ALPHA & OMEGA SEMICONDUCTOR

AOK50B65GL1

650V, 50A AlphaIGBT™

General Description

- 650V breakdown voltage
- Latest AlphaIGBT technology
- Optimized for current resonance application
- Very low conduction losses
- Switching with minimized tail current

Product Summary

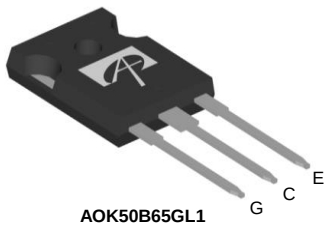
V_{CE}	650V
I_C (T_C=100°C)	50A
$V_{CE(sat)}$ (T_J=25°C)	1.6V

Applications

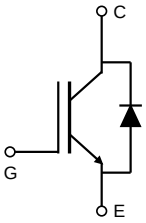
- Induction heating
- Microwave oven
- Flash Illumination
- Battery chargers

RoHS Compliant

TO-247



AOK50B65GL1



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOK50B65GL1	TO247	Tube	240

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	AOK50B65GL1	Units
Collector-Emitter Voltage		V_{CE}	650	V
Gate-Emitter Voltage		V_{GE}	±30	V
Continuous Collector Current	T_C=25°C	I_C	100	A
	T_C=100°C		50	
Pulsed Collector Current, Limited by T_{Jmax}		I_{CM}	300	A
Turn-Off SOA, V_{CE}≤650V, Limited by T_{Jmax}		I_{LM}	150	A
Continuous Diode Forward Current	T_C=25°C	I_F	40	A
	T_C=100°C		20	
Diode Pulsed Current, Limited by T_{Jmax}		I_{FM}	60	A
Power Dissipation	T_C=25°C	P_D	312	W
	T_C=100°C		156	
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	Typical	Units
Maximum Junction-to-Ambient	$R_{\theta JA}$	40	°C/W
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	0.48	°C/W
Maximum Diode Junction-to-Case	$R_{\theta JC}$	2.8	°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		650	-	-	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=50A	T_J=25°C	-	1.6	2	V
			T_J=125°C	-	1.86	-	
			T_J=175°C	-	2.00	-	
V_F	Diode Forward Voltage	V_{GE}=0V, I_F=20A	T_J=25°C	-	1.32	1.7	V
			T_J=125°C	-	1.31	-	
			T_J=175°C	-	1.33	-	
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	V_{CE}=5V, I_C=1mA		-	6.1	-	V
I_{CES}	Zero Gate Voltage Collector Current	V_{CE}=650V, V_{GE}=0V	T_J=25°C	-	-	10	µA
			T_J=125°C	-	-	100	
			T_J=175°C	-	-	5000	
I_{GES}	Gate-Emitter Leakage Current	V_{CE}=0V, V_{GE}=±30V		-	-	±100	nA
g_{FS}	Forward Transconductance	V_{CE}=20V, I_C=50A		-	53	-	S
DYNAMIC PARAMETERS							
C_{ies}	Input Capacitance	V_{GE}=0V, V_{CC}=25V, f=1MHz		-	4110	-	pF
C_{oes}	Output Capacitance			-	90	-	pF
C_{res}	Reverse Transfer Capacitance			-	70	-	pF
Q_g	Total Gate Charge	V_{GE}=15V, V_{CC}=520V, I_C=50A		-	120	-	nC
Q_{ge}	Gate to Emitter Charge			-	35	-	nC
Q_{gc}	Gate to Collector Charge			-	47	-	nC
R_g	Gate Resistance	V_{GE}=0V, V_{CC}=0V, f=1MHz		-	0.6	-	Ω
SWITCHING PARAMETERS, (Load Resistive, T_J=25°C)							
$t_{D(on)}$	Turn-On Delay Time	T_J=25°C V_{GE}=15V, V_{CC}=300V, I_C=50A, R_g=100Ω Resistive Load		-	282	-	ns
t_r	Turn-On Rise Time			-	176	-	ns
$t_{D(off)}$	Turn-Off Delay Time			-	915	-	ns
t_f	Turn-Off Fall Time			-	88	-	ns
E_{on}	Turn-On Energy			-	3.37	-	mJ
E_{off}	Turn-Off Energy			-	1.59	-	mJ
E_{total}	Total Switching Energy			-	4.96	-	mJ
SWITCHING PARAMETERS, (Load Resistive, T_J=175°C)							
$t_{D(on)}$	Turn-On Delay Time	T_J=175°C V_{GE}=15V, V_{CC}=300V, I_C=50A, R_g=100Ω Resistive Load		-	249	-	ns
t_r	Turn-On Rise Time			-	180	-	ns
$t_{D(off)}$	Turn-Off Delay Time			-	968	-	ns
t_f	Turn-Off Fall Time			-	75	-	ns
E_{on}	Turn-On Energy			-	3.73	-	mJ
E_{off}	Turn-Off Energy			-	1.91	-	mJ
E_{total}	Total Switching Energy			-	5.64	-	mJ

