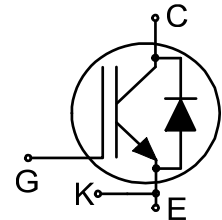


Hybrid CoolSiC™ IGBT

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

Features and Benefits:

- Ultra-low switching losses due to the combination of TRENCHSTOP™ 5 and CoolSiC™ 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	$V_{CEsat}, T_{vj}=25^{\circ}C$	T_{vjmax}	Marking	Package
IKZA50N65RH5	650V	50A	1.65V	175°C	K50ERH5	PG-TO247-4-3

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Hybrid CoolSiC™ IGBT

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}	650	V
DC collector current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ value limited by bondwire $T_c = 100^{\circ}\text{C}$	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 $V_{CE} \leq 650\text{V}$, $T_{vj} \leq 175^{\circ}\text{C}$, $t_p = 1\mu\text{s}$	-	200.0	A
Diode forward current, limited by T_{vjmax} $T_c = 25^{\circ}\text{C}$ $T_c = 100^{\circ}\text{C}$	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 ($t_p \leq 10\mu\text{s}$, $D < 0.010$)	V_{GE}	± 20 ± 30	V
Power dissipation $T_c = 25^{\circ}\text{C}$ Power dissipation $T_c = 100^{\circ}\text{C}$	P_{tot}	305.0 152.5	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

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"

Hybrid CoolSiC™ IGBT

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}	$V_{\text{GE}} = 15.0\text{V}$, $I_{\text{C}} = 50.0\text{A}$ $T_{\text{vj}} = 25^{\circ}\text{C}$ $T_{\text{vj}} = 125^{\circ}\text{C}$ $T_{\text{vj}} = 175^{\circ}\text{C}$	- - -	1.65 1.85 1.95	2.10 - -	V
Diode forward voltage	V_{F}	$V_{\text{GE}} = 0\text{V}$, $I_{\text{F}} = 20.0\text{A}$ $T_{\text{vj}} = 25^{\circ}\text{C}$ $T_{\text{vj}} = 125^{\circ}\text{C}$ $T_{\text{vj}} = 175^{\circ}\text{C}$	- - -	1.35 1.55 1.65	1.50 - -	V
Gate-emitter threshold voltage	$V_{\text{GE(th)}}$	$I_{\text{C}} = 0.50\text{mA}$, $V_{\text{CE}} = V_{\text{GE}}$	3.2	4.0	4.8	V
Zero gate voltage collector current	I_{CES}	$V_{\text{CE}} = 650\text{V}$, $V_{\text{GE}} = 0\text{V}$ $T_{\text{vj}} = 25^{\circ}\text{C}$ $T_{\text{vj}} = 175^{\circ}\text{C}$	- -	- 2000	700 -	μA
Zero gate voltage collector current	I_{CES}	$V_{\text{CE}} = 480\text{V}$, $V_{\text{GE}} = 0\text{V}$ $T_{\text{vj}} = 25^{\circ}\text{C}$	-	-	25	μA
Gate-emitter leakage current	I_{GES}	$V_{\text{CE}} = 0\text{V}$, $V_{\text{GE}} = 20\text{V}$	-	-	100	nA
Transconductance	g_{fs}	$V_{\text{CE}} = 20\text{V}$, $I_{\text{C}} = 50.0\text{A}$	-	62.0	-	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 = 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 $T_{vj} = 25^{\circ}\text{C}$						
Turn-on delay time	$t_{d(\text{on})}$	$T_{vj} = 25^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 25.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_{G(\text{on})} = 12.0\Omega$, $R_{G(\text{off})} = 12.0\Omega$, $L_{\sigma} = 30\text{nH}$, $C_{\sigma} = 30\text{pF}$ L_{σ} , C_{σ} from Fig. E Energy losses include “tail” and diode reverse recovery.	-	21	-	ns
Rise time	t_r		-	6	-	ns
Turn-off delay time	$t_{d(\text{off})}$		-	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

Hybrid CoolSiC™ IGBT

Turn-on delay time	$t_{d(on)}$	$T_{vj} = 25^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 5.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_{G(on)} = 12.0\Omega$, $R_{G(off)} = 12.0\Omega$, $L\sigma = 30\text{nH}$, $C\sigma = 30\text{pF}$ $L\sigma$, $C\sigma$ 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 $T_{vj} = 150^{\circ}\text{C}$

Turn-on delay time	$t_{d(on)}$	$T_{vj} = 150^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 25.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_{G(on)} = 12.0\Omega$, $R_{G(off)} = 12.0\Omega$, $L\sigma = 30\text{nH}$, $C\sigma = 30\text{pF}$ $L\sigma$, $C\sigma$ 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	$t_{d(on)}$	$T_{vj} = 150^{\circ}\text{C}$, $V_{CC} = 400\text{V}$, $I_C = 5.0\text{A}$, $V_{GE} = 0.0/15.0\text{V}$, $R_{G(on)} = 12.0\Omega$, $R_{G(off)} = 12.0\Omega$, $L\sigma = 30\text{nH}$, $C\sigma = 30\text{pF}$ $L\sigma$, $C\sigma$ 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

Hybrid CoolSiC™ IGBT

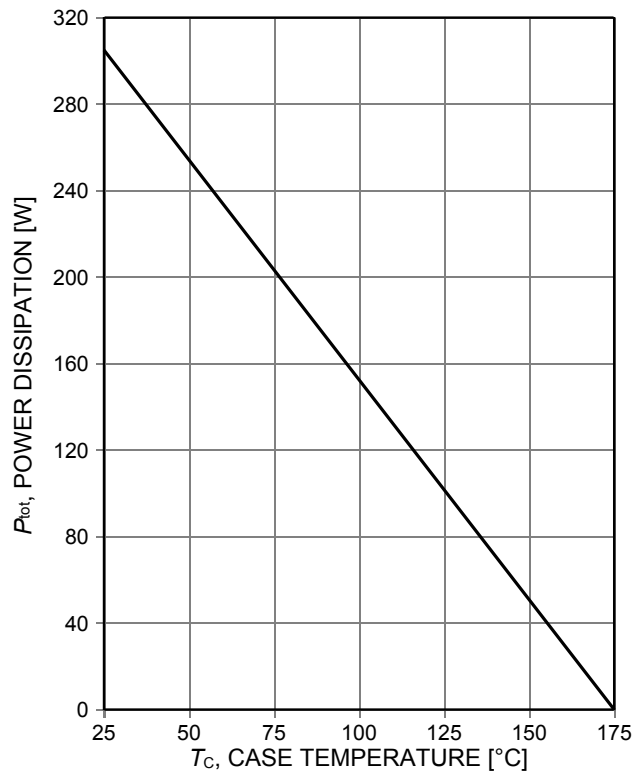


Figure 1. **Power dissipation as a function of case temperature**
($T_{vj} \leq 175^\circ\text{C}$)

