

General Description

- Latest AlphaIGBT (αIGBT) technology
- 650V Breakdown voltage
- Very low V_{CE(sat)}
- Very fast and soft recovery freewheeling diode
- High efficient turn-on di/dt controllability
- Low Turn-Off switching loss and softness
- Very good EMI behavior

Applications

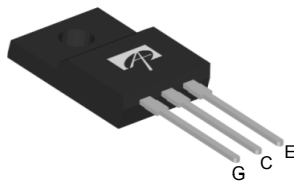
- Motor Drives
- Power Tools and Sewing Machines
- Mid to High Range Switching Frequency Converters
- Other Hard Switching Applications

Product Summary

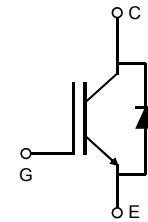
V _{CE}	650V
I _C (T _C =100°C)	20A
V _{CE(sat)} (T _J =25°C)	1.54V



TO-220F



AOTF20B65LN2



Orderable Part Number	Package Type	Form	Minimum Order Quantity
AOTF20B65LN2	TO220F	Tube	1000

Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter	Symbol	AOTF20B65LN2	Units
Collector-Emitter Voltage	V _{CE}	650	V
Gate-Emitter Voltage	V _{GE}	±30	V
Continuous Collector Current	I _C	T _C =25°C	40 ⁽²⁾
		T _C =100°C	20 ⁽²⁾
Pulsed Collector Current, Limited by T _{Jmax}	I _{CM}	60	A
Turn off SOA, V _{CE} ≤ 650V, Limited by T _{Jmax}	I _{LM}	60	A
Continuous Diode Forward Current	I _F	T _C =25°C	40 ⁽²⁾
		T _C =100°C	20 ⁽²⁾
Diode Pulsed Current, Limited by T _{Jmax}	I _{FM}	60	A
Power Dissipation	P _D	T _C =25°C	45
		T _C =100°C	18
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	AOTF20B65LN2	Units
Maximum Junction-to-Ambient	R _{θJA}	65	°C/W
Maximum IGBT Junction-to-Case	R _{θJC}	2.8	°C/W
Maximum Diode Junction-to-Case	R _{θJC}	3.2	°C/W

1) TO220F I_C follows TO220/TO263.

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 =20A	T _J =25°C	-	1.54	1.95	V
			T _J =125°C	-	1.83	-	
			T _J =150°C	-	1.91	-	
V _F	Diode Forward Voltage	V _{GE} =0V, I _F =20A	T _J =25°C	-	1.6	2.1	V
			T _J =125°C	-	1.66	-	
			T _J =150°C	-	1.63	-	
V _{GE(th)}	Gate-Emitter Threshold Voltage	V _{CE} =5V, I _C =1mA	-	4.7	-	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 =150°C	-	-	1000	
I _{GES}	Gate-Emitter leakage current	V _{CE} =0V, V _{GE} =±30V	-	-	±100	nA	
g _{FS}	Forward Transconductance	V _{CE} =20V, I _C =20A	-	19	-	S	
DYNAMIC PARAMETERS							
C _{ies}	Input Capacitance	V _{GE} =0V, V _{CC} =25V, f=1MHz	-	1237	-	pF	
C _{oes}	Output Capacitance		-	124	-	pF	
C _{res}	Reverse Transfer Capacitance		-	38	-	pF	
Q _g	Total Gate Charge	V _{GE} =15V, V _{CC} =520V, I _C =20A	-	52	-	nC	
Q _{ge}	Gate to Emitter Charge		-	14	-	nC	
Q _{gc}	Gate to Collector Charge		-	22	-	nC	
R _g	Gate resistance	V _{GE} =0V, V _{CC} =0V, f=1MHz	-	11	-	Ω	
SWITCHING PARAMETERS, (Load Inductive, T_J=25°C)							
T _{d(on)}	Turn-On Delay Time	T _J =25°C V _{GE} =15V, V _{CC} =400V, I _C =20A, R _G =15Ω	-	23	-	ns	
T _r	Turn-On Rise Time		-	23	-	ns	
T _{d(off)}	Turn-Off Delay Time		-	135	-	ns	
T _f	Turn-Off Fall Time		-	12	-	ns	
E _{on}	Turn-On Energy		-	0.45	-	mJ	
E _{off}	Turn-Off Energy		-	0.26	-	mJ	
E _{total}	Total Switching Energy		-	0.71	-	mJ	
T _{rr}	Diode Reverse Recovery Time		T _J =25°C	-	266	-	ns
Q _{rr}	Diode Reverse Recovery Charge		I _F =20A, dl/dt=200A/μs, V _{CC} =400V	-	0.6	-	μC
I _{rm}	Diode Peak Reverse Recovery Current	-	-	5.4	-	A	
SWITCHING PARAMETERS, (Load Inductive, T_J=150°C)							
T _{d(on)}	Turn-On Delay Time	T _J =150°C V _{GE} =15V, V _{CC} =400V, I _C =20A, R _G =15Ω	-	22	-	ns	
T _r	Turn-On Rise Time		-	24	-	ns	
T _{d(off)}	Turn-Off Delay Time		-	160	-	ns	
T _f	Turn-Off Fall Time		-	20	-	ns	
E _{on}	Turn-On Energy		-	0.49	-	mJ	
E _{off}	Turn-Off Energy		-	0.44	-	mJ	
E _{total}	Total Switching Energy		-	0.93	-	mJ	
T _{rr}	Diode Reverse Recovery Time		T _J =150°C	-	363	-	ns
Q _{rr}	Diode Reverse Recovery Charge		I _F =20A, dl/dt=200A/μs, V _{CC} =400V	-	1.3	-	μC
I _{rm}	Diode Peak Reverse Recovery Current	-	-	6.9	-	A	

