



ALPHA & OMEGA
SEMICONDUCTOR

AOK20B120E1

1200V, 20A Alpha IGBT™ with Diode

General Description

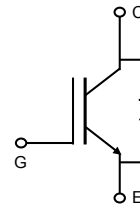
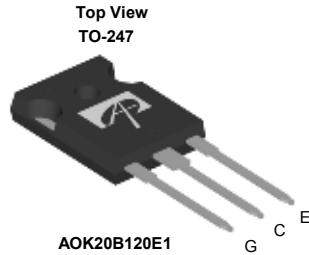
- Latest AlphaIGBT (α IGBT) technology
- Best in Class $V_{CE(SAT)}$ enables high efficiencies
- Low turn-off switching loss due to fast turn-off time
- Very smooth turn-off current waveforms reduce EMI
- Better thermal management
- High surge current capability
- Minimal gate spike due to high input 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	$T_C=25^\circ\text{C}$ 40	A
		$T_C=100^\circ\text{C}$ 20	
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	$T_C=25^\circ\text{C}$ 40	A
		$T_C=100^\circ\text{C}$ 20	
Diode Pulsed Current, Limited by T_{Jmax}	I_{Fpulse}	80	A
Power Dissipation	P_D	$T_C=25^\circ\text{C}$ 333	W
		$T_C=100^\circ\text{C}$ 167	
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	$I_C=1\text{mA}$, $V_{GE}=0\text{V}$, $T_J=25^\circ\text{C}$	1200	-	-	V	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15\text{V}$, $I_C=20\text{A}$	$T_J=25^\circ\text{C}$	-	1.68	2.1	V
			$T_J=125^\circ\text{C}$	-	2	-	
			$T_J=175^\circ\text{C}$	-	2.2	-	
V_F	Diode Forward Voltage	$V_{GE}=0\text{V}$, $I_C=20\text{A}$	$T_J=25^\circ\text{C}$	-	1.6	2	V
			$T_J=125^\circ\text{C}$	-	1.68		
			$T_J=175^\circ\text{C}$	-	1.7	-	
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$V_{CE}=5\text{V}$, $I_C=1\text{mA}$	4.5	5.15	5.8	V	
I_{CES}	Zero Gate Voltage Collector Current	$V_{CE}=1200\text{V}$, $V_{GE}=0\text{V}$	$T_J=25^\circ\text{C}$	-	-	10	μA
			$T_J=125^\circ\text{C}$	-	-	500	
			$T_J=175^\circ\text{C}$	-	-	5000	
I_{GES}	Gate-Emitter leakage current	$V_{CE}=0\text{V}$, $V_{GE}=\pm 30\text{V}$	-	-	± 100	nA	
g_{FS}	Forward Transconductance	$V_{CE}=20\text{V}$, $I_C=20\text{A}$	-	23	-	S	
DYNAMIC PARAMETERS							
C_{ies}	Input Capacitance	$V_{GE}=0\text{V}$, $V_{CE}=25\text{V}$, $f=1\text{MHz}$	-	1620	-	pF	
C_{oes}	Output Capacitance		-	90	-	pF	
C_{res}	Reverse Transfer Capacitance		-	28	-	pF	
Q_g	Total Gate Charge	$V_{GE}=15\text{V}$, $V_{CE}=960\text{V}$, $I_C=20\text{A}$	-	60.5	-	nC	
Q_{ge}	Gate to Emitter Charge		-	14.5	-	nC	
Q_{gc}	Gate to Collector Charge		-	28	-	nC	
R_g	Gate resistance	$V_{GE}=0\text{V}$, $V_{CE}=0\text{V}$, $f=1\text{MHz}$	-	2.1	-	Ω	
SWITCHING PARAMETERS, (Load Inductive, $T_J=25^\circ\text{C}$)							
$t_{D(off)}$	Turn-Off Delay Time	$T_J=25^\circ\text{C}$	-	134	-	ns	
t_f	Turn-Off Fall Time	$V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $I_C=20\text{A}$, $R_G=15\Omega$,	-	98	-	ns	
E_{off}	Turn-Off Energy	Parasitic Inductance=150nH	-	0.83	-	mJ	
SWITCHING PARAMETERS, (Load Inductive, $T_J=175^\circ\text{C}$)							
$t_{D(off)}$	Turn-Off Delay Time	$T_J=175^\circ\text{C}$	-	155	-	ns	
t_f	Turn-Off Fall Time	$V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $I_C=20\text{A}$, $R_G=15\Omega$,	-	184	-	ns	
E_{off}	Turn-Off Energy	Parasitic Inductance=150nH	-	1.37	-	mJ	

