IGBT

英飞凌 TRENCHSTOP™ 5 高速软开关 IGBT，带额定电流 RAPID 1 二极管

IKW75N65ES5

英飞凌 650V TRENCHSTOP™ 5 高速软开关 duopak

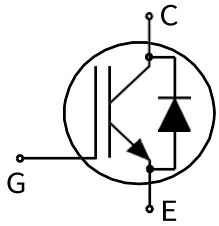
数据手册

工业功率控制

TRENCHSTOP™ 5 高速软开关 IGBT

与全电流 RAPID 1 快速、软的反并联二极管共同封装

特征和优点：



高速 S5 技术提供：
- 高速平滑开关器件适用于硬开关和软开关应用
- 极低V_{CEsat}，标称额定电流时为 1.42V
- 即插即用，替代上一代 IGBT
- 650 V 击穿电压
- 低栅极电荷 Q_G
- IGBT 与全电流 RAPID 1 快速反并联二极管共同封装
- 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：

- 谐振转换器
- UPS（不间断电源）
- 焊机
- 中高开关频率转换器

封装引脚定义：

- 引脚 1 - 栅极
- 引脚 2 & 背面 - 集电极
- 引脚 3 - 发射极

关键性能和封装参数

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IKW75N65ES5	650V	75A	1.42V	175°C	K75EES5	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}	650	V
DC collector current, limited by T_{vjmax} [1)] $T_C = 25°C$ $T_C = 100°C$	I_C	80.0 80.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	300.0	A
Turn off safe operating area $V_{CE} \leq 650V$, $T_{vj} \leq 175°C$, $t_p = 1µs$	-	300.0	A
Diode forward current, limited by T_{vjmax} [1)] $T_C = 25°C$ $T_C = 100°C$	I_F	80.0 80.0	A
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	300.0	A
Gate-emitter voltage Transient Gate-emitter voltage ($t_p \leq 10µs$, 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)]价值受接合线限制

电气特性，测于 T_{vj} = 25°C的条件下，除非另有规定

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	650	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	V_{GE} = 15.0V, I_C = 75.0A T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	- - -	1.42 1.55 1.65	1.75 - -	V
Diode forward voltage	V_F	V_{GE} = 0V, I_F = 75.0A T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	- - -	1.50 1.48 1.45	1.75 - -	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	- -	- 3000	50 -	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	-	100.0	-	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 min.	Value typ.	Value max.	Unit
动态特性						
Input capacitance	C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	4500	-	pF
Output capacitance	C_{oes}		-	130	-	
Reverse transfer capacitance	C_{res}		-	17	-	
Gate charge	Q_G	V_{CC} = 520V, I_C = 75.0A, V_{GE} = 15V	-	164.0	-	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 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 = 75.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 18.0Ω, $R_{G(off)}$ = 5.6Ω, $L\sigma$ = 30nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	40	-	ns
Rise time	t_r		-	46	-	ns
Turn-off delay time	$t_{d(off)}$		-	144	-	ns
Fall time	t_f		-	41	-	ns
Turn-on energy	E_{on}		-	2.40	-	mJ
Turn-off energy	E_{off}		-	0.95	-	mJ
Total switching energy	E_{ts}		-	3.35	-	mJ

Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 38.5A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 18.0Ω, $R_{G(off)}$ = 5.6Ω, $L\sigma$ = 30nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	36	-	ns
Rise time	t_r		-	24	-	ns
Turn-off delay time	$t_{d(off)}$		-	158	-	ns
Fall time	t_f		-	16	-	ns
Turn-on energy	E_{on}		-	0.96	-	mJ
Turn-off energy	E_{off}		-	0.36	-	mJ
Total switching energy	E_{ts}		-	1.32	-	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 = 75.0A, di_F/dt = 1230A/µs	-	85	-	ns
Diode reverse recovery charge	Q_{rr}		-	1.80	-	µC
Diode peak reverse recovery current	I_{rrm}		-	31.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-2170	-	A/µs

Diode reverse recovery time	t_{rr}	T_{vj} = 25°C, V_R = 400V, I_F = 38.5A, di_F/dt = 1330A/µs	-	64	-	ns
Diode reverse recovery charge	Q_{rr}		-	1.25	-	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		-	-2540	-	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 = 75.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 18.0Ω, $R_{G(off)}$ = 5.6Ω, $L\sigma$ = 30nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	38	-	ns
Rise time	t_r		-	56	-	ns
Turn-off delay time	$t_{d(off)}$		-	170	-	ns
Fall time	t_f		-	63	-	ns
Turn-on energy	E_{on}		-	3.45	-	mJ
Turn-off energy	E_{off}		-	1.47	-	mJ
Total switching energy	E_{ts}		-	4.92	-	mJ

Turn-on delay time	$t_{d(on)}$	T_{vj} = 150°C, V_{CC} = 400V, I_C = 38.5A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 18.0Ω, $R_{G(off)}$ = 5.6Ω, $L\sigma$ = 30nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	34	-	ns
Rise time	t_r		-	28	-	ns
Turn-off delay time	$t_{d(off)}$		-	200	-	ns
Fall time	t_f		-	46	-	ns
Turn-on energy	E_{on}		-	1.60	-	mJ
Turn-off energy	E_{off}		-	0.68	-	mJ
Total switching energy	E_{ts}		-	2.28	-	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 = 75.0A, di_F/dt = 1020A/µs	-	140	-	ns
Diode reverse recovery charge	Q_{rr}		-	4.05	-	µC
Diode peak reverse recovery current	I_{rrm}		-	44.5	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-2220	-	A/µs

Diode reverse recovery time	t_{rr}	T_{vj} = 150°C, V_R = 400V, I_F = 38.5A, di_F/dt = 1080A/µs	-	110	-	ns
Diode reverse recovery charge	Q_{rr}		-	2.95	-	µC
Diode peak reverse recovery current	I_{rrm}		-	41.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-2880	-	A/µs

