

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:

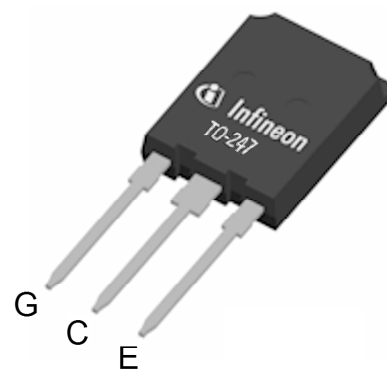
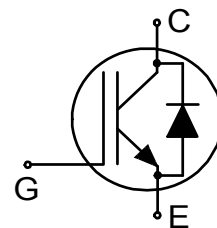
- 1200V TRENCHSTOP™ IGBT6 technology offering:
- High efficiency in hard switching and resonant topologies
 - Easy paralleling capability due to positive temperature coefficient in V_{CEsat}
 - Low EMI
 - Low Gate Charge Q_g
 - Very soft, fast recovery full current anti-parallel diode
 - Maximum junction 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} , $T_{vj}=25^\circ\text{C}$	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, $T_{vj} \geq 25^{\circ}\text{C}$	V_{CE}	1200	V
DC collector current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ $T_c = 100^{\circ}\text{C}$	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 $V_{CE} \leq 1200\text{V}$, $T_{vj} \leq 175^{\circ}\text{C}$	-	300.0	A
Diode forward current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ $T_c = 100^{\circ}\text{C}$	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 ($t_p \leq 0.5\mu\text{s}$, $D < 0.001$)	V_{GE}	± 20 25	V
Short circuit withstand time $V_{GE} = 15.0\text{V}$, $V_{CC} \leq 500\text{V}$ Allowed number of short circuits < 1000 Time between short circuits: $\geq 1.0\text{s}$ $T_{vj} = 150^{\circ}\text{C}$	t_{SC}	3	μs
Power dissipation $T_c = 25^{\circ}\text{C}$ Power dissipation $T_c = 100^{\circ}\text{C}$	P_{tot}	880.0 440.0	W
Operating junction temperature	T_{vj}	$-40 \dots +175$	$^{\circ}\text{C}$
Storage temperature	T_{stg}	$-55 \dots +150$	$^{\circ}\text{C}$
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	$^{\circ}\text{C}$

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

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Electrical Characteristic, at $T_{vj} = 25^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter saturation voltage	V_{CEsat}	$V_{\text{GE}} = 15.0\text{V}$, $I_{\text{C}} = 75.0\text{A}$ $T_{\text{vj}} = 25^{\circ}\text{C}$ $T_{\text{vj}} = 125^{\circ}\text{C}$ $T_{\text{vj}} = 175^{\circ}\text{C}$	- - -	1.85 2.15 2.25	2.15 - -	V
Diode forward voltage	V_{F}	$V_{\text{GE}} = 0\text{V}$, $I_{\text{F}} = 75.0\text{A}$ $T_{\text{vj}} = 25^{\circ}\text{C}$ $T_{\text{vj}} = 175^{\circ}\text{C}$	- -	2.10 2.15	2.20 -	V
Gate-emitter threshold voltage	$V_{\text{GE(th)}}$	$I_{\text{C}} = 3.50\text{mA}$, $V_{\text{CE}} = V_{\text{GE}}$	5.1	5.7	6.3	V
Zero gate voltage collector current	I_{CES}	$V_{\text{CE}} = 1200\text{V}$, $V_{\text{GE}} = 0\text{V}$ $T_{\text{vj}} = 25^{\circ}\text{C}$ $T_{\text{vj}} = 175^{\circ}\text{C}$	- -	- 3500	1600 -	μA
Gate-emitter leakage current	I_{GES}	$V_{\text{CE}} = 0\text{V}$, $V_{\text{GE}} = 20\text{V}$	-	-	600	nA
Transconductance	g_{fs}	$V_{\text{CE}} = 20\text{V}$, $I_{\text{C}} = 75.0\text{A}$	-	60.0	-	S

Electrical Characteristic, at $T_{vj} = 25^{\circ}\text{C}$, 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 $T_{vj} = 25^{\circ}\text{C}$						
Turn-on delay time	$t_{d(\text{on})}$	$T_{vj} = 25^{\circ}\text{C}$, $V_{CC} = 600\text{V}$, $I_C = 75.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_{G(\text{on})} = 4.0\Omega$, $R_{G(\text{off})} = 4.0\Omega$, $L\sigma = 70\text{nH}$, $C\sigma = 67\text{pF}$ $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	34	-	ns
Rise time	t_r		-	44	-	ns
Turn-off delay time	$t_{d(\text{off})}$		-	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

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Diode Characteristic, at $T_{vj} = 25^{\circ}\text{C}$

Diode reverse recovery time	t_{rr}	$T_{vj} = 25^{\circ}\text{C},$ $V_R = 600\text{V},$ $I_F = 75.0\text{A},$ $di_F/dt = 820\text{A}/\mu\text{s},$ $L\sigma = 70\text{nH},$ $C\sigma = 67\text{pF}$	-	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	-	$\text{A}/\mu\text{s}$

Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	

IGBT Characteristic, at $T_{vj} = 175^{\circ}\text{C}$

Turn-on delay time	$t_{d(on)}$	$T_{vj} = 175^{\circ}\text{C},$ $V_{CC} = 600\text{V}, I_C = 75.0\text{A},$ $V_{GE} = 0.0/15.0\text{V},$ $R_{G(on)} = 4.0\Omega, R_{G(off)} = 4.0\Omega,$ $L\sigma = 70\text{nH}, C\sigma = 67\text{pF}$ 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 $T_{vj} = 175^{\circ}\text{C}$

Diode reverse recovery time	t_{rr}	$T_{vj} = 175^{\circ}\text{C},$ $V_R = 600\text{V},$ $I_F = 75.0\text{A},$ $di_F/dt = 1020\text{A}/\mu\text{s},$ $L\sigma = 70\text{nH},$ $C\sigma = 67\text{pF}$	-	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	-	$\text{A}/\mu\text{s}$

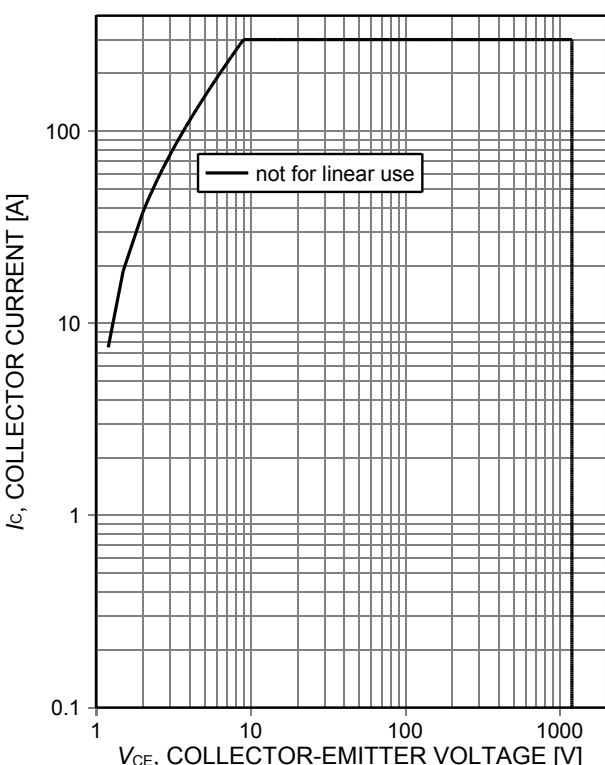


Figure 1. **Forward bias safe operating area**
($D=0$, $T_{vj} \leq 175^{\circ}\text{C}$; $V_{GE}=15\text{V}$, pulse width limited by T_{vjmax})

