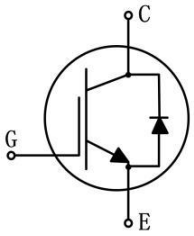
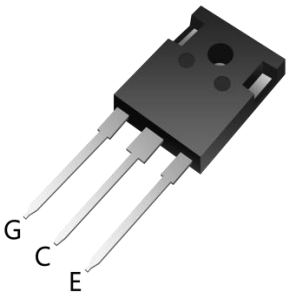
Trench Field-stop IGBT Discrete

Parameter	Value	Unit
V_{CE}	650	V
I_C	60	A
$V_{CE(sat)}$	1.6	V





TO-247-3L

Features

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

Applications

- Energy storage
- Solar string inverter
- Uninterruptible power supplies

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CES}	650	V
Gate-emitter voltage	V_{GES}	±20	V
Continuous collector current(T_C=25℃)	I_C	120	A
Continuous collector current(T_C=100℃)		60	A
Pulsed collector current,tp limited by T_{vjmax}	I_{CM}	240	A
Diode continuous forward current(T_C=100℃)	I_F	60	A
Diode maximum current,tp limited by T_{vjmax}	I_{FM}	240	A
Power dissipation(T_C=25℃)	P_{tot}	375	W
Power dissipation(T_C=100℃)		145	W
Operating junction temperature range	T_{vj}	-55 to+175	℃
Storage temperature range	T_{stg}	-55 to+150	℃

Thermal Characteristics

Parameter	Symbol	Value		Unit
		Typ	Max.	
Thermal resistance,junction to case for IGBT	$R_{th(j-c)}$	-	0.4	℃/W
Thermal resistance,junction to case for Diode	$R_{th(j-c)}$	-	0.7	℃/W
Thermal resistance,junction to ambient	$R_{th(j-a)}$	-	40	℃/W

Electrical Characteristics of IGBT (T_{vj}=25℃ unless otherwise specified)

Static characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	BV_{CES}	V_{GE}=0V,I_C=250μA	650	-	-	V
Collector-emitter leakage current	I_{CES}	V_{CE}=650V,V_{GE}=0V	-	-	25	μA
Gate leakage current,forward	I_{GES}	V_{GE}=±20V,V_{CE}=0V	-	-	±200	nA
Gate-emitter threshold voltage	$V_{GE(th)}$	V_{GE}=V_{CE},I_C=1mA	4.7	5.5	6.2	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE}=15V,I_C=60A	-	1.6	2	V
		V_{GE}=15V,I_C=60A	-	2.5	-	V

Dynamic Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{ies}	V_{CE}=25V V_{GE}=0V f=1MHz	-	3146	-	pF
Output capacitance	C_{oes}		-	121	-	pF
Reverse transfer capacitance	C_{res}		-	31	-	pF
Total gate charge	Q_g	V_{CC}=520V V_{GE}=15V I_C=60A	-	118	-	nC

Switching Characteristics

Parameter	Symbol	Test condition	Value			Unit
			Min.	Typ.	Max.	
Turn-on delay time	$t_{d(on)}$	V_{CC}=400V V_{GE}=15V I_C=60A R_G=5Ω Inductive load	-	44	-	ns
Rise time	t_r		-	47	-	ns
Turn-off delay time	$t_{d(off)}$		-	123	-	ns
Fall time	t_f		-	90	-	ns
Turn-on energy	E_{on}		-	1.2	-	mJ
Turn-off energy	E_{off}		-	1.5	-	mJ
Total switching energy	E_{ts}		-	2.7	-	mJ
Turn-on delay time	$t_{d(on)}$	V_{CC}=400V V_{GE}=15V I_C=60A R_G=5Ω Inductive load T_{vj}=175℃	-	36	-	ns
Rise time	t_r		-	46	-	ns
Turn-off delay time	$t_{d(off)}$		-	140	-	ns
Fall time	t_f		-	150	-	ns
Turn-on energy	E_{on}		-	1.3	-	mJ
Turn-off energy	E_{off}		-	2.34	-	mJ
Total switching energy	E_{ts}		-	3.64	-	mJ

