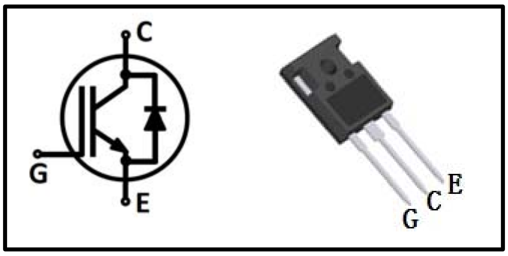
Features

- **Easy parallel switching capability due to positive temperature coefficient in V_{CEsat}**
- **Low V_{CEsat}, fast switching**
- **High ruggedness, good thermal stability**
- **Very tight parameter distribution**

Applications

- **Frequency converter**
- **UPS**



Type	Marking	Package Code
MPBW25N120BF	MP25N120BF	TO-247-3

Maximum Rated Values

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current, limited by T_{jmax} T_C=25℃ T_C=100℃	I_C	50 25	A
Pulsed collector current, t_p limited by T_{jmax} 1)	I_{Cpuls}	100	
Diode forward current, limited by T_{jmax} T_C=25℃ T_C=100℃	I_F	50 25	
Diode pulsed current, t_p limited by T_{jmax} 1)	I_{Fpuls}	100	
Gate-emitter voltage	V_{GE}	±20	V
Transient Gate-emitter voltage（t_p≤10us,D<0.01)		±30	
Short circuit withstand time V_{GE}=15V, V_{CC}=600V, T_j≤175℃ Allowed number of short circuits < 1000 Time between short circuits: ≥ 1.0s	t_{SC}	10	μs
Power dissipation T_C=25℃	P_{tot}	348	W
Power dissipation T_C=100℃		174	
Operating junction temperature	T_j	-40~175	℃
Storage temperature	T_{stg}	-55~150	
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

1) Defined by design. Not subject to production test.

Thermal Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
IGBT thermal resistance, junction-case	R_{thJC}	-	-	0.43	K/W
Diode thermal resistance, junction-case	R_{thJCD}	-	-	0.80	K/W
Thermal Resistance, junction-ambient	R_{thJA}	-	-	40	K/W

Electrical Characteristics（at T_j=25℃, unless otherwise specified）

Static Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=0.25mA	1200	-	-	V
Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=25A T_j=25℃	-	1.9	2.4	V
		T_j=150℃	-	2.5	-	V
		T_j=175℃	-	2.6	-	V
Diode forward voltage	V_F	V_{GE}=0V, I_F=25A T_j=25℃	-	2.2	-	V
		T_j=150℃	-	1.7	-	V
		T_j=175℃	-	1.6	-	V
G-E threshold voltage	$V_{GE(th)}$	I_C=1mA, V_{CE}=V_{GE}	5.5	6.0	6.5	V
C-E leakage current	I_{CES}	V_{CE}=1200V, V_{GE}=0V T_j=25℃	-	-	0.1	mA
		T_j=175℃	-	-	4.0	mA
G-E leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	200	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=25A	-	15	-	S

Dynamic Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input capacitance	C_{ies}	V_{CE}=25V, V_{GE}=0V, f=1MHz	-	1767	-	pF
Output capacitance	C_{oes}		-	116	-	pF
Reverse transfer capacitance	C_{res}		-	62	-	pF
Gate charge	Q_G	V_{CC}=960V, I_C=25A, V_{GE}=15V	-	171	-	nC
Short circuit collector current	$I_{C(SC)}$	V_{GE}=15V, V_{CC}≤600V, t_{SC}≤10μs, T_j=175℃	-	90	-	A

IGBT Switching Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$	T_j=25℃, V_{CC}=600V, I_C=25A, V_{GE}=0/15V, R_G=16Ω, Inductive load	-	32	-	ns
Rise time	t_r		-	52	-	
Turn-off delay time	$t_{d(off)}$		-	266	-	
Fall time	t_f		-	246	-	
Turn-on energy	E_{on}		-	1.6	-	mJ
Turn-off energy	E_{off}		-	1.9	-	
Total switching energy	E_{ts}		-	3.5	-	
Turn-on delay time	$t_{d(on)}$	T_j=175℃, V_{CC}=600V, I_C=25A, V_{GE}=0/15V, R_G=16Ω, Inductive load	-	30	-	ns
Rise time	t_r		-	50	-	
Turn-off delay time	$t_{d(off)}$		-	322	-	
Fall time	t_f		-	378	-	
Turn-on energy	E_{on}		-	1.7	-	mJ
Turn-off energy	E_{off}		-	2.5	-	
Total switching energy	E_{ts}		-	4.2	-	

Diode Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Diode reverse recovery time	t_{rr}	T_j=25℃, V_R=600V, I_F=25A, di_F/dt=400A/μs	-	256	-	ns
Diode reverse recovery charge	Q_{rr}		-	1.35	-	μC
Diode peak reverse recovery current	I_{rrm}		-	12.4	-	A
Diode reverse recovery time	t_{rr}	T_j=175℃, V_R=600V, I_F=25A, di_F/dt=400A/μs	-	350	-	ns
Diode reverse recovery charge	Q_{rr}		-	4.28	-	μC
Diode peak reverse recovery current	I_{rrm}		-	26.2	-	A

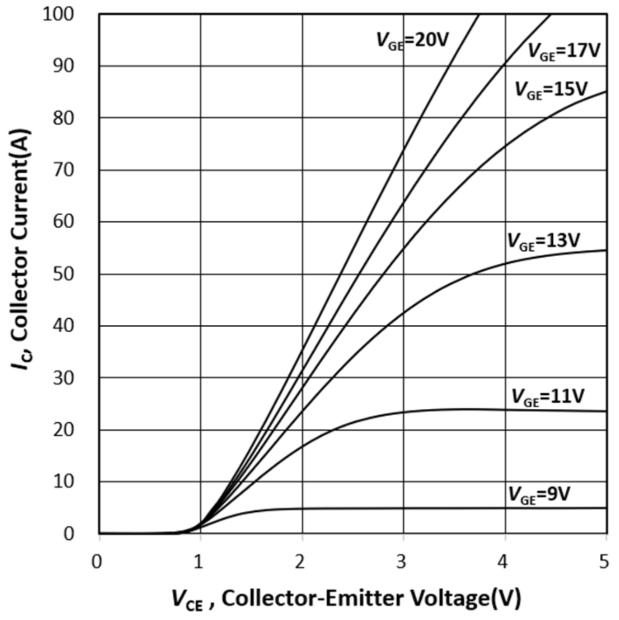


Figure 1. Typical output characteristic
(T_j =25 ℃)

