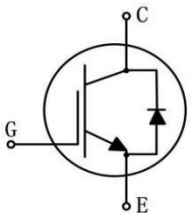
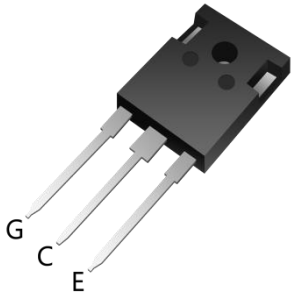
Trench Field-stop IGBT Discrete

Parameter	Value	Unit
V_{CE}	650	V
I_C	40	A
$V_{CE(sat)}$	1.65	V





TO-247-3L

Features

- Positive temperature coefficient
- Fast Switching
- Low VCE(sat)
- Reliable and Rugged

Applications

- Motor drives
- Solar inverter
- Resonant converters

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	VCES	650	V
Gate-emitter voltage	VGES	±30	V
Continuous collector current (TC=25℃)	IC	80	A
Continuous collector current (TC=100℃)		40	A
Pulsed collector current, tp limited by Tvjmax	ICM	160	A
Diode continuous forward current (TC=25℃)	IF	80	A
Diode continuous forward current (TC=100℃)		40	A
Diode maximum current, tp limited by Tvjmax	IFM	160	A
Operating junction temperature range	Tvj	-55 to +175	°C
Storage temperature range	Tstg	-55 to +175	°C

Thermal characteristics

Parameter	Symbol	Typ	Max.	Unit
Thermal resistance, junction to case for IGBT	Rth(j-c)	-	0.66	K/ W
Thermal resistance, junction to case for Diode	Rth(j-c)	-	0.58	K/ W

Thermal resistance, junction to ambient	Rth(j-a)	-	40	K/ W

Note1:Pulse test: 300 μs pulse width, 2 % duty cycle

Electrical characteristics of IGBT at Tvj=25℃ unless otherwise specified

Static characteristics

Parameter	Test Condition	Symbol	Min	Typ	Max	Unit
Collector-emitter breakdown voltage	VGE=0V, IC=250μA	BVCES	650	-	-	V
Collector-emitter leakage current	VCE=650V, VGE=0V	ICES	-	-	10	μA
Gate leakage current, forward	VGE=±20V, VCE=0V	IGES	-	-	±200	nA
Gate-emitter threshold voltage	VGE=VCE, IC=1mA	VGE(th)	4.3	5.3	6.3	V
Collector-emitter saturation voltage	VGE=15 V, IC=40A	VCE(sat)	-	1.65	1.95	V
	VGE=15V, IC=40A, Tvj=125℃		-	2	-	V
	VGE=15V, IC=40A, Tvj=175℃		-	2.15	-	V

Dynamic characteristics

Parameter	Test Condition	Symbol	Min	Typ	Max	Unit
Input capacitance	VCE=25V, VGE=0V f =1MHz	Cies	-	2540	-	pF
Output capacitance		Coes	-	126	-	pF
Reverse transfer capacitance		Cres	-	67	-	pF
Total gate charge	VCC=520V,VGE=15V IC=40A	Qg	-	146	-	nC
Gate- Emitter Charge		Qge	-	24	-	nC
Gate- Collector Charge		Qgc	-	71	-	nC
Short circuit collector current Max.1000 short circuits, times between short circuits: ≥ 1.0s	VGE=15V,VCC≤400V TJ≤175°C	t(SC)	-	8	-	μs

Electrical characteristics of IGBT at Tvj=25℃unless otherwise specified

Switching characteristics

Parameter	Test Condition	Symbol	Min	Typ	Max	Unit
Turn-on delay time	VCC=400V VGE=15V IC=40A RG=5Ω Inductive load	td(on)	-	20	-	ns
Rise time		tr	-	67	-	ns
Turn-off delay time		td(off)	-	104	-	ns
Fall time		tf	-	74	-	ns
Turn-on energy		Eon	-	0.95	-	mJ

