ALPHA & OMEGA SEMICONDUCTOR

AOK40B120N1

1200V, 40A Alpha IGBT™

With Soft and Fast Recovery Anti-Parallel Diode

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

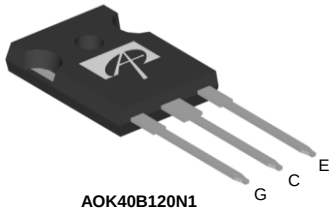
Product Summary

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

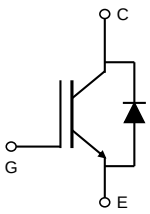
RoHS Compliant

Top View

TO-247



AOK40B120N1



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOK40B120N1	TO247	Tube	240

Absolute Maximum Ratings T_A=25°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	T_C=25°C	I_C	80	A
	T_C=100°C		40	
Pulsed Collector Current, Limited by T_{Jmax}		I_{CM}	160	A
Turn-Off SOA, V_{CE} ⩽ 1200V, Limited by T_{Jmax}		I_{LM}	160	A
Continuous Diode Forward Current	T_C=25°C	I_F	80	A
	T_C=100°C		40	
Diode Pulsed Current, Limited by T_{Jmax}		I_{FM}	160	A
Short Circuit Withstanding Time (1) V_{GE}=15V, V_{CC}⩽600V, T_J⩽175°C		t_{SC}	10	µs
Power Dissipation	T_C=25°C	P_D	600	W
	T_C=100°C		300	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	°C
Maximum Lead Temperature for Soldering Purpose, 1/8" from case for 5 seconds		T_L	300	°C

Thermal Characteristics

Parameter	Symbol	AOK40B120N1	Units
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	°C/W
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	0.25	°C/W
Maximum Diode Junction-to-Case	$R_{\theta JC}$	0.4	°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	-	1.97	2.5	V
			T_J=125°C	-	2.55	-	
			T_J=175°C	-	2.9	-	
V_F	Diode Forward Voltage	V_{GE}=0V, I_F=40A	T_J=25°C	-	1.53	2	V
			T_J=125°C	-	1.6	-	
			T_J=175°C	-	1.54	-	
$V_{GE(th)}$	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	-	-	10	µA
			T_J=125°C	-	-	2000	
			T_J=175°C	-	-	20000	
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

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

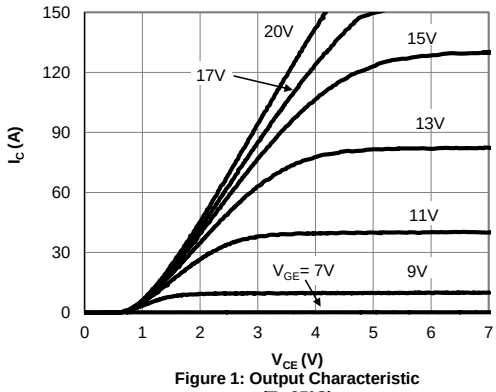


Figure 1: Output Characteristic (T_j=25°C)

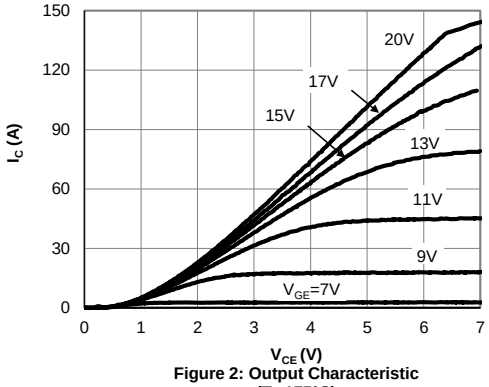


Figure 2: Output Characteristic (T_j=175°C)

