

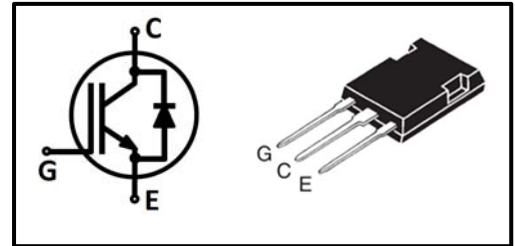
Features

- 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

Type	Marking	Package Code
MPBQ75N120BF	MP75N120BF	TO-247-3L Plus

Applications

- Frequency converter
- UPS
- Solar Inverter
- Welding



Maximum Rated Values

Parameter	Symbol	Value	Unit
Collector-emitter voltage	V_{CE}	1200	V
DC collector current, limited by T_{jmax} $T_C=25^\circ C$ $T_C=134.5^\circ C$	I_C	150 75	A
Pulsed collector current, t_p limited by $T_{jmax}^{1)}$	I_{Cpuls}	300	
Diode forward current, limited by T_{jmax} $T_C=25^\circ C$ $T_C=100^\circ C$	I_F	150 75	
Diode pulsed current, t_p limited by $T_{jmax}^{1)}$	I_{Fpuls}	300	
Gate-emitter voltage	V_{GE}	± 20	V
Transient Gate-emitter voltage ($t_p \leq 10\mu s, D < 0.01$)		± 30	
Short circuit withstand time $V_{GE}=15V, V_{CC}=600V, T_j \leq 175^\circ C$ Allowed number of short circuits < 1000 Time between short circuits: $\geq 1.0s$	t_{SC}	10	μs
Power dissipation $T_C=25^\circ C$	P_{tot}	833	W
Power dissipation $T_C=100^\circ C$		416	
Operating junction temperature	T_j	-40~175	$^\circ C$
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}	-	-	0.18	K/W
Diode thermal resistance, junction-case	R_{thJCD}	-	-	0.30	
Thermal Resistance, junction-ambient	R_{thJA}	-	-	40	

Electrical Characteristics (at $T_j=25^{\circ}C$, 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	$V_{CE(sat)}$	$V_{GE}=15V, I_C=75A$ $T_j=25^{\circ}C$	-	1.90	2.30	
		$T_j=125^{\circ}C$	-	2.35	-	
		$T_j=150^{\circ}C$	-	2.45	-	
		$T_j=175^{\circ}C$	-	2.60	-	
G-E threshold voltage	$V_{GE(th)}$	$I_C=2.4mA, V_{CE}=V_{GE}$	5.0	5.8	6.5	
C-E leakage current	I_{CES}	$V_{CE}=1200V, V_{GE}=0V$ $T_j=25^{\circ}C$	-	-	0.1	mA
		$T_j=175^{\circ}C$	-	-	4.0	
G-E leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=20V$	-	-	250	nA
Transconductance	g_{fs}	$V_{CE}=20V, I_C=75A$	-	30	-	S

Dynamic Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Input capacitance	C_{ies}	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1MHz$	-	5235	-	pF
Output capacitance	C_{oes}		-	400	-	
Reverse transfer capacitance	C_{res}		-	192	-	
Gate charge	Q_G	$V_{CC}=600V, I_C=75A,$ $V_{GE}=15V$	-	622	-	nC
Short circuit collector current	$I_{C(SC)}$	$V_{GE}=15V,$ $V_{CC} \leq 600V,$ $t_{SC} \leq 10\mu s, T_j=175^{\circ}C$	-	300	-	A
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	$t_{d(on)}$	$T_j=25^{\circ}\text{C}$, $V_{CC}=600\text{V}$, $I_C=75\text{A}$, $V_{GE}=-15/15\text{V}$, $R_G=10\Omega$, Inductive load	-	212	-	ns	
Rise time	t_r		-	52	-		
Turn-off delay time	$t_{d(off)}$		-	247	-		
Fall time	t_f		-	104	-		
Turn-on energy	E_{on}		$T_j=175^{\circ}\text{C}$, $V_{CC}=600\text{V}$, $I_C=75\text{A}$, $V_{GE}=-15/15\text{V}$, $R_G=10\Omega$, Inductive load	-	4.6	-	mJ
Turn-off energy	E_{off}			-	4.4	-	
Total switching energy	E_{ts}			-	9.0	-	
Turn-on delay time	$t_{d(on)}$	$T_j=175^{\circ}\text{C}$, $V_{CC}=600\text{V}$, $I_C=75\text{A}$, $V_{GE}=-15/15\text{V}$, $R_G=10\Omega$, Inductive load	-	209	-	ns	
Rise time	t_r		-	55	-		
Turn-off delay time	$t_{d(off)}$		-	327	-		
Fall time	t_f		-	171	-		
Turn-on energy	E_{on}		$T_j=175^{\circ}\text{C}$, $V_{CC}=600\text{V}$, $I_C=75\text{A}$, $V_{GE}=-15/15\text{V}$, $R_G=10\Omega$, Inductive load	-	10.7	-	mJ
Turn-off energy	E_{off}			-	6.6	-	
Total switching energy	E_{ts}			-	17.3	-	

Diode Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Diode forward voltage	V_F	$V_{GE}=0\text{V}$, $I_F=75\text{A}$ $T_j=25^{\circ}\text{C}$	-	2.2	-	V
		$T_j=150^{\circ}\text{C}$	-	1.9	-	
		$T_j=175^{\circ}\text{C}$	-	1.8	-	
Diode reverse recovery time	t_{rr}	$T_j=25^{\circ}\text{C}$, $V_R=600\text{V}$, $I_F=75\text{A}$, $di_F/dt=500\text{A}/\mu\text{s}$	-	292	-	ns
Diode reverse recovery charge	Q_{rr}		-	3.7	-	μC
Diode peak reverse recovery current	I_{rrm}		-	24	-	A
Diode reverse recovery time	t_{rr}	$T_j=175^{\circ}\text{C}$, $V_R=600\text{V}$, $I_F=75\text{A}$, $di_F/dt=500\text{A}/\mu\text{s}$	-	638	-	ns
Diode reverse recovery charge	Q_{rr}		-	14.7	-	μC
Diode peak reverse recovery current	I_{rrm}		-	58	-	A

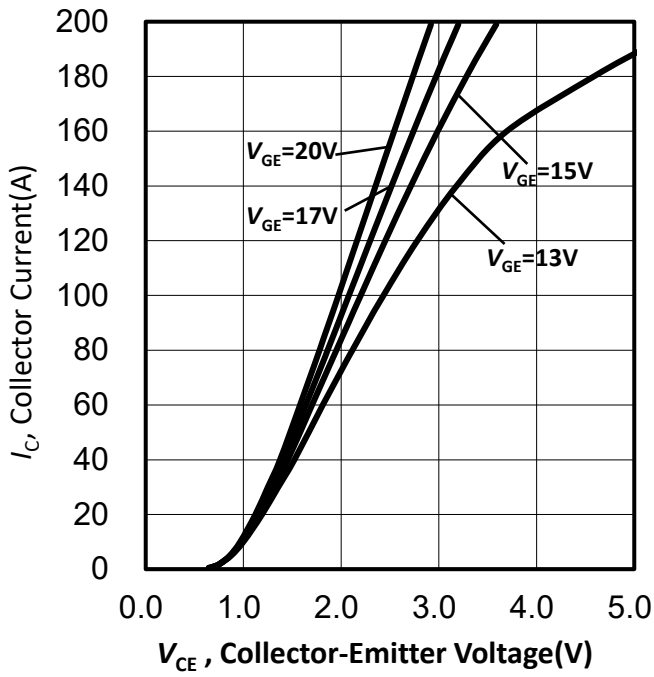


Figure 1. Typical output characteristic ($T_j=25^{\circ}\text{C}$)

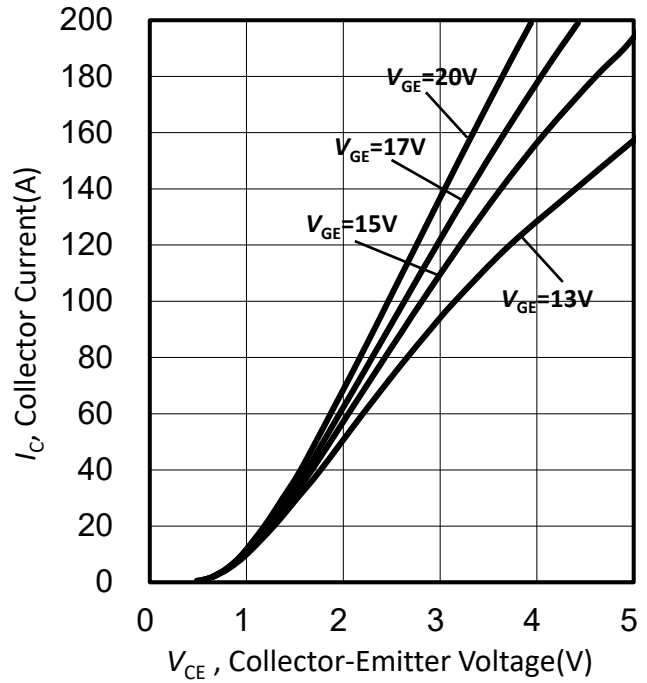


Figure 2. Typical output characteristic ($T_j=125^{\circ}\text{C}$)

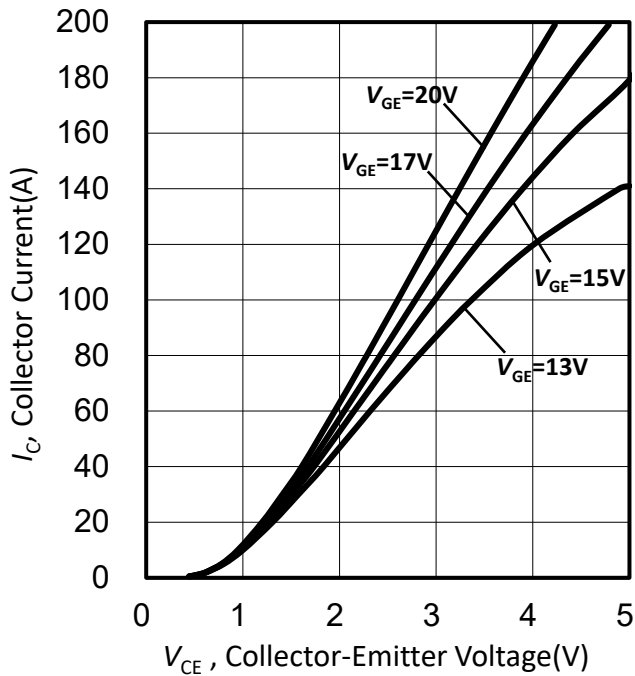


Figure 3. Typical output characteristic ($T_j=150^{\circ}\text{C}$)

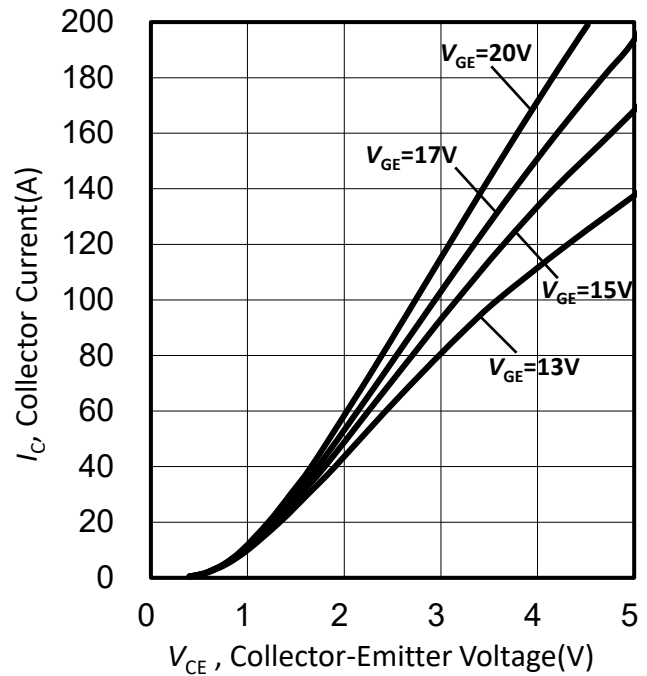


Figure 4. Typical output characteristic ($T_j=175^{\circ}\text{C}$)

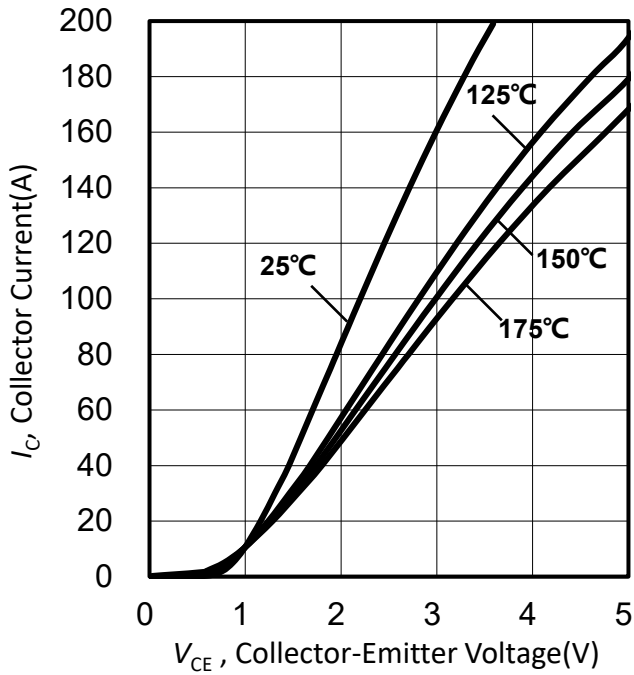


Figure 5. Typical $V_{CE(sat)}$ - I_c characteristic ($V_{GE}=15V$)

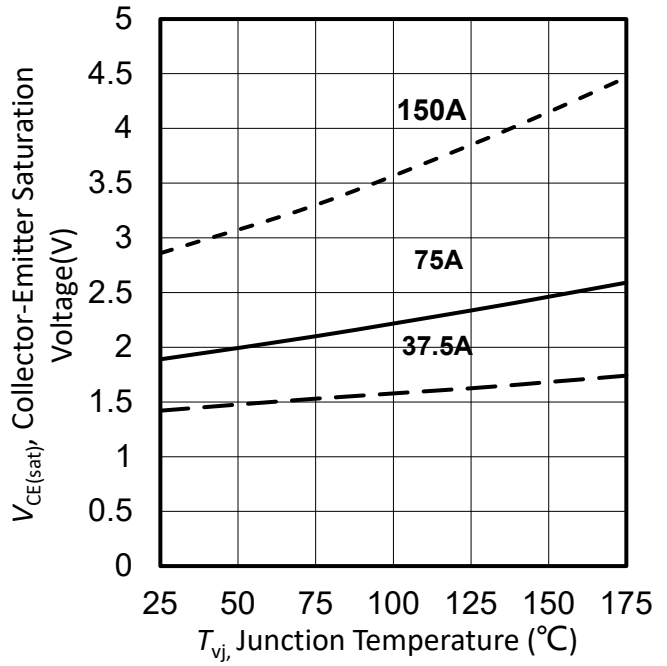


Figure 6. Typical $V_{CE(sat)}$ - T_j characteristic ($V_{GE}=15V$)

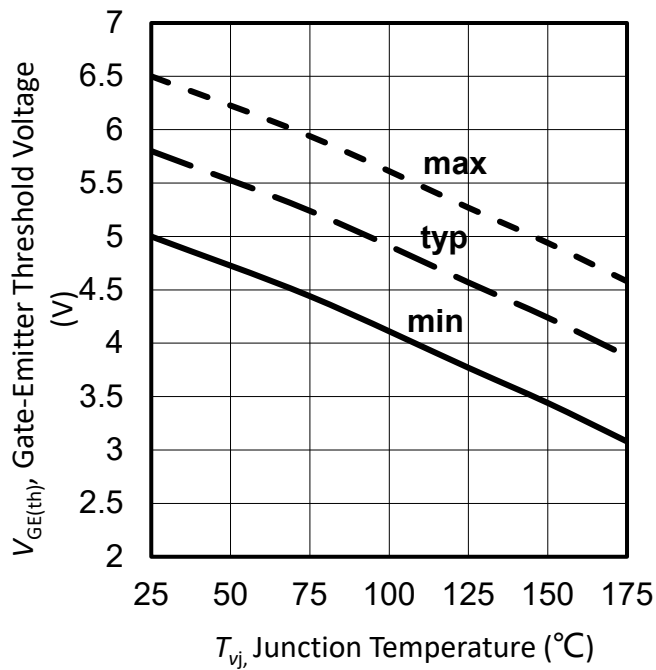


Figure 7. $V_{GE(th)}$ - T_j characteristic ($I_c=2.4mA$)