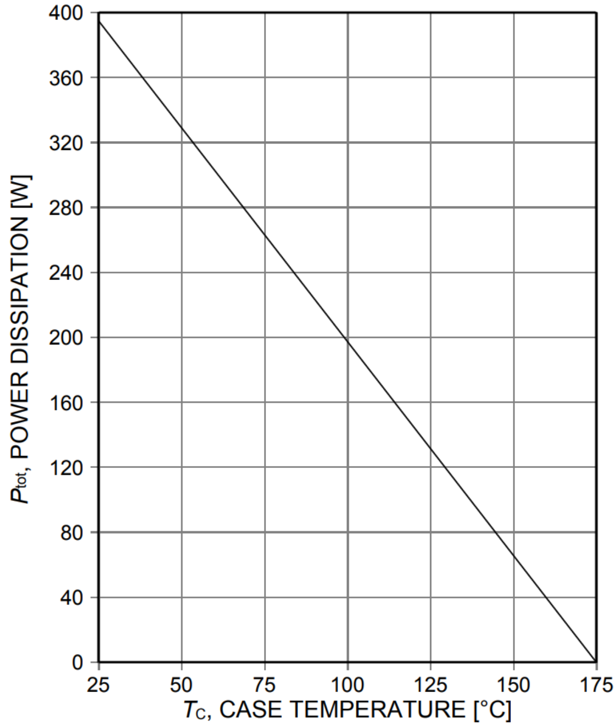


Figure 1. **Power dissipation as a function of case temperature**
(T_{vj}≤175°C)

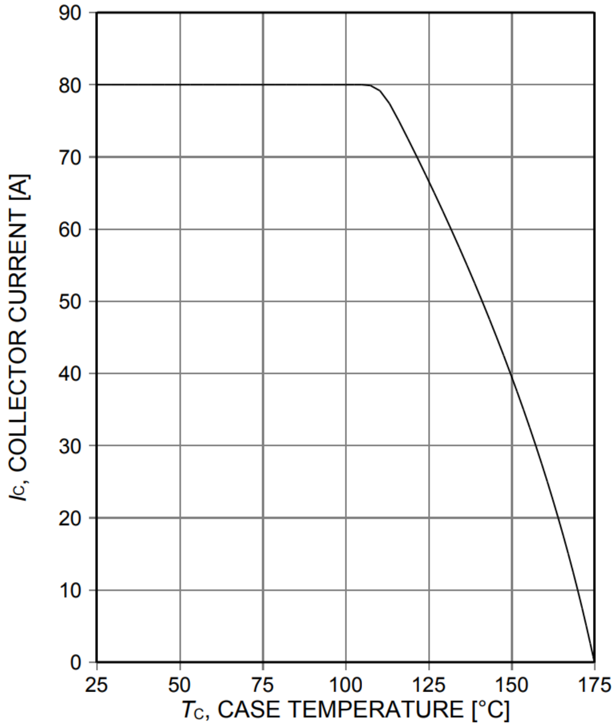


Figure 2. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_{vj}≤175°C)

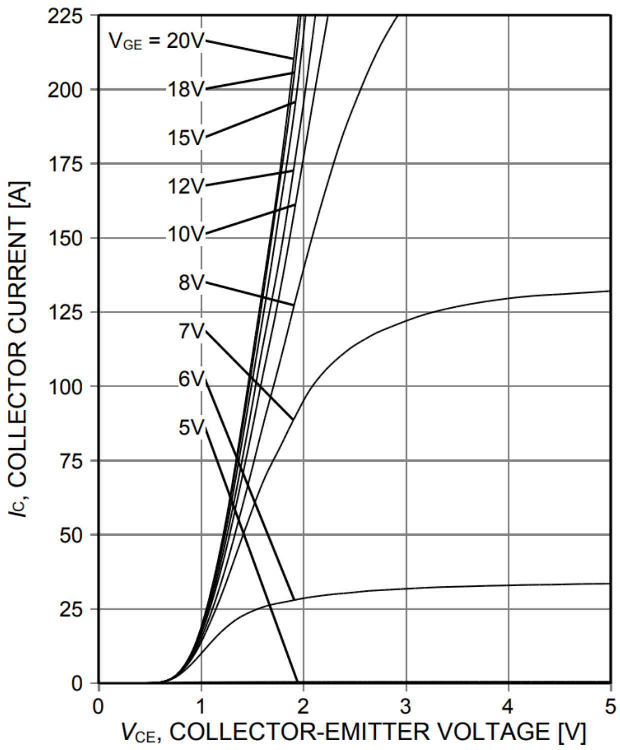


Figure 3. **Typical output characteristic**
(T_{vj}=25°C)

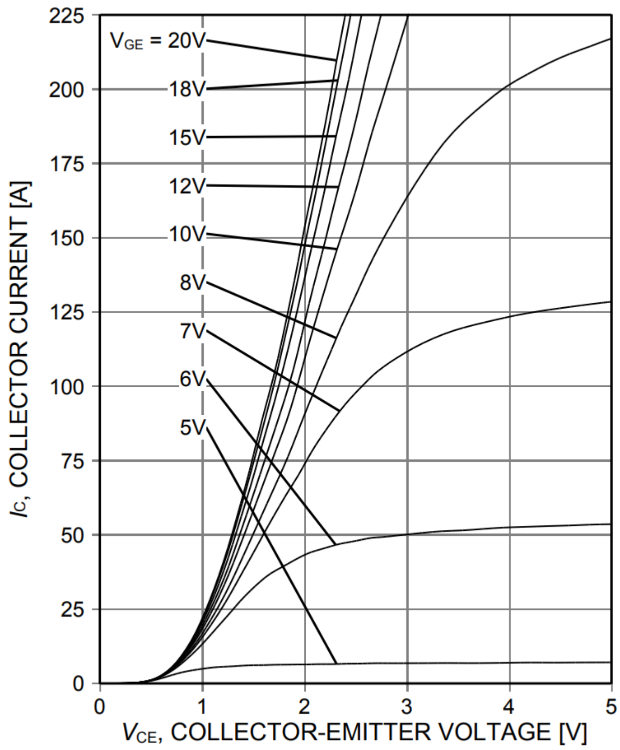


Figure 4. **Typical output characteristic**
(T_{vj}=175°C)

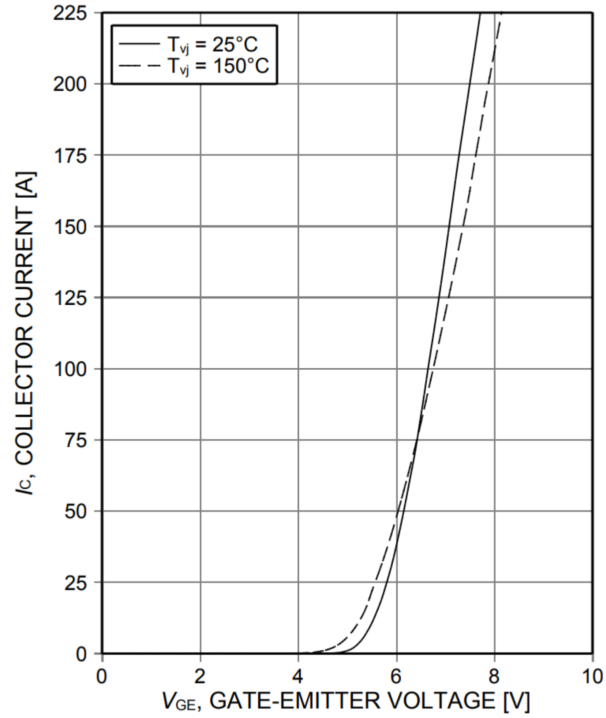


Figure 5. **Typical transfer characteristic**
(V_{CE}=20V)

