650V N-Channel Enhancement Mode Power IGBT

MAIN CHARACTERISTICS

$I_{C\ @TC=100}$	60A
V_{CE}	650V
VCE(sat)-typ	1.6V

FEATURES

- Trench and field-stop technology
- Easy parallel switching capability

APPLICATIONS

- Energy storage
- Solar string inverter
- Uninterruptible power supplies

Maximum Ratings

Characteristics	Symbol	Value TO-247	Unit
Collector-emitter voltage	V_{CES}	650	V
Gate-emitter voltage	V_{GES}	±20	V
Continuous collector current (TC=25)	I_C	120	A
Continuous collector current (TC=100)		60	A
Pulsed collector current, tp limited by Tvjmax	I_{CM}	240	A
Diode continuous forward current (TC=100)	I_F	60	A
Diode maximum current, tp limited by Tvjmax	I_{FM}	240	A
Power dissipation (TC=25)	P_{tot}	375	W
Power dissipation (TC=100)		145	W
Operating junction temperature range	T_{vj}	-55 to +175	°C

Electrical characteristics of IGBT at Tvj=25 unless otherwise specified

Characteristics	Test Condition	Symbol	Min	Typ	Max	Unit
Collector-emitter breakdown voltage	V_{GE}=0V, I_C=250μA	B_{VCES}	650	-	-	V
Collector-emitter leakage current	V_{CE}=650V, V_{GE}=0V	I_{CES}	-	-	25	μA
Gate leakage current, forward	V_{GE}=±20V, V_{CE}=0V	I_{GES}	-	-	±200	nA
Gate-emitter threshold voltage	V_{GE}=V_{CE}, I_C=1mA	$V_{GE(th)}$	4.7	5.5	6.2	V
Collector-emitter saturation voltage	V_{GE}=15 V, I_C=60A	$V_{CE(sat)}$	-	1.6	2	V
	V_{GE}=15V, I_C=60A, T_{vj}=175		-	2.1	-	V
Input capacitance	V_{CE}=25V V_{GE}=0V f =1MHz	C_{ies}	-	3146	-	pF
Output capacitance		C_{oes}	-	121	-	pF
Reverse transfer capacitance		C_{res}	-	31	-	pF
Total gate charge	V_{CC}=520V V_{GE}=15V I_C=60A	Q_g	-	118	-	nC
Turn-on delay time	V_{CC}=400V V_{GE}=15V I_C=60A R_G=5Ω Inductive load	td(on)	-	40	-	ns
Rise time		tr	-	47	-	ns
Turn-off delay time		td(off)	-	123	-	ns
Fall time		tf	-	90	-	ns
Turn-on energy		Eon	-	1.2	-	mJ
Turn-off energy		Eoff	-	1.5	-	mJ
Total switching energy		Ets	-	2.7	-	mJ
Turn-on delay time	V_{CC}=400V V_{GE}=15V I_C=60A R_G=5Ω Inductive load Tvj =175	td(on)	-	36	-	ns
Rise time		tr	-	46	-	ns
Turn-off delay time		td(off)	-	140	-	ns
Fall time		tf	-	150	-	ns
Turn-on energy		Eon	-	1.3	-	mJ
Turn-off energy		Eoff	-	2.34	-	mJ
Total switching energy		Ets	-	3.64	-	mJ
Diode forward voltage	I_F=60A	V_F	-	1.7	2.4	V
	I_F=60A,Tvj=175		-	1.45	-	V
Diode reverse recovery time	V_R=400V I_F=60A diF/dt=-450A/μs	trr	-	41	-	ns
Diode peak reverse recovery current		Irrm	-	3.3	-	A
Diode reverse recovery charge		Qrr	-	70	-	nC
Diode reverse recovery time	V_R=400V I_F=60A diF/dt=-450A/μs Tvj=175	trr	-	219	-	ns
Diode peak reverse recovery current		Irrm	-	11.5	-	A
Diode reverse recovery charge		Qrr	-	1454	-	nC

