IGBT

英飞凌TRENCHSTOPTM性能技术与 RAPID 1 快速反并联二极管共同封装

IKW50N60DTP

英飞凌600V DuoPack IGBT 和二极管

TRENCHSTOP™高性能系列

数据手册

工业功率控制

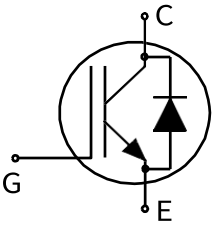
采用 Trench 和 Fieldstop 技术的高速 IGBT

特性：

TRENCHSTOP™技术产品

- 极低 V_{CEsat}
- 低关断损耗
- 低拖尾电流
- 低电磁干扰
- 非常柔软、快速恢复的反并联二极管
- 最高结温 175°C
- 符合 JEDEC 目标应用要求s
- 无铅镀层；符合RoHS标准
- 完整的产品品类和 PSpice 模型：

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



应用：

- 驱动器
- 太阳能逆变器
- UPS（不间断电源）
- 中等开关频率转换器

Green

Halogen-Free

RoHS

关键性能和封装参数

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IKW50N60DTP	600V	50A	1.6V	175°C	K50DDTP	PG-TO247-3

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

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 $T_C = 100°C$	I_C	80.0 61.0	A
Pulsed collector current, t_p limited by T_{vjmax} [1)]	I_{Cpuls}	150.0	A
Turn off safe operating area $V_{CE} \leq 600V$, $T_{vj} \leq 175°C$, $t_p = 1\mu s$[1)]	-	150.0	A
Diode forward current, limited by T_{vjmax} $T_C = 25°C$ $T_C = 100°C$	I_F	62.0 39.0	A
Diode pulsed current, t_p limited by T_{vjmax} [1)]	I_{Fpuls}	150.0	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 $T_C = 25°C$ Power dissipation $T_C = 100°C$	P_{tot}	319.2 159.6	W
Operating junction temperature	T_{vj}	-40...+175	°C
Storage temperature	T_{stg}	-55...+150	°C
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	°C
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

热阻抗

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
R_{th} 特性						
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		-	0.36	0.47	K/W
Diode thermal resistance, junction - case	$R_{th(j-c)}$		-	0.62	0.95	K/W

[1)]由设计标定，不受制于生产测试。

电气特性，测于 T_{vj} = 25°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 = 0.20mA	600	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	V_{GE} = 15.0V, I_C = 50.0A T_{vj} = 25°C T_{vj} = 175°C	- -	1.60 1.94	1.80 -	V
Diode forward voltage	V_F	V_{GE} = 0V, I_F = 30.0A T_{vj} = 25°C T_{vj} = 175°C	- -	1.45 1.39	1.70 -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 0.80mA, V_{CE} = V_{GE}	4.1	5.1	5.7	V
Zero gate voltage collector current	I_{CES}	V_{CE} = 600V, V_{GE} = 0V T_{vj} = 25°C T_{vj} = 175°C	- -	- -	40 -	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	-	78.0	-	S

电气特性，测于 T_{vj} = 25°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	-	1950	-	pF
Output capacitance	C_{oes}		-	109	-	
Reverse transfer capacitance	C_{res}		-	67	-	
Gate charge	Q_G	V_{CC} = 480V, I_C = 50.0A, V_{GE} = 15V	-	249.0	-	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} = 150°C	-	255	-	A

开关特性、感性负载

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
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 = 50.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 7.0Ω, $R_{G(off)}$ = 7.0Ω, Lσ = 32nH, Cσ = 60pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	20	-	ns
Rise time	t_r		-	30	-	ns
Turn-off delay time	$t_{d(off)}$		-	215	-	ns
Fall time	t_f		-	18	-	ns
Turn-on energy	E_{on}		-	1.53	-	mJ
Turn-off energy	E_{off}		-	0.85	-	mJ
Total switching energy	E_{ts}		-	2.38	-	mJ

Diode reverse recovery time	t_{rr}	T_{vj} = 25°C, V_R = 400V, I_F = 30.0A, di_F/dt = 870A/µs	-	115	-	ns
Diode reverse recovery charge	Q_{rr}		-	0.75	-	µC
Diode peak reverse recovery current	I_{rrm}		-	11.3	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	125	-	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 = 50.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 7.0Ω, $R_{G(off)}$ = 7.0Ω, Lσ = 32nH, Cσ = 60pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	21	-	ns
Rise time	t_r		-	34	-	ns
Turn-off delay time	$t_{d(off)}$		-	277	-	ns
Fall time	t_f		-	55	-	ns
Turn-on energy	E_{on}		-	2.25	-	mJ
Turn-off energy	E_{off}		-	1.39	-	mJ
Total switching energy	E_{ts}		-	3.64	-	mJ
Diode reverse recovery time	t_{rr}	T_{vj} = 175°C, V_R = 400V, I_F = 30.0A, di_F/dt = 870A/µs	-	194	-	ns
Diode reverse recovery charge	Q_{rr}		-	2.15	-	µC
Diode peak reverse recovery current	I_{rrm}		-	18.8	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	120	-	A/µs

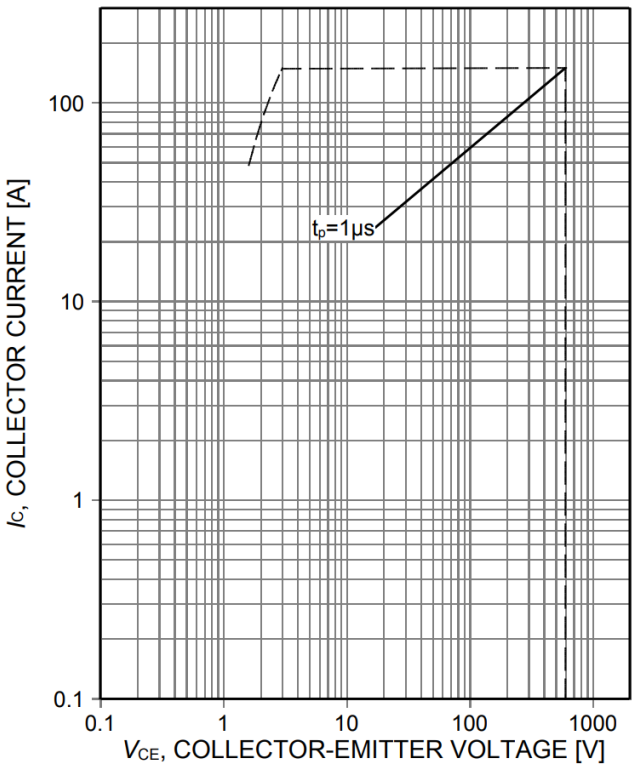


Figure 1. **Forward bias safe operating area**
(D=0, T_C=25°C, T_j≤175°C; V_{GE}=15V)

