

英飞凌第三代高速开关 IGBT 系列

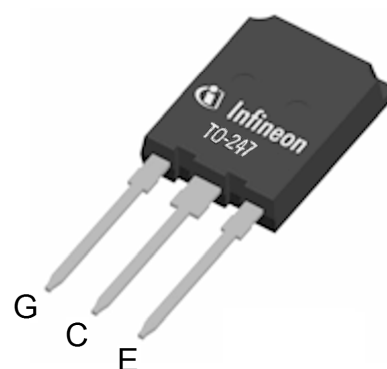
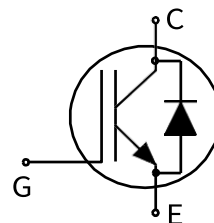
采用 Highspeed3 技术的低开关损耗 IGBT

与软、快速恢复全额定电流反并联 EC 二极管共封装

特性：

高速 H3 技术提供：

- 展现在硬开关和谐振拓扑中的高效率
- $T_{vj}=175^{\circ}\text{C}$ 时短路耐受时间为 $10\mu\text{sec}$
- 由于 V_{CEsat} 具有正温度系数，因此易于并联
- 低电磁干扰
- 低栅极电荷 Q_G
- 非常软、快速恢复的全电流反并联二极管
- 最高结温 $T_{vjmax}=175^{\circ}\text{C}$
- 无铅镀层；符合 RoHS 标准
- 完整的产品系列和 PSpice 模型：

<http://www.infineon.com/igbt/>


应用：

- 工业级不间断电源 (UPS)
- 充电器
- 储能
- 三电平组串太阳能逆变器
- 焊接

产品验证

符合 JEDEC47/20/22 相关测试的工业应用要求



关键性能和封装参数

Type	V_{CE}	I_C	$V_{CEsat}, T_{vj}=25^{\circ}\text{C}$	T_{vjmax}	Marking	Package
IKQ50N120CH3	1200V	50A	2V	175°C	K50MCH3	PG-TO247-3-46

本数据手册的原文使用英文撰写。为方便起见，英飞凌提供了译文；由于翻译过程中可能使用了自动化工具，英飞凌不保证译文的准确性。为确认准确性，请务必访问 [infineon.com](http://www.infineon.com) 参考最新的英文版本（控制文档）。

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最大额定值

注意：为了获得最佳的使用寿命和可靠性，英飞凌建议运行条件不超过本数据手册中所述最大额定值的 80%。

Parameter	Symbol	Value	Unit
Collector-emitter voltage, $T_{vj} \geq 25^{\circ}\text{C}$	V_{CE}	1200	V
DC collector current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ $T_c = 135^{\circ}\text{C}$	I_C	100.0 50.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	200.0	A
Turn off safe operating area $V_{CE} \leq 1200\text{V}$, $T_{vj} \leq 175^{\circ}\text{C}$, $t_p = 1\mu\text{s}$	-	200.0	A
Diode forward current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ $T_c = 100^{\circ}\text{C}$	I_F	100.0 50.0	A
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	200.0	A
Gate-emitter voltage Transient Gate-emitter voltage ($t_p \leq 10\mu\text{s}$, $D < 0.010$)	V_{GE}	± 20 ± 30	V
Short circuit withstand time $V_{GE} = 15.0\text{V}$, $V_{CC} \leq 600\text{V}$ Allowed number of short circuits < 1000 Time between short circuits: $\geq 1.0\text{s}$ $T_{vj} = 175^{\circ}\text{C}$	t_{SC}	10	μs
Power dissipation $T_c = 25^{\circ}\text{C}$ Power dissipation $T_c = 135^{\circ}\text{C}$	P_{tot}	652.0 173.0	W
Operating junction temperature	T_{vj}	-40...+175	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-55...+150	$^{\circ}\text{C}$
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	$^{\circ}\text{C}$

热阻抗

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

R_{th} 特性

IGBT thermal resistance, ¹⁾ junction - case	$R_{th(j-c)}$		-	-	0.23	K/W
Diode thermal resistance, ¹⁾ junction - case	$R_{th(j-c)}$		-	-	0.42	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		-	-	40	K/W

¹⁾热阻抗 $R_{th(c-s)}$ (外壳到散热器) 大于 0.1K/W 的导热硅脂不包括在内。

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电气特性，测于 $T_{vj} = 25^{\circ}\text{C}$ 的条件下，除非另有规定

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
静态特性						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0V, I_C = 0.50mA$	1200	-	-	V
Collector-emitter saturation voltage	V_{CESat}	$V_{GE} = 15.0V, I_C = 50.0A$ $T_{vj} = 25^{\circ}C$ $T_{vj} = 175^{\circ}C$	- -	2.00 2.50	2.35 -	V
Diode forward voltage	V_F	$V_{GE} = 0V, I_F = 50.0A$ $T_{vj} = 25^{\circ}C$ $T_{vj} = 175^{\circ}C$	- -	1.90 1.85	2.30 -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 1.70mA, V_{CE} = V_{GE}$	5.1	5.8	6.5	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 1200V, V_{GE} = 0V$ $T_{vj} = 25^{\circ}C$ $T_{vj} = 175^{\circ}C$	- -	- 4000	350 -	μA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0V, V_{GE} = 20V$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE} = 20V, I_C = 50.0A$	-	17.0	-	S

电气特性，测于 $T_{vj} = 25^{\circ}\text{C}$ 的条件下，除非另有规定

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
动态特性						
Input capacitance	C_{ies}	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$	-	3269	-	pF
Output capacitance	C_{oes}		-	355	-	
Reverse transfer capacitance	C_{res}		-	199	-	
Gate charge	Q_G	$V_{CC} = 960V, I_C = 40.0A,$ $V_{GE} = 15V$	-	235.0	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13.0	-	nH

开关特性、感性负载

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT 特性，测于 $T_{vj} = 25^{\circ}\text{C}$ 的条件下						
Turn-on delay time	$t_{d(\text{on})}$	$T_{vj} = 25^{\circ}\text{C}$, $V_{CC} = 600\text{V}$, $I_C = 50.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_{G(\text{on})} = 10.0\Omega$, $R_{G(\text{off})} = 10.0\Omega$, $L\sigma = 90\text{nH}$, $C\sigma = 67\text{pF}$ $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	34	-	ns
Rise time	t_r		-	32	-	ns
Turn-off delay time	$t_{d(\text{off})}$		-	297	-	ns
Fall time	t_f		-	30	-	ns
Turn-on energy	E_{on}		-	3.00	-	mJ
Turn-off energy	E_{off}		-	1.90	-	mJ
Total switching energy	E_{ts}		-	4.90	-	mJ

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二极管特性, $T_{vj} = 25^{\circ}\text{C}$

Diode reverse recovery time	t_{rr}	$T_{vj} = 25^{\circ}\text{C},$ $V_R = 600\text{V}, I_F = 50.0\text{A},$ $di_F/dt = 1200\text{A}/\mu\text{s}$	-	240	-	ns
Diode reverse recovery charge	Q_{rr}		-	3.50	-	μC
Diode peak reverse recovery current	I_{rrm}		-	34.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-403	-	$\text{A}/\mu\text{s}$

开关特性、感性负载

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

IGBT 特性, 测于 $T_{vj} = 175^{\circ}\text{C}$ 的条件

Turn-on delay time	$t_{d(on)}$	$T_{vj} = 175^{\circ}\text{C},$ $V_{CC} = 600\text{V}, I_C = 50.0\text{A},$ $V_{GE} = 0.0/15.0\text{V},$ $R_{G(on)} = 10.0\Omega, R_{G(off)} = 10.0\Omega,$ $L\sigma = 90\text{nH}, C\sigma = 67\text{pF}$ $L\sigma, C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	32	-	ns
Rise time	t_r		-	36	-	ns
Turn-off delay time	$t_{d(off)}$		-	400	-	ns
Fall time	t_f		-	66	-	ns
Turn-on energy	E_{on}		-	5.30	-	mJ
Turn-off energy	E_{off}		-	4.10	-	mJ
Total switching energy	E_{ts}		-	9.40	-	mJ

