IGBT

采用 TRENCHSTOP™ 5 技术的高速快开关IGBT，与 RAPID 1 快速软恢复反并联二极管共封装

IKZ75N65EH5

英飞凌650V DuoPack IGBT 和二极管

高速系列第五代

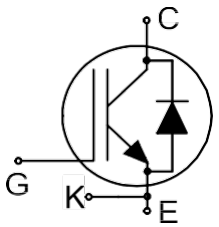
数据手册

工业功率控制

采用 TRENCHSTOP™ 5 技术的高速快开关IGBT

与 RAPID 1 快速软恢复反并联二极管共封装

特征和优点：



高速 H5 技术提供：
• 开尔文发射极引脚与 TRENCHSTOP™ 5 结合，实现超低损耗开关
• 硬开关和谐振拓扑中的行业领先效率
• 即插即用，替代上一代 IGBT
• 650 V 击穿电压
• 低栅极电荷 Q_G
• IGBT 与 RAPID 1 快速软恢复反并联二极管共封装
• 最高结温 175°C
• 符合 JEDEC 目标应用要求
• 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

• UPS（不间断电源）
• 焊机
• 中高开关频率转换器
• 光伏组串逆变器

封装引脚定义：

• 引脚 C & 背面 - 集电极
• 引脚 E - 发射极
• 引脚 K - 开尔文发射极
• 引脚G - 栅极
请注意：发射器和开尔文发射器引脚不可互换。它们的交换可能会导致故障。

关键性能和封装参数

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IKZ75N65EH5	650V	75A	1.65V	175°C	K75EEH5	PG-TO247-4

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}	650	V
DC collector current, limited by T_{vjmax} $T_C = 25°C$ value limited by bondwire $T_C = 100°C$	I_C	90.0 75.0	A
Pulsed collector current, t_p limited by T_{vjmax} [1)]	I_{Cpuls}	300.0	A
Turn off safe operating area $V_{CE} \leq 650V$, $T_{vj} \leq 175°C$, $t_p = 1\mu s$[1)]	-	300.0	A
Diode forward current, limited by T_{vjmax} $T_C = 25°C$ value limited by bondwire $T_C = 100°C$	I_F	95.0 85.0	A
Diode pulsed current, t_p limited by T_{vjmax} [1)]	I_{Fpuls}	300.0	A
Gate-emitter voltage Transient Gate-emitter voltage ($t_p \leq 10\mu s$, D < 0.010)	V_{GE}	±20 ±30	V
Power dissipation $T_C = 25°C$ Power dissipation $T_C = 100°C$	P_{tot}	395.0 197.0	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

热阻抗特性

Parameter	Symbol	Conditions	Max. Value	Unit
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		0.38	K/W
Diode thermal resistance, junction - case	$R_{th(j-c)}$		0.46	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		40	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	650	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	V_{GE} = 15.0V, I_C = 75.0A T_{vj} = 25°C T_{vj} = 100°C T_{vj} = 150°C	 - - -	 1.65 1.82 1.90	 2.10 - -	V
Diode forward voltage	V_F	V_{GE} = 0V, I_F = 75.0A T_{vj} = 25°C T_{vj} = 100°C T_{vj} = 150°C	 - - -	 1.35 1.33 1.30	 1.70 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 0.75mA, V_{CE} = V_{GE}	3.2	4.0	4.8	V
Zero gate voltage collector current	I_{CES}	V_{CE} = 650V, V_{GE} = 0V T_{vj} = 25°C T_{vj} = 175°C	 - -	 - 3300.0	 75.0 -	µA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0V, V_{GE} = 20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE} = 20V, I_C = 75.0A	-	104.0	-	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	-	4300	-	pF
Output capacitance	C_{oes}		-	130	-	
Reverse transfer capacitance	C_{res}		-	16	-	
Gate charge	Q_G	V_{CC} = 520V, I_C = 75.0A, V_{GE} = 15V	-	166.0	-	nC
Internal emitter inductance[1)] 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°C的条件下						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 37.5A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 10.0Ω, $R_{G(off)}$ = 18.0Ω, Lσ = 30nH, Cσ = 25pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	26	-	ns
Rise time	t_r		-	11	-	ns
Turn-off delay time	$t_{d(off)}$		-	347	-	ns
Fall time	t_f		-	15	-	ns
Turn-on energy	E_{on}		-	0.68	-	mJ
Turn-off energy	E_{off}		-	0.43	-	mJ
Total switching energy	E_{ts}		-	1.11	-	mJ

[1)]如果使用发射极检测引脚旁路，内部发射极电感不会影响栅极控制电路。

二极管特性， T_{vj} = 25°C

Diode reverse recovery time	t_{rr}	T_{vj} = 25°C, V_R = 400V, I_F = 37.5A, di_F/dt = 1500A/µs	-	58	-	ns
Diode reverse recovery charge	Q_{rr}		-	1.02	-	µC
Diode peak reverse recovery current	I_{rrm}		-	29.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-2800	-	A/µs

开关特性、感性负载

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT 特性， T_{vj} = 150°C						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 150°C, V_{CC} = 400V, I_C = 37.5A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 10.0Ω, $R_{G(off)}$ = 18.0Ω, Lσ = 30nH, Cσ = 25pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	24	-	ns
Rise time	t_r		-	13	-	ns
Turn-off delay time	$t_{d(off)}$		-	400	-	ns
Fall time	t_f		-	15	-	ns
Turn-on energy	E_{on}		-	1.10	-	mJ
Turn-off energy	E_{off}		-	0.48	-	mJ
Total switching energy	E_{ts}		-	1.58	-	mJ

二极管特性， T_{vj} = 150°C

Diode reverse recovery time	t_{rr}	T_{vj} = 150°C, V_R = 400V, I_F = 37.5A, di_F/dt = 1500A/µs	-	91	-	ns
Diode reverse recovery charge	Q_{rr}		-	2.58	-	µC
Diode peak reverse recovery current	I_{rrm}		-	42.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-1845	-	A/µs

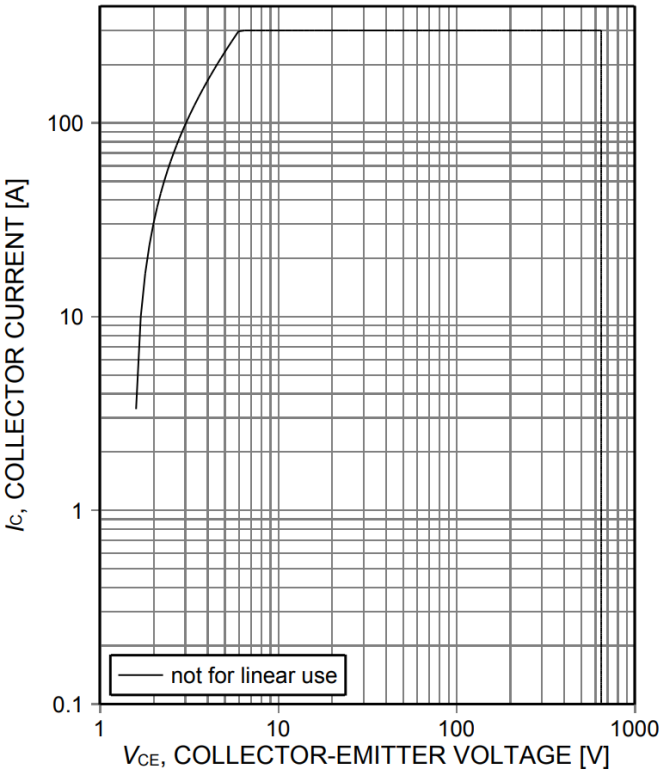


Figure 1. **Forward bias safe operating area**
(D=0, T_C=25°C, T_{vj}≤175°C, V_{GE}=15V, t_p=1µs, I_{Cmax} defined by design - not subject to production test)

