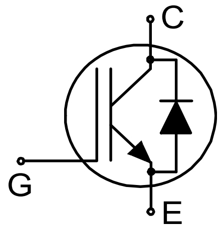
IKW75N65EH5

High speed series fifth generation

High speed 5 IGBT in TRENCHSTOP™ 5 technology copacked with full-rated RAPID 1 fast and soft antiparallel diode

Features and Benefits:



High speed H5 technology offering
• Best-in-Class efficiency in hard switching and resonant topologies
• Plug and play replacement of previous generation IGBTs
• 650V breakdown voltage
• Low gate charge Q_G
• IGBT copacked with full-rated RAPID 1 fast and soft antiparallel diode
• Maximum junction temperature 175°C
• Qualified according to JEDEC for target applications
• Pb-free lead plating; RoHS compliant
• Complete product spectrum and PSpice Models: http://www.infineon.com/igbt/

Applications:

• Uninterruptible power supplies
• Solar converters
• Welding converters
• Mid to high range switching frequency converters

Package pin definition:

• Pin 1 - gate
• Pin 2 & backside - collector
• Pin 3 - emitter

Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IKW75N65EH5	650V	75A	1.65V	175°C	K75EEH5	PG-TO247-3

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Maximum Ratings

For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

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	90.0 75.0	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}	395.0 198.0	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, PG-TO247-pin123 Maximum of mounting processes: 3	M	0.6	Nm

Thermal Resistance

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
R_{th} Characteristics						
IGBT thermal resistance, junction - case	$R_{th(j-C)}$		-	-	0.38	K/W
Diode thermal resistance, junction - case	$R_{th(j-C)}$		-	-	0.45	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		-	-	40	K/W

1) Defined by design. Not subject to production test.

Electrical Characteristic, at T_{vj} = 25°C, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
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	- - -	1.65 1.85 1.95	2.10 - -	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	- - -	1.35 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	- -	1 3000	75 -	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

Electrical Characteristic, at T_{vj} = 25°C, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Dynamic Characteristic						
Input capacitance	C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	-	4200	-	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	-	160.0	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13.0	-	nH

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at T_{vj} = 25°C						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 75.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 8.0Ω, $R_{G(off)}$ = 8.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 25pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	28	-	ns
Rise time	t_r		-	33	-	ns
Turn-off delay time	$t_{d(off)}$		-	174	-	ns
Fall time	t_f		-	41	-	ns
Turn-on energy	E_{on}		-	2.30	-	mJ
Turn-off energy	E_{off}		-	0.90	-	mJ
Total switching energy	E_{ts}		-	3.20	-	mJ

Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 37.5A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 8.0Ω, $R_{G(off)}$ = 8.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 20pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	25	-	ns
Rise time	t_r		-	14	-	ns
Turn-off delay time	$t_{d(off)}$		-	178	-	ns
Fall time	t_f		-	15	-	ns
Turn-on energy	E_{on}		-	0.90	-	mJ
Turn-off energy	E_{off}		-	0.30	-	mJ
Total switching energy	E_{ts}		-	1.20	-	mJ

Diode Characteristic, at T_{vj} = 25°C

Diode reverse recovery time	t_{rr}	T_{vj} = 25°C, V_R = 400V, I_F = 75.0A, di_F/dt = 1000A/µs, $L\sigma$ = 30nH, $C\sigma$ = 25pF	-	92	-	ns
Diode reverse recovery charge	Q_{rr}		-	1.33	-	µC
Diode peak reverse recovery current	I_{rrm}		-	20.5	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-600	-	A/µs
Diode reverse recovery time	t_{rr}	T_{vj} = 25°C, V_R = 400V, I_F = 37.5A, di_F/dt = 1000A/µs, $L\sigma$ = 30nH, $C\sigma$ = 25pF	-	59	-	ns
Diode reverse recovery charge	Q_{rr}		-	1.00	-	µC
Diode peak reverse recovery current	I_{rrm}		-	25.8	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-1750	-	A/µs

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at 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, $R_{G(on)}$ = 8.0Ω, $R_{G(off)}$ = 8.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 25pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	27	-	ns
Rise time	t_r		-	34	-	ns
Turn-off delay time	$t_{d(off)}$		-	194	-	ns
Fall time	t_f		-	38	-	ns
Turn-on energy	E_{on}		-	3.00	-	mJ
Turn-off energy	E_{off}		-	1.00	-	mJ
Total switching energy	E_{ts}		-	4.00	-	mJ
Turn-on delay time	$t_{d(on)}$	T_{vj} = 150°C, V_{CC} = 400V, I_C = 37.5A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 8.0Ω, $R_{G(off)}$ = 8.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 20pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	25	-	ns
Rise time	t_r		-	16	-	ns
Turn-off delay time	$t_{d(off)}$		-	207	-	ns
Fall time	t_f		-	18	-	ns
Turn-on energy	E_{on}		-	1.80	-	mJ
Turn-off energy	E_{off}		-	0.40	-	mJ
Total switching energy	E_{ts}		-	2.20	-	mJ

Diode Characteristic, at T_{vj} = 150°C

Diode reverse recovery time	t_{rr}	T_{vj} = 150°C, V_R = 400V, I_F = 75.0A, di_F/dt = 1000A/µs, $L\sigma$ = 30nH, $C\sigma$ = 25pF	-	123	-	ns
Diode reverse recovery charge	Q_{rr}		-	3.70	-	µC
Diode peak reverse recovery current	I_{rrm}		-	43.8	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-2000	-	A/µs

Diode reverse recovery time	t_{rr}	T_{vj} = 150°C, V_R = 400V, I_F = 37.5A, di_F/dt = 1000A/µs, $L\sigma$ = 30nH, $C\sigma$ = 25pF	-	108	-	ns
Diode reverse recovery charge	Q_{rr}		-	2.70	-	µC
Diode peak reverse recovery current	I_{rrm}		-	38.7	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-1050	-	A/µs

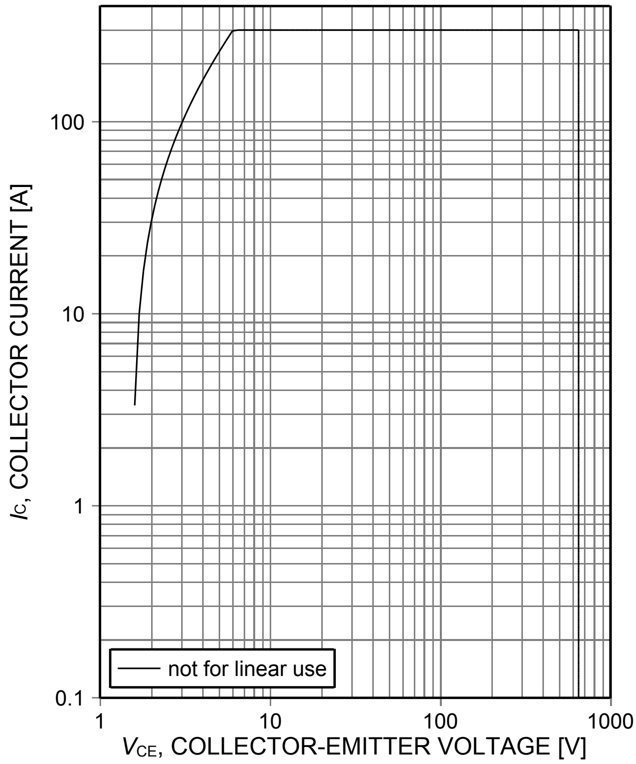


Figure 1. **Forward bias safe operating area** (D=0, T_C=25°C, T_{vj}≤175°C, V_{GE}=15V, t_p=1µs, I_{Cmax} defined by design - not subject to production test)

