MPBQ100N120E

1200V-100A Trench and Field Stop IGBT

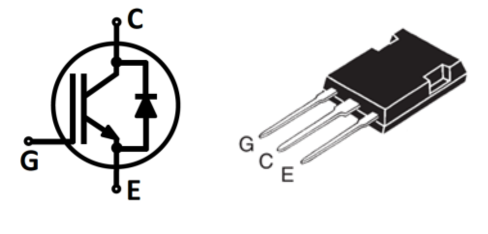
Features

- 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

- Industrial UPS
- Charger
- Energy Storage
- Welding

Type	Marking	Package Code
MPBQ100N120E	MP100N120E	TO-247-3L Plus



Maximum Rated Values

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current, limited by T_{vjmax} T_C=25℃ T_C=100℃	I_C	 200 100	A
Pulsed collector current, t_p limited by T_{vjmax} [1)]	I_{Cpuls}	400	
Diode forward current, limited by T_{vjmax} T_C=25℃ T_C=100℃	I_F	 200 100	
Diode pulsed current, t_p limited by T_{vjmax} [1)]	I_{Fpuls}	400	
Gate-emitter voltage	V_{GE}	±20	V
Transient Gate-emitter voltage（t_p≤10us,D<0.01)		±30	
Power dissipation T_C=25℃	P_{tot}	1070	W
Power dissipation T_C=100℃		535	
Operating junction temperature	T_{vj}	-40~175	℃
Storage temperature	T_{stg}	-55~150	
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	

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

Thermal Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
IGBT thermal resistance, junction-case	R_{thJC}	-	-	0.14	K/W
Diode thermal resistance, junction-case	R_{thJCD}	-	-	0.3	
Thermal Resistance, junction-ambient	R_{thJA}	-	-	40	

Electrical Characteristics（at T_{vj}=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=100A T_{vj}=25℃	-	1.70	1.95	
		T_{vj}=125℃	-	2.01	-	
		T_{vj}=150℃	-	2.09	-	
		T_{vj}=175℃	-	2.15	-	
G-E threshold voltage	$V_{GE(th)}$	I_C=2.4mA, V_{CE}=V_{GE}	4.8	5.4	6.0	
C-E leakage current	I_{CES}	V_{CE}=1200V,V_{GE}=0V T_{vj}=25℃	-	-	0.1	mA
		T_{vj}=175℃	-	-	4.0	
G-E leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	250	nA
Transconductance	g_{fs}	V_{CE}=20V, I_C=40A	-	35	-	S

Dynamic Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input capacitance	C_{ies}	V_{CE}=25V, V_{GE}=0V, f=1MHz	-	15370	-	pF
Output capacitance	C_{oes}		-	377	-	
Reverse transfer capacitance	C_{res}		-	116	-	
Gate charge	Q_G	V_{CC}=600V, I_C=100A, V_{GE}=15V	-	583	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH

IGBT Switching Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Turn-on delay time	$t_{d(on)}$	T_{vj}=25℃, V_{CC}=600V, I_C=100A, V_{GE}=0V/15V, R_G=10Ω, Inductive load	-	172	-	ns
Rise time	t_r		-	112	-	
Turn-off delay time	$t_{d(off)}$		-	600	-	
Fall time	t_f		-	116	-	
Turn-on energy	E_{on}		-	8.9	-	mJ
Turn-off energy	E_{off}		-	6.2	-	
Total switching energy	E_{ts}		-	15.2	-	
Turn-on delay time	$t_{d(on)}$	T_{vj}=175℃, V_{CC}=600V, I_C=100A, V_{GE}=0V/15V, R_G=10Ω, Inductive load	-	151	-	ns
Rise time	t_r		-	116	-	
Turn-off delay time	$t_{d(off)}$		-	707	-	
Fall time	t_f		-	142	-	
Turn-on energy	E_{on}		-	14.0	-	mJ
Turn-off energy	E_{off}		-	8.3	-	
Total switching energy	E_{ts}		-	22.3	-	

Diode Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Diode forward voltage	V_F	V_{GE}=0V, I_F=100A T_{vj}=25℃	-	2.1	2.6	V
		T_{vj}=150℃	-	2.0	-	
		T_{vj}=175℃	-	1.9	-	
Diode reverse recovery time	t_{rr}	T_{vj}=25℃, V_R=600V, I_F=100A, di_F/dt=600A/μs	-	361	-	ns
Diode reverse recovery charge	Q_{rr}		-	5.7	-	μC
Diode peak reverse recovery current	I_{rrm}		-	31	-	A
Diode reverse recovery time	t_{rr}	T_{vj}=175℃, V_R=600V, I_F=100A, di_F/dt=600A/μs	-	677	-	ns
Diode reverse recovery charge	Q_{rr}		-	15.9	-	μC
Diode peak reverse recovery current	I_{rrm}		-	58	-	A

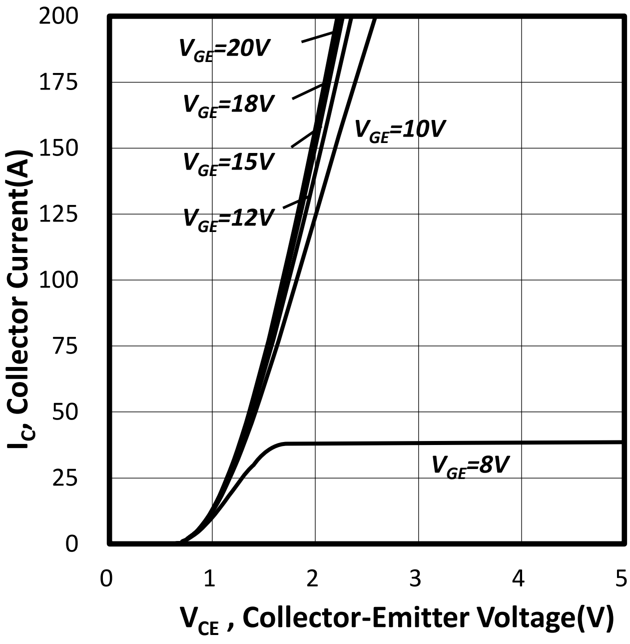


Figure 1. Typical output characteristic
(T_{vj}=25℃)

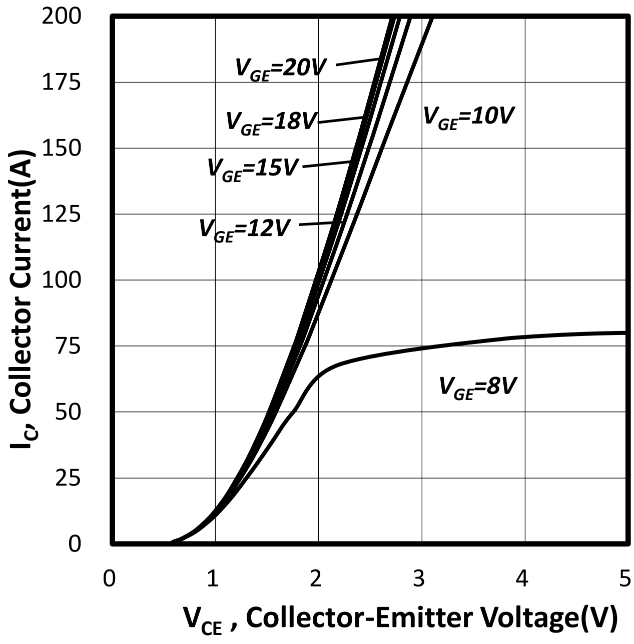


Figure 2. Typical output characteristic
(T_{vj}=125℃)

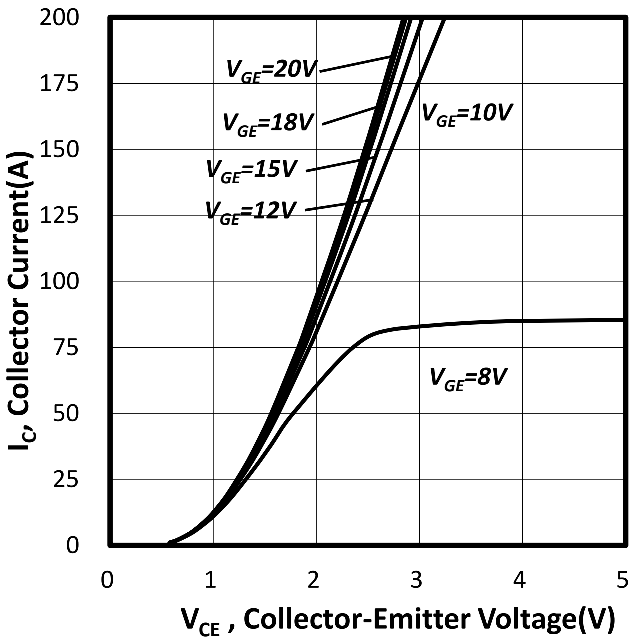


Figure 3. Typical output characteristic
(T_{vj}=150℃)