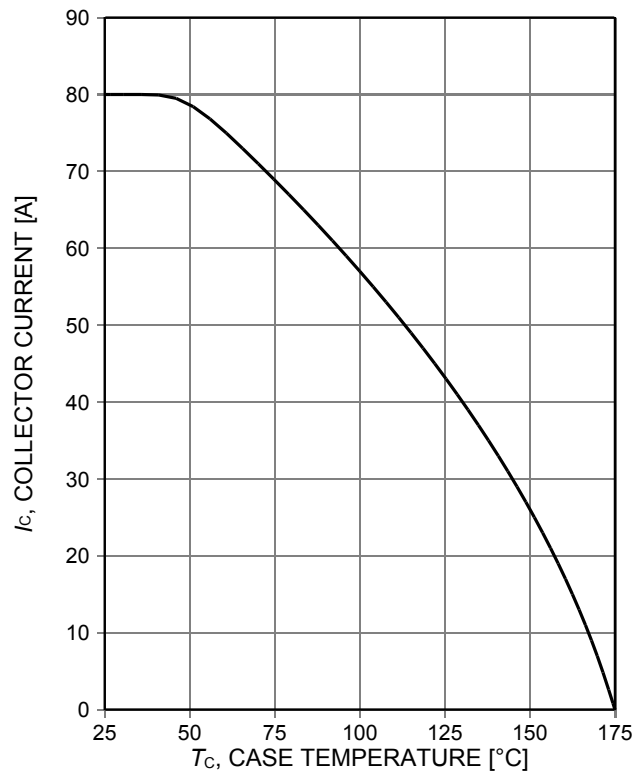


Figure 2. **Collector current as a function of case temperature**
($V_{GE} \geq 15\text{V}$, $T_{vj} \leq 175^\circ\text{C}$)

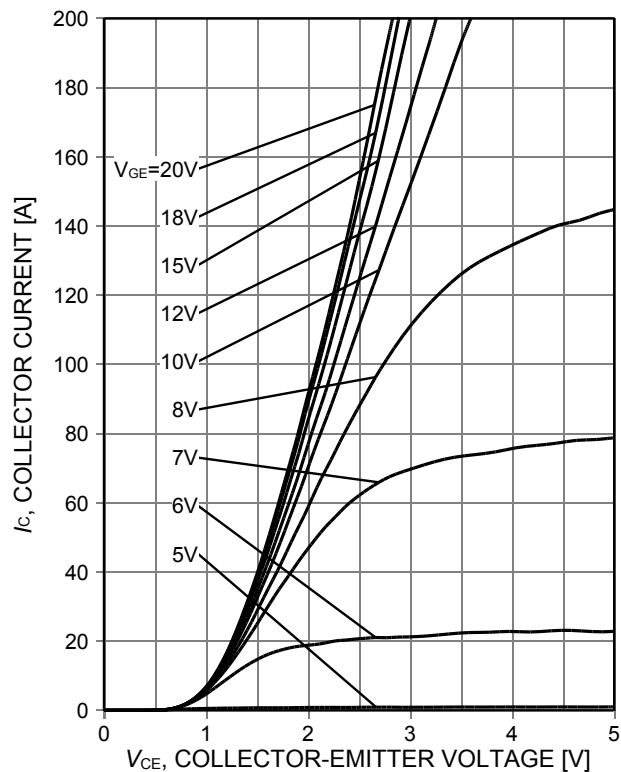


Figure 3. **Typical output characteristic**
($T_{vj} = 25^\circ\text{C}$)

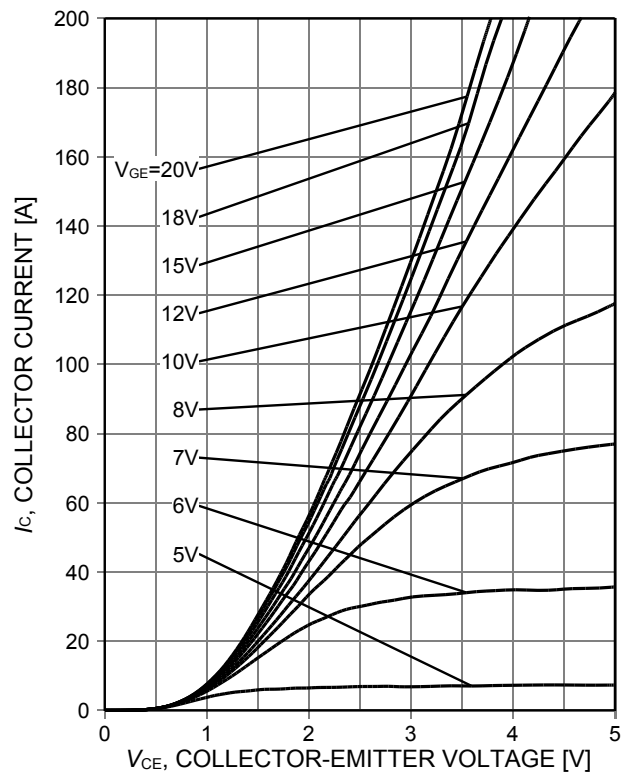


Figure 4. **Typical output characteristic**
($T_{vj} = 150^\circ\text{C}$)

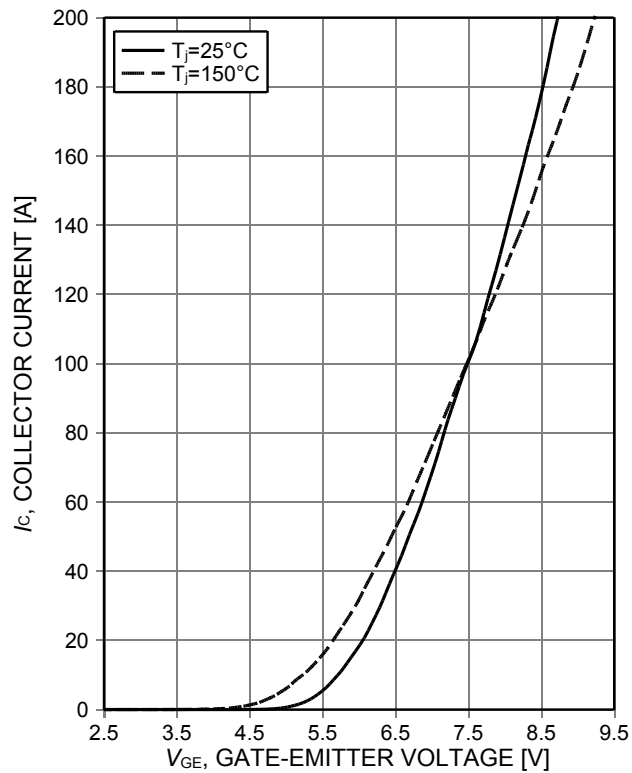


Figure 5. **Typical transfer characteristic**
($V_{CE}=20V$)