THIS PRODUCT HAS BEEN DESIGNED AND QUALIFIED FOR THE CONSUMER MARKET. APPLICATIONS OR USES 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

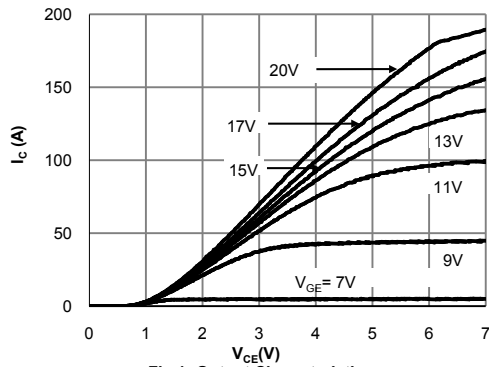


Fig 1: Output Characteristic
($T_J = 25^\circ\text{C}$)

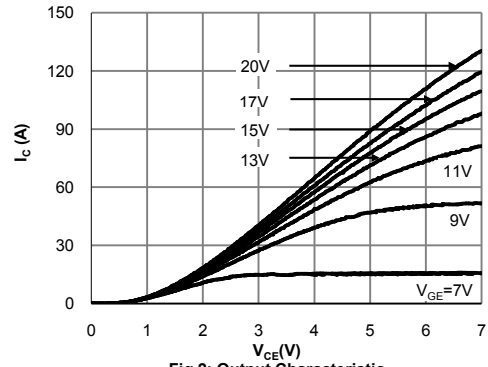


Fig 2: Output Characteristic
($T_J = 175^\circ\text{C}$)

