

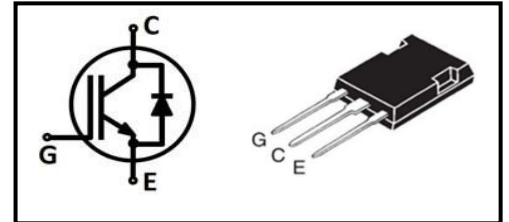
特征/Features

- 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

型号/Type	打标/Marking	封装/Package
QMQ75N120E	QMQ75N120E	TO-247-3L Plus

应用领域/Applications

- 工业不间断电源/Industrial UPS
- 充电器/Charger
- 储能/Energy Storage
- 焊接/Welding



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} $T_C=25^\circ C$ $T_C=134.5^\circ C$	I_C	150 75	A
集电极脉冲电流 Pulsed collector current, t_p limited by T_{jmax1}	I_{Cpuls}	300	
二极管正向电流 Diode forward current, limited by T_{jmax} $T_C=25^\circ C$ $T_C=100^\circ C$	I_F	150 75	
二极管脉冲电流 Diode pulsed current, t_p limited by T_{jmax1}	I_{Fpuls}	300	
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 ($t_p \leq 10\mu s, D < 0.01$)		± 30	
耗散功率 Power dissipation $T_C=25^\circ C$ $T_C=100^\circ C$	P_{tot}	833	W
		416	
工作结温 Operating junction temperature	T_j	-40~175	°C
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	

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

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}	-	-	-	0.18	K/W
二极管结-外壳热阻 Diode thermal resistance, junction-case	R_{thJCD}	-	-	-	0.30	
结-环境热阻 Thermal Resistance, junction-ambient	R_{thJA}	-	-	-	40	

电学特性/Electrical Characteristics

静态特性/Static Characteristics (at $T_j=25^\circ\text{C}$ 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	$V_{CE(sat)}$	$V_{GE}=15V, I_C=75A$ $T_j=25^\circ\text{C}$	-	1.58	1.90	
		$T_j=125^\circ\text{C}$	-	2.09	-	
		$T_j=150^\circ\text{C}$	-	2.21	-	
阈值电压 G-E threshold voltage	$V_{GE(th)}$	$I_C=2.4mA,$ $V_{CE}=V_{GE}$	5.0	5.6	6.2	
集电极-发射极漏电流 C-E leakage current	I_{CES}	$V_{CE}=1200V,$ $V_{GE}=0V$ $T_j=25^\circ\text{C}$	-	-	0.1	mA
		$T_j=175^\circ\text{C}$	-	-	4.0	
栅极-发射极漏电流 G-E leakage current	I_{GES}	$V_{CE}=0V,$ $V_{GE}=20V$	-	-	250	nA
跨导 Transconductance	g_{FS}	$V_{CE}=20V,$ $I_C=75A$	-	30	-	S

动态特性/Dynamic Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
输入电容 Input capacitance	C_{ies}	$V_{CE}=25V,$ $V_{GE}=0V,$ $f=1MHz$	-	11533	-	pF
输出电容 Output capacitance	C_{oes}		-	253	-	
反馈电容 Reverse transfer capacitance	C_{res}		-	60	-	
栅电荷 Gate charge	Q_G	$V_{CC}=600V,$ $I_C=75A, V_{GE}=15V$	-	750	-	nC
内部发射极电感从外壳测量5毫米 (0.197英寸) Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13	-	nH

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	$t_{d(on)}$	$T_j=25^{\circ}C,$ $V_{CC}=600V,$ $I_C=75A,$ $V_{GE}=0V/15V,$ $R_G=10\Omega,$ <i>Inductive load</i>	-	151	-	ns	
上升时间 Rise time	t_r		-	86	-		
关断延迟时间 Turn-off delay time	$t_{d(off)}$		-	488	-		
下降时间 Fall time	t_f			-	55.6	-	
开通损耗 Turn-on energy	E_{on}			-	4.97	-	mJ
关断损耗 Turn-off energy	E_{off}			-	3.42	-	
开关损耗 Total switching energy	E_{ts}			-	8.39	-	
开通延迟时间 Turn-on delay time	$t_{d(on)}$		$T_j=175^{\circ}C,$ $V_{CC}=600V,$ $I_C=75A,$ $V_{GE}=0V/15V,$ $R_G=10\Omega,$ <i>Inductive load</i>	-	145	-	ns
上升时间 Rise time	t_r			-	86	-	
关断延迟时间 Turn-off delay time	$t_{d(off)}$	-		525	-		
下降时间 Fall time	t_f			-	81.2	-	
开通损耗 Turn-on energy	E_{on}			-	5.21	-	mJ
关断损耗 Turn-off energy	E_{off}			-	3.98	-	
开关损耗 Total switching energy	E_{ts}			-	9.19	-	

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	$V_{GE}=0V, I_F=75A$ $T_j=25^{\circ}C$	-	2.4	-	V
		$T_j=150^{\circ}C$	-	2.2	-	
		$T_j=175^{\circ}C$	-	2.1	-	
反向恢复时间 Diode reverse recovery time	t_{rr}	$T_j=25^{\circ}C,$ $V_R=600V,$ $I_F=75A,$ $di_F/dt=500A/\mu s$	-	255	-	ns
反向恢复电荷 Diode reverse recovery charge	Q_{rr}		-	3.0	-	μC
反向恢复峰值电流 Diode peak reverse recovery current	I_{rrm}		-	25.5	-	A
反向恢复时间 Diode reverse recovery time	t_{rr}	$T_j=175^{\circ}C,$ $V_R=600V, I_F=75A,$ $di_F/dt=500A/\mu s$	-	271	-	ns
反向恢复电荷 Diode reverse recovery charge	Q_{rr}		-	3.2	-	μC
反向恢复峰值电流 Diode peak reverse recovery current	I_{rrm}		-	26.5	-	A

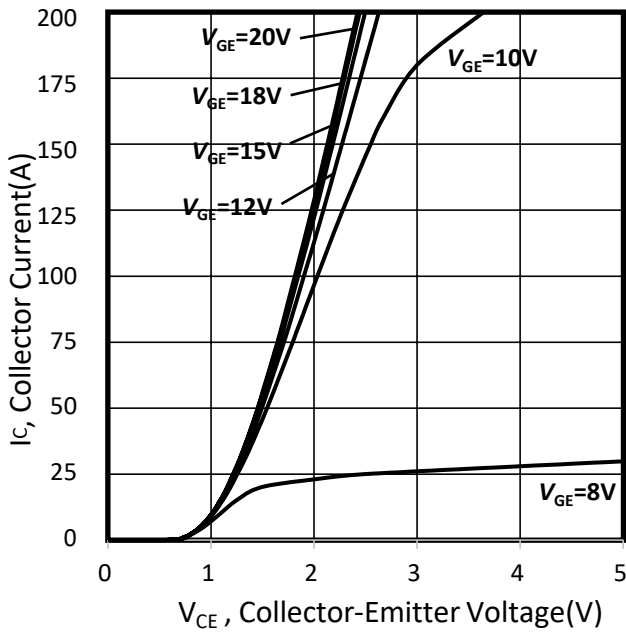


Figure 1. 典型输出特性/Typical output characteristic
($T_j=25^{\circ}\text{C}$)

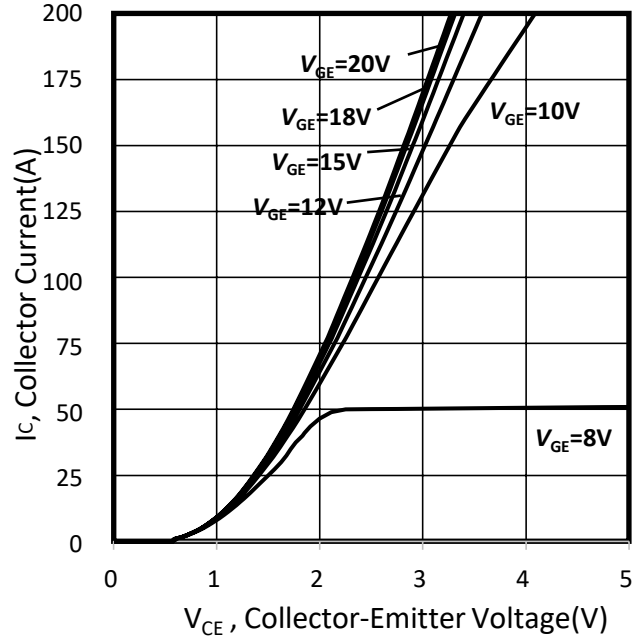


Figure 2. 典型输出特性/Typical output characteristic
($T_j=125^{\circ}\text{C}$)

