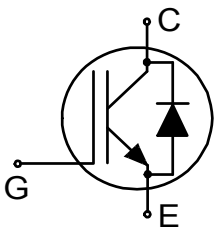
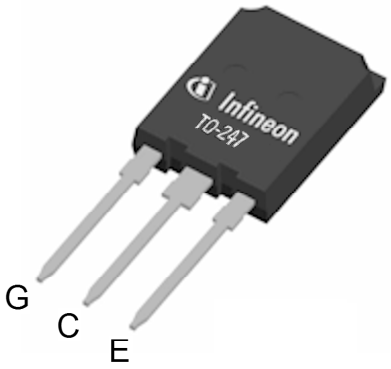
Sixth generation, high speed soft switching series

High speed soft switching TRENCHSTOP™ IGBT 6 in Trench and Fieldstop technology copacked with soft and fast recovery anti-parallel diode

Features:



1200V TRENCHSTOP™ IGBT6 technology offering:
• High efficiency in hard switching and resonant topologies
• Easy paralleling capability due to positive temperature coefficient in V_{CEsat}
• Low EMI
• Low Gate Charge Q_g
• Very soft, fast recovery full current anti-parallel diode
• Maximum junction temperature 175°C
• Pb-free lead plating; RoHS compliant
• Complete product spectrum and PSpice Models: http://www.infineon.com/igbt/



Applications:

• Industrial UPS
• Charger
• Energy storage
• Three-level Solar String Inverter
• Welding

Product Validation:

Qualified for industrial applications according to the relevant tests of JEDEC47/20/22

Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IKQ75N120CS6	1200V	75A	1.85V	175°C	K75MCS6	PG-TO247-3-46

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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}	1200	V
DC collector current, limited by T_{vjmax} $T_c = 25°C$ $T_c = 100°C$	I_C	 150.0 75.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	300.0	A
Turn off safe operating area $V_{CE} \leq 1200V$, $T_{vj} \leq 175°C$	-	300.0	A
Diode forward current, limited by T_{vjmax} $T_c = 25°C$ $T_c = 100°C$	I_F	 150.0 75.0	A
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	300.0	A
Gate-emitter voltage Transient Gate-emitter voltage ($t_p \leq 0.5\mu s$, $D < 0.001$)	V_{GE}	±20 25	V
Short circuit withstand time $V_{GE} = 15.0V$, $V_{CC} \leq 500V$ Allowed number of short circuits < 1000 Time between short circuits: ≥ 1.0s $T_{vj} = 150°C$	t_{SC}	 3	µs
Power dissipation $T_c = 25°C$ Power dissipation $T_c = 100°C$	P_{tot}	880.0 440.0	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

Thermal Resistance

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
R_{th} Characteristics						
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		-	-	0.17	K/W
Diode thermal resistance, junction - case	$R_{th(j-c)}$		-	-	0.41	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		-	-	40	K/W

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
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	 - - -	 1.85 2.15 2.25	 2.15 - -	V
Diode forward voltage	V_F	V_{GE} = 0V, I_F = 75.0A T_{vj} = 25°C T_{vj} = 175°C	 - -	 2.10 2.15	 2.20 -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 3.50mA, V_{CE} = V_{GE}	5.1	5.7	6.3	V
Zero gate voltage collector current	I_{CES}	V_{CE} = 1200V, V_{GE} = 0V T_{vj} = 25°C T_{vj} = 175°C	 - -	 - 3500	 1600 -	µA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0V, V_{GE} = 20V	-	-	600	nA
Transconductance	g_{fs}	V_{CE} = 20V, I_C = 75.0A	-	60.0	-	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	-	4900	-	pF
Output capacitance	C_{oes}		-	360	-	
Reverse transfer capacitance	C_{res}		-	225	-	
Gate charge	Q_G	V_{CC} = 960V, I_C = 75.0A, V_{GE} = 15V	-	530.0	-	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} = 600V, I_C = 75.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 4.0Ω, $R_{G(off)}$ = 4.0Ω, Lσ = 70nH, Cσ = 67pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	34	-	ns
Rise time	t_r		-	44	-	ns
Turn-off delay time	$t_{d(off)}$		-	300	-	ns
Fall time	t_f		-	31	-	ns
Turn-on energy	E_{on}		-	5.15	-	mJ
Turn-off energy	E_{off}		-	2.95	-	mJ
Total switching energy	E_{ts}		-	8.10	-	mJ

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

Diode reverse recovery time	t_{rr}	T_{vj} = 25°C, V_R = 600V, I_F = 75.0A, di_F/dt = 820A/µs, Lσ = 70nH, Cσ = 67pF	-	440	-	ns
Diode reverse recovery charge	Q_{rr}		-	4.70	-	µC
Diode peak reverse recovery current	I_{rrm}		-	27.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-95	-	A/µs

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
IGBT Characteristic, at T_{vj} = 175°C						
Turn-on delay time	$t_{d(on)}$	T_{vj} = 175°C, V_{CC} = 600V, I_C = 75.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 4.0Ω, $R_{G(off)}$ = 4.0Ω, Lσ = 70nH, Cσ = 67pF Lσ, Cσ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	31	-	ns
Rise time	t_r		-	45	-	ns
Turn-off delay time	$t_{d(off)}$		-	370	-	ns
Fall time	t_f		-	58	-	ns
Turn-on energy	E_{on}		-	7.35	-	mJ
Turn-off energy	E_{off}		-	5.30	-	mJ
Total switching energy	E_{ts}		-	12.65	-	mJ

Diode Characteristic, at T_{vj} = 175°C

Diode reverse recovery time	t_{rr}	T_{vj} = 175°C, V_R = 600V, I_F = 75.0A, di_F/dt = 1020A/µs, Lσ = 70nH, Cσ = 67pF	-	765	-	ns
Diode reverse recovery charge	Q_{rr}		-	12.50	-	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		-	-115	-	A/µs

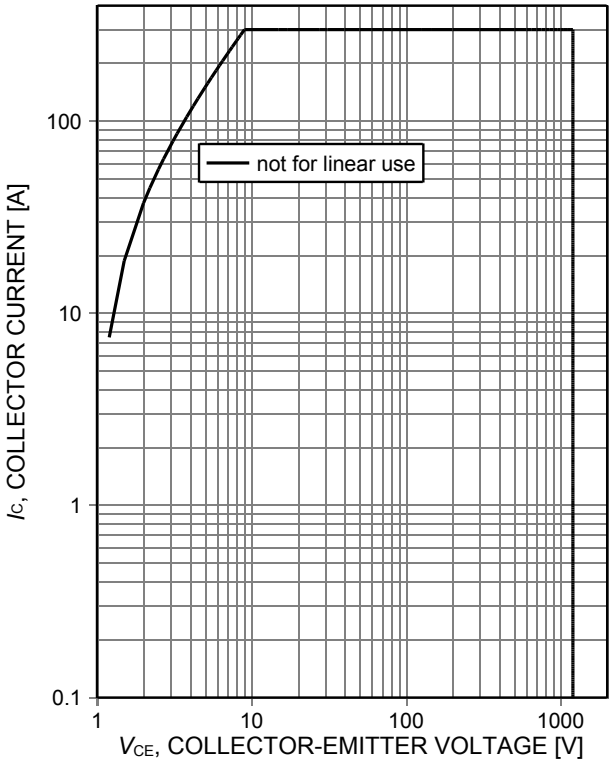


Figure 1. **Forward bias safe operating area** (D=0, T_{vj}≤175°C; V_{GE}=15V, pulse width limited by T_{vjmax})

