

Final datasheet

High speed and low saturation voltage 650 V TRENCHSTOP™ IGBT7 technology copacked with soft, fast recovery
Emitter Controlled 7 diode

Features

- $V_{CE} = 650\text{ V}$
- $I_C = 100\text{ A}$
- Low switching losses
- Very low collector-emitter saturation voltage V_{CEsat}
- Very soft, fast recovery antiparallel diode
- Smooth switching behavior
- Humidity robustness
- Optimized for hard switching, two- and three-level topologies
- Complete product spectrum and PSpice Models: <http://www.infineon.com/igbt/>

Potential applications

- Industrial UPS
- EV-Charging
- String inverter
- Welding

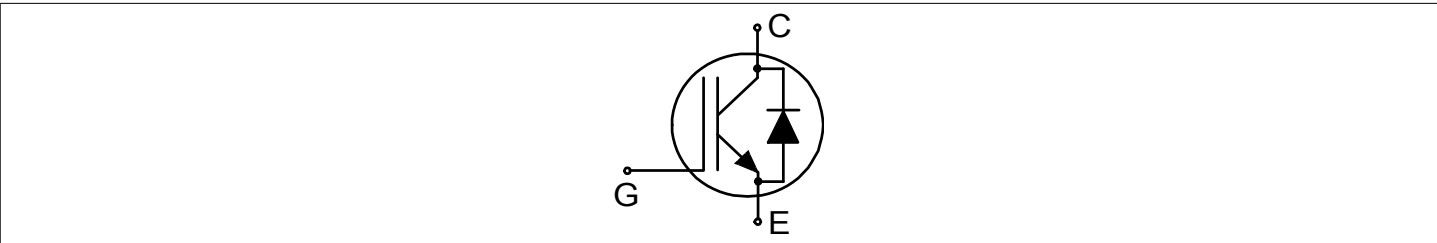
Product validation

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



-  Lead-free
-  Green
-  Halogen-free
-  RoHS

Description



Type	Package	Marking
IKWH100N65EH7	PG-TO247-3-STD-NN4.8	K100EEH7



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1 Package

1 Package

Table 1 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Internal emitter inductance measured 5 mm (0.197 in.) from case	L_E			13		nH
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature	T_{sold}	wave soldering 1.6 mm (0.063 in.) from case for 10 s			260	°C
Mounting torque	M	M3 screw, Maximum of mounting processes: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$			0.27	0.35	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$			0.36	0.47	K/W

2 IGBT

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25\text{ °C}$		650	V
DC collector current, limited by T_{vjmax}	I_C	limited by bondwire	$T_c = 25\text{ °C}$	140	A
			$T_c = 100\text{ °C}$	116	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}			400	A
Turn-off safe operating area		$V_{CE} \leq 650\text{ V}$, $t_p \leq 1\text{ }\mu\text{s}$, $T_{vj} \leq 175\text{ °C}$		400	A
Gate-emitter voltage	V_{GE}			± 20	V
Transient gate-emitter voltage	V_{GE}	$t_p \leq 10\text{ }\mu\text{s}$, $D < 0.01$		± 30	V
Power dissipation	P_{tot}		$T_c = 25\text{ °C}$	427	W
			$T_c = 100\text{ °C}$	214	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 100\text{ A}$, $V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$		1.4	1.65	V
			$T_{vj} = 175\text{ °C}$		1.6		
Gate-emitter threshold voltage	V_{GETh}	$I_C = 0.88\text{ mA}$, $V_{CE} = V_{GE}$		2.9	3.85	4.8	V
Zero gate-voltage collector current	I_{CES}	$V_{CE} = 650\text{ V}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$			30	μA
			$T_{vj} = 175\text{ °C}$		3800		
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = 20\text{ V}$				100	nA
Transconductance	g_{fs}	$I_C = 100\text{ A}$, $V_{CE} = 20\text{ V}$			104		S
Input capacitance	C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$			5221		pF
Output capacitance	C_{oes}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$			159		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$			20.9		pF
Gate charge	Q_G	$V_{CC} = 520\text{ V}$, $I_C = 100\text{ A}$, $V_{GE} = 15\text{ V}$			199		nC
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\text{ }\Omega$, $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 100\text{ A}$		32		ns
			$T_{vj} = 175\text{ °C}$, $I_C = 100\text{ A}$		32		
Rise time (inductive load)	t_r	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\text{ }\Omega$, $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 100\text{ A}$		56		ns
			$T_{vj} = 175\text{ °C}$, $I_C = 100\text{ A}$		56		
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\text{ }\Omega$, $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 100\text{ A}$		240		ns
			$T_{vj} = 175\text{ °C}$, $I_C = 100\text{ A}$		270		
Fall time (inductive load)	t_f	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\text{ }\Omega$, $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 100\text{ A}$		82		ns
			$T_{vj} = 175\text{ °C}$, $I_C = 100\text{ A}$		79		
Turn-on energy	E_{on}	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\text{ }\Omega$, $R_{G(off)} = 10\text{ }\Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 100\text{ A}$		3.58		mJ
			$T_{vj} = 175\text{ °C}$, $I_C = 100\text{ A}$		5.3		

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off energy	E_{off}	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\ \Omega$, $R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 100\text{ A}$	2.37		mJ
			$T_{vj} = 175\text{ °C}$, $I_C = 100\text{ A}$	2.6		
Total switching energy	E_{ts}	$V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_{G(on)} = 10\ \Omega$, $R_{G(off)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}$, $I_C = 100\text{ A}$	5.95		mJ
			$T_{vj} = 175\text{ °C}$, $I_C = 100\text{ A}$	7.9		
Operating junction temperature	T_{vj}		-40		175	°C

3 Diode

Table 4 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Diode forward current, limited by T_{vjmax}	I_F	limited by bondwire	$T_c = 25\text{ °C}$	A
			$T_c = 100\text{ °C}$	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}		400	A
Power dissipation	P_{tot}		$T_c = 25\text{ °C}$	W
			$T_c = 100\text{ °C}$	

Table 5 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 100\text{ A}$	$T_{vj} = 25\text{ °C}$	1.65	2	V
			$T_{vj} = 175\text{ °C}$	1.55		
Diode reverse recovery time	t_{rr}	$V_R = 400\text{ V}$, $R_{G(on)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}$, $I_F = 100\text{ A}$	106		ns
			$T_{vj} = 175\text{ °C}$, $I_F = 100\text{ A}$	178		
Diode reverse recovery charge	Q_{rr}	$V_R = 400\text{ V}$, $R_{G(on)} = 10\ \Omega$	$T_{vj} = 25\text{ °C}$, $I_F = 100\text{ A}$	2.3		μC
			$T_{vj} = 175\text{ °C}$, $I_F = 100\text{ A}$	6.1		

(table continues...)