二极管特性, 测于 $T_{vj} = 175^{\circ}\text{C}$ 的条件下

Diode reverse recovery time	t_{rr}	$T_{vj} = 175^{\circ}\text{C}, V_R = 600\text{V}, I_F = 50.0\text{A},$ $di_F/dt = 1200\text{A}/\mu\text{s}$	-	390	-	ns
Diode reverse recovery charge	Q_{rr}		-	8.60	-	μC
Diode peak reverse recovery current	I_{rrm}		-	46.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-210	-	$\text{A}/\mu\text{s}$

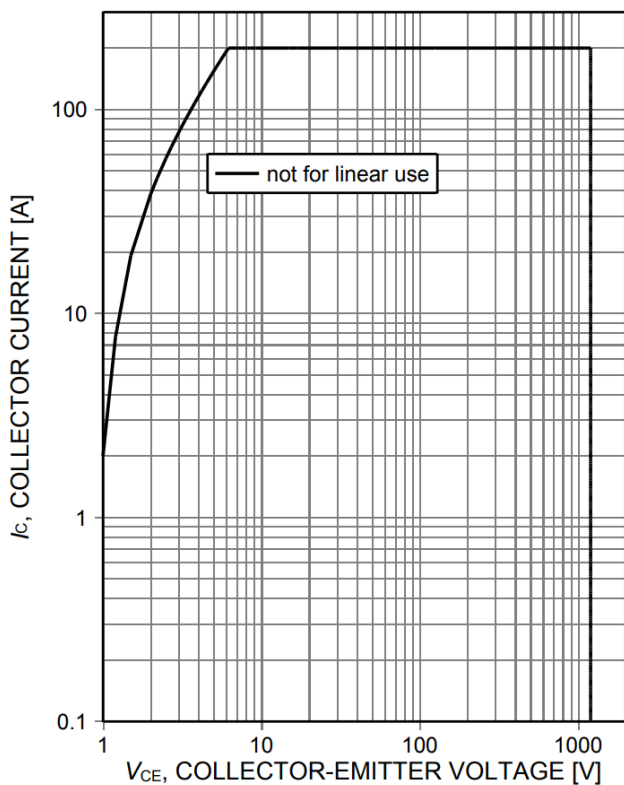


Figure 1. **Forward bias safe operating area**
($D=0$, $T_C=25^\circ\text{C}$, $T_{vj}\leq 175^\circ\text{C}$; $V_{GE}=15\text{V}$)

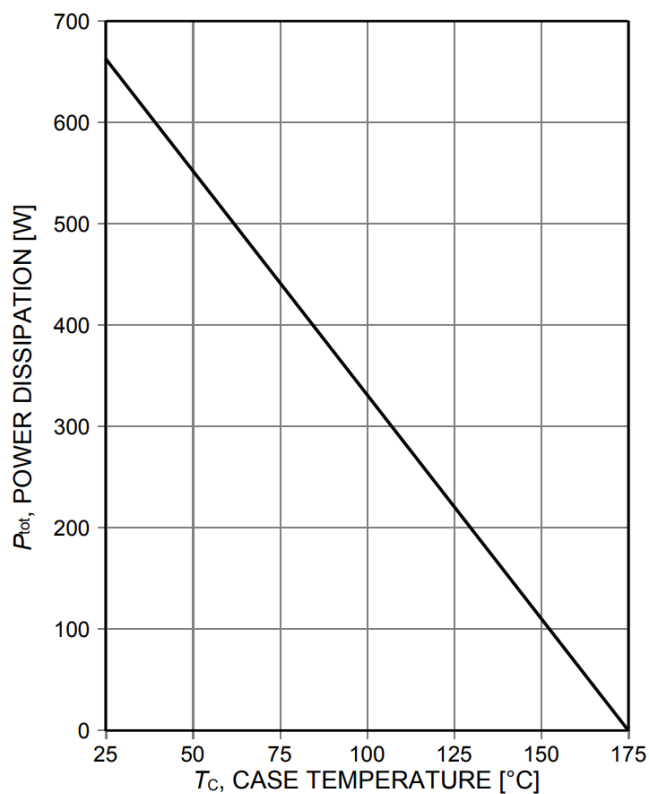


Figure 2. **Power dissipation as a function of case temperature**
($T_{vj}\leq 175^\circ\text{C}$)

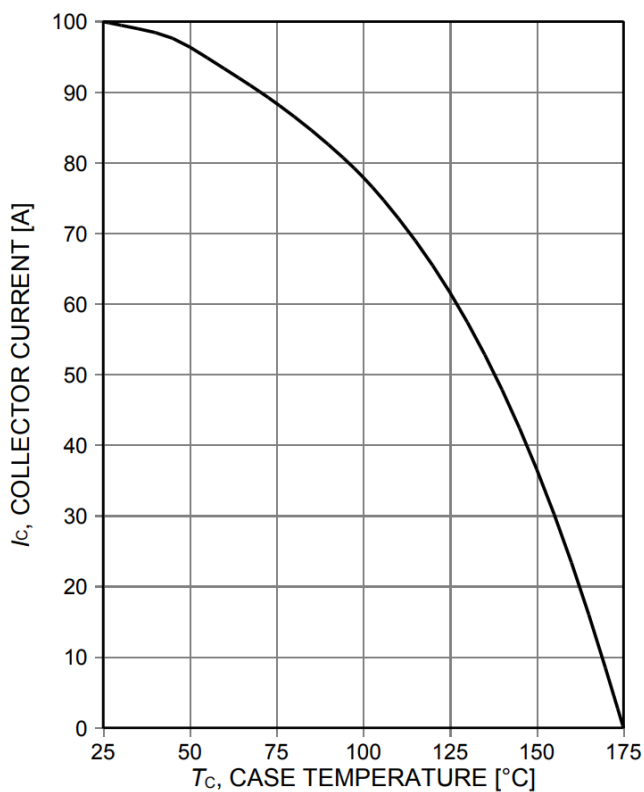


Figure 3. **Collector current as a function of case temperature**
($V_{GE}\geq 15\text{V}$, $T_{vj}\leq 175^\circ\text{C}$)

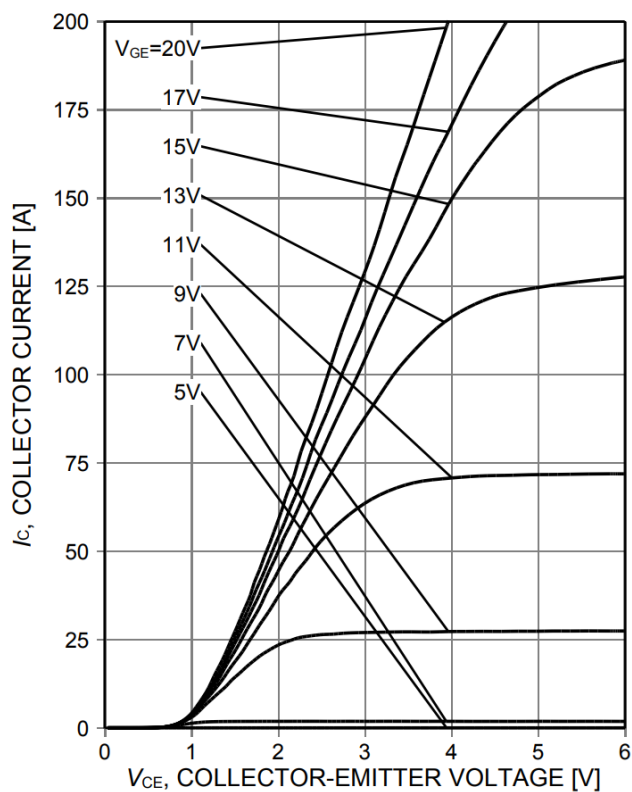


Figure 4. **Typical output characteristic**
($T_{vj}=25^\circ\text{C}$)