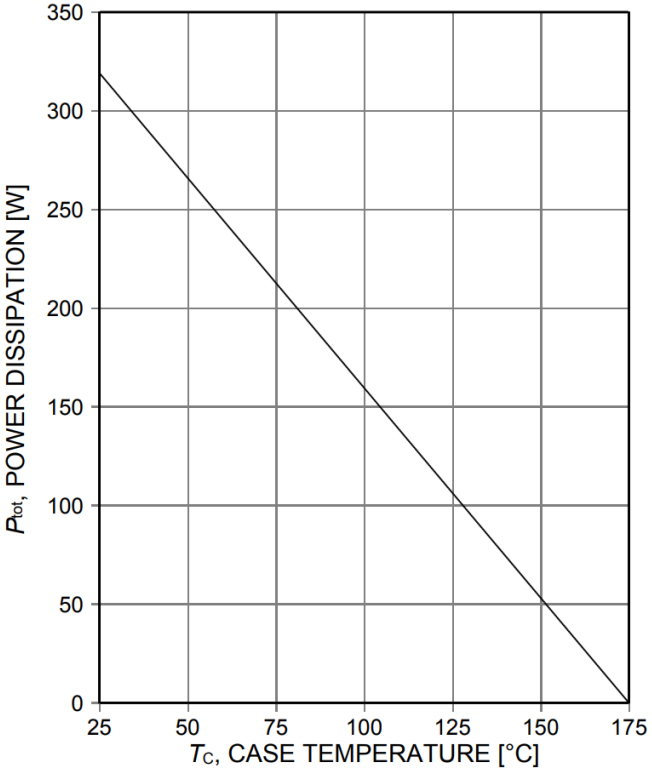


Figure 2. **Power dissipation as a function of case temperature**
(T_j≤175°C)

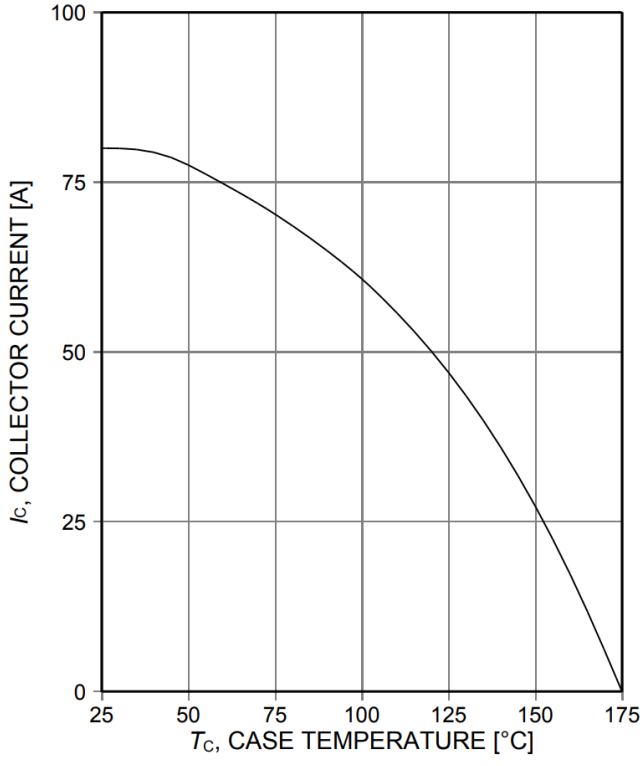


Figure 3. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_j≤175°C)

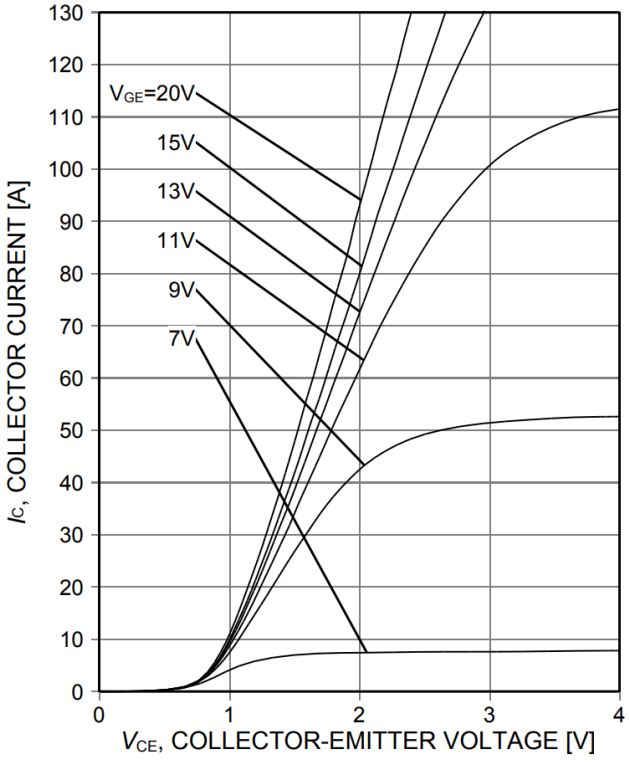


Figure 4. **Typical output characteristic**
(T_j=25°C)

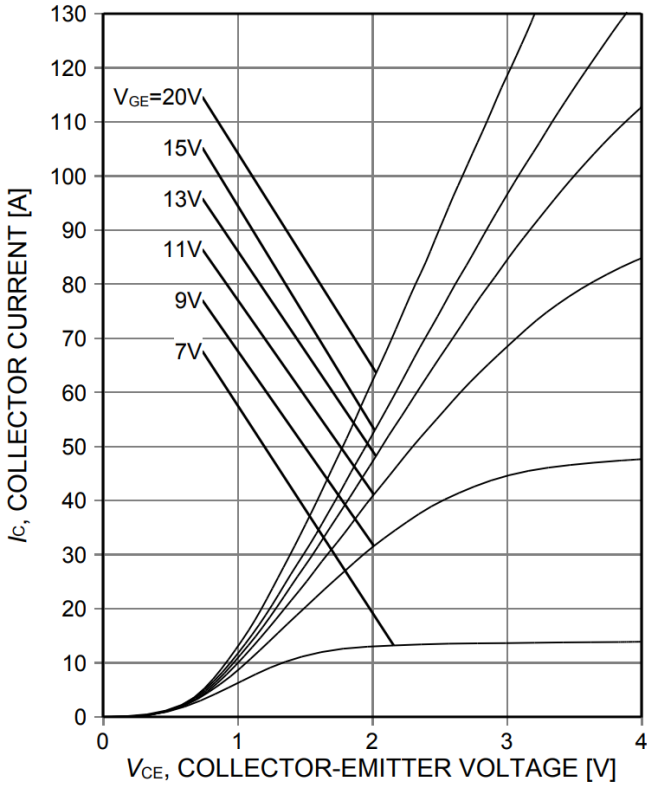


Figure 5. **Typical output characteristic** (T_j=175°C)

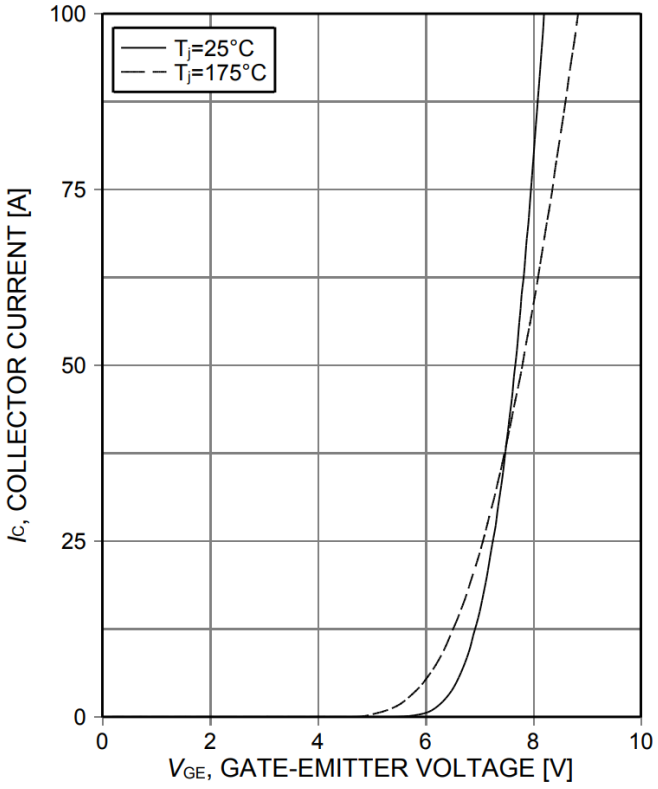


Figure 6. **Typical transfer characteristic** (V_{CE}=20V)