Table 5 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Diode peak reverse recovery current	I_{rrm}	$V_R = 400 \text{ V}, R_{G(on)} = 10 \Omega$		$T_{vj} = 25^\circ\text{C}, I_F = 100 \text{ A}$	36.4	A
				$T_{vj} = 175^\circ\text{C}, I_F = 100 \text{ A}$	55.5	
Diode peak rate of fall of reverse recovery current	di_{rr}/dt	$V_R = 400 \text{ V}, R_{G(on)} = 10 \Omega$		$T_{vj} = 25^\circ\text{C}, I_F = 100 \text{ A}$	-2170	A/ μs
				$T_{vj} = 175^\circ\text{C}, I_F = 100 \text{ A}$	-1980	
Reverse recovery energy	E_{rec}	$V_R = 400 \text{ V}, R_{G(on)} = 10 \Omega$		$T_{vj} = 25^\circ\text{C}, I_F = 100 \text{ A}$	0.52	mJ
				$T_{vj} = 175^\circ\text{C}, I_F = 100 \text{ A}$	1.5	
Operating junction temperature	T_{vj}		-40		175	$^\circ\text{C}$

Note: For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

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

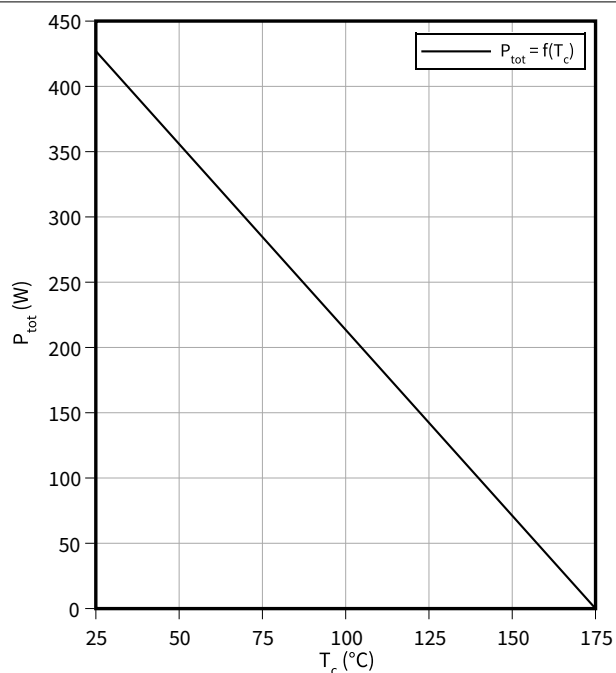
Dynamic test circuit, parasitic inductance $L_\sigma = 8 \text{ nH}$, parasitic capacitor $C_\sigma = 30 \text{ pF}$ from Fig. E. Energy losses include "tail" and diode reverse recovery.

4 Characteristics diagrams

Power dissipation as a function of case temperature

$$P_{\text{tot}} = f(T_c)$$

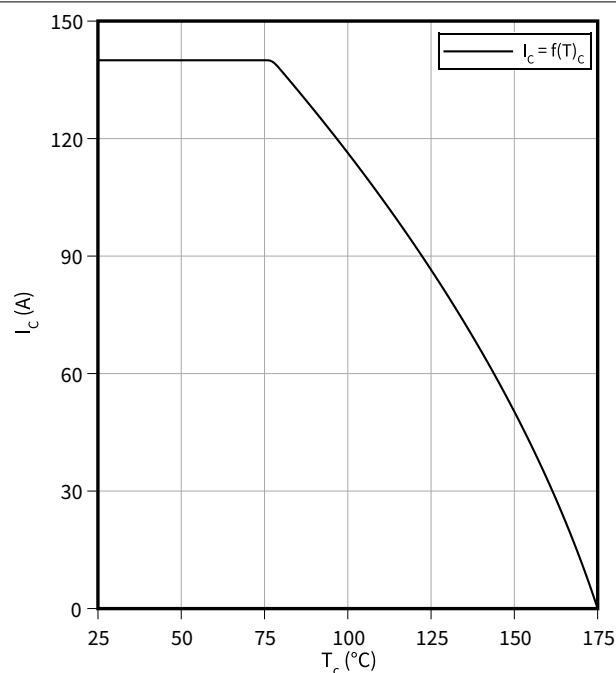
$$T_{vj} \leq 175\text{ °C}$$



Collector current as a function of case temperature

$$I_c = f(T_c)$$

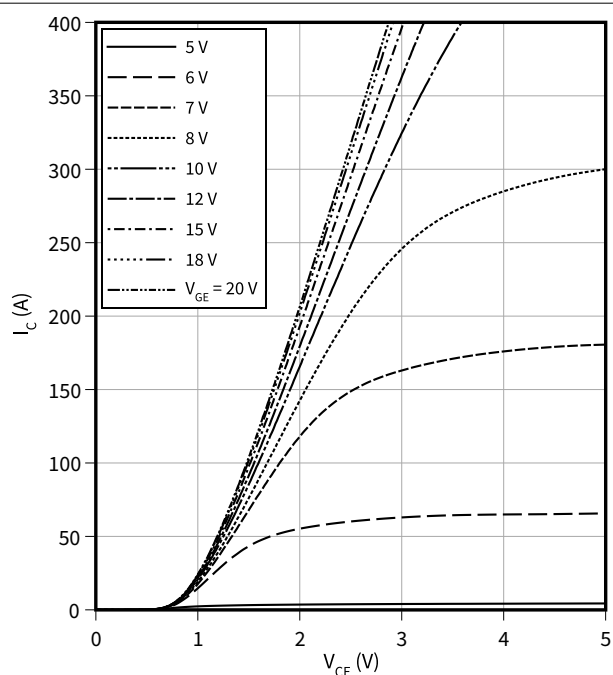
$$T_{vj} \leq 175\text{ °C}, V_{GE} \geq 15\text{ V}$$



