

1. Description

BLG15T65FUL is obtained by advanced Trench Field Stop (T-FS) technology which is characteristic with low $V_{CE(sat)}$, optimized switching performance and low gate charge Q_g . The IGBT is suitable device for BLDC, UPS, and low $V_{CE(sat)}$ applications.

KEY CHARACTERISTICS

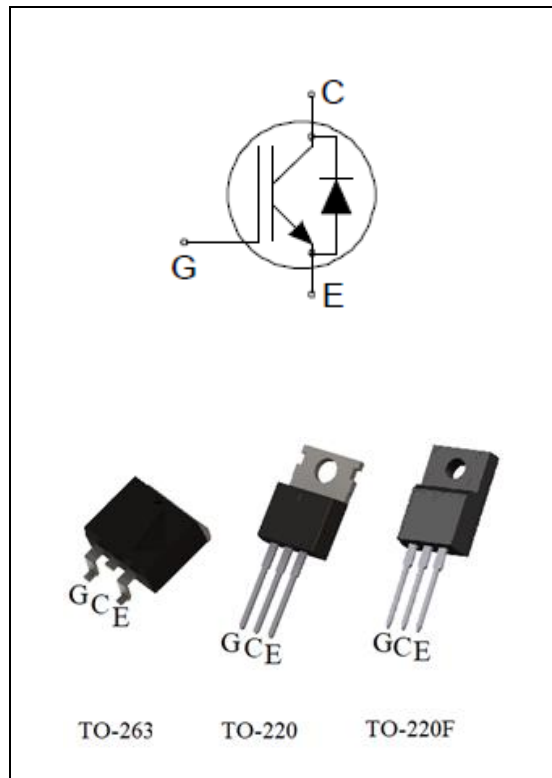
Parameter	Value	Unit
V_{CES}	650	V
I_c	15	A
$V_{CE(sat).typ}$	1.4	V

FEATURES

- Fast Switching
- LOW $V_{CE(sat)}$
- Positive temperature coefficient
- Very soft, fast recovery anti-parallel diode
- RoHS product

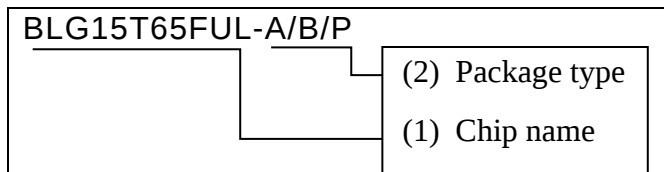
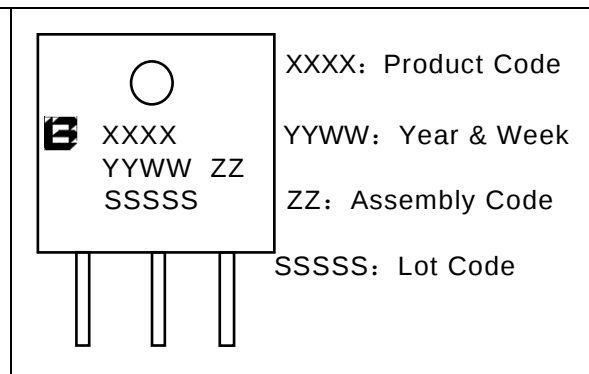
APPLICATIONS

- UPS
- Air condition
- Motor drives
- PFC



ORDERING INFORMATION

Ordering Codes	Package	Product Code	Packing
BLG15T65FUL-B	TO-263	G15T65FUL	Reel
BLG15T65FUL-P	TO-220	G15T65FUL	Tube
BLG15T65FUL-A	TO-220F	G15T65FUL	Tube

BLG15T65FUL-A/B/P  (1) BLG15T65FUL: 650V 15A (2) B:TO-263 P:TO-220 A:TO-220F	 XXXX: Product Code YYWW: Year & Week ZZ: Assembly Code SSSS: Lot Code
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2. ABSOLUTE RATINGS

at $T_C = 25^\circ\text{C}$, unless otherwise specified

Symbol	Parameter	TO-220/ TO-263	TO-220F	Units
V_{CES}	Collector-Emitter Voltage	650	650	V
I_C	Collector Current @ $T_C=25^\circ\text{C}$	30	30	A
	Collector Current @ $T_C=100^\circ\text{C}$	15	15	A
I_{CM}	Pulsed Collector Current, tp limited by T_{Jmax}	60	60	A
I_F	Diode Continuous Forward Current @ $T_C=25^\circ\text{C}$	30	30	A
	Diode Continuous Forward Current @ $T_C=100^\circ\text{C}$	15	15	A
I_{FM}	Diode Maximum Forward Current, limited by T_{Jmax}	60	60	A
V_{GES}	Gate-Emitter Voltage	± 30	± 30	V
t_{SC}	Short circuit withstand time $V_{GE}=15\text{V}$, $V_{CC}\leq 400\text{V}$, Allowed number of short circuits<1000, Times between short circuits: $\geq 1.0\text{s}$, $T_J \leq 175^\circ\text{C}$	3.0		μs
P_D	Power Dissipation @ $T_C=25^\circ\text{C}$	136	41	W
T_{Jmax}, T_{stg}	Operating Junction and Storage Temperature Range	175, -55 to 175		$^\circ\text{C}$
T_L	Maximum Temperature for Soldering	260		$^\circ\text{C}$

3. Thermal characteristics

Symbol	Parameter	TO-220/TO-263	TO-220F	Units
$R_{\theta JC}$	Junction-to-Case (IGBT)	1.1	3.6	$^\circ\text{C/W}$
$R_{\theta JC}$	Junction-to-Case (Diode)	2.1	3.9	$^\circ\text{C/W}$
$R_{\theta JA}$	Junction-to-Ambient	62.5	78	$^\circ\text{C/W}$

4. Electrical Characteristics

at $T_C = 25^\circ\text{C}$, unless otherwise specified

Static Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
V_{CES}	Collector-Emitter Breakdown Voltage	$V_{GE} = 0\text{V}$, $I_C = 250\mu\text{A}$	650	--	--	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15\text{V}$, $I_C = 15\text{A}$	--	1.40	1.80	V
		$T_J=25^\circ\text{C}$	--	1.60	--	
		$T_J=125^\circ\text{C}$	--	1.70	--	

$V_{GE(TH)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}, I_C = 1mA$	5.1	5.8	6.5	V
V_F	Diode Forward Voltage	$I_F = 7.5A$ $T_J = 25^\circ C$ $T_J = 125^\circ C$ $T_J = 175^\circ C$	--	1.55 1.30 1.20	2.10 -- --	V
V_F	Diode Forward Voltage	$I_F = 15A$ $T_J = 25^\circ C$ $T_J = 125^\circ C$ $T_J = 175^\circ C$	--	1.80 1.60 1.50	2.40 -- --	V
I_{CES}	Collector-Emitter Leakage Current	$V_{CE} = 650V$, $V_{GE} = 0V$	--	--	4	μA
$I_{GES(F)}$	Gate-Emitter Forward Leakage Current	$V_{GE} = +30V$	--	--	200	nA
$I_{GES(R)}$	Gate-Emitter Reverse Leakage Current	$V_{GE} = -30V$	--	--	-200	nA
Pulse width $t_p \leq 300\mu s$, $\delta \leq 2\%$						