Turn-off energy		Eoff	-	0.93	-	mJ
Total switching energy		Ets	-	1.88	-	mJ
Turn-on delay time	VCC=400V VGE=15V IC=40A RG=5Ω Inductive load Tvj=175℃	td(on)	-	22	-	ns
Rise time		tr	-	73	-	ns
Turn-off delay time		td(off)	-	178	-	ns
Fall time		tf	-	70	-	ns
Turn-on energy		Eon	-	1.82	-	mJ
Turn-off energy		Eoff	-	1.16	-	mJ
Total switching energy		Ets	-	2.98	-	mJ

Electrical characteristics of Diode at Tvj=25℃ unless otherwise specified

Parameter	Test Condition	Symbol	Min	Typ	Max	Unit
Diode forward voltage	IF=40A	VF	-	2.2	2.55	V
	IF=40A Tvj=125℃		-	1.84	-	V
	IF=40A Tvj=175℃		-	1.62	-	V
Diode reverse recovery time	VR=400V IF=40A diF/dt=-200A/μs	trr	-	188	-	ns
Diode peak reverse recovery current		Qrr	-	243	-	nC
Diode reverse recovery charge		Irrm	-	6.8	-	A
Diode reverse recovery time	VR=400V IF=40A diF/dt=-200A/μs Tvj=175℃	trr	-	215	-	ns
Diode peak reverse recovery current		Qrr	-	278	-	nC
Diode reverse recovery charge		Irrm	-	9.7	-	A