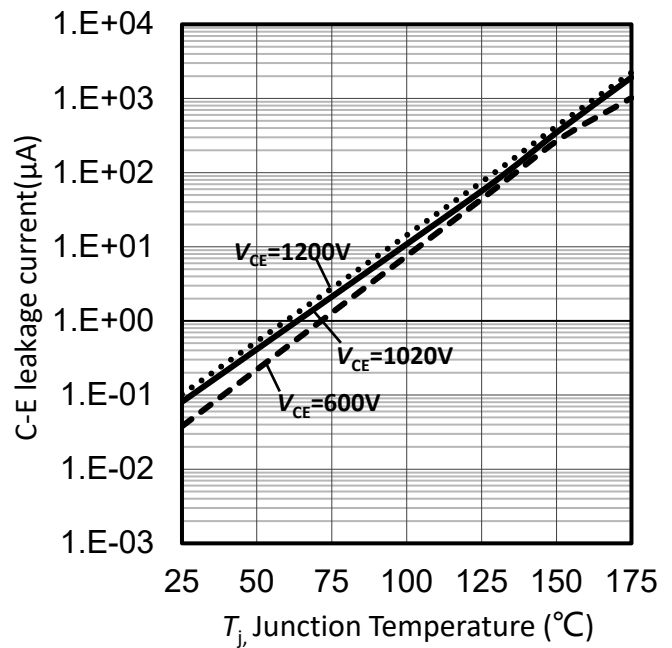


Figure 8. Typical I_{CES} - T_j characteristic ($V_{GE}=0V$)

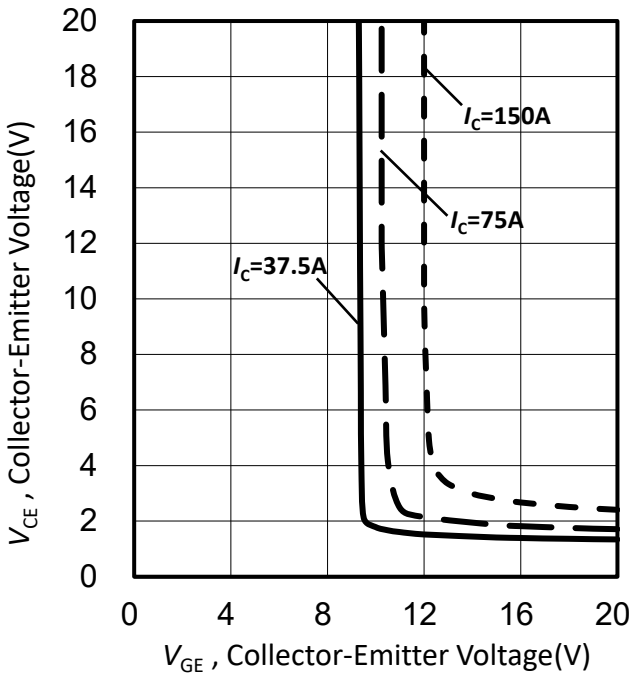


Figure 9. Typical $V_{CE(sat)}-V_{GE(th)}$ characteristic ($T_{vj}=25^{\circ}C$)

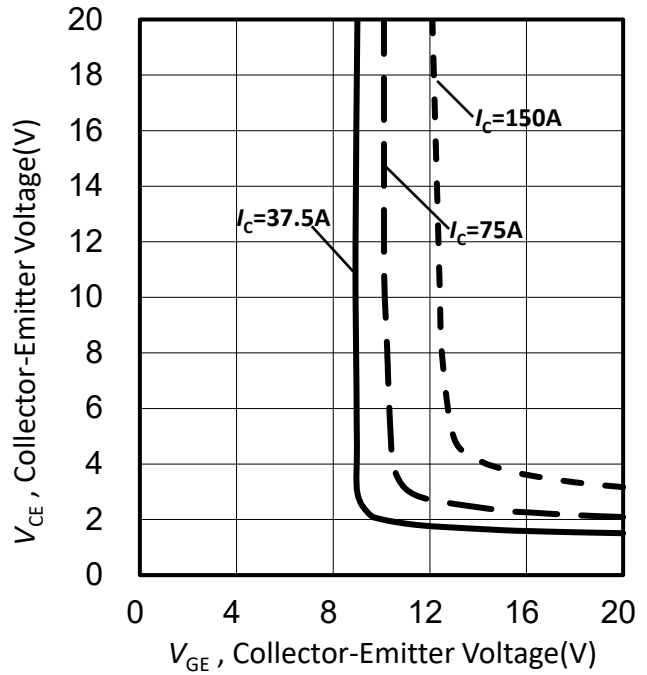


Figure 10. Typical $V_{CE(sat)}-V_{GE(th)}$ characteristic ($T_{vj}=125^{\circ}C$)

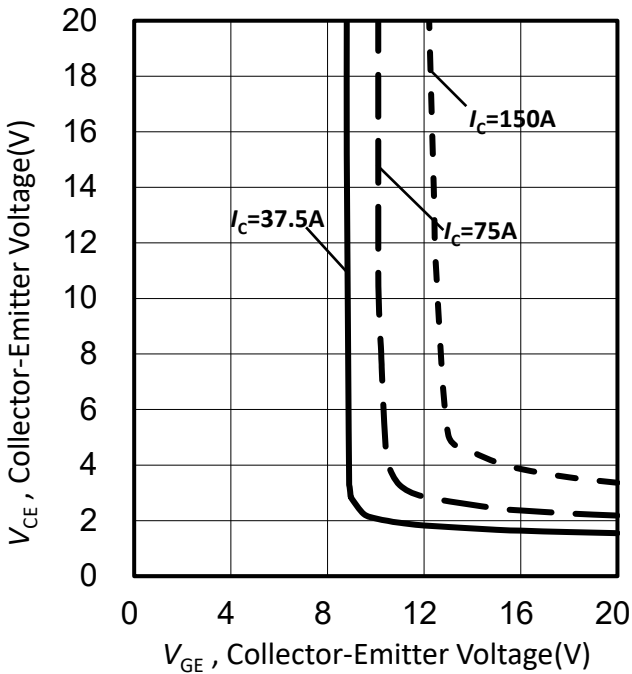


Figure 11. Typical $V_{CE(sat)}-V_{GE(th)}$ characteristic ($T_{vj}=150^{\circ}C$)

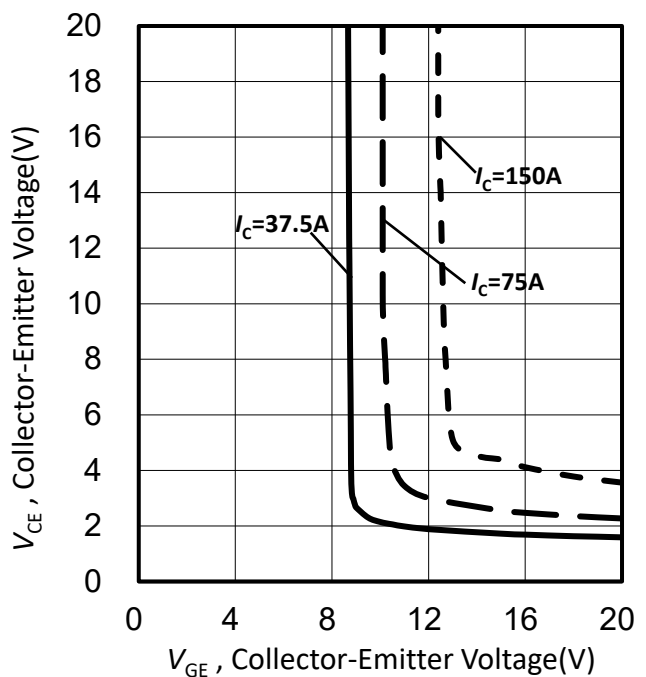


Figure 12. Typical $V_{CE(sat)}-V_{GE(th)}$ characteristic ($T_{vj}=175^{\circ}C$)

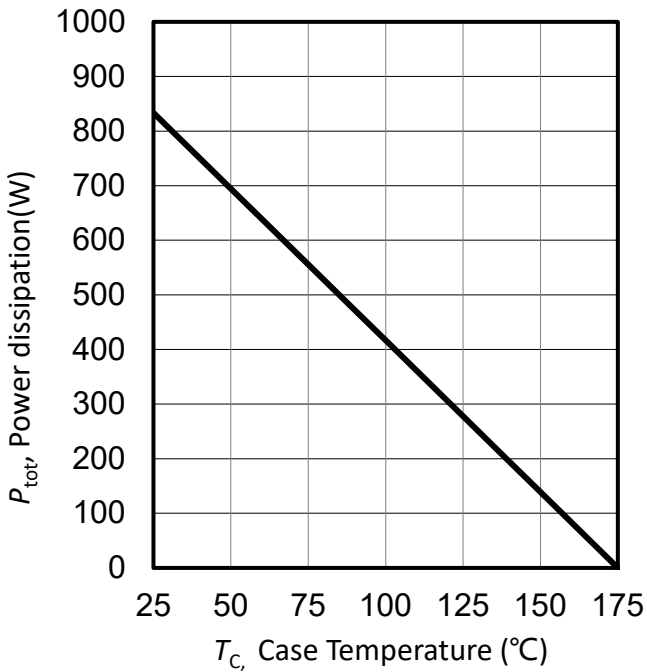


Figure 13. Power dissipation as a function of case temperature ($T_j \leq 175^\circ\text{C}$)

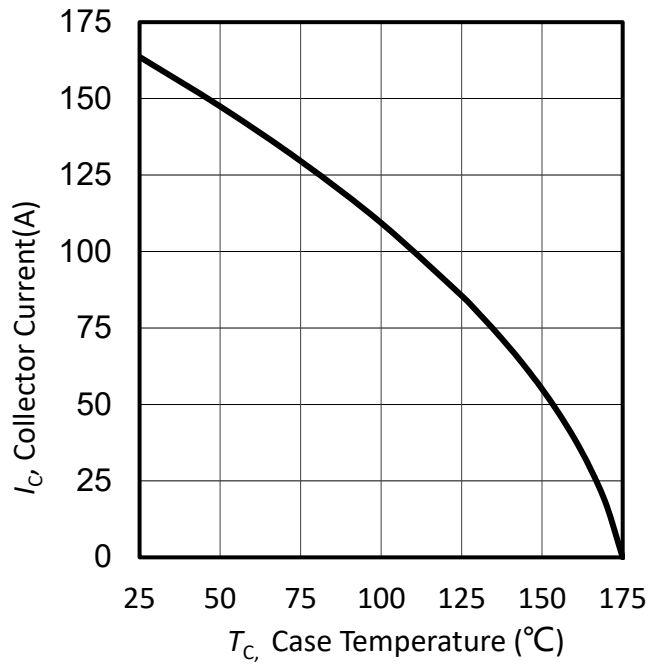


Figure 14. Collector current as a function of case temperature ($T_j \leq 175^\circ\text{C}, V_{GE} \geq 15\text{V}$)

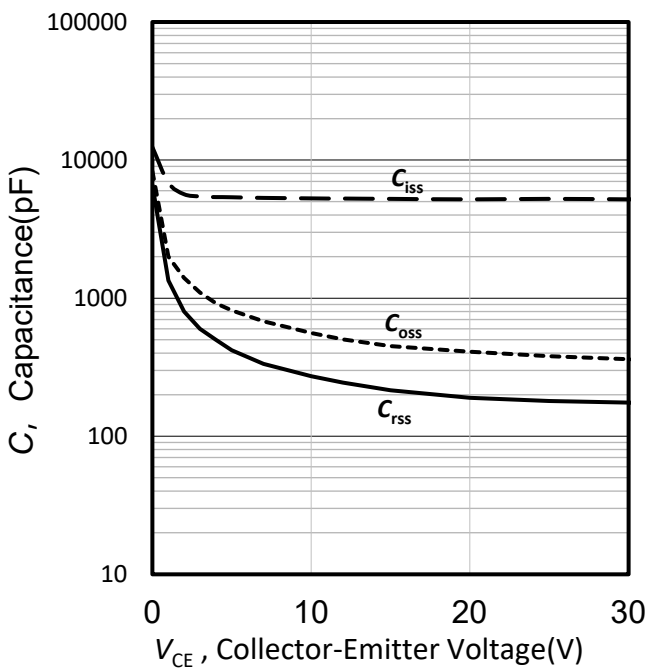


Figure 15. Typical capacitance as a function of collector-emitter voltage ($V_{GE}=0\text{V}, f=1\text{MHz}$)

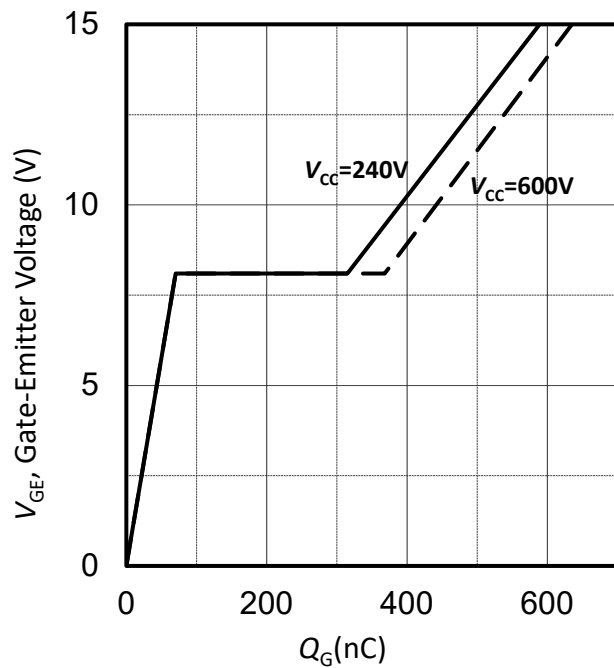


Figure 16. Typical gate charge

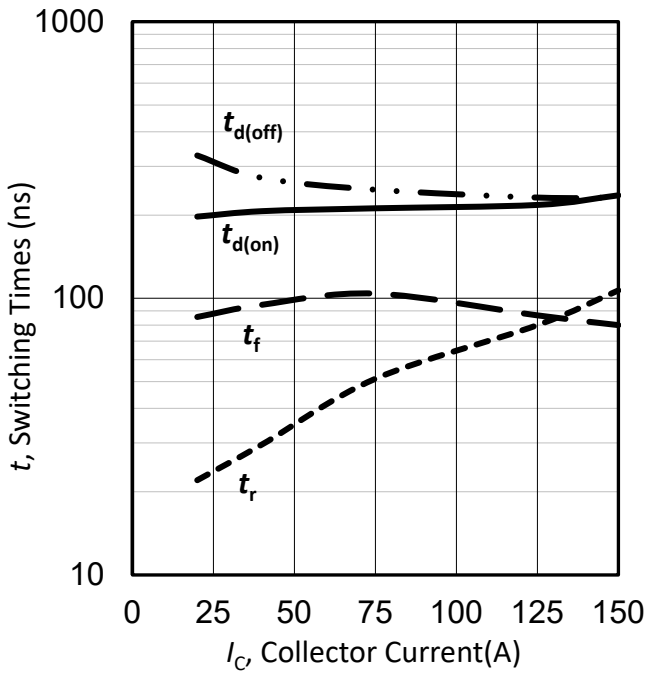


Figure 17. Typical switching times as a function of collector current
(inductive load, $T_{vj}=25^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $R_G=10\Omega$)

