



ALPHA & OMEGA
SEMICONDUCTOR

AOK20B120E1

1200V, 20A Alpha IGBT™ with Diode

General Description

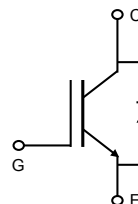
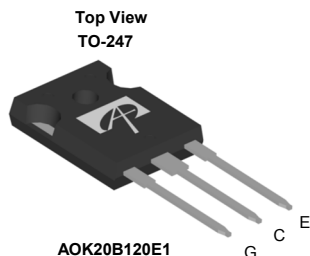
- Latest AlphaIGBT (α IGBT) technology
- Best in Class $V_{CE(SAT)}$ enables high efficiencies
- Low turn-off switching loss due to fast turn-off time
- Very smooth turn-off current waveforms reduce EMI
- Better thermal management
- High surge current capability
- Minimal gate spike due to high input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

Applications

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

Product Summary

V_{CE}	1200V
I_C ($T_C=100^\circ\text{C}$)	20A
$V_{CE(sat)}$ ($T_C=25^\circ\text{C}$)	1.68V



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOK20B120E1	TO247	Tube	240

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

Parameter	Symbol	AOK20B120E1	Units
Collector-Emitter Voltage	V_{CE}	1200	V
Gate-Emitter Voltage	V_{GE}	± 30	V
Continuous Collector Current	I_C	40	A
$T_C=25^\circ\text{C}$		20	
$T_C=100^\circ\text{C}$			
Pulsed Collector Current, Limited by T_{Jmax}	I_{Cpulse}	80	A
Non repetitive peak collector current ^A	I_{CSM}	200	A
Turn off SOA, $V_{CE} \leq 600\text{V}$, Limited by T_{Jmax}	I_{LM}	80	A
Continuous Diode Forward Current	I_F	40	A
$T_C=25^\circ\text{C}$		20	
$T_C=100^\circ\text{C}$			
Diode Pulsed Current, Limited by T_{Jmax}	I_{Fpulse}	80	A
Power Dissipation	P_D	333	W
$T_C=25^\circ\text{C}$		167	
$T_C=100^\circ\text{C}$			
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	AOK20B120E1	Units
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	$^\circ\text{C/W}$
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	0.45	$^\circ\text{C/W}$
Maximum Diode Junction-to-Case	$R_{\theta JC}$	1.6	$^\circ\text{C/W}$

Note A: Capacitor charging saturation current limited by $T_{Jmax} < 175^\circ\text{C}$ and $t_p < 3\mu\text{s}$

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	$V_{GE}=15V, I_C=20A$	$T_J=25^{\circ}C$	-	1.68	2.1	V
			$T_J=125^{\circ}C$	-	2	-	
			$T_J=175^{\circ}C$	-	2.2	-	
V_F	Diode Forward Voltage	$V_{GE}=0V, I_C=20A$	$T_J=25^{\circ}C$	-	1.6	2	V
			$T_J=125^{\circ}C$	-	1.68		
			$T_J=175^{\circ}C$	-	1.7	-	
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$V_{CE}=5V, I_C=1mA$	4.5	5.15	5.8	V	
I_{CES}	Zero Gate Voltage Collector Current	$V_{CE}=1200V, V_{GE}=0V$	$T_J=25^{\circ}C$	-	-	10	μA
			$T_J=125^{\circ}C$	-	-	500	
			$T_J=175^{\circ}C$	-	-	5000	
I_{GES}	Gate-Emitter leakage current	$V_{CE}=0V, V_{GE}=\pm 30V$	-	-	± 100	nA	
g_{FS}	Forward Transconductance	$V_{CE}=20V, I_C=20A$	-	23	-	S	
DYNAMIC PARAMETERS							
C_{ies}	Input Capacitance	$V_{GE}=0V, V_{CE}=25V, f=1MHz$	-	1620	-	pF	
C_{oes}	Output Capacitance		-	90	-	pF	
C_{res}	Reverse Transfer Capacitance		-	28	-	pF	
Q_g	Total Gate Charge	$V_{GE}=15V, V_{CE}=960V, I_C=20A$	-	60.5	-	nC	
Q_{ge}	Gate to Emitter Charge		-	14.5	-	nC	
Q_{gc}	Gate to Collector Charge		-	28	-	nC	
R_g	Gate resistance	$V_{GE}=0V, V_{CE}=0V, f=1MHz$	-	2.1	-	Ω	
SWITCHING PARAMETERS, (Load Inductive, $T_J=25^{\circ}C$)							
$t_{D(off)}$	Turn-Off Delay Time	$T_J=25^{\circ}C$ $V_{GE}=15V, V_{CE}=600V, I_C=20A,$ $R_G=15\Omega,$ Parasitic Inductance=150nH	-	134	-	ns	
t_f	Turn-Off Fall Time		-	98	-	ns	
E_{off}	Turn-Off Energy		-	0.83	-	mJ	
SWITCHING PARAMETERS, (Load Inductive, $T_J=175^{\circ}C$)							
$t_{D(off)}$	Turn-Off Delay Time	$T_J=175^{\circ}C$ $V_{GE}=15V, V_{CE}=600V, I_C=20A,$ $R_G=15\Omega,$ Parasitic Inductance=150nH	-	155	-	ns	
t_f	Turn-Off Fall Time		-	184	-	ns	
E_{off}	Turn-Off Energy		-	1.37	-	mJ	