Diode Characteristics

Parameter	Symbol	Test condition	Values			Unit
			Min.	Typ.	Max.	
Diode forward voltage	V_F	I_F=60A	-	1.7	2.4	V
		I_F=60A,T_{vj}=175℃	-	1.45	-	V
Diode reverse recovery time	t_{rr}	V_R=400V I_F=60A diF/dt=-450A/μs	-	41	-	ns
Diode peak reverse recovery current	I_{rrm}		-	3.3	-	A
Diode reverse recovery charge	Q_{rr}		-	70	-	nC
Diode reverse recovery time	t_{rr}	V_R=400V I_F=60A diF/dt=-450A/μs T_{vj}=175℃	-	219	-	ns
Diode peak reverse recovery current	I_{rrm}		-	11.5	-	A
Diode reverse recovery charge	Q_{rr}		-	1454	-	nC

Typical Characteristics

Figure 1: Power Dissipation

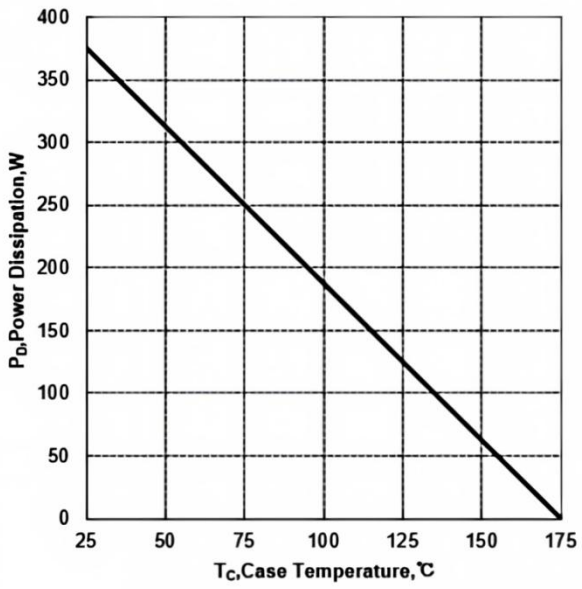


Figure 2: Collector Current vs. Case Temperature

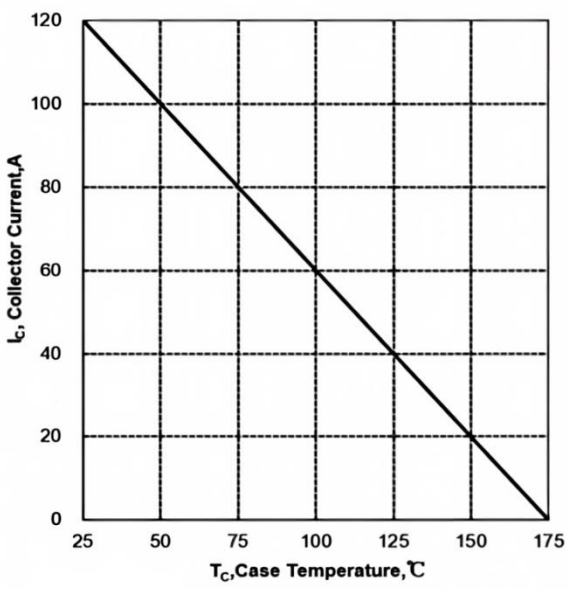


Figure 3: Safe Operation Area

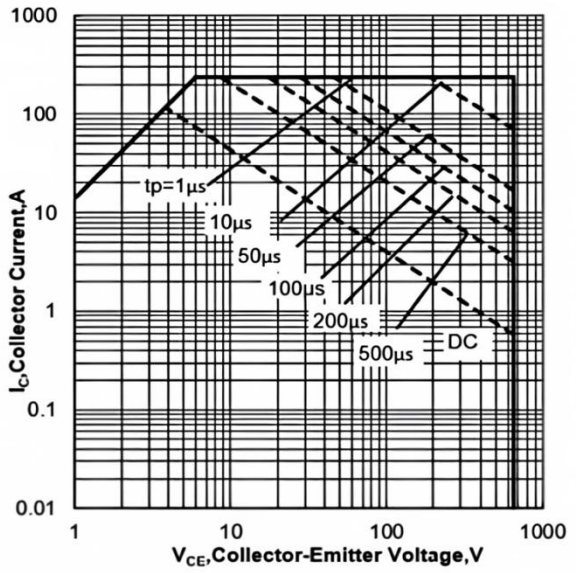


Figure 4: Typical Transfer Characteristics

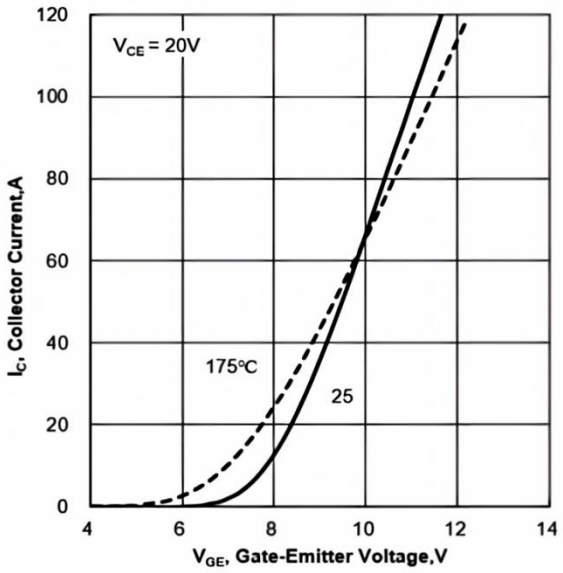


Figure 5: Typical Output Characteristics

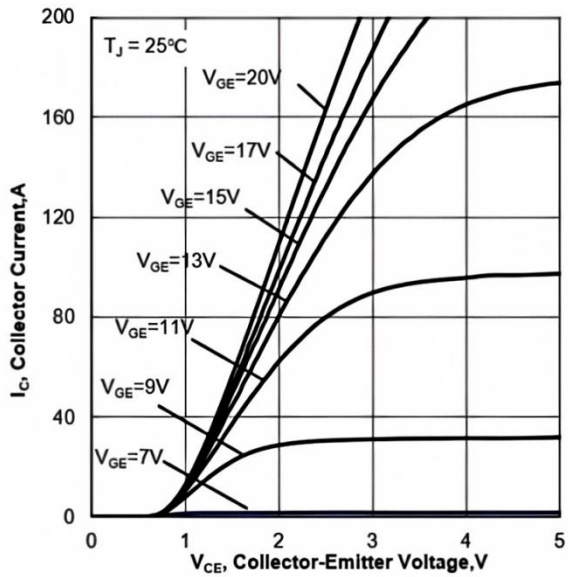


Figure 6: Typical Output Characteristics

