



General Description

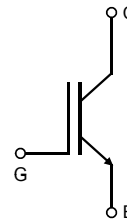
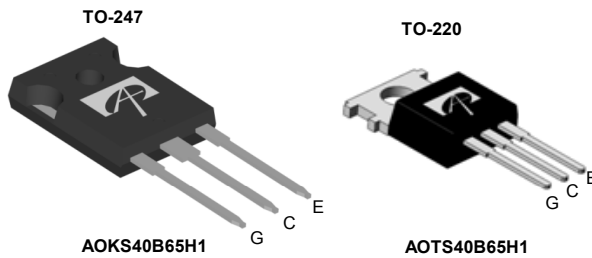
- Latest AlphaIGBT (α IGBT) technology
- 650V breakdown voltage
- High efficient turn-on di/dt controllability
- Very high switching speed
- Low turn-off switching loss and softness
- Very good EMI behavior
- Short-circuit ruggedness

Applications

- Power factor correction
- UPS & Solar Inverters
- Very High Switching Frequency Applications
- Welding Machines

Product Summary

V_{CE}	650V
I_C ($T_C=100^\circ\text{C}$)	40A
$V_{CE(sat)}$ ($T_J=25^\circ\text{C}$)	1.9V



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOKS40B65H1	TO247	Tube	240
AOTS40B65H1	TO220	Tube	1000

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

Parameter	Symbol	AOKS40B65H1/AOTS40B65H1	Units
Collector-Emitter Voltage	V_{CE}	650	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}	120	A
Turn off SOA, $V_{CE} \leq 650\text{V}$, Limited by T_{Jmax}	I_{LM}	120	A
Short circuit withstanding time ¹⁾ $V_{GE} = 15\text{V}$, $V_{CC} \leq 300\text{V}$, $T_J \leq 175^\circ\text{C}$	t_{SC}	5	μs
Power Dissipation	P_D	$T_C=25^\circ\text{C}$	300
		$T_C=100^\circ\text{C}$	150
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	AOKS40B65H1/AOTS40B65H1	Units
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	$^\circ\text{C/W}$
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	0.5	$^\circ\text{C/W}$

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	$I_C=1mA, V_{GE}=0V, T_J=25^\circ C$	650	-	-	V	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15V, I_C=40A$	$T_J=25^\circ C$	-	1.9	2.4	V
			$T_J=125^\circ C$	-	2.36	-	
			$T_J=175^\circ C$	-	2.63	-	
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$V_{CE}=5V, I_C=1mA$	-	4.9	-	V	
I_{CES}	Zero Gate Voltage Collector Current	$V_{CE}=650V, V_{GE}=0V$	$T_J=25^\circ C$	-	-	10	μA
			$T_J=125^\circ C$	-	-	500	
			$T_J=175^\circ C$	-	-	10000	
I_{GES}	Gate-Emitter leakage current	$V_{CE}=0V, V_{GE}=\pm 30V$	-	-	± 100	nA	
g_{FS}	Forward Transconductance	$V_{CE}=20V, I_C=40A$	-	30	-	S	
DYNAMIC PARAMETERS							
C_{ies}	Input Capacitance	$V_{GE}=0V, V_{CC}=25V, f=1MHz$	-	1789	-	pF	
C_{oes}	Output Capacitance		-	129	-	pF	
C_{res}	Reverse Transfer Capacitance		-	64	-	pF	
Q_g	Total Gate Charge	$V_{GE}=15V, V_{CC}=520V, I_C=40A$	-	63	-	nC	
Q_{ge}	Gate to Emitter Charge		-	18	-	nC	
Q_{gc}	Gate to Collector Charge		-	25	-	nC	
$I_{C(SC)}$	Short circuit collector current	$V_{GE}=15V, V_{CC}=300V,$ $t_{sc} \leq 5\mu s, T_J \leq 175^\circ C$	-	256	-	A	
R_g	Gate resistance	$V_{GE}=0V, V_{CC}=0V, f=1MHz$	-	14	-	Ω	
SWITCHING PARAMETERS, (Load Inductive, T_J=25°C)							
$t_{D(on)}$	Turn-On Delay Time	$T_J=25^\circ C$ $V_{GE}=15V, V_{CC}=400V, I_C=40A,$ $R_G=7.5\Omega$ Eon and Etotal include diode (AOK40B65H1) reverse recovery	-	41	-	ns	
t_r	Turn-On Rise Time		-	36	-	ns	
$t_{D(off)}$	Turn-Off Delay Time		-	130	-	ns	
t_f	Turn-Off Fall Time		-	14	-	ns	
E_{on}	Turn-On Energy		-	1.27	-	mJ	
E_{off}	Turn-Off Energy		-	0.46	-	mJ	
E_{total}	Total Switching Energy		-	1.73	-	mJ	
SWITCHING PARAMETERS, (Load Inductive, T_J=175°C)							
$t_{D(on)}$	Turn-On Delay Time	$T_J=175^\circ C$ $V_{GE}=15V, V_{CC}=400V, I_C=40A,$ $R_G=7.5\Omega$ Eon and Etotal include diode (AOK40B65H1) reverse recovery	-	38	-	ns	
t_r	Turn-On Rise Time		-	44	-	ns	
$t_{D(off)}$	Turn-Off Delay Time		-	155	-	ns	
t_f	Turn-Off Fall Time		-	18	-	ns	
E_{on}	Turn-On Energy		-	1.35	-	mJ	
E_{off}	Turn-Off Energy		-	0.8	-	mJ	
E_{total}	Total Switching Energy		-	2.15	-	mJ	