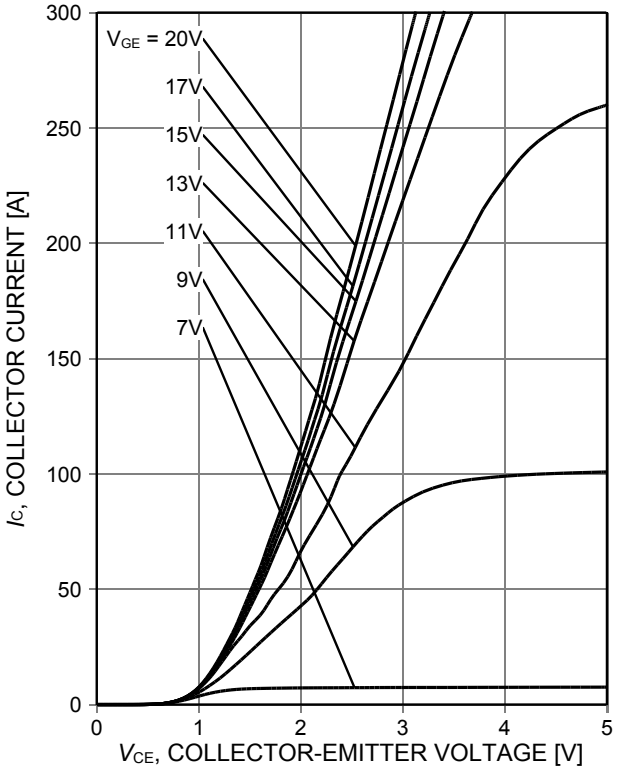


Figure 2. **Typical output characteristic** (T_{vj}=25°C)

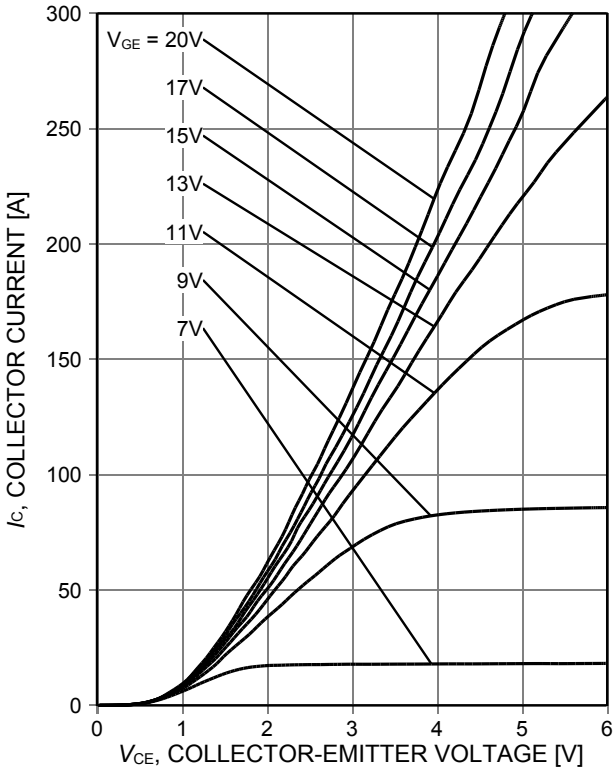


Figure 3. **Typical output characteristic** (T_{vj}=175°C)

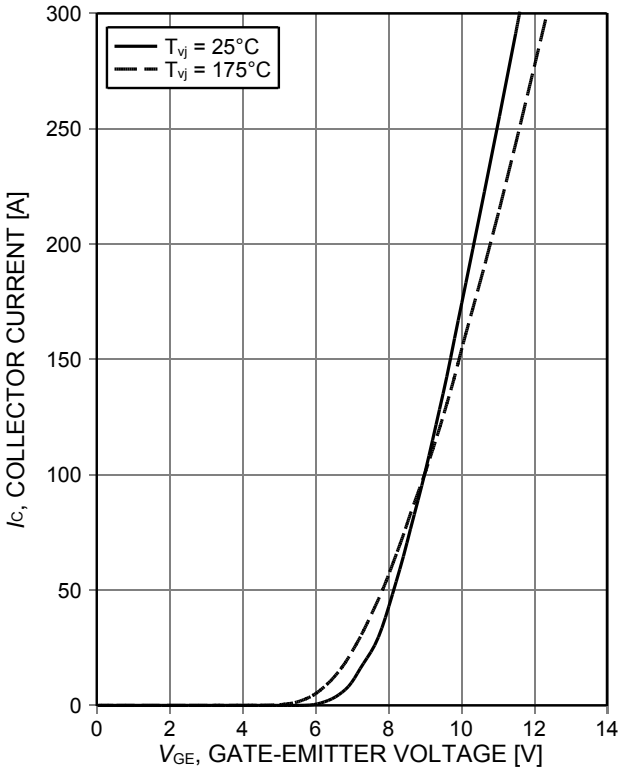


Figure 4. **Typical transfer characteristic** (V_{CE}=20V)

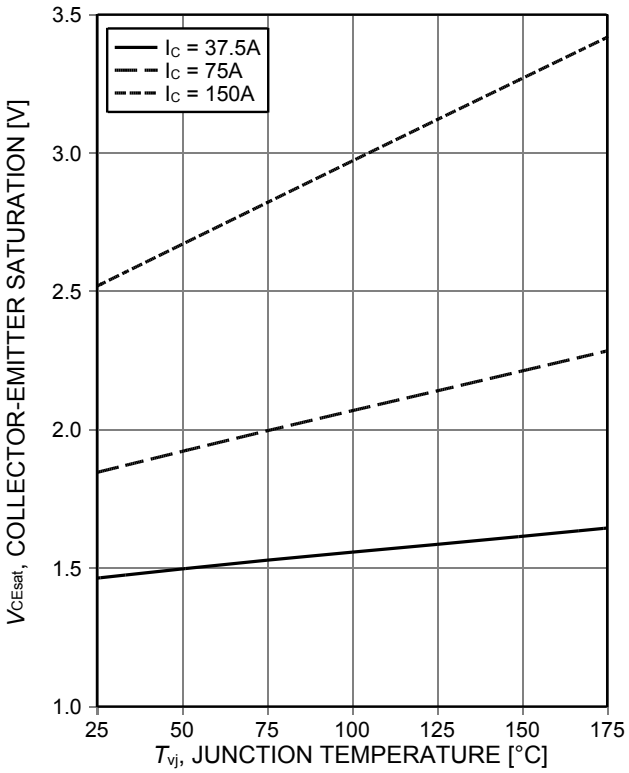


Figure 5. **Typical collector-emitter saturation voltage as a function of junction temperature**
(V_{GE}=15V)