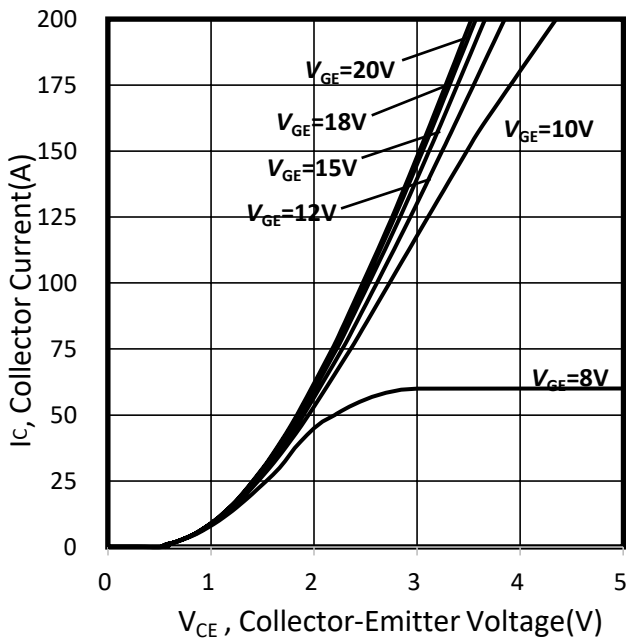


Figure 3. 典型输出特性/Typical output characteristic
($T_j=150^{\circ}\text{C}$)

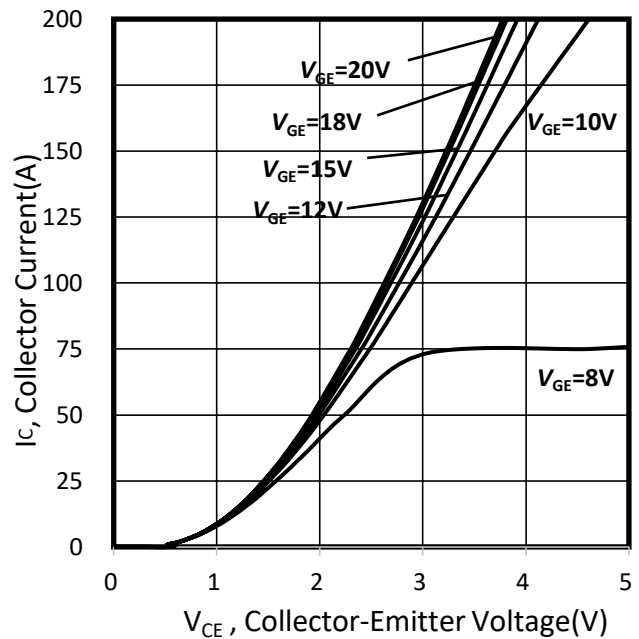


Figure 4. 典型输出特性/Typical output characteristic
($T_j=175^{\circ}\text{C}$)

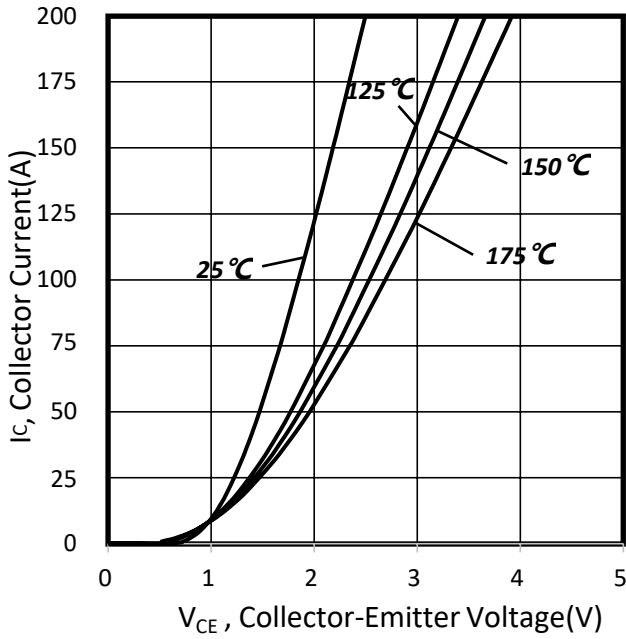


Figure 5. 典型 $V_{CE(sat)}$ - I_c 特性曲线/Typical $V_{CE(sat)}$ - I_c characteristic ($V_{GE}=15V$)

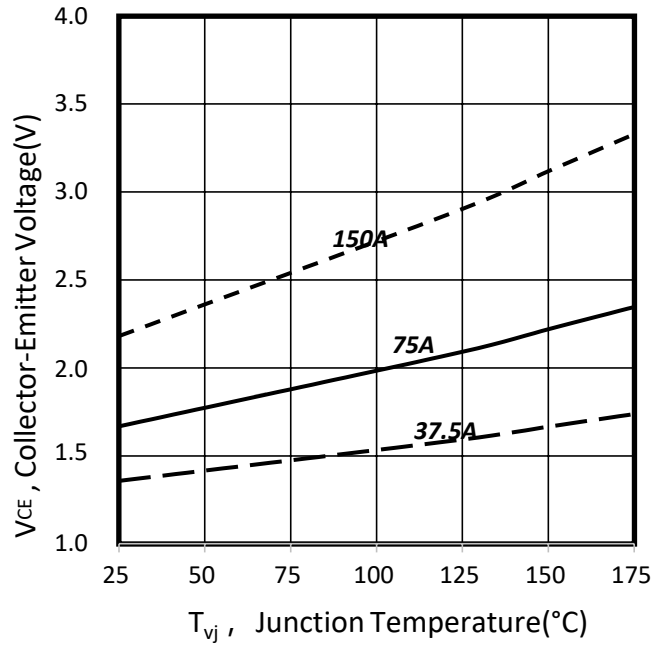


Figure 6. 典型 $V_{CE(sat)}$ - T_j 特性曲线/Typical $V_{CE(sat)}$ - T_j characteristic ($V_{GE}=15V$)

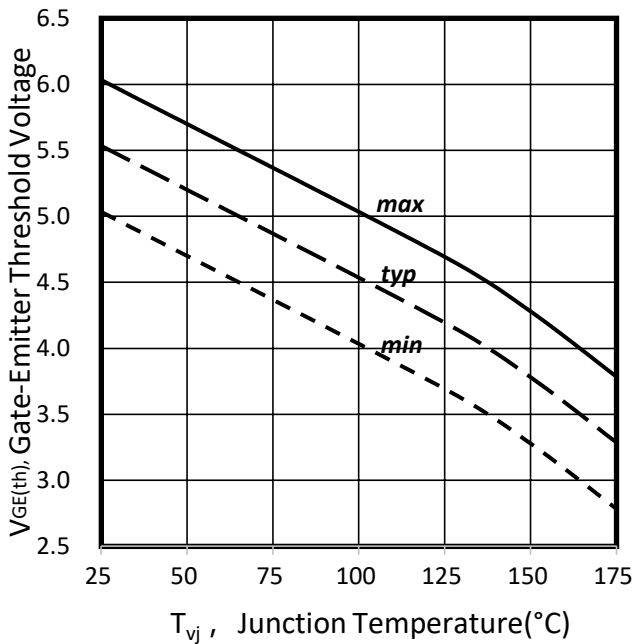


Figure 7. 典型 $V_{GE(th)}$ - T_j 特性曲线 / $V_{GE(th)}$ - T_j characteristic ($I_c=2.4mA$)

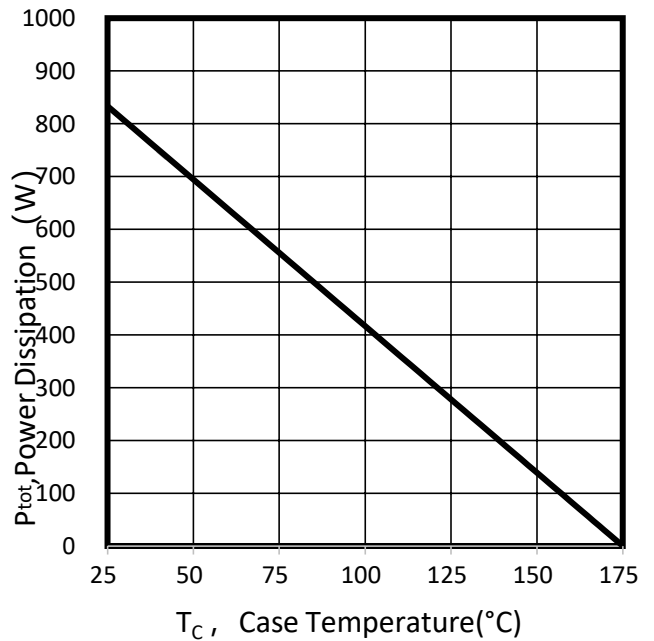


Figure 8. 功耗与外壳温度的关系/Power dissipation as a function of case temperature ($T_j \leq 175^\circ C$)

