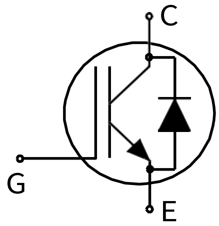
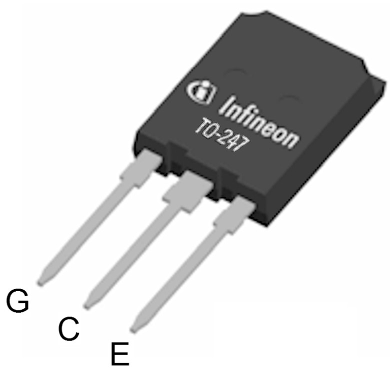
英飞凌 TRENCHSTOP™ 系列

低损耗 DuoPack：采用 TRENCHSTOP™和 Fieldstop 技术的 IGBT，搭配软、快速恢复反并联发射器控制二极管



特性：

- 极低 VCE $_{(sat)}$ 1.5V（典型值）
- 最高结温 175°C
- 短路耐受时间 5 µs
- 适用于 600V 应用的TRENCHSTOP TM和 Fieldstop 技术提供：
- 参数分布紧密
- 高稳健性、温度稳定性
- 切换速度快
- $V_{CE(sat)}$ 正温度系数
- 低电磁干扰
- 低栅极电荷Q_G
- 增强的电流能力
- 绿色封装
- 非常软、快速恢复的反并联发射级控制 HE 二极管



应用：

- 通用逆变器
- UPS（不间断电源）
- 电机驱动
- 中低开关频率功率转换器

关键性能和封装参数

Type	V_{CE}	I_C	V_{CEsat}，T_{vj}=25°C	T_{vjmax}	Marking	Package
IKQ120N60T	600V	120A	1.5V	175°C	K120T60	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 参考最新的英文版本（控制文档）。

目录

1 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, $T_{vj} \geq 25°C$	V_{CE}	600	V
DC collector current, limited by T_{vjmax} $T_c = 25°C$ value limited by bondwire $T_c = 135°C$	I_C	160.0 120.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	480.0	A
Turn off safe operating area $V_{CE} \leq 600V$, $T_{vj} \leq 175°C$, $t_p = 1µs$	-	480.0	A
Diode forward current, limited by T_{vjmax} $T_c = 25°C$ $T_c = 124°C$	I_F	160.0 120.0	A
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	480.0	A
Gate-emitter voltage	V_{GE}	±20	V
Short circuit withstand time $V_{GE} = 15.0V$, $V_{CC} \leq 400V$ Allowed number of short circuits < 1000 Time between short circuits: ≥ 1.0s $T_{vj} = 150°C$	t_{SC}	5	µs
Power dissipation $T_c = 25°C$	P_{tot}	833.0	W
Operating junction temperature	T_{vj}	-40...+175	°C
Storage temperature	T_{stg}	-55...+150	°C
Soldering temperature,[1] wave soldering 1.6mm (0.063in.) from case for 10s		260	°C

2 热阻抗

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
R_{th} 特性						
IGBT thermal resistance,[2] junction - case	$R_{th(j-c)}$		-	-	0.18	K/W
Diode thermal resistance,[2] junction - case	$R_{th(j-c)}$		-	-	0.30	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		-	-	40	K/W

[1] 封装不推荐用于表面贴装应用

[2] 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。

3 电气特性

电气特性，测于 T_{vj} = 25°C的条件下，除非另有说明

Parameter	Symbol	Conditions	Value min.	Value typ.	Value max.	Unit
静态特性						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	V_{GE} = 0V, I_C = 0.20mA	600	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	V_{GE} = 15.0V, I_C = 120.0A T_{vj} = 25°C T_{vj} = 175°C	- -	1.50 1.90	2.00 -	V
Diode forward voltage	V_F	V_{GE} = 0V, I_F = 120.0A T_{vj} = 25°C T_{vj} = 175°C	- -	1.65 1.60	2.05 -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 1.92mA, V_{CE} = V_{GE}	4.1	4.9	5.7	V
Zero gate voltage collector current	I_{CES}	V_{CE} = 600V, V_{GE} = 0V T_{vj} = 25°C T_{vj} = 175°C	- -	- 3000	40 -	µA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0V, V_{GE} = 20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE} = 20V, I_C = 120.0A	-	75.0	-	S
Integrated gate resistor	r_G			none		Ω

电气特性，测于 T_{vj} = 25°C的条件下，除非另有说明

Parameter	Symbol	Conditions	Value min.	Value typ.	Value max.	Unit
动态特性						
Input capacitance	C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	7530	-	pF
Output capacitance	C_{oes}		-	446	-	
Reverse transfer capacitance	C_{res}		-	206	-	
Gate charge	Q_G	V_{CC} = 480V, I_C = 120.0A, V_{GE} = 15V	-	703.0	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13.0	-	nH
Short circuit collector current Max. 1000 short circuits Time between short circuits: ≥ 1.0s	$I_{C(SC)}$	V_{GE} = 15.0V, V_{CC} ≤ 400V, t_{SC} ≤ 5µs T_{vj} = 175°C	-	846	-	A

开关特性、感性负载

Parameter	Symbol	Conditions	Value min.	Value typ.	Value max.	Unit
IGBT 特性，测于 T_{vj} = 25°C的条件下						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 120.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 3.0Ω, $R_{G(off)}$ = 3.0Ω, $L\sigma$ = 63nH, $C\sigma$ = 31pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	33	-	ns
Rise time	t_r		-	43	-	ns
Turn-off delay time	$t_{d(off)}$		-	310	-	ns
Fall time	t_f		-	33	-	ns
Turn-on energy	E_{on}		-	4.10	-	mJ
Turn-off energy	E_{off}		-	2.80	-	mJ
Total switching energy	E_{ts}		-	6.90	-	mJ

二极管特性， T_{vj} = 25°C

Diode reverse recovery time	t_{rr}	T_{vj} = 25°C, V_R = 400V, I_F = 120.0A, di_F/dt = 1100A/µs	-	280	-	ns
Diode reverse recovery charge	Q_{rr}		-	3.50	-	µC
Diode peak reverse recovery current	I_{rrm}		-	25.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-500	-	A/µs

开关特性、感性负载

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT 特性，测于 T_{vj} = 175°C的条件						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 175°C, V_{CC} = 400V, I_C = 120.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 3.0Ω, $R_{G(off)}$ = 3.0Ω, $L\sigma$ = 63nH, $C\sigma$ = 31pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	33	-	ns
Rise time	t_r		-	51	-	ns
Turn-off delay time	$t_{d(off)}$		-	355	-	ns
Fall time	t_f		-	43	-	ns
Turn-on energy	E_{on}		-	6.70	-	mJ
Turn-off energy	E_{off}		-	4.10	-	mJ
Total switching energy	E_{ts}		-	10.80	-	mJ

二极管特性，测于 T_{vj} = 175°C的条件下

Diode reverse recovery time	t_{rr}	T_{vj} = 175°C, V_R = 400V, I_F = 120.0A, di_F/dt = 1000A/µs	-	410	-	ns
Diode reverse recovery charge	Q_{rr}		-	10.80	-	µC
Diode peak reverse recovery current	I_{rrm}		-	45.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-520	-	A/µs

4 电气特性图

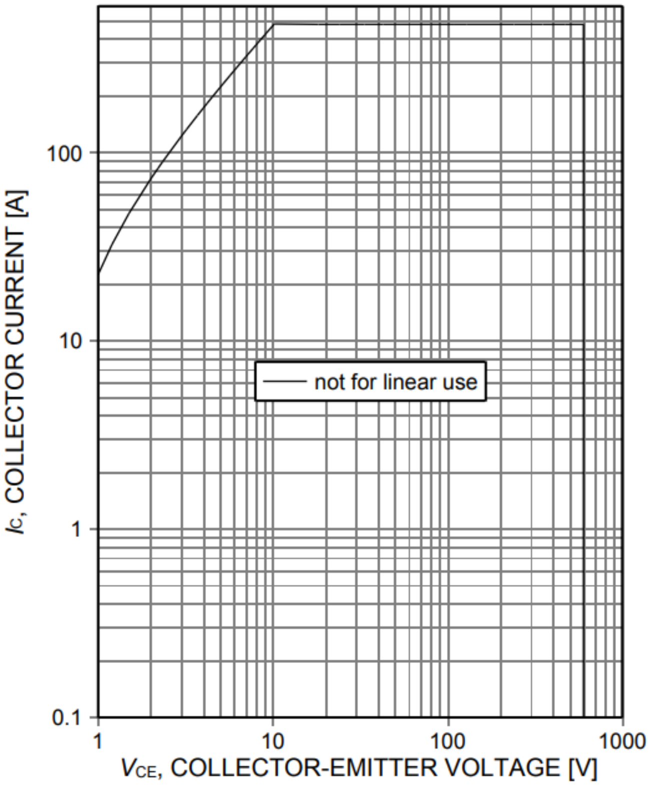


Figure 1. **Safe operating area**
(D=0, T_C=25°C, T_j≤175°C, V_{GE}=0/15V, t_p=1µs)