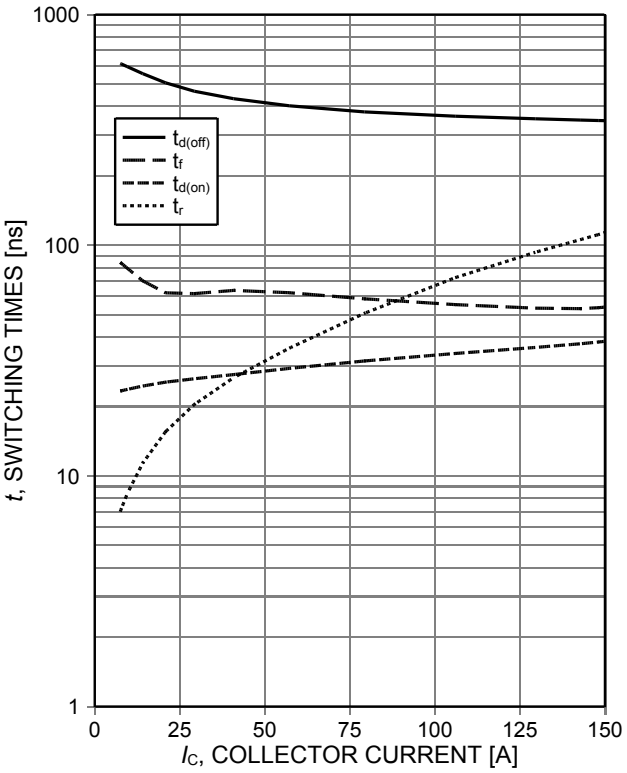


Figure 6. **Typical switching times as a function of collector current**
(inductive load, T_{vj}=175°C, V_{CE}=600V, V_{GE}=15/0V, R_G=4Ω, Dynamic test circuit in Figure E)

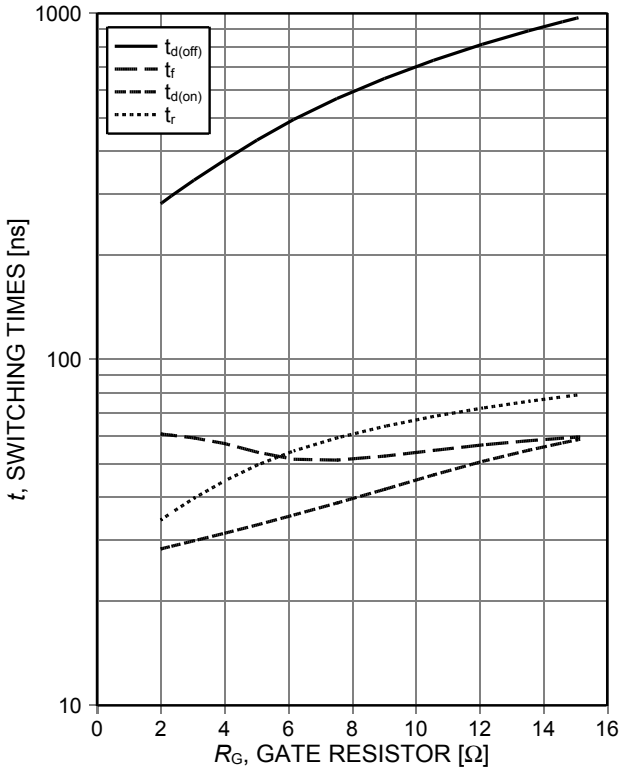


Figure 7. **Typical switching times as a function of gate resistor**
(inductive load, T_{vj}=175°C, V_{CE}=600V, V_{GE}=15/0V, I_C=75A, Dynamic test circuit in Figure E)

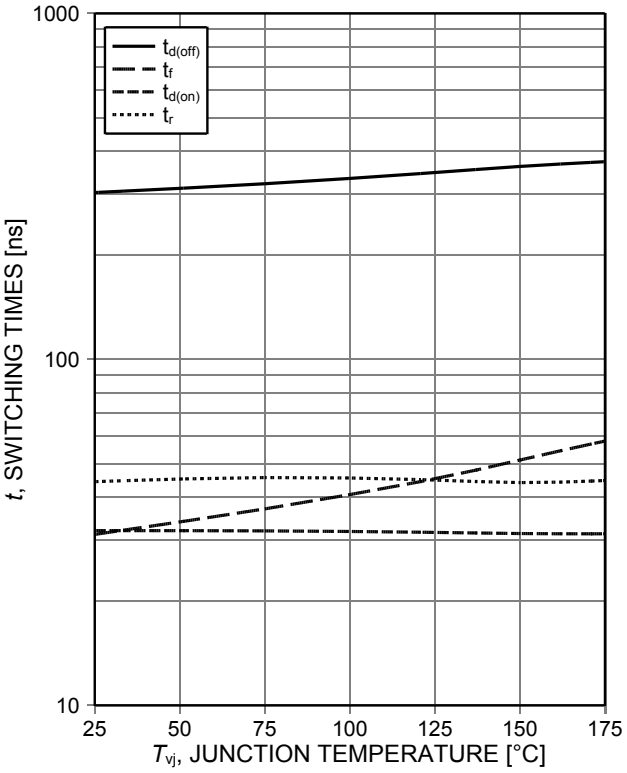


Figure 8. **Typical switching times as a function of junction temperature**
(inductive load, V_{CE}=600V, V_{GE}=15/0V, I_C=75A, R_G=4Ω, Dynamic test circuit in Figure E)

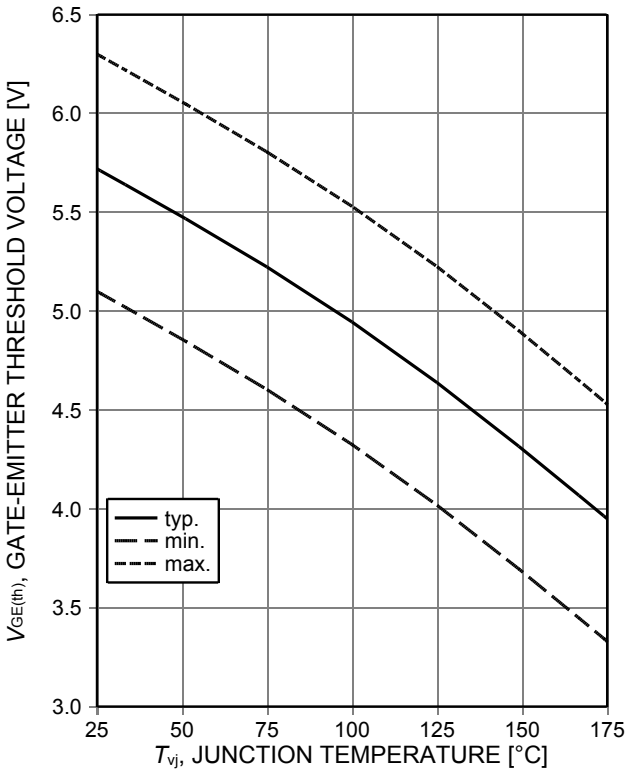


Figure 9. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=3.5mA)

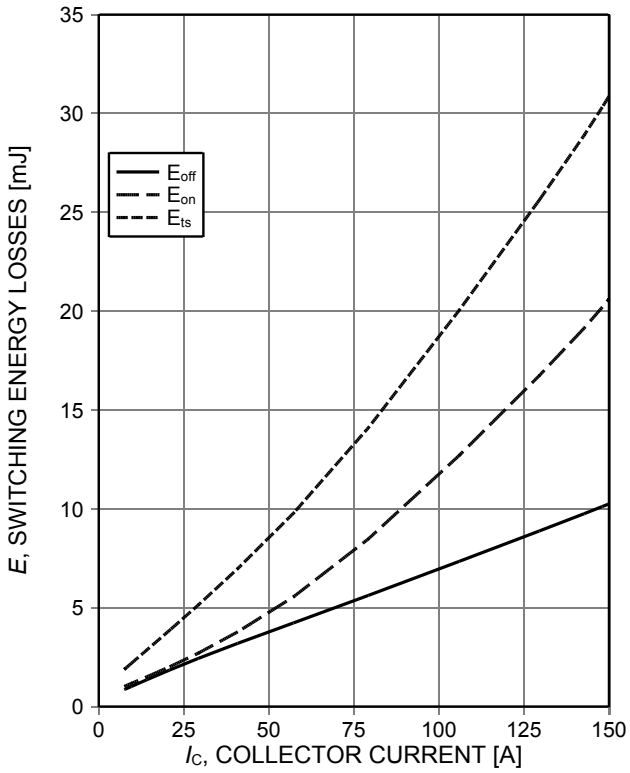


Figure 10. **Typical switching energy losses as a function of collector current**
(inductive load, T_{vj}=175°C, V_{CE}=600V, V_{GE}=15/0V, R_G=4Ω,Dynamic test circuit in Figure E)