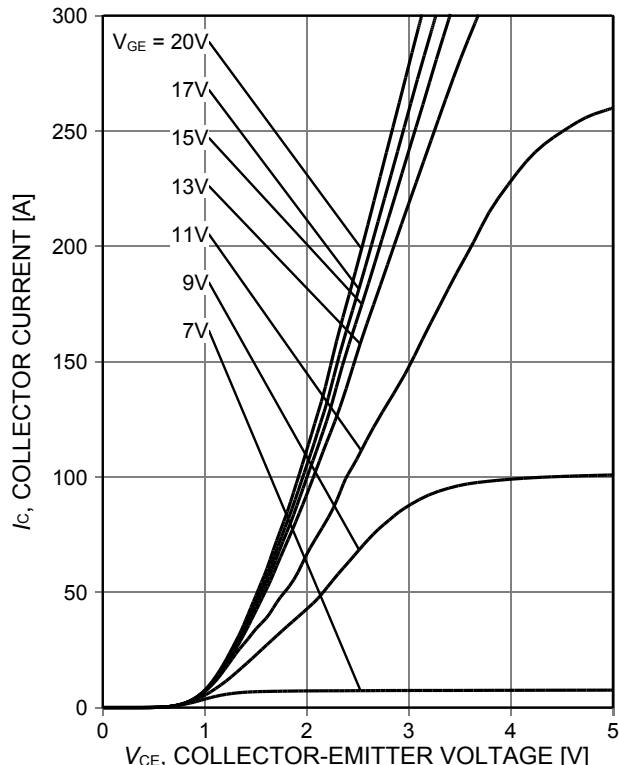


Figure 2. **Typical output characteristic**
($T_{vj}=25^{\circ}\text{C}$)

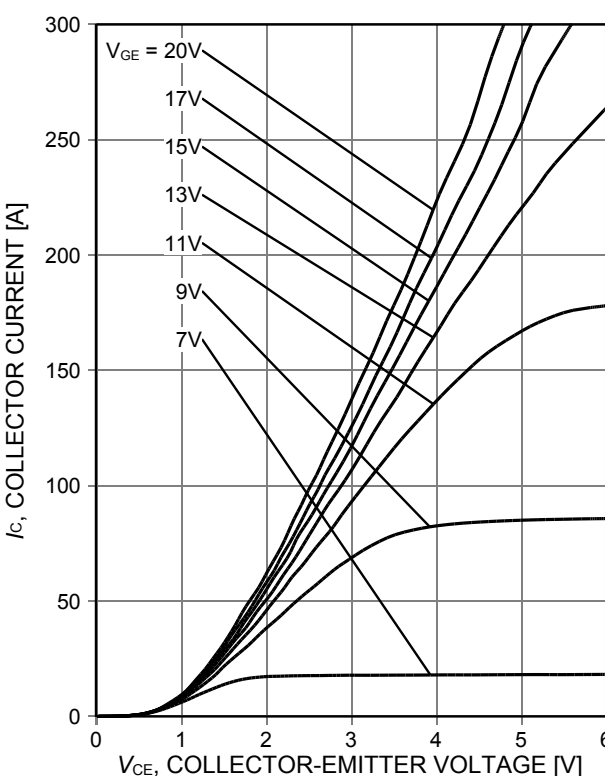


Figure 3. **Typical output characteristic**
($T_{vj}=175^{\circ}\text{C}$)

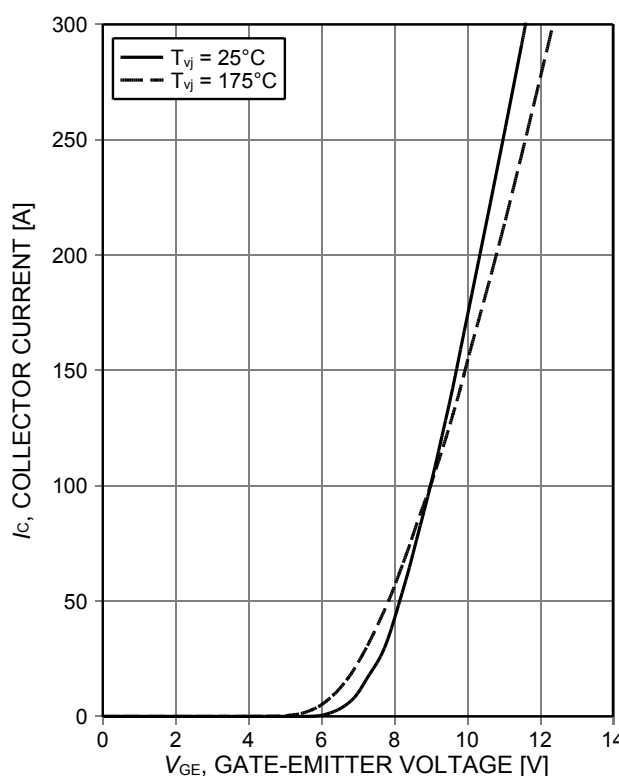


Figure 4. **Typical transfer characteristic**
($V_{CE}=20\text{V}$)

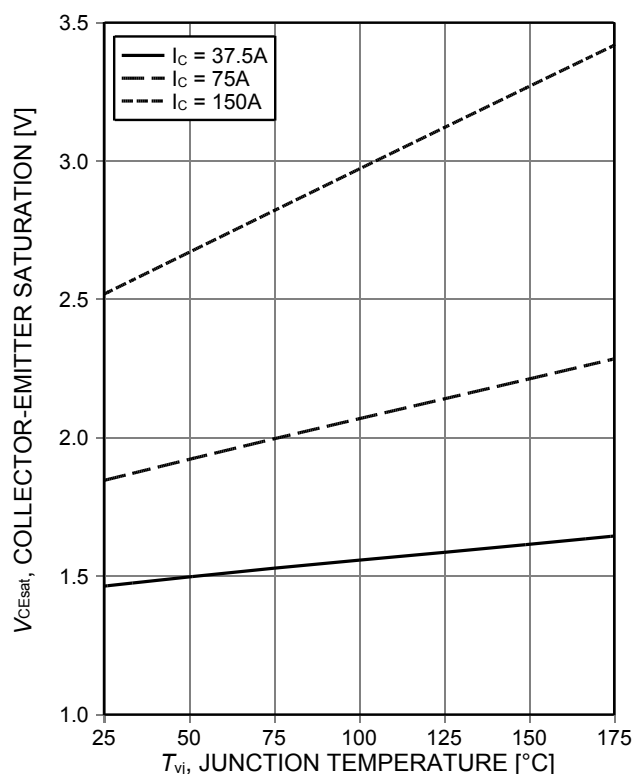


Figure 5. **Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}=15V$)

