



ALPHA & OMEGA
SEMICONDUCTOR

AOK40B120H1

1200V, 40A AlphaIGBT™

With Soft and Fast Recovery Anti-parallel Diode

General Description

- Latest AlphaIGBT (α IGBT) technology
- 1200V breakdown voltage
- Very fast and soft recovery freewheeling diode
- High efficient turn-on di/dt controllability
- Very high switching speed
- Low turn-off switching loss and softness
- Very good EMI behavior

Applications

- Welding Machines
- UPS & Solar Inverters
- Very High Switching Frequency Applications

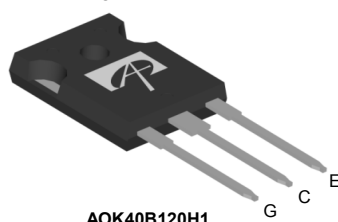
Product Summary

V_{CE}	1200V
I_C ($T_C=100^\circ\text{C}$)	40A
$V_{CE(sat)}$ ($T_J=25^\circ\text{C}$)	1.8V

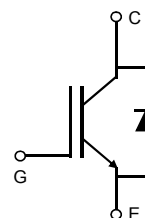


Top View

TO-247



AOK40B120H1



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOK40B120H1	TO247	Tube	240
Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted			
Parameter	Symbol	AOK40B120H1	Units
Collector-Emitter Voltage	V_{CE}	1200	V
Gate-Emitter Voltage	V_{GE}	± 30	V
Continuous Collector Current	$T_C=25^\circ\text{C}$	80	A
	$T_C=100^\circ\text{C}$	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	$T_C=25^\circ\text{C}$	48	A
	$T_C=100^\circ\text{C}$	24	
Diode Pulsed Current, Limited by T_{Jmax}	I_{FM}	120	A
Power Dissipation	$T_C=25^\circ\text{C}$	500	W
	$T_C=100^\circ\text{C}$	250	
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	AOK40B120H1	Units
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	$^\circ\text{C/W}$
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	0.30	$^\circ\text{C/W}$
Maximum Diode Junction-to-Case	$R_{\theta JC}$	0.85	$^\circ\text{C/W}$