Typical Characteristics

Figure 1: Power Dissipation

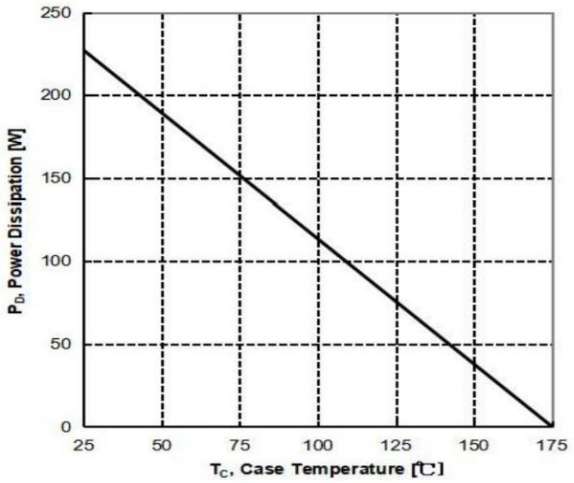


Figure 2: Collector Current vs. Case Temperature

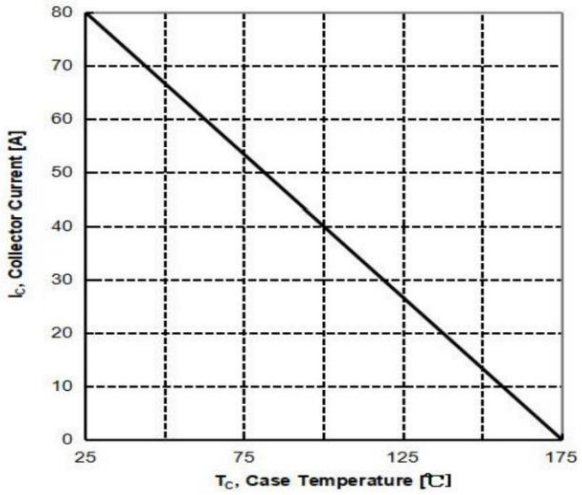


Figure 3: Safe Operation Area

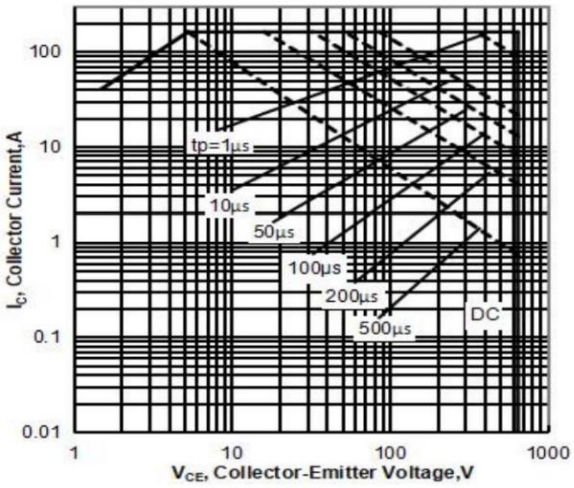


Figure 4: Typical Transfer Characteristics

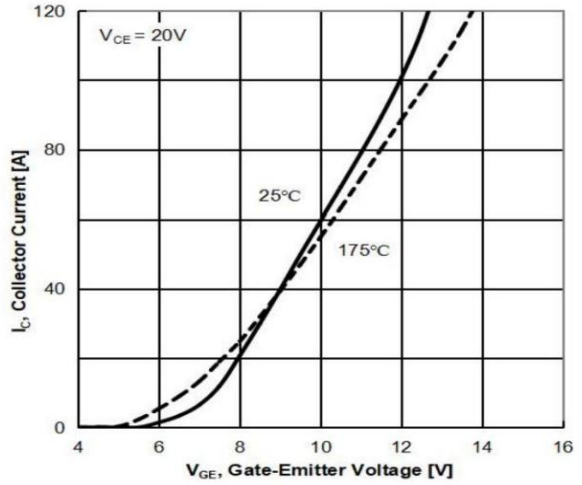


Figure 5: Typical Output Characteristics

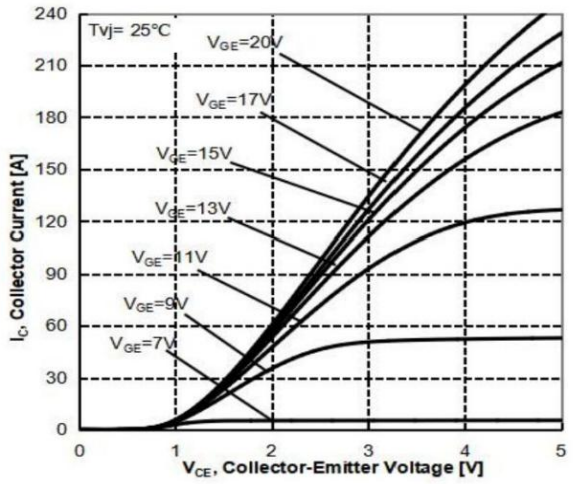


Figure 6: Typical Output Characteristics

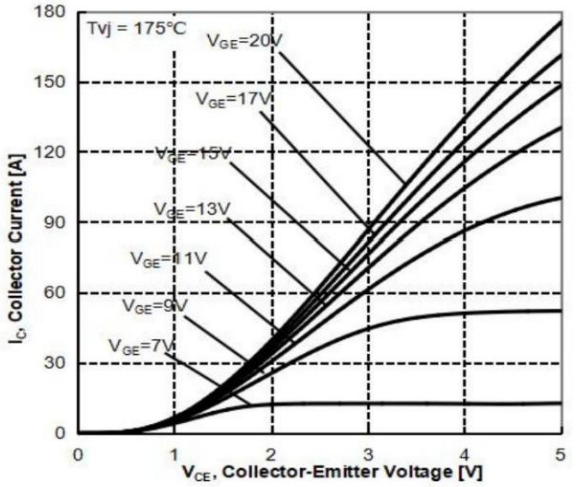


Figure 7: Typical Collector-Emitter Saturation Voltage vs. Junction Temperature