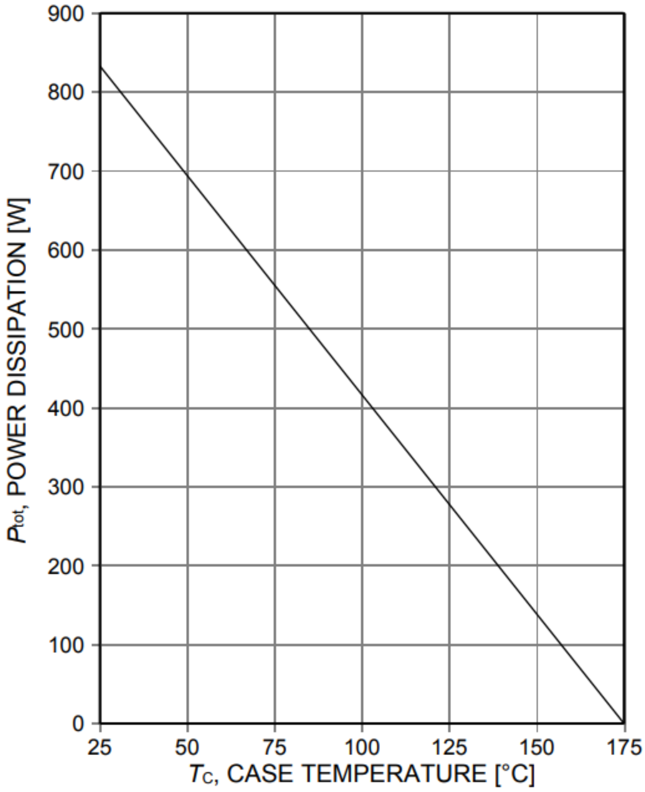


Figure 2. **Power dissipation as a function of case temperature**
(T_j≤175°C)

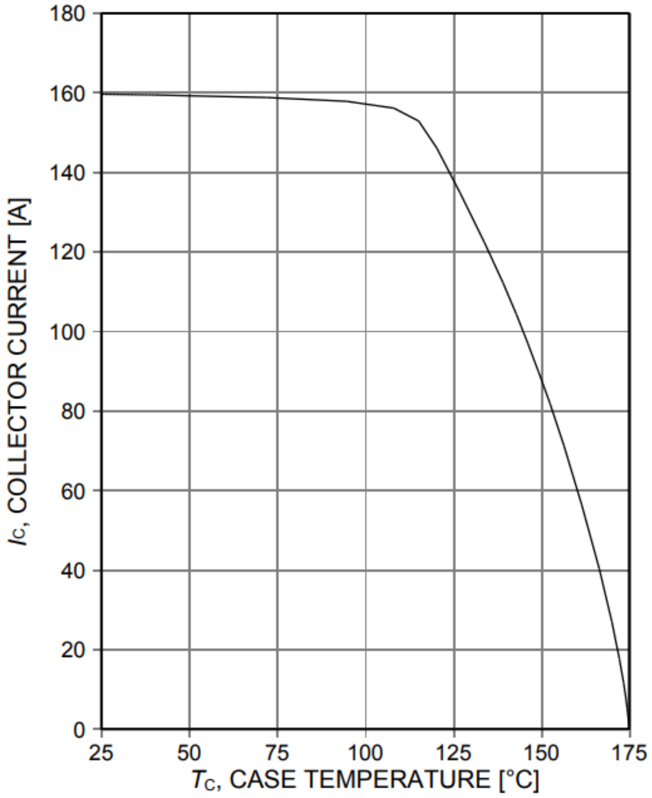


Figure 3. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_j≤175°C)

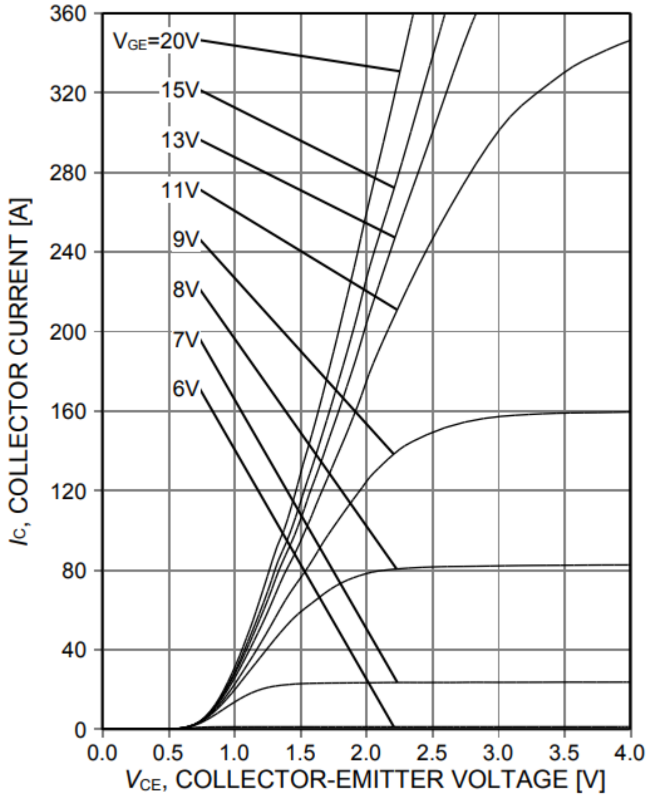


Figure 4. **Typical output characteristic**
(T_j=25°C)

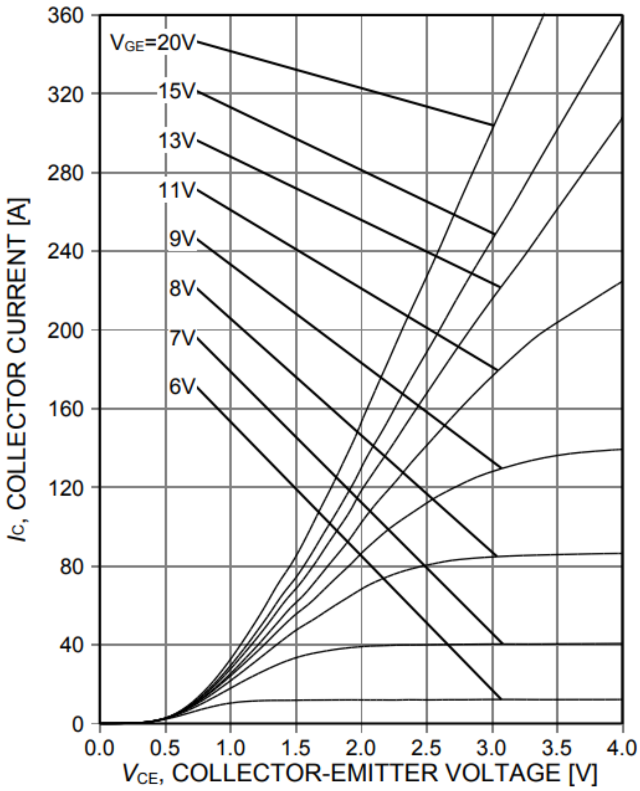


Figure 5. **Typical output characteristic**
(T_j=175°C)