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

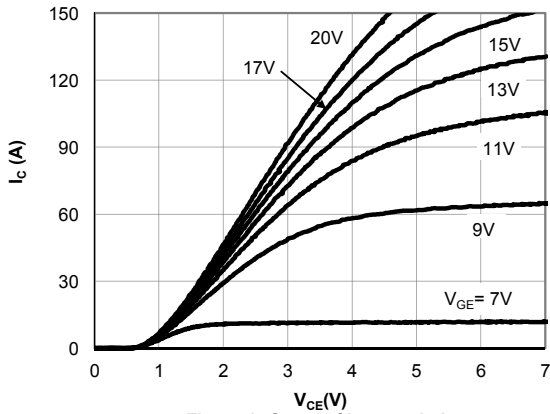


Figure 1: Output Characteristic
($T_j=25^\circ\text{C}$)

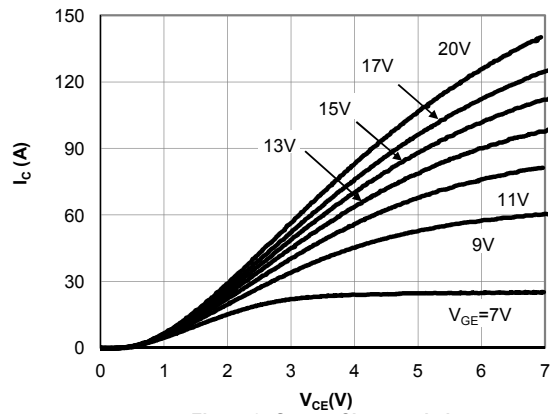


Figure 2: Output Characteristic
($T_j=175^\circ\text{C}$)