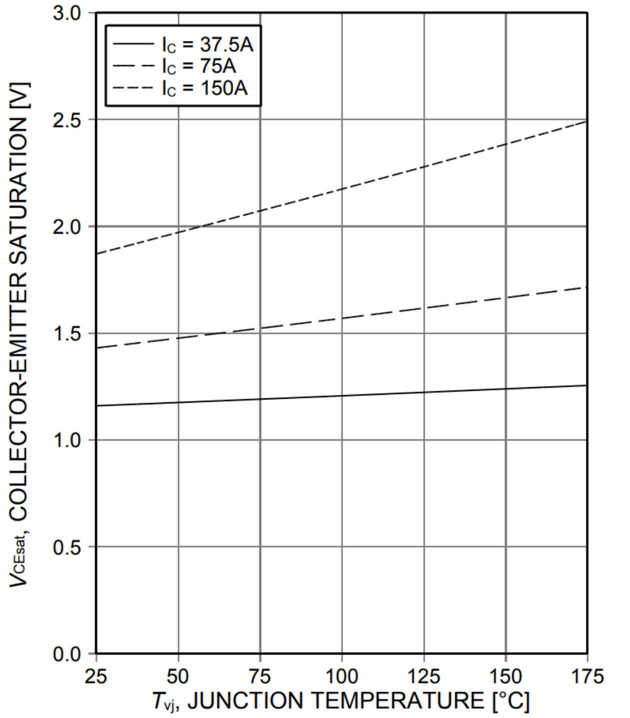


Figure 6. **Typical collector-emitter saturation voltage as a function of junction temperature**
(V_{GE}=15V)

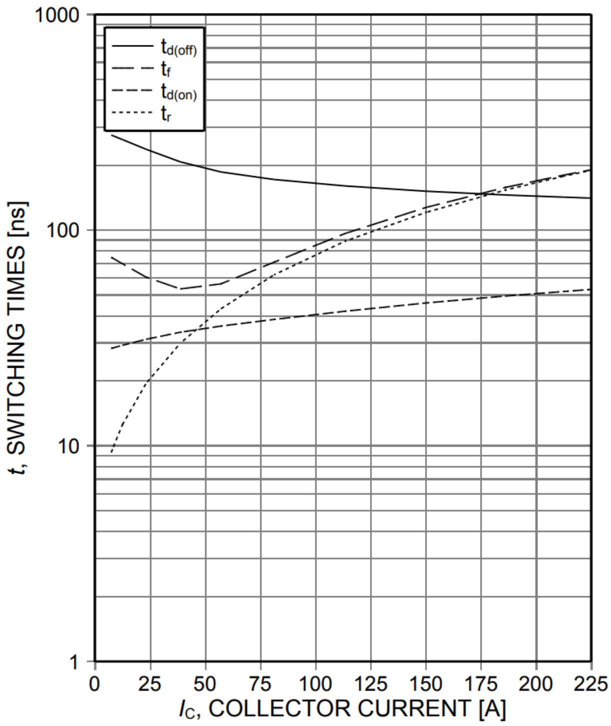


Figure 7. **Typical switching times as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, R_{Gon}=18Ω, R_{Goff}=5.6Ω, dynamic test circuit in Figure E)

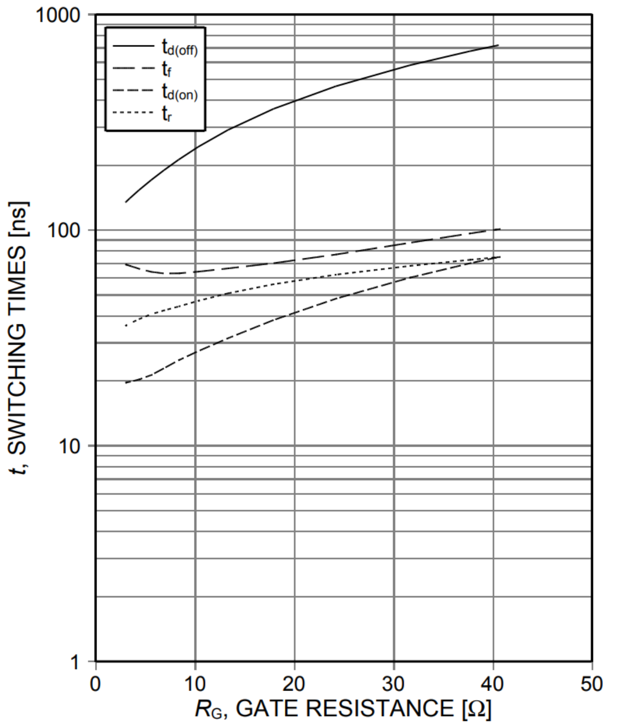


Figure 8. **Typical switching times as a function of gate resistance**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=75A, dynamic test circuit in Figure E)

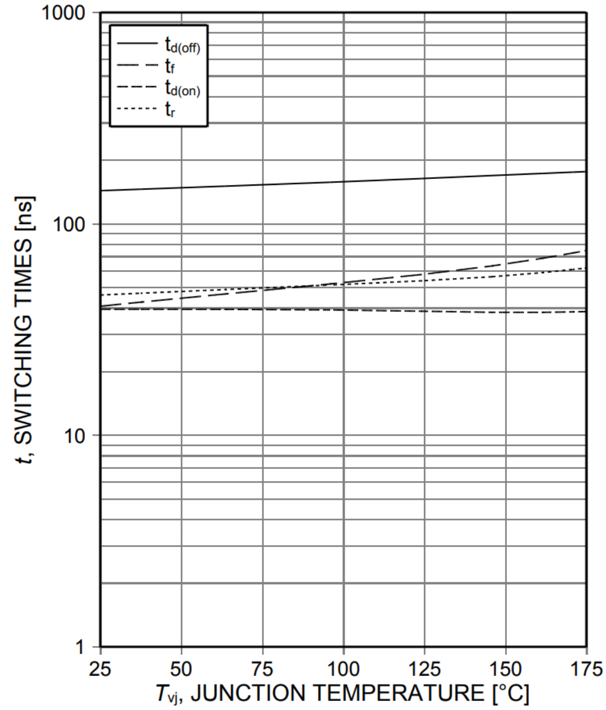


Figure 9. **Typical switching times as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=75A, R_{Gon}=18Ω, R_{Goff}=5.6Ω, dynamic test circuit in Figure E)