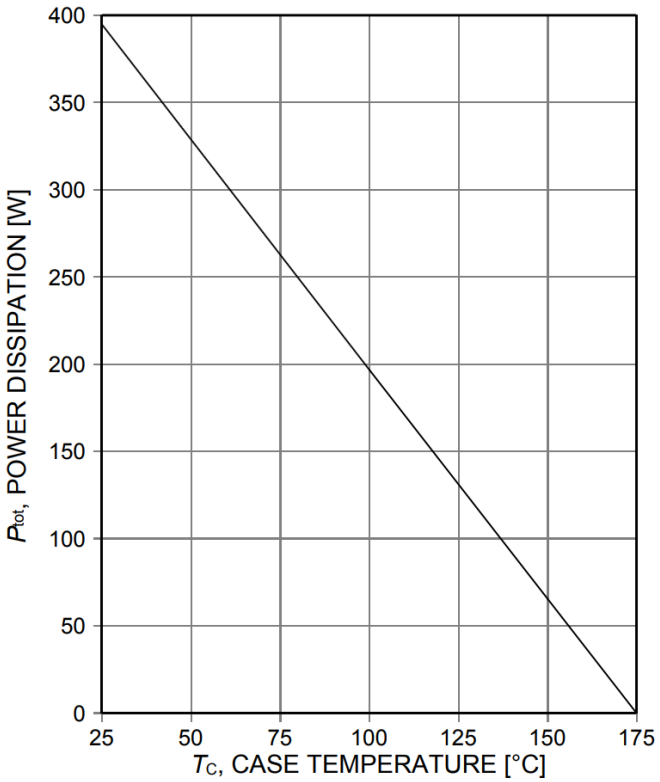


Figure 2. **Power dissipation as a function of case temperature**
(T_{vj}≤175°C)

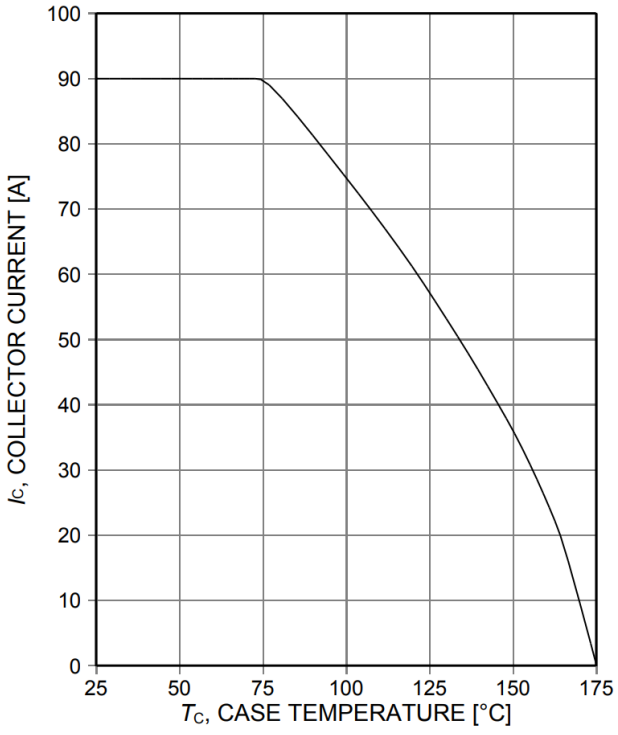


Figure 3. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_{vj}≤175°C)

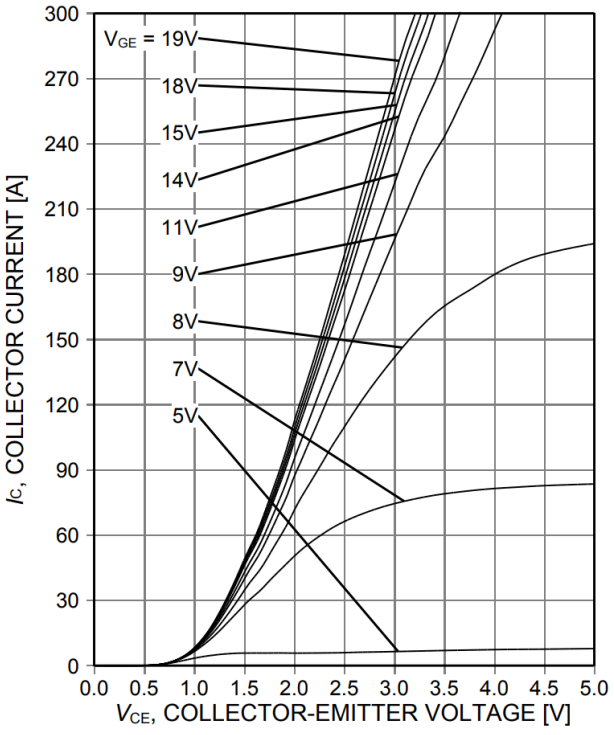


Figure 4. **Typical output characteristic**
(T_{vj}=25°C)

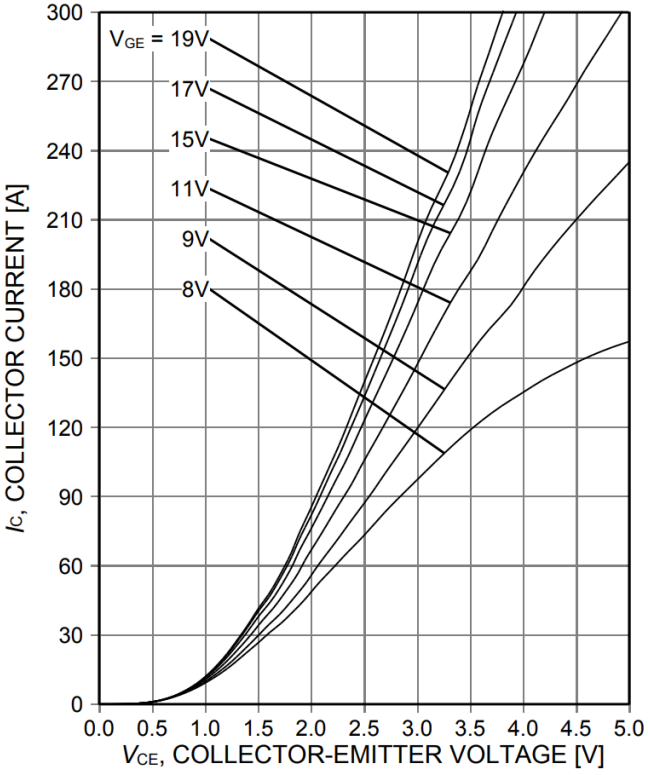


Figure 5. **Typical output characteristic**
(T_{vj}=175°C)