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TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

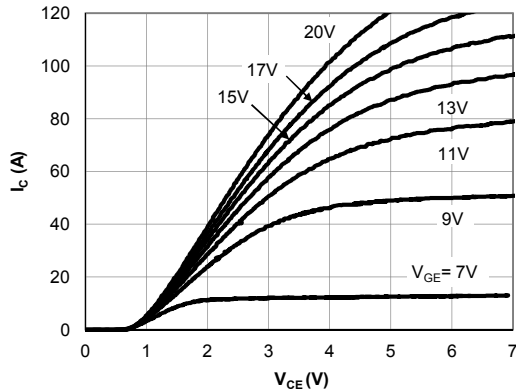


Figure 1: Output Characteristic
($T_j=25^\circ\text{C}$)

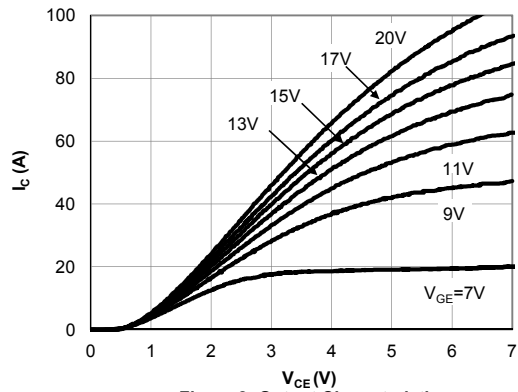


Figure 2: Output Characteristic
($T_j=150^\circ\text{C}$)

