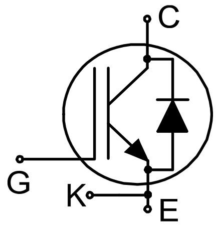
TRENCHSTOP^{TM} 5 H5 IGBT co-packed with half-rated 6th generation CoolSiC^{TM} Schottky barrier diode

Features and Benefits:



- Ultra-low switching losses due to the combination of TRENCHSTOP^{TM} 5 and CoolSiC^{TM} technology as well as the Kelvin emitter pin
- Benchmark efficiency in hard switching topologies
- Plug-and-play replacement of pure silicon devices
- Simplified PCB design due to the optimized pin-out of the four-pin package
- Improved wave soldering quality due to the increased clearance of the Kelvin emitter and gate pins
- 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/

Potential Applications:

- Industrial Power Supplies
  - Industrial SMPS
  - Industrial UPS
- Energy Generation
  - Solar String Inverter
- Energy Distribution
  - Energy Storage
- Infrastructure – Charge
  - Charger

Product Validation:

Qualified for applications listed above based on the test conditions in the relevant tests of JEDEC20/22

Package pin definition:

- Pin C & backside - collector
- Pin E - emitter
- Pin K - Kelvin emitter
- Pin G - gate

Key Performance and Package Parameters

Type	V_{CE}	I_C	V_{CEsat}, T_{vj}=25°C	T_{vjmax}	Marking	Package
IKZA50N65RH5	650V	50A	1.65V	175°C	K50ERH5	PG-TO247-4-3

Table of Contents

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	80.0 56.0	A
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpuls}	200.0	A
Turn off safe operating area $V_{CE} \leq 650V$, $T_{vj} \leq 175°C$, $t_p = 1µs$	-	200.0	A
Diode forward current, limited by T_{vjmax} $T_c = 25°C$ $T_c = 100°C$	I_F	33.7 22.8	A
Diode pulsed current, t_p limited by T_{vjmax}[1)]	I_{Fpuls}	75.0	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}	305.0 152.5	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

Thermal Resistance

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
R_{th} Characteristics						
IGBT thermal resistance, junction - case	$R_{th(j-c)}$		-	-	0.50	K/W
Diode thermal resistance, junction - case	$R_{th(j-c)}$		-	-	1.50	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$		-	-	40	K/W

1) Pulse current level depends on T_{vj} of diode chip, see also Fig. "Maximum pulse current as a function of junction temperature"

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 = 50.0A 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 = 20.0A T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 175°C	- - -	1.35 1.55 1.65	1.50 - -	V
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 0.50mA, 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	- -	- 2000	700 -	µA
Zero gate voltage collector current	I_{CES}	V_{CE} = 480V, V_{GE} = 0V T_{vj} = 25°C	-	-	25	µA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0V, V_{GE} = 20V	-	-	100	nA
Transconductance	g_{fs}	V_{CE} = 20V, I_C = 50.0A	-	62.0	-	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 = 250kHz	-	2660	-	pF
Output capacitance	C_{oes}		-	320	-	
Reverse transfer capacitance	C_{res}		-	10	-	
Gate charge	Q_G	V_{CC} = 520V, I_C = 50.0A, V_{GE} = 15V	-	120.0	-	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 = 25.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 12.0Ω, $R_{G(off)}$ = 12.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include “tail” and diode reverse recovery.	-	21	-	ns
Rise time	t_r		-	6	-	ns
Turn-off delay time	$t_{d(off)}$		-	180	-	ns
Fall time	t_f		-	18	-	ns
Turn-on energy	E_{on}		-	0.20	-	mJ
Turn-off energy	E_{off}		-	0.18	-	mJ
Total switching energy	E_{ts}		-	0.38	-	mJ

Turn-on delay time	$t_{d(on)}$	T_{vj} = 25°C, V_{CC} = 400V, I_C = 5.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 12.0Ω, $R_{G(off)}$ = 12.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	19	-	ns
Rise time	t_r		-	3	-	ns
Turn-off delay time	$t_{d(off)}$		-	200	-	ns
Fall time	t_f		-	25	-	ns
Turn-on energy	E_{on}		-	0.05	-	mJ
Turn-off energy	E_{off}		-	0.05	-	mJ
Total switching energy	E_{ts}		-	0.10	-	mJ

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 = 25.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 12.0Ω, $R_{G(off)}$ = 12.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	20	-	ns
Rise time	t_r		-	7	-	ns
Turn-off delay time	$t_{d(off)}$		-	200	-	ns
Fall time	t_f		-	25	-	ns
Turn-on energy	E_{on}		-	0.27	-	mJ
Turn-off energy	E_{off}		-	0.27	-	mJ
Total switching energy	E_{ts}		-	0.54	-	mJ

Turn-on delay time	$t_{d(on)}$	T_{vj} = 150°C, V_{CC} = 400V, I_C = 5.0A, V_{GE} = 0.0/15.0V, $R_{G(on)}$ = 12.0Ω, $R_{G(off)}$ = 12.0Ω, $L\sigma$ = 30nH, $C\sigma$ = 30pF $L\sigma$, $C\sigma$ from Fig. E Energy losses include "tail" and diode reverse recovery.	-	18	-	ns
Rise time	t_r		-	3	-	ns
Turn-off delay time	$t_{d(off)}$		-	250	-	ns
Fall time	t_f		-	35	-	ns
Turn-on energy	E_{on}		-	0.08	-	mJ
Turn-off energy	E_{off}		-	0.08	-	mJ
Total switching energy	E_{ts}		-	0.16	-	mJ

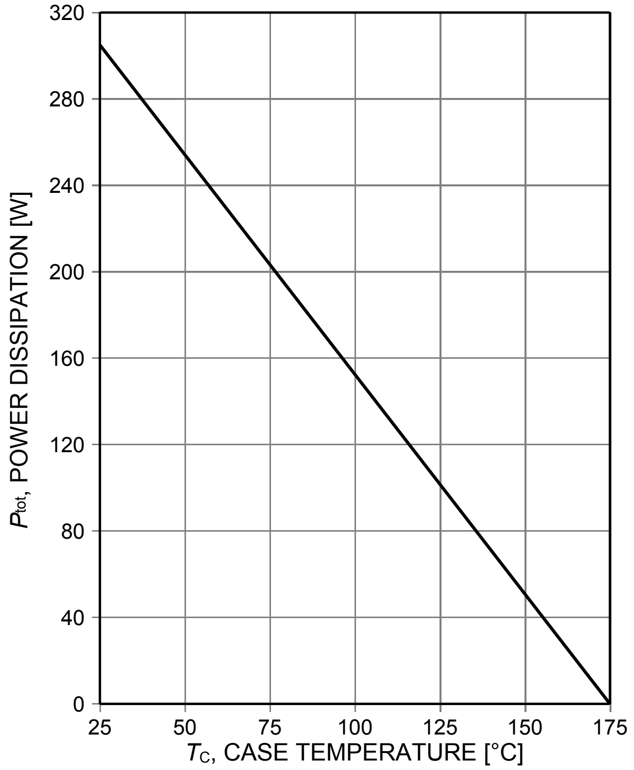


Figure 1. **Power dissipation as a function of case temperature**
(T_{vj}≤175°C)