Ratings and Characteristic Curves

Figure 1: Power Dissipation

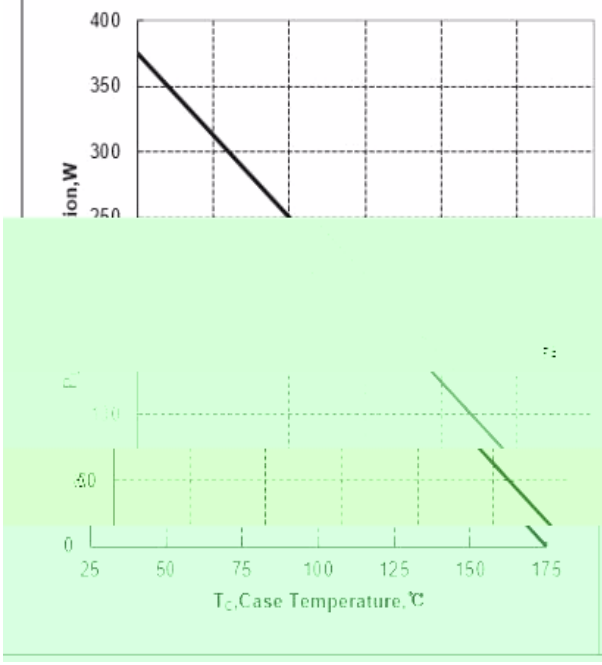

Figure 2: Collector Current vs. Case Temperature

Figure 3: Safe Operation Area

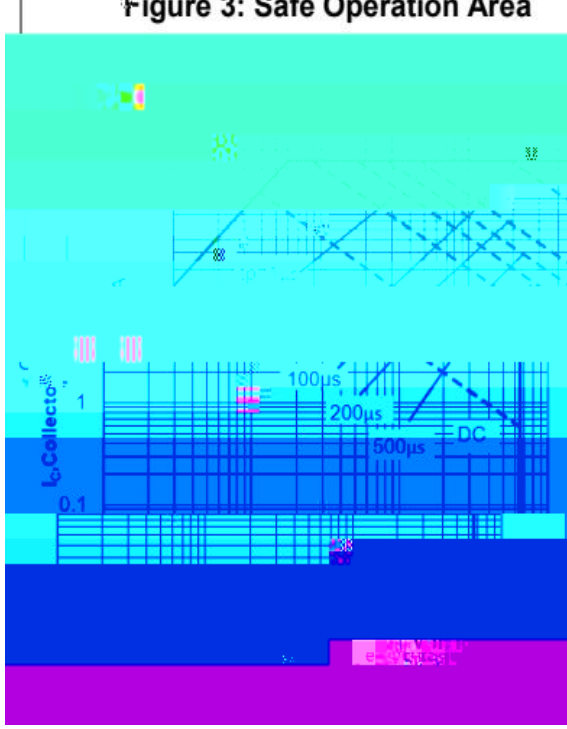

Figure 4: Typical Transfer Characteristics

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Figure 5: Typical Output Characteristics

