

1. Description

BLG40T65FUK 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 welding, UPS, and high switching frequency applications.

KEY CHARACTERISTICS

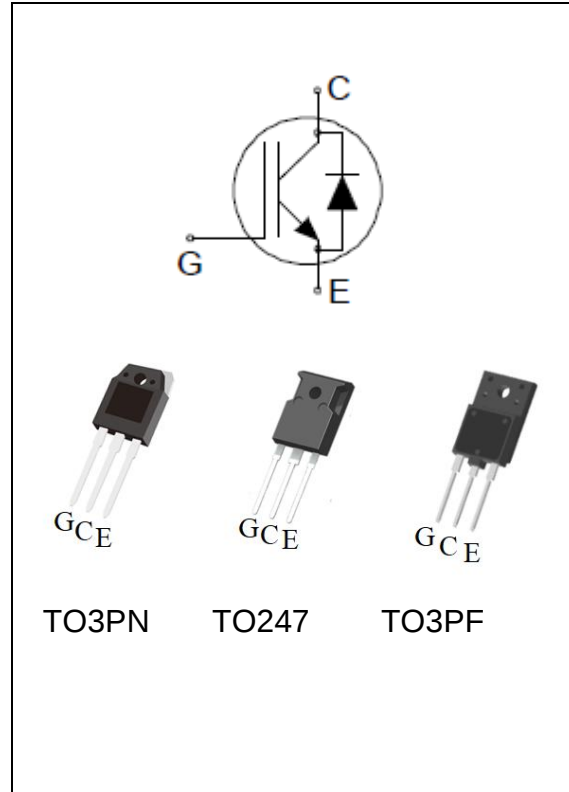
Parameter	Value	Unit
V_{CES}	650	V
I_C	40	A
$V_{CE(sat).typ}$	1.55	V

FEATURES

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

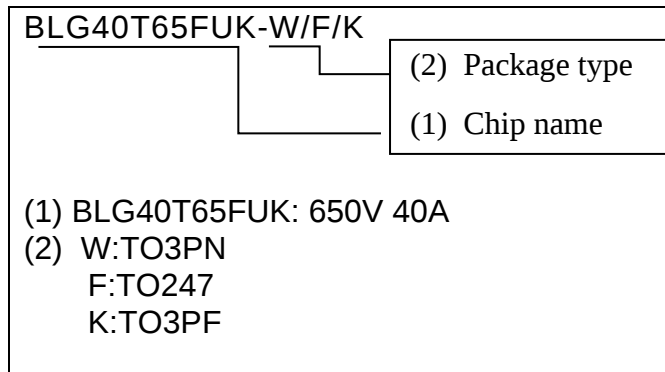
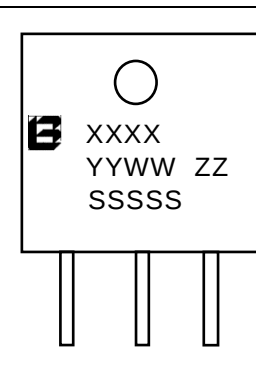
APPLICATIONS

- Welding converters
- UPS
- Boost Chopper
- Air condition



ORDERING INFORMATION

Device Marking	Ordering Codes	Package	Product Code	Packing
G40T65FUK	BLG40T65FUK-W	TO3PN	BLG40T65FUK	Tube
	BLG40T65FUK-F	TO247	BLG40T65FUK	Tube
	BLG40T65FUK-K	TO3PF	BLG40T65FUK	Tube

BLG40T65FUK-W/F/K  (1) BLG40T65FUK: 650V 40A (2) W:TO3PN F:TO247 K:TO3PF		 XXXX: Device Marking YYWW: Year & Week ZZ: Assembly Code SSSSS: Lot Code
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2. ABSOLUTE RATINGS

Symbol	Parameter	TO3PN/TO247	TO3PF	Units
V_{CES}	Collector-Emitter Voltage	650	650	V
I_C	Collector Current @ $T_C=25^{\circ}\text{C}$	80	80	A
	Collector Current @ $T_C=100^{\circ}\text{C}$	40	40	A
I_{CM}	Pulsed Collector Current, tp limited by T_{Jmax}	160	160	A
I_F	Diode Continuous Forward Current @ $T_C=25^{\circ}\text{C}$	40	40	A
	Diode Continuous Forward Current @ $T_C=100^{\circ}\text{C}$	20	20	A
I_{FM}	Diode Maximum Forward Current, limited by T_{Jmax}	80	80	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: $\geq 1.0\text{s}$, $T_J \leq 150^{\circ}\text{C}$	3.0	3.0	μs
P_D	Power Dissipation @ $T_C=25^{\circ}\text{C}$	300	50	W
T_{VJ}	Operating Junction Temperature Range	-40 to 175		$^{\circ}\text{C}$
T_{stg}	Storage Temperature Range	-50 to 175		$^{\circ}\text{C}$
T_L	Maximum Temperature for Soldering	260		$^{\circ}\text{C}$

3. Thermal characteristics

Symbol	Parameter	TO3PN/TO247	TO3PF	Units
$R_{\theta JC}$	Junction-to-Case (IGBT)	0.5	2.5	$^{\circ}\text{C/W}$
$R_{\theta JC}$	Junction-to-Case (Diode)	0.8	3.2	$^{\circ}\text{C/W}$
$R_{\theta JA}$	Junction-to-Ambient	40	40	$^{\circ}\text{C/W}$

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	$V_{GE} = 15\text{V}$, $I_C = 40\text{A}$ $T_J=25^{\circ}\text{C}$	--	1.55	1.95	V
		$T_J=125^{\circ}\text{C}$	--	1.80	--	
		$T_J=175^{\circ}\text{C}$	--	1.90	--	

$V_{GE(TH)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}, I_C = 1mA$	4.7	5.5	6.2	V
V_F	Diode Forward Voltage	$I_F = 20A$ $T_J = 25^\circ C$ $T_J = 125^\circ C$ $T_J = 175^\circ C$	--	2.20 1.80 1.65	2.8 -- --	V
I_{CES}	Collector-Emitter Leakage Current	$V_{CE} = 650V$, $V_{GE} = 0V$	--	--	25	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 $tp \leq 300\mu s$, $\delta \leq 2\%$						

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
C_{ies}	Input Capacitance	$V_{GE} = 0V$ $V_{CE} = 25V$ $f = 1.0MHz$	--	2225	--	pF
C_{oes}	Output Capacitance		--	90	--	
C_{res}	Reverse Transfer Capacitance		--	27	--	
Q_G	Gate charge	$V_{CC} = 520V$ $I_{CE} = 20A$ $V_{GE} = 15V$	--	110	--	nC
Q_{GC}	Gate-emitter charge		--	23	--	
Q_{GE}	Gate-collector charge		--	52	--	
$I_{C(SC)}$	Short circuit collector current Max.1000 short circuits, Times between short circuits: $\geq 1.0s$	$V_{GE} = 15.0V, V_{CC} \leq 400V$, $t_{sc} \leq 3\mu s, T_J \leq 150^\circ C$		320		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	$I_C = 40A$ $V_{CE} = 400V$ $V_{GE} = 15V$ $R_G = 5\Omega$ $T_J = 25^\circ C$ Inductive Load	--	19	--	ns
t_r	Rise Time		--	35	--	
$t_{d(off)}$	Turn-Off Delay Time		--	90	--	
t_f	Fall Time		--	26	--	
E_{on}	Turn-On Switching Loss		--	0.60	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.38	--	
E_{ts}	Total Switching Loss		--	0.98	--	