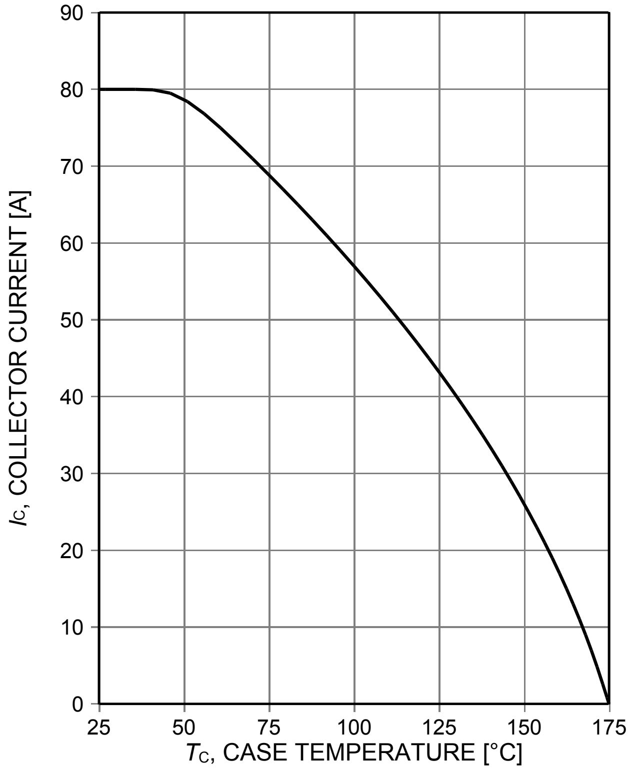


Figure 2. **Collector current as a function of case temperature**
(V_{GE}≥15V, T_{vj}≤175°C)

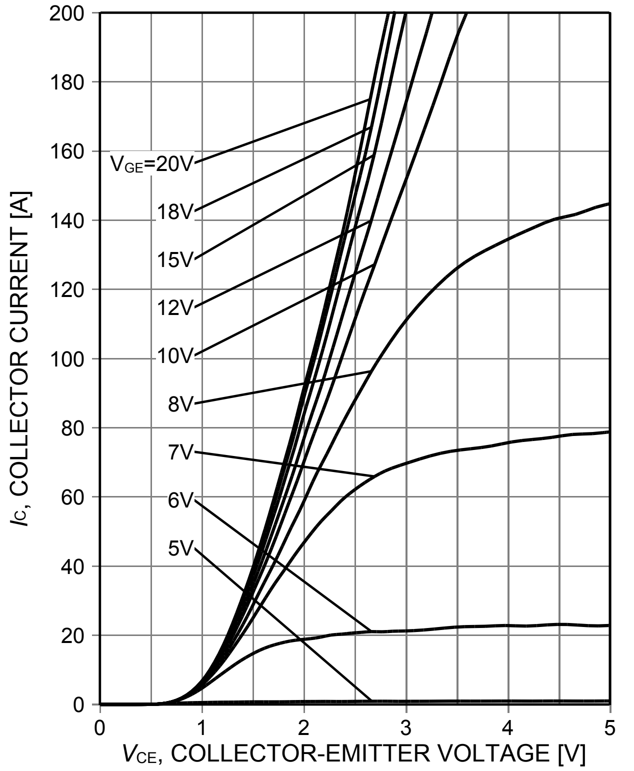


Figure 3. **Typical output characteristic**
(T_{vj}=25°C)

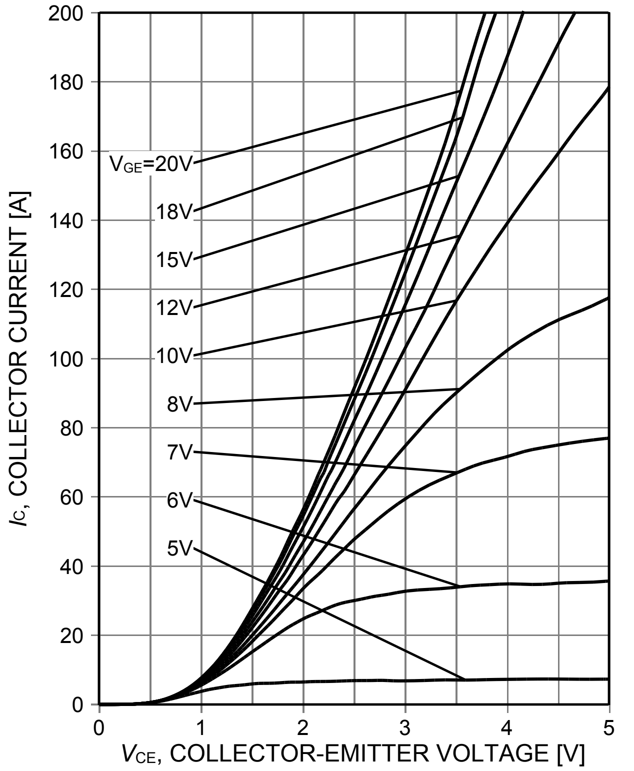


Figure 4. **Typical output characteristic**
(T_{vj}=150°C)

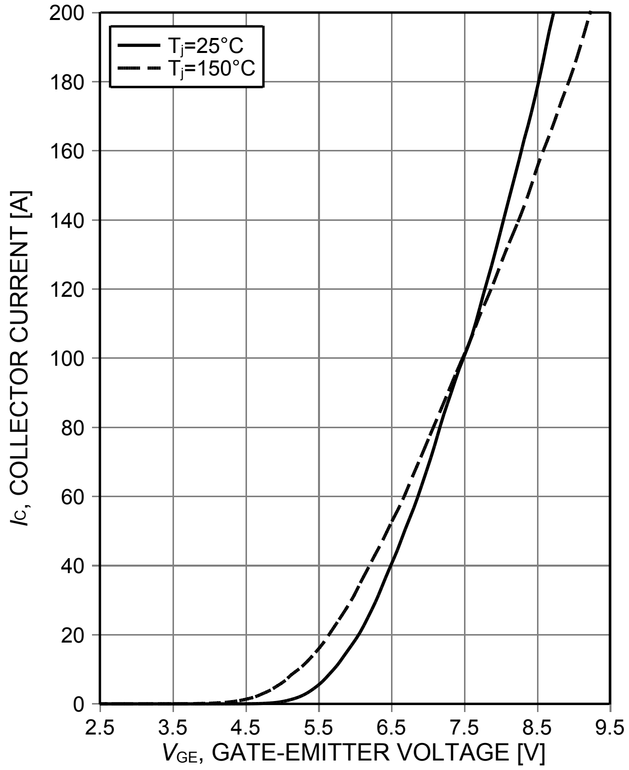


Figure 5. **Typical transfer characteristic**
(V_{CE}=20V)