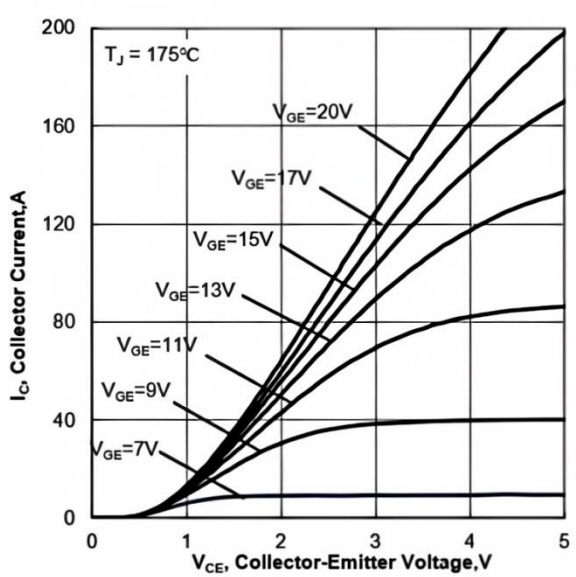


Figure 7: Typical Collector-Emitter Saturation Voltage vs. Junction Temperature

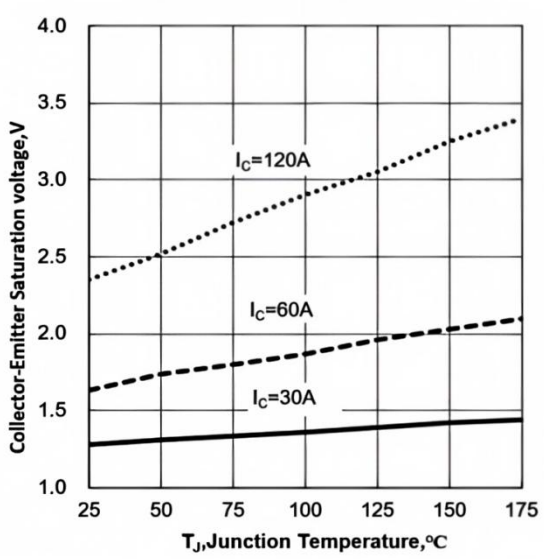


Figure 8: Typical Gate-Emitter Threshold Voltage vs. Junction Temperature

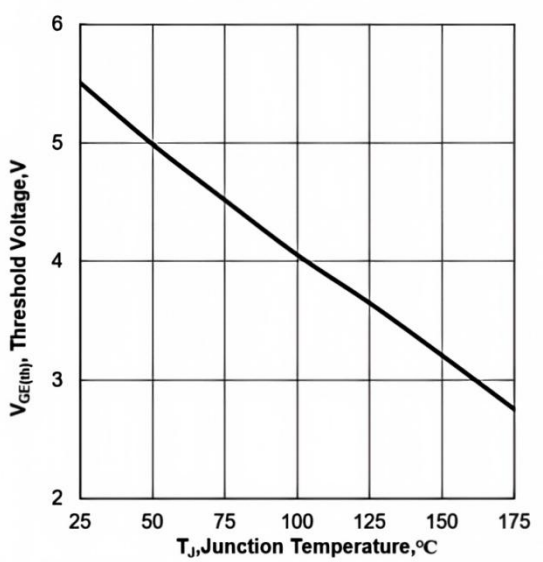


Figure 9: Typical Switching Times vs. Gate Resistor (T_J=25℃, V_{CE}=400V, V_{GE}=15V, I_C=60A)

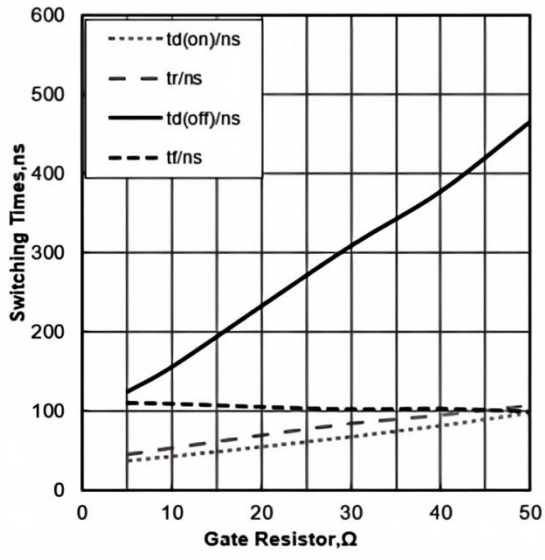


Figure 10: Typical Switching Energy vs. Gate Resistor (T_J=25℃, V_{CE}=400V, V_{GE}=15V, I_C=60A)