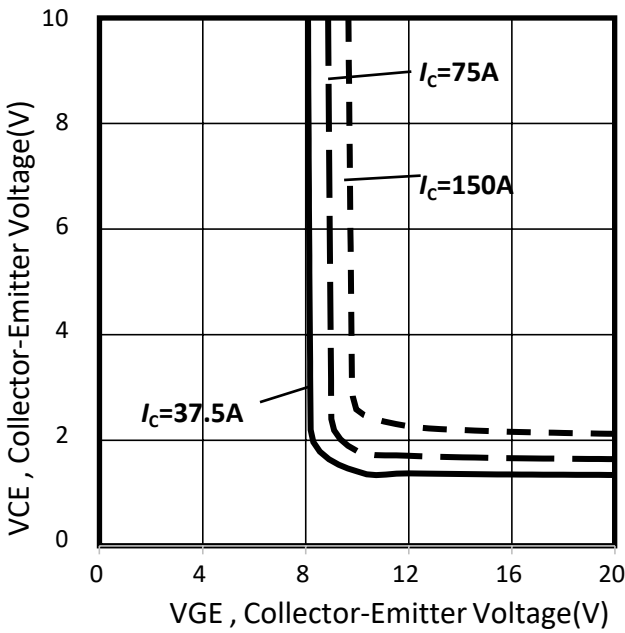


Figure 9. 典型 $V_{CE(sat)} - V_{GE(th)}$ 特性曲线
/Typical $V_{CE(sat)} - V_{GE(th)}$ characteristic
($T_{vj}=25^{\circ}C$)

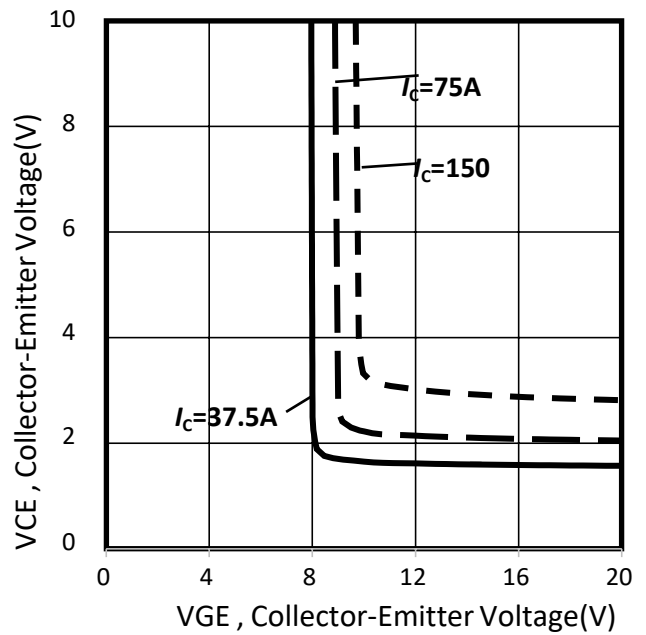


Figure 10. 典型 $V_{CE(sat)} - V_{GE(th)}$ 特性曲线/Typical
 $V_{CE(sat)} - V_{GE(th)}$ characteristic
($T_{vj}=125^{\circ}C$)

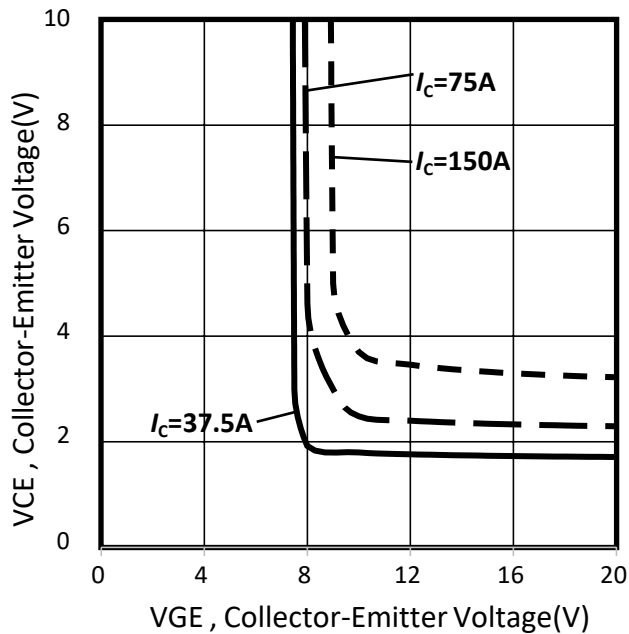


Figure 11. 典型 $V_{CE(sat)} - V_{GE(th)}$ 特性曲线/Typical
 $V_{CE(sat)} - V_{GE(th)}$ characteristic
($T_{vj}=150^{\circ}C$)

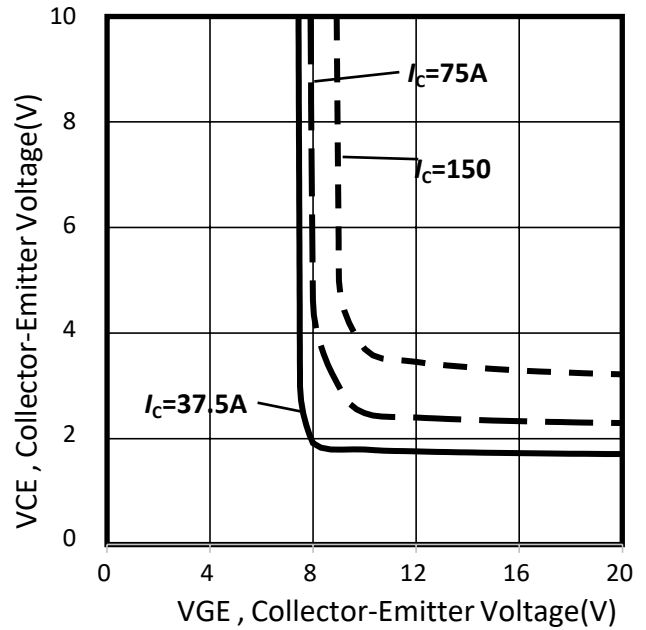


Figure 12. 典型 $V_{CE(sat)} - V_{GE(th)}$ 特性曲线/Typical $V_{CE(sat)} - V_{GE(th)}$ characteristic
($T_{vj}=175^{\circ}C$)

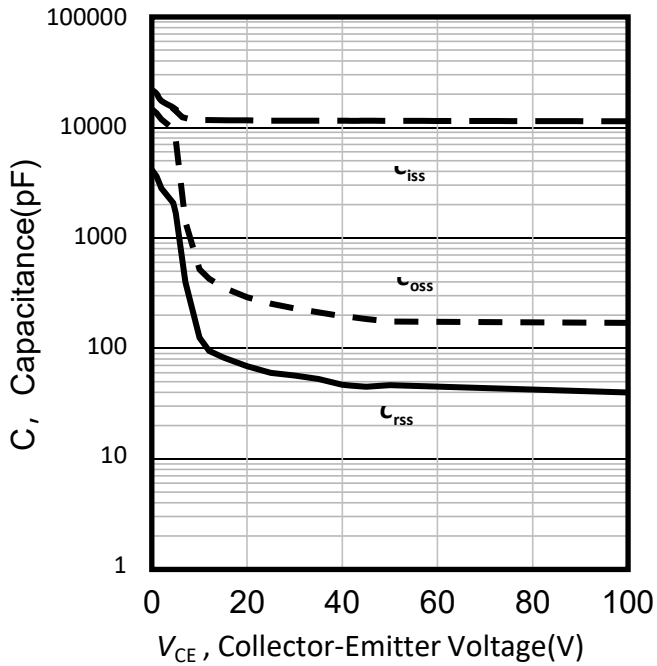


Figure 13. 典型电容与集电极-发射极电压的关系
/Typical capacitance as a function of collector-emitter voltage ($V_{GE}=0V$, $f=1MHz$)