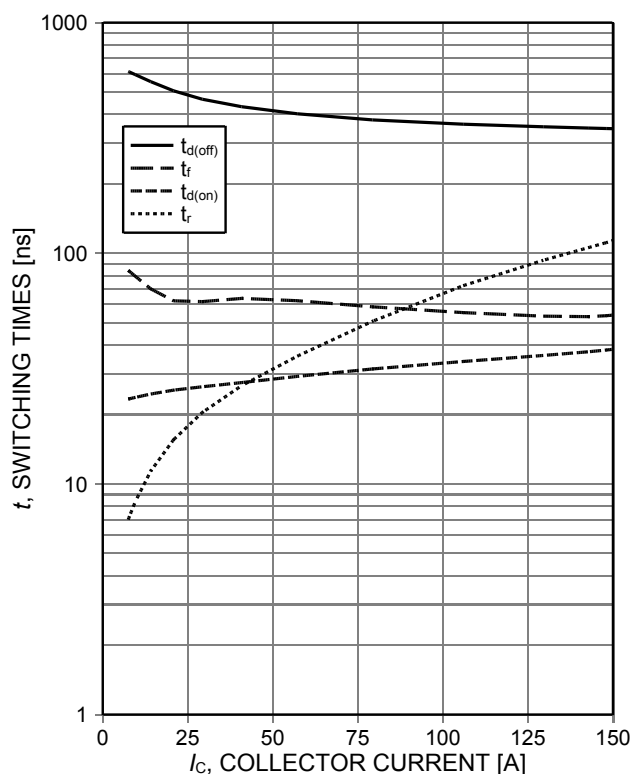


Figure 6. **Typical switching times as a function of collector current**
(inductive load, $T_{vj}=175^{\circ}C$, $V_{CE}=600V$, $V_{GE}=15/0V$, $R_G=4\Omega$, Dynamic test circuit in Figure E)

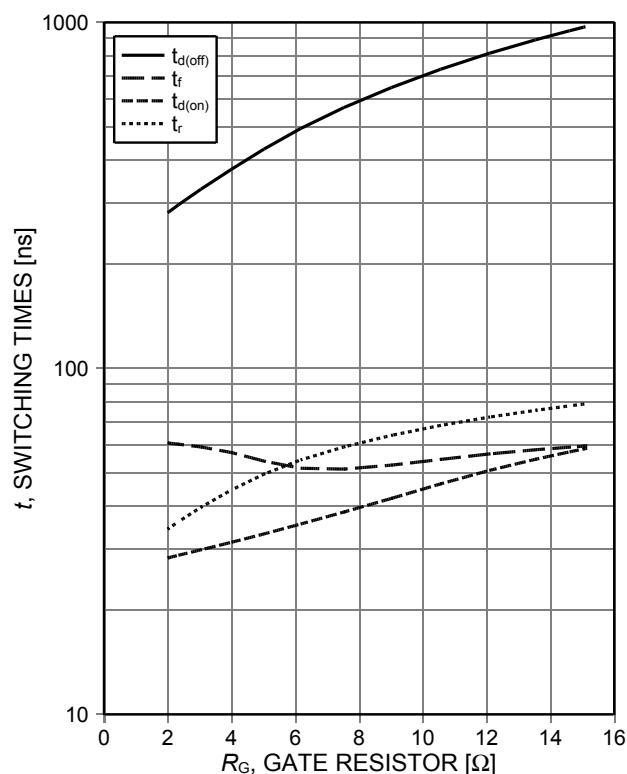


Figure 7. **Typical switching times as a function of gate resistor**
(inductive load, $T_{vj}=175^{\circ}C$, $V_{CE}=600V$, $V_{GE}=15/0V$, $I_C=75A$, Dynamic test circuit in Figure E)

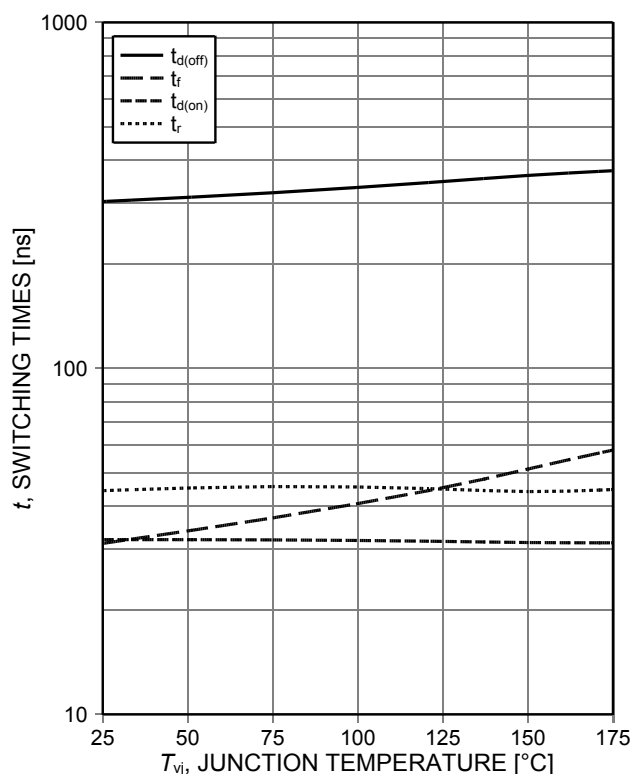


Figure 8. **Typical switching times as a function of junction temperature**
(inductive load, $V_{CE}=600V$, $V_{GE}=15/0V$, $I_C=75A$, $R_G=4\Omega$, Dynamic test circuit in Figure E)

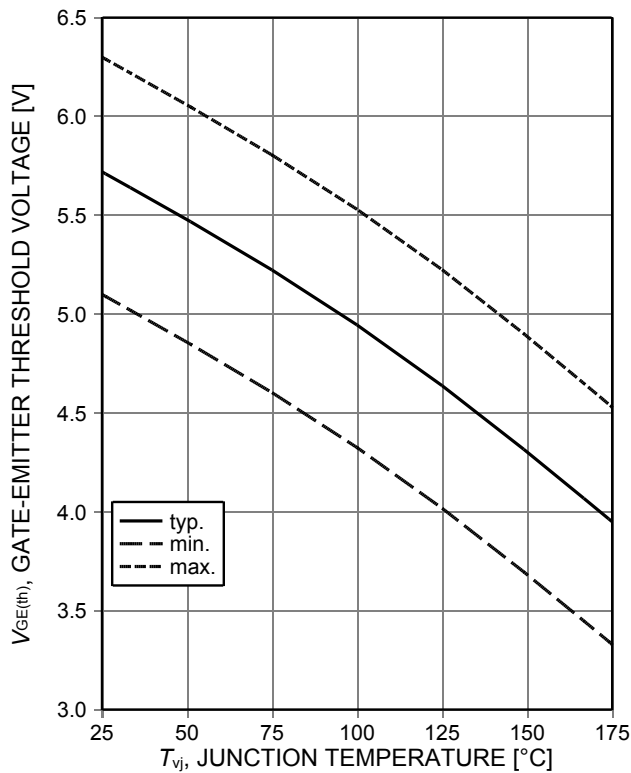


Figure 9. Gate-emitter threshold voltage as a function of junction temperature ($I_C=3.5\text{mA}$)

