

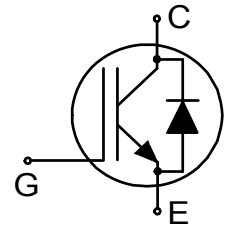
TRENCHSTOP™ Advanced Isolation

TRENCHSTOP™ IGBT copacked with Rapid 1 fast and soft antiparallel diode in fully isolated package

Features:

TRENCHSTOP™ technology offers :

- Very low $V_{CE(sat)}$
- Short circuit withstand time $5\mu s$ at $T_{vj} = 175^{\circ}C$
- Positive temperature coefficient in $V_{CE(sat)}$
- Low EMI
- Very soft, fast recovery anti-parallel diode
- Maximum junction temperature $175^{\circ}C$
- 2500 V_{RMS} electrical isolation, 50/60 Hz, $t = 1$ min
- 100 % tested isolated mounting surface
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models : <http://www.infineon.com/igbt>



Fully isolated package TO-247

Potential Applications:

- General Purpose Drives (GPD)
- Servo Drives
- Industrial UPS
- Welding
- Solar String Inverter

Product Validation:

Qualified for industrial applications according to the relevant tests of JEDEC 47/20/22

**Key Performance and Package Parameters**

Type	V_{CE}	I_C	$V_{CE(sat)}$, $T_{vj}=25^{\circ}C$	T_{vjmax}	Marking	Package
IKFW75N60ET	600V	75A	1.5V	$175^{\circ}C$	K75DET	PG-TO247-3-AI

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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}	600	V
DC collector current, limited by T_{vjmax} $T_h = 25^{\circ}\text{C}$ $T_h = 65^{\circ}\text{C}$ $T_h = 65^{\circ}\text{C}$	I_C	80.0 72.0 95.0 ¹⁾	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	225.0	A
Turn off safe operating area $V_{CE} \leq 600\text{V}$, $T_{vj} \leq 175^{\circ}\text{C}$, $t_p = 1\mu\text{s}$	-	225.0	A
Diode forward current, limited by T_{vjmax} $T_h = 25^{\circ}\text{C}$ value limited by bondwire $T_h = 65^{\circ}\text{C}$	I_F	80.0 72.0	A
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpuls}	225.0	A
Gate-emitter voltage Transient Gate-emitter voltage ($t_p \leq 10\mu\text{s}$, $D < 0.010$)	V_{GE}	± 20 ± 30	V
Short circuit withstand time $V_{GE} = 15.0\text{V}$, $V_{CC} \leq 400\text{V}$ Allowed number of short circuits < 1000 Time between short circuits: $\geq 1.0\text{s}$ $T_{vj} = 150^{\circ}\text{C}$	t_{SC}	5	μs
Power dissipation $T_h = 25^{\circ}\text{C}$ Power dissipation $T_h = 65^{\circ}\text{C}$	P_{tot}	178.0 130.0	W
Operating junction temperature	T_{vj}	-40...+175	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-55...+150	$^{\circ}\text{C}$
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	$^{\circ}\text{C}$
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm
Isolation voltage RMS, $f = 50/60\text{Hz}$, $t = 1\text{min}^{2)}$	V_{isol}	2500	V

Thermal Resistance

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
R_{th} Characteristics						
IGBT thermal resistance, ³⁾ junction - heatsink	$R_{th(j-h)}$		-	0.71	0.84	K/W
Diode thermal resistance, ³⁾ junction - heatsink	$R_{th(j-h)}$		-	1.00	1.10	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		-	-	65	K/W

¹⁾ Equivalent current rating in TO-247-3 at $T_h = 65^{\circ}\text{C}$ using reference insulation material: 152 μm , 1.3 W/mK, standard polyimide based reinforced carrier insulator

²⁾ For a proper handling and assembly of the advanced isolation device in the application refer to the note at the package drawing.

³⁾ At force on body $F = 500\text{N}$, $T_a = 25^{\circ}\text{C}$

TRENCHSTOP™ Advanced Isolation

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

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
Static Characteristic						
Collector-emitter breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0\text{V}, I_C = 0.50\text{mA}$	600	-	-	V
Collector-emitter saturation voltage	V_{CEsat}	$V_{GE} = 15.0\text{V}, I_C = 75.0\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	- -	1.50 1.90	2.00 -	V
Diode forward voltage	V_F	$V_{GE} = 0\text{V}, I_F = 75.0\text{A}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	- -	1.45 1.40	1.75 -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 1.20\text{mA}, V_{CE} = V_{GE}$	4.1	4.9	5.7	V
Zero gate voltage collector current	I_{CES}	$V_{CE} = 600\text{V}, V_{GE} = 0\text{V}$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	- -	- 1200	40 -	μA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}$	-	-	100	nA
Transconductance	g_{fs}	$V_{CE} = 20\text{V}, I_C = 75.0\text{A}$	-	34.0	-	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}	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$	-	4726	-	pF
Output capacitance	C_{oes}		-	215	-	
Reverse transfer capacitance	C_{res}		-	127	-	
Gate charge	Q_G	$V_{CC} = 480\text{V}, I_C = 50.0\text{A},$ $V_{GE} = 15\text{V}$	-	440.0	-	nC
Internal emitter inductance measured 5mm (0.197 in.) from case	L_E		-	13.0	-	nH
Short circuit collector current Max. 1000 short circuits Time between short circuits: $\geq 1.0\text{s}$	$I_{C(SC)}$	$V_{GE} = 15.0\text{V}, V_{CC} \leq 400\text{V},$ $t_{SC} \leq 5\mu\text{s}$ $T_{vj} = 150^{\circ}\text{C}$	-	690	-	A

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	$t_{d(on)}$	$T_{vj} = 25^{\circ}\text{C},$ $V_{CC} = 400\text{V}, I_C = 75.0\text{A},$ $V_{GE} = 0.0/15.0\text{V},$ $R_{G(on)} = 5.0\Omega, R_{G(off)} = 5.0\Omega,$ $L\sigma = 75\text{nH}, C\sigma = 30\text{pF}$ $L\sigma, C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	33	-	ns
Rise time	t_r		-	45	-	ns
Turn-off delay time	$t_{d(off)}$		-	340	-	ns
Fall time	t_f		-	35	-	ns
Turn-on energy	E_{on}		-	2.70	-	mJ
Turn-off energy	E_{off}		-	2.35	-	mJ
Total switching energy	E_{ts}		-	5.05	-	mJ

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

Diode reverse recovery time	t_{rr}	$T_{vj} = 25^{\circ}\text{C}$, $V_R = 400\text{V}$, $I_F = 75.0\text{A}$, $di_F/dt = 1000\text{A}/\mu\text{s}$	-	107	-	ns
Diode reverse recovery charge	Q_{rr}		-	1.94	-	μC
Diode peak reverse recovery current	I_{rrm}		-	23.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-1687	-	$\text{A}/\mu\text{s}$

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	$t_{d(on)}$	$T_{vj} = 175^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 75.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_{G(on)} = 5.0\Omega$, $R_{G(off)} = 5.0\Omega$, $L\sigma = 75\text{nH}$, $C\sigma = 30\text{pF}$ $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	32	-	ns
Rise time	t_r		-	47	-	ns
Turn-off delay time	$t_{d(off)}$		-	377	-	ns
Fall time	t_f		-	40	-	ns
Turn-on energy	E_{on}		-	3.96	-	mJ
Turn-off energy	E_{off}		-	3.12	-	mJ
Total switching energy	E_{ts}		-	7.08	-	mJ