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	$I_C = 40\text{A}$ $V_{CE} = 400\text{V}$ $V_{GE} = 15\text{V}$ $R_G = 5\Omega$ $T_J = 175^\circ\text{C}$ Inductive Load	--	17	--	ns
t_r	Rise Time		--	32	--	
$t_{d(off)}$	Turn-Off Delay Time		--	142	--	
t_f	Fall Time		--	36	--	
E_{on}	Turn-On Switching Loss		--	0.8	--	mJ
E_{off}	Turn-Off Switching Loss		--	0.65	--	
E_{ts}	Total Switching Loss		--	1.45	--	

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

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
T_{rr}	Reverse Recovery Time	$I_F = 20\text{A}$, $di/dt = 200\text{A}/\mu\text{s}$, $T_J = 25^\circ\text{C}$	--	97	--	ns
Q_{rr}	Reverse Recovery Charge		--	109	--	nC
I_{rrm}	Reverse Recovery Current		--	1.8	--	A
T_{rr}	Reverse Recovery Time	$I_F = 40\text{A}$, $di/dt = 200\text{A}/\mu\text{s}$, $T_J = 25^\circ\text{C}$	--	127	--	ns
Q_{rr}	Reverse Recovery Charge		--	326	--	nC
I_{rrm}	Reverse Recovery Current		--	4.8	--	A

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

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
T_{rr}	Reverse Recovery Time	$I_F = 20\text{A}$, $di/dt = 200\text{A}/\mu\text{s}$, $T_J = 175^\circ\text{C}$	--	147	--	ns
Q_{rr}	Reverse Recovery Charge		--	742	--	nC
I_{rrm}	Reverse Recovery Current		--	7.8	--	A
T_{rr}	Reverse Recovery Time	$I_F = 40\text{A}$, $di/dt = 200\text{A}/\mu\text{s}$, $T_J = 175^\circ\text{C}$	--	158	--	ns
Q_{rr}	Reverse Recovery Charge		--	870	--	nC
I_{rrm}	Reverse Recovery Current		--	9	--	A