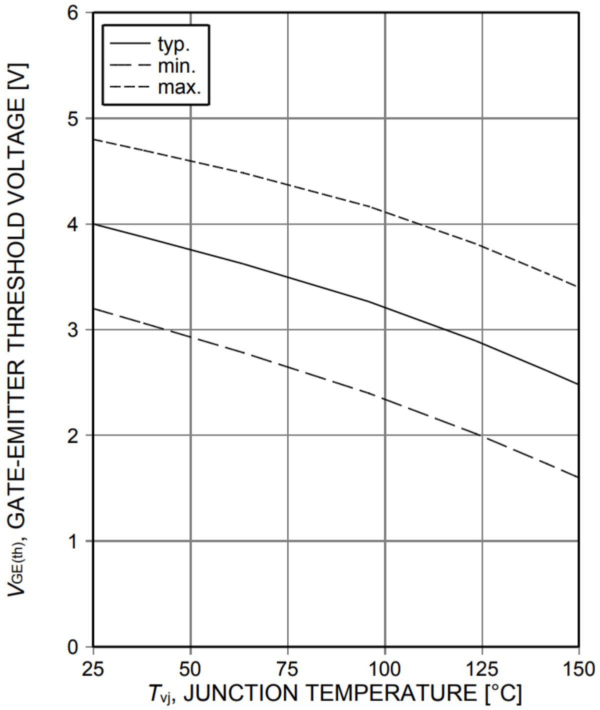


Figure 10. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0.75mA)

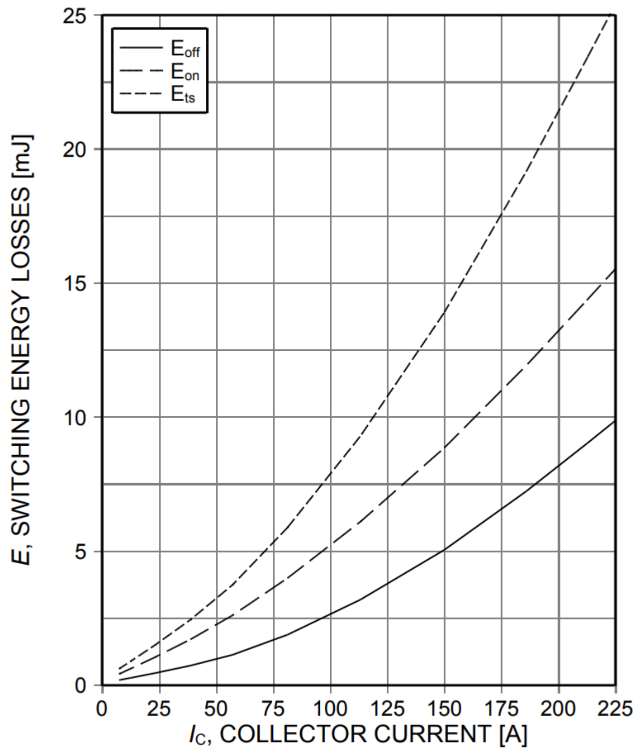


Figure 11. **Typical switching energy losses as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, R_{Gon}=18Ω, R_{Goff}=5.6Ω, dynamic test circuit in Figure E)

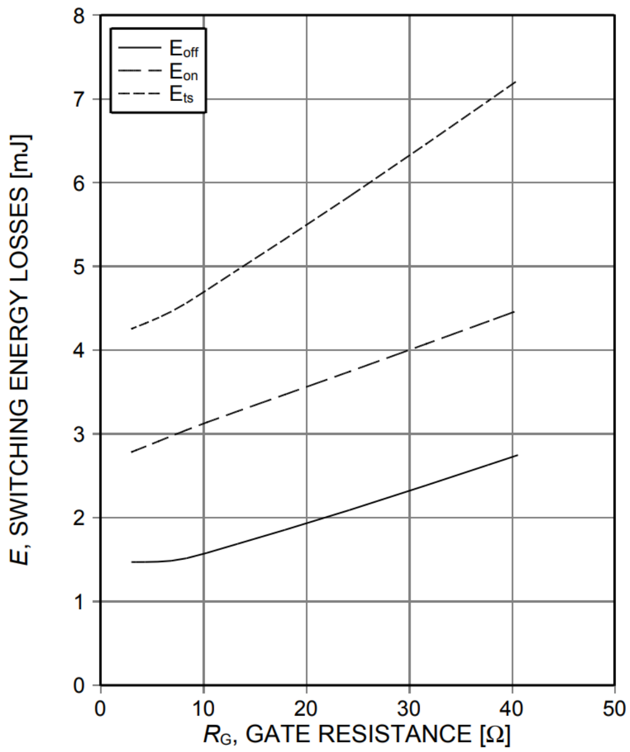


Figure 12. **Typical switching energy losses as a function of gate resistance**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=75A, dynamic test circuit in Figure E)

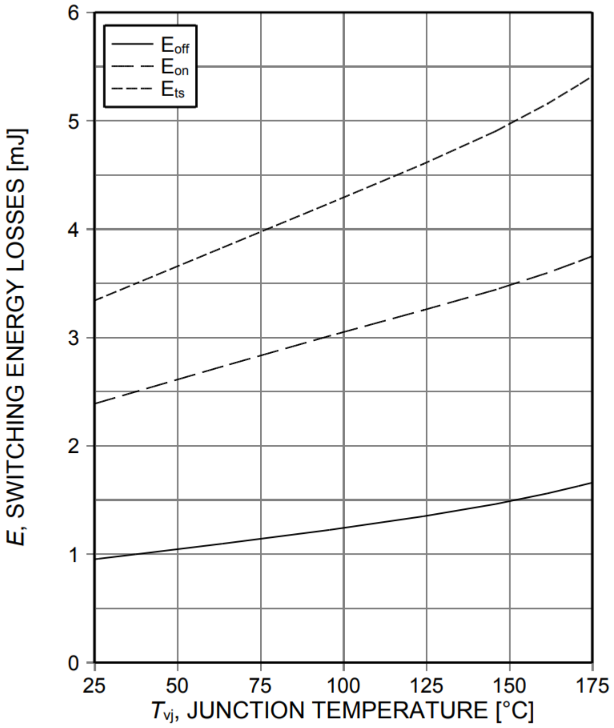


Figure 13. **Typical switching energy losses as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=75A, R_{Gon}=18Ω, R_{Goff}=5.6Ω, dynamic test circuit in Figure E)