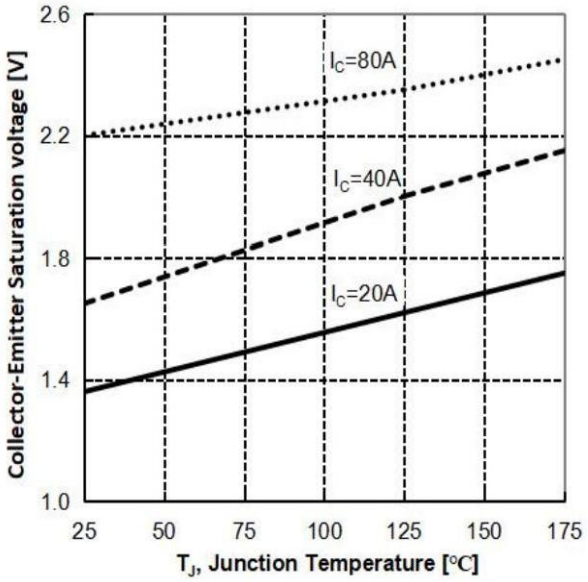


Figure 8: Typical Gate-Emitter Threshold Voltage vs. Junction Temperature

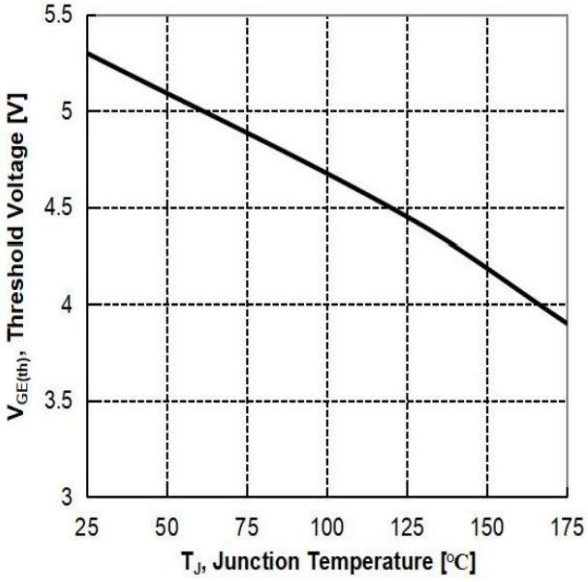


Figure 9: Typical Switching Times vs. Gate Resistor (T_J=25℃, V_{CE}=400V, V_{GE}=15/0V, I_C=40A)

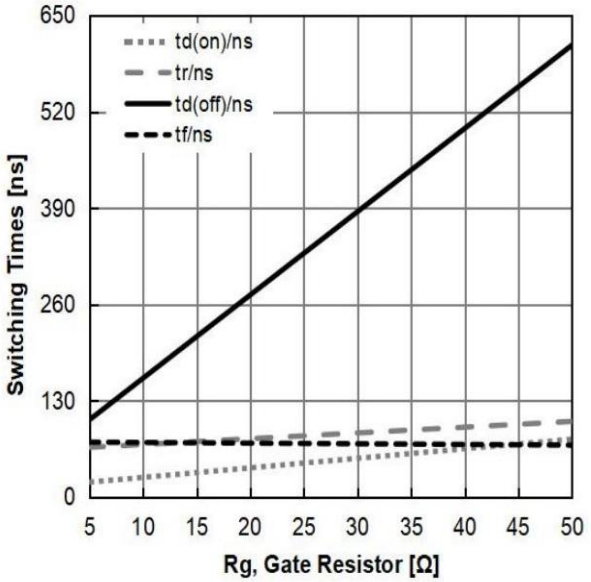


Figure 10: Typical Switching Energy vs. Gate Resistor (T_J=25℃, V_{CE}=400V, V_{GE}=15/0V, I_C=40A)

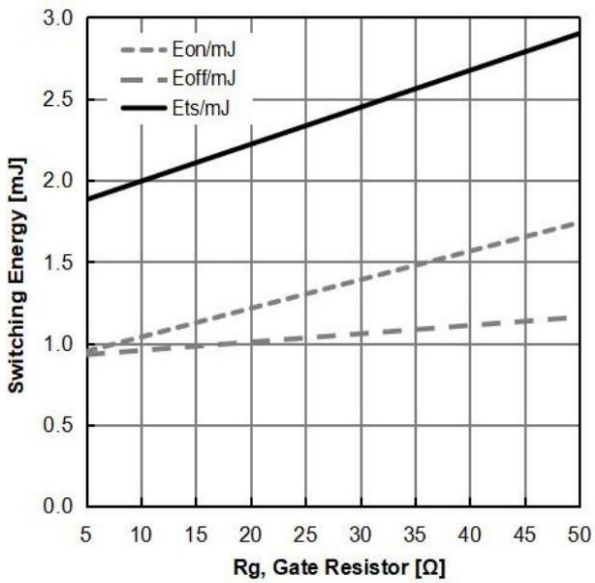


Figure 11: Typical Switching Times vs. Junction Temperature (V_{CE}=400V, V_{GE}=15/0V, I_C=40A)