5. Characteristics Curves

Figure 1. Forward Bias Safe Operating Area for TO3PN/TO247

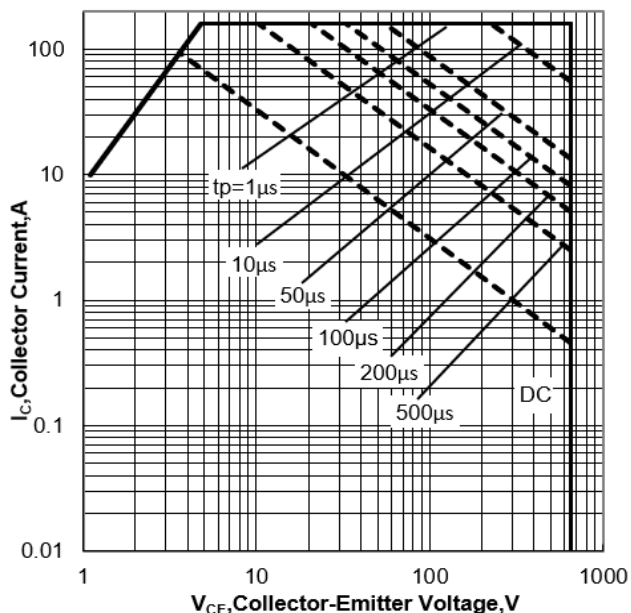


Figure 2. Power Dissipation vs Case Temperature for TO3PF

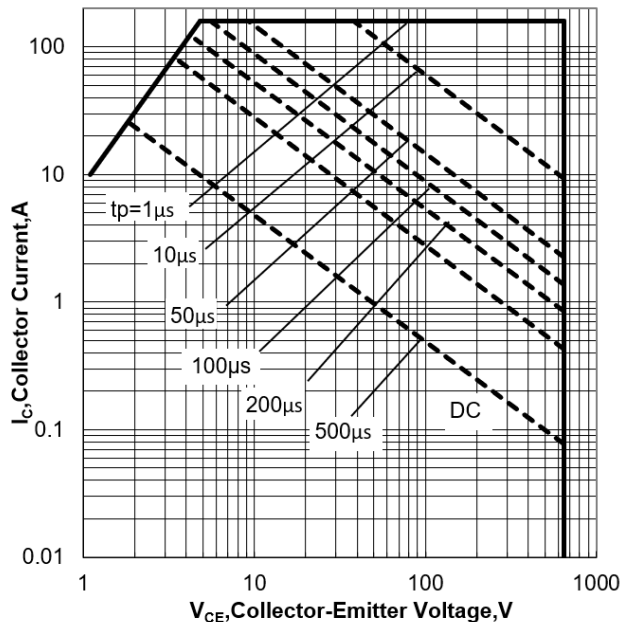


Figure 3. Power Dissipation vs Case Temperature for TO247/TO3PN

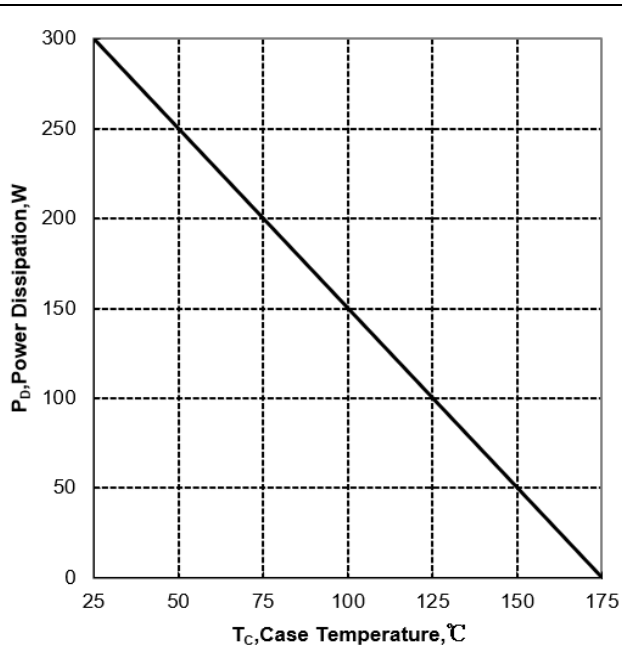


Figure 4. Power Dissipation vs Case Temperature for TO3PF

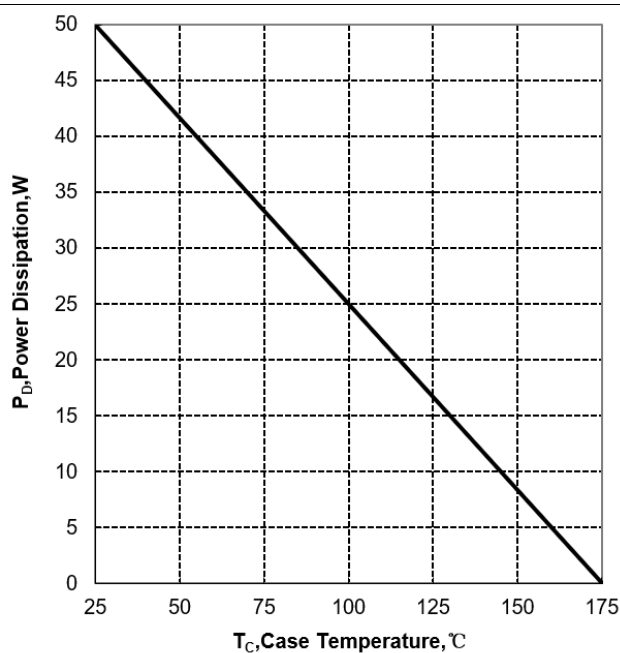


Figure 5. Collector Current vs Case Temperature for TO247/TO3PN

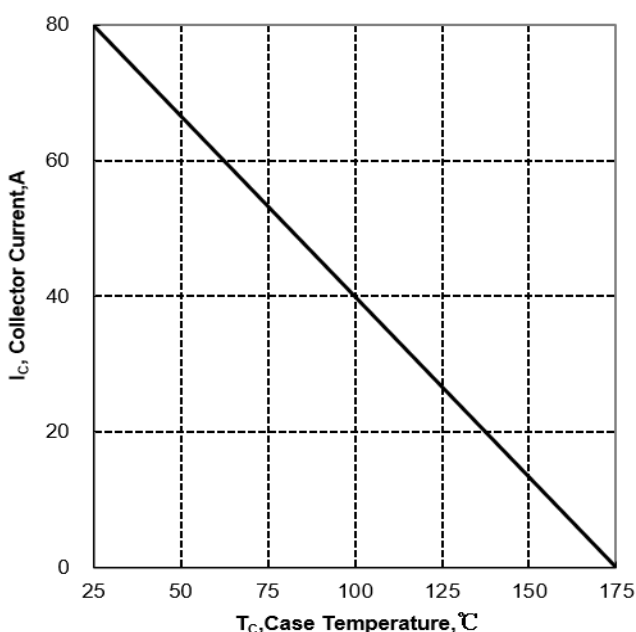


Figure 6. Collector Current vs Case Temperature for TO3PF

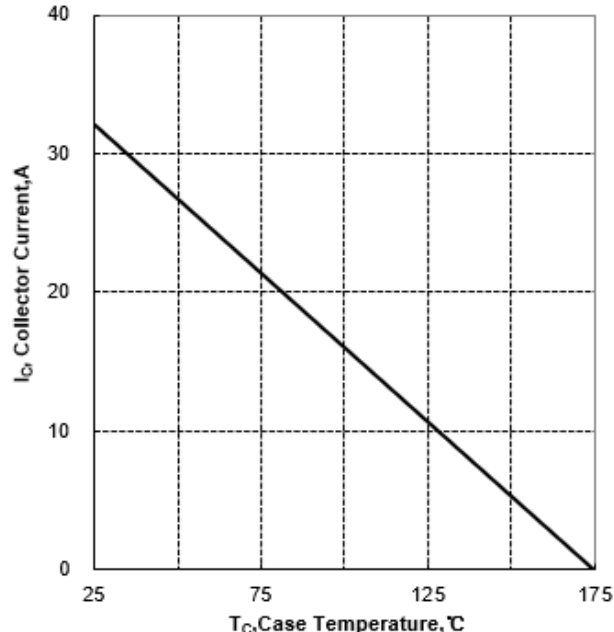


Figure 7. Typical Output Characteristics ($T_J=25^{\circ}C$)

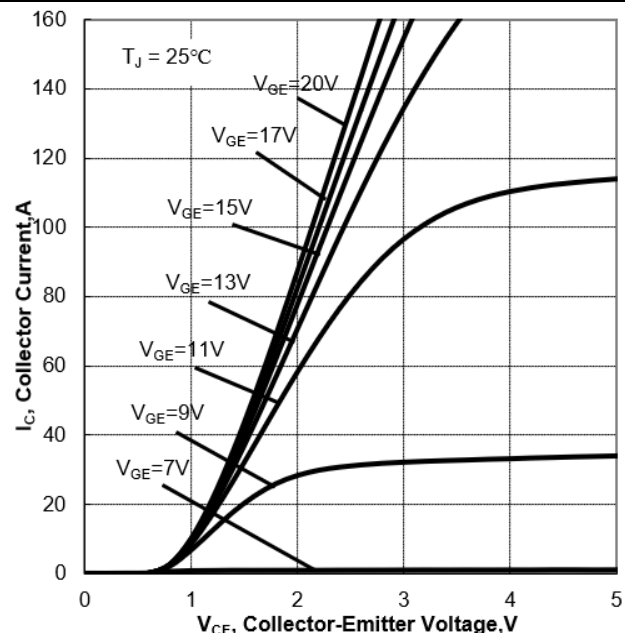


Figure 8. Typical Output Characteristics ($T_J=175^{\circ}C$)