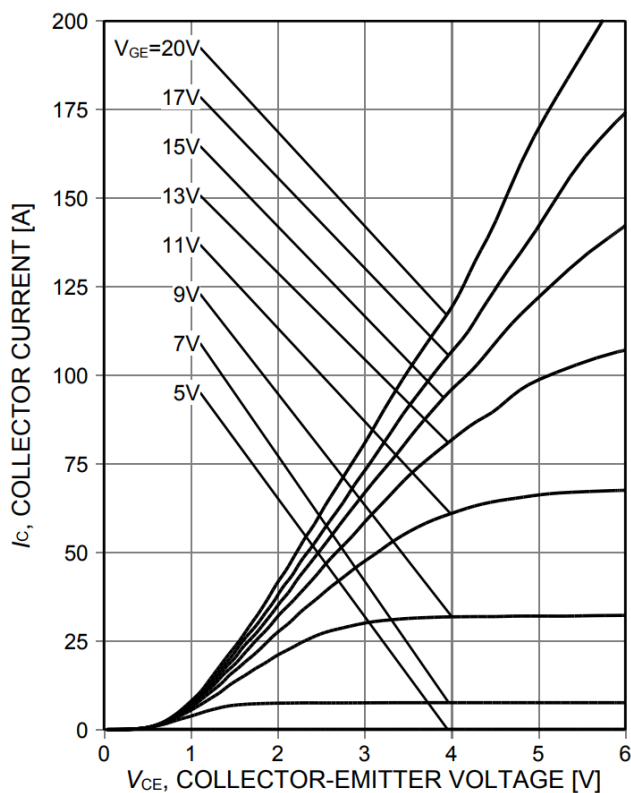


Figure 5. **Typical output characteristic**
($T_{vj}=175^{\circ}\text{C}$)

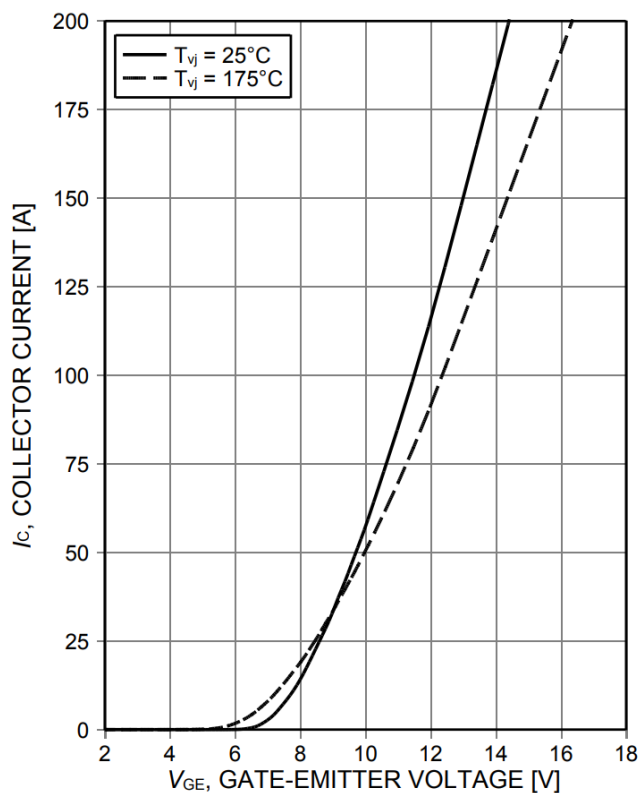


Figure 6. **Typical transfer characteristic**
($V_{CE}=20\text{V}$)

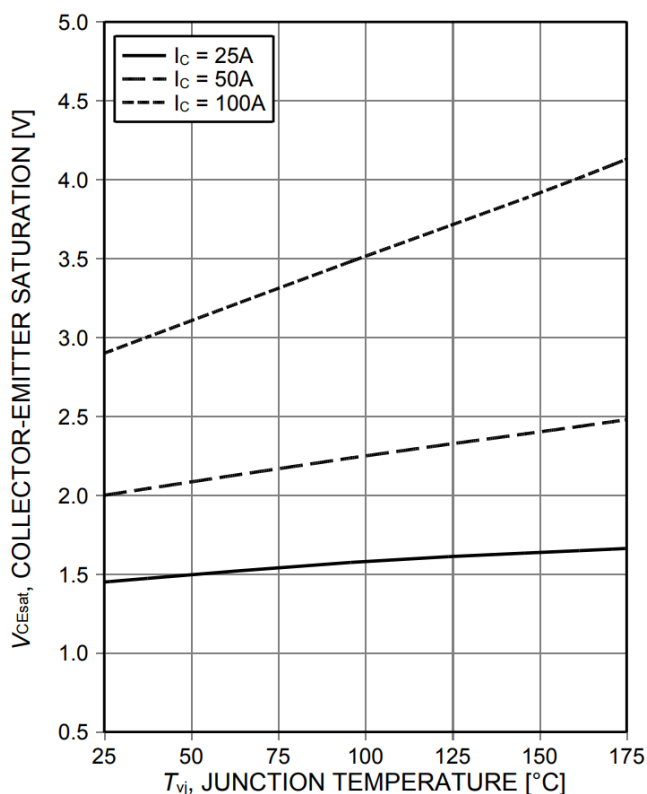


Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}=15\text{V}$)

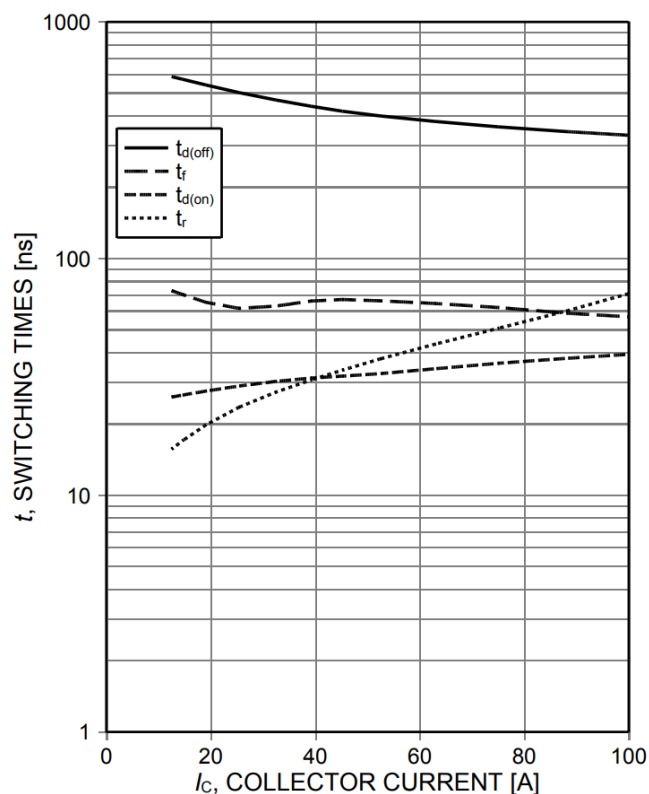


Figure 8. **Typical switching times as a function of collector current**
(inductive load, $T_{vj}=175^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, Dynamic test circuit in Figure E)

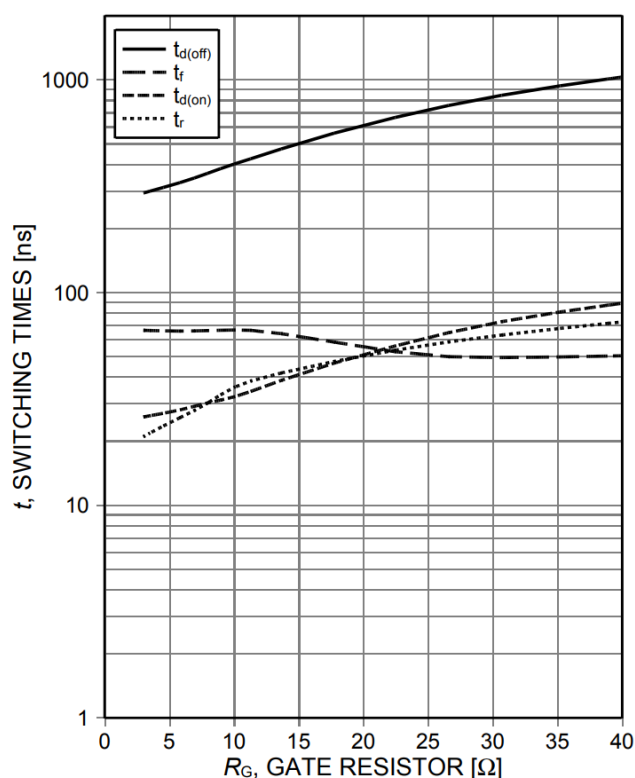


Figure 9. **Typical switching times as a function of gate resistor**
(inductive load, $T_{vj}=175^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=50\text{A}$, Dynamic test circuit in Figure E)

