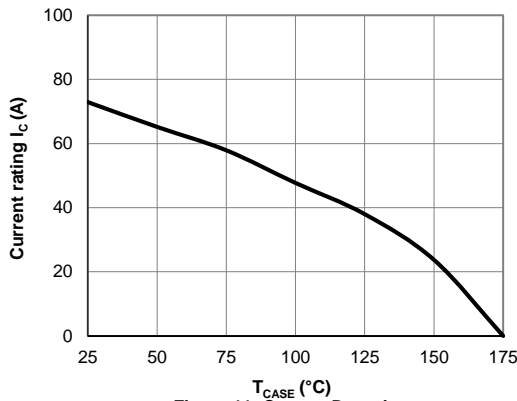


Figure 11: Current De-rating

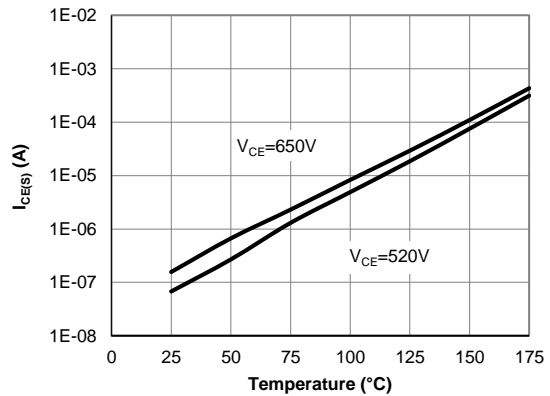


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

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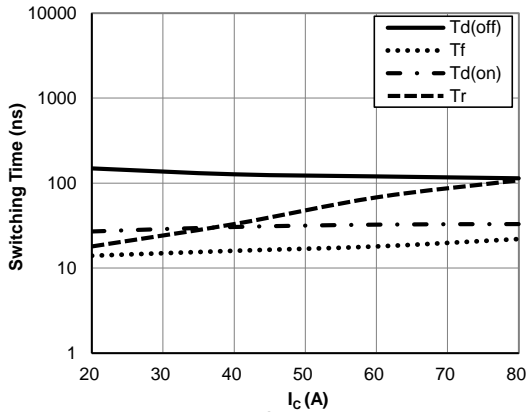


Figure 13: Switching Time vs. I_C
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $R_g=7.5\Omega$)

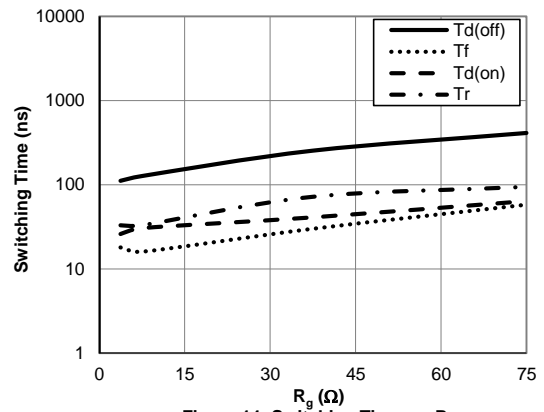


Figure 14: Switching Time vs. R_g
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_C=40\text{A}$)

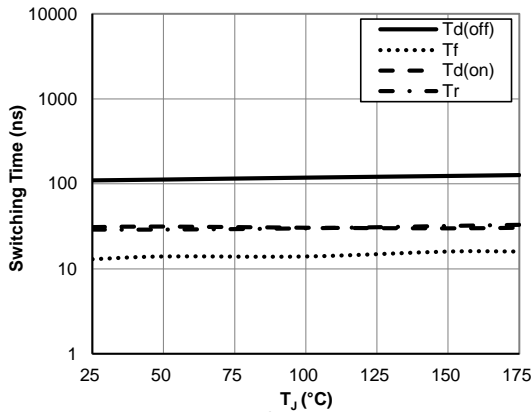


Figure 15: Switching Time vs. T_J
($V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_C=40\text{A}$, $R_g=7.5\Omega$)