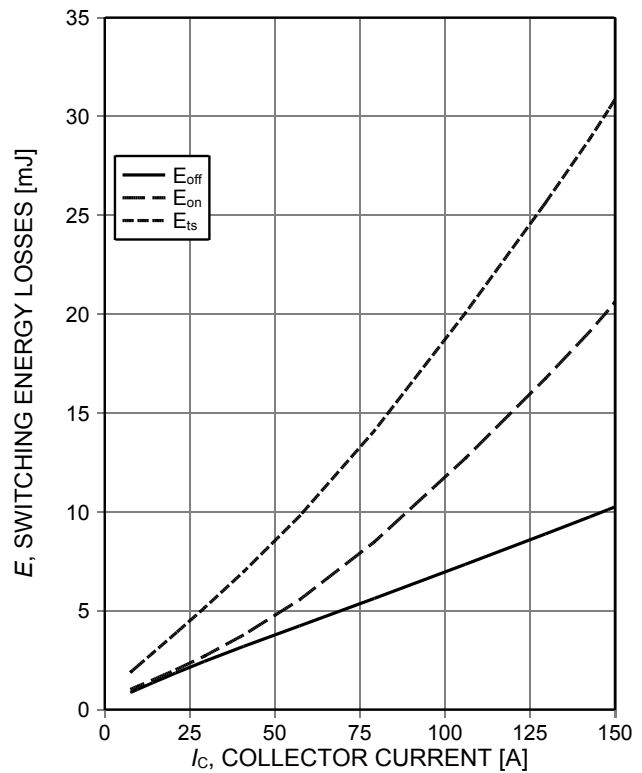


Figure 10. Typical switching energy losses as a function of collector current (inductive load, $T_{vj}=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $R_G=4\Omega$, Dynamic test circuit in Figure E)

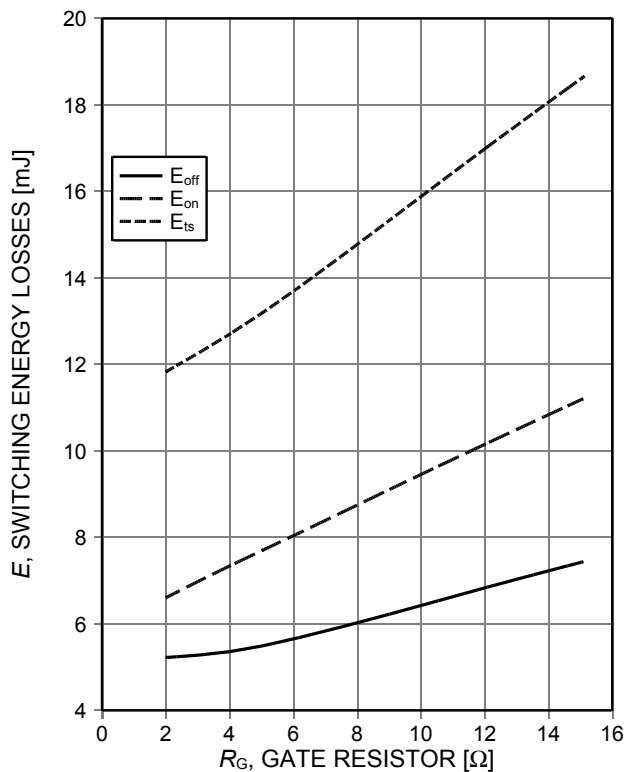


Figure 11. Typical switching energy losses as a function of gate resistor (inductive load, $T_{vj}=175^\circ\text{C}$, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=75\text{A}$, Dynamic test circuit in Figure E)

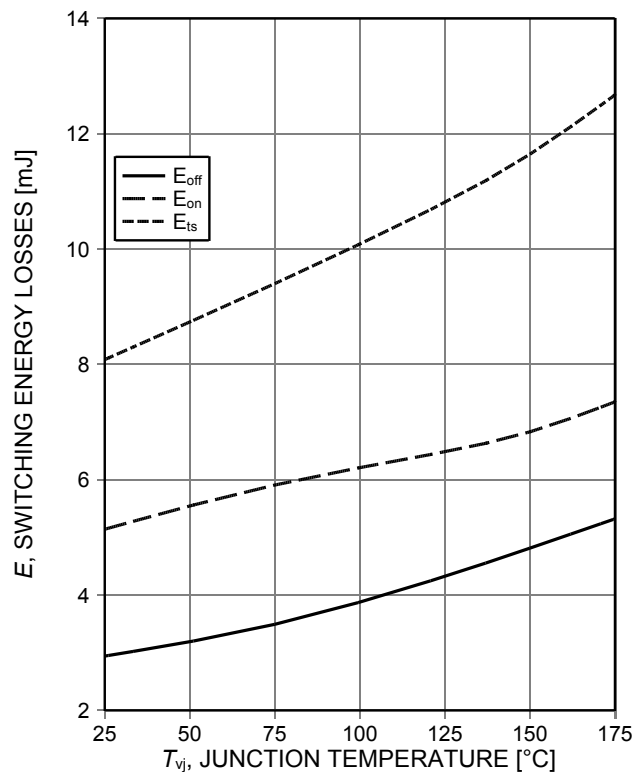


Figure 12. Typical switching energy losses as a function of junction temperature (inductive load, $V_{CE}=600\text{V}$, $V_{GE}=15/0\text{V}$, $I_C=75\text{A}$, $R_G=4\Omega$, Dynamic test circuit in Figure E)

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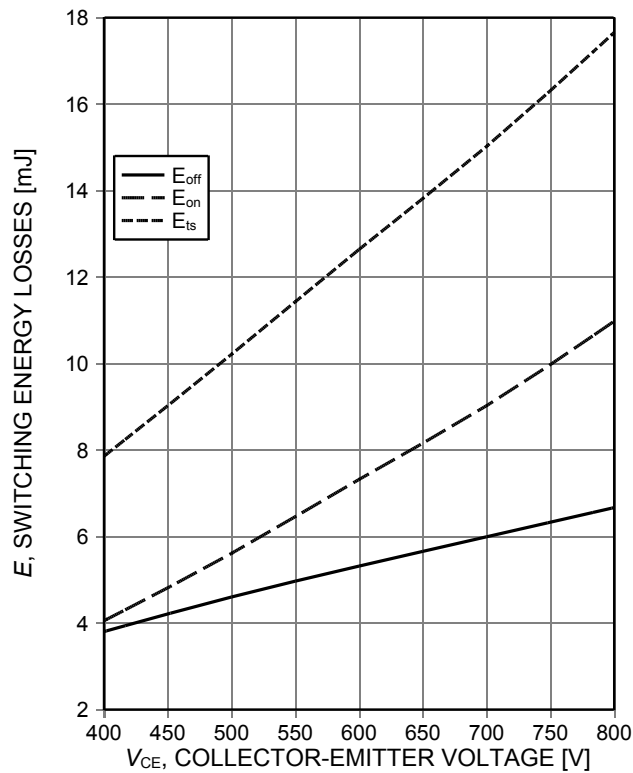


Figure 13. **Typical switching energy losses as a function of collector emitter voltage**
(inductive load, $T_{vj}=175^{\circ}\text{C}$, $V_{GE}=15/0\text{V}$, $I_C=75\text{A}$, $R_G=4\Omega$, Dynamic test circuit in Figure E)