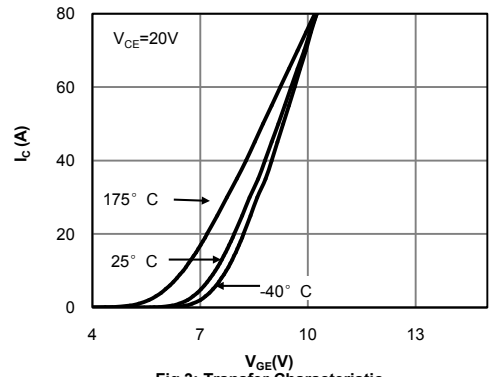


Fig 3: Transfer Characteristic

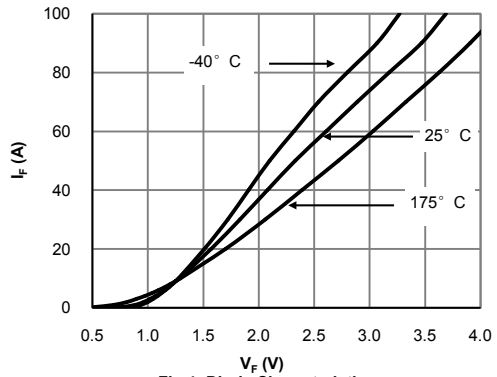


Fig 4: Diode Characteristic

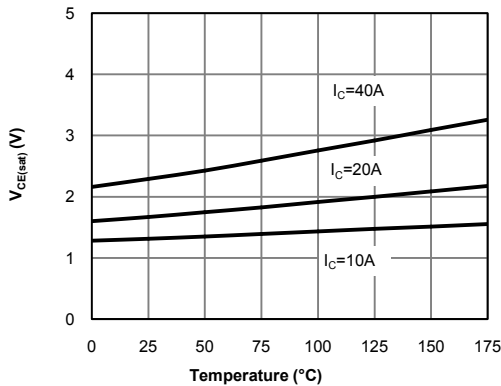


Fig 5: Collector-Emitter Saturation Voltage vs.
Junction Temperature

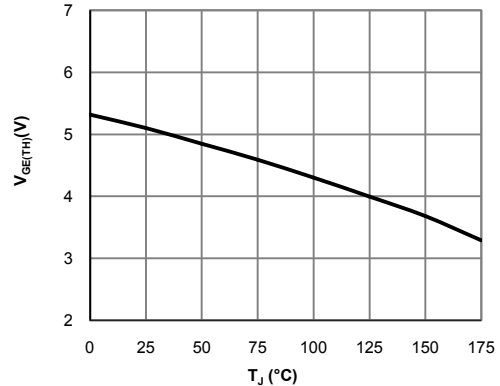
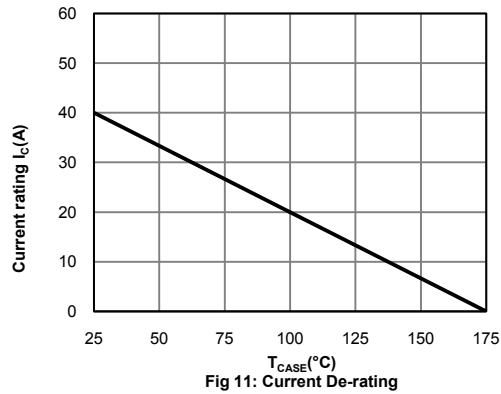
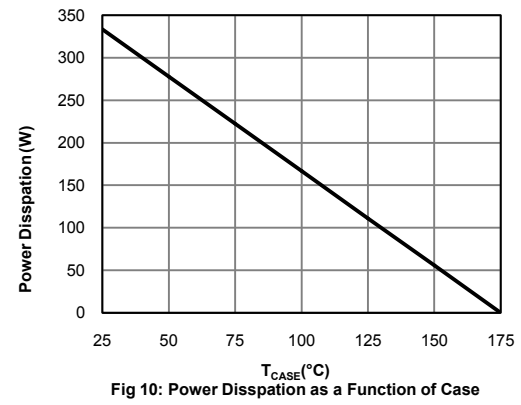
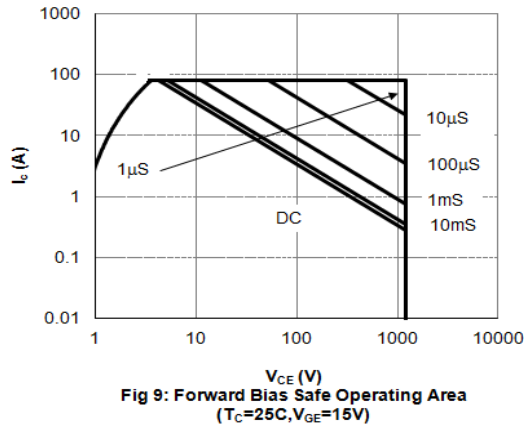
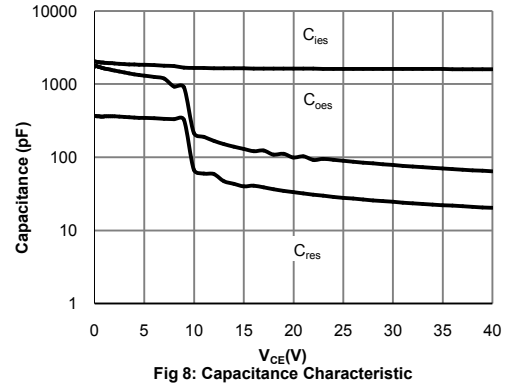
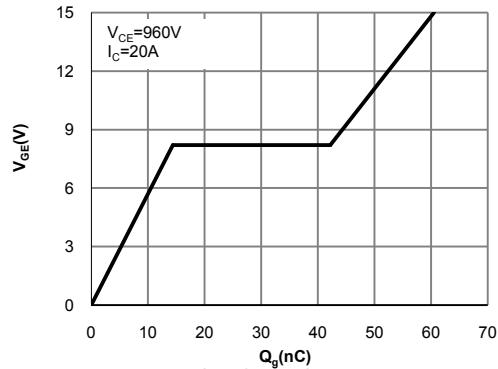