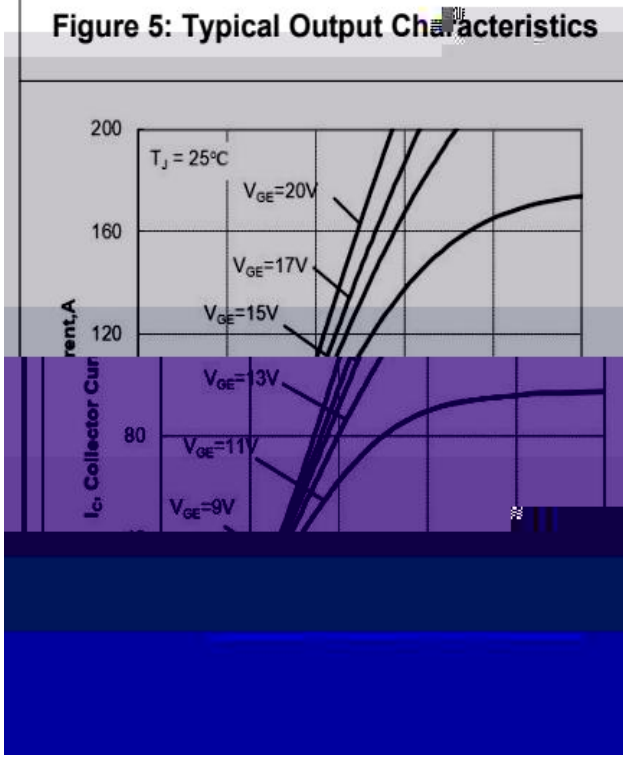


Figure 6: Typical Output Characteristics

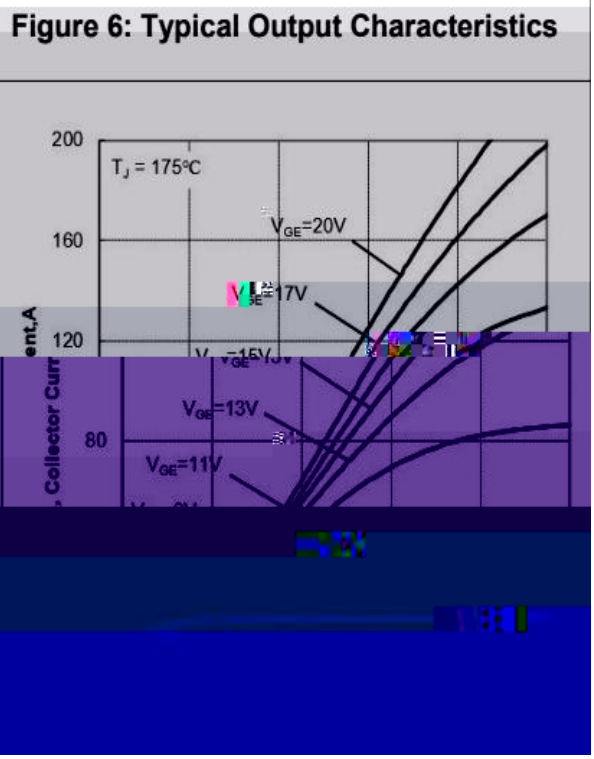


Figure 7: Typical Collector-Emitter Temperature

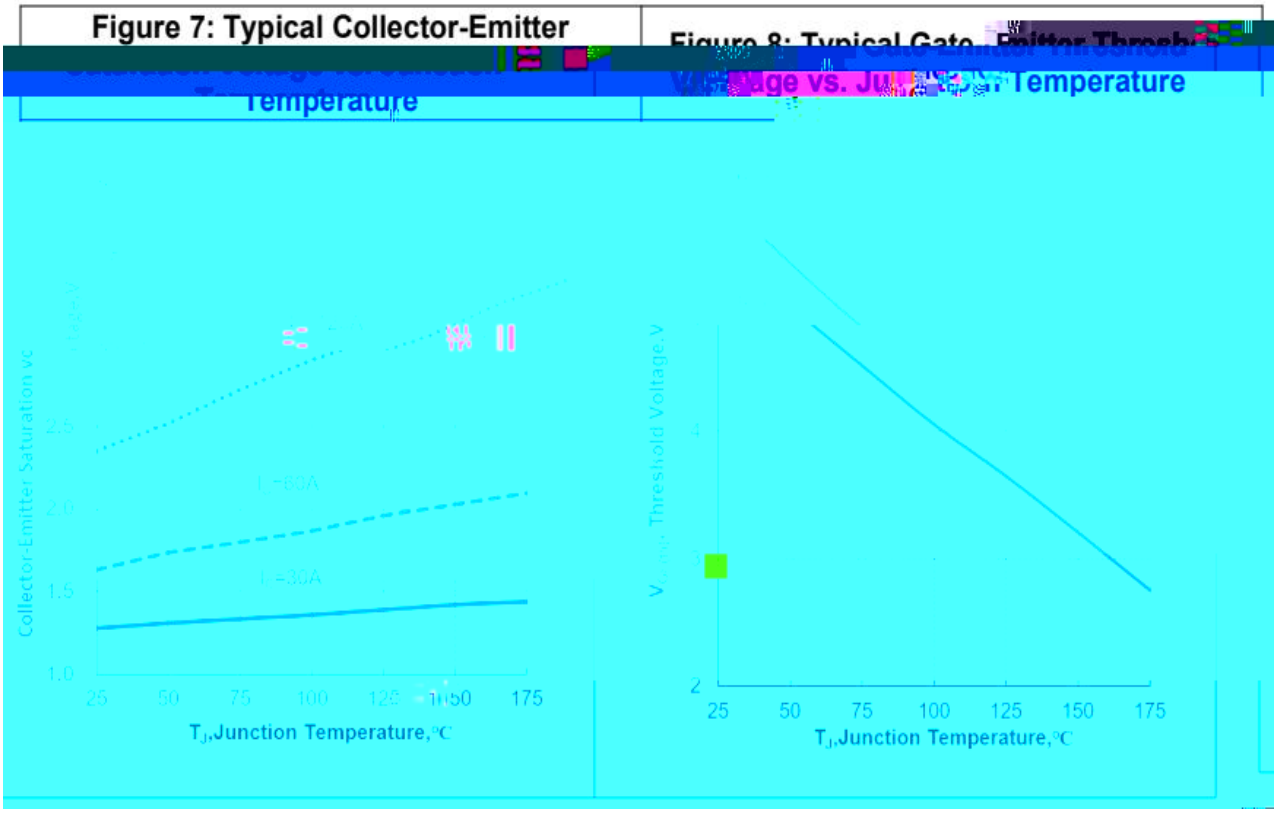


Figure 8: Typical Gate-Emitter Threshold Voltage vs. Junction Temperature