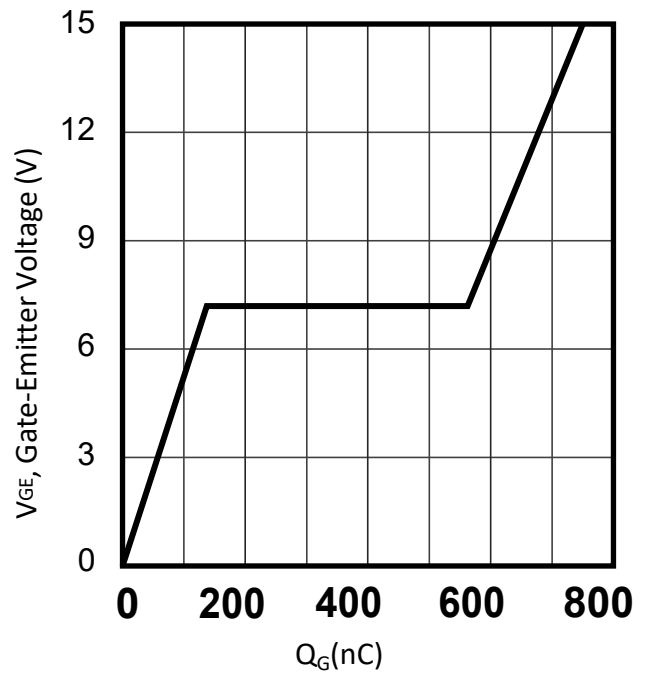


Figure 14. 典型栅极电荷
/Typical gate charge ($V_{CE}=600V$)

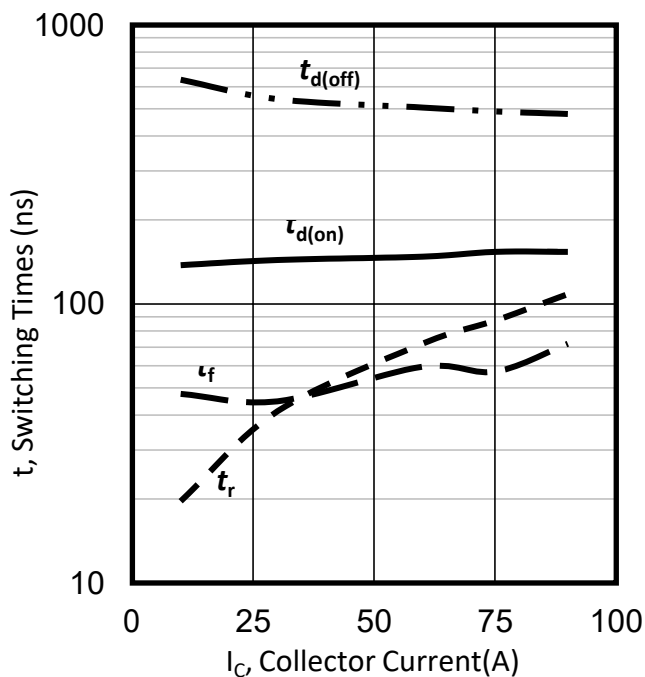


Figure 15. 典型开关时间与集电极电流的关系
/Typical switching times as a function of collector current (inductive load, $T_{vj}=25^{\circ}C$, $V_{CE}=600V$, $V_{GE}=0/15V$, $R_G=10\Omega$)

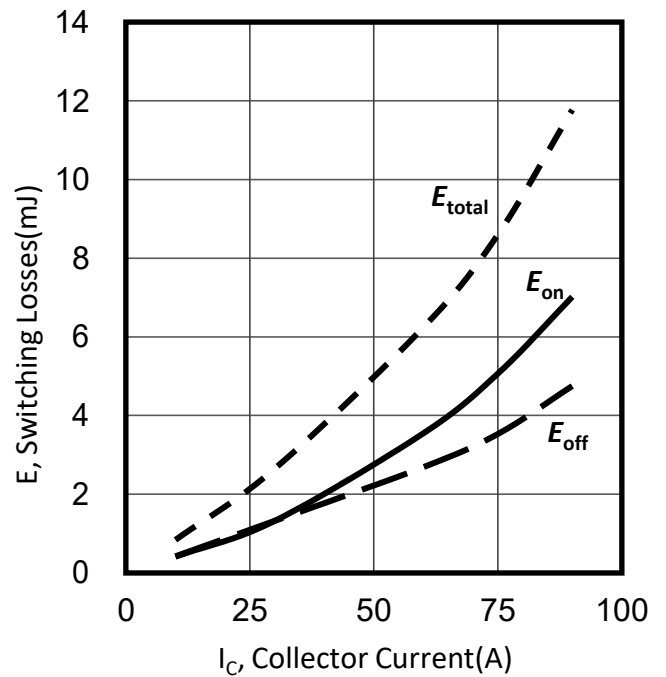


Figure 16. 典型开关时间与集电极电流的关系
/Typical switching times as a function of collector current (inductive load, $T_{vj}=25^{\circ}C$, $V_{CE}=600V$, $V_{GE}=0/15V$, $R_G=10\Omega$)

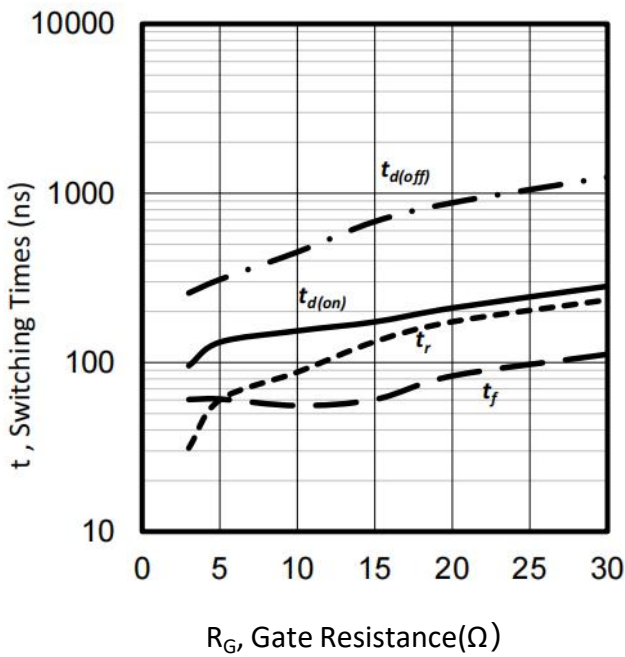


Figure 17. 典型开关时间与栅极电阻器的关系
/Typical switching times as a function of gate resistor
 (inductive load, $T_{vj}=25^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$)

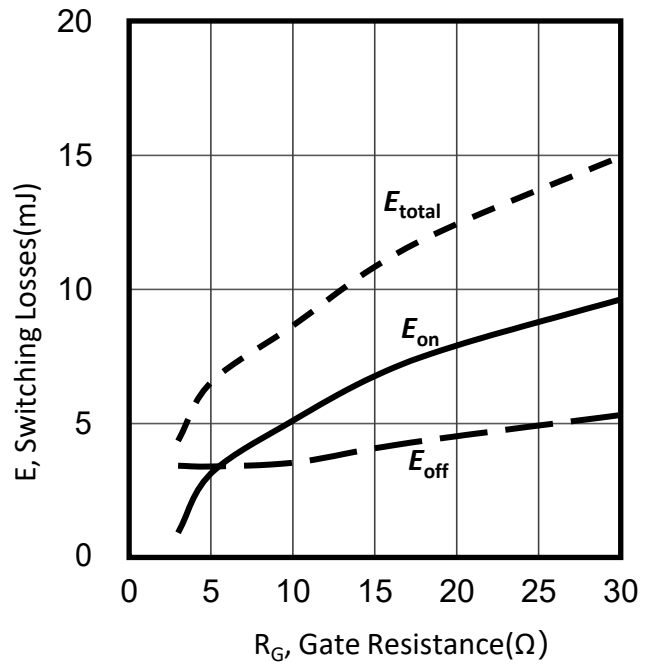


Figure 18. 典型开关能量损耗与栅极电阻器的关系
/Typical switching energy losses as a function of gate resistor
 (inductive load, $T_{vj}=25^{\circ}\text{C}$,
 $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$)