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

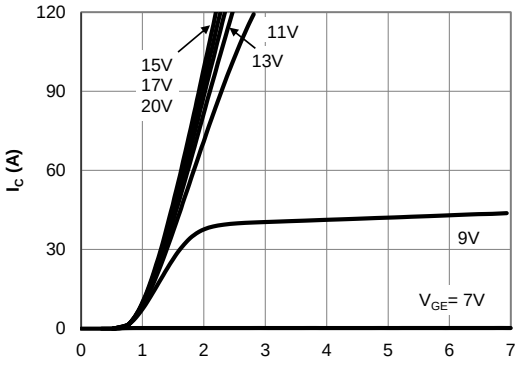


Figure 1: Output Characteristic (T_j=25°C)

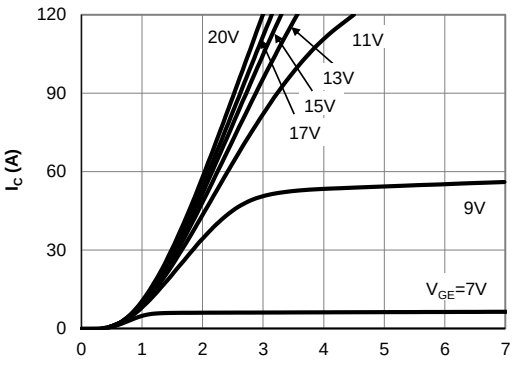


Figure 2: Output Characteristic (T_j=175°C)