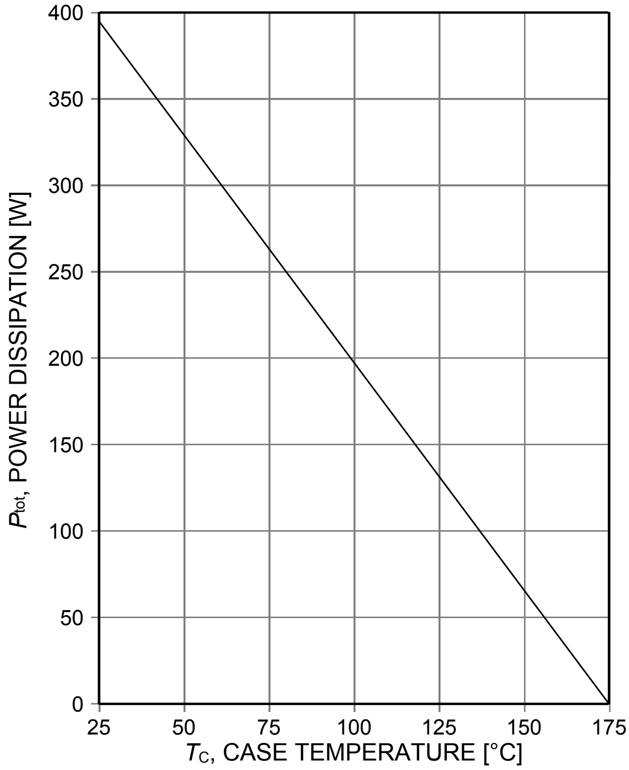


Figure 2. **Power dissipation as a function of case temperature** (T_{vj}≤175°C)

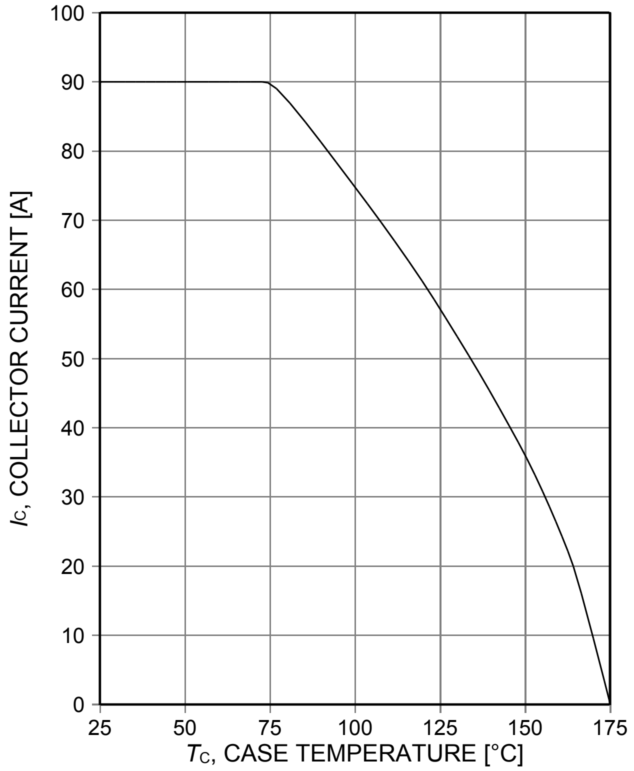


Figure 3. **Collector current as a function of case temperature** (V_{GE}≥15V, T_{vj}≤175°C)

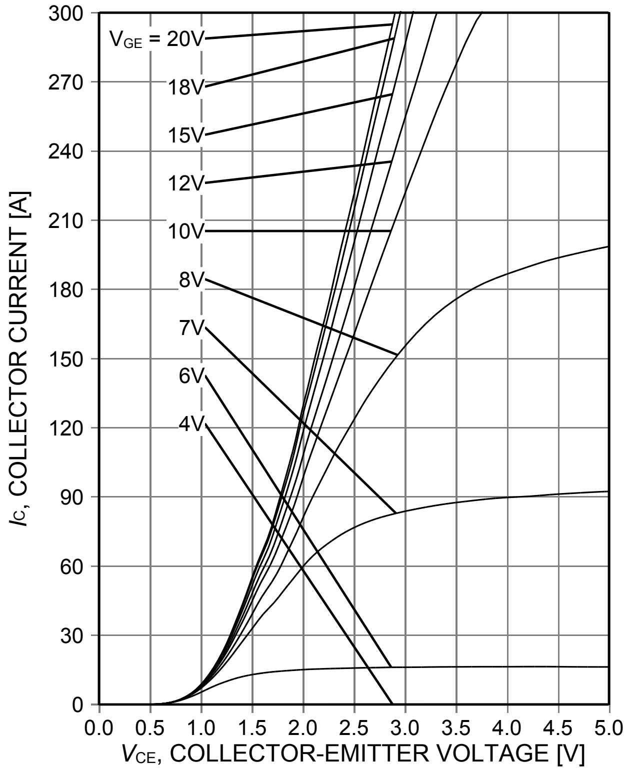


Figure 4. **Typical output characteristic** (T_{vj}=25°C)

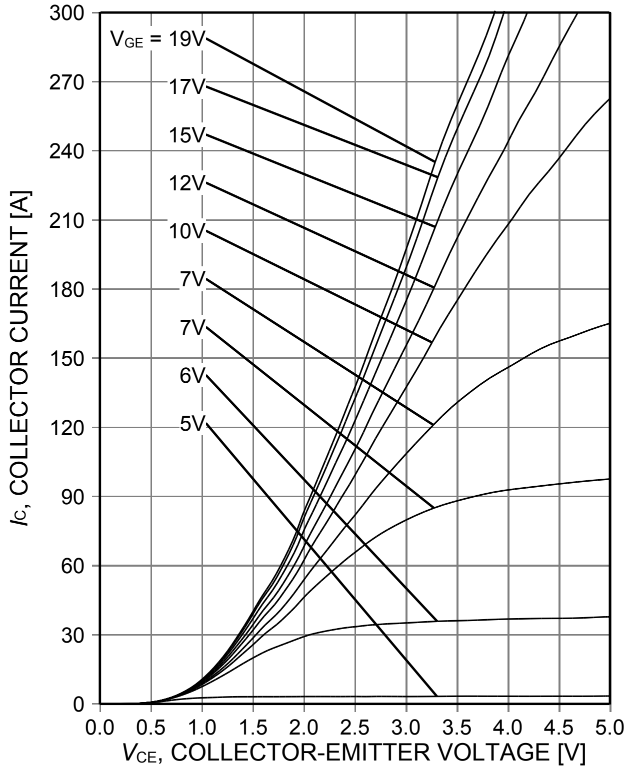


Figure 5. **Typical output characteristic**
(T_{vj}=150°C)