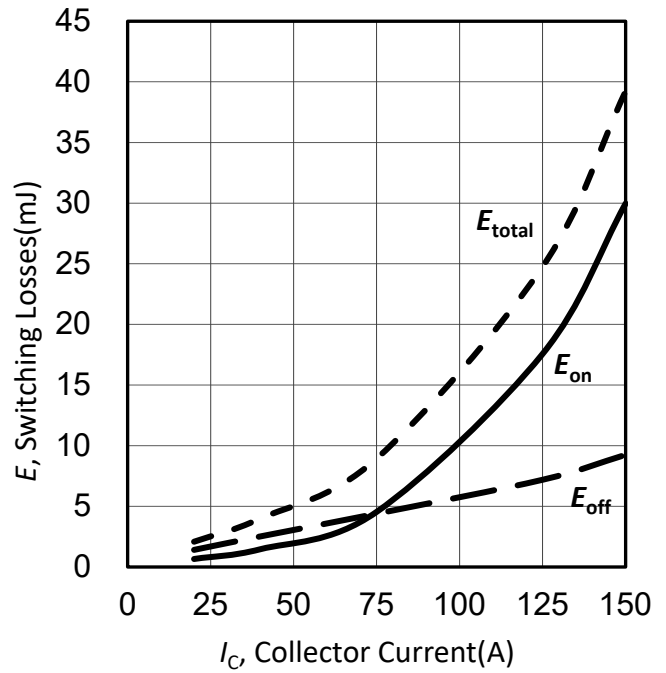


Figure 18. Typical switching losses as a function of collector current
(inductive load, $T_{vj}=25^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $R_G=10\Omega$)

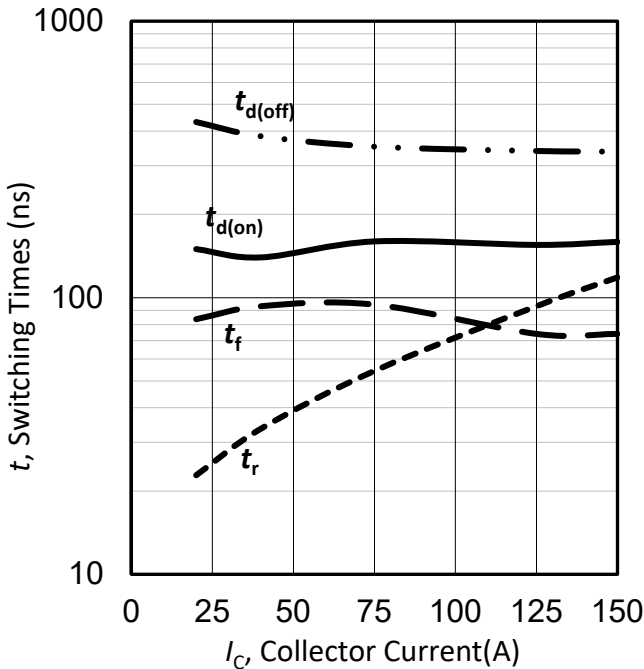


Figure 19. Typical switching times as a function of collector current
(inductive load, $T_{vj}=25^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $R_G=10\Omega$)

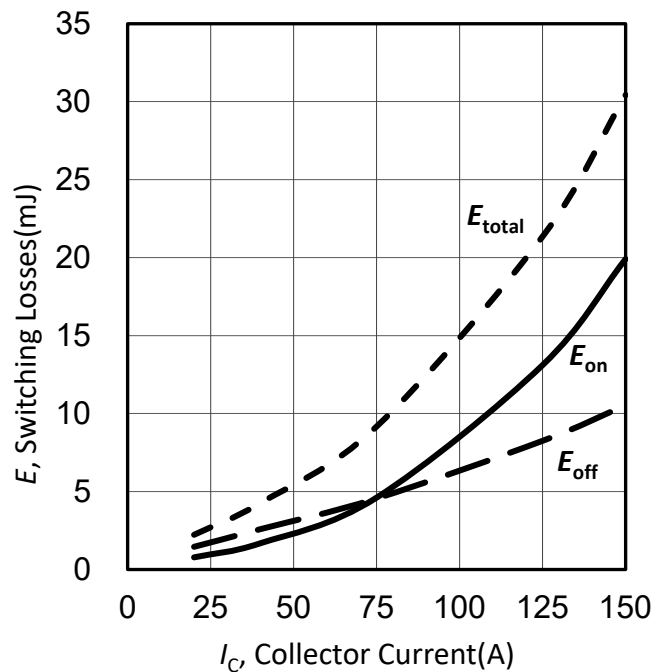


Figure 20. Typical switching losses as a function of collector current
(inductive load, $T_{vj}=25^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $R_G=10\Omega$)

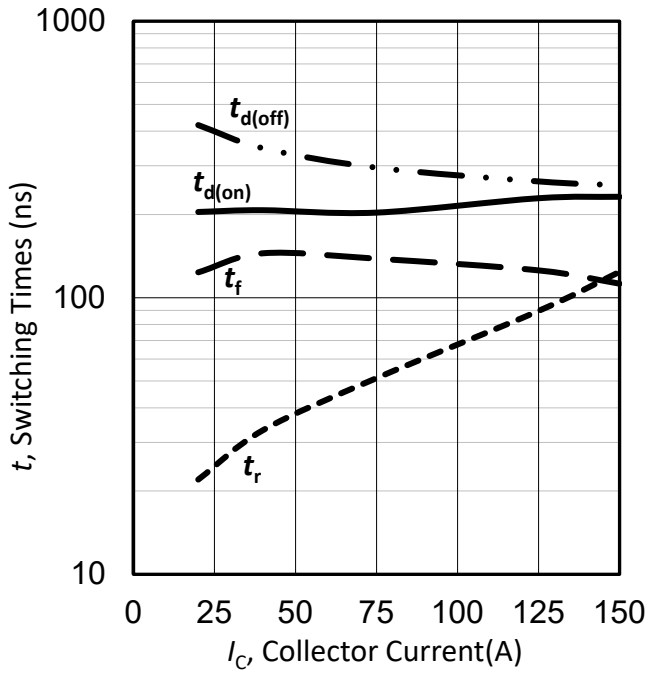


Figure 21. Typical switching times as a function of collector current
(inductive load, $T_{vj}=125^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $R_G=10\Omega$)

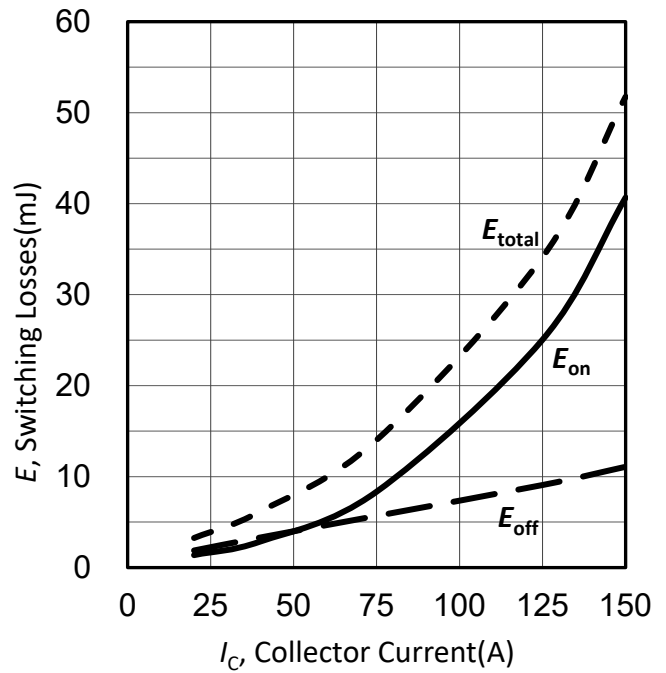


Figure 22. Typical switching losses as a function of collector current
(inductive load, $T_{vj}=125^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $R_G=10\Omega$)

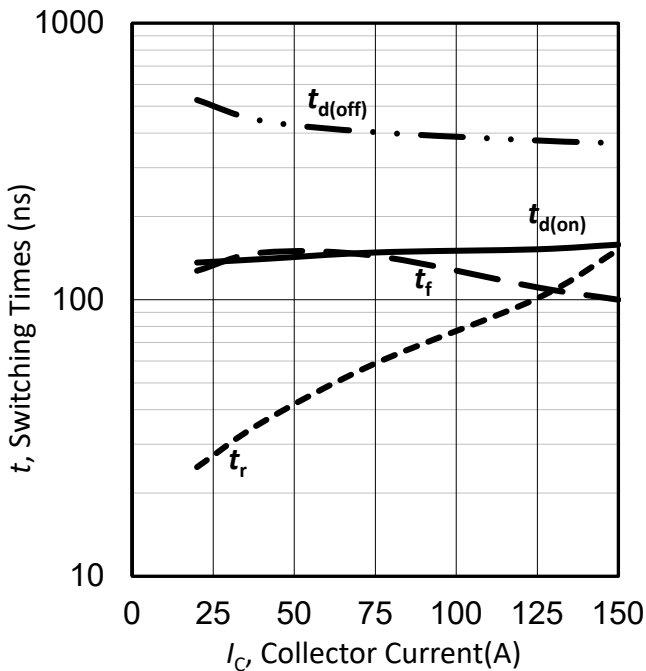


Figure 23. Typical switching times as a function of collector current
(inductive load, $T_{vj}=125^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $R_G=10\Omega$)

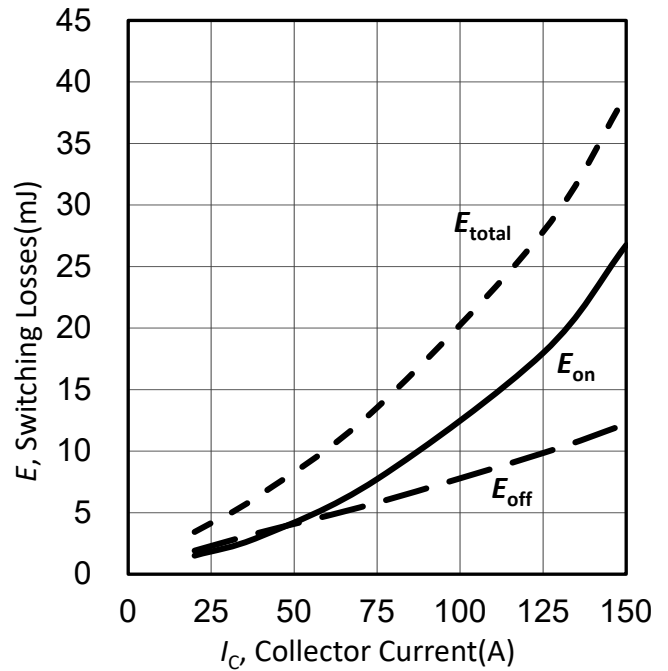


Figure 24. Typical switching losses as a function of collector current
(inductive load, $T_{vj}=125^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $R_G=10\Omega$)

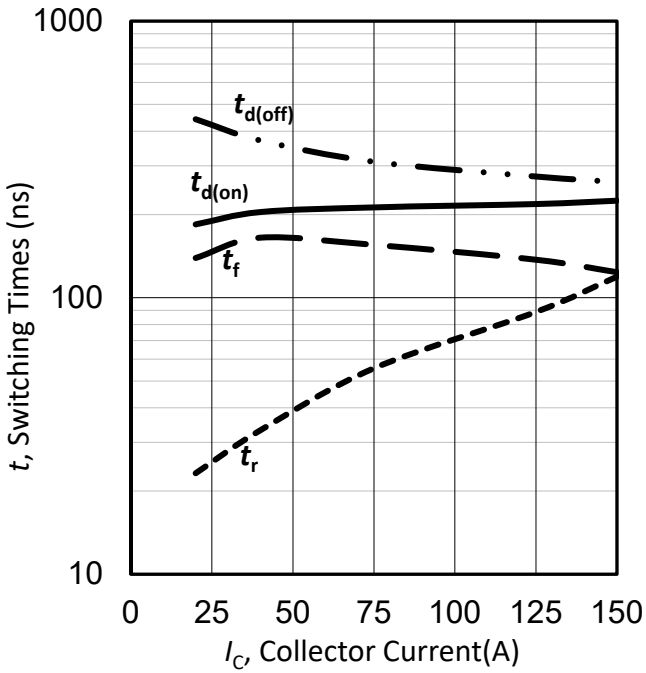


Figure 25. Typical switching times as a function of collector current
(inductive load, $T_{vj}=150^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $R_G=10\Omega$)

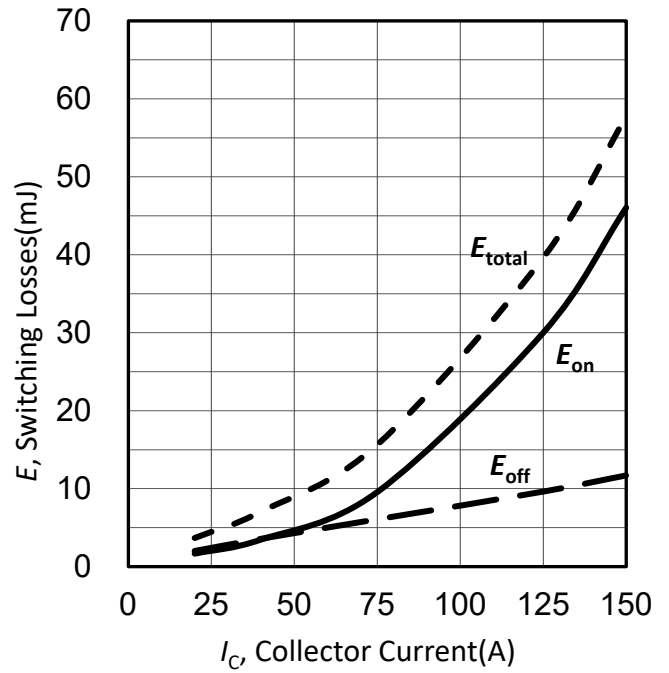


Figure 26. Typical switching losses as a function of collector current
(inductive load, $T_{vj}=150^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $R_G=10\Omega$)

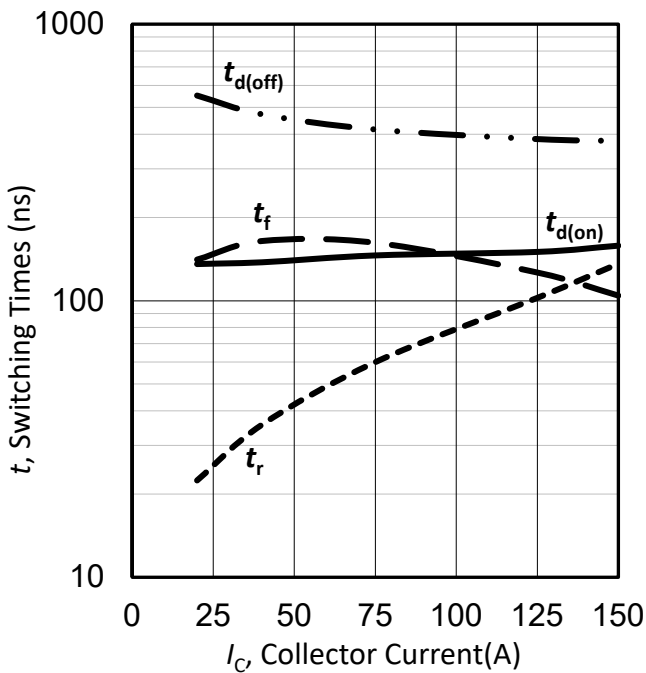


Figure 27. Typical switching times as a function of collector current
(inductive load, $T_{vj}=150^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $R_G=10\Omega$)