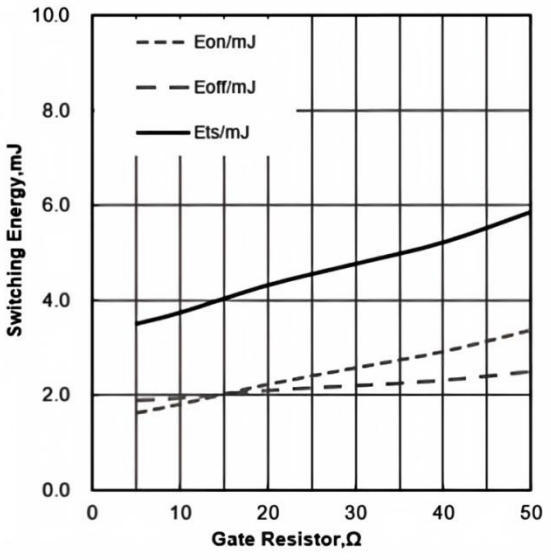


Figure 11: Typical Switching Times vs. Junction Temperature (V_{CE}=400V, V_{GE}=15V, I_C=60A,Rg=5Ω)

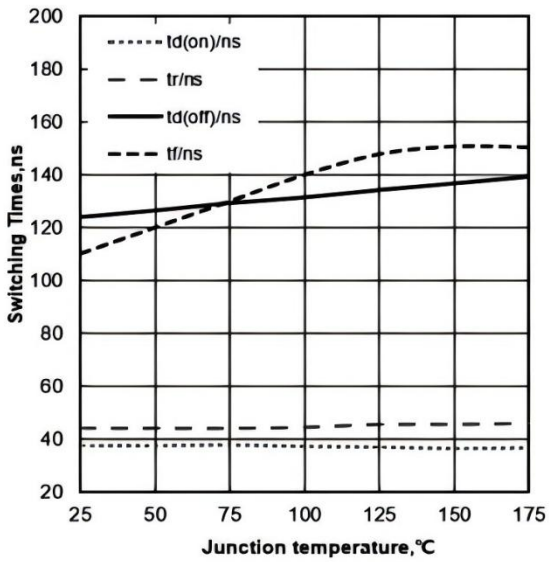


Figure 12: Typical Switching Energy vs. Junction Temperature (V_{CE}=400V, V_{GE}=15V, I_C=60A,Rg=5Ω)

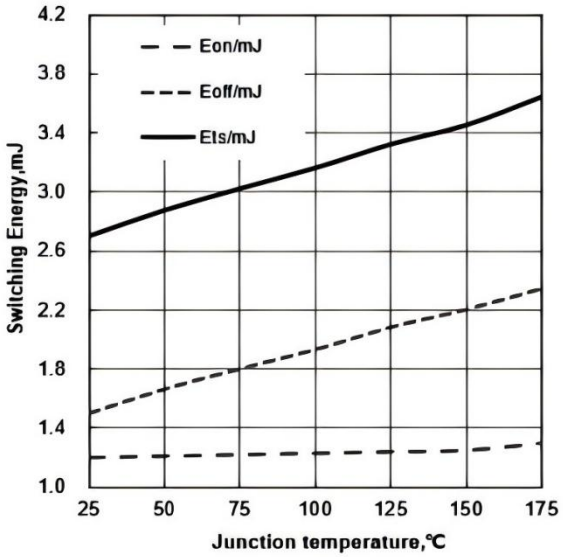


Figure 13: Typical Switching Times vs. Collector Current (T_J=25℃, V_{CE}=400V, V_{GE}=15V,Rg=5Ω)

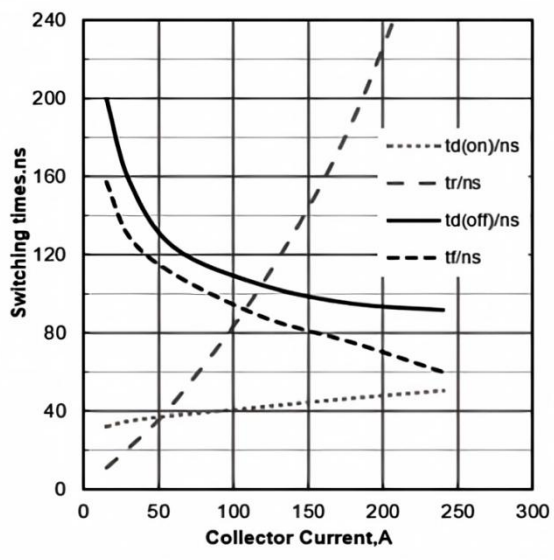


Figure 14: Typical Switching Energy vs. Collector Current (T_J=25℃, V_{CE}=400V, V_{GE}=15V,Rg=5Ω)