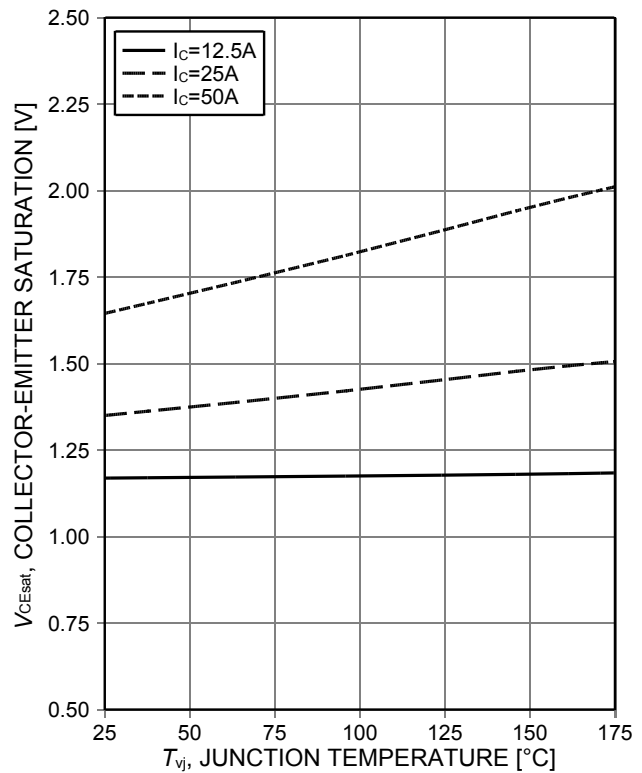


Figure 6. **Typical collector-emitter saturation voltage as a function of junction temperature**
($V_{GE}=15V$)

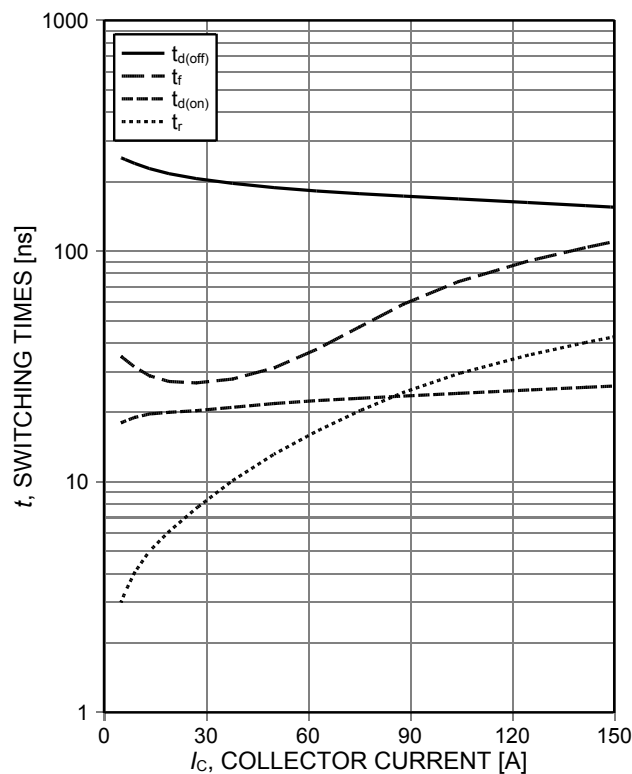


Figure 7. **Typical switching times as a function of collector current**
(inductive load, $T_{vj}=150^{\circ}C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $R_G=12\Omega$, Dynamic test circuit in Figure E)

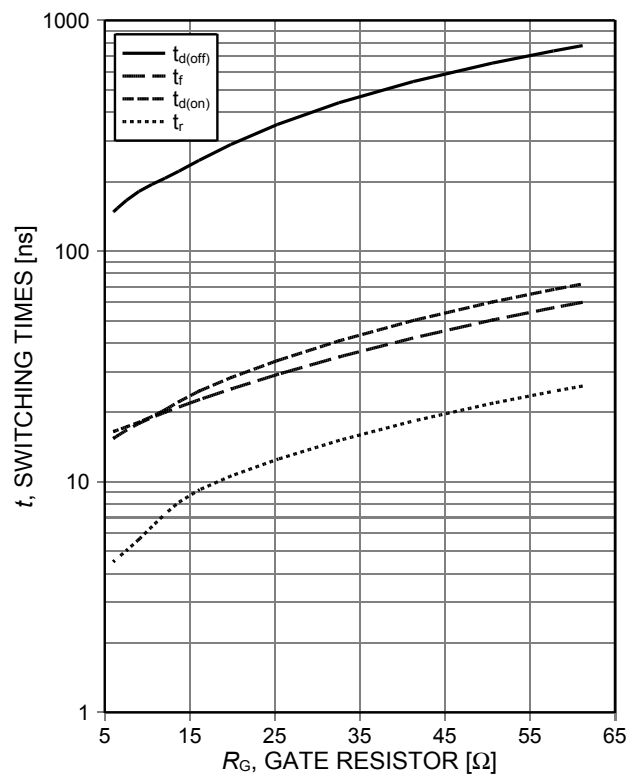


Figure 8. **Typical switching times as a function of gate resistor**
(inductive load, $T_{vj}=150^{\circ}C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=25A$, Dynamic test circuit in Figure E)