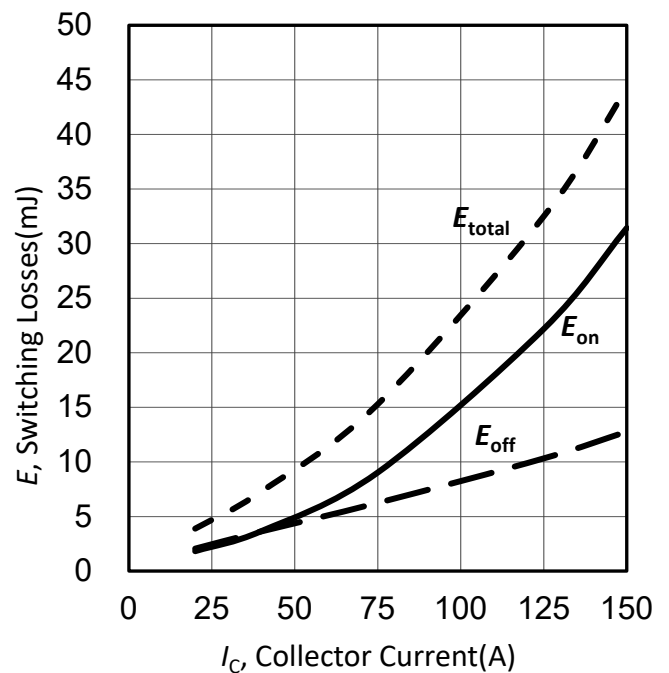


Figure 28. Typical switching losses as a function of collector current
(inductive load, $T_{vj}=150^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $R_G=10\Omega$)

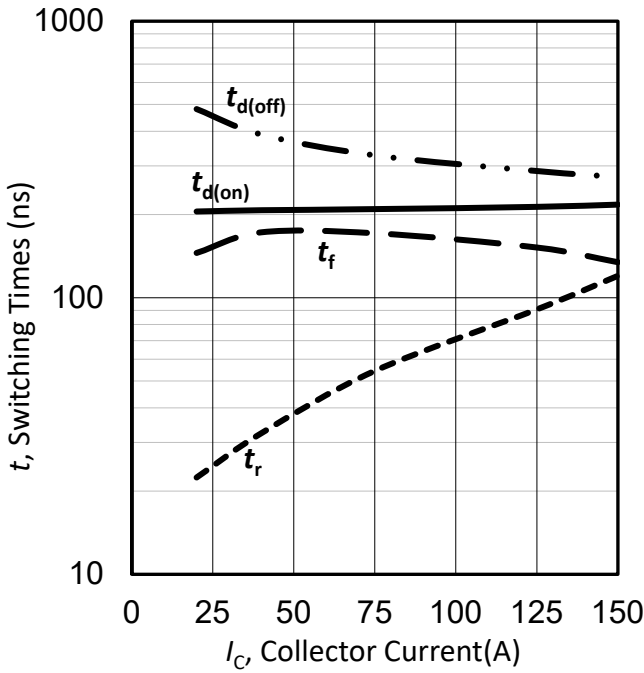


Figure 29. Typical switching times as a function of collector current
(inductive load, $T_{vj}=175^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $R_G=10\Omega$)

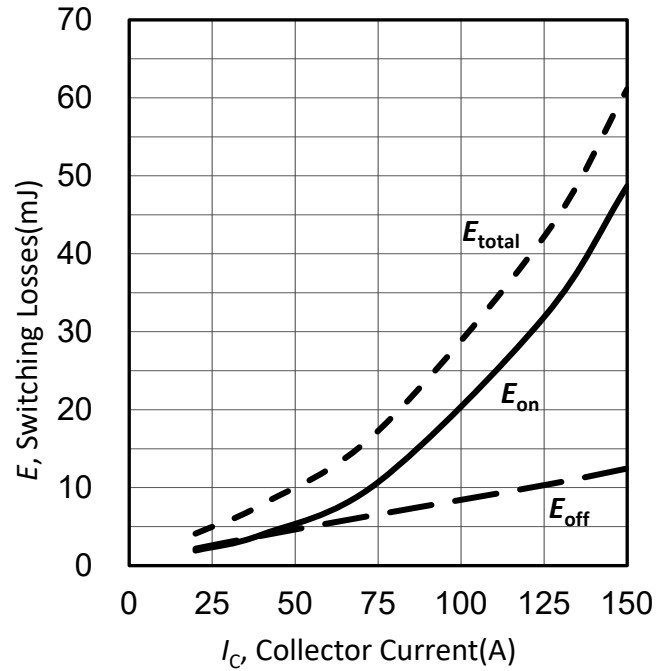


Figure 30. Typical switching times as a function of collector current
(inductive load, $T_{vj}=175^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $R_G=10\Omega$)

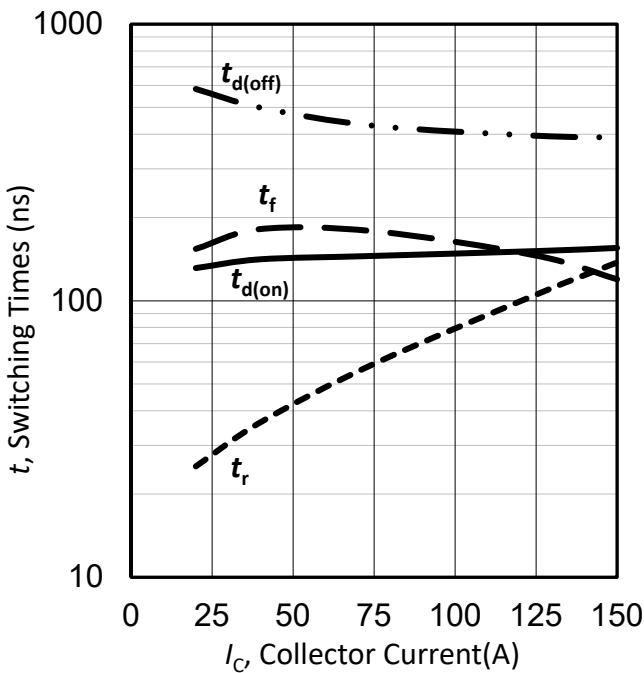


Figure 31. Typical switching times as a function of collector current
(inductive load, $T_{vj}=175^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $R_G=10\Omega$)

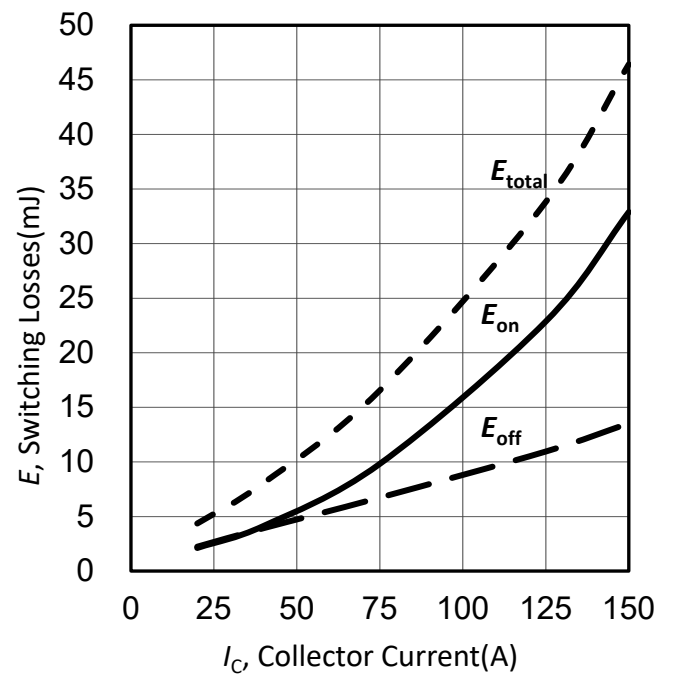


Figure 32. Typical switching times as a function of collector current
(inductive load, $T_{vj}=175^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $R_G=10\Omega$)

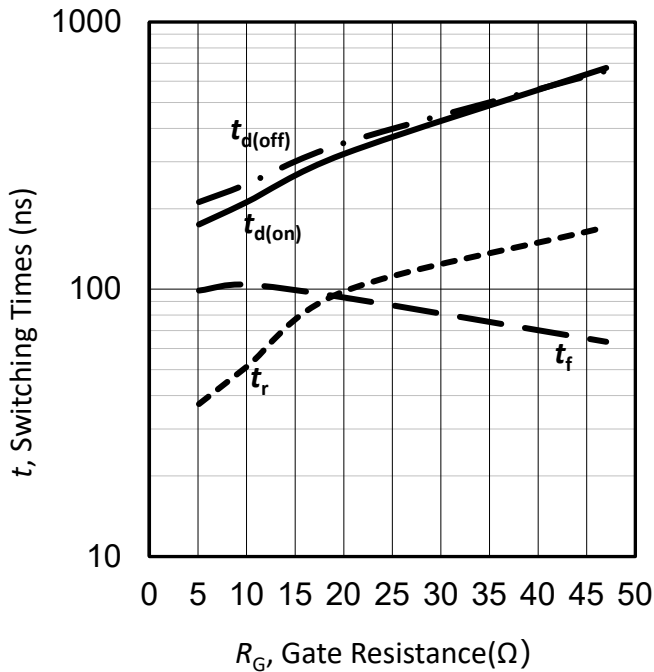


Figure 33. Typical switching times as a function of gate resistor
(inductive load, $T_{vj}=25^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $I_C=75\text{A}$)

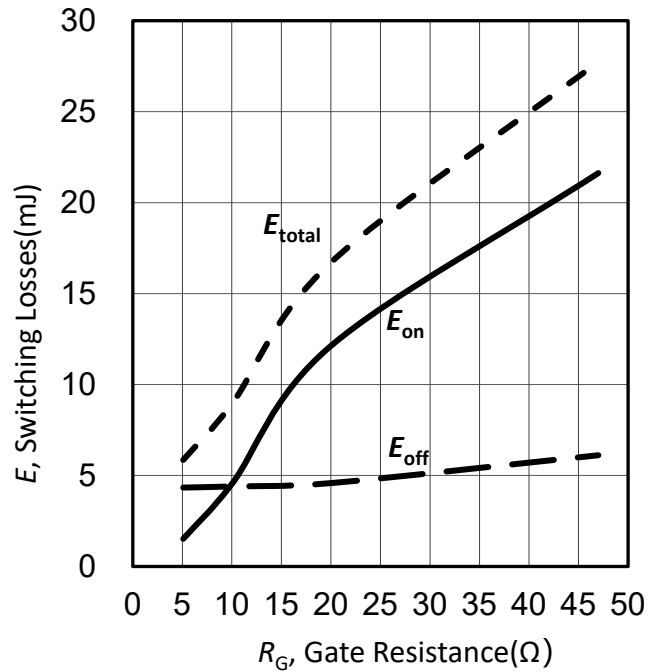


Figure 34. Typical switching energy losses as a function of gate resistor
(inductive load, $T_{vj}=25^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $I_C=75\text{A}$)

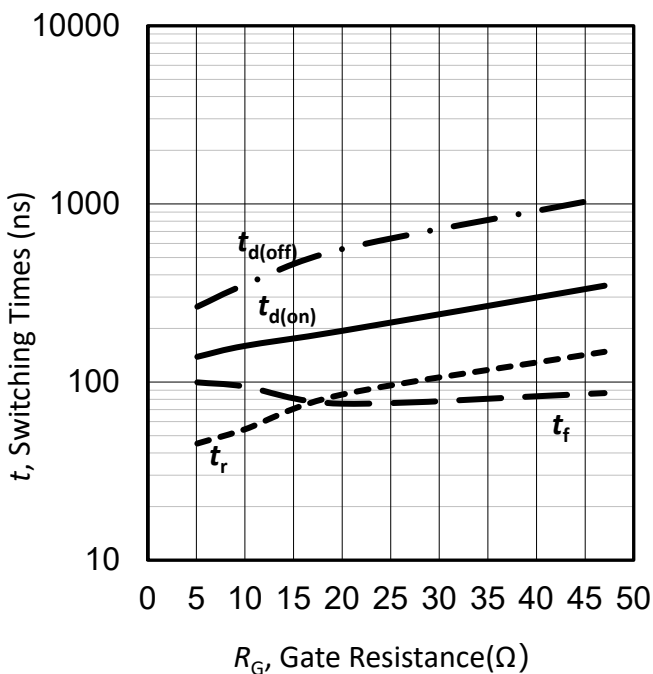


Figure 35. Typical switching times as a function of gate resistor
(inductive load, $T_{vj}=25^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $I_C=75\text{A}$)

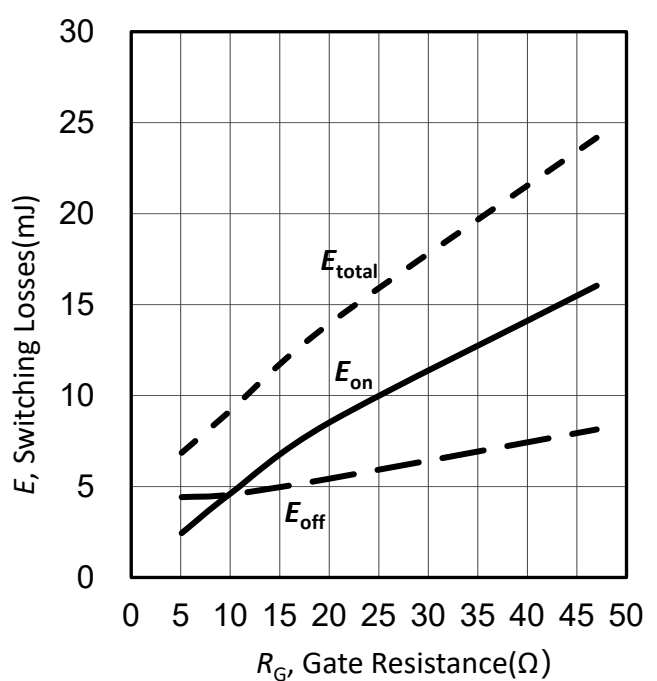


Figure 36. Typical switching energy losses as a function of gate resistor
(inductive load, $T_{vj}=25^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $I_C=75\text{A}$)

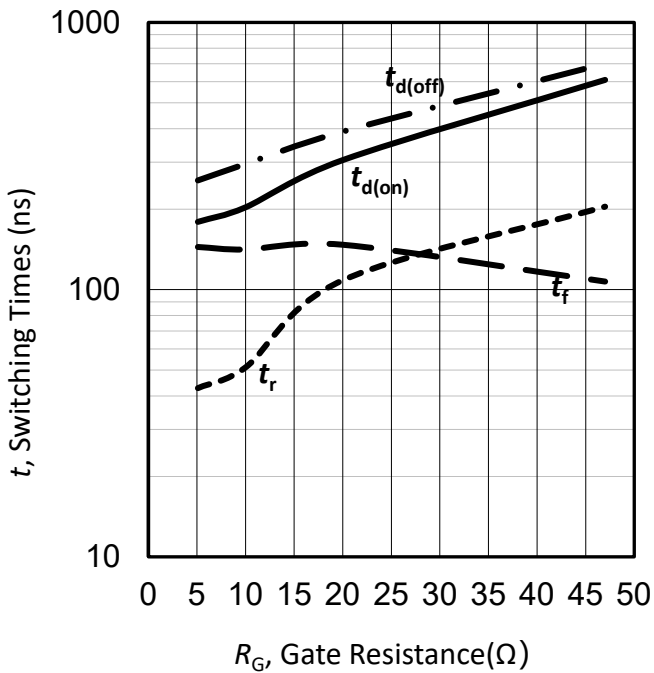


Figure 37. Typical switching times as a function of gate resistor
(inductive load, $T_{vj}=125^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $I_C=75\text{A}$)

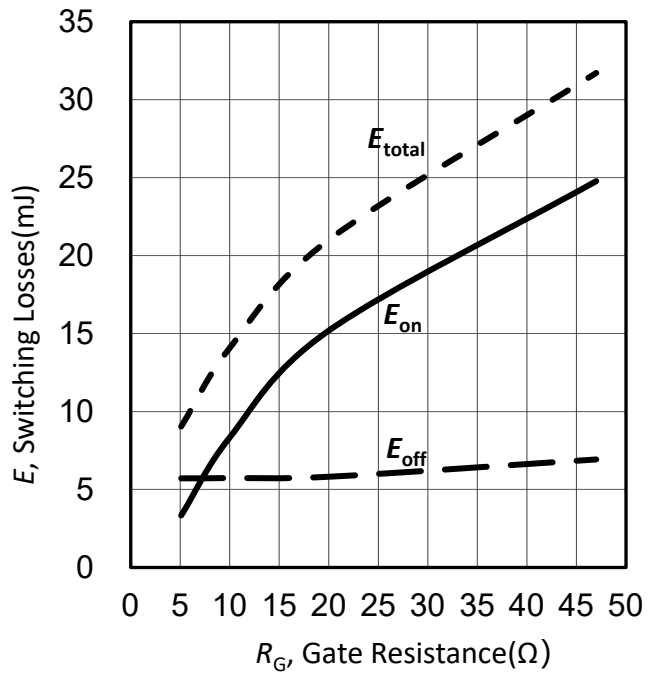


Figure 38. Typical switching energy losses as a function of gate resistor
(inductive load, $T_{vj}=125^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $I_C=75\text{A}$)

