QMW40N120EH

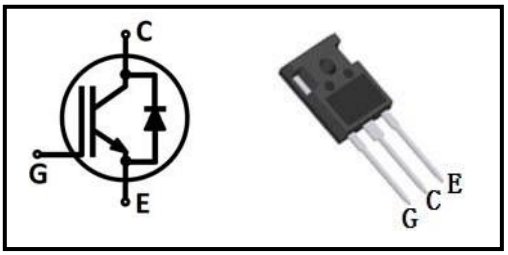
1200V-40A Trench and Field Stop IGBT

特征/Features

- 饱和压降为正温度系数，易于并联使用
  Easy parallel switching capability due to positive temperature coefficient in V_{CEsat}
- 内置快速恢复二极管
  Built- in fast recovery diode
- 高可靠性及热稳定性，良好的参数一致性
  High reliability and thermal stability, good parameter consistency

应用领域/Applications

- 太阳能逆变器/Solar Inverter
- 焊接机/ Welding Machine
- 不间断电源/UPS
- 功率因数校正/PFC
- PTC加热器/PTC heater
- 气候压缩机Climate compressor



型号/Type	打标/Marking	封装/Package
QMW40N120EH	QMW40N120EH	TO-247

最大额定值/Maximum Rated Values

Item	Symbol	Value	Unit
集电极-发射极电压 Collector- emitter voltage	V_{CE}	1200	V
集电极电流 DC collector current, limited by T_{vjmax} T_C=25℃ T_C=130℃	I_C	 80 40	A
集电极脉冲电流 Pulsed collector current, t_p limitedby Tjmax1)	I_{Cpuls}	160	
二极管正向电流 Diode forward current, limited by T_{jmax} T_C=25℃ T_C=100℃	I_F	 80 40	
二极管脉冲电流 Diode pulsed current, t_p limited by T_{jmax}1)	I_{Fpuls}	160	
栅极-发射极电压 Gate-emitter voltage	V_{GE}	±20	V
瞬态栅极-发射极电压 Transient Gate-emitter voltage（t_p≤10us,D<0.01)		±30	
耗散功率 Power dissipation T_C=25℃ T_C=100℃	P_{tot}	428 214	W
工作结温 Operating junction temperature	T_j	-40~175	℃
储存温度 Storage temperature	T_{stg}	-55~150	
焊接温度 Soldering temperature,wave soldering 1.6mm (0.063in.) from case for 10s		260	
安装扭矩，M3 螺钉最大安装过程：3 Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

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

电学特性/Electrical Characteristics

静态特性/Static Characteristics (at Tj=25℃ unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
集电极－发射极击穿电压 Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE}=0V, I_C=0.25mA	1200	-	-	V
集电极－发射极饱和电压 Collector-emitter saturation voltage	$V_{CE(sat)}$	V_{GE}=15V, I_C=40A T_j=25℃	-	1.9	2.2	
		T_j=150℃	-	2.3	-	
		T_j=175℃	-	2.45	-	
阈值电压 G-E threshold voltage	$V_{GE(th)}$	I_C=1.5mA, V_{CE}=V_{GE}	5.0	5.8	6.5	
集电极-发射极漏电流 C-E leakage current	I_{CES}	V_{CE}=1200V, V_{GE}=0V T_j=25℃	-	-	0.01	mA
		T_j=175℃	-	-	4.0	
栅极-发射极漏电流 G-E leakage current	I_{GES}	V_{CE}=0V, V_{GE}=20V	-	-	250	nA

动态特性/Dynamic Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
输入电容 Input capacitance	C_{iss}	V_{CE}=25V, V_{GE}=0V, f=1MHz	-	5348	-	pF
输出电容 Output capacitance	C_{oss}		-	130	-	
反馈电容 Reverse transfer capacitance	C_{rss}		-	46	-	
栅电荷 Gate charge	Q_G	V_{CC}=400V, I_C=40A, V_{GE}=15V	-	251	-	nC

热学特性/Thermal Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
结－外壳热阻 IGBT thermal resistance, junction-case	R_{thJC}	-	-	0.28	0.35	K/W
二极管结－外壳热阻 Diode thermal resistance, junction-case	R_{thJCD}	-	-	-	0.80	
结-环境热阻 Thermal Resistance, junction-ambient	R_{thJA}	-	-	-	40	

IGBT开关特性(感性负载)/IGBT Switching Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
开通延迟时间 Turn-on delay time	$t_{d(on)}$	T_j=25℃, V_{CC}=600V, I_C=40A, V_{GE}=0/15V, R_G=10Ω, Inductive load	-	125	-	ns
上升时间 Rise time	t_r		-	64	-	
关断延迟时间 Turn-off delay time	$t_{d(off)}$		-	323	-	
下降时间 Fall time	t_f		-	70	-	
开通损耗 Turn-on energy	E_{on}		-	1.98	-	mJ
关断损耗 Turn-off energy	E_{off}		-	1. 46	-	
开关损耗 Total switching energy	E_{ts}		-	3.44	-	
开通延迟时间 Turn-on delay time	$t_{d(on)}$	T_j=175℃, V_{CC}=600V, I_C=40A, V_{GE}=0/15V, R_G=10Ω, Inductive load	-	102	-	ns
上升时间 Rise time	t_r		-	63	-	
关断延迟时间 Turn-off delay time	$t_{d(off)}$		-	392	-	
下降时间 Fall time	t_f		-	110	-	
开通损耗 Turn-on energy	E_{on}		-	3.35	-	mJ
关断损耗 Turn-off energy	E_{off}		-	2.21	-	
开关损耗 Total switching energy	E_{ts}		-	5.56	-	

二极管开关特性/Diode Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
二极管正向压降 Diode forward voltage	V_F	V_{GE}=0V,I_F=40A T_j=25℃	-	2.4	2.8	V
		T_j=150℃	-	2.1	-	
		T_j=175℃	-	2.0	-	
反向恢复时间 Diode reverse recovery time	t_{rr}	T_j=25℃, V_R=600V, I_F=40A, di_F/dt=550A/μs	-	164	-	ns
反向恢复电荷 Diode reverse recovery charge	Q_{rr}		-	1.49	-	μC
反向恢复峰值电流 Diode peak reverse recovery current	I_{rrm}		-	20.0	-	A
反向恢复时间 Diode reverse recovery time	t_{rr}	T_j=175℃, V_R=600V, I_F=40A, di_F/dt=550A/μs	-	286	-	ns
反向恢复电荷 Diode reverse recovery charge	Q_{rr}		-	3.52	-	uC
反向恢复峰值电流 Diode peak reverse recovery current	I_{rrm}		-	28.8	-	A