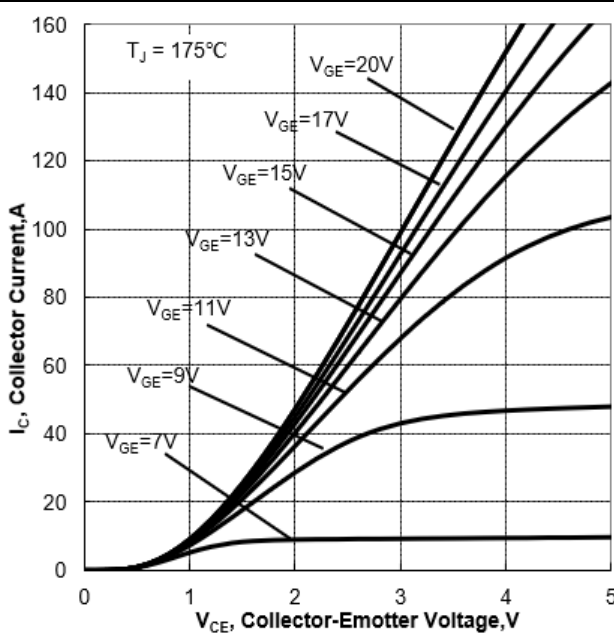


Figure 9. Typical Transfer Characteristics

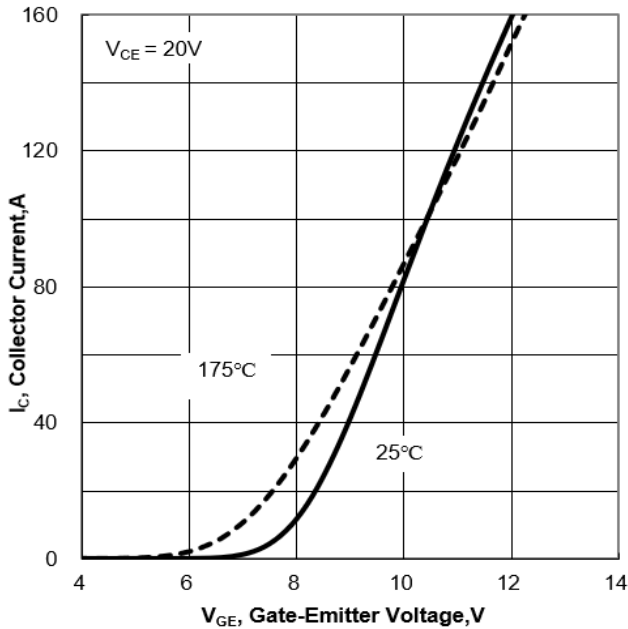


Figure 10. Typical Gate-Emitter Threshold Voltage vs Junction Temperature

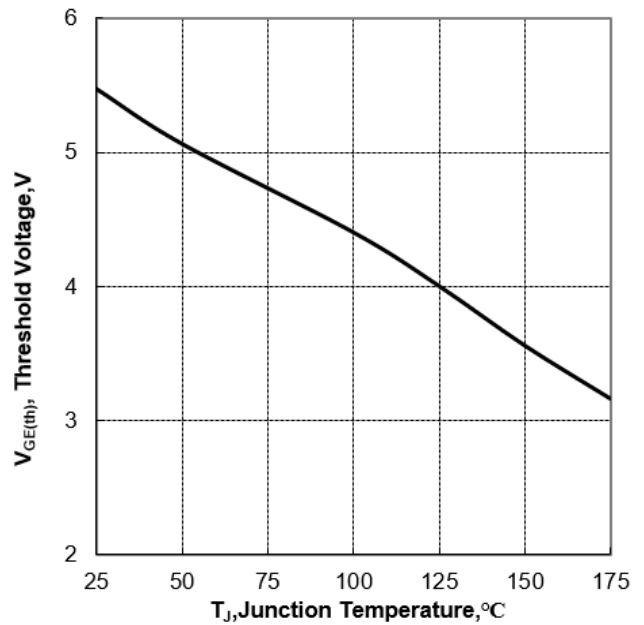


Figure 11. Typical Collector-Emitter Saturation Voltage vs Junction Temperature

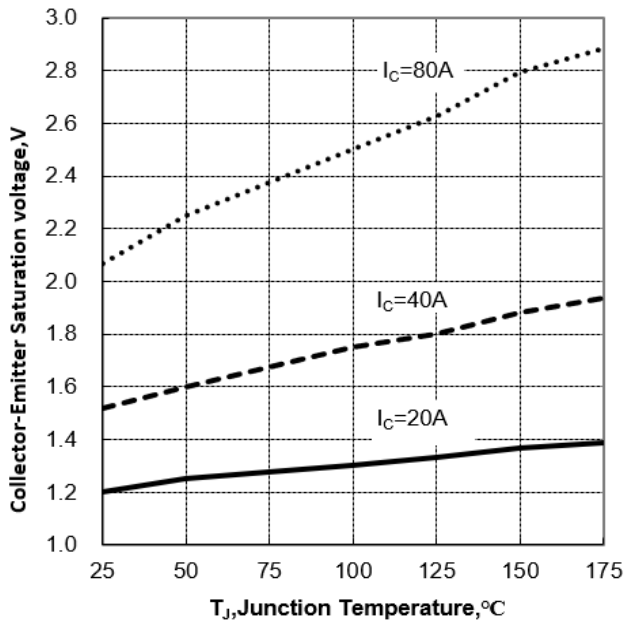


Figure 12. Typical Diode Forward Current vs Forward Voltage

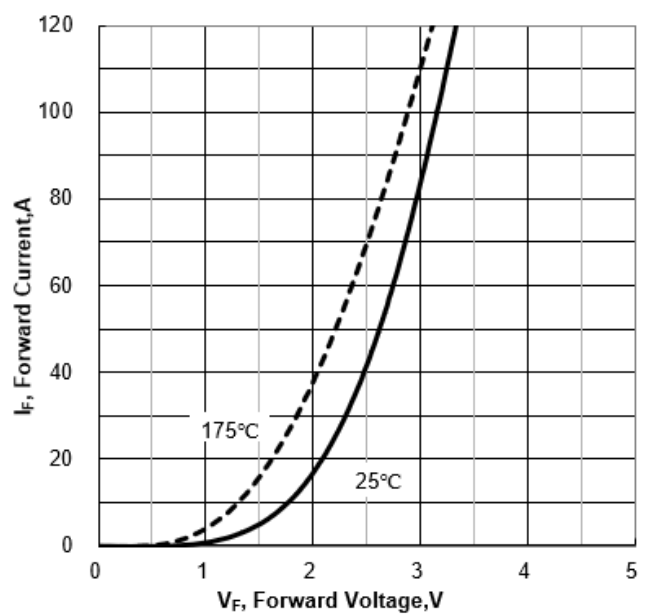


Figure 13. Typical Switching Times vs Gate Resistor ($T_J=25^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$)

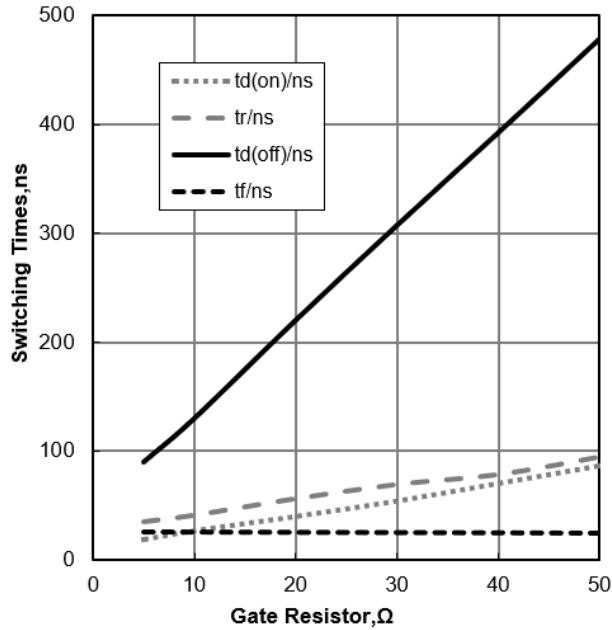


Figure 14. Typical Switching Energy vs Gate Resistor ($T_J=25^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$)

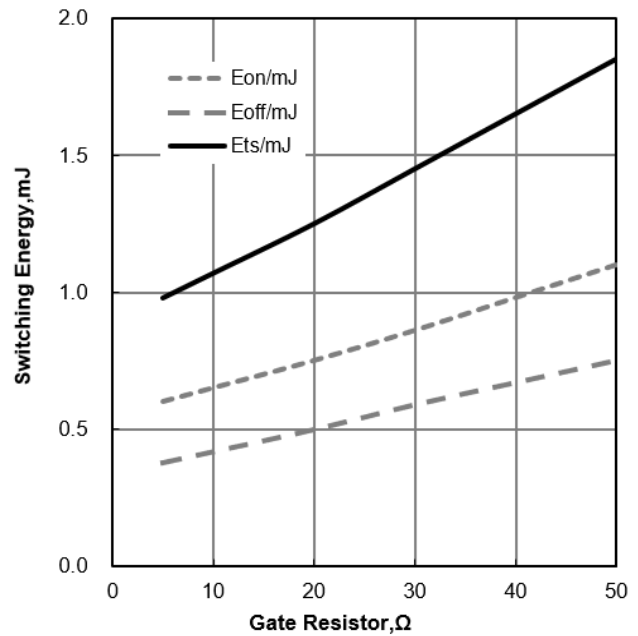


Figure 15. Typical Switching Times vs Junction Temperature ($V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$)

