ALPHA & OMEGA SEMICONDUCTOR

AOK20B135D1

1350V, 20A Alpha IGBT™ with Diode

General Description

- Latest AlphaIGBT (αIGBT) technology
- Best in Class $V_{CE(SAT)}$ enables high efficiencies
- Low turn-off switching loss due to fast turn-off time
- Very smooth turn-off current waveforms reduce EMI
- Better thermal management
- High surge current capability
- Minimal gate spike due to high input capacitance

Applications

- Induction Cooking
- Rice Cookers
- Microwave Ovens
- Other soft switching applications

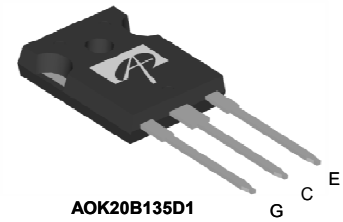
Product Summary

V_{CE}	1350V
I_C (T_C=100°C)	20A
$V_{CE(sat)}$ (T_C=25°C)	1.57V

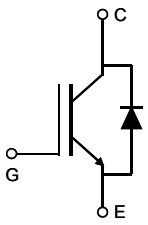
RoHS Compliant

Top View

TO-247



AOK20B135D1



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOK20B135D1	TO247	Tube	240

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	AOK20B135D1	Units
Collector-Emitter Voltage		V_{CE}	1350	V
Gate-Emitter Voltage		V_{GE}	±20	V
Transient Voltage (tp≤1μs,D<0.025)			±30	
Continuous Collector Current	T_C=25°C	I_C	40	A
	T_C=100°C		20	
Pulsed Collector Current, Limited by T_{Jmax}		I_{Cpulse}	80	A
Turn off SOA, V_{CE} ≤ 600V, Limited by T_{Jmax}		I_{LM}	80	A
Continuous Diode Forward Current	T_C=25°C	I_F	40	A
	T_C=100°C		20	
Diode Pulsed Current, Limited by T_{Jmax}		I_{Fpulse}	80	A
Power Dissipation	T_C=25°C	P_D	340	W
	T_C=100°C		170	
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	AOK20B135D1	Units
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	°C/W
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	0.44	°C/W
Maximum Diode Junction-to-Case	$R_{\theta JC}$	1.20	°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		1350	-	-	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=20A	T_J=25°C	-	1.57	1.8	V
			T_J=125°C	-	1.86	-	
			T_J=175°C	-	2	-	
V_F	Diode Forward Voltage	V_{GE}=0V, I_C=20A	T_J=25°C	-	1.46	1.8	V
			T_J=125°C	-	1.51		
			T_J=175°C	-	1.52	-	
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	V_{CE}=5V, I_C=1mA		4.7	5.3	5.9	V
I_{CES}	Zero Gate Voltage Collector Current	V_{CE}=1350V, V_{GE}=0V	T_J=25°C	-	-	10	µA
			T_J=125°C	-	-	800	
			T_J=175°C	-	-	8000	
I_{GES}	Gate-Emitter leakage current	V_{CE}=0V, V_{GE}=±20V		-	-	±100	nA
g_{FS}	Forward Transconductance	V_{CE}=20V, I_C=20A		-	21	-	S
DYNAMIC PARAMETERS							
C_{ies}	Input Capacitance	V_{GE}=0V, V_{CE}=25V, f=1MHz		-	1900	-	pF
C_{oes}	Output Capacitance			-	107	-	pF
C_{res}	Reverse Transfer Capacitance			-	32	-	pF
Q_g	Total Gate Charge	V_{GE}=15V, V_{CE}=1080V, I_C=20A		-	66	-	nC
Q_{ge}	Gate to Emitter Charge			-	14	-	nC
Q_{gc}	Gate to Collector Charge			-	31.5	-	nC
R_g	Gate resistance	V_{GE}=0V, V_{CE}=0V, f=1MHz		-	1.63	-	Ω
SWITCHING PARAMETERS, (Load Iductive, T_J=25°C)							
$t_{D(off)}$	Turn-Off Delay Time	T_J=25°C V_{GE}=15V, V_{CE}=600V, I_C=20A, R_G=15Ω, Parasitic Inductance=150nH		-	156	-	ns
t_f	Turn-Off Fall Time			-	150	-	ns
E_{off}	Turn-Off Energy			-	1.05	-	mJ
SWITCHING PARAMETERS, (Load Iductive, T_J=175°C)							
$t_{D(off)}$	Turn-Off Delay Time	T_J=150°C V_{GE}=15V, V_{CE}=600V, I_C=20A, R_G=15Ω, Parasitic Inductance=150nH		-	180	-	ns
t_f	Turn-Off Fall Time			-	300	-	ns
E_{off}	Turn-Off Energy			-	1.76	-	mJ