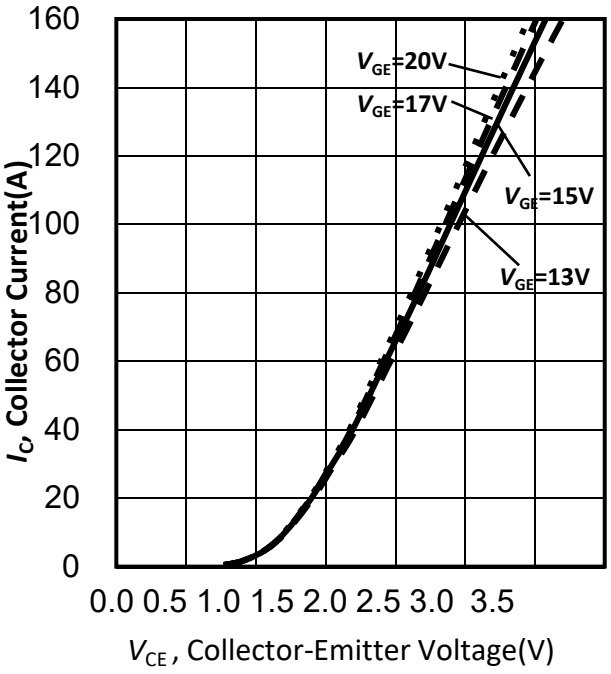


Figure 1. 典型输出特性/Typical output characteristic（T_{vj}=25℃）

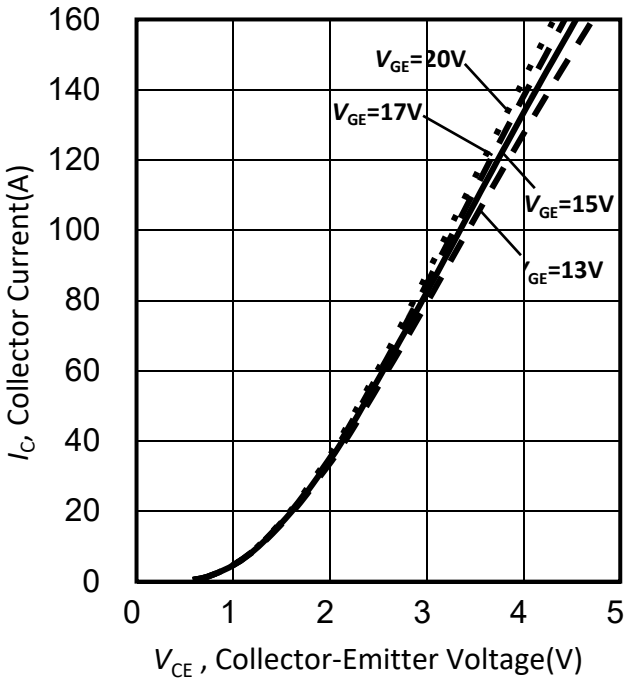


Figure 2. 典型输出特性/Typical output characteristic（T_{vj}=125℃）

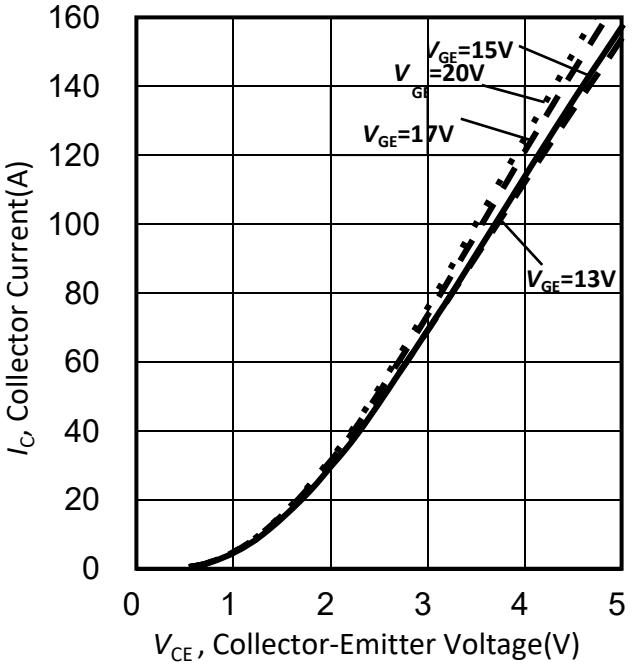


Figure 3. 典型输出特性/Typical output characteristic （T_{vj}=150℃）

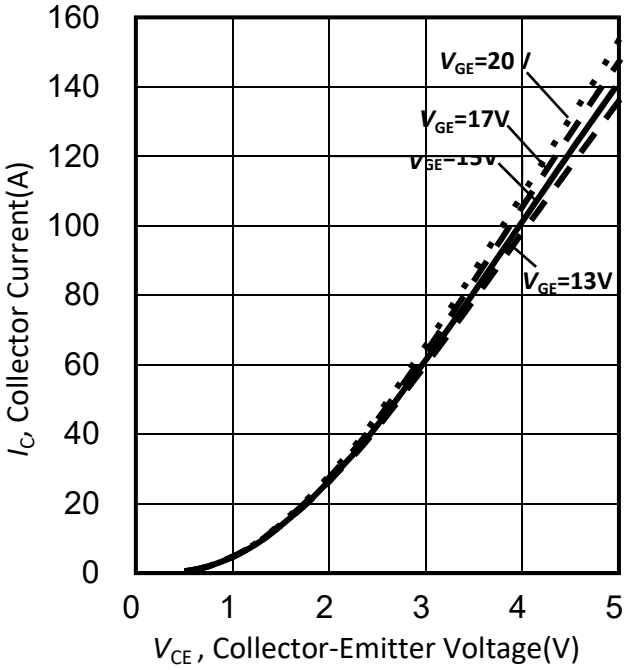


Figure 4. 典型输出特性/Typical output characteristic（T_{vj}=175℃）

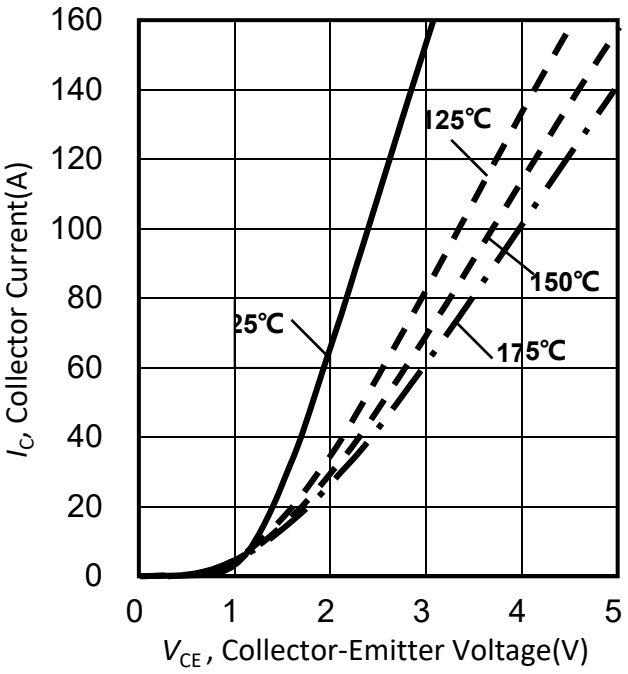


Figure 5. 典型 $V_{CE(sat)}$- I_c特性曲线/Typical $V_{CE(sat)}$-I_c **characteristic**（V_{GE}=15V）