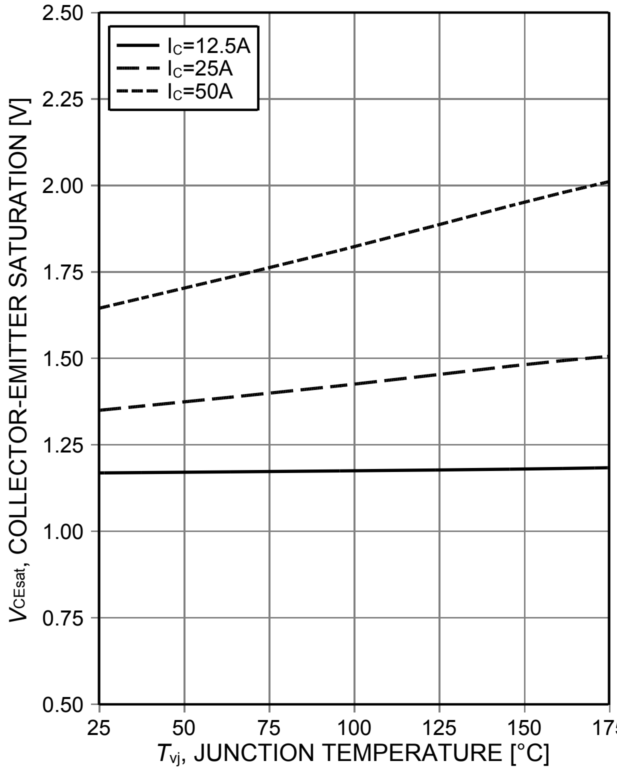


Figure 6. **Typical collector-emitter saturation voltage as a function of junction temperature**
(V_{GE}=15V)

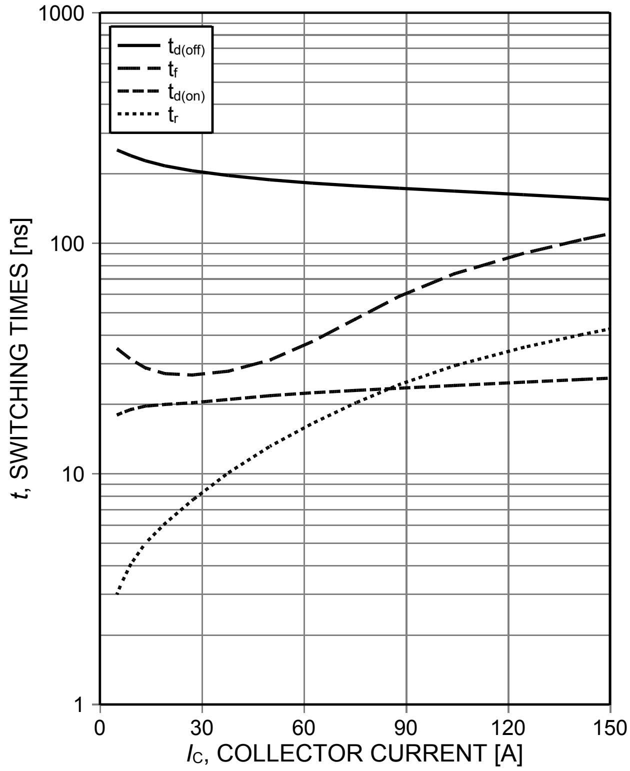


Figure 7. **Typical switching times as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=15/0V, R_G=12Ω, Dynamic test circuit in Figure E)

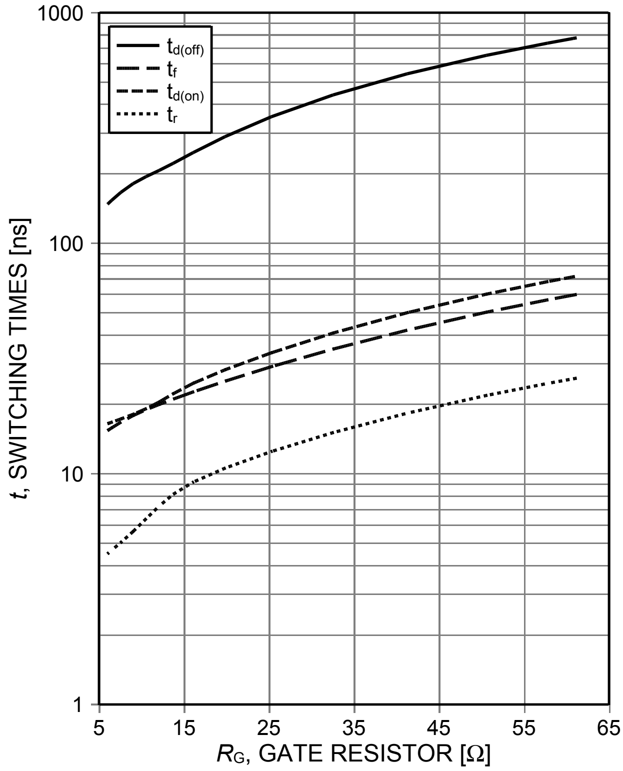


Figure 8. **Typical switching times as a function of gate resistor**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=15/0V, I_C=25A, Dynamic test circuit in Figure E)