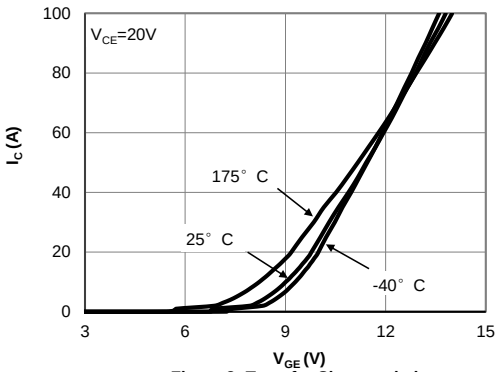


Figure 3: Transfer Characteristic

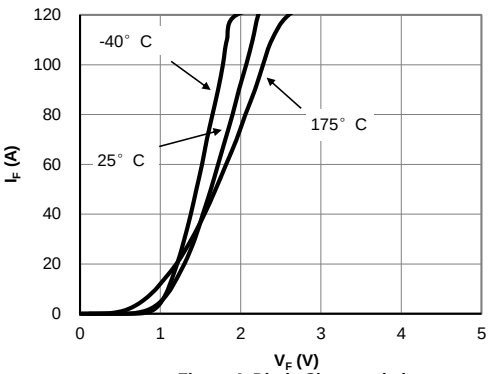


Figure 4: Diode Characteristic

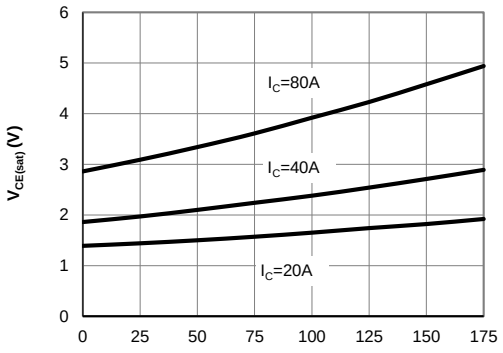


Figure 5: Collector-Emitter Saturation Voltage vs. Junction Temperature

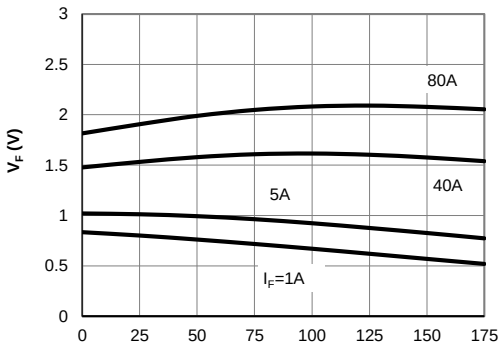


Figure 6: Diode Forward voltage vs. Junction Temperature

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

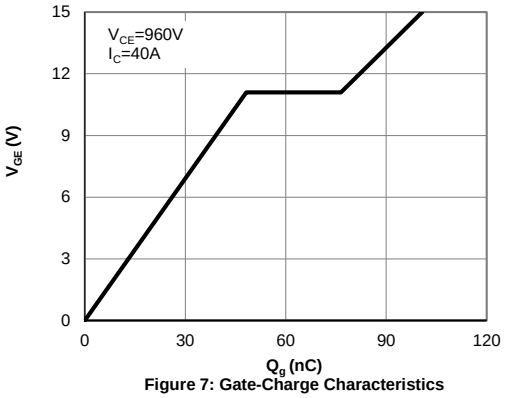


Figure 7: Gate-Charge Characteristics

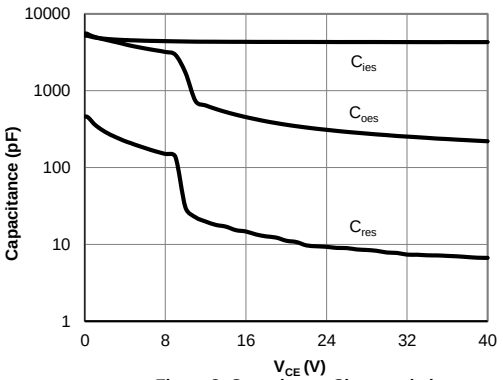


Figure 8: Capacitance Characteristic