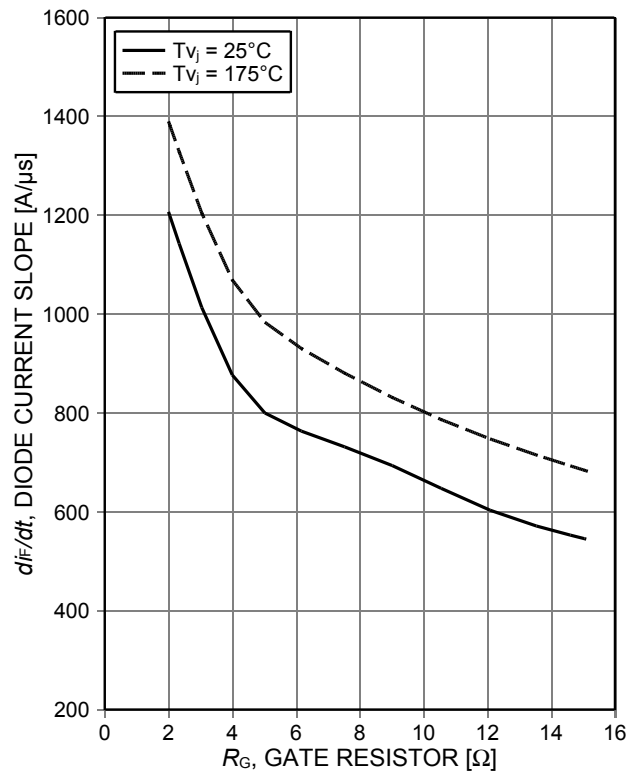


Figure 14. **Typical diode current slope as a function of gate resistor**
(inductive load, $V_{CE}=600\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$, Dynamic test circuit in Figure E)

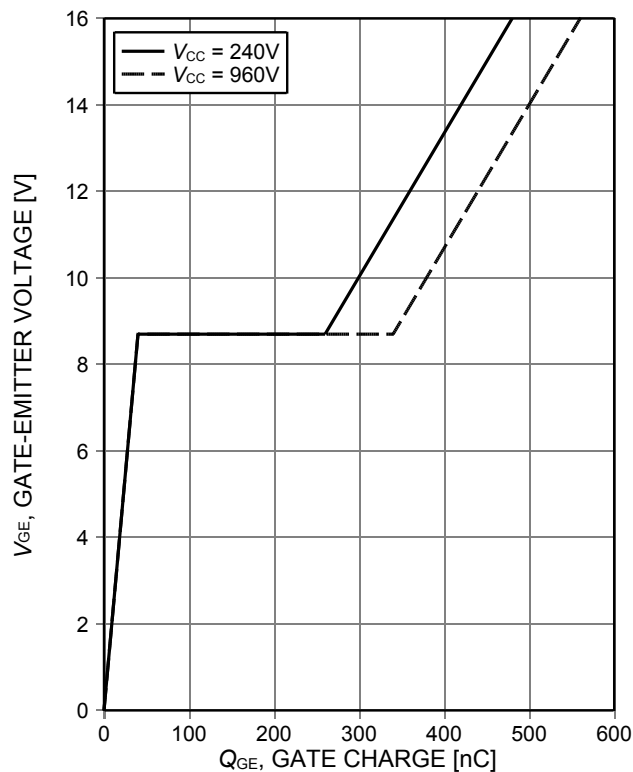


Figure 15. **Typical gate charge**
($I_C=75\text{A}$)

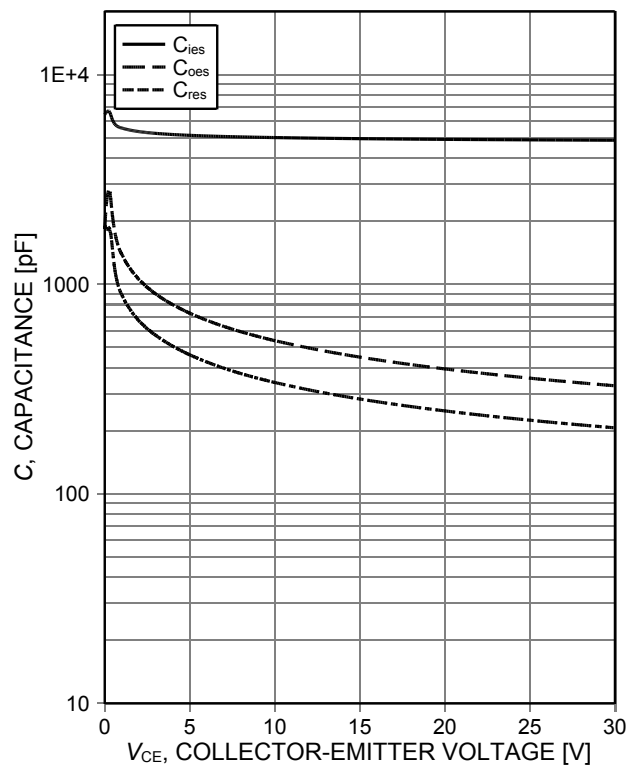


Figure 16. **Typical capacitance as a function of collector-emitter voltage**
($V_{GE}=0\text{V}$, $f=1\text{MHz}$)

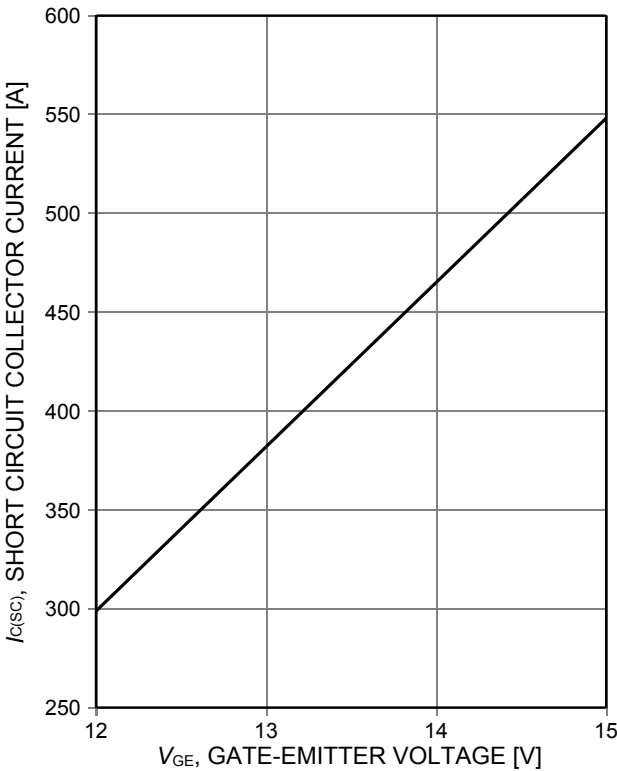


Figure 17. Typical short circuit collector current as a function of gate-emitter voltage ($V_{CE} \leq 500V$, $T_{vj} \leq 175^{\circ}C$)