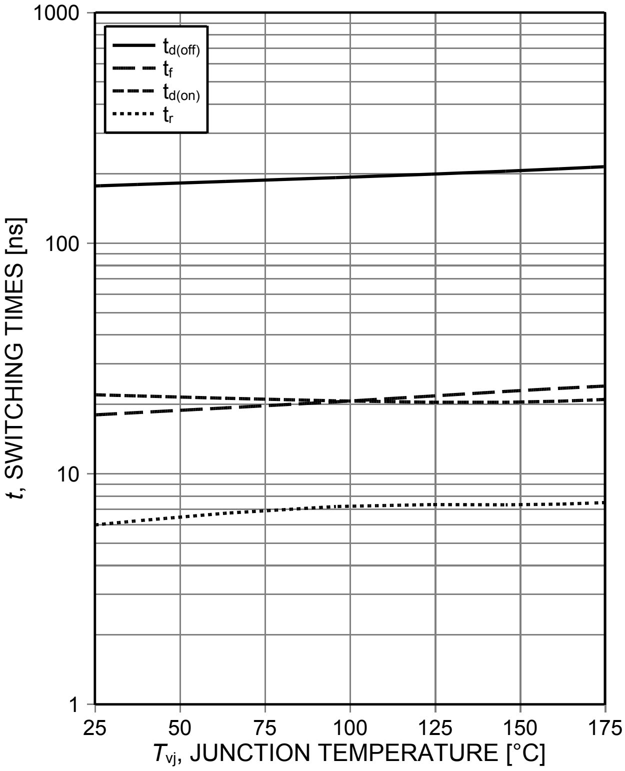


Figure 9. **Typical switching times as a function of junction temperature**
(inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=25A, R_G=12Ω, Dynamic test circuit in Figure E)

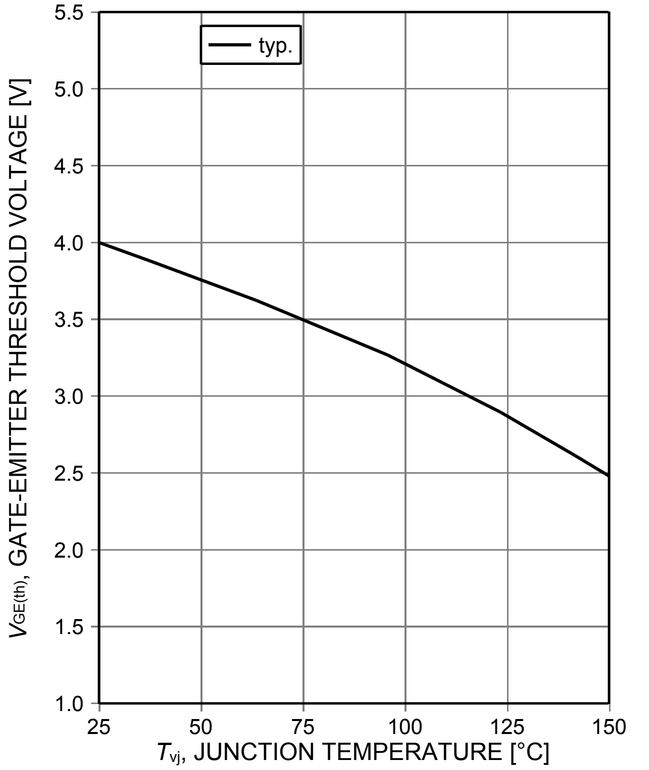


Figure 10. **Gate-emitter threshold voltage as a function of junction temperature**
(I_C=0.5mA)

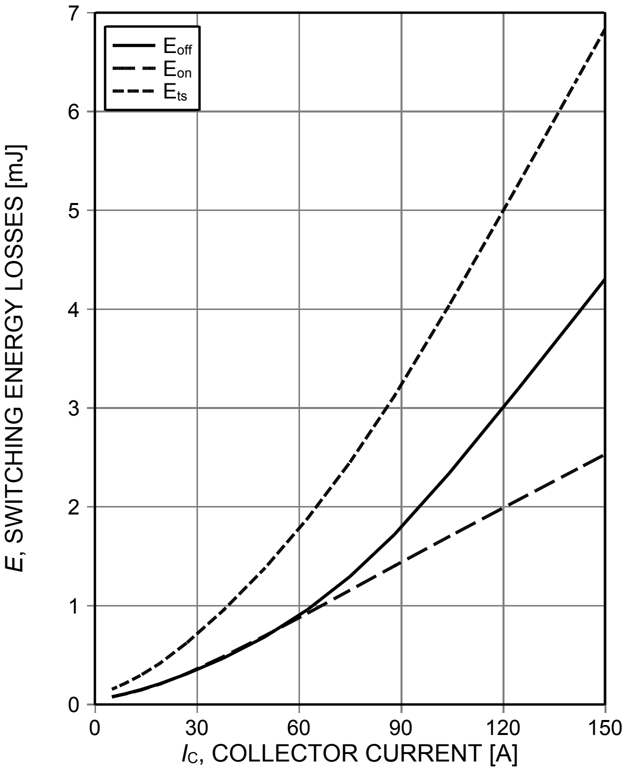


Figure 11. **Typical switching energy losses as a function of collector current**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=15/0V, R_G=12Ω, Dynamic test circuit in Figure E)

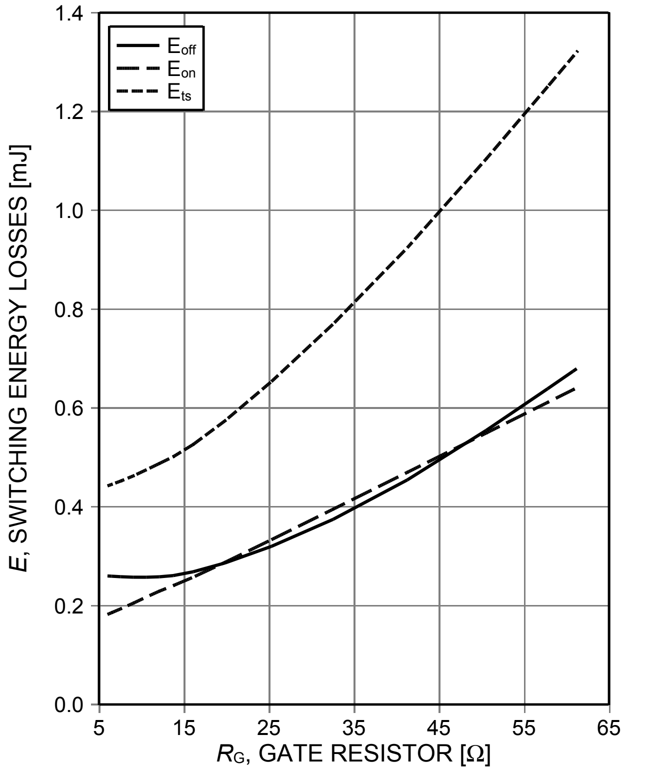


Figure 12. **Typical switching energy losses as a function of gate resistor**
(inductive load, T_{vj}=150°C, V_{CE}=400V, V_{GE}=15/0V, I_C=25A, Dynamic test circuit in Figure E)