Typical output characteristic

$$I_c = f(V_{CE})$$

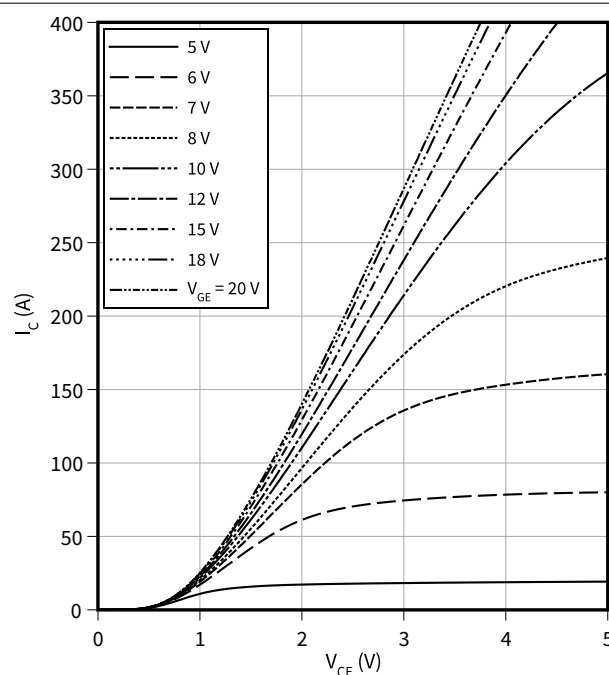
$$T_{vj} = 25\text{ °C}$$



Typical output characteristic

$$I_c = f(V_{CE})$$

$$T_{vj} = 175\text{ °C}$$

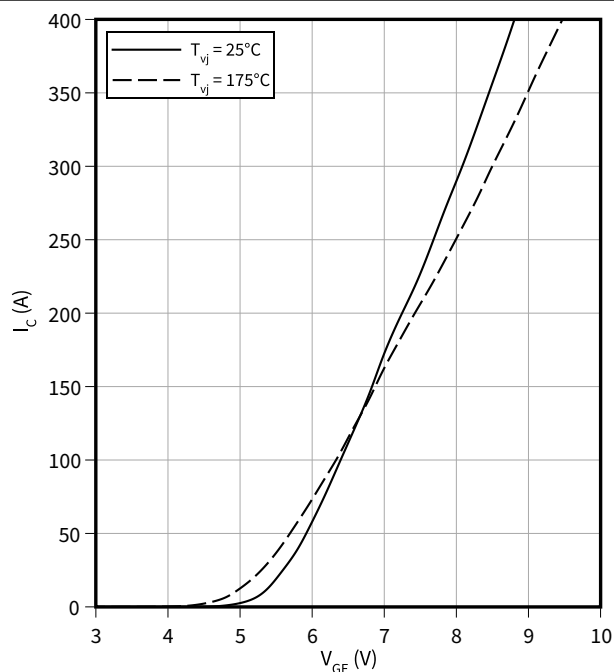


4 Characteristics diagrams

Typical transfer characteristic

$$I_C = f(V_{GE})$$

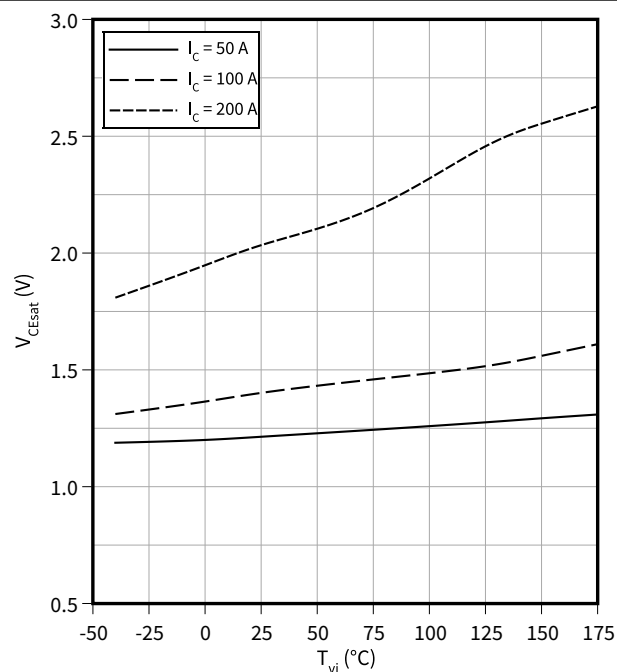
$$V_{CE} = 20 \text{ V}$$



Typical collector-emitter saturation voltage as a function of junction temperature

$$V_{CEsat} = f(T_{vj})$$

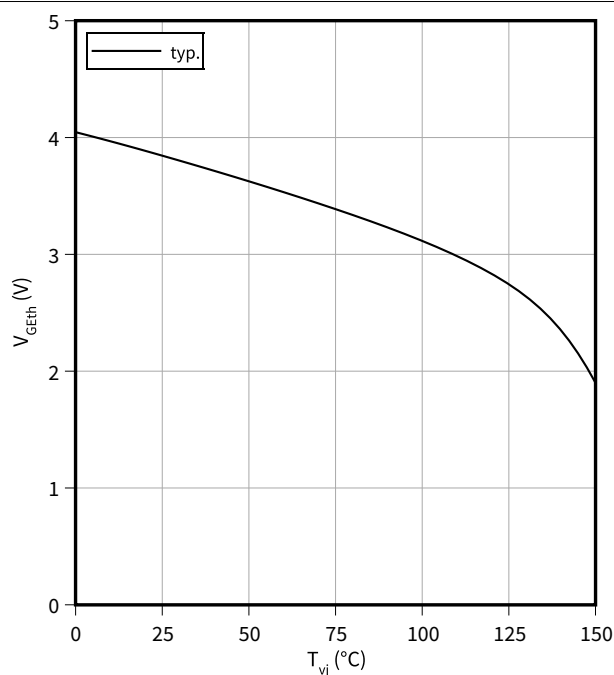
$$V_{GE} = 15 \text{ V}$$



Gate-emitter threshold voltage as a function of junction temperature

$$V_{GEth} = f(T_{vj})$$

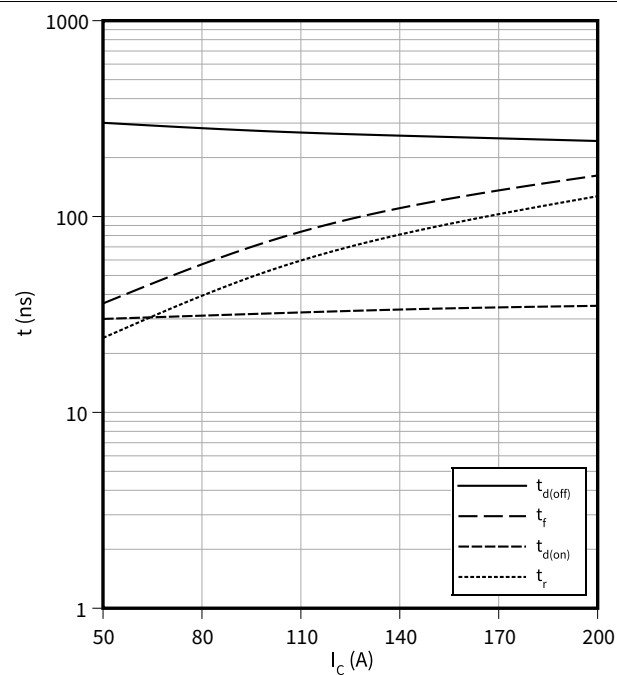
$$I_C = 0.88 \text{ mA}$$



Typical switching times as a function of collector current

$$t = f(I_C)$$

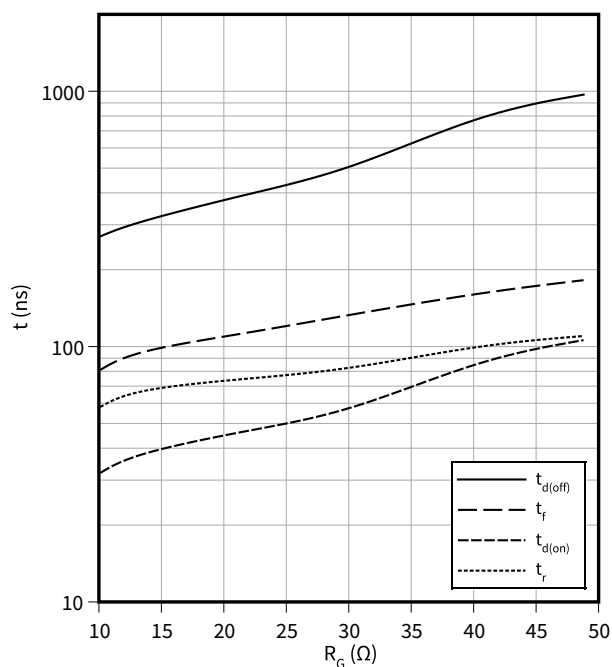
$$V_{CC} = 400 \text{ V}, T_{vj} = 175^\circ\text{C}, V_{GE} = 0/15 \text{ V}, R_G = 10 \Omega$$