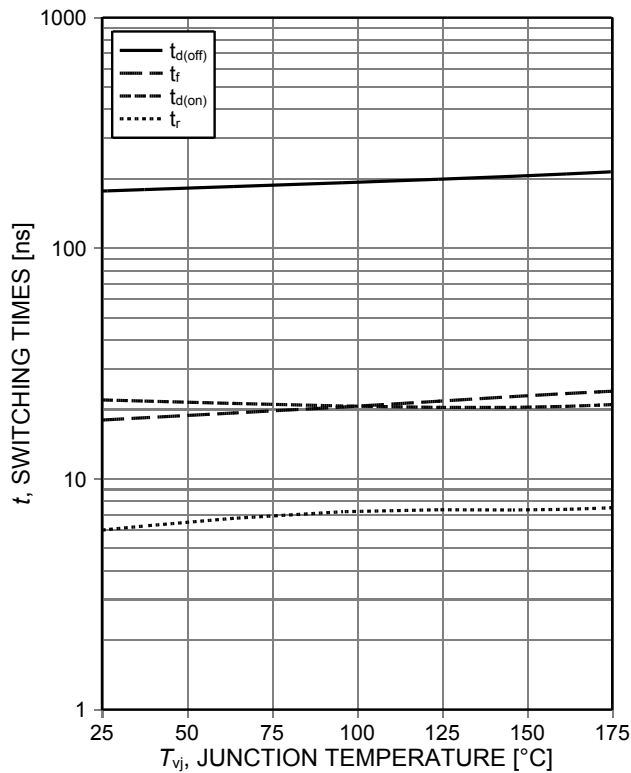


Figure 9. **Typical switching times as a function of junction temperature**
(inductive load, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=25A$, $R_G=12\Omega$, Dynamic test circuit in Figure E)

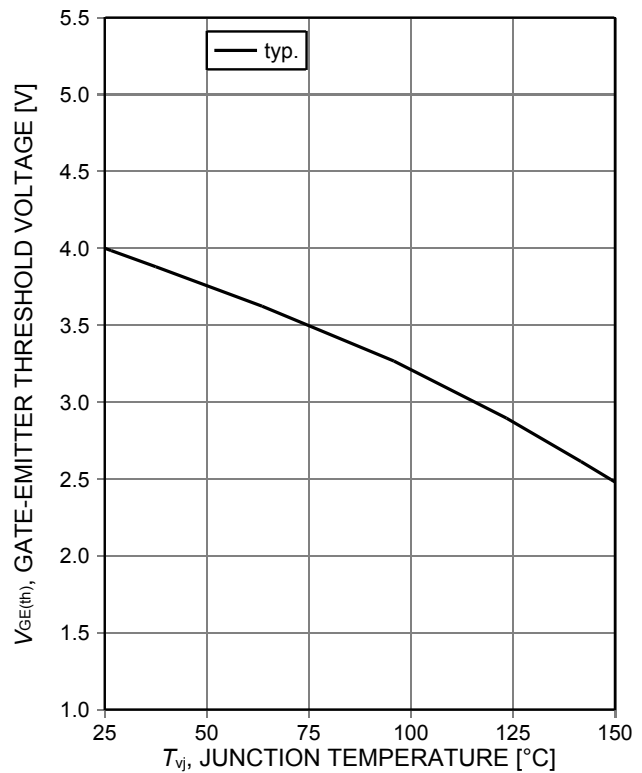


Figure 10. **Gate-emitter threshold voltage as a function of junction temperature**
($I_C=0.5mA$)

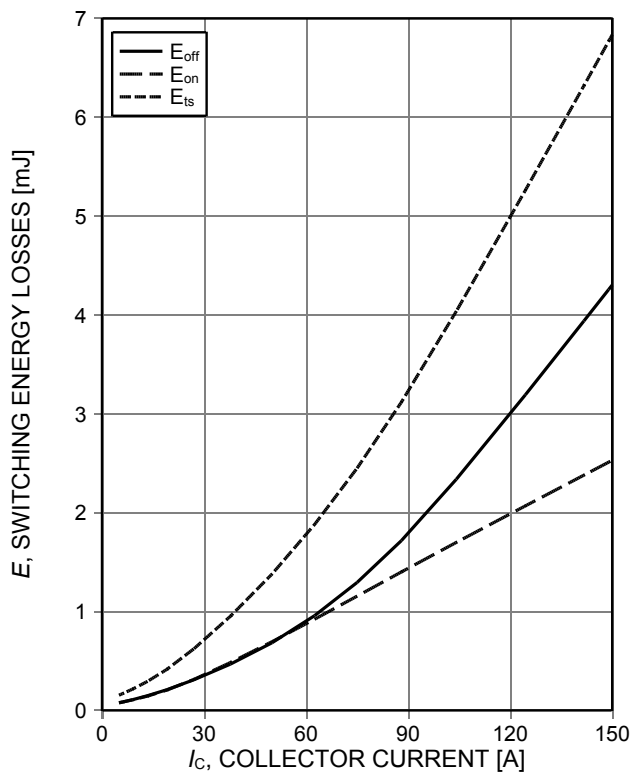


Figure 11. **Typical switching energy losses as a function of collector current**
(inductive load, $T_{vj}=150^{\circ}C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $R_G=12\Omega$, Dynamic test circuit in Figure E)

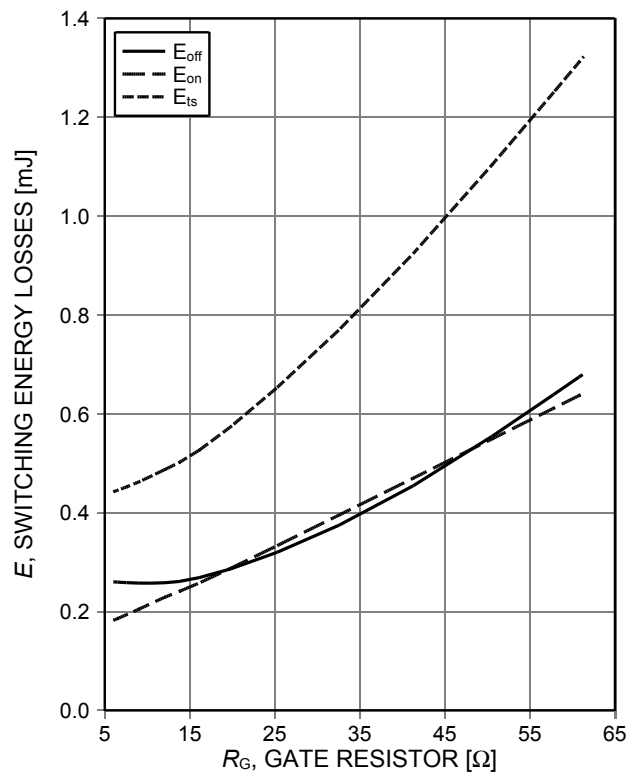


Figure 12. **Typical switching energy losses as a function of gate resistor**
(inductive load, $T_{vj}=150^{\circ}C$, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=25A$, Dynamic test circuit in Figure E)