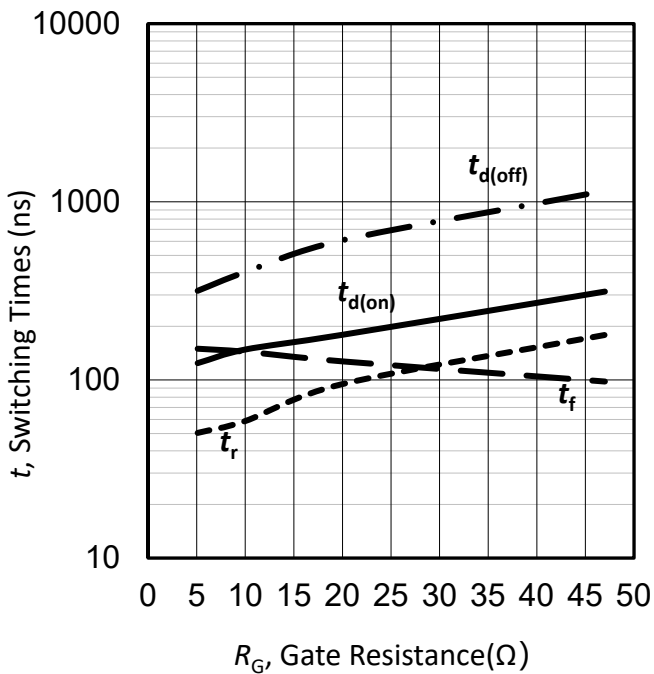


Figure 39. Typical switching times as a function of gate resistor
(inductive load, $T_{vj}=125^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $I_C=75\text{A}$)

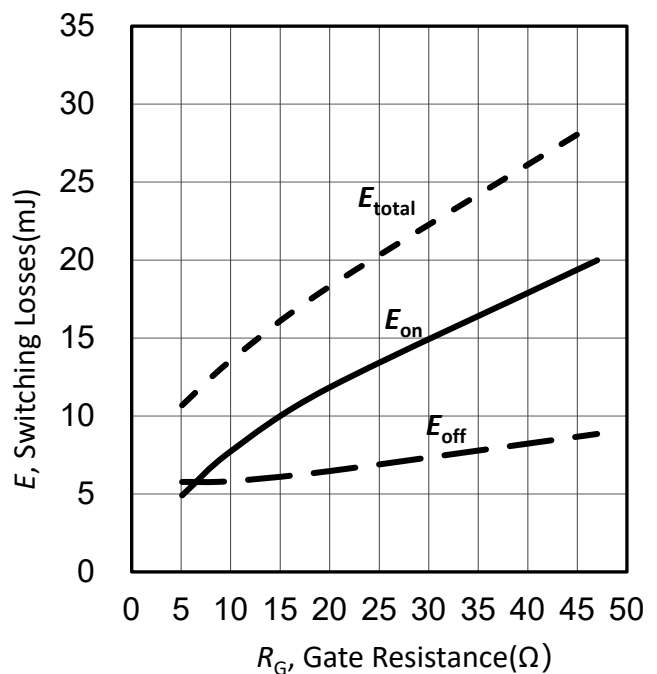


Figure 40. Typical switching energy losses as a function of gate resistor
(inductive load, $T_{vj}=125^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $I_C=75\text{A}$)

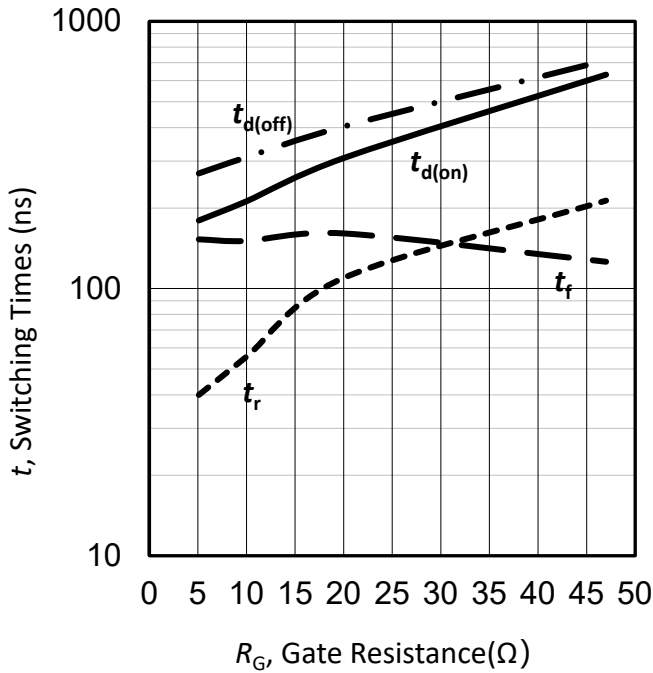


Figure 41. Typical switching times as a function of gate resistor
(inductive load, $T_{vj}=150^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $I_C=75\text{A}$)

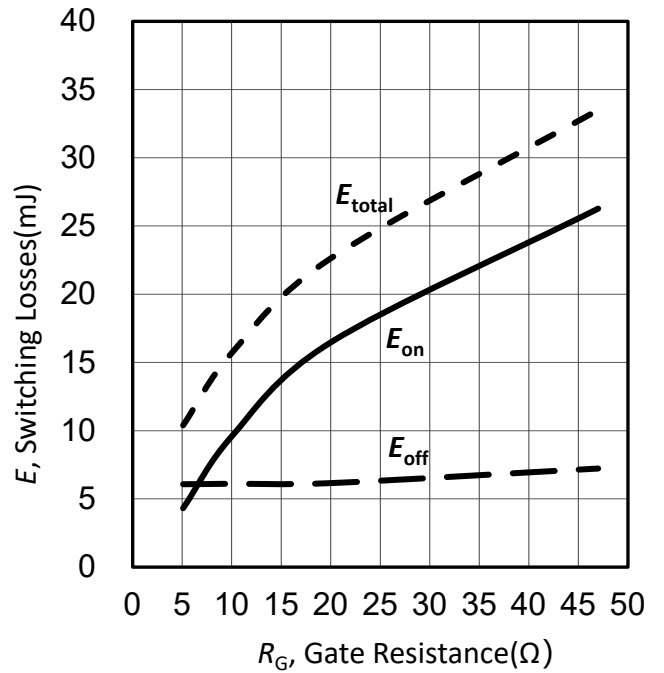


Figure 42. Typical switching energy losses as a function of gate resistor
(inductive load, $T_{vj}=150^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $I_C=75\text{A}$)

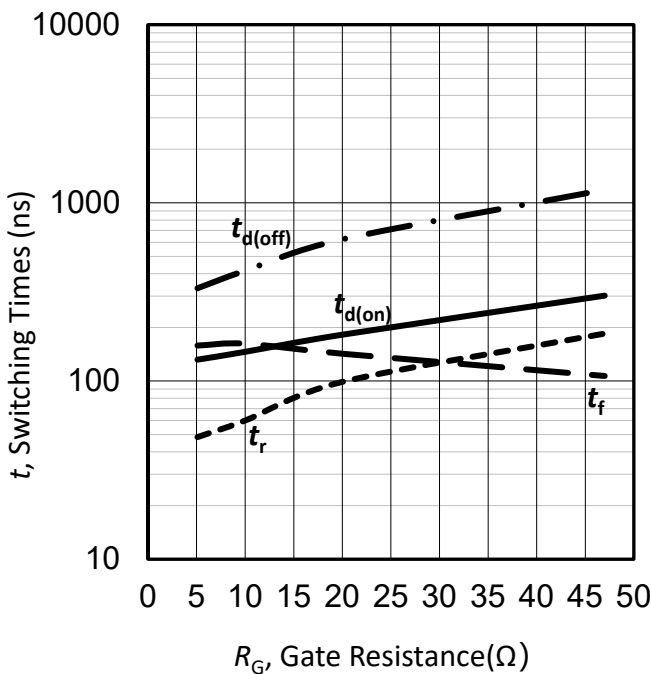


Figure 43. Typical switching times as a function of gate resistor
(inductive load, $T_{vj}=150^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $I_C=75\text{A}$)

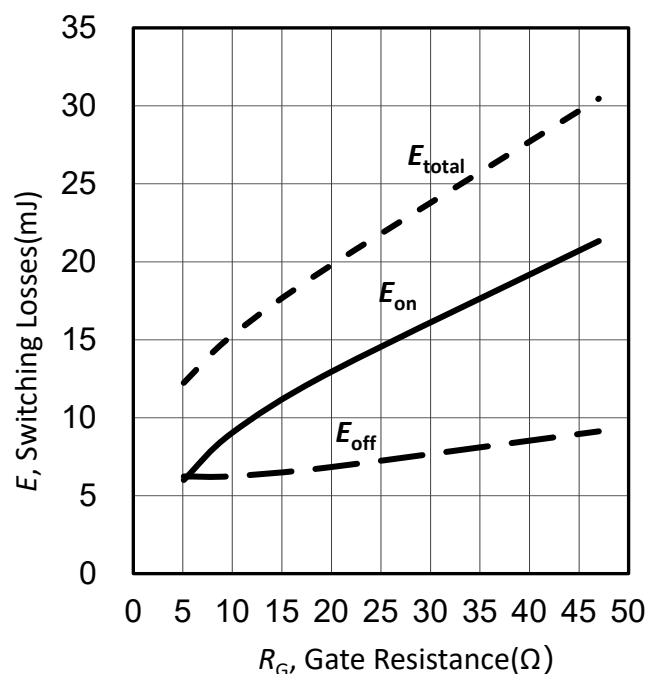


Figure 44. Typical switching energy losses as a function of gate resistor
(inductive load, $T_{vj}=150^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $I_C=75\text{A}$)

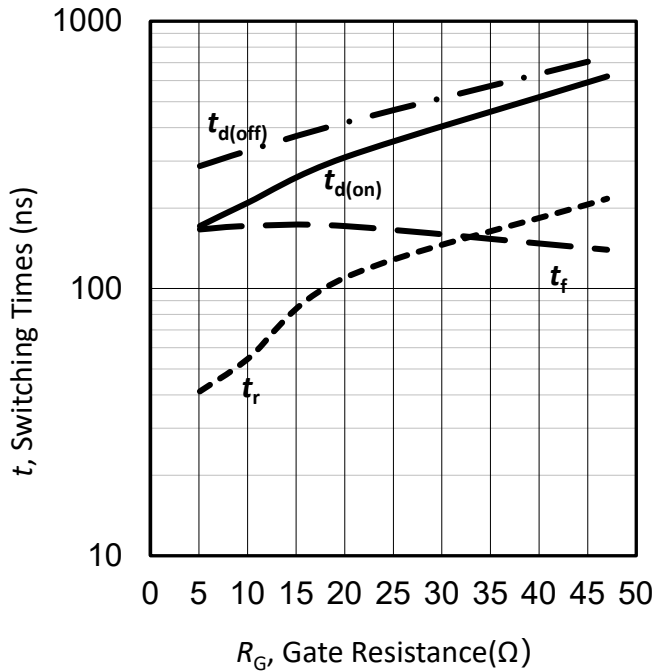


Figure 45. Typical switching times as a function of gate resistor
(inductive load, $T_{vj}=175^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $I_C=75\text{A}$)

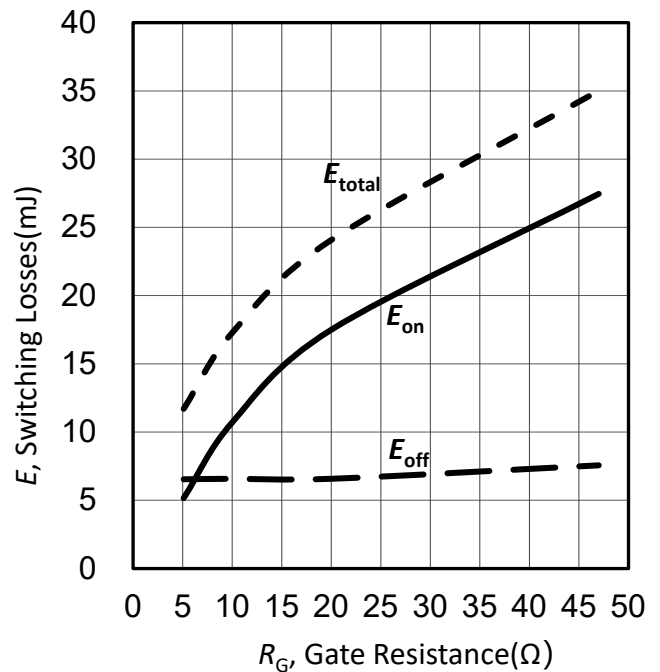


Figure 46. Typical switching energy losses as a function of gate resistor
(inductive load, $T_{vj}=175^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-15/15\text{V}$, $I_C=75\text{A}$)

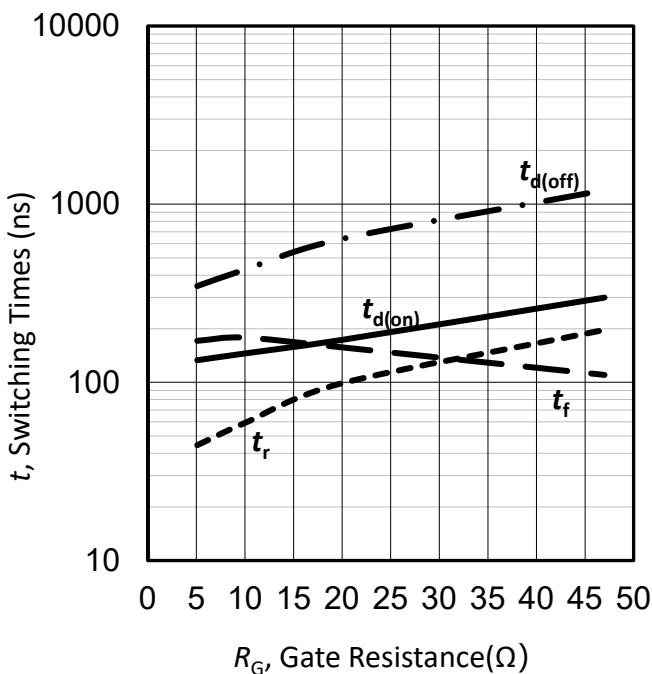


Figure 47. Typical switching times as a function of gate resistor
(inductive load, $T_{vj}=175^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $I_C=75\text{A}$)

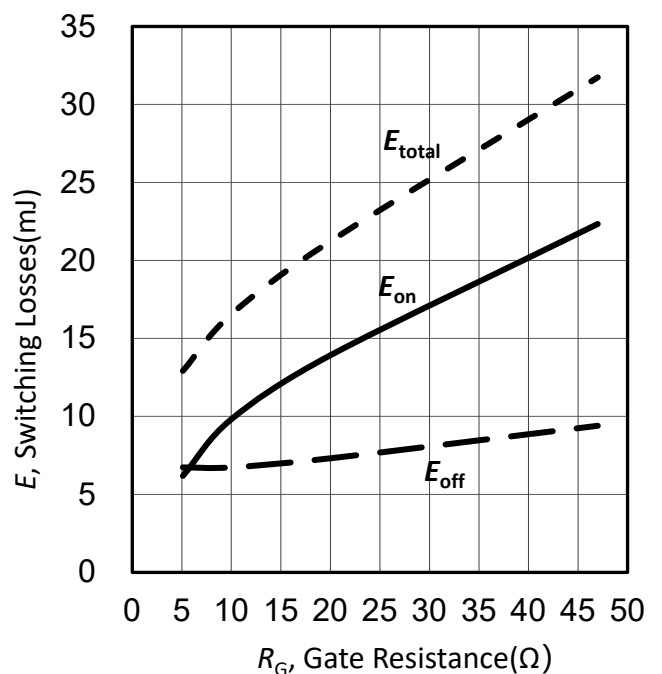


Figure 48. Typical switching energy losses as a function of gate resistor
(inductive load, $T_{vj}=175^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=-5/17\text{V}$, $I_C=75\text{A}$)