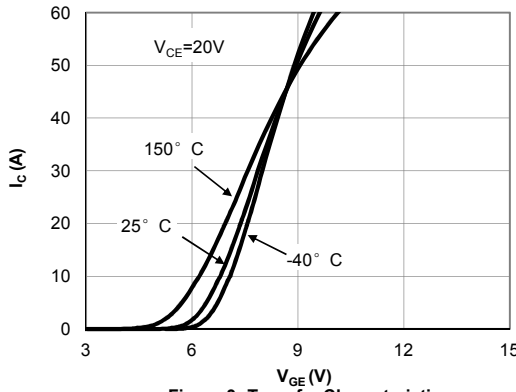


Figure 3: Transfer Characteristic

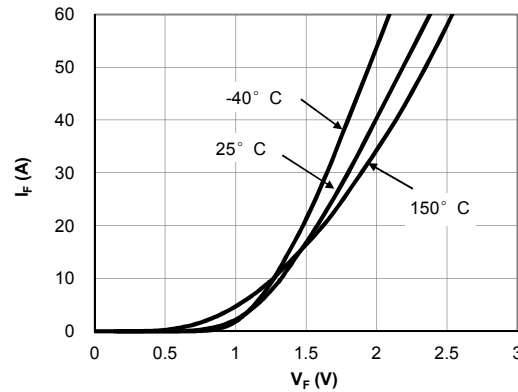


Figure 4: Diode Characteristic

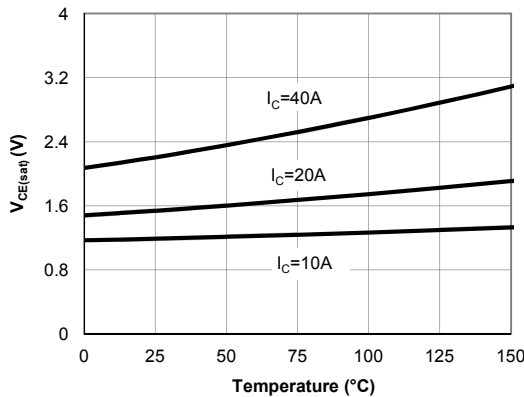


Figure 5: Collector-Emitter Saturation Voltage vs. Junction Temperature

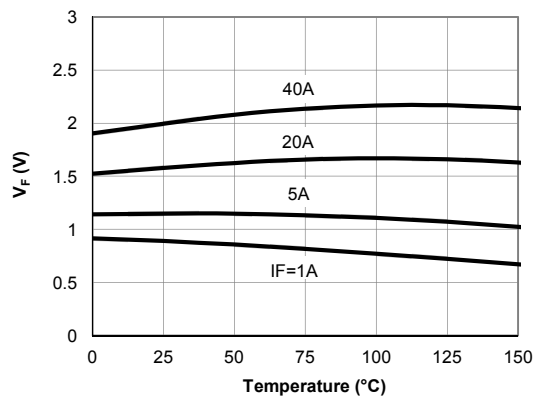


Figure 6: Diode Forward voltage vs. Junction Temperature

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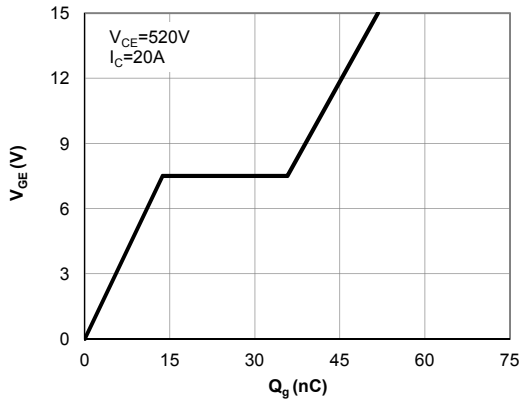


Figure 7: Gate-Charge Characteristics

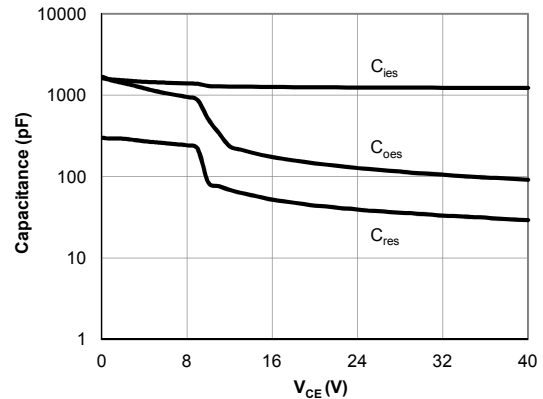


Figure 8: Capacitance Characteristic

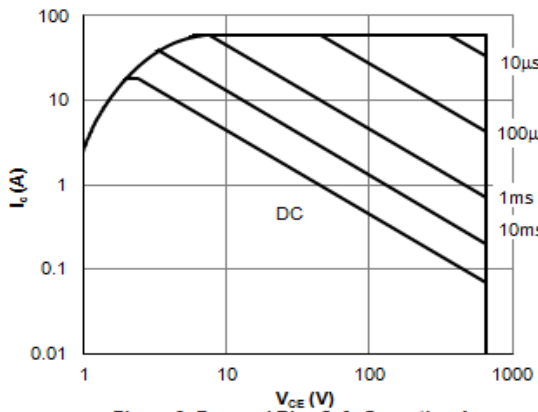


Figure 9: Forward Bias Safe Operating Area
($T_C=25^\circ\text{C}$, $V_{GE}=15\text{V}$)