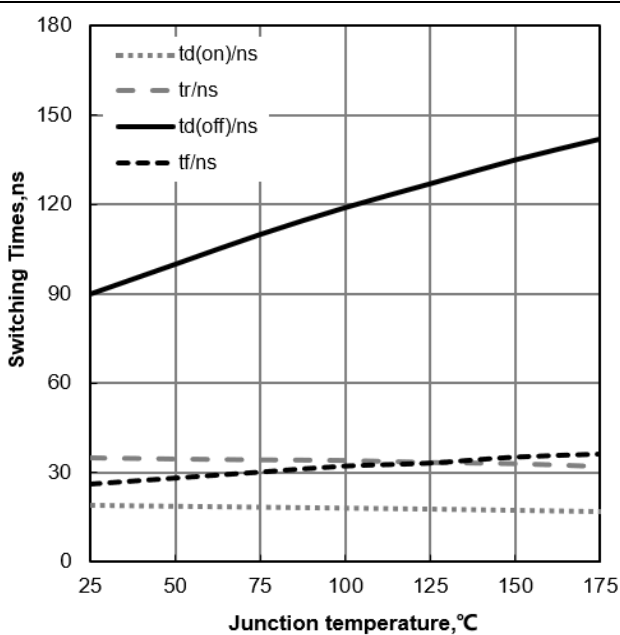


Figure 16. Typical Switching Energy vs Junction Temperature ($V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$)

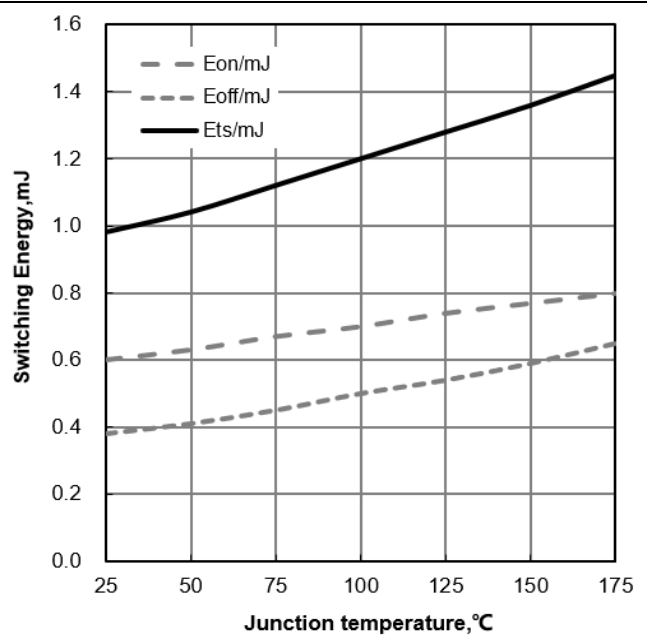


Figure 17. Typical Switching Times vs Collector Current ($T_J=25^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$)

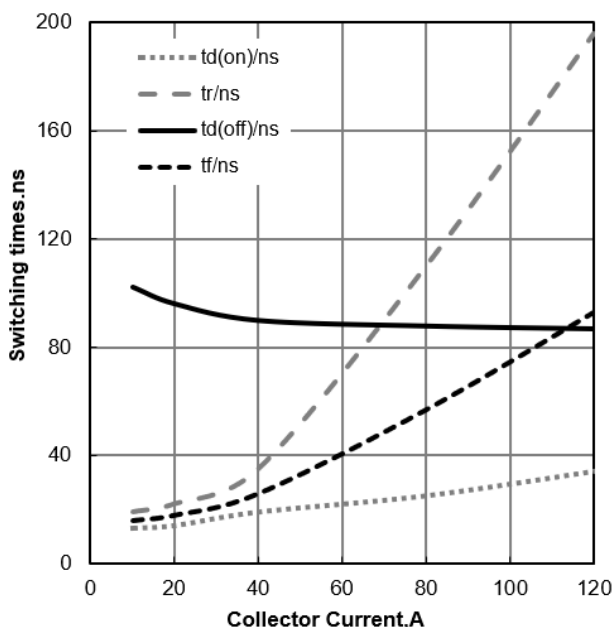


Figure 18. Typical Switching Energy vs Collector Current ($T_J=25^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=15/0\text{V}$)

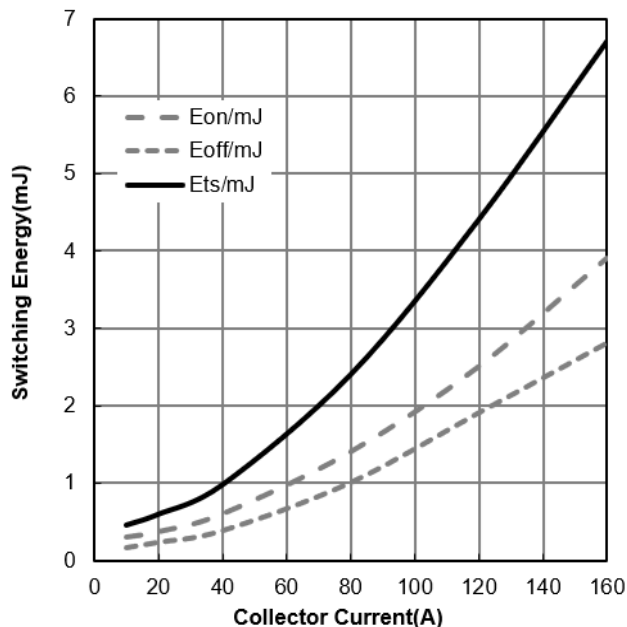


Figure 19. Typical Switching Times vs V_{CE} ($T_J=25^\circ\text{C}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$)

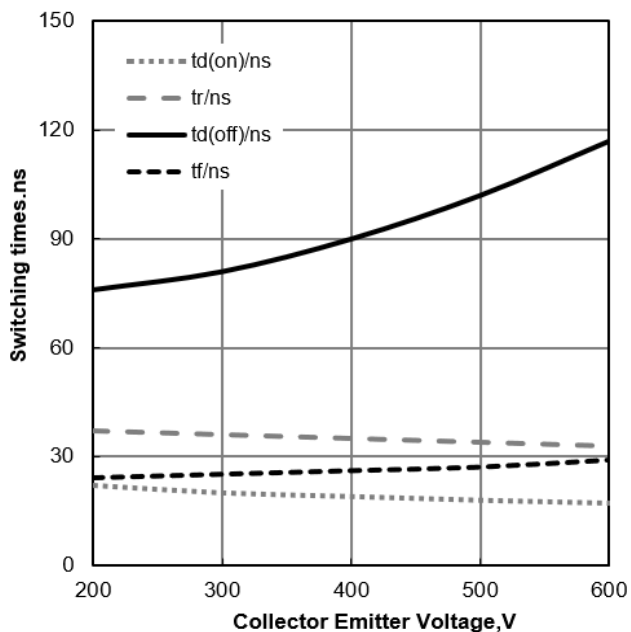


Figure 20. Typical Switching Energy vs V_{CE} ($T_J=25^\circ\text{C}$, $V_{GE}=15/0\text{V}$, $I_C=40\text{A}$)