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

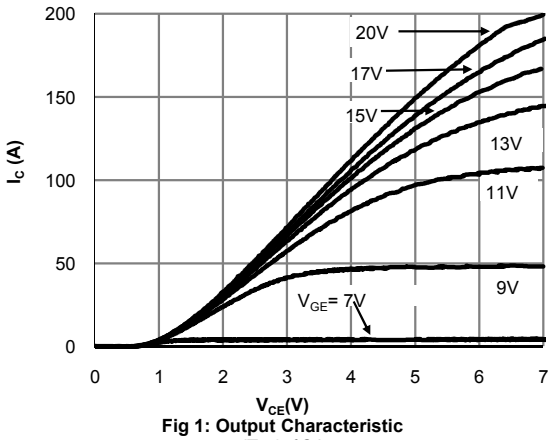


Fig 1: Output Characteristic (T_j=25°C)

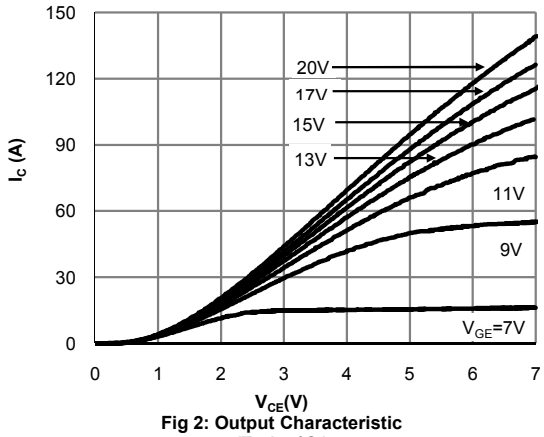


Fig 2: Output Characteristic (T_j=175°C)