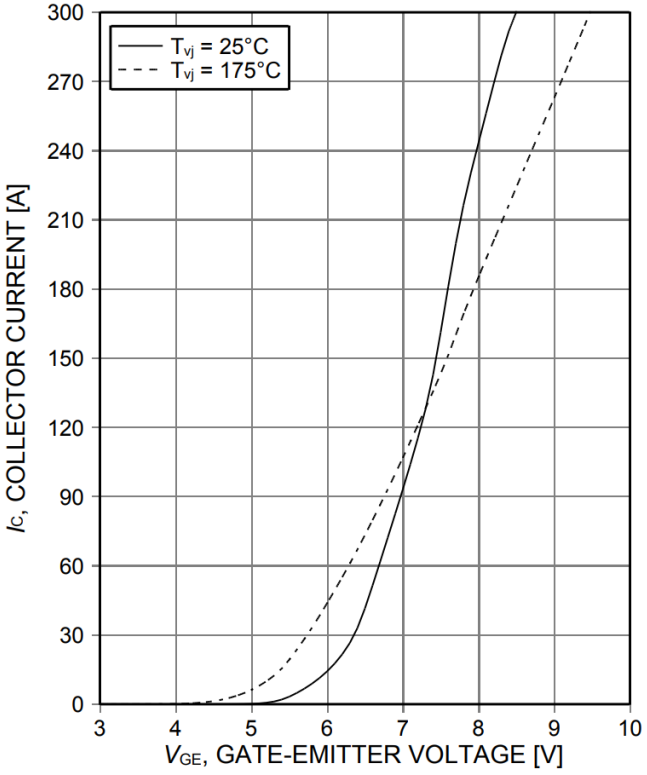


Figure 6. **Typical transfer characteristic**
(V_{CE}=20V)

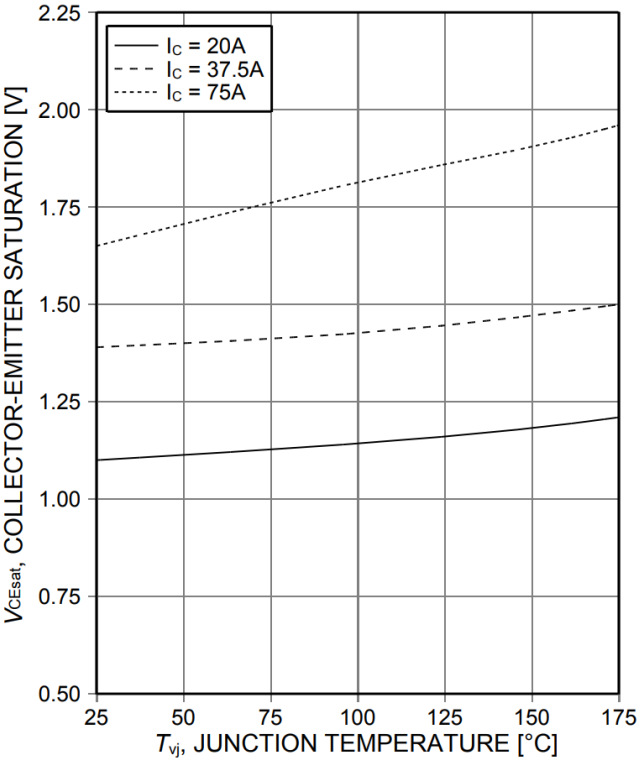


Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature**
(V_{GE}=15V)

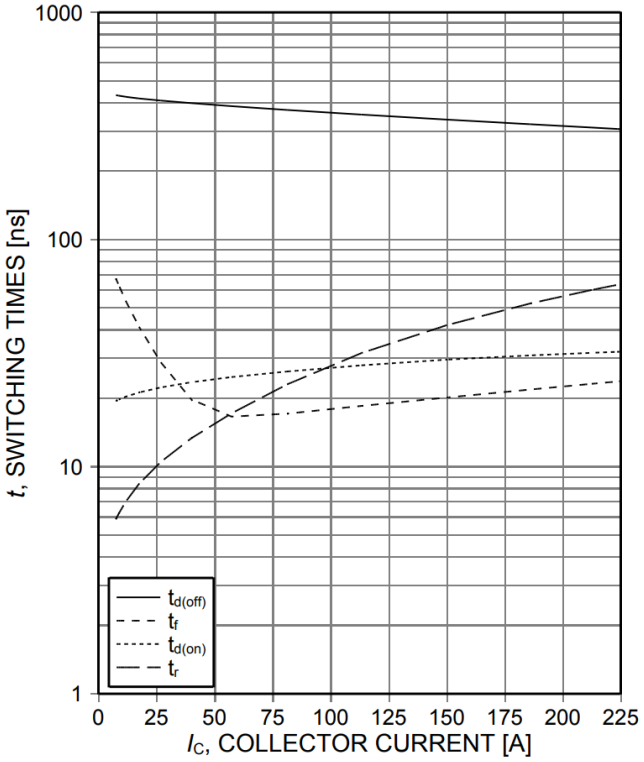


Figure 8. **Typical switching times as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, $R_{G(on)}$=10Ω, $R_{G(off)}$=18Ω, dynamic test circuit in Figure E)

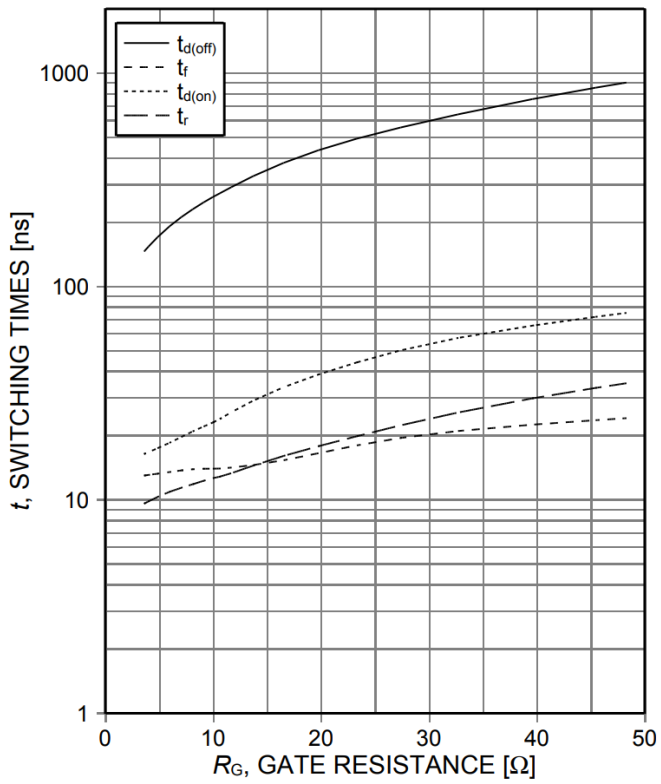


Figure 9. **Typical switching times as a function of gate resistance**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=37.5A, dynamic test circuit in Figure E)