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units	
STATIC PARAMETERS							
BV_{CES}	Collector-Emitter Breakdown Voltage	$I_C=1mA, V_{GE}=0V, T_J=25^{\circ}C$	1200	-	-	V	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=40A$	$T_J=25^{\circ}C$	-	1.8	2.3	V
			$T_J=125^{\circ}C$	-	2.1	-	
			$T_J=175^{\circ}C$	-	2.3	-	
V_F	Diode Forward Voltage	$V_{GE}=0V, I_F=40A$	$T_J=25^{\circ}C$	-	2.8	3.5	V
			$T_J=125^{\circ}C$	-	3.2	-	
			$T_J=175^{\circ}C$	-	3.1	-	
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$V_{CE}=5V, I_C=1mA$	-	5.9	-	V	
I_{CES}	Zero Gate Voltage Collector Current	$V_{CE}=1200V, V_{GE}=0V$	$T_J=25^{\circ}C$	-	-	10	μA
			$T_J=125^{\circ}C$	-	-	1000	
			$T_J=175^{\circ}C$	-	-	10000	
I_{GES}	Gate-Emitter leakage current	$V_{CE}=0V, V_{GE}=\pm 30V$	-	-	± 100	nA	
g_{FS}	Forward Transconductance	$V_{CE}=20V, I_C=40A$	-	45	-	S	
DYNAMIC PARAMETERS							
C_{ies}	Input Capacitance	$V_{GE}=0V, V_{CC}=25V, f=1MHz$	-	3910	-	pF	
C_{oes}	Output Capacitance		-	230	-	pF	
C_{res}	Reverse Transfer Capacitance		-	100	-	pF	
Q_g	Total Gate Charge	$V_{GE}=15V, V_{CC}=960V, I_C=40A$	-	128	-	nC	
Q_{ge}	Gate to Emitter Charge		-	36	-	nC	
Q_{gc}	Gate to Collector Charge		-	60	-	nC	
R_g	Gate resistance	$V_{GE}=0V, V_{CC}=0V, f=1MHz$	-	14	-	Ω	
SWITCHING PARAMETERS, (Load Inductive, $T_J=25^{\circ}C$)							
$t_{D(on)}$	Turn-On DelayTime	$T_J=25^{\circ}C$ $V_{GE}=15V, V_{CC}=600V, I_C=40A,$ $R_G=7.5\Omega$	-	73	-	ns	
t_r	Turn-On Rise Time		-	60	-	ns	
$t_{D(off)}$	Turn-Off Delay Time		-	230	-	ns	
t_f	Turn-Off Fall Time		-	32	-	ns	
E_{on}	Turn-On Energy		-	2.45	-	mJ	
E_{off}	Turn-Off Energy		-	1.24	-	mJ	
E_{total}	Total Switching Energy		-	3.69	-	mJ	
t_{rr}	Diode Reverse Recovery Time	$T_J=25^{\circ}C$ $I_F=40A, di/dt=200A/\mu s, V_{CC}=600V$	-	387	-	ns	
Q_{rr}	Diode Reverse Recovery Charge		-	1.1	-	μC	
I_{rm}	Diode Peak Reverse Recovery Current		-	6.5	-	A	
SWITCHING PARAMETERS, (Load Inductive, $T_J=175^{\circ}C$)							
$t_{D(on)}$	Turn-On DelayTime	$T_J=175^{\circ}C$ $V_{GE}=15V, V_{CC}=600V, I_C=40A,$ $R_G=7.5\Omega$	-	53	-	ns	
t_r	Turn-On Rise Time		-	80	-	ns	
$t_{D(off)}$	Turn-Off Delay Time		-	290	-	ns	
t_f	Turn-Off Fall Time		-	85	-	ns	
E_{on}	Turn-On Energy		-	2.85	-	mJ	
E_{off}	Turn-Off Energy		-	2.20	-	mJ	
E_{total}	Total Switching Energy		-	5.05	-	mJ	
t_{rr}	Diode Reverse Recovery Time	$T_J=175^{\circ}C$ $I_F=40A, di/dt=200A/\mu s, V_{CC}=600V$	-	564	-	ns	
Q_{rr}	Diode Reverse Recovery Charge		-	2.9	-	μC	
I_{rm}	Diode Peak Reverse Recovery Current		-	10	-	A	

APPLICATIONS OR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS ARE NOT AUTHORIZED. AOS DOES NOT ASSUME ANY LIABILITY ARISING OUT OF SUCH APPLICATIONS OR USES OF ITS PRODUCTS. AOS RESERVES THE RIGHT TO IMPROVE PRODUCT DESIGN, FUNCTIONS AND RELIABILITY WITHOUT NOTICE.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

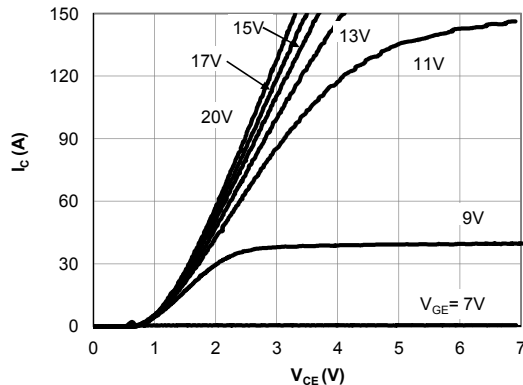


Figure 1: Output Characteristic
($T_j=25^\circ\text{C}$)

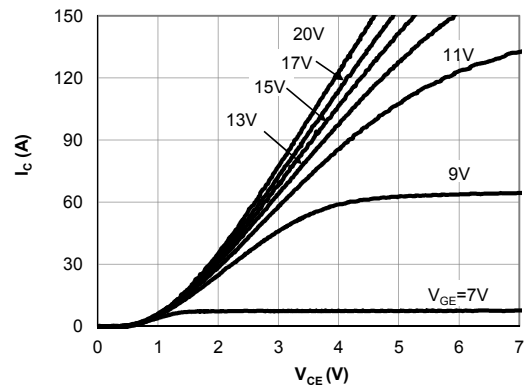


Figure 2: Output Characteristic
($T_j=175^\circ\text{C}$)

