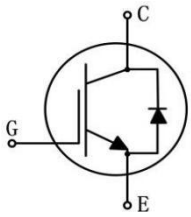
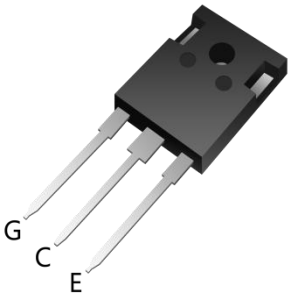
Trench Field-stop IGBT Discrete

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	V_{CES}	650	V
Gate-emitter voltage	V_{GES}	±30	V
Continuous collector current (T_C=25℃)	I_C	80	A
Continuous collector current (T_C=100℃)		40	A
Pulsed collector current, tp limited by Tvjmax	I_{CM}	160	A
Diode continuous forward current (T_C=25℃)	I_F	80	A
Diode continuous forward current (T_C=100℃)		40	A
Diode maximum current, tp limited by Tvjmax	I_{FM}	160	A
Operating junction temperature range	T_{vj}	-55 to +175	°C
Storage temperature range	T_{stg}	-55 to +175	°C

Thermal characteristics

Parameter	Symbol	Typ	Max.	Unit
Thermal resistance, junction to case for IGBT	$R_{th(j-c)}$	-	0.66	K/ W
Thermal resistance, junction to case for Diode	$Rt_{h(j-c)}$	-	0.58	K/ W
Thermal resistance, junction to ambient	$R_{th(j-a)}$	-	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	V_{GE}=0V, I_C=250μA	B_{VCES}	650	-	-	V
Collector-emitter leakage current	V_{CE}=650V, V_{GE}=0V	I_{CES}	-	-	10	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	$V_{GE(th)}$	4.3	5.3	6.3	V
Collector-emitter saturation voltage	V_{GE}=15 V, I_C=40A	$V_{CE(sat)}$	-	1.65	1.95	V
	V_{GE}=15V, I_C=40A, T_{vj}=125℃		-	2	-	V
	V_{GE}=15V, I_C=40A, T_{vj}=175℃		-	2.15	-	V

Dynamic characteristics

Parameter	Test Condition	Symbol	Min	Typ	Max	Unit
Input capacitance	V_{CE}=25V, V_{GE}=0V f =1MHz	C_{ies}	-	2540	-	pF
Output capacitance		C_{oes}	-	126	-	pF
Reverse transfer capacitance		C_{res}	-	67	-	pF
Total gate charge	V_{CC}=520V,V_{GE}=15V I_C=40A	Q_g	-	146	-	nC
Gate- Emitter Charge		Q_{ge}	-	24	-	nC
Gate- Collector Charge		Q_{gc}	-	71	-	nC
Short circuit collector current Max.1000 short circuits, times between short circuits: ≥ 1.0s	V_{GE}=15V,V_{CC}≤400V T_J≤175℃	$t_{(SC)}$	-	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	V_{CC}=400V V_{GE}=15V I_C=40A R_G=5Ω Inductive load	$t_{d(on)}$	-	20	-	ns
Rise time		t_r	-	67	-	ns
Turn-off delay time		$t_{d(off)}$	-	104	-	ns
Fall time		t_f	-	74	-	ns
Turn-on energy		E_{on}	-	0.95	-	mJ
Turn-off energy		E_{off}	-	0.93	-	mJ
Total switching energy		E_{ts}	-	1.88	-	mJ
Turn-on delay time	V_{CC}=400V	$t_{d(on)}$	-	22	-	ns

Rise time	V_{GE}=15V I_C=40A R_G=5Ω Inductive load T_{vj}=175℃	t_r	-	73	-	ns
Turn-off delay time		$t_{d(off)}$	-	178	-	ns
Fall time		t_f	-	70	-	ns
Turn-on energy		E_{on}	-	1.82	-	mJ
Turn-off energy		E_{off}	-	1.16	-	mJ
Total switching energy		E_{ts}	-	2.98	-	mJ