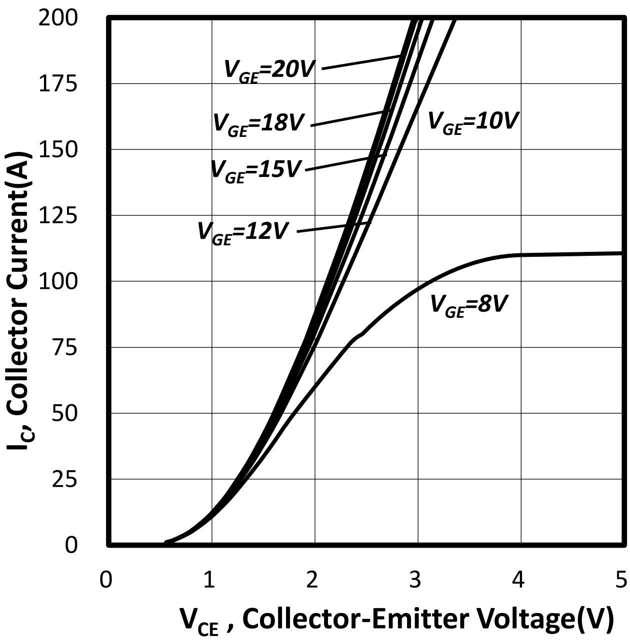


Figure 4. Typical output characteristic
(T_{vj}=175℃)

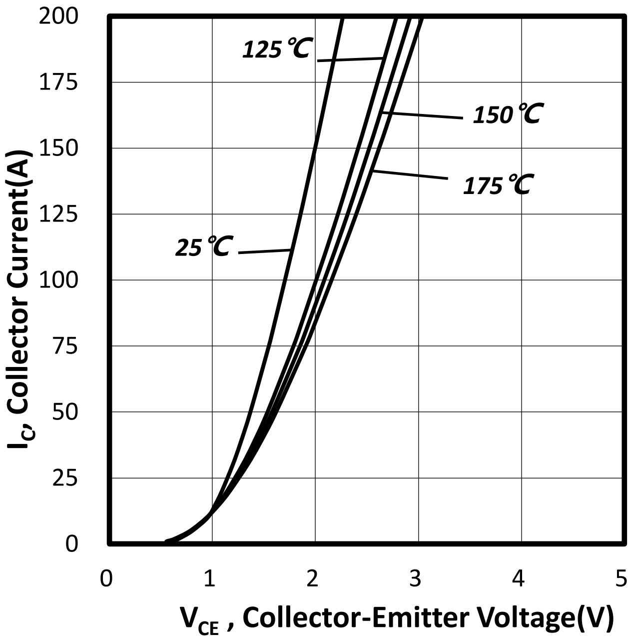


Figure 5. Typical $V_{CE(sat)}$-I_c characteristic
（V_{GE}=15V）

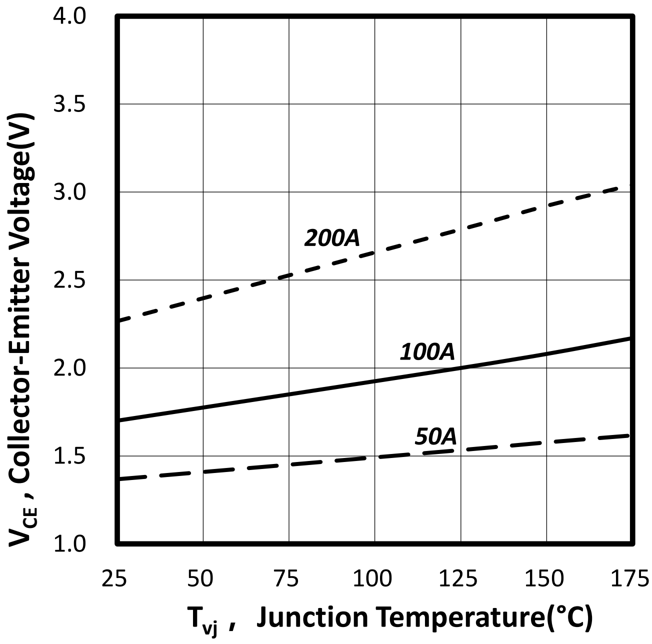


Figure 6. Typical $V_{CE(sat)}$-T_{vj} characteristic
（V_{GE}=15V）

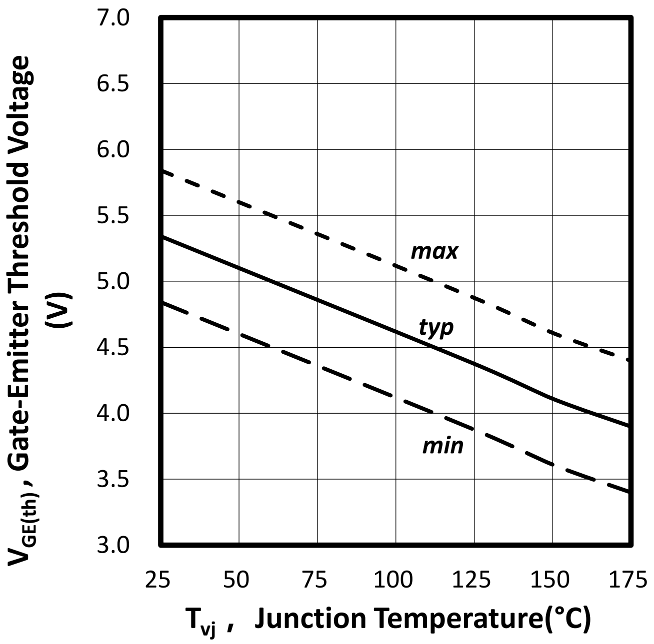


Figure 7.$V_{GE(th)}$-T_{vj} characteristic
（I_c=2.4mA）

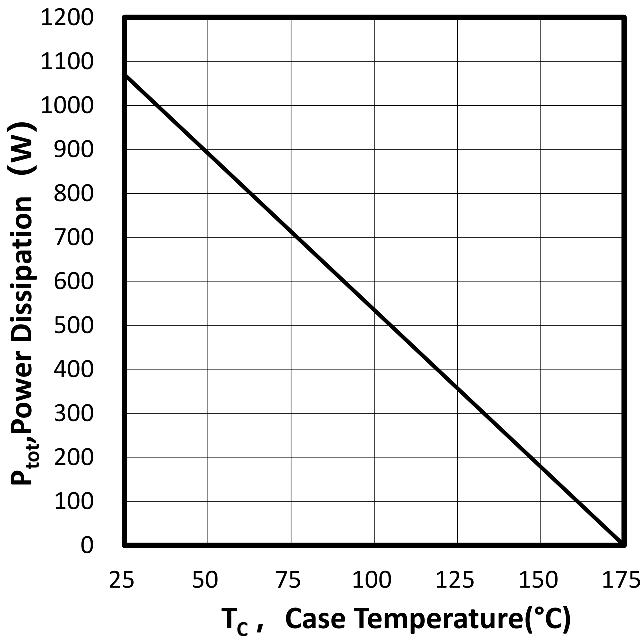


Figure 8. Power dissipation as a function of case temperature（T_{vj}≤175℃ ）

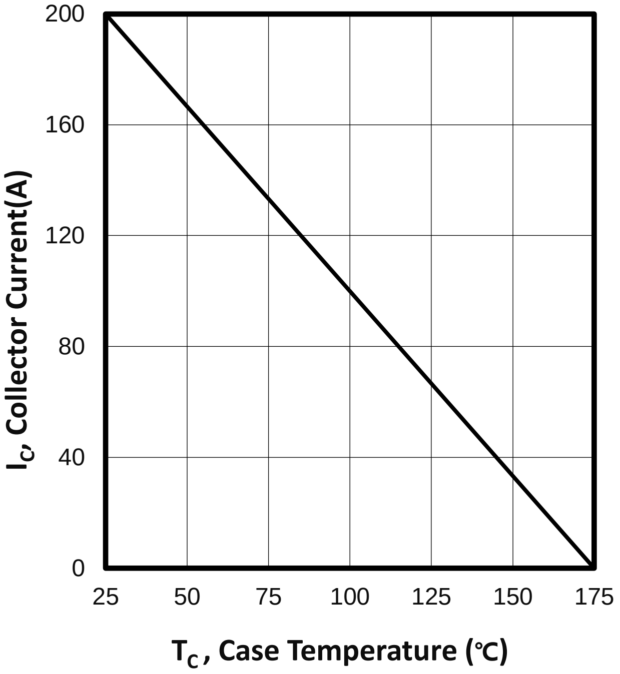


Figure 9. Collector current as a function of case temperature
(V_{GE}≥15V, T_{vj}≤175 ℃)