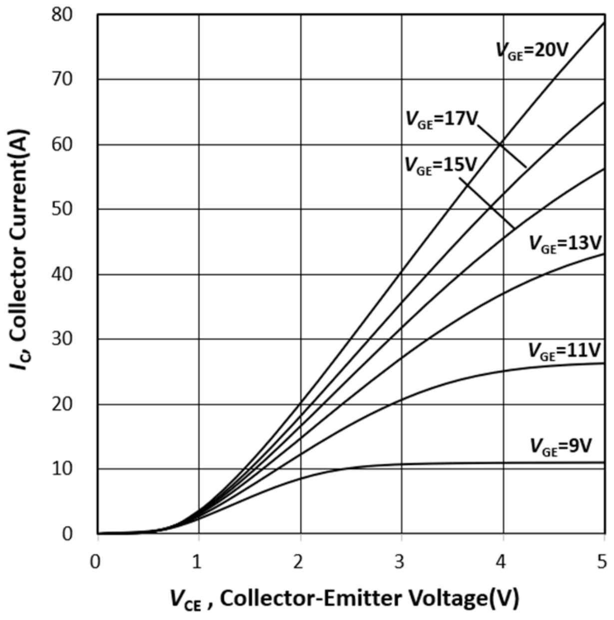


Figure 2. Typical output characteristic
(T_j =175℃)

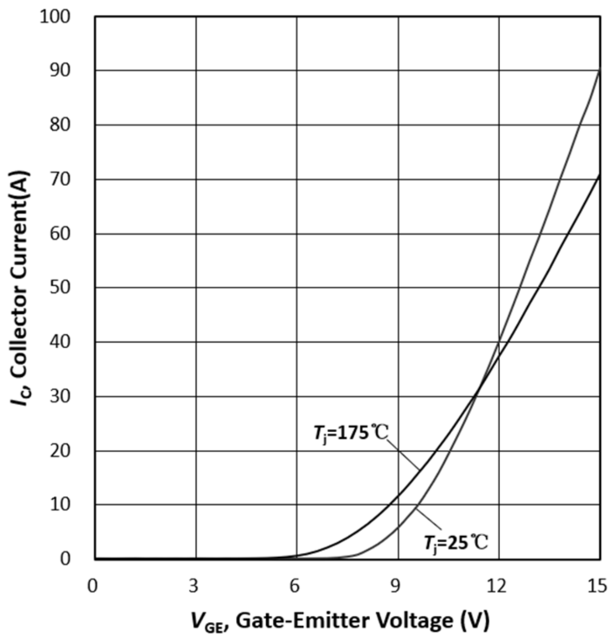


Figure 3. Typical transfer characteristic
(V_{CE}=25V)

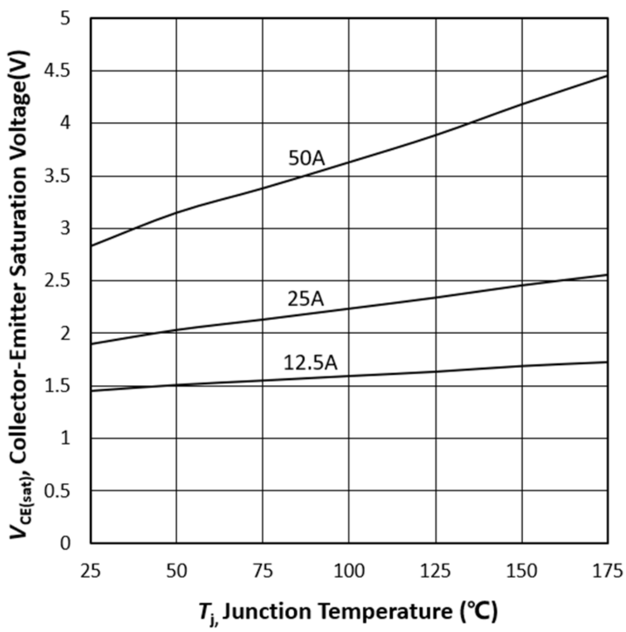


Figure 4. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE}=15V)

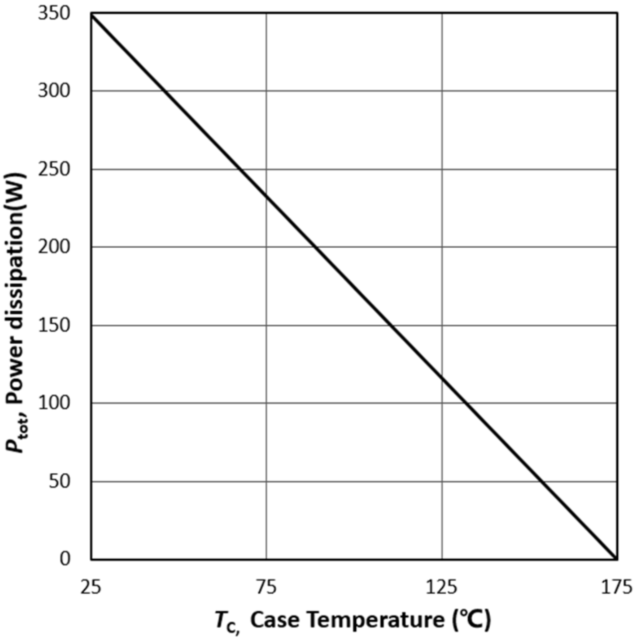


Figure 5. Power dissipation as a function of case temperature
(T_j≤175℃)

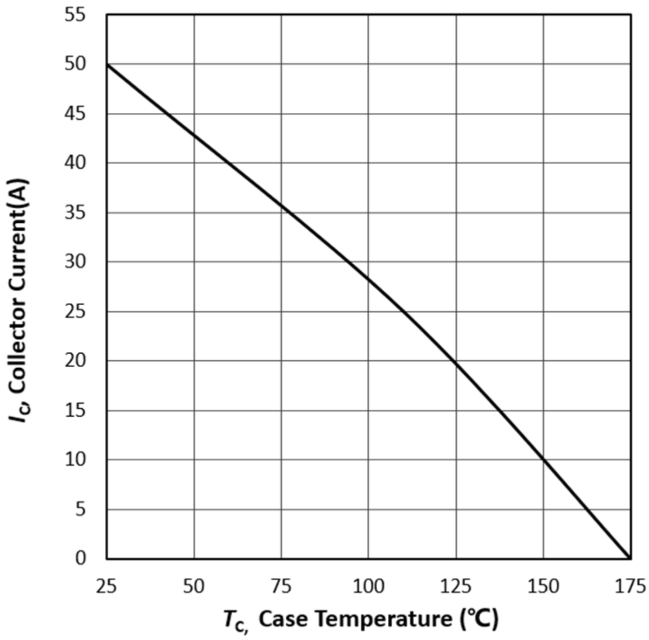


Figure 6. Collector current as a function of case temperature
(V_{GE}≥15V, T_j≤175℃)