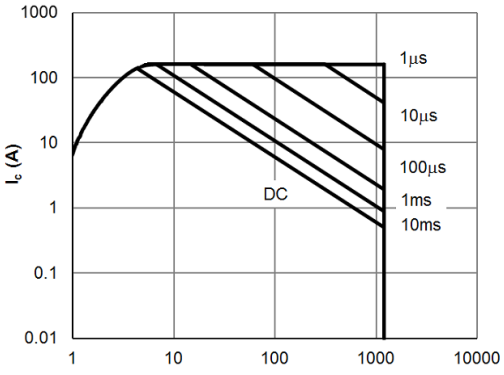


Figure 9: Forward Bias Safe Operating Area
(T_C=25°C, V_{GE}=15V)

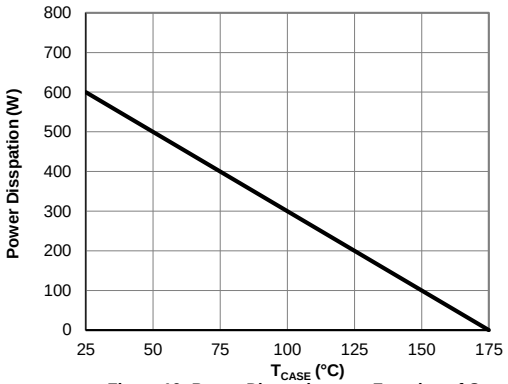


Figure 10: Power Disspation as a Function of Case

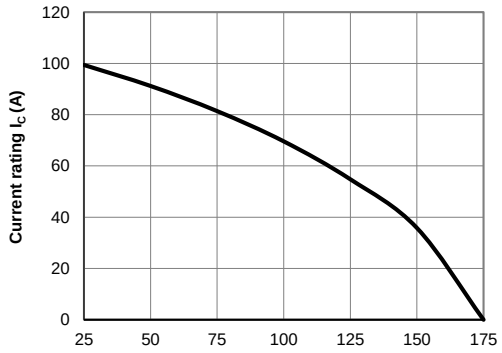


Figure 11: Current De-rating

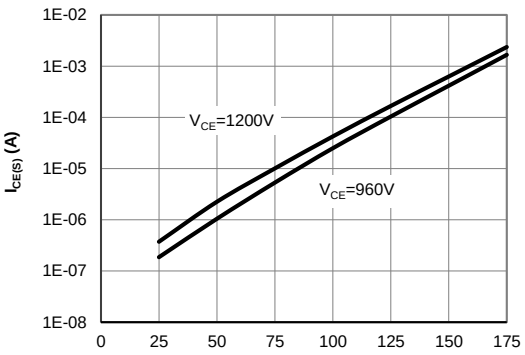


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

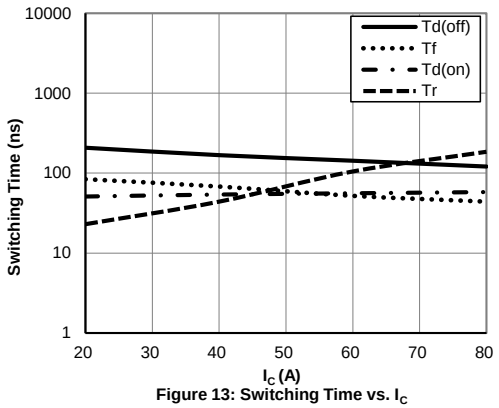


Figure 13: Switching Time vs. I_C
(T_j=175°C, V_{GE}=15V, V_{CE}=600V, R_g=7.5Ω)

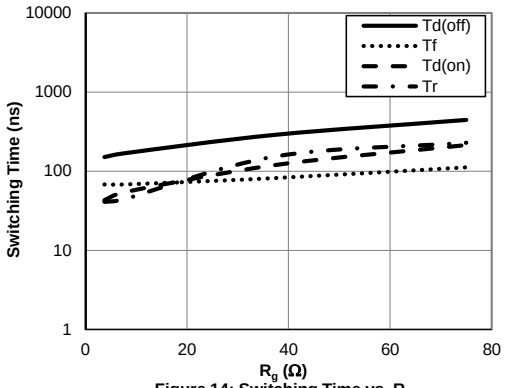


Figure 14: Switching Time vs. R_g
(T_j=175°C, V_{GE}=15V, V_{CE}=600V, I_C=40A)