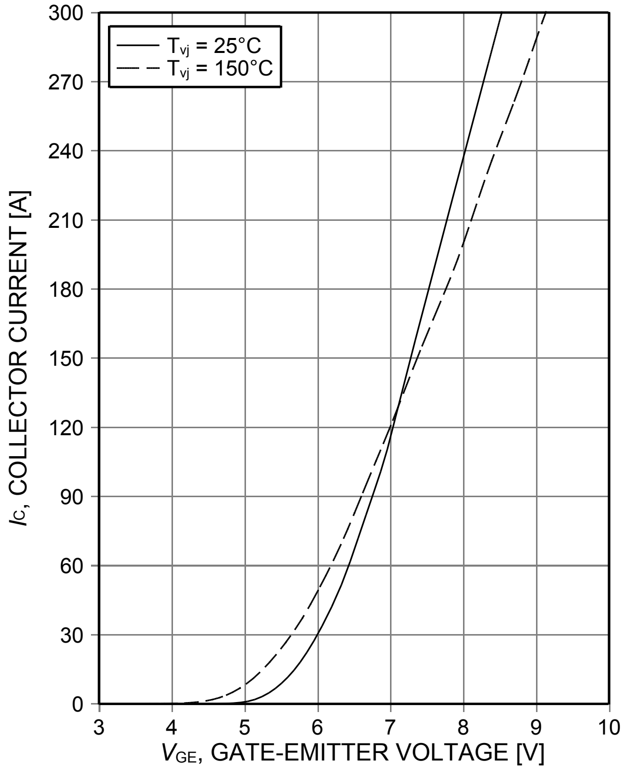


Figure 6. **Typical transfer characteristic**
(V_{CE}=20V)

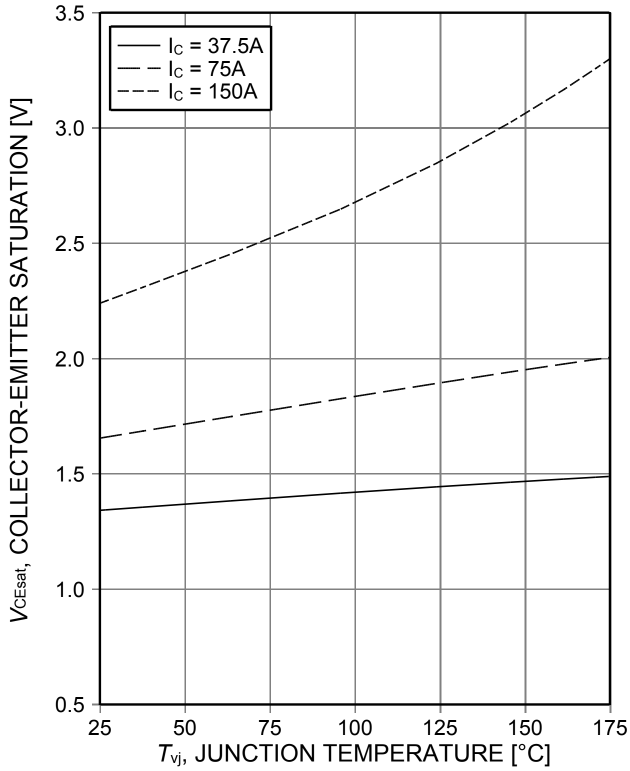


Figure 7. **Typical collector-emitter saturation voltage as a function of junction temperature**
(V_{GE}=15V)

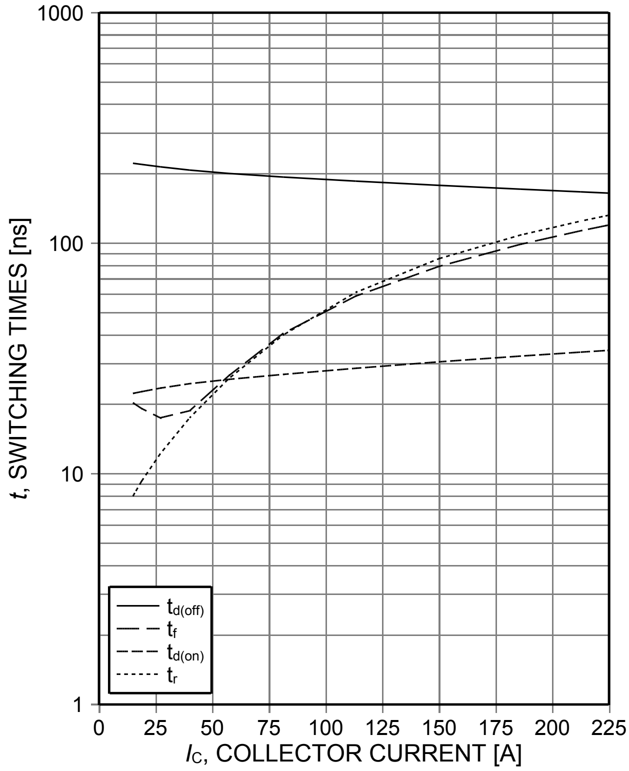


Figure 8. **Typical switching times as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, $R_{G(on)}$=8Ω, $R_{G(off)}$=8Ω, dynamic test circuit in Figure E)

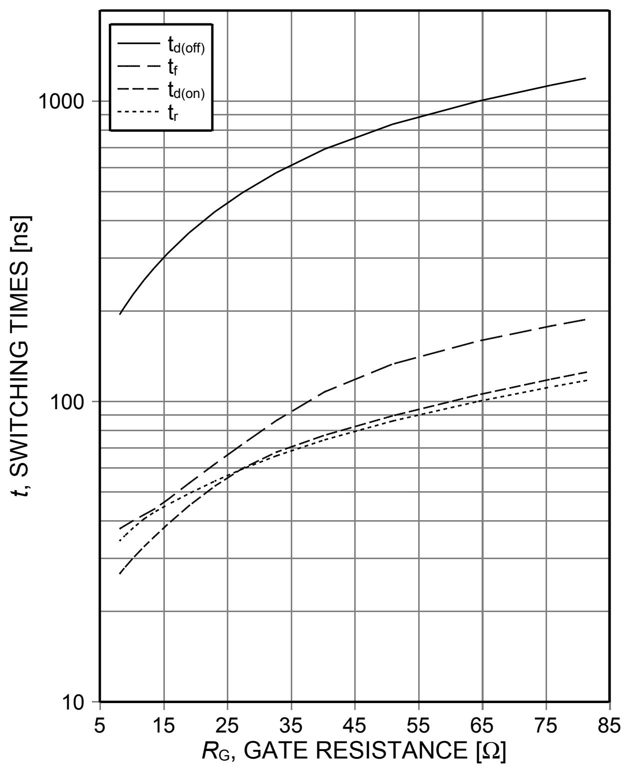


Figure 9. **Typical switching times as a function of gate resistance**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=75A, dynamic test circuit in Figure E)

