AOKS40B65H1/AOTS40B65H1

650V, 40A Alpha IGBT™

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

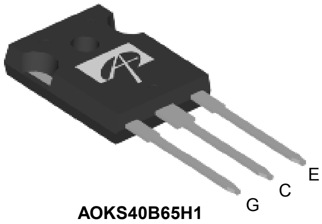
Product Summary

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

Applications

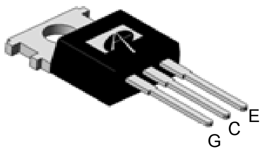
- Power factor correction
- UPS & Solar Inverters
- Very High Switching Frequency Applications
- Welding Machines

TO-247

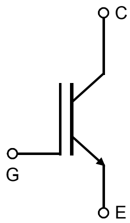


AOKS40B65H1

TO-220



AOTS40B65H1



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

Absolute Maximum Ratings T_A=25°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	T_C=25°C	I_C	80	A
	T_C=100°C		40	
Pulsed Collector Current, Limited by T_{Jmax}		I_{CM}	120	A
Turn off SOA, $V_{CE} \leqslant$ 650V, Limited by T_{Jmax}		I_{LM}	120	A
Short circuit withstanding time [1)] V_{GE} = 15V, $V_{CC} \leqslant$ 300V, $T_J \leqslant$ 175°C		t_{SC}	5	µs
Power Dissipation	T_C=25°C	P_D	300	W
	T_C=100°C		150	
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	AOKS40B65H1/AOTS40B65H1	Units
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	°C/W
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	0.5	°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		650	-	-	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=40A	T_J=25°C	-	1.9	2.4	V
			T_J=125°C	-	2.36	-	
			T_J=175°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°C	-	-	10	µA
			T_J=125°C	-	-	500	
			T_J=175°C	-	-	10000	
I_{GES}	Gate-Emitter leakage current	V_{CE}=0V, V_{GE}=±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}≤5us, T_J≤175°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 DelayTime	T_J=25°C V_{GE}=15V, V_{CC}=400V, I_C=40A, R_G=7.5Ω 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 DelayTime	T_J=175°C V_{GE}=15V, V_{CC}=400V, I_C=40A, R_G=7.5Ω 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

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

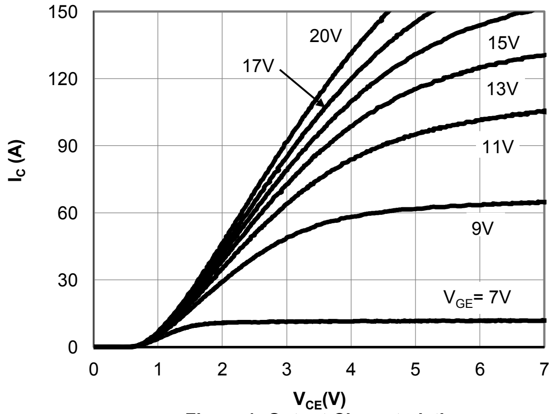


Figure 1: Output Characteristic (T_j=25°C)

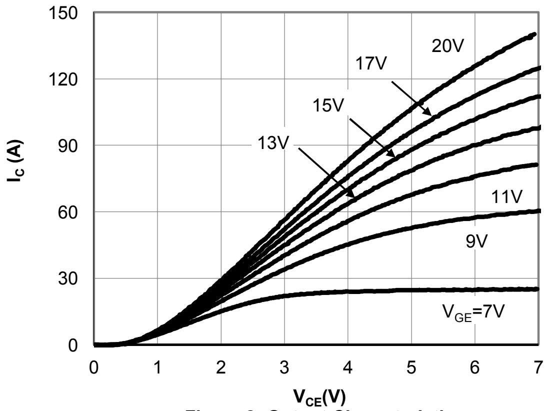


Figure 2: Output Characteristic (T_j=175°C)

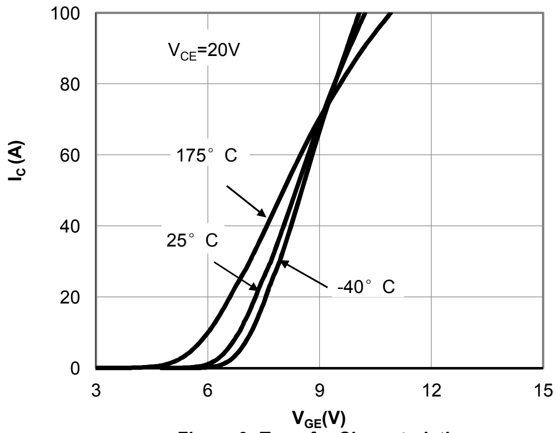


Figure 3: Transfer Characteristic

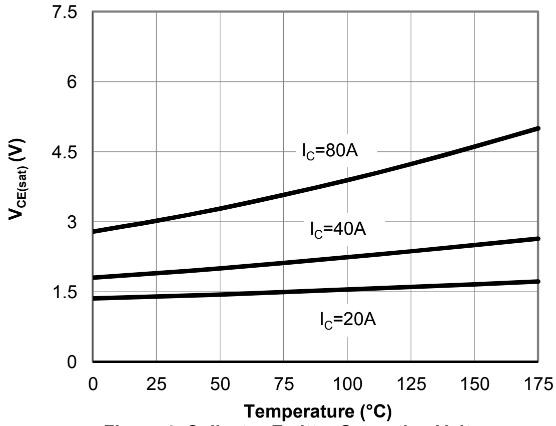


Figure 4: Collector-Emitter Saturation Voltage vs. Junction Temperature

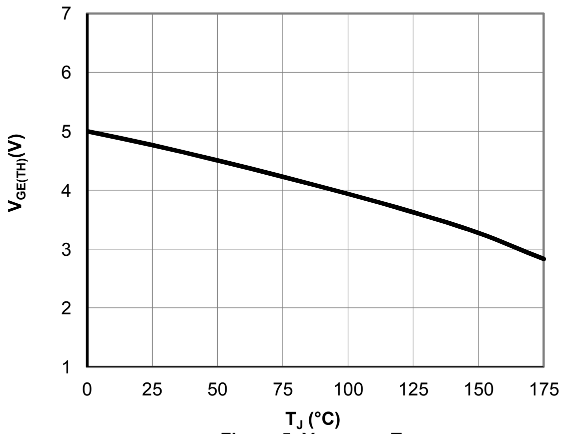


Figure 5: $V_{GE(TH)}$ vs. T_j

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

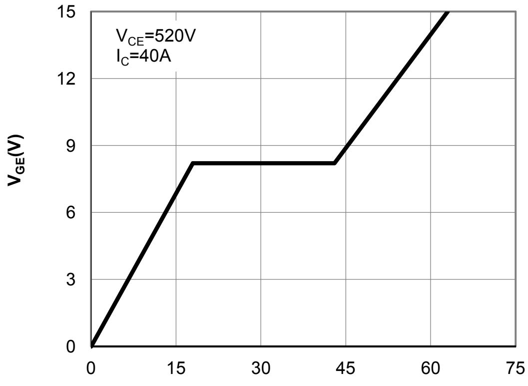


Figure 6: Gate-Charge Characteristics

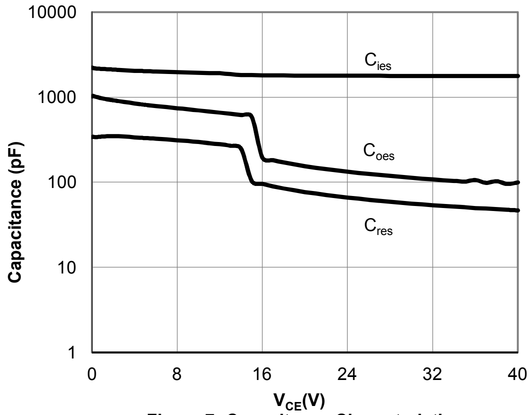


Figure 7: Capacitance Characteristic

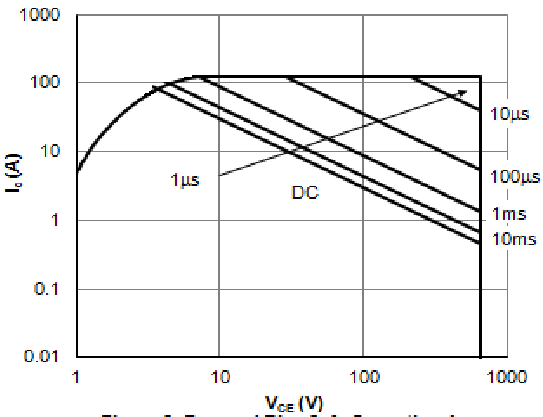


Figure 8: Forward Bias Safe Operating Area
(T_C=25°C,V_{GE}=15V)

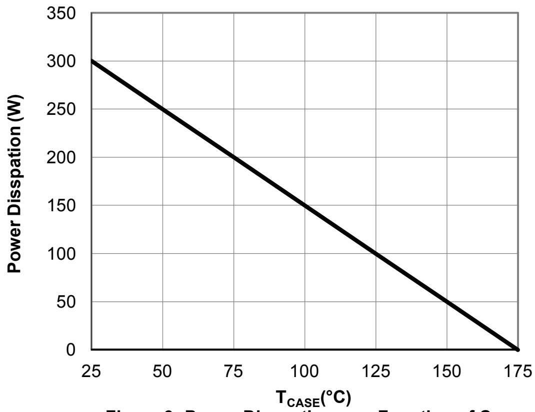


Figure 9: Power Disspation as a Function of Case

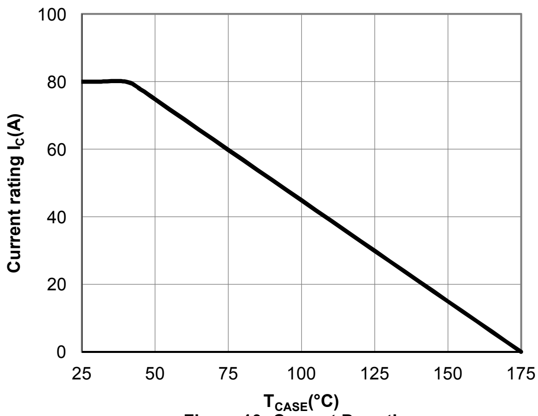


Figure 10: Current De-rating

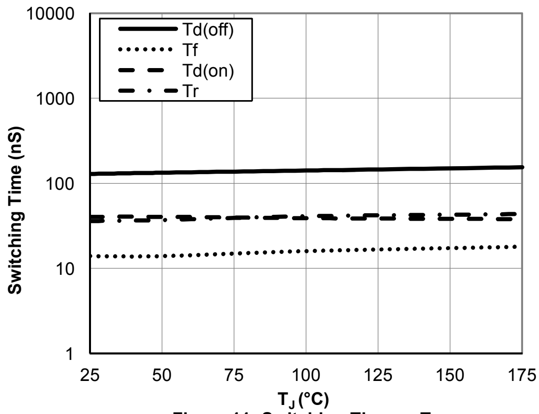


Figure 11: Switching Time vs.T_j
(V_{GE}=15V,V_{CE}=400V,I_C=40A,R_g=7.5Ω)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

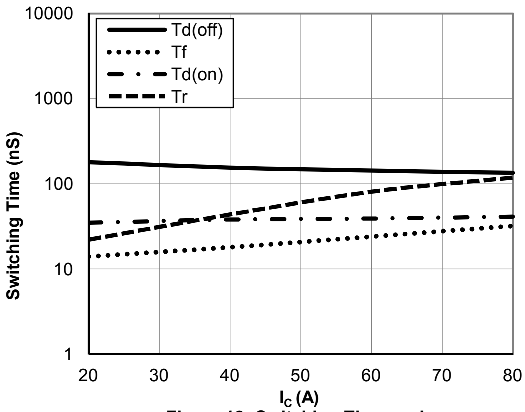


Figure 12: Switching Time vs. I_C
(T_j=175°C,V_{GE}=15V,V_{CE}=400V,R_g=7.5Ω)

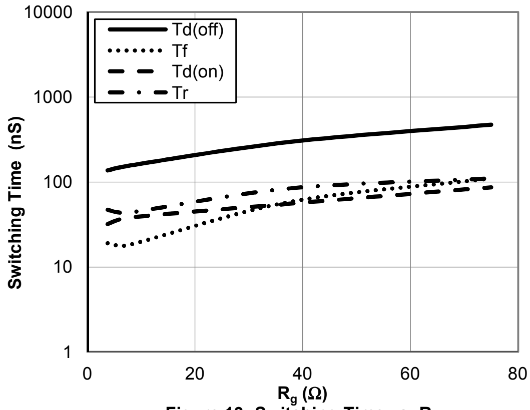


Figure 13: Switching Time vs. R_g
(T_j=175°C,V_{GE}=15V,V_{CE}=400V,I_C=40A)

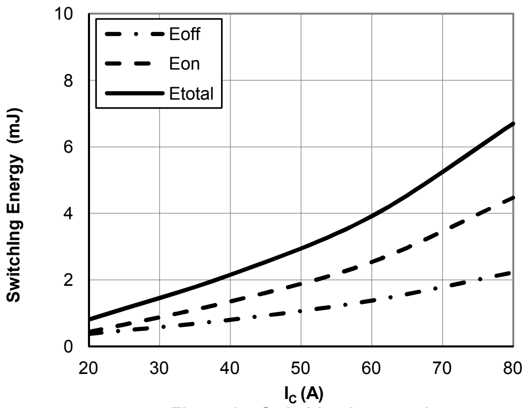


Figure 14: Switching Loss vs. I_C
(T_j=175°C,V_{GE}=15V,V_{CE}=400V,R_g=7.5Ω)

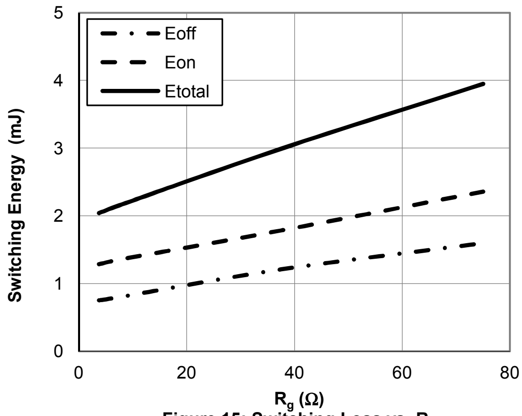


Figure 15: Switching Loss vs. R_g
(T_j=175°C,V_{GE}=15V,V_{CE}=400V,I_C=40A)

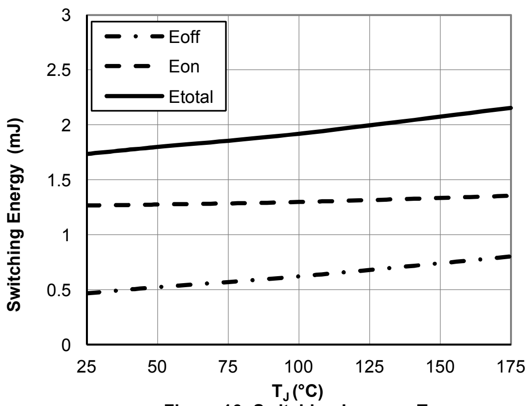


Figure 16: Switching Loss vs. T_j
(V_{GE}=15V,V_{CE}=400V,I_C=40A,R_g=7.5Ω)

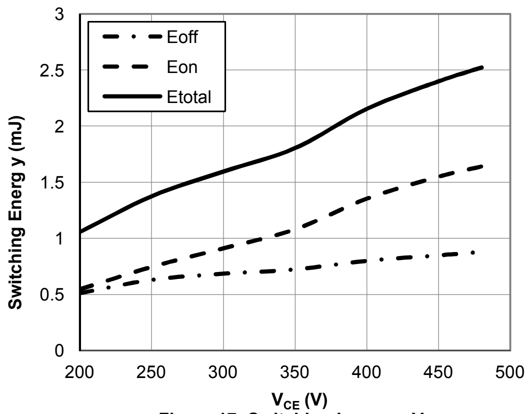


Figure 17: Switching Loss vs. V_{CE}
(T_j=175°C,V_{GE}=15V,I_C=40A,R_g=7.5Ω)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

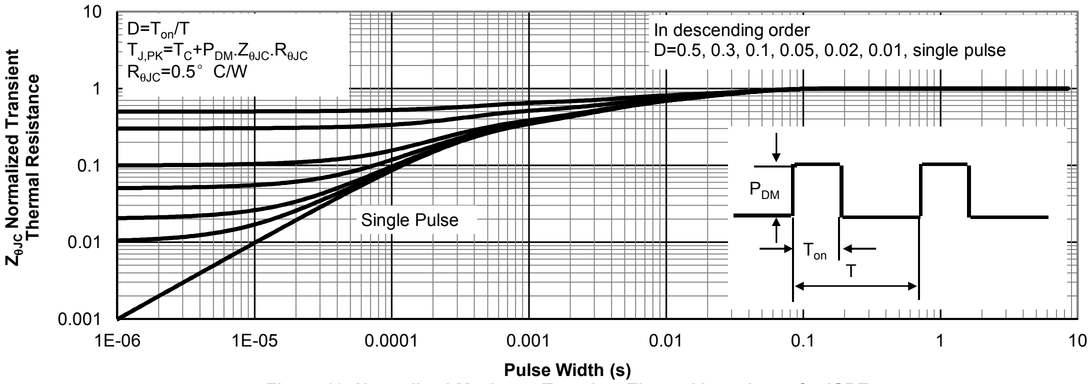


Figure 18: Normalized Maximum Transient Thermal Impedance for IGBT

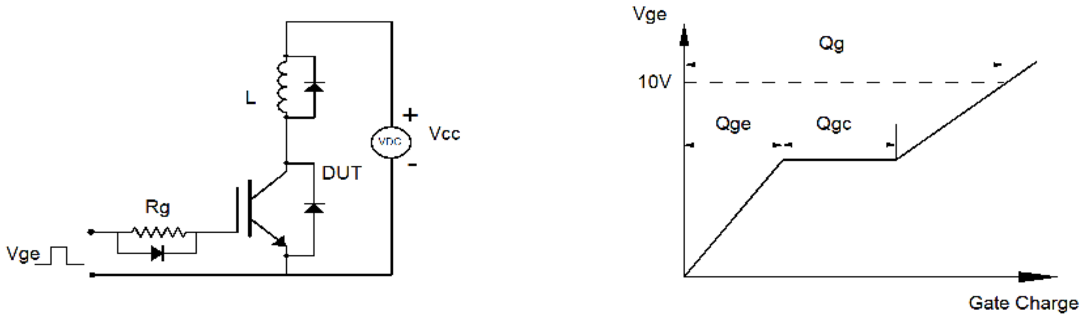


Figure A: Gate Charge Test Circuit & Waveforms

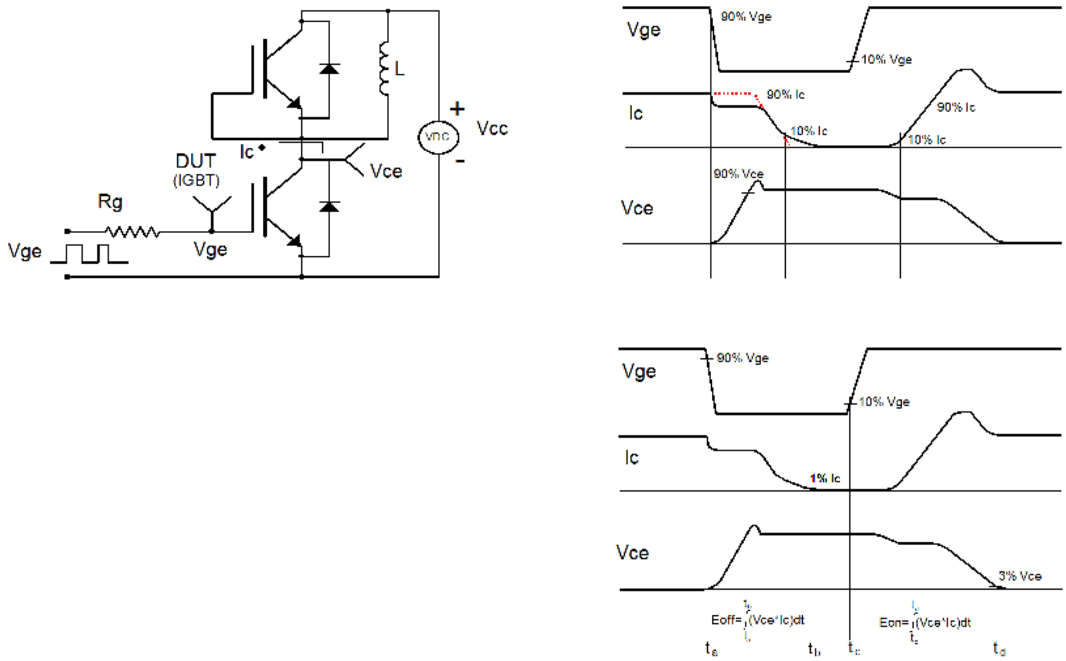


Figure B: Inductive Switching Test Circuit & Waveforms