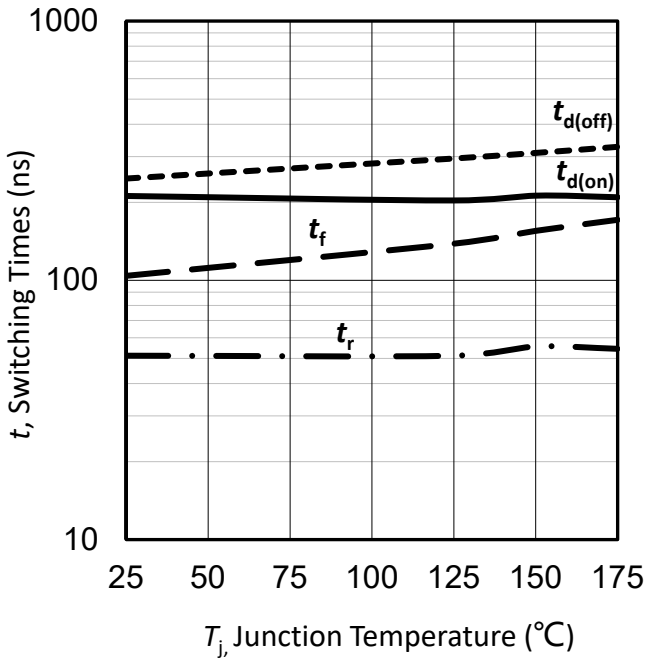


Figure 49. Typical switching times as a function of junction temperature
(inductive load, $V_{CE}=600V$, $V_{GE}=-15/15V$, $I_C=75A$, $R_G=10\Omega$)

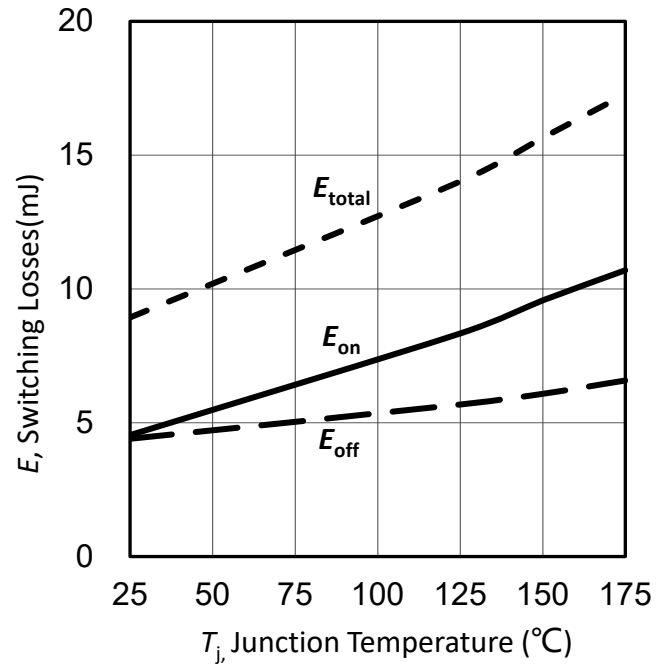


Figure 50. Typical switching energy losses as a function of junction temperature
(inductive load, $V_{CE}=600V$, $V_{GE}=-15/15V$, $I_C=75A$, $R_G=10\Omega$)

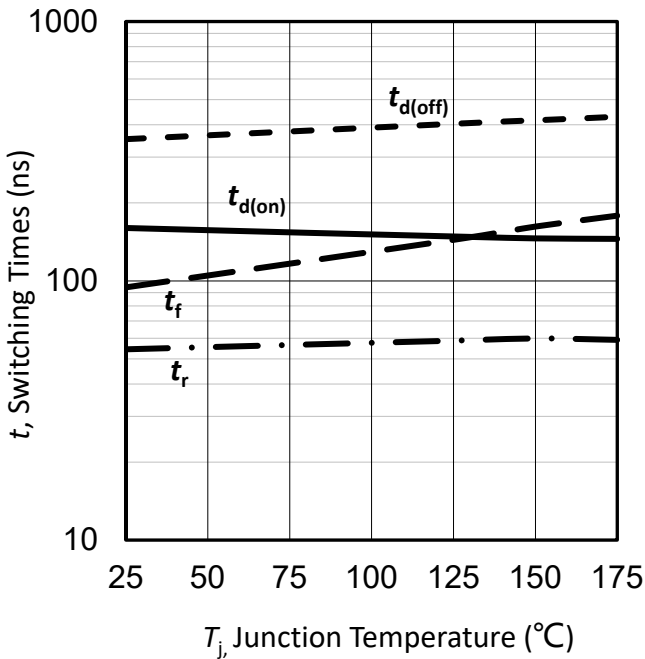


Figure 51. Typical switching times as a function of junction temperature
(inductive load, $V_{CE}=600V$, $V_{GE}=-5/17V$, $I_C=75A$, $R_G=10\Omega$)

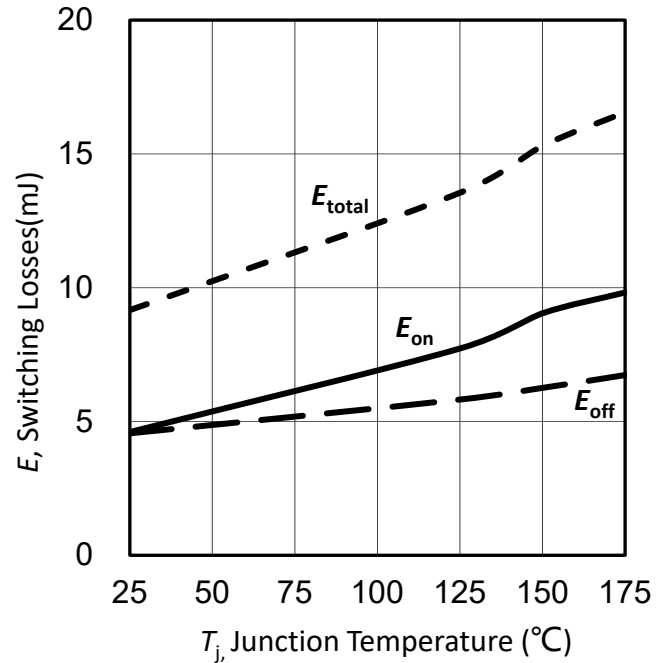


Figure 52. Typical switching energy losses as a function of junction temperature
(inductive load, $V_{CE}=600V$, $V_{GE}=-5/17V$, $I_C=75A$, $R_G=10\Omega$)

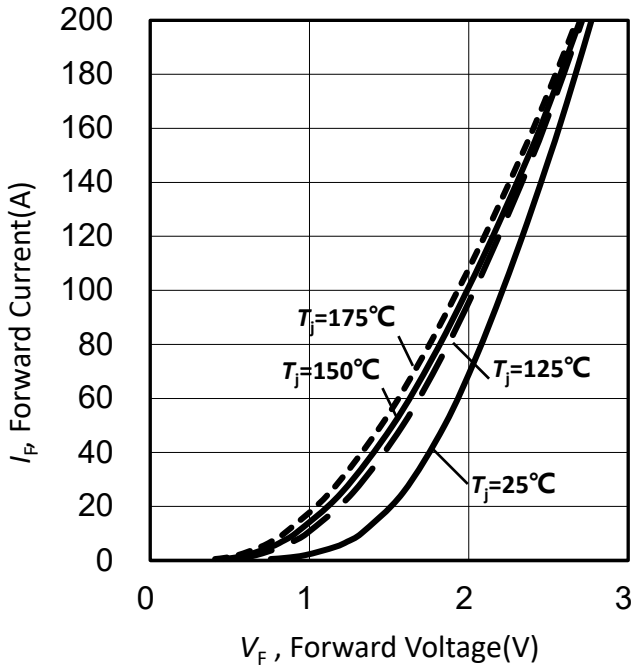


Figure 53. Typical diode forward current as a function of forward voltage

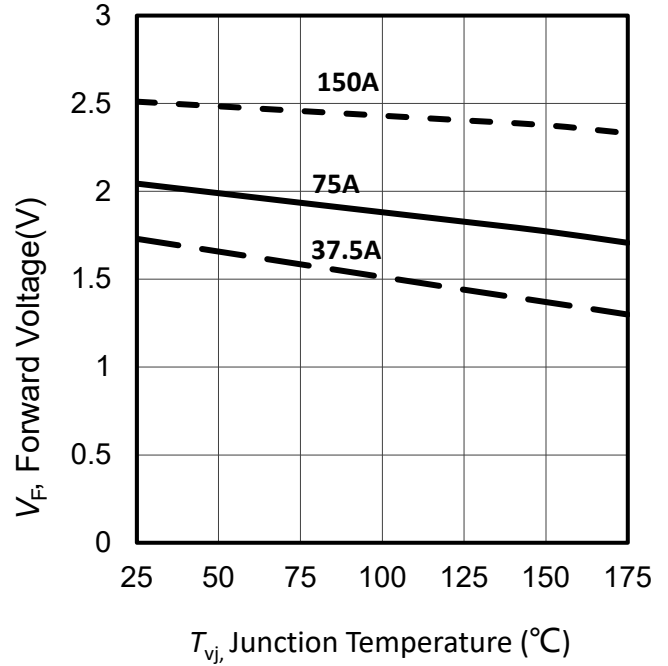


Figure 54. Typical diode forward voltage as a function of junction temperature

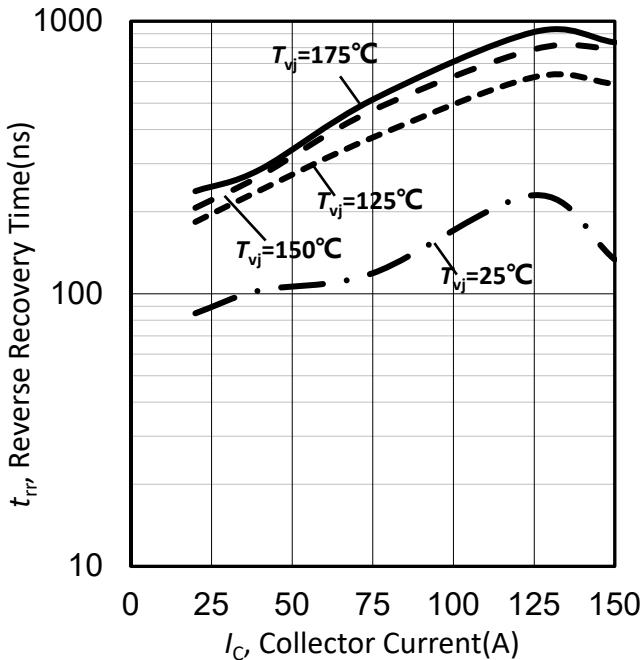


Figure 55. Typical reverse recovery time as a function of collector current (inductive load, $V_{CE}=600V$, $V_{GE}=-15/15V$, $R_G=10\Omega$)

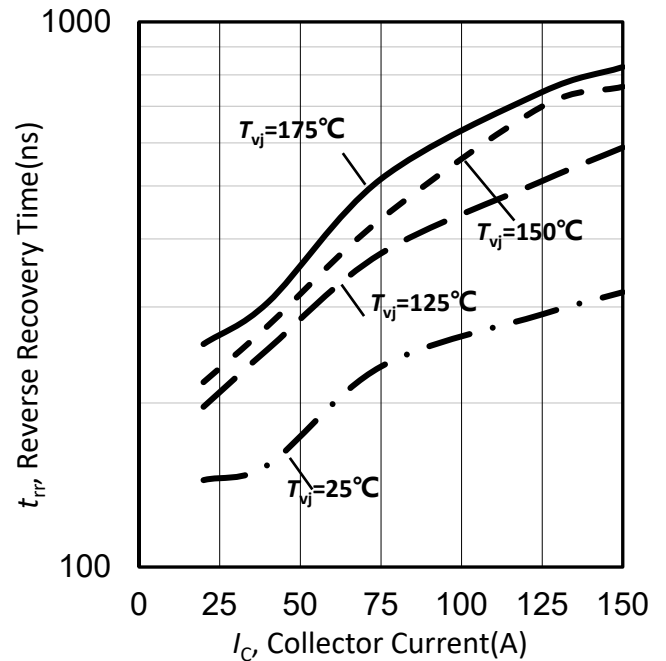


Figure 56. Typical reverse recovery time as a function of collector current (inductive load, $V_{CE}=600V$, $V_{GE}=-5/17V$, $R_G=10\Omega$)

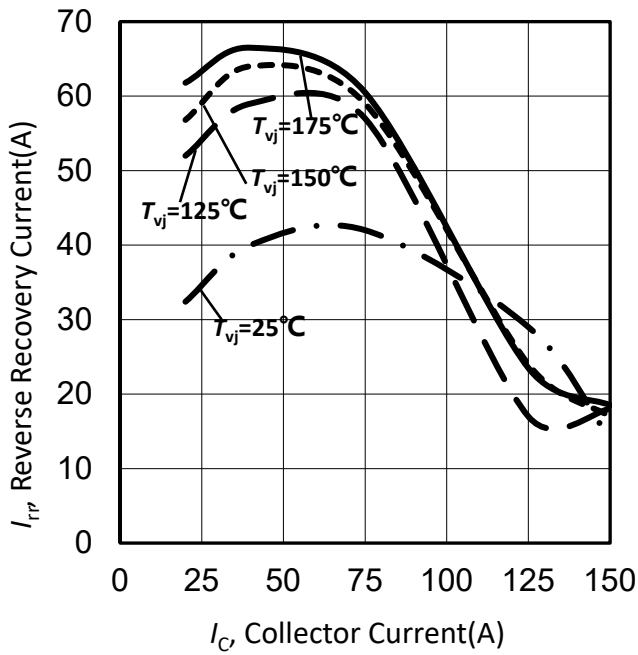


Figure 57. Typical reverse recovery current as a function of collector current
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-15/15V$, $R_G=10\Omega$)

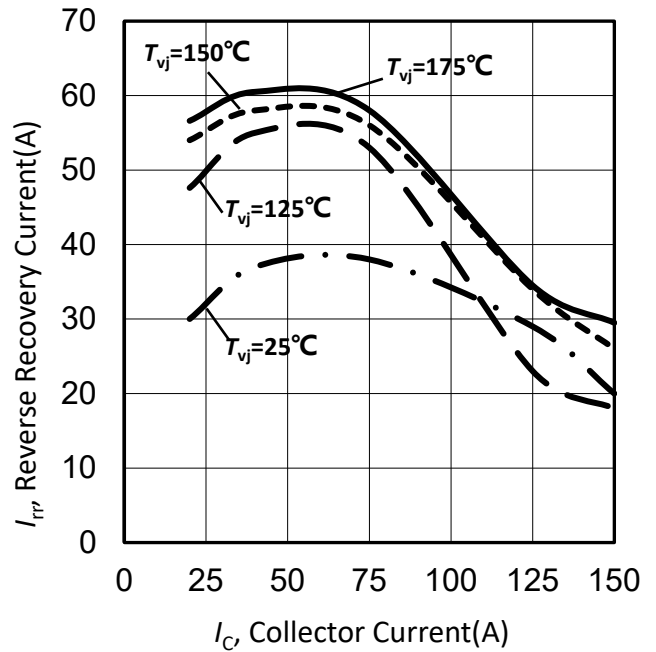


Figure 58. Typical reverse recovery current as a function of collector current
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-5/17V$, $R_G=10\Omega$)