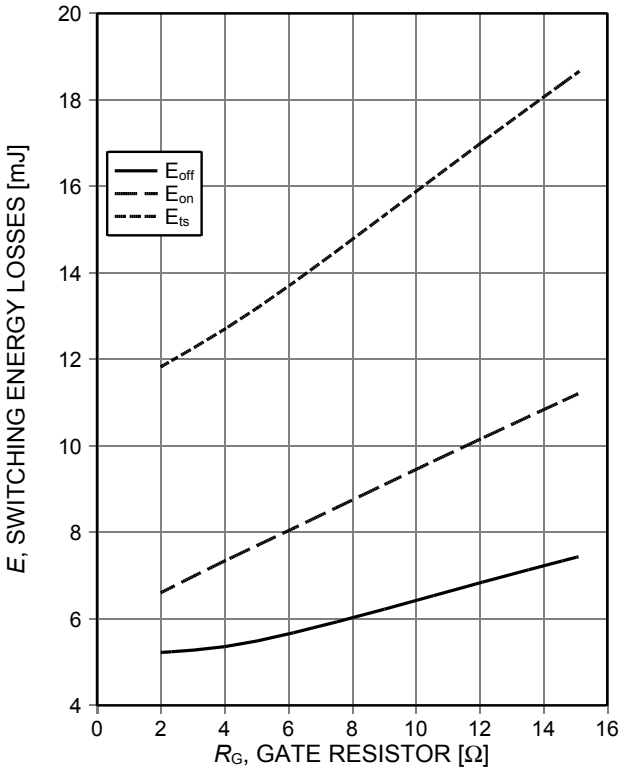


Figure 11. **Typical switching energy losses as a function of gate resistor**
(inductive load, T_{vj}=175°C, V_{CE}=600V, V_{GE}=15/0V, I_C=75A, Dynamic test circuit in Figure E)

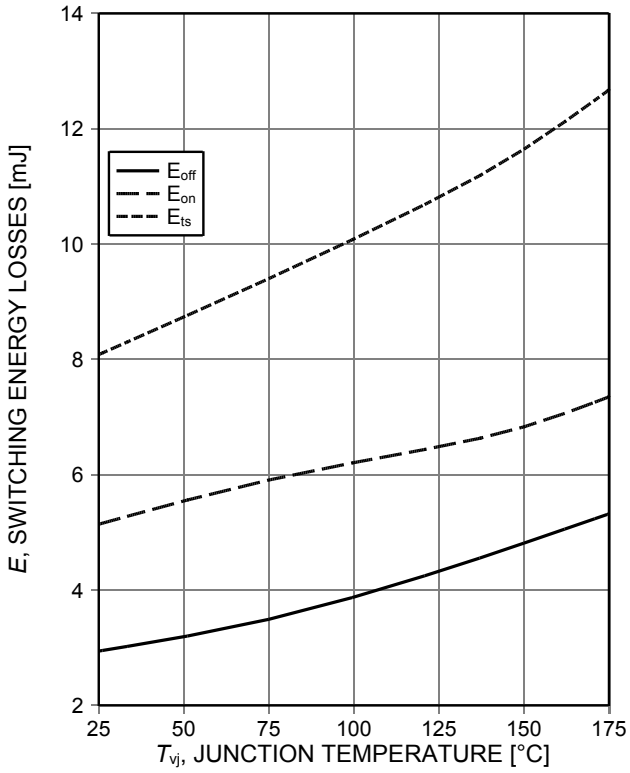


Figure 12. **Typical switching energy losses as a function of junction temperature**
(inductive load, V_{CE}=600V, V_{GE}=15/0V, I_C=75A, R_G=4Ω, Dynamic test circuit in Figure E)

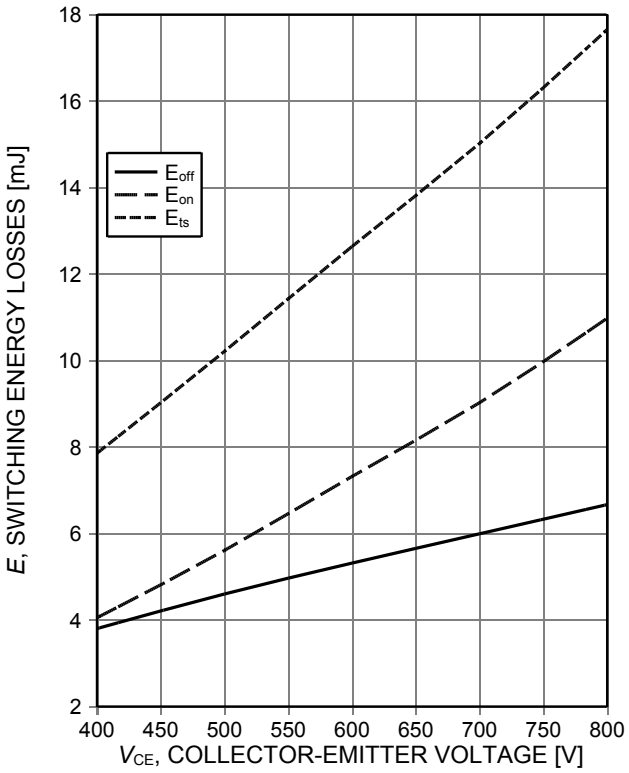


Figure 13. **Typical switching energy losses as a function of collector emitter voltage** (inductive load, T_{vj}=175°C, V_{GE}=15/0V, I_C=75A, R_G=4Ω,Dynamic test circuit in Figure E)

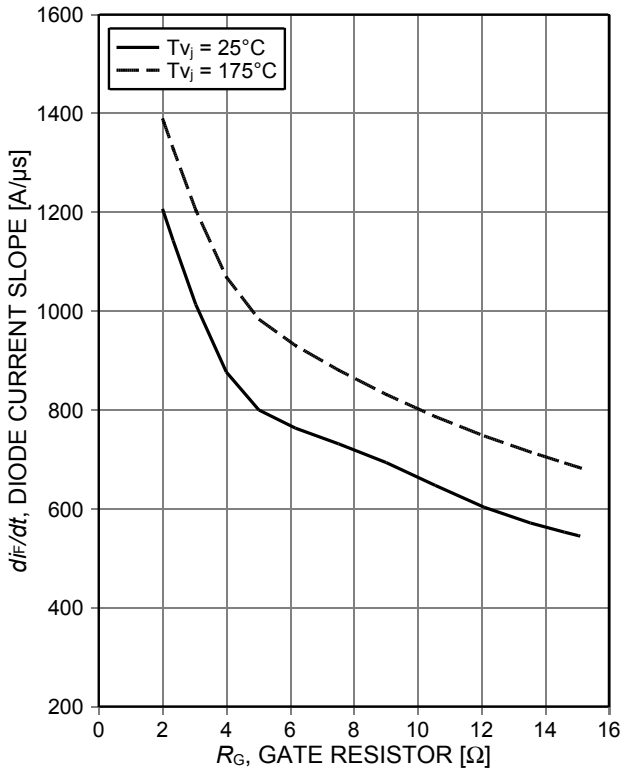


Figure 14. **Typical diode current slope as a function of gate resistor** (inductive load, V_{CE}=600V, V_{GE}=0/15V, I_C=75A, Dynamic test circuit in Figure E)