4 Characteristics diagrams

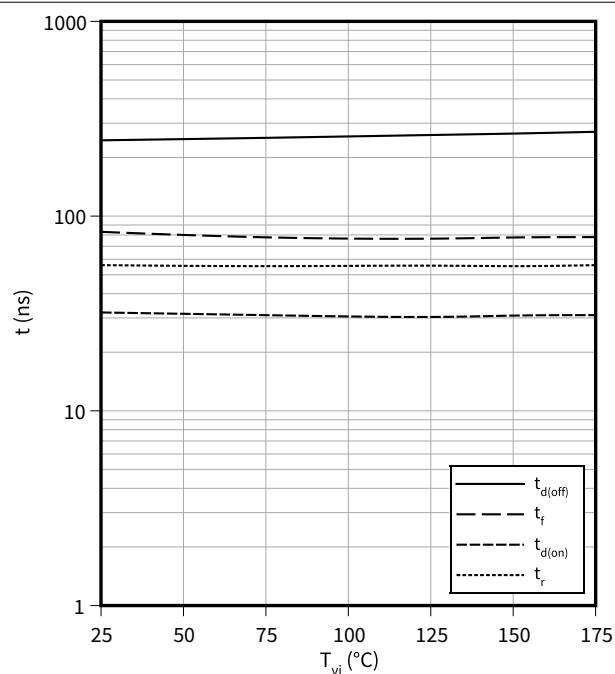
Typical switching times as a function of gate resistor

$$t = f(R_G)$$

 $I_C = 100\text{ A}, V_{CC} = 400\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}$


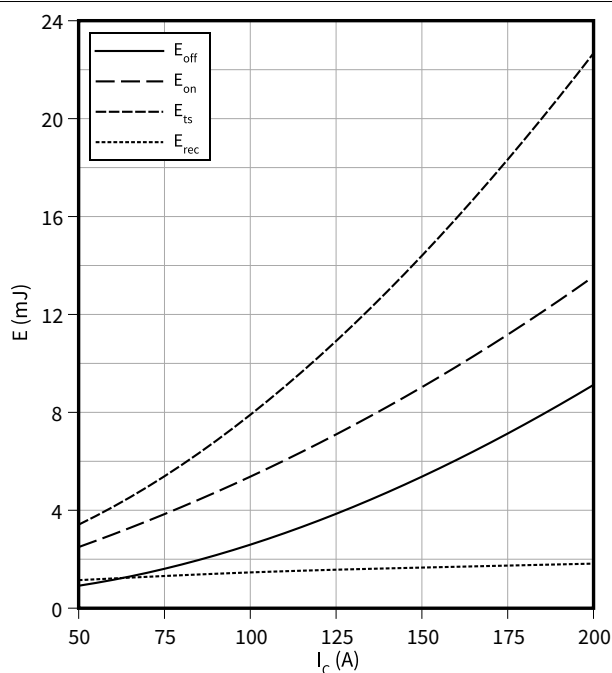
Typical switching times as a function of junction temperature

$$t = f(T_{vj})$$

 $I_C = 100\text{ A}, V_{CC} = 400\text{ V}, V_{GE} = 0/15\text{ V}, R_G = 10\text{ Ω}$


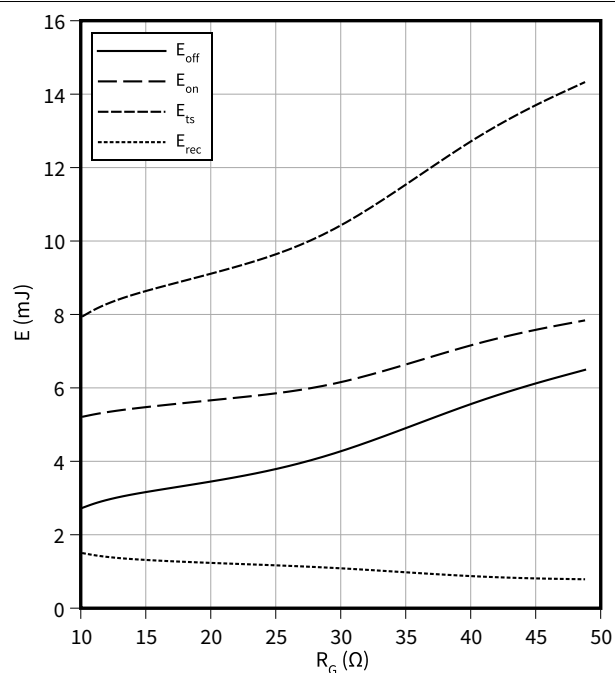
Typical switching energy losses as a function of collector current

$$E = f(I_C)$$

 $V_{CC} = 400\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}, R_G = 10\text{ Ω}$


Typical switching energy losses as a function of gate resistor

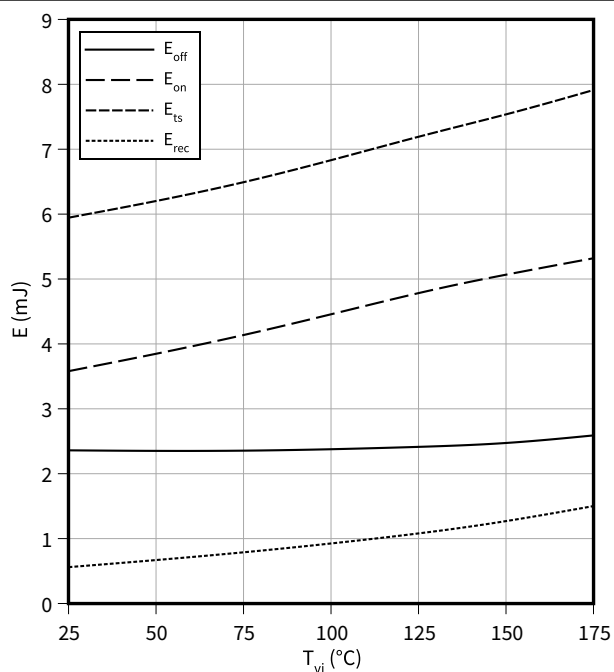
$$E = f(R_G)$$

 $I_C = 100\text{ A}, V_{CC} = 400\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}$