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

Parameter	Test Condition	Symbol	Min	Typ	Max	Unit
Diode forward voltage	I_F=40A	V_F	-	2.2	2.55	V
	I_F=40A T_{vj}=125℃		-	1.84	-	V
	I_F=40A T_{vj}=175℃		-	1.62	-	V
Diode reverse recovery time	V_R=400V I_F=40A diF/dt=-200A/μs	t_{rr}	-	188	-	ns
Diode peak reverse recovery current		Q_{rr}	-	243	-	nC
Diode reverse recovery charge		I_{rrm}	-	6.8	-	A
Diode reverse recovery time	V_R=400V I_F=40A diF/dt=-200A/μs T_{vj}=175℃	t_{rr}	-	215	-	ns
Diode peak reverse recovery current		Q_{rr}	-	278	-	nC
Diode reverse recovery charge		I_{rrm}	-	9.7	-	A

Typical Characteristics

Figure 1: Power Dissipation

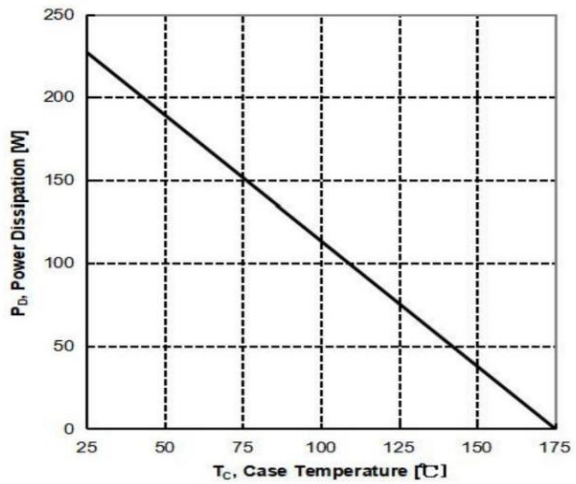


Figure 2: Collector Current vs. Case Temperature

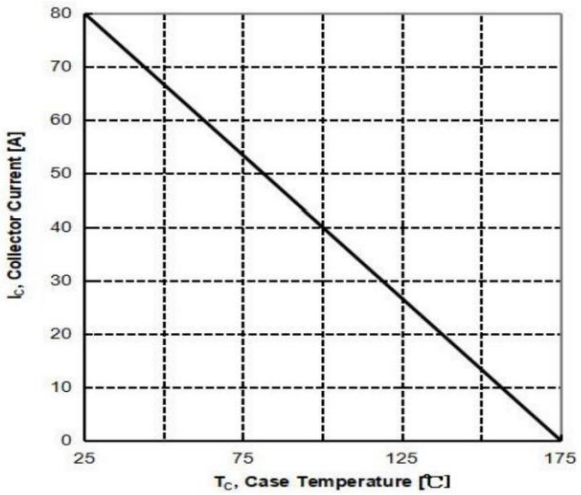


Figure 3: Safe Operation Area

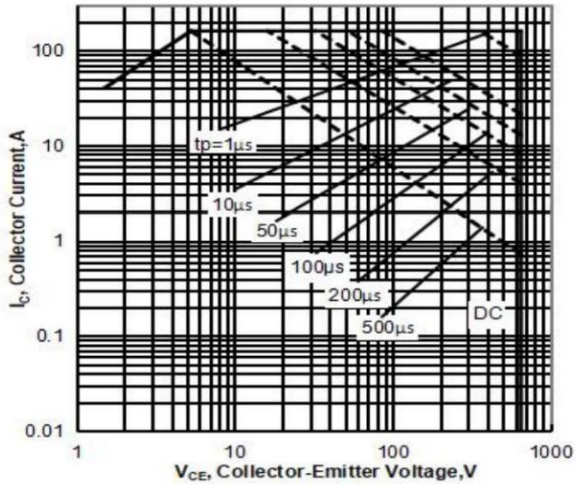


Figure 4: Typical Transfer Characteristics

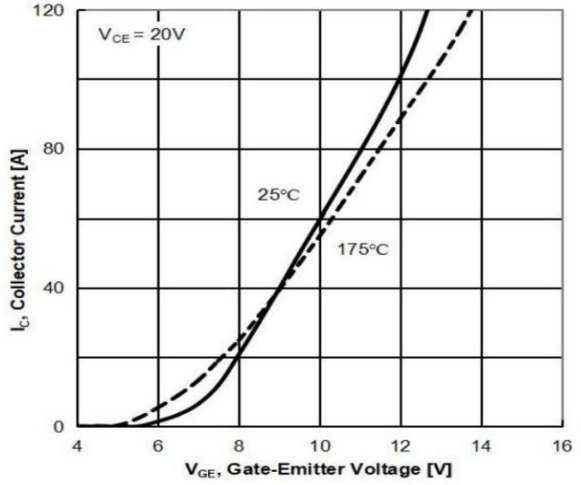


Figure 5: Typical Output Characteristics

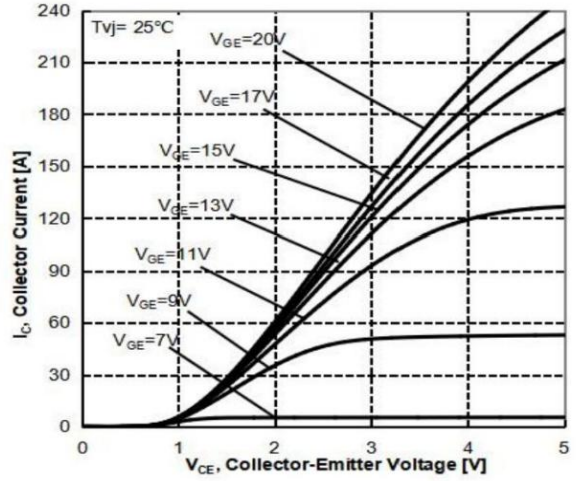


Figure 6: Typical Output Characteristics

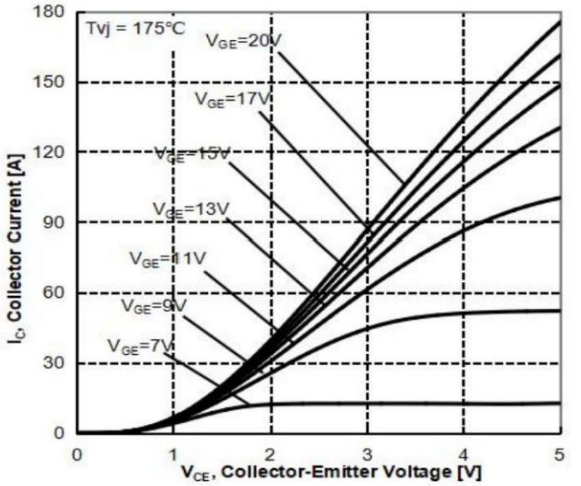


Figure 7: Typical Collector-Emitter Saturation Voltage vs. Junction Temperature

