ALPHA & OMEGA SEMICONDUCTOR

AOD5B65N1

650V, 5A Alpha IGBT™

With soft and fast recovery anti-parallel diode

General Description

- Latest Alpha IGBT (α IGBT) technology
- 650V breakdown voltage
- Very low turn-off switching loss with softness
- Fast and soft recovery freewheeling diode
- High efficient turn-on di/dt controllability
- Very good EMI behavior
- Short-circuit ruggedness

Applications

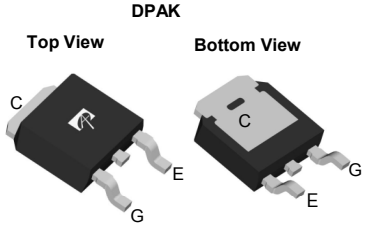
- Motor Drives
- Home Appliance and Fan Motor Applications
- Other Hard Switching Applications

Product Summary

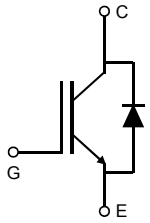
V_{CE}	650V
I_C (T_C=100°C)	5A
$V_{CE(sat)}$ (T_J=25°C)	2V

Green Product

TO-252
DPAK



AOD5B65N1



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOD5B65N1	TO252	Tape & Reel	2500

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	AOD5B65N1	Units
Collector-Emitter Voltage		V_{CE}	650	V
Gate-Emitter Voltage		V_{GE}	±30	V
Continuous Collector Current	T_C=25°C	I_C	10	A
	T_C=100°C		5	
Pulsed Collector Current, Limited by T_{Jmax}		I_{CM}	15	A
Turn off SOA, V_{CE}≤650V, Limited by T_{Jmax}		I_{LM}	15	A
Continuous Diode Forward Current	T_C=25°C	I_F	6.6	A
	T_C=100°C		2.6	
Diode Pulsed Current, Limited by T_{Jmax}		I_{FM}	15	A
Short circuit withstanding time 1) V_{GE}=15V, V_{CC}≤300V, T_J≤150°C		t_{SC}	5	µs
Power Dissipation	T_C=25°C	P_D	52	W
	T_C=100°C		21	
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	AOD5B65N1	Units
Maximum Junction-to-Ambient	$R_{\theta JA}$	55	°C/W
Maximum IGBT Junction-to-Case	$R_{\theta JC}$	2.4	°C/W
Maximum Diode Junction-to-Case	$R_{\theta JC}$	6.8	°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=5A	T_J=25°C	-	2	2.5	V
			T_J=125°C	-	2.5	-	
			T_J=150°C	-	2.64	-	
V_F	Diode Forward Voltage	V_{GE}=0V, I_C=5A	T_J=25°C	-	2.13	2.7	V
			T_J=125°C	-	2.21	-	
			T_J=150°C	-	2.17	-	
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	V_{CE}=5V, I_C=1mA		-	5.2	-	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=150°C	-	-	500	
I_{GES}	Gate-Emitter leakage current	V_{CE}=0V, V_{GE}=±30V		-	-	±100	nA
g_{FS}	Forward Transconductance	V_{CE}=20V, I_C=5A		-	3.1	-	S
DYNAMIC PARAMETERS							
C_{ies}	Input Capacitance	V_{GE}=0V, V_{CC}=25V, f=1MHz		-	230	-	pF
C_{oes}	Output Capacitance			-	20	-	pF
C_{res}	Reverse Transfer Capacitance			-	6.6	-	pF
Q_g	Total Gate Charge	V_{GE}=15V, V_{CC}=520V, I_C=5A		-	9.2	-	nC
Q_{ge}	Gate to Emitter Charge			-	2.2	-	nC
Q_{gc}	Gate to Collector Charge			-	4.3	-	nC
$I_{C(SC)}$	Short circuit collector current	V_{GE}=15V, V_{CC}=300V, $t_{sc}\leqslant$5us, $T_J\leqslant$150°C		-	24	-	A
R_g	Gate resistance	V_{GE}=0V, V_{CC}=0V, f=1MHz		-	20	-	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=5A, R_G=60Ω		-	8	-	ns
t_r	Turn-On Rise Time			-	14	-	ns
$t_{D(off)}$	Turn-Off Delay Time			-	73	-	ns
t_f	Turn-Off Fall Time			-	16	-	ns
E_{on}	Turn-On Energy			-	0.081	-	mJ
E_{off}	Turn-Off Energy			-	0.049	-	mJ
E_{total}	Total Switching Energy			-	0.13	-	mJ
t_{rr}	Diode Reverse Recovery Time	T_J=25°C, I_F=5A, dI/dt=200A/µs, V_{CC}=400V		-	170	-	ns
Q_{rr}	Diode Reverse Recovery Charge			-	0.19	-	µC
I_{rm}	Diode Peak Reverse Recovery Current			-	2.5	-	A
SWITCHING PARAMETERS, (Load Inductive, T_J=150°C)							
$t_{D(on)}$	Turn-On DelayTime	T_J=150°C, V_{GE}=15V, V_{CC}=400V, I_C=5A, R_G=60Ω		-	7	-	ns
t_r	Turn-On Rise Time			-	16	-	ns
$t_{D(off)}$	Turn-Off Delay Time			-	88	-	ns
t_f	Turn-Off Fall Time			-	26	-	ns
E_{on}	Turn-On Energy			-	0.09	-	mJ
E_{off}	Turn-Off Energy			-	0.089	-	mJ
E_{total}	Total Switching Energy			-	0.179	-	mJ
t_{rr}	Diode Reverse Recovery Time	T_J=150°C, I_F=5A, dI/dt=200A/µs, V_{CC}=400V		-	273	-	ns
Q_{rr}	Diode Reverse Recovery Charge			-	0.34	-	µC
I_{rm}	Diode Peak Reverse Recovery Current			-	3.2	-	A