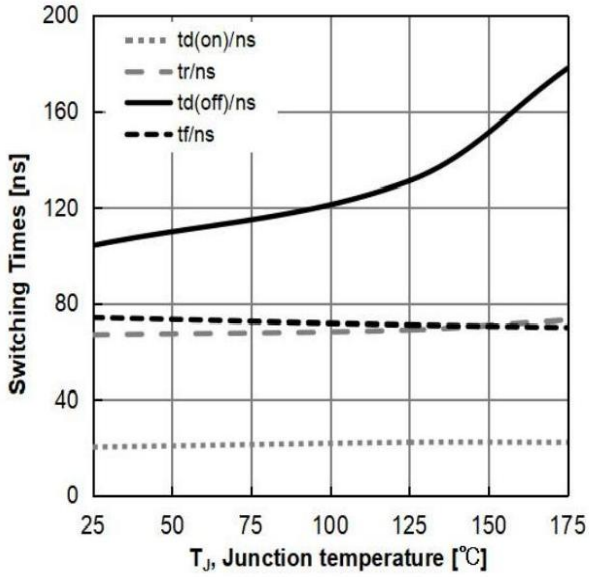


Figure 12: Typical Switching Energy vs. Junction Temperature (V_{CE}=400V, V_{GE}=15/0V, I_C=40A)

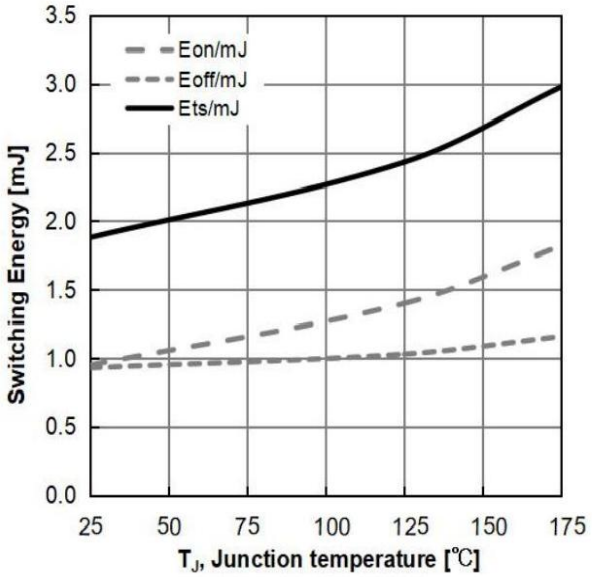


Figure 13: Typical Switching Times vs. Collector Current (T_J=25℃, V_{CE}=400V, V_{GE}=15/0V)

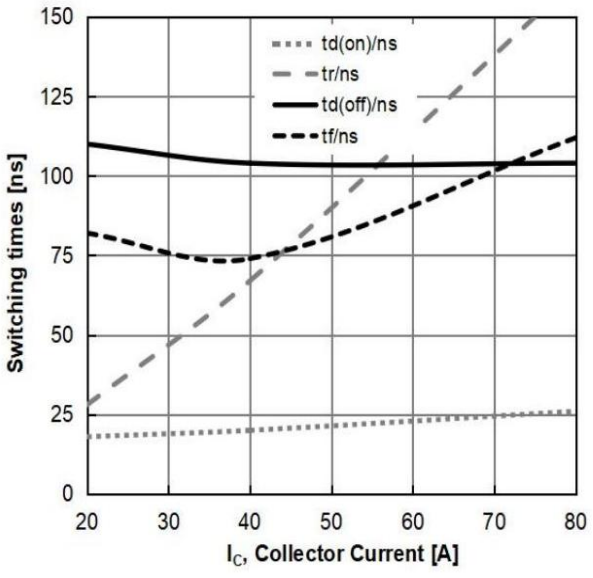


Figure 14: Typical Switching Energy vs. Collector Current (T_J=25℃, V_{CE}=400V, V_{GE}=15/0V)