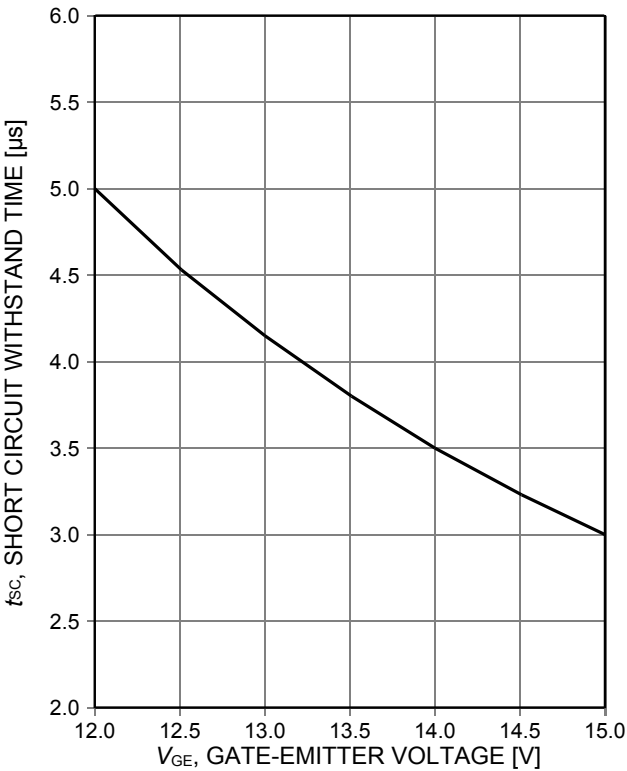


Figure 18. Short circuit withstand time as a function of gate-emitter voltage ($V_{CE} \leq 500V$, start at $T_{vj} \leq 175^{\circ}C$)

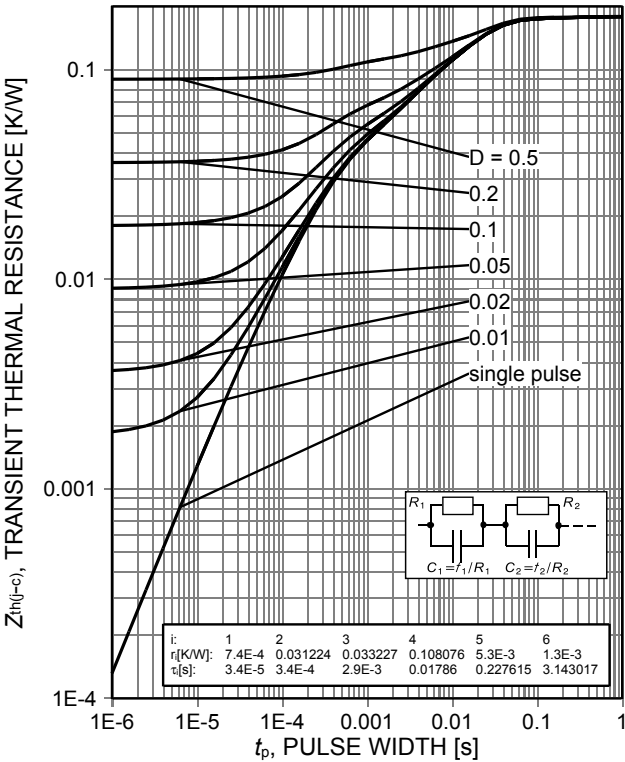


Figure 19. IGBT transient thermal resistance ($D = t_p/T$)

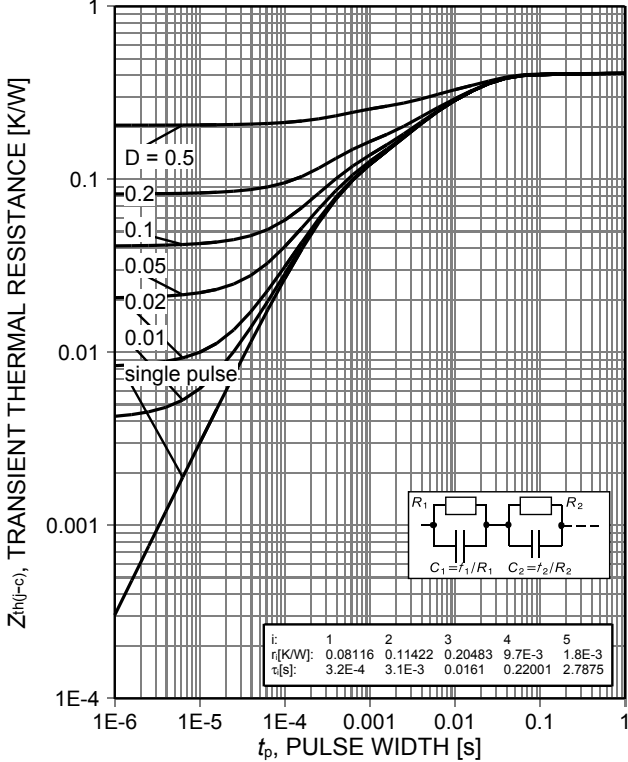


Figure 20. Diode transient thermal impedance as a function of pulse width ($D = t_p/T$)

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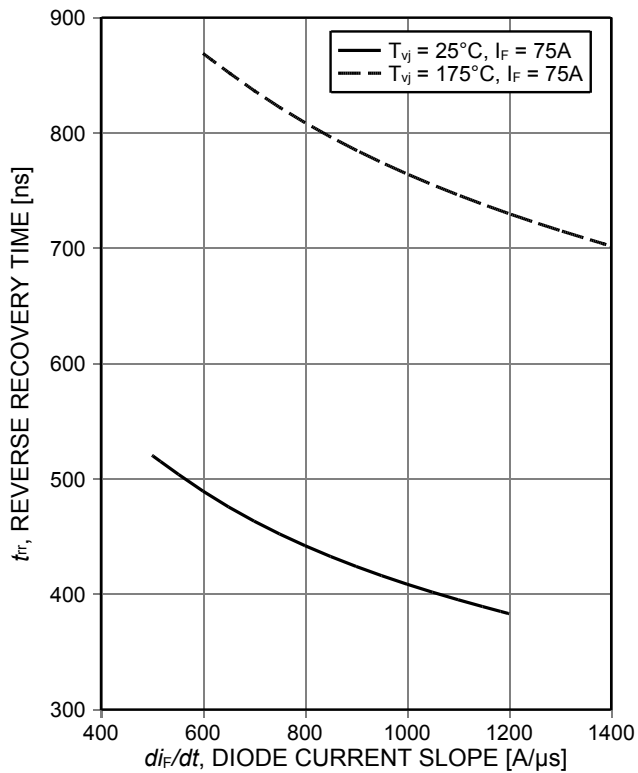


Figure 21. **Typical reverse recovery time as a function of diode current slope**
($V_R=600V$)