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

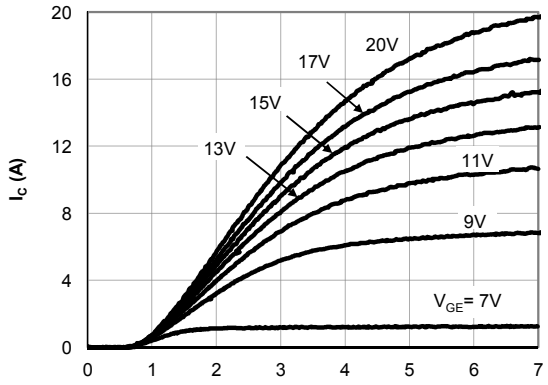


Figure 1: Output Characteristic (T_j=25°C)

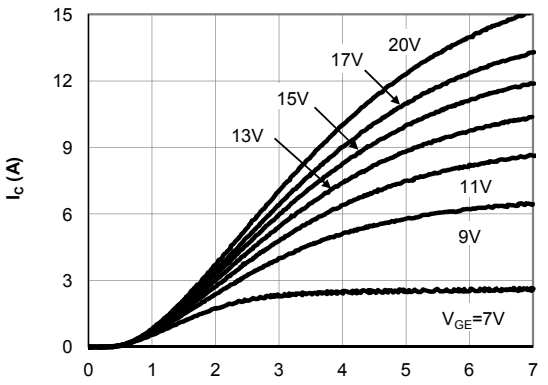


Figure 2: Output Characteristic (T_j=150°C)