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

Diode reverse recovery time	t_{rr}	$T_{vj} = 175^{\circ}\text{C}$, $V_R = 400\text{V}$, $I_F = 75.0\text{A}$, $di_F/dt = 1000\text{A}/\mu\text{s}$	-	170	-	ns
Diode reverse recovery charge	Q_{rr}		-	4.93	-	μC
Diode peak reverse recovery current	I_{rrm}		-	39.0	-	A
Diode peak rate of fall of reverse recovery current during t_b	di_{rr}/dt		-	-1704	-	$\text{A}/\mu\text{s}$

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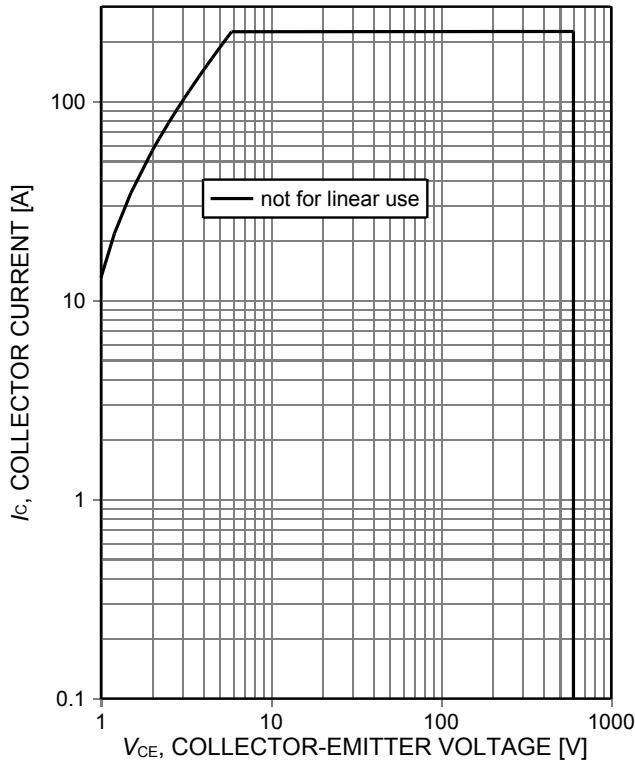


Figure 1. **Forward bias safe operating area**
 ($D=0$, $T_h=25^\circ\text{C}$, $T_j\leq 175^\circ\text{C}$, $V_{GE}=15\text{V}$, $t_p\leq 1\mu\text{s}$)

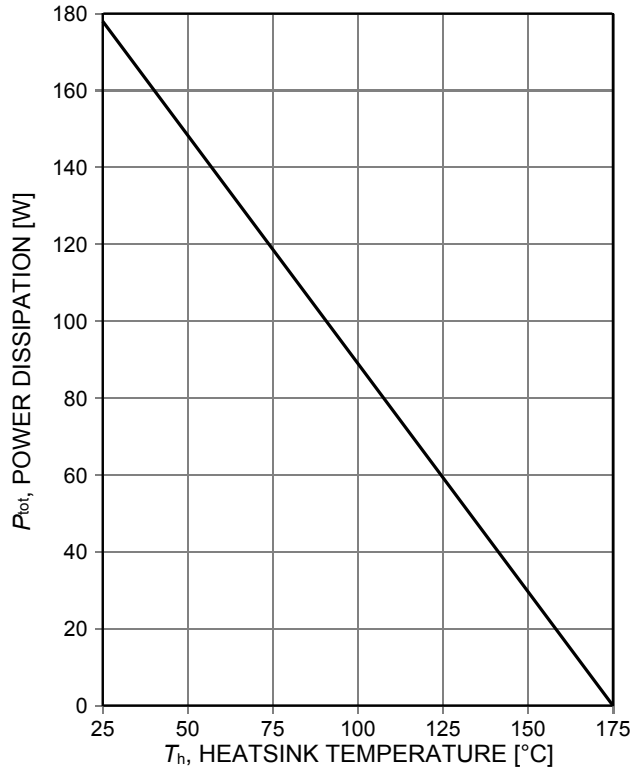


Figure 2. **Power dissipation as a function of heatsink temperature**
 ($T_j\leq 175^\circ\text{C}$)

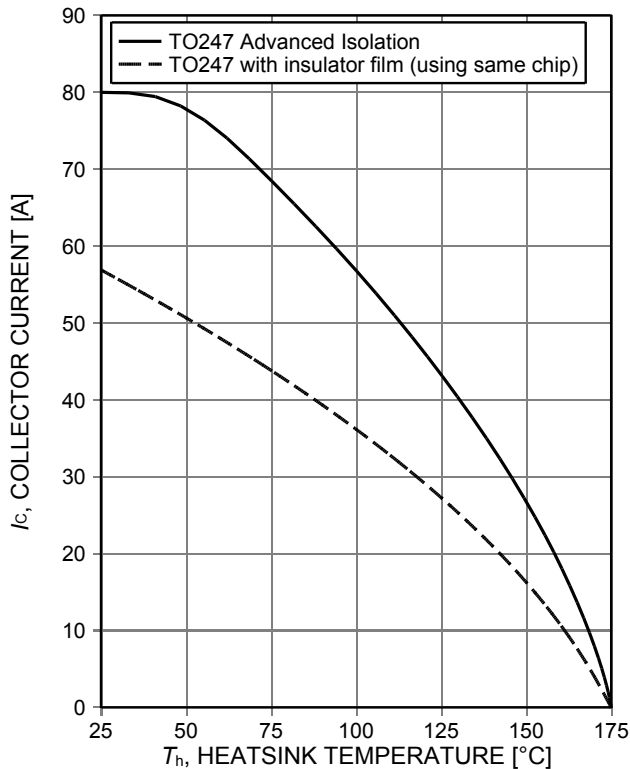


Figure 3. **Collector current as a function of heatsink temperature**
 ($V_{GE}\geq 15\text{V}$, $T_j\leq 175^\circ\text{C}$, insulator film: 152 μm , 1.3W/mK)

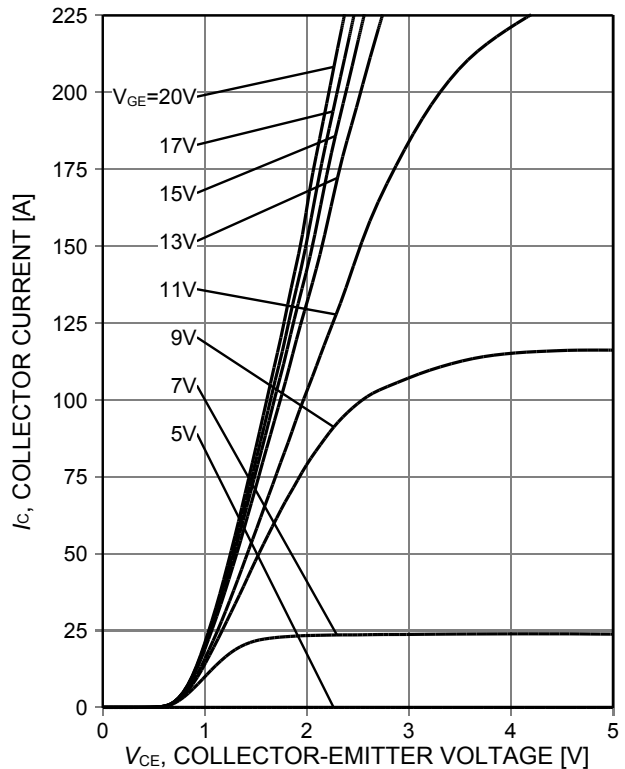


Figure 4. **Typical output characteristic**
 ($T_j=25^\circ\text{C}$)