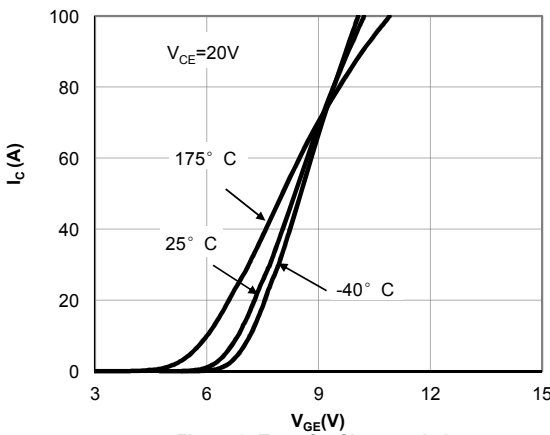


Figure 3: Transfer Characteristic

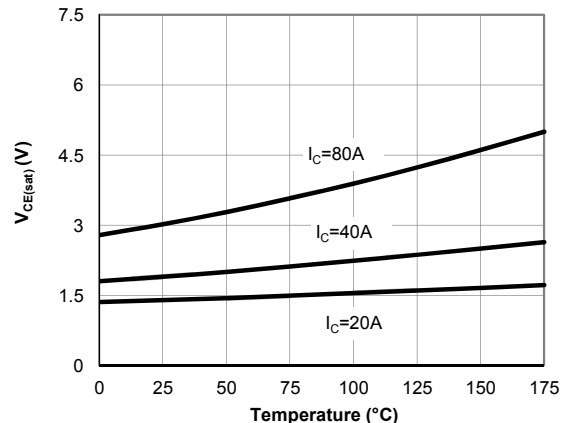


Figure 4: Collector-Emitter Saturation Voltage vs. Junction Temperature

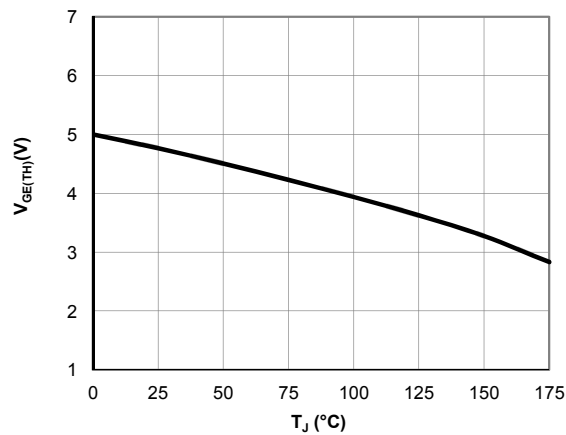


Figure 5: $V_{GE(TH)}$ vs. T_j

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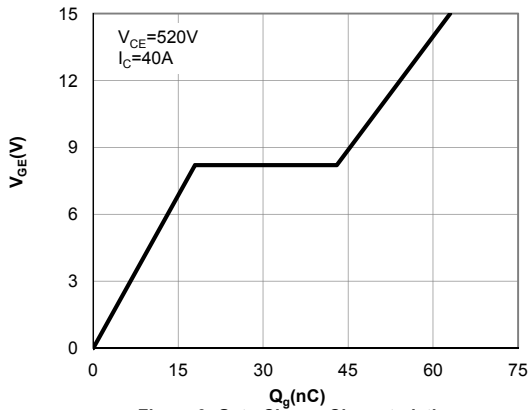


Figure 6: Gate-Charge Characteristics

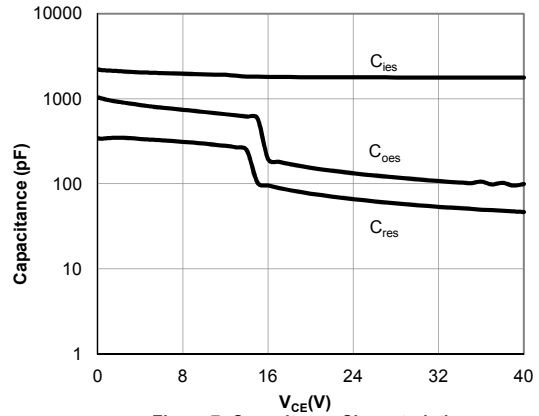


Figure 7: Capacitance Characteristic

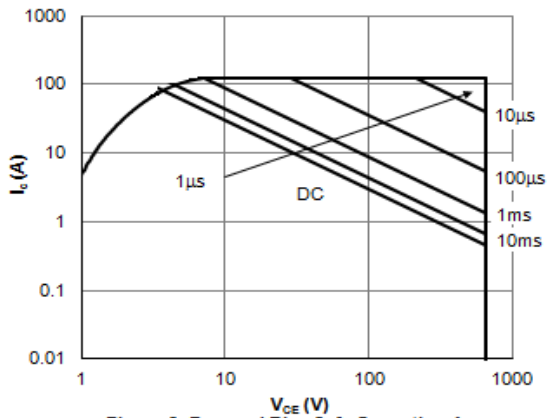


Figure 8: Forward Bias Safe Operating Area
($T_C=25^\circ\text{C}, V_{GE}=15\text{V}$)