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
C_{iss}	Input Capacitance	$V_{GE} = 0V$ $V_{CE} = 25V$ $f = 1.0MHz$	--	892	--	pF
C_{oss}	Output Capacitance		--	43	--	
C_{rss}	Reverse Transfer Capacitance		--	10	--	
Q_G	Gate charge	$V_{CC} = 520V$ $I_{CE} = 15A$ $V_{GE} = 15V$	--	44	--	nC
Q_{GE}	Gate-emitter charge		--	13	--	
Q_{GC}	Gate-collector charge		--	18	--	
$I_{C(SC)}$	Short circuit collector current Max.1000 short circuits, Times between short circuits: $\geq 1.0s$	$V_{GE} = 15.0V, V_{CC} \leq 400V$, $t_{sc} \leq 3\mu s$, $T_J \leq 175^\circ C$		100		A

IGBT Switching Characteristics, at $T_J = 25^\circ C$

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on Delay Time	$I_C = 15A$ $V_{CE} = 400V$ $V_{GE} = 15V$ $R_G = 5\Omega$ $T_J = 25^\circ C$ Inductive Load	--	11	--	ns
t_r	Rise Time		--	14	--	
$t_{d(off)}$	Turn-Off Delay Time		--	66	--	
t_f	Fall Time		--	99	--	
E_{on}	Turn-On Switching Loss		--	0.21	--	mJ

E_{off}	Turn-Off Switching Loss		--	0.26	--	
E_{ts}	Total Switching Loss		--	0.47	--	

IGBT Switching Characteristics, at $T_J=175^\circ\text{C}$

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on Delay Time	$I_C = 15\text{A}$ $V_{CE} = 400\text{V}$ $V_{GE} = 15\text{V}$ $R_G = 5\Omega$ $T_J = 175^\circ\text{C}$ Inductive Load	--	12	--	ns
t_r	Rise Time		--	15	--	
$t_{d(off)}$	Turn-Off Delay Time		--	125	--	
t_f	Fall Time		--	145	--	
E_{on}	Turn-On Switching Loss		--	0.26	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.35	--	
E_{ts}	Total Switching Loss		--	0.61	--	

Diode Characteristics, at $T_J=25^\circ\text{C}$

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
T_{rr}	Reverse Recovery Time	$I_F = 7.5\text{A}$, $di/dt = 200\text{A}/\mu\text{s}$, $T_J = 25^\circ\text{C}$	--	58	--	ns
Q_{rr}	Reverse Recovery Charge		--	168	--	nC
I_{rrm}	Reverse Recovery Current		--	4.2	--	A
T_{rr}	Reverse Recovery Time	$I_F = 15\text{A}$, $di/dt = 200\text{A}/\mu\text{s}$, $T_J = 25^\circ\text{C}$	--	72	--	ns
Q_{rr}	Reverse Recovery Charge		--	214	--	nC
I_{rrm}	Reverse Recovery Current		--	5.2	--	A

Diode Characteristics, at $T_J=175^\circ\text{C}$

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
T_{rr}	Reverse Recovery Time	$I_F = 7.5\text{A}$, $di/dt = 200\text{A}/\mu\text{s}$, $T_J = 175^\circ\text{C}$	--	110	--	ns
Q_{rr}	Reverse Recovery Charge		--	620	--	nC
I_{rrm}	Reverse Recovery Current		--	8.5	--	A
T_{rr}	Reverse Recovery Time	$I_F = 15\text{A}$, $di/dt = 200\text{A}/\mu\text{s}$, $T_J = 175^\circ\text{C}$	--	140	--	ns
Q_{rr}	Reverse Recovery Charge		--	880	--	nC
I_{rrm}	Reverse Recovery Current		--	10.2	--	A