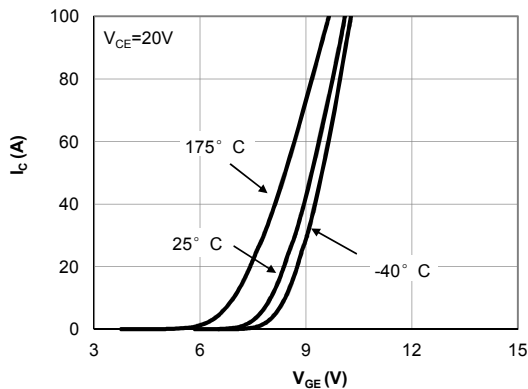


Figure 3: Transfer Characteristic

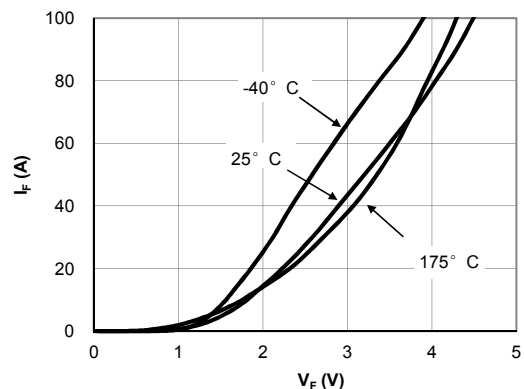


Figure 4: Diode Characteristic

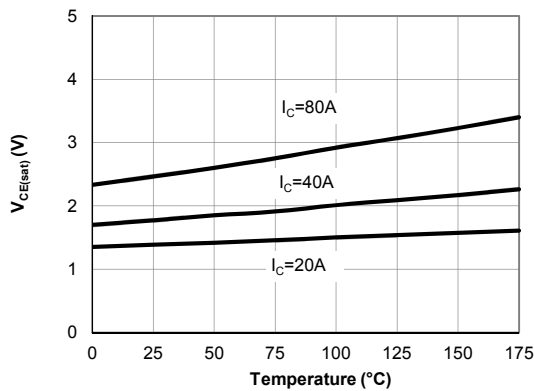


Figure 5: Collector-Emitter Saturation Voltage vs. Junction Temperature

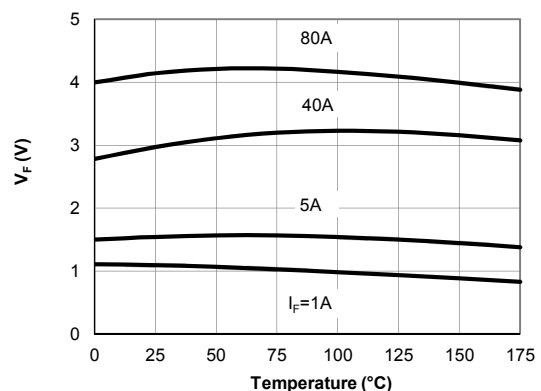


Figure 6: Diode Forward voltage vs. Junction Temperature

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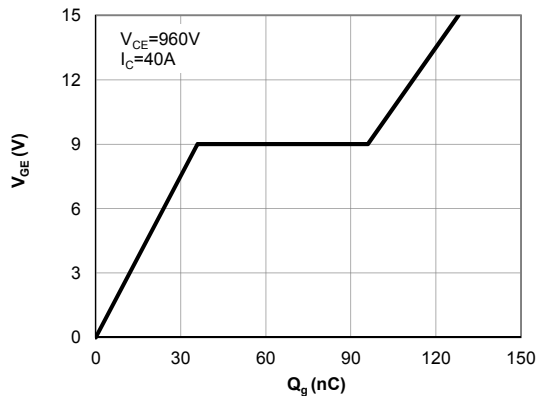