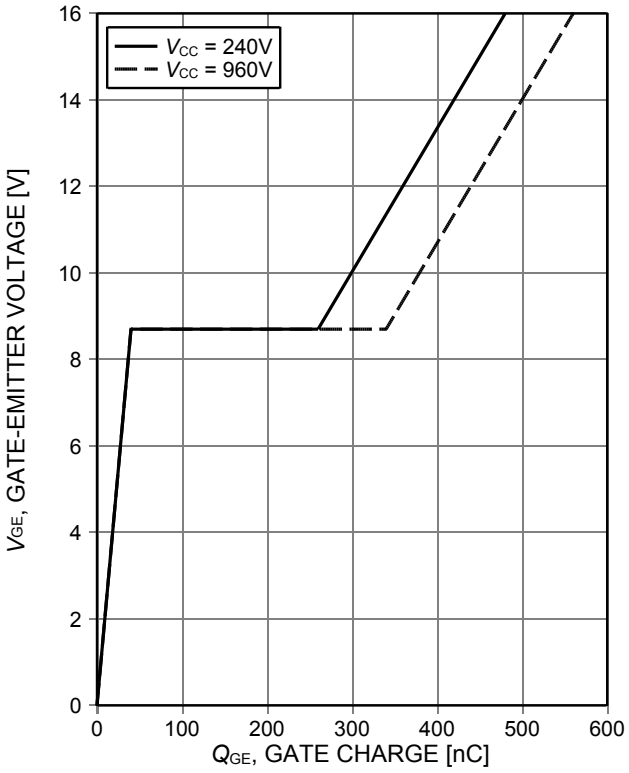


Figure 15. **Typical gate charge** (I_C=75A)

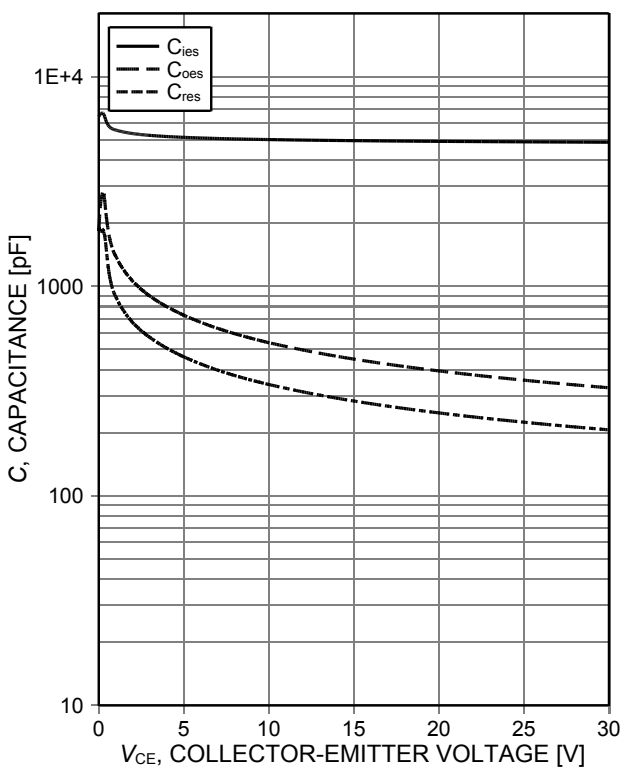


Figure 16. **Typical capacitance as a function of collector-emitter voltage** (V_{GE}=0V, f=1MHz)

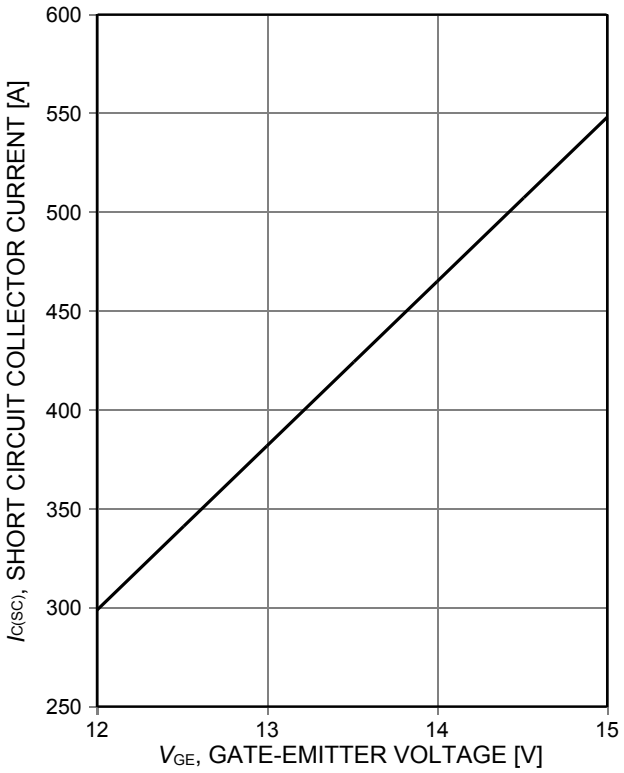


Figure 17. **Typical short circuit collector current as a function of gate-emitter voltage**
(V_{CE}≤500V, T_{vj}≤175°C)

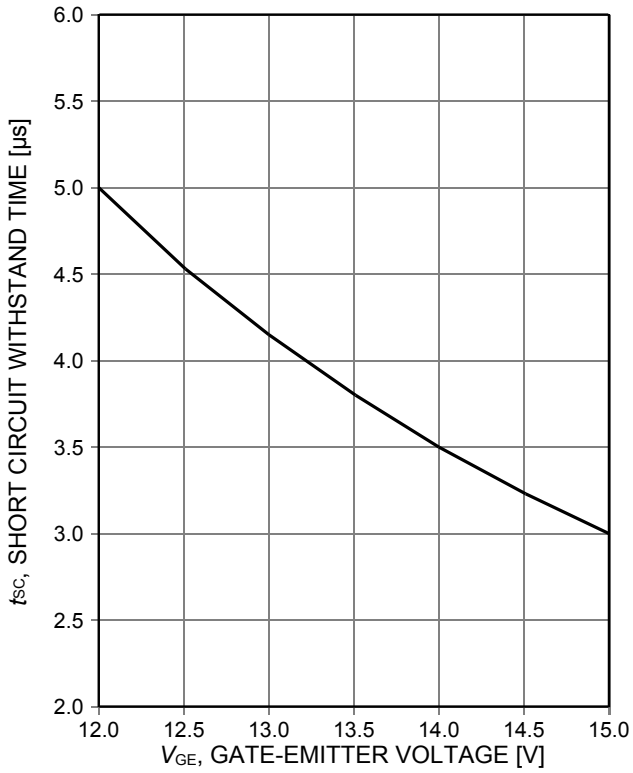


Figure 18. **Short circuit withstand time as a function of gate-emitter voltage**
(V_{CE}≤500V, start at T_{vj}≤175°C)