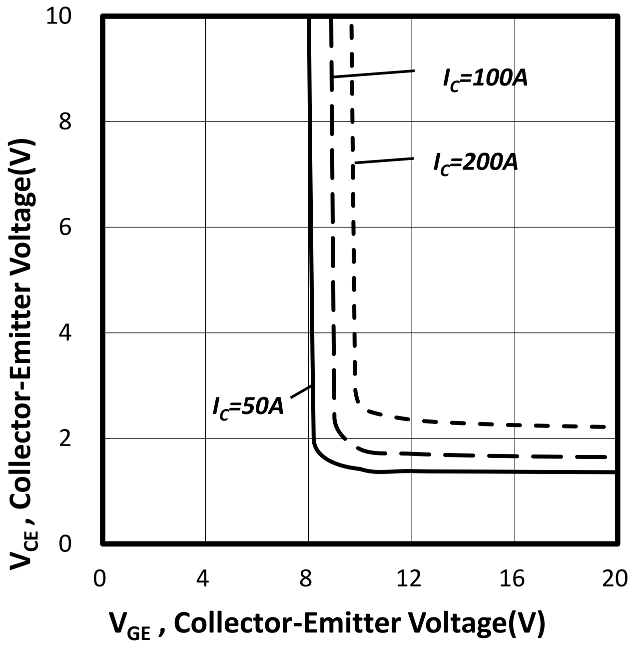


Figure 10. Typical $V_{CE(sat)}$-$V_{GE(th)}$ characteristic
(T_{vj}=25℃)

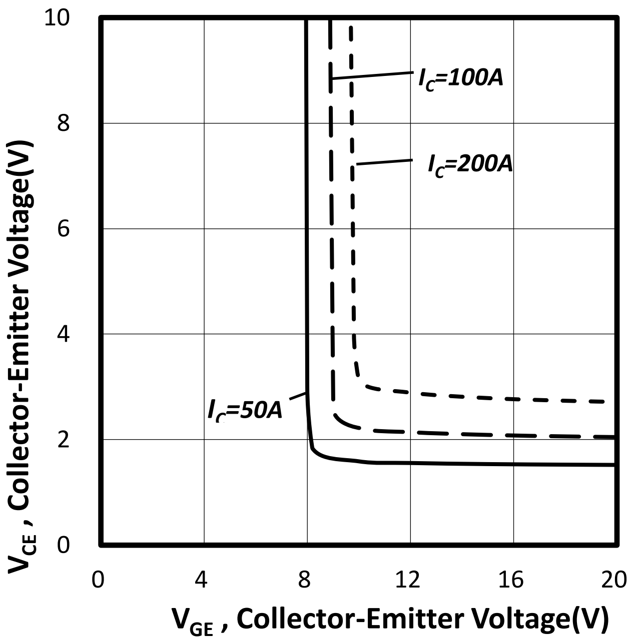


Figure 11. Typical $V_{CE(sat)}$-$V_{GE(th)}$ characteristic
(T_{vj}=125℃)

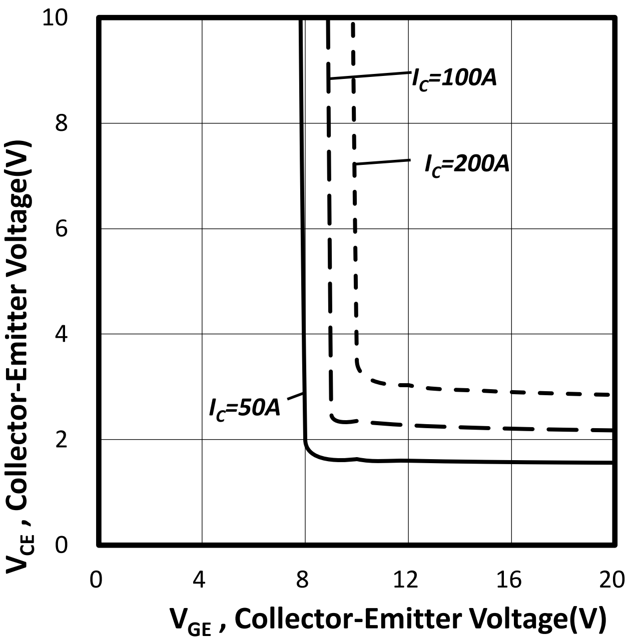


Figure 12. Typical $V_{CE(sat)}$-$V_{GE(th)}$ characteristic
(T_{vj}=150℃)

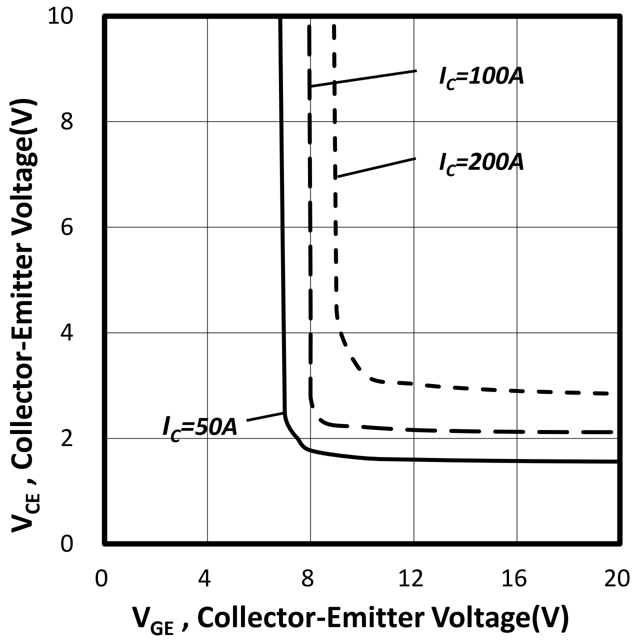


Figure 13. Typical $V_{CE(sat)}$-$V_{GE(th)}$ characteristic
(T_{vj}=175℃)

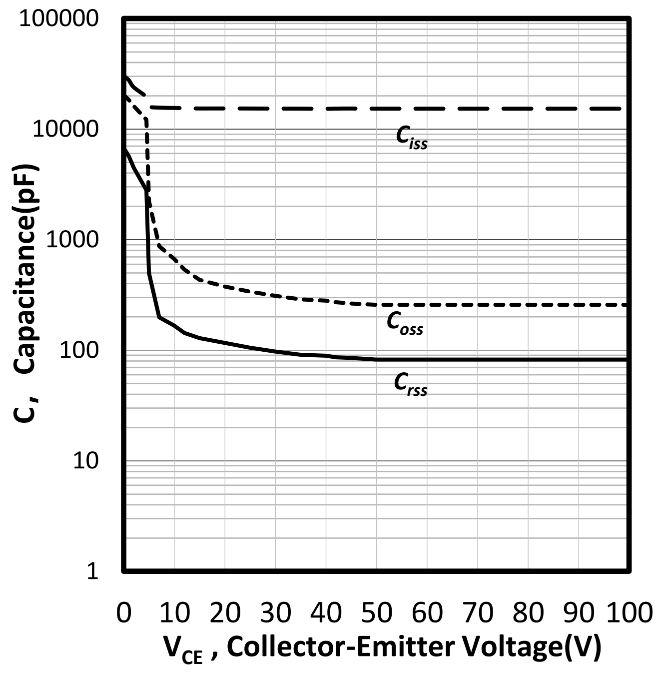


Figure 14. Typical capacitance as a function of collector-emitter voltage
(V_{GE}=0V f=1MHz)