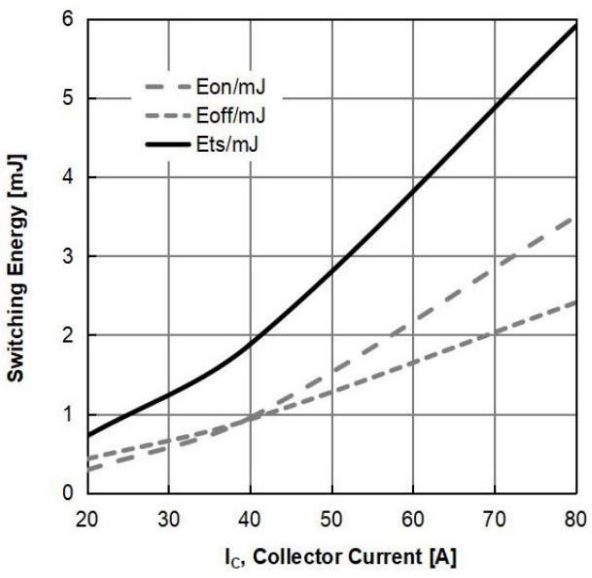


Figure 15: Typical Switching Times vs. VCE (T_J=25℃,V_{GE}=15/0V, I_C=40A)

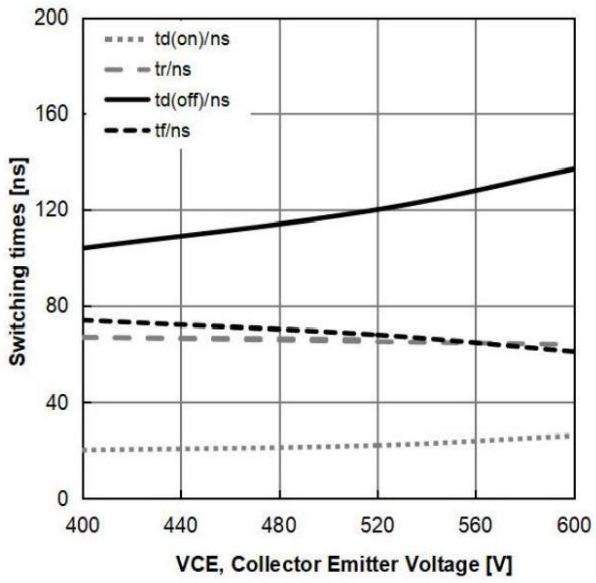


Figure 16: Typical Switching Energy vs. VCE (T_J=25℃, V_{GE}=15/0V, I_C=40A)