Hybrid CoolSiC™ IGBT

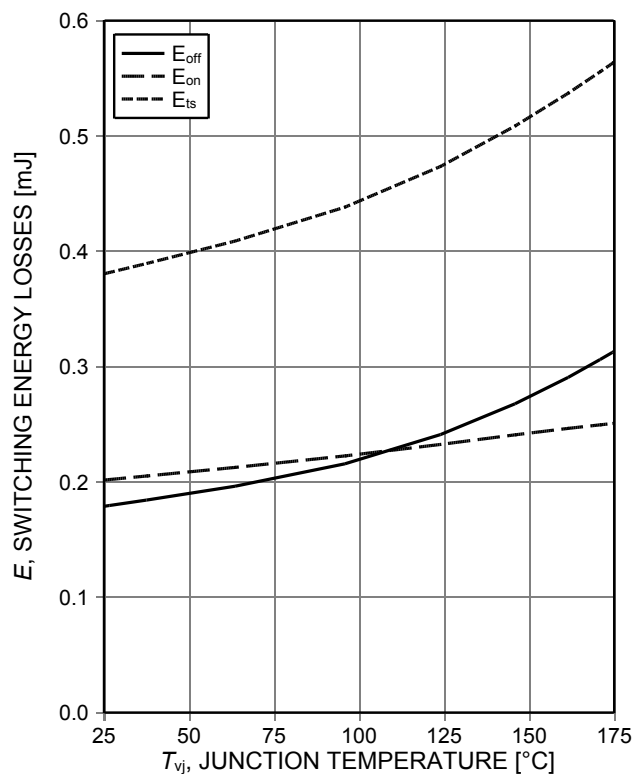


Figure 13. **Typical switching energy losses as a function of junction temperature**
(inductive load, $V_{CE}=400V$, $V_{GE}=15/0V$, $I_C=25A$, $R_G=12\Omega$, Dynamic test circuit in Figure E)

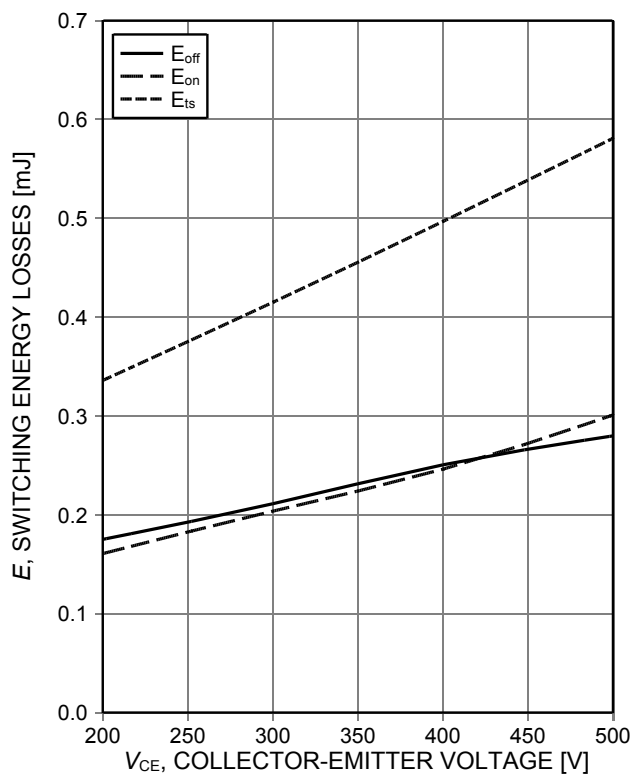


Figure 14. **Typical switching energy losses as a function of collector emitter voltage**
(inductive load, $T_{vj}=150^\circ C$, $V_{GE}=15/0V$, $I_C=25A$, $R_G=12\Omega$, Dynamic test circuit in Figure E)

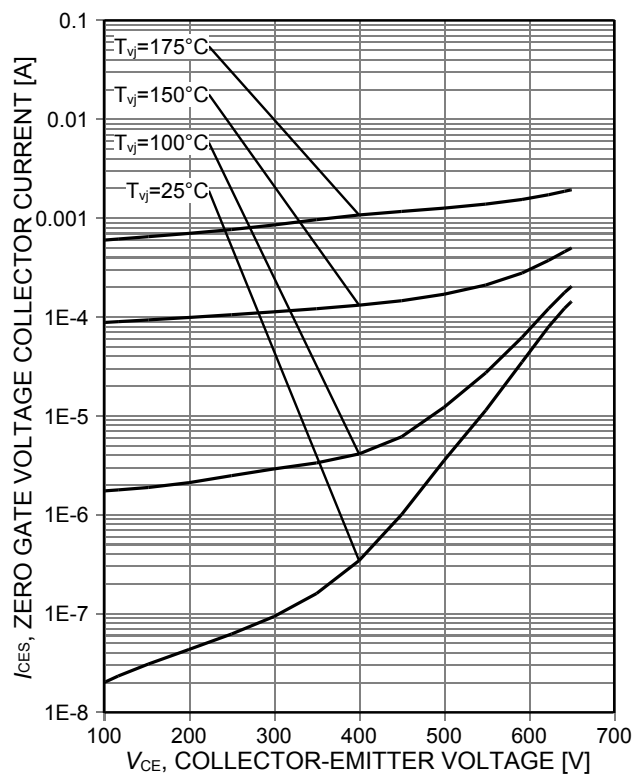


Figure 15. **Typ. reverse current vs. reverse voltage as a function of T_{vj}**

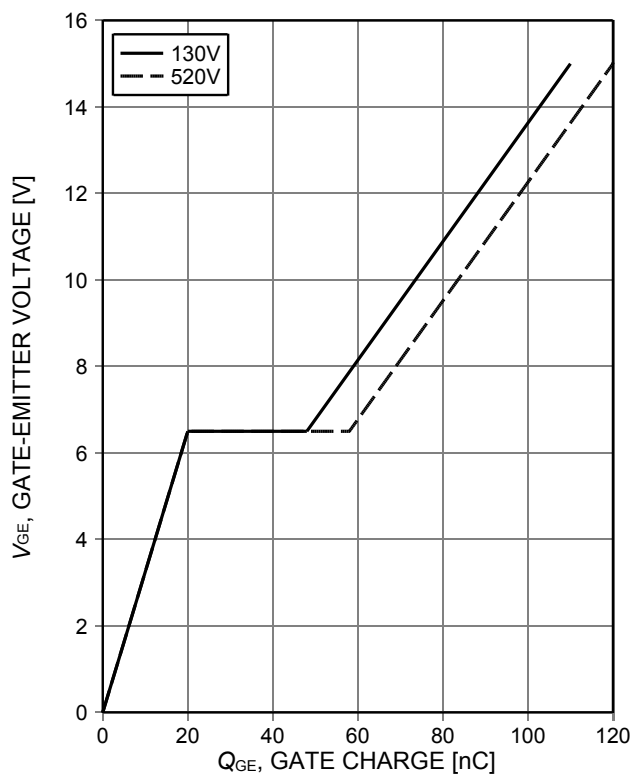


Figure 16. **Typical gate charge**
($I_C=50A$)