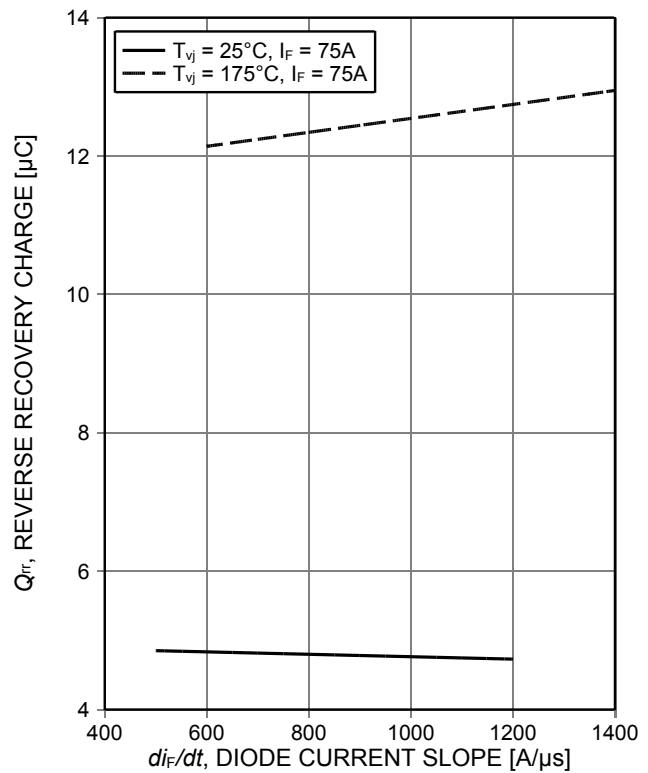


Figure 22. **Typical reverse recovery charge as a function of diode current slope**
($V_R=600V$)

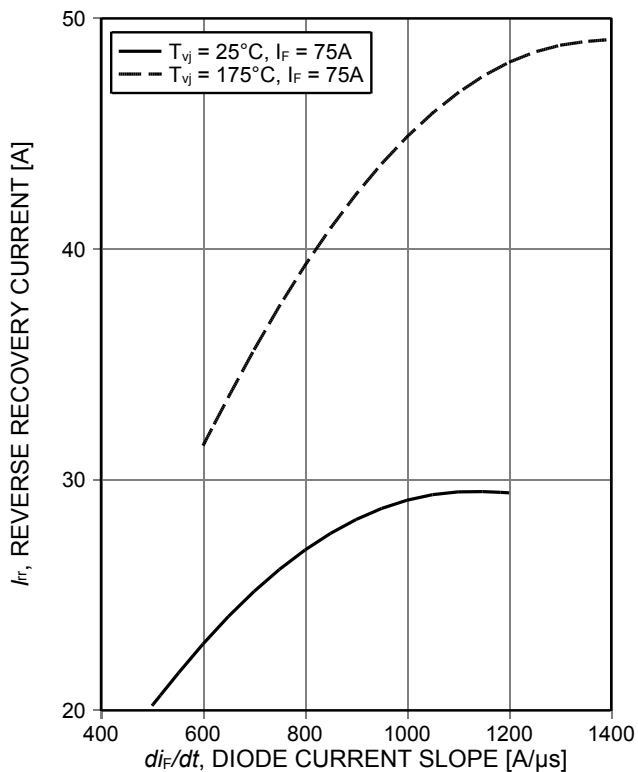


Figure 23. **Typical reverse recovery current as a function of diode current slope**
($V_R=600V$)

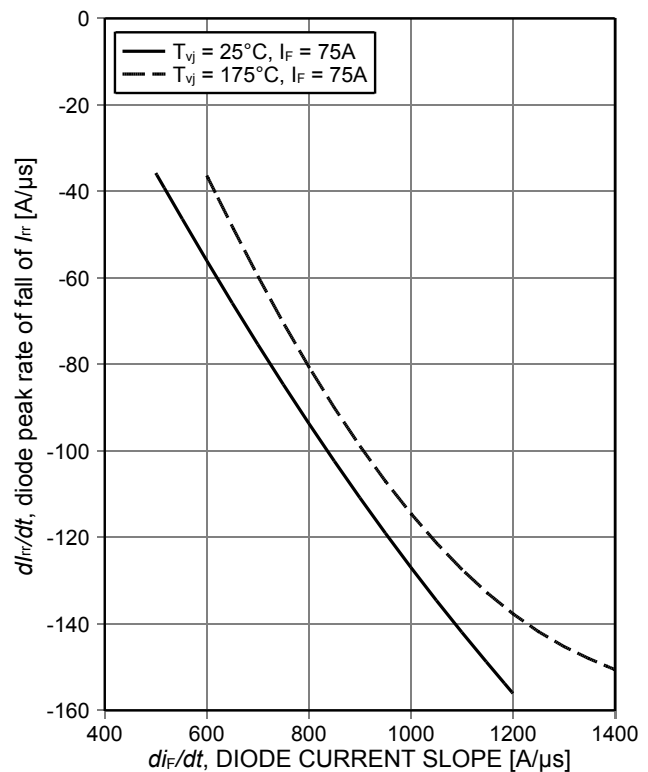


Figure 24. **Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**
($V_R=600V$)

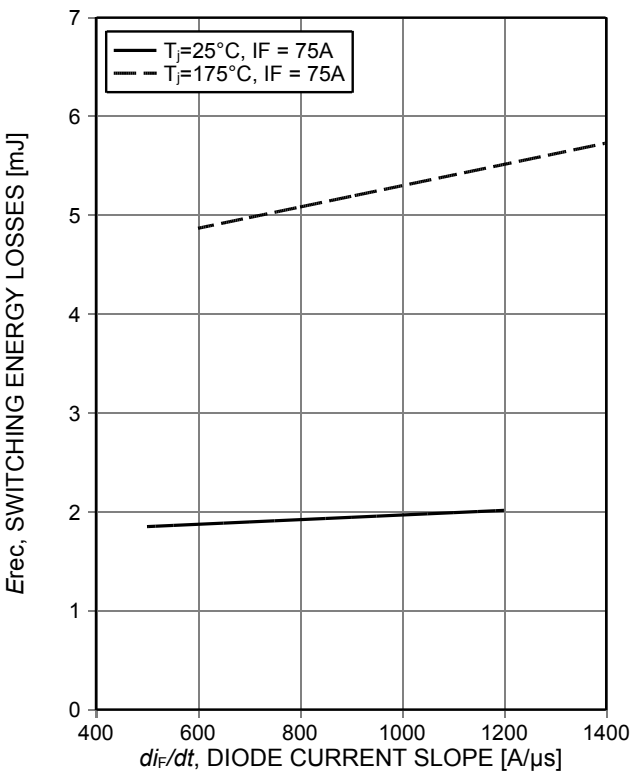


Figure 25. Typical reverse energy losses as a function of diode current slope ($V_R=600\text{V}$)