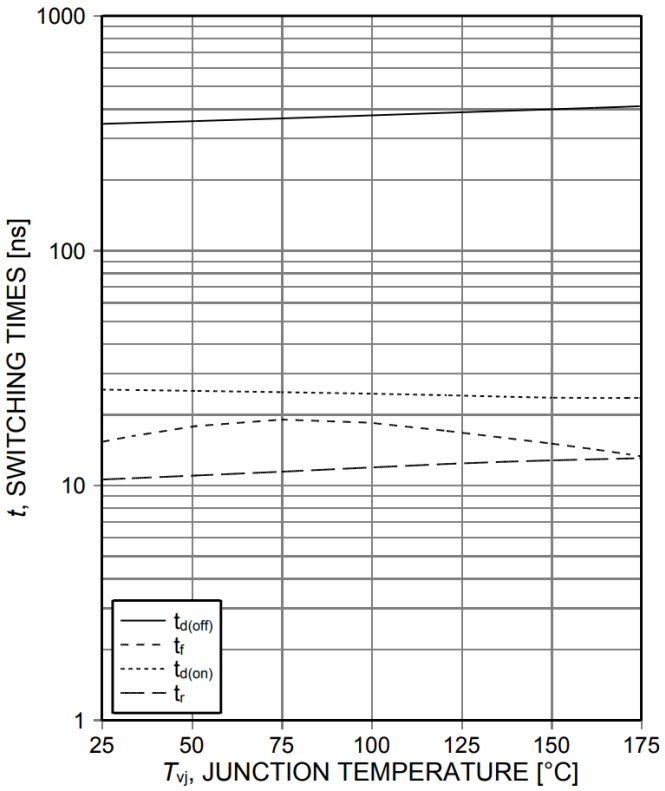


Figure 10. **Typical switching times as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=37.5A, $R_{G(on)}$=10Ω, $R_{G(off)}$=18Ω, dynamic test circuit in Figure E)

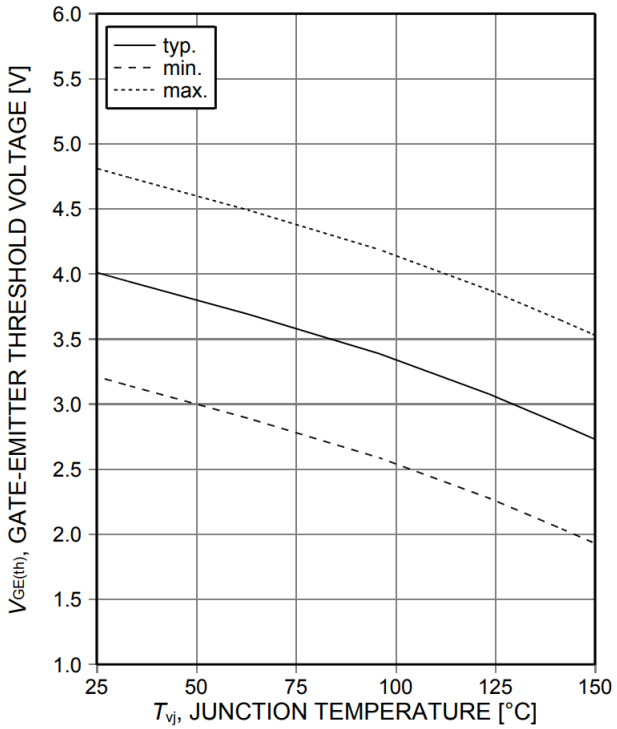


Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0.75mA)

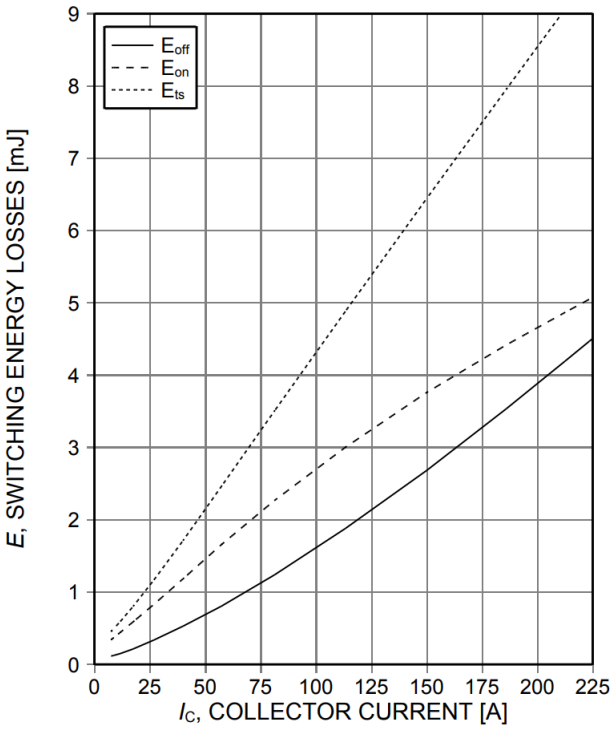


Figure 12. **Typical switching energy losses as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, $R_{G(on)}$=10Ω, $R_{G(off)}$=18Ω, dynamic test circuit in Figure E)

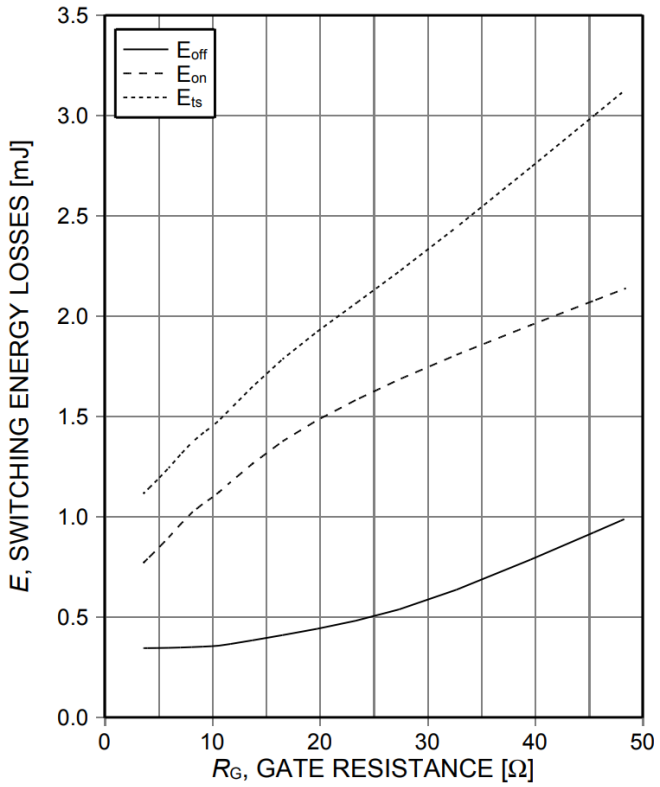


Figure 13. **Typical switching energy losses as a function of gate resistance** (inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=37.5A, dynamic test circuit in Figure E)

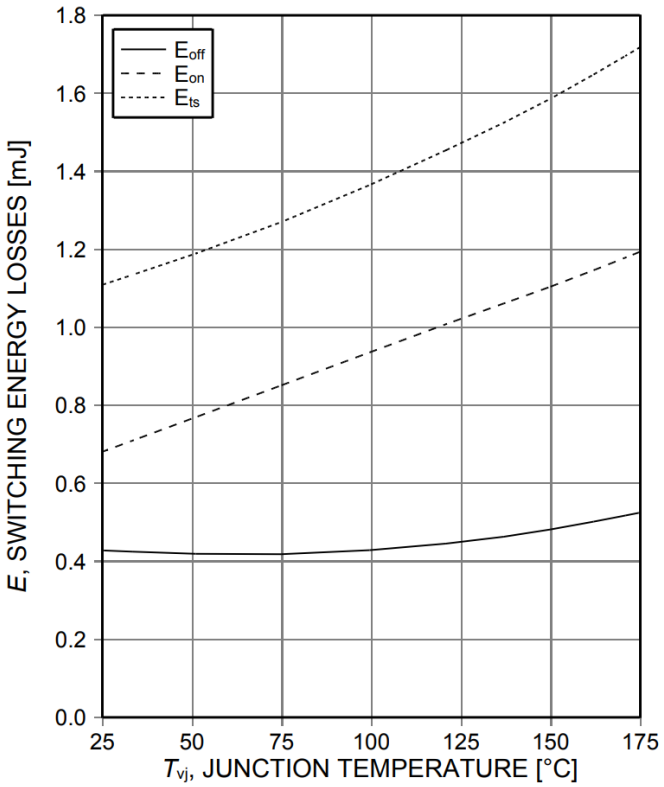


Figure 14. **Typical switching energy losses as a function of junction temperature** (inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=37.5A, $R_{G(on)}$=10Ω, $R_{G(off)}$=18Ω, dynamic test circuit in Figure E)