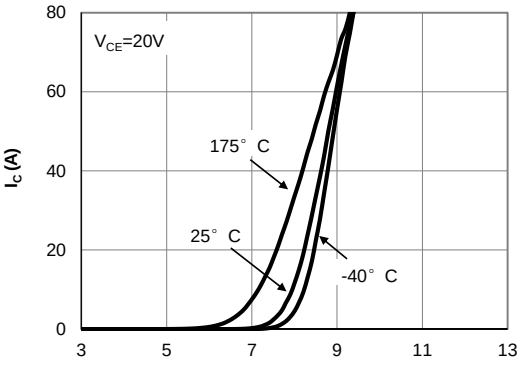


Figure 3: Transfer Characteristic

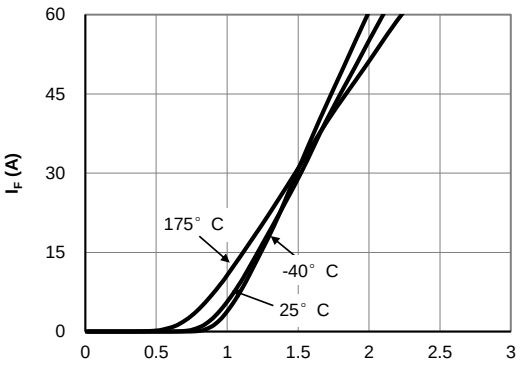


Figure 4: Diode Characteristic

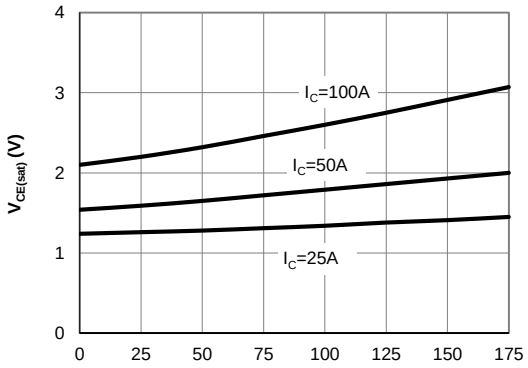


Figure 5: Collector-Emitter Saturation Voltage vs. Junction Temperature

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

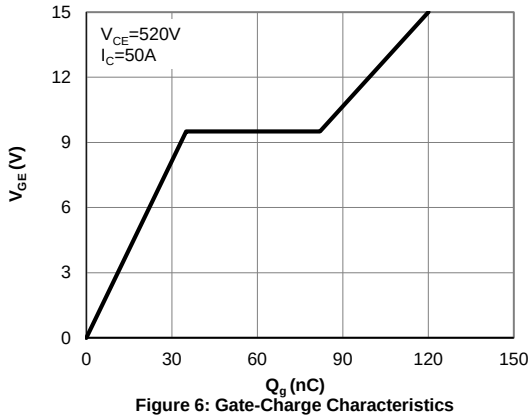


Figure 6: Gate-Charge Characteristics

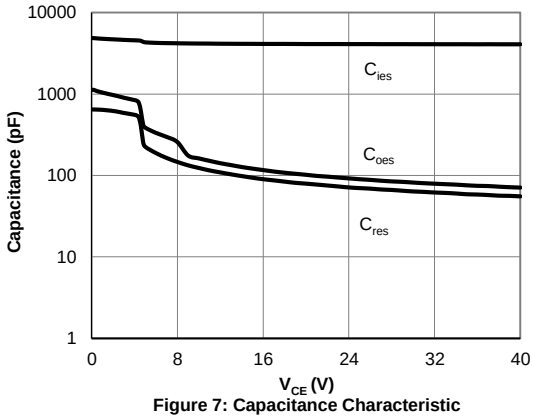


Figure 7: Capacitance Characteristic

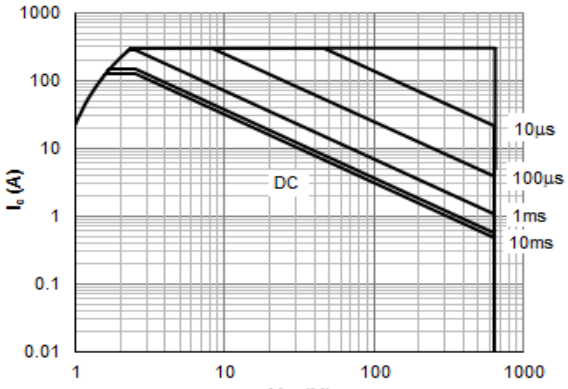


Figure 8: Forward Bias Safe Operating Area
(T_C=25°C, V_{GE}=15V)