Figure 7: Gate-Charge Characteristics

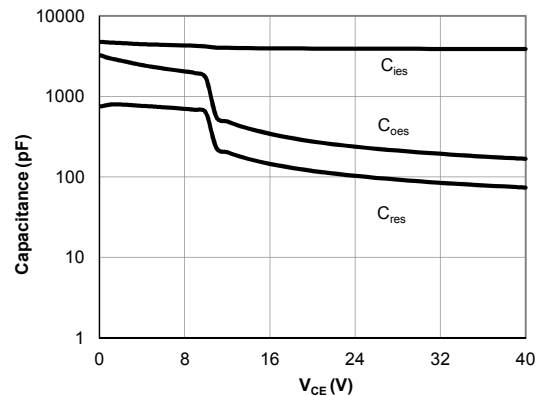


Figure 8: Capacitance Characteristic

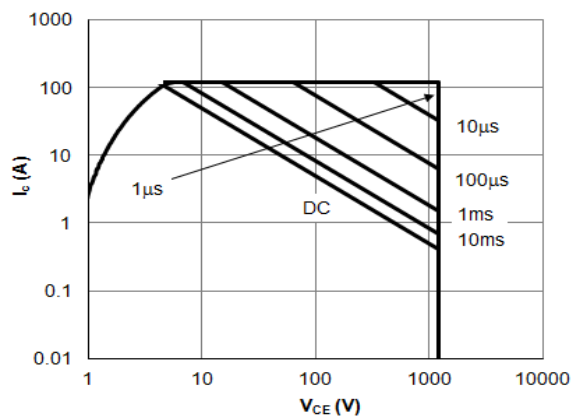


Figure 9: Forward Bias Safe Operating Area
($T_C=25^{\circ}\text{C}$, $V_{GE}=15\text{V}$)

