

General Description

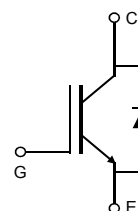
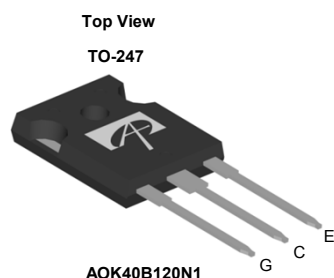
- 1200V latest Alpha IGBT (αIGBT) technology
- Very low $V_{CE(sat)}$ and V_F
- High short-circuit ruggedness
- Very low turn-on EMI
- Easy paralleling capability
- Low gate charge Q_g
- High efficiency and ruggedness in hard switching converters
- Maximum junction temperature 175°C
- Very soft and fast recovery anti-parallel diode

Applications

- Motor drives
- Industrial UPS

Product Summary

V_{CE}	1200V
I_C ($T_C=100^\circ\text{C}$)	40A
$V_{CE(sat)}$ ($T_J=25^\circ\text{C}$)	1.97V



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOK40B120N1	TO247	Tube	240
Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise noted			
Parameter	Symbol	AOK40B120N1	Units
Collector-Emitter Voltage	V_{CE}	1200	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}	160	A
Turn-Off SOA, $V_{CE} \leq 1200\text{V}$, Limited by T_{Jmax}	I_{LM}	160	A
Continuous Diode Forward Current	I_F	$T_C=25^\circ\text{C}$	80
		$T_C=100^\circ\text{C}$	40
Diode Pulsed Current, Limited by T_{Jmax}	I_{FM}	160	A
Short Circuit Withstanding Time ⁽¹⁾ $V_{GE}=15\text{V}$, $V_{CC} \leq 600\text{V}$, $T_J \leq 175^\circ\text{C}$	t_{SC}	10	μs
Power Dissipation	P_D	$T_C=25^\circ\text{C}$	600
		$T_C=100^\circ\text{C}$	300
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	AOK40B120N1	Units
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	$^\circ\text{C/W}$
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	0.25	$^\circ\text{C/W}$
Maximum Diode Junction-to-Case	$R_{\theta JC}$	0.4	$^\circ\text{C/W}$

(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	1200	-	-	V
V _{CE(sat)}	Collector-Emitter Saturation Voltage	V _{GE} =15V, I _C =40A	T _J =25°C T _J =125°C T _J =175°C	- 1.97 2.55 2.9	2.5 - -	V
V _F	Diode Forward Voltage	V _{GE} =0V, I _F =40A	T _J =25°C T _J =125°C T _J =175°C	- 1.53 1.6 1.54	2 - -	V
V _{GE(th)}	Gate-Emitter Threshold Voltage	V _{CE} =5V, I _C =1mA	-	6.1	-	V
I _{CES}	Zero Gate Voltage Collector Current	V _{CE} =1200V, V _{GE} =0V	T _J =25°C T _J =125°C T _J =175°C	- - -	10 2000 20000	μA
I _{GES}	Gate-Emitter Leakage Current	V _{CE} =0V, V _{GE} =±30V	-	-	±100	nA
g _{FS}	Forward Transconductance	V _{CE} =20V, I _C =40A	-	18	-	S
DYNAMIC PARAMETERS						
C _{ies}	Input Capacitance	V _{GE} =0V, V _{CC} =25V, f=1MHz	-	4300	-	pF
C _{oes}	Output Capacitance		-	300	-	pF
C _{res}	Reverse Transfer Capacitance		-	9	-	pF
Q _g	Total Gate Charge	V _{GE} =15V, V _{CC} =960V, I _C =40A	-	100	-	nC
Q _{ge}	Gate to Emitter Charge		-	48	-	nC
Q _{gc}	Gate to Collector Charge		-	28	-	nC
R _g	Gate Resistance	V _{GE} =0V, V _{CC} =0V, f=1MHz	-	4.4	-	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} =600V, I _C =40A, R _G =7.5Ω	-	57	-	ns
t _r	Turn-On Rise Time		-	35	-	ns
t _{D(off)}	Turn-Off Delay Time		-	146	-	ns
t _f	Turn-Off Fall Time		-	42	-	ns
E _{on}	Turn-On Energy		-	3.4	-	mJ
E _{off}	Turn-Off Energy		-	1.4	-	mJ
E _{total}	Total Switching Energy		-	4.8	-	mJ
t _{rr}	Diode Reverse Recovery Time	T _J =25°C I _F =40A, di/dt=200A/μs, V _{CC} =600V	-	300	-	ns
Q _{rr}	Diode Reverse Recovery Charge		-	3.0	-	μC
I _{rm}	Diode Peak Reverse Recovery Current		-	18.5	-	A
SWITCHING PARAMETERS, (Load Inductive, T _J =175°C)						
t _{D(on)}	Turn-On Delay Time	T _J =175°C V _{GE} =15V, V _{CC} =600V, I _C =40A, R _G =7.5Ω	-	54	-	ns
t _r	Turn-On Rise Time		-	55	-	ns
t _{D(off)}	Turn-Off Delay Time		-	168	-	ns
t _f	Turn-Off Fall Time		-	73	-	ns
E _{on}	Turn-On Energy		-	4.1	-	mJ
E _{off}	Turn-Off Energy		-	1.9	-	mJ
E _{total}	Total Switching Energy		-	6.0	-	mJ
t _{rr}	Diode Reverse Recovery Time	T _J =175°C I _F =40A, di/dt=200A/μs, V _{CC} =600V	-	490	-	ns
Q _{rr}	Diode Reverse Recovery Charge		-	6.6	-	μC
I _{rm}	Diode Peak Reverse Recovery Current		-	25.5	-	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