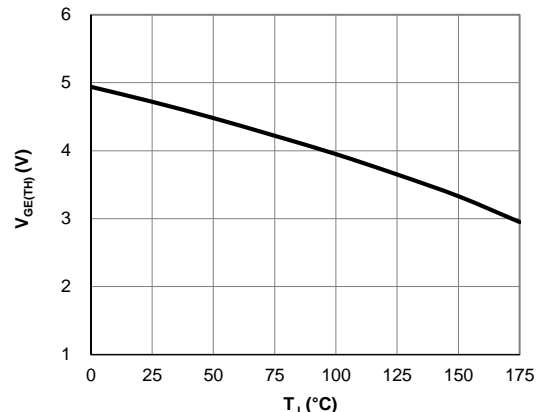


Figure 16: $V_{GE(TH)}$ vs. T_J

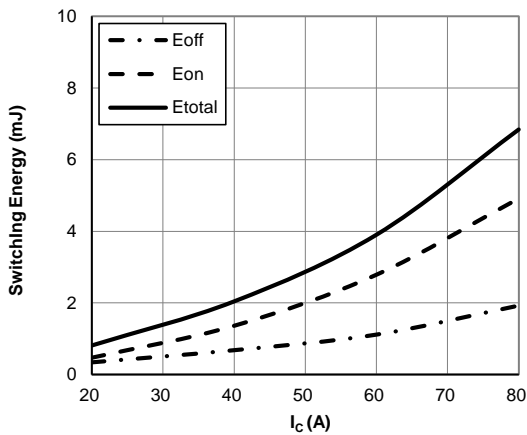


Figure 17: Switching Loss vs. I_C
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $R_g=7.5\Omega$)

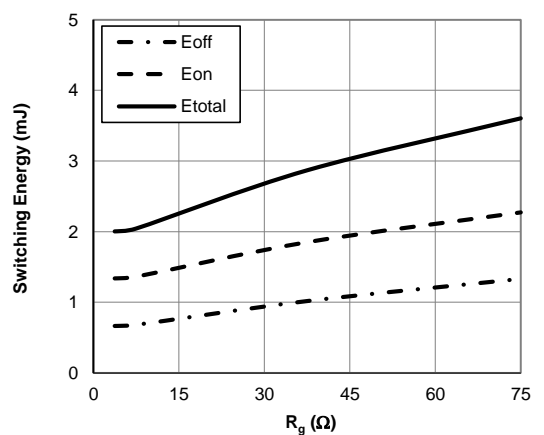


Figure 18: Switching Loss vs. R_g
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_C=40\text{A}$)

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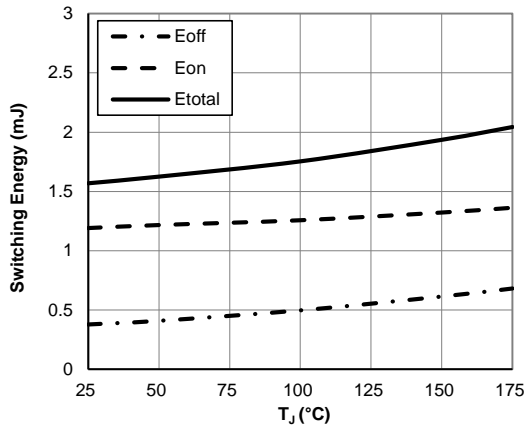


Figure 19: Switching Loss vs. T_j
($V_{GE}=15V, V_{CE}=400V, I_C=40A, R_{\theta}=7.5\Omega$)

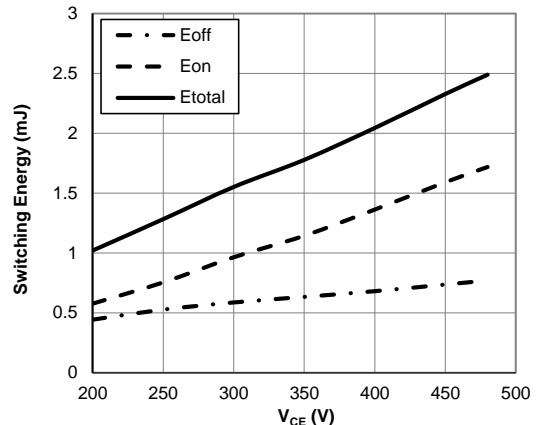


Figure 20: Switching Loss vs. V_{CE}
($T_j=175^\circ C, V_{GE}=15V, I_C=40A, R_{\theta}=7.5\Omega$)

