MPBQ50N120B

1200V-50A Trench and Field Stop IGBT

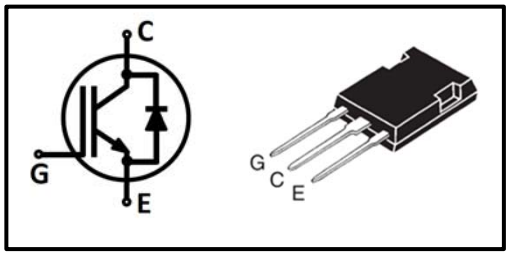
Features

- 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

- Solar Inverter
- UPS
- Welding

Type	Marking	Package
MPBQ50N120B	MP50N120B	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=135℃	I_C	100 50	A
Pulsed collector current, t_p limited by T_{vjmax} [1)]	I_{Cpuls}	200	
Turn off safe operating area V_{CE}≤1200V, T_{vj} ≤175℃, t_p=1μs	-	200	
Diode forward current, limited by T_{vjmax} T_C=25℃ T_C=100℃	I_F	100 50	
Diode pulsed current, t_p limited by T_{vjmax} [1)]	I_{Fpuls}	200	
Gate-emitter voltage	V_{GE}	±20	V
Transient gate-emitter voltage（t_p≤10μs,D<0.01)		±30	
Power dissipation T_C=25℃	P_{tot}	600	W
Power dissipation T_C=135℃		160	
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}	-	-	0.25	K/W
Diode thermal resistance, junction-case	R_{thJCD}	-	-	0.48	
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=50A T_{vj}=25℃	-	1.80	2.30	
		T_{vj}=150℃	-	2.35	-	
		T_{vj}=175℃	-	2.50	-	
Diode forward voltage	V_F	V_{GE}=0V, I_F=50A T_{vj}=25℃	-	2.0	-	
		T_{vj}=150℃	-	1.8	-	
		T_{vj}=175℃	-	1.7	-	
G-E threshold voltage	$V_{GE(th)}$	I_C=1.7mA, V_{CE}=V_{GE}	5.2	5.8	6.4	
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	-	-	100	nA

Dynamic Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input capacitance	C_{ies}	V_{CE}=25V, V_{GE}=0V, f=1MHz	-	6050	-	pF
Output capacitance	C_{oes}		-	145	-	
Reverse transfer capacitance	C_{res}		-	135	-	
Gate charge	Q_G	V_{CC}=960V, I_C=50A, V_{GE}=15V	-	516	-	nC

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=50A, V_{GE}=0/15V, R_G=10Ω, Inductive load	-	96	-	ns
Rise time	t_r		-	121	-	
Turn-off delay time	$t_{d(off)}$		-	575	-	
Fall time	t_f		-	39	-	
Turn-on energy	E_{on}		-	5.50	-	mJ
Turn-off energy	E_{off}		-	3.21	-	
Total switching energy	E_{ts}		-	8.71	-	
Turn-on delay time	$t_{d(on)}$	T_{vj}=175℃, V_{CC}=600V, I_C=50A, V_{GE}=0/15V, R_G=10Ω, Inductive load	-	90	-	ns
Rise time	t_r		-	135	-	
Turn-off delay time	$t_{d(off)}$		-	655	-	
Fall time	t_f		-	82	-	
Turn-on energy	E_{on}		-	5.90	-	mJ
Turn-off energy	E_{off}		-	4.23	-	
Total switching energy	E_{ts}		-	10.13	-	

Diode Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Diode reverse recovery time	t_{rr}	T_{vj}=25℃, V_R=600V, I_F=50A, di_F/dt=400A/μs	-	233	-	ns
Diode reverse recovery charge	Q_{rr}		-	2.76	-	μC
Diode peak reverse recovery current	I_{rrm}		-	18.8	-	A
Diode reverse recovery time	t_{rr}	T_{vj}=175℃, V_R=600V, I_F=50A, di_F/dt=400A/μs	-	465	-	ns
Diode reverse recovery charge	Q_{rr}		-	9.82	-	μC
Diode peak reverse recovery current	I_{rrm}		-	44.0	-	A

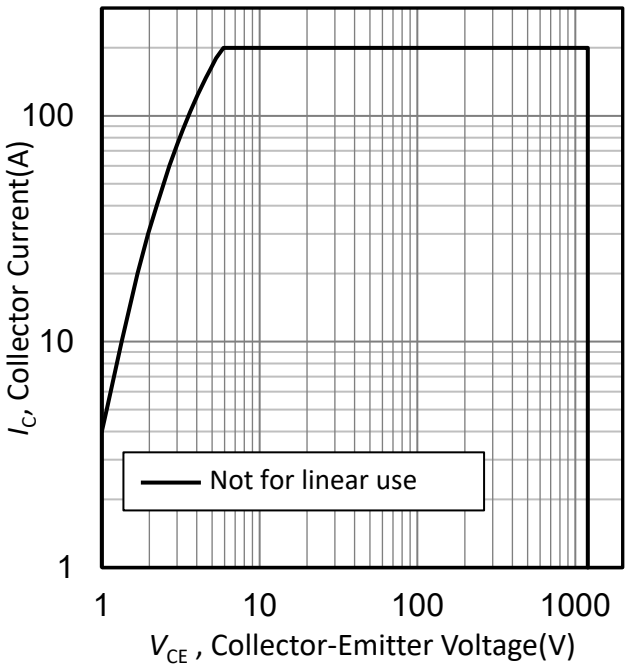


Figure 1. Forward bias safe operating area
(D=0, T_C=25 ℃, T_{vj}≤175℃,V_{GE}=15V)

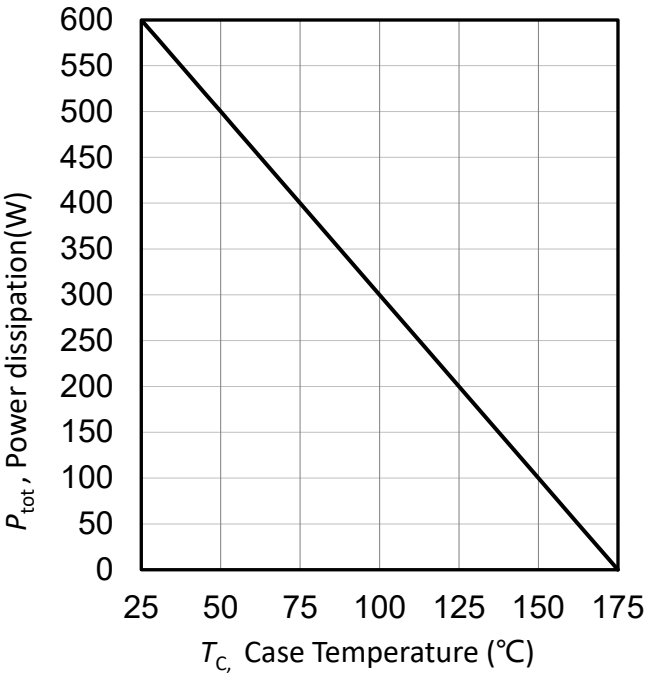


Figure 2. Power dissipation as a function of case temperature
(T_{vj}≤175℃)