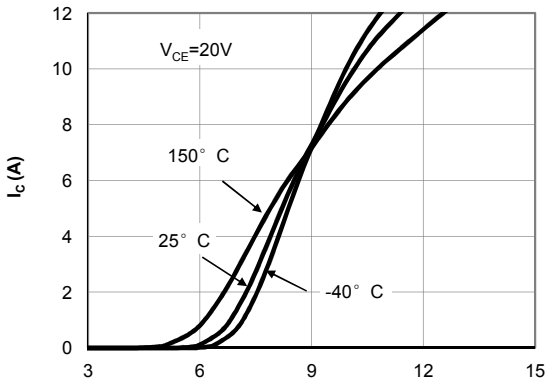


Figure 3: Transfer Characteristic

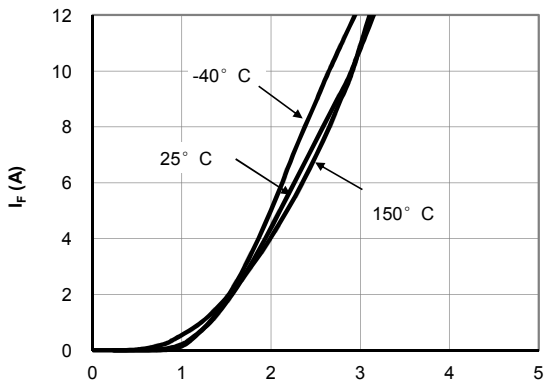


Figure 4: Diode Characteristic

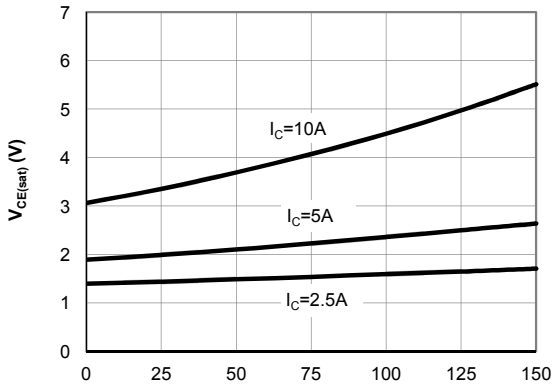


Figure 5: Collector-Emitter Saturation Voltage vs. Junction Temperature

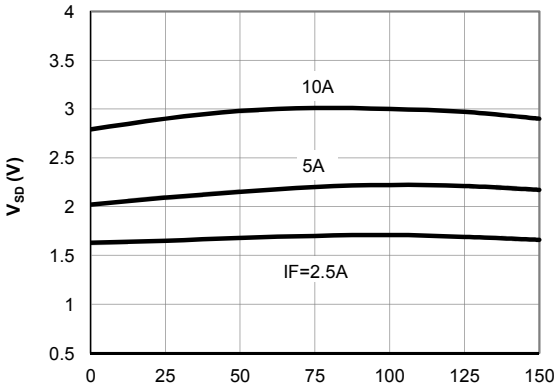


Figure 6: Diode Forward voltage vs. Junction Temperature

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

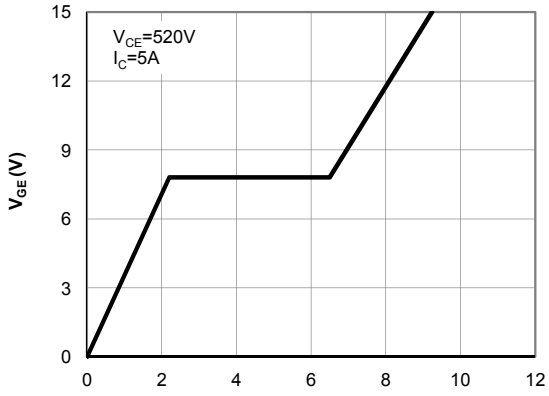


Figure 7: Gate-Charge Characteristics

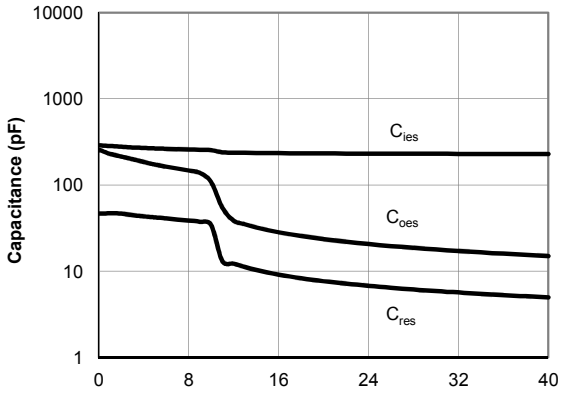


Figure 8: Capacitance Characteristic

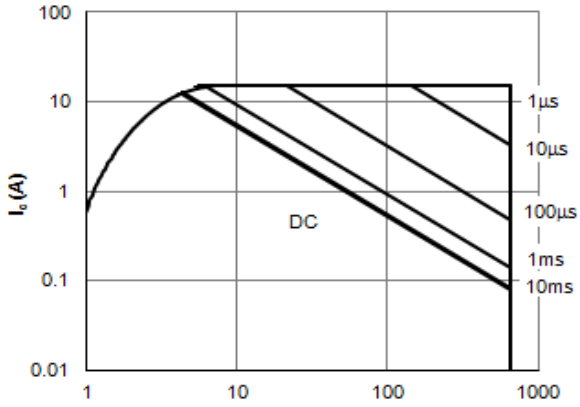


Figure 9: Forward Bias Safe Operating Area
(T_C=25°C, V_{GE}=15V)