Ratings and Characteristic Curves

Figure 9: Typical Switching Times vs. Gate Resistor (T_J=25℃, V_{CE}=400V, V_{GE}=15V, I_C=60A)

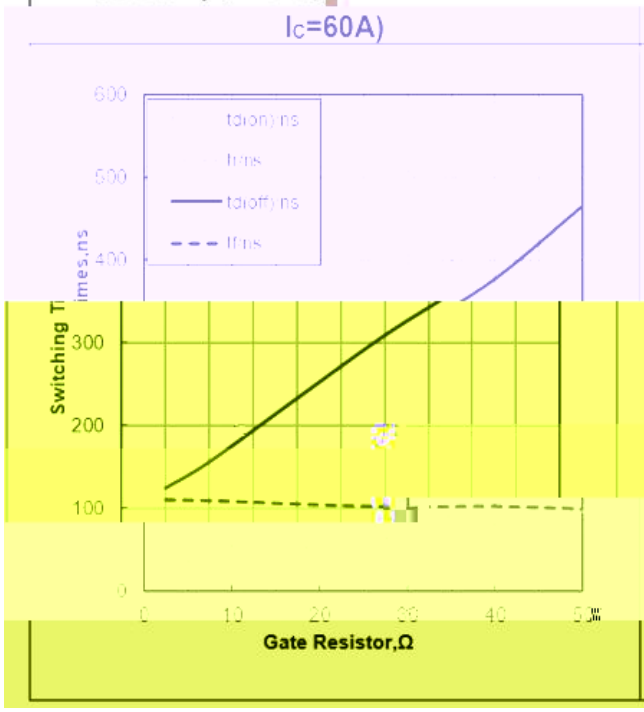


Figure 10: Typical Switching Energy vs. Gate Resistor (T_J=25℃, V_{CE}=400V, V_{GE}=15V, I_C=60A)