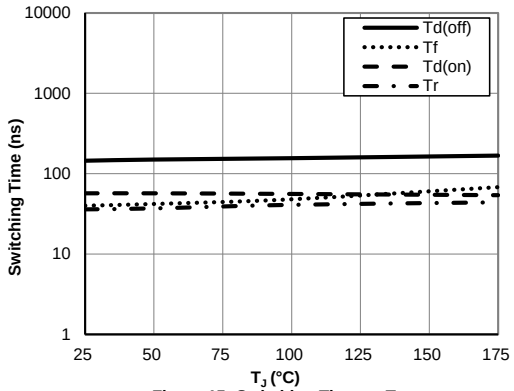


Figure 15: Switching Time vs.T_j
(V_{GE}=15V, V_{CE}=600V, I_C=40A, R_g=7.5Ω)

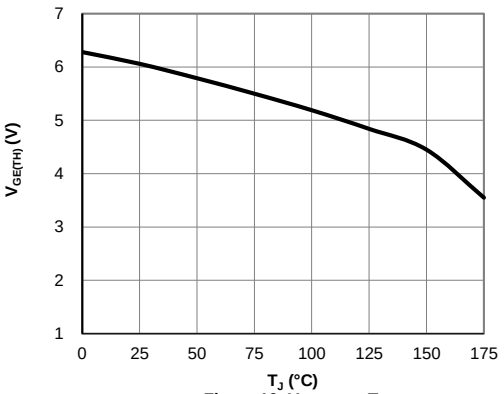


Figure 16: $V_{GE(TH)}$ vs. T_j

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

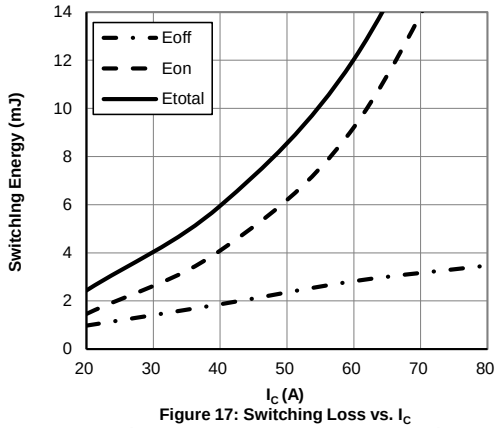


Figure 17: Switching Loss vs. I_C
(T_j=175°C, V_{GE}=15V, V_{CE}=600V, R_g=7.5Ω)

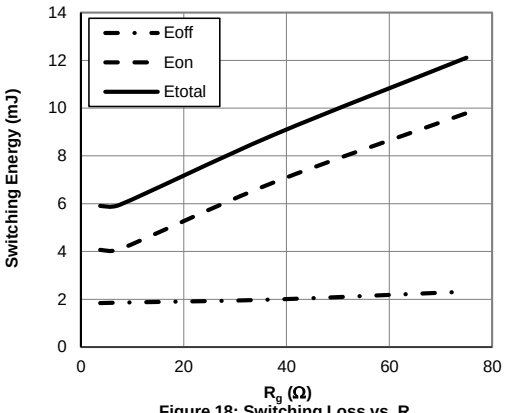


Figure 18: Switching Loss vs. R_g
(T_j=175°C, V_{GE}=15V, V_{CE}=600V, I_C=40A)