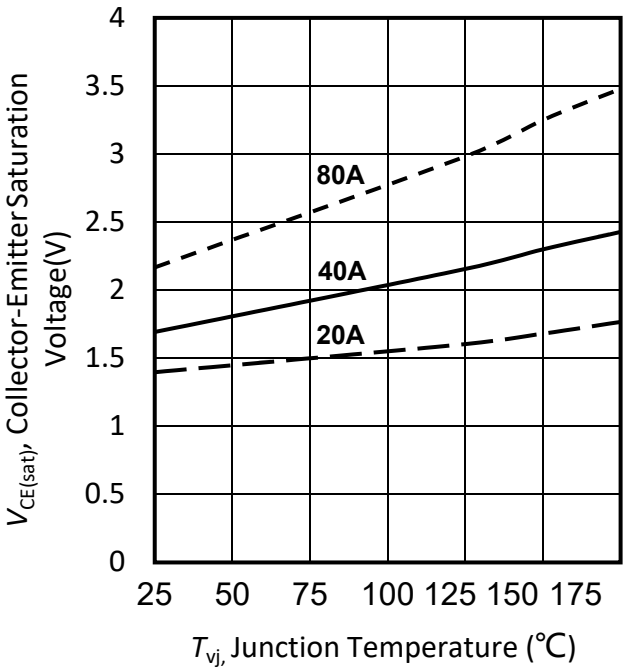


Figure 6. 典型 $V_{CE(sat)}$- T_j 特性曲线/Typical $V_{CE(sat)}$-T_j **characteristic**（V_{GE}=15V）

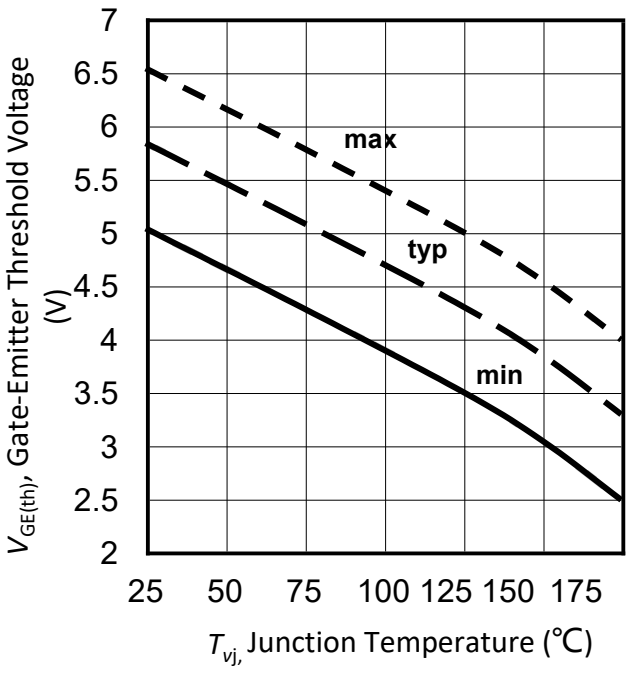


Figure 7.典型 $V_{CE(sat)}$-T_j特性曲线 /$V_{GE(th)}$-T_j **characteristic**（I_c=1.5mA）

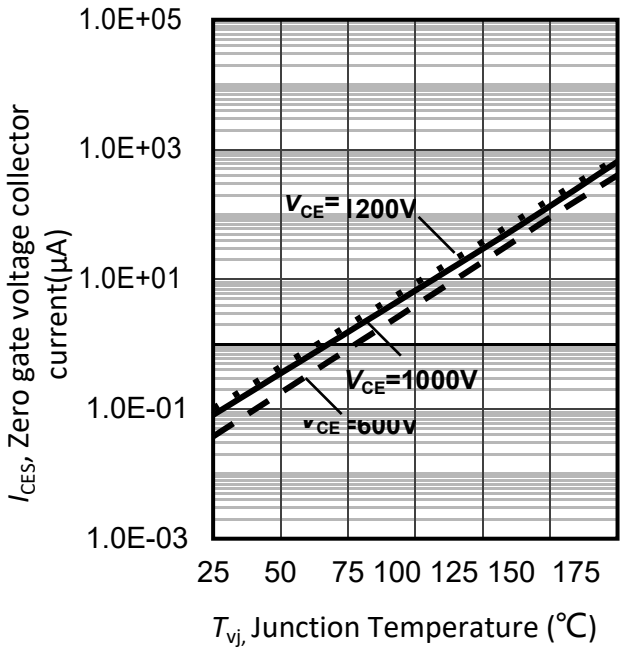


Figure 8. 典型 I_{CES}-T_j 特性曲线/Typical I_{CES}-T_j **characteristic**（ V_{GE}=0V ）

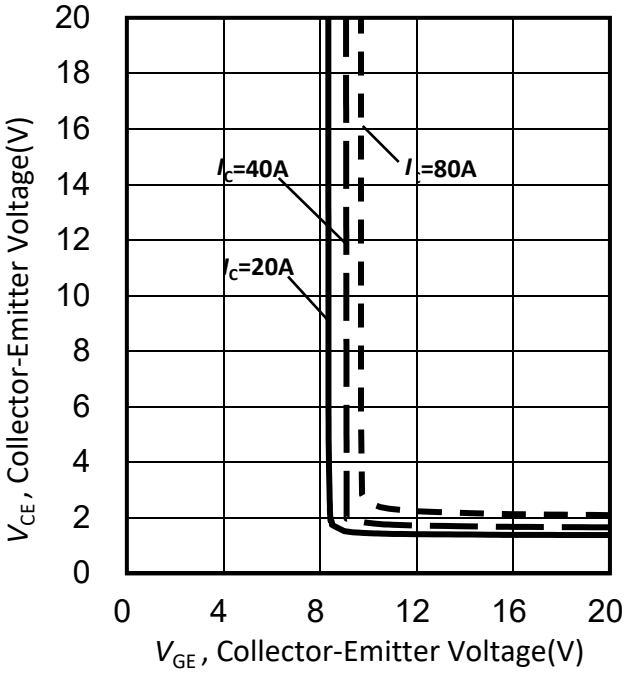


Figure 9. 典型 $V_{CE(sat)}$-$V_{GE(th)}$特性曲线/Typical $V_{CE(sat)}$-$V_{GE(th)}$ **characteristic**(T_{vj}=25℃)

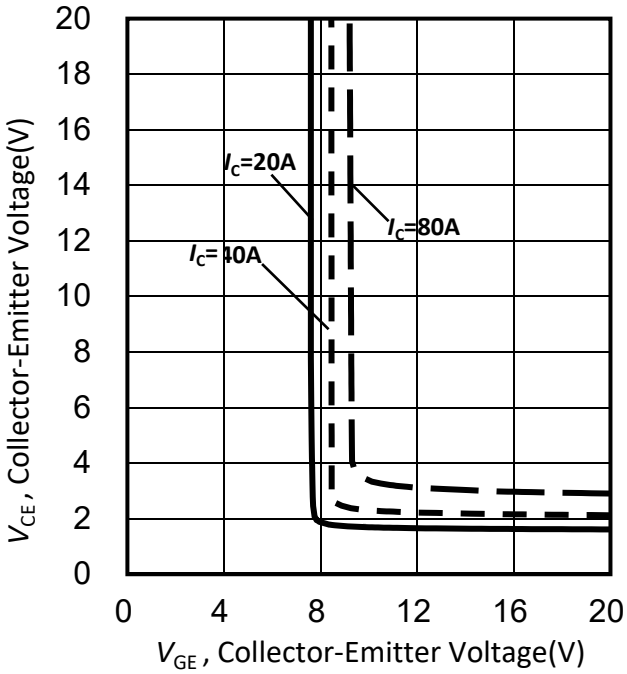


Figure 10. 典型 $V_{CE(sat)}$-$V_{GE(th)}$特性曲线/Typical $V_{CE(sat)}$-$V_{GE(th)}$ **characteristic**(T_{vj}=125℃)