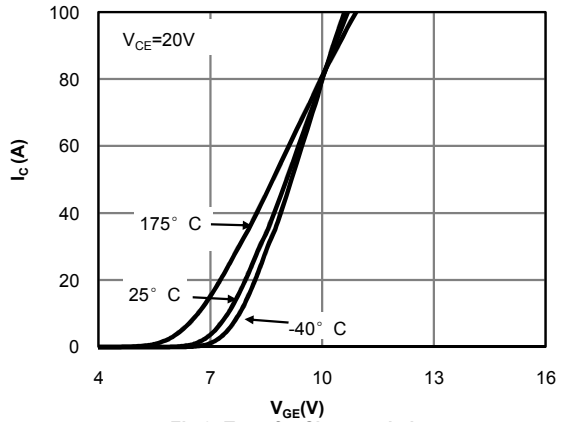


Fig 3: Transfer Characteristic

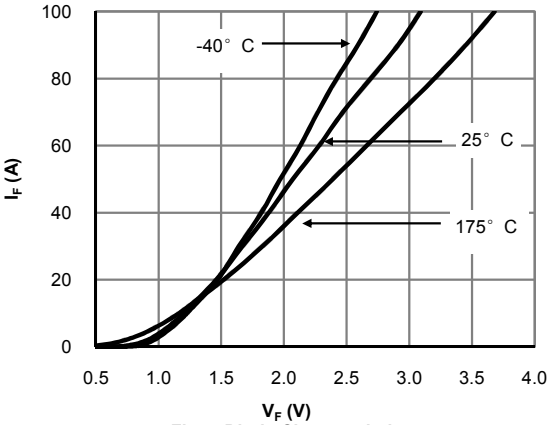


Fig 4: Diode Characteristic

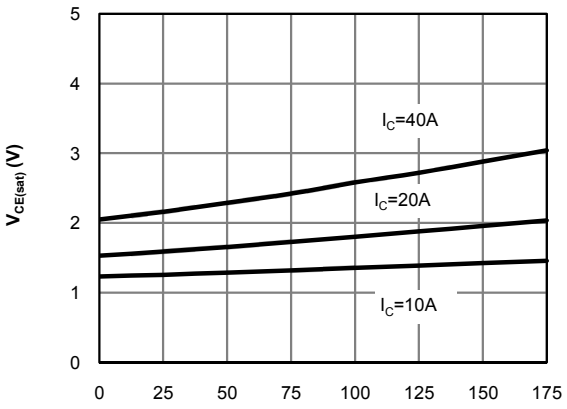


Fig 5: Collector-Emitter Saturation Voltage vs. Junction Temperature

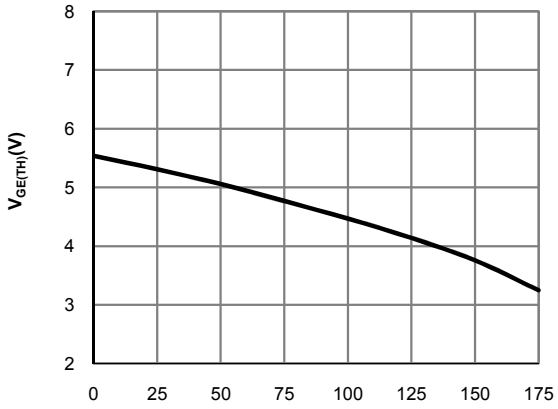


Figure 6: $V_{GE(TH)}$ vs. T_j

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

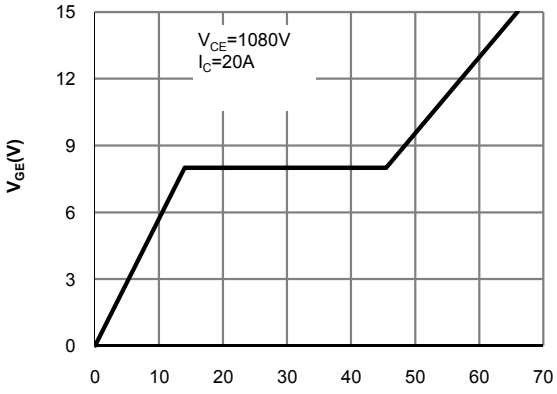


Fig 7: Gate-Charge Characteristics

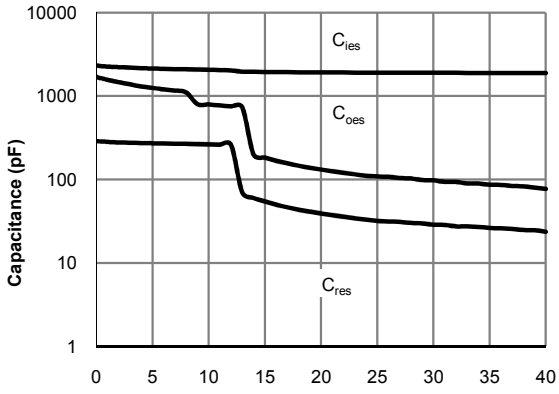


Fig 8: Capacitance Characteristic

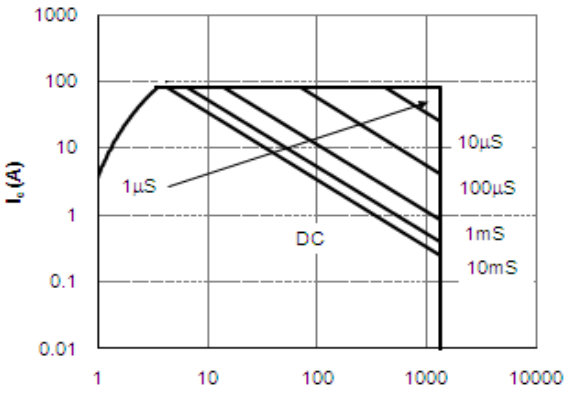


Fig 9: Forward Bias Safe Operating Area
(T_C=25C,V_{GE}=15V)