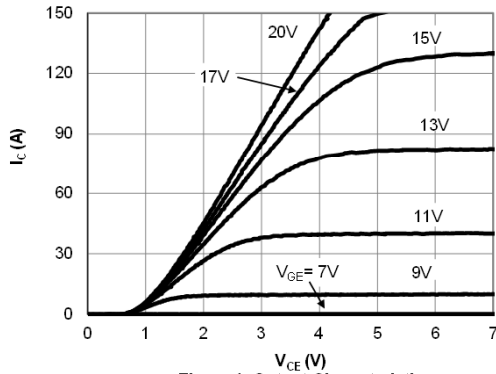


Figure 1: Output Characteristic
($T_j=25^\circ\text{C}$)

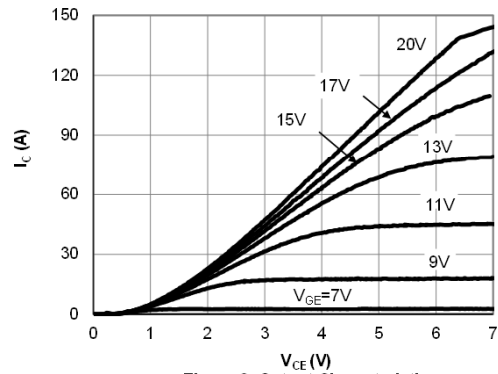


Figure 2: Output Characteristic
($T_j=175^\circ\text{C}$)