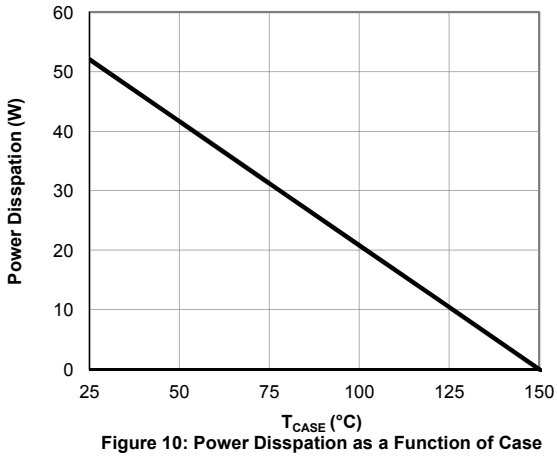


Figure 10: Power Disspation as a Function of Case

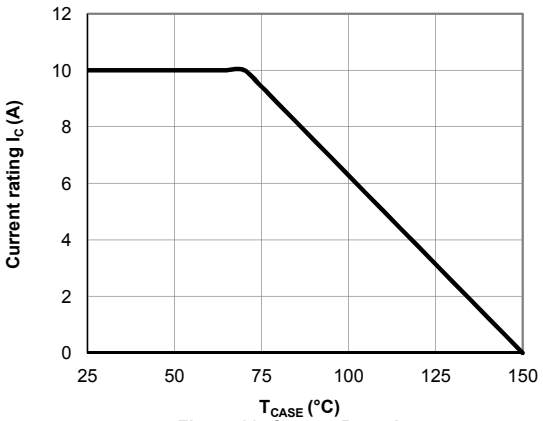


Figure 11: Current De-rating

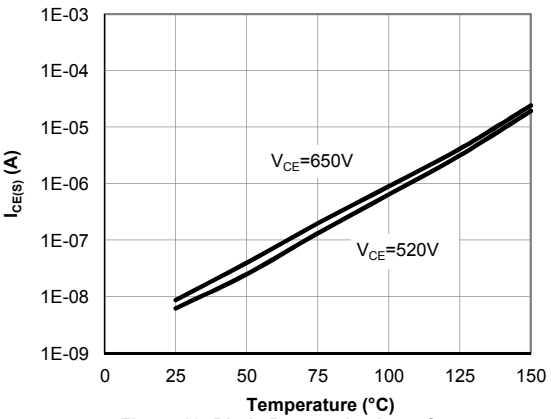


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

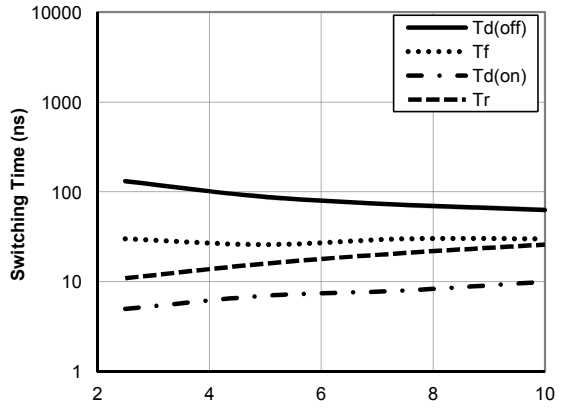


Figure 13: Switching Time vs. I_C
(T_j=150°C, V_{GE}=15V, V_{CE}=400V, R_g=60Ω)

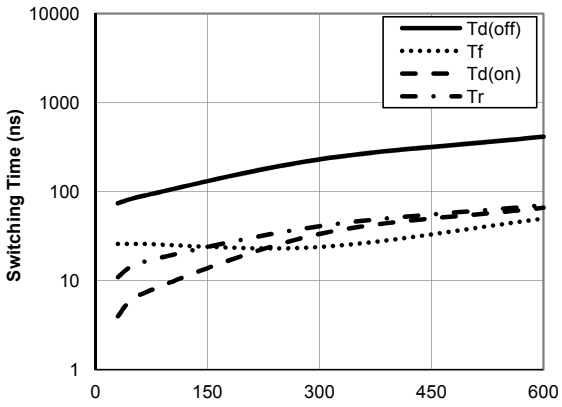


Figure 14: Switching Time vs. R_g
(T_j=150°C, V_{GE}=15V, V_{CE}=400V, I_C=5A)

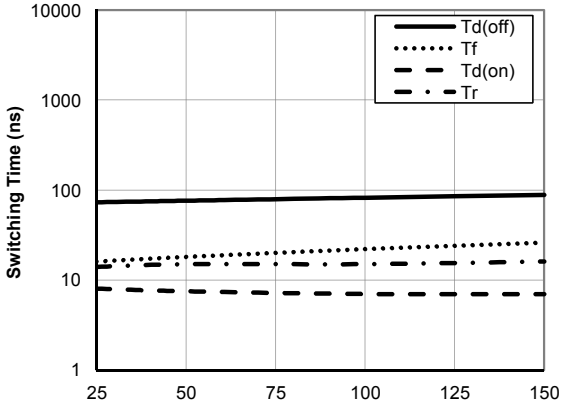


Figure 15: Switching Time vs.T_j
(V_{GE}=15V, V_{CE}=400V, I_C=5A, R_g=60Ω)