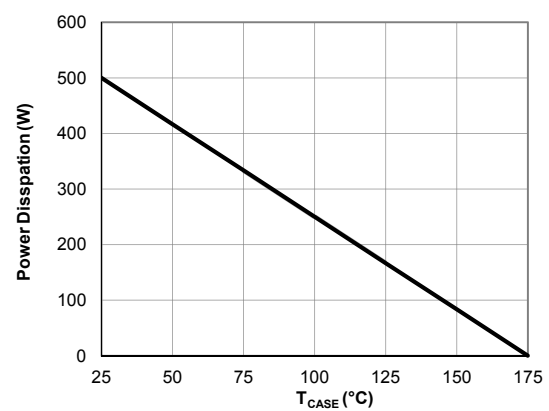


Figure 10: Power Dissipation as a Function of Case

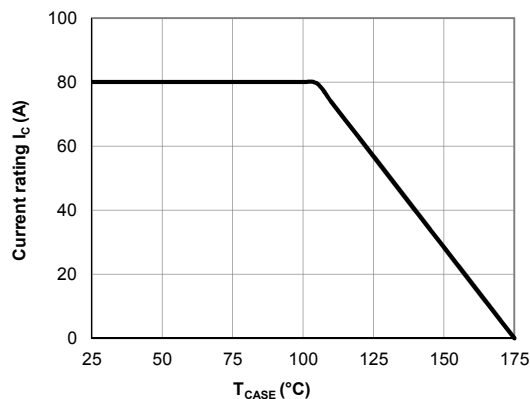


Figure 11: Current De-rating

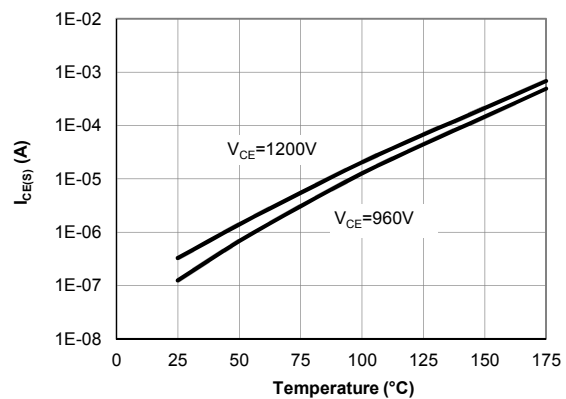
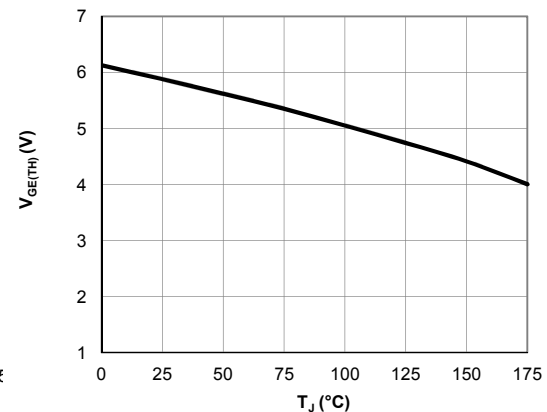
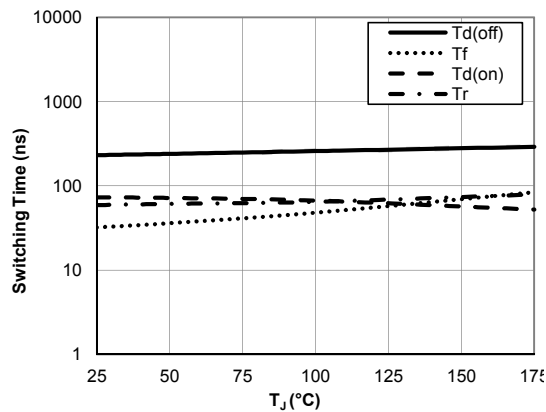
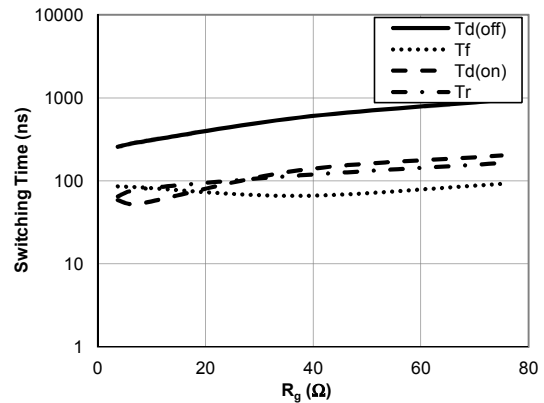
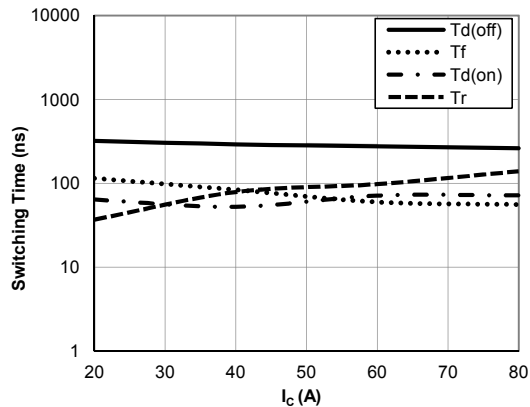
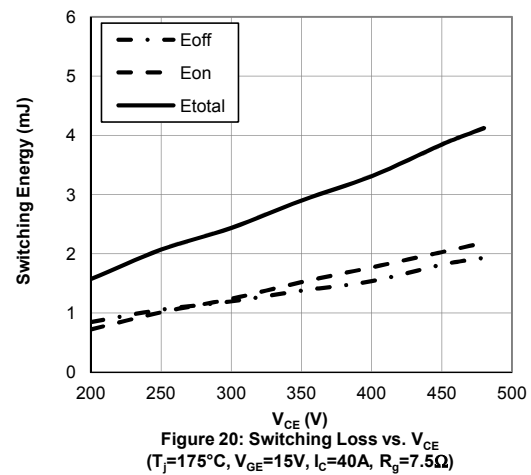
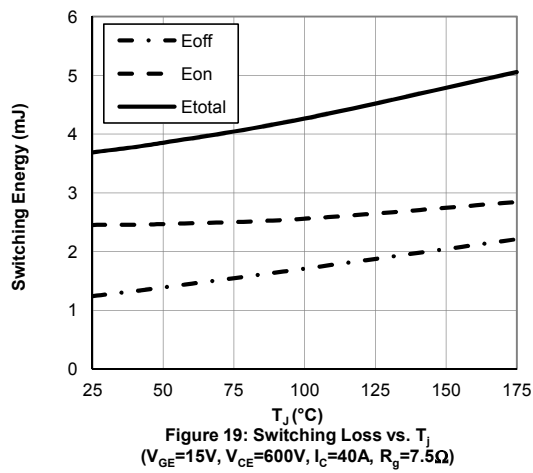
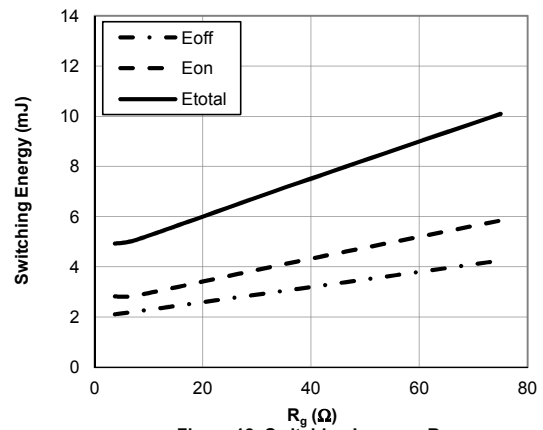
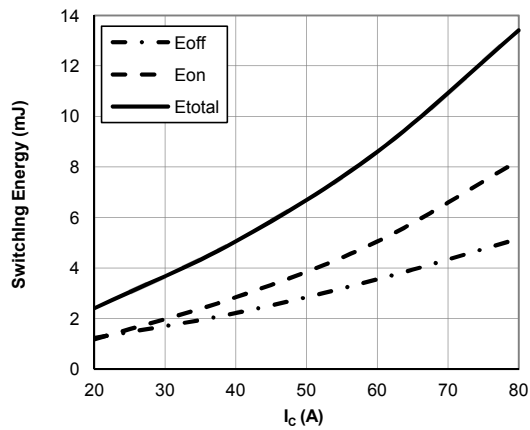