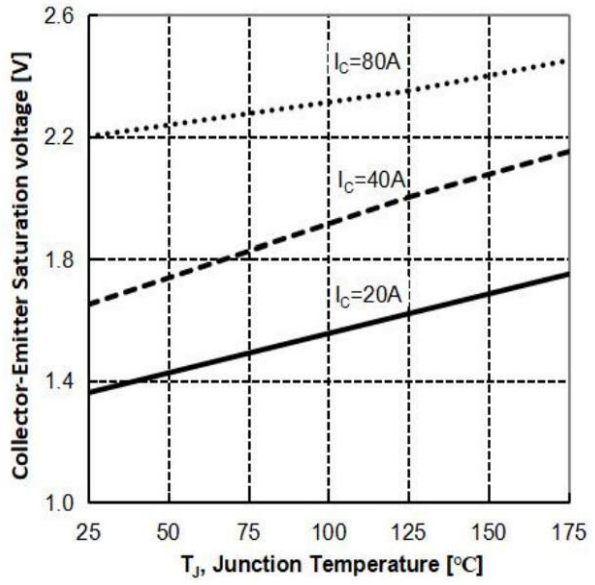


Figure 8: Typical Gate-Emitter Threshold Voltage vs. Junction Temperature

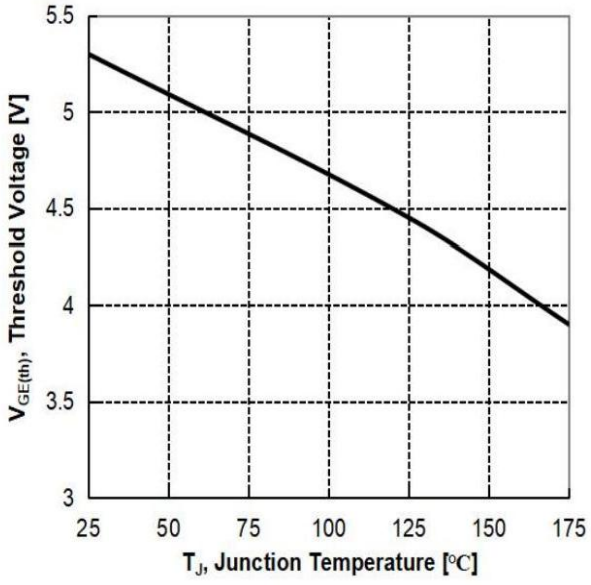


Figure 9: Typical Switching Times vs. Gate Resistor (T_J=25°C, V_{CE}=400V, V_{GE}=15/0V, I_C=40A)

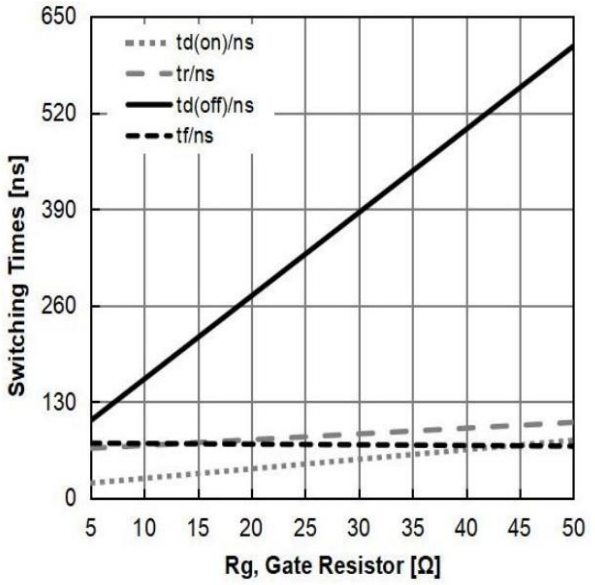


Figure 10: Typical Switching Energy vs. Gate Resistor (T_J=25°C, V_{CE}=400V, V_{GE}=15/0V, I_C=40A)

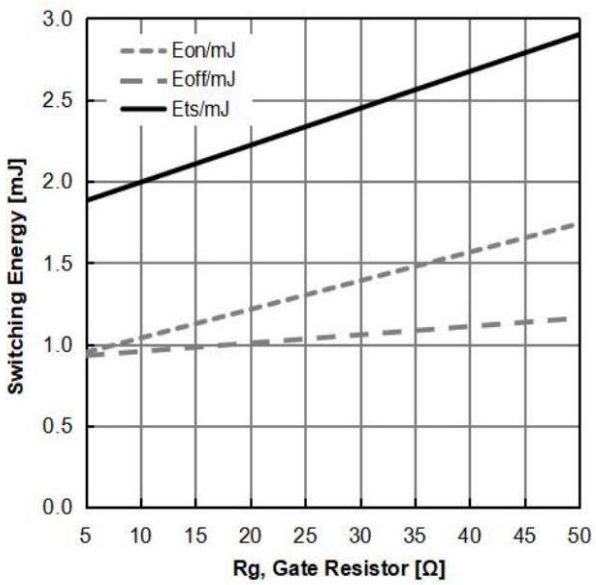


Figure 11: Typical Switching Times vs. Junction Temperature (V_{CE}=400V, V_{GE}=15/0V, I_C=40A)