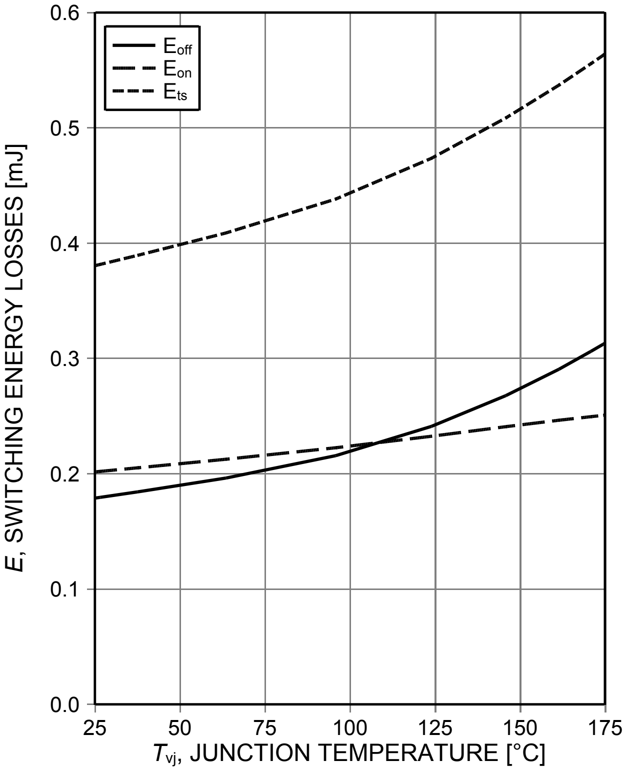


Figure 13. **Typical switching energy losses as a function of junction temperature** (inductive load, V_{CE}=400V, V_{GE}=15/0V, I_C=25A, R_G=12Ω, Dynamic test circuit in Figure E)

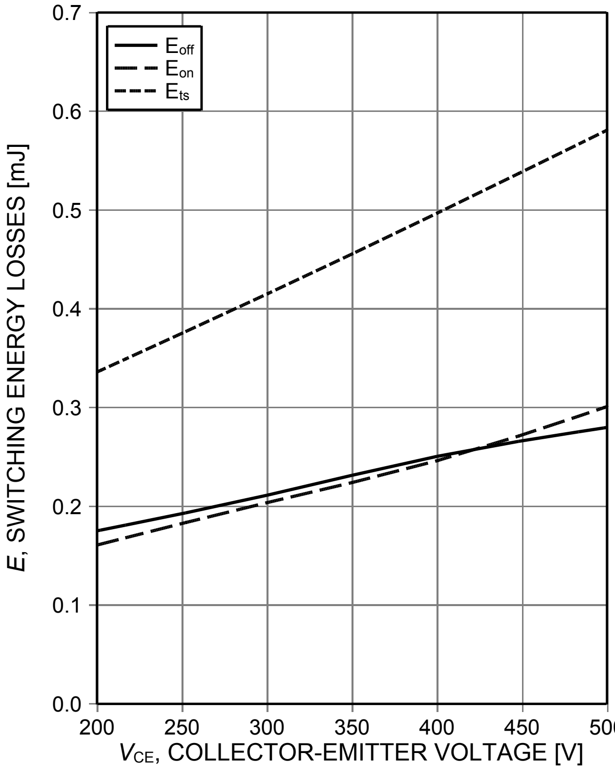


Figure 14. **Typical switching energy losses as a function of collector emitter voltage** (inductive load, T_{vj}=150°C, V_{GE}=15/0V, I_C=25A, R_G=12Ω, Dynamic test circuit in Figure E)

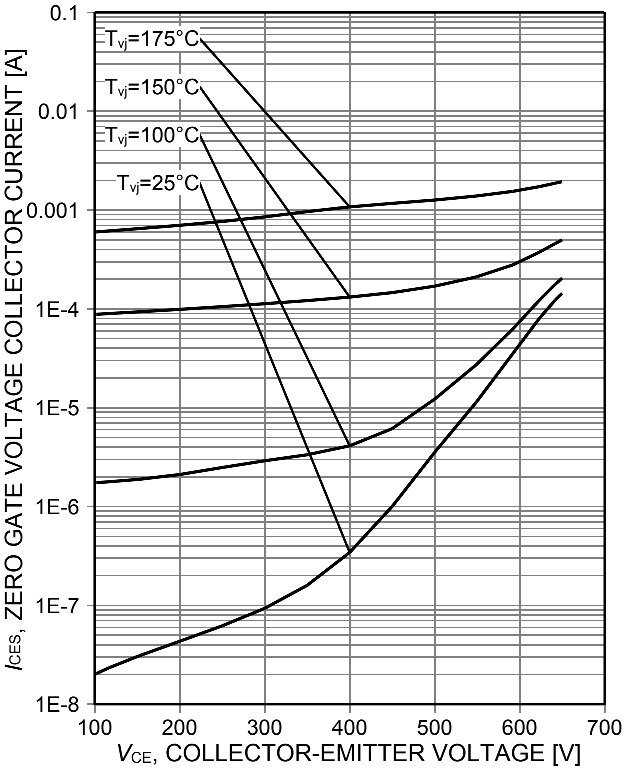


Figure 15. **Typ. reverse current vs. reverse voltage as a function of Tvj**

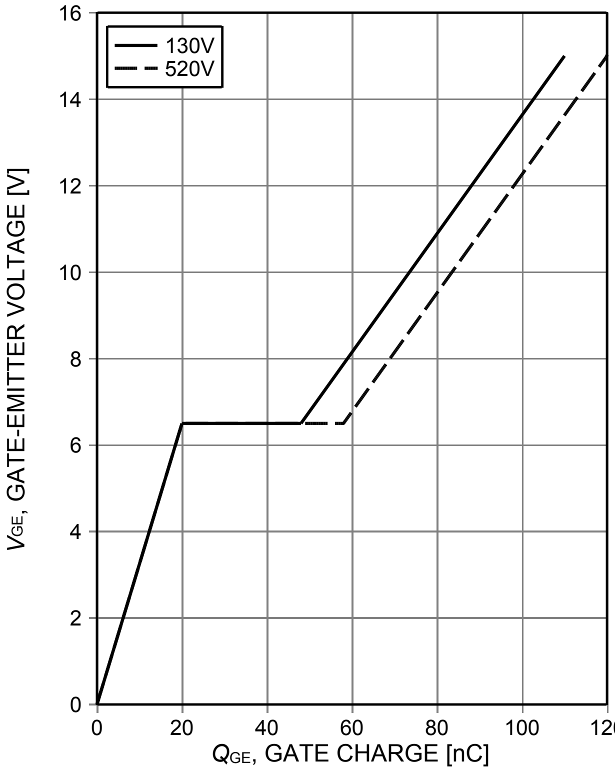


Figure 16. **Typical gate charge** (I_C=50A)