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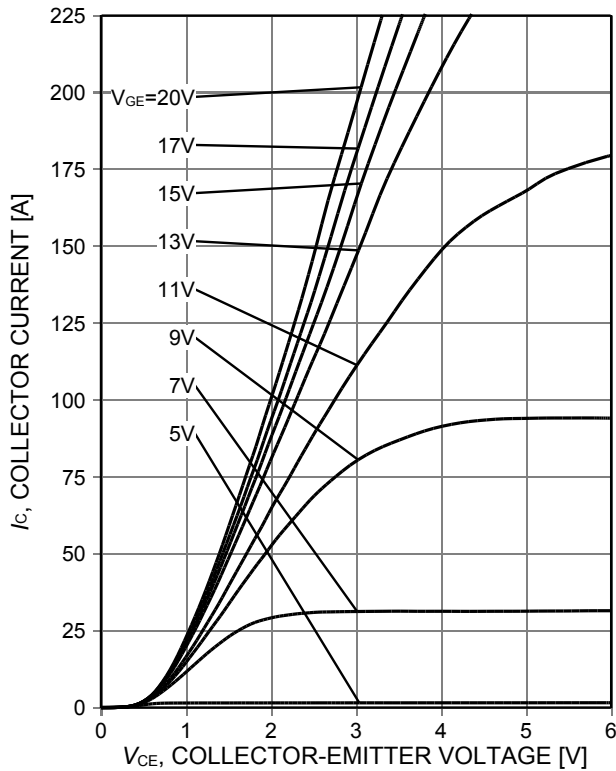


Figure 5. Typical output characteristic ($T_j=175^\circ\text{C}$)

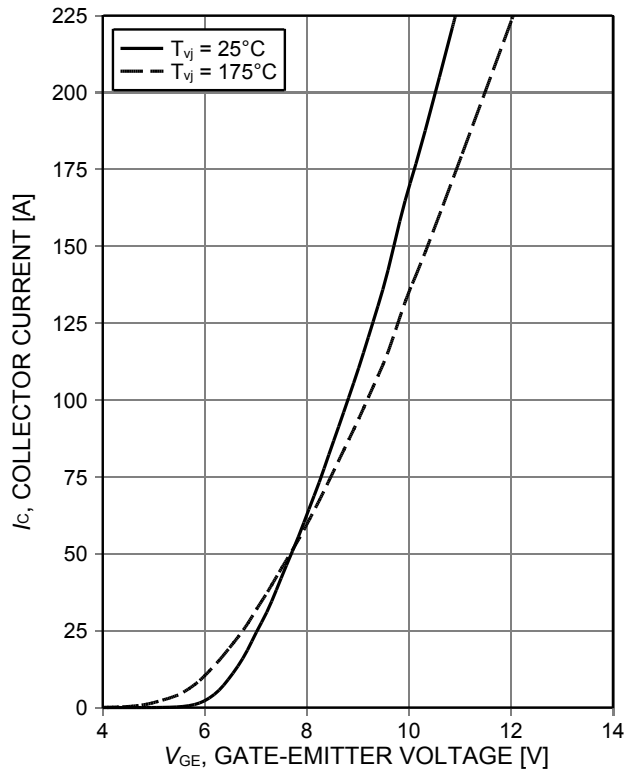


Figure 6. Typical transfer characteristic ($V_{CE}=20\text{V}$)

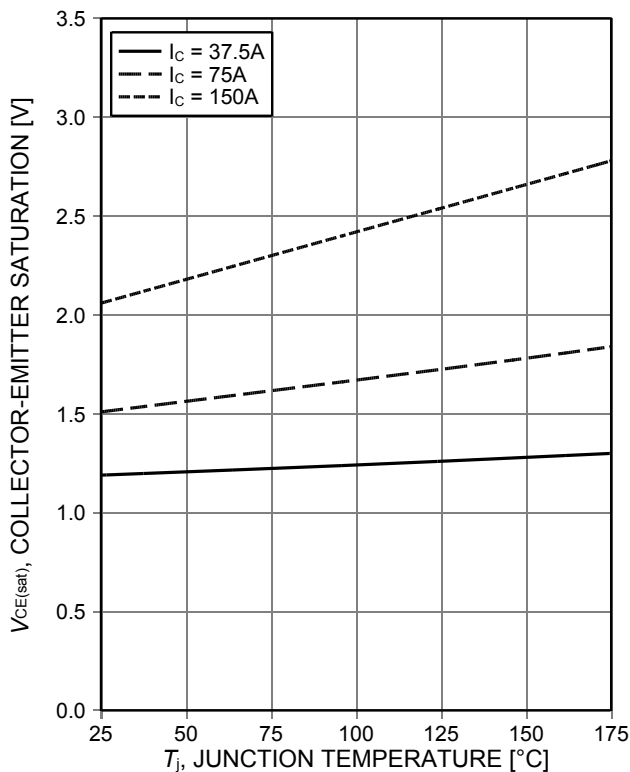


Figure 7. Typical collector-emitter saturation voltage as a function of junction temperature ($V_{GE}=15\text{V}$)

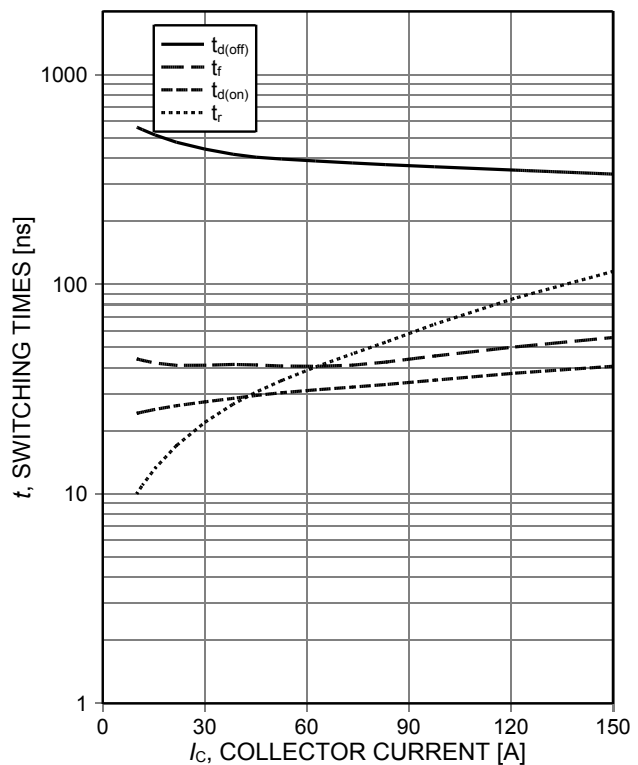


Figure 8. Typical switching times as a function of collector current (ind. load, $T_j=175^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=5\Omega$, test circuit in Fig. E)

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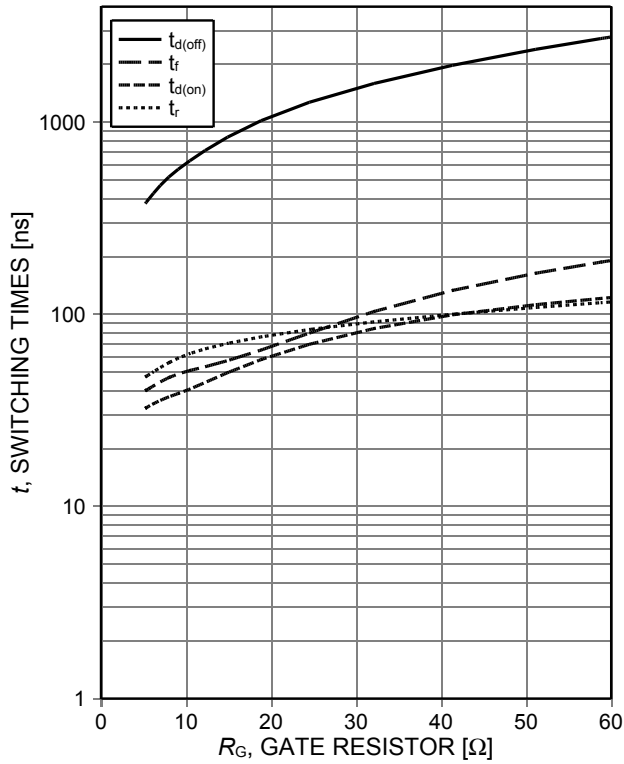