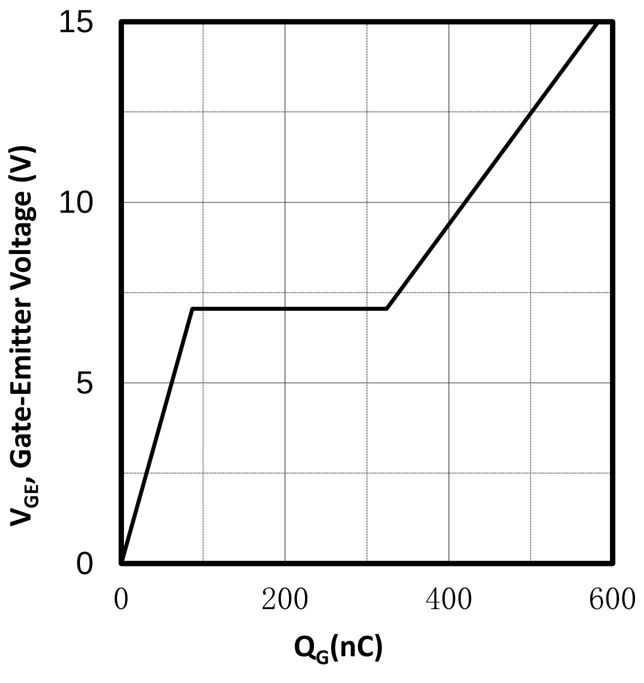


Figure 15. Typical gate charge
(V_{CE}=600V)

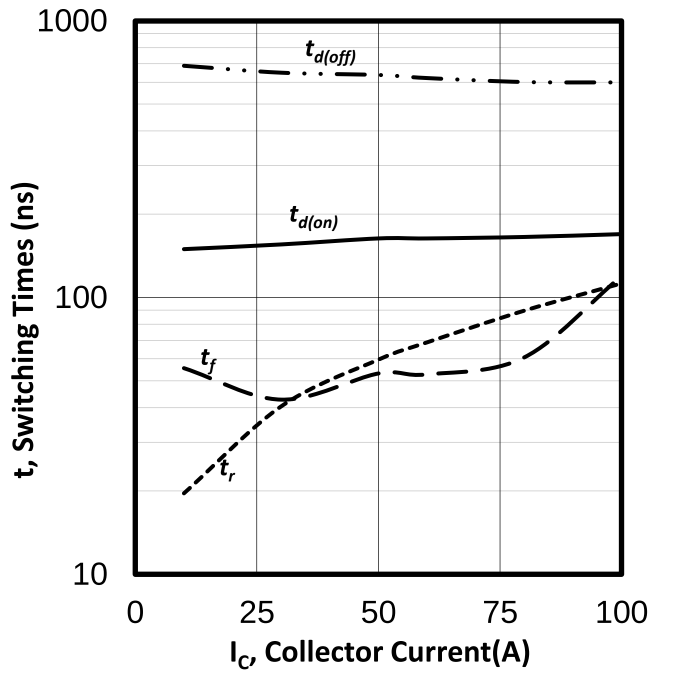


Figure 16. Typical switching times as a function of collector current
(inductive load, T_{vj}=25℃
V_{CE}=600V V_{GE}=0/15V R_G=10Ω)

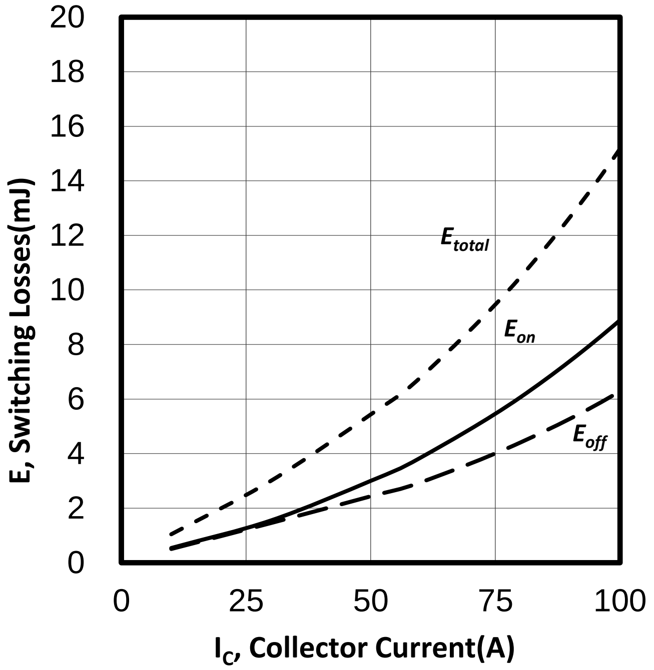


Figure 17. Typical switching energy losses as a function of collector current
(inductive load, T_{vj}=25℃
V_{CE}=600V V_{GE}=0/15V R_G=10Ω)

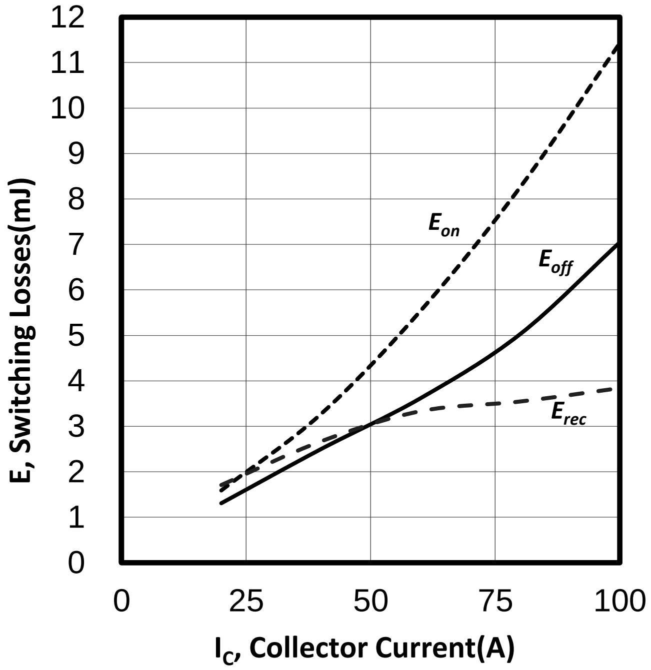


Figure 18. Typical switching energy losses as a function of collector current
(inductive load, T_{vj}=125℃
V_{CE}=600V V_{GE}=0/15V R_G=10Ω)

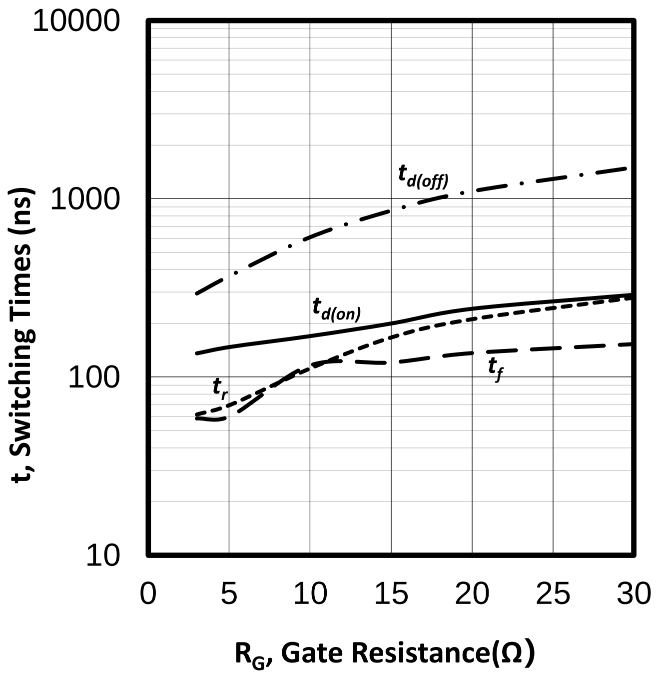


Figure 19. Typical switching times as a function of gate resistor
(inductive load, T_{vj}=25℃
V_{CE}=600V V_{GE}=0/15V I_C=100A)