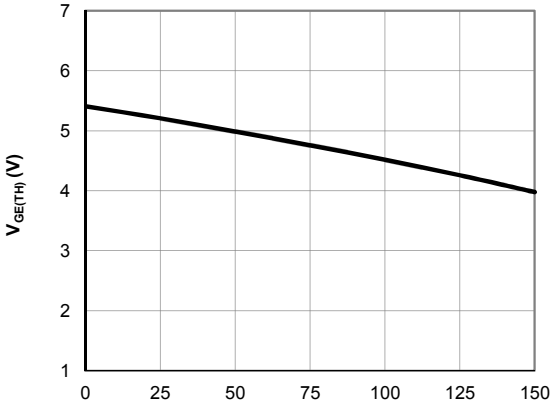


Figure 16: $V_{GE(TH)}$ vs. T_j

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

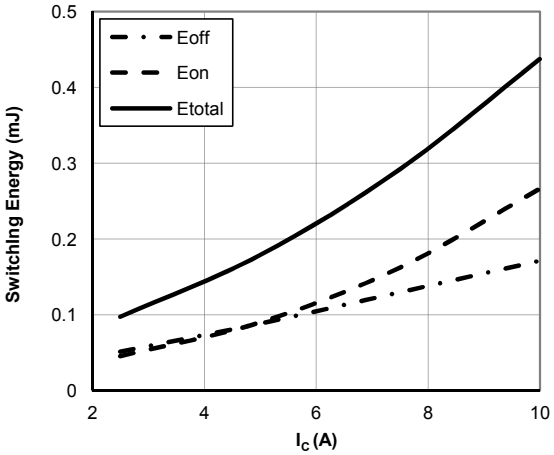


Figure 17: Switching Loss vs. I_C
(T_j=150°C, V_{GE}=15V, V_{CE}=400V, R_g=60Ω)

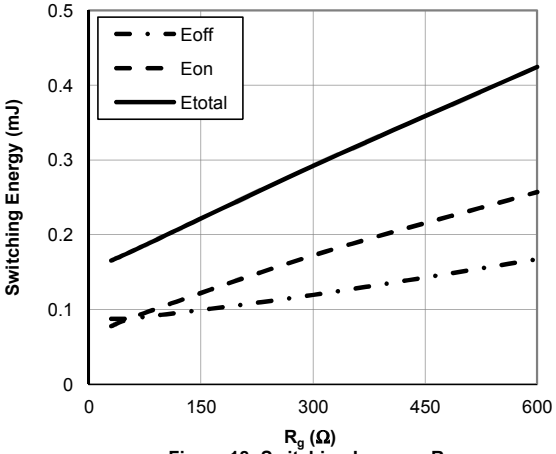


Figure 18: Switching Loss vs. R_g
(T_j=150°C, V_{GE}=15V, V_{CE}=400V, I_C=5A)

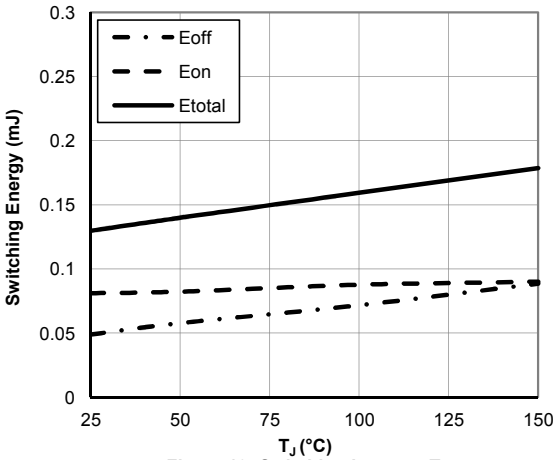


Figure 19: Switching Loss vs. T_j
(V_{GE}=15V, V_{CE}=400V, I_C=5A, R_g=60Ω)