5. Characteristics Curves

Figure 1. Forward Bias Safe Operating Area for TO220/TO263

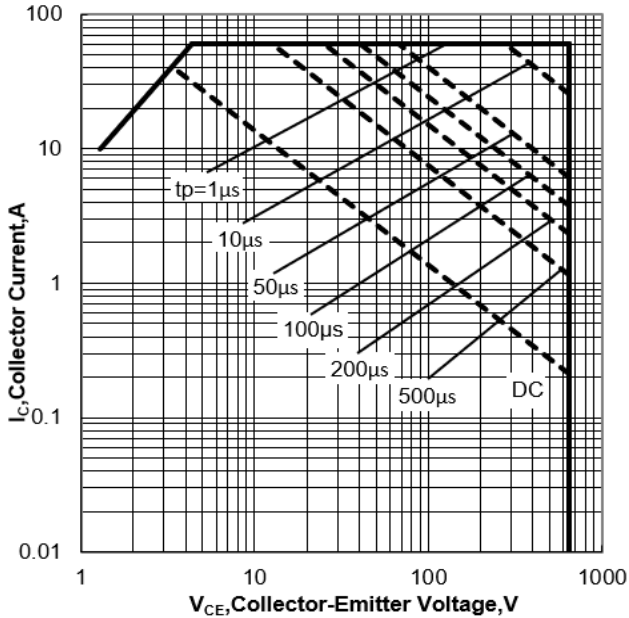


Figure 2. Forward Bias Safe Operating Area for TO220F

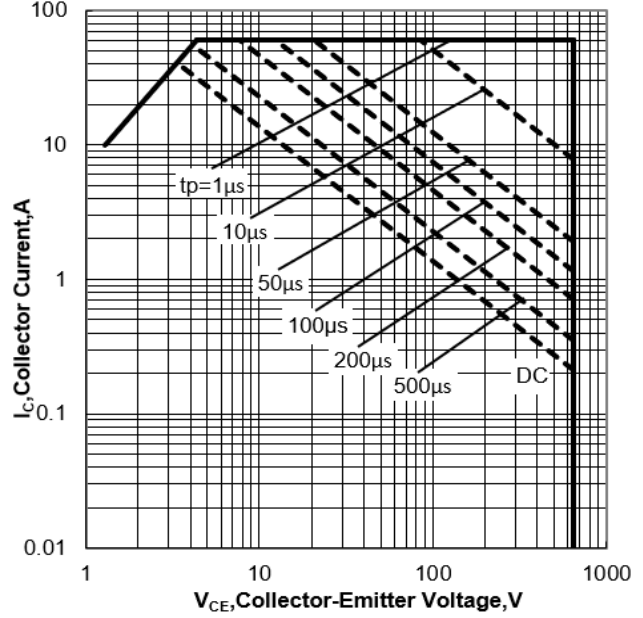


Figure 3. Power Dissipation vs Case Temperature for TO220/TO263

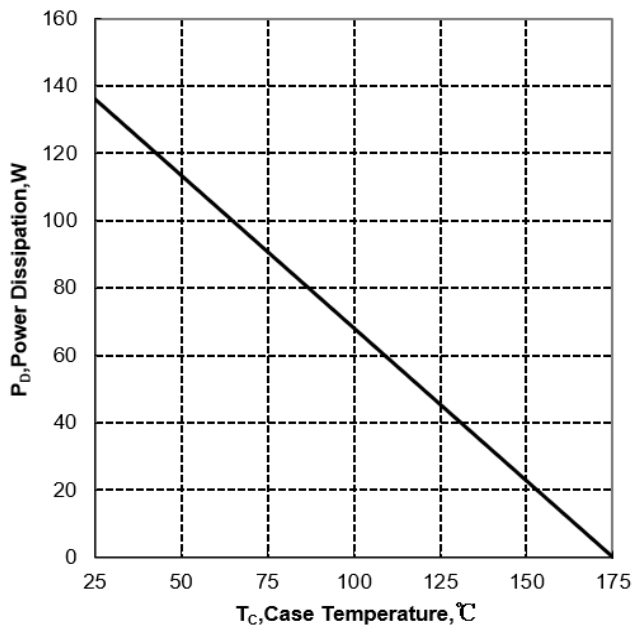


Figure 4. Power Dissipation vs Case Temperature for TO220F

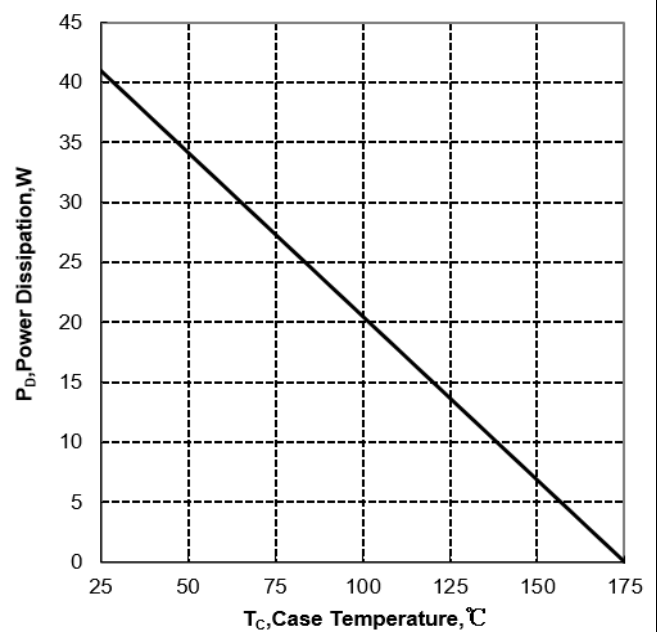


Figure 5. Collector Current vs Case Temperature

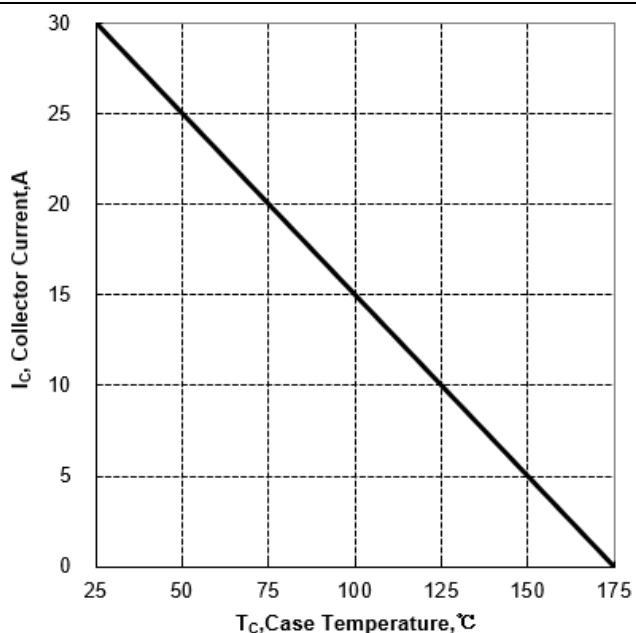


Figure 6. Typical Transfer Characteristics

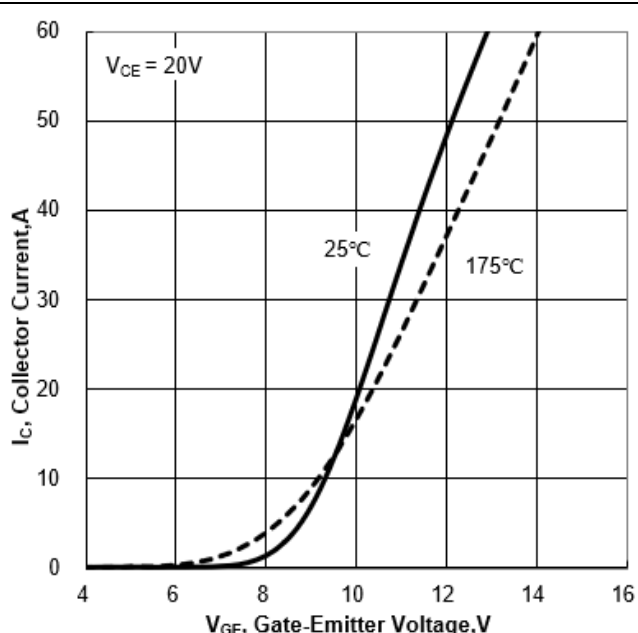


Figure 7. Typical Output Characteristics ($T_J=25^\circ\text{C}$)

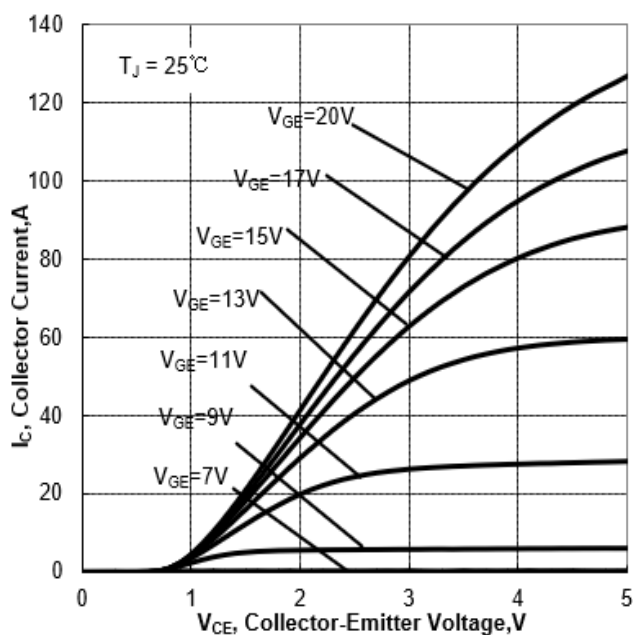


Figure 8. Typical Output Characteristics ($T_J=175^\circ\text{C}$)