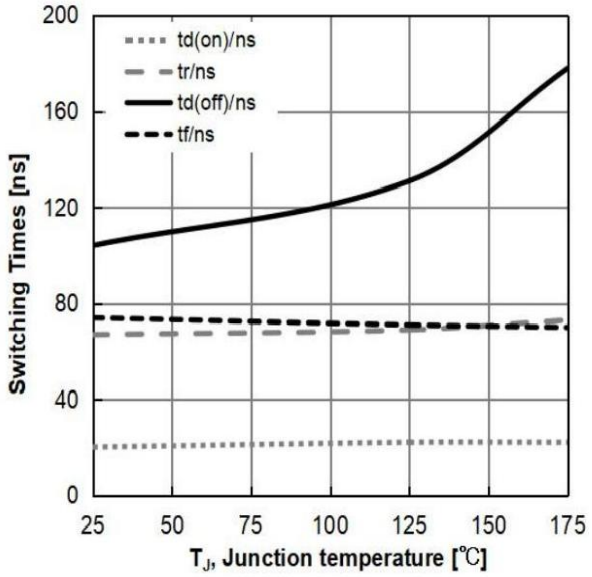


Figure 12: Typical Switching Energy vs. Junction Temperature (V_{CE}=400V, V_{GE}=15/0V, I_C=40A)

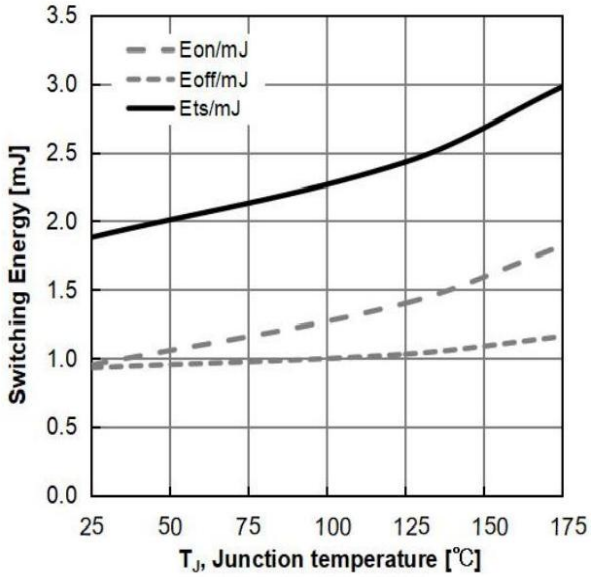


Figure 13: Typical Switching Times vs. Collector Current (T_J=25℃, V_{CE}=400V, V_{GE}=15/0V)

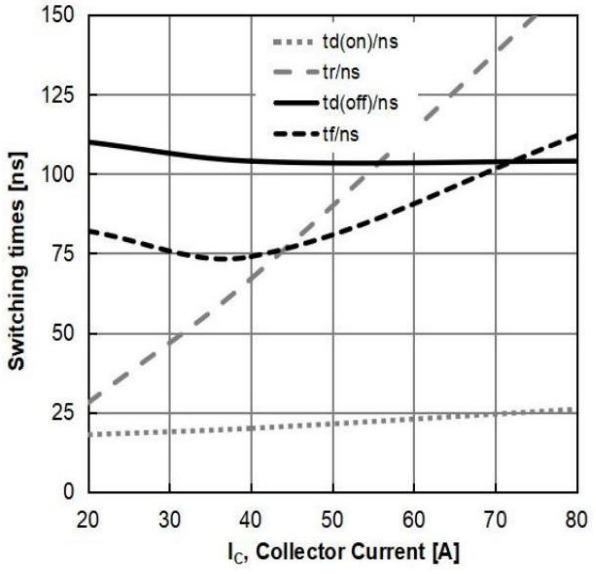


Figure 14: Typical Switching Energy vs. Collector Current (T_J=25℃, V_{CE}=400V, V_{GE}=15/0V)

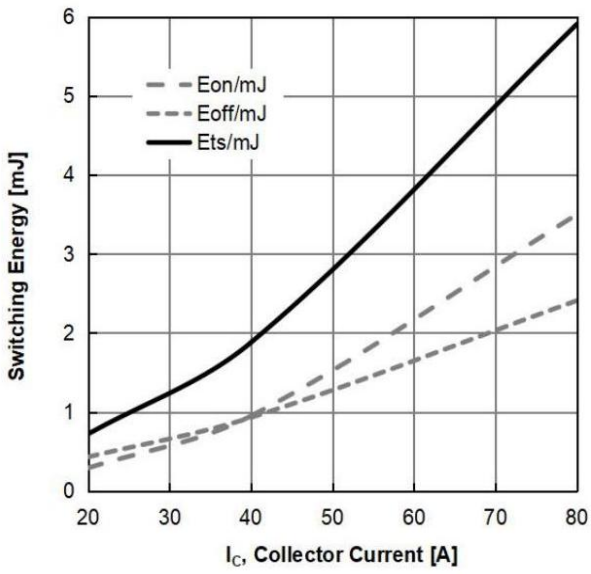


Figure 15: Typical Switching Times vs. VCE (T_J=25℃,V_{GE}=15/0V, I_C=40A)