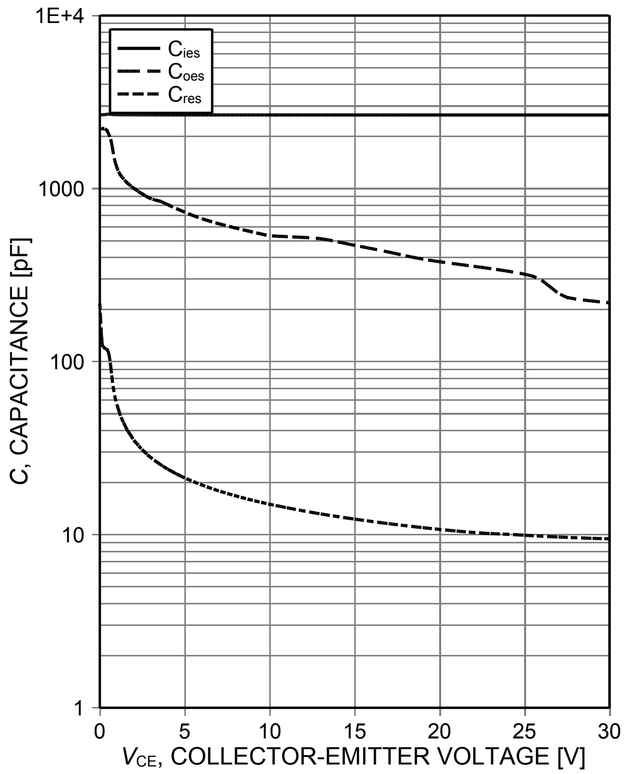


Figure 17. **Typical capacitance as a function of collector-emitter voltage**
(V_{GE}=0V, f=250kHz)

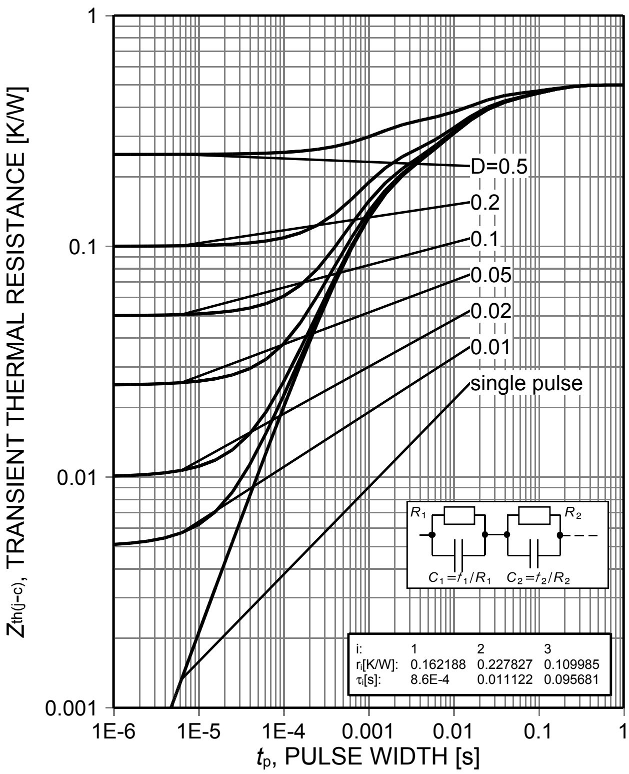


Figure 18. **IGBT transient thermal resistance**
(D=t_p/T)

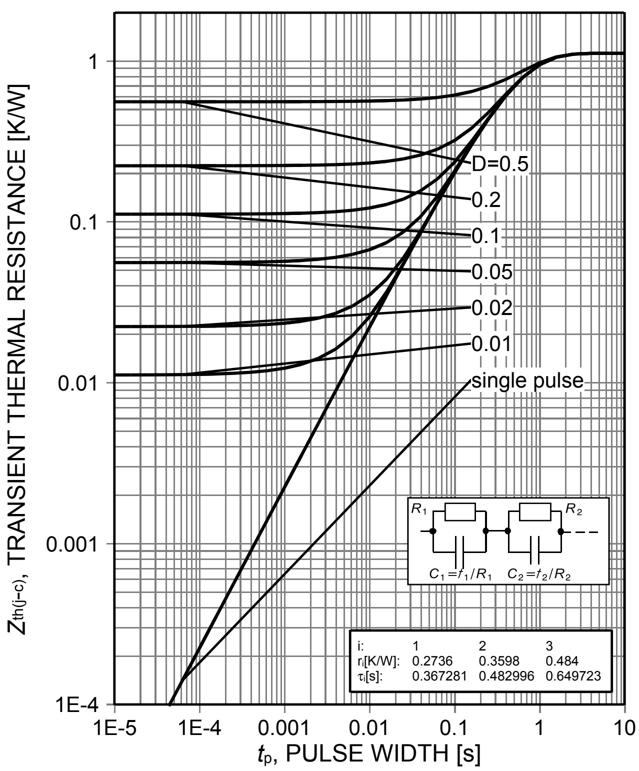


Figure 19. **Diode transient thermal impedance as a function of pulse width**
(D=t_p/T)