Hybrid CoolSiC™ IGBT

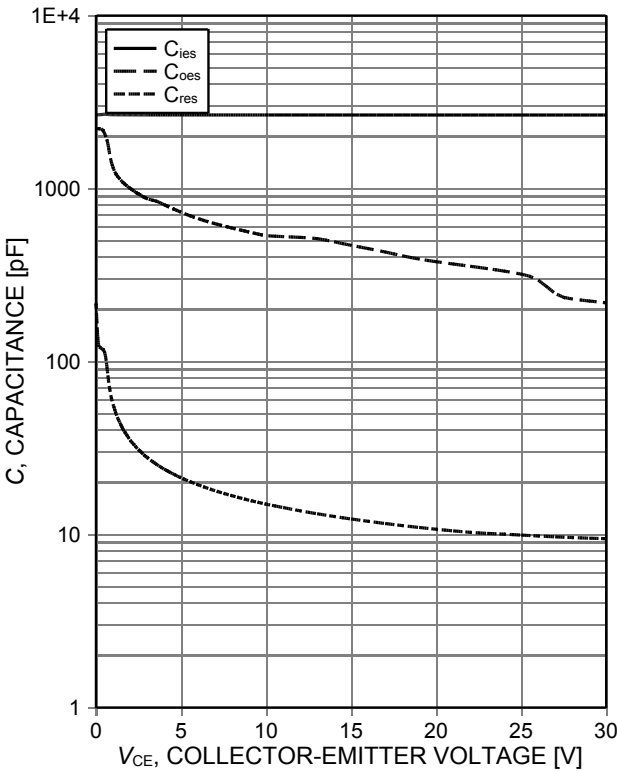


Figure 17. Typical capacitance as a function of collector-emitter voltage ($V_{GE}=0V$, $f=250kHz$)

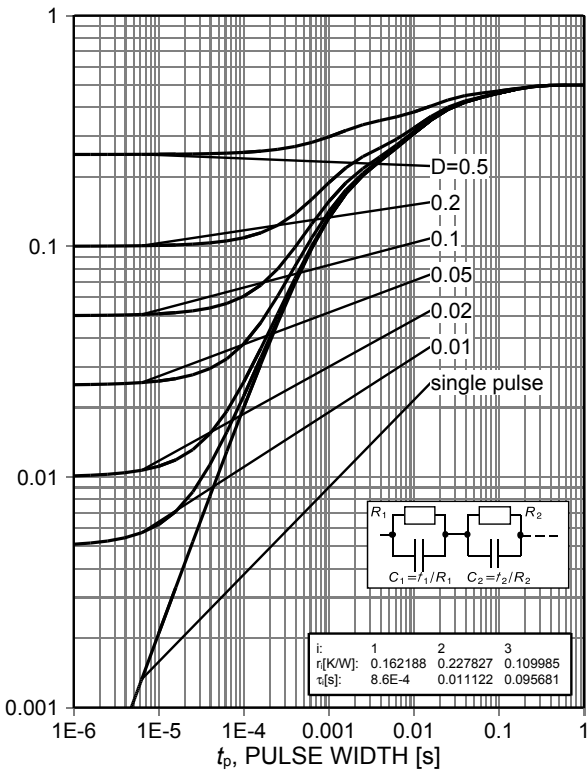


Figure 18. IGBT transient thermal resistance ($D=t_p/T$)

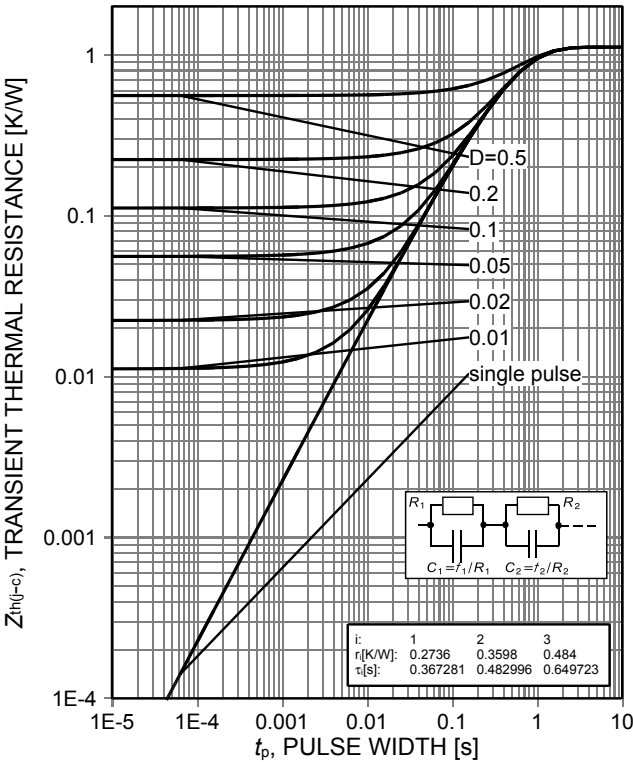


Figure 19. Diode transient thermal impedance as a function of pulse width ($D=t_p/T$)