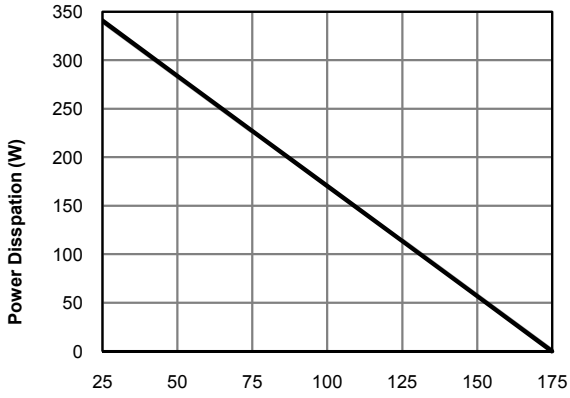


Fig 10: Power Disspation as a Function of Case

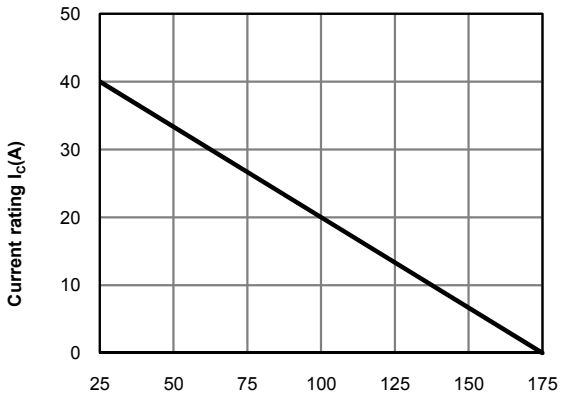


Fig 11: Current De-rating

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

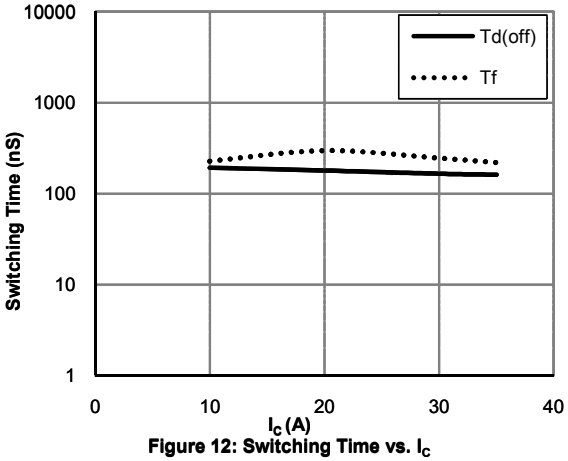


Figure 12: Switching Time vs. I_C
(T_j=175°C,V_{GE}=15V,V_{CE}=600V,R_g=15Ω)

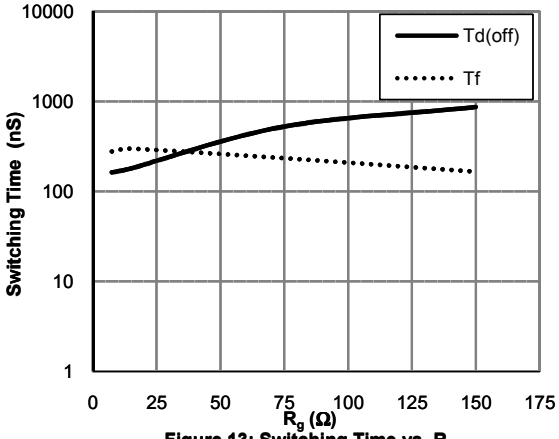


Figure 13: Switching Time vs. R_g
(T_j=175°C,V_{GE}=15V,V_{CE}=600V,I_C=20A)

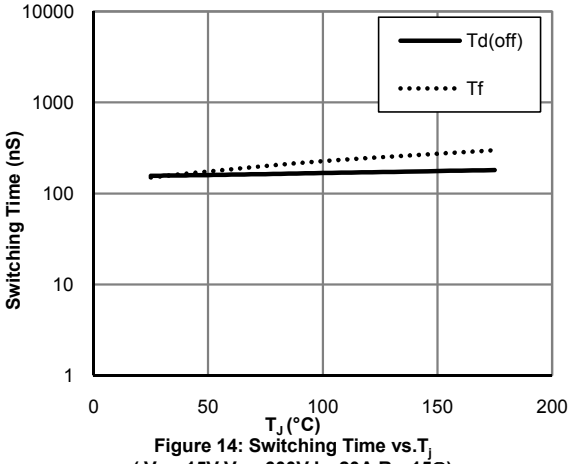


Figure 14: Switching Time vs.T_j
(V_{GE}=15V,V_{CE}=600V,I_C=20A,R_g=15Ω)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