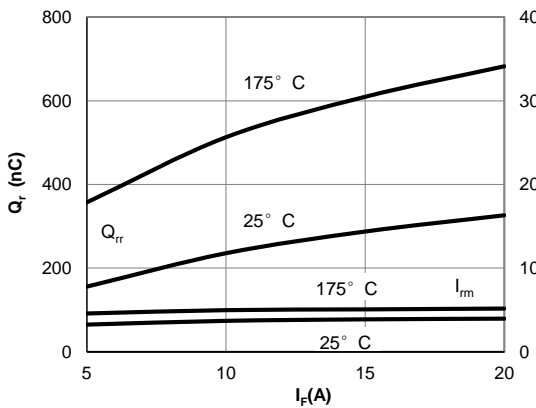


Figure 21: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current
($V_{GE}=15V, V_{CE}=400V, di/dt=200A/\mu s$)

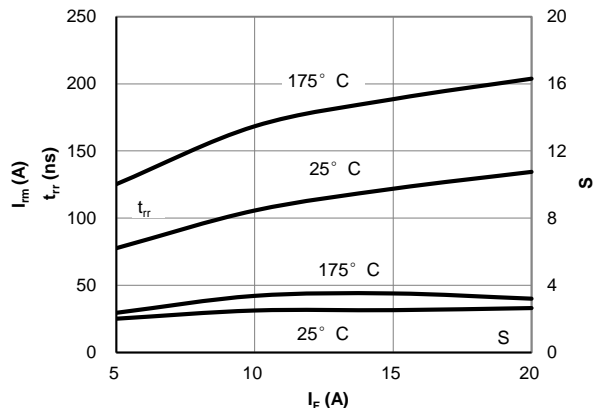


Figure 22: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current
($V_{GE}=15V, V_{CE}=400V, di/dt=200A/\mu s$)

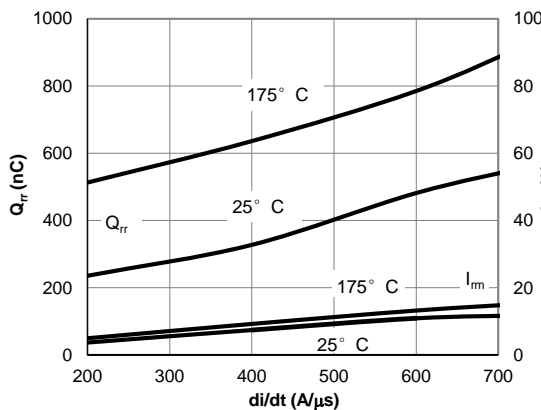


Figure 23: Diode Reverse Recovery Charge and Peak Current vs. di/dt
($V_{GE}=15V, V_{CE}=400V, I_F=10A$)

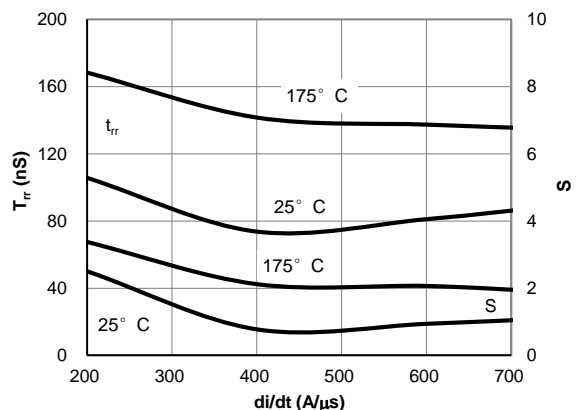


Figure 24: Diode Reverse Recovery Time and Softness Factor vs. di/dt
($V_{GE}=15V, V_{CE}=400V, I_F=10A$)