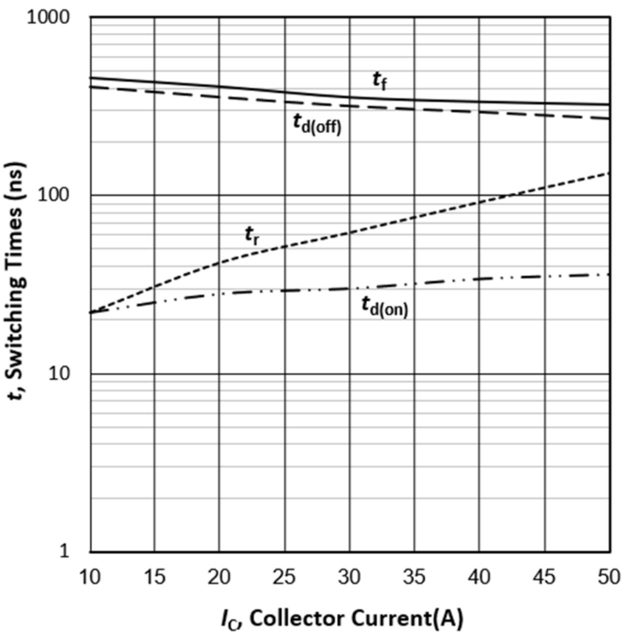


Figure 7. Typical switching times as a function of collector current
(inductive load, T_j=175℃,
V_{CE}=600V, V_{GE}=0/15V, R_G=16Ω,
Dynamic test circuit in Figure E)

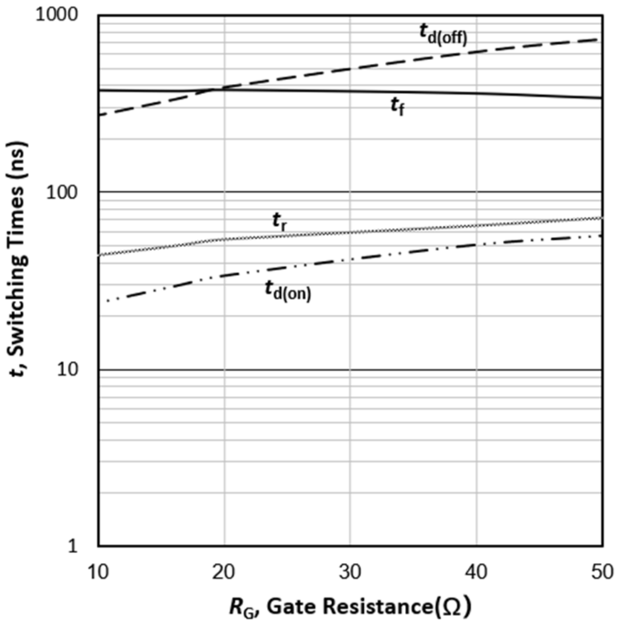


Figure 8. Typical switching times as a function of gate resistor
(inductive load, T_j=175℃,
V_{CE}=600V, V_{GE}=0/15V, I_C=25A,
Dynamic test circuit in Figure E)

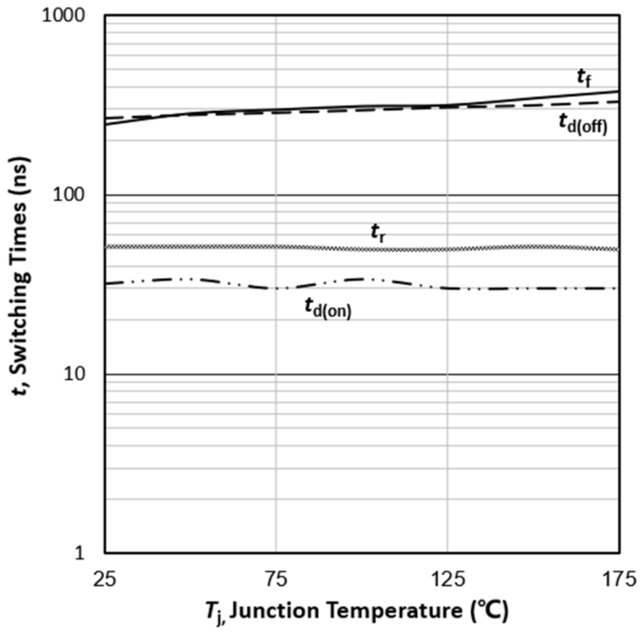


Figure 9. Typical switching times as a function of junction temperature
(inductive load, V_{CE}=600V, V_{GE}=0/15V, I_C=25A, R_G=16Ω, Dynamic test circuit in Figure E)

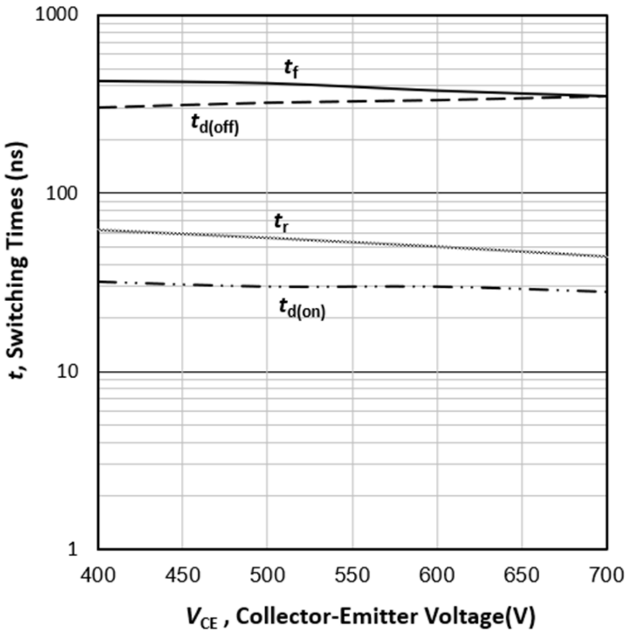


Figure 10. Typical switching times as a function of collector emitter voltage
(inductive load, T_j=175℃, V_{GE}=0/15V, I_C=25A, R_G=16Ω, Dynamic test circuit in Figure E)