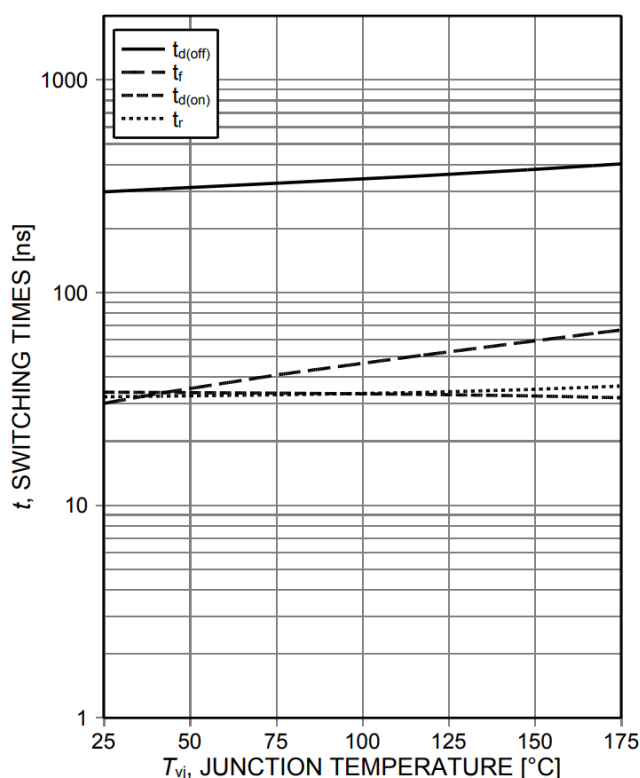


Figure 10. **Typical switching times as a function of junction temperature**
(inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=50\text{A}$, $R_G=10\Omega$, Dynamic test circuit in Figure E)

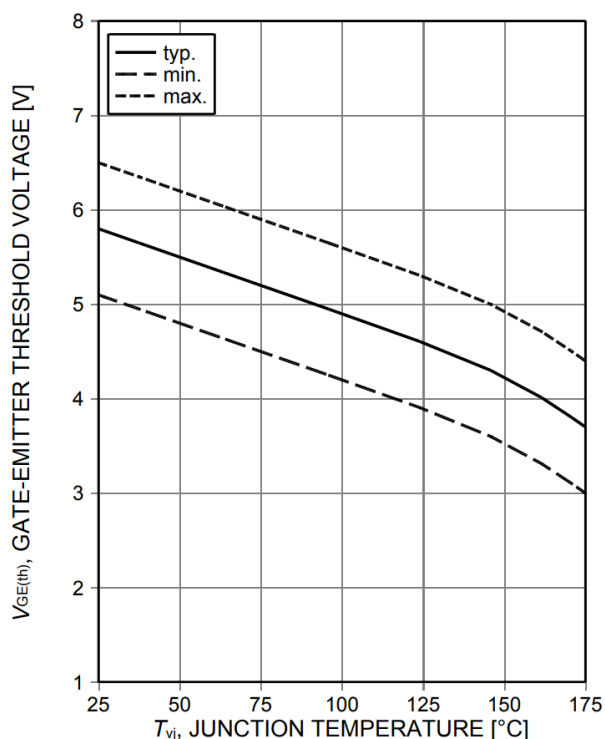


Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**
($I_C=1.7\text{mA}$)

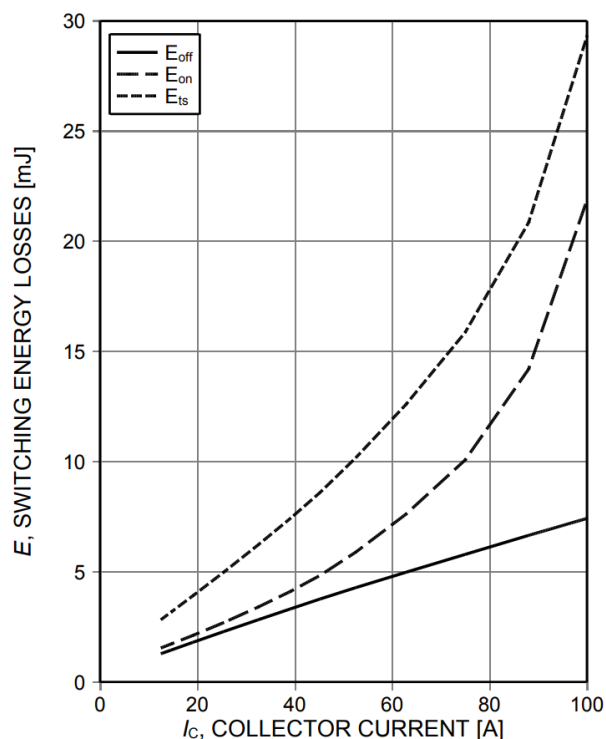


Figure 12. **Typical switching energy losses as a function of collector current**
(inductive load, $T_{vj}=175^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=10\Omega$, Dynamic test circuit in Figure E)

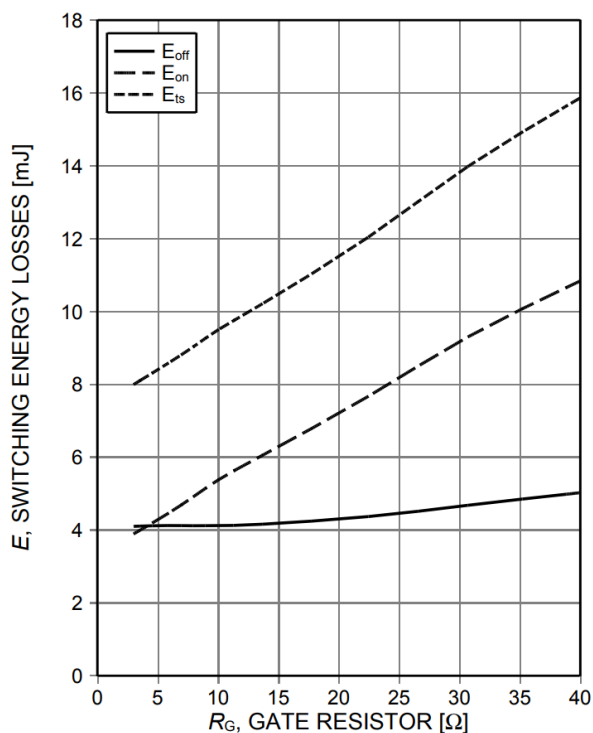


Figure 13. **Typical switching energy losses as a function of gate resistor**
(inductive load, $T_{vj}=175^{\circ}\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=50\text{A}$, Dynamic test circuit in Figure E)