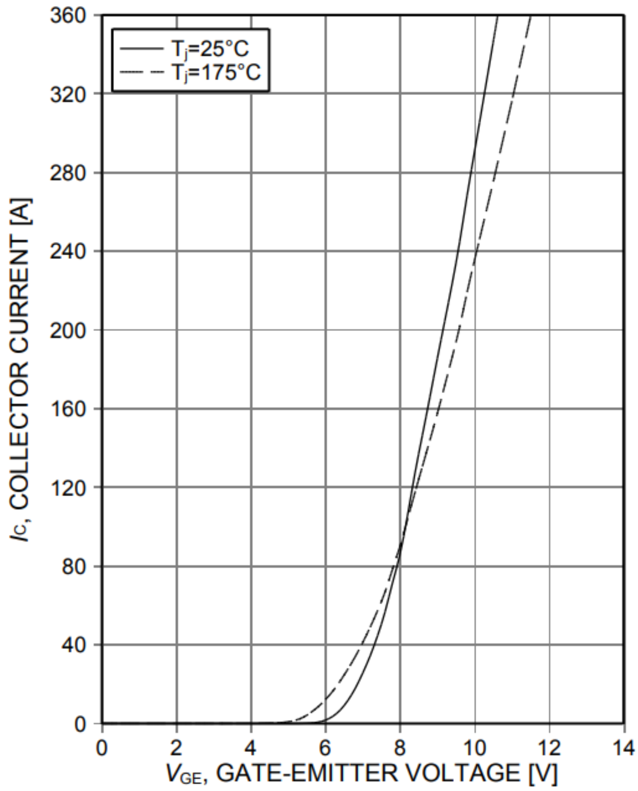


Figure 6. **Typical transfer characteristic**
(V_{GE}=20V)

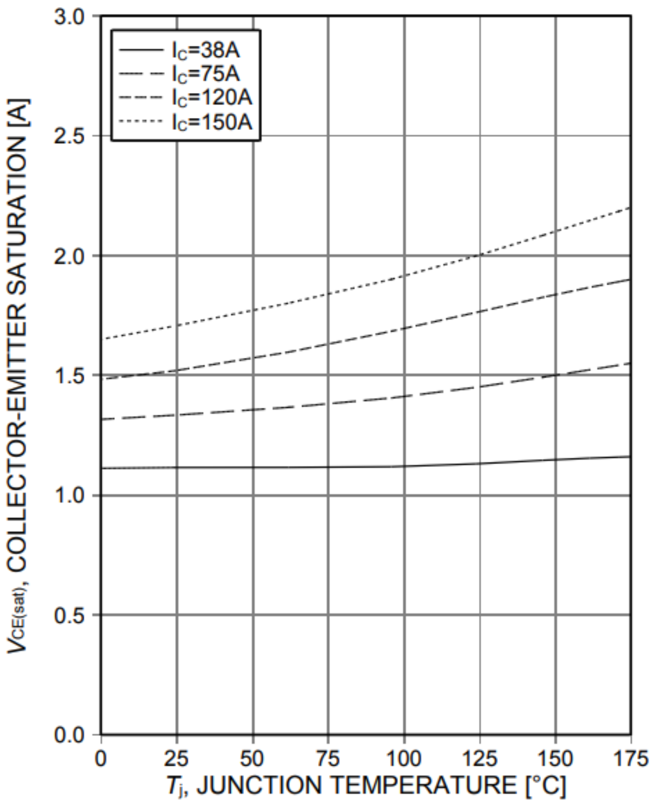


Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature**
(V_{GE}=15V)

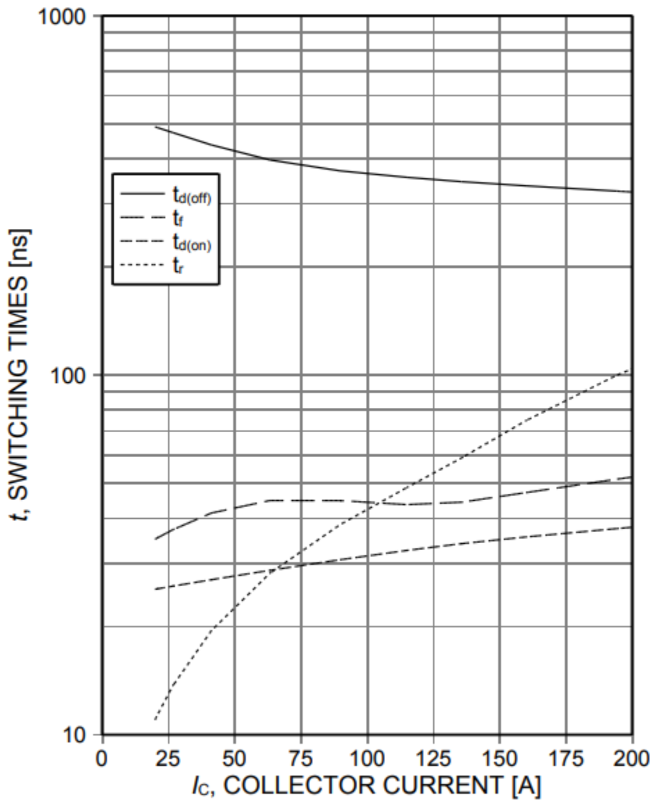


Figure 8. **Typical switching times as a function of collector current**
(inductive load, T_j=175°C, V_{CE}=400V,
V_{GE}=15/0V, r_G=3Ω,Dynamic test circuit in
Figure E)

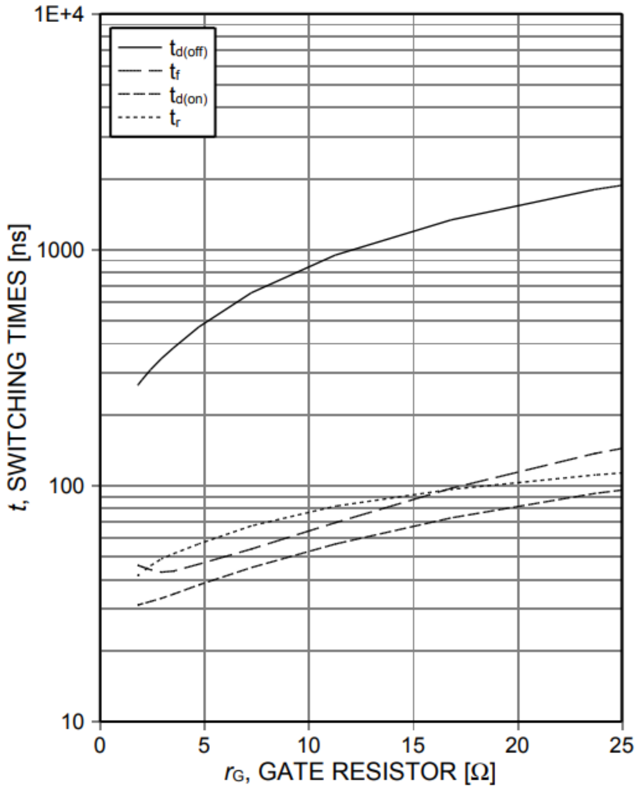


Figure 9. **Typical switching times as a function of gate resistor**
(inductive load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, I_C=120A,Dynamic test circuit in Figure E)

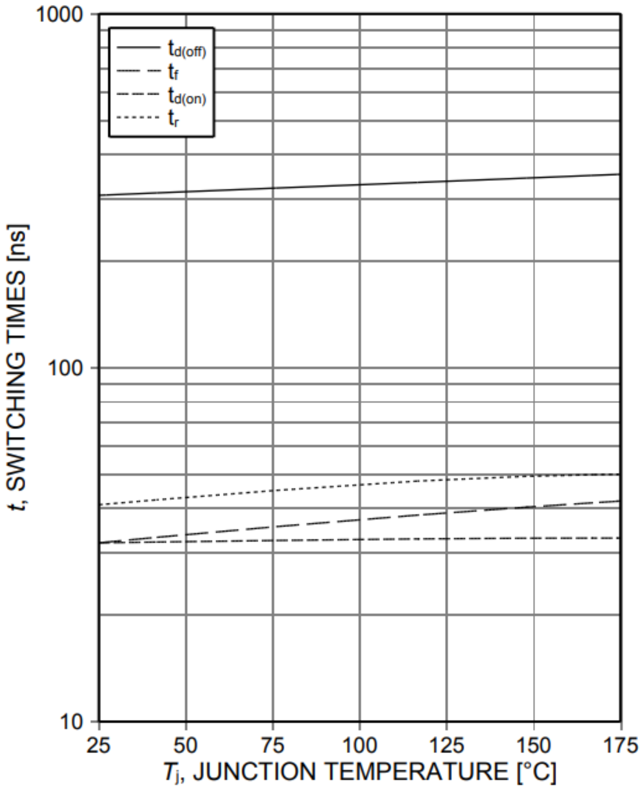


Figure 10. **Typical switching times as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=120A, r_G=3Ω,Dynamic test circuit in Figure E)