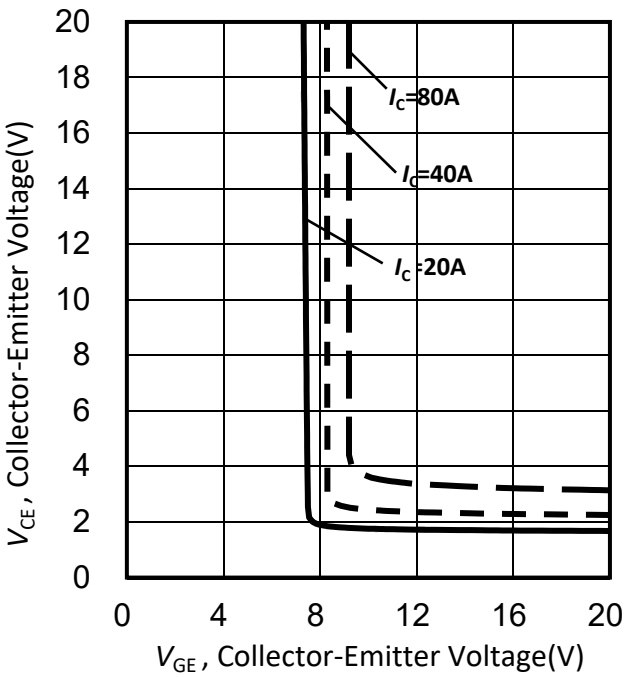


Figure 11. 典型 $V_{CE(sat)}$-$V_{GE(th)}$特性曲线/Typical $V_{CE(sat)}$-$V_{GE(th)}$ **characteristic**(T_{vj}=150℃)

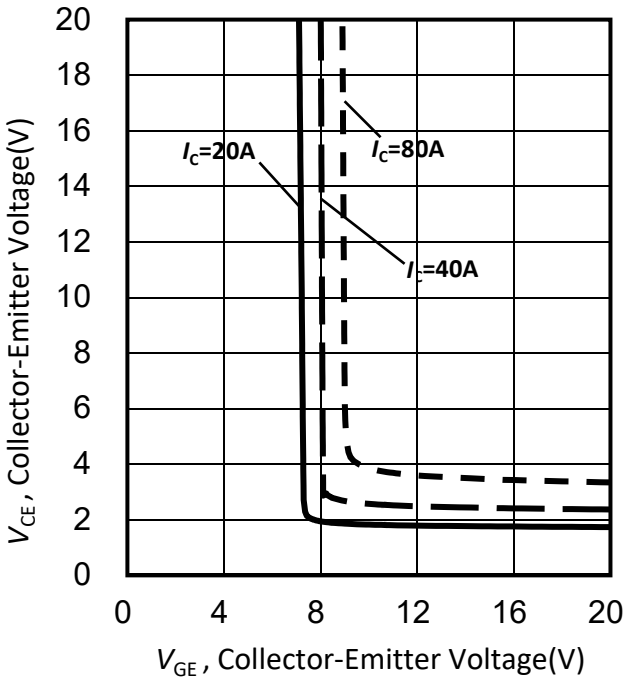


Figure 12. 典型 $V_{CE(sat)}$-$V_{GE(th)}$特性曲线/Typical $V_{CE(sat)}$-$V_{GE(th)}$ **characteristic**(T_{vj}=175℃)

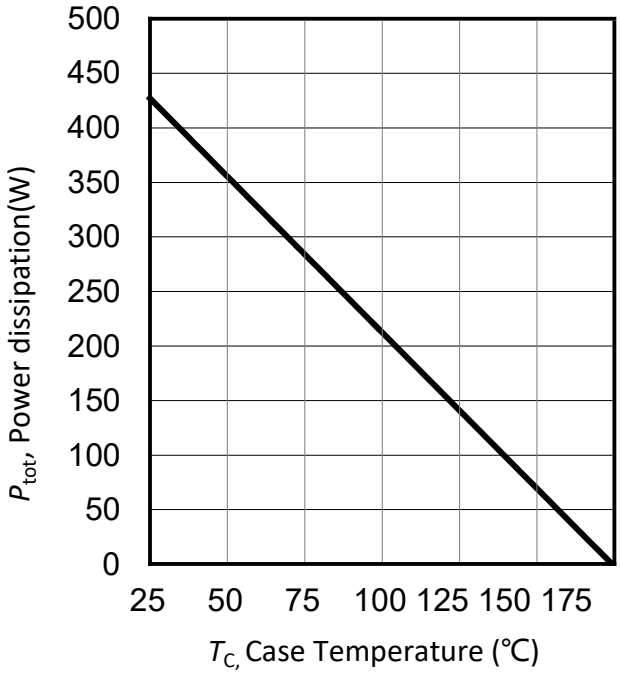


Figure 13. 功耗与外壳温度的关系/**Power dissipation as a function of case temperature**（T_{vj} ≤175℃）

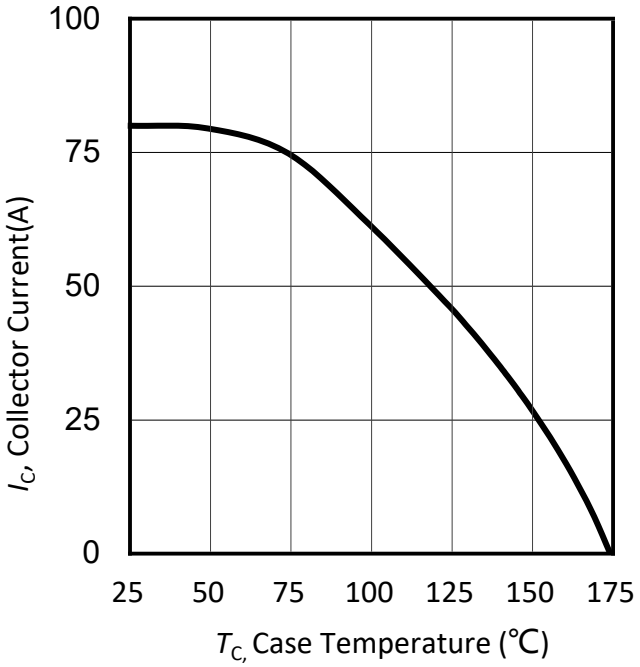


Figure 14. 集电极电流与外壳温度的关系/**Collector current as a function of case temperature(*T_{vj}*≤*175* ℃ ,*V_{GE}*≥*15V*)**

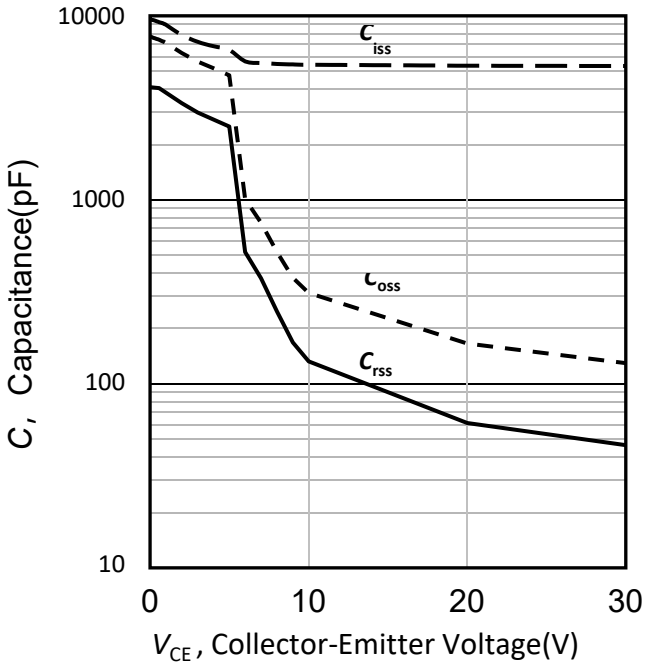


Figure 15. 典型电容与集电极-发射极电压的关系/**Typical capacitance as a function of collector -emitter voltage**
(V_{GE}=0V, *f*=1MHz)