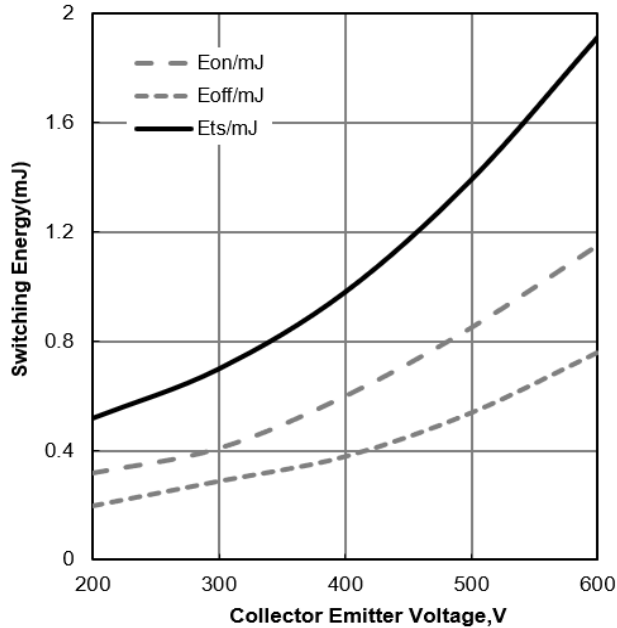


Figure 21. Typical Gate Charge

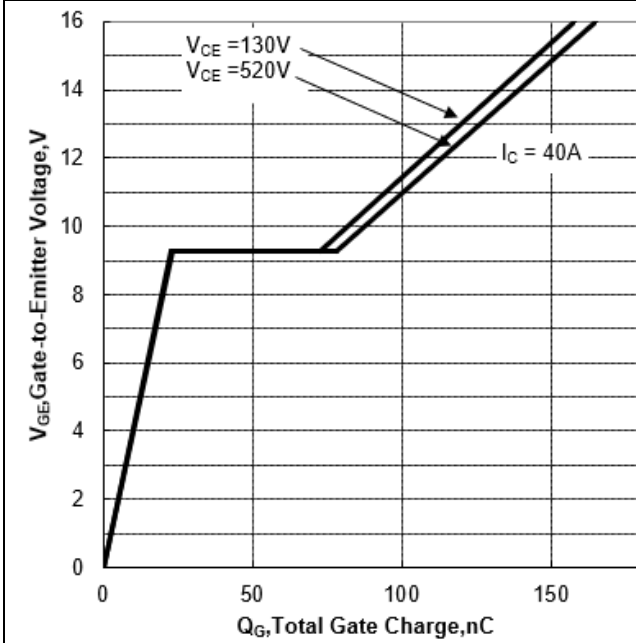


Figure 22. Typical Capacitance vs Collector-Emitter Voltage

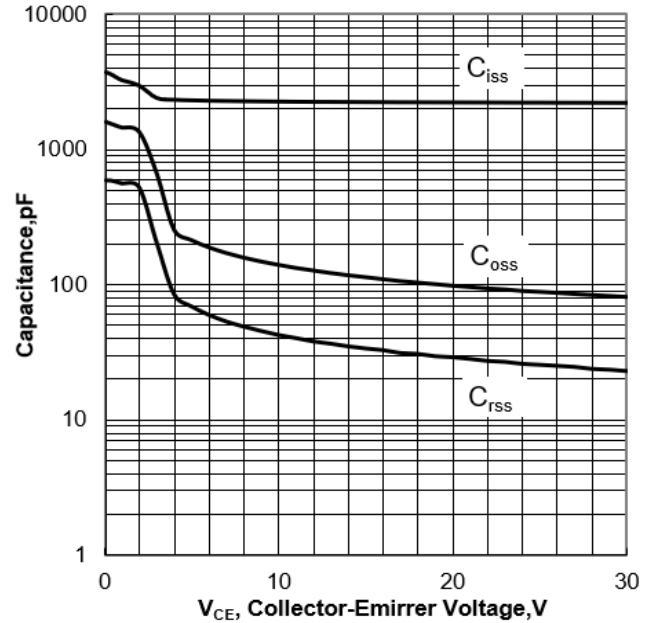


Figure 23. IGBT Transient Thermal Impedance vs Pulse Width(TO3PN/TO247)

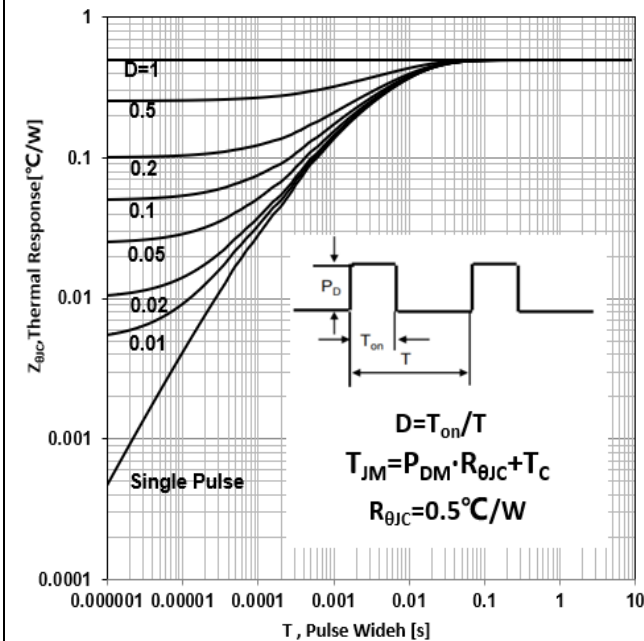


Figure 24. IGBT Transient Thermal Impedance vs Pulse Width(TO3PF)

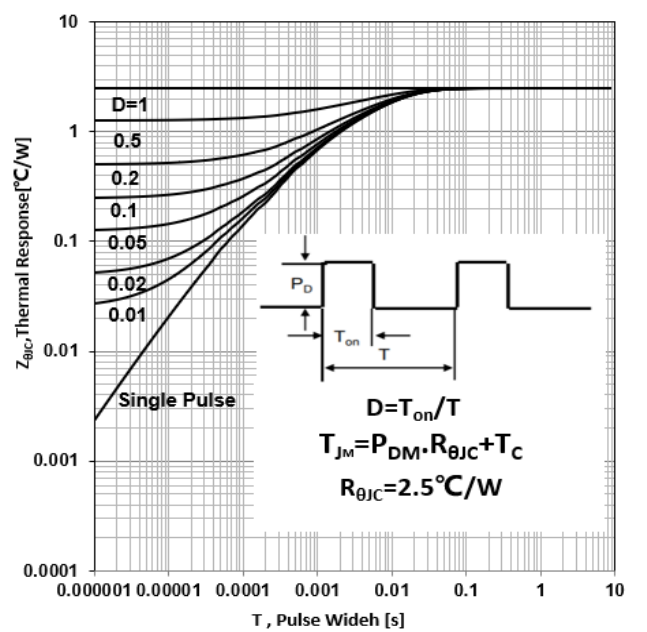


Figure 25. Diode Transient Thermal Impedance vs Pulse Width(TO247/TO3PN)