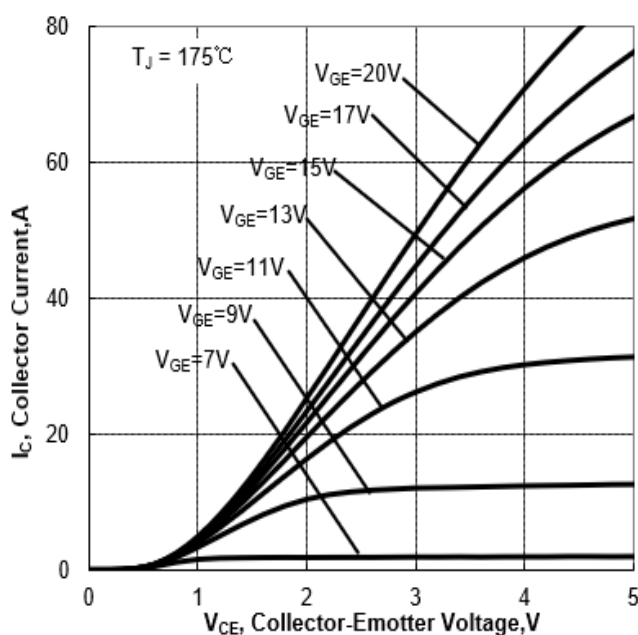


Figure 9. Typical Collector-Emitter Saturation Voltage vs Junction Temperature

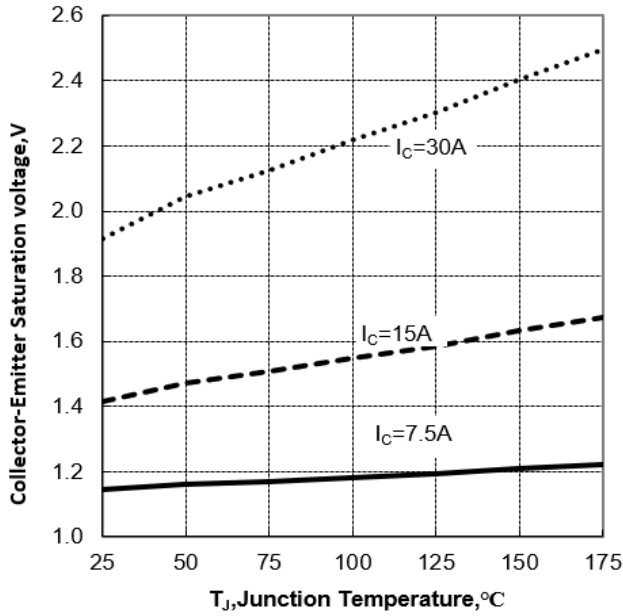


Figure 10. Typical Gate-Emitter Threshold Voltage vs Junction Temperature

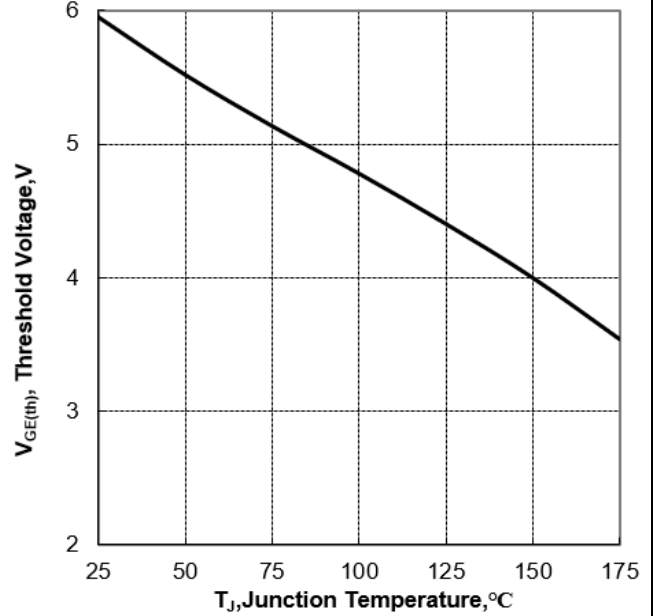


Figure 11. Typical Switching Times vs Gate Resistor (T_J=25°C, V_{CE}=400V, V_{GE}=15/0V, I_C=15A)

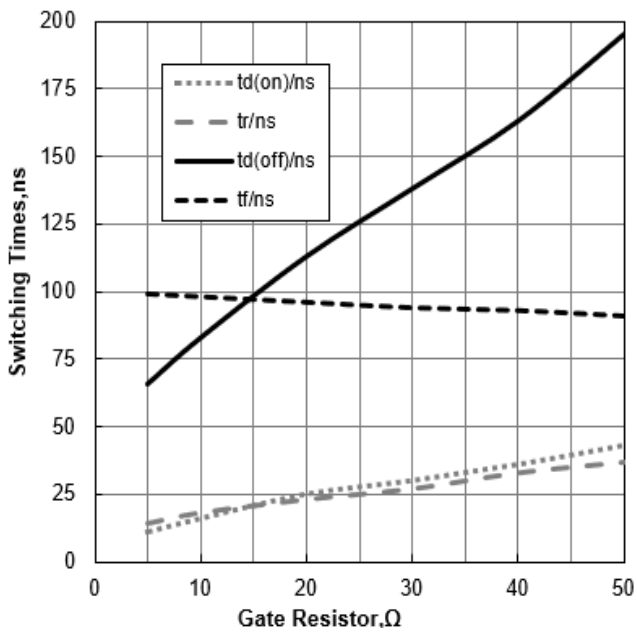


Figure 12. Typical Switching Energy vs Gate Resistor (T_J=25°C, V_{CE}=400V, V_{GE}=15/0V, I_C=15A)

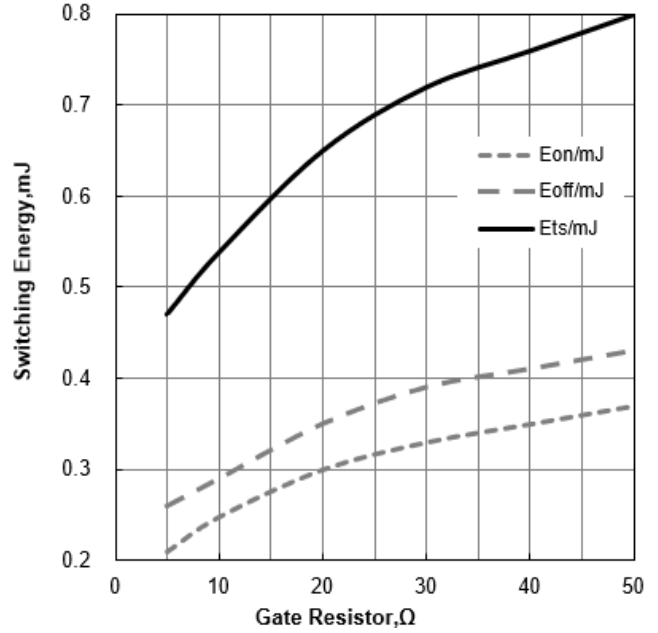


Figure 13. Typical Switching Times vs Junction Temperature ($V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=15A$)