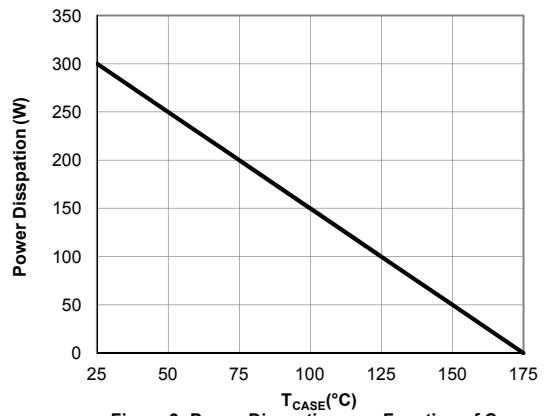


Figure 9: Power Dissipation as a Function of Case

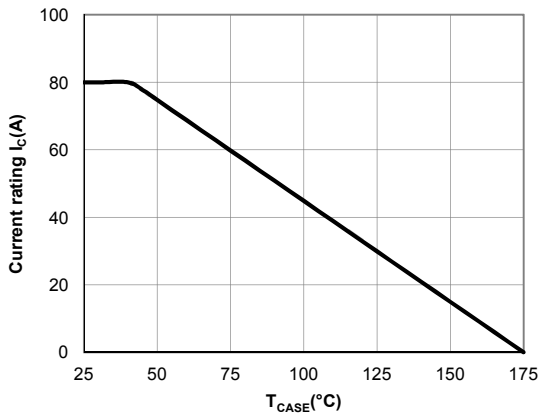


Figure 10: Current De-rating

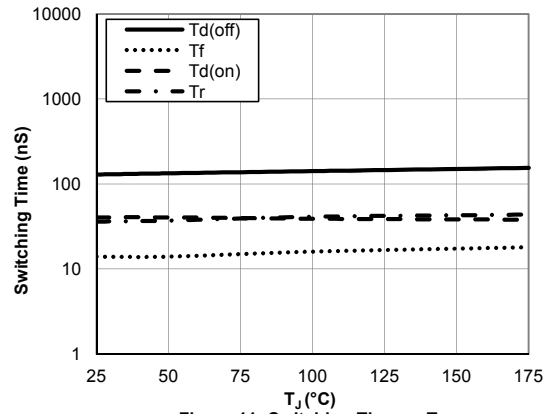


Figure 11: Switching Time vs. T_j
($V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=40\text{A}, R_g=7.5\Omega$)

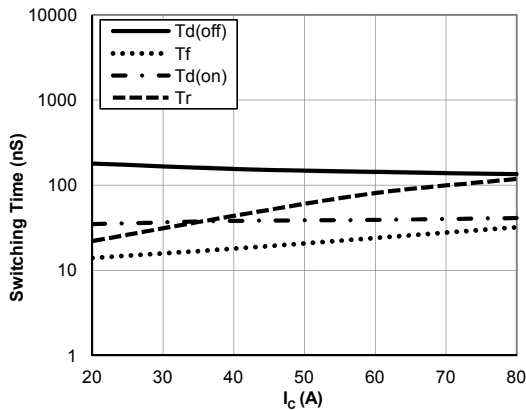
TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS


Figure 12: Switching Time vs. I_C
 ($T_J=175^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=400\text{V}, R_g=7.5\Omega$)

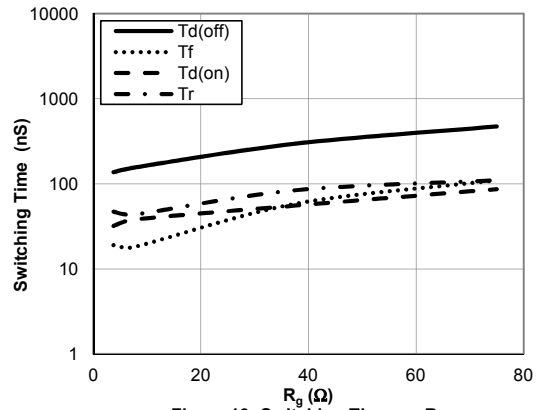


Figure 13: Switching Time vs. R_g
 ($T_J=175^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=40\text{A}$)