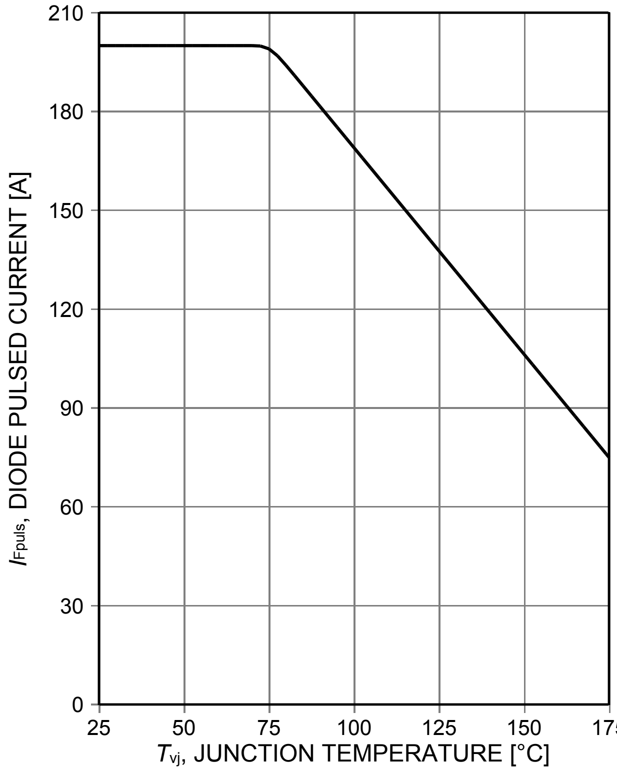


Figure 20. **Maximum pulse current as a function of junction temperature**

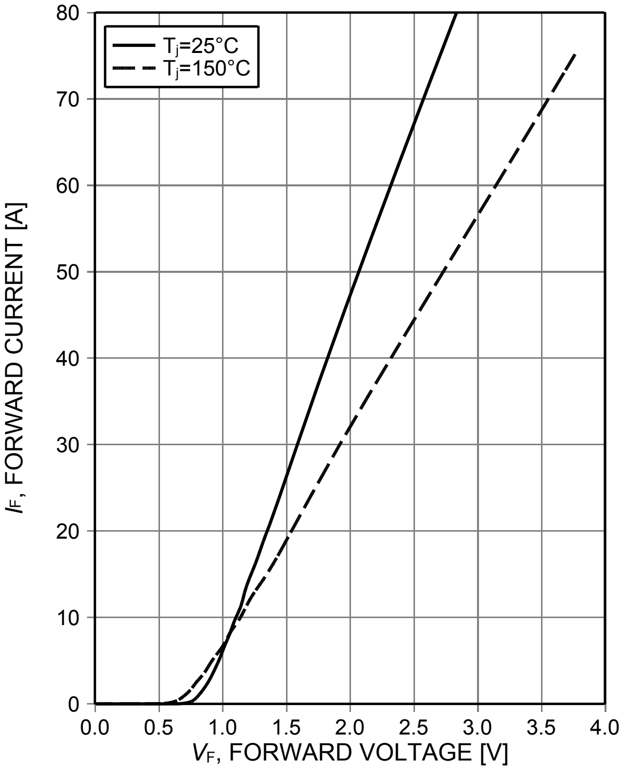


Figure 21. **Typical diode forward current as a function of forward voltage**

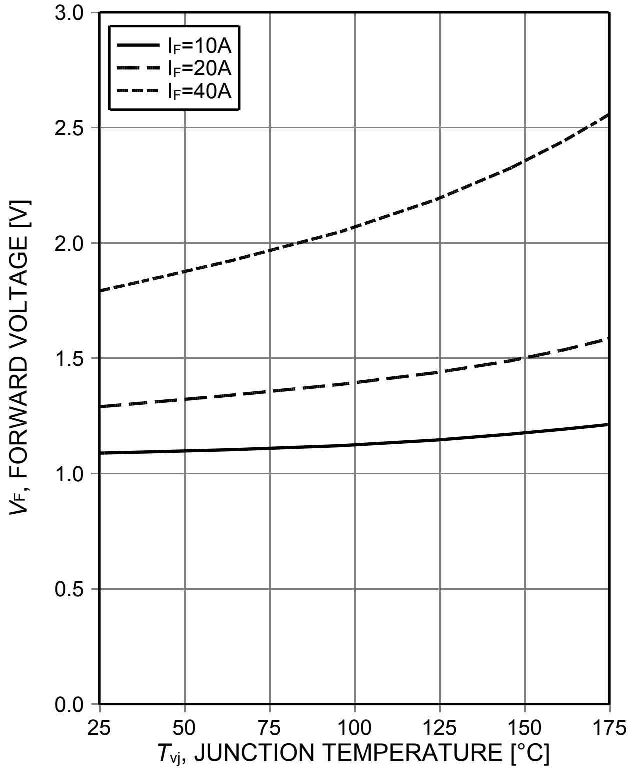


Figure 22. **Typical diode forward voltage as a function of junction temperature**

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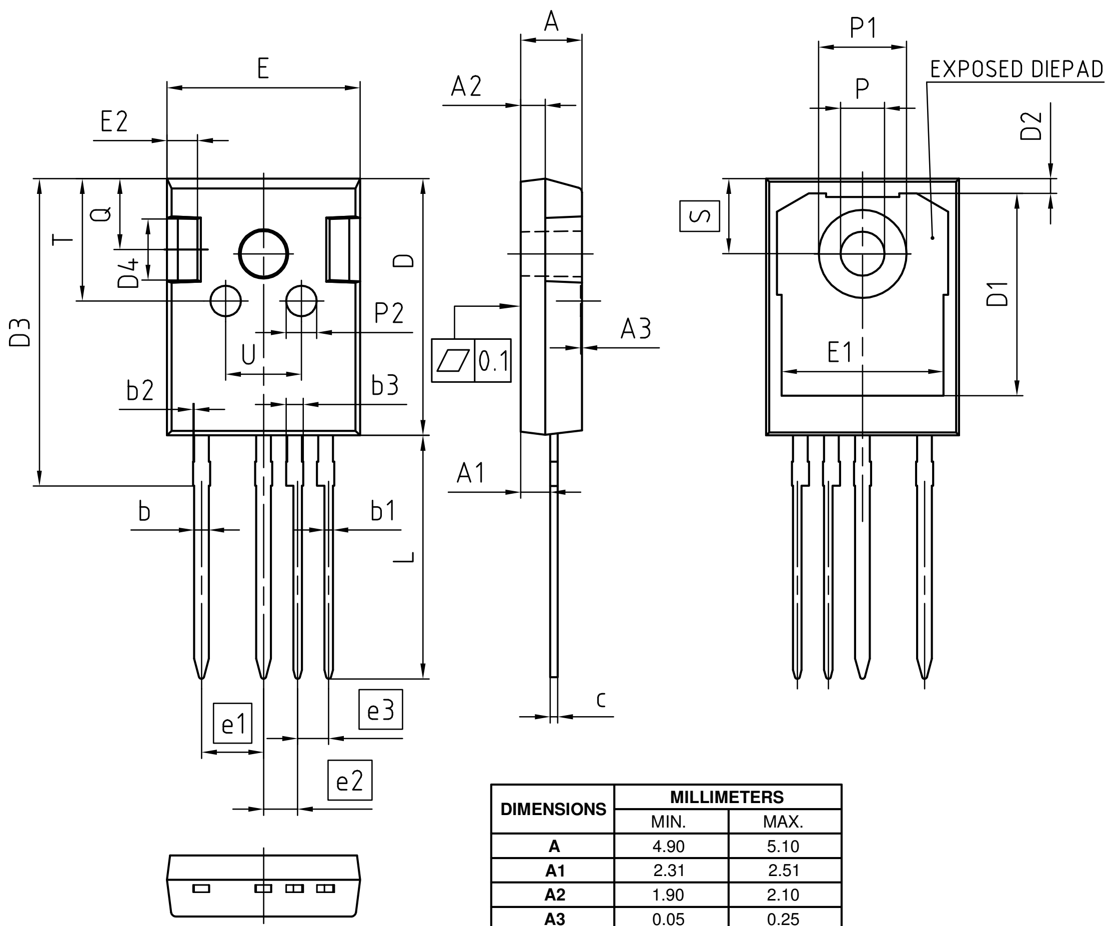