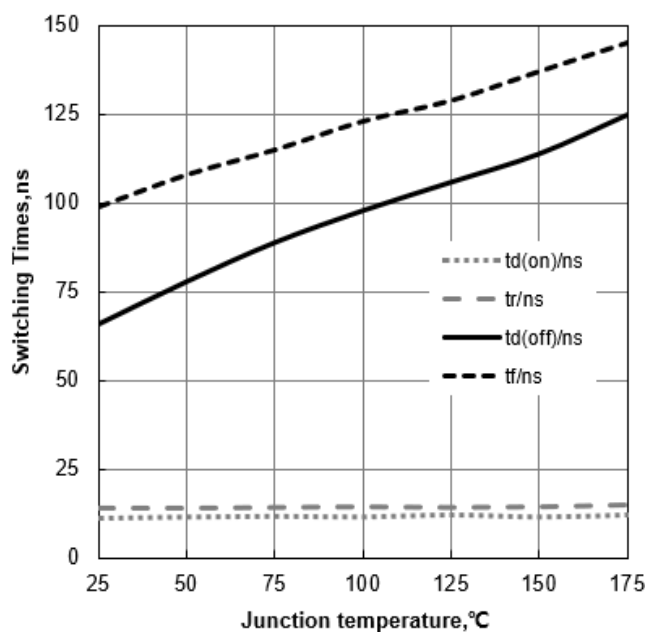


Figure 14. Typical Switching Energy vs Junction Temperature ($V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=15A$)

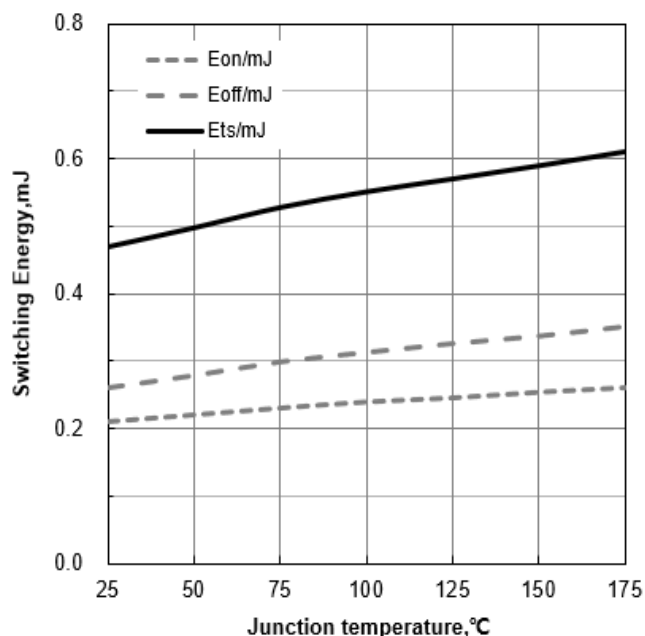


Figure 15. Typical Switching Times vs Collector Current ($T_J=25^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$)

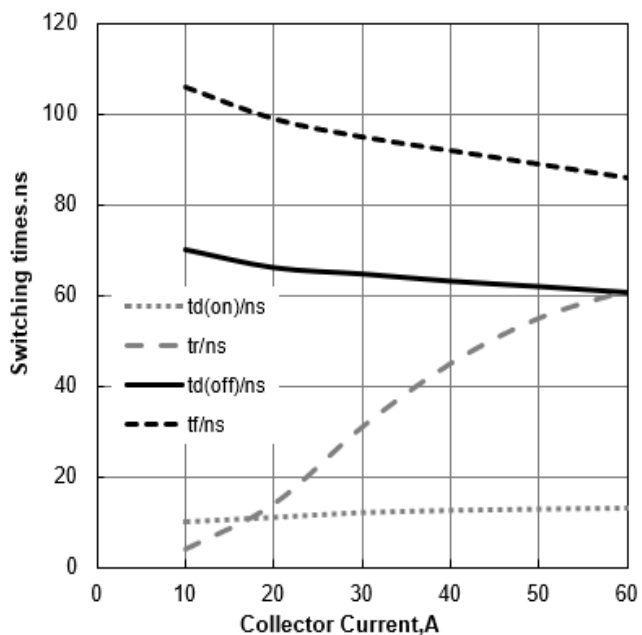


Figure 16. Typical Switching Energy vs Collector Current ($T_J=25^\circ C$, $V_{CE}=400V$, $V_{GE}=15/0V$)

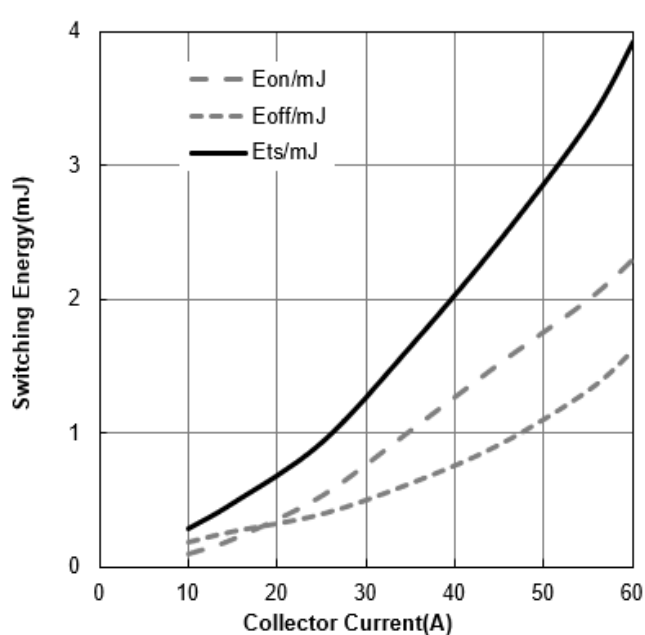


Figure 17. Typical Switching Times vs V_{CE}
($T_J=25^\circ\text{C}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$)

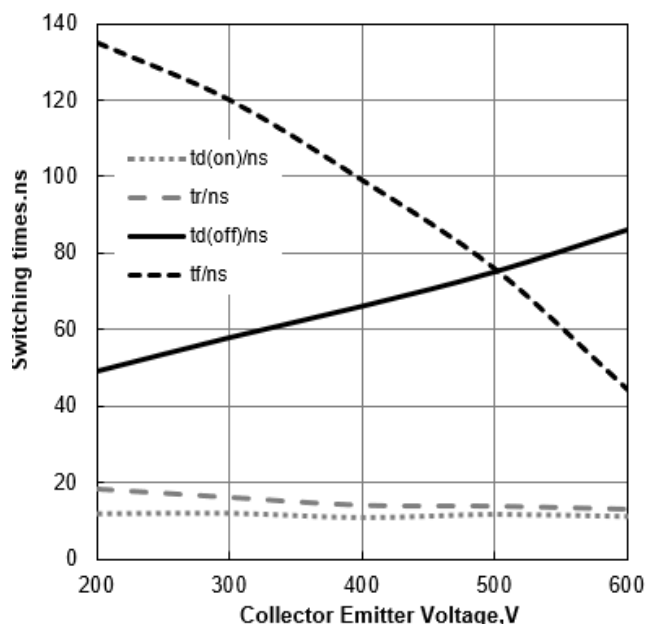


Figure 18. Typical Switching Energy vs V_{CE}
($T_J=25^\circ\text{C}$, $V_{GE}=15/0\text{V}$, $I_C=15\text{A}$)