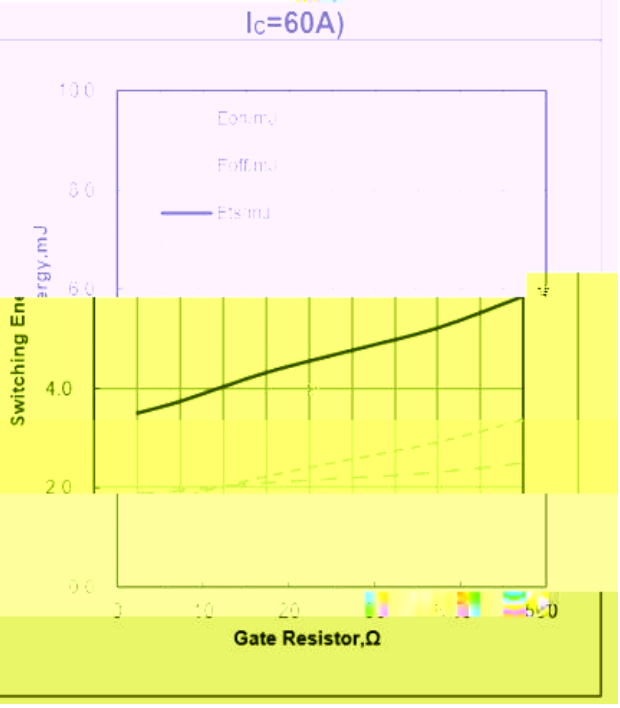
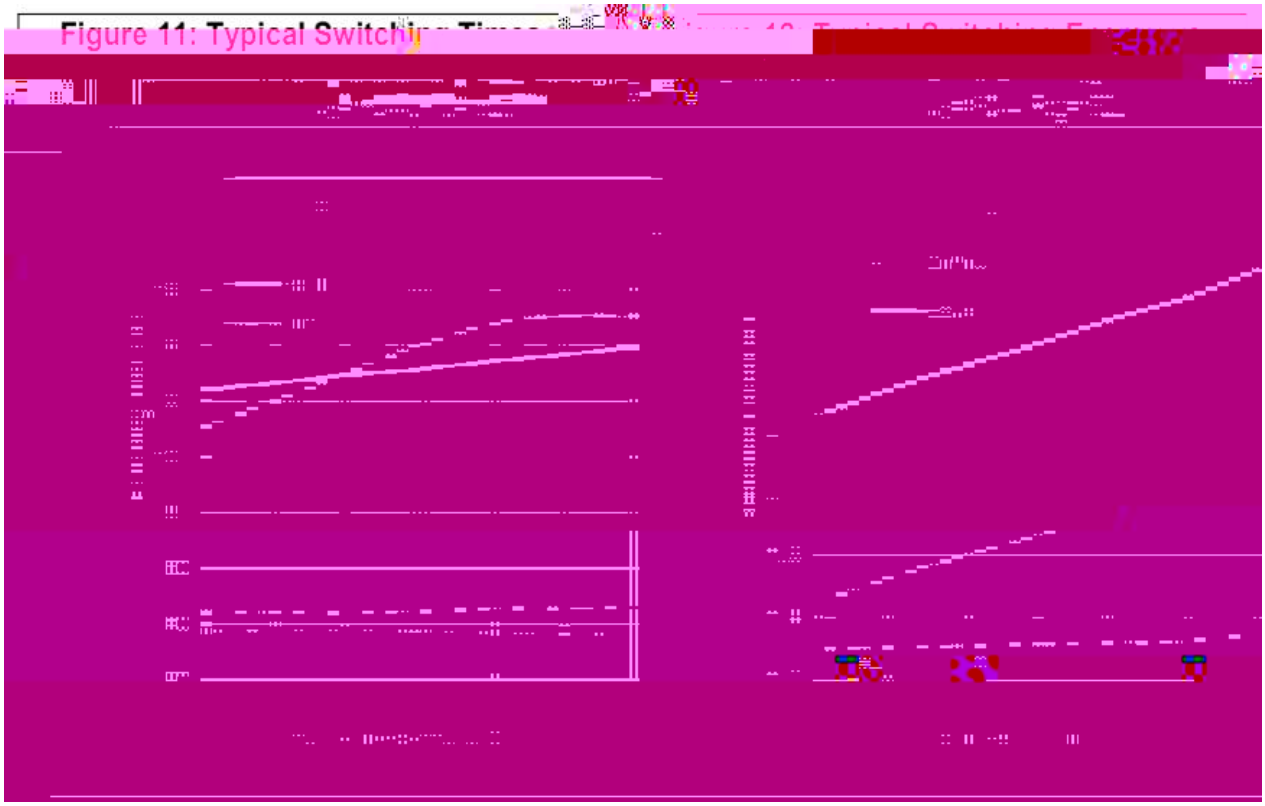