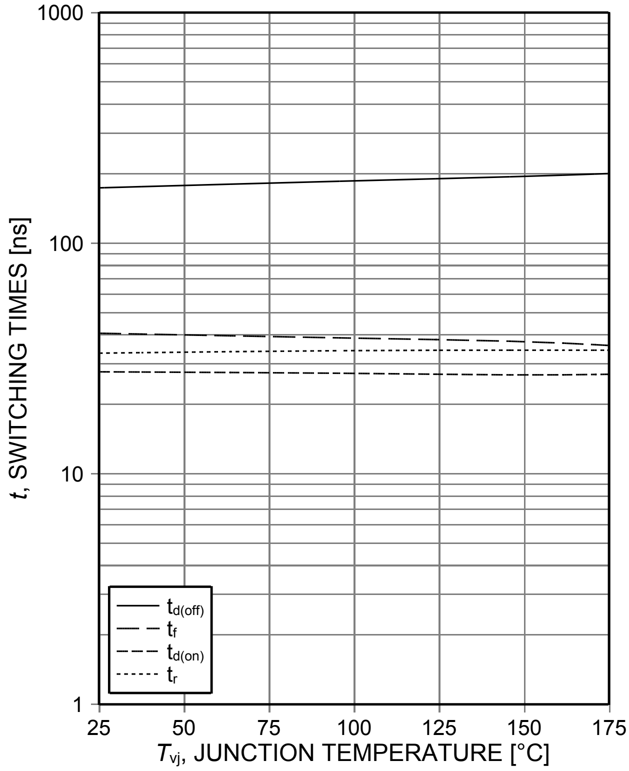


Figure 10. **Typical switching times as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=75A, $R_{G(on)}$=8Ω, $R_{G(off)}$=8Ω, dynamic test circuit in Figure E)

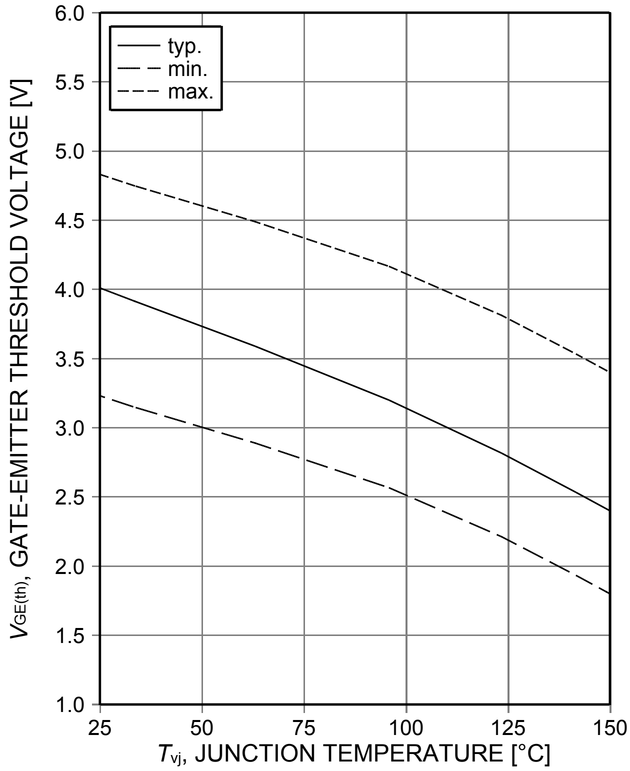


Figure 11. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0.75mA)

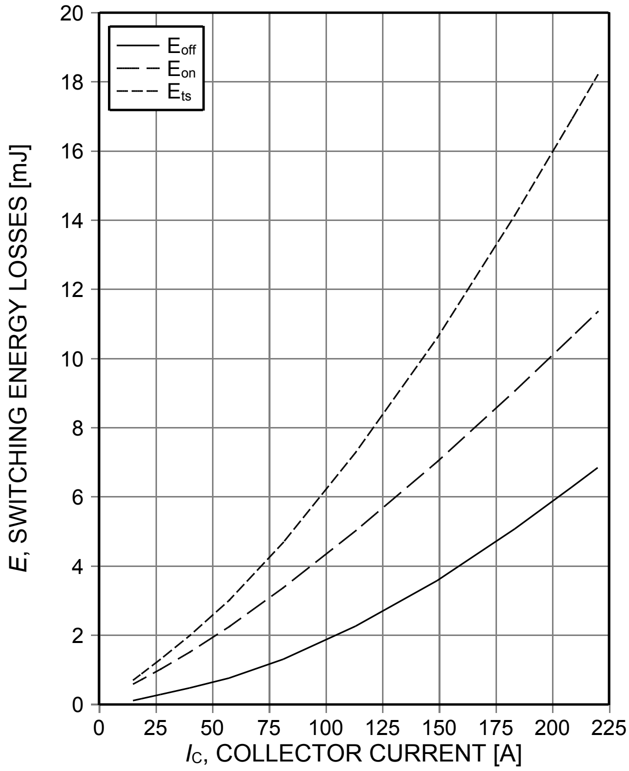


Figure 12. **Typical switching energy losses as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, $R_{G(on)}$=8Ω, $R_{G(off)}$=8Ω, dynamic test circuit in Figure E)

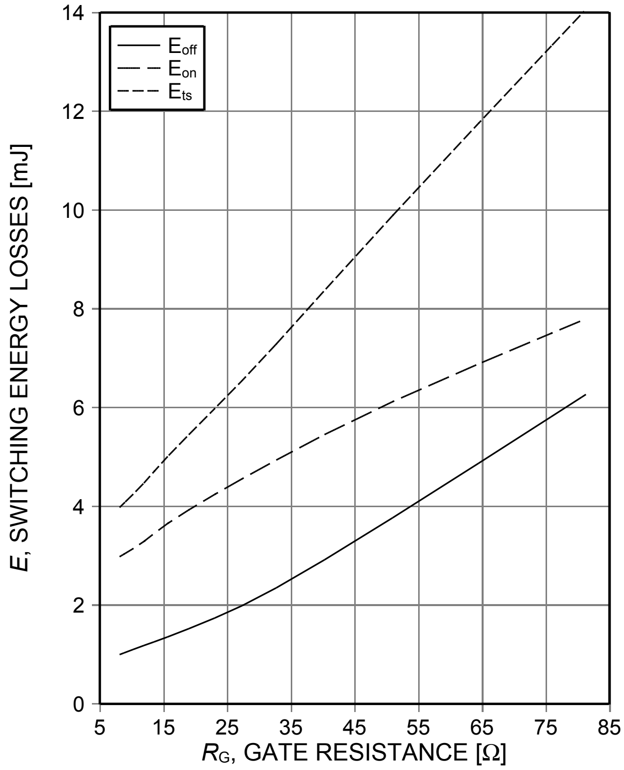


Figure 13. **Typical switching energy losses as a function of gate resistance**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=0/15V, I_C=75A, dynamic test circuit in Figure E)