Figure 6: $V_{GE(TH)}$ vs. T_J

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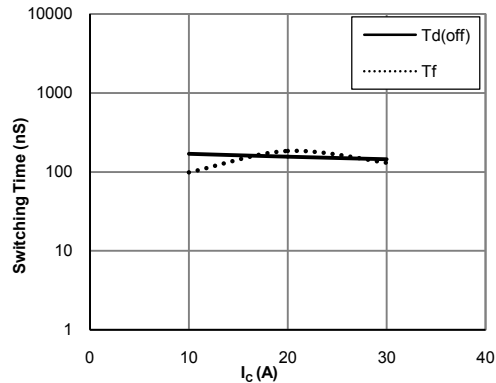


Figure 12: Switching Time vs. I_C
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $R_g=15\Omega$)

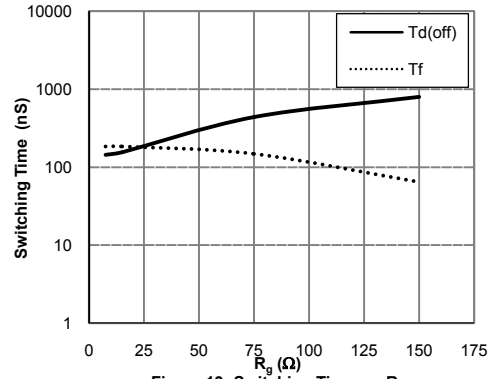


Figure 13: Switching Time vs. R_g
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $I_C=20\text{A}$)

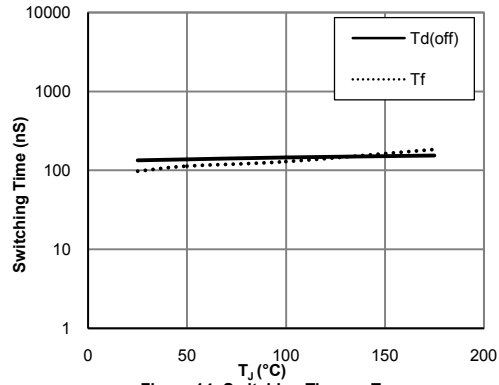


Figure 14: Switching Time vs. T_J
($V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $I_C=20\text{A}$, $R_g=15\Omega$)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

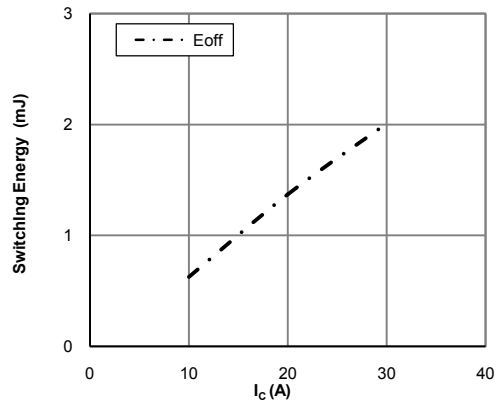


Figure 15: Switching Loss vs. I_C
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $R_g=15\Omega$)

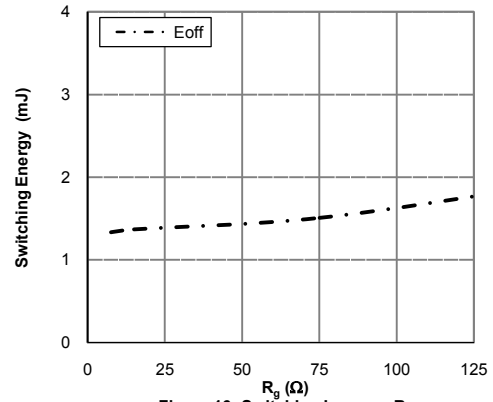


Figure 16: Switching Loss vs. R_g
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $I_C=20\text{A}$)