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

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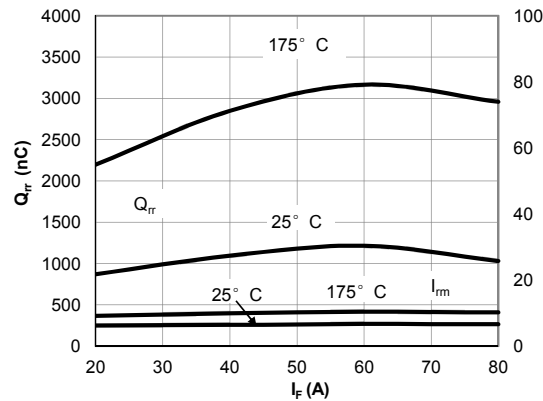


Figure 21: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current
($V_{GE}=15V$, $V_{CE}=600V$, $di/dt=200A/\mu s$)

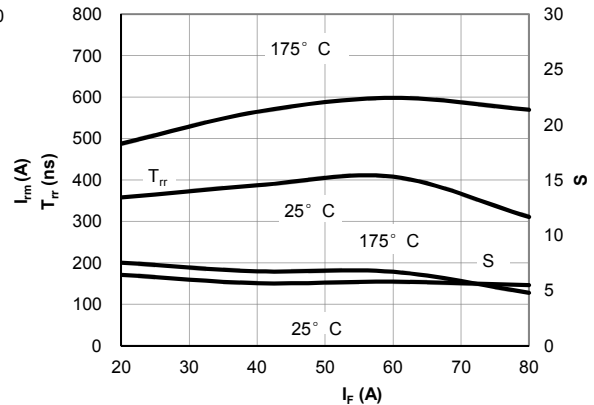


Figure 22: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current
($V_{GE}=15V$, $V_{CE}=600V$, $di/dt=200A/\mu s$)

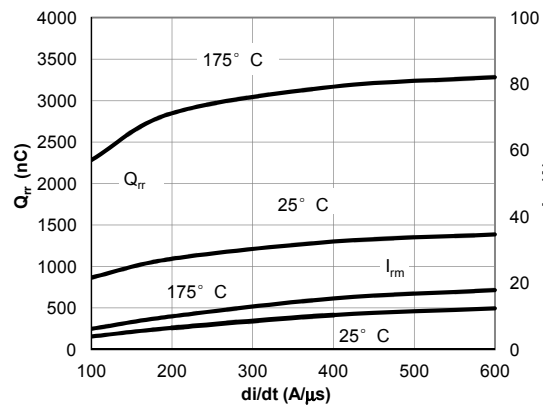


Figure 23: Diode Reverse Recovery Charge and Peak Current vs. di/dt
($V_{GE}=15V$, $V_{CE}=600V$, $I_F=40A$)