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

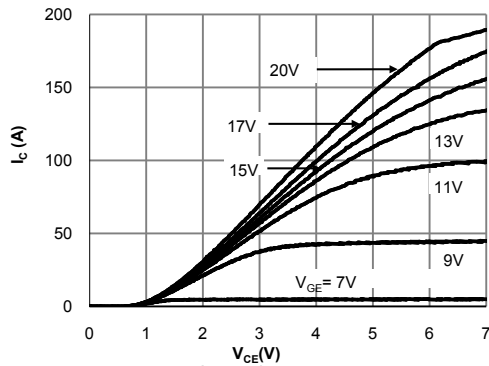


Fig 1: Output Characteristic
($T_J = 25^\circ\text{C}$)

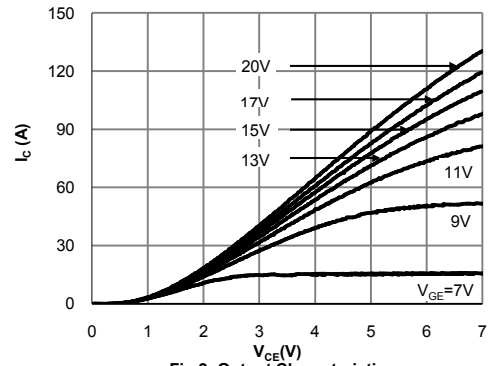


Fig 2: Output Characteristic
($T_J = 175^\circ\text{C}$)