Figure 9. Typical switching times as a function of gate resistor (ind. load, $T_j=175^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$, test circuit in Fig. E)

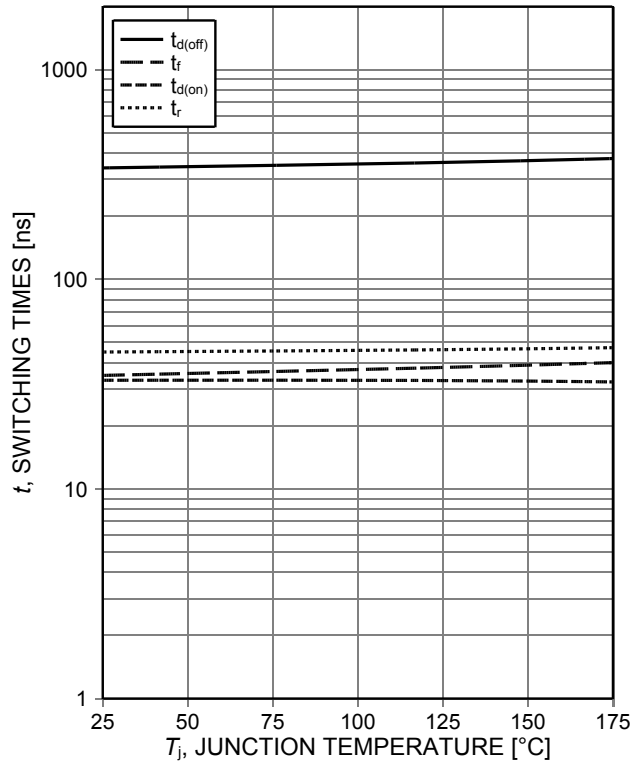


Figure 10. Typical switching times as a function of junction temperature (ind. load, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$, $r_G=5\Omega$, test circuit in Fig. E)

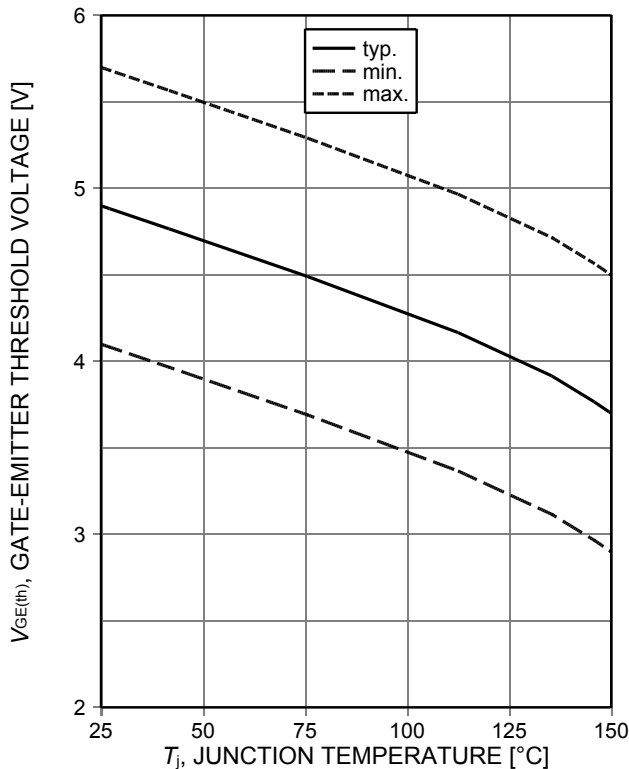


Figure 11. Gate-emitter threshold voltage as a function of junction temperature ($I_C=1.2\text{mA}$)

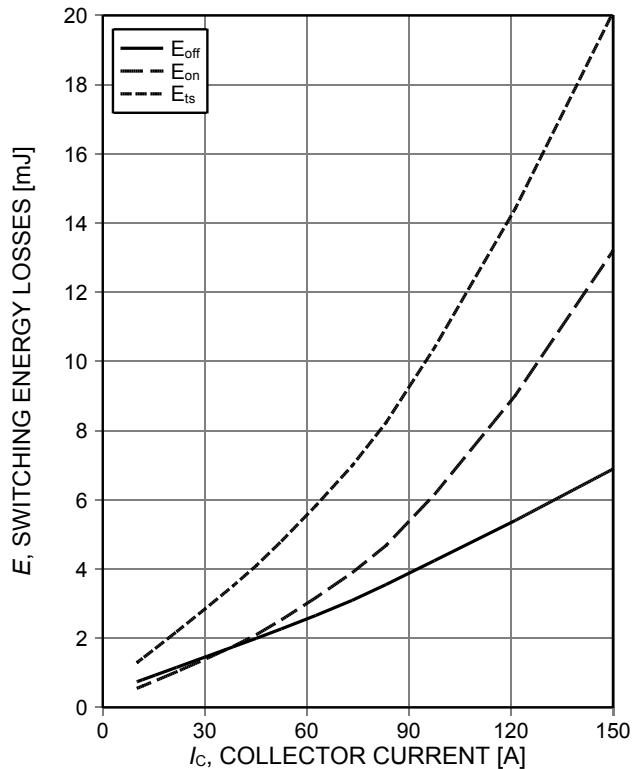


Figure 12. Typical switching energy losses as a function of collector current (ind. load, $T_j=175^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $R_G=5\Omega$, test circuit in Fig. E)

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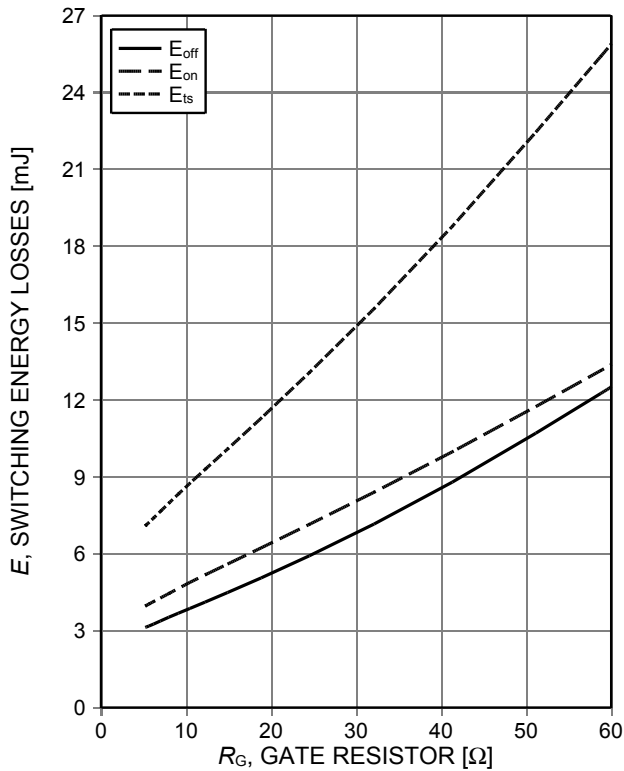


Figure 13. **Typical switching energy losses as a function of gate resistor**
 (ind. load, $T_j=175^\circ\text{C}$, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$, test circuit in Fig. E)