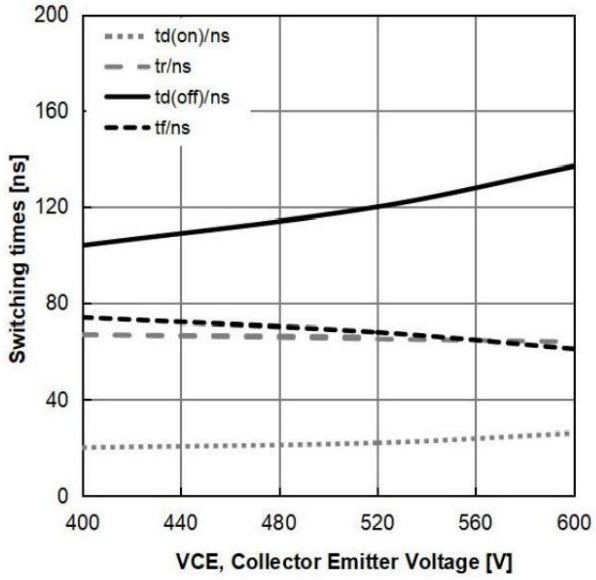


Figure 16: Typical Switching Energy vs. VCE (T_J=25℃, V_{GE}=15/0V, I_C=40A)