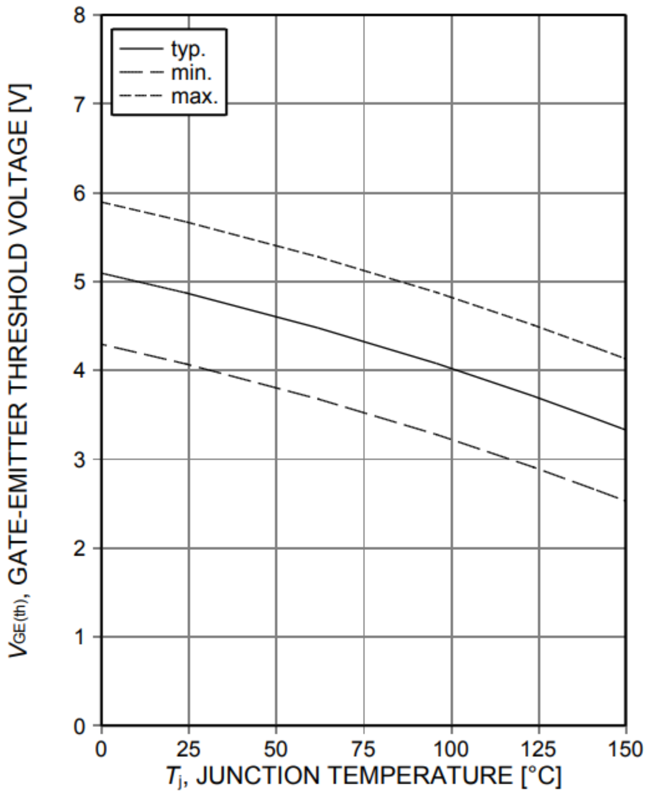


Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=1,92mA)

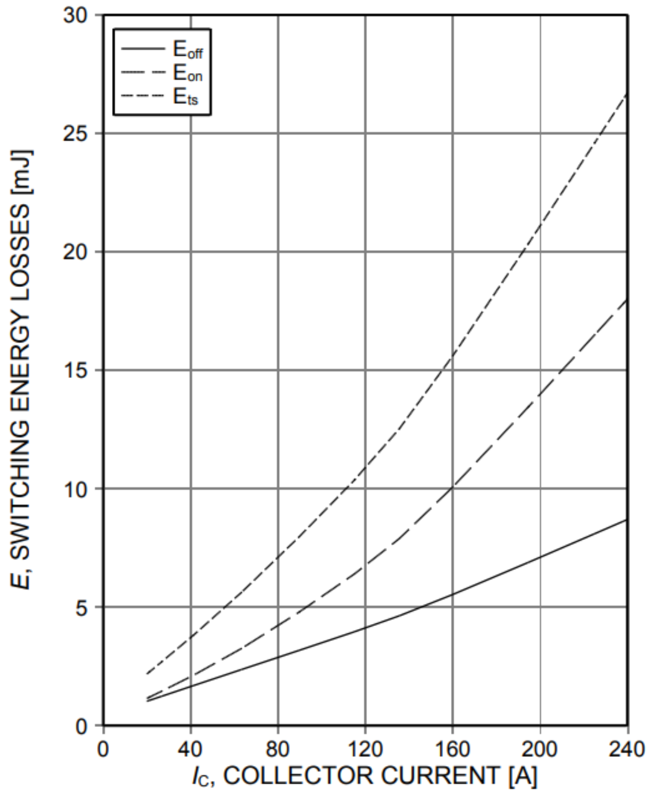


Figure 12. **Typical switching energy losses as a function of collector current**
(inductive load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, r_G=3Ω,Dynamic test circuit in Figure E)

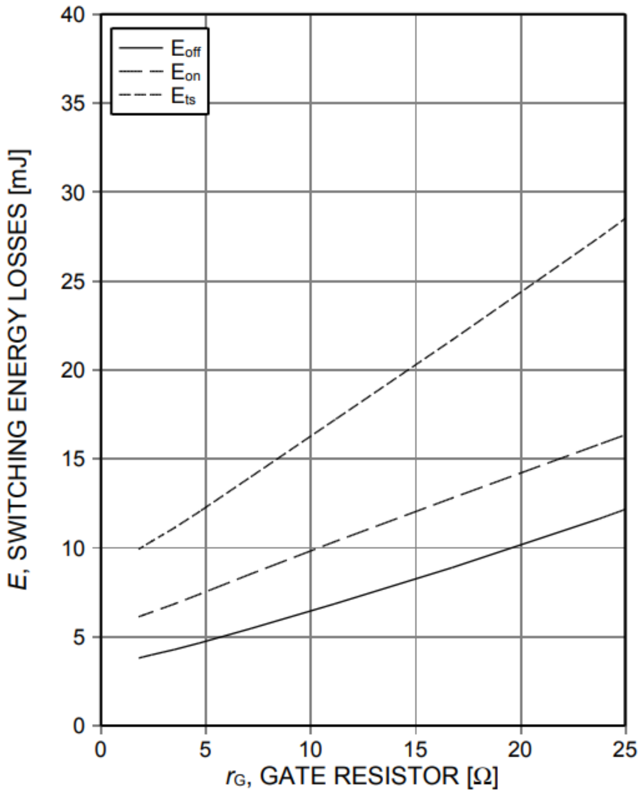


Figure 13. **Typical switching energy losses as a function of gate resistor**
(inductive load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, I_C=120A,Dynamic test circuit in Figure E)

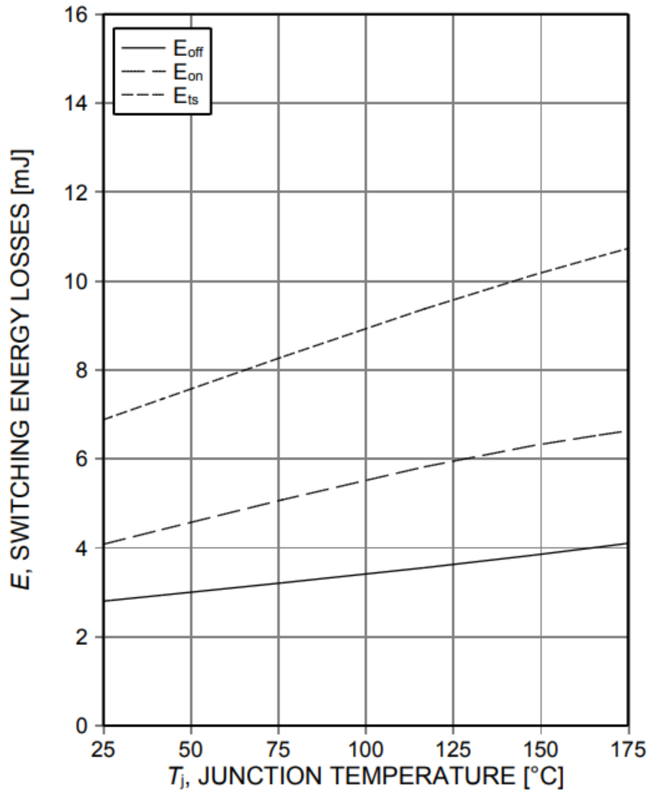


Figure 14. **Typical switching energy losses as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=120A, r_G=3Ω,Dynamic test circuit in Figure E)