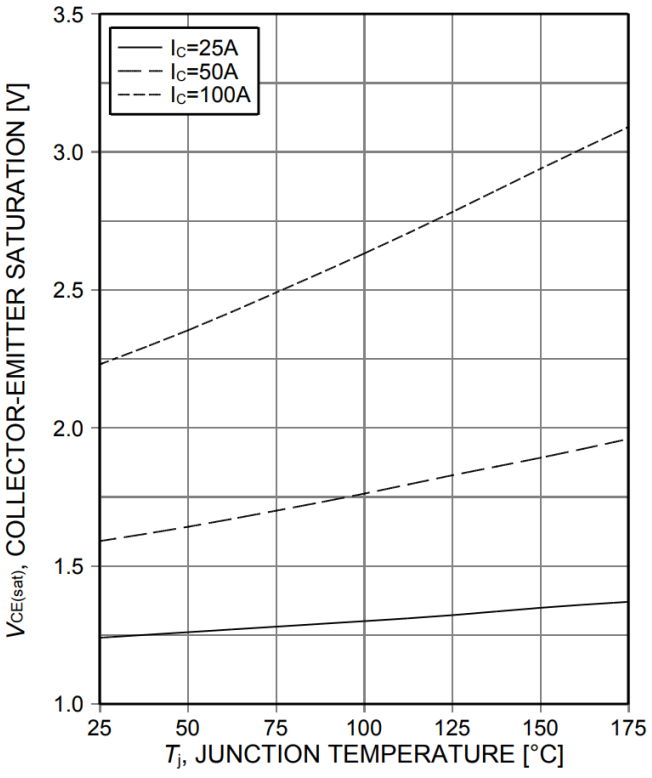


Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature** (V_{GE}=15V)

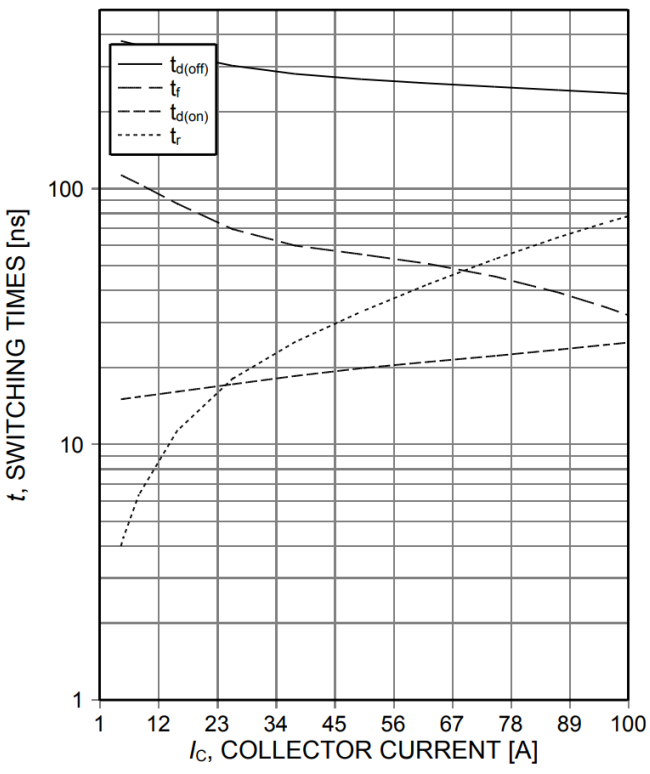


Figure 8. **Typical switching times as a function of collector current** (ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, r_G=7Ω, test circuit in Fig. E)

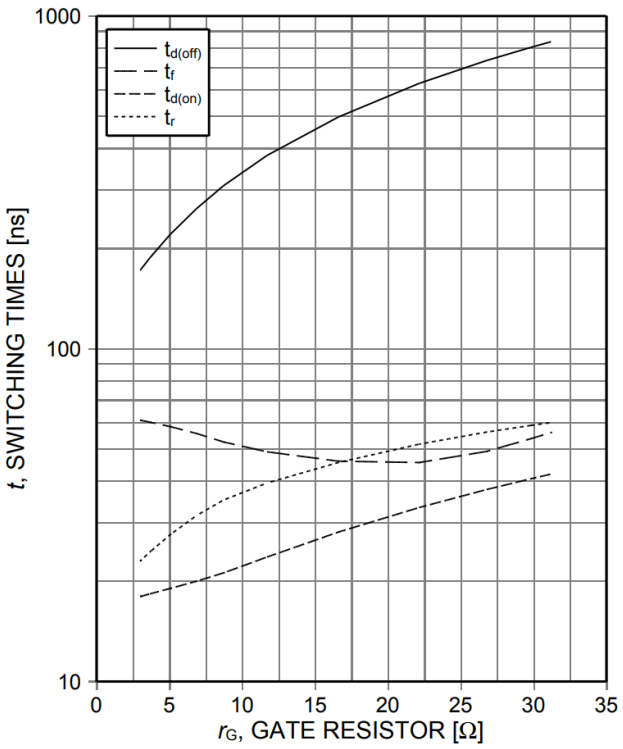


Figure 9. **Typical switching times as a function of gate resistor**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, I_C=50A, test circuit in Fig. E)

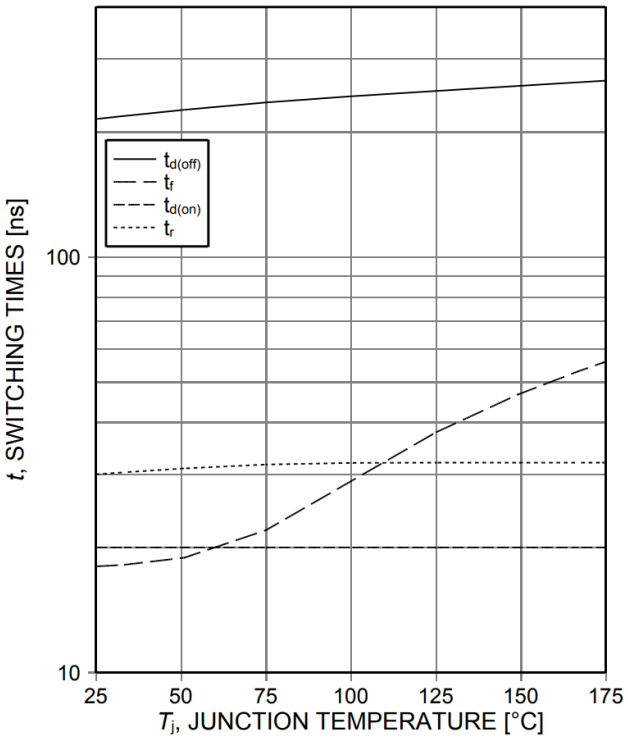


Figure 10. **Typical switching times as a function of junction temperature**
(ind. load, V_{CE}=400V, V_{GE}=15/0V, I_C=50A, r_G=7Ω, test circuit in Fig. E)