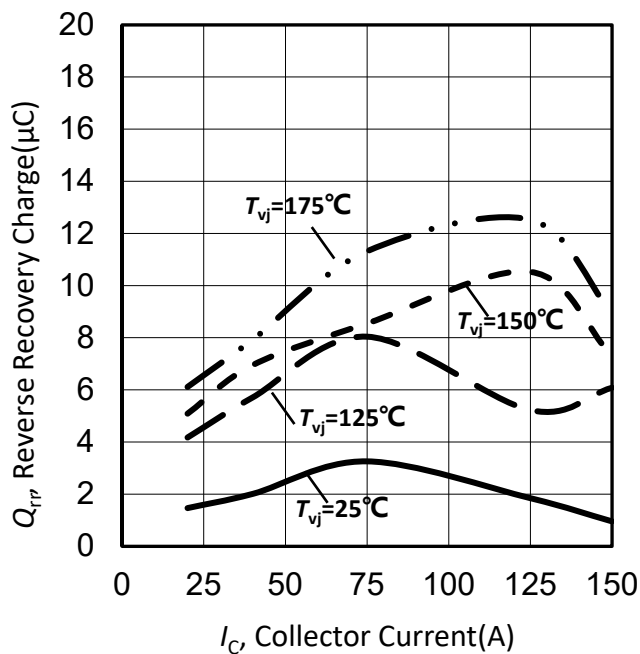


Figure 59. Typical reverse recovery charge as a function of collector current
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-15/15V$, $R_G=10\Omega$)

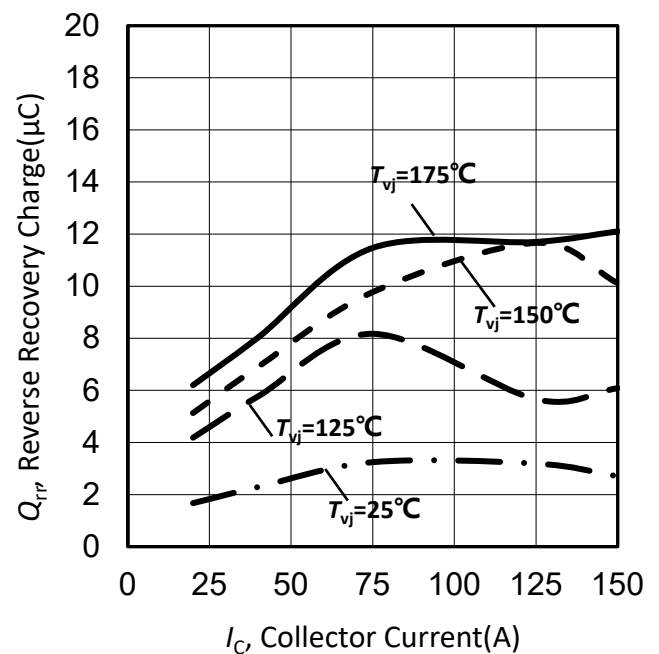


Figure 60. Typical reverse recovery charge as a function of collector current
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-5/17V$, $R_G=10\Omega$)

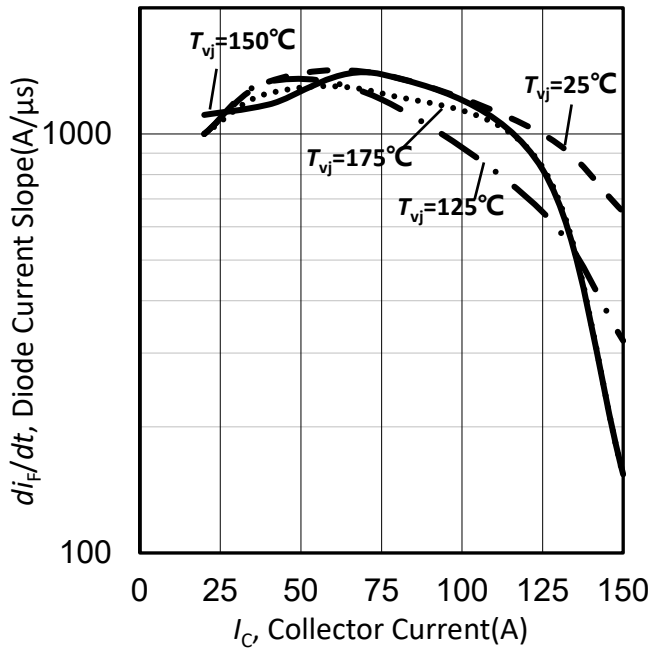


Figure 61. Typical diode current slope as a function of collector current
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-15/15V$, $R_G=10\Omega$)

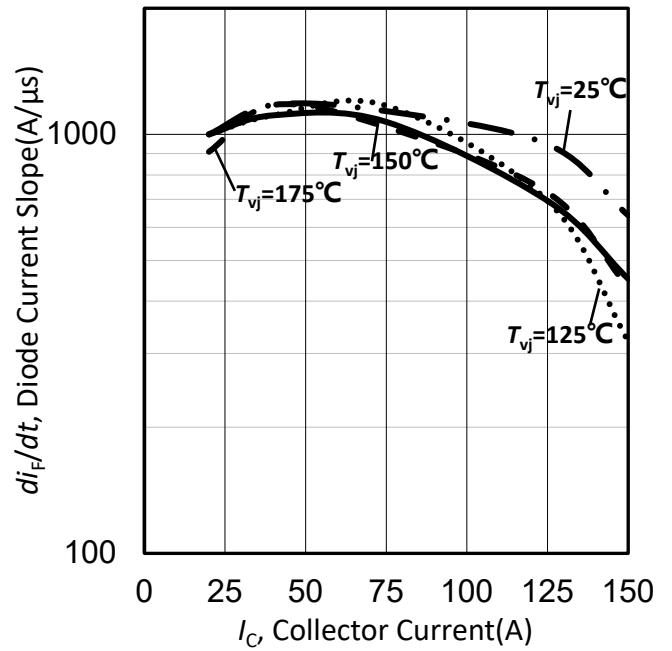


Figure 62. Typical diode current slope as a function of collector current
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-5/17V$, $R_G=10\Omega$)

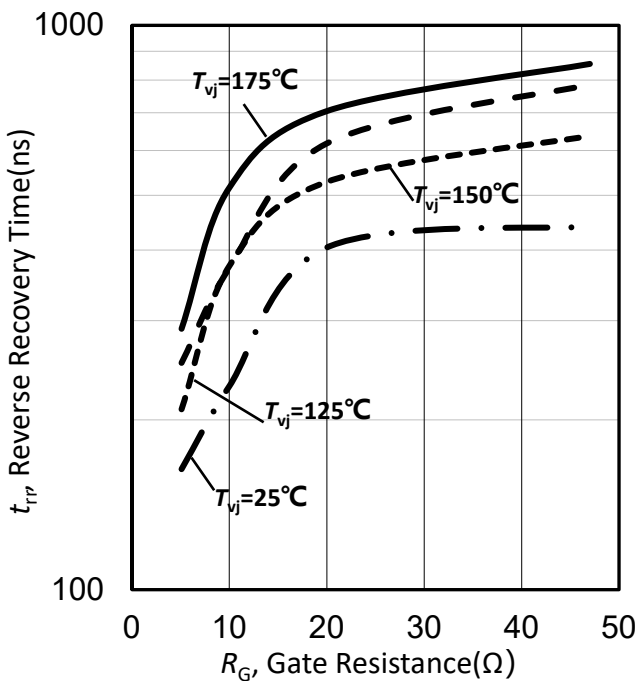


Figure 63. Typical reverse recovery time as a function of gate resistor
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-15/15V$, $I_C=75A$)

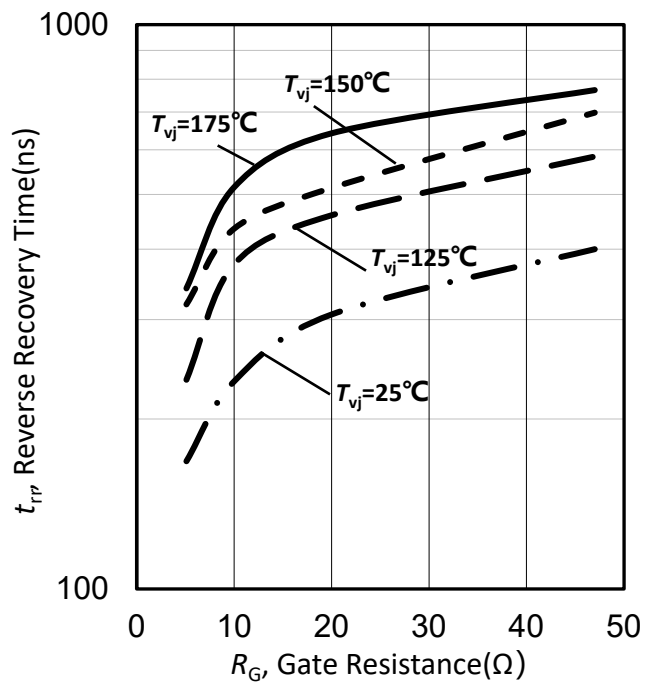


Figure 64. Typical reverse recovery time as a function of gate resistor
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-5/17V$, $I_C=75A$)

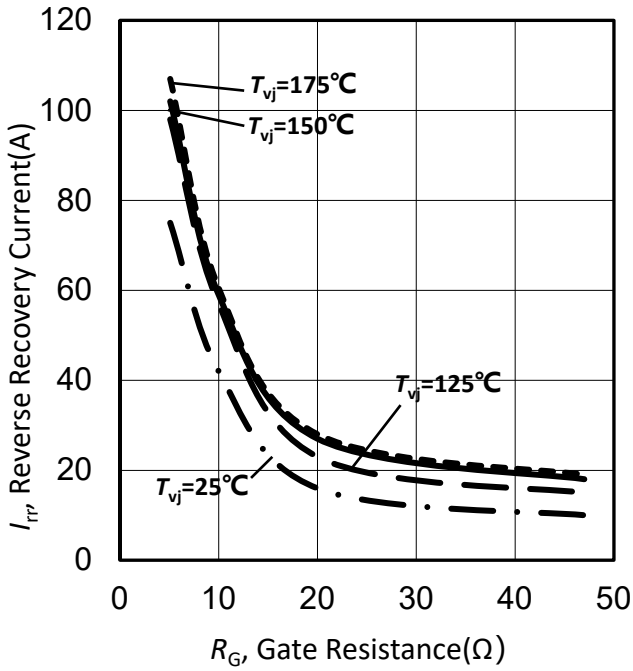


Figure 65. Typical reverse recovery current as a function of gate resistor
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-15/15V$, $I_C=75A$)

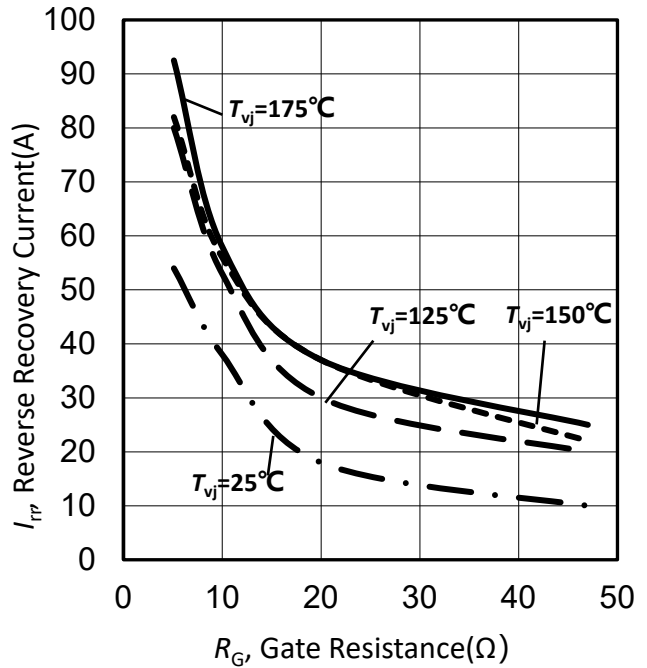


Figure 66. Typical reverse recovery current as a function of gate resistor
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-5/17V$, $I_C=75A$)

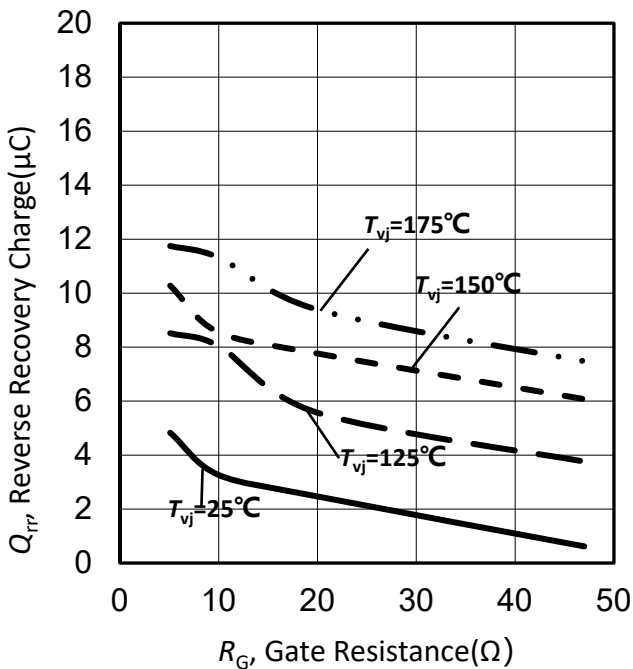


Figure 67. Typical reverse recovery charge as a function of gate resistor
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-15/15V$, $I_C=75A$)

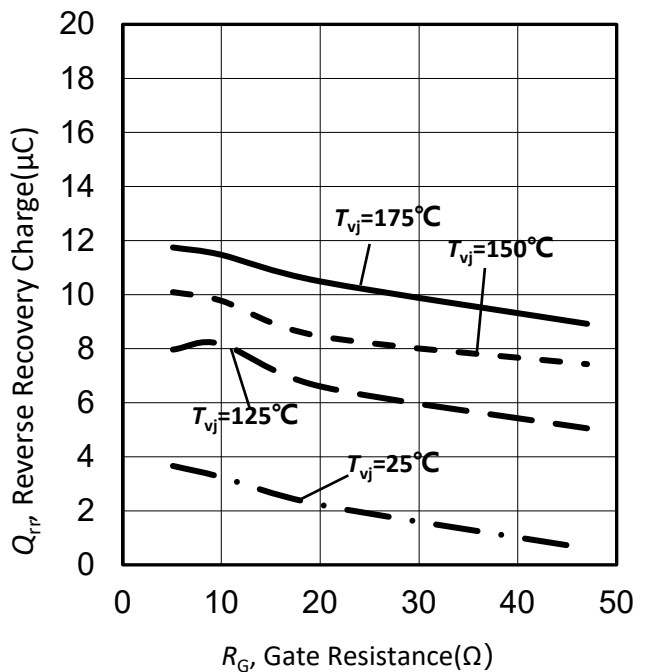


Figure 68. Typical reverse recovery charge as a function of gate resistor
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-5/17V$, $I_C=75A$)

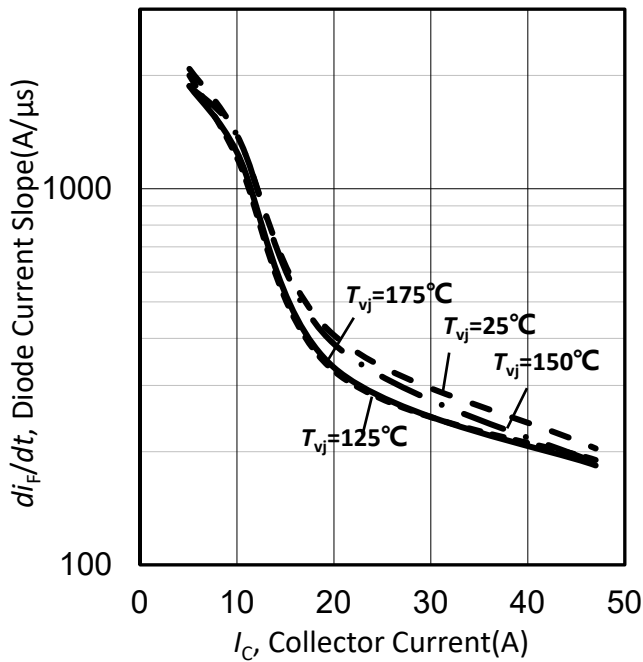


Figure 69. Typical diode current slope as a function of gate resistor
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-15/15V$, $I_C=75A$)