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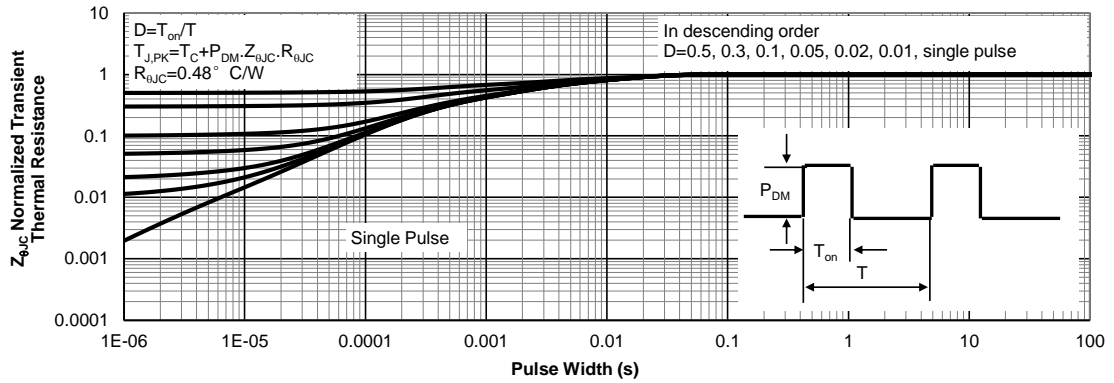