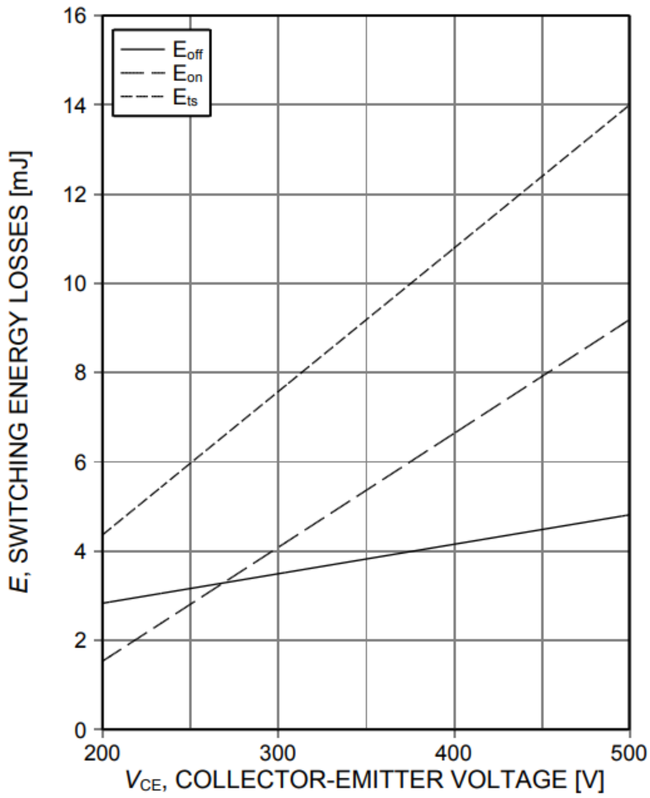


Figure 15. **Typical switching energy losses as a function of collector emitter voltage**
(inductive load, T_j=175°C, V_{GE}=15/0V, I_C=120A, R_G=3Ω, Dynamic test circuit in Figure E)

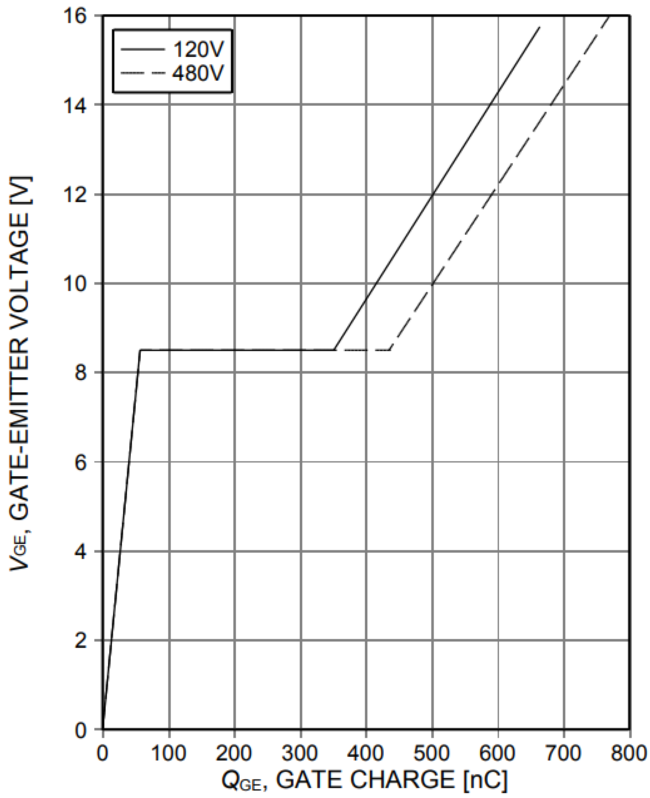


Figure 16. **Typical gate charge**
(I_C=120A)

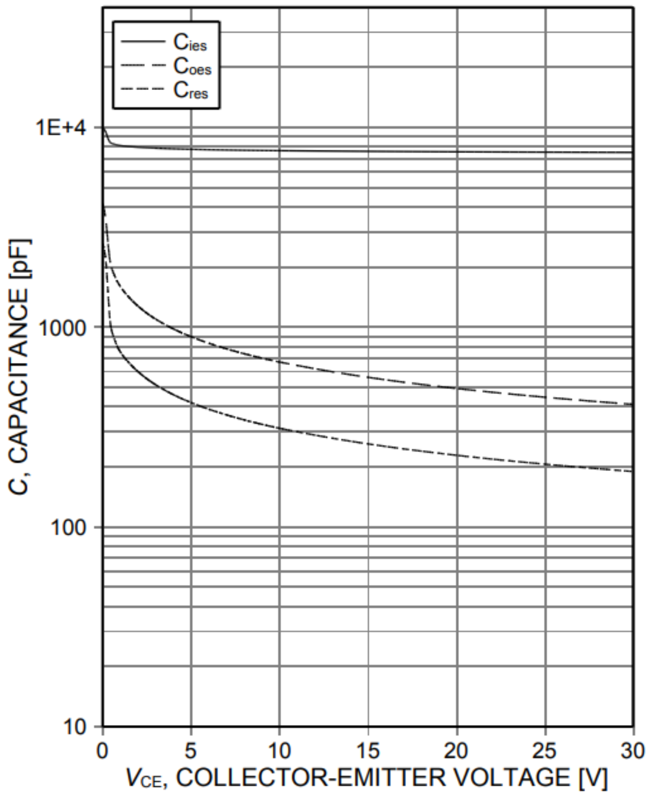


Figure 17. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=1MHz)

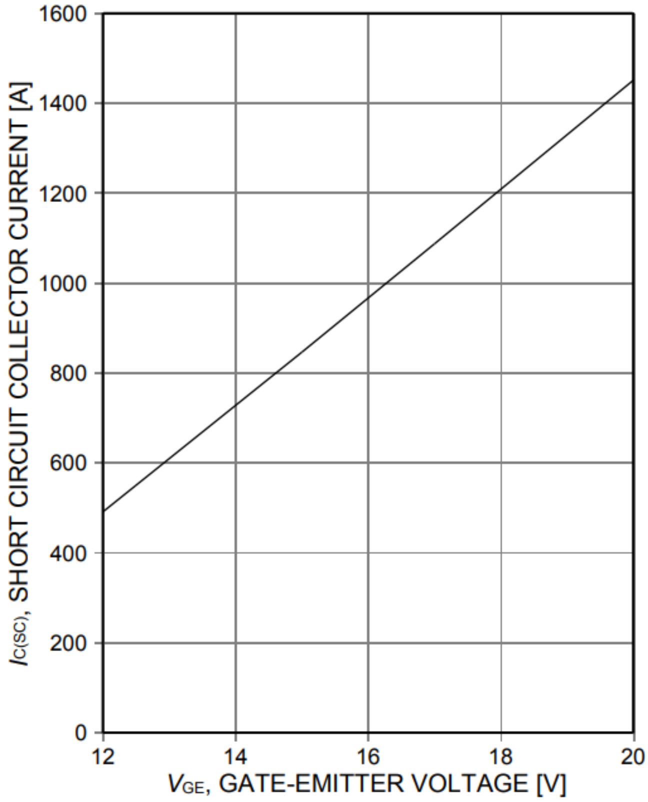


Figure 18. **Typical short circuit collector current as a function of gate-emitter voltage**
(V_{CE}≤400V, T_j≤150°C)

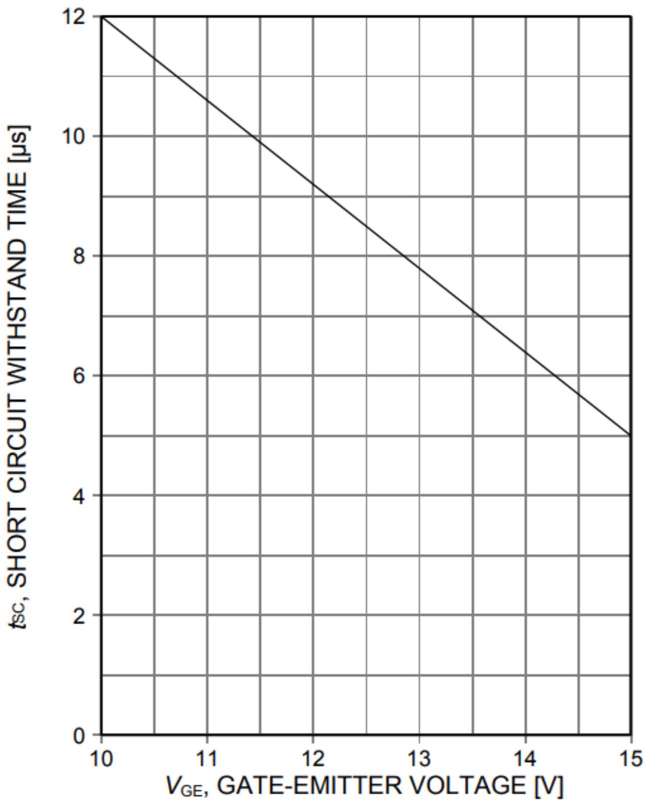


Figure 19. **Short circuit withstand time as a function of gate-emitter voltage**
(V_{CE}=400V, start at T_j=25°C, $T_j$max≤150°C)