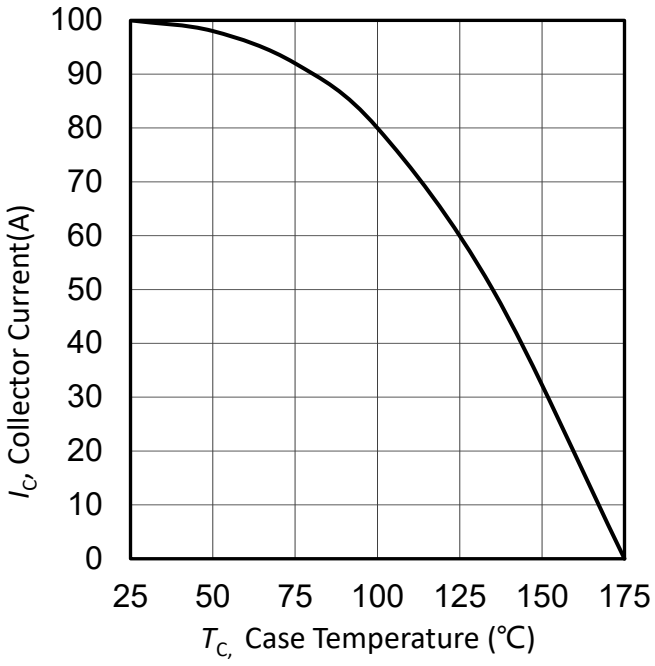


Figure 3. Collector current as a function of case temperature
(T_{vj}≤175℃ ,V_{GE}≥15V)

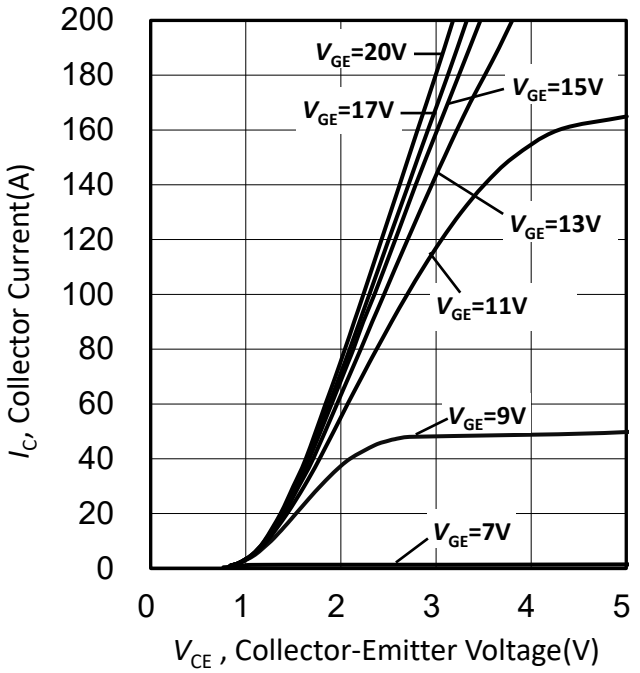


Figure 4. Typical output characteristic
(T_{vj}=25℃)

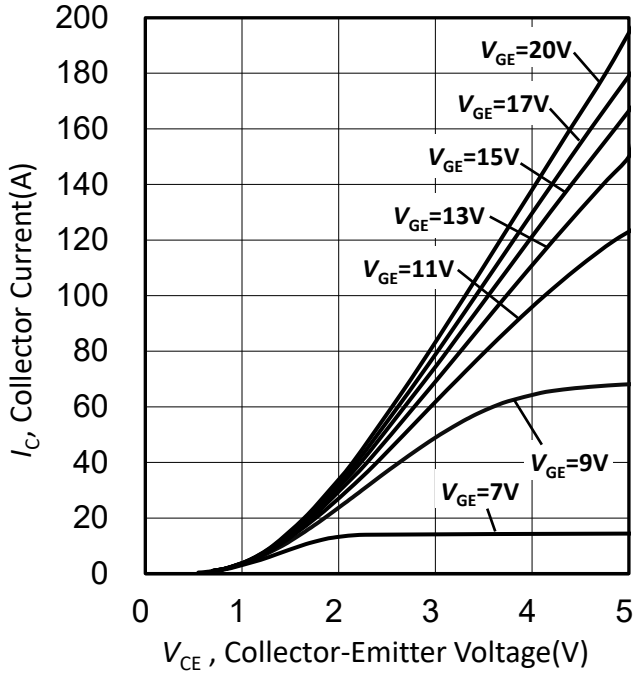


Figure 5. Typical output characteristic
(T_{vj}=175℃)

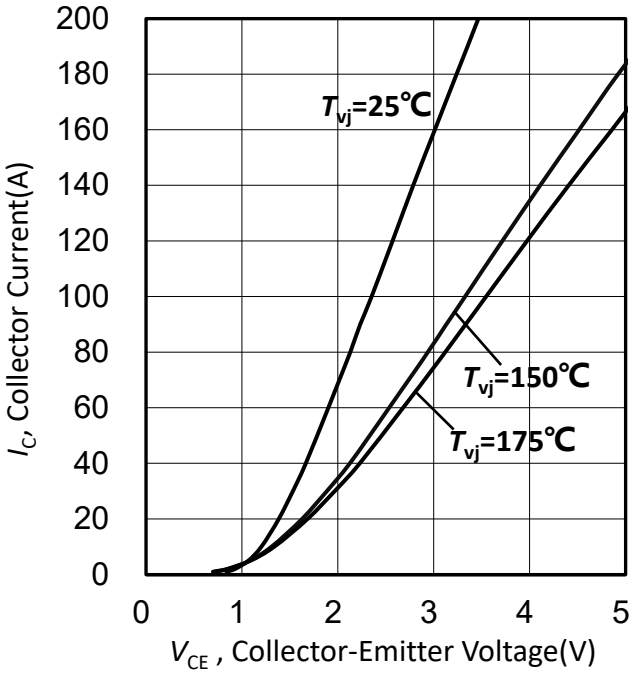


Figure 6. Collector-emitter saturation voltage characteristic
(V_{GE}=15V)

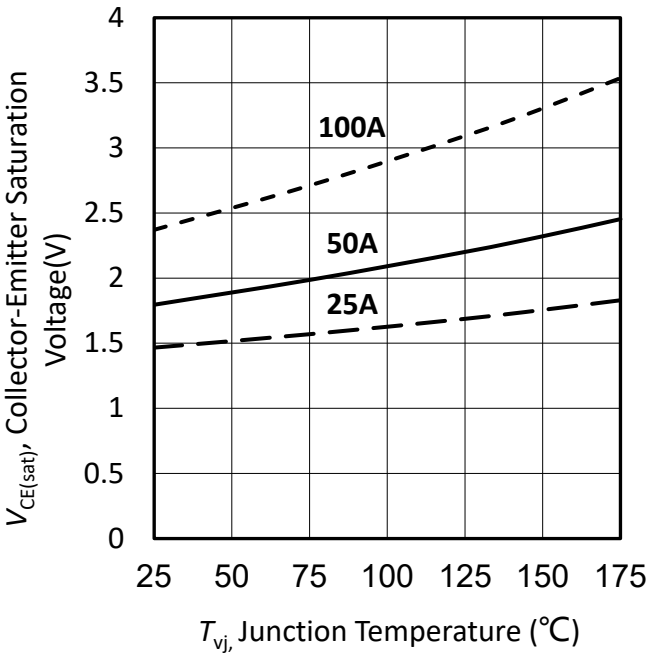


Figure 7. Typical collector-emitter saturation voltage as a function of junction temperature
(V_{GE}=15V)