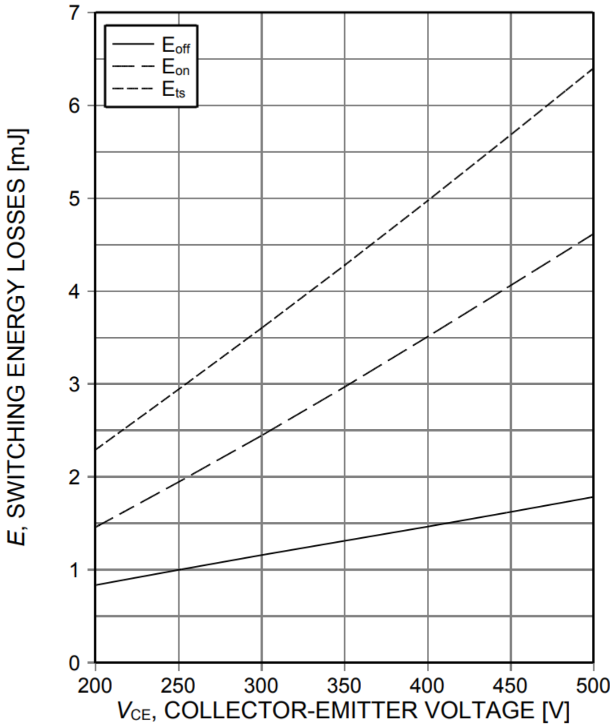


Figure 14. **Typical switching energy losses as a function of collector emitter voltage**
(inductive load, T_{vj}=150°C, V_{GE}=0/15V, I_C=75A, R_{Gon}=18Ω, R_{Goff}=5.6Ω, dynamic test circuit in Figure E)

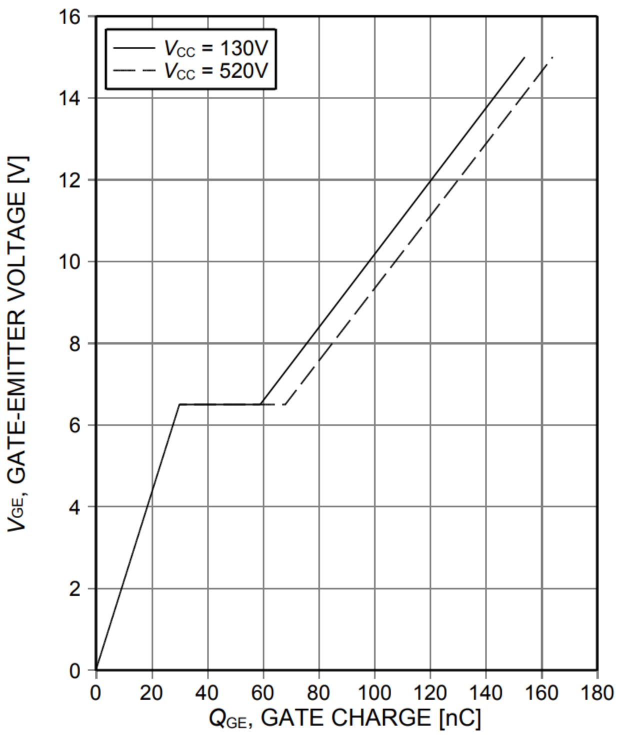


Figure 15. **Typical gate charge**
(I_C=75A)

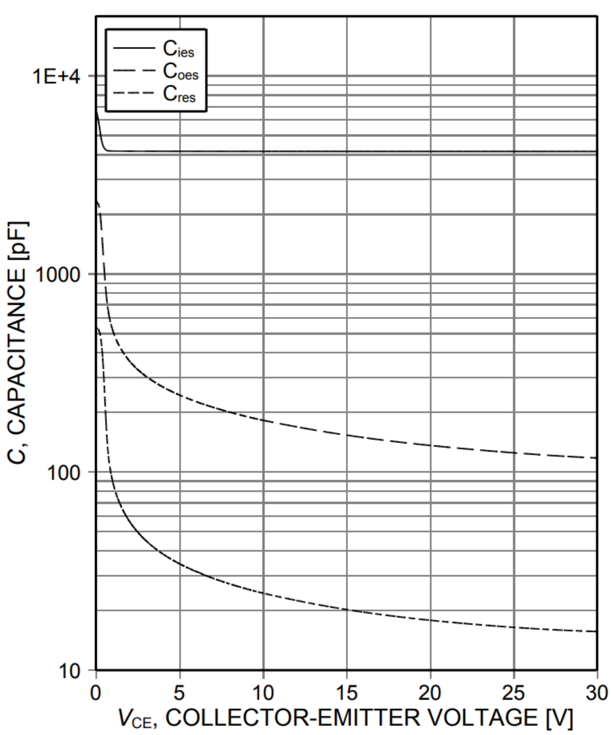


Figure 16. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=1MHz)

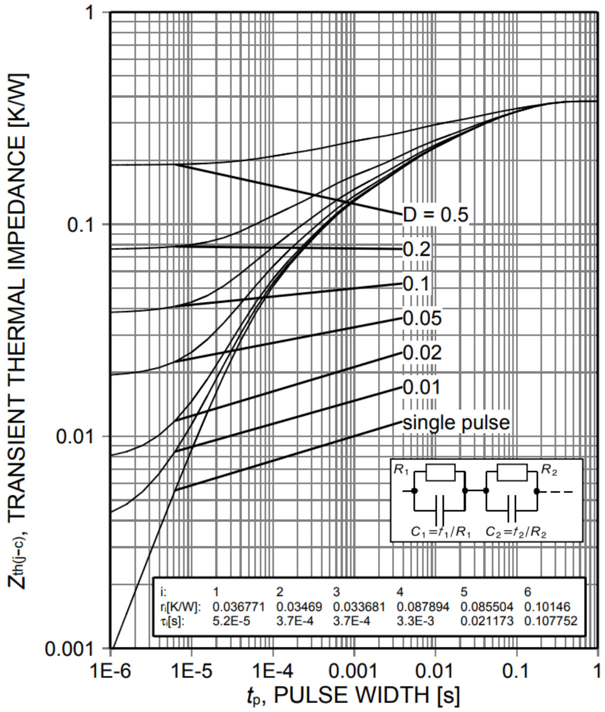


Figure 17. **IGBT transient thermal impedance**
($D=t_p/T$)