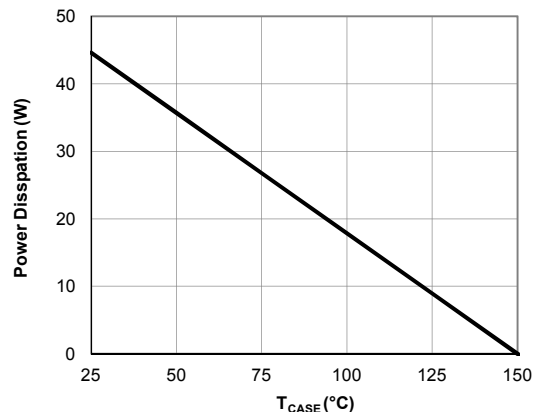


Figure 10: Power Dissipation as a Function of Case

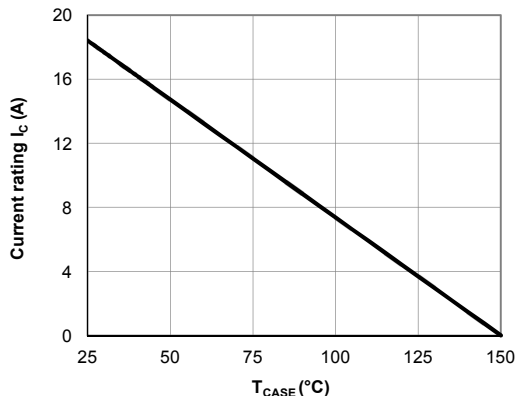


Figure 11: Current De-rating

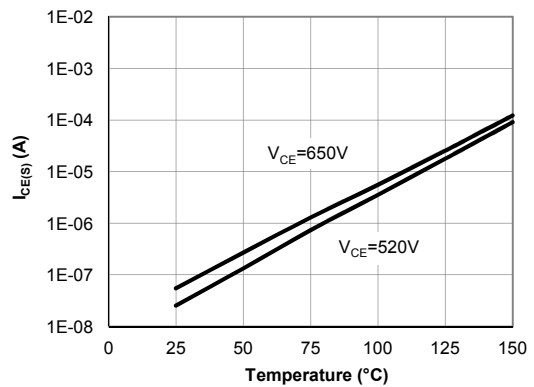


Figure 12: Diode Reverse Leakage Current vs. Junction Temperature

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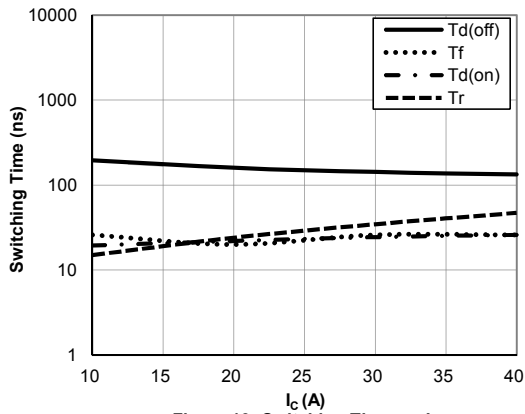


Figure 13: Switching Time vs. I_c
($T_J=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $R_g=15\Omega$)

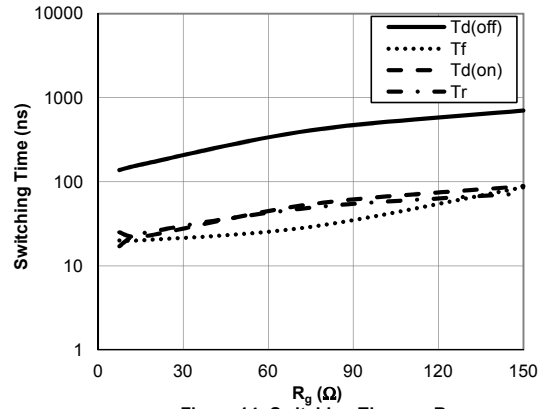


Figure 14: Switching Time vs. R_g
($T_J=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_c=20\text{A}$)