4 Characteristics diagrams

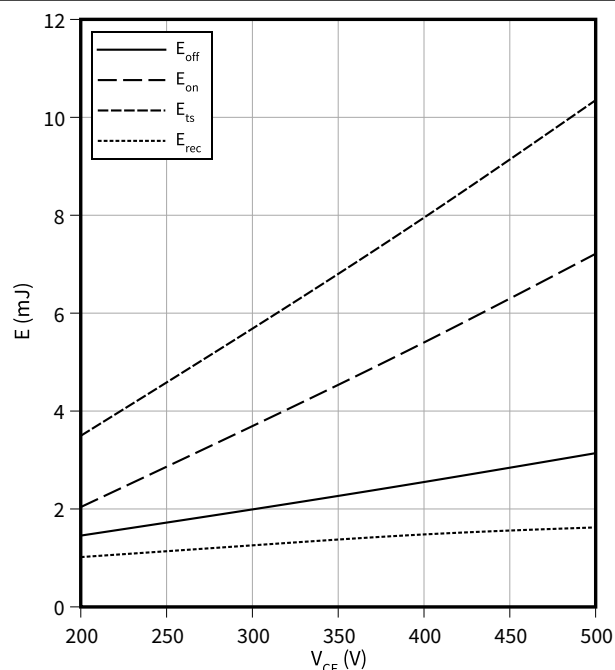
Typical switching energy losses as a function of junction temperature

$$E = f(T_{vj})$$

 $I_C = 100\text{ A}$, $V_{CC} = 400\text{ V}$, $V_{GE} = 0/15\text{ V}$, $R_G = 10\ \Omega$


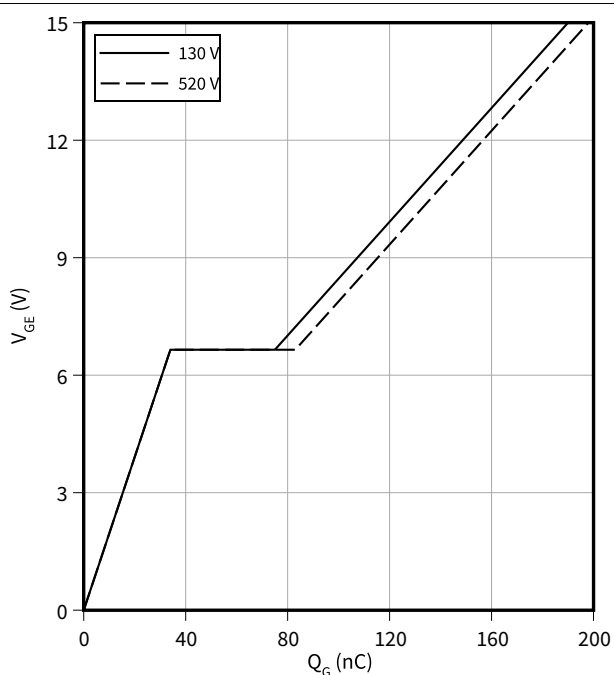
Typical switching energy losses as a function of collector emitter voltage

$$E = f(V_{CE})$$

 $I_C = 100\text{ A}$, $T_{vj} = 175\text{ °C}$, $V_{GE} = 0/15\text{ V}$, $R_G = 10\ \Omega$


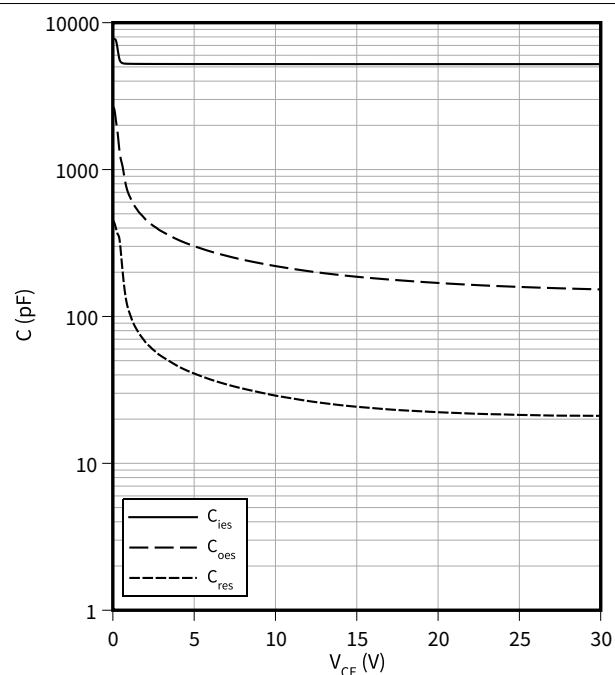
Typical gate charge

$$V_{GE} = f(Q_G)$$

 $I_C = 100\text{ A}$


Typical capacitance as a function of collector-emitter voltage

$$C = f(V_{CE})$$

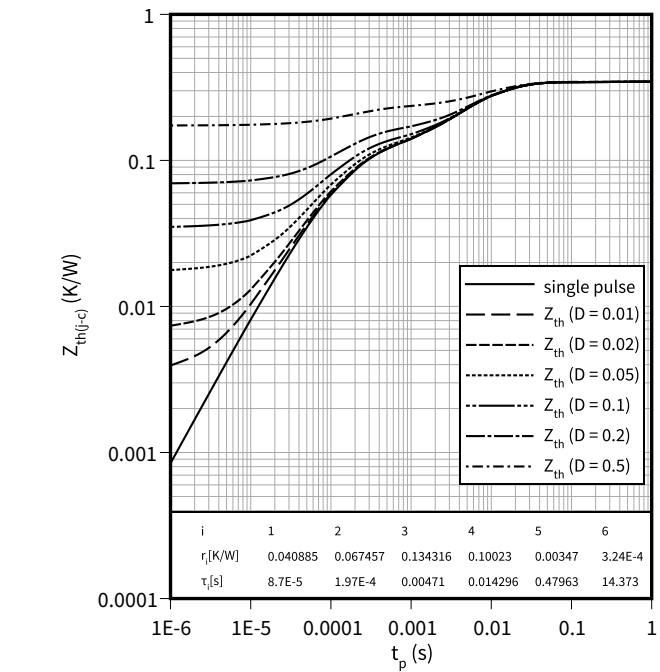
 $f = 100\text{ kHz}$, $V_{GE} = 0\text{ V}$