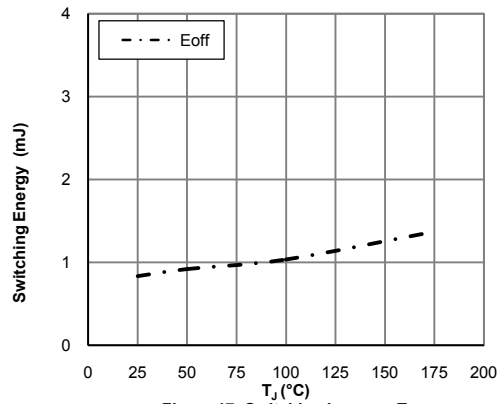


Figure 17: Switching Loss vs. T_J
($V_{GE}=15\text{V}$, $V_{CE}=600\text{V}$, $I_C=20\text{A}$, $R_g=15\Omega$)

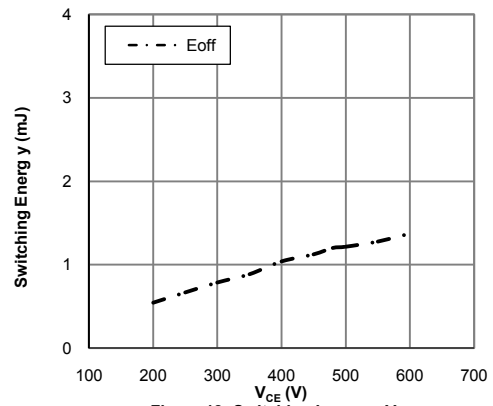


Figure 18: Switching Loss vs. V_{CE}
($T_J=175^\circ\text{C}$, $V_{GE}=15\text{V}$, $I_C=20\text{A}$, $R_g=15\Omega$)

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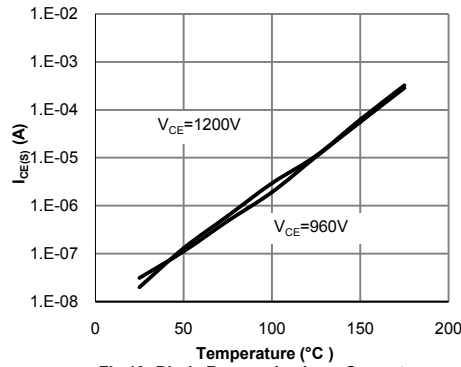