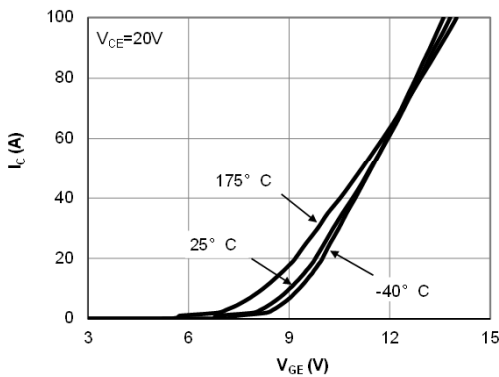


Figure 3: Transfer Characteristic

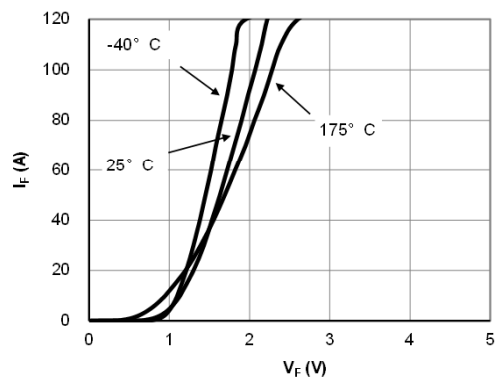


Figure 4: Diode Characteristic

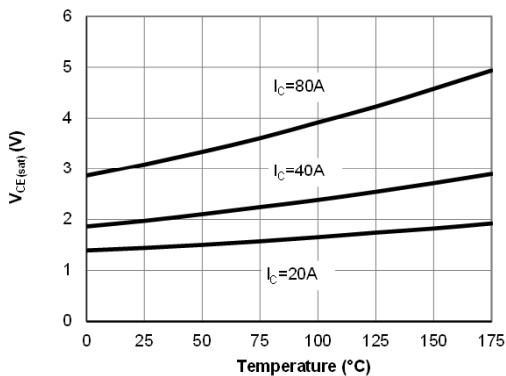


Figure 5: Collector-Emitter Saturation Voltage vs. Junction Temperature

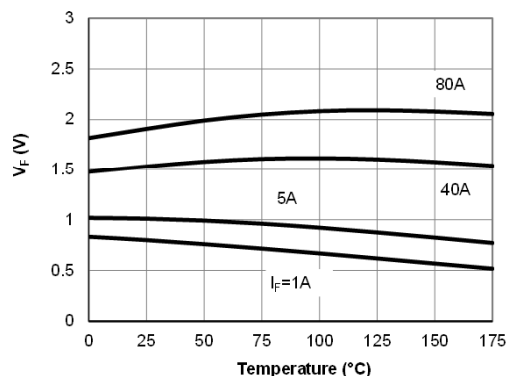


Figure 6: Diode Forward voltage vs. Junction Temperature

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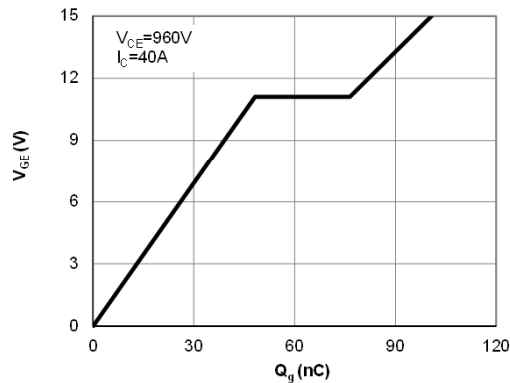


Figure 7: Gate-Charge Characteristics

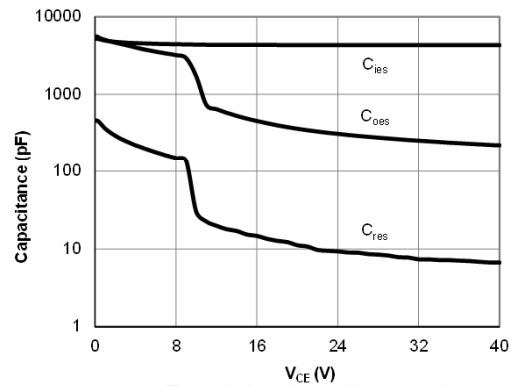


Figure 8: Capacitance Characteristic

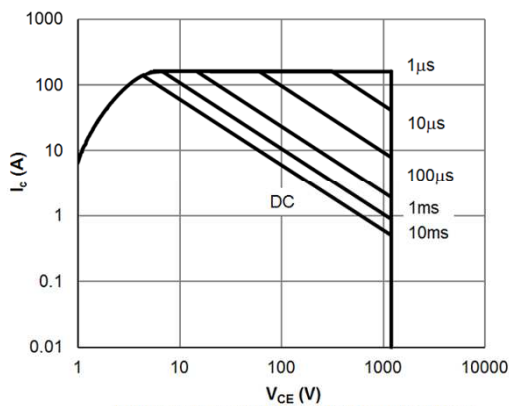


Figure 9: Forward Bias Safe Operating Area
($T_C = 25^\circ\text{C}$, $V_{GE} = 15\text{V}$)