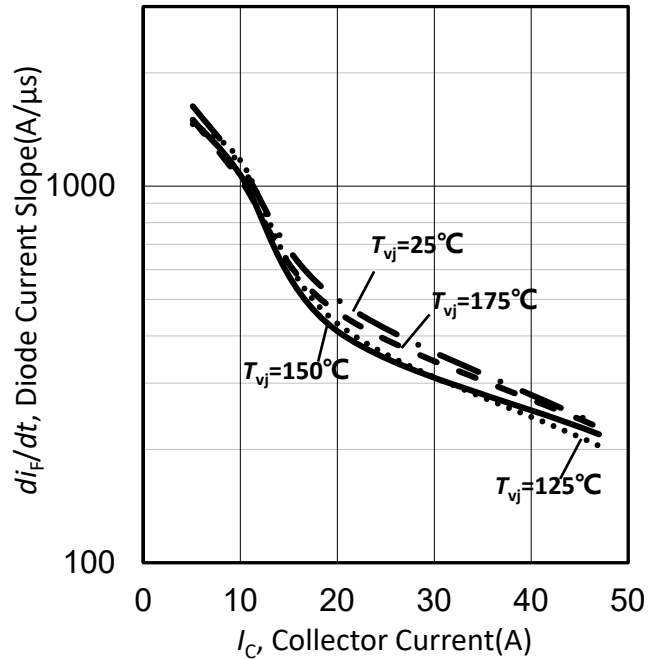


Figure 70. Typical diode current slope as a function of gate resistor
(inductive load,
 $V_{CE}=600V$, $V_{GE}=-5/17V$, $I_C=75A$)

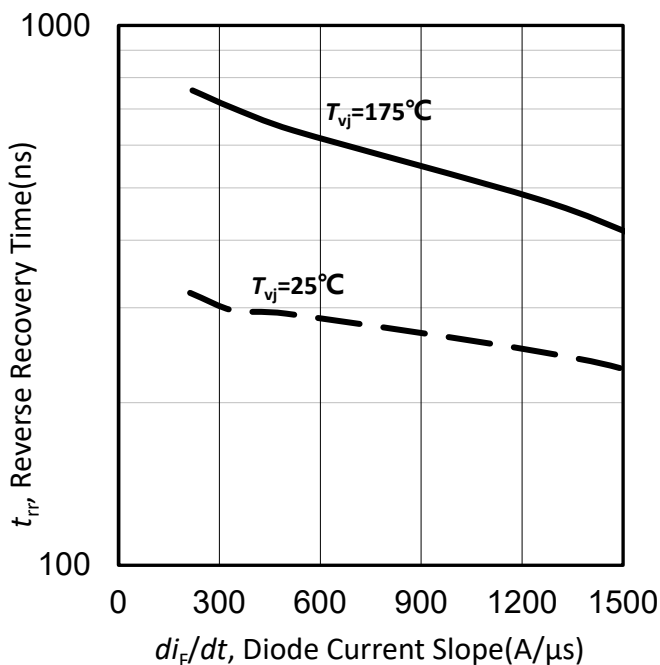


Figure 71. Typical reverse recovery time as a function of diode current slope
($V_R=600V$, $I_F=75A$)

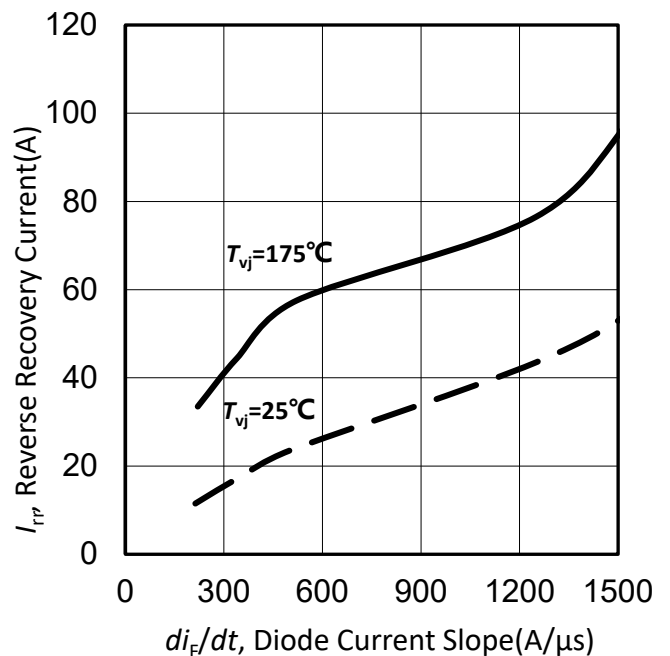


Figure 72. Typical reverse recovery current as a function of diode current slope
($V_R=600V$, $I_F=75A$)

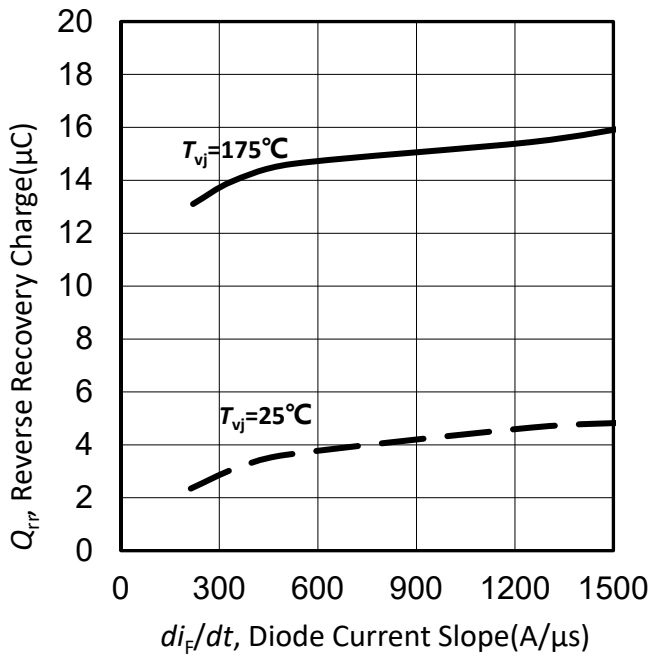


Figure 73. Typical reverse recovery charge as a function of diode current slope ($V_R=600V$, $I_F=75A$)

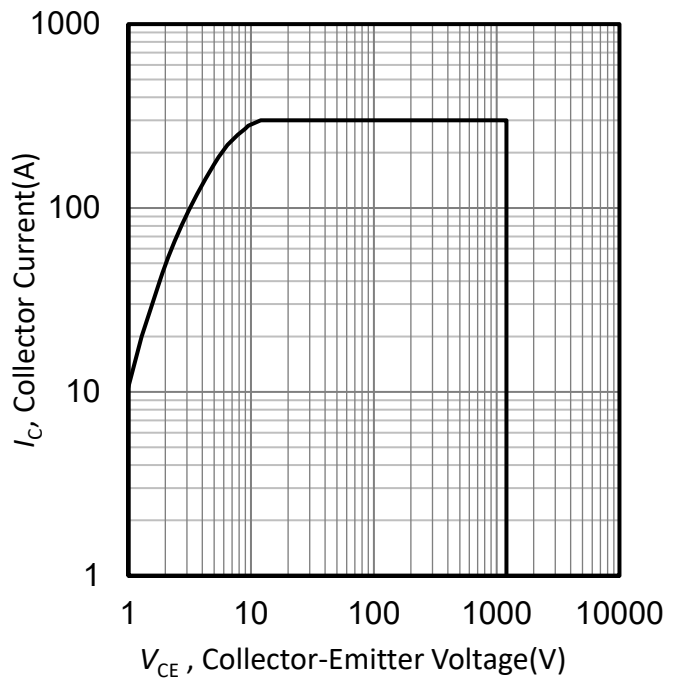


Figure 74. IGBT reverse bias safe operating area ($T_{vj} \leq 175^\circ C$, $V_{GE} = 15V$)

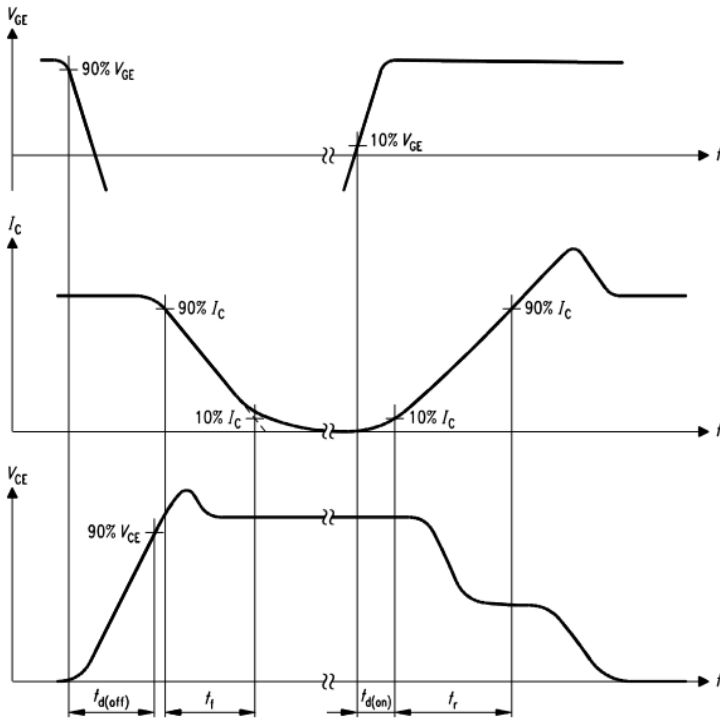


Figure A. Definition of switching times

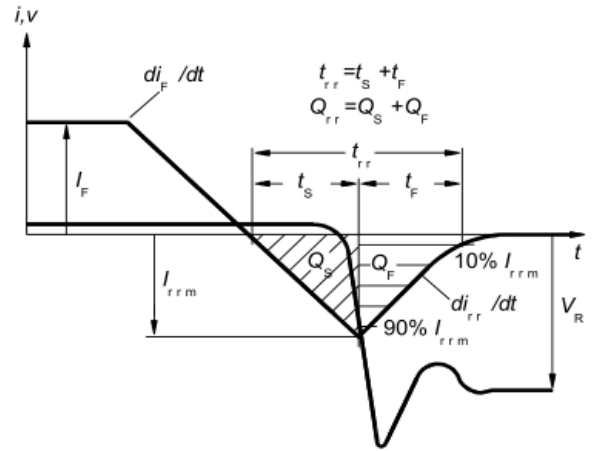


Figure C. Definition of diodes switching characteristics

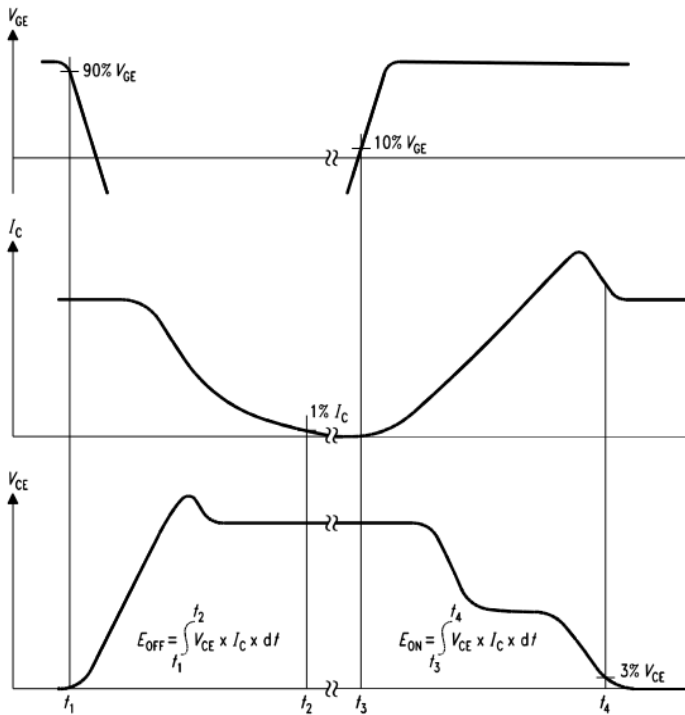


Figure B. Definition of switching losses

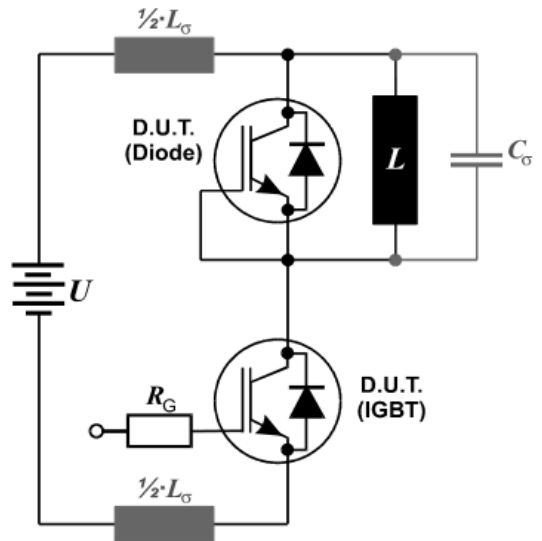
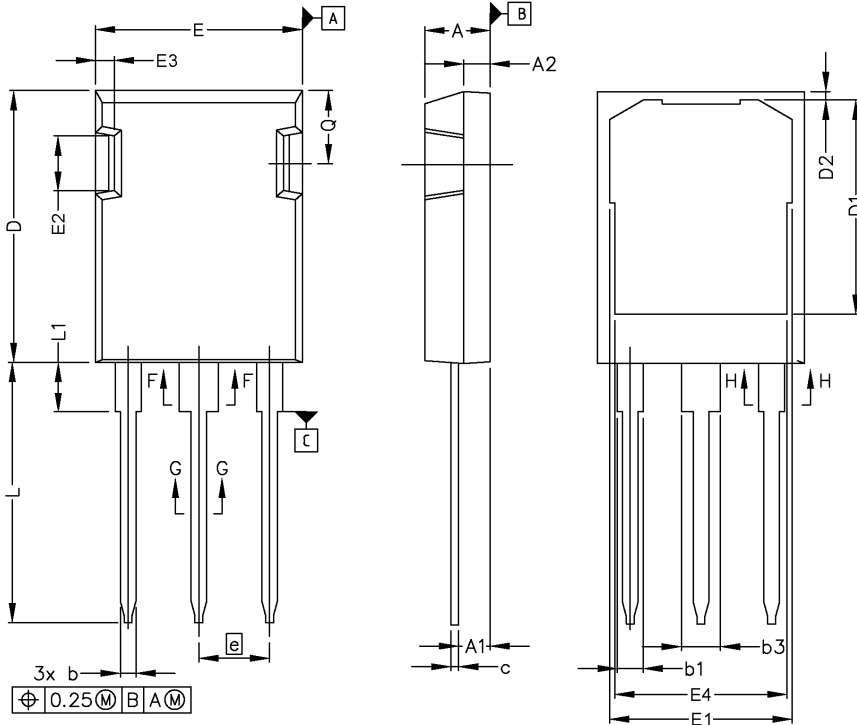


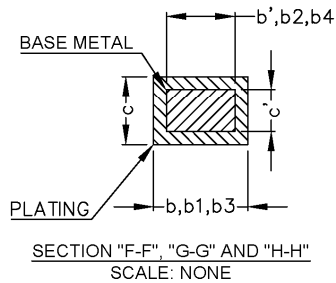
Figure D. Switching test circuit

TO-247-3L Plus



NOTE:
 1. ALL METAL SURFACES, TIN PLATED, EXCEPT AREA OF CUT
 2. DIMENSIONING & TOLERANCING 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)





Revision History

Revision	Subjects (major changes since last revision)	Date
1.0	Initial version	2020.8
1.1	Update Thermal Characteristics	2021.3
2.0	Update Electrical Characteristics at $T_j=175^{\circ}\text{C}$	2021.8
2.1	Update Electrical Characteristics and charts	2021.11
3.0	Update Electrical Characteristics and add charts	2021.11

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