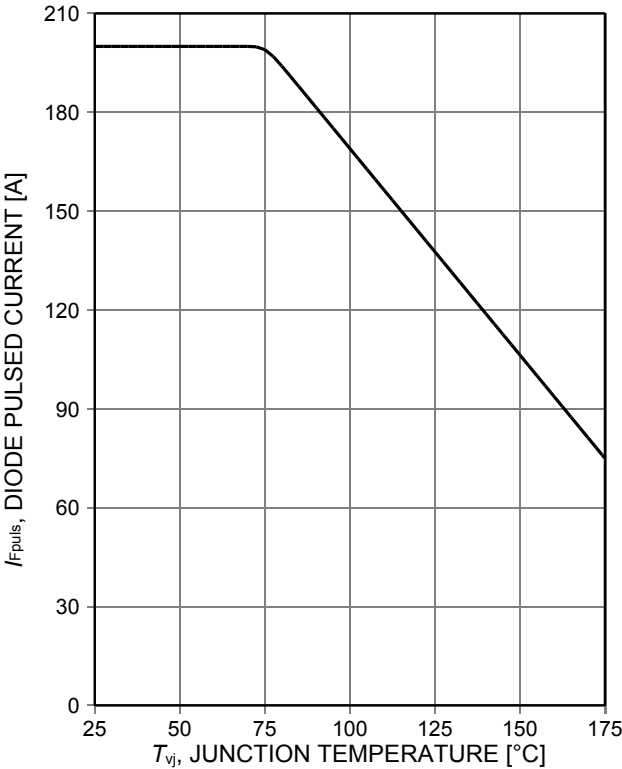


Figure 20. Maximum pulse current as a function of junction temperature

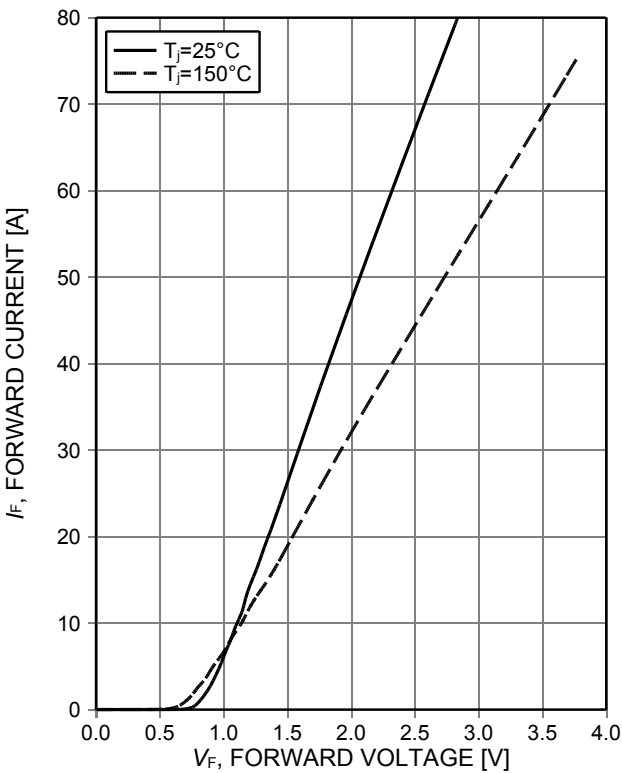


Figure 21. Typical diode forward current as a function of forward voltage

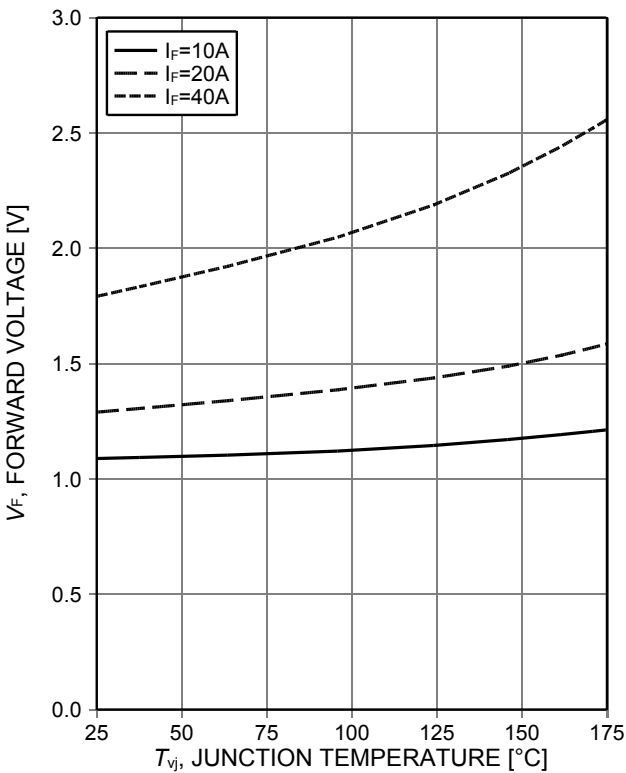
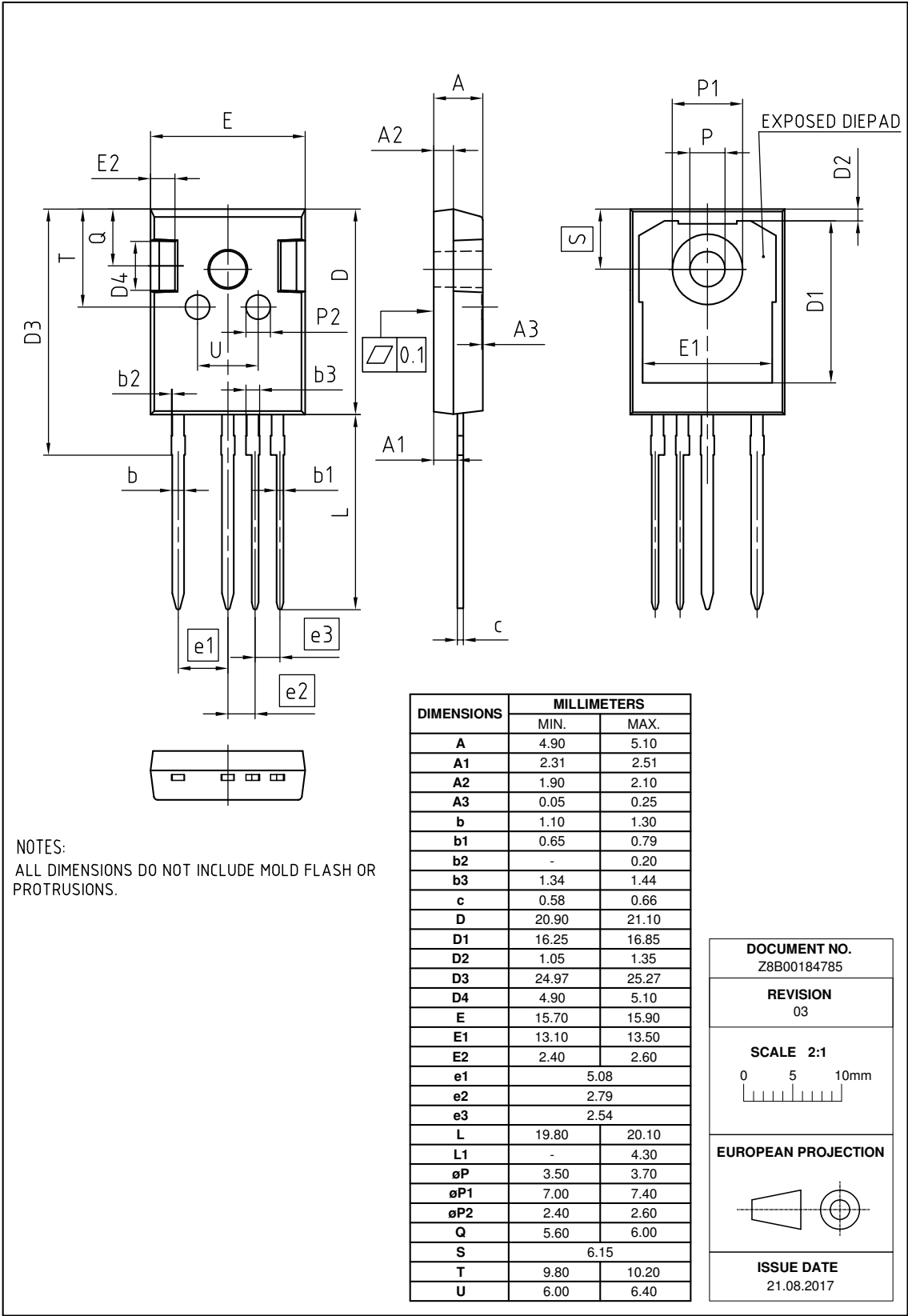