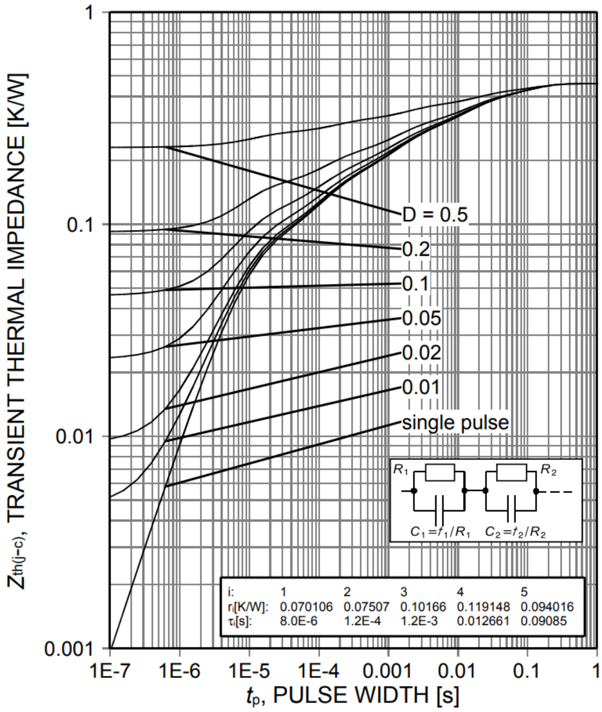


Figure 18. **Diode transient thermal impedance as a function of pulse width**
($D=t_p/T$)

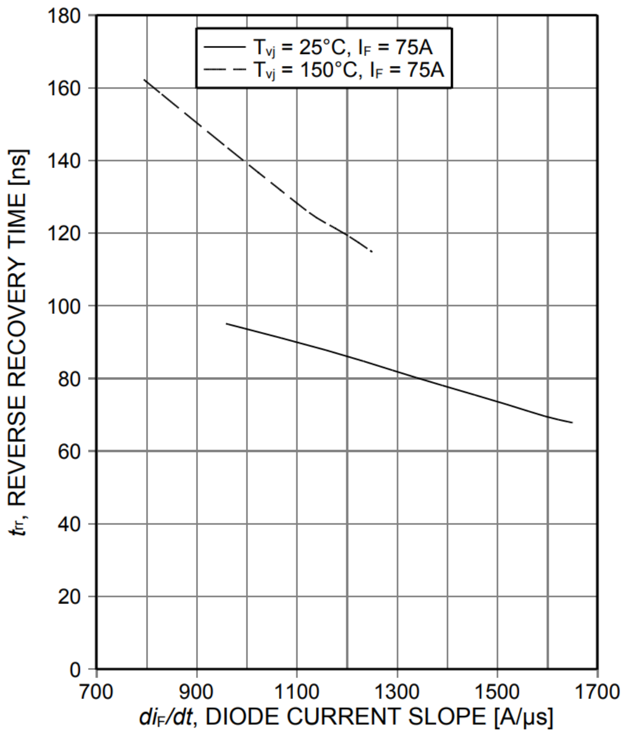


Figure 19. **Typical reverse recovery time as a function of diode current slope**
(V_R=400V)

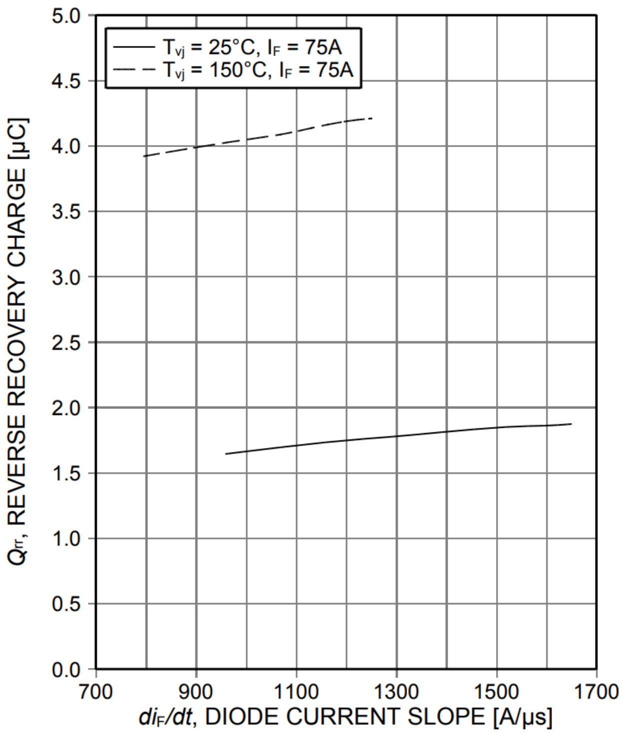


Figure 20. **Typical reverse recovery charge as a function of diode current slope**
(V_R=400V)

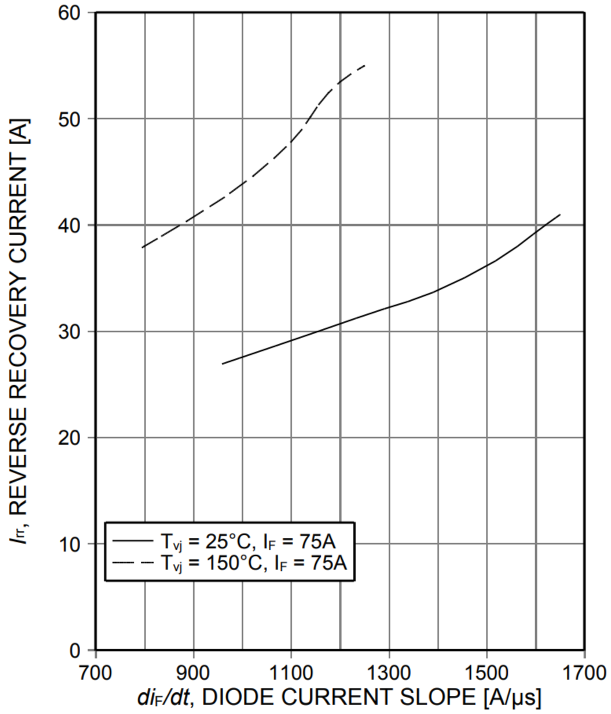


Figure 21. **Typical reverse recovery current as a function of diode current slope**
(V_R=400V)