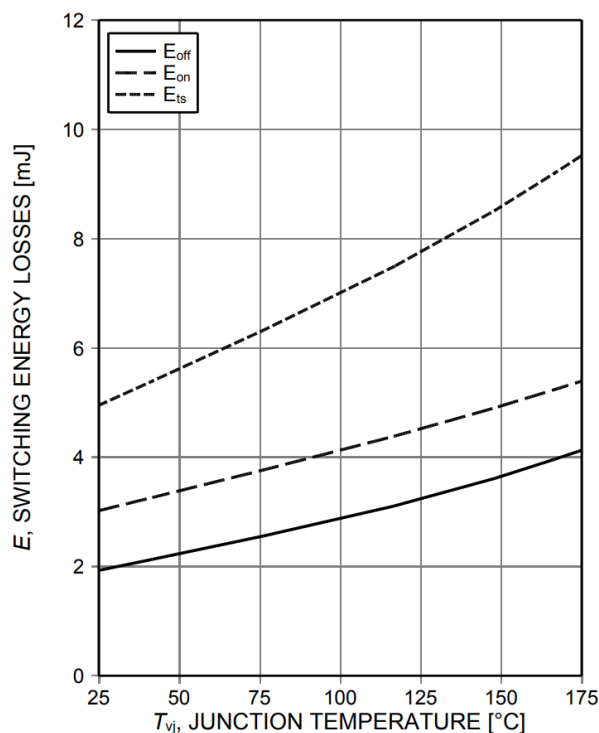


Figure 14. **Typical switching energy losses as a function of junction temperature**
(inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=50\text{A}$, $R_G=10\Omega$, Dynamic test circuit in Figure E)

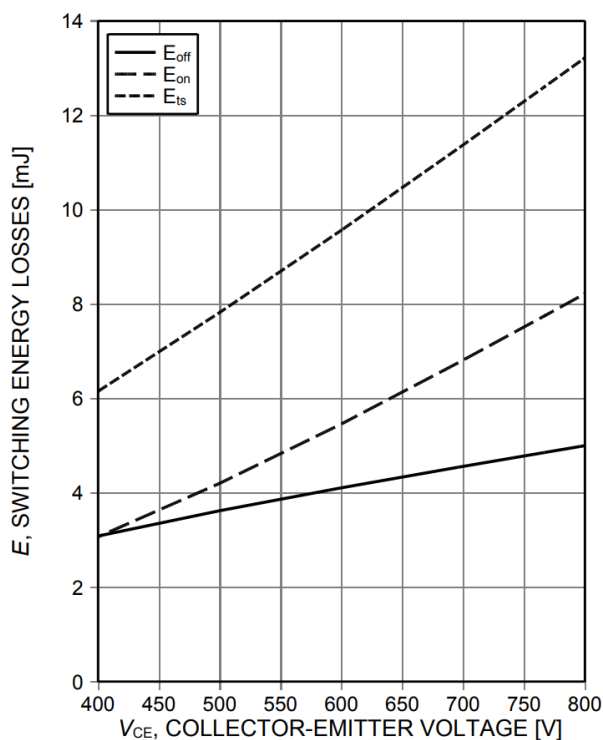


Figure 15. **Typical switching energy losses as a function of collector emitter voltage**
(inductive load, $T_{vj}=175^{\circ}\text{C}$, $V_{GE}=0/15\text{V}$, $I_C=50\text{A}$, $R_G=10\Omega$, Dynamic test circuit in Figure E)

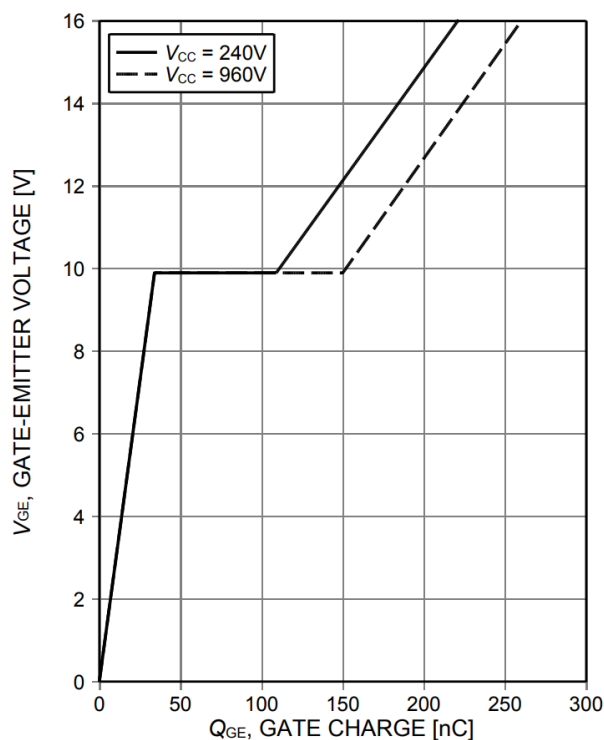


Figure 16. **Typical gate charge**
($I_C=50\text{A}$)

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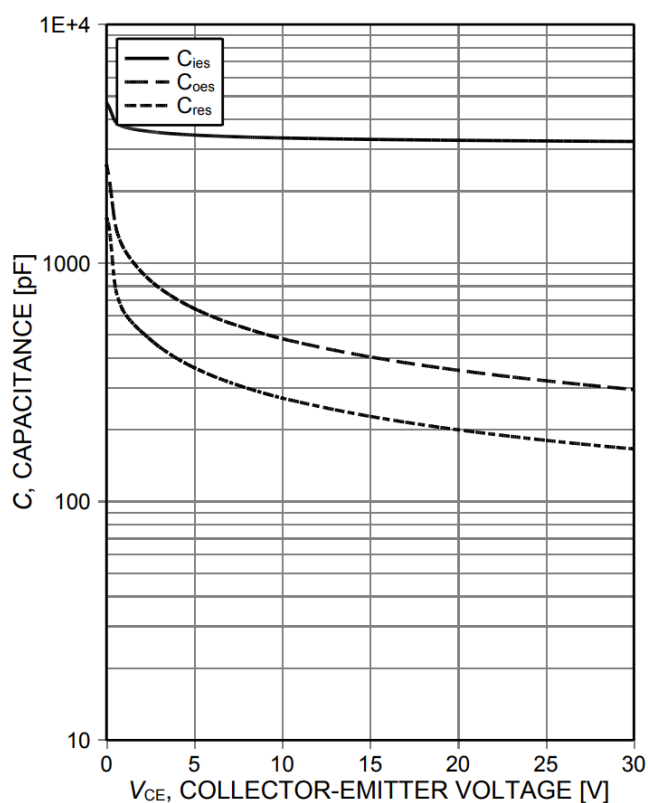


Figure 17. **Typical capacitance as a function of collector-emitter voltage**
($V_{GE}=0V$, $f=1MHz$)

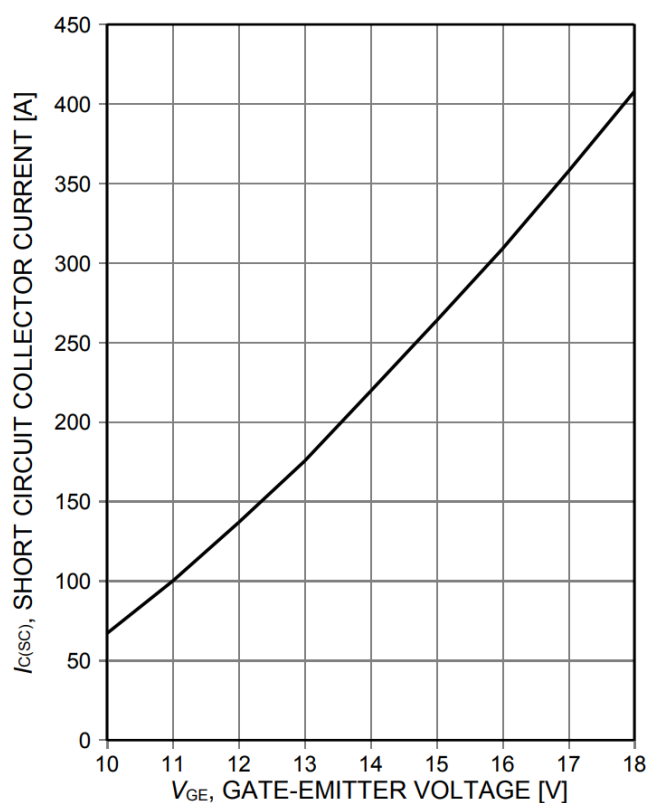


Figure 18. **Typical short circuit collector current as a function of gate-emitter voltage**
($V_{CE} \leq 600V$, $T_{vj} \leq 175^{\circ}C$)