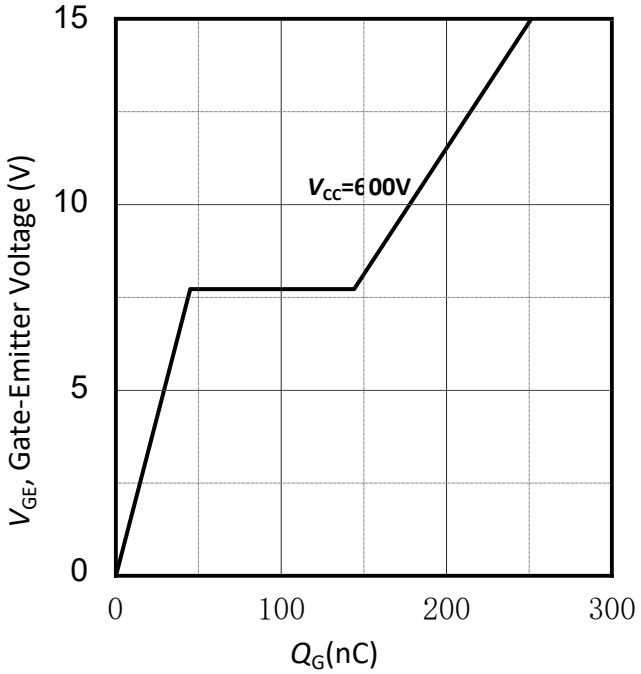


Figure 16. 典型栅极电荷/**Typical gate charge**

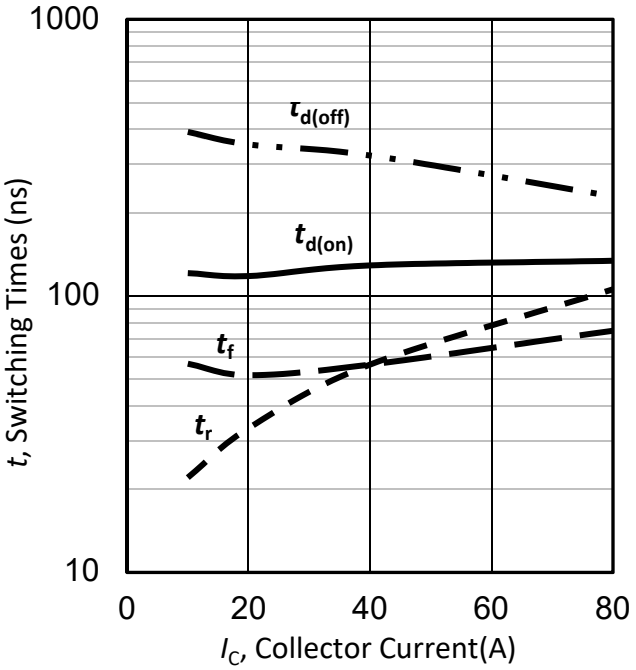


Figure 17. 典型开关时间与集电极电流的关系 **/Typical switching times as a function of collector current**
(inductive load, T_{vj}=25℃, V_{CE}=600V, V_{GE}=-0/15V, R_G=10Ω)

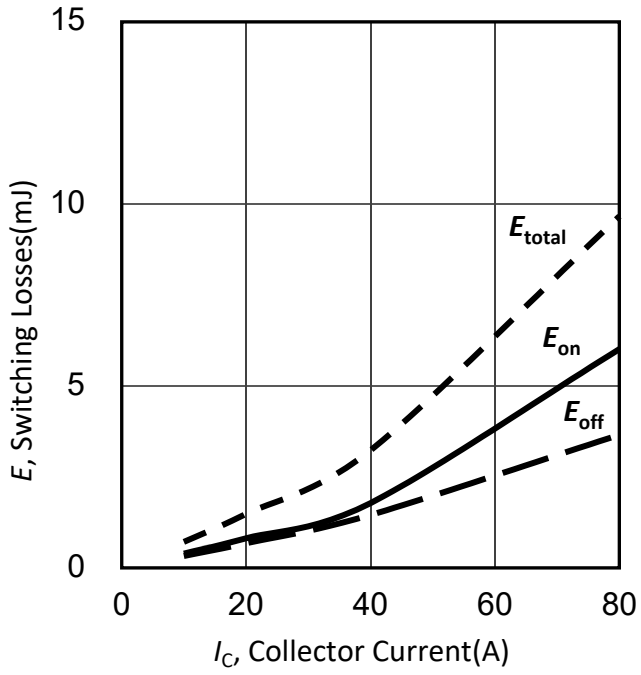


Figure 18. 典型开关时间与集电极电流的关系 **/Typical switching times as a function of collector current**
(inductive load, T_{vj}=25℃, V_{CE}=600V, V_{GE}=0/15V, R_G=10Ω)

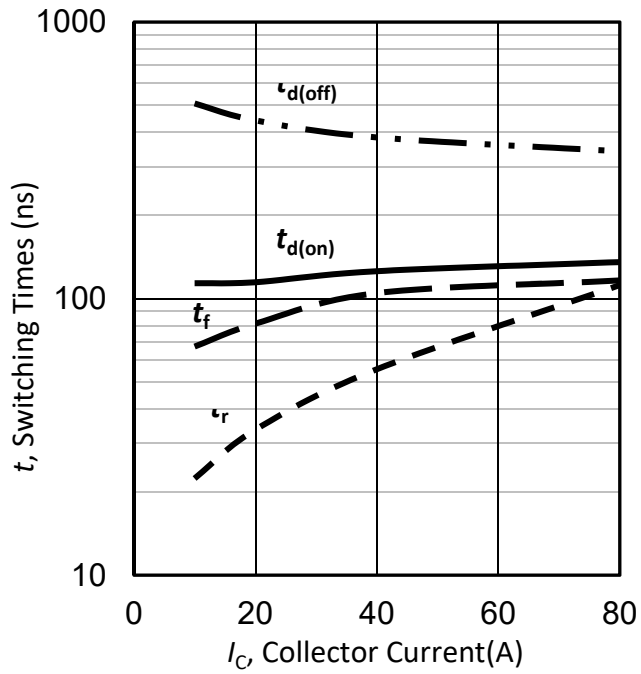


Figure 19. 典型开关时间与集电极电流的关系 **/Typical switching times as a function of collector current**
(inductive load, T_{vj}=175℃, V_{CE}=600V, V_{GE}=0/15V, R_G=10Ω)