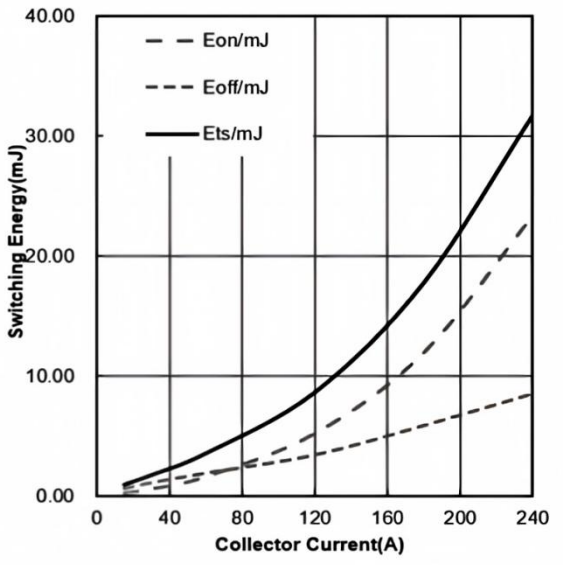


Figure 15: Typical Switching Times vs. VCE
(T_J=25℃, V_{GE}=15V, I_C=60A,Rg=5Ω)

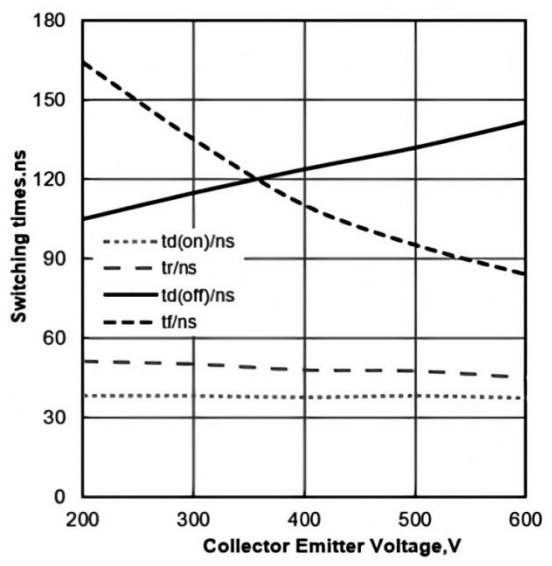


Figure 16: Typical Switching Energy vs. VCE
(T_J=25℃, V_{GE}=15V, I_C=60A,Rg=5Ω)