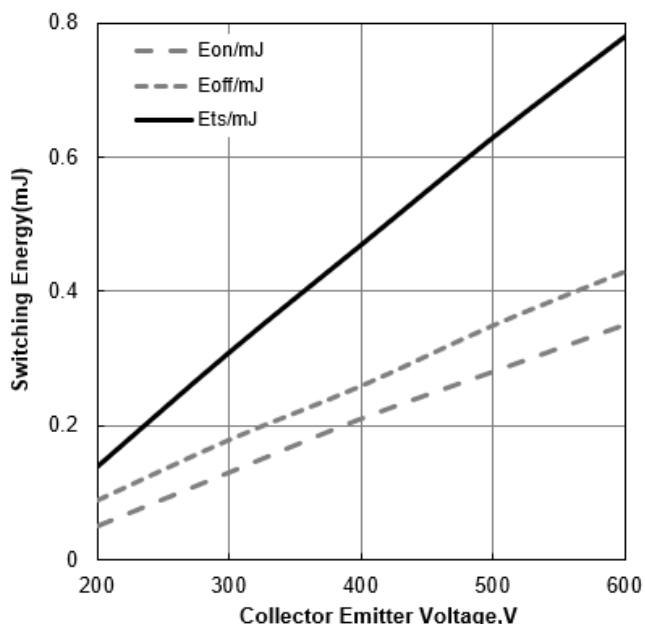


Figure 19. Typical Gate Charge

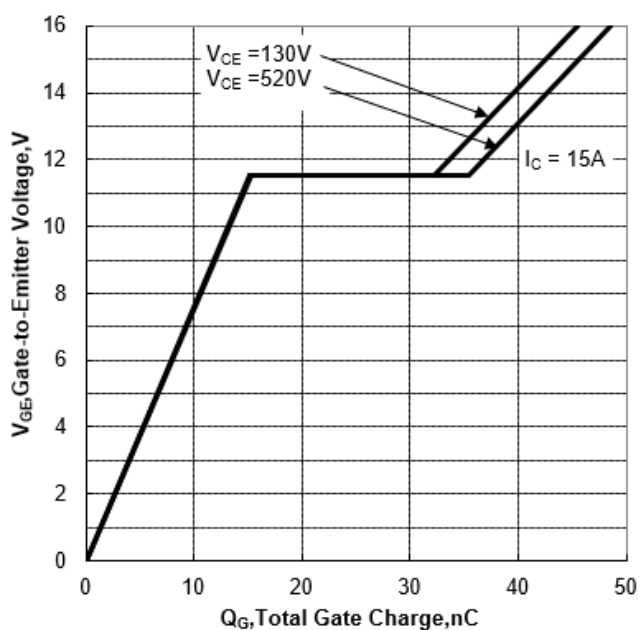


Figure 20. Typical Gate Charge

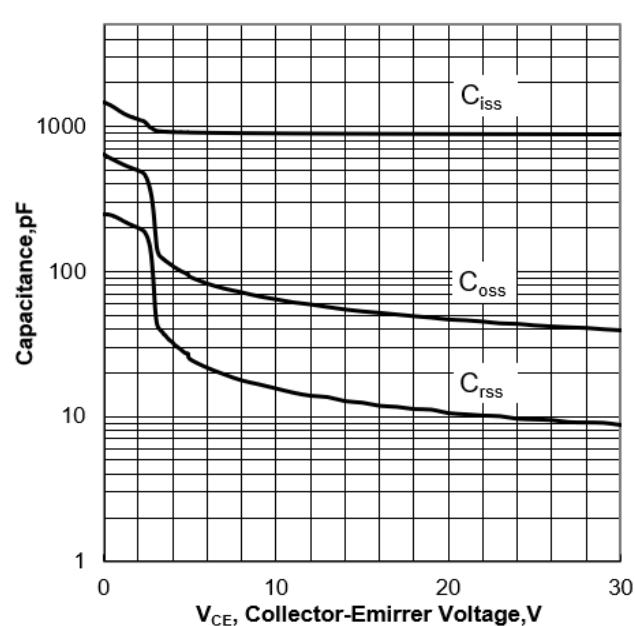


Figure 21. IGBT Transient Thermal Impedance vs Pulse Width(TO220/TO263)

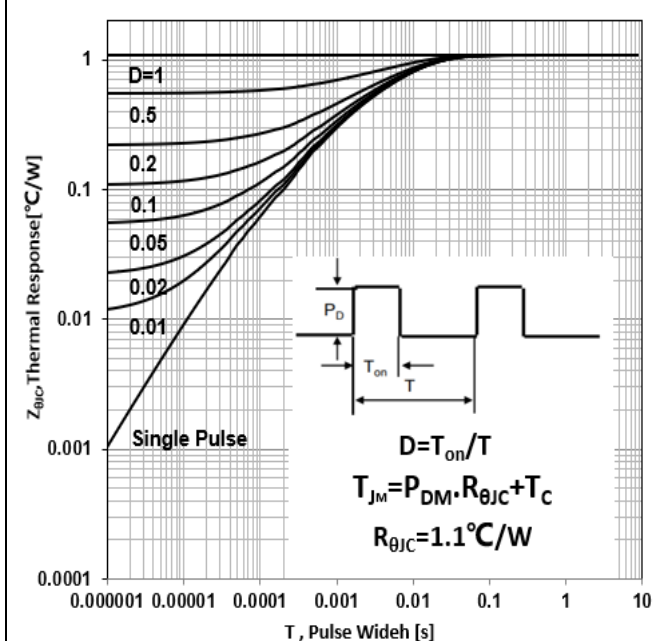


Figure 22. IGBT Transient Thermal Impedance vs Pulse Width(TO220F)

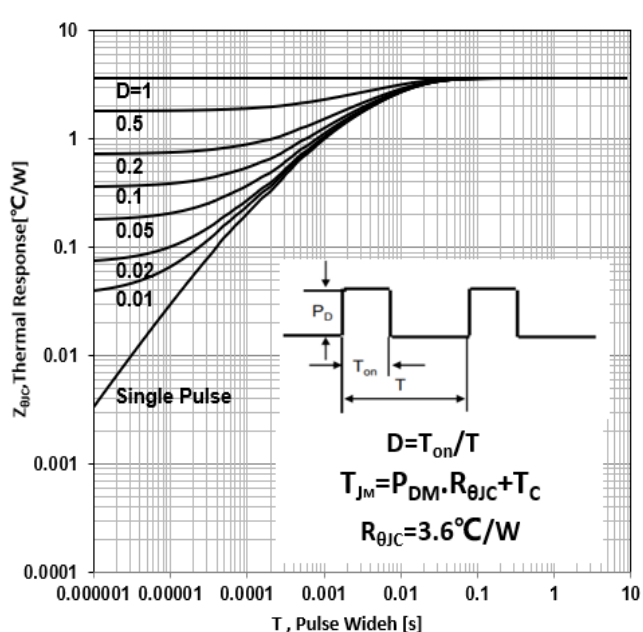


Figure 23. Diode Transient Thermal Impedance vs Pulse Width(TO220/TO263)