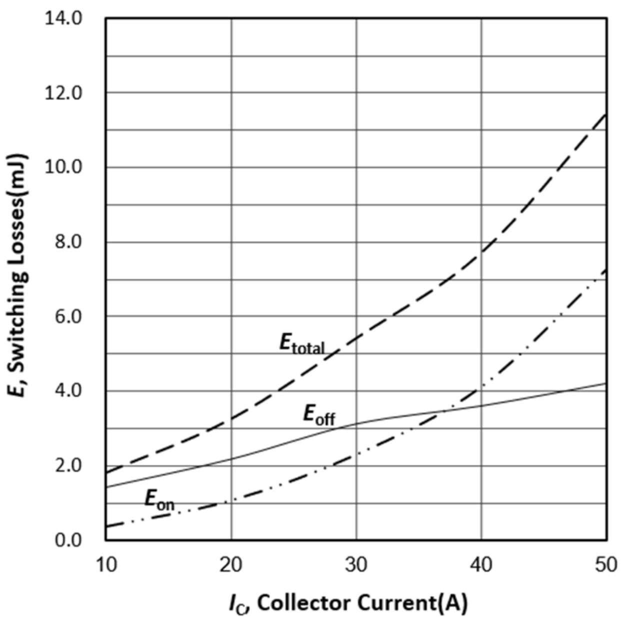


Figure 11. Typical switching energy losses as a function of collector current
(inductive load, T_j=175℃, V_{CE}=600V, V_{GE}=0/15V, R_G=16Ω, Dynamic test circuit in Figure E)

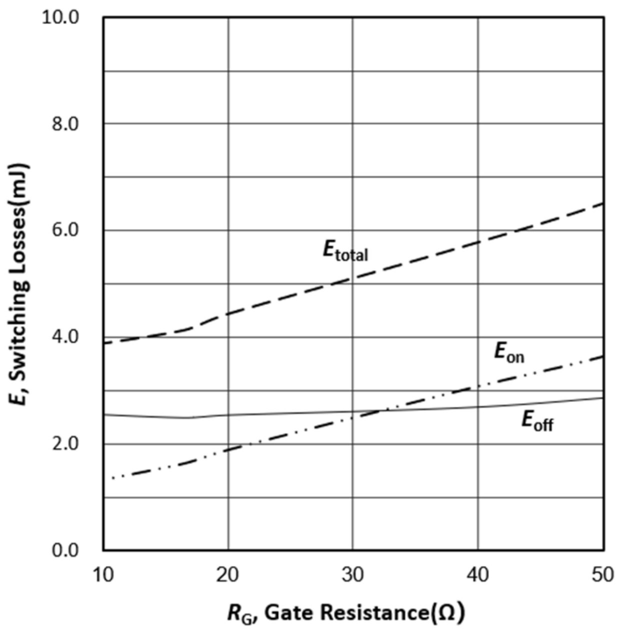


Figure 12. Typical switching energy losses as a function of gate resistor
(inductive load, T_j=175℃, V_{CE}=600V, V_{GE}=0/15V, I_C=25A, Dynamic test circuit in Figure E)

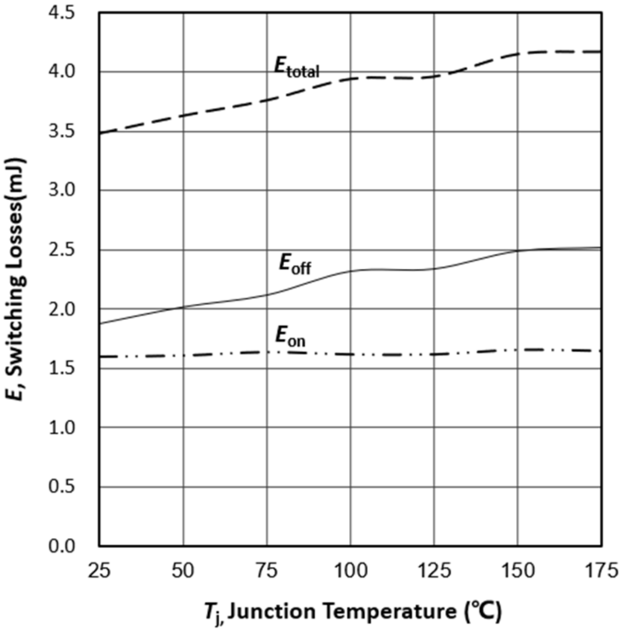


Figure 13. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE}=600V, V_{GE}=0/15V, I_C=25A, R_G=16Ω, Dynamic test circuit in Figure E)

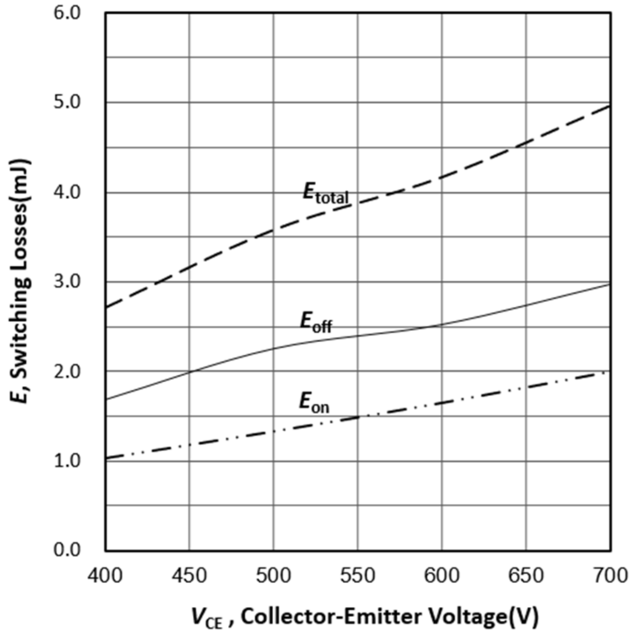


Figure 14. Typical switching energy losses as a function of collector emitter voltage
(inductive load, T_j=175℃, V_{GE}=0/15V, I_C=25A, R_G=16Ω, Dynamic test circuit in Figure E)