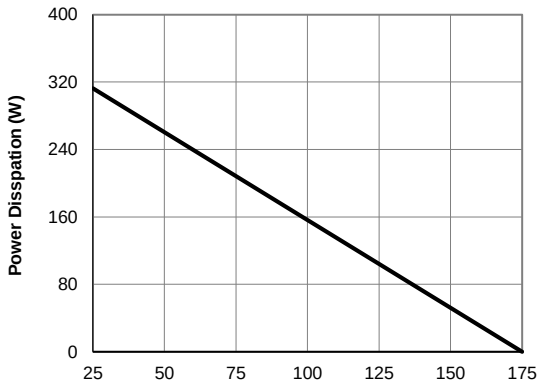


Figure 9: Power Disspation as a Function of Case

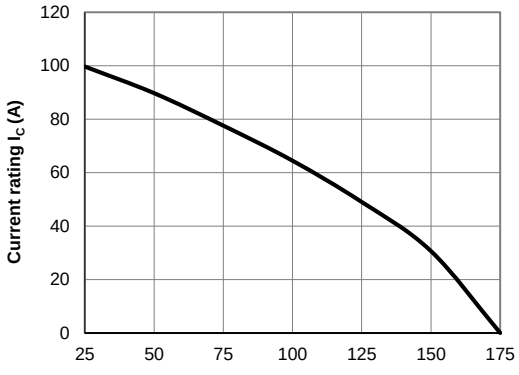


Figure 10: Current De-rating

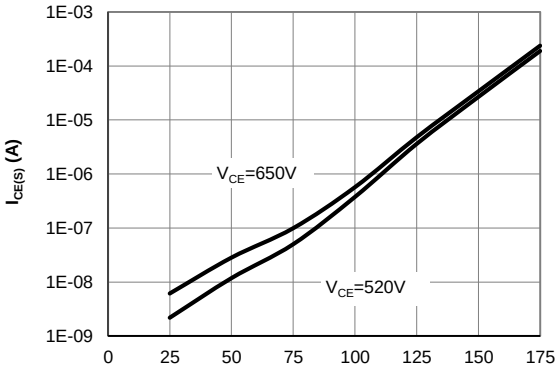


Figure 11: Diode Reverse Leakage Current vs. Junction Temperature

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

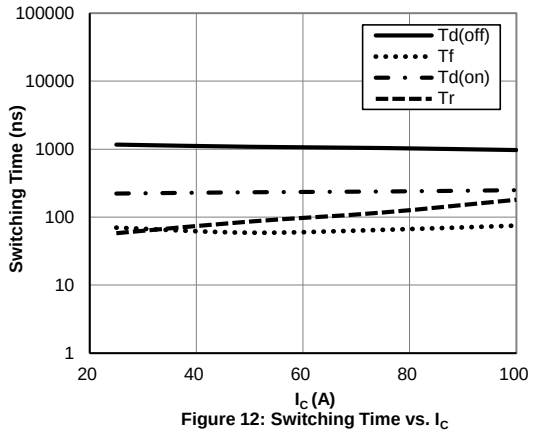


Figure 12: Switching Time vs. I_C
(T_j=175°C, V_{GE}=15V, V_{CE}=300V, R_g=100Ω)

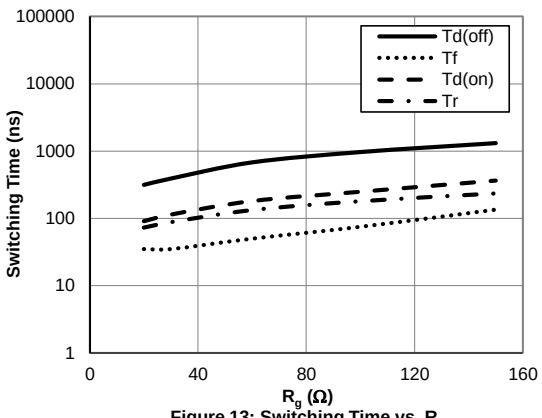


Figure 13: Switching Time vs. R_g
(T_j=175°C, V_{GE}=15V, V_{CE}=300V, I_C=50A)

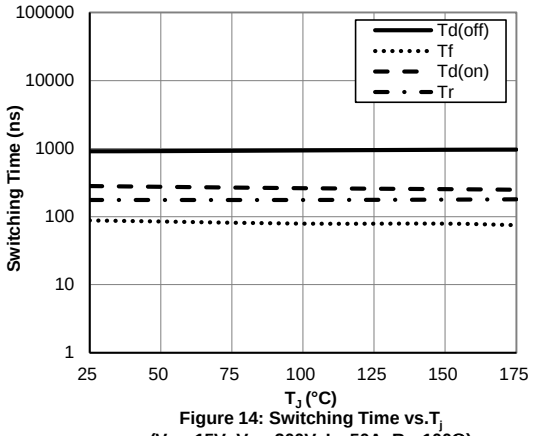


Figure 14: Switching Time vs.T_j
(V_{GE}=15V, V_{CE}=300V, I_C=50A, R_g=100Ω)