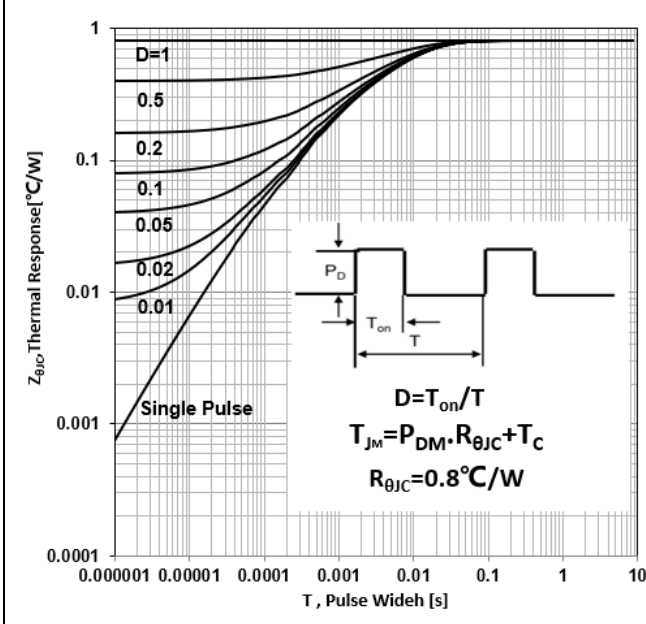
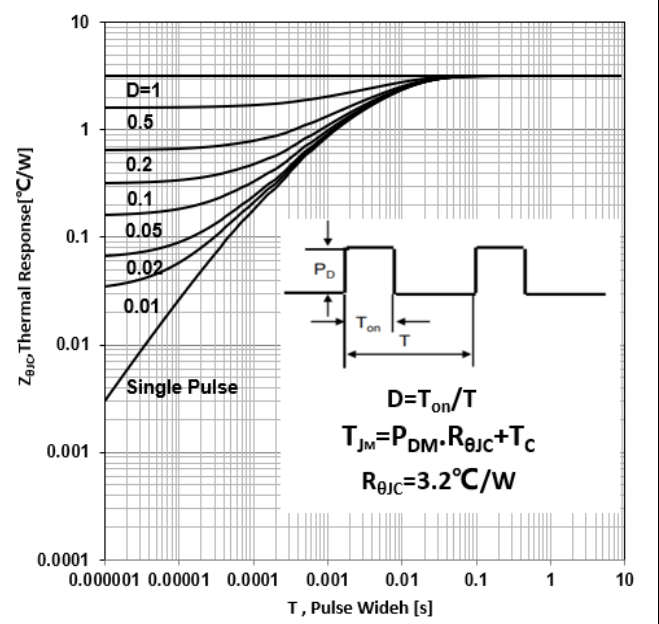


Figure 26. Diode Transient Thermal Impedance vs Pulse Width (TO3PF)