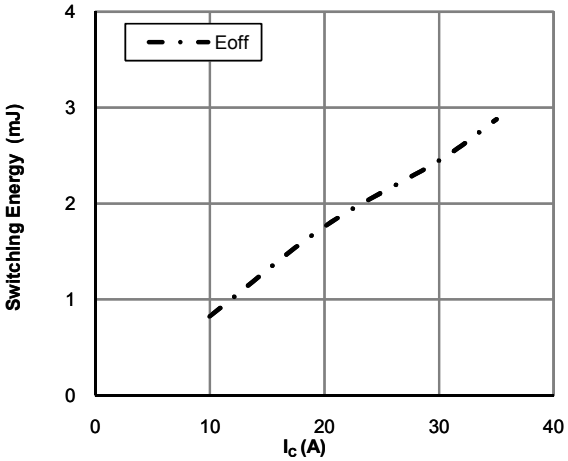


Figure 15: Switching Loss vs. I_C
(T_j=175°C,V_{GE}=15V,V_{CE}=600V,R_g=15Ω)

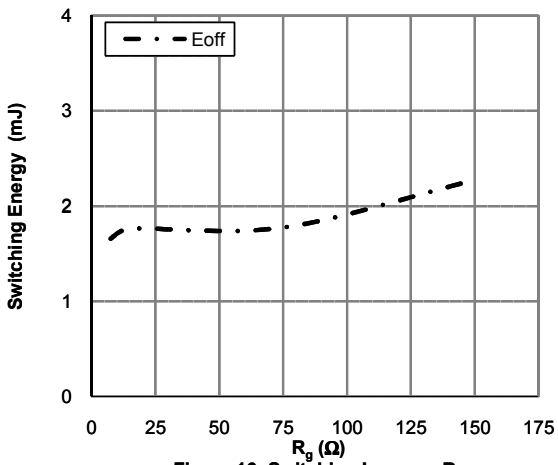


Figure 16: Switching Loss vs. R_g
(T_j=175°C,V_{GE}=15V,V_{CE}=600V,I_C=20A)

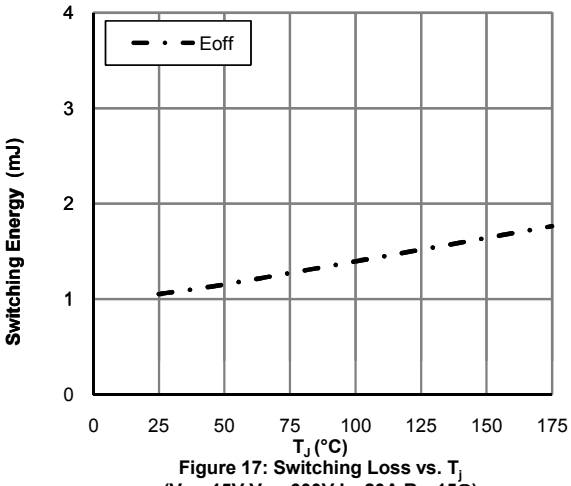


Figure 17: Switching Loss vs. T_j
(V_{GE}=15V,V_{CE}=600V,I_C=20A,R_g=15Ω)

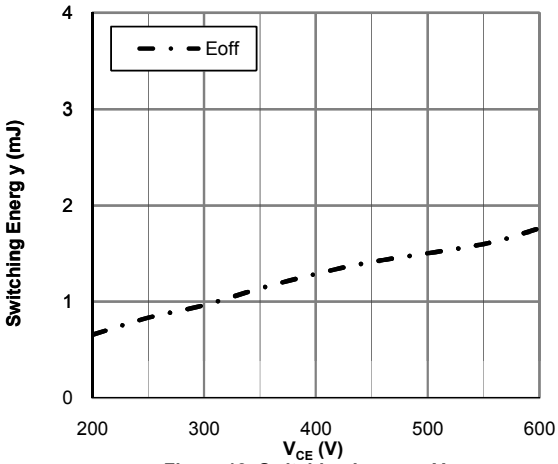


Figure 18: Switching Loss vs. V_{CE}
(T_j=175°C,V_{GE}=15V,I_C=20A,R_g=15Ω)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