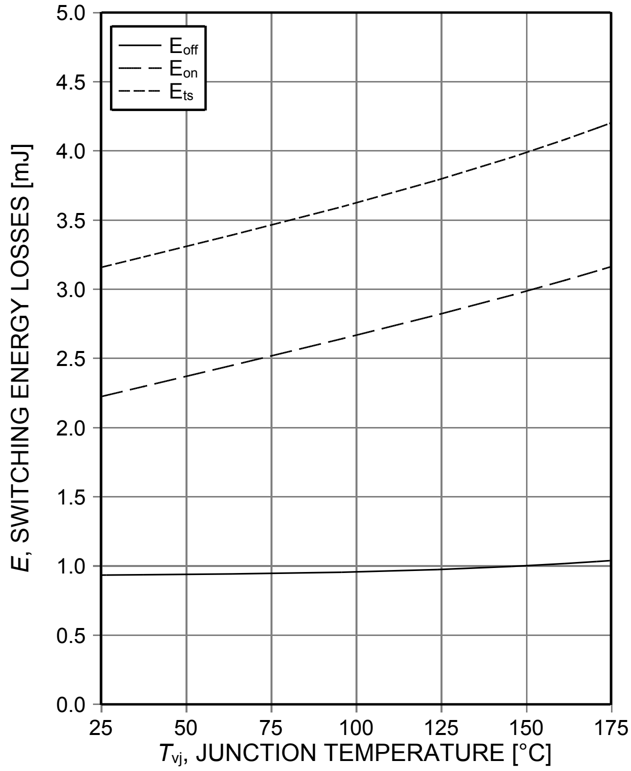


Figure 14. **Typical switching energy losses as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=0/15V, I_C=75A, $R_{G(on)}$=8Ω, $R_{G(off)}$=8Ω, dynamic test circuit in Figure E)

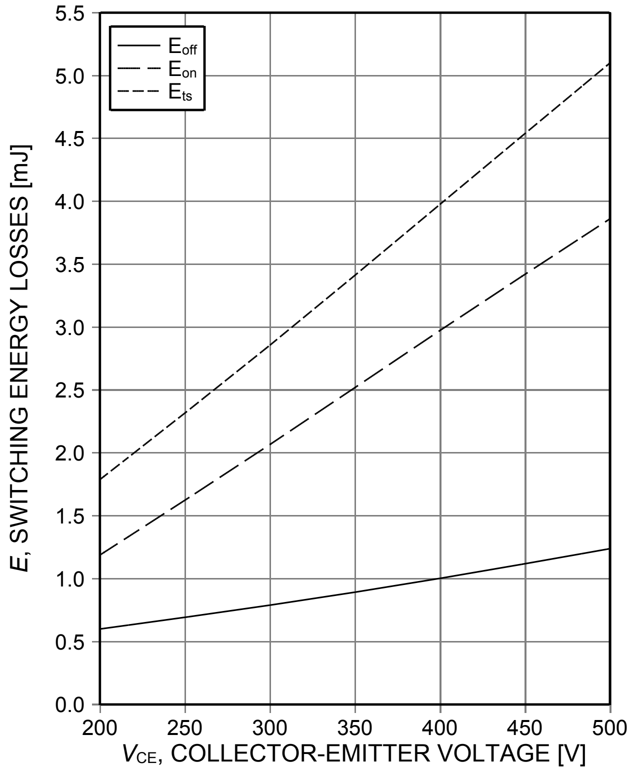


Figure 15. **Typical switching energy losses as a function of collector emitter voltage**
(inductive load, T_{vj}=150°C, V_{GE}=0/15V, I_C=75A, $R_{G(on)}$=8Ω, $R_{G(off)}$=8Ω, dynamic test circuit in Figure E)

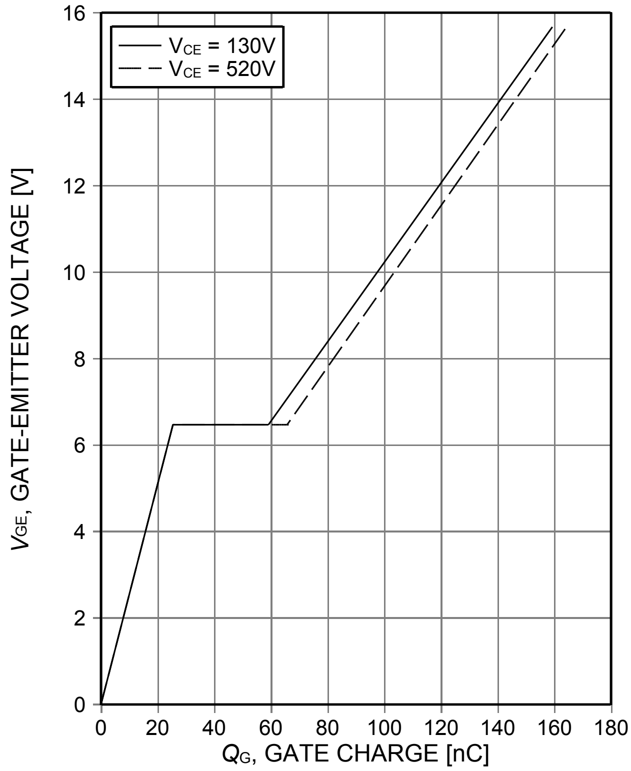


Figure 16. **Typical gate charge**
(I_C=75A)

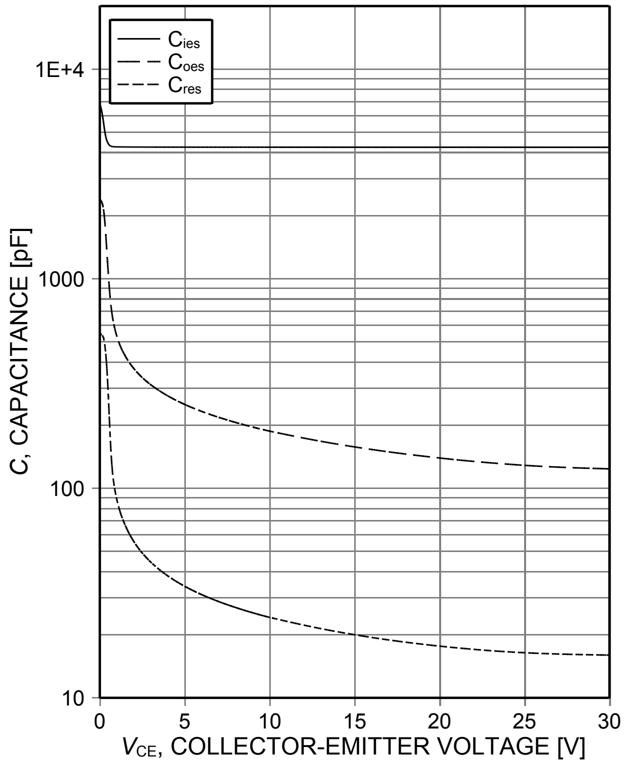


Figure 17. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=1MHz)