Figure 22. Typical diode forward voltage as a function of junction temperature

PG-TO247-4-3



Testing Conditions

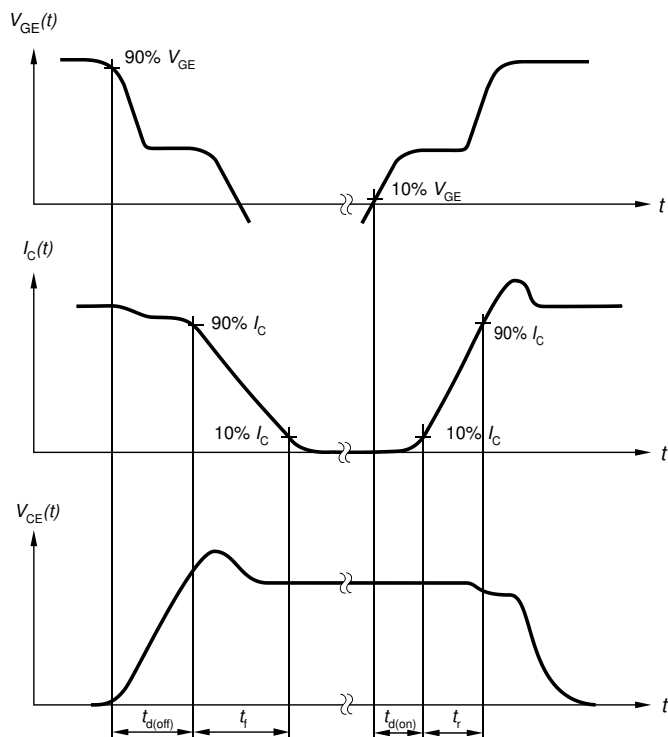


Figure A. Definition of switching times

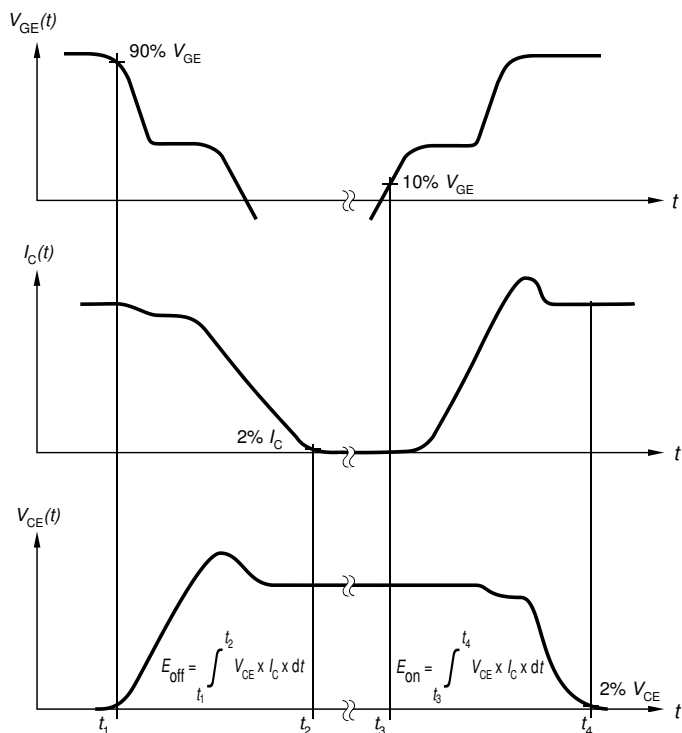


Figure B. Definition of switching losses

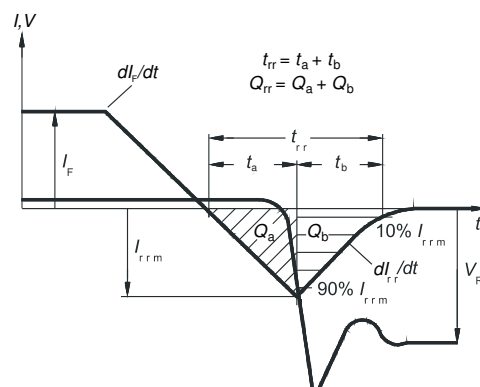


Figure C. Definition of diode switching characteristics

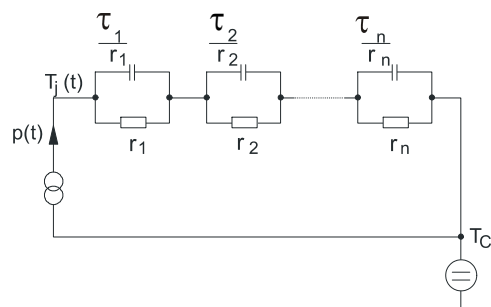


Figure D. Thermal equivalent circuit

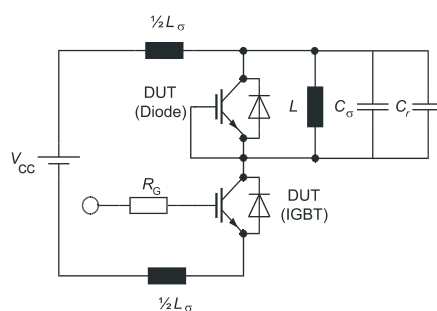


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ ,
parasitic capacitor C_σ ,
relief capacitor C_r ,
(only for ZVT switching)

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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