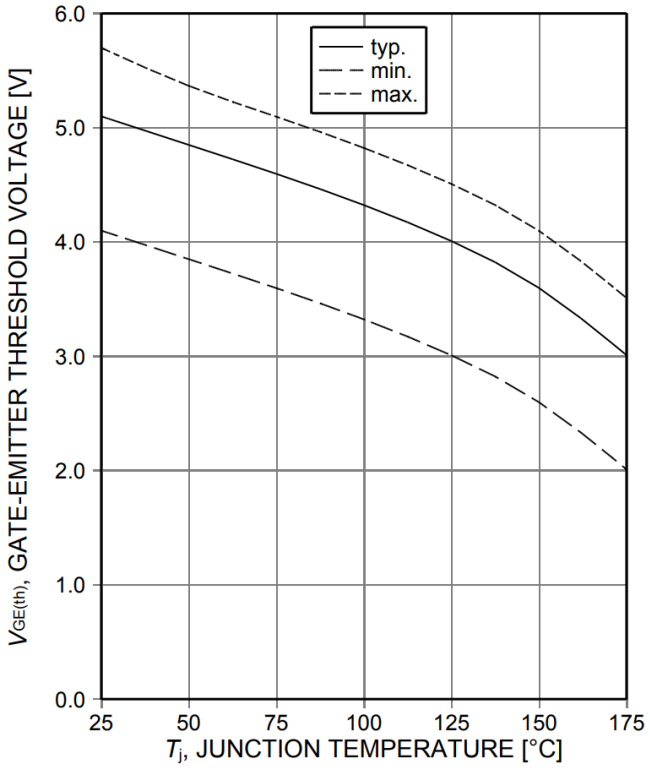


Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0,8mA)

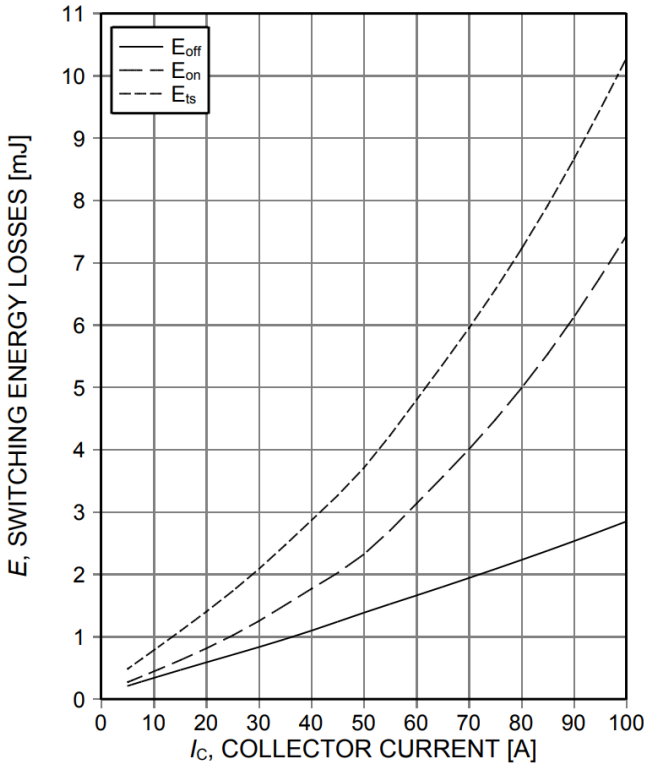


Figure 12. **Typical switching energy losses as a function of collector current**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, r_G=7Ω, test circuit in Fig. E)

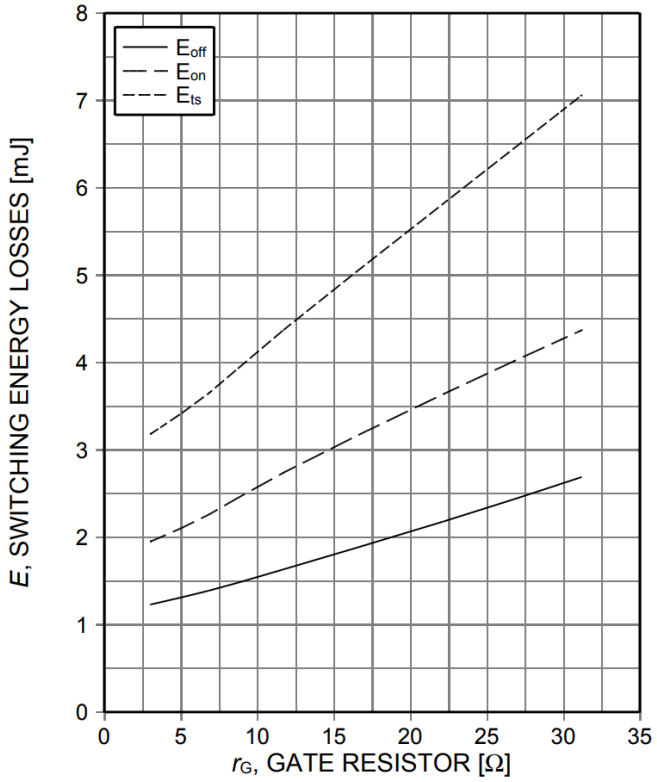


Figure 13. **Typical switching energy losses as a function of gate resistor**
(ind. load, T_j=175°C, V_{CE}=400V, V_{GE}=15/0V, I_C=50A, test circuit in Fig. E)

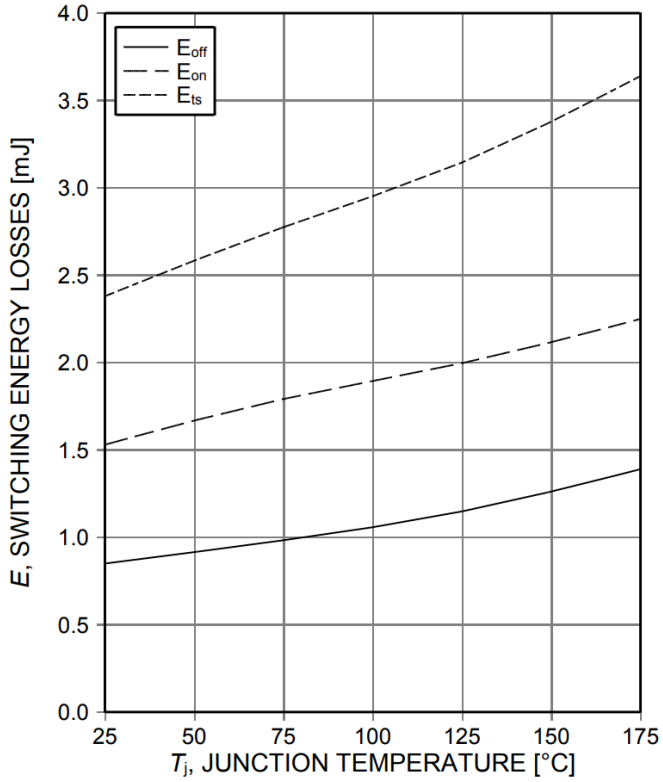


Figure 14. **Typical switching energy losses as a function of junction temperature**
(ind load, V_{CE}=400V, V_{GE}=15/0V, I_C=50A, r_G=7Ω, test circuit in Fig. E)