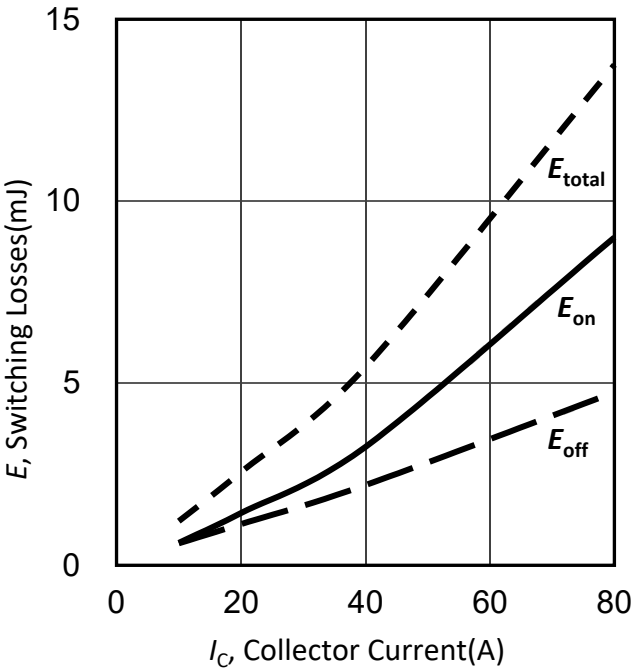


Figure 20. 典型开关时间与集电极电流的关系 **/Typical switching times as a function of collector current**
(inductive load, T_{vj}=175℃, V_{CE}=600V, V_{GE}=0/15V, R_G=10Ω)

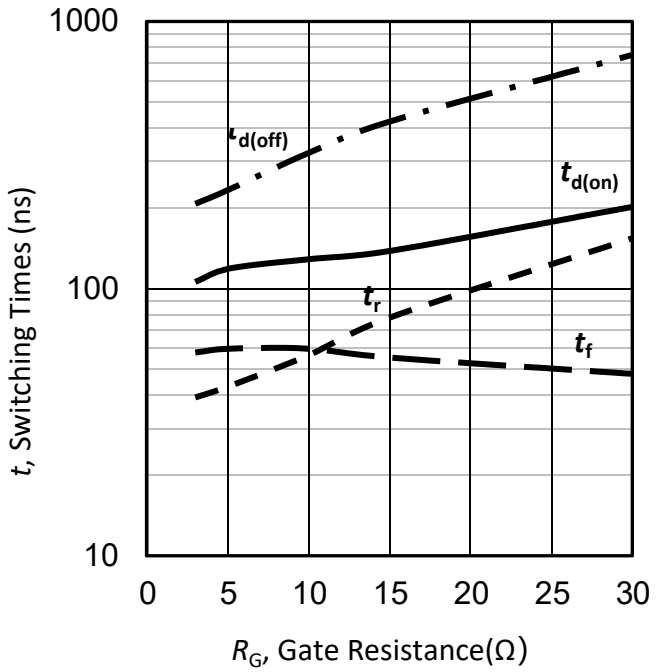


Figure 21. 典型开关时间与栅极电阻器的关系/**Typical switching times as a function of gate resistor**
(inductive load, T_{vj}=25℃, V_{CE}=600V, V_{GE}=0/15V, I_C=40A)

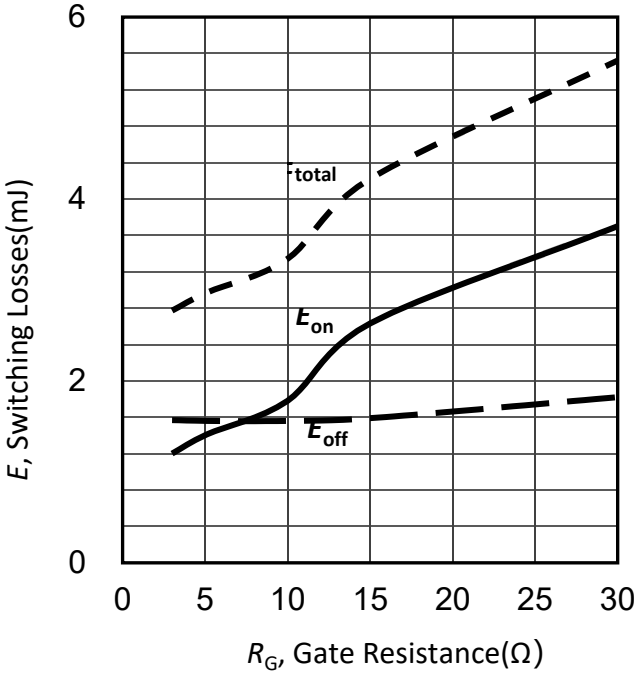


Figure 22. 典型开关时间与栅极电阻器的关系 **Typical switching energy losses as a function of gate resistor**
(inductive load, T_{vj}=25℃, V_{CE}=600V, V_{GE}=0/15V, I_C=40A)

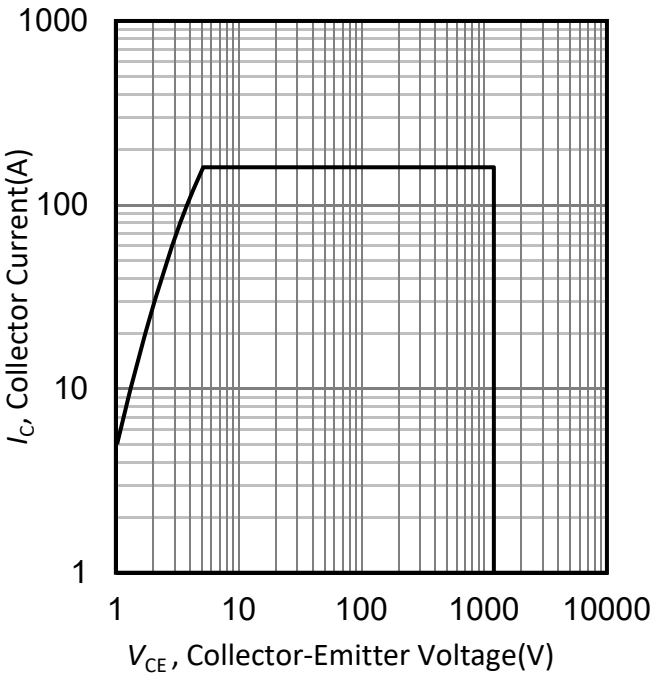


Figure 23. IGBT反向偏置安全工作区/IGBT reverse bias safe operating area
(T_{vj}≤175℃,V_{GE}=15V)

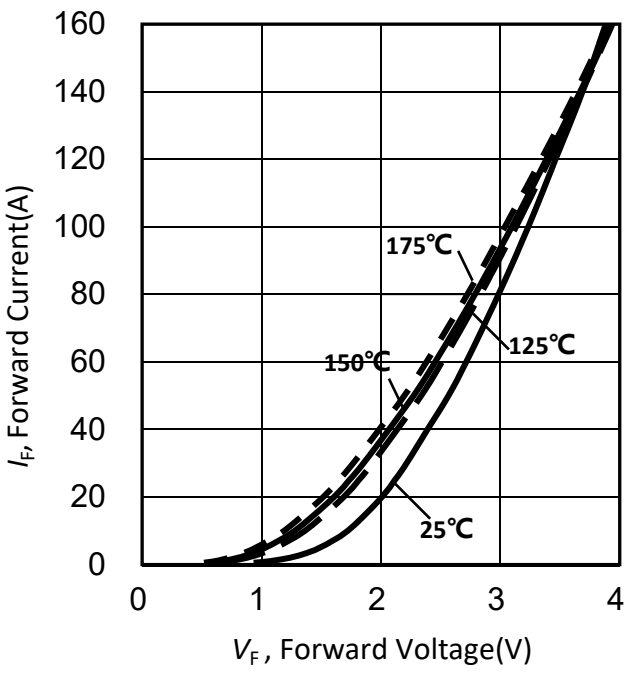


Figure 24. 典型二极管正向电流与正向电压的函数关系/**Typical diode forward current as a function of forward voltage**