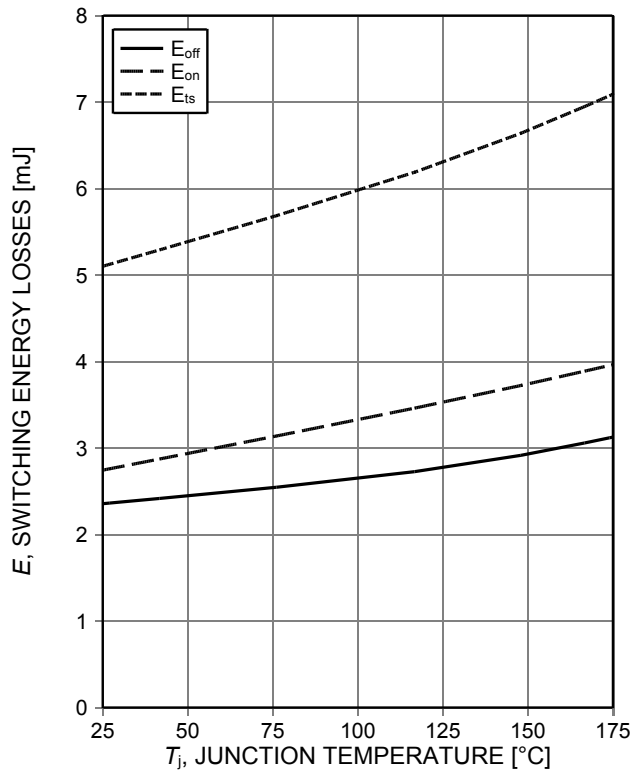


Figure 14. **Typical switching energy losses as a function of junction temperature**
 (ind. load, $V_{CE}=400\text{V}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$, $R_G=5\Omega$, test circuit in Fig. E)

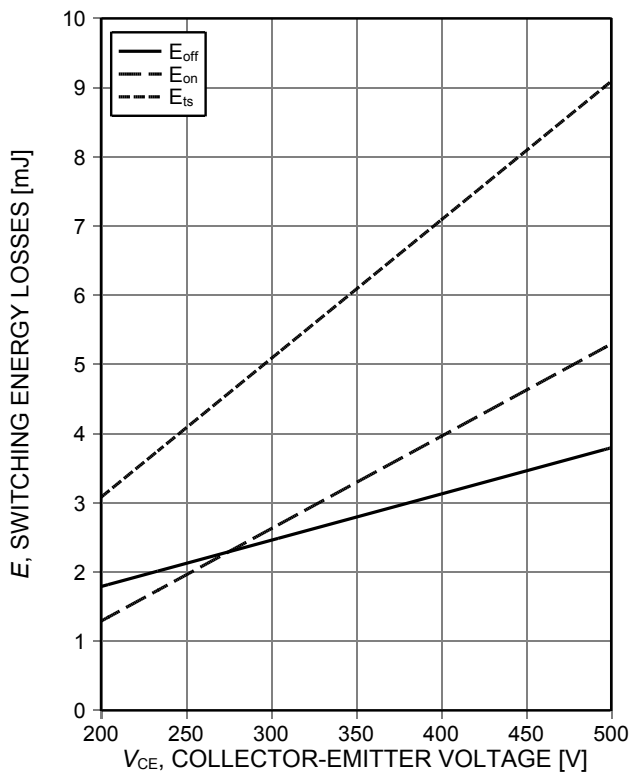


Figure 15. **Typical switching energy losses as a function of collector emitter voltage**
 (ind. load, $T_j=175^\circ\text{C}$, $V_{GE}=0/15\text{V}$, $I_C=75\text{A}$, $R_G=5\Omega$, test circuit in Fig. E)

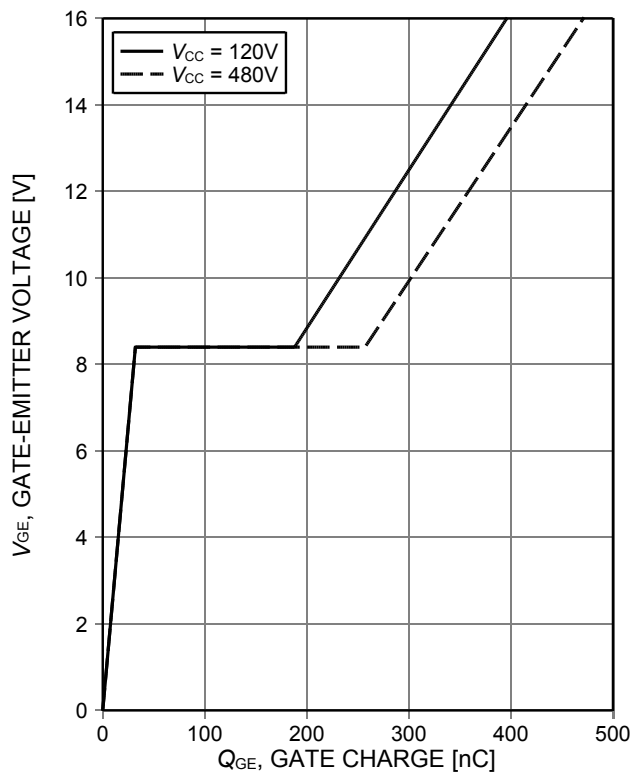


Figure 16. **Typical gate charge**
 ($I_C=75\text{A}$)

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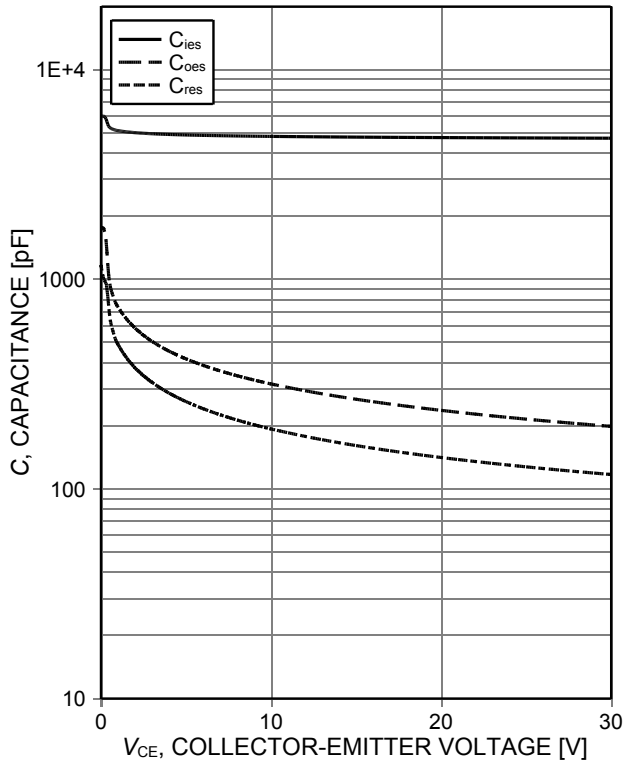


Figure 17. Typical capacitance as a function of collector-emitter voltage ($V_{GE}=0V$, $f=1MHz$)

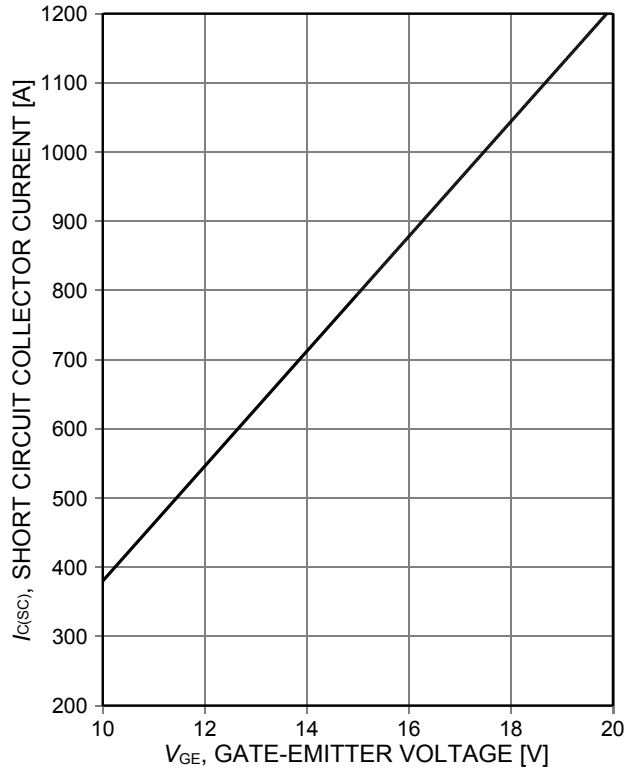


Figure 18. Typical short circuit collector current as a function of gate-emitter voltage ($V_{CE}\leq 400V$, start at $T_j=25^\circ C$)