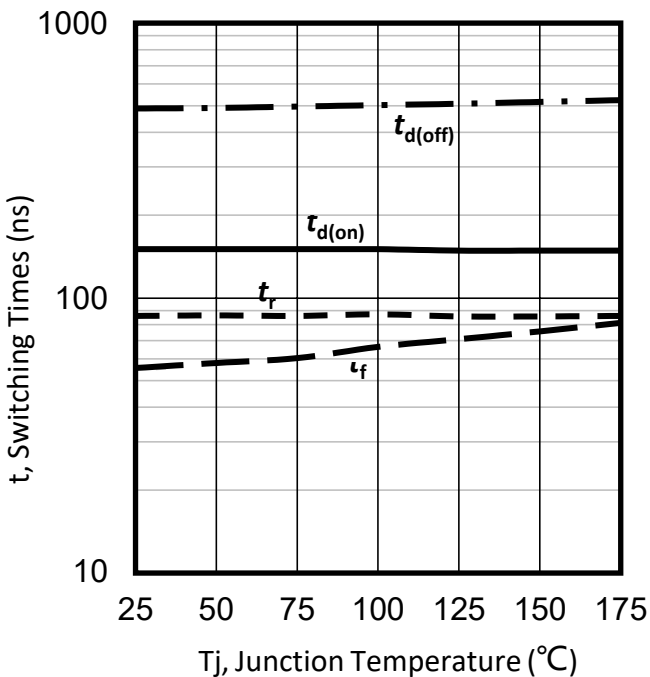


Figure 19. 典型开关时间与结温的关系
/Typical switching times as a function of junction temperature (inductive load,
 $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$,
 $R_G=10\Omega$)

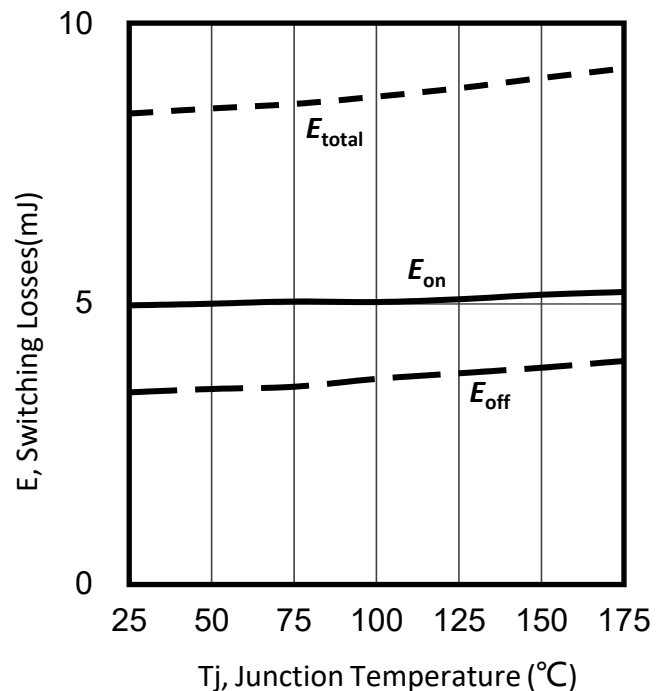


Figure 20. 典型开关能量损耗与结温的关系
/Typical switching energy losses as a function of junction temperature (inductive load,
 $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$,
 $R_G=10\Omega$)

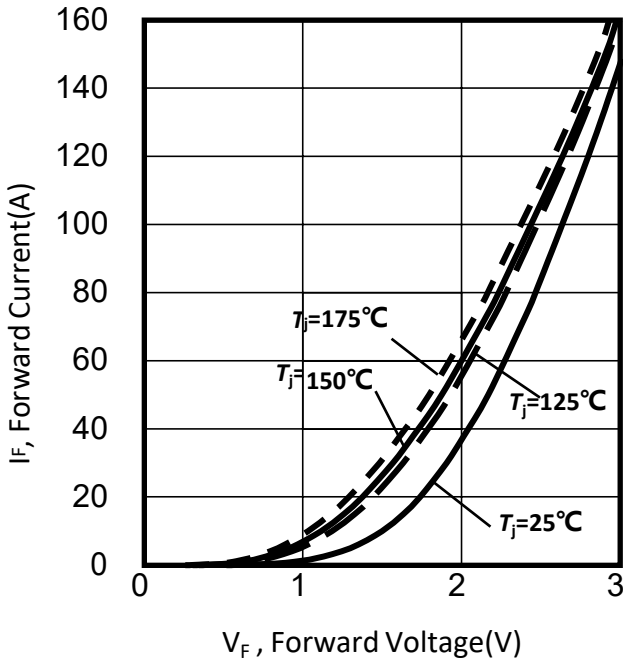


Figure 21. 典型二极管正向电流与正向电压的函数关系 / Typical diode forward current as a function of forward voltage

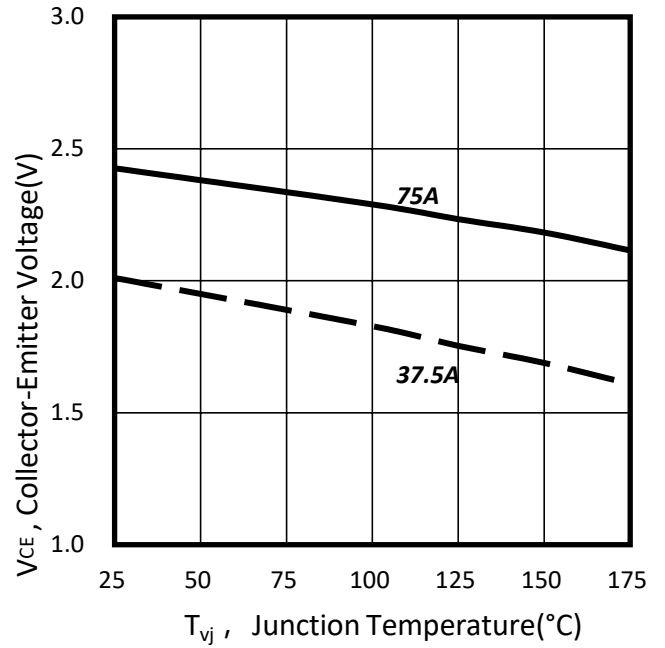


Figure 22. 典型二极管正向电压与结温的关系 / Typical diode forward voltage as a function of junction temperature

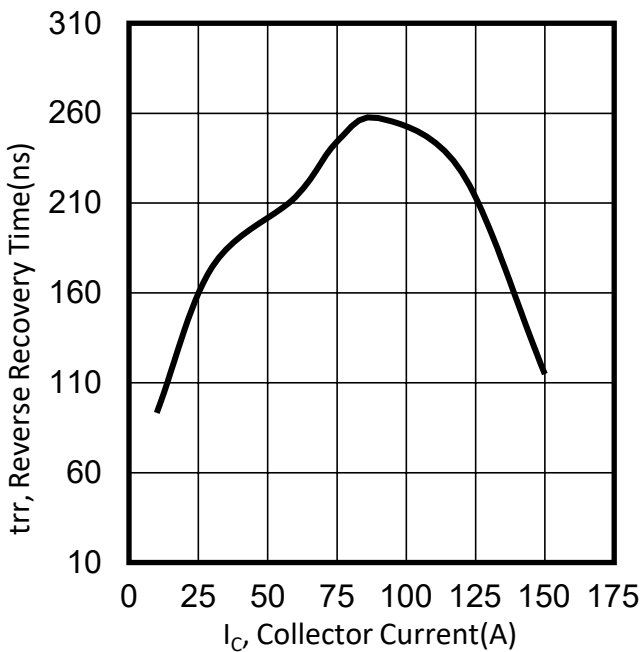


Figure 23. 典型反向恢复时间与集电极电流的关系 / Typical reverse recovery time as a function of collector current (inductive load, $T_{vj}=25^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$)