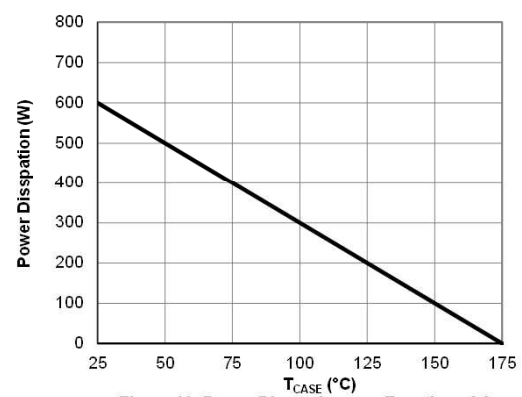


Figure 10: Power Dissipation as a Function of Case

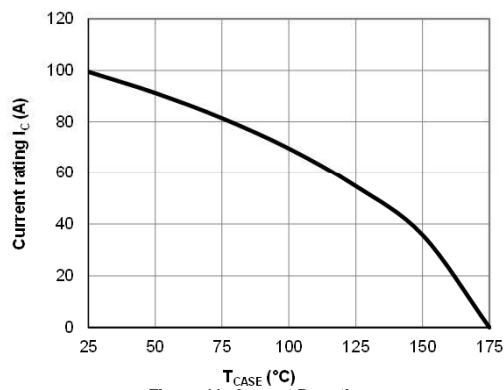


Figure 11: Current De-rating

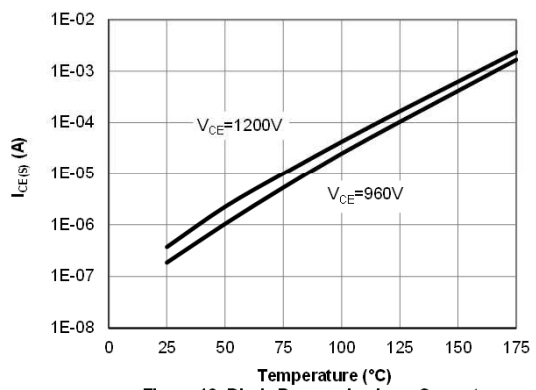


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

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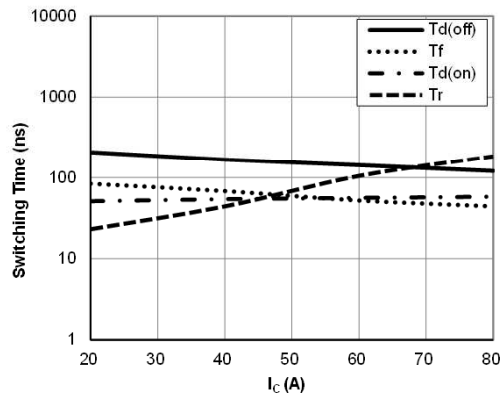


Figure 13: Switching Time vs. I_C
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $R_J=7.5\Omega$)

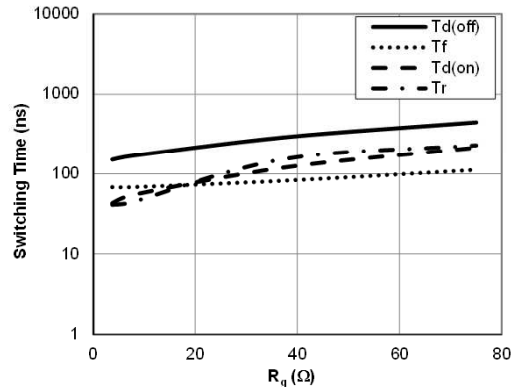


Figure 14: Switching Time vs. R_g
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $I_C=40\text{A}$)

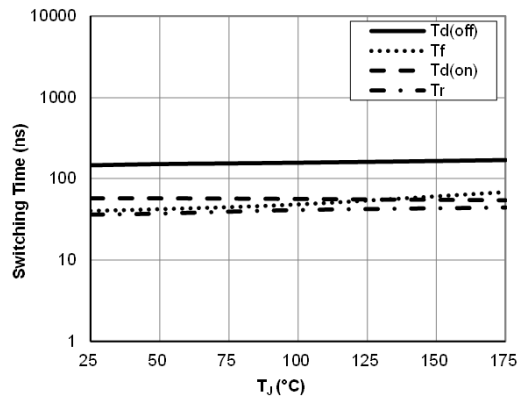


Figure 15: Switching Time vs. T_J
($V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $I_C=40\text{A}$, $R_J=7.5\Omega$)