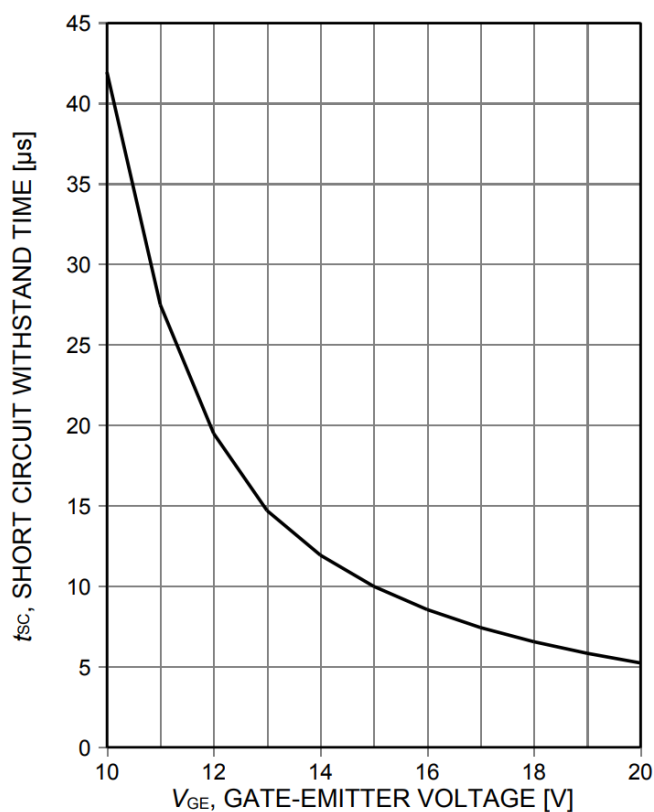


Figure 19. **Short circuit withstand time as a function of gate-emitter voltage**
($V_{CE} \leq 600V$, start at $T_{vj} \leq 175^{\circ}C$)

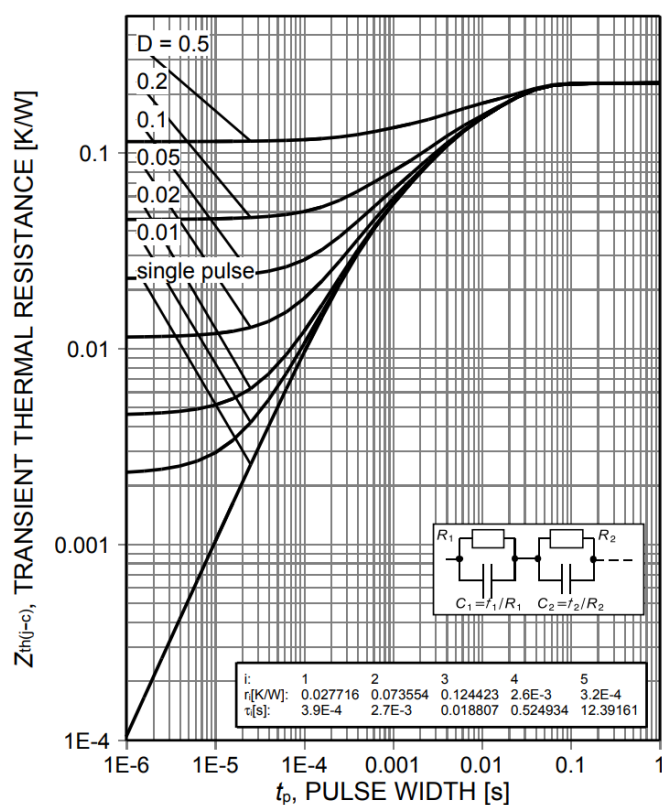


Figure 20. **IGBT transient thermal resistance**
($D=t_p/T$)

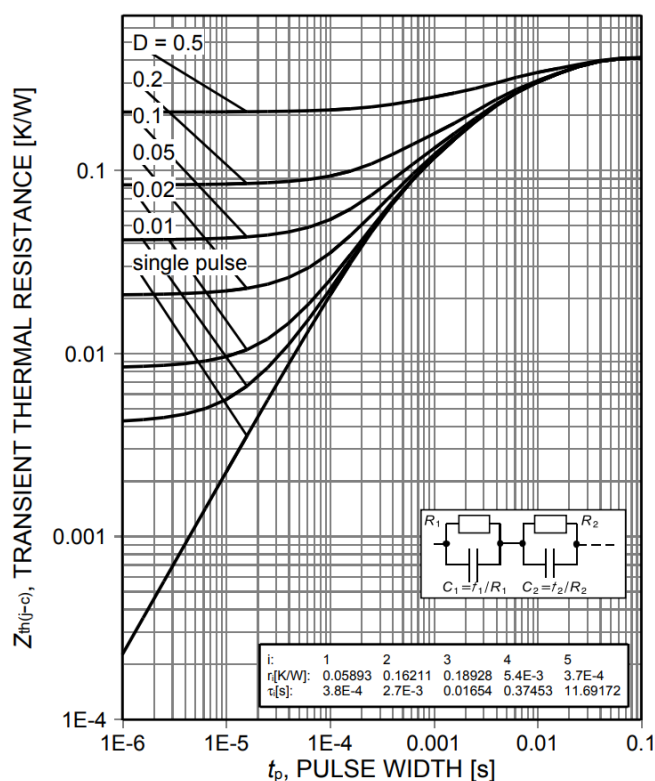


Figure 21. Diode transient thermal impedance as a function of pulse width ($D=t_p/T$)

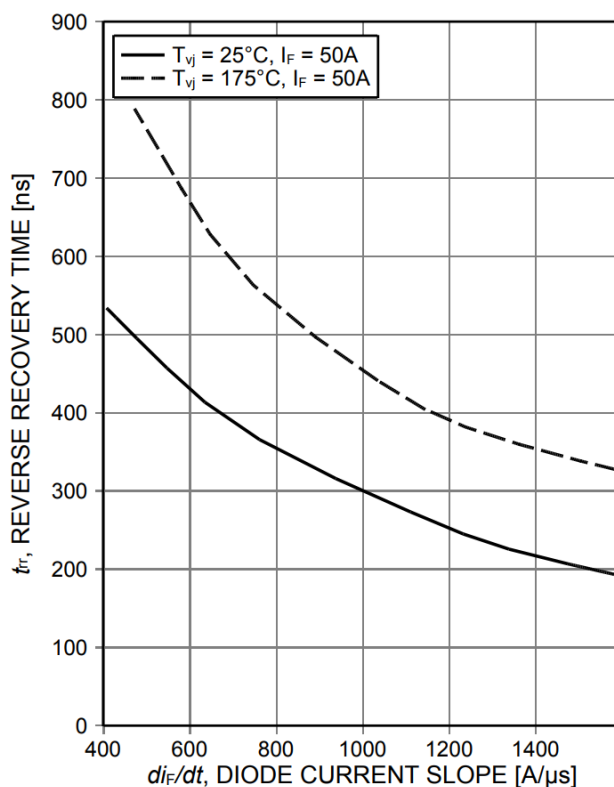


Figure 22. Typical reverse recovery time as a function of diode current slope ($V_R=600V$)

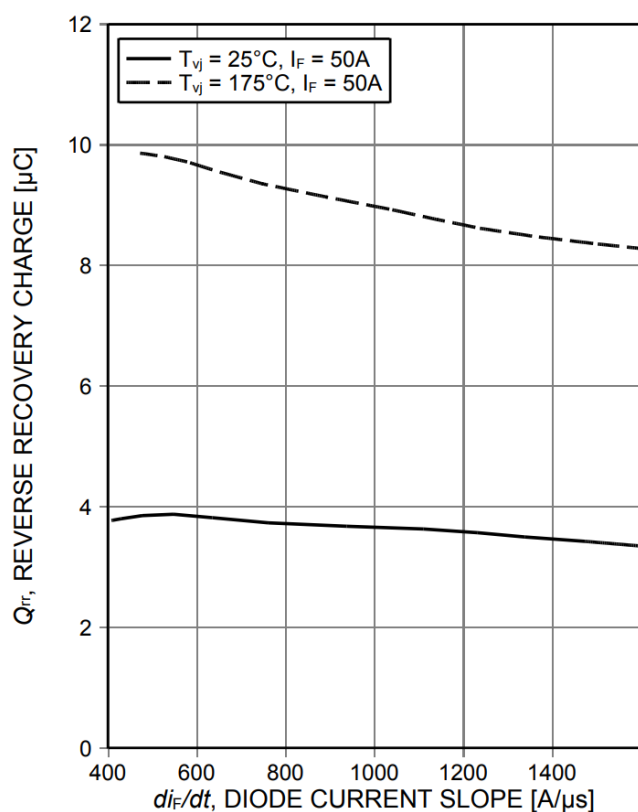


Figure 23. Typical reverse recovery charge as a function of diode current slope ($V_R=600V$)