6. Test Circuit and Waveform

Figure 1. Inductive Switching Test Circuit

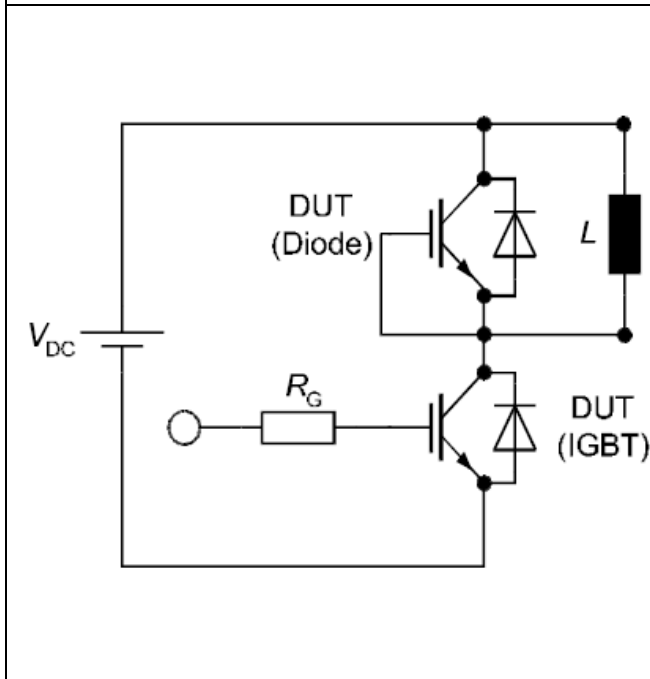


Figure 2. Definition of switching times

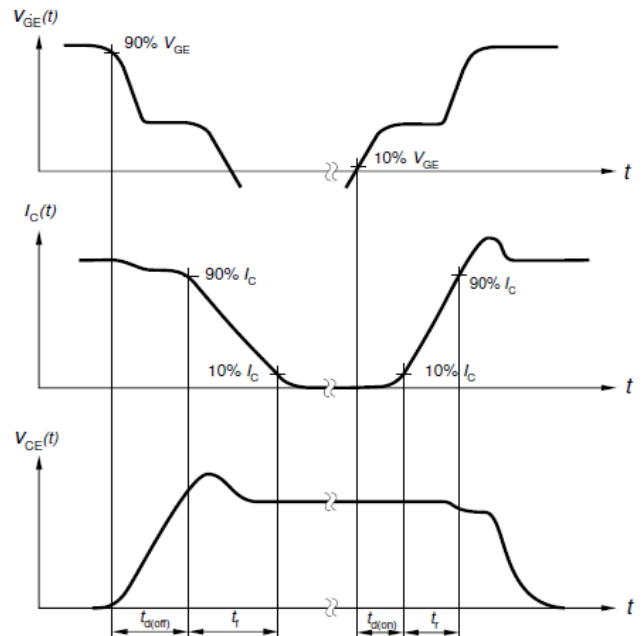


Figure 3. Definition of switching losses

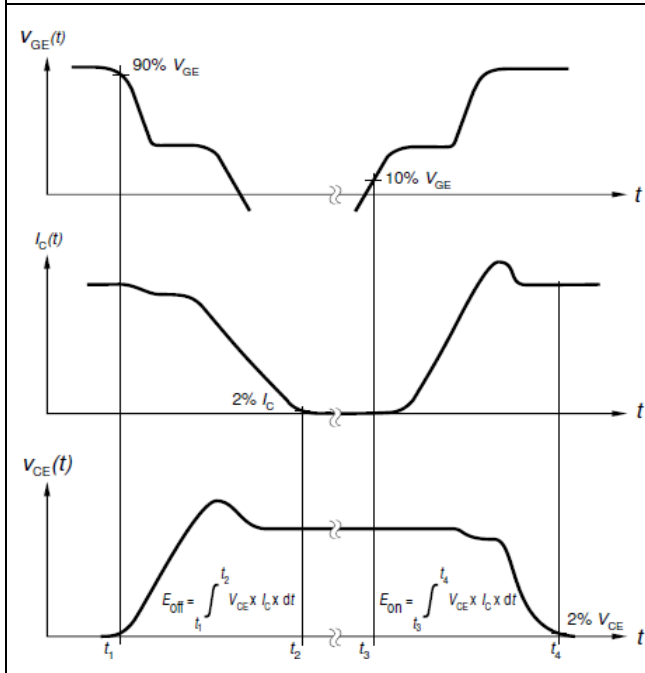
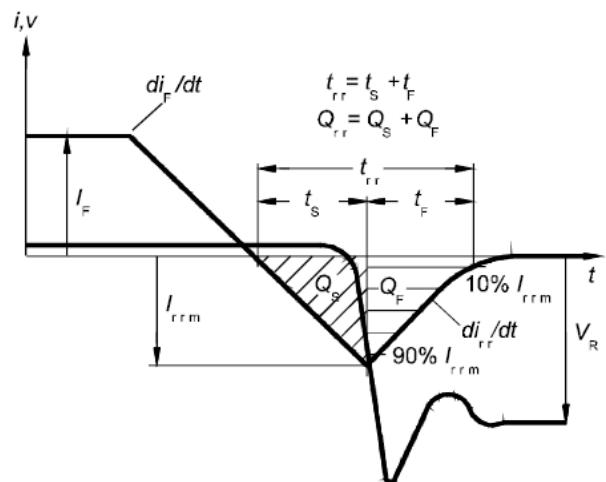
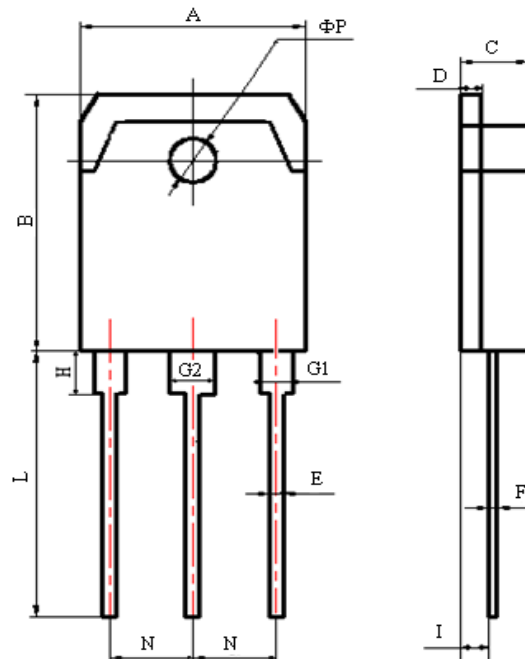


Figure 4. Definition of diode switching characteristics

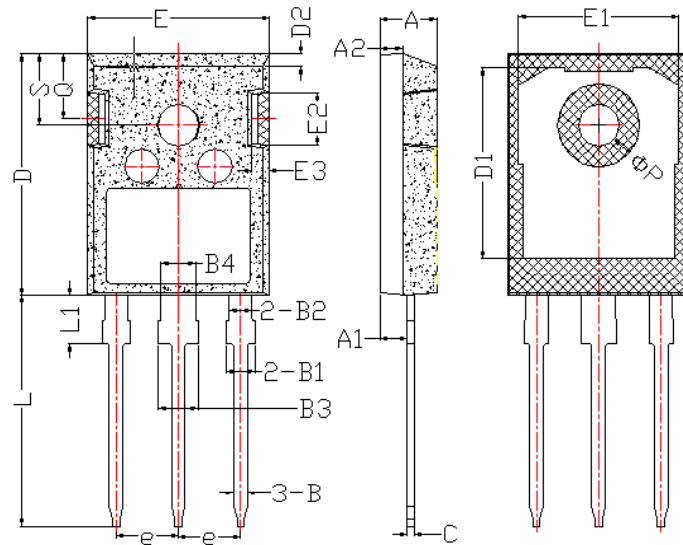


7. Package Description



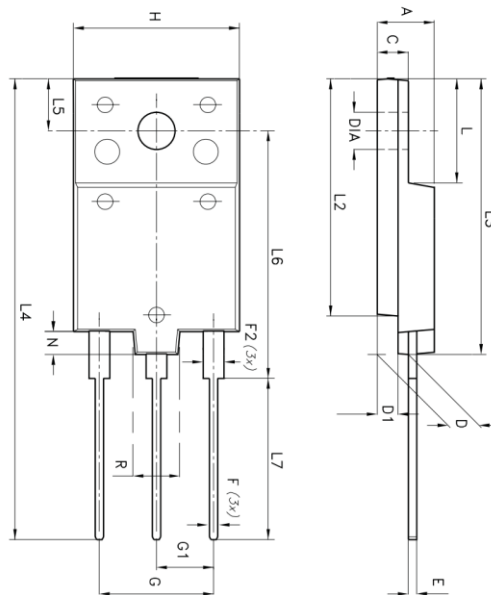
TO3PN Package

Items	Values(mm)	
	MIN	MAX
A	15.00	16.00
B	19.20	20.60
C	4.60	5.00
D	1.40	1.60
E	0.90	1.10
F	0.50	0.70
G1	2.00	2.20
G2	3.00	3.20
H	3.00	3.70
I	1.20	1.70
	2.70	2.90
L	19.00	21.00
N	5.25	5.65
Φ P	3.10	3.30



TO247 Package

Items	Values(mm)	
	MIN	MAX
A	4.90	5.16
A1	2.27	2.53
A2	1.85	2.11
B	1.07	1.33
B1	1.90	2.41
B2	1.75	2.15
B3	2.87	3.38
B4	2.87	3.13
C	0.55	0.68
D	20.82	21.10
D1	16.25	17.65
D2	1.05	1.35
E	15.70	16.03
E1	13.10	14.15
E2	3.68	5.10
E3	1.68	2.60
e	5.44	
L	19.80	20.31
L1	4.17	4.47
ΦP	3.50	3.70
Q	5.49	6.00
S	6.04	6.30



TO3PF Package

Items	Values(mm)	
	MIN	MAX
A	5.30	5.70
C	2.80	3.20
D	3.10	3.50
D1	1.80	2.20
E	0.80	1.10
F	0.65	0.95
F2	1.80	2.20
G	10.30	11.50
G1	5.45	
H	15.30	15.70
L	9.80	10.20
L2	22.80	23.20
L3	26.30	26.70
L4	43.20	44.40
L5	4.3	4.70
L6	24.3	24.70
L7	14.6	15
N	1.8	2.2
R	3.8	4.2
Dia	3.4	3.8

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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Revision History:

Previous Revision

Revision	Date	Revision Date Subjects (major changes since last revision)
4.0	2023-11-17	(1) Product Code (2) CONTACT
5.0	2024-01-10	(1) Updated $R_{\theta JC}$ (TO3PF)
6.0	2025-03-25	(1) Add Low Operating Junction Temperature