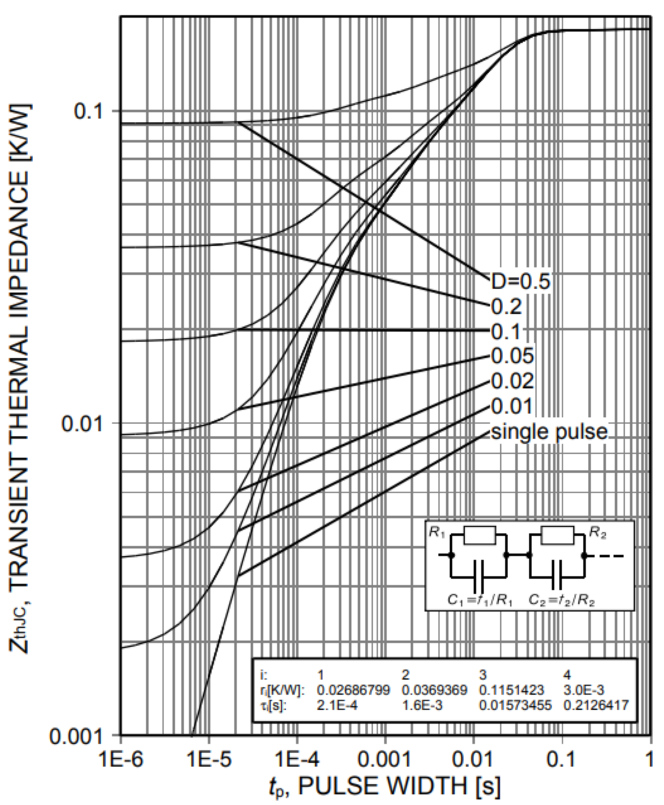


Figure 20. **IGBT transient thermal impedance as a function of pulse width for different duty cycles *D***
(D=t_p/T)

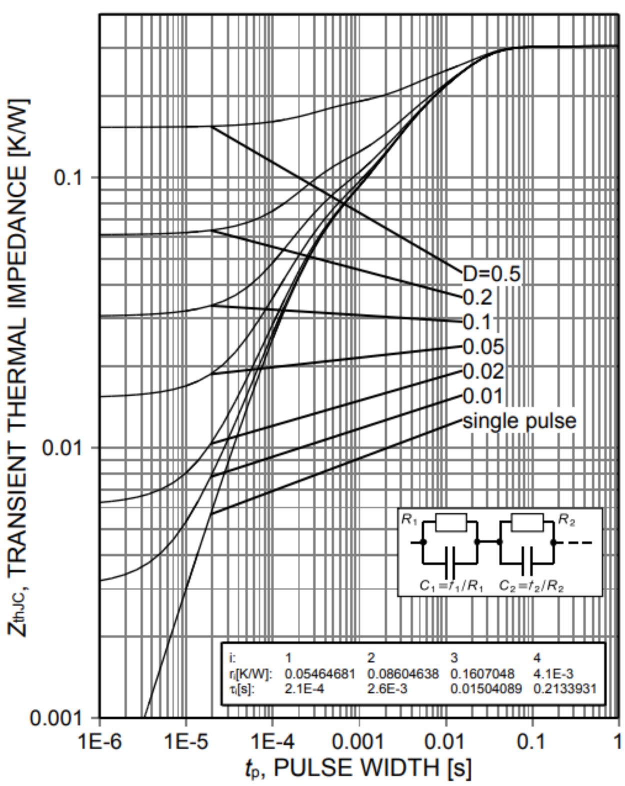


Figure 21. **Diode transient thermal impedance as a function of pulse width for different duty cycles *D***
(*D*=t_p/T)

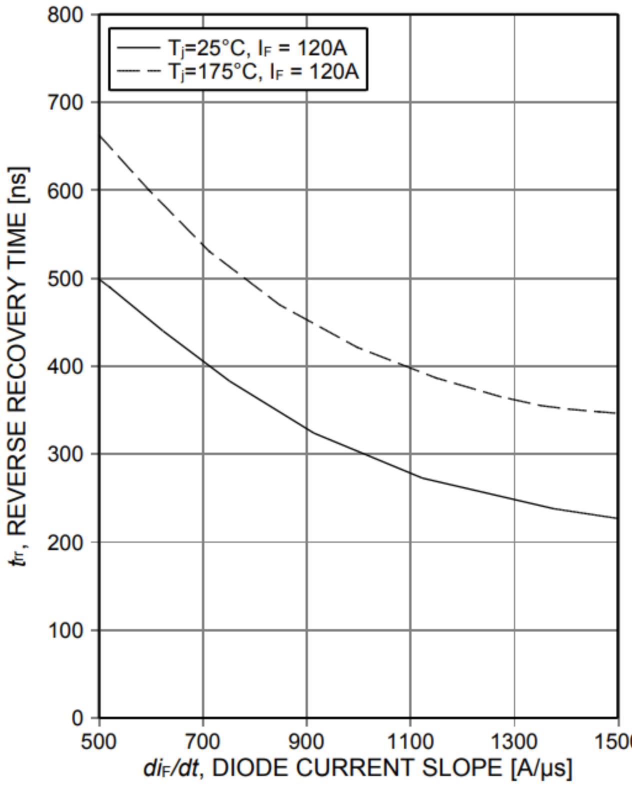


Figure 22. **Typical reverse recovery time as a function of diode current slope**
(V_R=400V,Dynamic test circuit in Figure E)

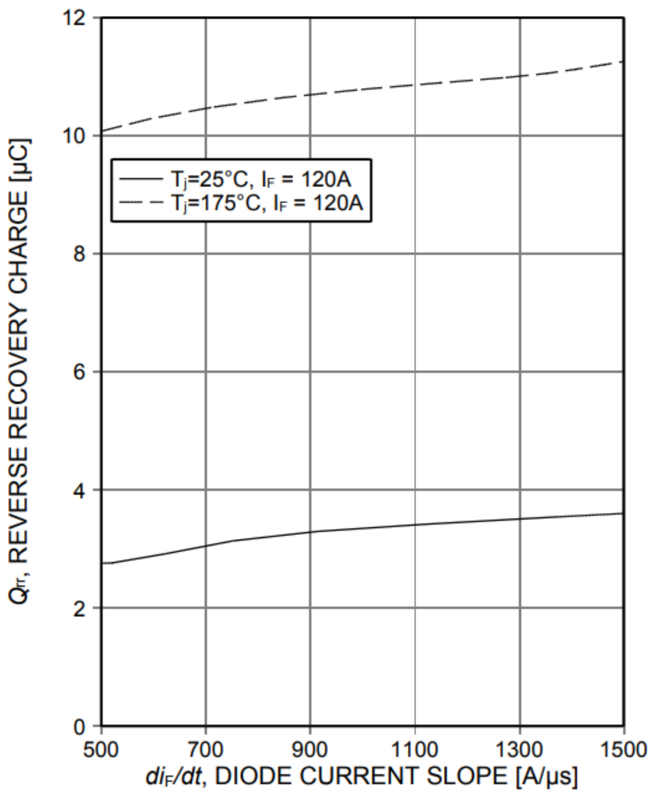


Figure 23. **Typical reverse recovery charge as a function of diode current slope**
(V_R=400V, Dynamic test circuit in Figure E)