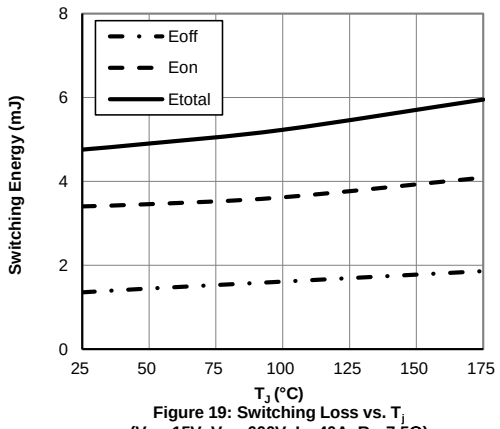


Figure 19: Switching Loss vs. T_j
(V_{GE}=15V, V_{CE}=600V, I_C=40A, R_g=7.5Ω)

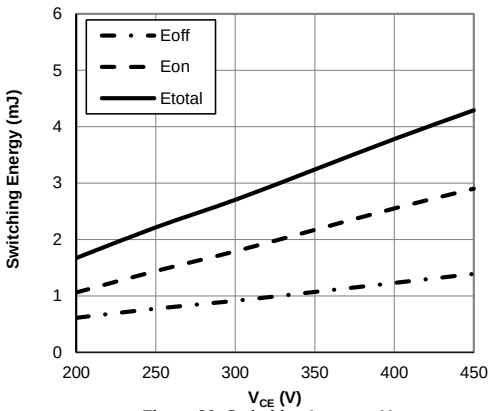


Figure 20: Switching Loss vs. V_{CE}
(T_j=175°C, V_{GE}=15V, I_C=40A, R_g=7.5Ω)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

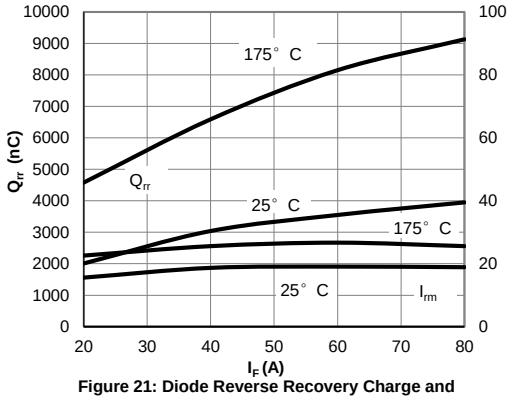


Figure 21: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current (V_{GE}=15V, V_{CE}=600V, di/dt=200A/µs)

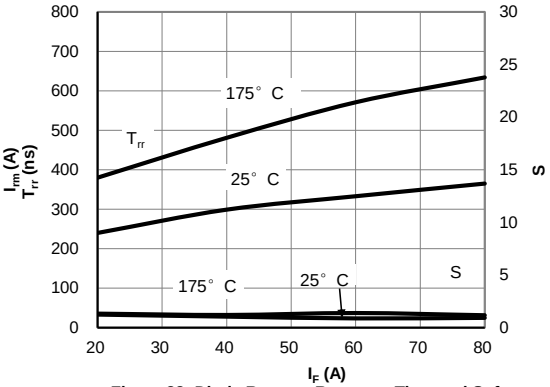


Figure 22: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current (V_{GE}=15V, V_{CE}=600V, di/dt=200A/µs)

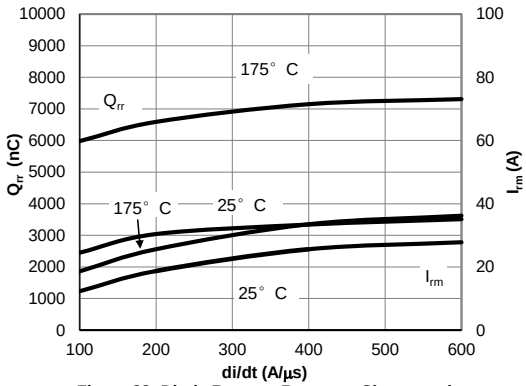


Figure 23: Diode Reverse Recovery Charge and Peak Current vs. di/dt (V_{GE}=15V, V_{CE}=600V, I_F=40A)