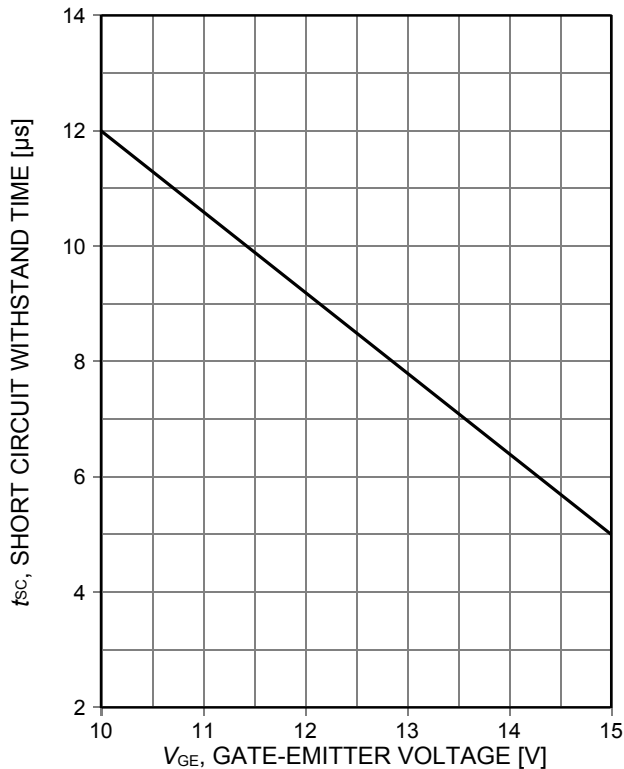


Figure 19. Short circuit withstand time as a function of gate-emitter voltage ($V_{CE}\leq 400V$, start at $T_j\leq 150^\circ C$)

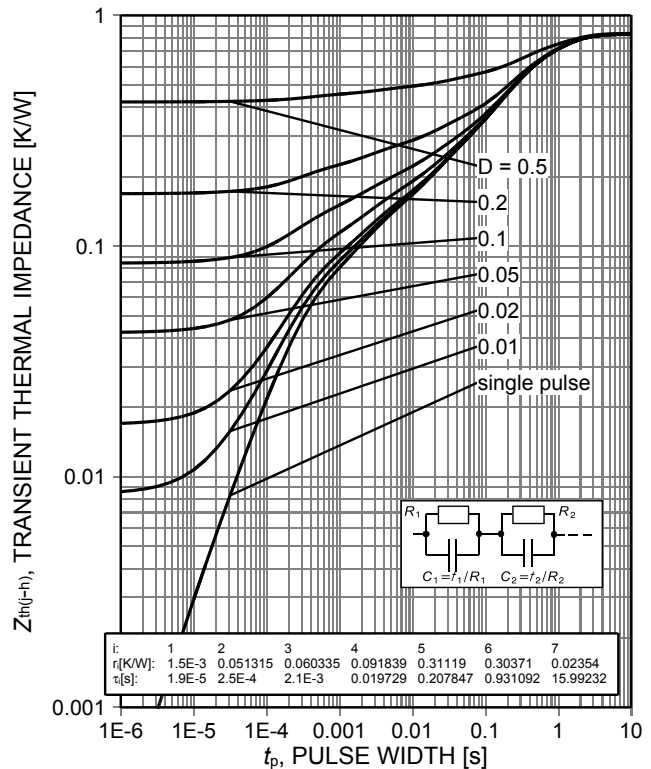


Figure 20. IGBT transient thermal impedance as a function of pulse width ($D=t_p/T$)

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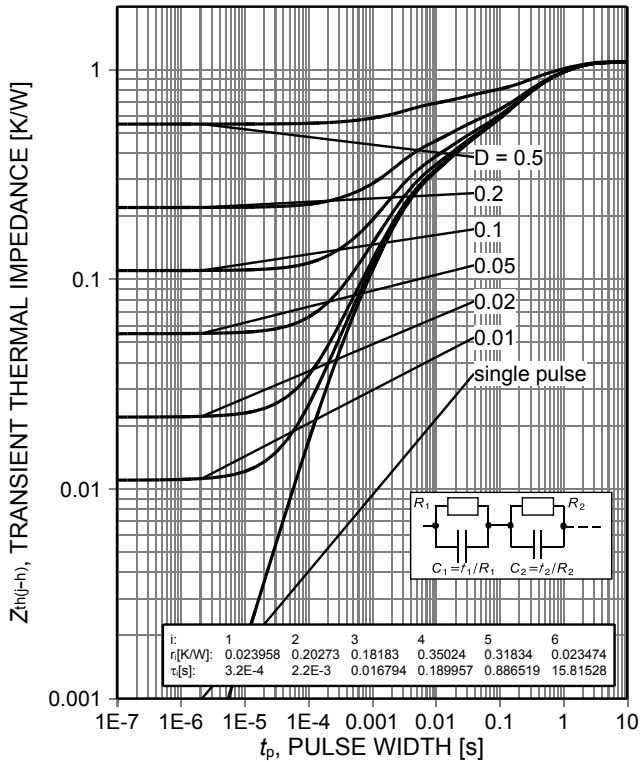


Figure 21. Diode transient thermal impedance as a function of pulse width ($D=t_p/T$)

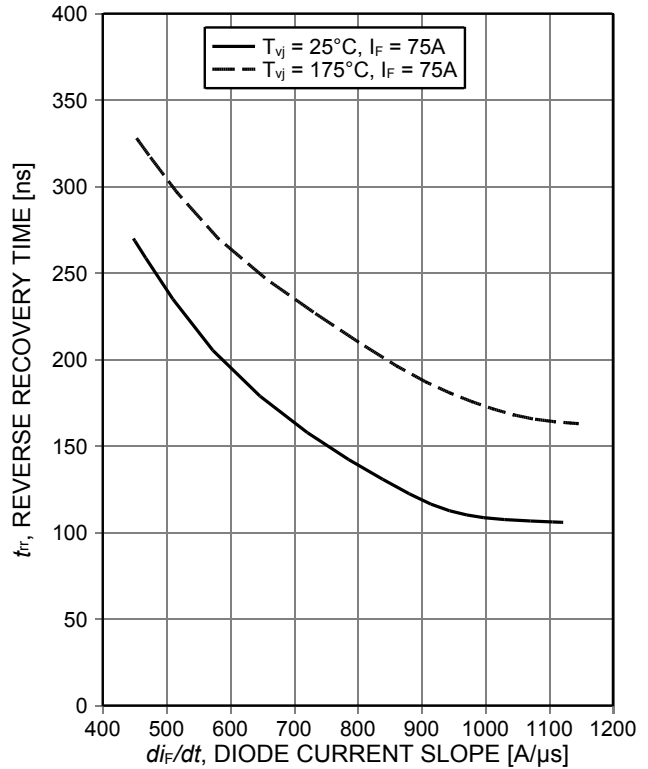


Figure 22. Typical reverse recovery time as a function of diode current slope ($V_R=400V$)