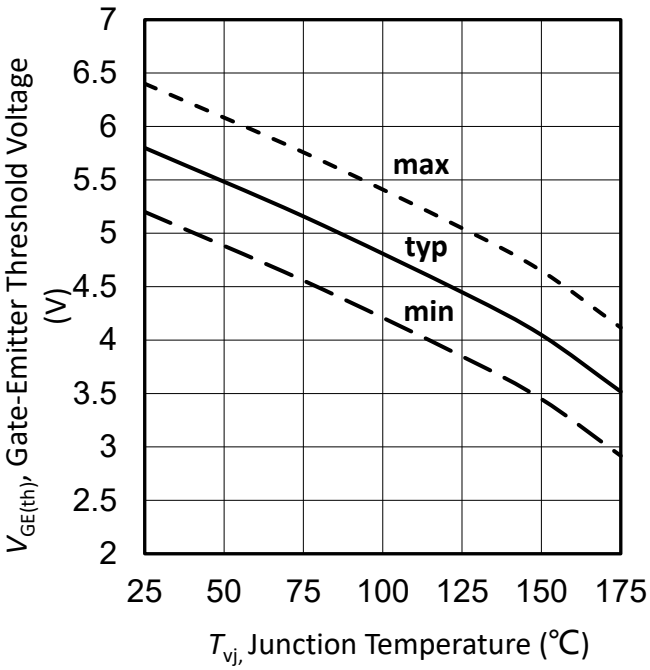


Figure 8. Gate-emitter threshold voltage as a function of junction temperature
(I_C=1.7mA)

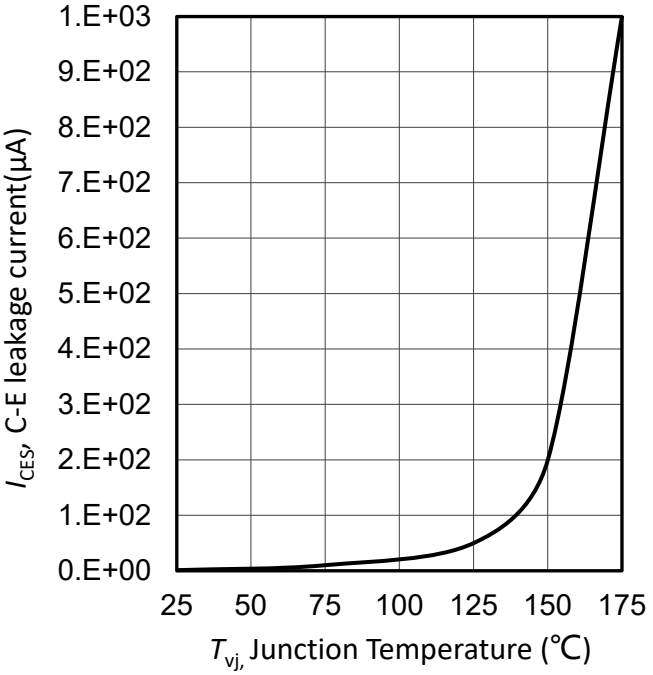


Figure 9. Typical C-E leakage current as a function of junction temperature
(V_{CE}=1200V, V_{GE}=0V)

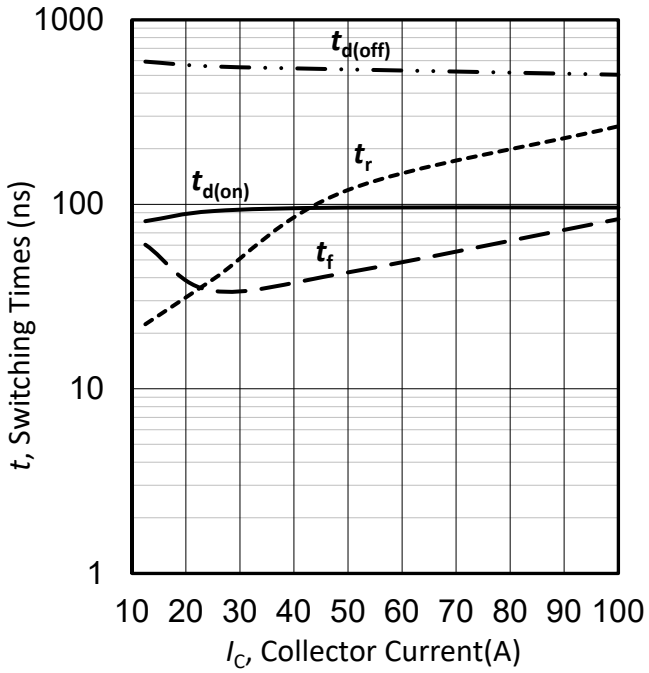


Figure 10. Typical switching times as a function of collector current
(inductive load, T_{vj}=25℃, V_{CE}=600V, V_{GE}=0/15V, R_G=10Ω)

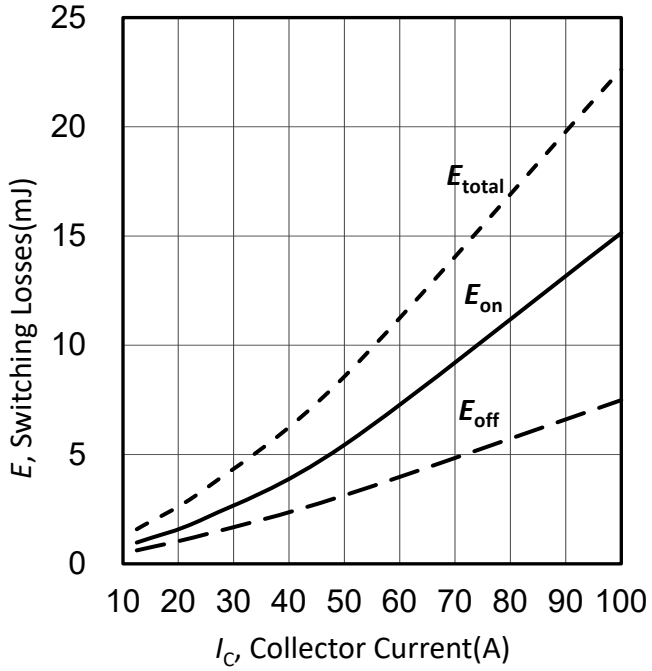


Figure 11. Typical switching energy losses as a function of collector current
(inductive load, T_{vj}=25℃, V_{CE}=600V, V_{GE}=0/15V, R_G=10Ω)

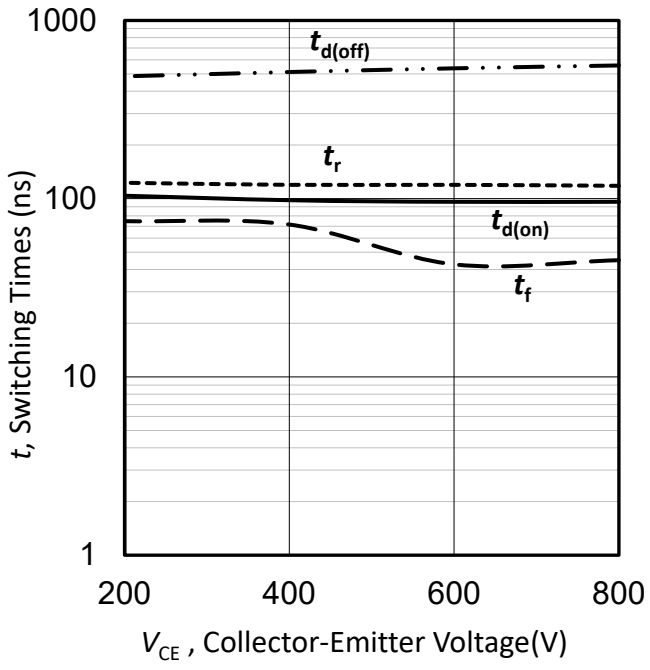


Figure 12. Typical switching times as a function of collector emitter voltage
(inductive load, T_{vj}=25℃, I_C=50A, V_{GE}=0/15V, R_G=10Ω)