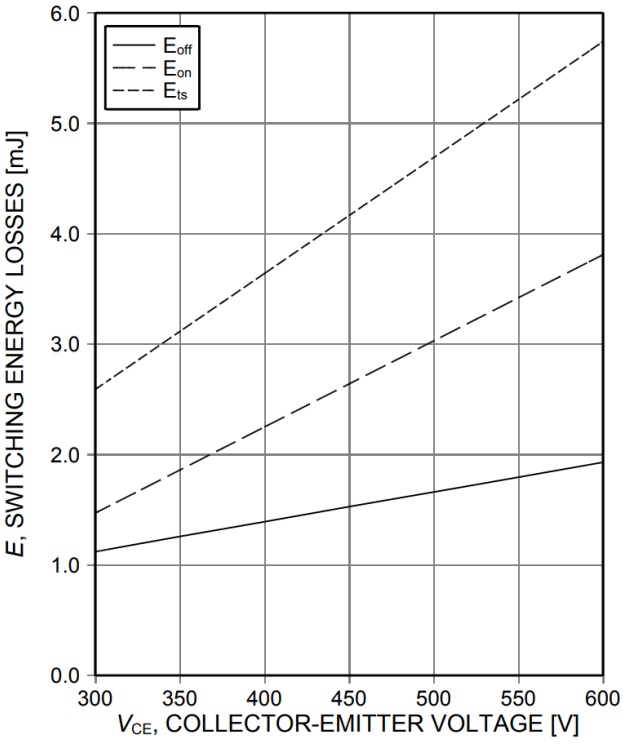


Figure 15. **Typical switching energy losses as a function of collector emitter voltage**
(ind. load, T_j=175°C, V_{GE}=15/0V, I_C=50A, r_G=7Ω, test circuit in Fig. E)

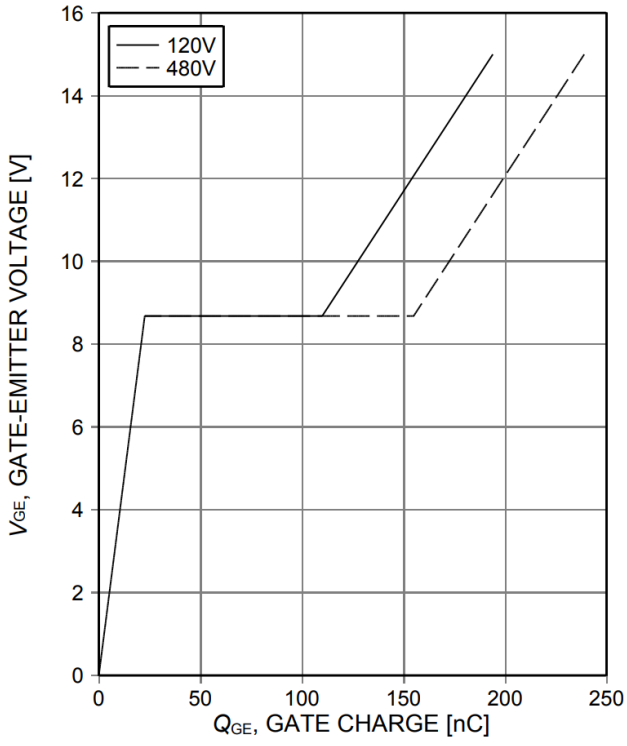


Figure 16. **Typical gate charge**
(I_C=50A)

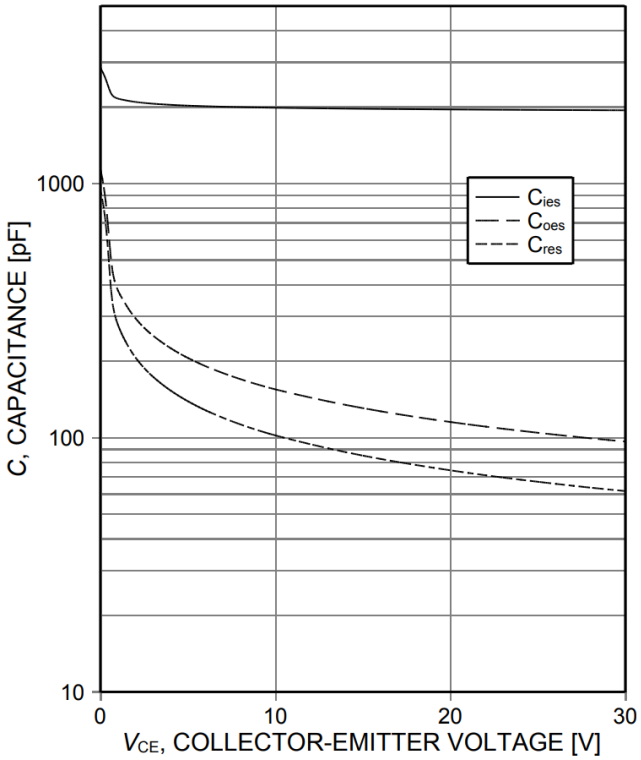


Figure 17. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=1MHz)

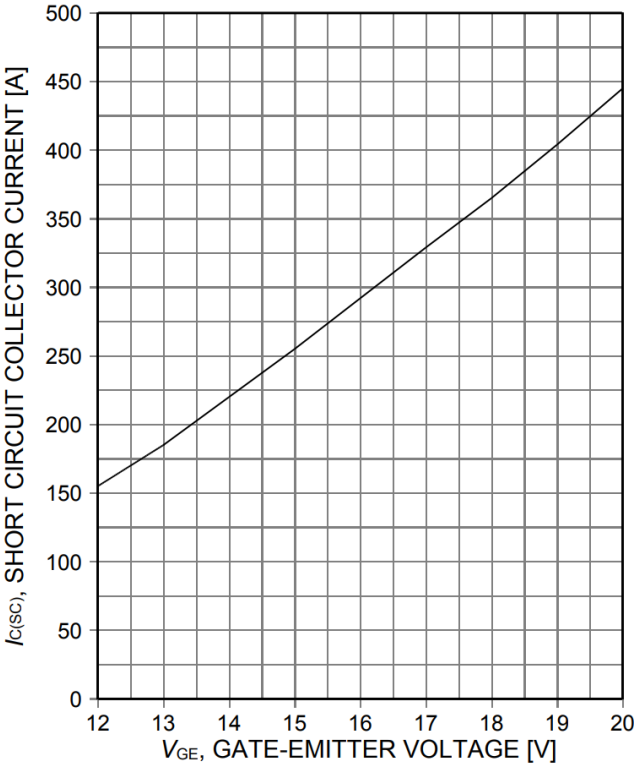


Figure 18. **Typical short circuit collector current as a function of gate-emitter voltage**
(V_{CE}≤400V, start at T_j=150°C)

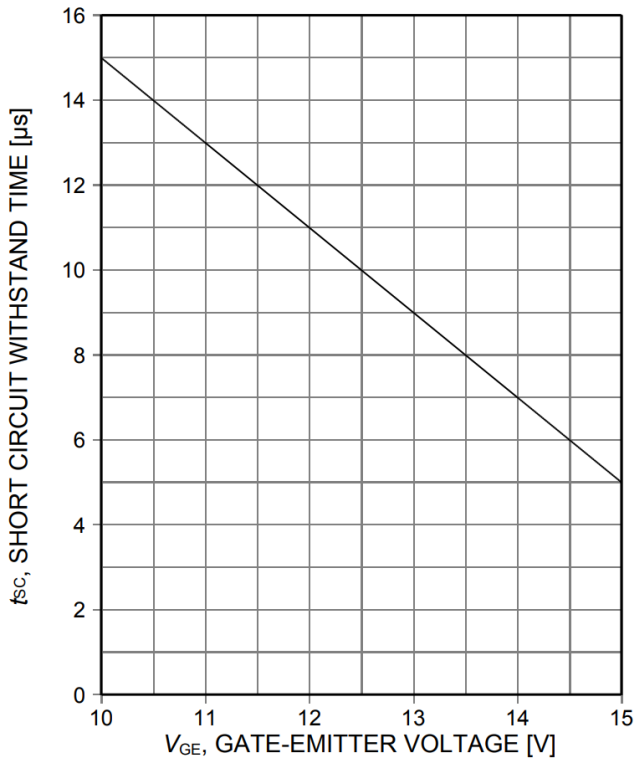


Figure 19. **Short circuit withstand time as a function of gate-emitter voltage**
(V_{CE}≤400V, start at T_j≤150°C)