NOTES:
ALL DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

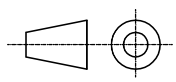
DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.90	5.10
A1	2.31	2.51
A2	1.90	2.10
A3	0.05	0.25
b	1.10	1.30
b1	0.65	0.79
b2	-	0.20
b3	1.34	1.44
c	0.58	0.66
D	20.90	21.10
D1	16.25	16.85
D2	1.05	1.35
D3	24.97	25.27
D4	4.90	5.10
E	15.70	15.90
E1	13.10	13.50
E2	2.40	2.60
e1	5.08	
e2	2.79	
e3	2.54	
L	19.80	20.10
L1	-	4.30
øP	3.50	3.70
øP1	7.00	7.40
øP2	2.40	2.60
Q	5.60	6.00
S	6.15	
T	9.80	10.20
U	6.00	6.40

DOCUMENT NO.
Z8B00184785

REVISION
03

SCALE 2:1
0 5 10mm

EUROPEAN PROJECTION



ISSUE DATE
21.08.2017

Testing Conditions

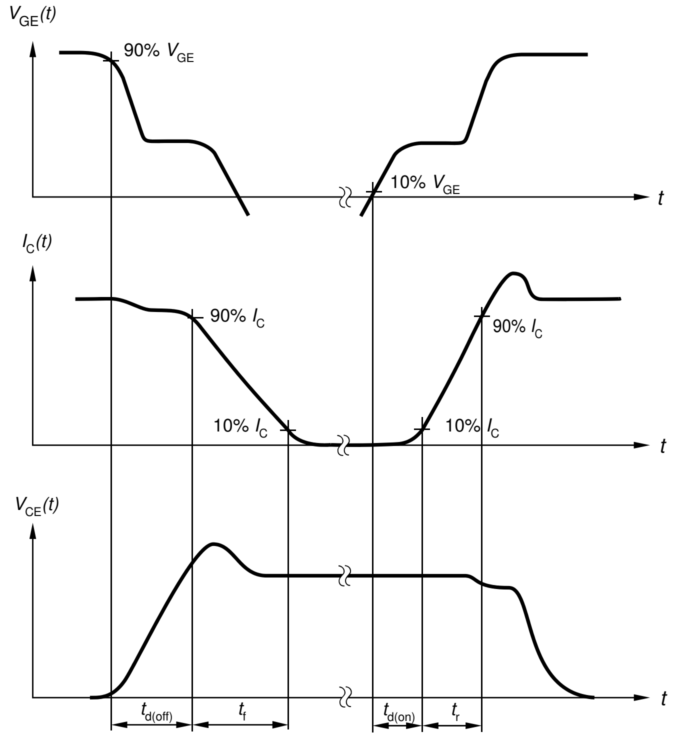


Figure A. **Definition of switching times**

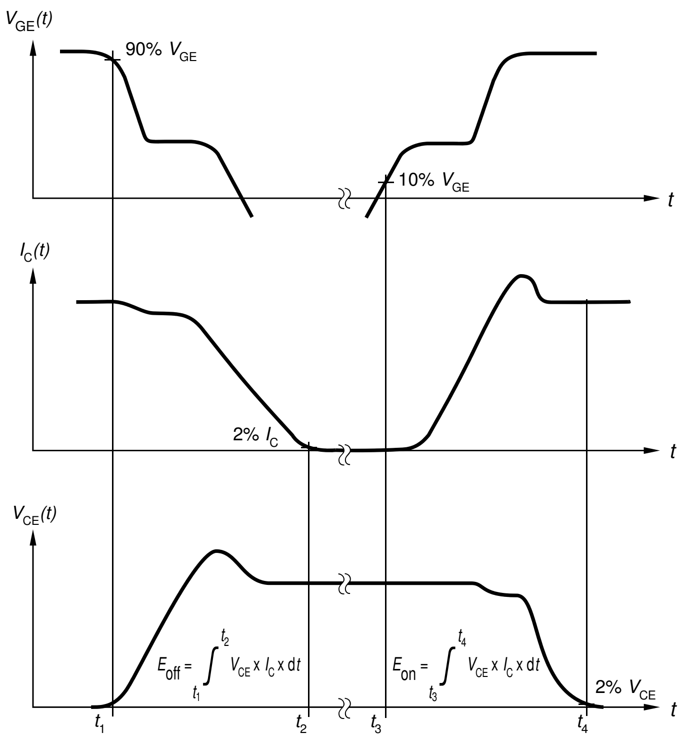


Figure B. **Definition of switching losses**

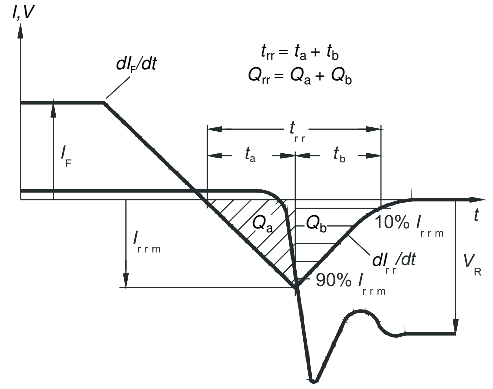


Figure C. **Definition of diode switching characteristics**

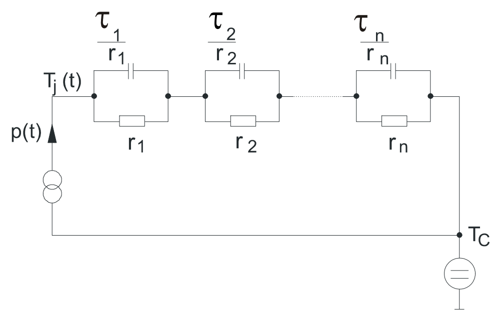


Figure D. **Thermal equivalent circuit**

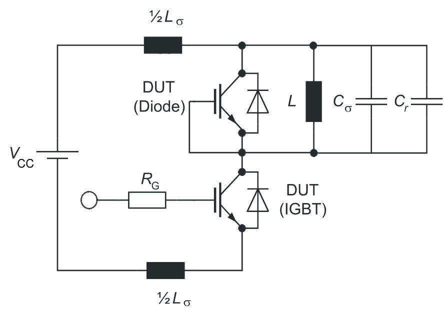


Figure E. **Dynamic test circuit**
Parasitic inductance L_{σ},
parasitic capacitor C_{σ},
relief capacitor C_r,
(only for ZVT switching)

Revision History

IKZA50N65RH5

Revision: 2020-07-27, Rev. 2.1

Previous Revision

Revision	Date	Subjects (major changes since last revision)
1.1	2020-03-20	Preliminary Data Sheet
2.1	2020-07-27	Final Data Sheet

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