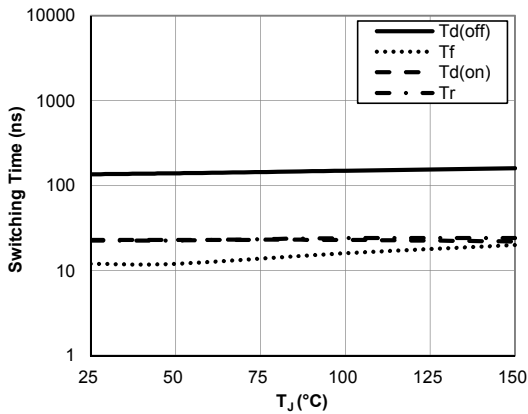


Figure 15: Switching Time vs. T_J
($V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_c=20\text{A}$, $R_g=15\Omega$)

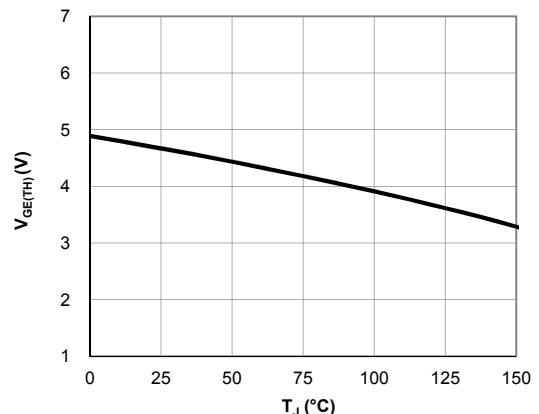


Figure 16: $V_{GE(TH)}$ vs. T_J

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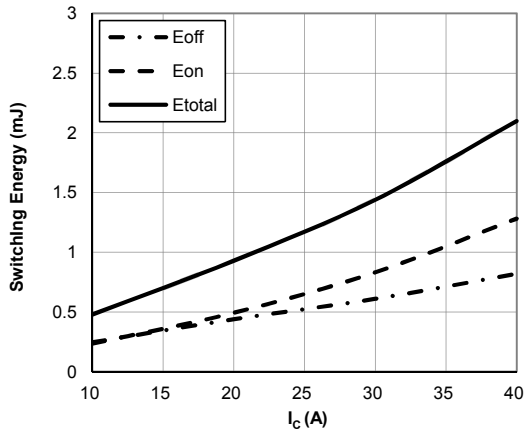


Figure 17: Switching Loss vs. I_c
($T_j=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $R_g=15\Omega$)

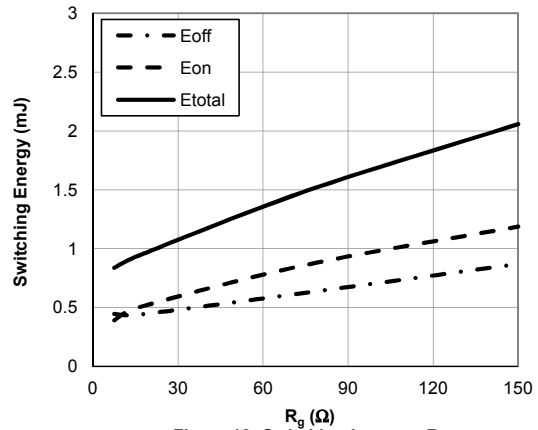


Figure 18: Switching Loss vs. R_g
($T_j=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_c=20\text{A}$)

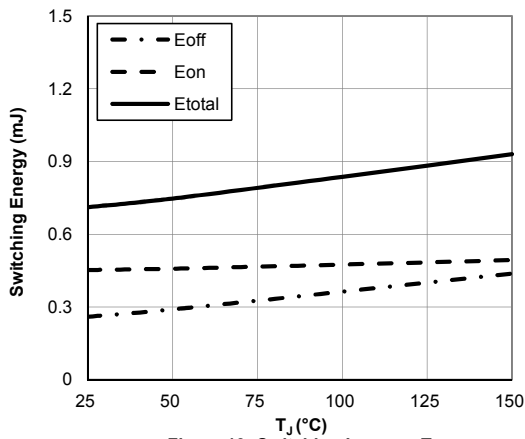


Figure 19: Switching Loss vs. T_j
($V_{GE}=15\text{V}$, $V_{CE}=400\text{V}$, $I_c=20\text{A}$, $R_g=15\Omega$)