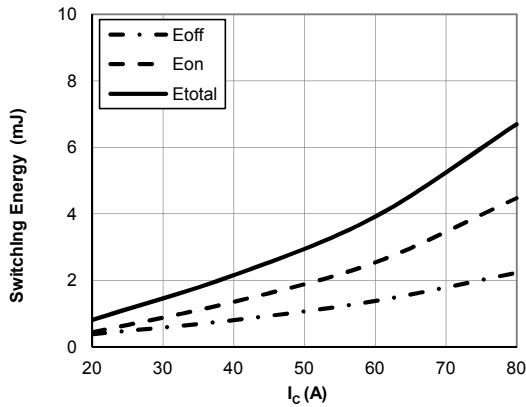


Figure 14: Switching Loss vs. I_C
 ($T_J=175^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=400\text{V}, R_g=7.5\Omega$)

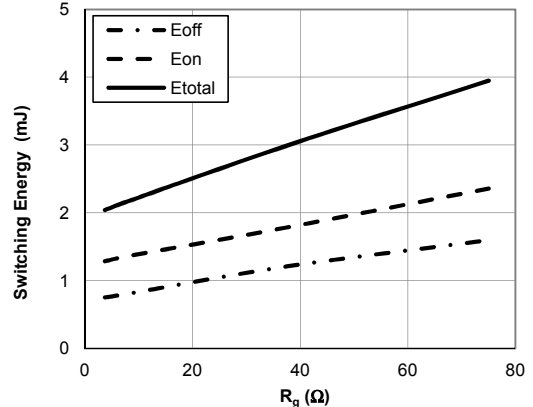


Figure 15: Switching Loss vs. R_g
 ($T_J=175^\circ\text{C}, V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=40\text{A}$)

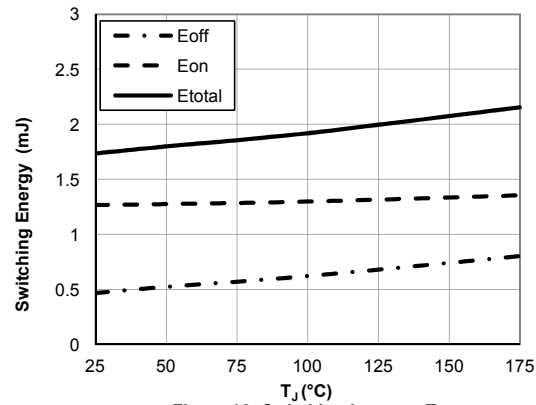


Figure 16: Switching Loss vs. T_J
 ($V_{GE}=15\text{V}, V_{CE}=400\text{V}, I_C=40\text{A}, R_g=7.5\Omega$)

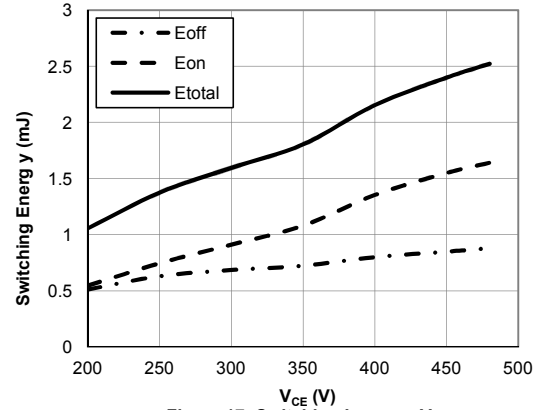


Figure 17: Switching Loss vs. V_{CE}
 ($T_J=175^\circ\text{C}, V_{GE}=15\text{V}, I_C=40\text{A}, R_g=7.5\Omega$)