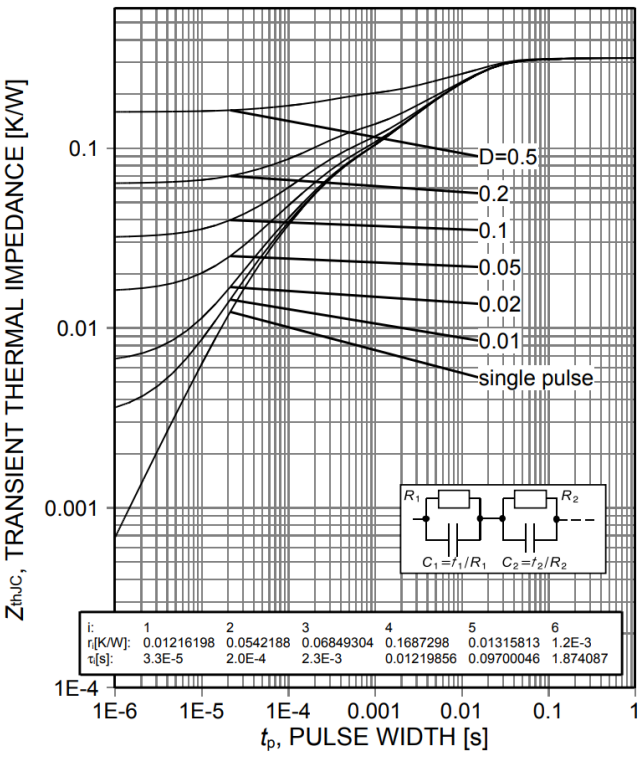


Figure 20. **Typical IGBT transient thermal impedance**
($D=t_p/T$)

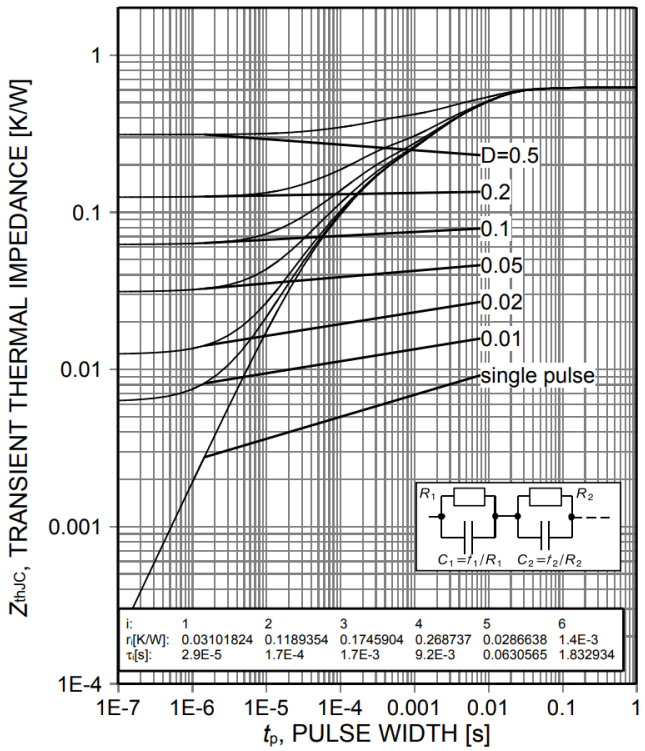


Figure 21. **Typical diode transient thermal impedance as a function of pulse width**
($D=t_p/T$)

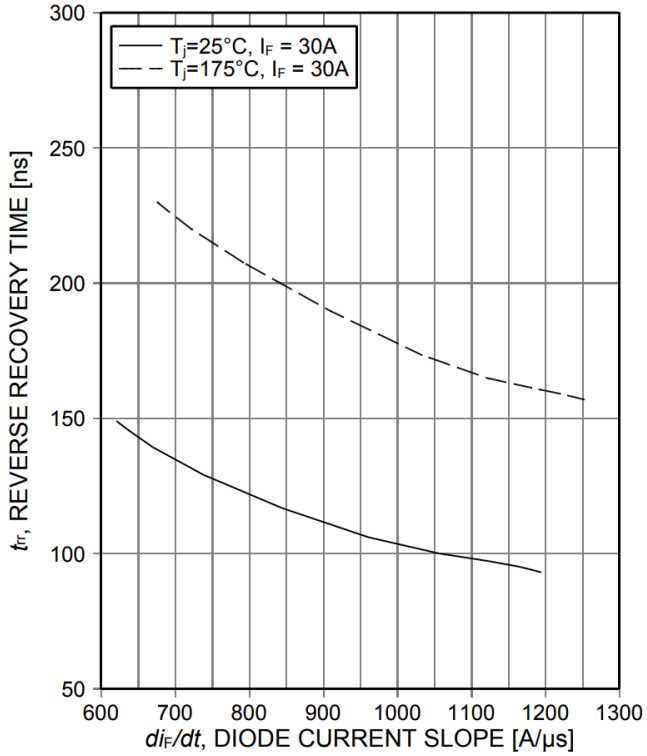


Figure 22. **Typical reverse recovery time as a function of diode current slope**
(V_R=400V)

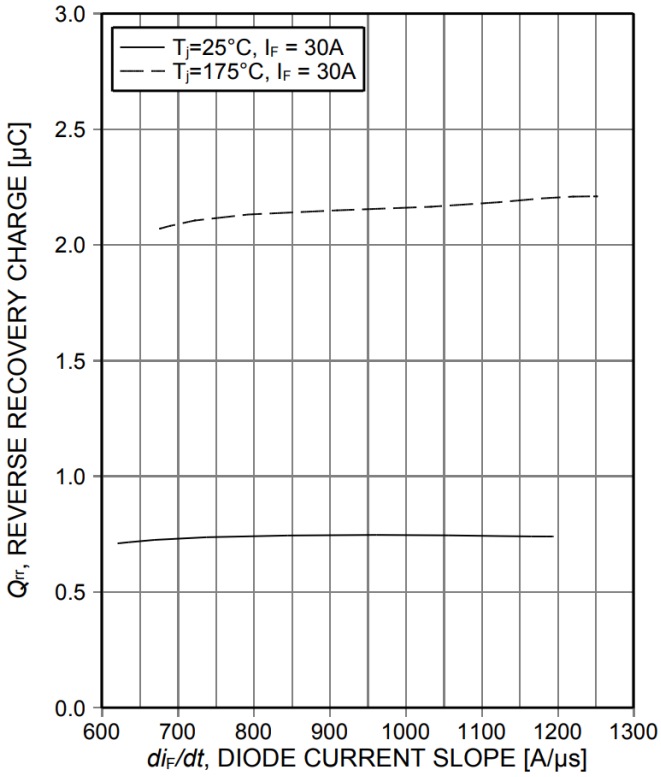


Figure 23. **Typical reverse recovery charge as a function of diode current slope**
(V_R=400V)