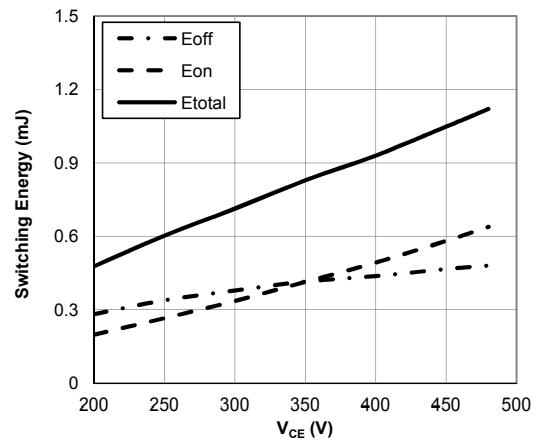


Figure 20: Switching Loss vs. V_{CE}
($T_j=150^\circ\text{C}$, $V_{GE}=15\text{V}$, $I_c=20\text{A}$, $R_g=15\Omega$)

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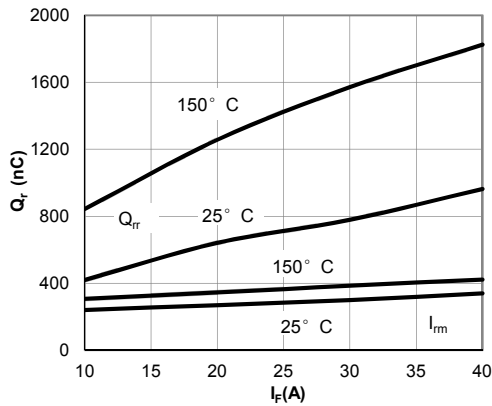


Figure 21: Diode Reverse Recovery Charge and Peak Current vs. Conduction Current
($V_{GE}=15V, V_{CE}=400V, di/dt=200A/\mu s$)

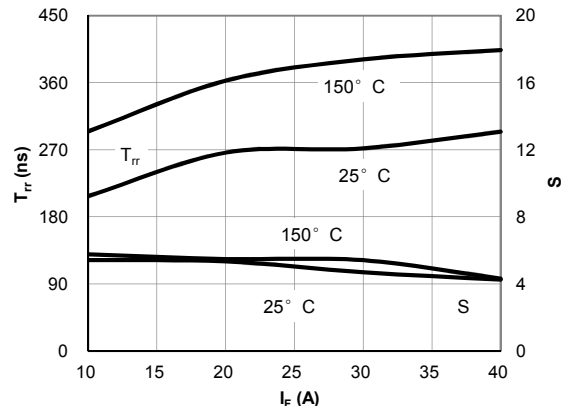


Figure 22: Diode Reverse Recovery Time and Softness Factor vs. Conduction Current
($V_{GE}=15V, V_{CE}=400V, di/dt=200A/\mu s$)

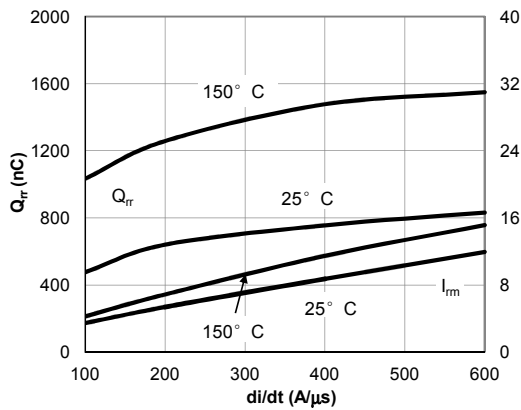


Figure 23: Diode Reverse Recovery Charge and Peak Current vs. di/dt
($V_{GE}=15V, V_{CE}=400V, I_F=20A$)