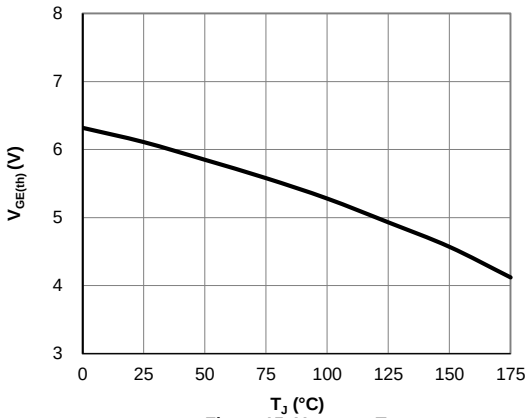


Figure 15: $V_{GE(th)}$ vs. T_j

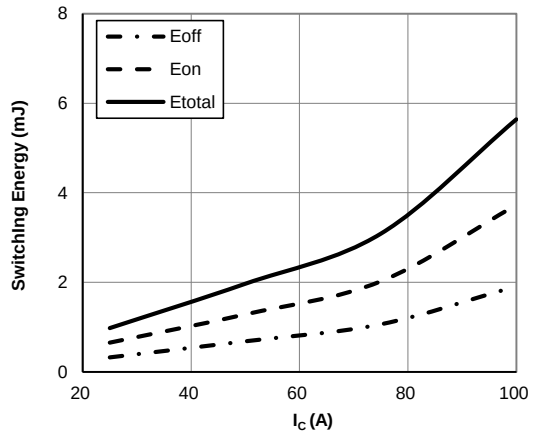


Figure 16: Switching Loss vs. I_C
(T_j=175°C, V_{GE}=15V, V_{CE}=300V, R_g=100Ω)

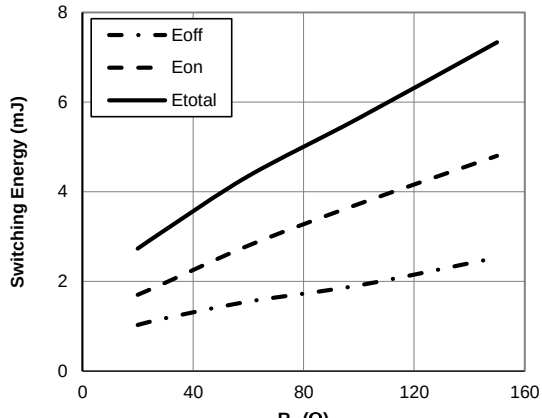


Figure 17: Switching Loss vs. R_g
(T_j=175°C, V_{GE}=15V, V_{CE}=300V, I_C=50A)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

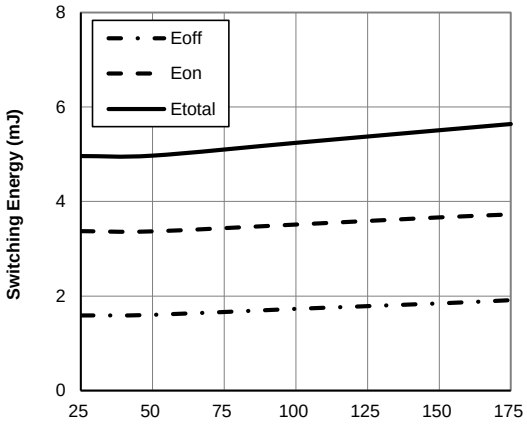


Figure 18: Switching Loss vs. T_j
(V_{GE}=15V, V_{CE}=300V, I_C=50A, R_g=100Ω)