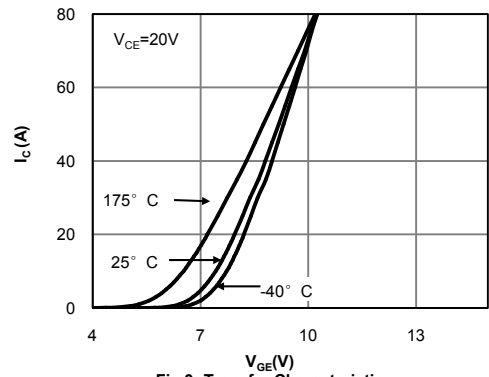


Fig 3: Transfer Characteristic

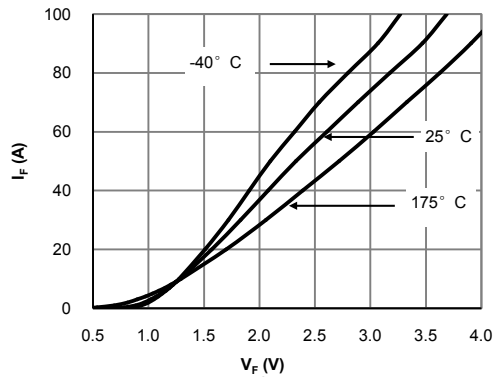


Fig 4: Diode Characteristic

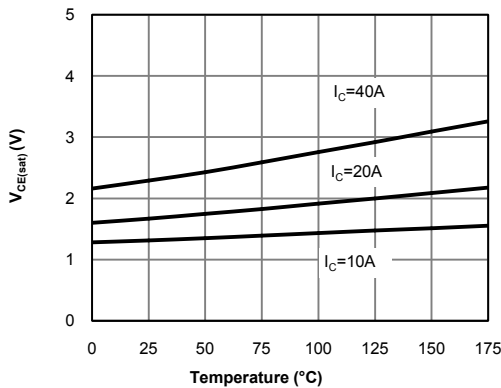


Fig 5: Collector-Emitter Saturation Voltage vs.
Junction Temperature

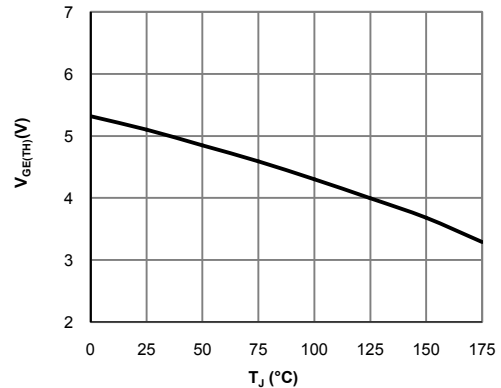