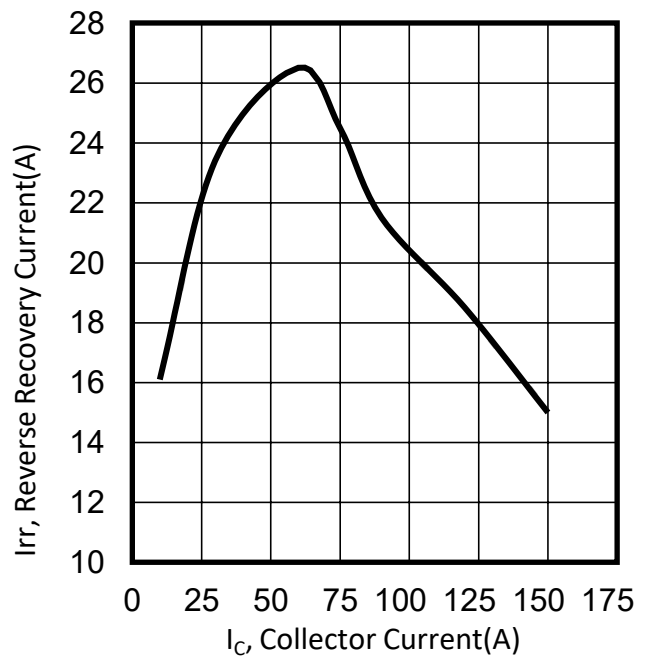


Figure 24. 典型反向恢复电流与集电极电流的函数关系 / Typical reverse recovery current as a function of collector current (inductive load, $T_{vj}=25^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$)

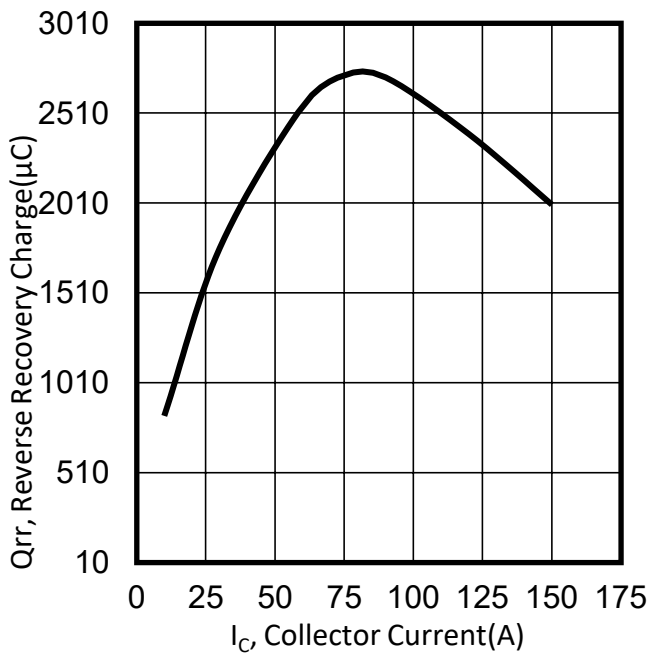


Figure 25. 典型反向恢复电荷与集电极电流的函数关系/Typical reverse recovery charge as a function of collector current (inductive load, $T_{vj}=25^{\circ}C$, $V_{CE}=600V$, $V_{GE}=0/15V$, $R_G=10\Omega$)

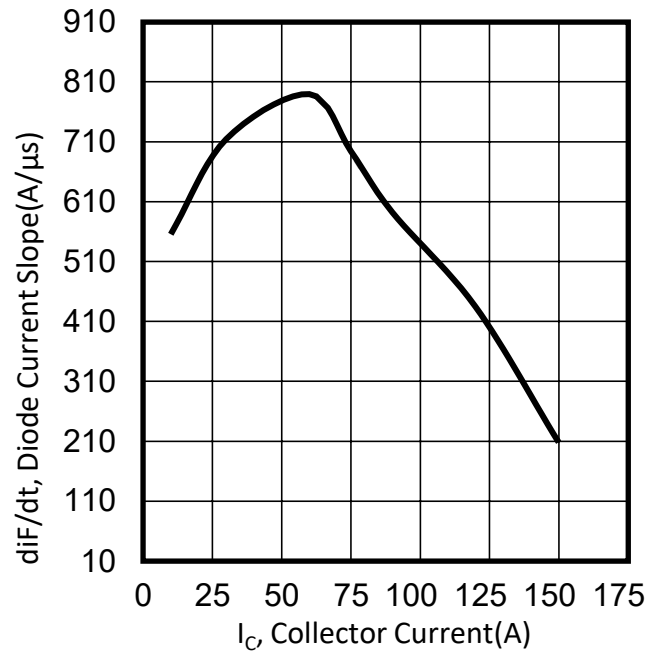


Figure 26. 典型二极管电流斜率与集电极电流的函数关系/Typical diode current slope as a function of collector current (inductive load, $T_{vj}=25^{\circ}C$, $V_{CE}=600V$, $V_{GE}=0/15V$, $R_G=10\Omega$)

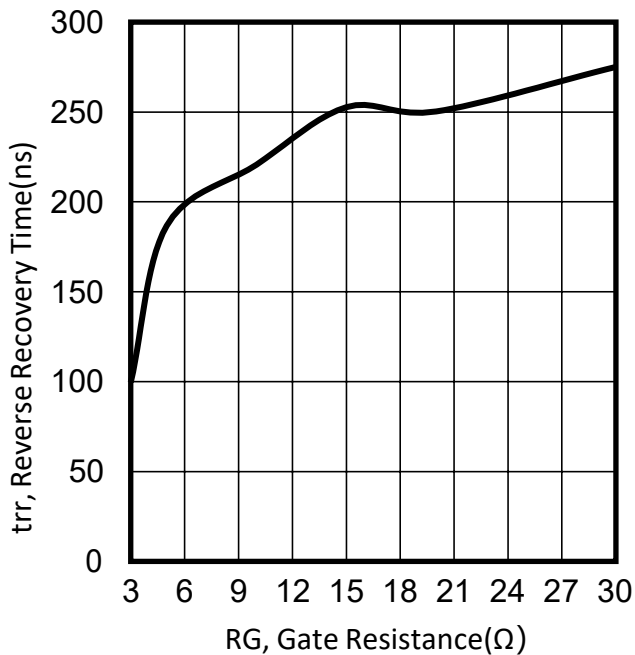


Figure 27. 典型反向恢复时间与栅极电阻器的关系/Typical reverse recovery time as a function of gate resistor (inductive load, $T_{vj}=25^{\circ}C$, $V_{CE}=600V$, $V_{GE}=0/15V$, $I_C=75A$)

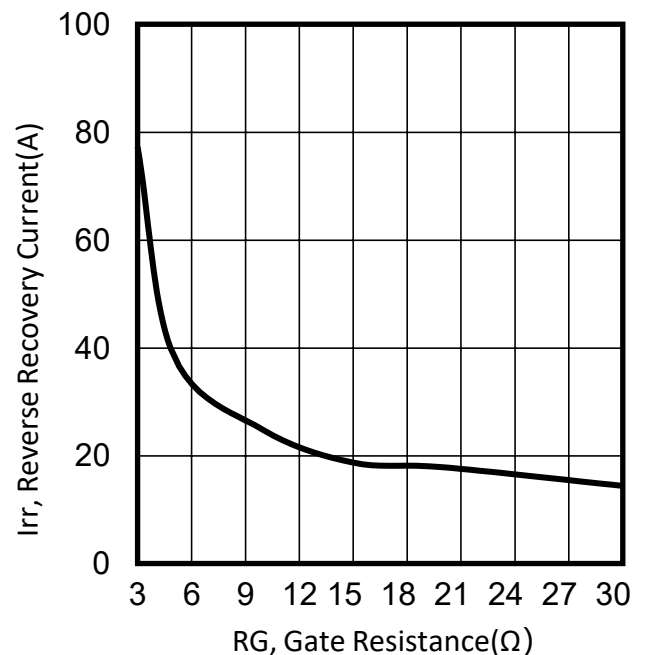


Figure 28. 典型反向恢复电流与栅极电阻器的关系/Typical reverse recovery current as a function of gate resistor (inductive load, $T_{vj}=25^{\circ}C$, $V_{CE}=600V$, $V_{GE}=0/15V$, $I_C=75A$)

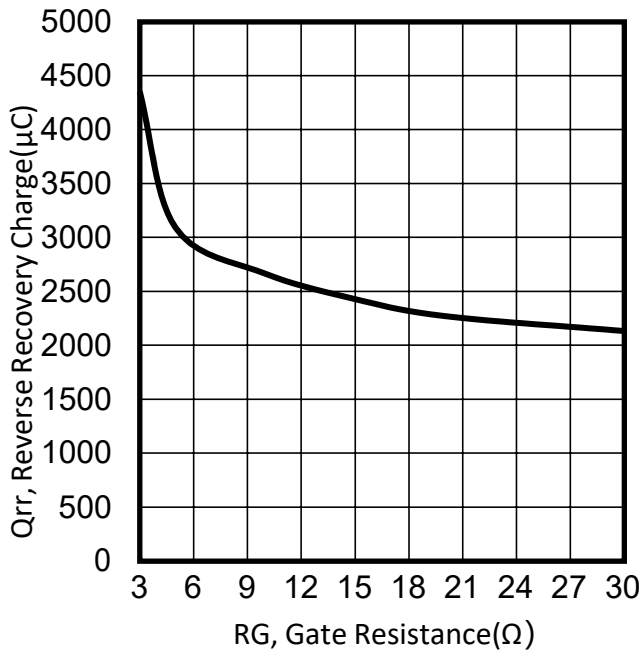


Figure 29. 典型反向恢复电荷与栅极电阻的函数关系
/Typical reverse recovery charge as a function of gate resistor
 (inductive load, $T_{vj}=25^{\circ}\text{C}$
 $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$)