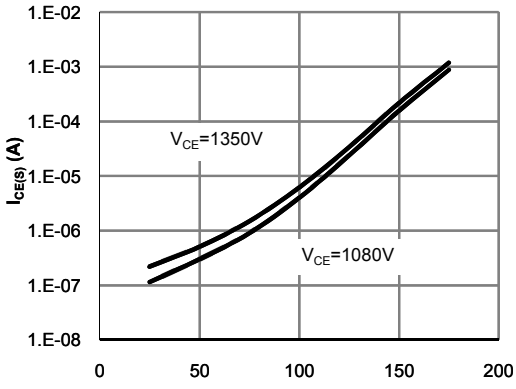


Fig 19: Diode Reverse Leakage Current vs. Junction Temperature

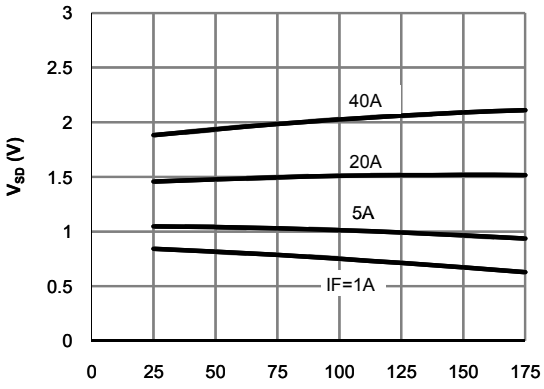


Fig 20: Diode Forward voltage vs. Junction Temperature

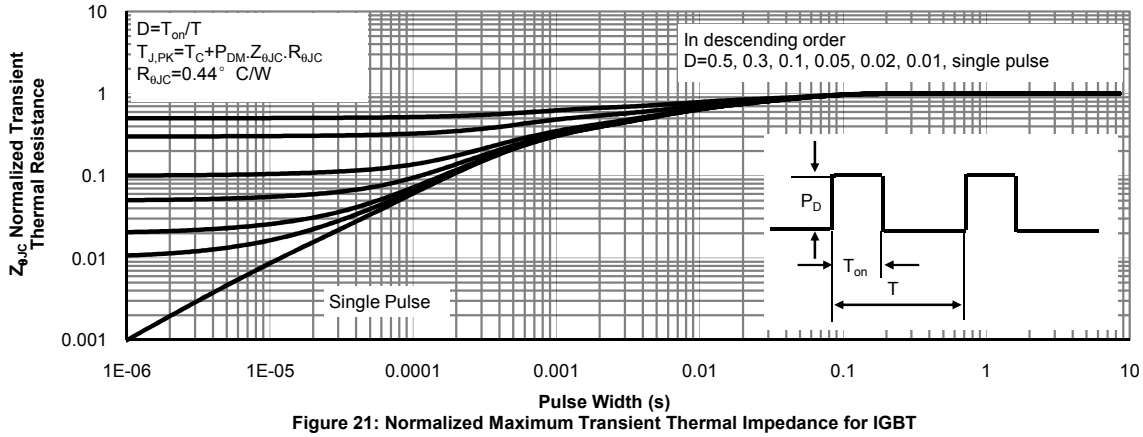


Figure 21: Normalized Maximum Transient Thermal Impedance for IGBT