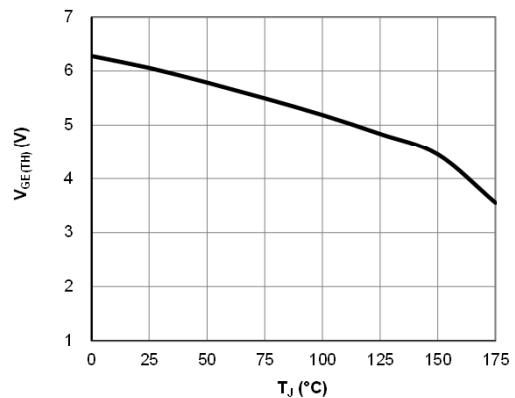
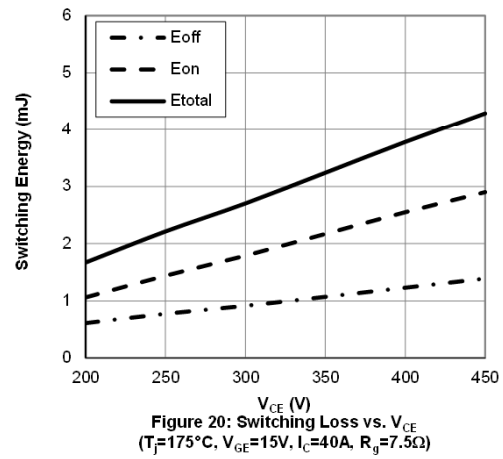
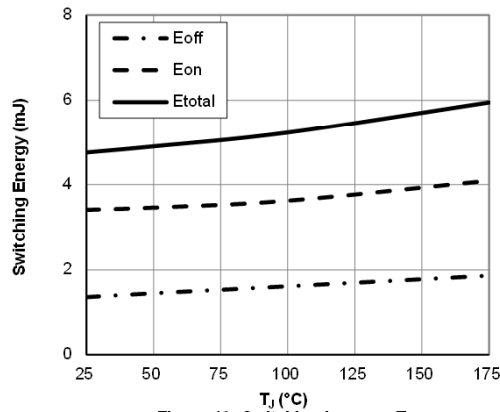
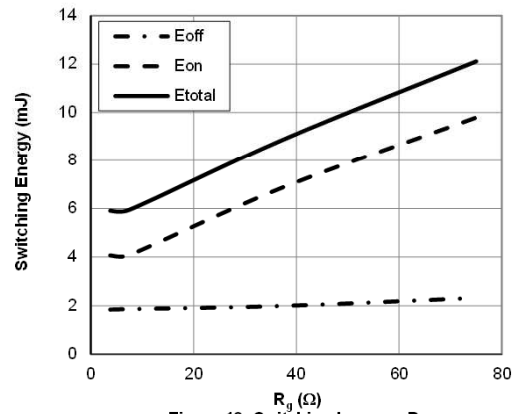
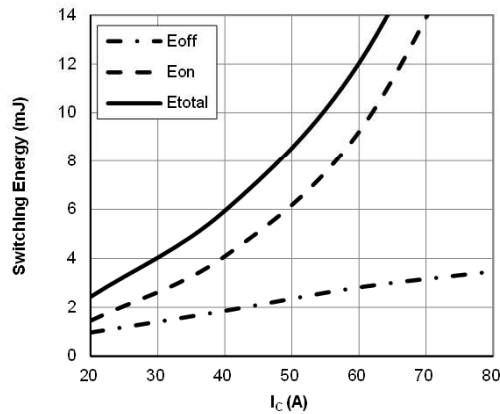


Figure 16: $V_{GE(TH)}$ vs. T_J

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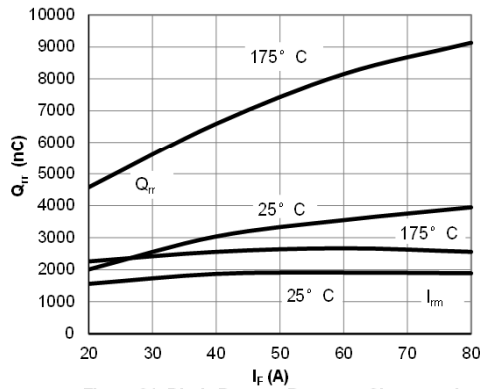


Figure 21: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current
($V_{GE}=15V$, $V_{CE}=600V$, $di/dt=200A/\mu s$)

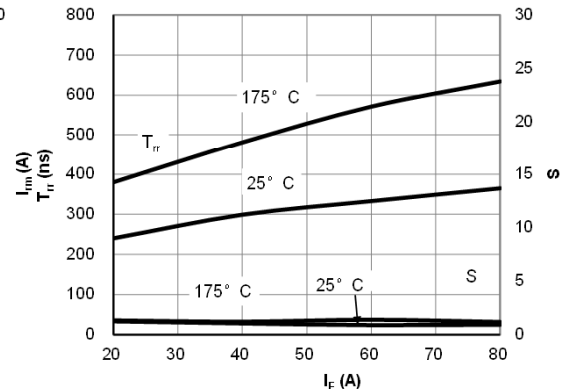


Figure 22: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current
($V_{GE}=15V$, $V_{CE}=600V$, $di/dt=200A/\mu s$)