4 Characteristics diagrams

IGBT transient thermal impedance as a function of pulse width

$$Z_{th(j-c)} = f(t_p)$$

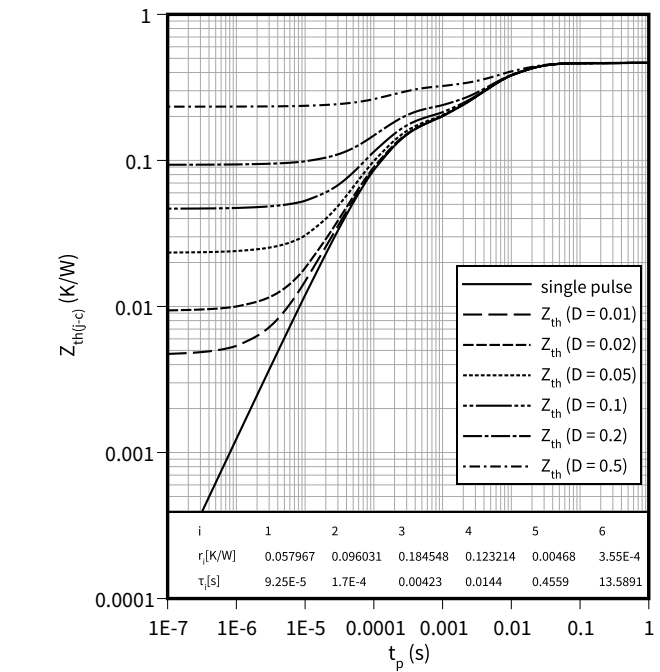
$$D = t_p/T$$



Diode transient thermal impedance as a function of pulse width

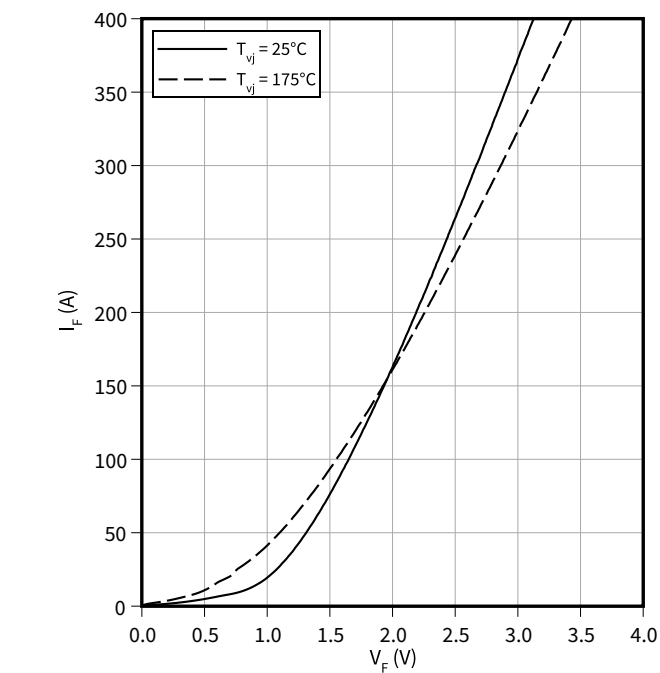
$$Z_{th(j-c)} = f(t_p)$$

$$D = t_p/T$$



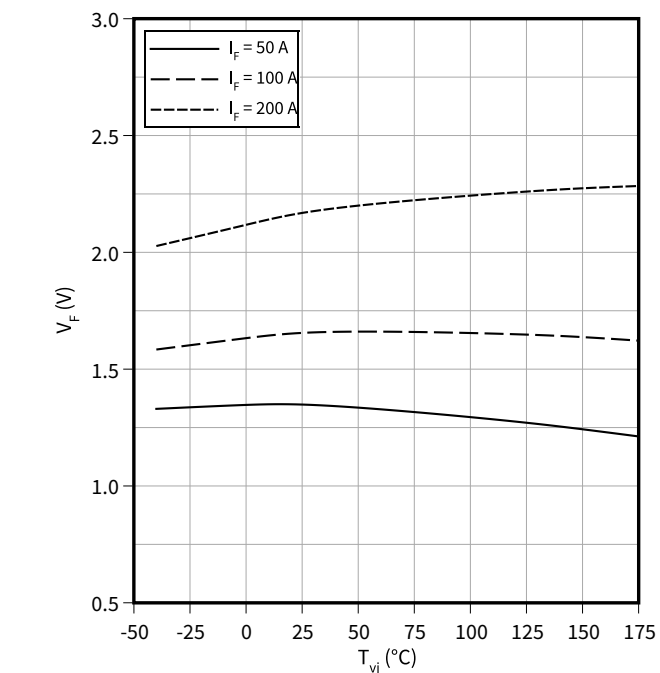
Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$



Typical diode forward voltage as a function of junction temperature

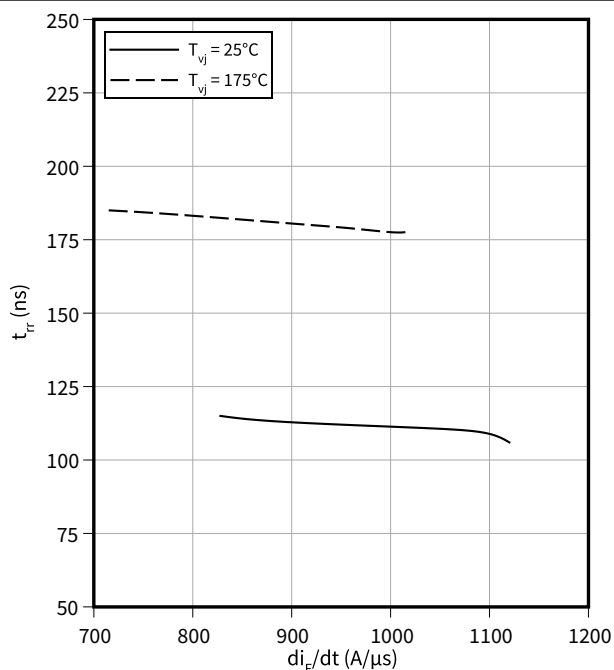
$$V_F = f(T_{vj})$$



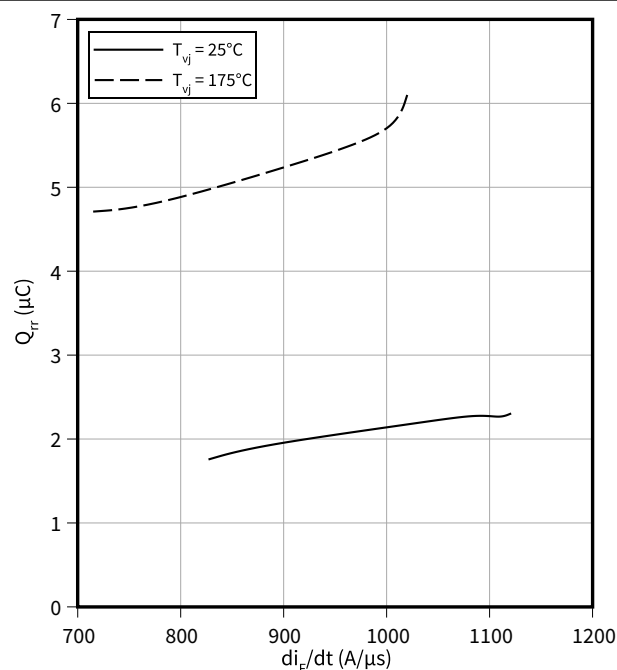
4 Characteristics diagrams

Typical reverse recovery time as a function of diode current slope

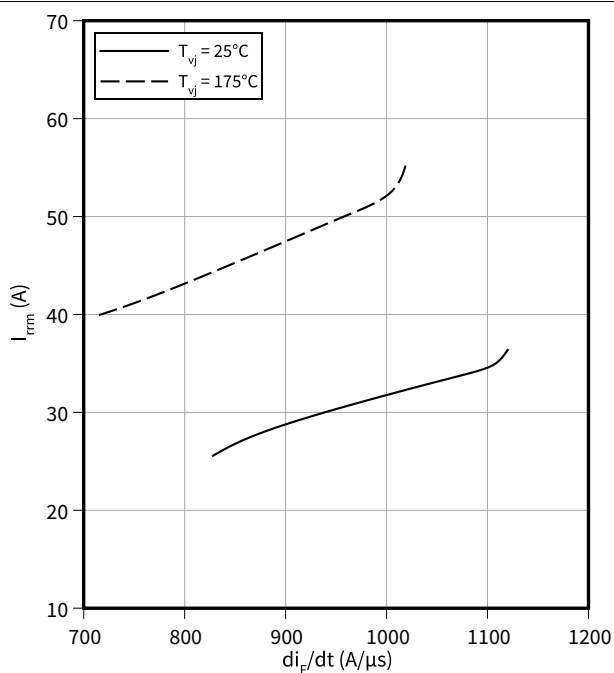
$$t_{rr} = f(di_F/dt)$$

 $V_R = 400 \text{ V}, I_F = 100 \text{ A}$
**Typical reverse recovery charge as a function of diode current slope**