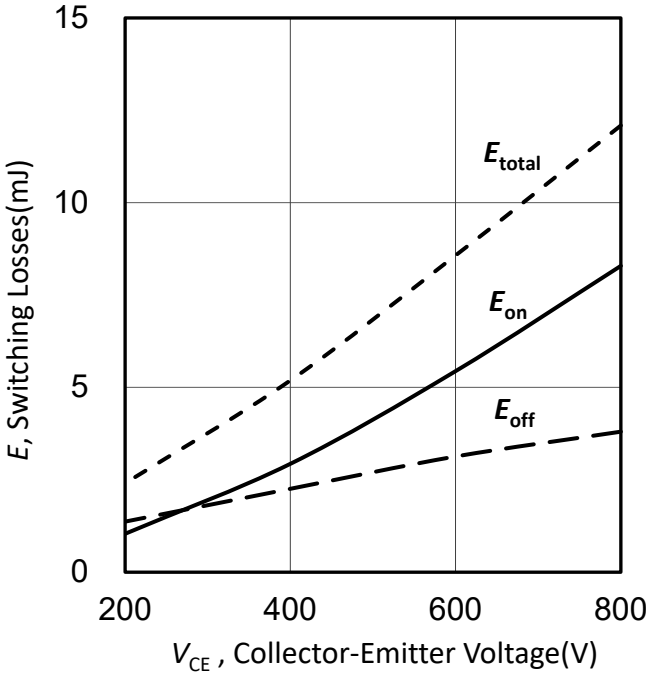


Figure 13. Typical switching energy losses as a function of collector emitter voltage
(inductive load, T_{vj}=25℃,
I_C=50A, V_{GE}=0/15V, R_G=10Ω)

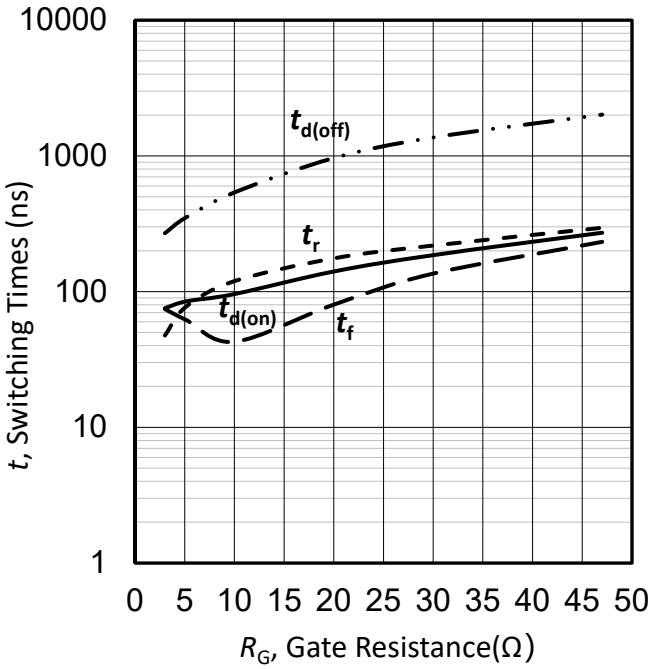


Figure 14. Typical switching times as a function of gate resistor
(inductive load, T_{vj}=25℃,
V_{CE}=600V, V_{GE}=0/15V, I_C=50A)

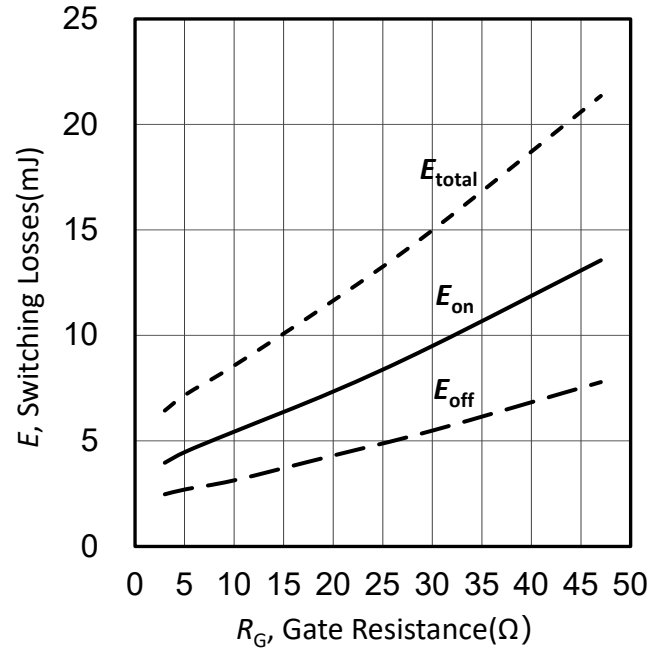


Figure 15. Typical switching energy losses as a function of gate resistor
(inductive load, T_{vj}=25℃,
V_{CE}=600V, V_{GE}=0/15V, I_C=50A)

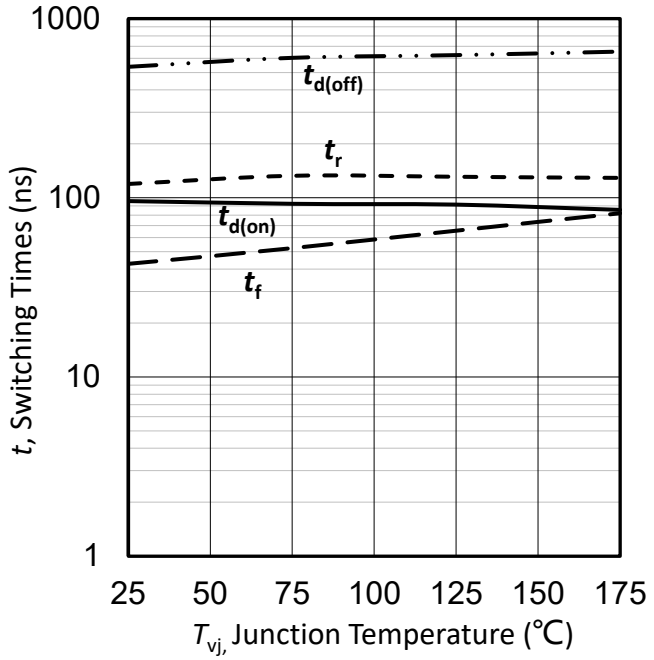


Figure 16. Typical switching times as a function of junction temperature
(inductive load, V_{CE}=600V, V_{GE}=0/15V,
I_C=50A, , R_G=10Ω)