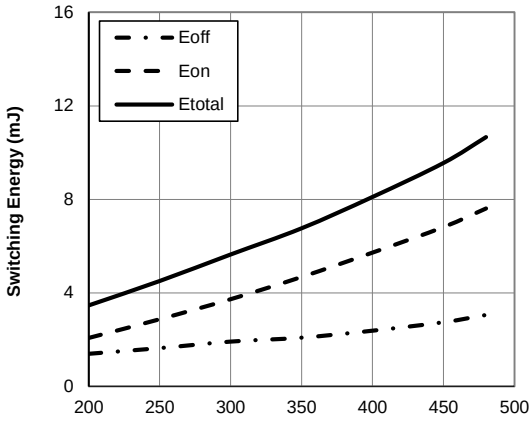


Figure 19: Switching Loss vs. V_{CE}
(T_j=175°C, V_{GE}=15V, I_C=50A, R_g=100Ω)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

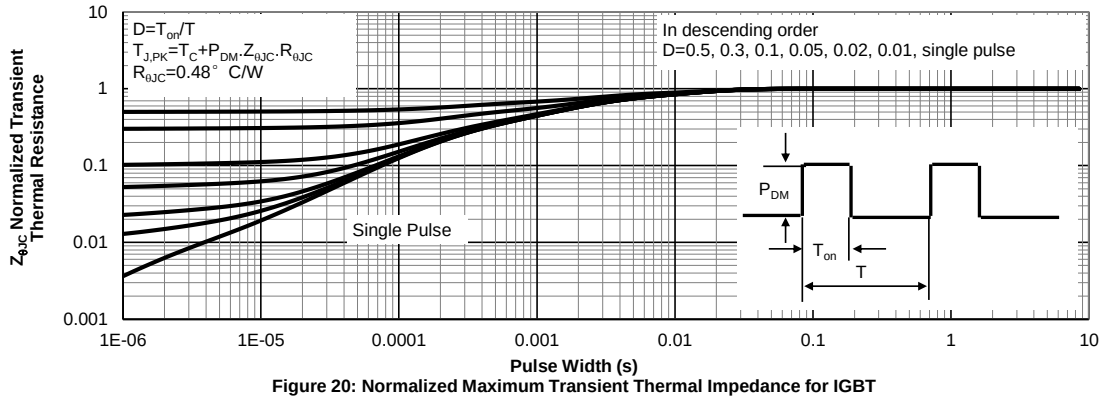


Figure 20: Normalized Maximum Transient Thermal Impedance for IGBT