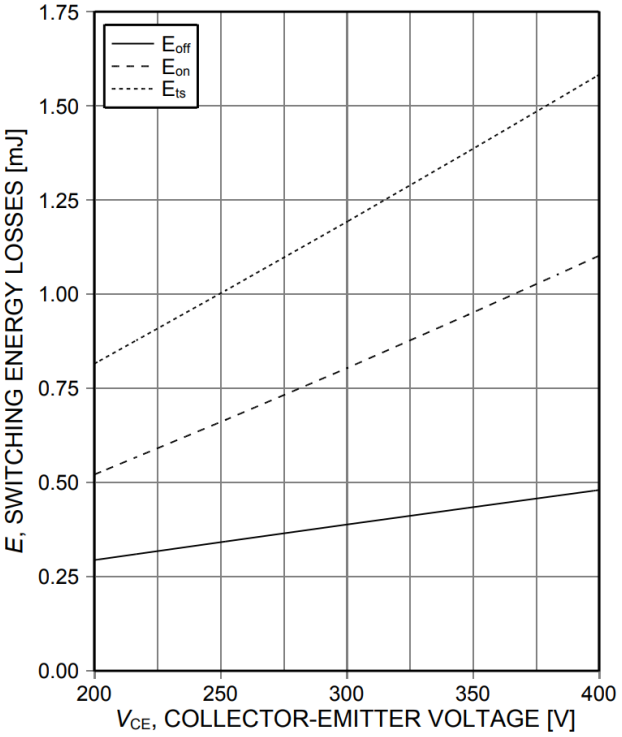


Figure 15. **Typical switching energy losses as a function of collector emitter voltage** (inductive load, T_{vj}=150°C, V_{GE}=0/15V, I_C=37.5A, $R_{G(on)}$=10Ω, $R_{G(off)}$=18Ω, dynamic test circuit in Figure E)

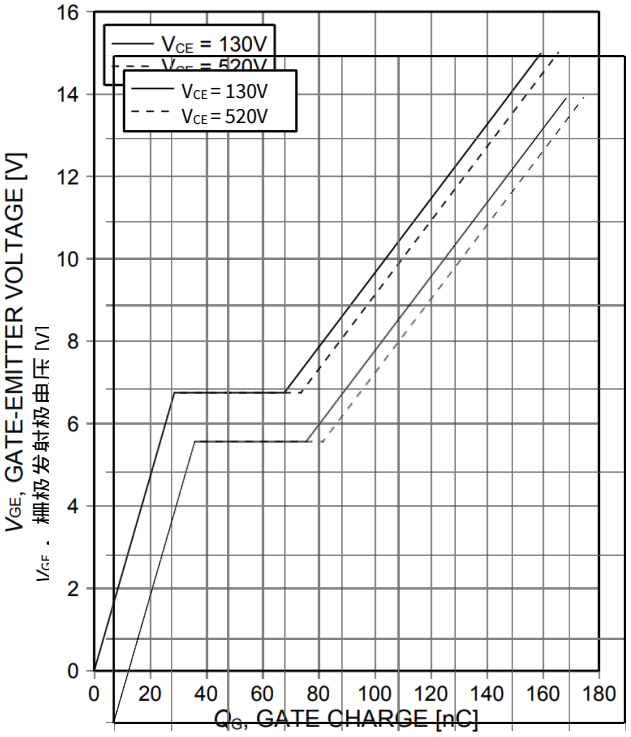


Figure 16. **Typical gate charge** (I_C=75A)

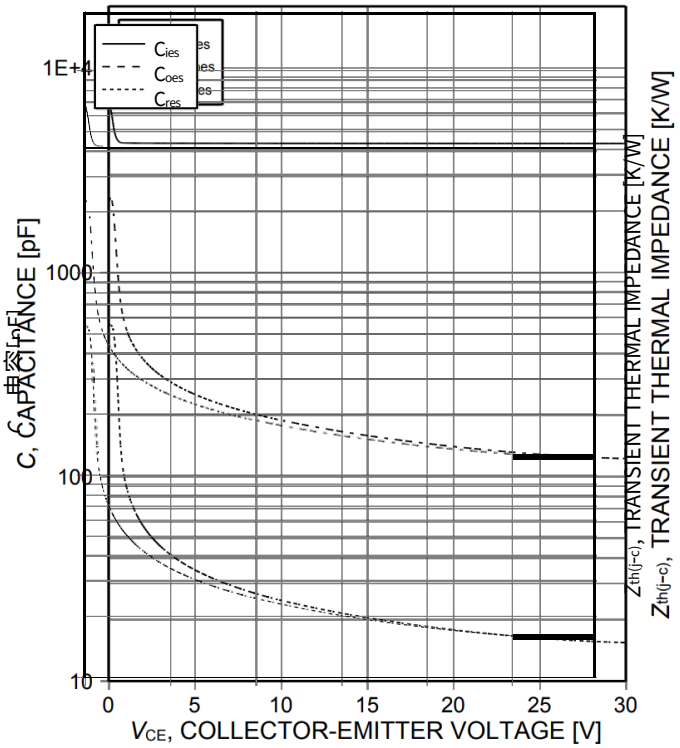


Figure 17. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=1MHz)

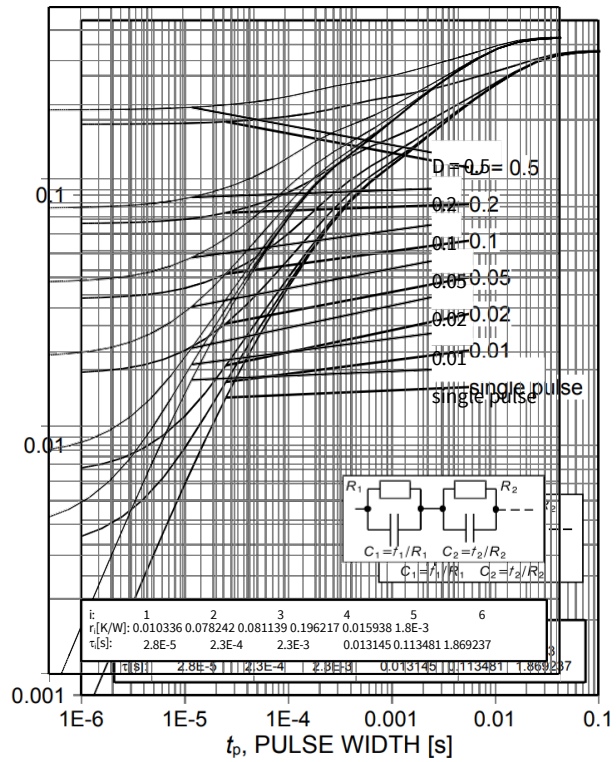


Figure 18. **IGBT transient thermal impedance**
($D=t_p/T$)