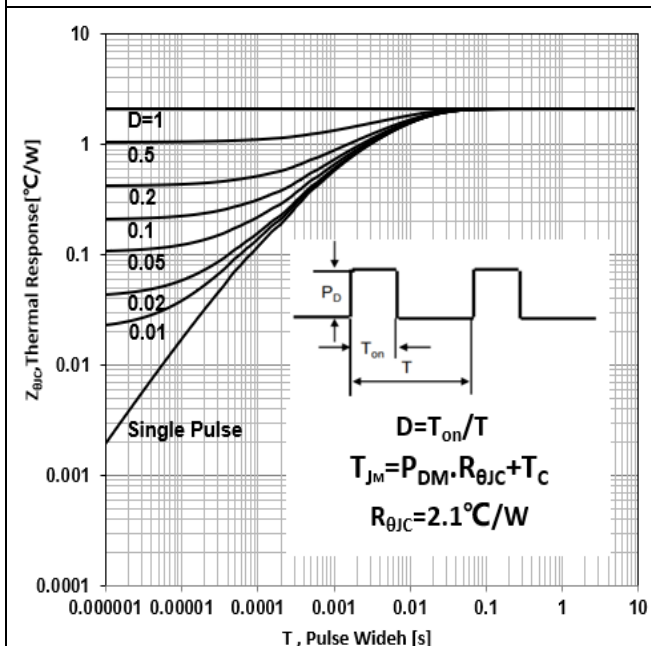


Figure 24. Diode Transient Thermal Impedance vs Pulse Width(TO220F)

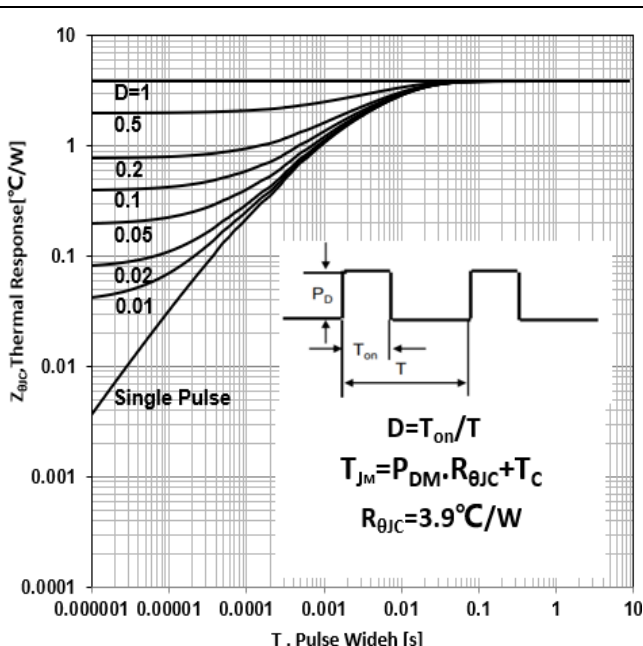
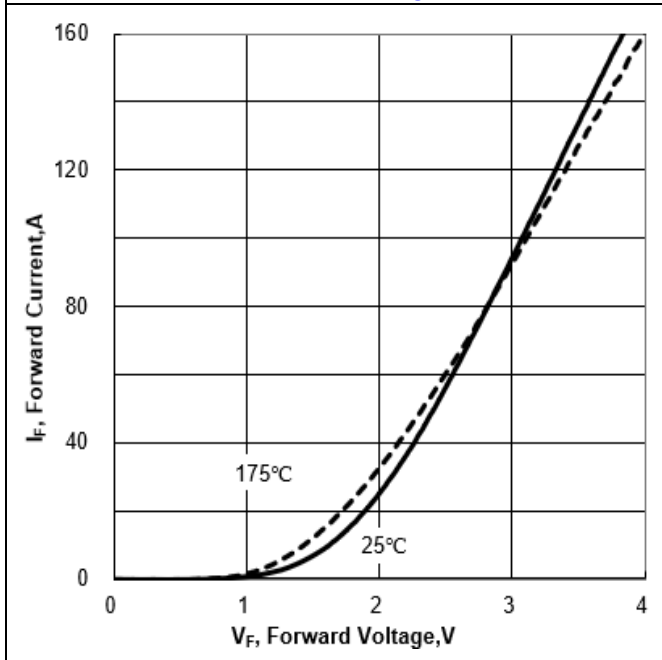