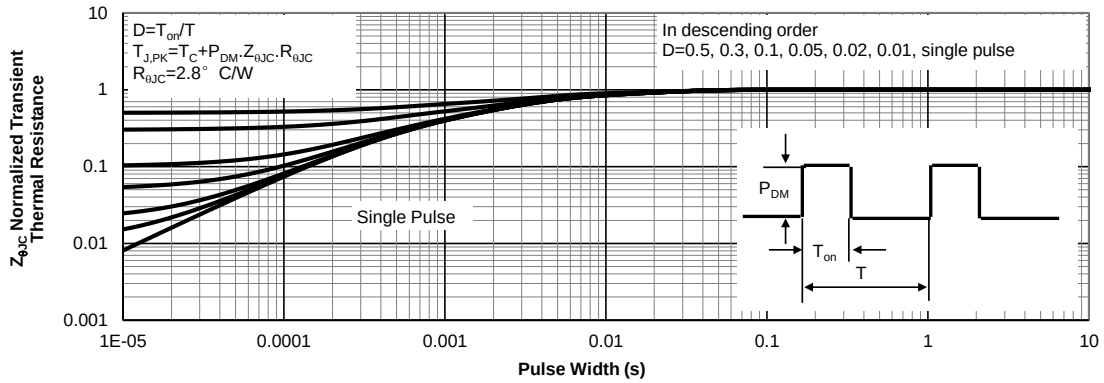


Figure 21: Normalized Maximum Transient Thermal Impedance for Diode

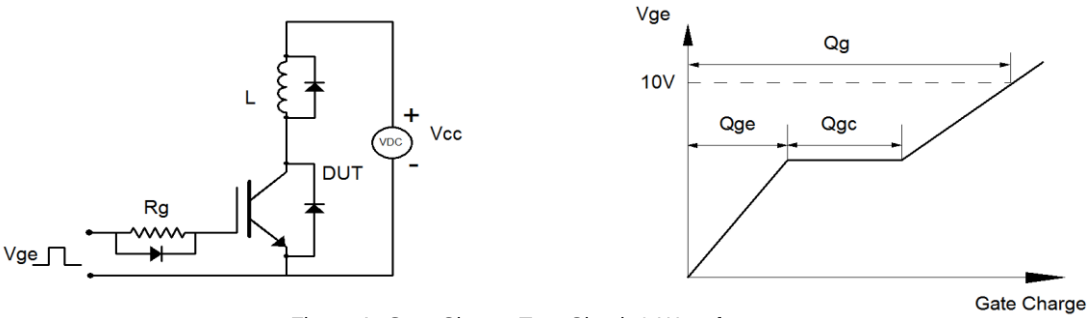


Figure A: Gate Charge Test Circuit & Waveforms

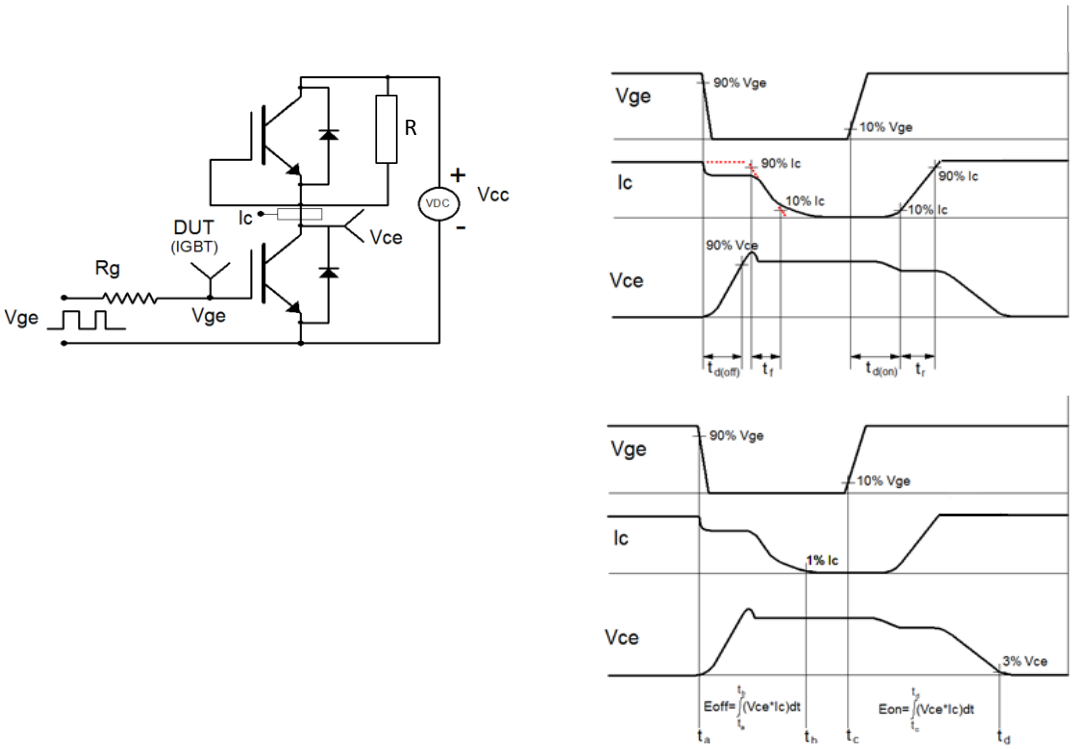


Figure B: Resistive Switching Test Circuit & Waveforms