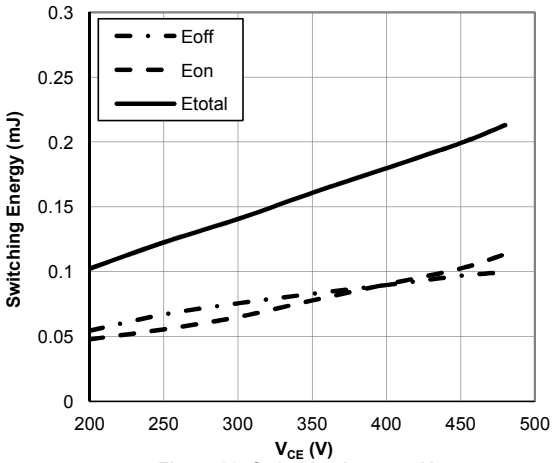


Figure 20: Switching Loss vs. V_{CE}
(T_j=150°C, V_{GE}=15V, I_C=5A, R_g=60Ω)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

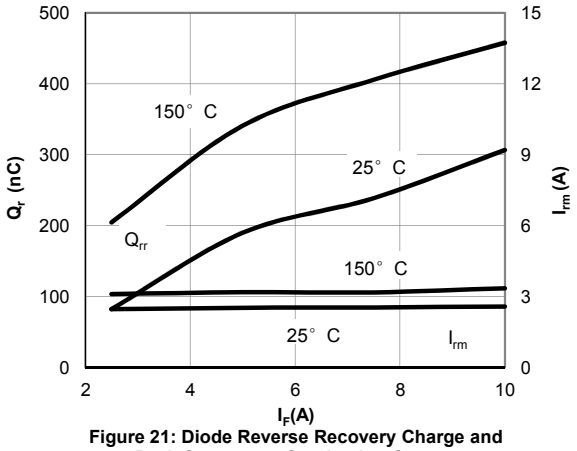


Figure 21: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current (V_{GE}=15V, V_{CE}=400V, di/dt=200A/µs)

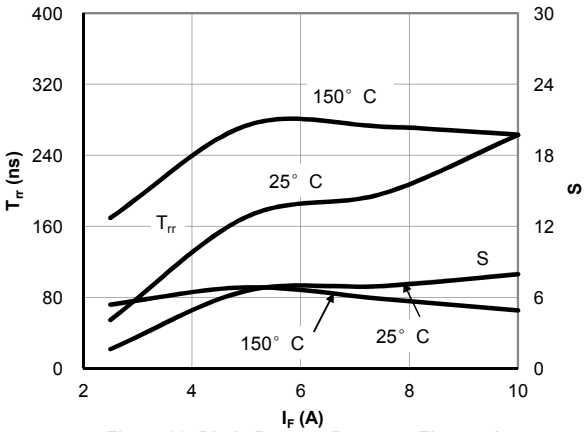


Figure 22: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current (V_{GE}=15V, V_{CE}=400V, di/dt=200A/µs)

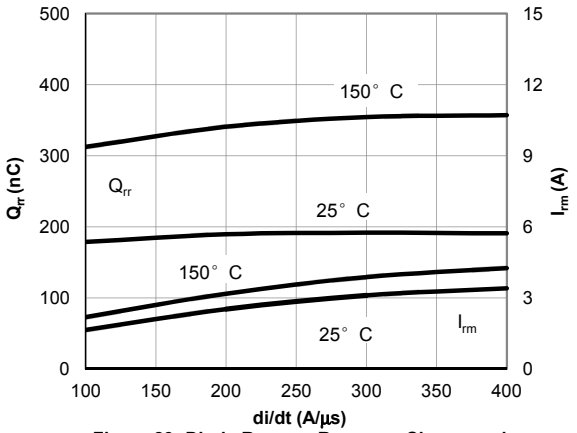


Figure 23: Diode Reverse Recovery Charge and Peak Current vs. di/dt (V_{GE}=15V, V_{CE}=400V, I_F=5A)

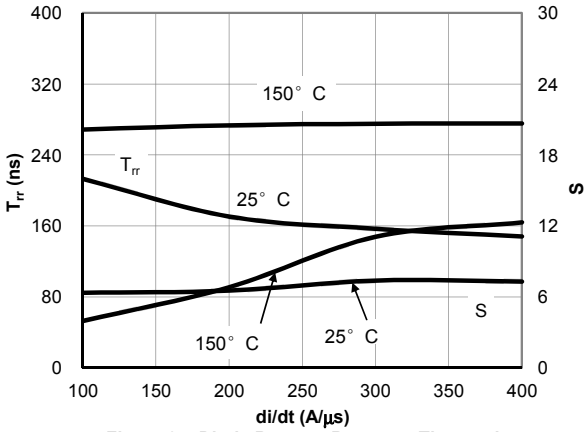


Figure 24: Diode Reverse Recovery Time and Softness Factor vs. di/dt (V_{GE}=15V, V_{CE}=400V, I_F=5A)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