Figure 11: Typical Switching Times vs. Gate Resistor



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Ratings and Characteristic Curves

Figure 17: Typical Capacitance vs.

Figure 18:

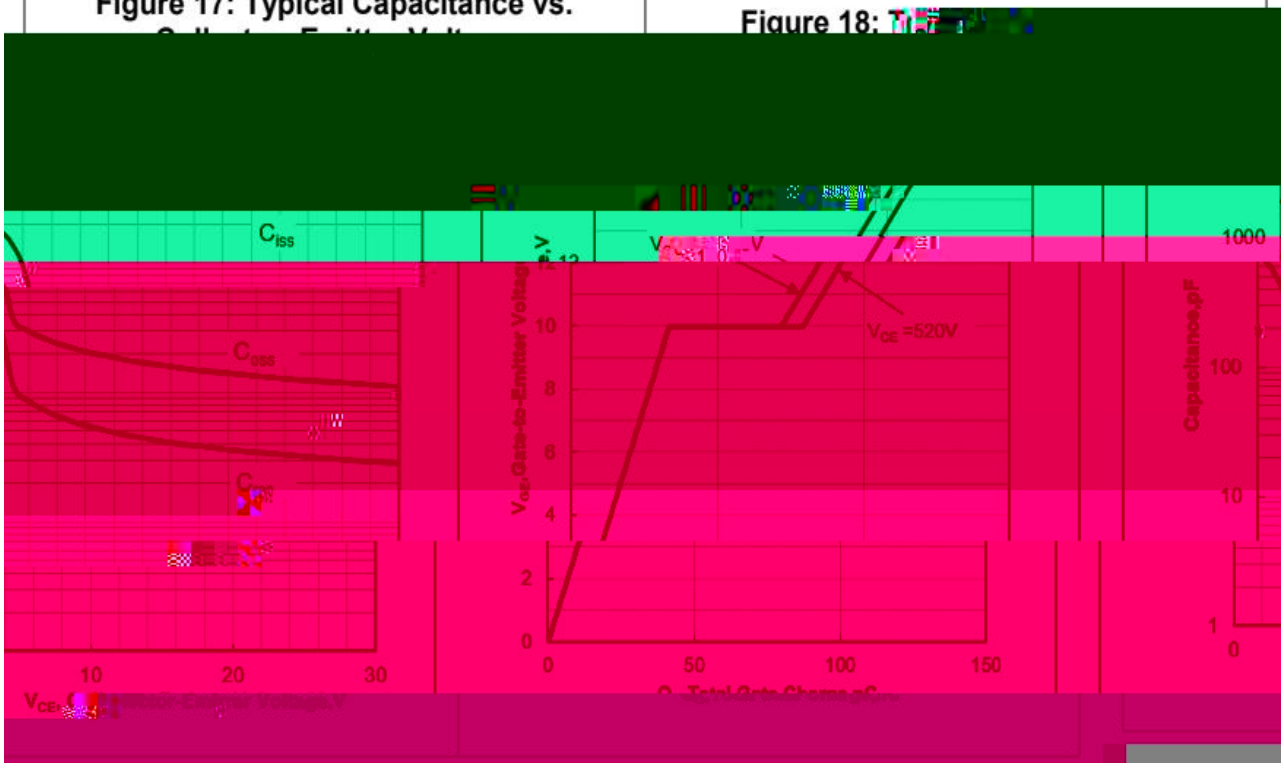