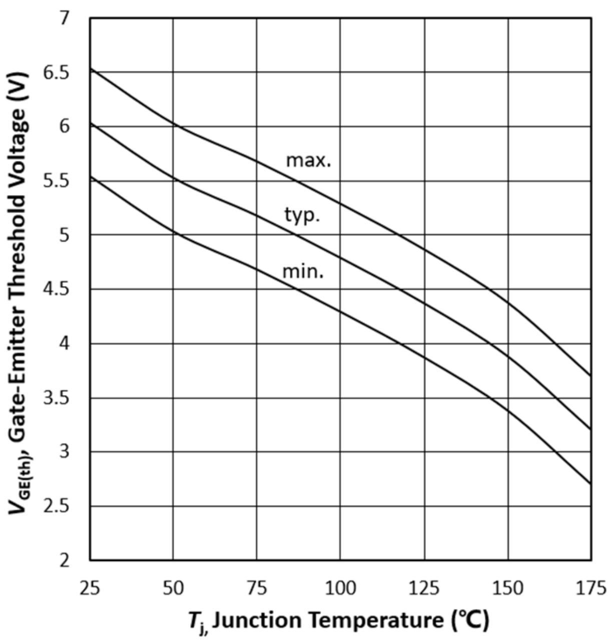


Figure 15. Gate-emitter threshold voltage as a function of junction temperature
(I_C=1mA)

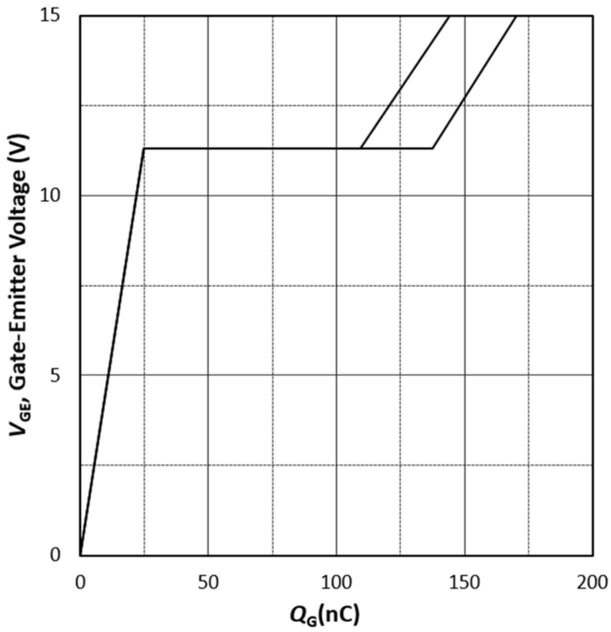


Figure 16. Typical gate charge
(I_C=25A)

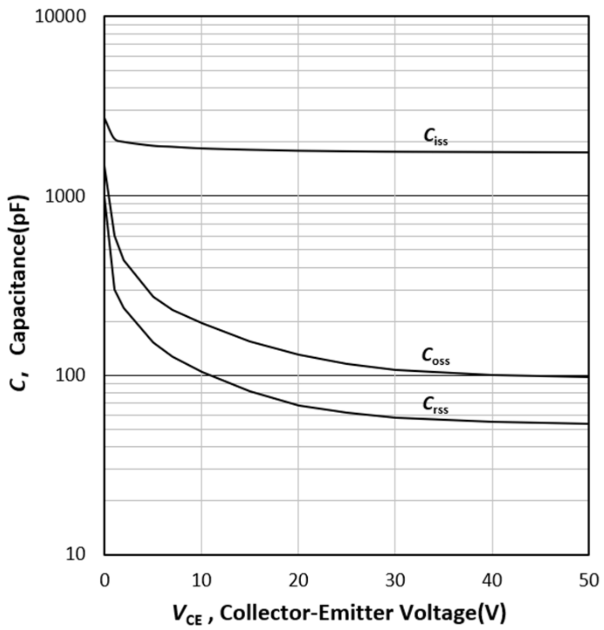


Figure 17. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V, f=1MHz)

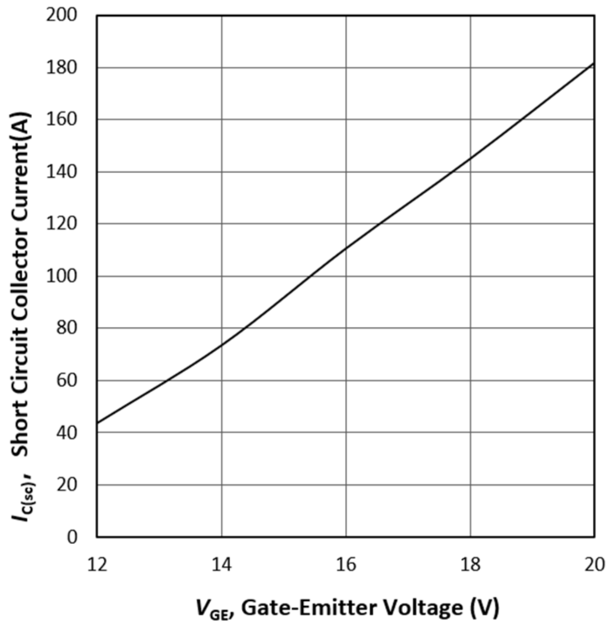


Figure 18. Typical short circuit collector current as a function of gate emitter voltage
(V_{CE}≤600V, T_j≤175 ℃)

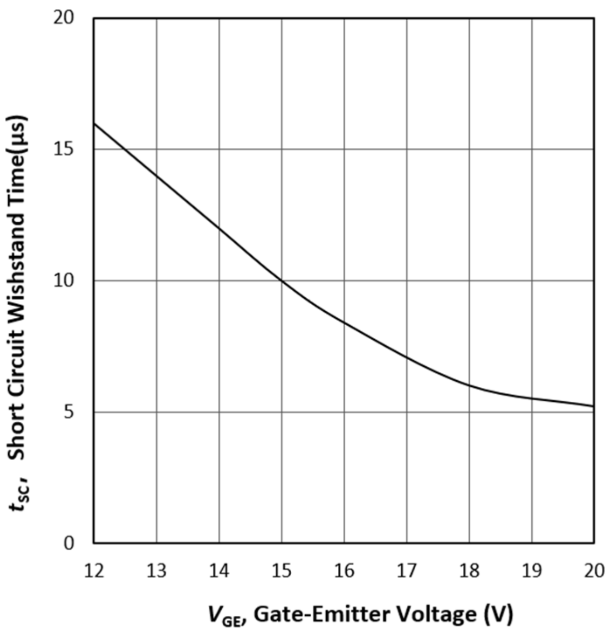


Figure 19. Typical short circuit withstand time as a function of gate emitter voltage
(V_{CE}=600V, start at T_{jmax}≤175 ℃)