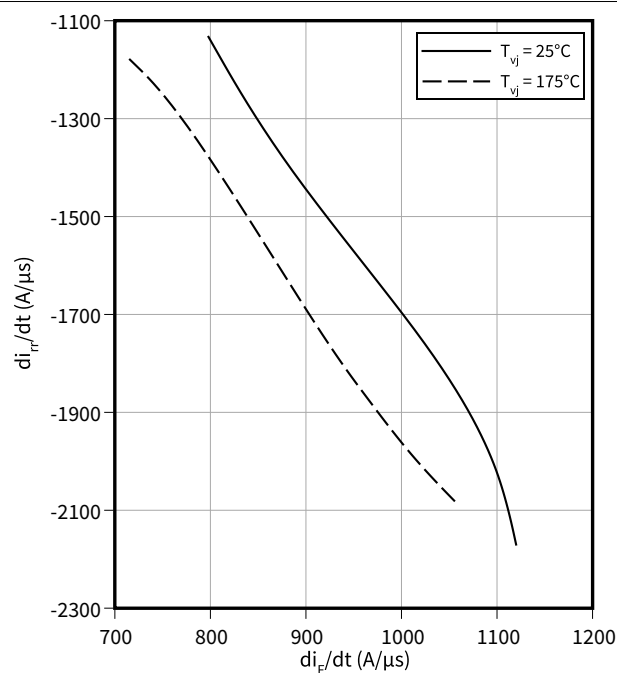
$$Q_{rr} = f(di_F/dt)$$

 $V_R = 400 \text{ V}, I_F = 100 \text{ A}$
**Typical reverse recovery current as a function of diode current slope**

$$I_{rrm} = f(di_F/dt)$$

 $V_R = 400 \text{ V}, I_F = 100 \text{ A}$
**Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**

$$di_{rr}/dt = f(di_F/dt)$$

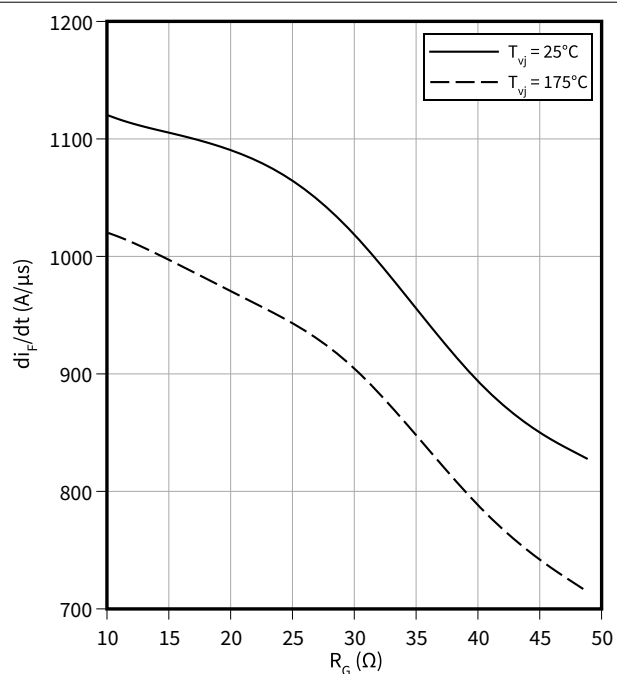
 $V_R = 400 \text{ V}, I_F = 100 \text{ A}$