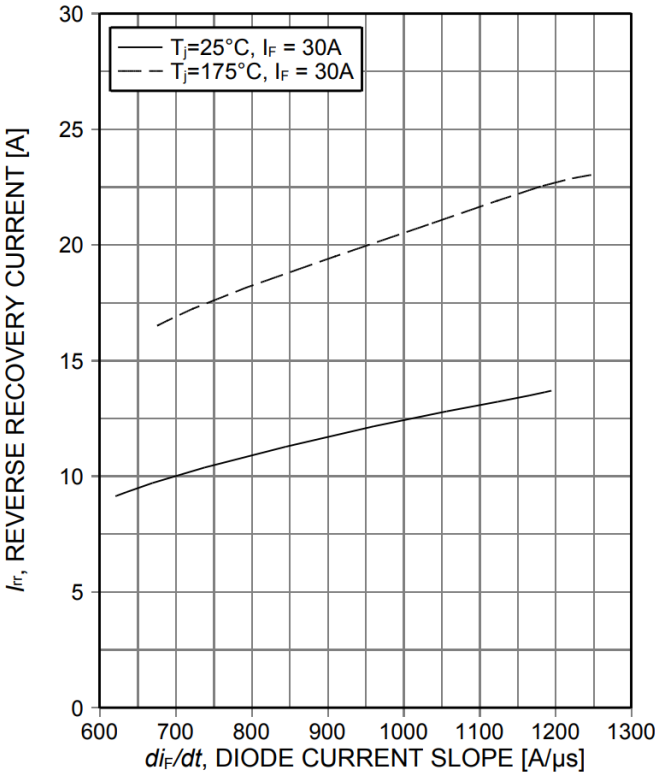


Figure 24. **Typical reverse recovery current as a function of diode current slope**
(V_R=400V)

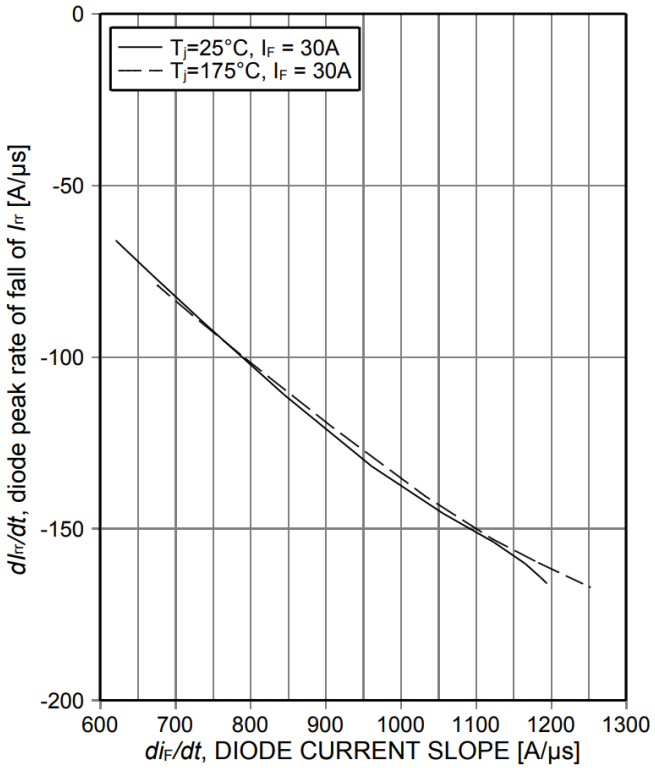


Figure 25. **Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**
(V_R=400V)

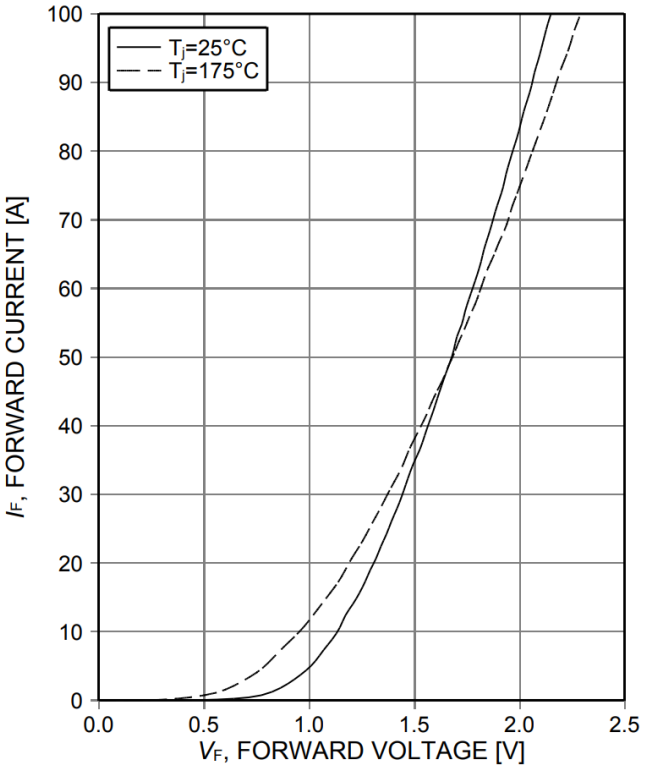


Figure 26. **Typical diode forward current as a function of forward voltage**

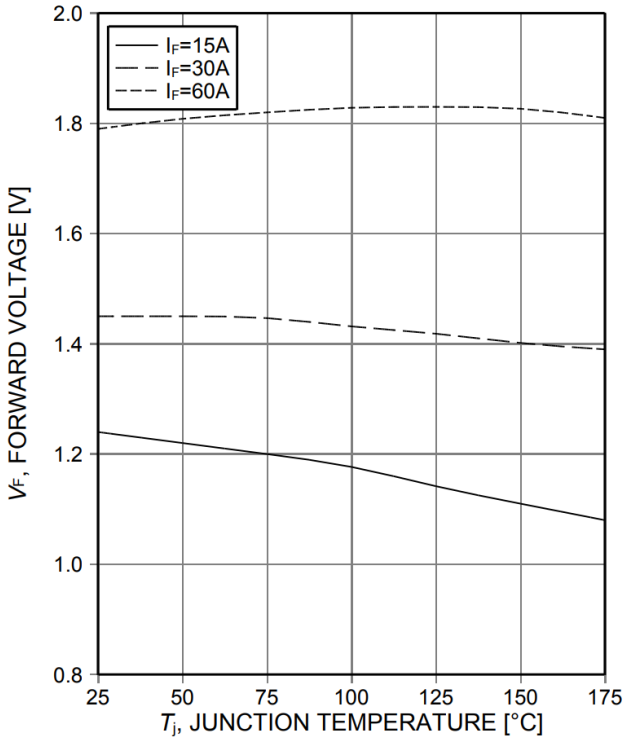
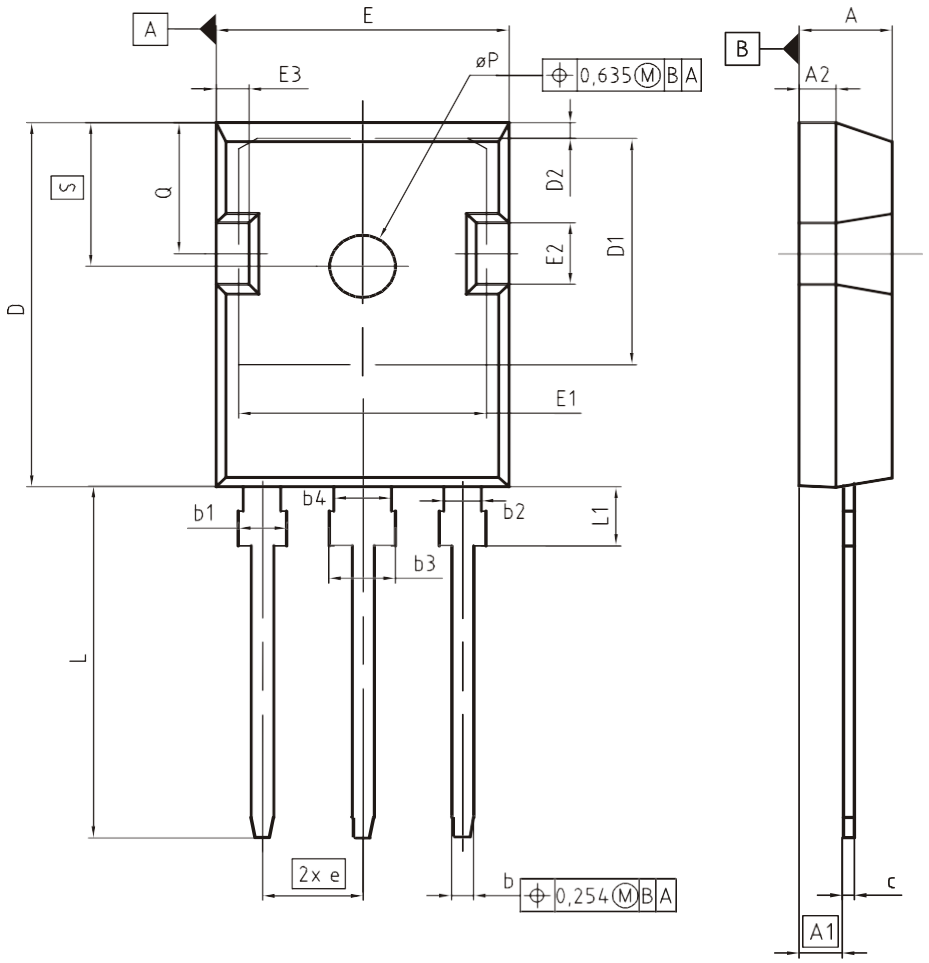