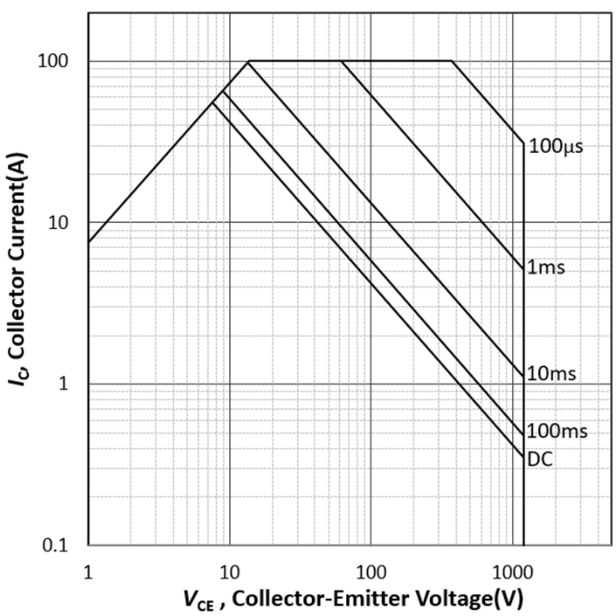


Figure 20. Forward Bias SOA
(D=0, T_C=25 ℃, T_j≤175 ℃, V_{GE}=15V)

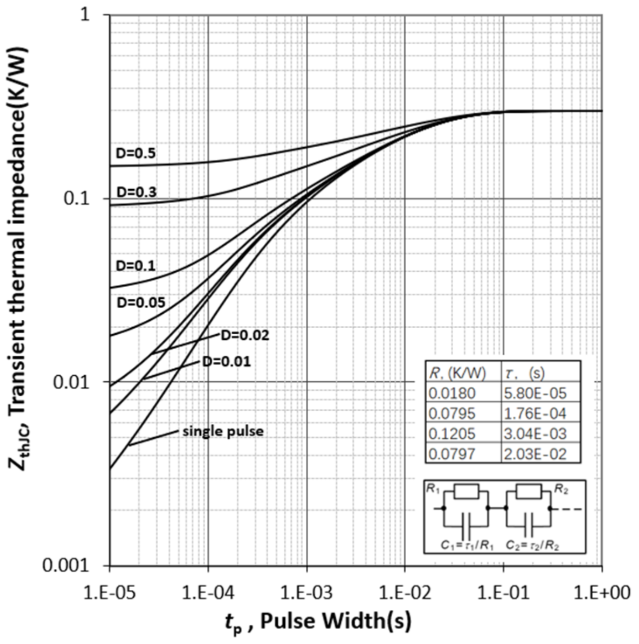


Figure 21. IGBT transient thermal impedance(typical)
($D=t_p/T$)

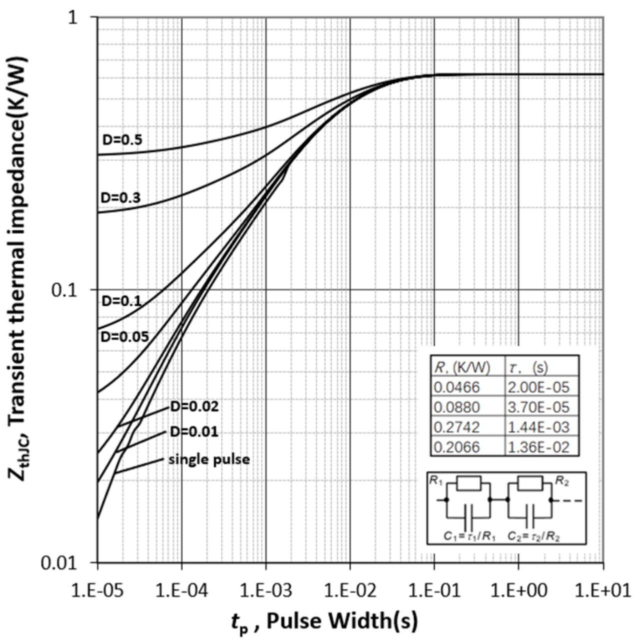


Figure 22. FRD transient thermal impedance(typical)
($D=t_p/T$)