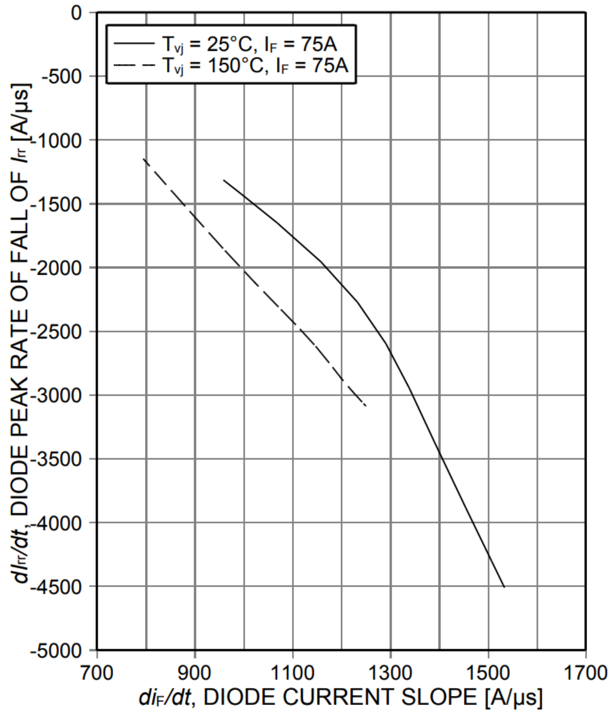


Figure 22. **Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**
(V_R=400V)

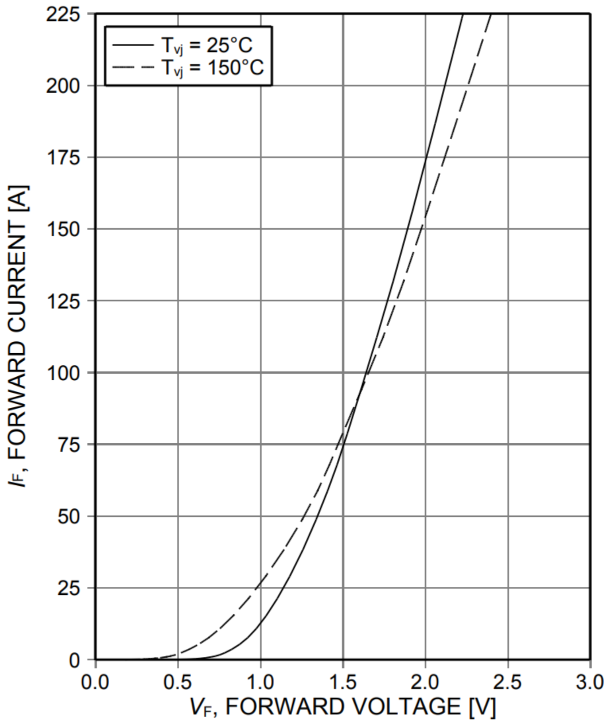


Figure 23. **Typical diode forward current as a function of forward voltage**

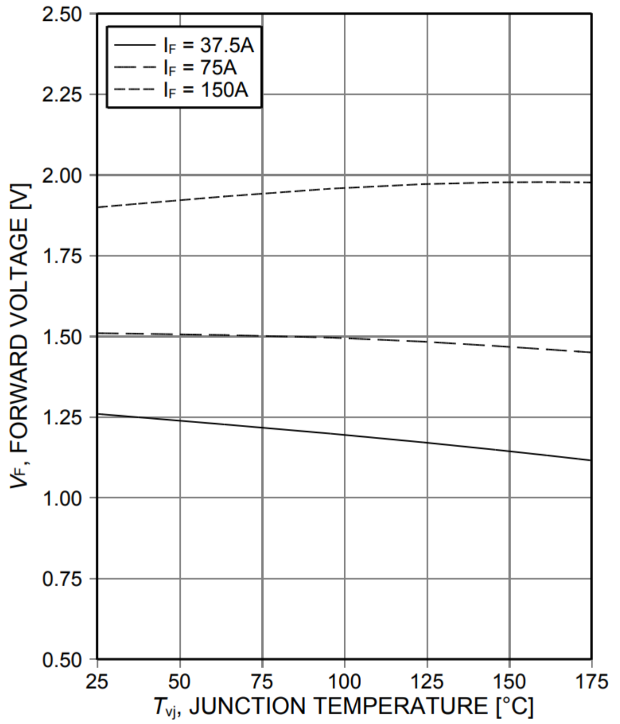
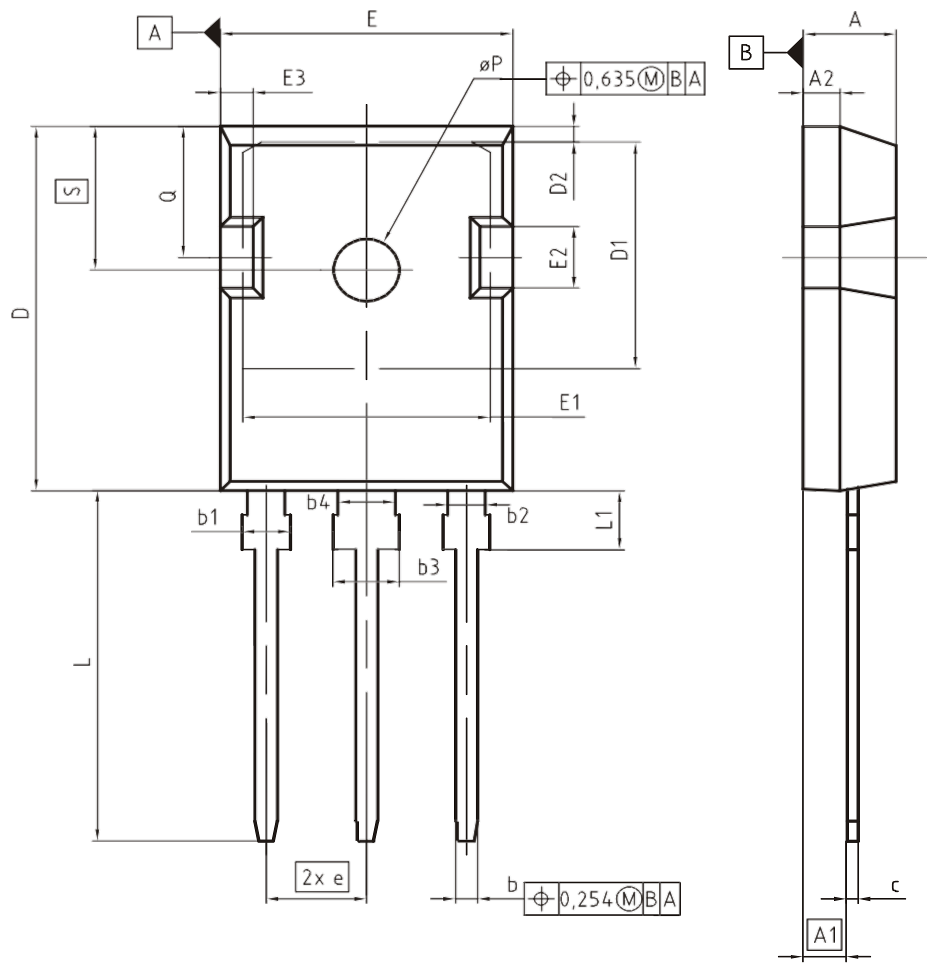