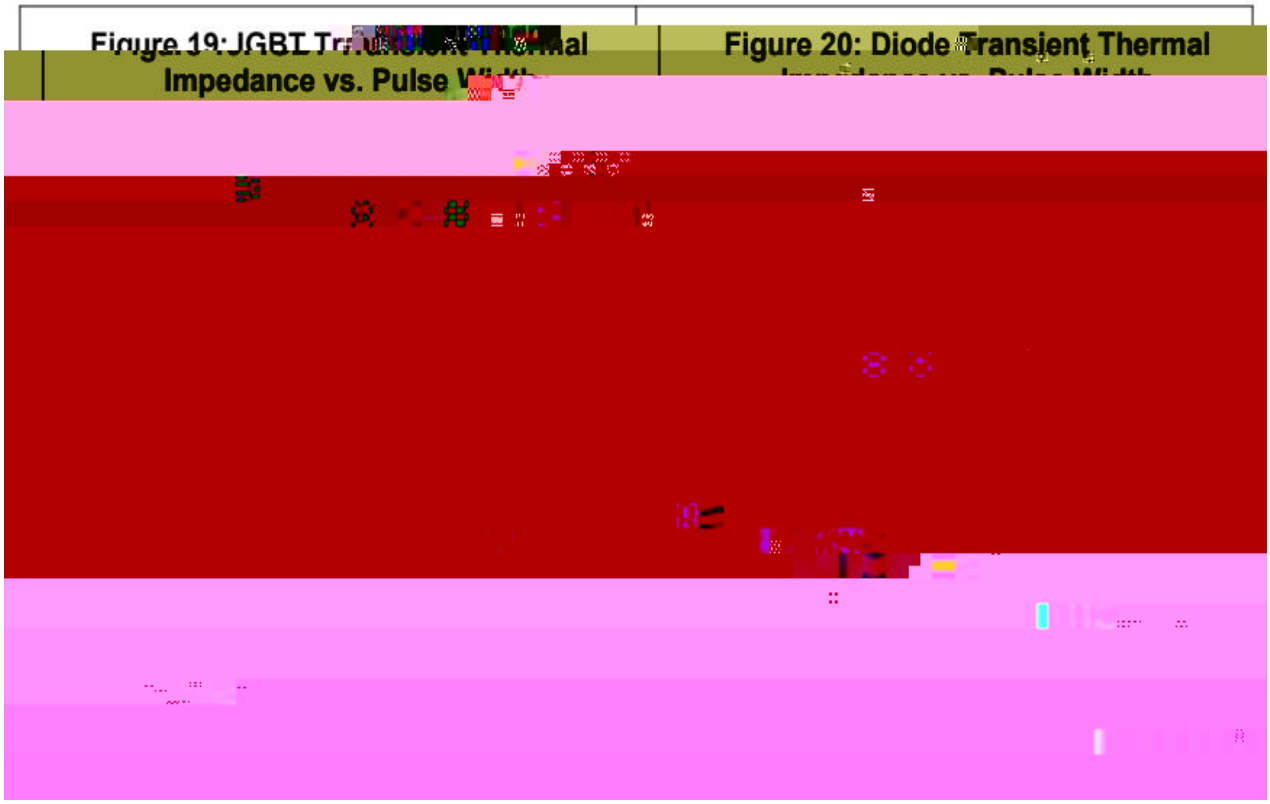


Figure 19: IGBT Transient Thermal Impedance vs. Pulse Width

Figure 20: Diode Transient Thermal



Ratings and Characteristic Curves

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