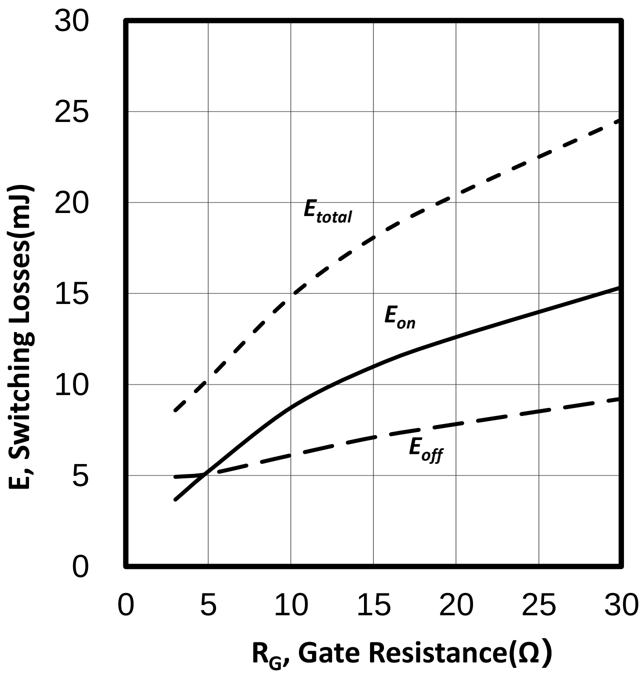


Figure 20. Typical switching energy losses as a function of gate resistor
(inductive load, T_{vj}=25℃
V_{CE}=600V V_{GE}=0/15V I_C=100A)

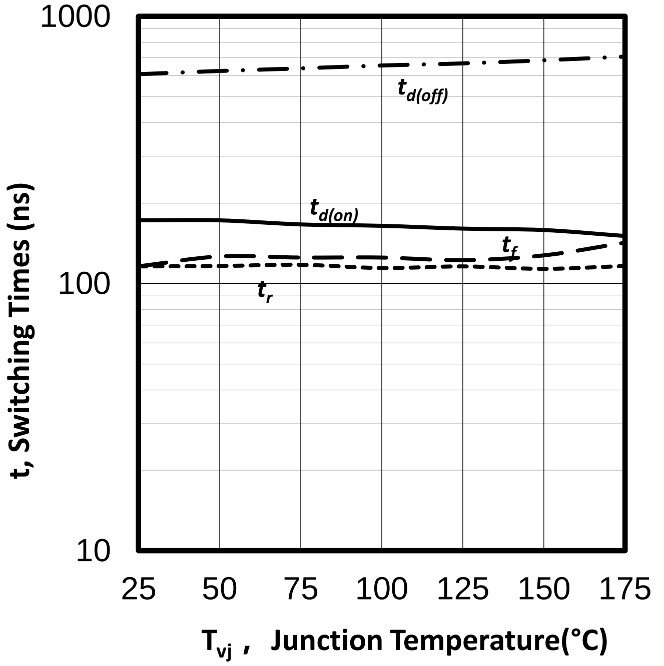


Figure 21. Typical switching times as a function of junction temperature
(inductive load, V_{CE}=600V V_{GE}=0/15V I_C=100A R_G=10Ω)

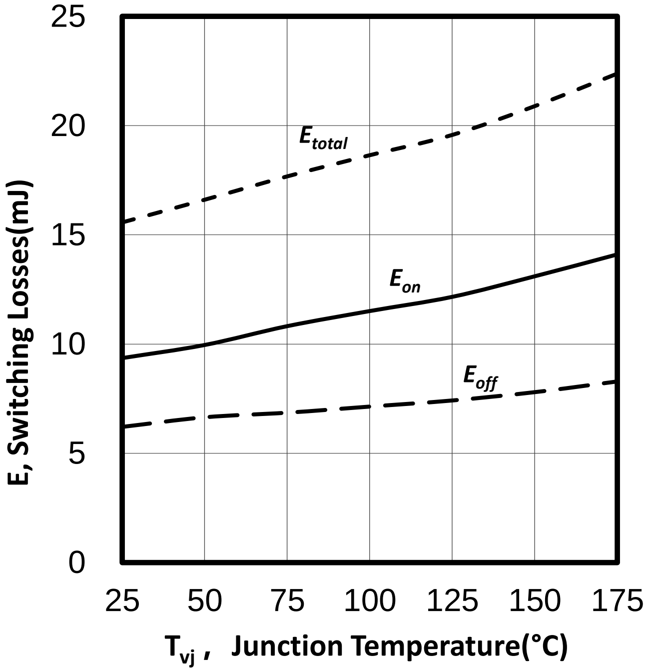


Figure 22. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE}=600V V_{GE}=0/15V I_C=100A R_G=10Ω)

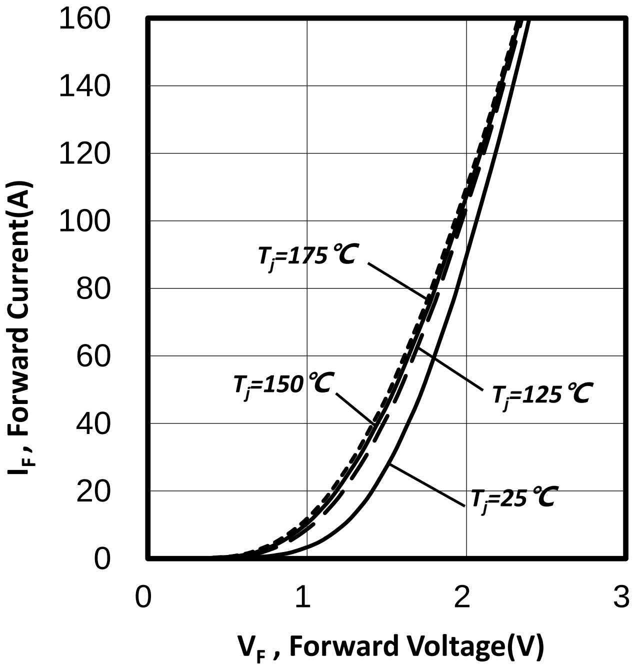


Figure 23. Typical diode forward current as a function of forward voltage

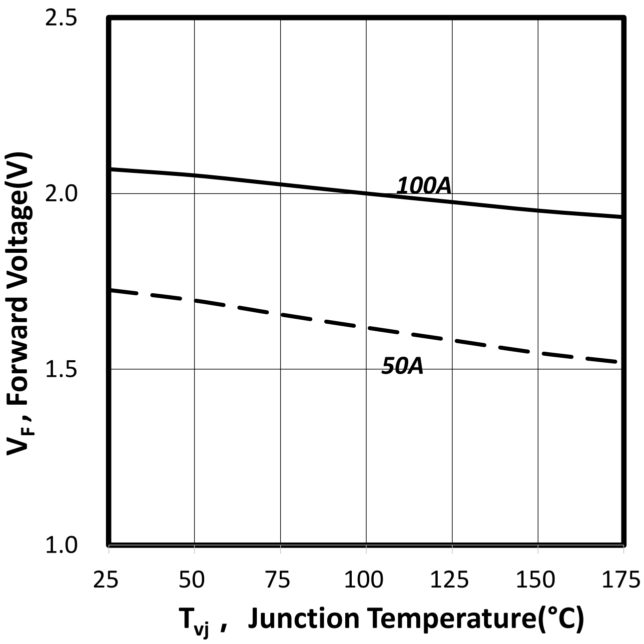


Figure 24. Typical diode forward voltage as a function of junction temperature

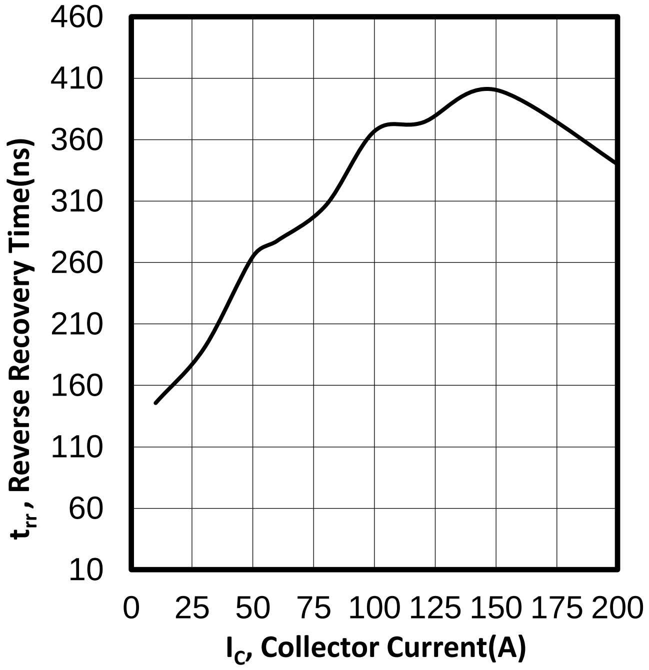


Figure 25. Typical reverse recovery time as a function of collector current
(inductive load, T_{vj}=25℃
V_{CE}=600V V_{GE}=0/15V R_G=10Ω)