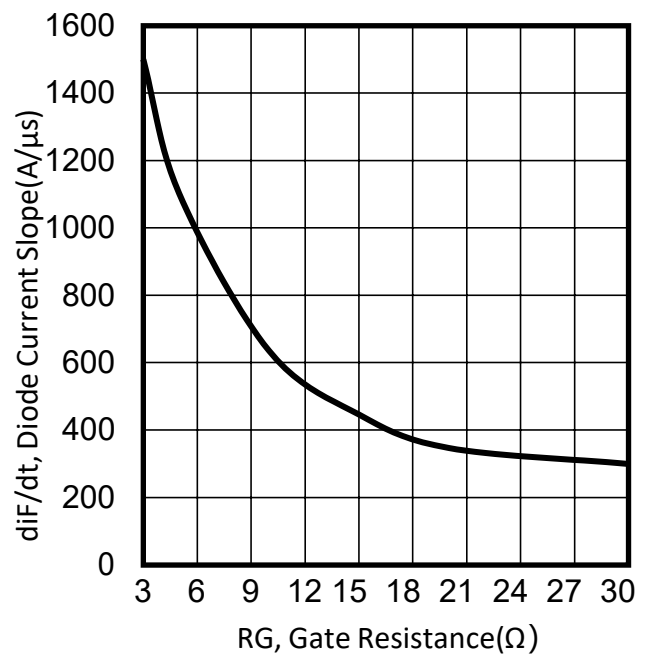


Figure 30. 典型二极管电流斜率为栅极电阻器的作用
/Typical diode current slope as a function of gate resistor (inductive load, $T_{vj}=25^{\circ}\text{C}$ $V_{CE}=600\text{V}$,
 $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$)

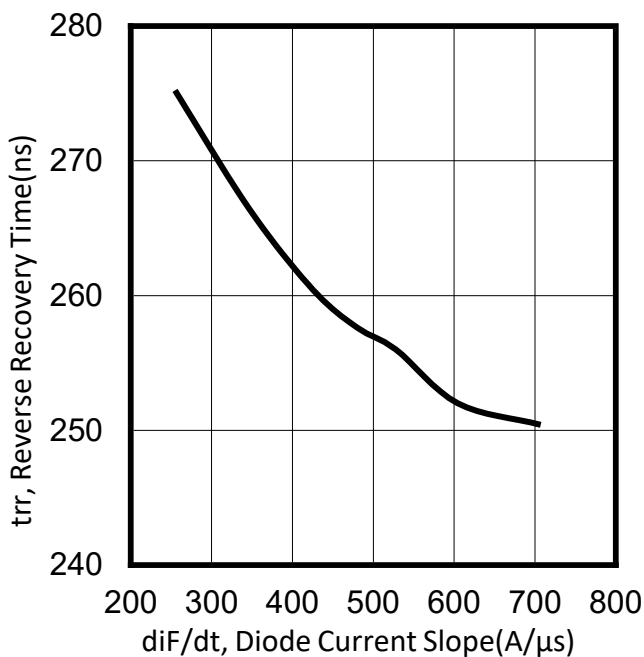


Figure 31. 典型反向恢复时间与二极管电流斜率的关系
/Typical reverse recovery time as a function of diode current slope
 ($V_R=600\text{V}$, $I_F=75\text{A}$ $T_{vj}=25^{\circ}\text{C}$)

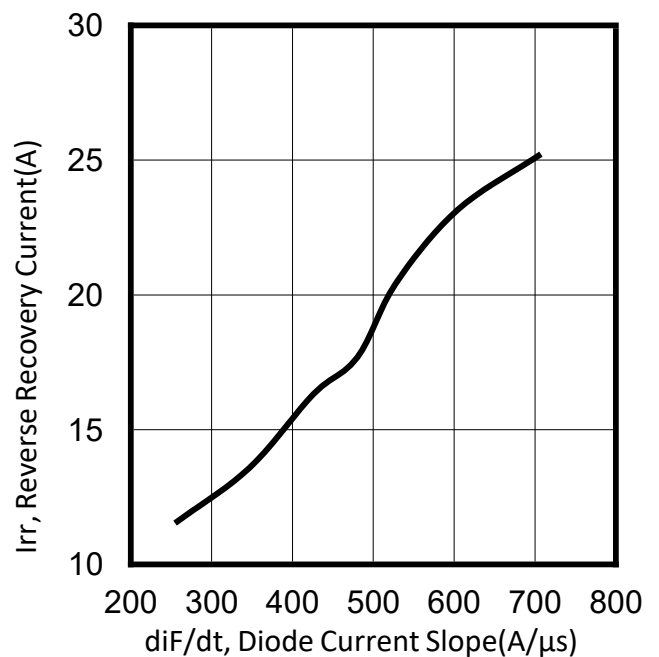


Figure 32. 典型反向恢复电流与二极管电流斜率的关系
/Typical reverse recovery current as a function of diode current slope
 ($V_R=600\text{V}$, $I_F=75\text{A}$ $T_{vj}=25^{\circ}\text{C}$)

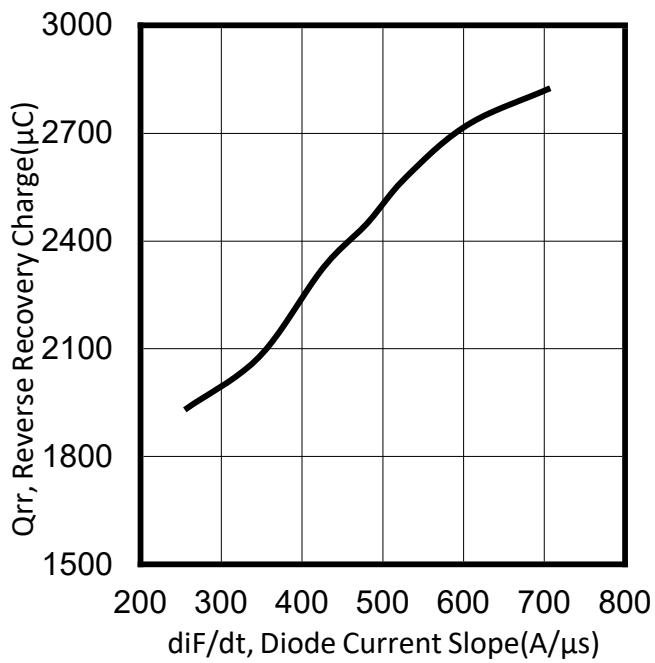


Figure 33. 典型反向恢复电荷与二极管电流斜率的关系/Typical reverse recovery charge as a function of diode current slope
 (V_R=600V, I_F=75A T_{vj}=25°C)

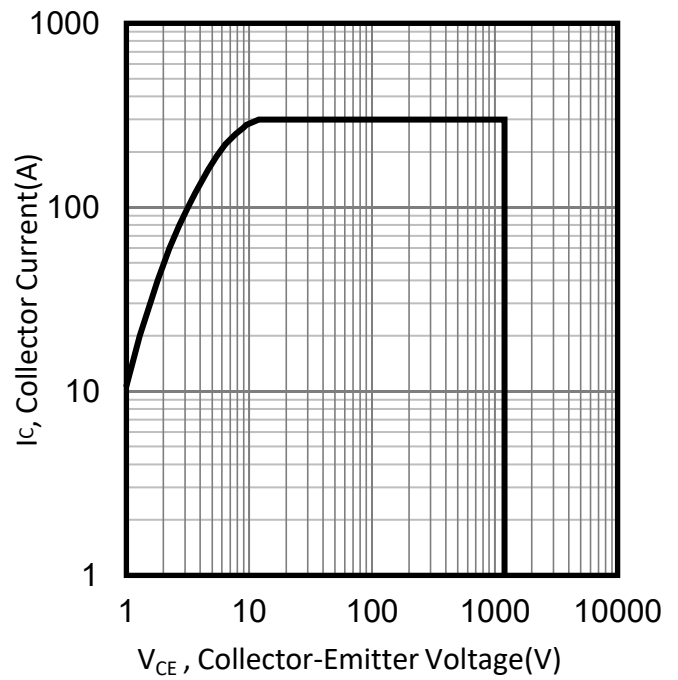


Figure 34. IGBT反向偏置安全工作区/IGBT reverse bias safe operating area
 (T_{vj}≤175°C, V_{GE}=15V)