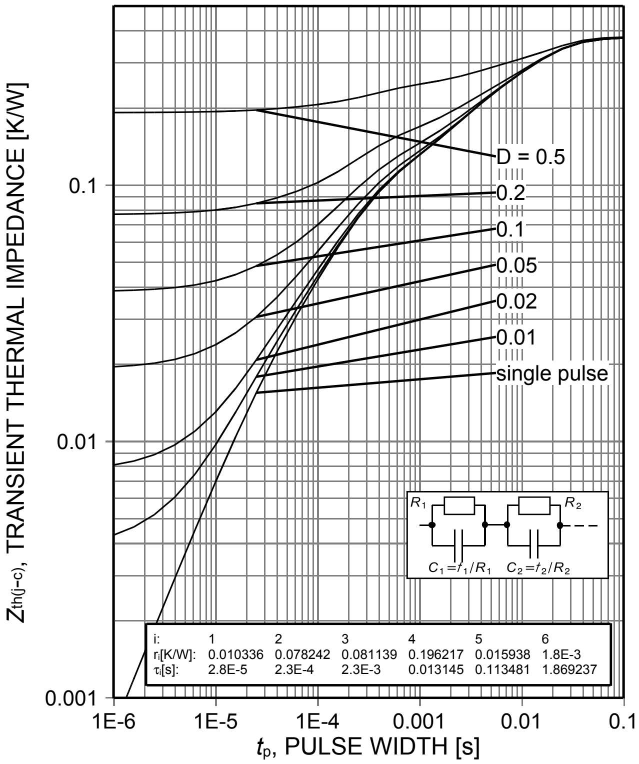


Figure 18. **IGBT transient thermal impedance**
(D=t_p/T)

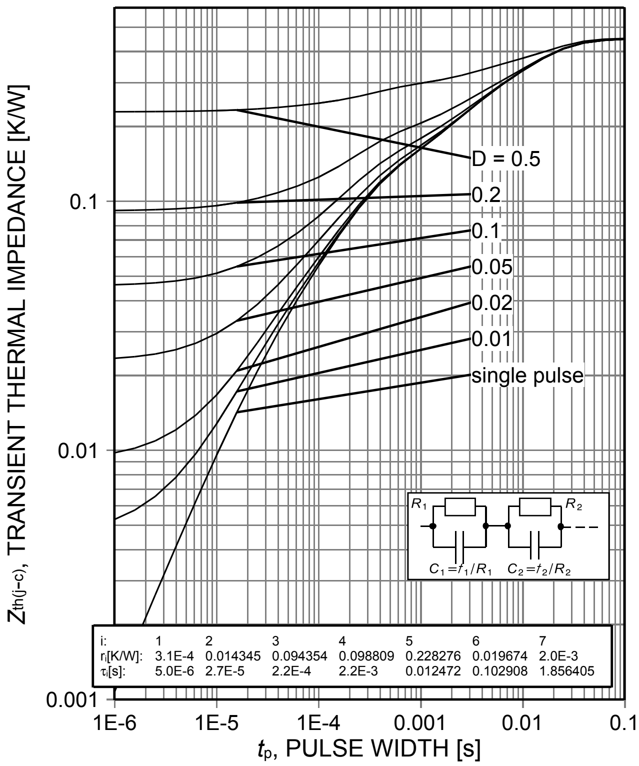


Figure 19. **Diode transient thermal impedance as a function of pulse width**
(D=t_p/T)

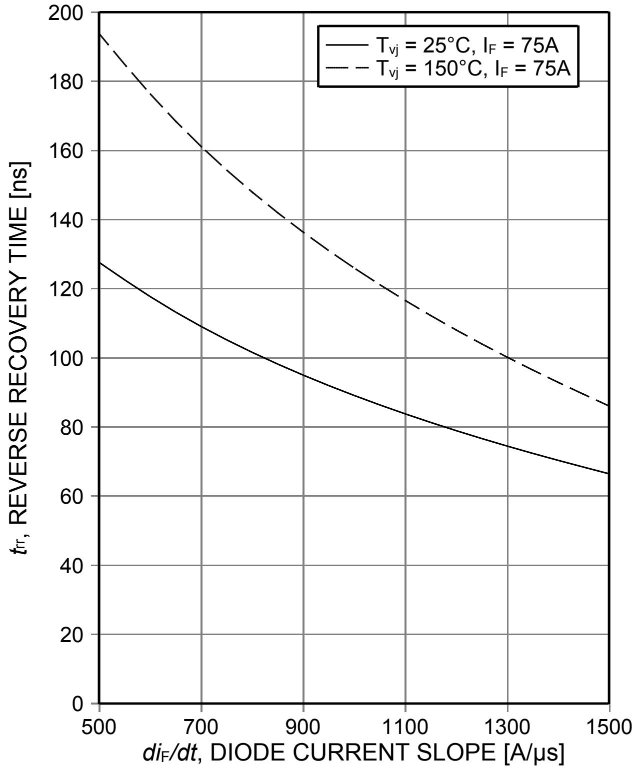


Figure 20. **Typical reverse recovery time as a function of diode current slope**
(V_R=400V)

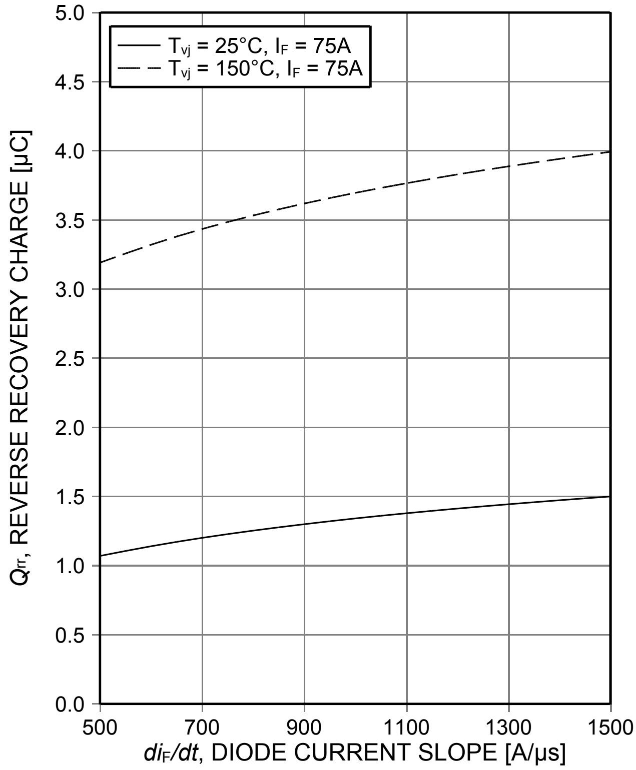


Figure 21. **Typical reverse recovery charge as a function of diode current slope**
(V_R=400V)

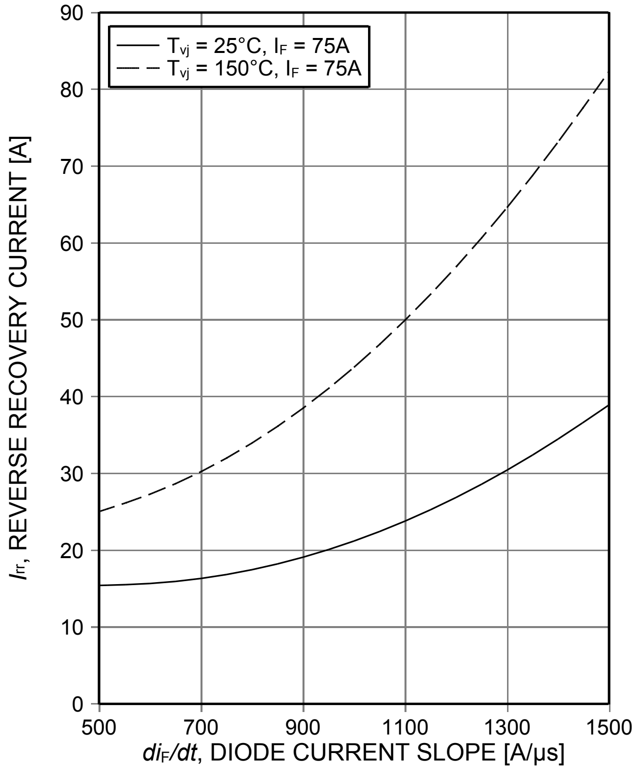


Figure 22. **Typical reverse recovery current as a function of diode current slope**
(V_R=400V)