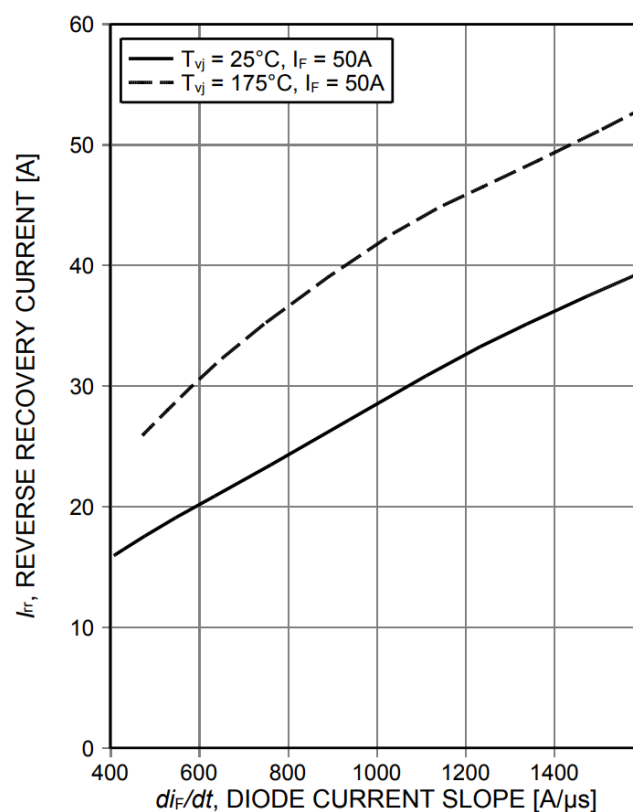


Figure 24. Typical reverse recovery current as a function of diode current slope ($V_R=600V$)

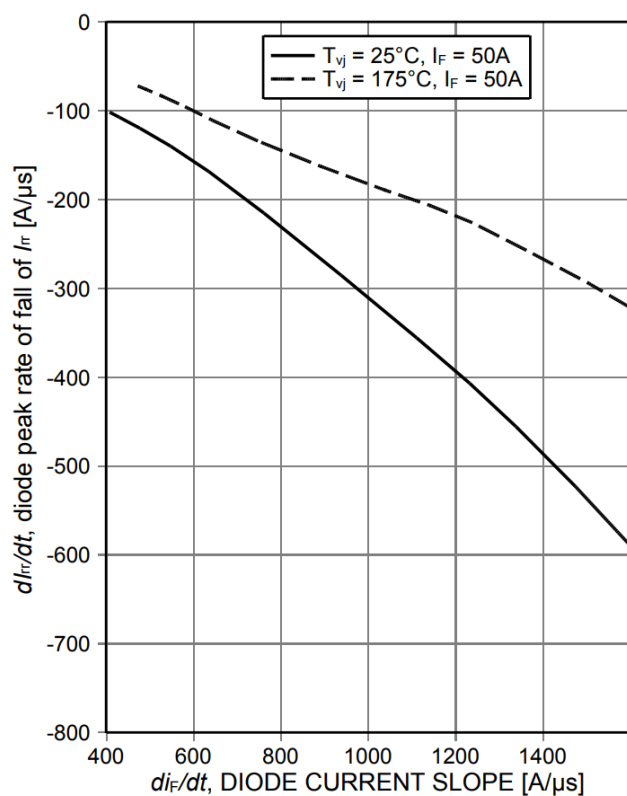


Figure 25. **Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**
($V_R=600V$)

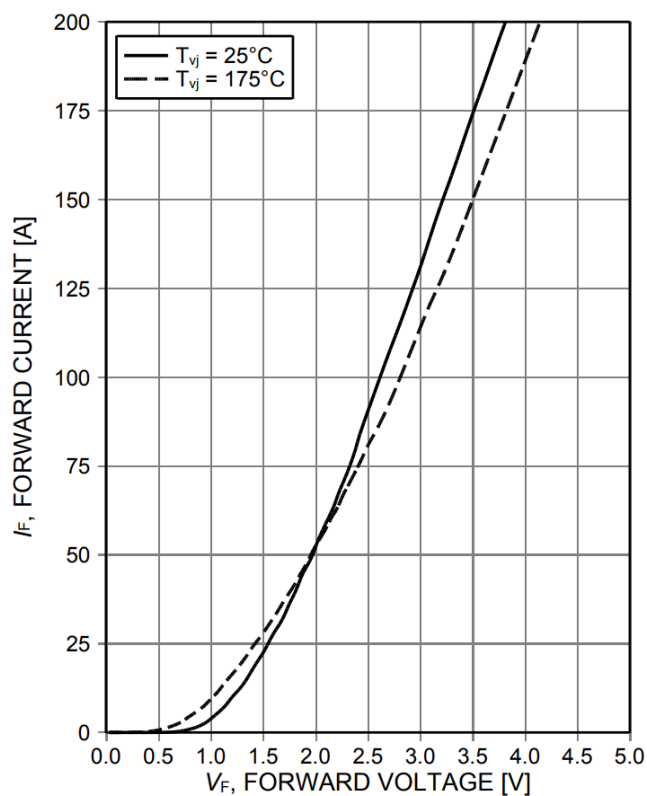


Figure 26. **Typical diode forward current as a function of forward voltage**

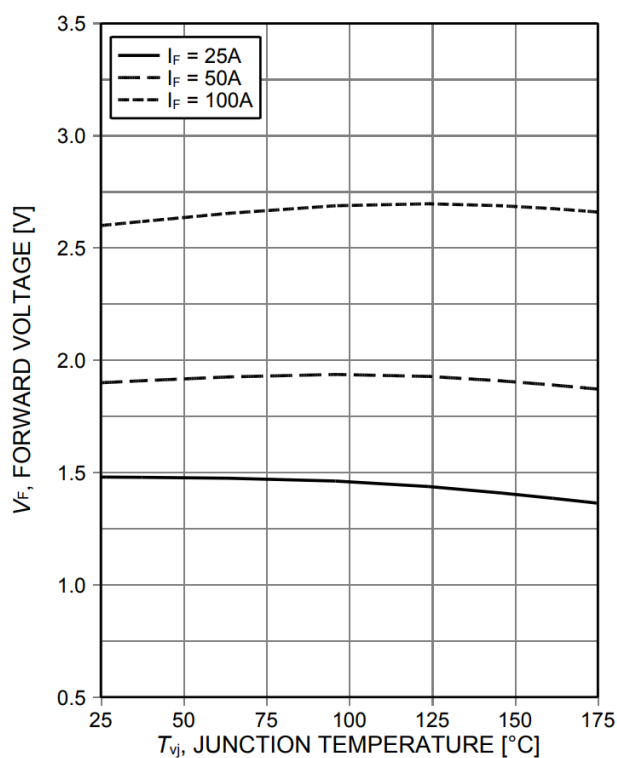
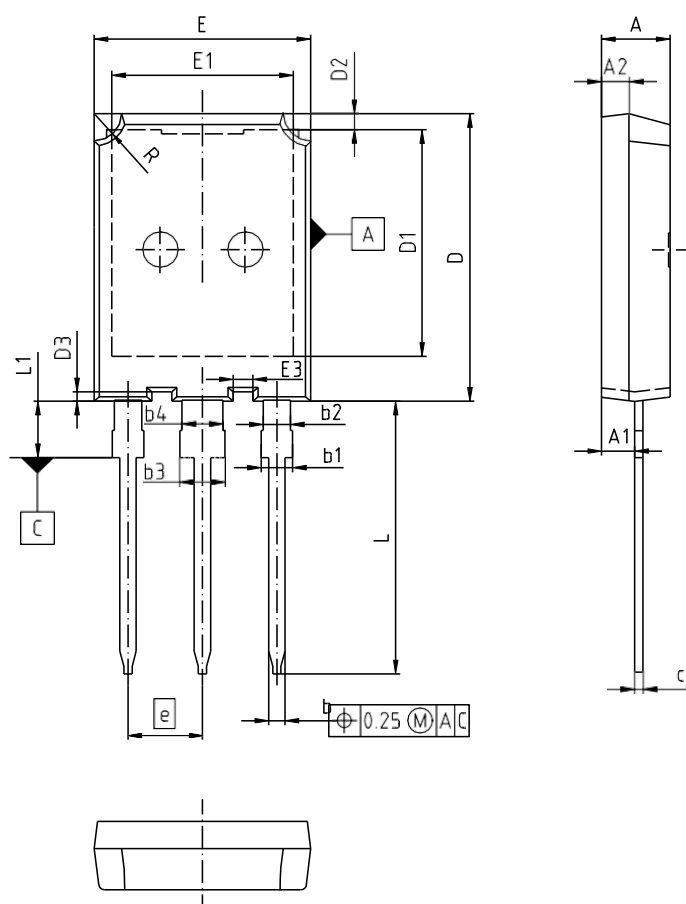
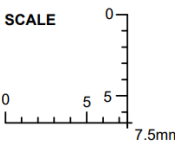
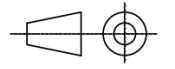