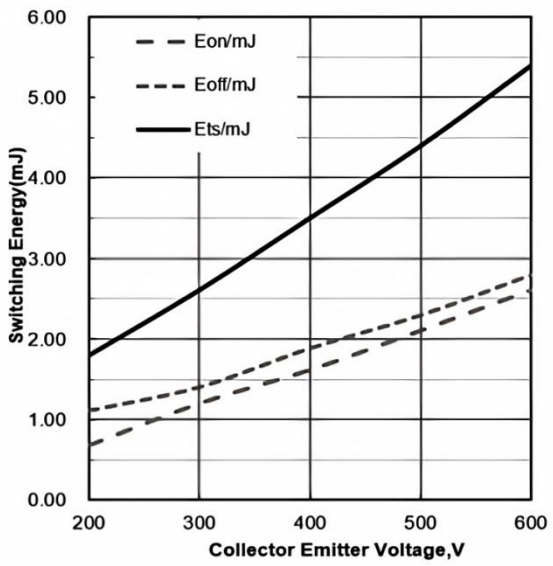


Figure 17: Typical Capacitance vs. Collector- Emitter Voltage

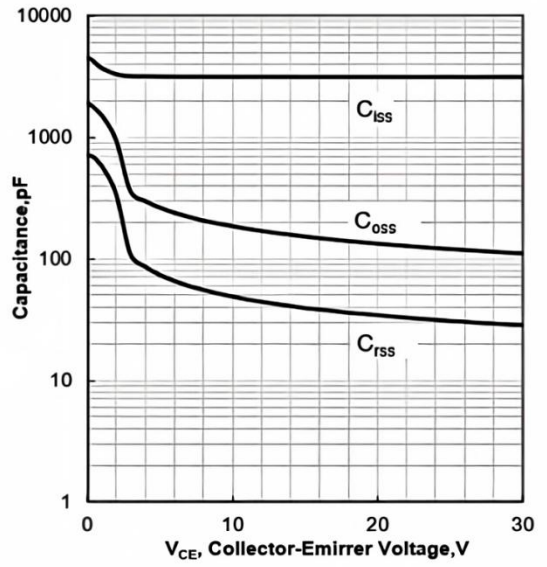


Figure 18: Typical Gate Charge

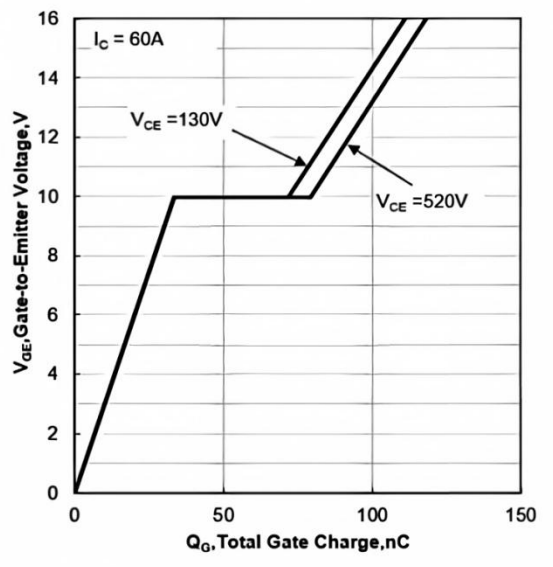


Figure 19: IGBT Transient Thermal Impedance vs. Pulse Width

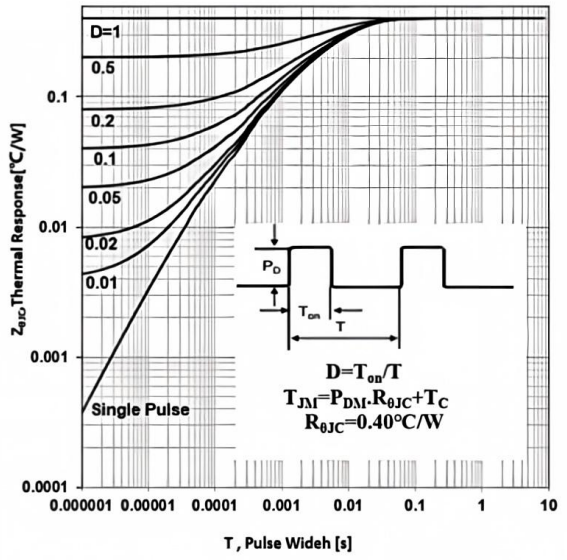


Figure 20: Diode Transient Thermal Impedance vs. Pulse Width

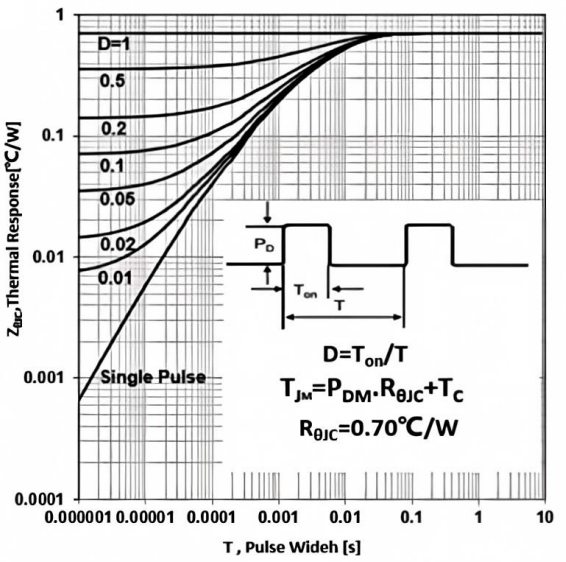