Figure 25: Normalized Maximum Transient Thermal Impedance for IGBT

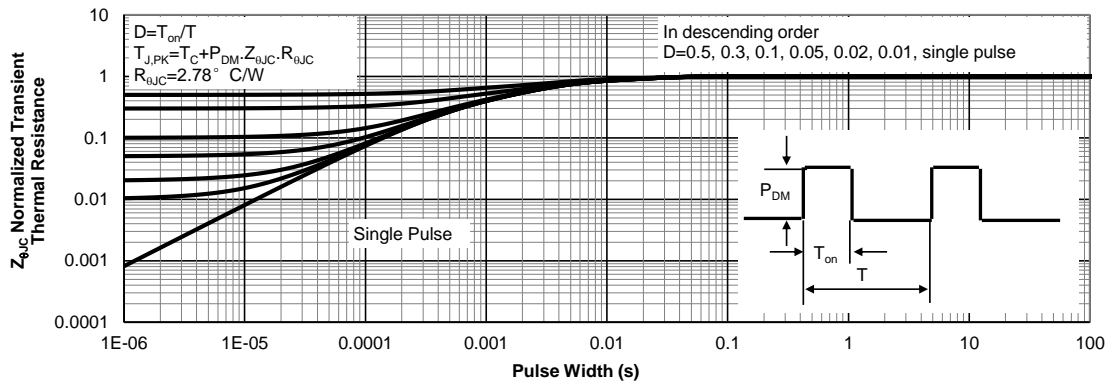


Figure 26: Normalized Maximum Transient Thermal Impedance for Diode

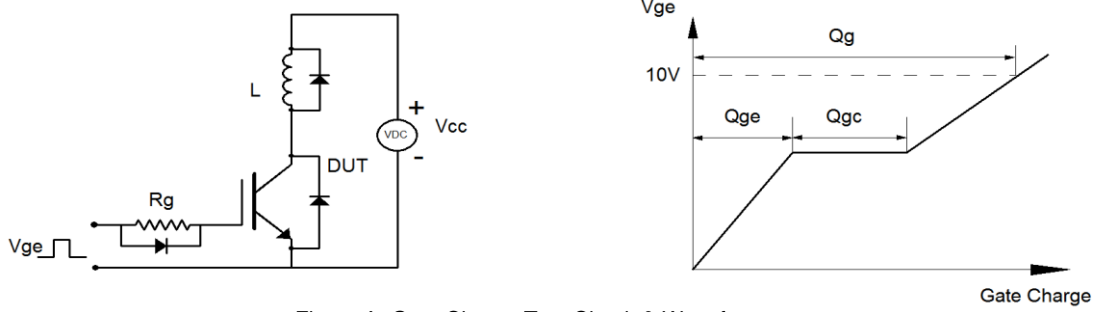


Figure A: Gate Charge Test Circuit & Waveforms

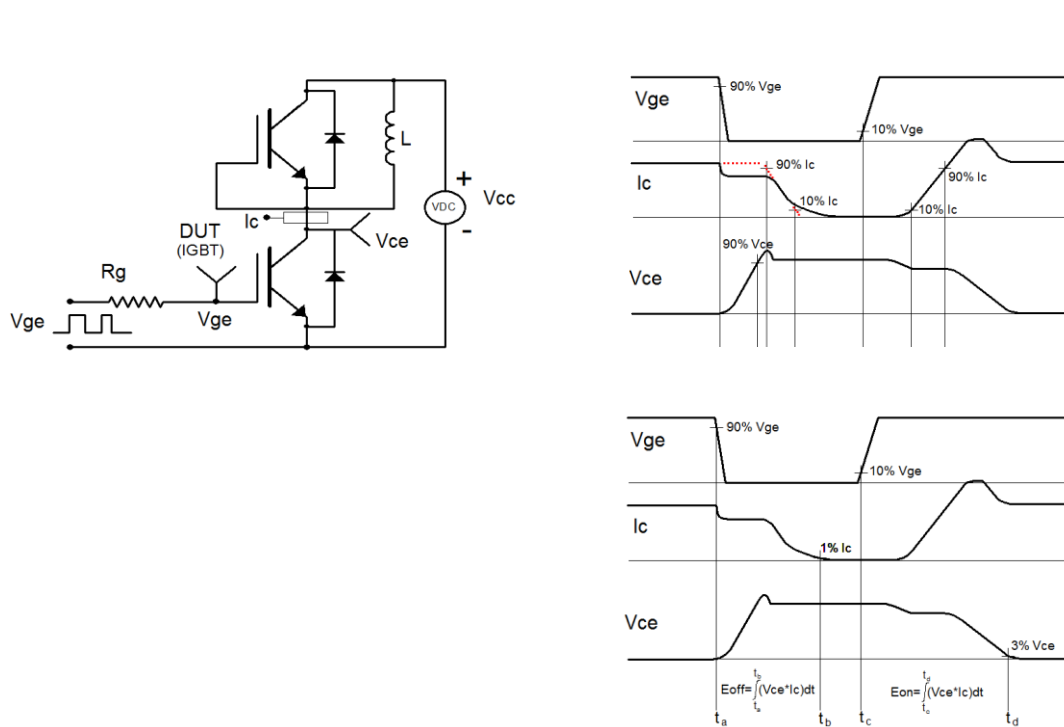


Figure B: Inductive Switching Test Circuit & Waveforms

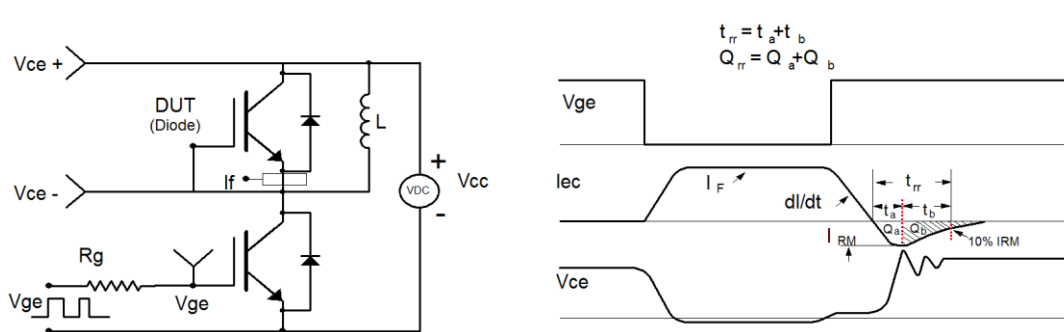


Figure C: Diode Recovery Test Circuit & Waveforms

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