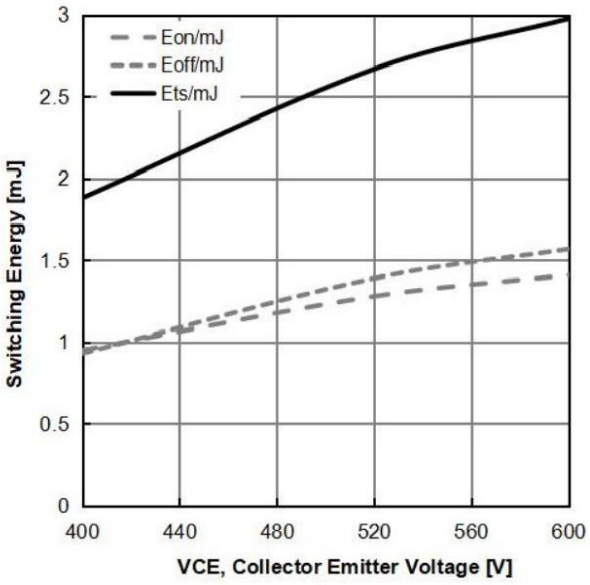


Figure 17: Typical Gate Charge

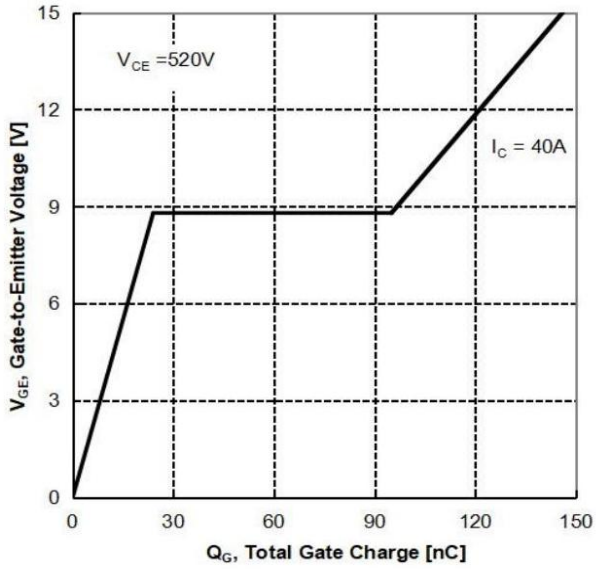


Figure 18: Typical Capacitance vs. Collector- Emitter Voltage

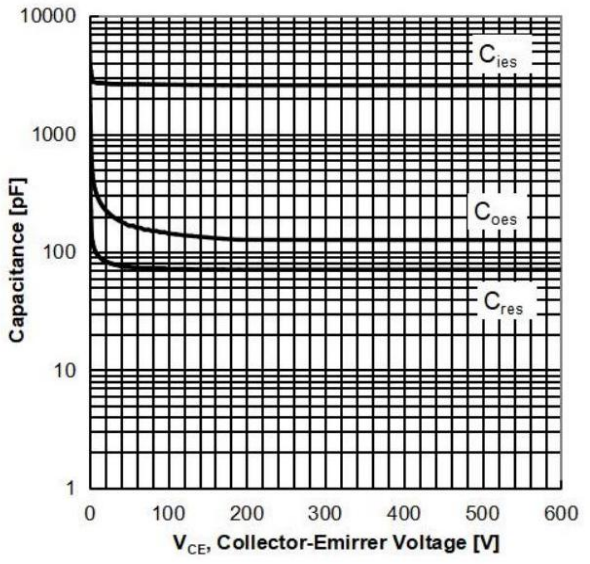


Figure 19: IGBT Transient Thermal Impedance vs. Pulse Width

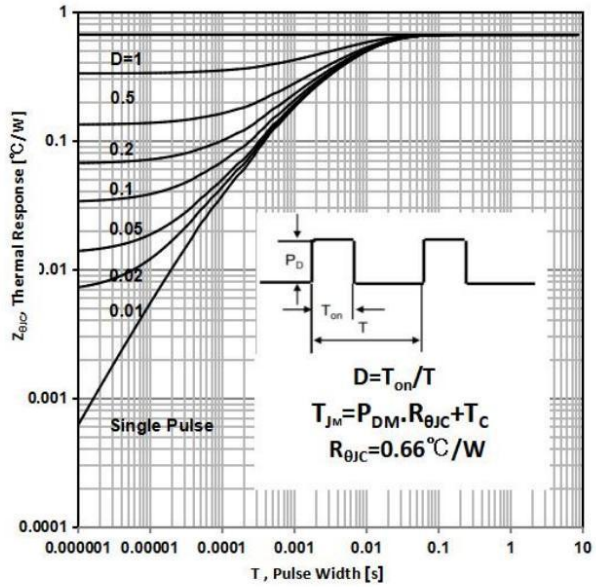