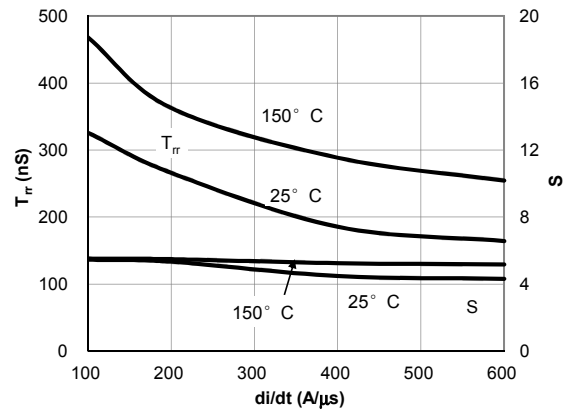


Figure 24: Diode Reverse Recovery Time and Softness Factor vs. di/dt
($V_{GE}=15V, V_{CE}=400V, I_F=20A$)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

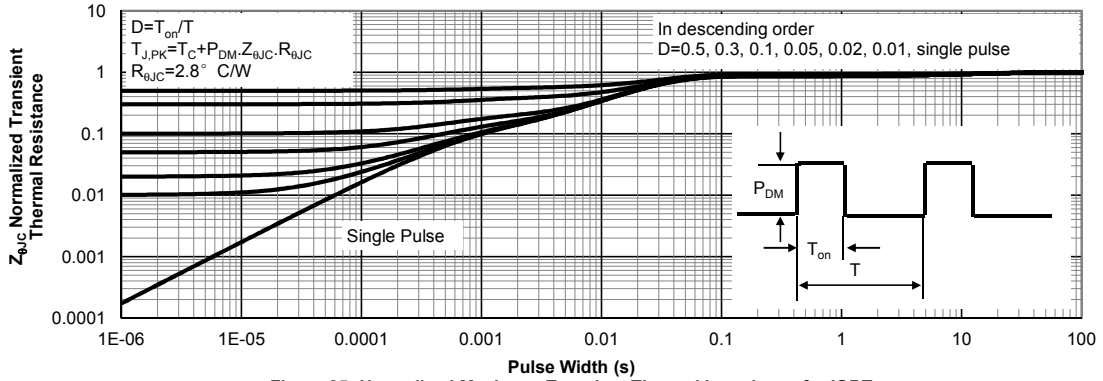


Figure 25: Normalized Maximum Transient Thermal Impedance for IGBT