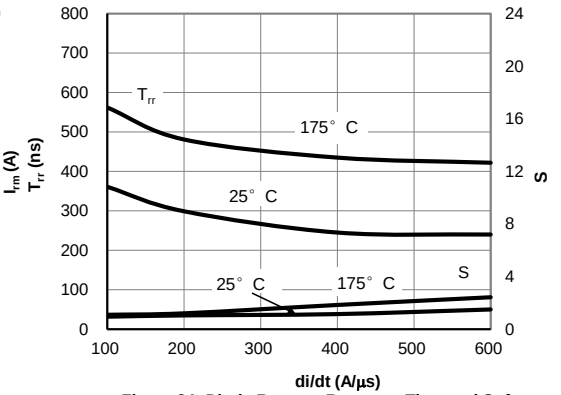


Figure 24: Diode Reverse Recovery Time and Softness Factor vs. di/dt (V_{GE}=15V, V_{CE}=600V, I_F=40A)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

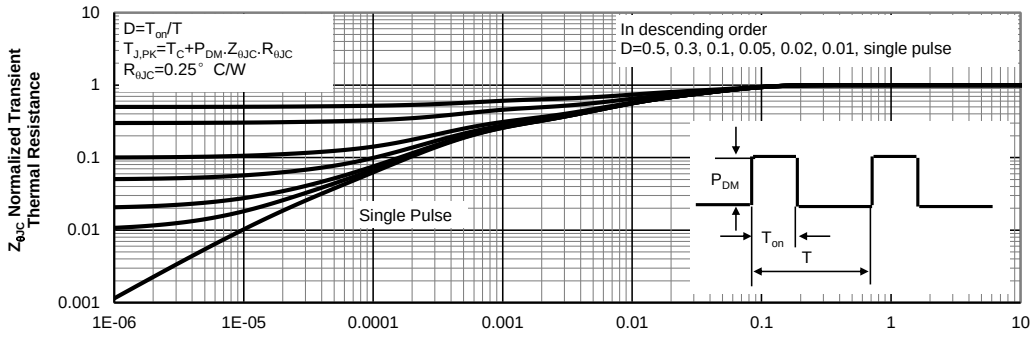


Figure 25: Normalized Maximum Transient Thermal Impedance for IGBT

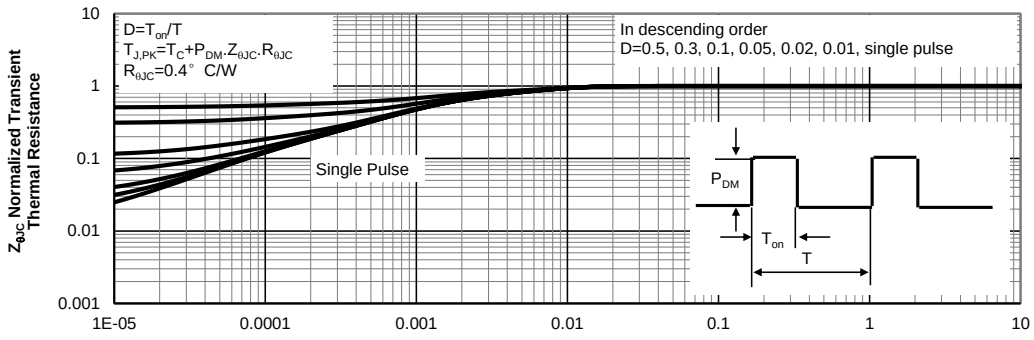


Figure 26: Normalized Maximum Transient Thermal Impedance for Diode

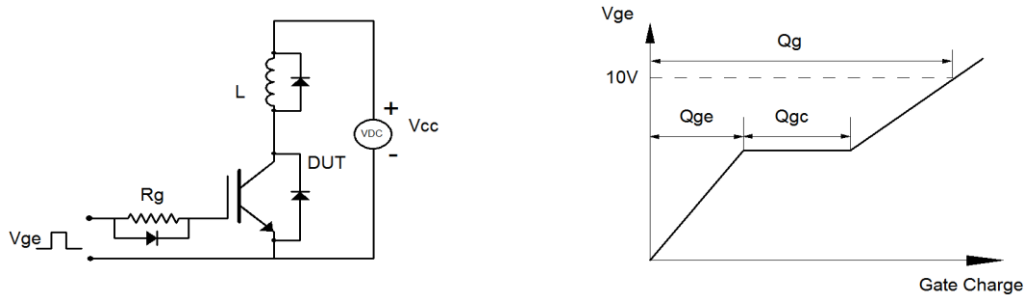