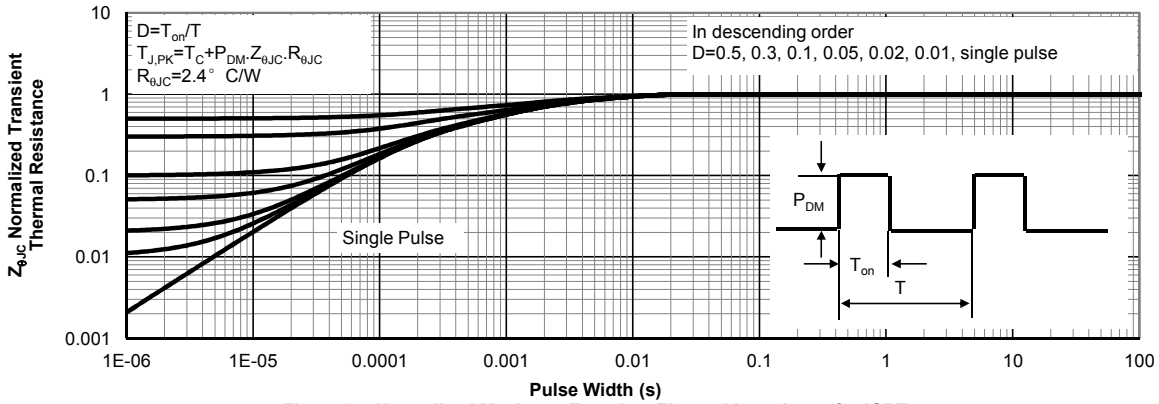


Figure 25: Normalized Maximum Transient Thermal Impedance for IGBT

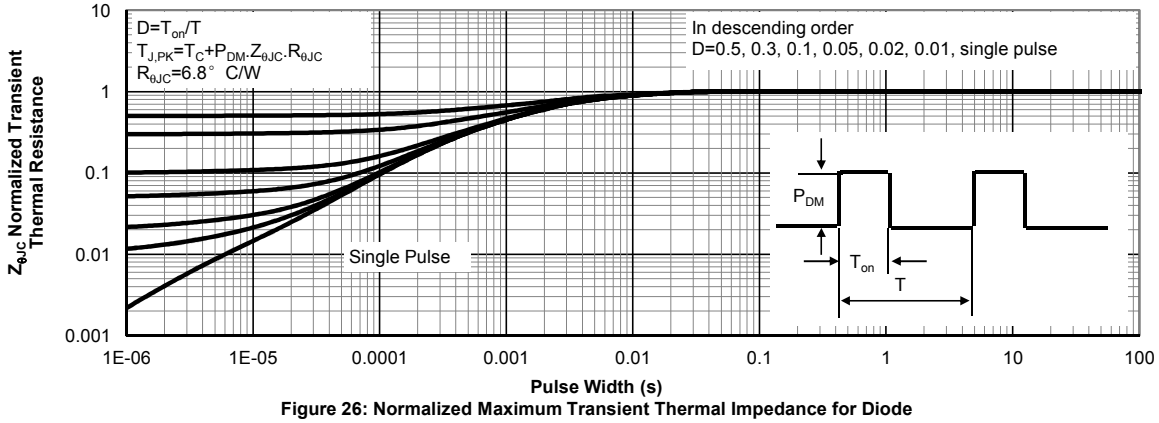


Figure 26: Normalized Maximum Transient Thermal Impedance for Diode

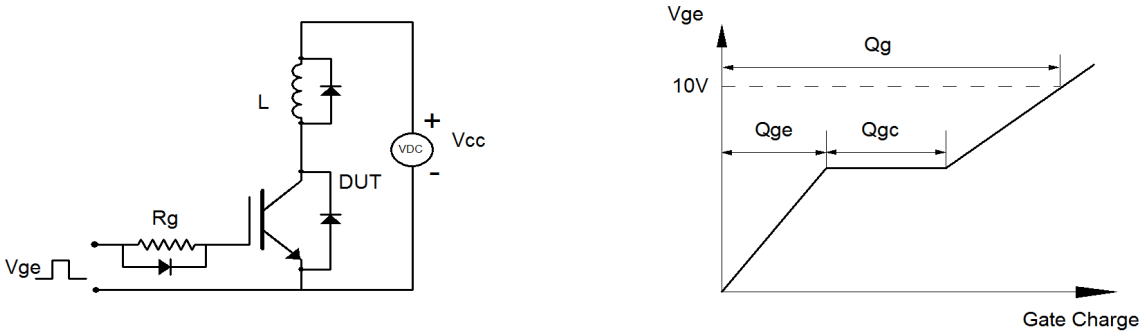