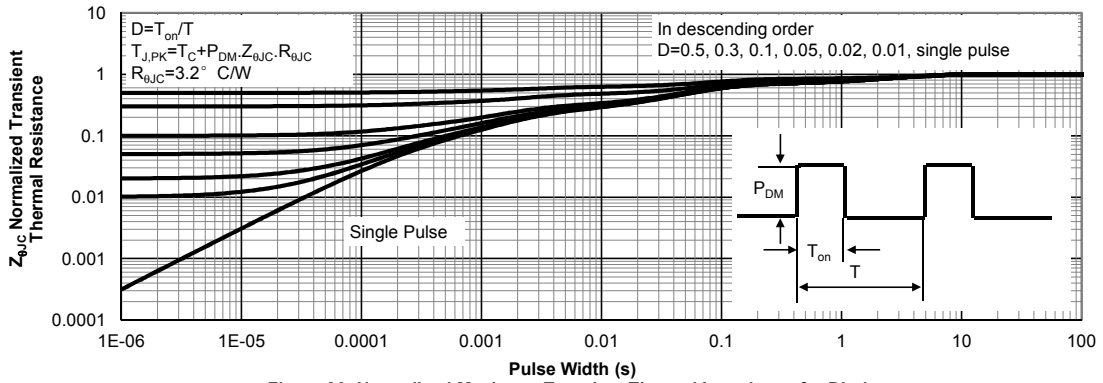
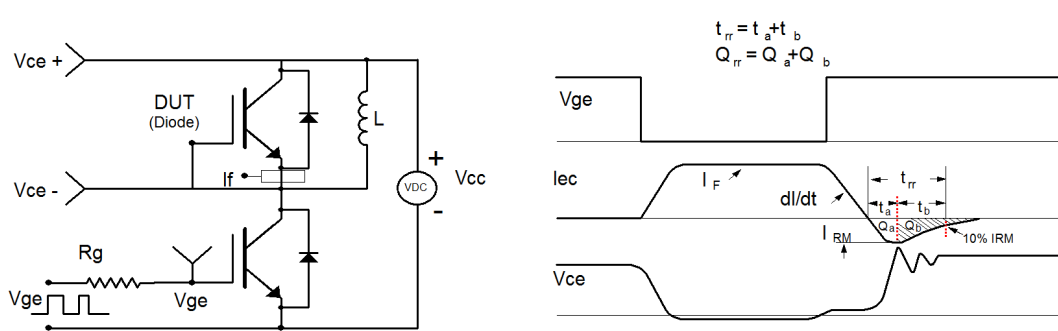
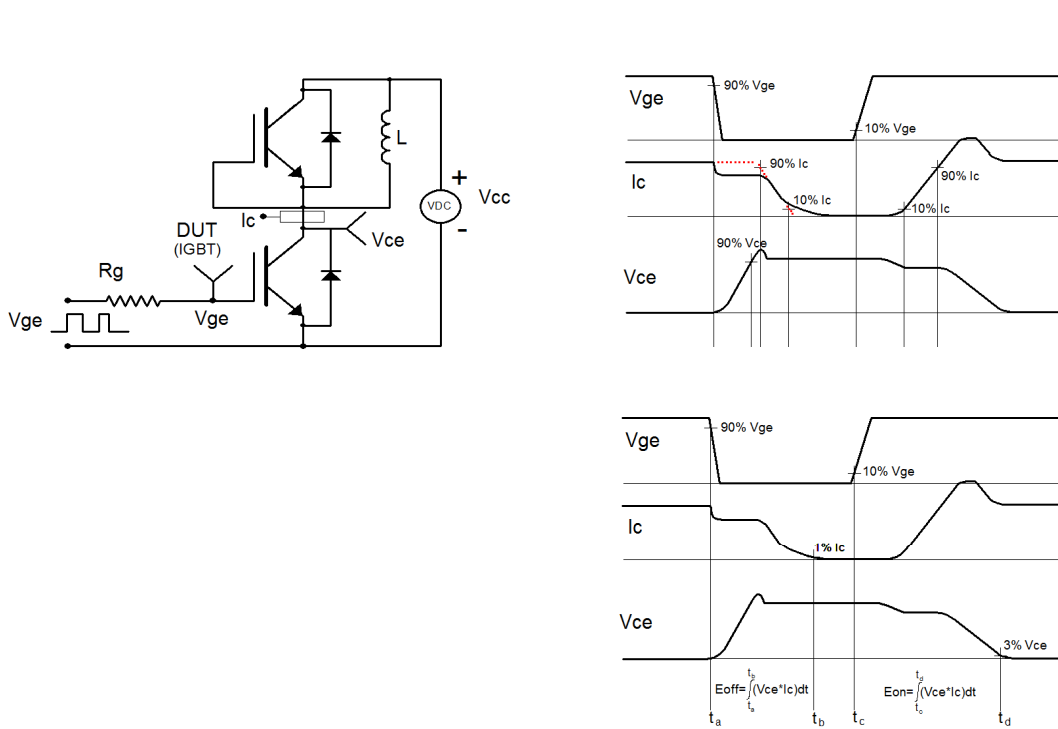
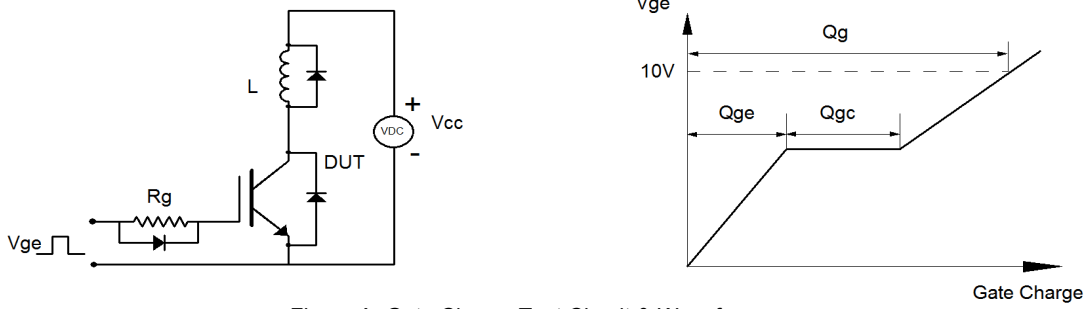


Figure 26: Normalized Maximum Transient Thermal Impedance for Diode



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