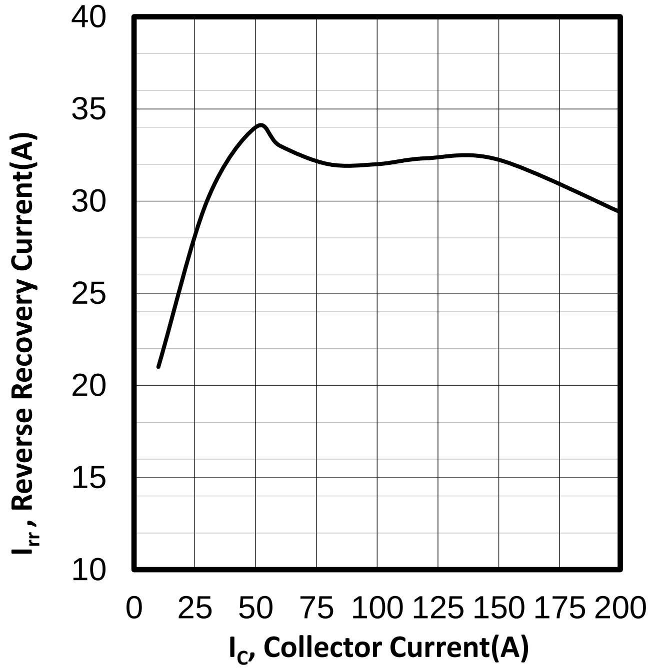


Figure 26. Typical reverse recovery current as a function of collector current
(inductive load, T_{vj}=25℃
V_{CE}=600V V_{GE}=0/15V R_G=10Ω)

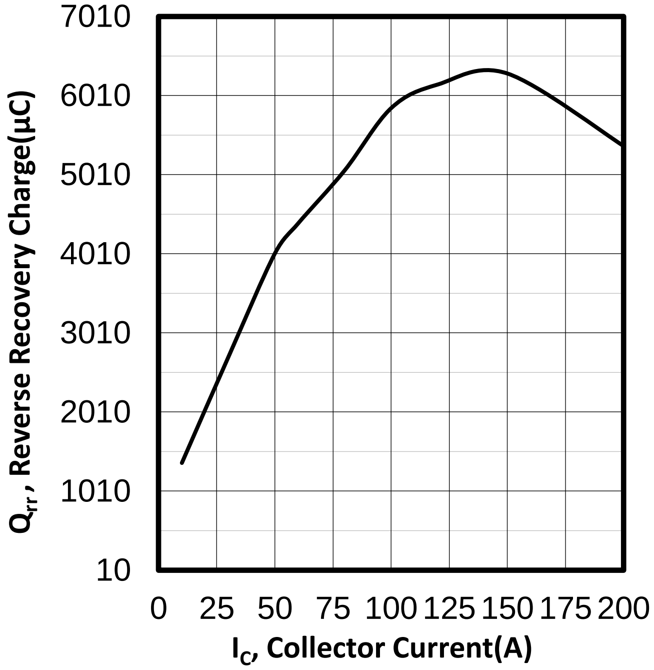


Figure 27. Typical reverse recovery charge as a function of collector current
(inductive load, T_{vj}=25℃
V_{CE}=600V V_{GE}=0/15V R_G=10Ω)

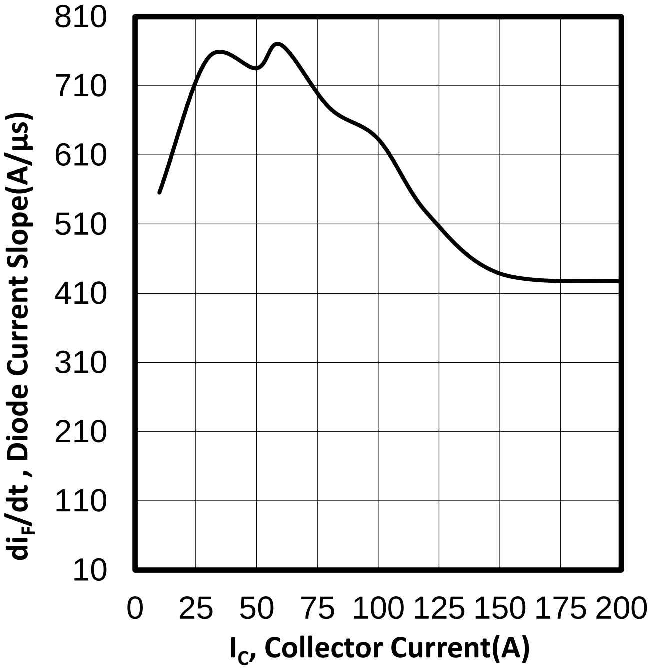


Figure 28. Typical diode current slope as a function of collector current
(inductive load, T_{vj}=25℃
V_{CE}=600V V_{GE}=0/15V R_G=10Ω)

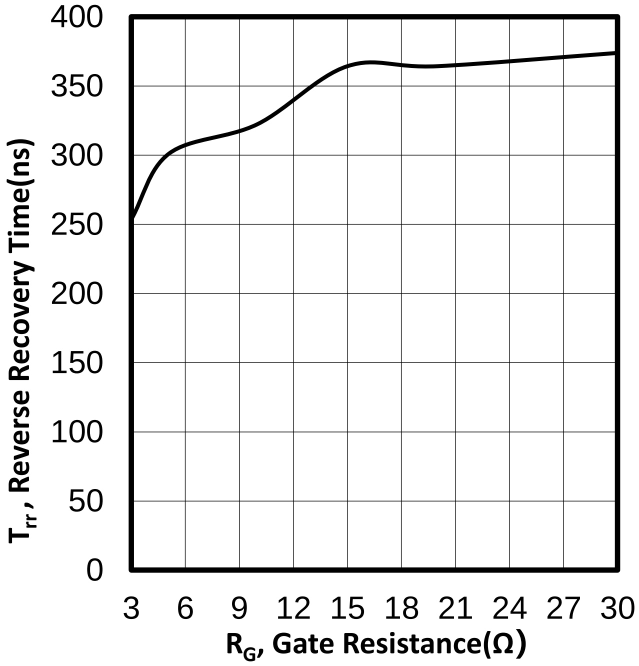


Figure 29. Typical reverse recovery time as a function of gate resistor
(inductive load, T_{vj}=25℃
V_{CE}=600V V_{GE}=0/15V I_C=100A)

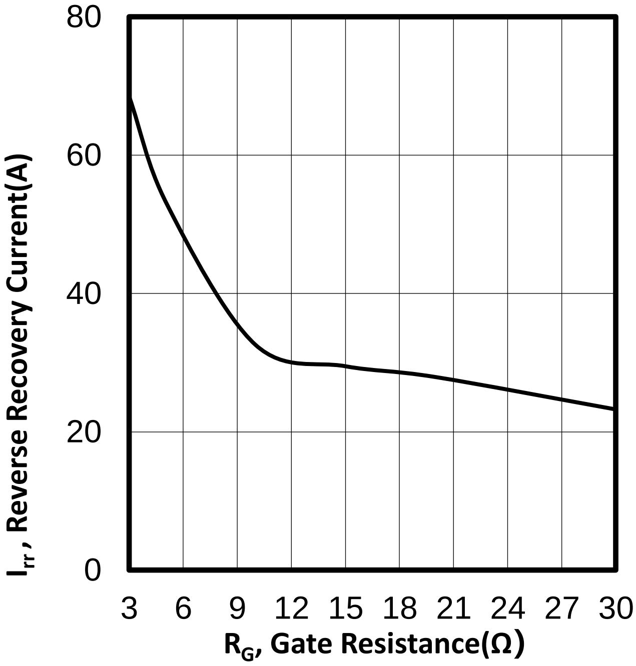


Figure 30. Typical reverse recovery current as a function of gate resistor
(inductive load, T_{vj}=25℃
V_{CE}=600V V_{GE}=0/15V I_C=100A)