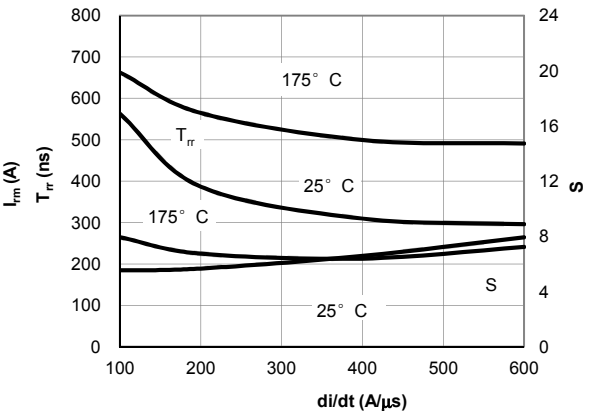


Figure 24: Diode Reverse Recovery Time and Softness Factor vs. di/dt
($V_{GE}=15V$, $V_{CE}=600V$, $I_F=40A$)

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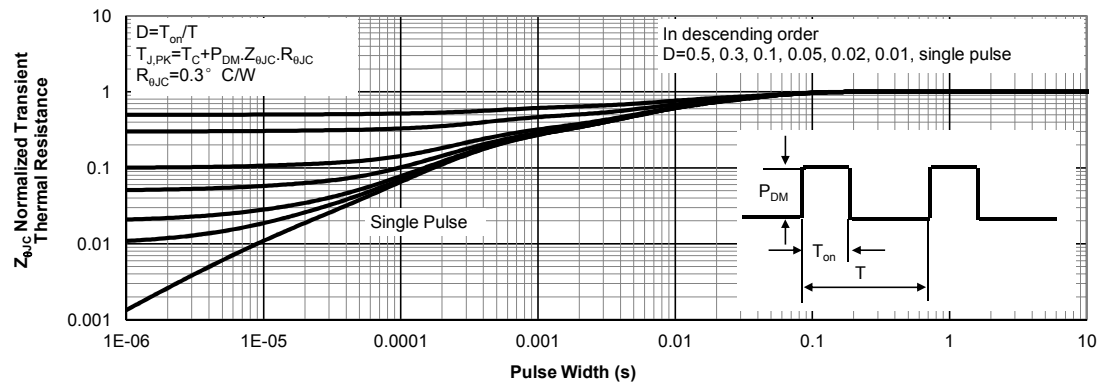


Figure 25: Normalized Maximum Transient Thermal Impedance for IGBT

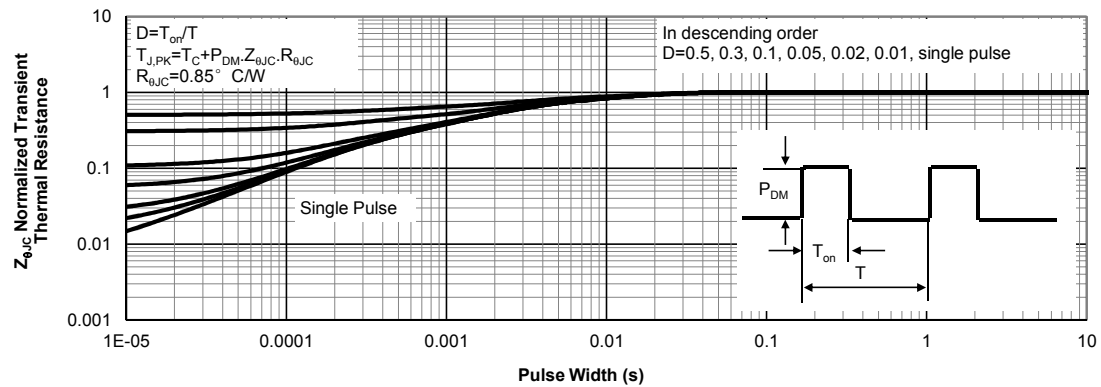


Figure 26: Normalized Maximum Transient Thermal Impedance for Diode