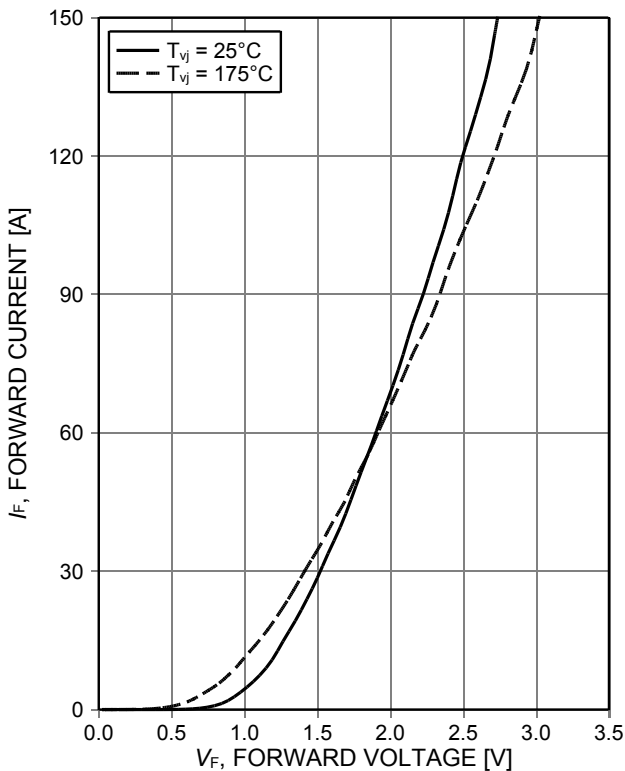


Figure 26. Typical diode forward current as a function of forward voltage

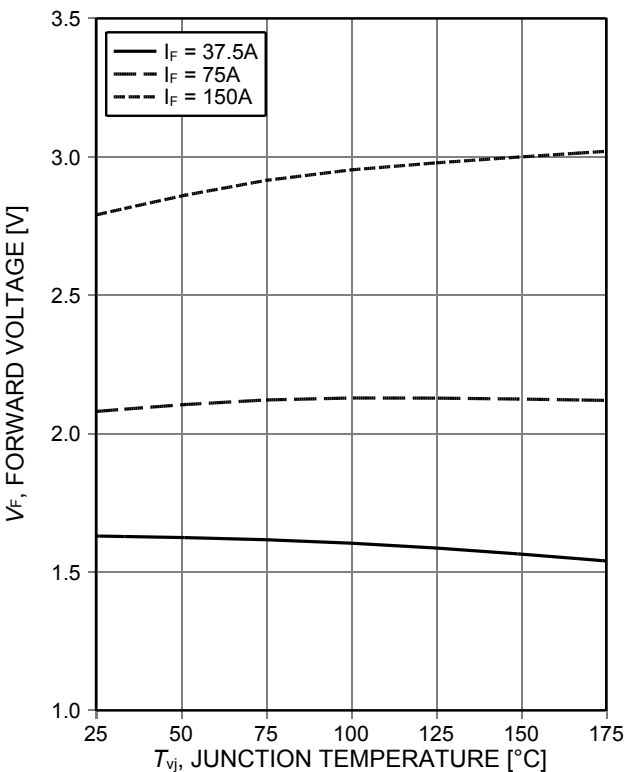
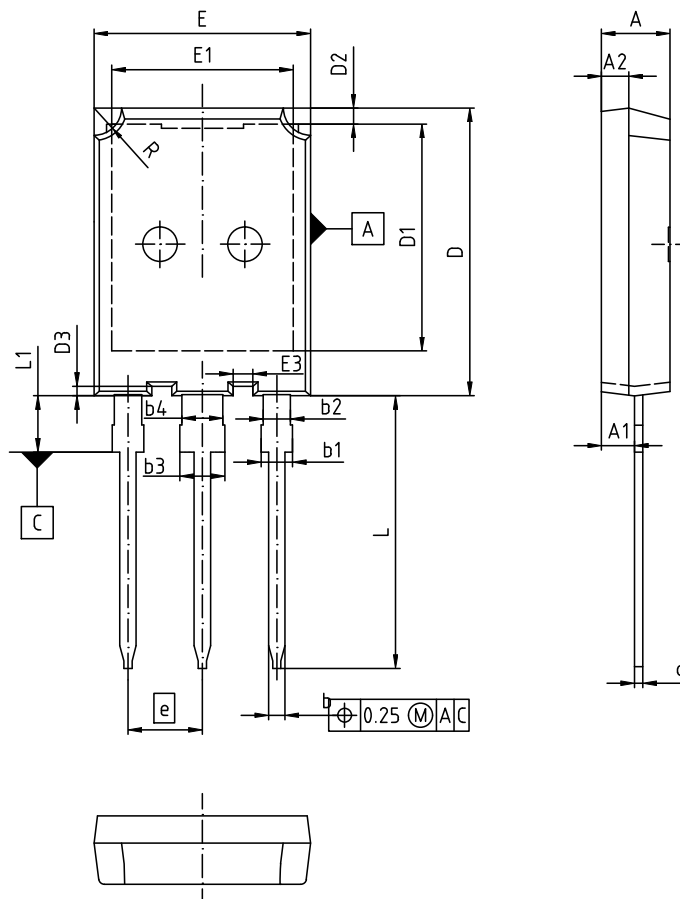
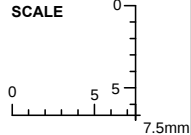
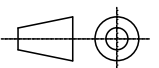


Figure 27. Typical diode forward voltage as a function of junction temperature

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	
EUROPEAN PROJECTION	
	
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REVISION 01	

Testing Conditions

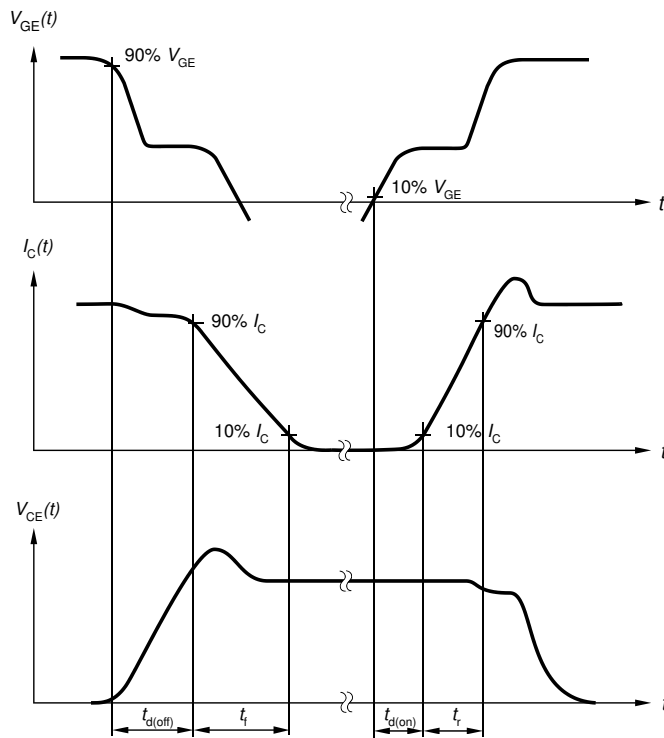


Figure A. Definition of switching times



Figure B. Definition of switching losses

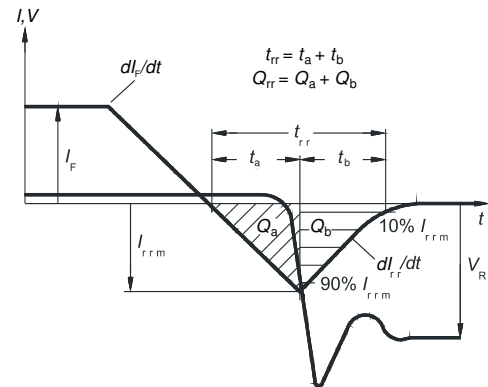


Figure C. Definition of diode switching characteristics

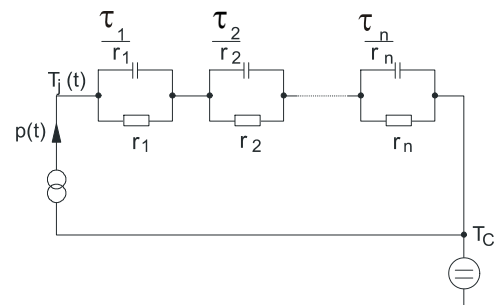


Figure D. Thermal equivalent circuit



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

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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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