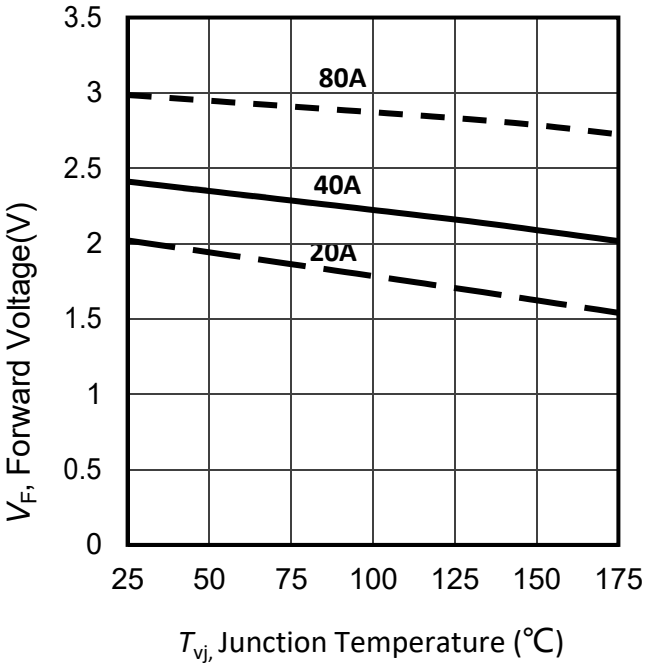


Figure 25. 典型二极管正向电压为结温函数/**Typical diode forward voltage as a function of junction temperature**

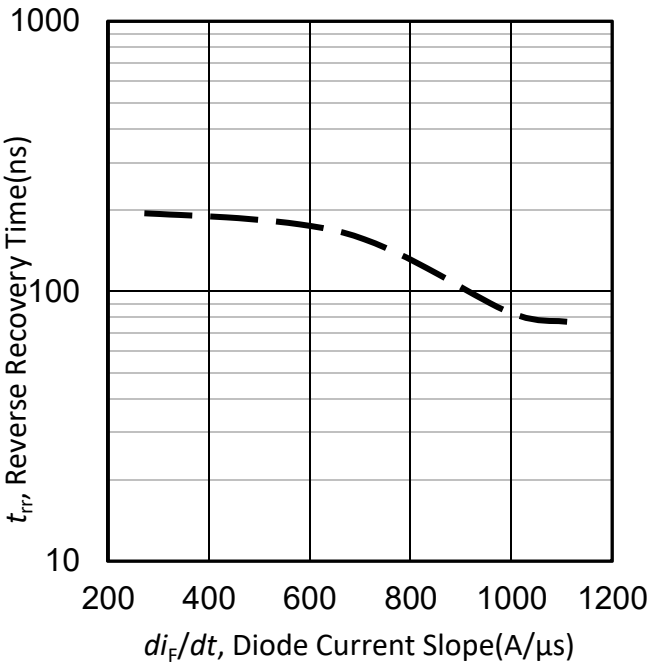


Figure 26. 典型反向恢复时间与二极管电流斜率的关系/**Typical reverse recovery time as a function of diode current slope**
(V_R=600V， I_F=40A， T_{vj}=25℃)

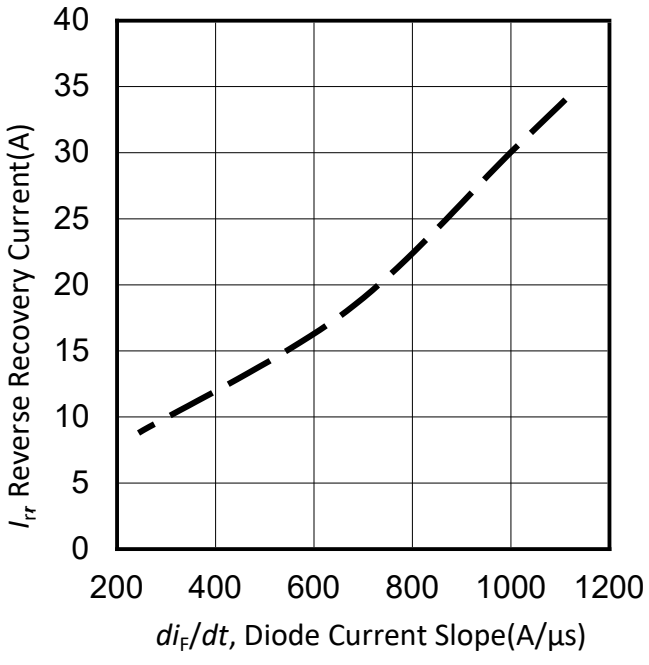


Figure 27. 典型反向恢复电流与二极管电流斜率的关系/**Typical reverse recovery current as a function of diode current slope**
(V_R=600V， I_F=40A， T_{vj}=25℃)

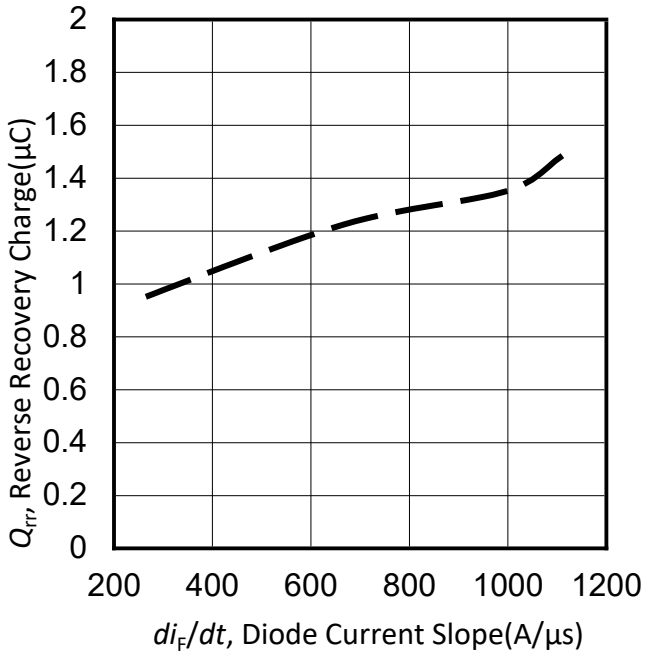


Figure 28. 典型反向恢复电荷与二极管电流斜率的关系/**Typical reverse recovery charge as a function of diode current slope**
(V_R=600V， I_F=40A， T_{vj}=25℃)