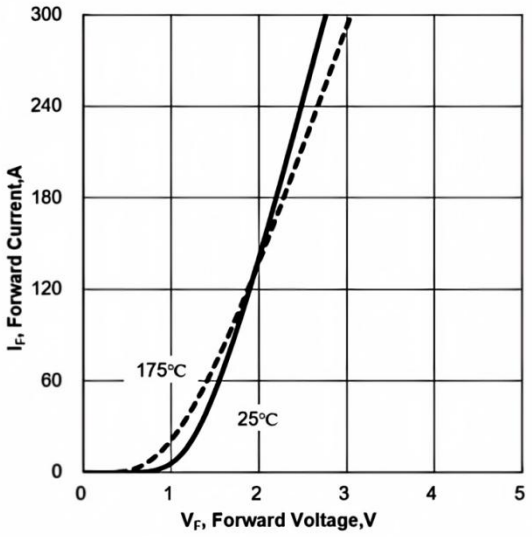
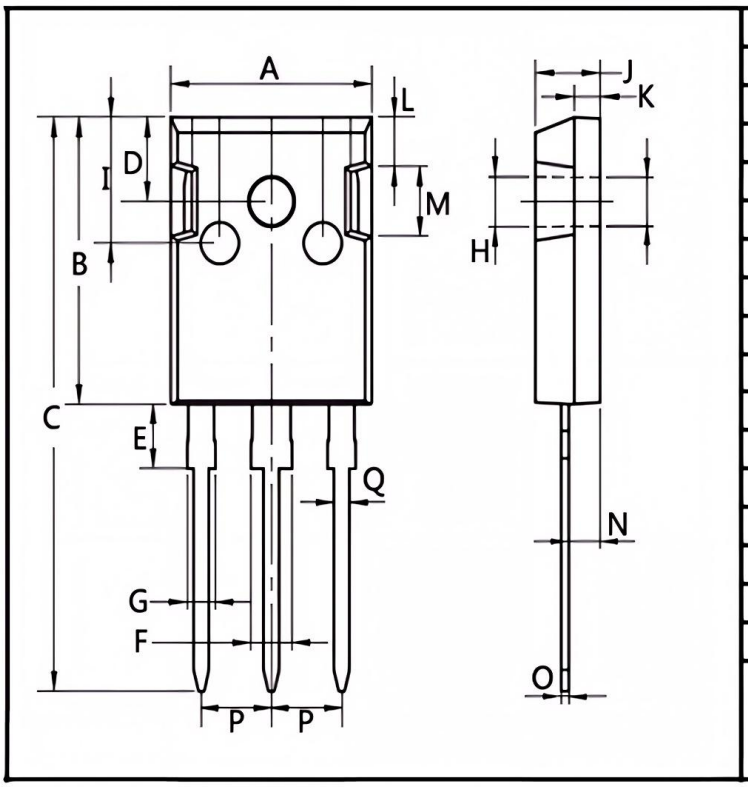


Figure 21: Typical Diode Forward Current vs. Forward Voltage



Package Outline Dimensions

TO-247-3L



Dim.	Min.	Max.
A	15	16
B	20	21
C	40	42
D	5.5	6.5
E	4	5.5
F	2.5	3.5
G	1.75	2.5
H	3	4
I	8	10
J	4.9	5.1
K	1.9	2.1
L	3.5	4
M	4.75	5.25
N	2	3
O	0.55	0.75
P	Typ 5.4	
Q	1.17	1.3

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