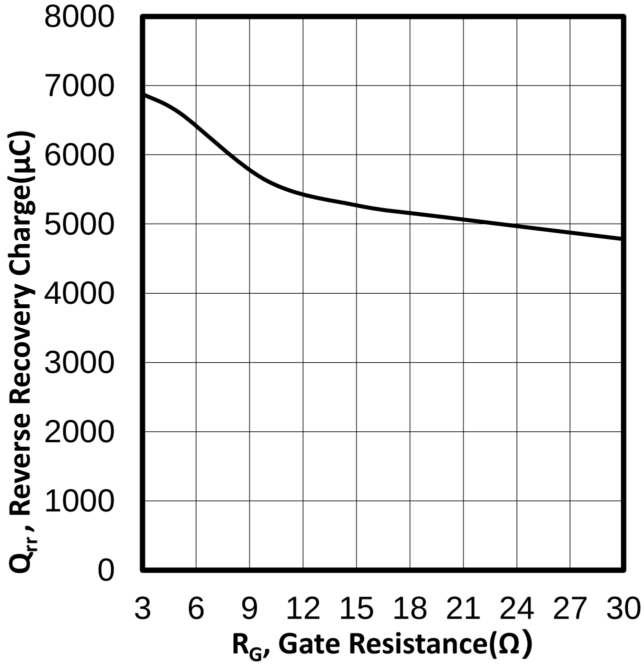


Figure 31. Typical reverse recovery charge as a function of gate resistor
(inductive load, T_{vj}=25℃
V_{CE}=600V V_{GE}=0/15V I_C=100A)

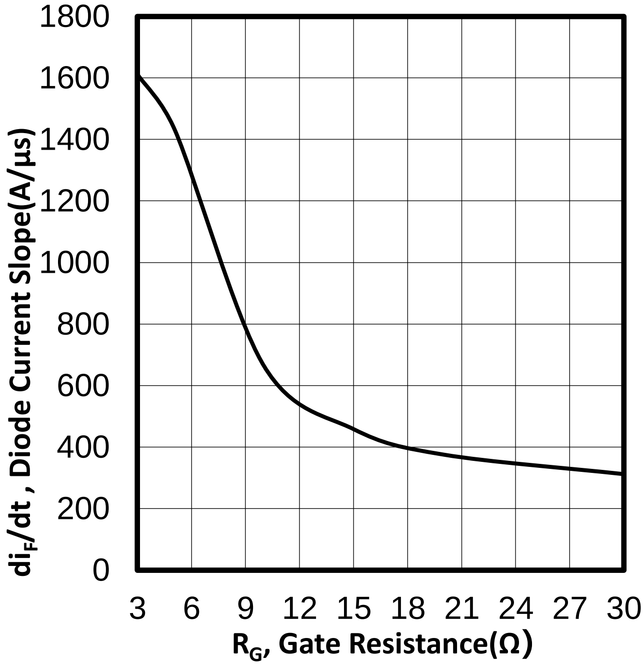


Figure 32. Typical diode current slope as a function of gate resistor
(inductive load, T_{vj}=25℃
V_{CE}=600V V_{GE}=0/15V I_C=100A)

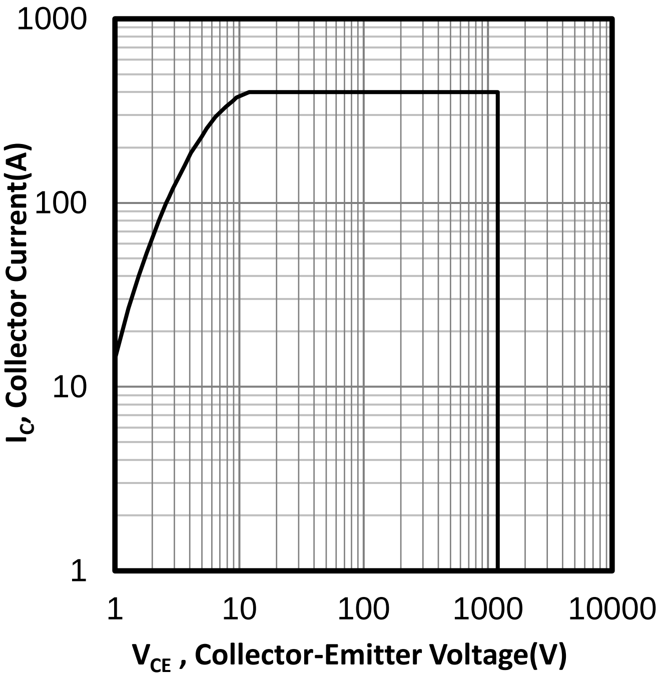


Figure 33. IGBT Reverse bias safe operating area
(T_{vj}≤175℃ V_{GE}=15V)

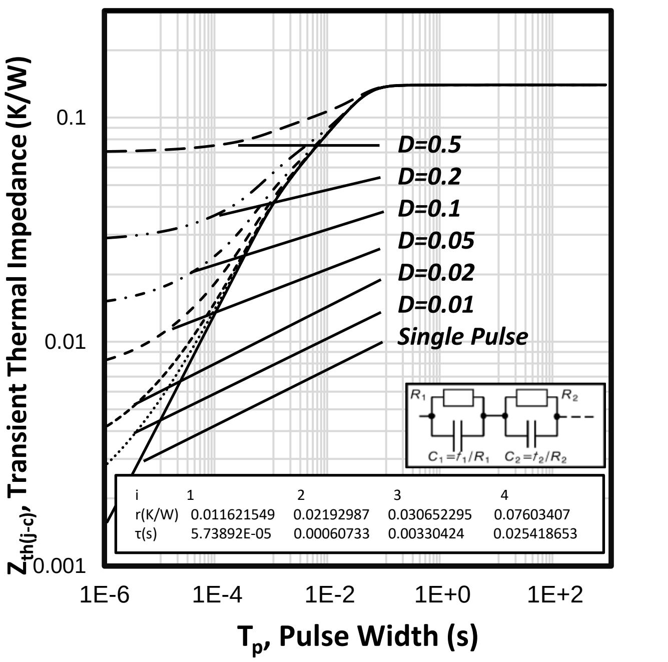


Figure 34. IGBT transient thermal impedance as a function of pulse width
(D=t_p/T**)**

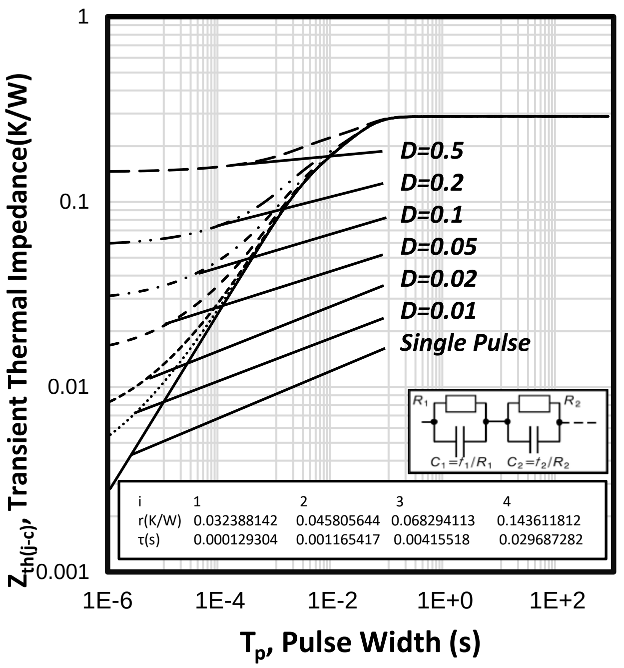


Figure 35. Diode transient thermal impedance as a function of pulse width
(D=t_p/T)