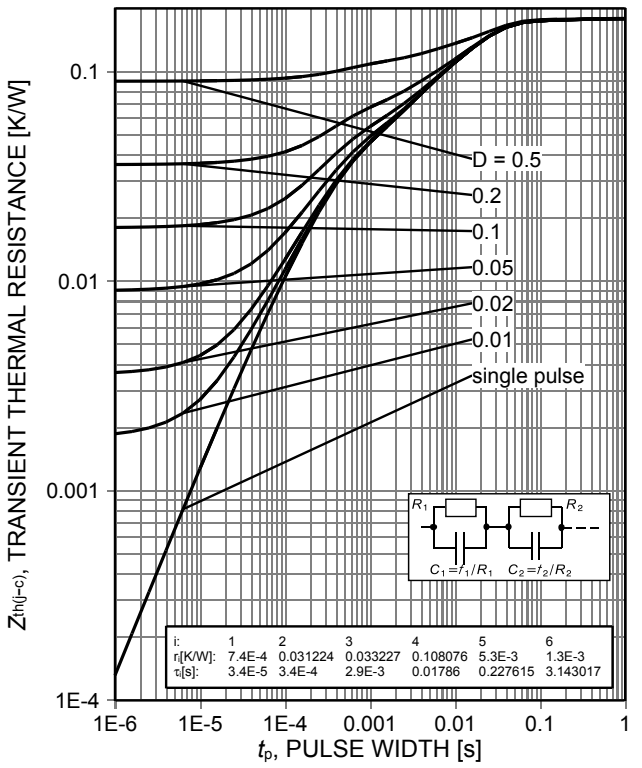


Figure 19. **IGBT transient thermal resistance**
($D=t_p/T$)

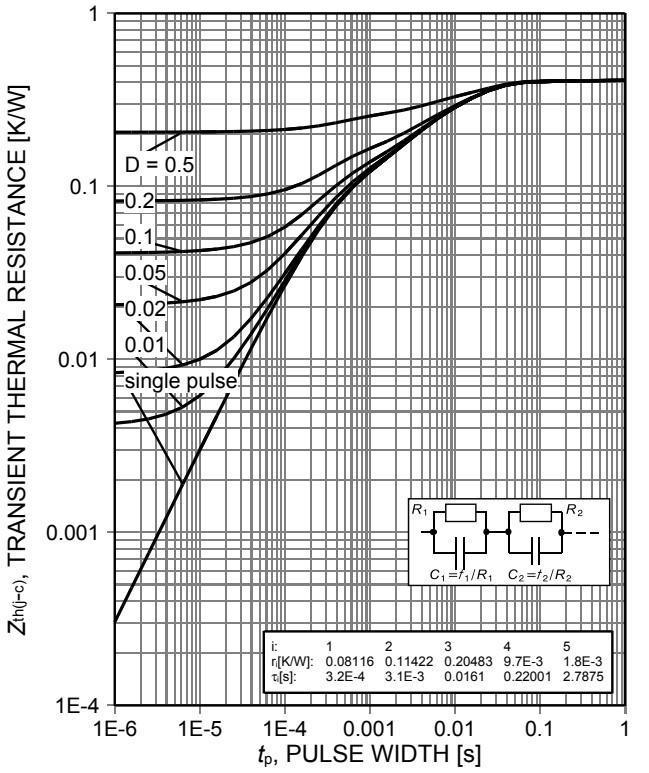


Figure 20. **Diode transient thermal impedance as a function of pulse width**
($D=t_p/T$)

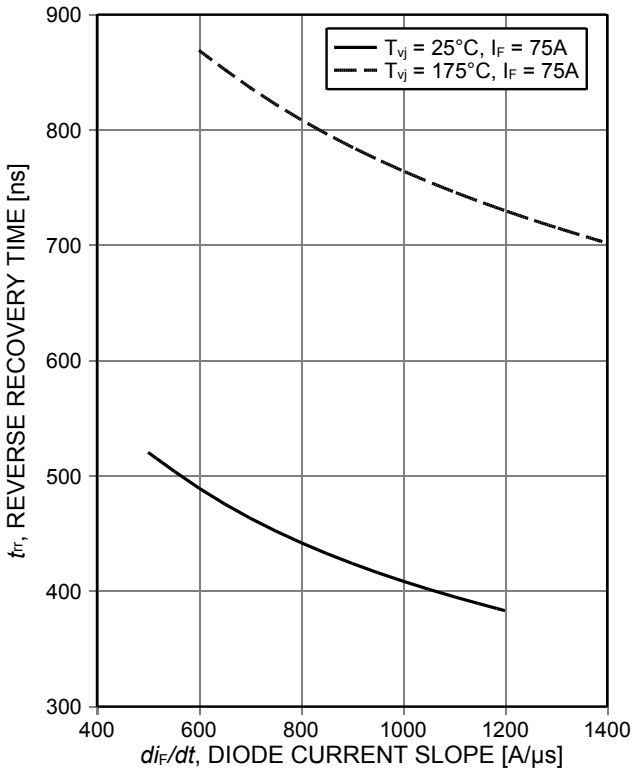


Figure 21. **Typical reverse recovery time as a function of diode current slope**
(V_R=600V)

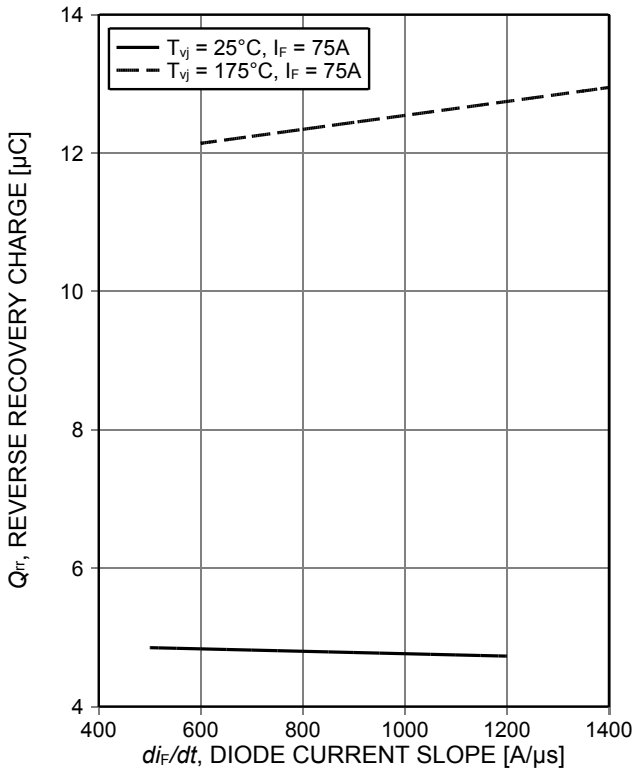


Figure 22. **Typical reverse recovery charge as a function of diode current slope**
(V_R=600V)

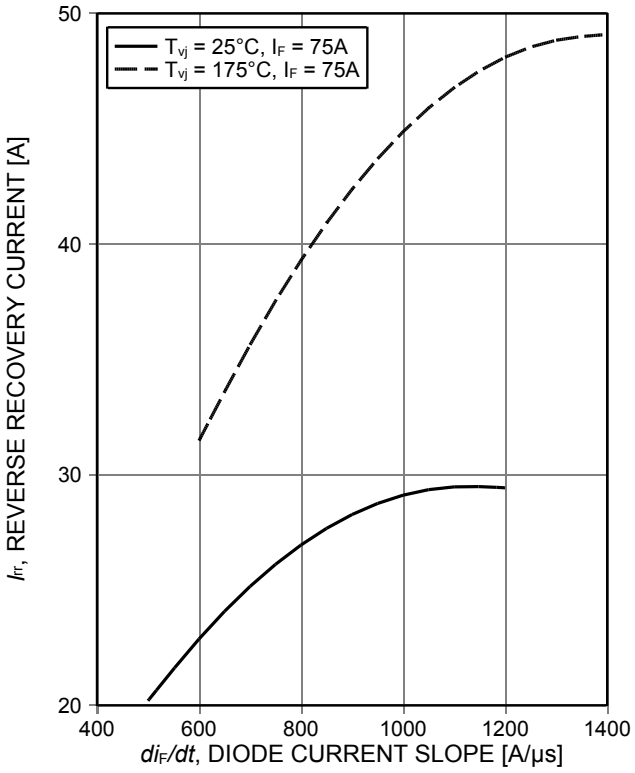


Figure 23. **Typical reverse recovery current as a function of diode current slope**
(V_R=600V)