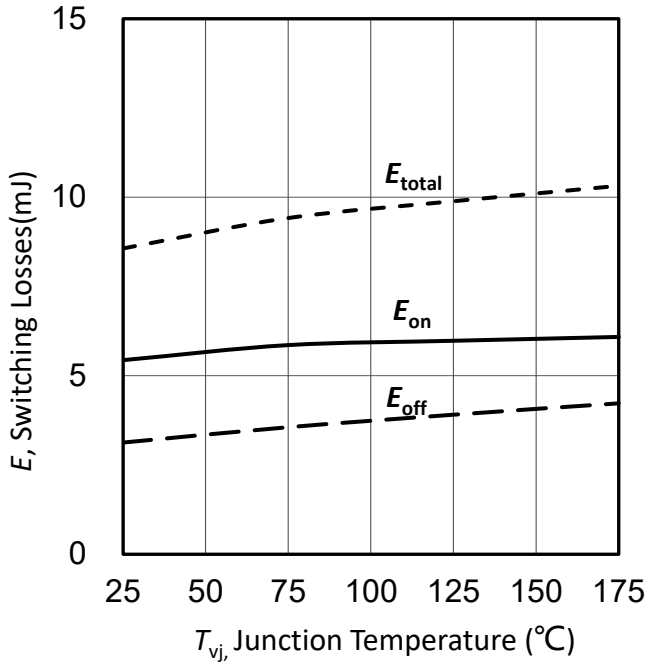


Figure 17. Typical switching energy losses as a function of junction temperature
(inductive load, V_{CE}=600V, V_{GE}=0/15V, I_C=50A, , R_G=10Ω)

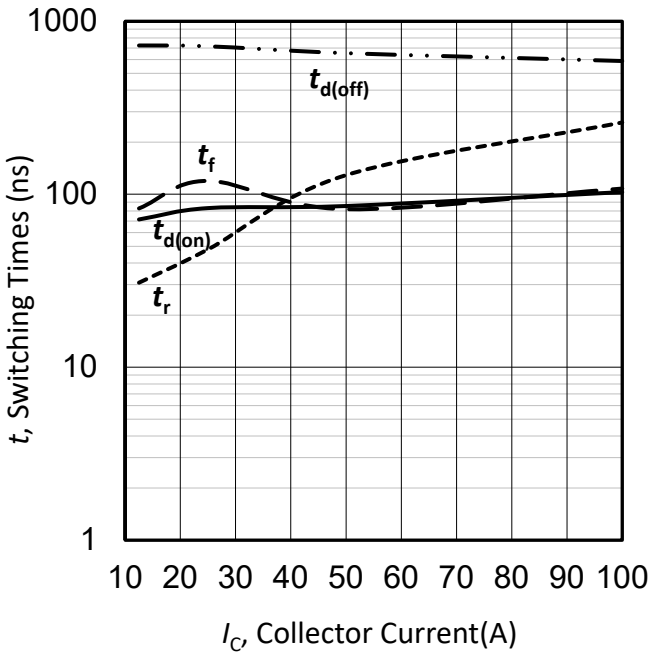


Figure 18. Typical switching times as a function of collector current
(inductive load, T_{vj}=175℃, V_{CE}=600V, V_{GE}=0/15V, R_G=10Ω)

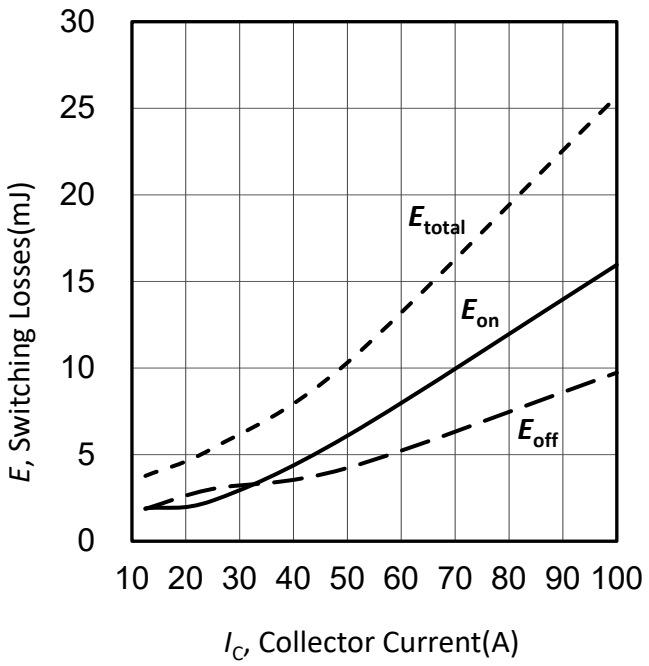


Figure 19. Typical switching energy losses as a function of collector current
(inductive load, T_{vj}=175℃, V_{CE}=600V, V_{GE}=0/15V, R_G=10Ω)

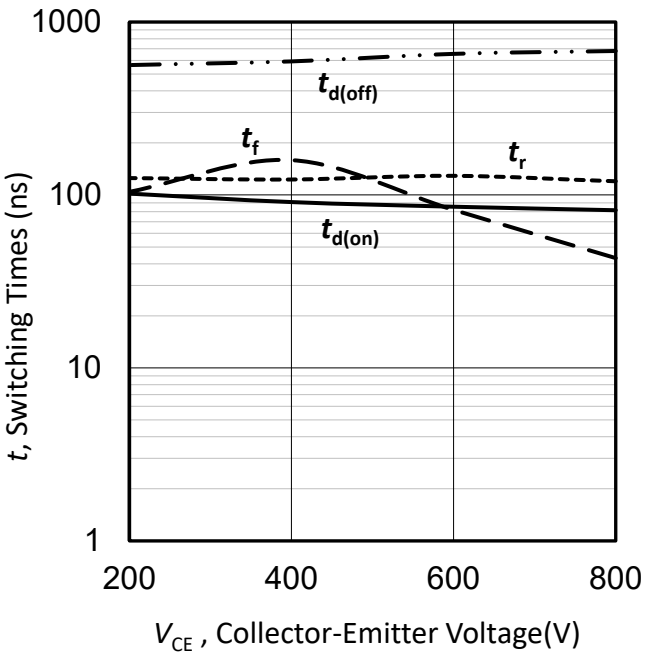


Figure 20. Typical switching times as a function of collector emitter voltage
(inductive load, T_{vj}=175℃, I_C=50A, V_{GE}=0/15V, R_G=10Ω)

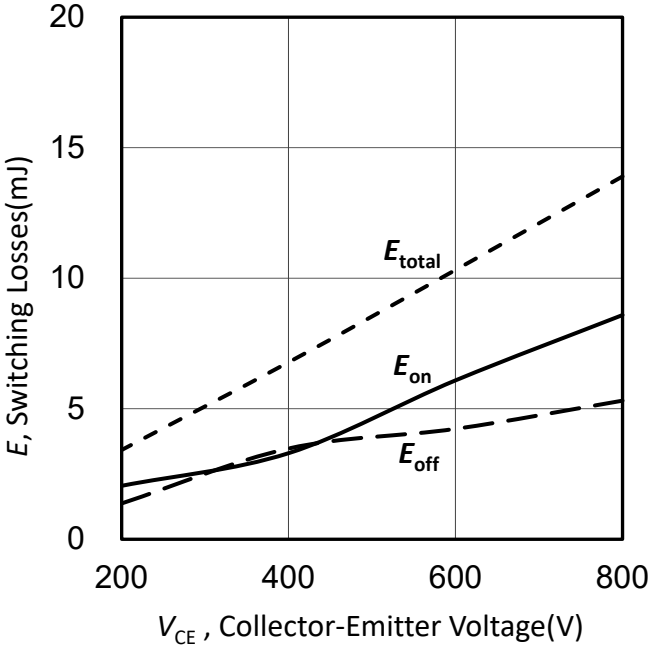


Figure 21. Typical switching energy losses as a function of collector emitter voltage
(inductive load, T_{vj}=175℃, I_C=50A, V_{GE}=0/15V, R_G=10Ω)