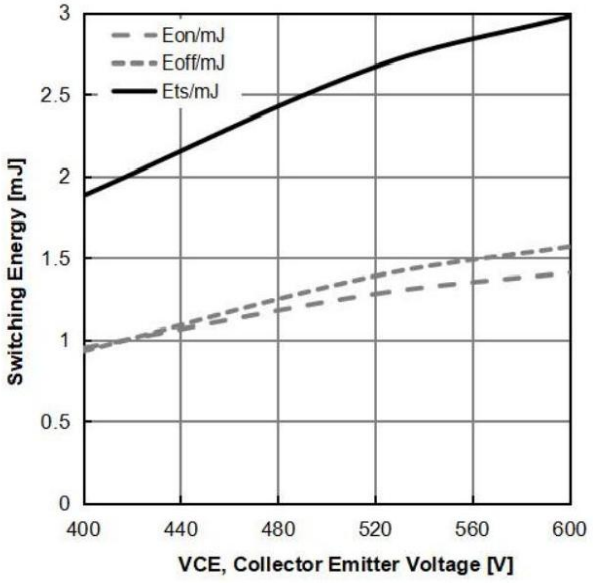


Figure 17: Typical Gate Charge

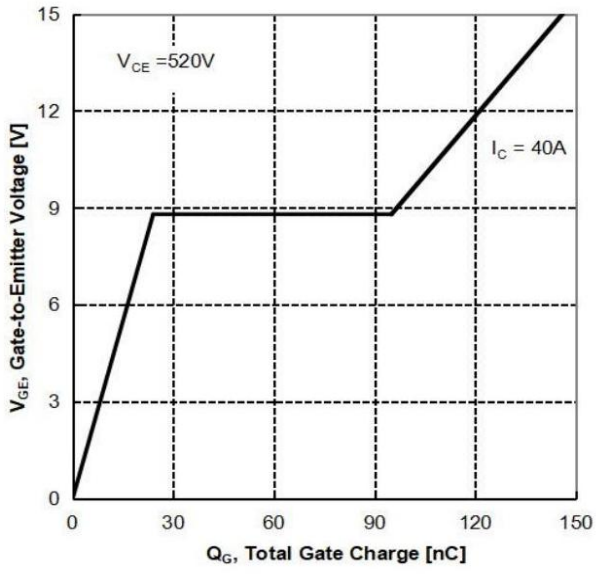


Figure 18: Typical Capacitance vs. Collector- Emitter Voltage

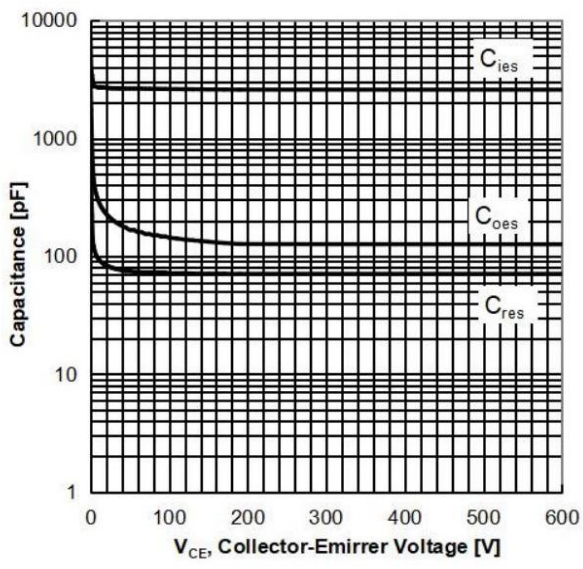


Figure 19: IGBT Transient Thermal Impedance vs. Pulse Width

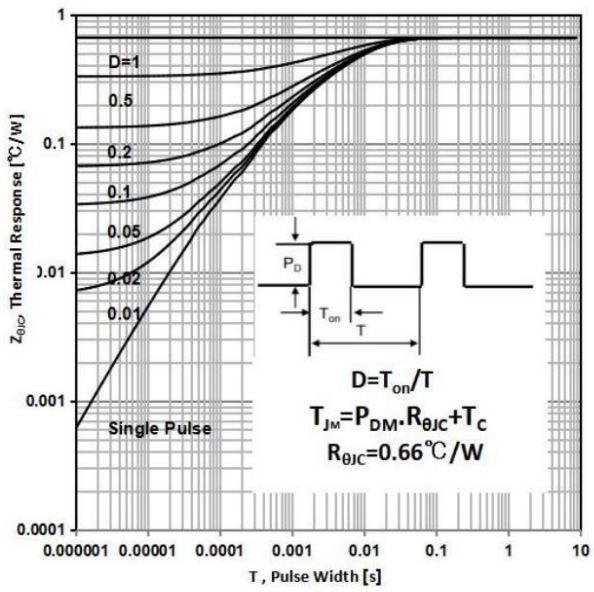