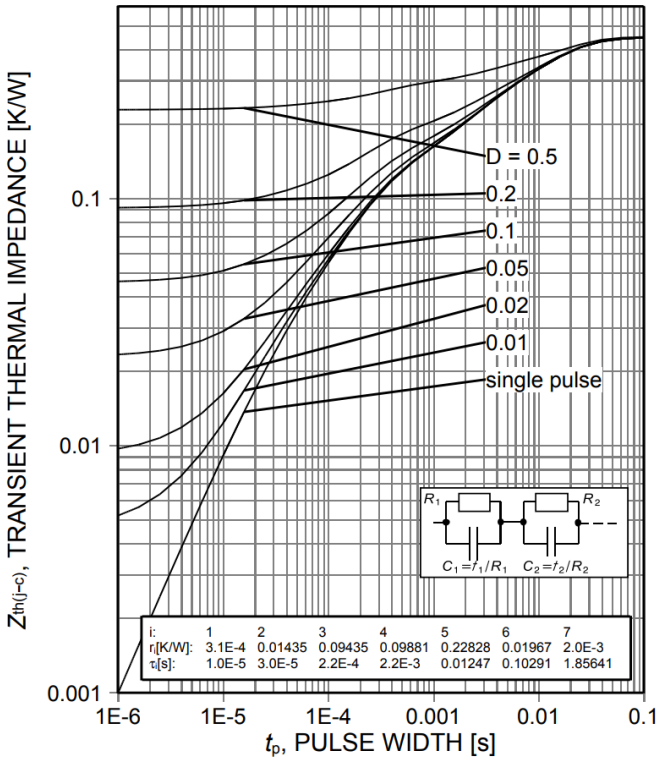


Figure 19. **Diode transient thermal impedance as a function of pulse width**
($D=t_p/T$)

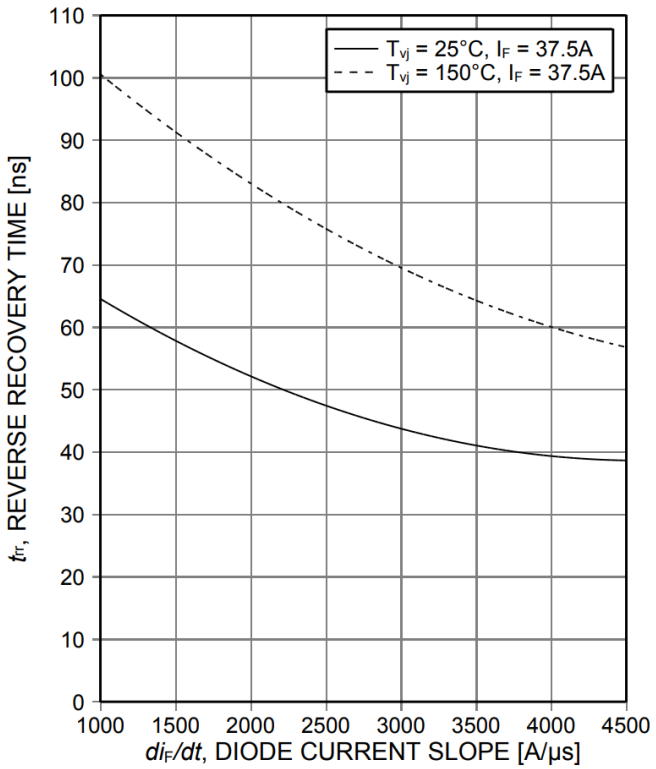


Figure 20. **Typical reverse recovery time as a function of diode current slope**
(V_R=400V)

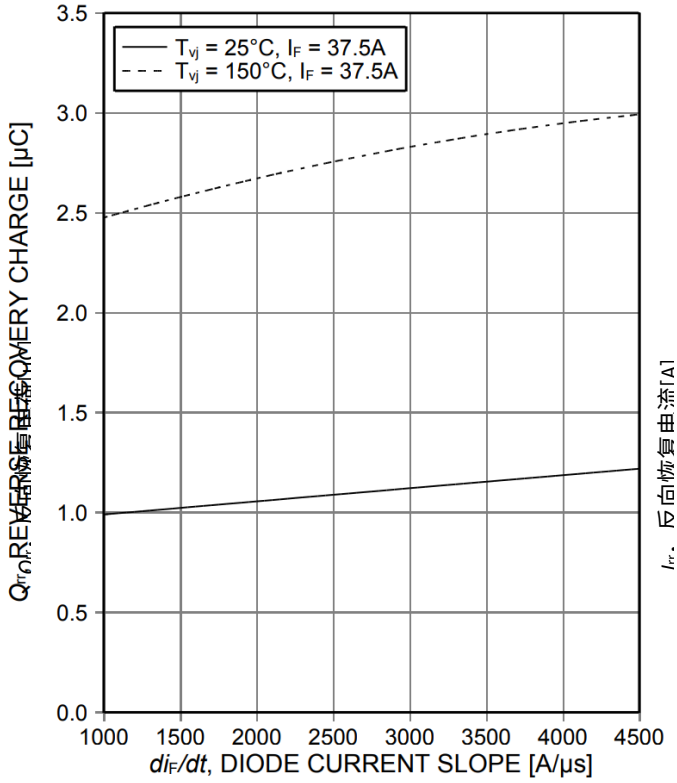


Figure 21. **Typical reverse recovery charge as a function of diode current slope**
(V_R=400V)

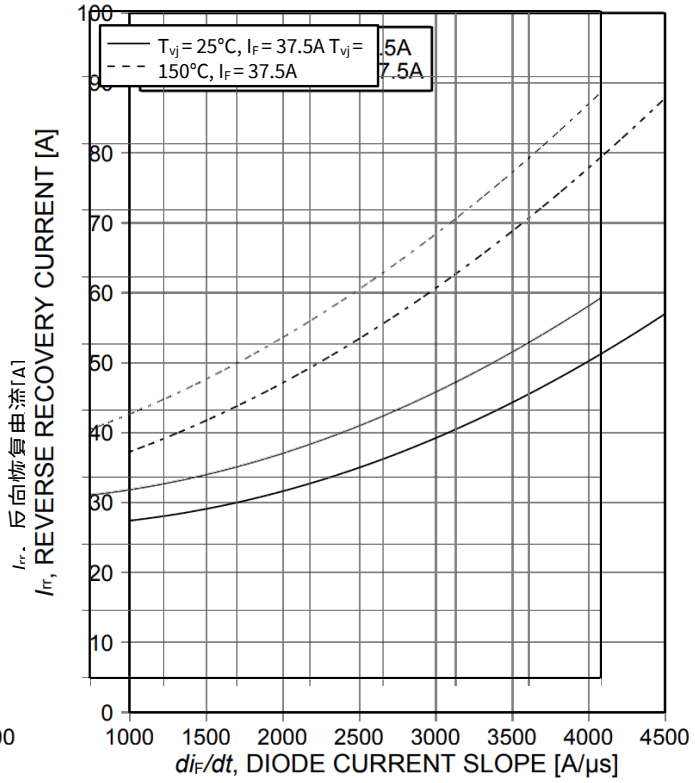


Figure 22. **Typical reverse recovery current as a function of diode current slope**
(V_R=400V)