Figure 27. **Typical diode forward voltage as a function of junction temperature**

封装图 PG-TO247-3



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	5.44 (BSC)		0.214 (BSC)	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
øP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

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EUROPEAN PROJECTION	
ISSUE DATE	09-07-2010
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测试条件

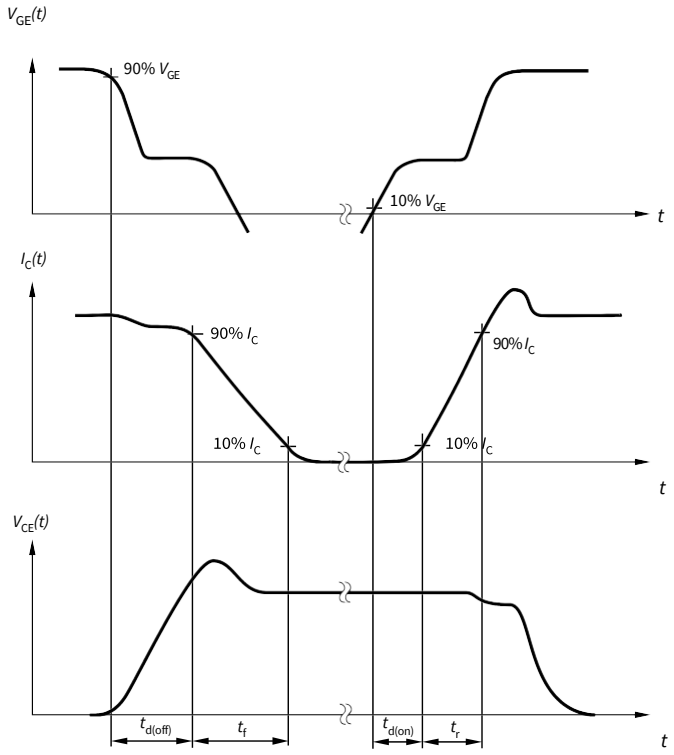

Figure A. **Definition of switching times**

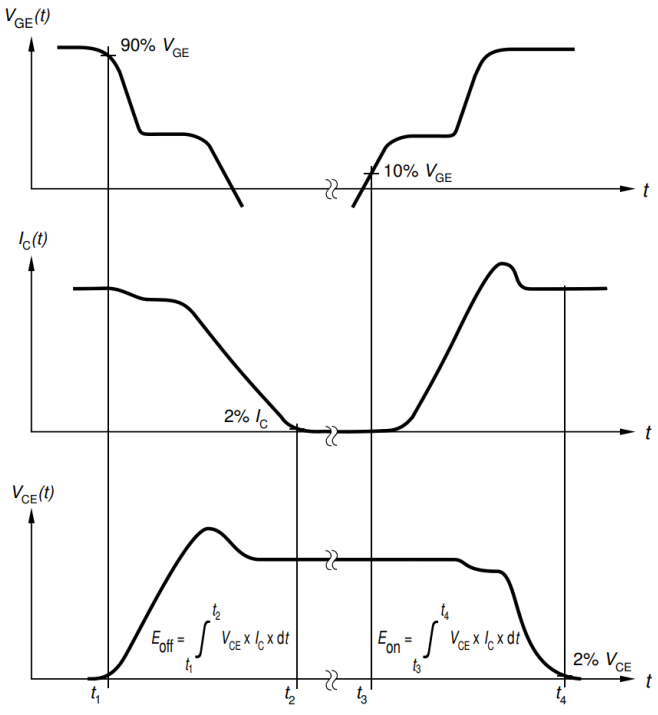

Figure B. **Definition of switching losses**

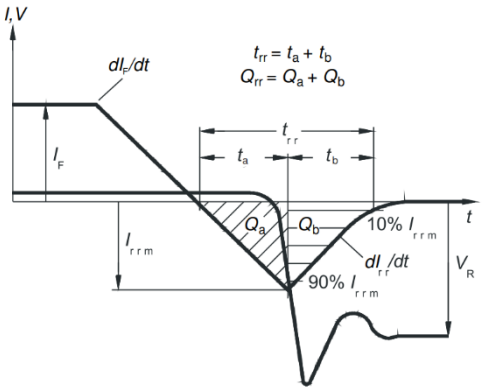

Figure C. **Definition of diode switching characteristics**

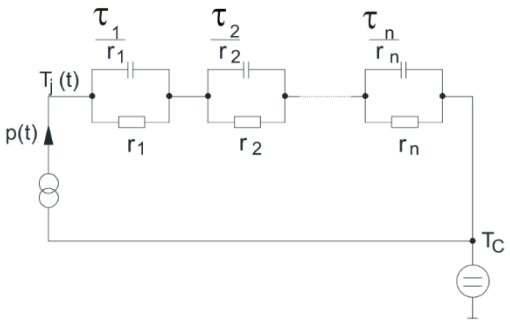

Figure D. **Thermal equivalent circuit**

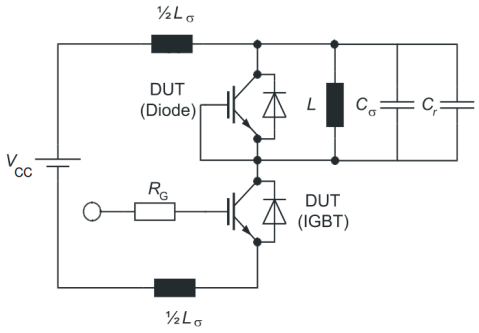

Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

修订记录

IKW50N60DTP

Revision: 2016-02-08, Rev. 2.1

历史修订版本

Revision	Date	Subjects (major changes since last revision)
2.1	-	Release final datasheet

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