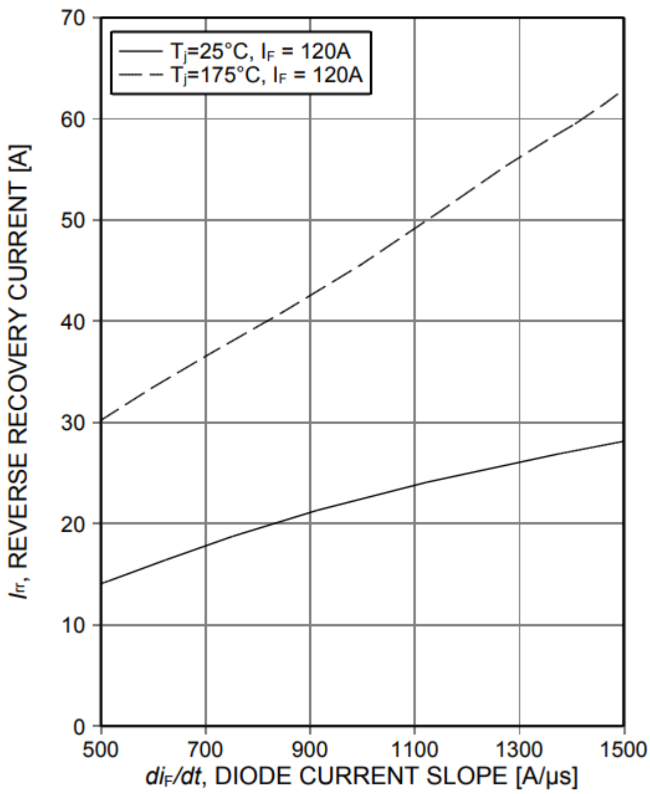


Figure 24. **Typical reverse recovery current as a function of diode current slope**
(V_R=400V, Dynamic test circuit in Figure E)

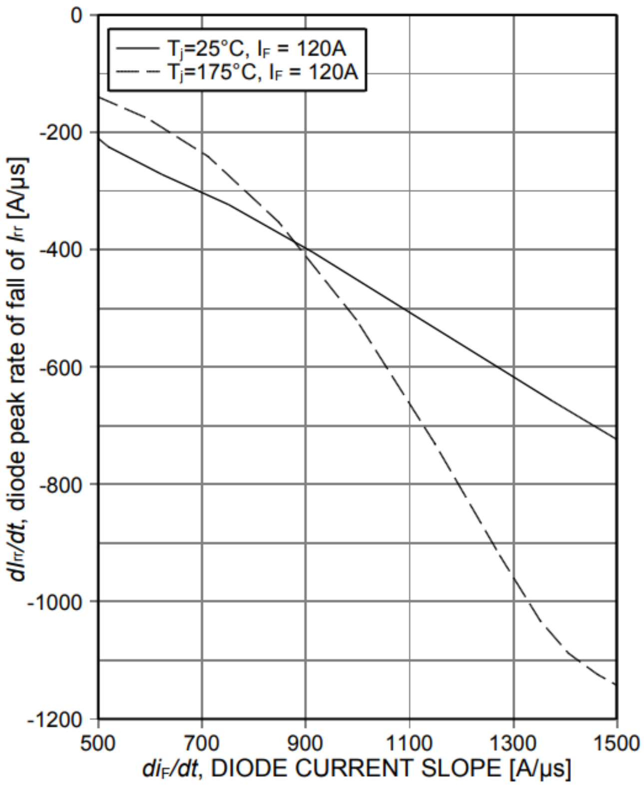


Figure 25. **Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**
(V_R=400V, Dynamic test circuit in Figure E)

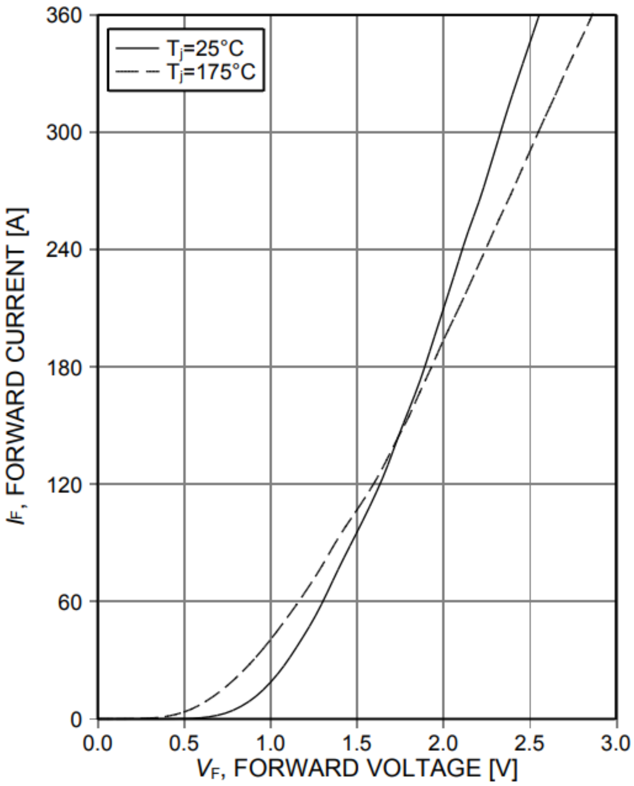


Figure 26. **Typical diode forward current as a function of forward voltage**

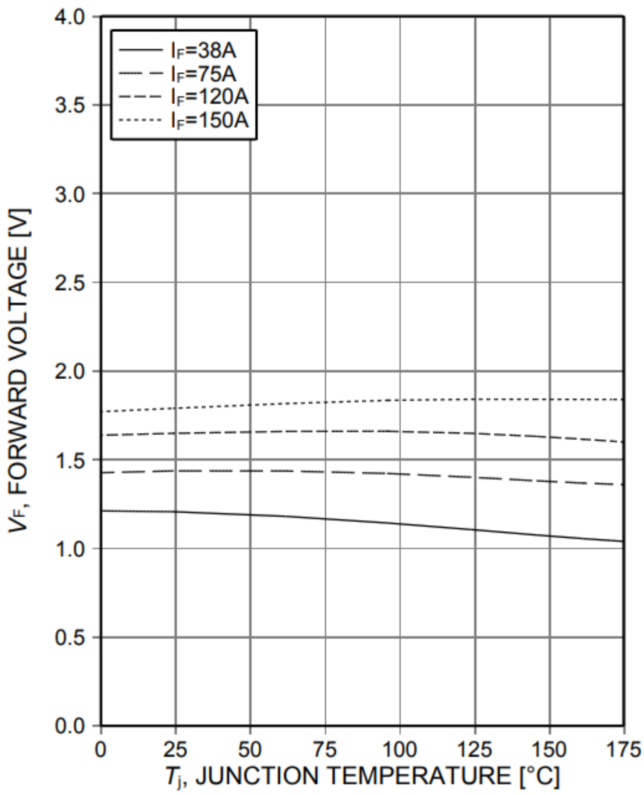
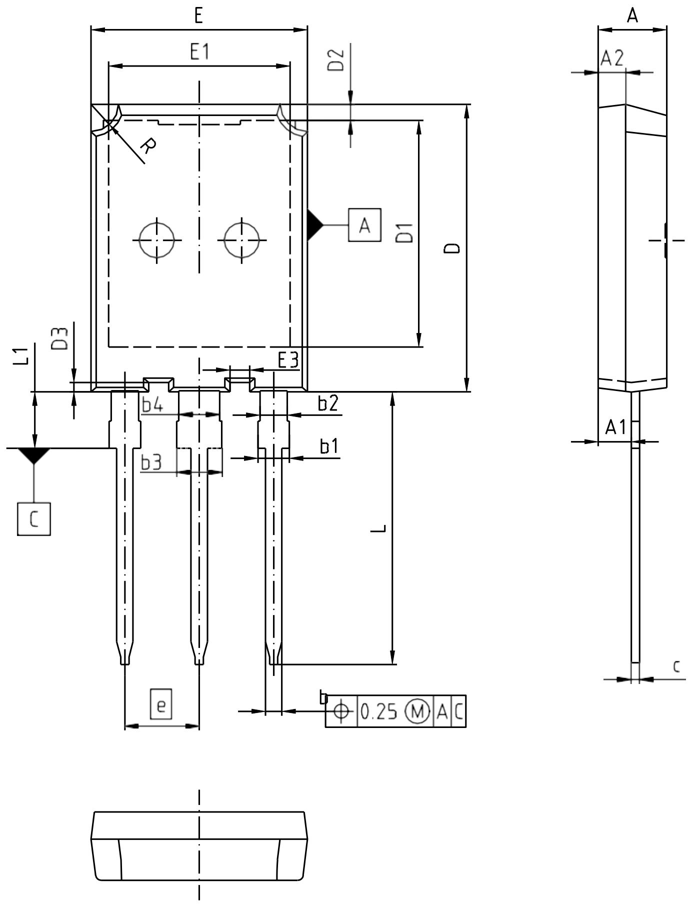