Figure 25. Typical Diode Forward Current vs Forward Voltage



6. Test Circuit and Waveform

Figure 26. Inductive Switching Test Circuit

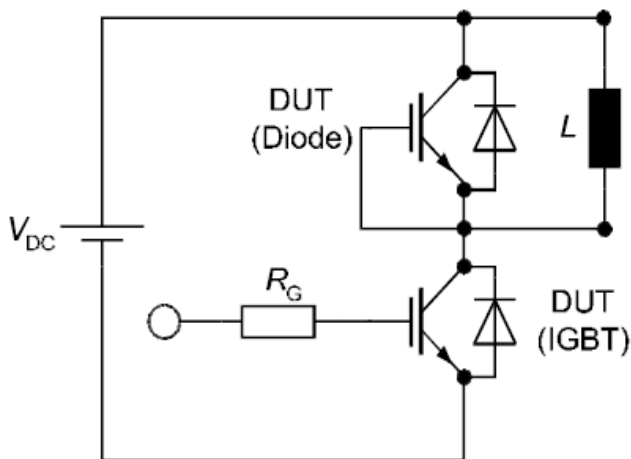


Figure 27. Definition of switching times

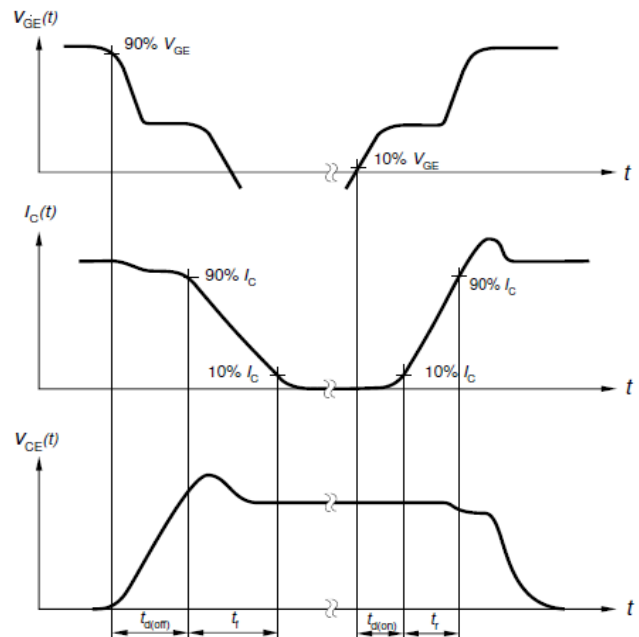


Figure 28. Definition of switching losses

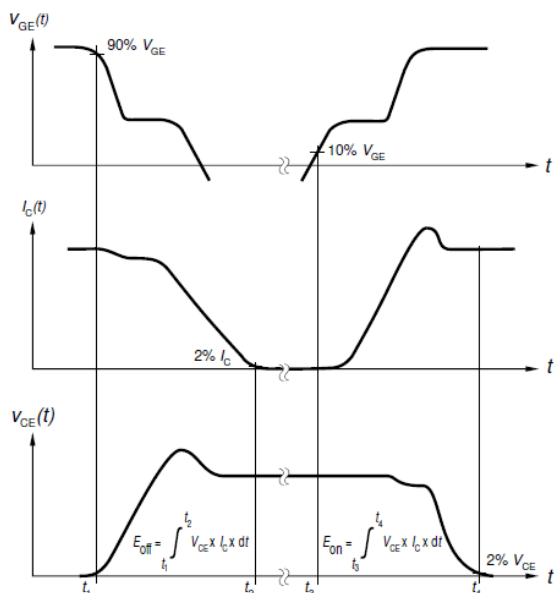
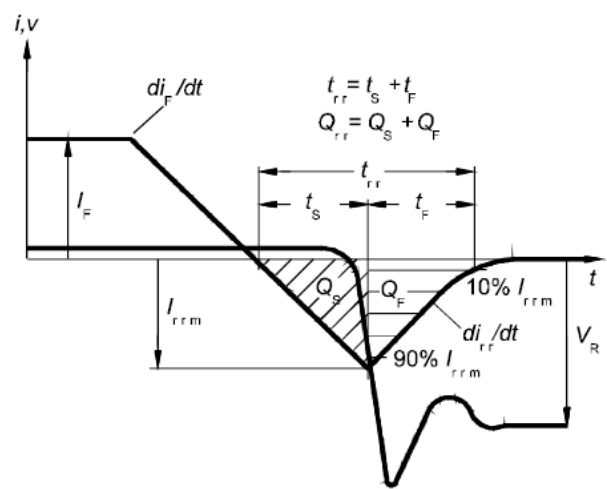
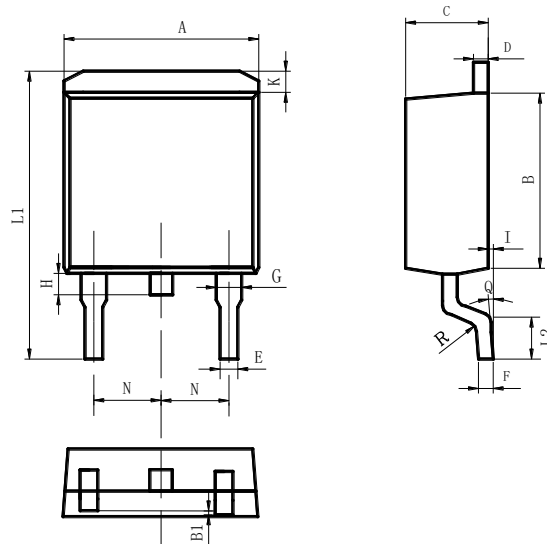


Figure 29. Definition of diode switching characteristics



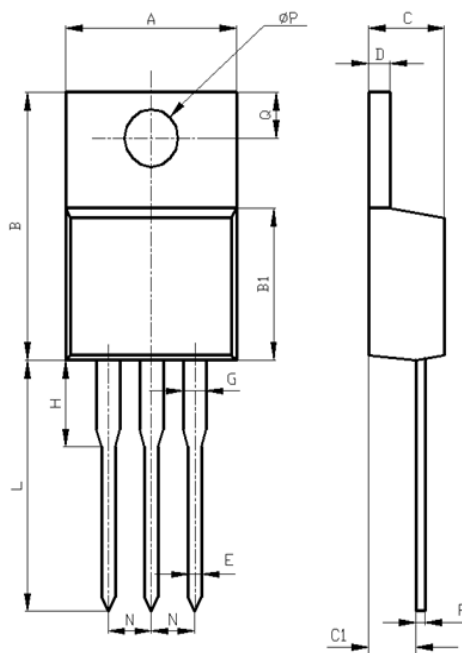
7. Package Description



TO-263 Package

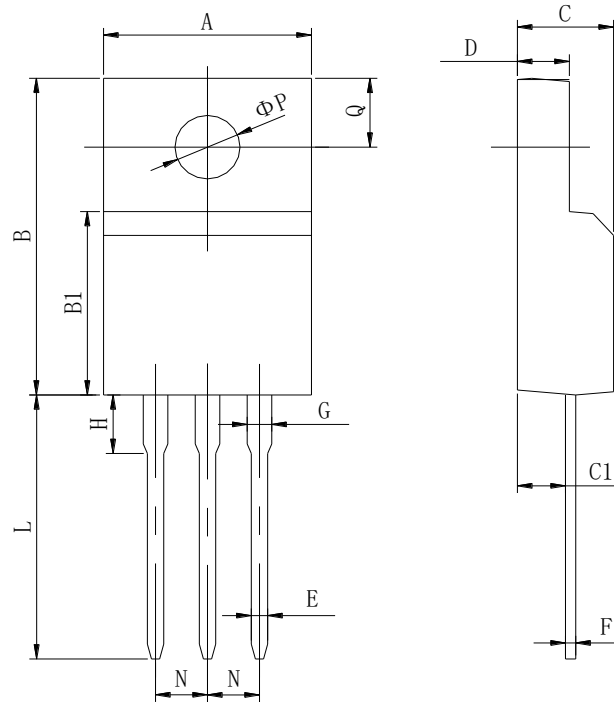
Items	Values(mm)	
	MIN	MAX
A	9.80	10.40
B	8.90	9.50
B1	0	0.10
C	4.40	4.80
D	1.16	1.37
E	0.70	0.95
F	0.30	0.60
G	1.07	1.47
H	1.30	1.80
K	0.95	1.37
L1	14.50	16.50
L2	1.60	2.30
I	0	0.2
Q	0°	8°
R	0.4	

N	2.39	2.69
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TO-220 Package

Items	Values(mm)	
	MIN	MAX
A	9.60	10.6
B	15.0	16.0
B1	8.90	9.50
C	4.30	4.80
C1	2.30	3.10
D	1.20	1.40
E	0.70	0.90
F	0.30	0.60
G	1.17	1.37
H	2.70	3.80
L	12.6	14.8
N	2.34	2.74
Q	2.40	3.00
Φ P	3.50	3.90



TO-220F Package

Items	Values(mm)	
	MIN	MAX
A	9.60	10.4
B	15.4	16.2
B1	8.90	9.50
C	4.30	4.90
C1	2.10	3.00
D	2.40	3.00
E	0.60	1.00
F	0.30	0.60
G	1.12	1.42
H	3.40	3.80
	1.60	2.90
L	12.0	14.0
N	2.34	2.74
Q	3.15	3.55
Φ P	2.90	3.30

NOTE:

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. Please do not exceed the absolute maximum ratings of the device when circuit designing.
2. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
3. IGBTs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. Shanghai Belling reserves the right to make changes in this specification sheet and is subject to change without prior notice.

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