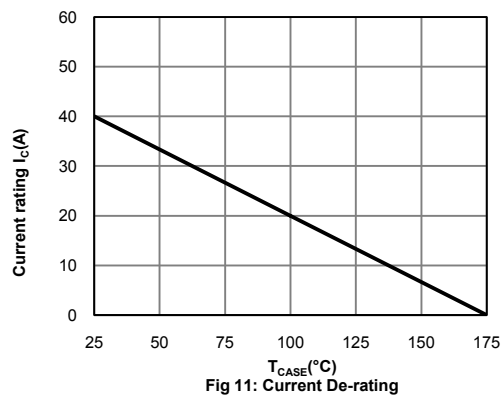
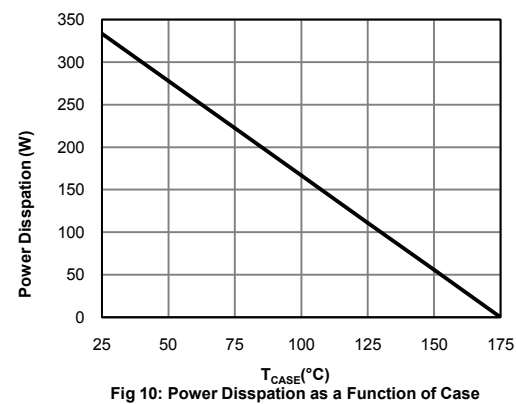
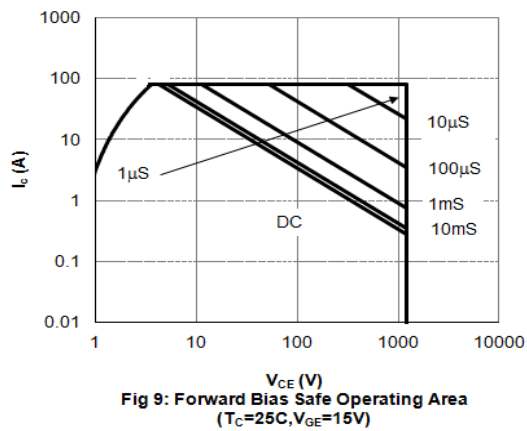
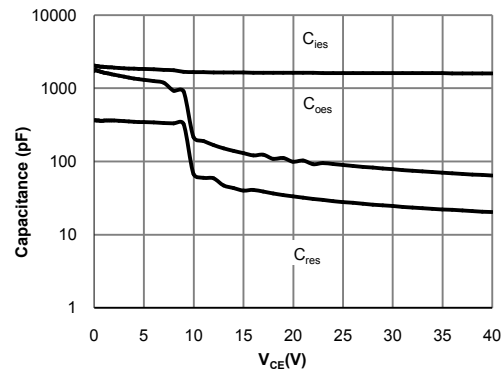
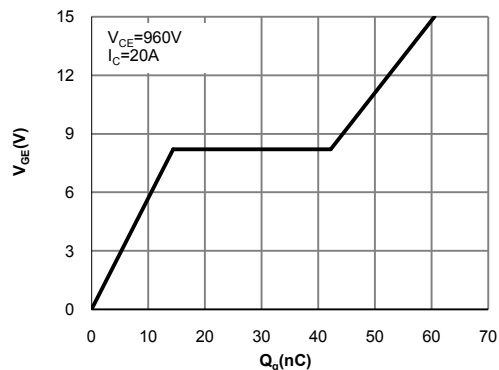
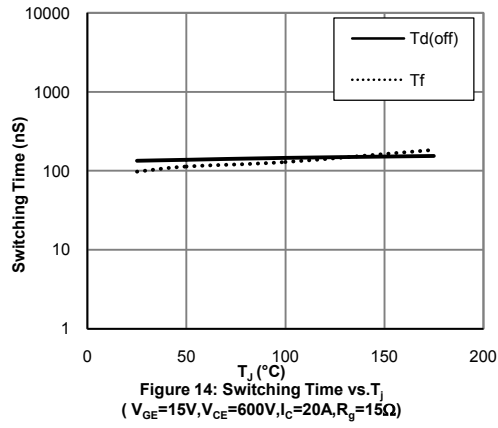
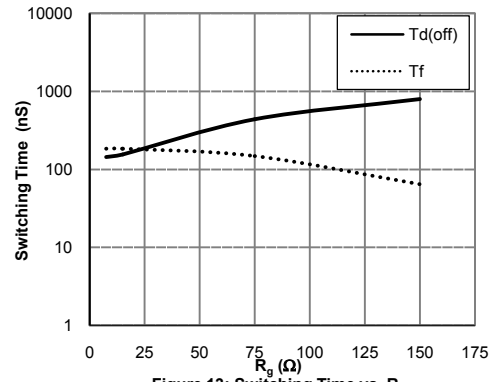
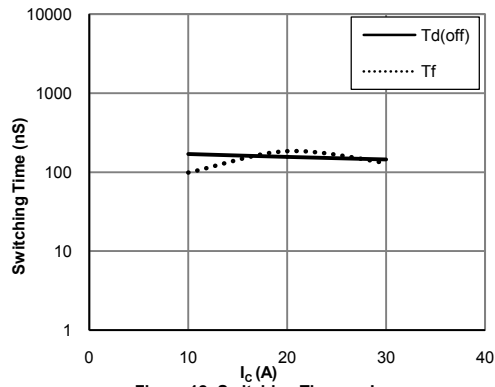