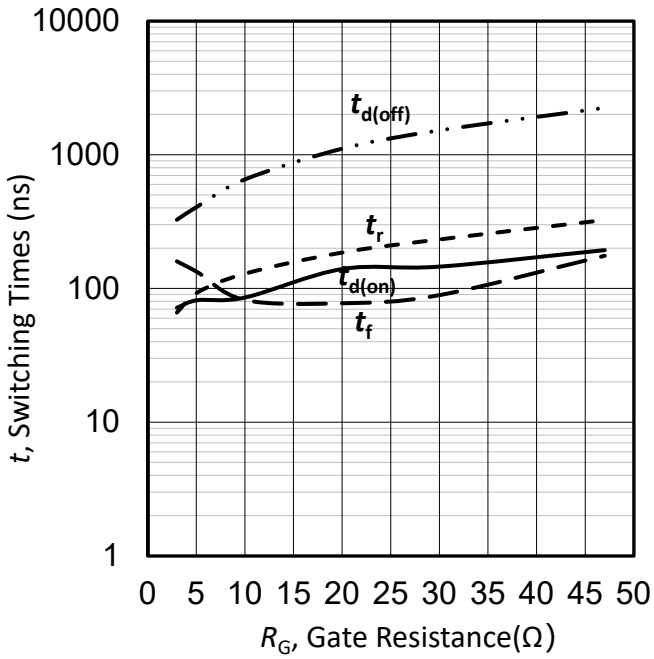


Figure 22. Typical switching times as a function of gate resistor
(inductive load, T_{vj}=175℃, V_{CE}=600V, V_{GE}=0/15V, I_C=50A)

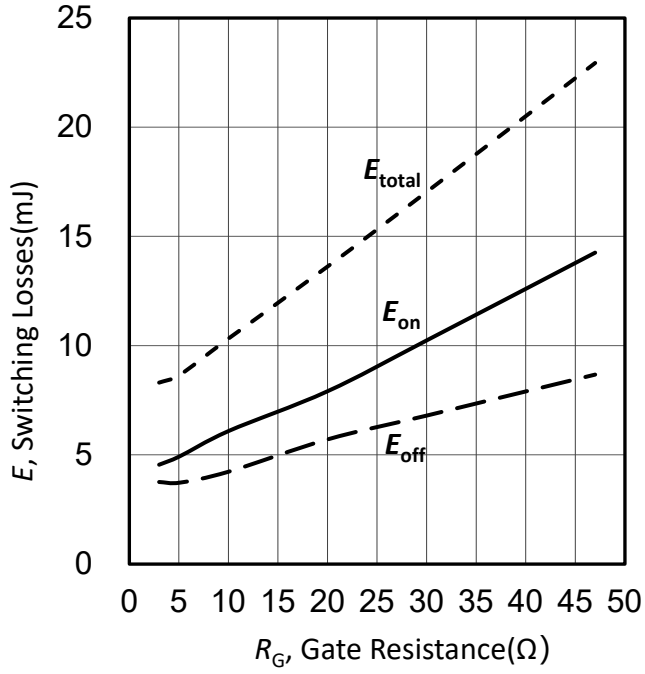


Figure 23. Typical switching energy losses as a function of gate resistor
(inductive load, T_{vj}=175℃, V_{CE}=600V, V_{GE}=0/15V, I_C=50A)

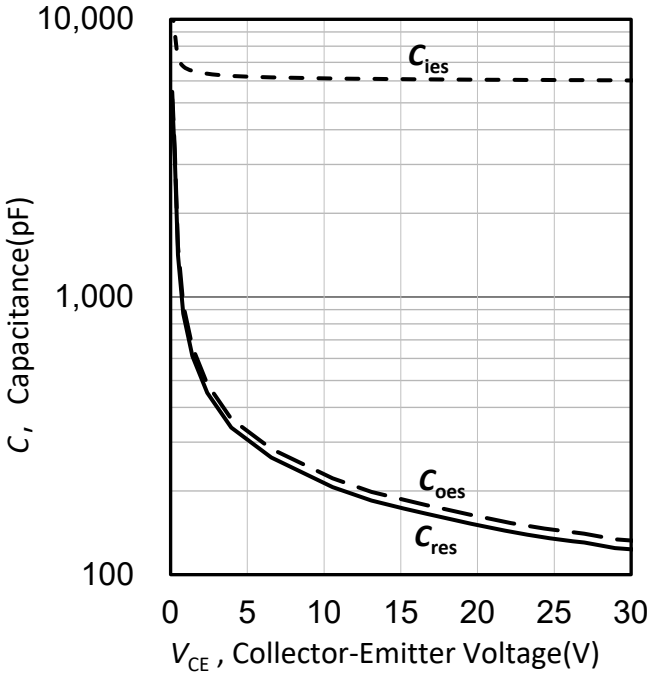


Figure 24. Typical capacitance as a function of collector-emitter voltage

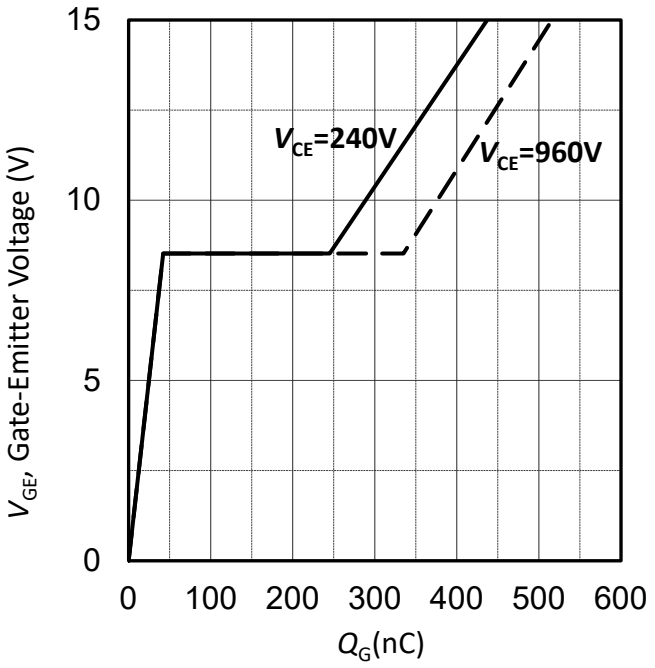


Figure 25. Typical gate charge
(I_C=50A)