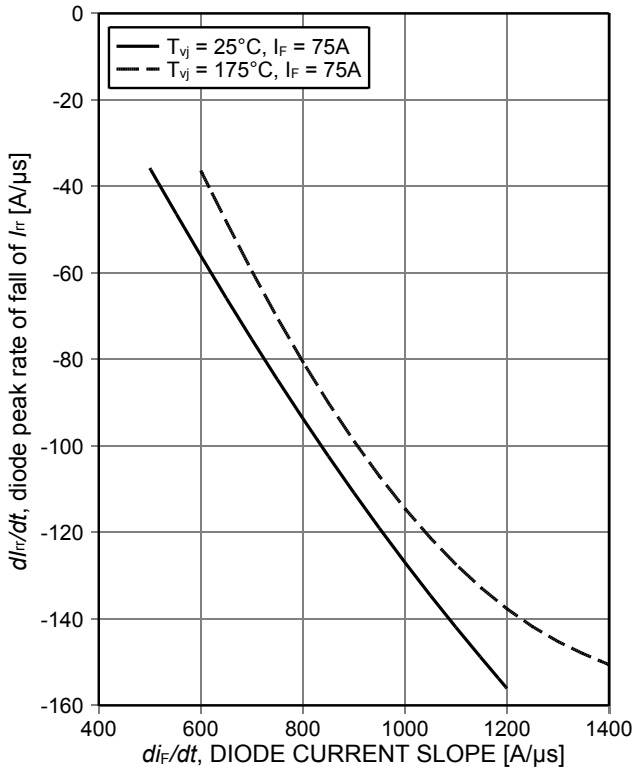


Figure 24. **Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**
(V_R=600V)

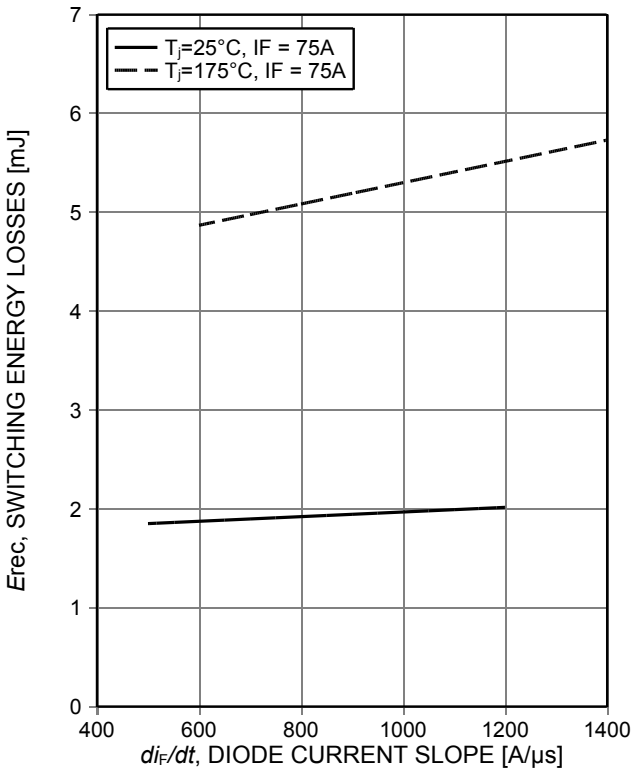


Figure 25. **Typical reverse energy losses as a function of diode current slope**
(V_R=600V)