Figure 20: Diode Transient Thermal Impedance vs. Pulse Width

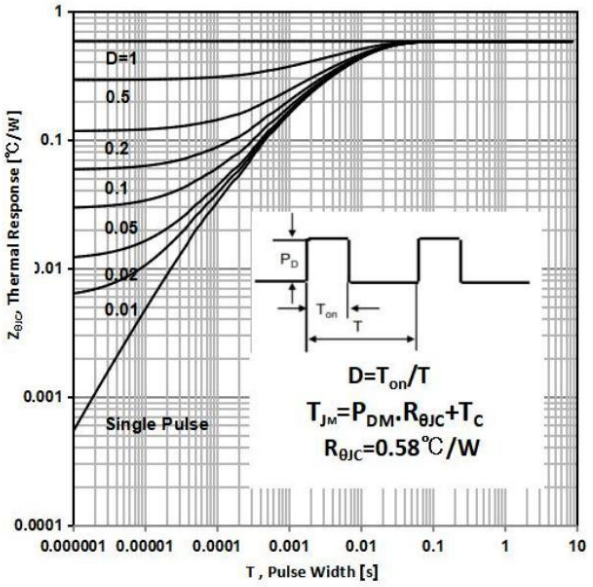
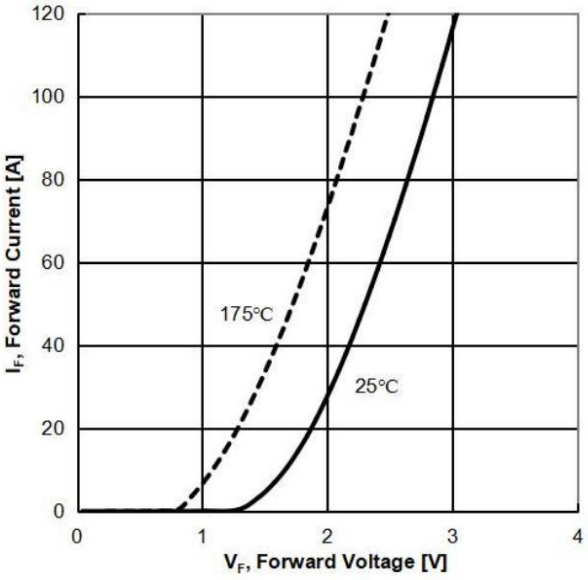
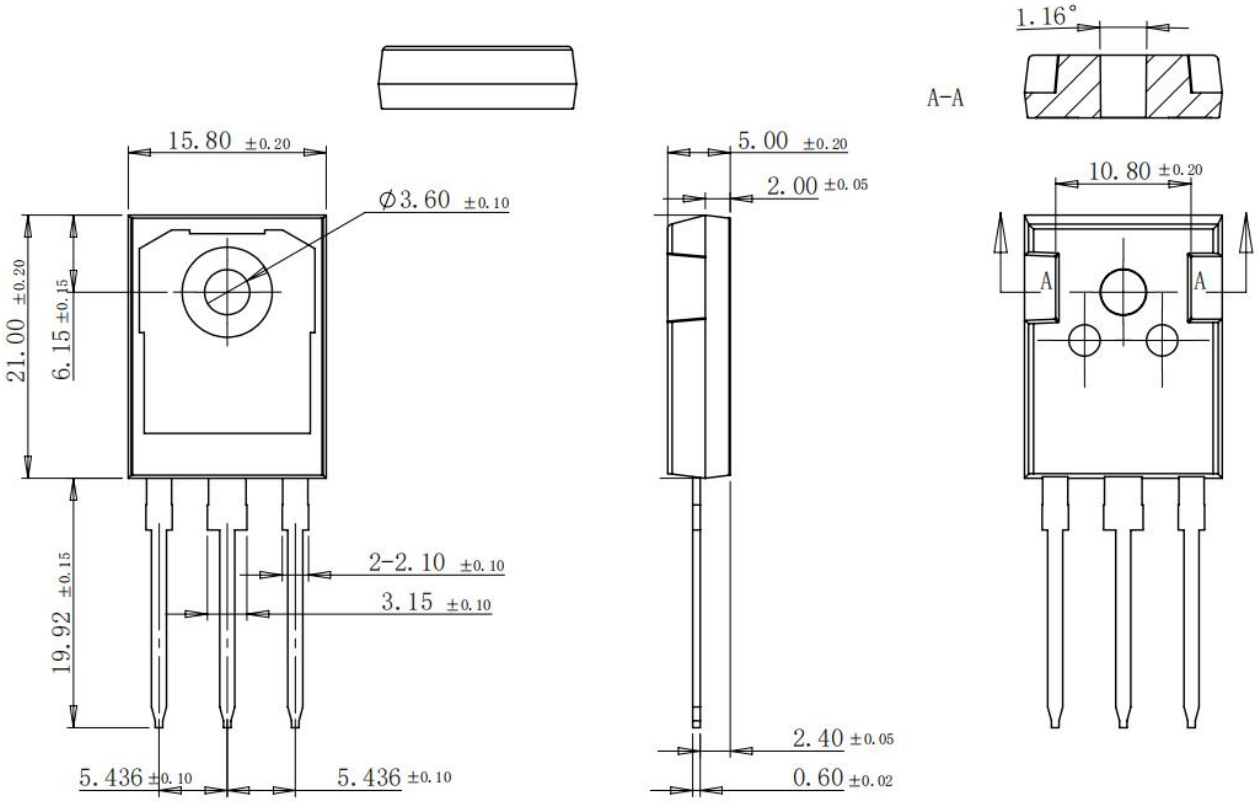


Figure 21: Typical Diode Forward Current vs. Forward Voltage



Package Outlines (Unit：mm)

TO-247-3L



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