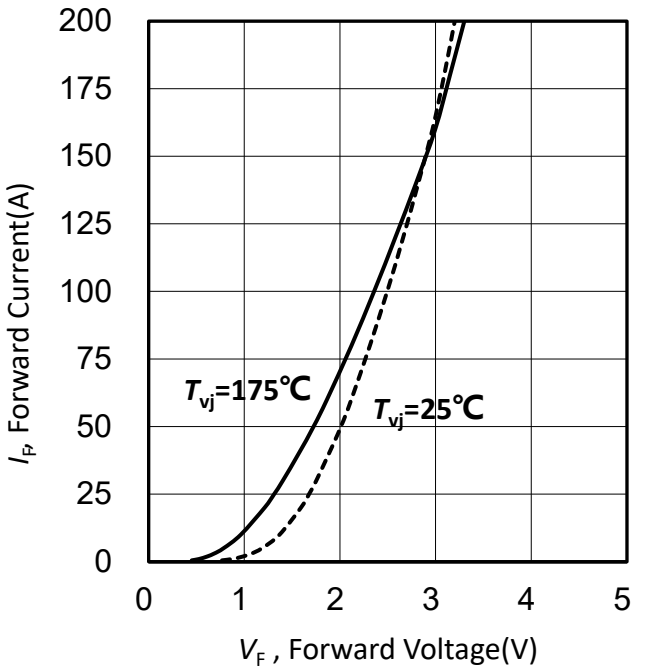


Figure 26. Typical diode forward current as a function of forward voltage

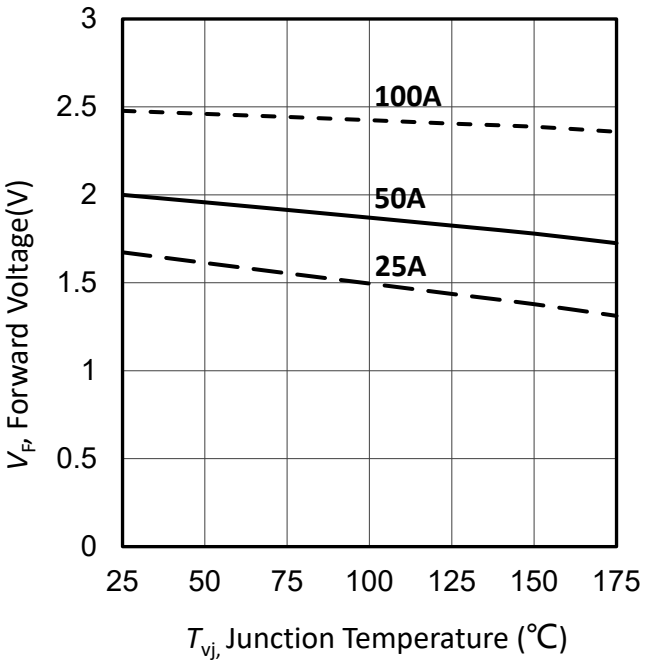


Figure 27. Typical diode forward voltage as a function of junction temperature

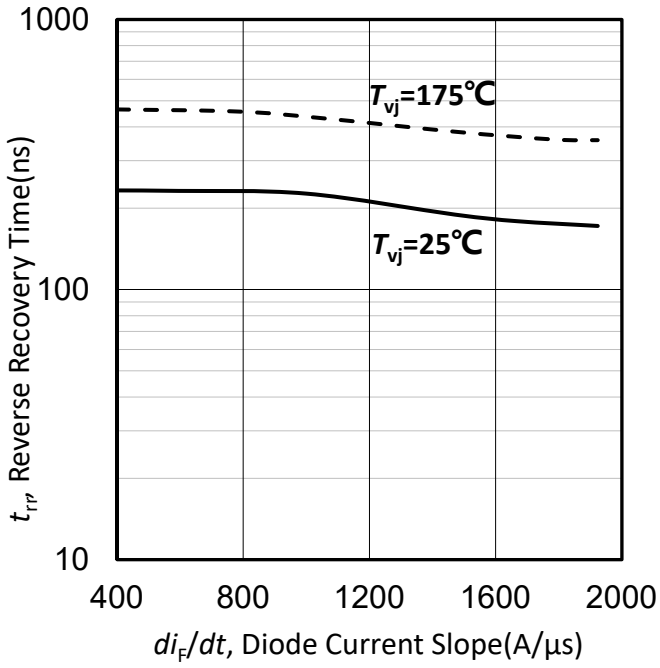


Figure 28. Typical reverse recovery time as a function of diode current slope
(V_R=600V)

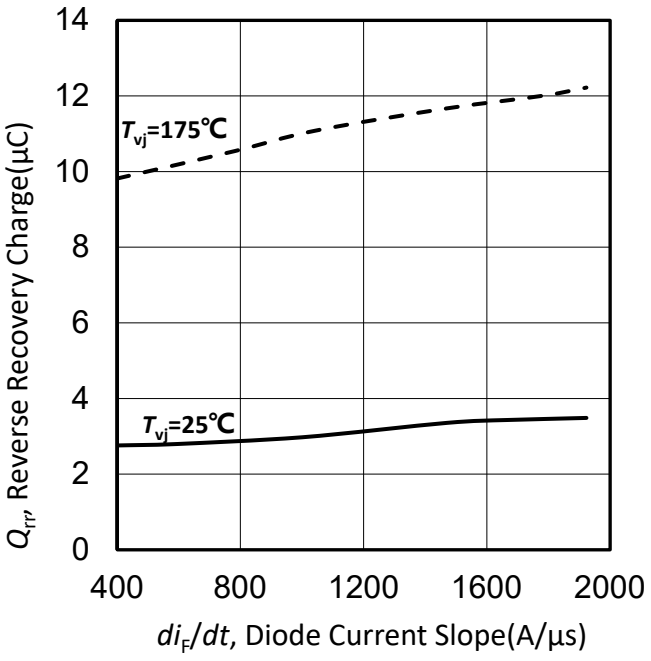


Figure 29. Typical reverse recovery charge as a function of diode current slope
(V_R=600V)

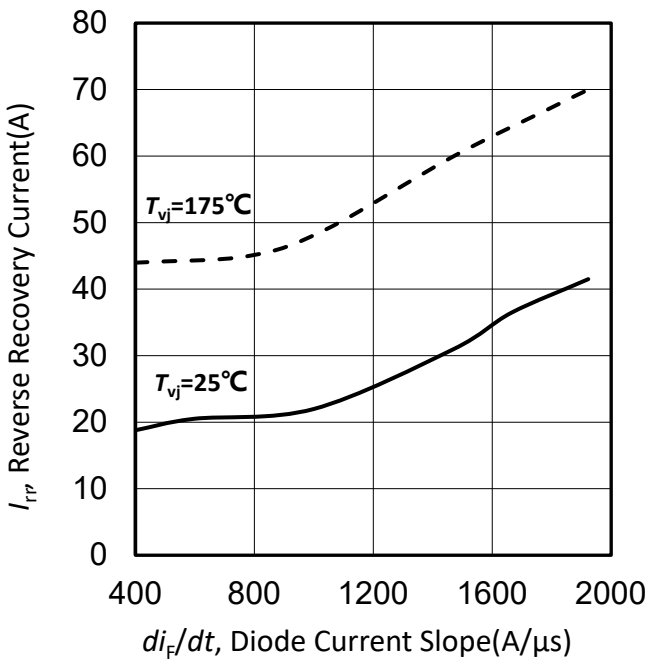


Figure 30. Typical reverse recovery current as a function of diode current slope
(V_R=600V)