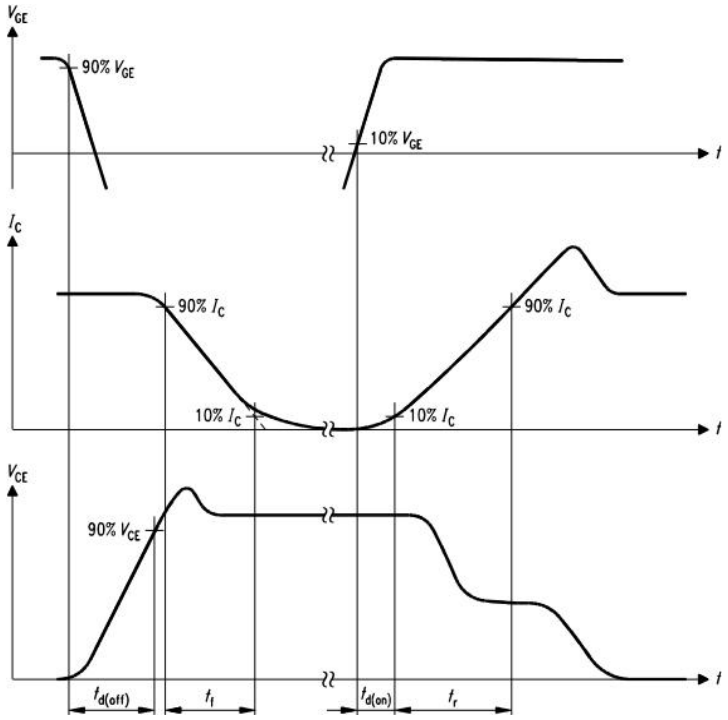


Figure A. 开关时间的定义/Definition of switching times

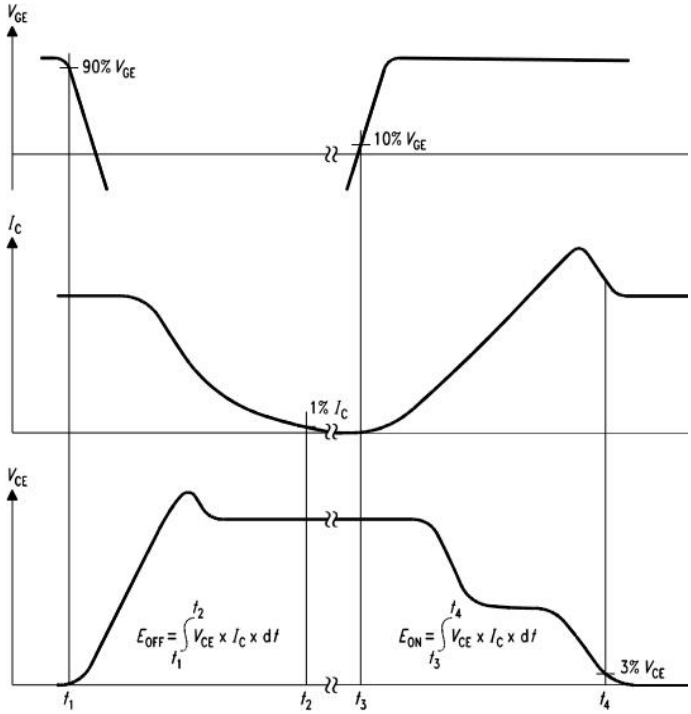


Figure B. 开关损耗的定义/Definition of switching losses

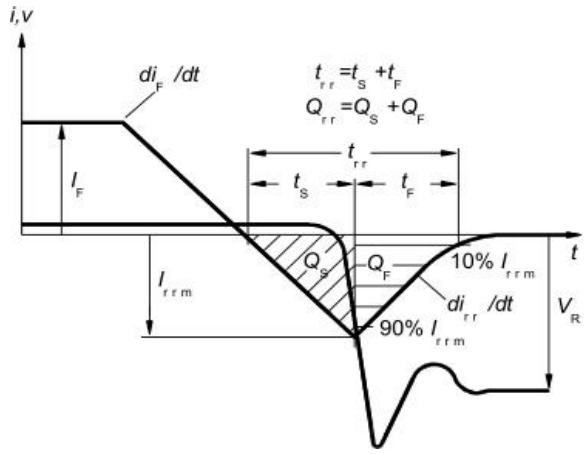


Figure C. 二极管开关特性的定义/Definition of diodes switching characteristics

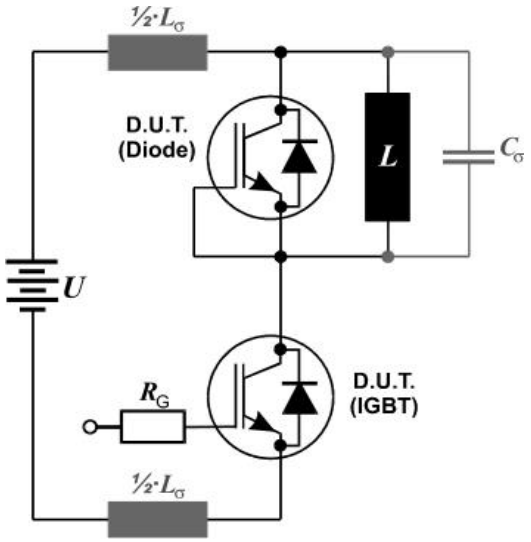


Figure D. 开关测试电路/Switching test circuit

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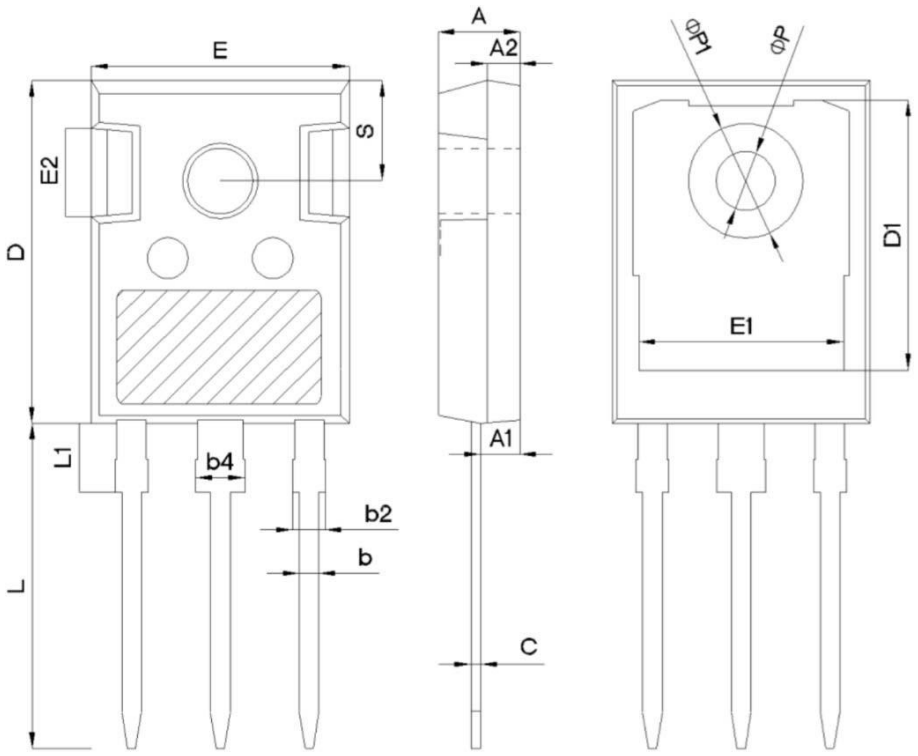

SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2 21	2 41	2 61
A2	1.85	2.00	2. 15
b	1. 11	1.21	1.36
b_2	1.91	2.01	2.21
b_4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16 25	16 55	16 85
E	15.50	15.80	16. 10
E1	13 00	13 30	13 60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ΦP	3.40	3.60	3.80
ΦP1	-	-	7.30
S	6. 15BSC		

修订历史/Revision History：

修订 /Revision	主题（自上次修订以来的主要变化） /Subjects (major changes since last revision)	日期 /Date
1.0	Initial Version	2022-06
2.0	Update the English and Chinese versions	2023-04

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