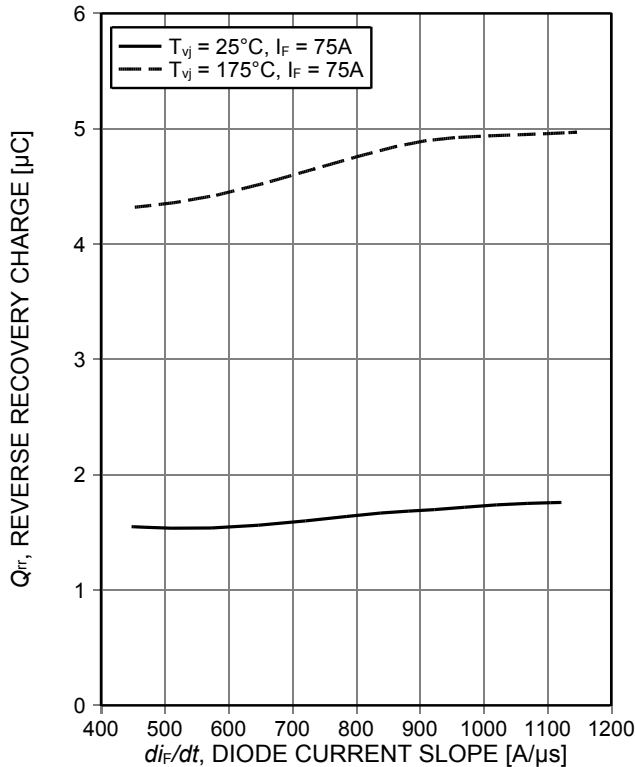


Figure 23. Typical reverse recovery charge as a function of diode current slope ($V_R=400V$)

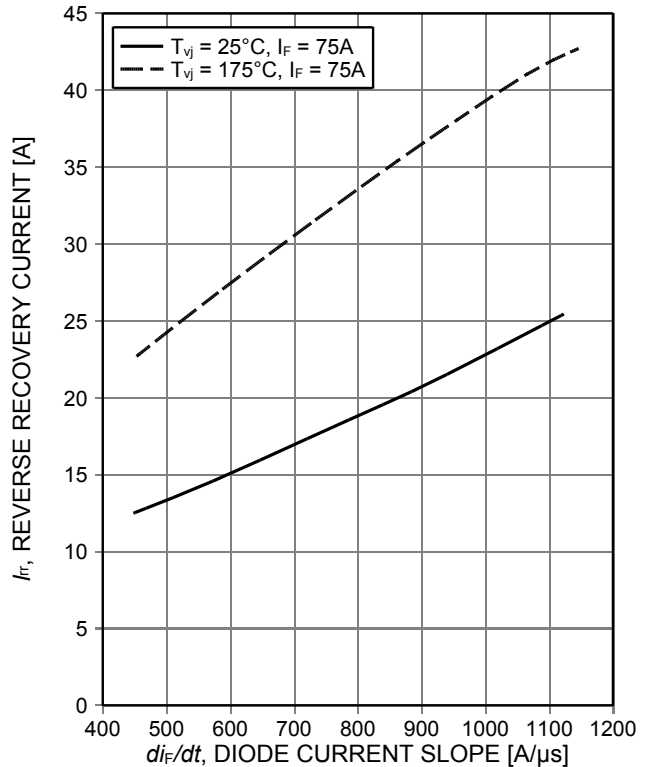


Figure 24. Typical reverse recovery current as a function of diode current slope ($V_R=400V$)

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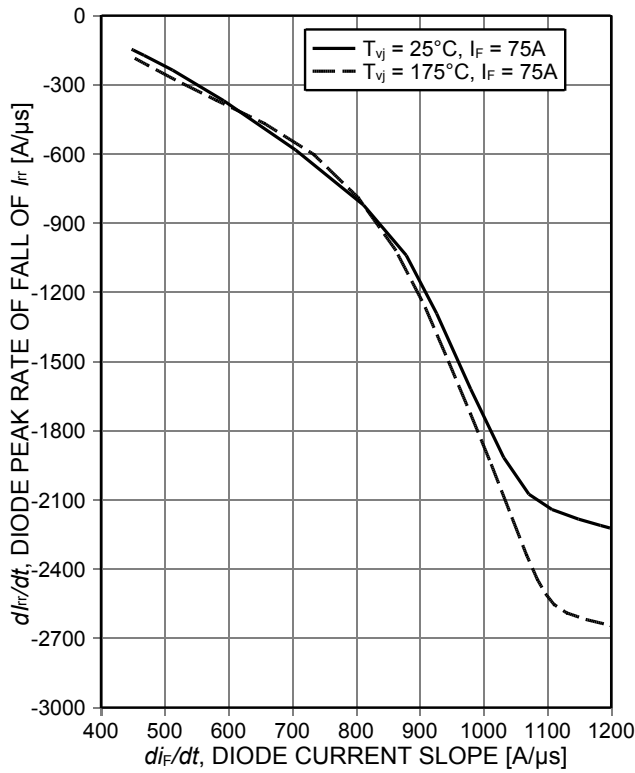


Figure 25. Typical diode peak rate of fall of reverse recovery current as a function of diode current slope ($V_R=400V$)