Figure 20: Diode Transient Thermal Impedance vs. Pulse Width

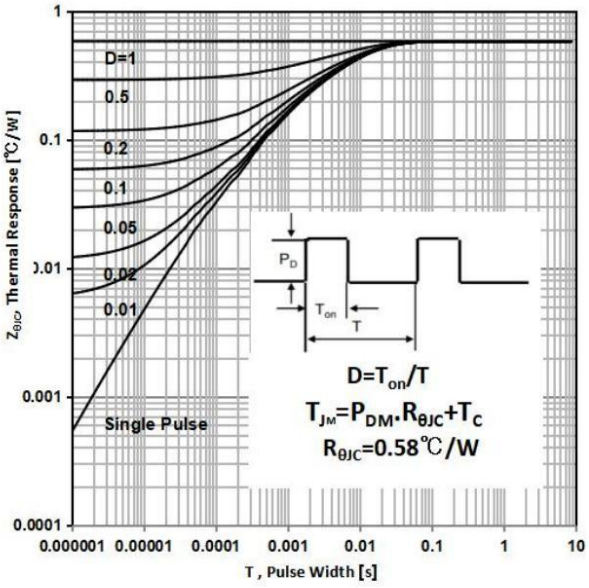
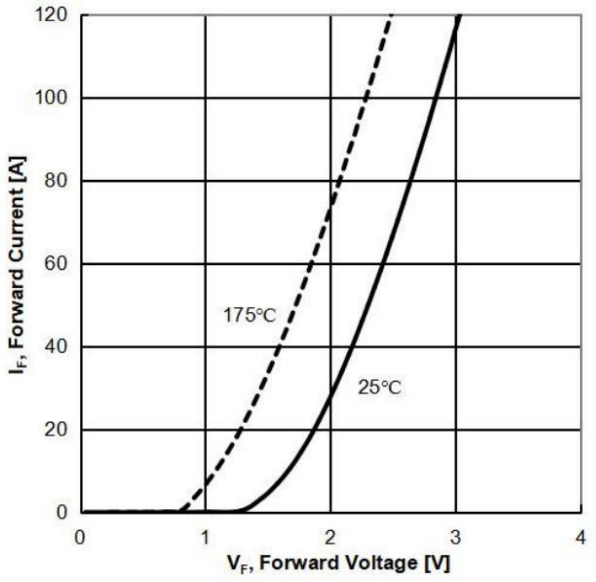
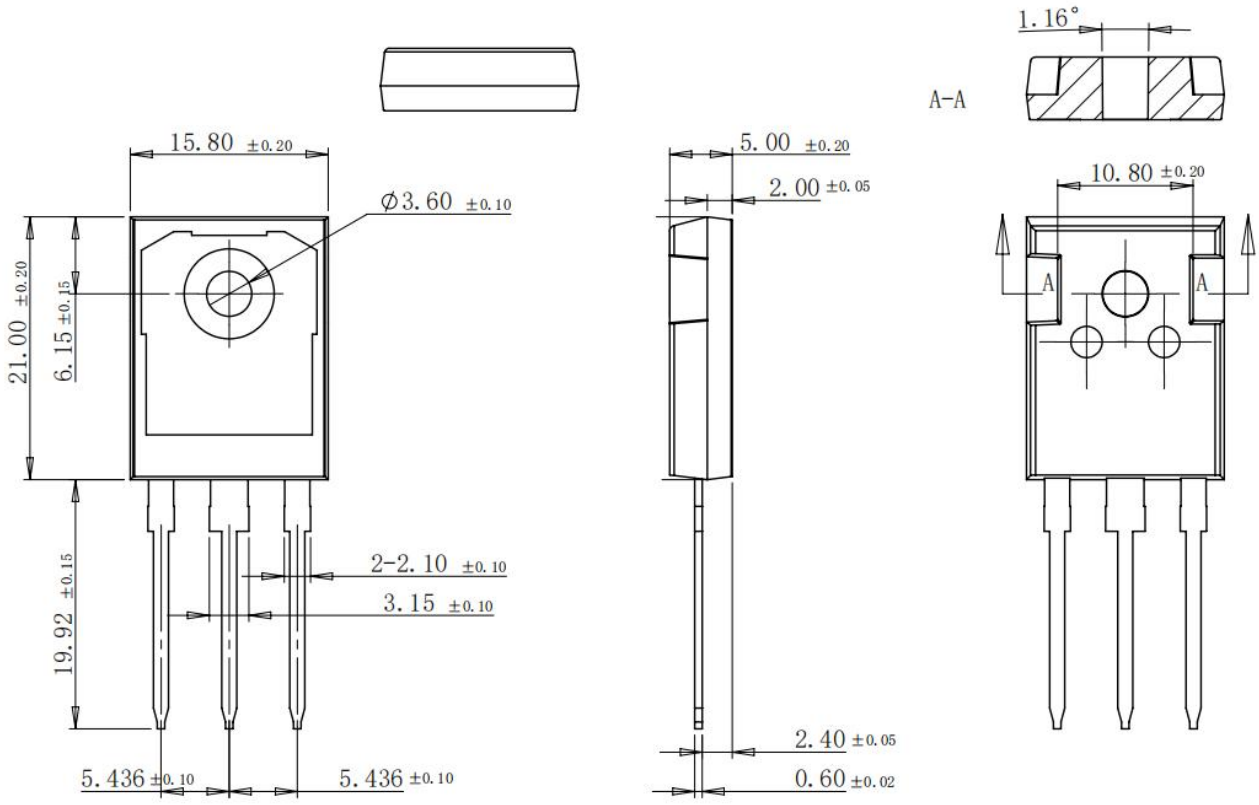


Figure 21: Typical Diode Forward Current vs. Forward Voltage



Package Outlines (Unit：mm)

TO-247-3L



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