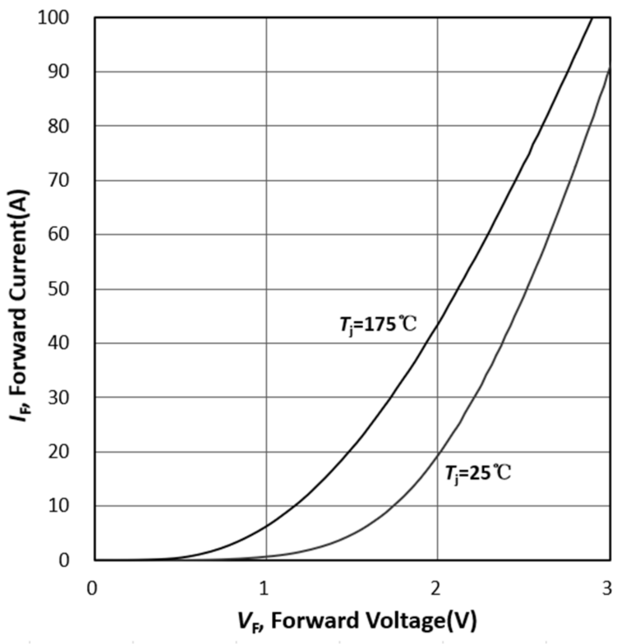


Figure 23. Typical diode forward current as a function of forward voltage

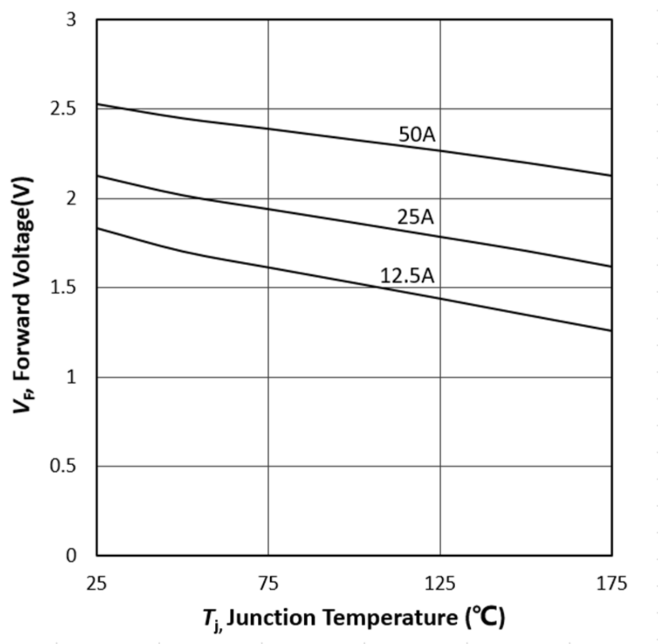


Figure 24. Typical diode forward voltage as a function of junction temperature

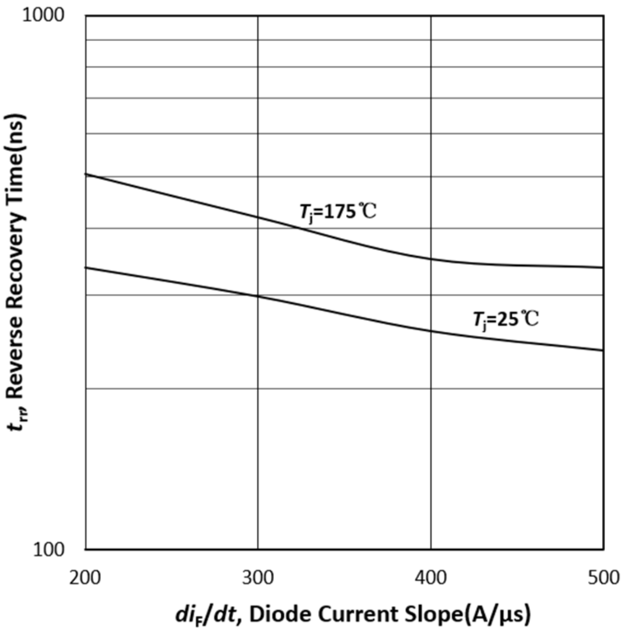


Figure 25. Typical reverse recovery time as a function of diode current slope
(V_R=600V, I_F=25A,
Dynamic test circuit in Figure E)

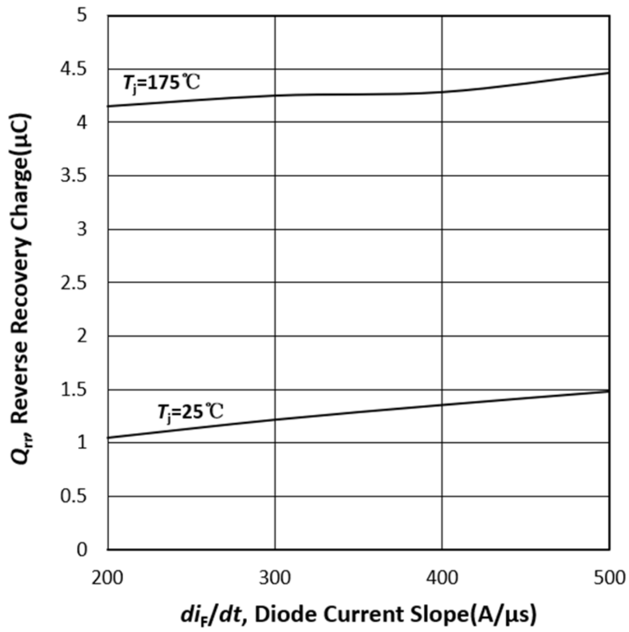


Figure 26. Typical reverse recovery charge as a function of diode current slope
(V_R=600V, I_F=25A,
Dynamic test circuit in Figure E)

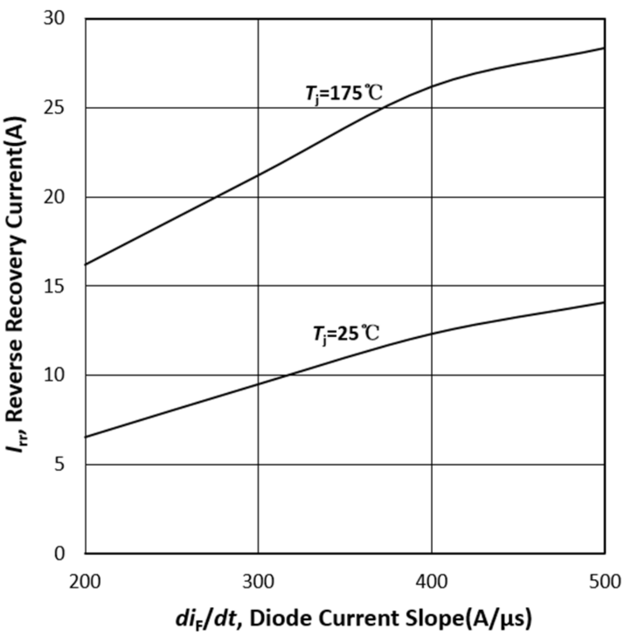


Figure 27. Typical reverse recovery current as a function of diode current slope
(V_R=600V, I_F=25A,
Dynamic test circuit in Figure E)