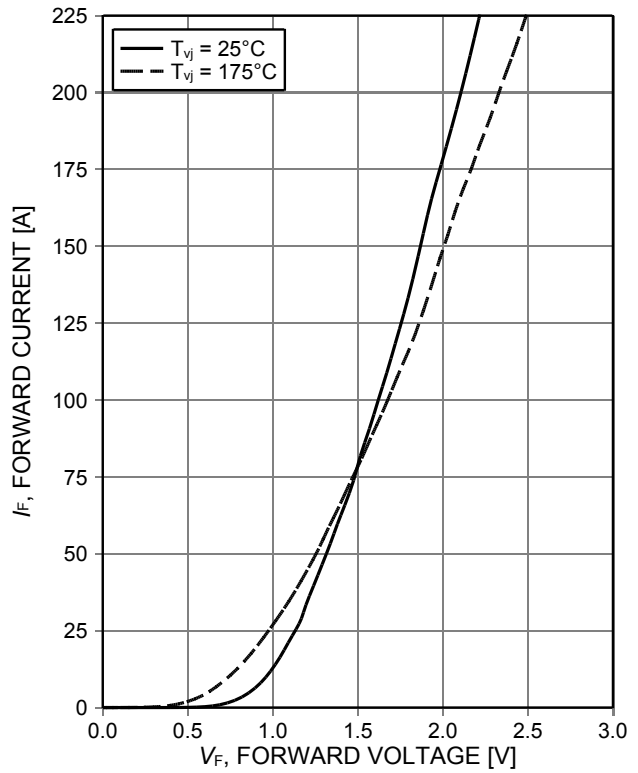


Figure 26. Typical diode forward current as a function of forward voltage

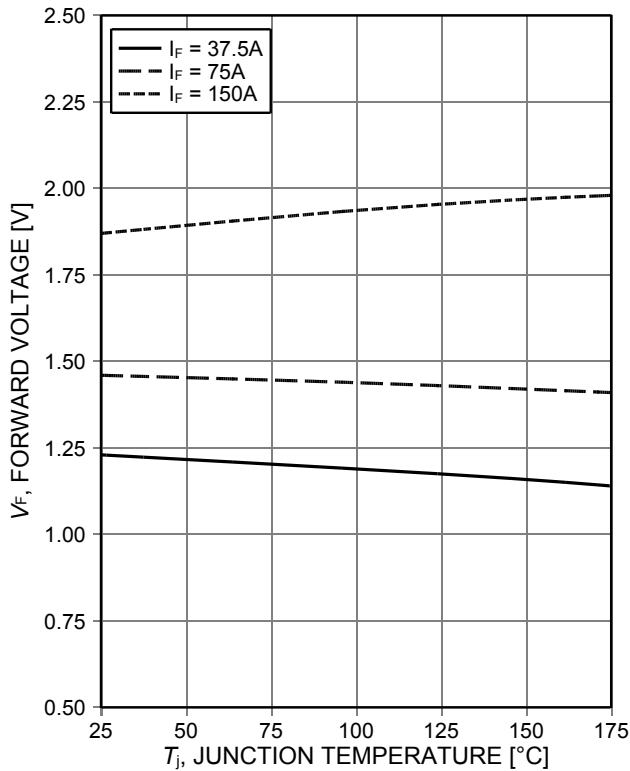
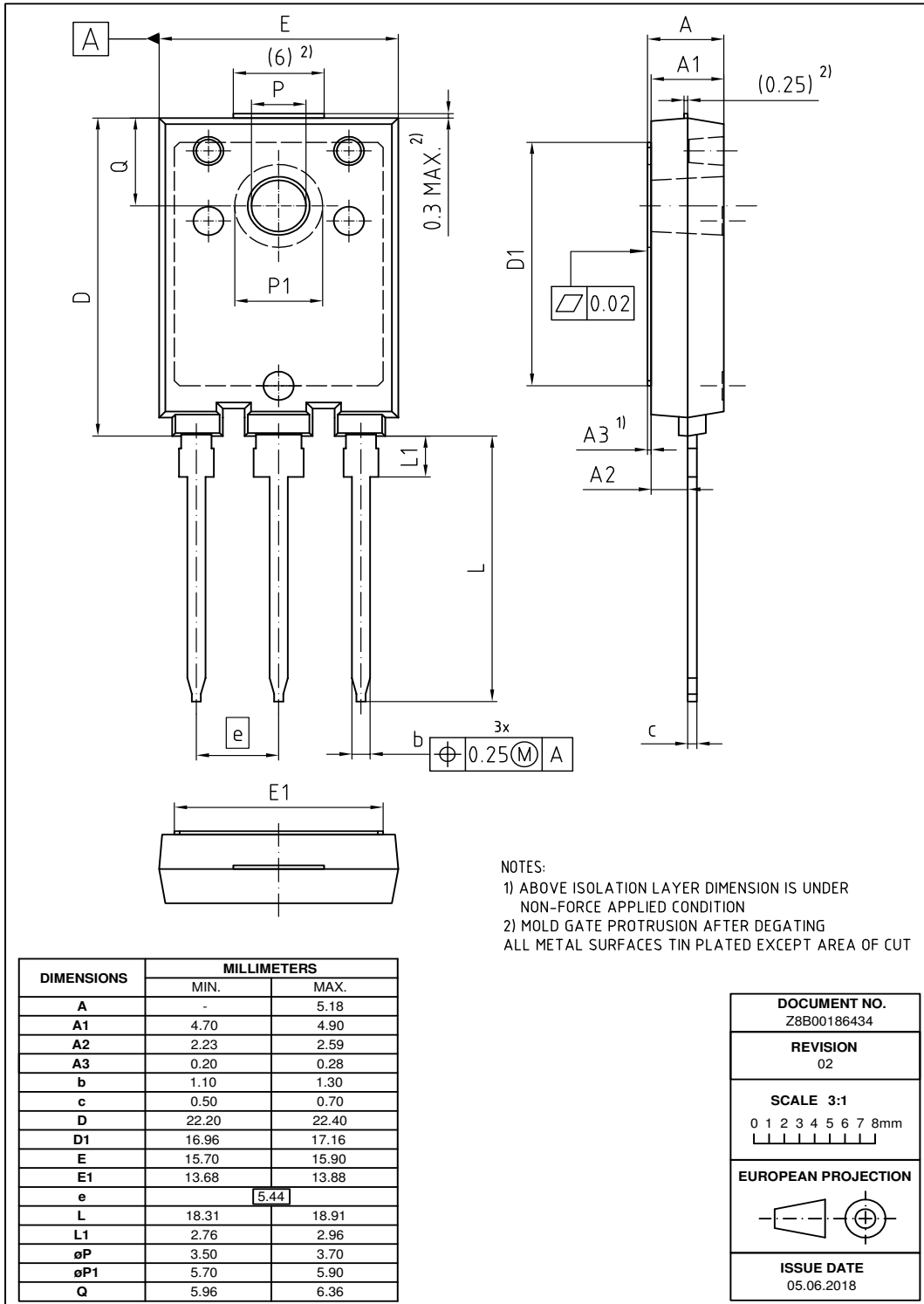


Figure 27. Typical diode forward voltage as a function of junction temperature

PG-TO247-3-AI (PG-HSIP247-3)



Note: For a proper handling and assembly of the advanced isolation device in the application the isolation layer must not be exposed to potential penetration via sharp implements or mechanical impacts/shocks, which exceed levels indicated in International Standard (IEC60068-2-6 and IEC60068-2-27). The advanced isolation device is intended only to be used assembled on an appropriate heatsink with recommended flatness of <20µm per 100mm and roughness of <10µm.

Testing Conditions



Figure A. Definition of switching times



Figure B. Definition of switching losses

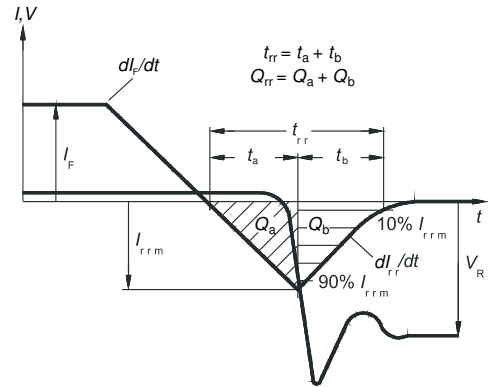


Figure C. Definition of diode switching characteristics

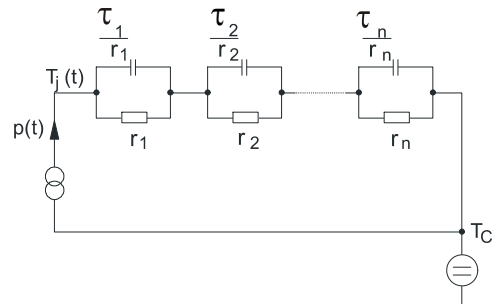


Figure D. Thermal equivalent circuit



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

Revision History

IKFW75N60ET

Revision: 2017-09-21, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.1	2017-09-21	Final data sheet

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[STGWA25H120F2](#) [NGTB75N65FL2WAG](#) [2MBI150VA-060-50](#) [NTE3320](#) [FGD3040G2-F085](#) [FGD3440G2-F085](#) [STGW80H65DFB-4](#)
[AFGY160T65SPD-B4](#) [IGW30N60TP](#) [IGW40N60TP](#) [IGW50N60TP](#) [IHW30N65R5](#) [IKFW40N60DH3E](#) [IKP15N65H5](#) [IKQ100N60T](#)
[IKQ120N60T](#) [IKW30N65WR5](#) [IKW75N60H3](#) [IKZ50N65NH5](#) [IKZ75N65NH5](#) [FGD3040G2-F085C](#) [FGH4L50T65SQD](#) [FGHL40T65MQDT](#)
[FGHL50T65MQD](#) [FGHL50T65MQDTL4](#) [FGHL75T65LQDT](#) [FGHL75T65MQD](#) [FGHL75T65MQDT](#) [FGHL75T65MQDTL4](#)
[FGY75T120SWD](#) [EL3120S1\(TA\)\(SAS\)-V](#) [IHW15N120E1](#) [IKQ75N120CS6](#) [IKW50N65WR5](#) [SL15T65FK](#) [KGF50N65KDF-U/H](#)
[IHF40N65R5S](#) [IKW08N120CS7XKSA1](#) [IKQ75N120CH3](#) [IHW30N160R5](#) [SGM100HF12A1TFD](#) [CRG50T60AK3SD](#) [CRG40T60AN3S](#)