Figure A: Gate Charge Test Circuit & Waveforms

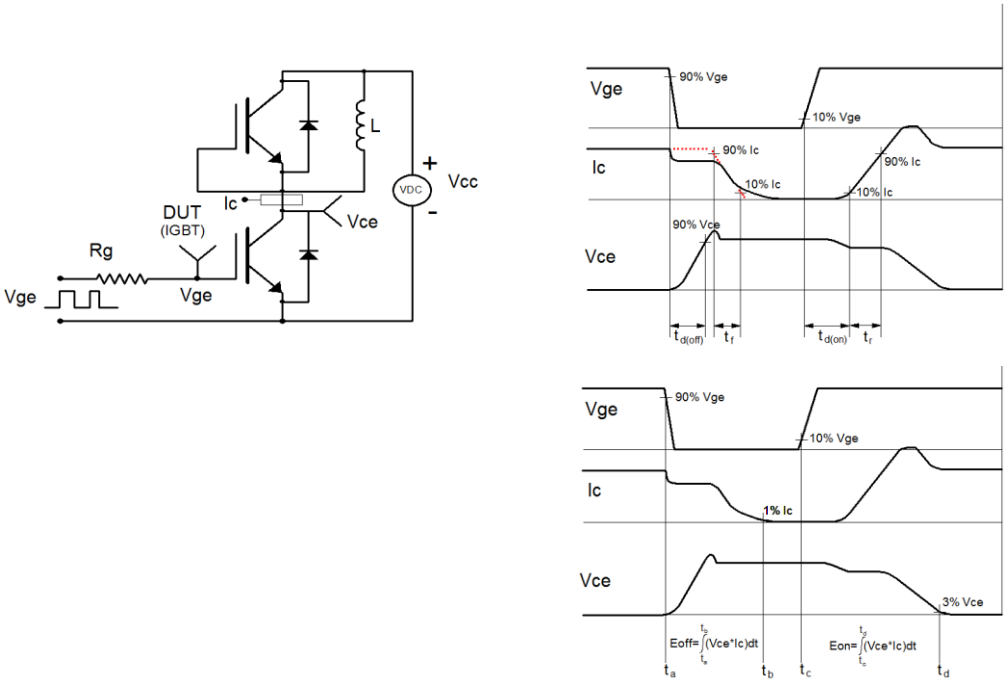


Figure B: Inductive Switching Test Circuit & Waveforms

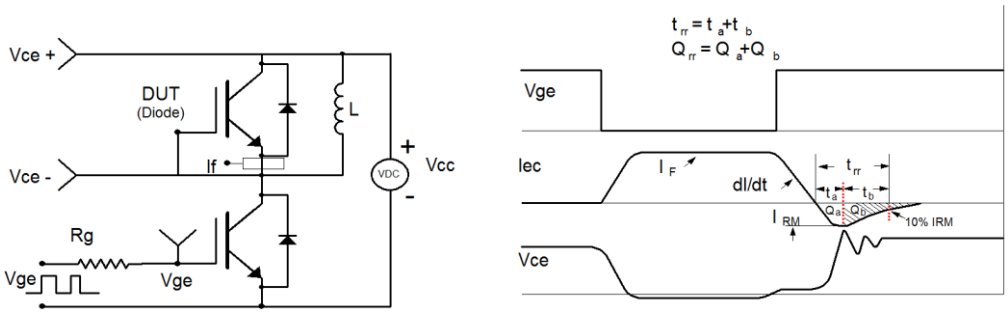


Figure C: Diode Recovery Test Circuit & Waveforms

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Kategorilere göz atın

Üreticiler

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Üreticileri görün

Toplu alım ve teklif

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