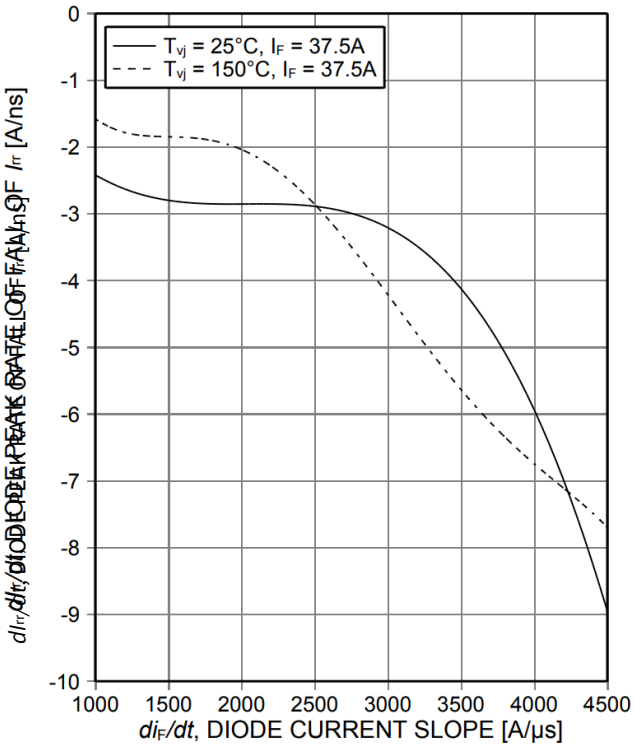


Figure 23. **Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**
(V_R=400V)

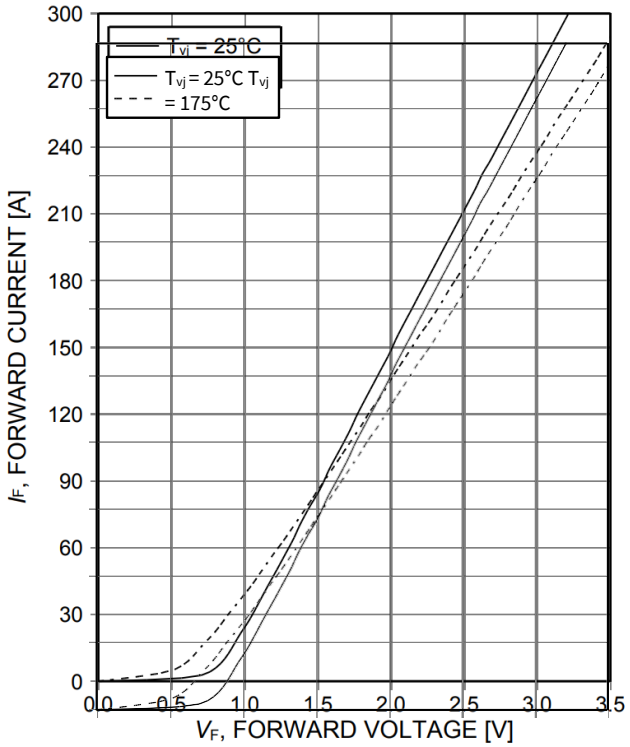


Figure 24. **Typical diode forward current as a function of forward voltage**

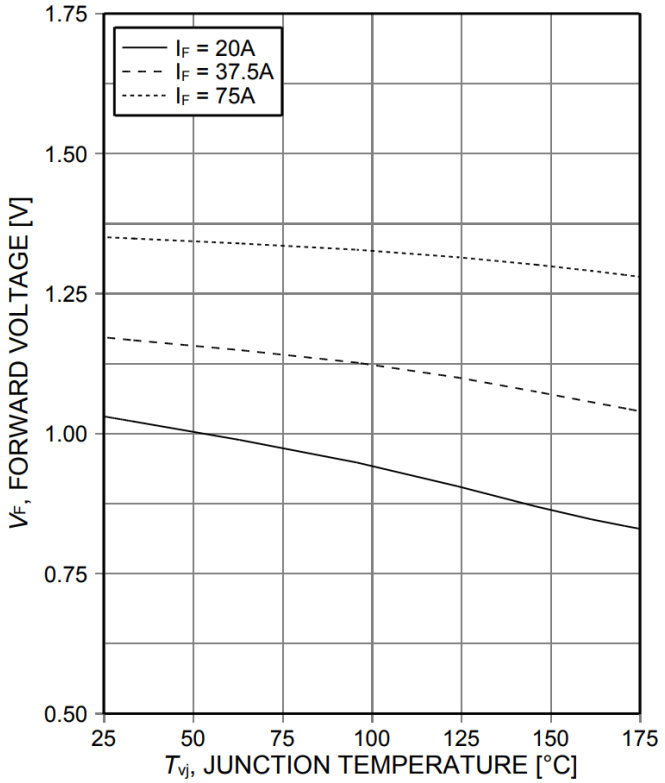
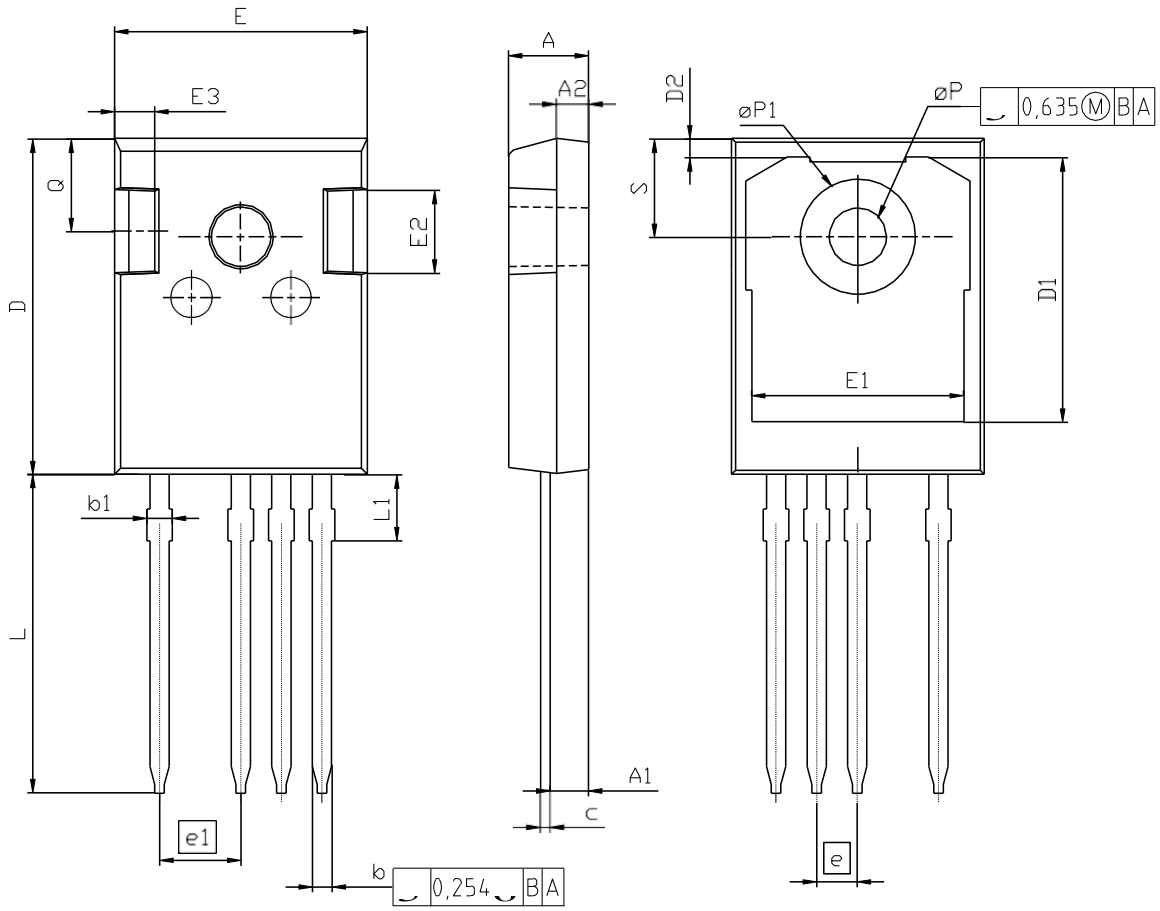