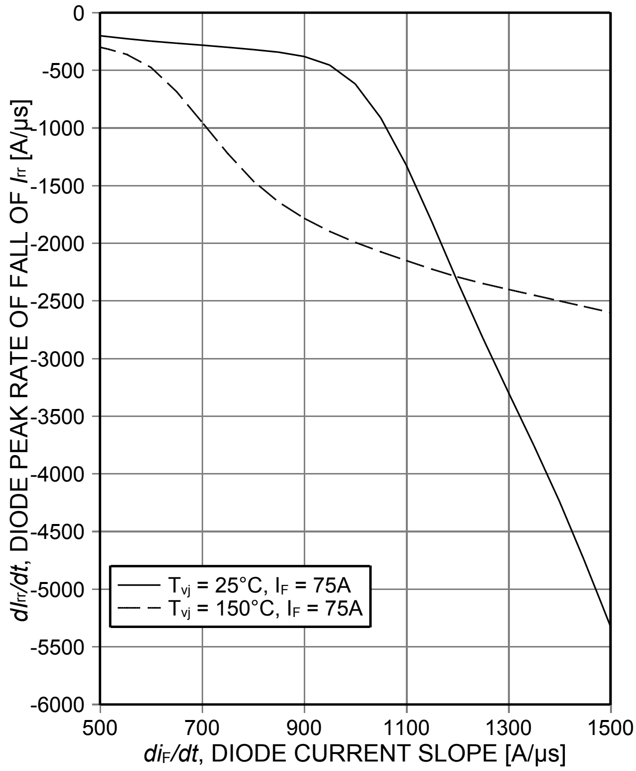


Figure 23. **Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**
(V_R=400V)

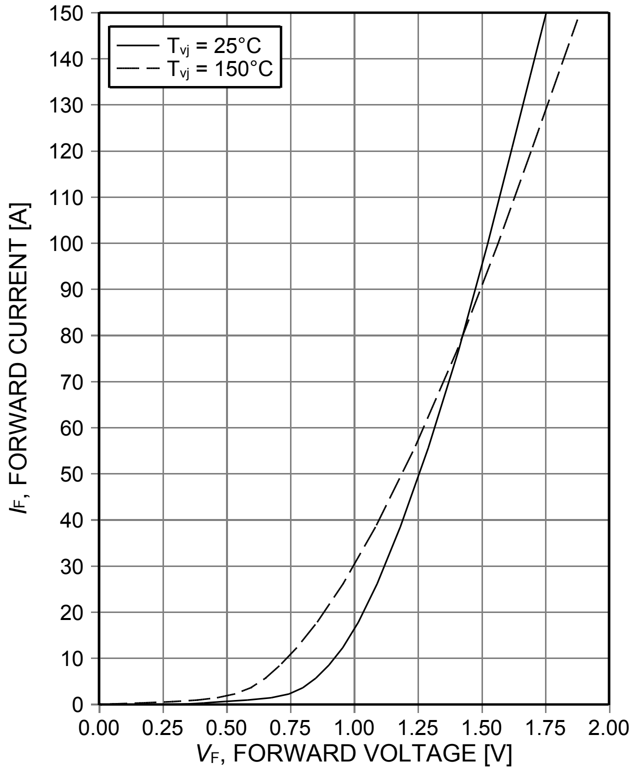


Figure 24. **Typical diode forward current as a function of forward voltage**

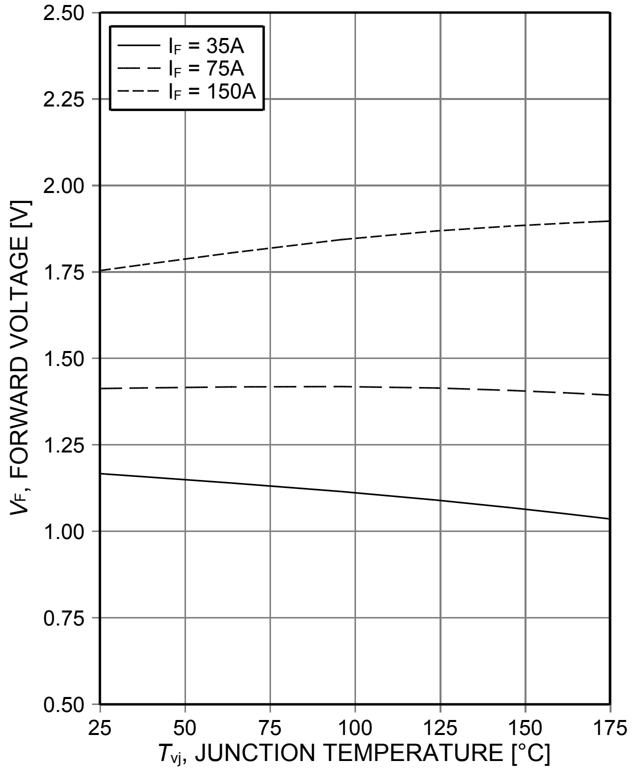
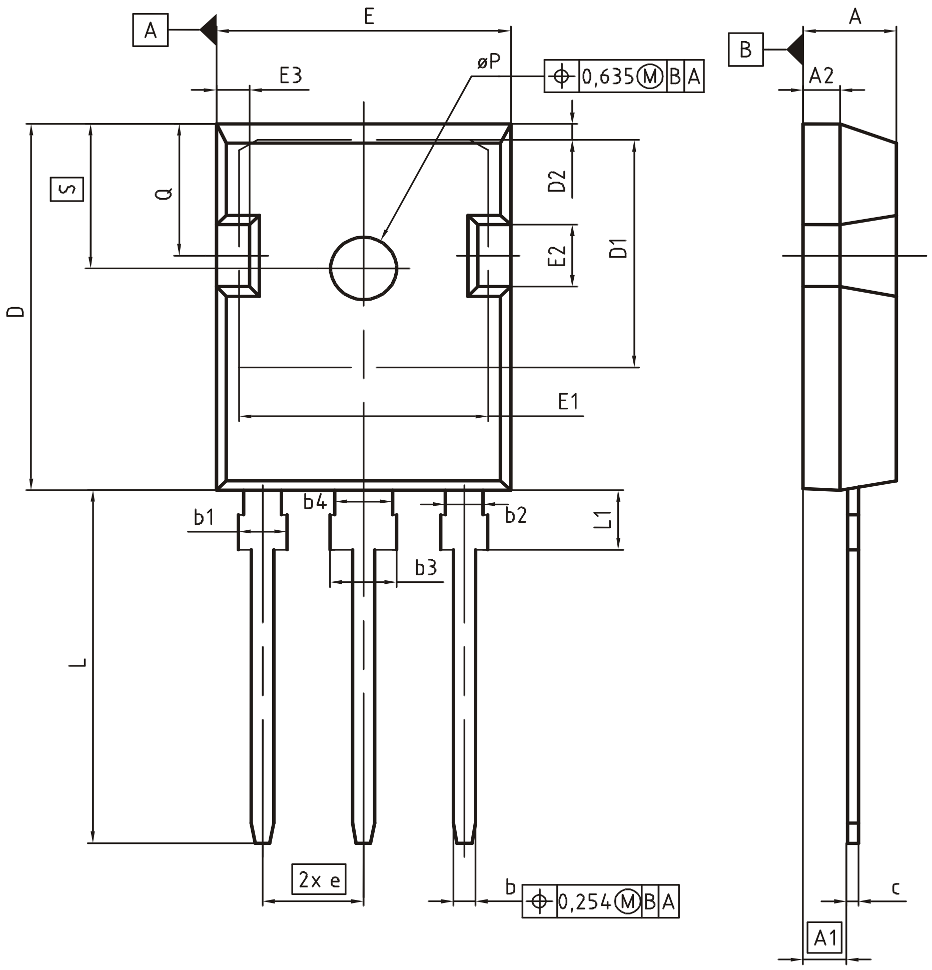