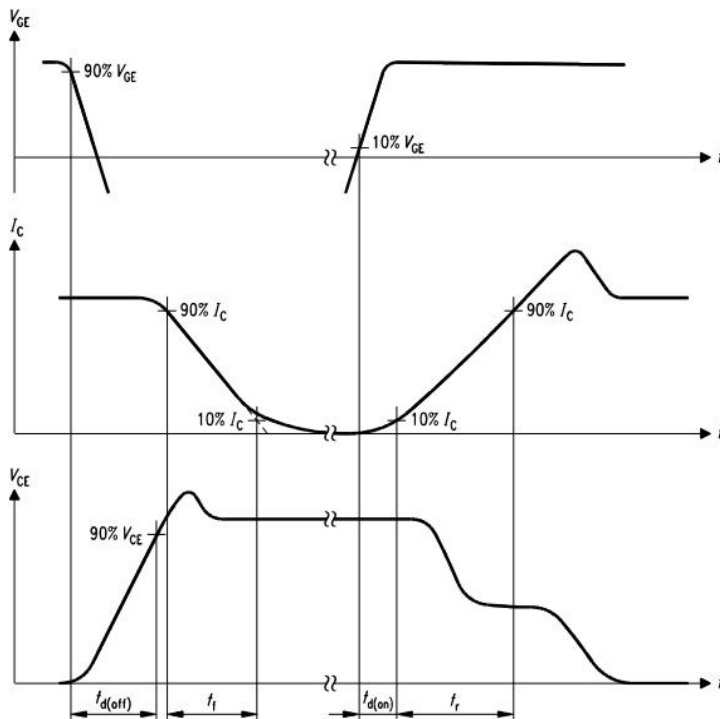


Figure A. 开关时间的定义 / Definition of switching times

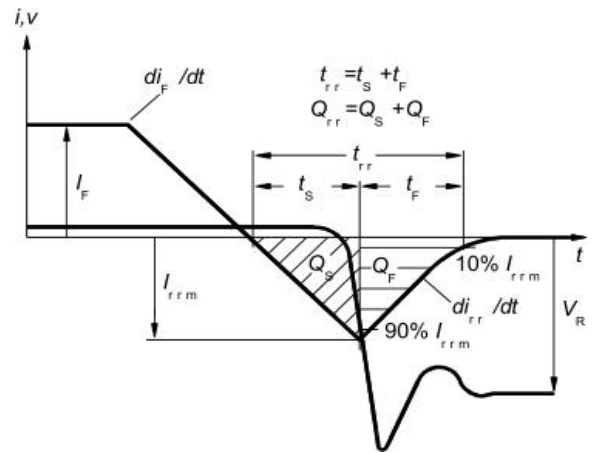


Figure C. 二极管开关特性的定义 / Definition of diodes switching characteristics

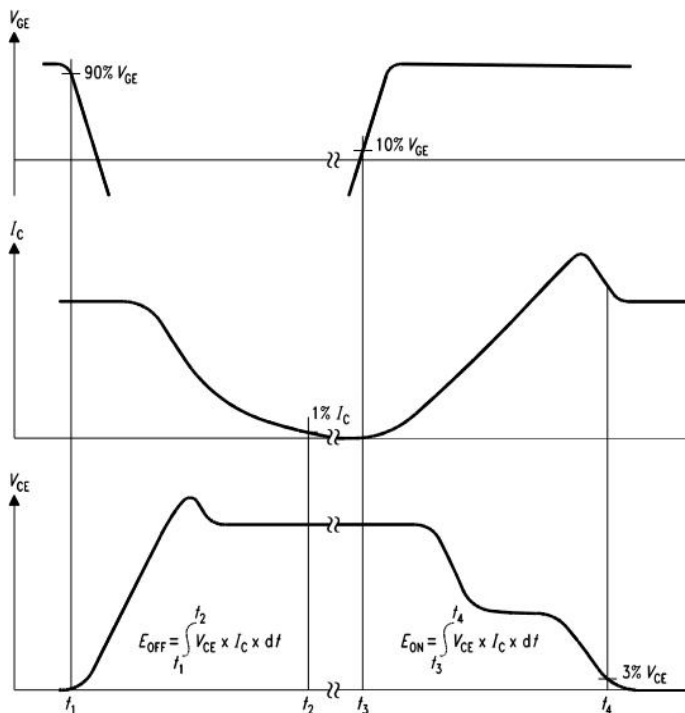


Figure B. 开关损耗的定义 / Definition of switching losses

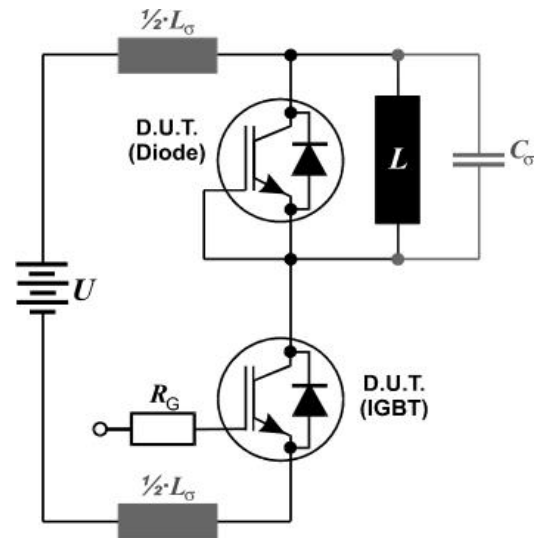
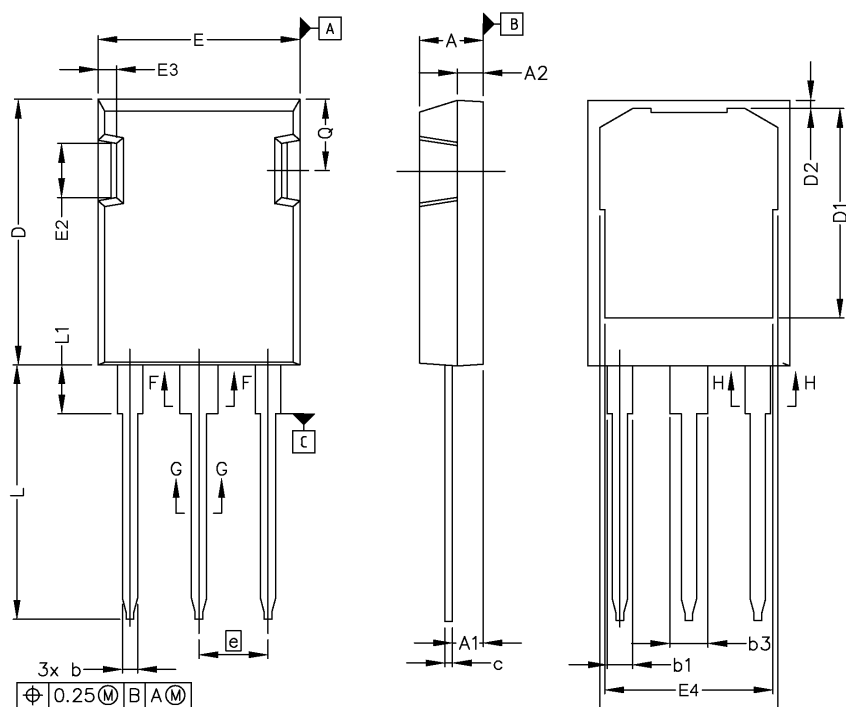


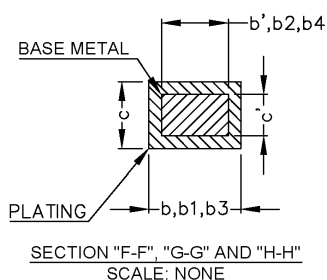
Figure D. 开关测试电路 / Switching test circuit

TO-247-3L Plus



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)



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	2021-11
2.0	Update the English and Chinese versions	2023-04

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