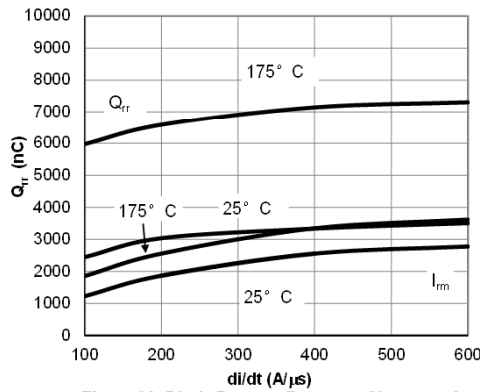


Figure 23: Diode Reverse Recovery Charge and Peak Current vs. di/dt
($V_{GE}=15V$, $V_{CE}=600V$, $I_F=40A$)

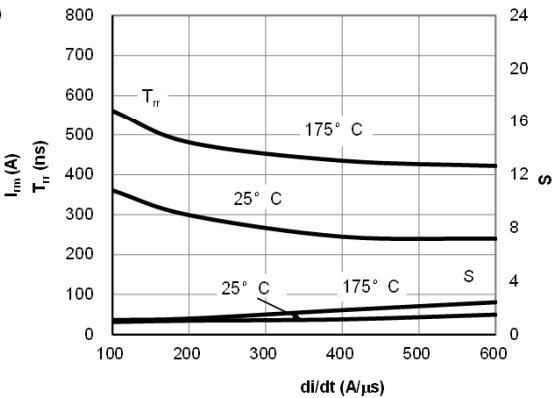


Figure 24: Diode Reverse Recovery Time and Softness Factor vs. di/dt
($V_{GE}=15V$, $V_{CE}=600V$, $I_F=40A$)

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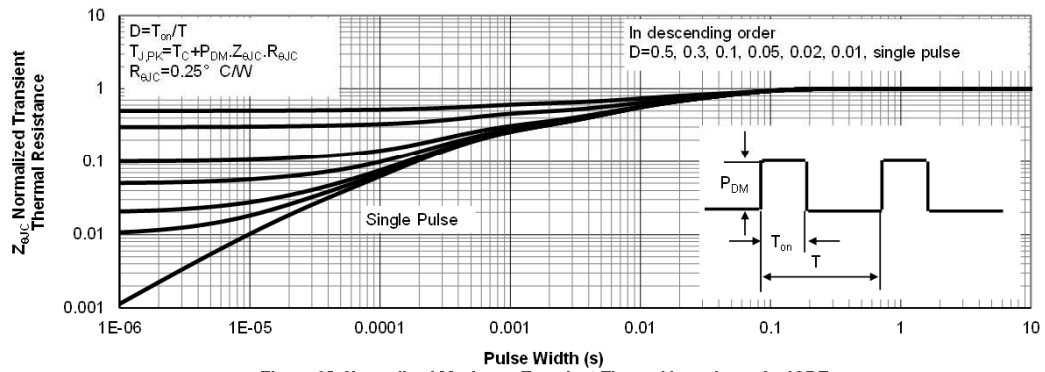


Figure 25: Normalized Maximum Transient Thermal Impedance for IGBT

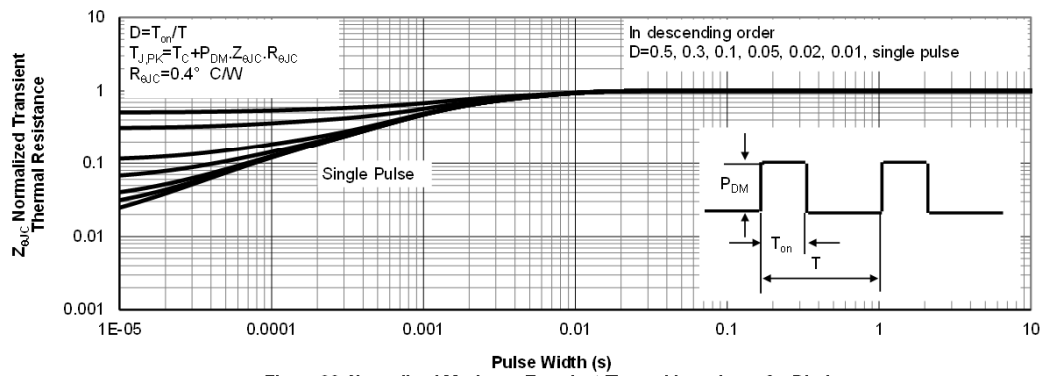


Figure 26: Normalized Maximum Transient Thermal Impedance for Diode