Figure 25. **Typical diode forward voltage as a function of junction temperature**

Package Drawing 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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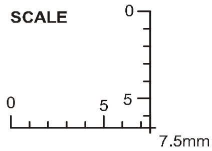
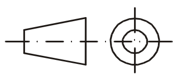
SCALE



EUROPEAN PROJECTION



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REVISION
05

Testing Conditions

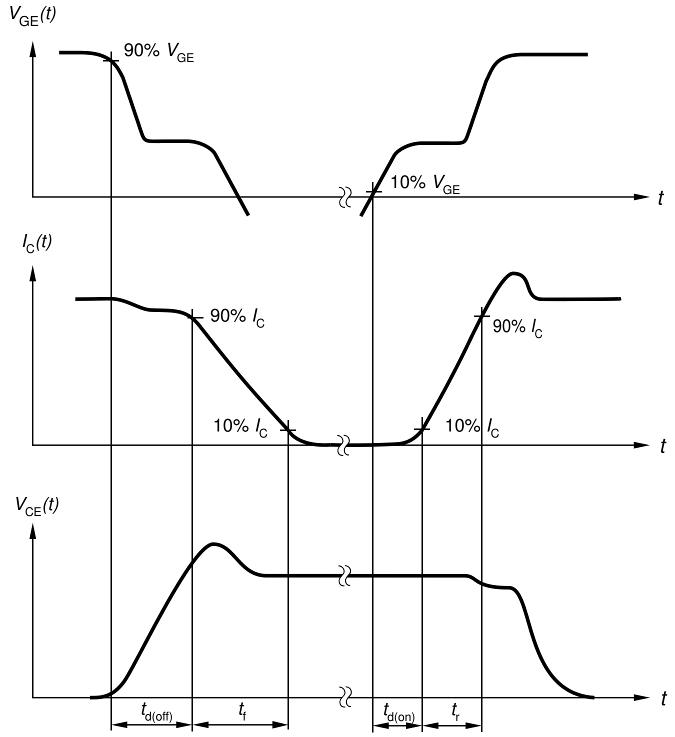

Figure A. **Definition of switching times**

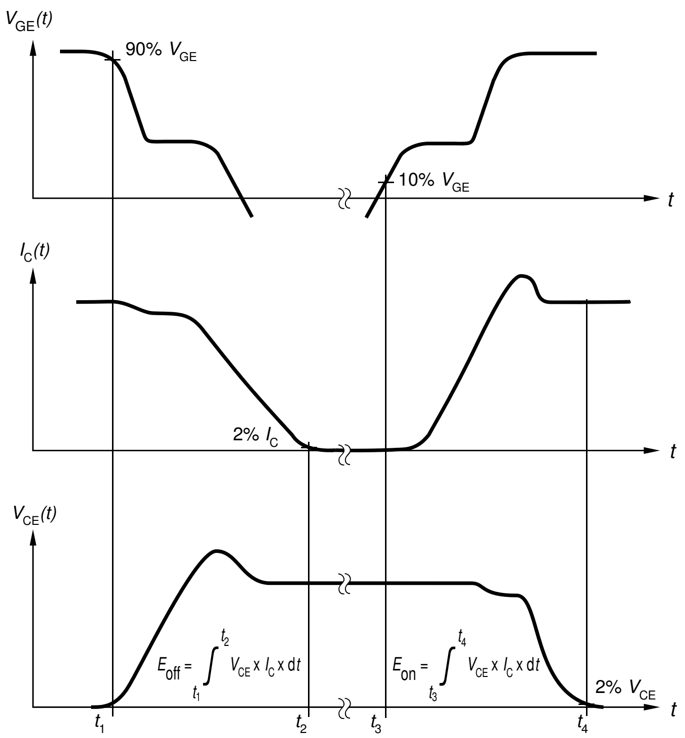

Figure B. **Definition of switching losses**

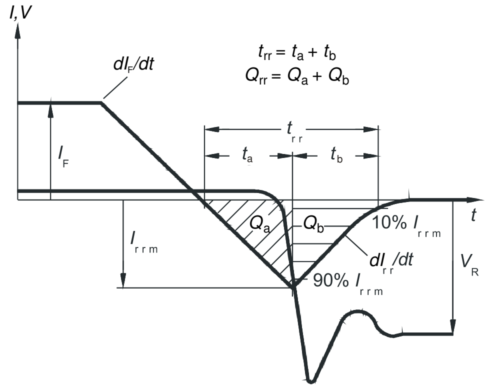

Figure C. **Definition of diode switching characteristics**

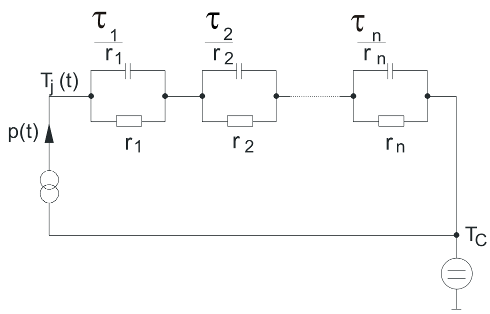

Figure D. **Thermal equivalent circuit**

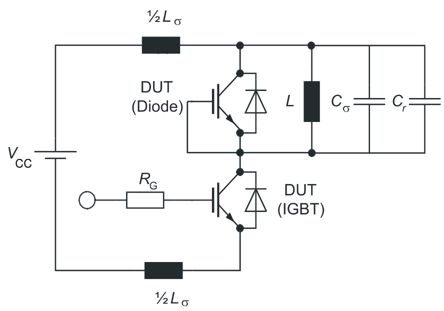

Figure E. **Dynamic test circuit**
Parasitic inductance L_{σ},
parasitic capacitor C_{σ},
relief capacitor C_r,
(only for ZVT switching)

Revision History

IKW75N65EH5

Revision: 2017-07-27, Rev. 2.2

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.1	2015-05-20	Final data sheet
2.2	2017-07-27	Correction Fig.1