Figure 25. **Typical diode forward voltage as a function of junction temperature**

PG-TO247-4

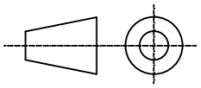


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.29	2.54	0.090	0.100
A2	1.90	2.16	0.075	0.085
b	1.07	1.33	0.042	0.052
b1	1.10	1.70	0.043	0.067
c	0.50	0.70	0.020	0.028
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	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	2.54 (BSC)		0.100 (BSC)	
e1	5.08		0.200	
N	4		4	
L	19.72	20.32	0.776	0.800
L1	4.02	4.40	0.158	0.173
øP	3.50	3.70	0.138	0.146
øP1	7.00	7.40	0.276	0.291
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

DOCUMENT NO.
Z8B00168124

SCALE
0 5 5 7.5mm

EUROPEAN PROJECTION



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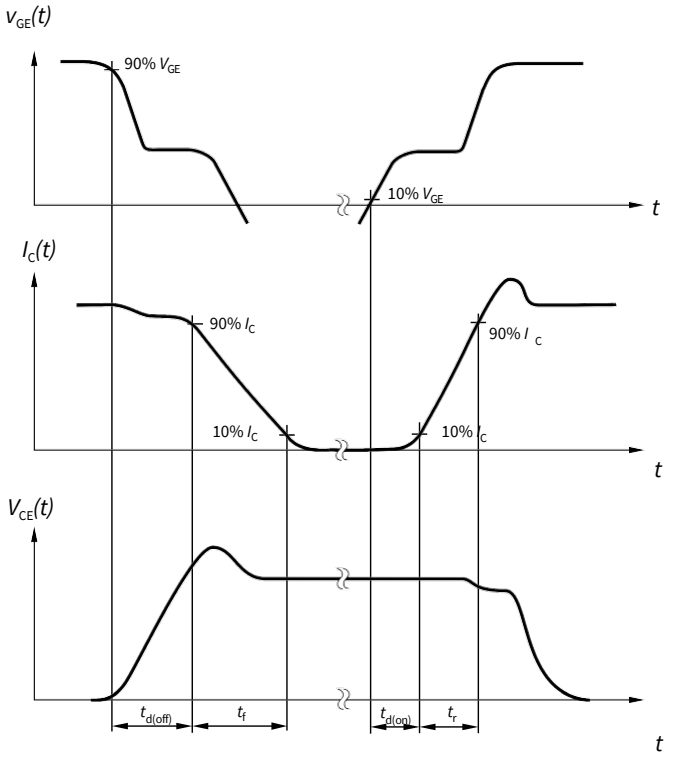

Figure A. Definition of switching times

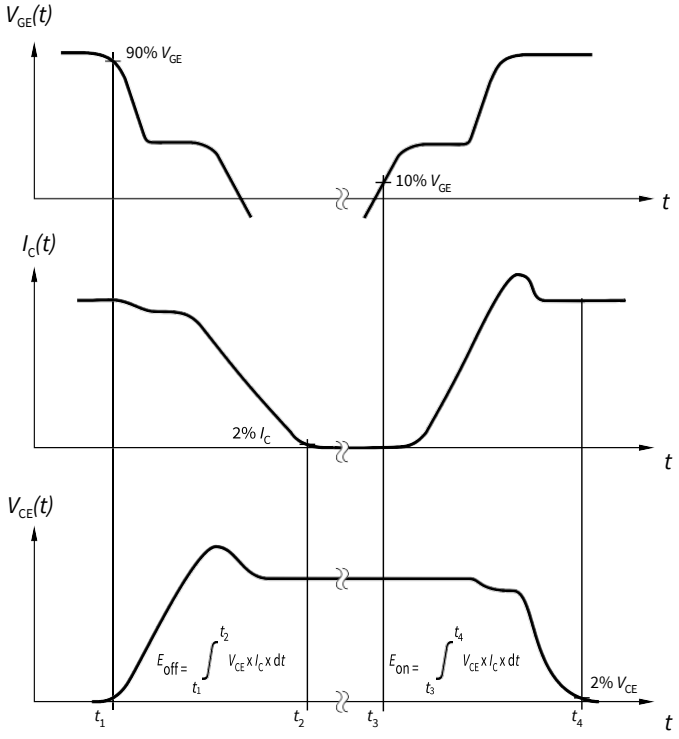

Figure B. Definition of switching losses

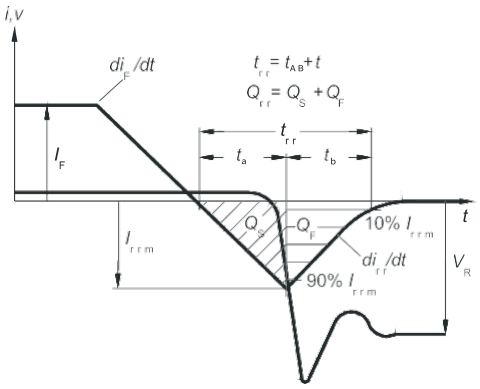

Figure C. Definition of diodes switching characteristics

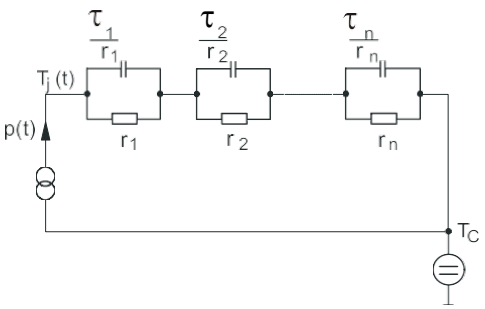

Figure D. Thermal equivalent circuit

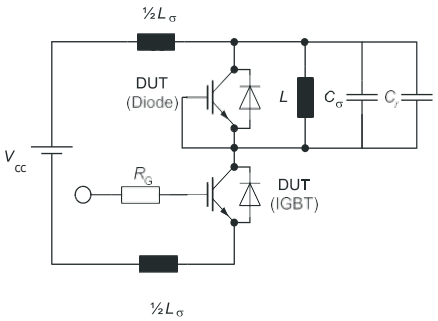

Figure E. Dynamic test circuit
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r
(only for ZVT switching)

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