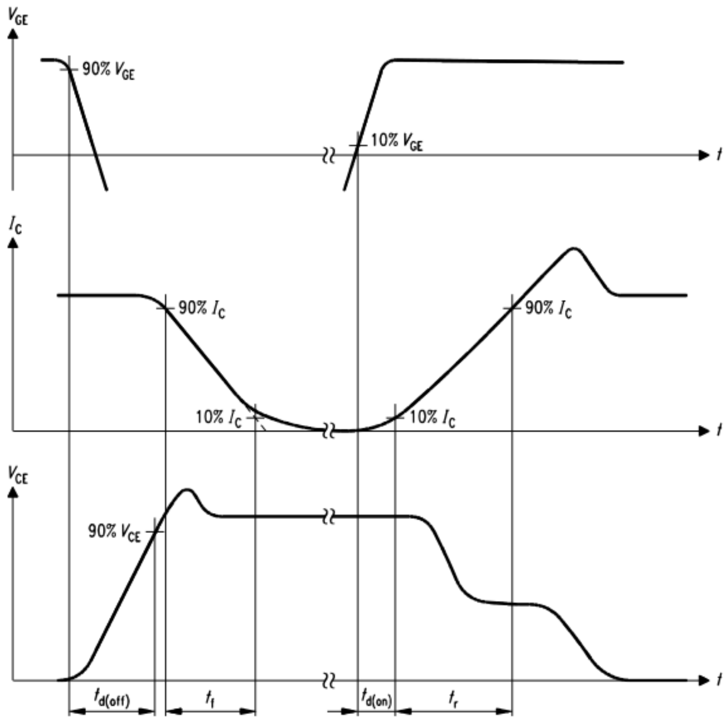


Figure A. Definition of switching times

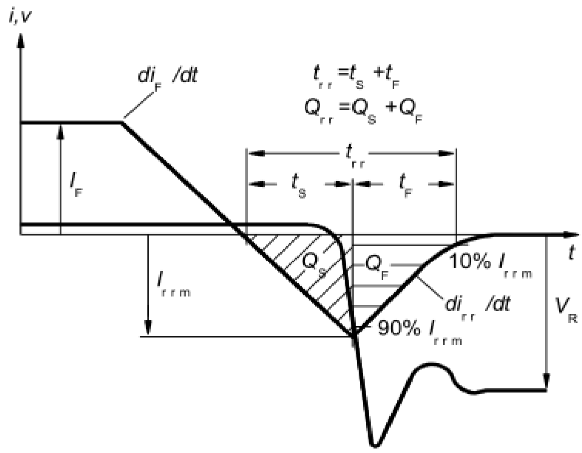


Figure C. Definition of diodes switching characteristics

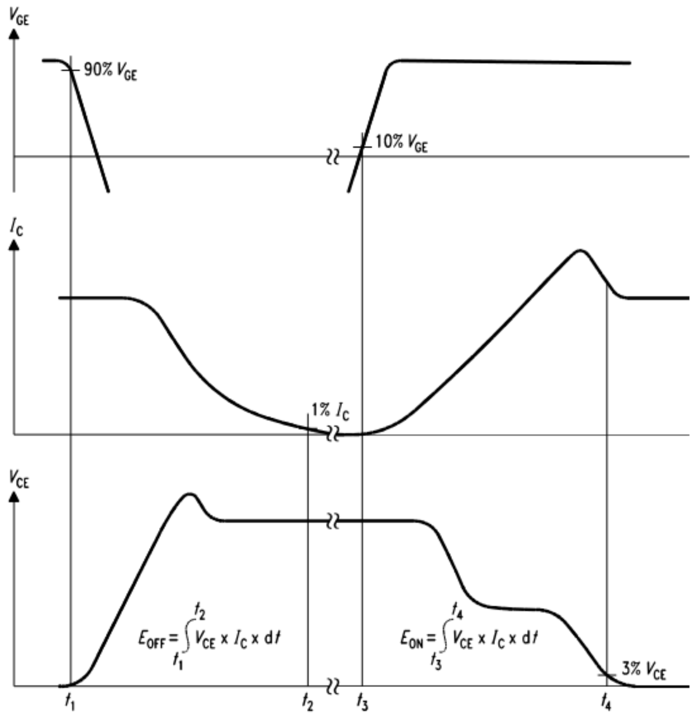


Figure B. Definition of switching losses

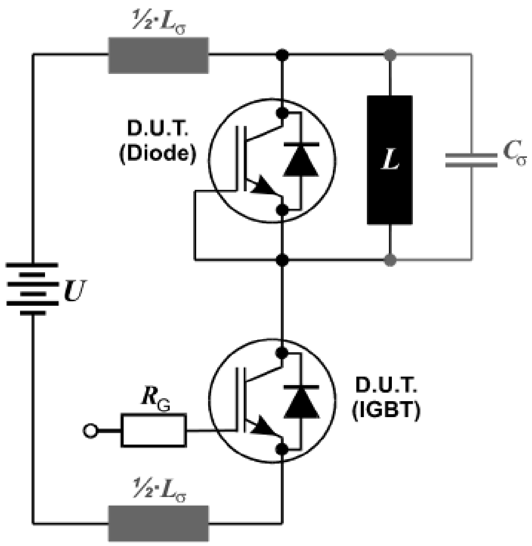


Figure D. Switching test circuit

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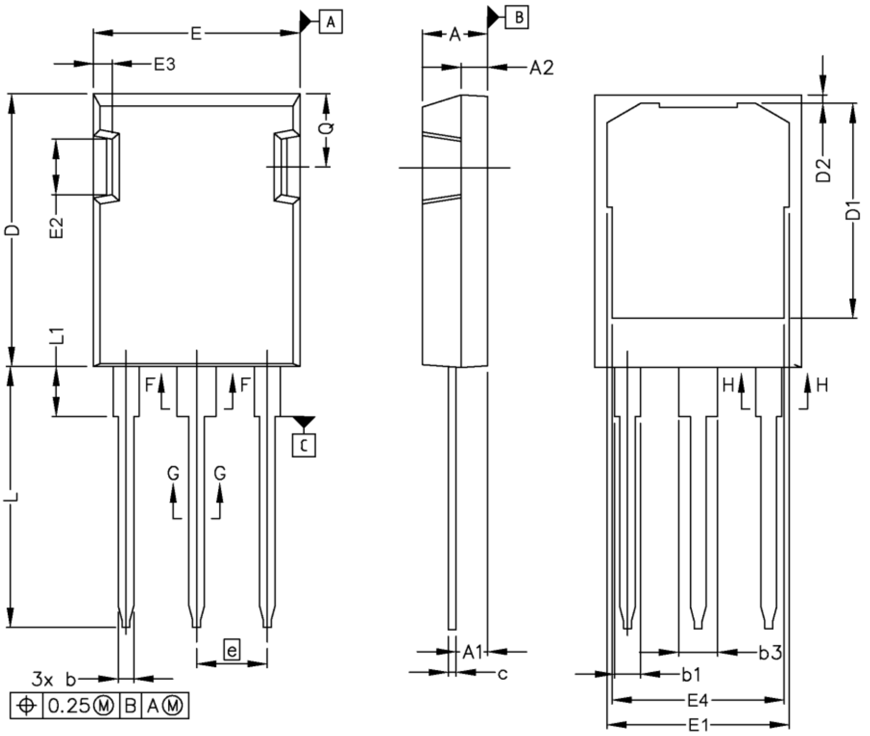
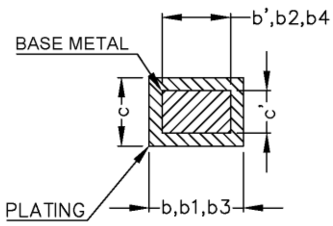


SYMBOL	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b'	1.07	1.28
b	1.07	1.33
b1	1.91	2.41
b2	1.91	2.16
b3	2.87	3.38
b4	2.87	3.13
c'	0.55	0.65
c	0.55	0.68
D	20.80	21.10
D1	16.25	17.65
D2	0.50	0.80
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	5.44 BSC	
N	3	
L	19.81	20.32
L1	3.70	4.00
Q	5.49	6.00

NOTE ;
1. ALL METAL SURFACES: TIN PLATED,EXCEPT AREA OF CUT
2. DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
3. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
4. THIS DRAWING WILL MEET ALL DIMENSIONS REQUIREMENT OF JEDEC outlines TO-247 AD.

1 - GATE
2 - DRAIN (COLLECTOR)
3 - SOURCE (EMITTER)
4 - DRAIN (COLLECTOR)



SECTION "F-F", "G-G" AND "H-H"
SCALE: NONE

Revision History

Revision	Subjects (major changes since last revision)	Date
1.0	Initial version	2022.5
1.1	Modify Diode Parameter values	2022.9
1.2	Update charts and add chart	2023.1
1.3	Add charts，update R_{thJCD} data	2023.9
1.4	Add IC-TC charts	2023.10

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1. The product specifications, characteristics, data, materials and structures given in this datasheet are subject to change without notice.
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