Figure A: Gate Charge Test Circuit & Waveforms

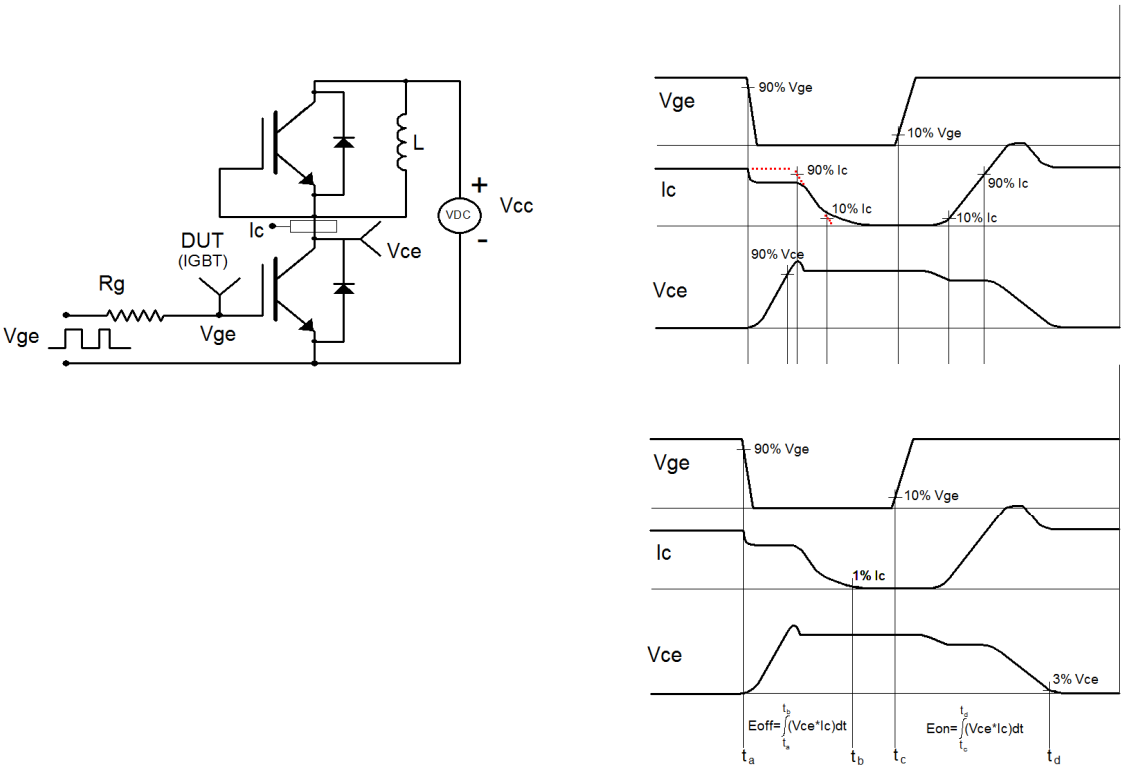


Figure B: Inductive Switching Test Circuit & Waveforms

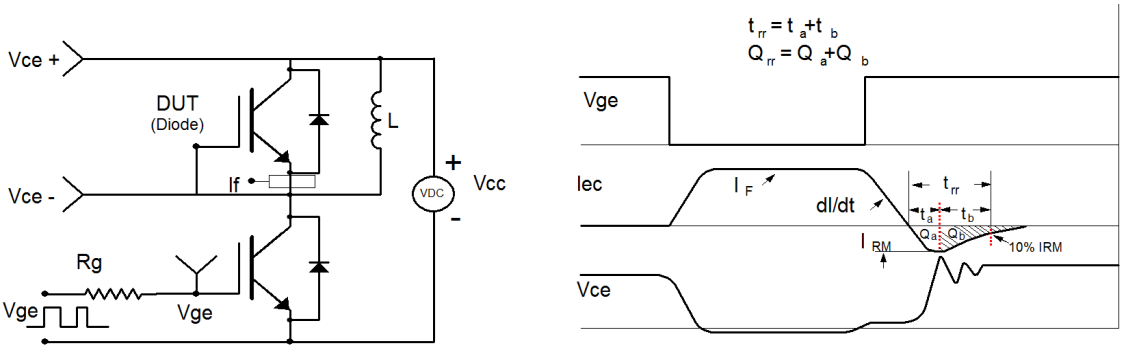


Figure C: Diode Recovery Test Circuit & Waveforms