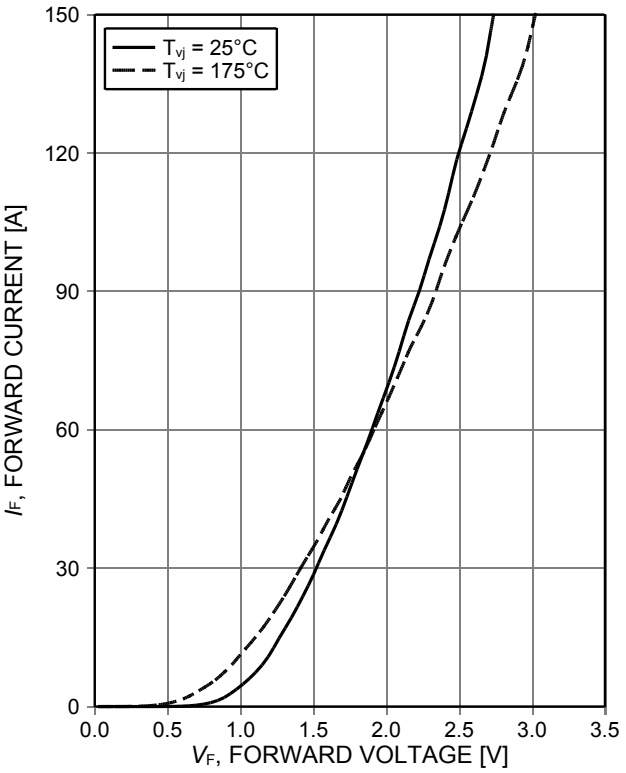


Figure 26. **Typical diode forward current as a function of forward voltage**

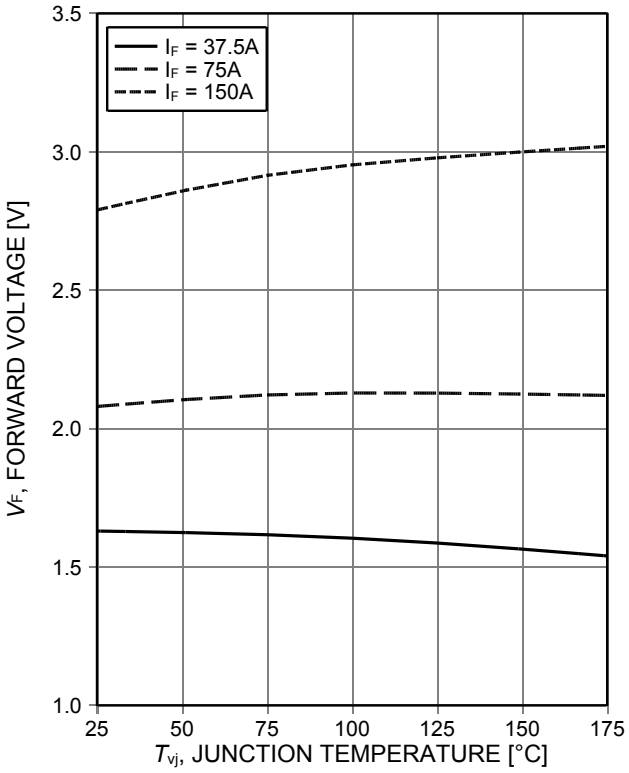
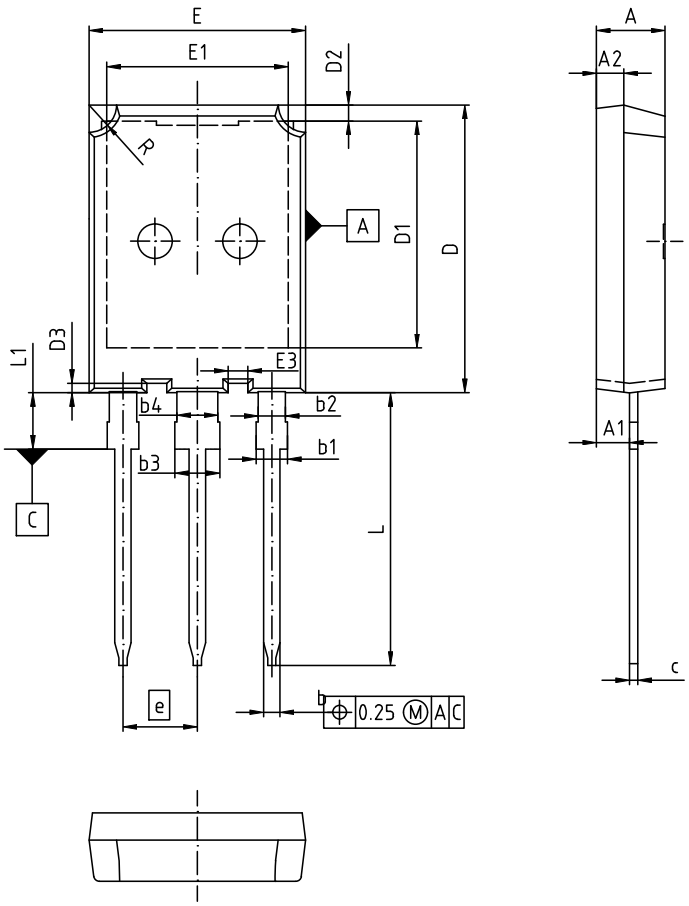


Figure 27. **Typical diode forward voltage as a function of junction temperature**

Package Drawing 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 5 7.5mm
EUROPEAN PROJECTION	
ISSUE DATE	13-08-2014
REVISION	01

Testing Conditions

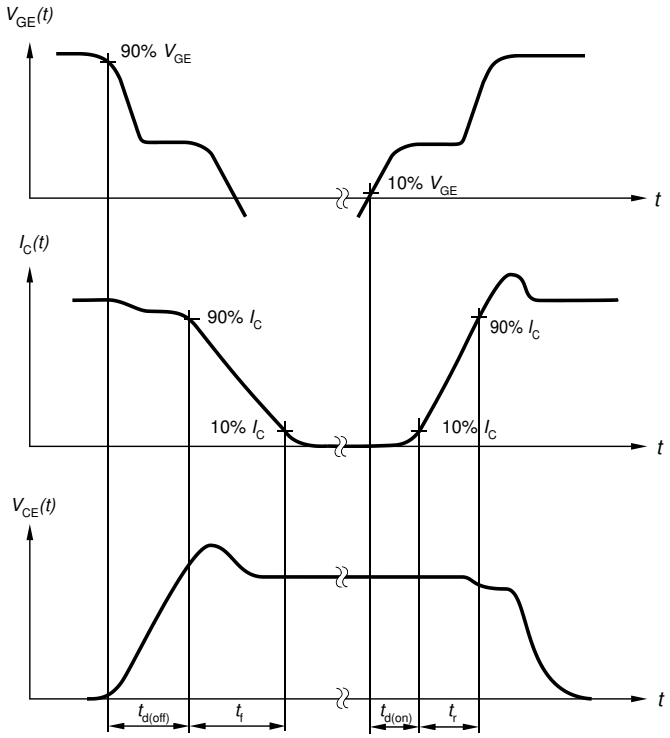


Figure A. **Definition of switching times**

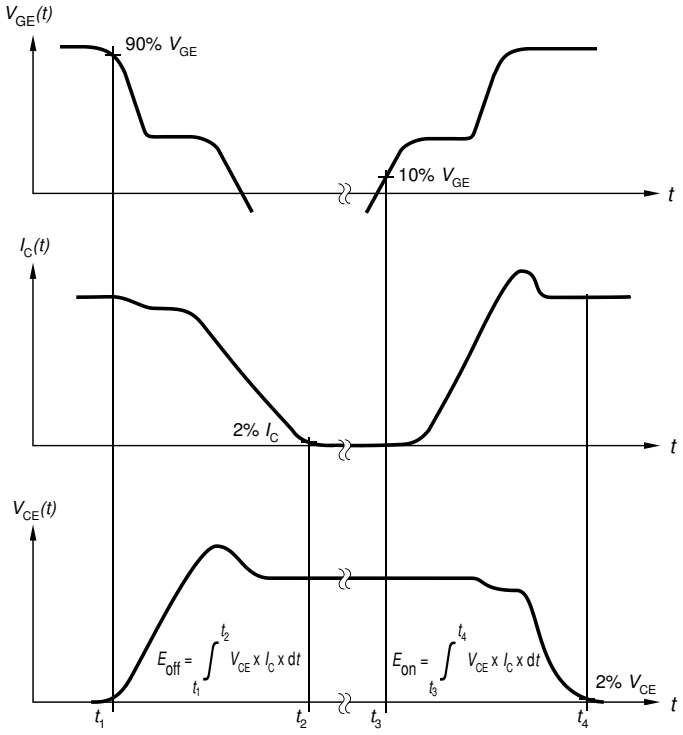


Figure B. **Definition of switching losses**

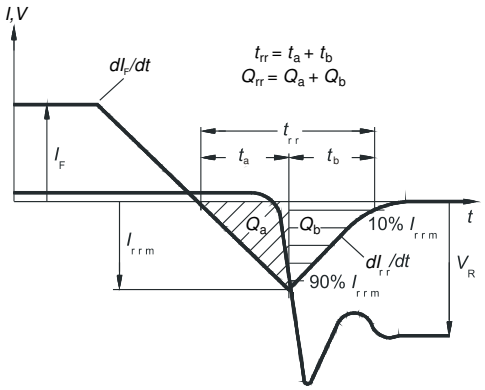


Figure C. **Definition of diode switching characteristics**

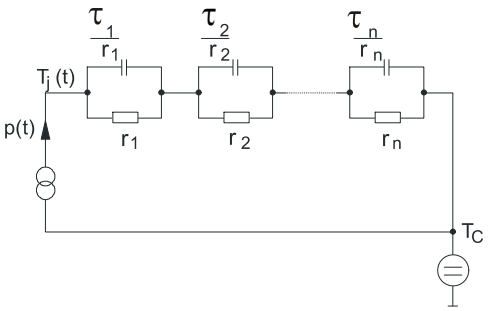


Figure D. **Thermal equivalent circuit**

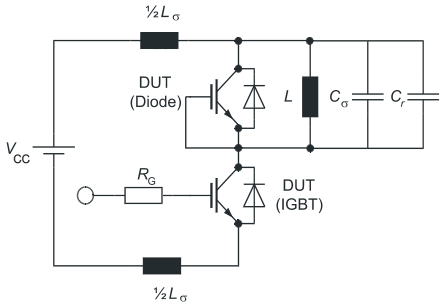


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

Revision History

IKQ75N120CS6

Revision: 2018-08-07, Rev. 2.2

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.1	2018-05-07	Final data sheet
2.2	2018-08-07	Fig.5 and Fig.27 legend correction

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