Figure 27. **Typical diode forward voltage as a function of junction temperature**

PG-T0247-3-46 封装图



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.96	2.25	0.077	0.089
b2	1.96	2.06	0.077	0.081
c	0.59	0.66	0.023	0.026
D	20.90	21.10	0.823	0.831
D1	16.25	16.85	0.640	0.663
D2	1.05	1.35	0.041	0.053
D3	0.58	0.78	0.023	0.031
E	15.70	15.90	0.618	0.626
E1	13.10	13.50	0.516	0.531
E3	1.35	1.55	0.053	0.061
e	5.44 (BSC)		0.214 (BSC)	
N	3		3	
L	19.80	20.10	0.780	0.791
L1	-	4.30	-	0.169
R	1.90	2.10	0.075	0.083

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SCALE 
EUROPEAN PROJECTION 
ISSUE DATE 13-08-2014
REVISION 01

测试条件

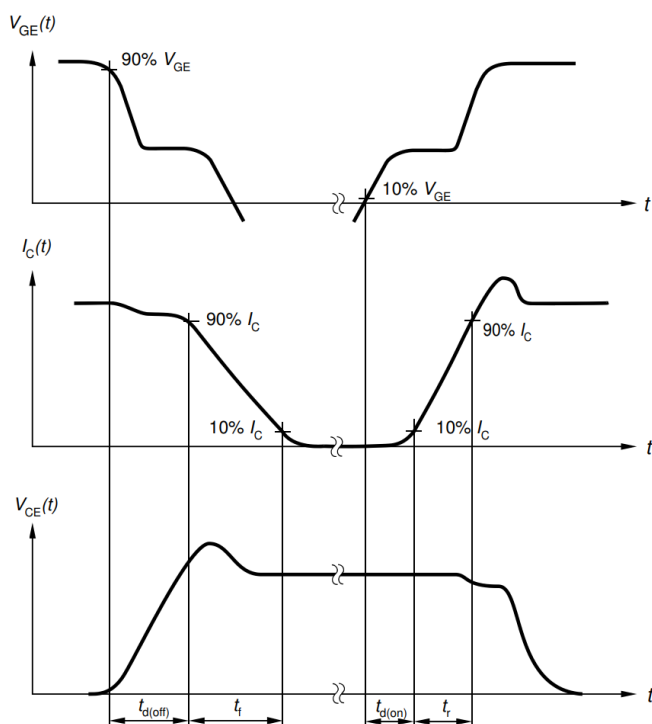


Figure A. Definition of switching times

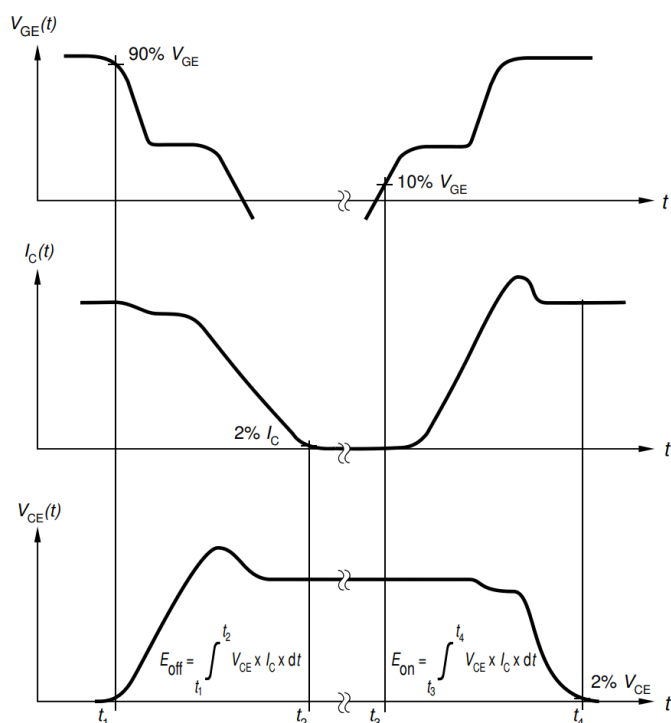


Figure B. Definition of switching losses

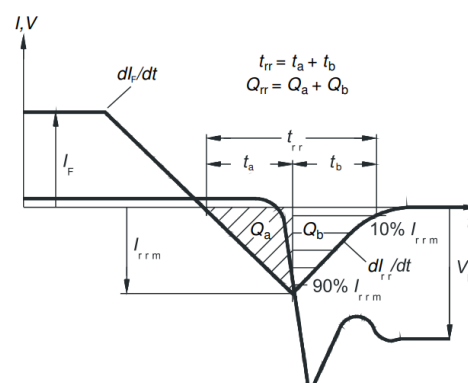


Figure C. Definition of diode switching characteristics

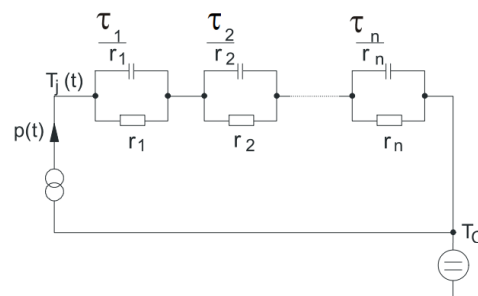


Figure D. Thermal equivalent circuit

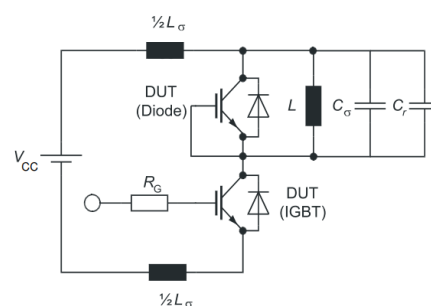


Figure E. Dynamic test circuit
Parasitic inductance L_{σ} ,
parasitic capacitor C_{σ} ,
relief capacitor C_r ,
(only for ZVT switching)

IKQ50N120CH3

第三代高速开关 IGBT 系列

修订记录

IKQ50N120CH3

Revision: 2019-04-15, Rev. 2.4

历史修订版本

Revision	Date	Subjects (major changes since last revision)
2.1	2017-04-26	Final data sheet
2.2	2017-05-10	Minor change Conditions Diode Characteristic
2.3	2017-06-09	Update Figure 26
2.4	2019-04-15	Update condition for V _{geth} page 4 and Fig. 11



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