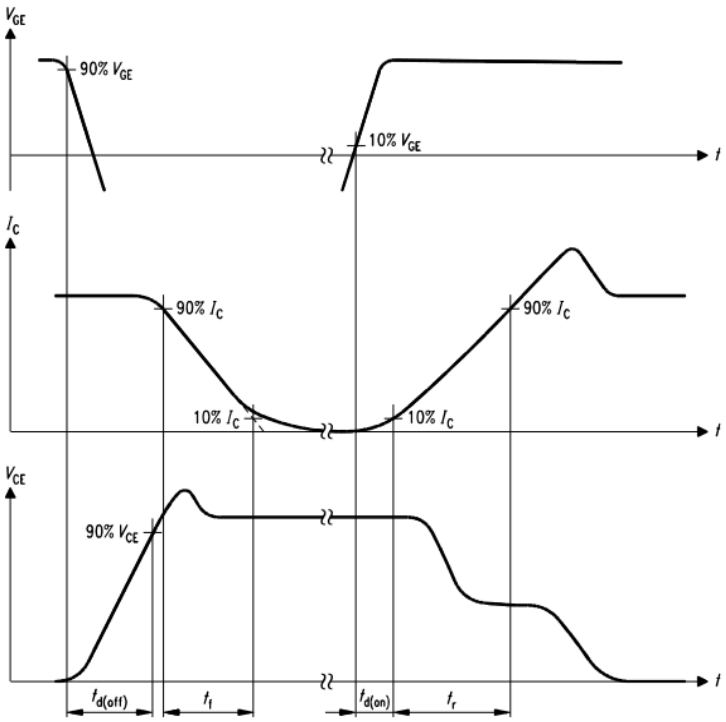


Figure A. Definition of switching times

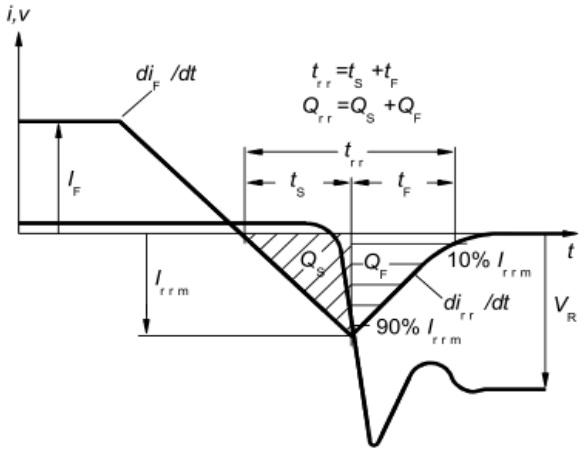


Figure C. Definition of diodes switching characteristics

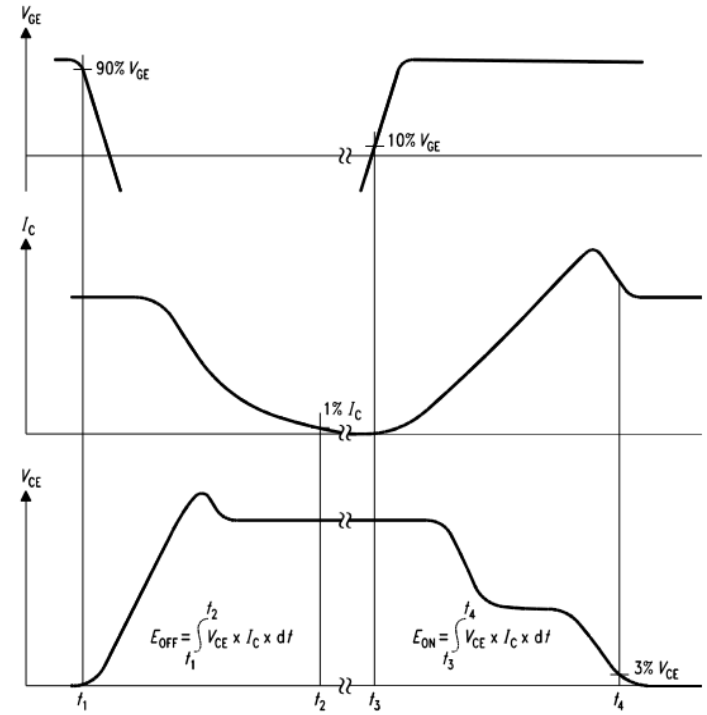


Figure B. Definition of switching losses

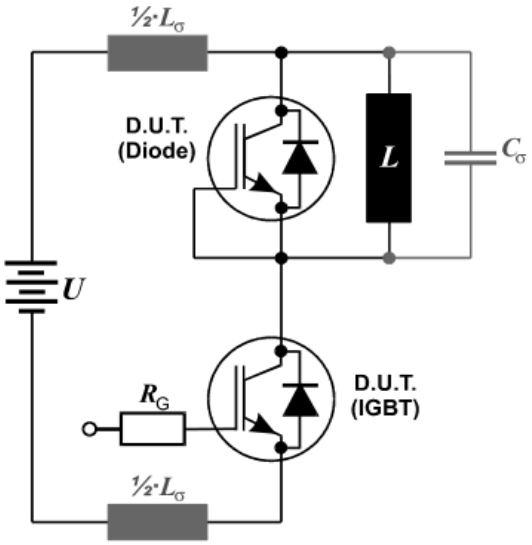
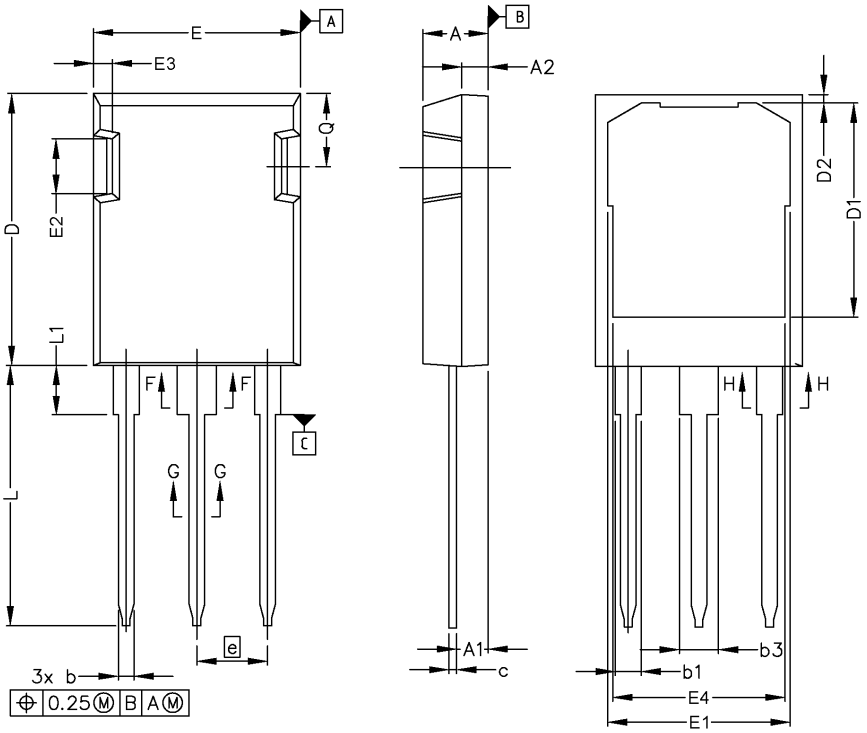


Figure D. Switching test circuit

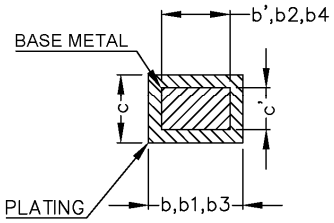
TO-247-3L Plus



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	2021.9

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