Figure 6: $V_{GE(TH)}$ vs. T_J

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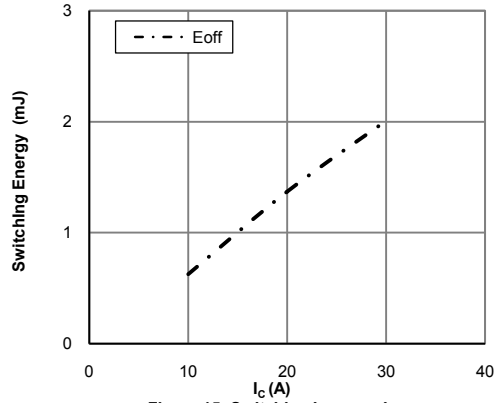


Figure 15: Switching Loss vs. I_C
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $R_g=15\Omega$)

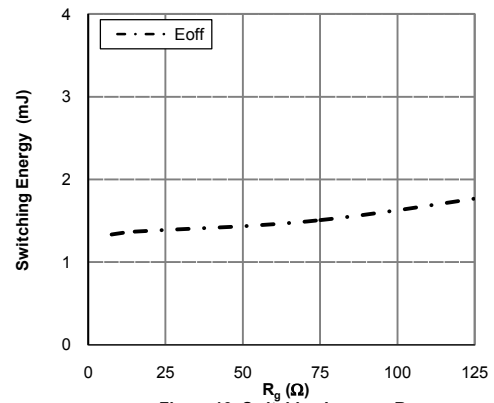


Figure 16: Switching Loss vs. R_g
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $I_C=20\text{A}$)

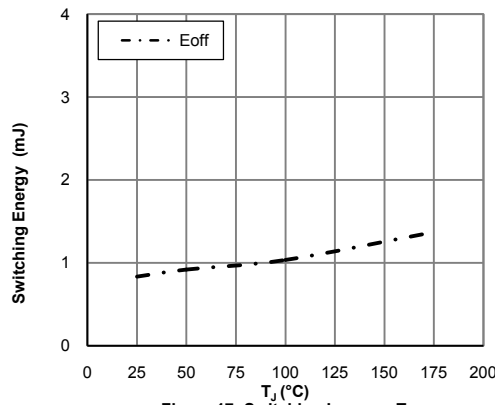


Figure 17: Switching Loss vs. T_J
($V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $I_C=20\text{A}$, $R_g=15\Omega$)

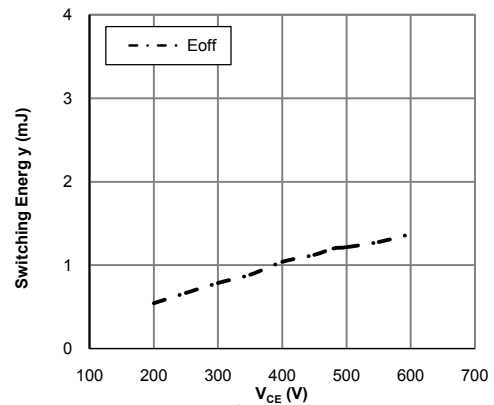


Figure 18: Switching Loss vs. V_{CE}
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $I_C=20\text{A}$, $R_g=15\Omega$)

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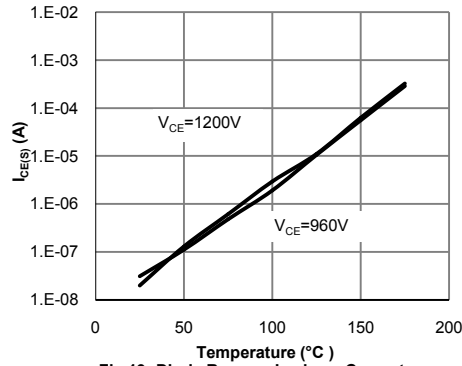