Fig 19: Diode Reverse Leakage Current vs. Junction Temperature

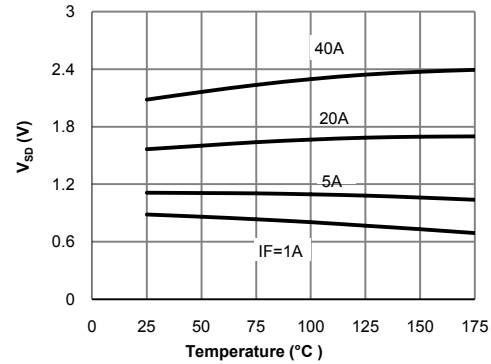


Fig 20: Diode Forward voltage vs. Junction Temperature

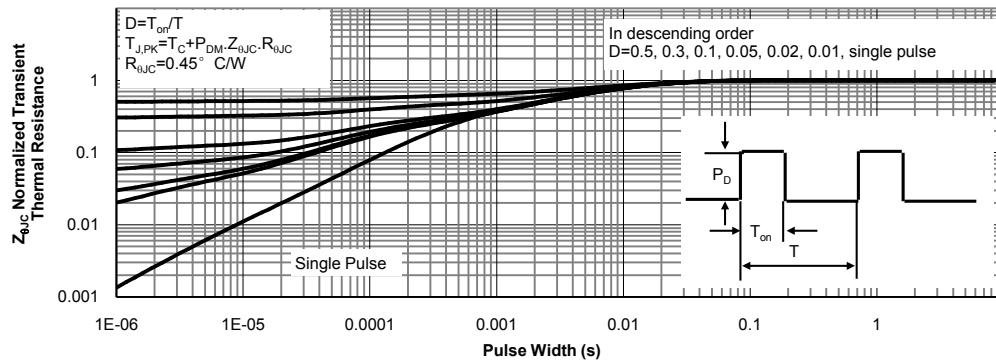


Figure 21: Normalized Maximum Transient Thermal Impedance for IGBT

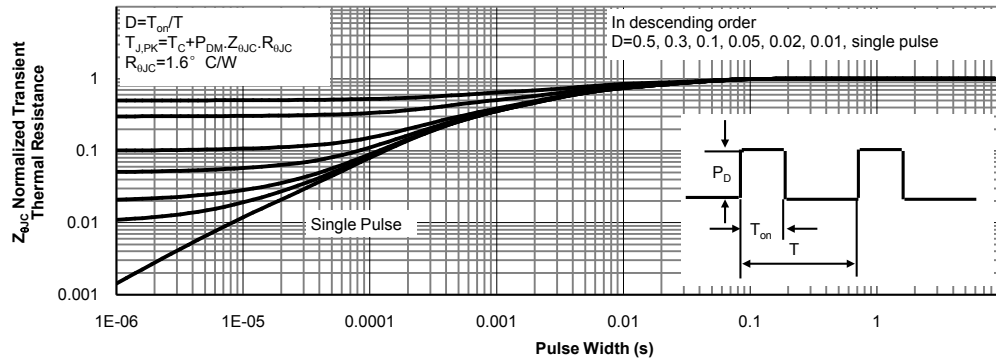
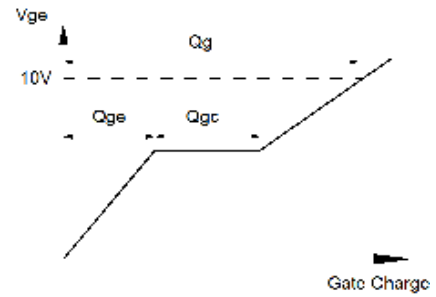
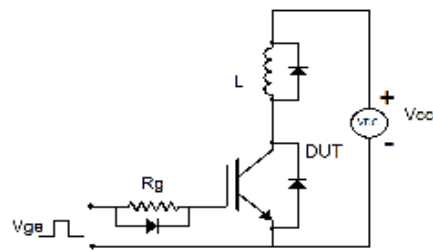
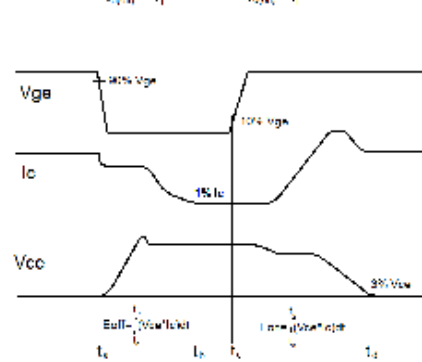
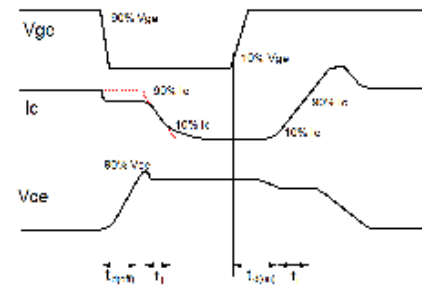
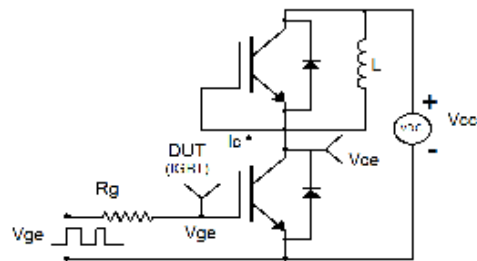


Figure 22: Normalized Maximum Transient Thermal Impedance for Diode

Gate Charge Test Circuit & Waveform



Inductive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