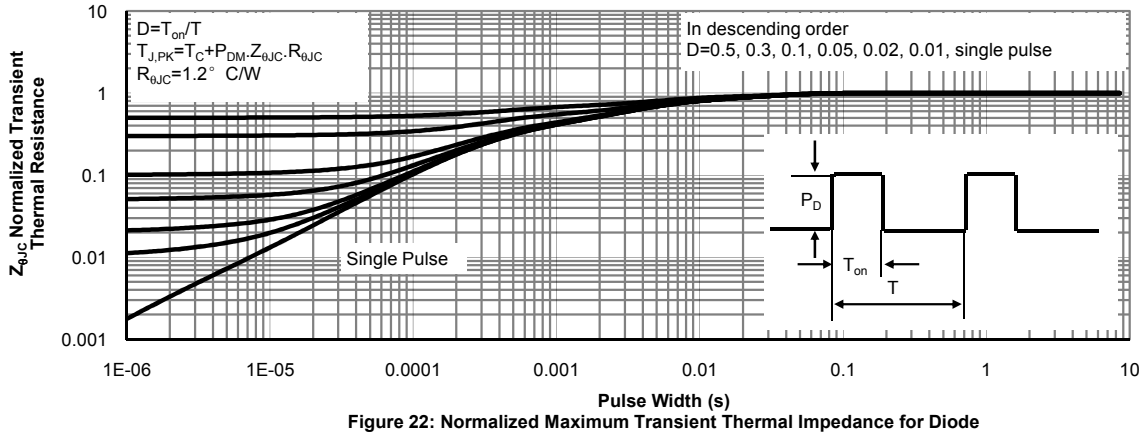
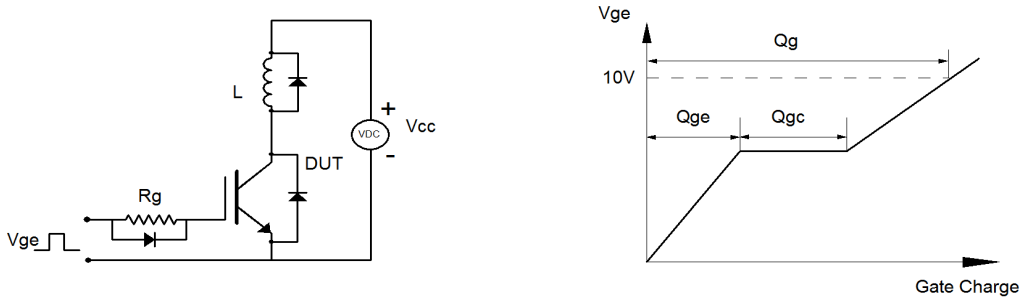
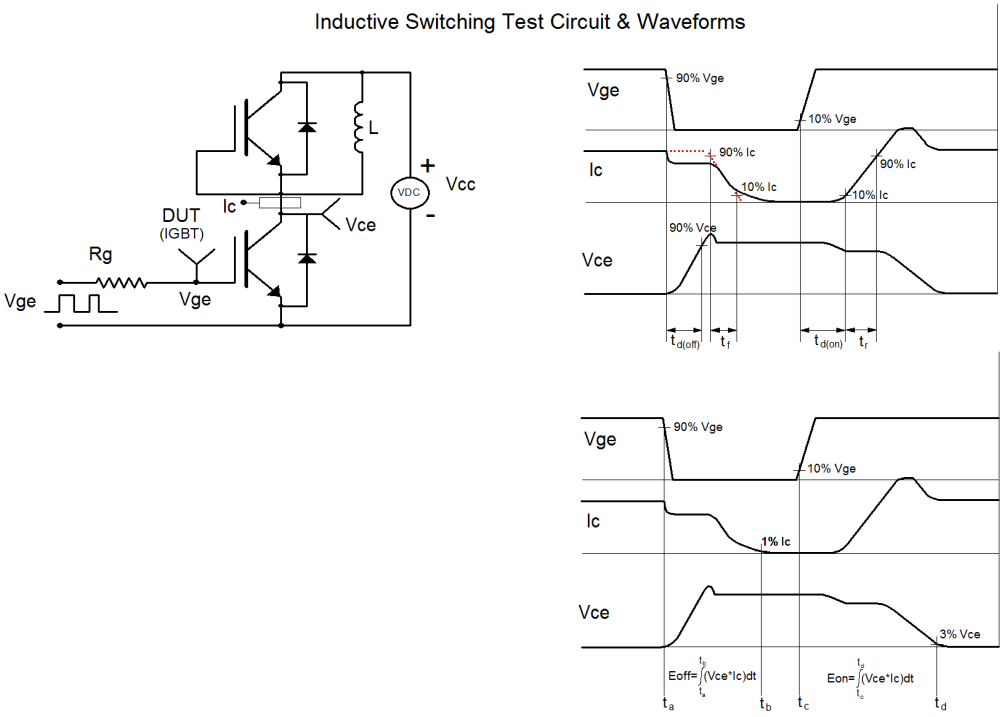


Figure 22: Normalized Maximum Transient Thermal Impedance for Diode

Gate Charge Test Circuit & Waveform



Inductive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms