ALPHA & OMEGA SEMICONDUCTOR

AOKS30B60D1

600V, 30A Alpha IGBT™

General Description

- Latest Alpha IGBT (α IGBT) technology
- 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

- Welding Machines
- Motor Drives
- UPS & Solar Inverters
- Very High Switching Frequency Applications

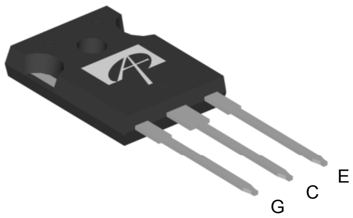
Product Summary

V_{CE}	600V
I_C (T_C=100°C)	30A
$V_{CE(sat)}$ (T_C=25°C)	2.0V

RoHS Compliant

Top View

TO-247



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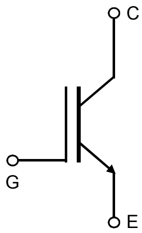

Absolute Maximum Ratings T_A=25°C unless otherwise noted				
Parameter		**Symbol**	**AOKS30B60D1**	**Units**
Collector-Emitter Voltage		V_{CE}	600	V
Gate-Emitter Voltage		V_{GE}	±20	V
V_{GE} Spike	500ns	V_{SPIKE}	24	V
Continuous Collector Current	T_C=25°C	I_C	60	A
	T_C=100°C		30	
Pulsed Collector Current, Limited by T_{Jmax}		I_{CM}	96	A
Turn off SOA, $V_{CE} \leqslant$ 600V, Limited by T_{Jmax}		I_{LM}	96	A
Short circuit withstanding time V_{GE} = 15V, $V_{CE} \leqslant$ 400V, Delay between short circuits $\geqslant$ 1.0s, T_C=25°C		t_{SC}	10	µs
Power Dissipation	T_C=25°C	P_D	208	W
	T_C=100°C		83	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 150	°C
Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds		T_L	300	°C

Thermal Characteristics			
Parameter	**Symbol**	**AOKS30B60D1**	**Units**
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	°C/W
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	0.6	°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		600	-	-	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=30A	T_J=25°C	-	2.0	2.5	V
			T_J=125°C	-	2.4	-	
			T_J=150°C	-	2.5	-	
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	V_{CE}=5V, I_C=1mA		-	5.6	-	V
I_{CES}	Zero Gate Voltage Collector Current	V_{CE}=600V, V_{GE}=0V	T_J=25°C	-	-	10	µA
			T_J=125°C	-	-	400	
			T_J=150°C	-	-	2000	
I_{GES}	Gate-Emitter leakage current	V_{CE}=0V, V_{GE}=±20V		-	-	±100	nA
g_{FS}	Forward Transconductance	V_{CE}=20V, I_C=30A		-	13	-	S
DYNAMIC PARAMETERS							
C_{ies}	Input Capacitance	V_{GE}=0V, V_{CE}=25V, f=1MHz		-	1324	-	pF
C_{oes}	Output Capacitance			-	120	-	pF
C_{res}	Reverse Transfer Capacitance			-	5	-	pF
Q_g	Total Gate Charge	V_{GE}=15V, V_{CE}=480V, I_C=30A		-	34	-	nC
Q_{ge}	Gate to Emitter Charge			-	14.3	-	nC
Q_{gc}	Gate to Collector Charge			-	10.7	-	nC
$I_{C(SC)}$	Short circuit collector current, Max. 1000 short circuits, Delay between short circuits ≥ 1.0s	V_{GE}=15V, V_{CE}=400V, R_G=25Ω		-	96	-	A
R_g	Gate resistance	f=1MHz		-	1.3	-	Ω
SWITCHING PARAMETERS, (Load Iductive, T_J=25°C)							
$t_{D(on)}$	Turn-On DelayTime	T_J=25°C V_{GE}=15V, V_{CE}=400V, I_C=30A, R_G=10Ω, Parasitic Inductance=150nH Eon and Etotal include diode (AOK30B60D1) reverse recovery		-	20	-	ns
t_r	Turn-On Rise Time			-	44	-	ns
$t_{D(off)}$	Turn-Off Delay Time			-	58	-	ns
t_f	Turn-Off Fall Time			-	16	-	ns
E_{on}	Turn-On Energy			-	1.1	-	mJ
E_{off}	Turn-Off Energy			-	0.24	-	mJ
E_{total}	Total Switching Energy			-	1.34	-	mJ
SWITCHING PARAMETERS, (Load Iductive, T_J=150°C)							
$t_{D(on)}$	Turn-On DelayTime	T_J=150°C V_{GE}=15V, V_{CE}=400V, I_C=30A, R_G=10Ω, Parasitic Inductance=150nH Eon and Etotal include diode (AOK30B60D1) reverse recovery		-	21	-	ns
t_r	Turn-On Rise Time			-	45	-	ns
$t_{D(off)}$	Turn-Off Delay Time			-	70	-	ns
t_f	Turn-Off Fall Time			-	19	-	ns
E_{on}	Turn-On Energy			-	1.3	-	mJ
E_{off}	Turn-Off Energy			-	0.46	-	mJ
E_{total}	Total Switching Energy			-	1.76	-	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

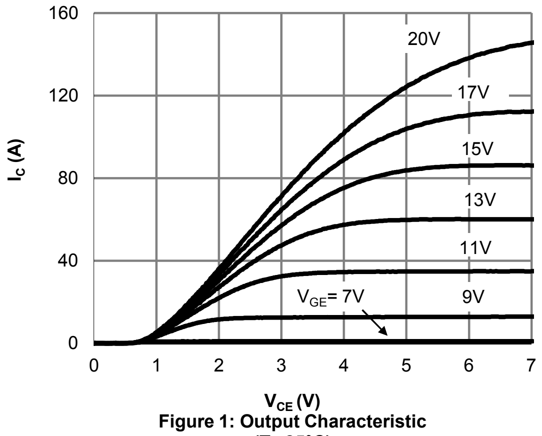

Figure 1: Output Characteristic (T_j=25°C)

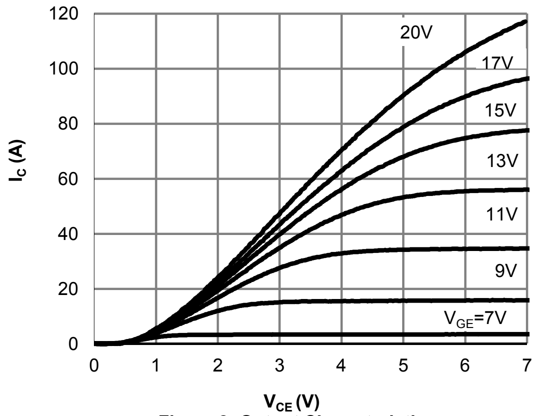

Figure 2: Output Characteristic (T_j=150°C)

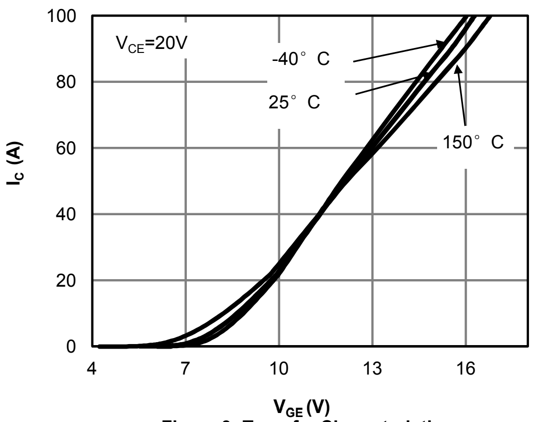

Figure 3: Transfer Characteristic

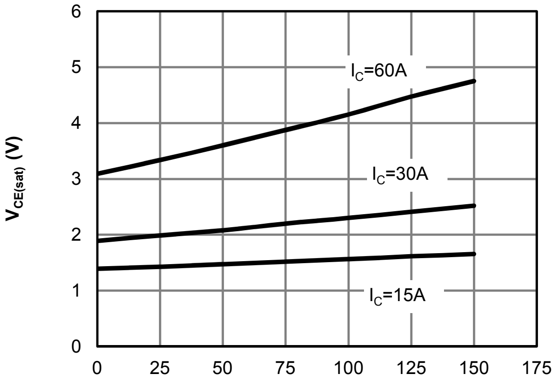

Figure 4: Collector-Emitter Saturation Voltage vs. Junction Temperature

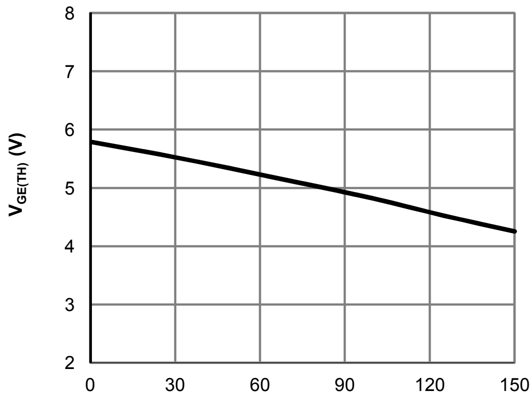

Figure 5: $V_{GE(TH)}$ vs. T_j

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

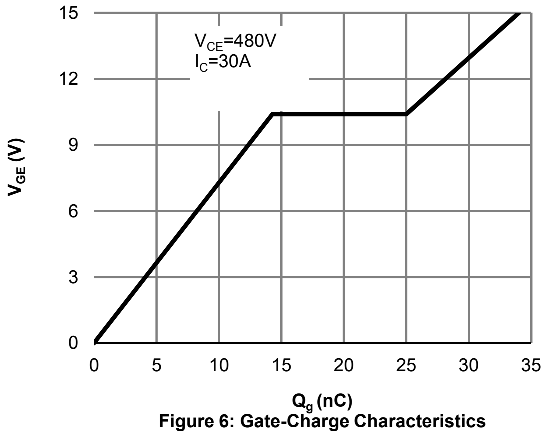

Figure 6: Gate-Charge Characteristics

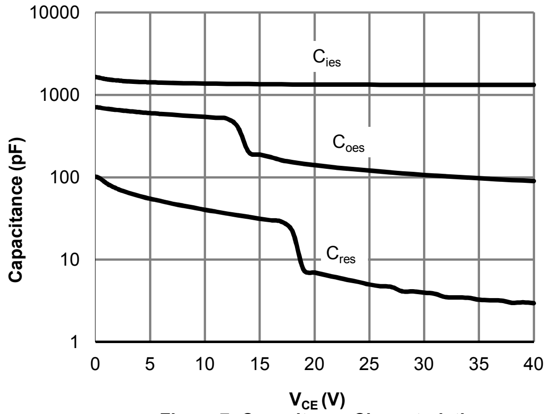

Figure 7: Capacitance Characteristic

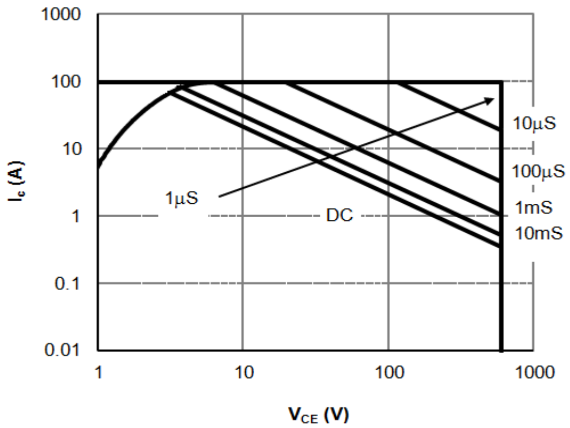

Figure 8: Forward Bias Safe Operating Area (T_C=25C, V_{GE}=15V)

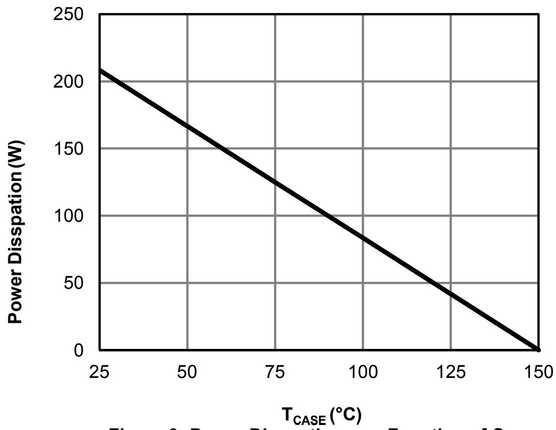

Figure 9: Power Disspation as a Function of Case

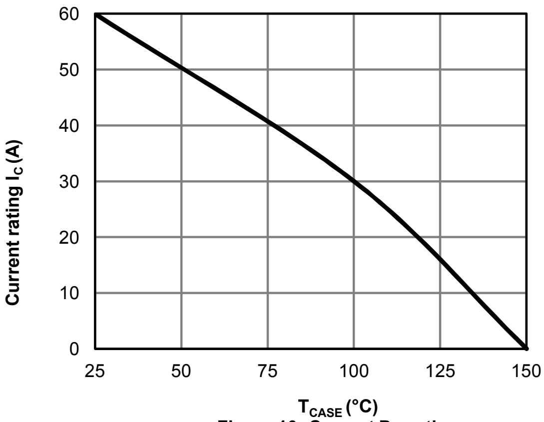

Figure 10: Current De-rating

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

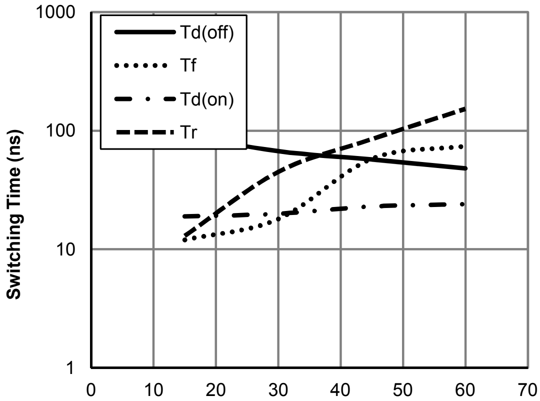

Figure 11: Switching Time vs. I_C
(T_j=150°C, V_{GE}=15V, V_{CE}=400V, R_g=10Ω)

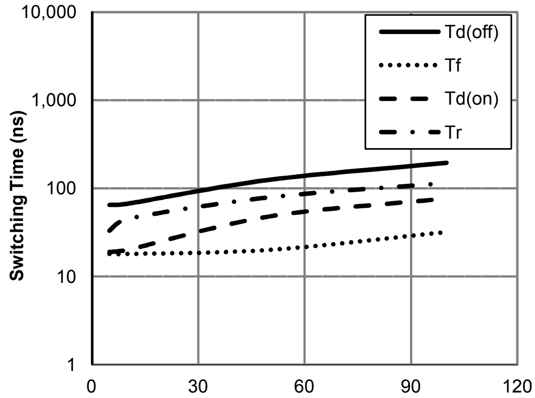

Figure 12: Switching Time vs. R_g
(T_j=150°C, V_{GE}=15V, V_{CE}=400V, I_C=30A)

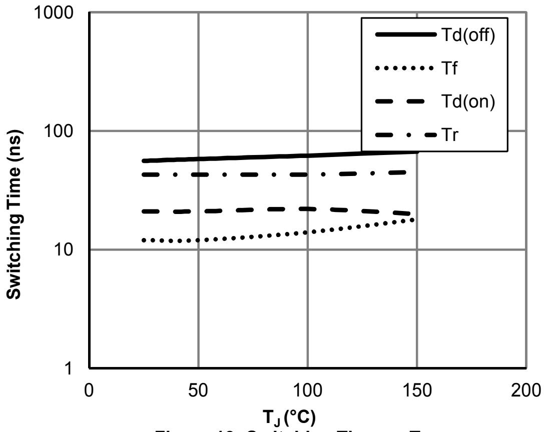

Figure 13: Switching Time vs. T_j
(V_{GE}=15V, V_{CE}=400V, I_C=30A, R_g=10Ω)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

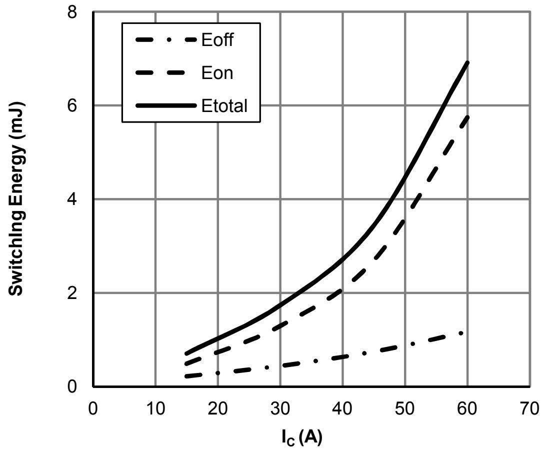

Figure 14: Switching Loss vs. I_C
(T_j=150°C, V_{GE}=15V, V_{CE}=400V, R_g=10Ω)

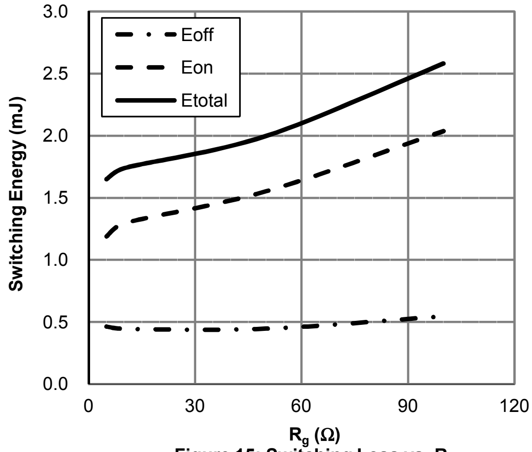

Figure 15: Switching Loss vs. R_g
(T_j=150°C, V_{GE}=15V, V_{CE}=400V, I_C=30A)

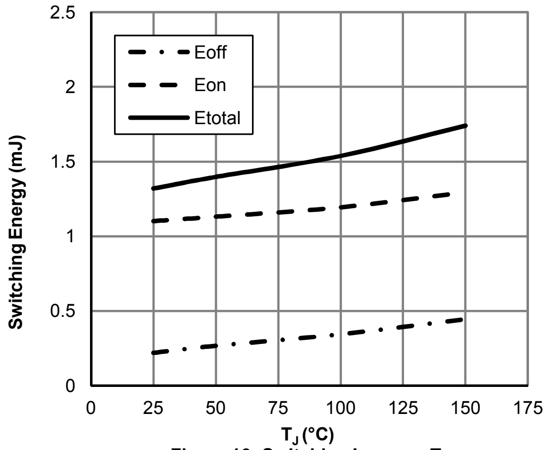

Figure 16: Switching Loss vs. T_j
(V_{GE}=15V, V_{CE}=400V, I_C=30A, R_g=10Ω)

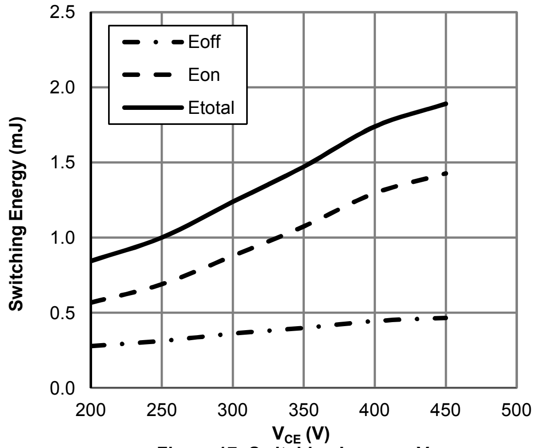

Figure 17: Switching Loss vs. V_{CE}
(T_j=150°C, V_{GE}=15V, I_C=30A, R_g=10Ω)

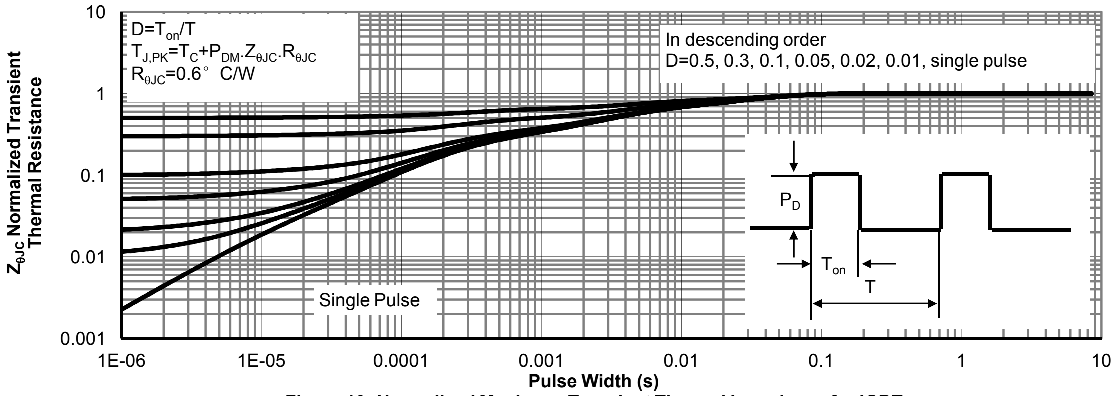

Figure 18: Normalized Maximum Transient Thermal Impedance for IGBT

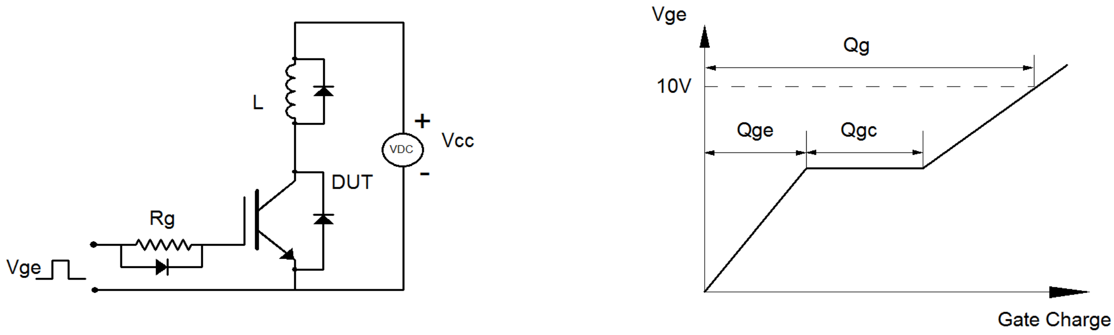

Figure A: Gate Charge Test Circuit & Waveforms

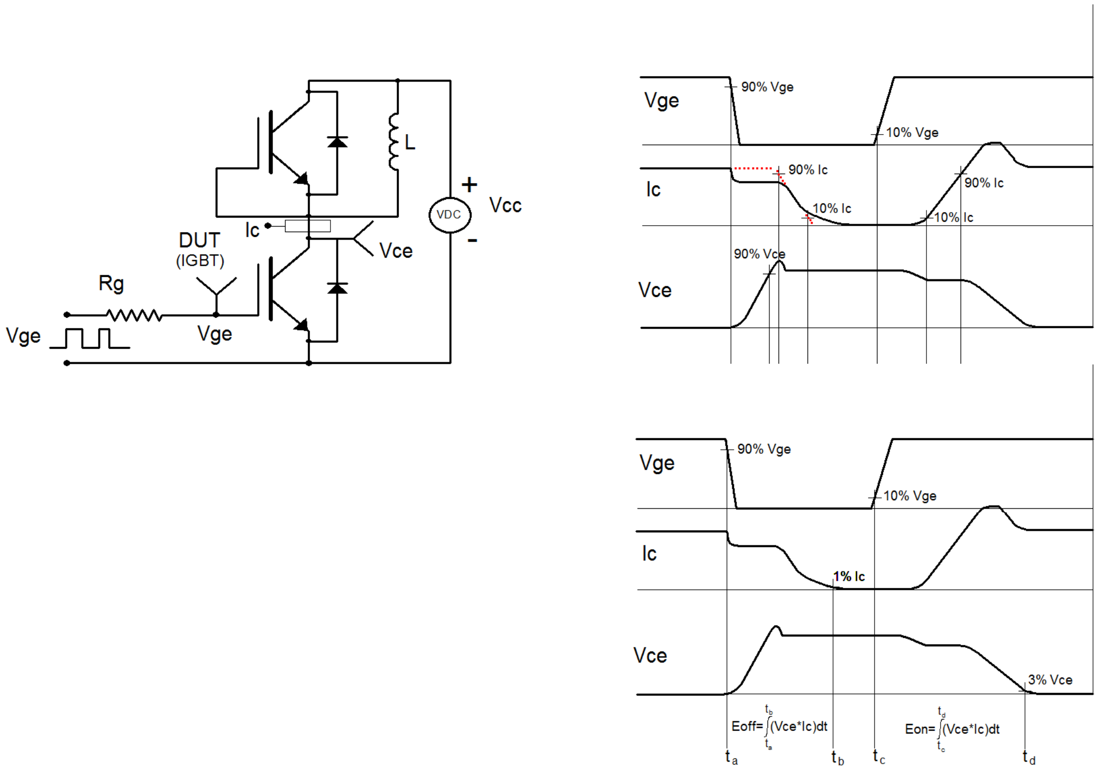

Figure B: Inductive Switching Test Circuit & Waveforms