4 Characteristics diagrams

Typical diode current slope as a function of gate resistor

$$di_F/dt = f(R_G)$$

$$V_R = 400 \text{ V}, I_F = 100 \text{ A}$$



5 Package outlines

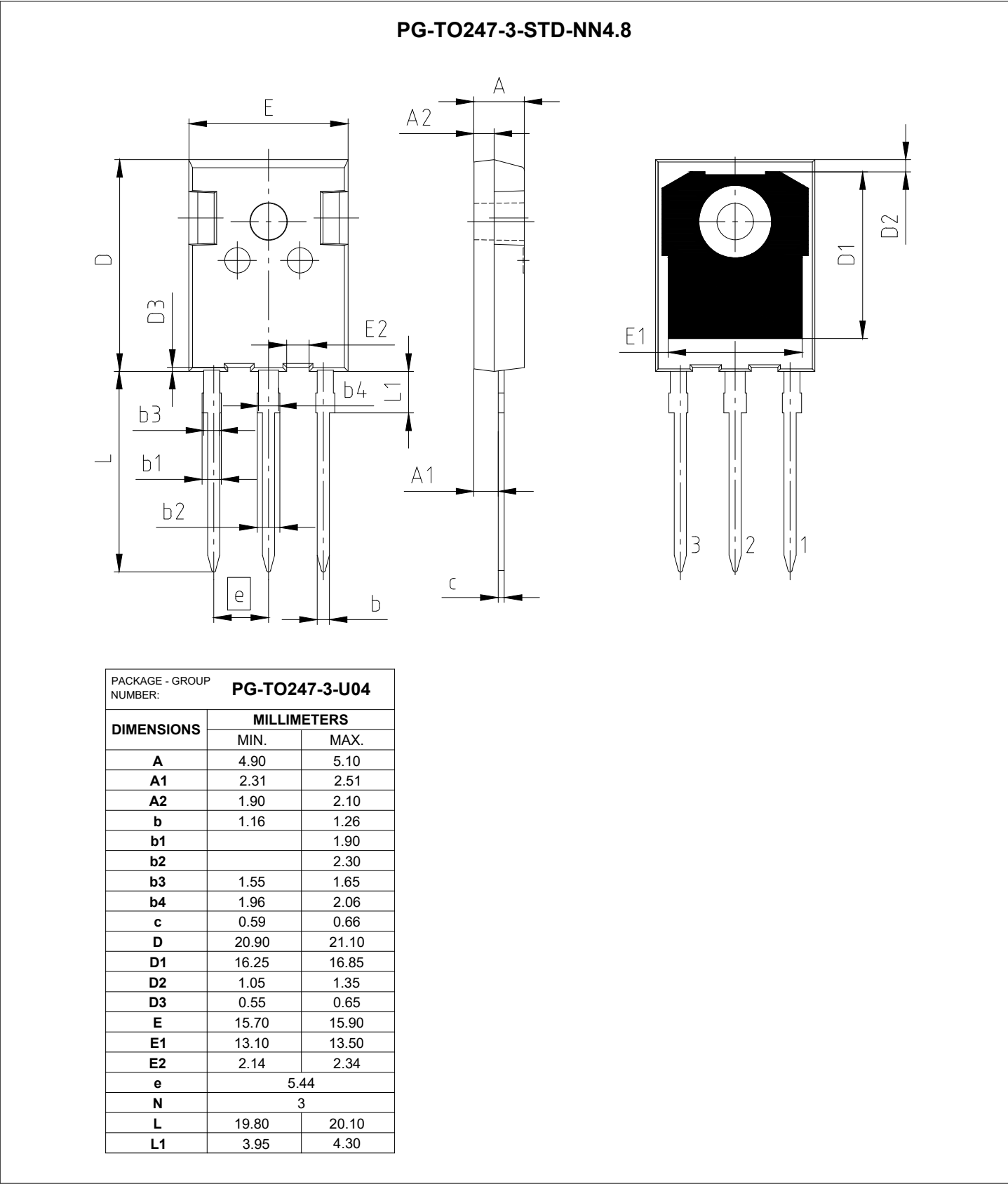


Figure 1

6 Testing conditions

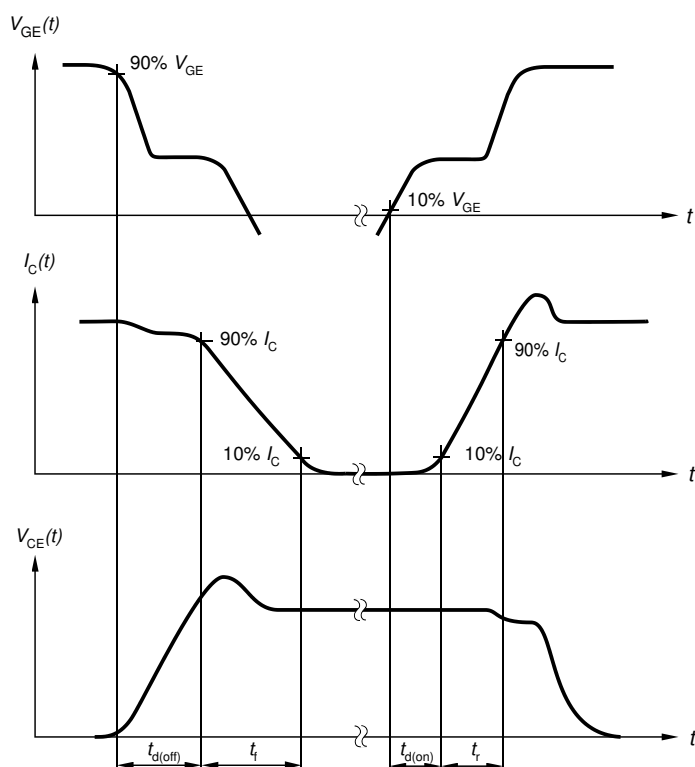


Figure A. Definition of switching times

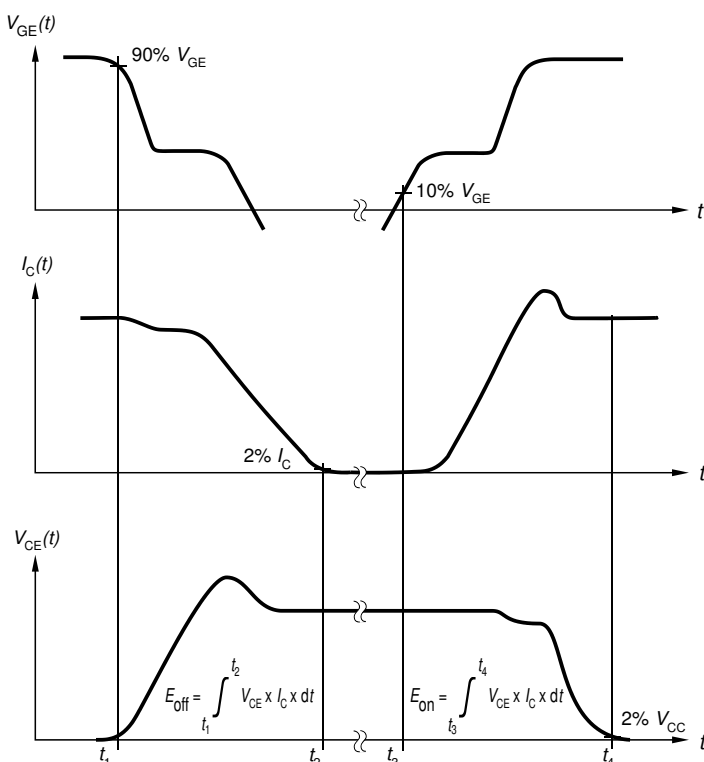


Figure B. Definition of switching losses

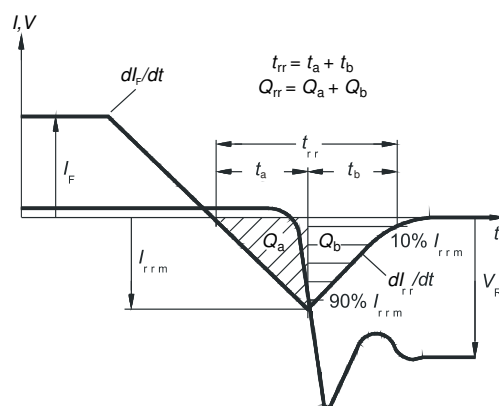


Figure C. Definition of diode switching characteristics

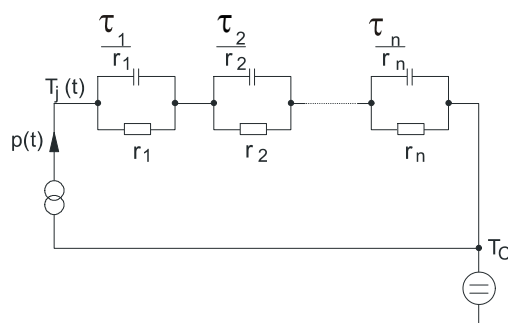


Figure D. Thermal equivalent circuit

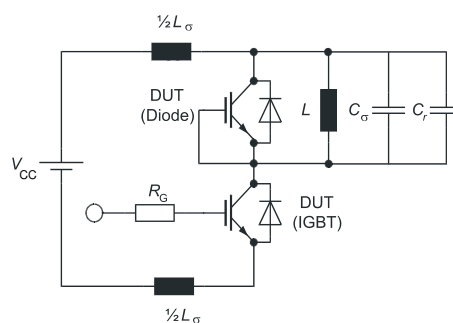


Figure E. **Dynamic test circuit**
Parasitic inductance L_σ ,
parasitic capacitor C_σ ,
relief capacitor C_r ,
(only for ZVT switching)

Revision history

Document revision	Date of release	Description of changes
1.00	2023-04-27	Final datasheet
1.10	2023-11-15	Update of energy diagrams

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