Fig 19: Diode Reverse Leakage Current vs. Junction Temperature

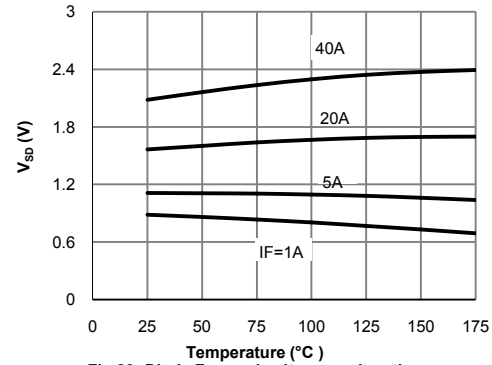


Fig 20: Diode Forward voltage vs. Junction Temperature

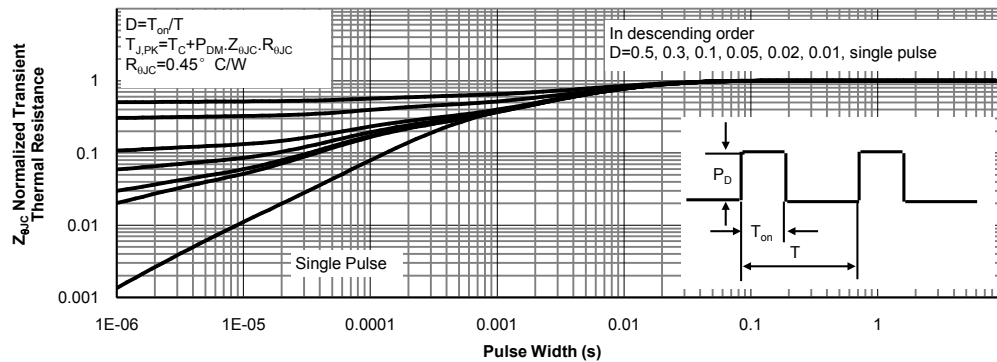


Figure 21: Normalized Maximum Transient Thermal Impedance for IGBT

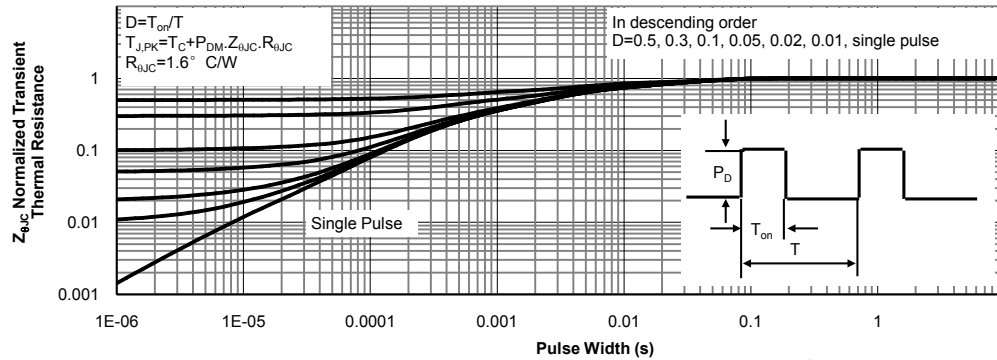
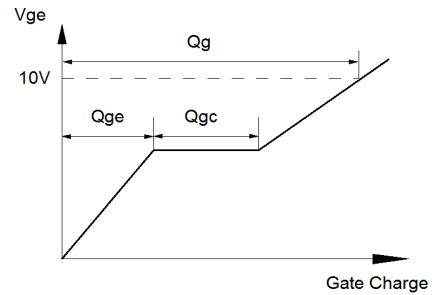
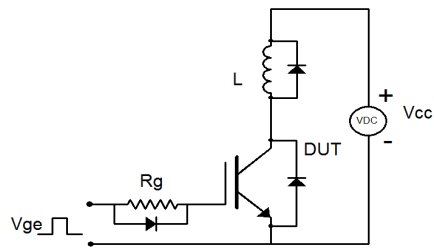
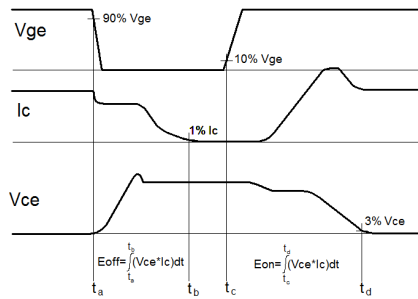
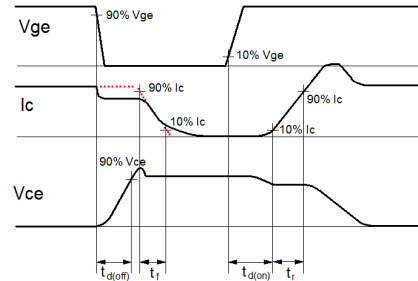
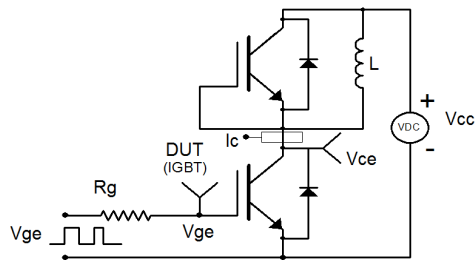


Figure 22: Normalized Maximum Transient Thermal Impedance for Diode

Gate Charge Test Circuit & Waveform



Inductive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