Figure 27. **Typical diode forward voltage as a function of junction temperature**

5 封装图

封装图 PG-TO247-3-46

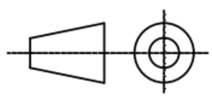


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.96	2.25	0.077	0.089
b2	1.96	2.06	0.077	0.081
c	0.59	0.66	0.023	0.026
D	20.90	21.10	0.823	0.831
D1	16.25	16.85	0.640	0.663
D2	1.05	1.35	0.041	0.053
D3	0.58	0.78	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

DOCUMENT NO.
Z8B00174295

SCALE
0 5 7.5mm
0 5

EUROPEAN PROJECTION



ISSUE DATE
13-08-2014

REVISION
01

6 测试条件

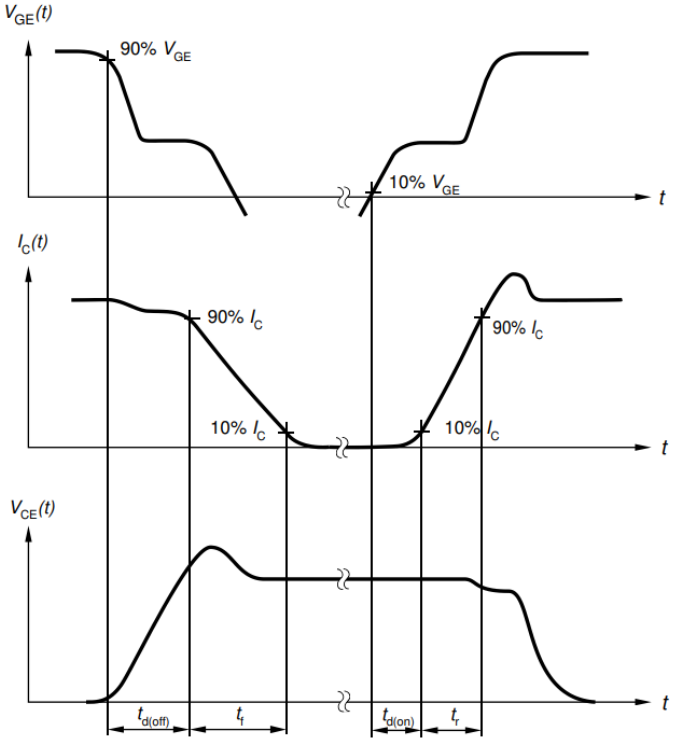


Figure A. **Definition of switching times**

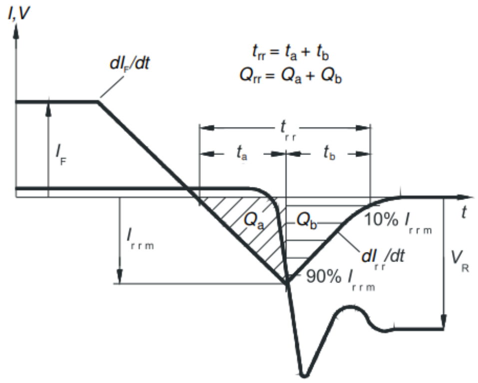


Figure C. **Definition of diode switching characteristics**

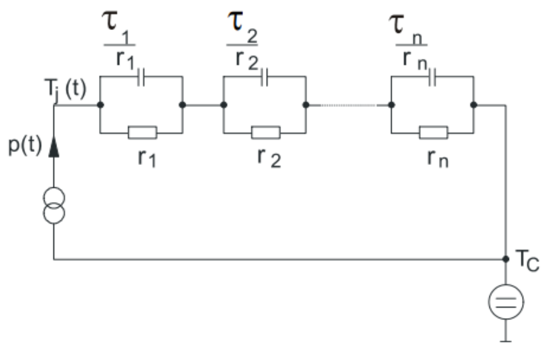


Figure D. **Thermal equivalent circuit**

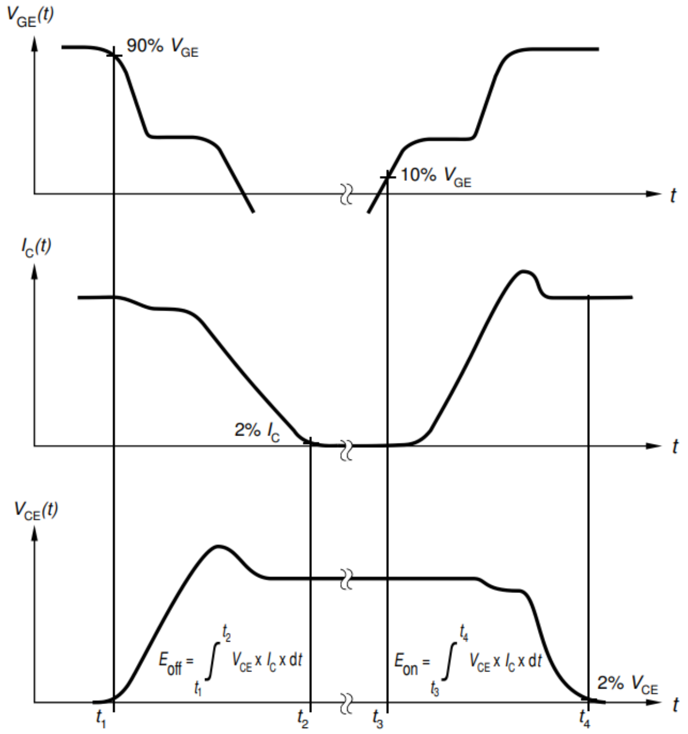


Figure B. **Definition of switching losses**

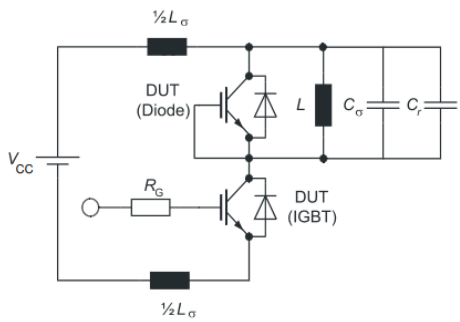


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

修订记录

IKQ120N60T

Revision: 2017-11-13, Rev. 2.3

历史修订版本

Revision	Date	Subjects (major changes since last revision)
2.1	2014-11-18	Final data sheet
2.2	2014-11-18	Update of Transconductance gfs
2.3	2017-11-13	Minor change Fig. 20 and Fig. 21

免责声明

请注意，本文件的原文使用英文撰写，为方便客户浏览英飞凌提供了中文译文。该中文译文仅供参考，并不可作为任何论点之依据。
由于翻译过程中可能使用了自动化程序，以及语言翻译和转换过程中的差异，最后的中文译文与最新的英文版本原文含义可能存在不尽相同之处。
因此，我们同时提供该中文译文版本的最新英文原文供您阅读，请参见 http://www.infineon.com
英文原文和中文译文版本之间若存有任何歧异，以最新的英文版本为准，并且仅认可英文版本为正式文件。

您如果使用本文件，即表示您同意并理解上述说明。英飞凌不对因翻译过程中可能存在的任何不完整或不准确信息而产生的任何直接或间接损失或损害负责。英飞凌不承担中文译文版本的完整性和准确性责任。如果您不同意上述说明，请不要使用本文件。

Trademarks
All referenced product or service names and trademarks are the property of their respective owners.

版本 **2025-08-28**

Infineon Technologies AG 出版，
德国 **Neubiberg 85579**

Do you have a question about this document?

Email:

erratum@infineon.com