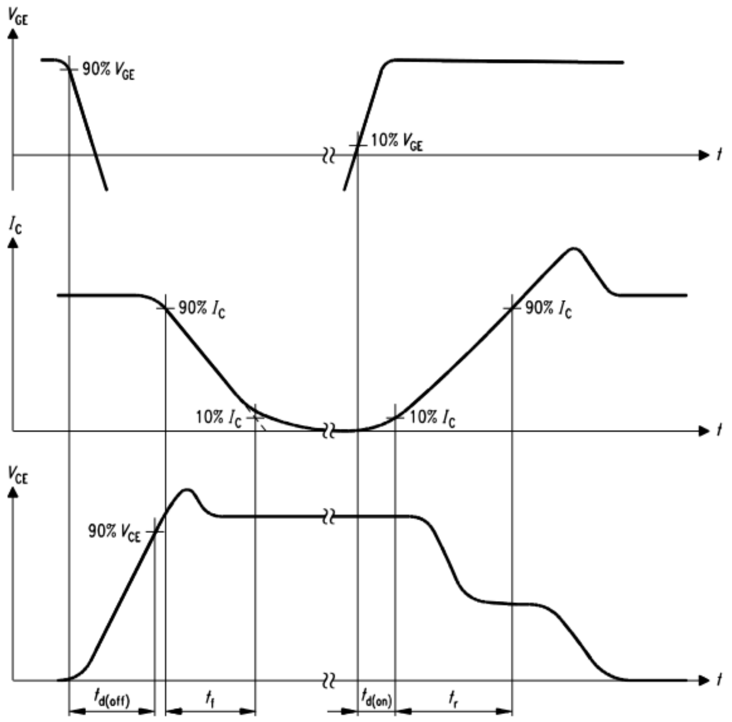


Figure A. Definition of switching times

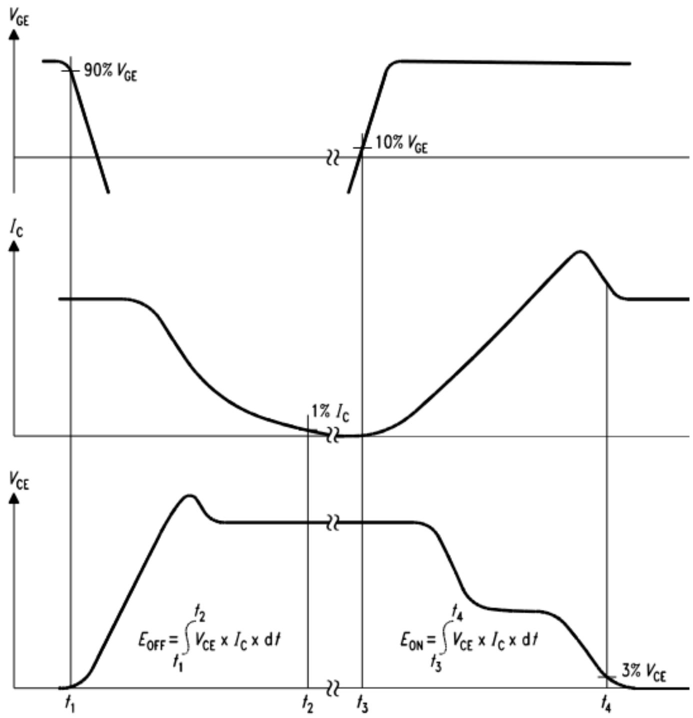


Figure B. Definition of switching losses

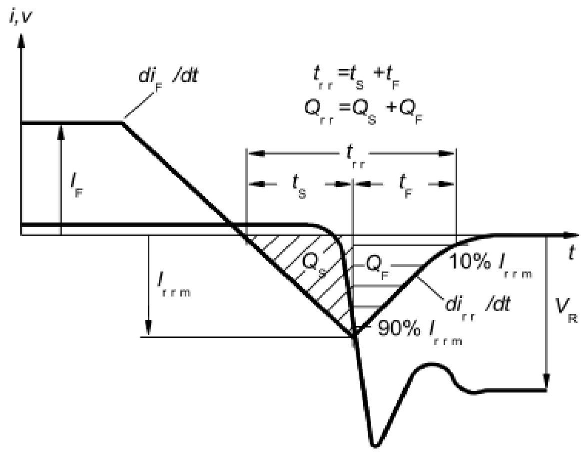


Figure C. Definition of diodes switching characteristics

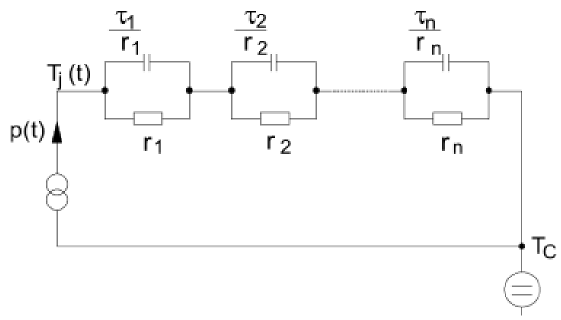


Figure D. Thermal equivalent circuit

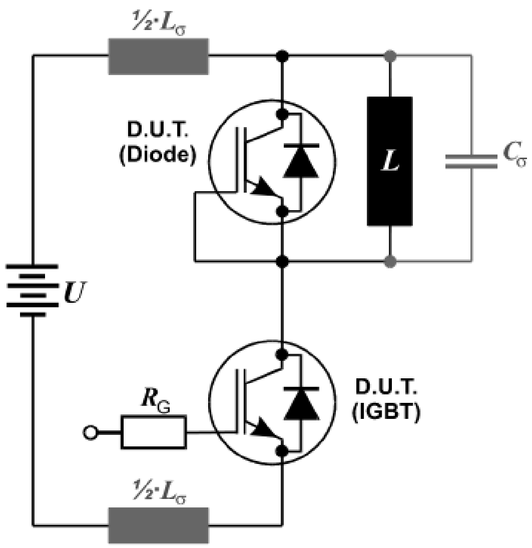
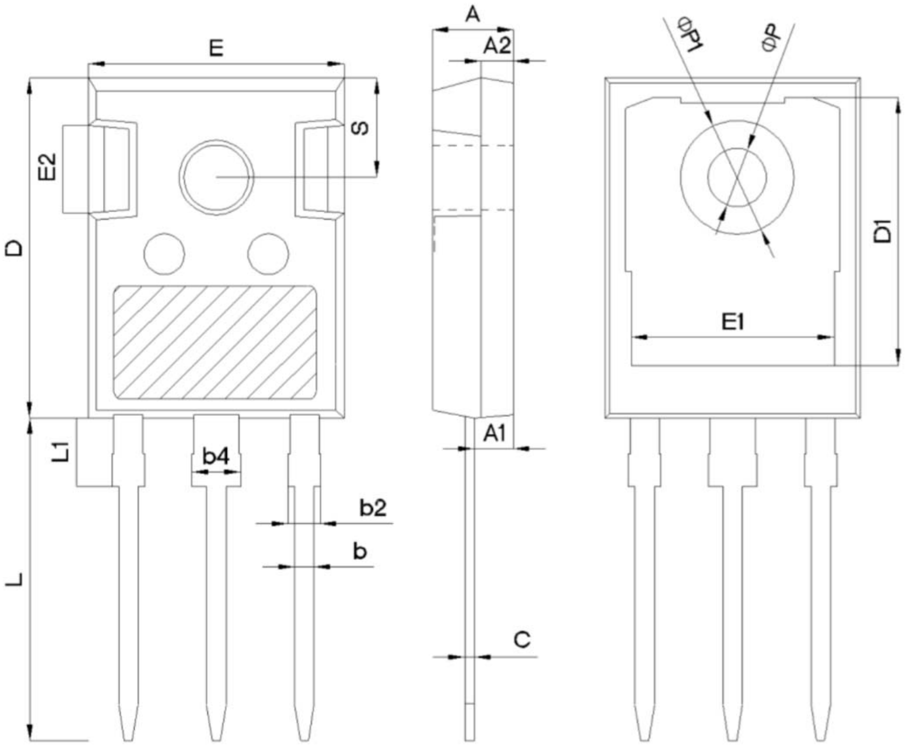


Figure E. Switching test circuit

TO-247-3



SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6.15BSC		

Revision History

Revision	Subjects (major changes since last revision)	Date
1.0	Initial version	2019.7
2.0	Add chart	2020.3
2.1	Update chart	2020.8

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