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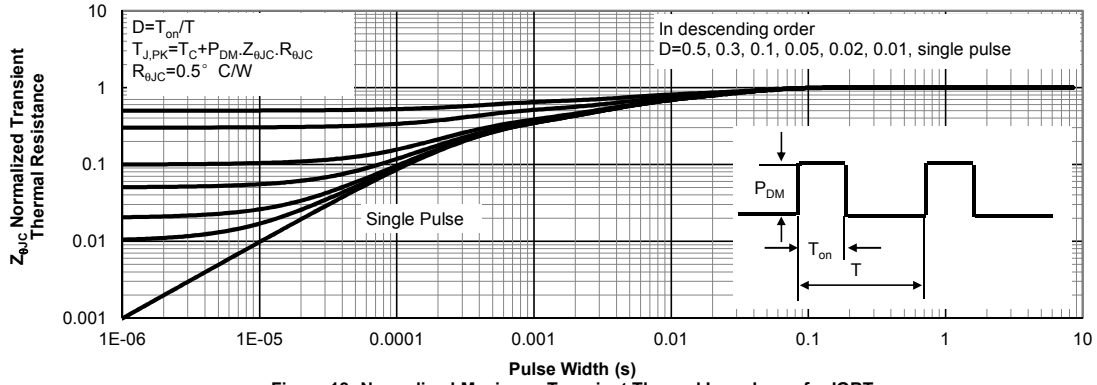


Figure 18: Normalized Maximum Transient Thermal Impedance for IGBT

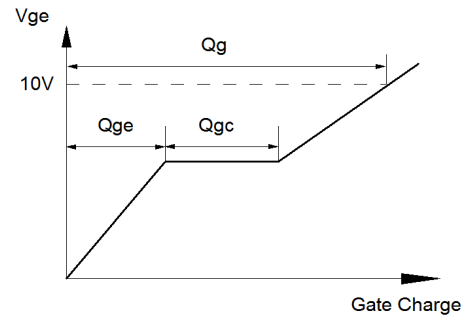
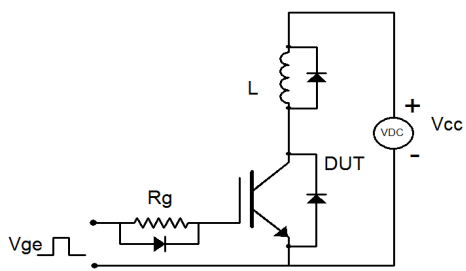


Figure A: Gate Charge Test Circuit & Waveforms

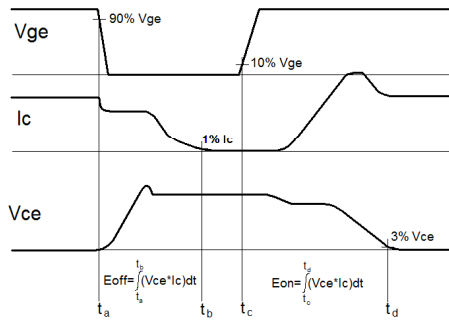
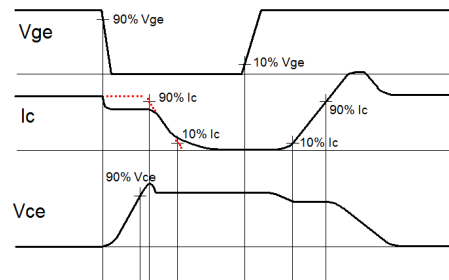
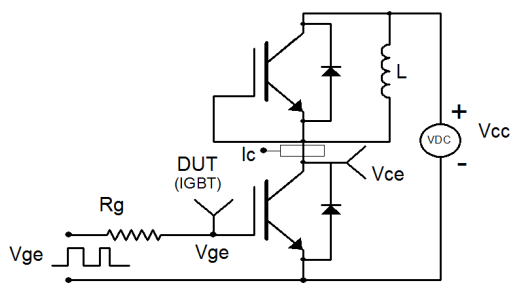


Figure B: Inductive Switching Test Circuit & Waveforms