Figure 24. **Typical diode forward voltage as a function of junction temperature**

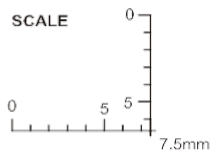
封装图 PG-TO247-3



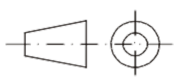
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	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

DOCUMENT NO.
Z8B00003327

SCALE



EUROPEAN PROJECTION



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05

测试条件

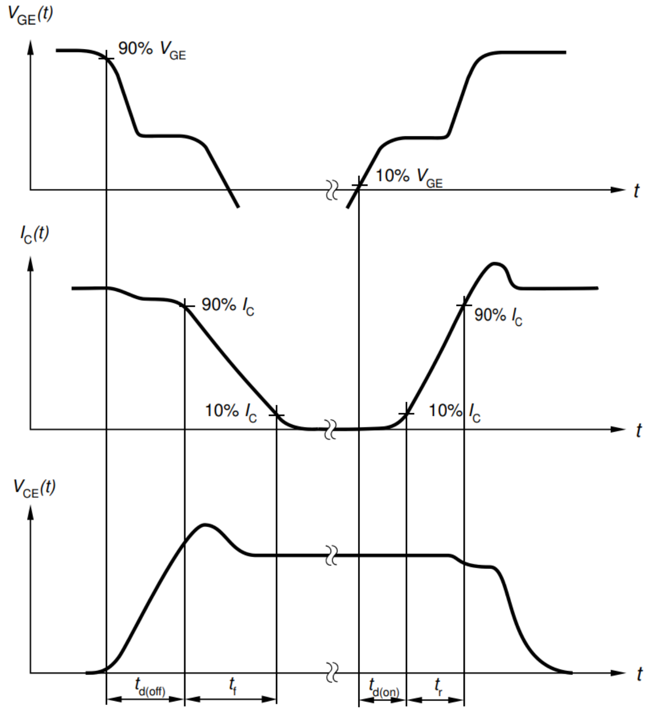

Figure A. **Definition of switching times**

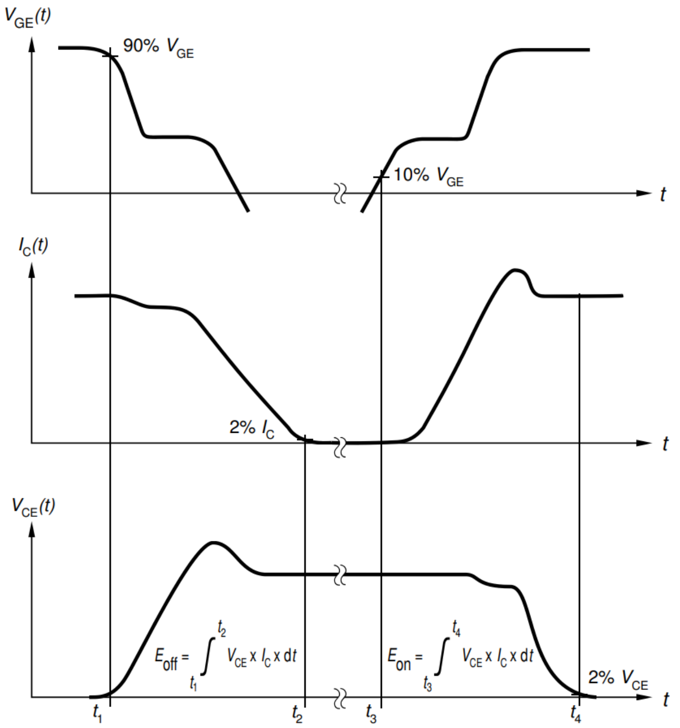

Figure B. **Definition of switching losses**

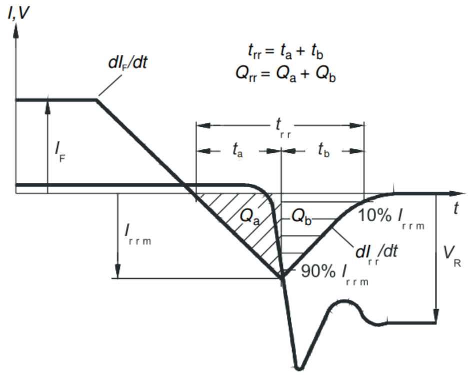

Figure C. **Definition of diode switching characteristics**

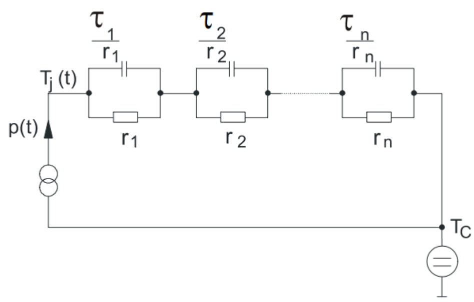

Figure D. **Thermal equivalent circuit**

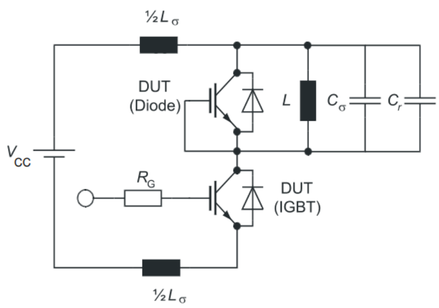

Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

修订记录

IKW75N65ES5

Revision: 2015-10-16, Rev. 2.2

历史修订版本

Revision	Date	Subjects (major changes since last revision)
1.1	2015-08-28	Preliminary data sheet
2.1	2015-09-22	Final data sheet
2.2	2015-10-16	Minor change Ic(VCE) Fig. 3 and Fig. 4

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