

### Short circuit rugged 1200 V TRENCHSTOP™ IGBT 7 technology

#### Features

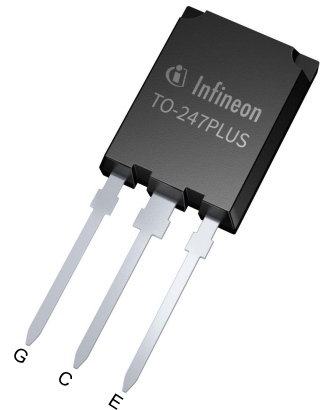
- $V_{CE} = 1200\text{ V}$
- $I_C = 120\text{ A}$
- Low saturation voltage  $V_{CEsat} = 2.0\text{ V}$  at  $T_{vj} = 175^\circ\text{C}$
- Short circuit ruggedness  $8\ \mu\text{s}$
- Wide range of  $dv/dt$  controllability
- Complete product spectrum and PSpice Models: <http://www.infineon.com/igbt/>

#### Potential applications

- Industrial power supplies
- Solar

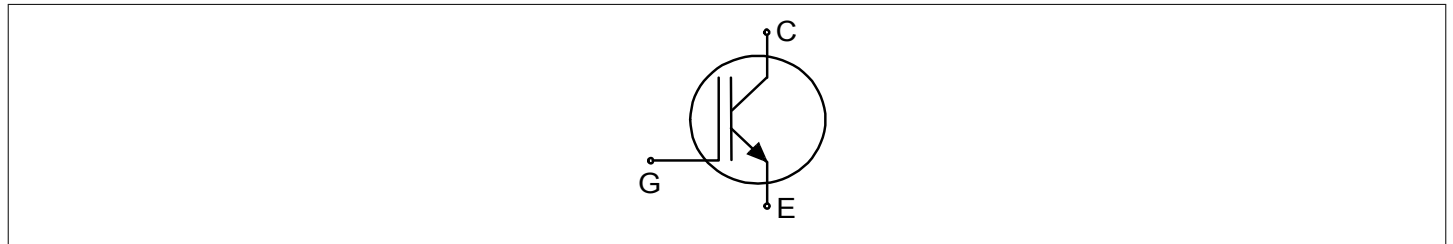
#### Product validation

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



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

#### Description



Type	Package	Marking
IGQ120N120S7	PG-TO247-3-PLUS-NN3.7	G120MS7

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## 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
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
IGBT thermal resistance, junction-case	$R_{th(j-c)}$			0.11	0.15	K/W

## 2 IGBT

**Table 2** Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Collector-emitter voltage	$V_{CE}$	$T_{vj} \geq 25\text{ °C}$	1200	V	
DC collector current, limited by $T_{vjmax}$	$I_C$	limited by bondwire	$T_C = 25\text{ °C}$	216	A
			$T_C = 100\text{ °C}$	144	
Pulsed collector current, $t_p$ limited by $T_{vjmax}$	$I_{Cpulse}$		360	A	
Turn-off safe operating area		$V_{CE} \leq 1200\text{ V}, T_{vj} \leq 175\text{ °C}$	360	A	
Gate-emitter voltage	$V_{GE}$		$\pm 20$	V	
Transient gate-emitter voltage	$V_{GE}$	$t_p \leq 0.5\text{ }\mu\text{s}, D < 0.001$	$\pm 25$	V	
Short-circuit withstand time	$t_{SC}$	$V_{CC} \leq 600\text{ V}, V_{GE} = 15\text{ V}$ , Allowed number of short circuits < 1000, Time between short circuits $\geq 1.0\text{ s}, T_{vj} = 150\text{ °C}$	8	$\mu\text{s}$	
Power dissipation	$P_{tot}$	$T_{vj} \leq 175\text{ °C}$	$T_C = 25\text{ °C}$	1004	W
			$T_C = 100\text{ °C}$	502	

**Table 3** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CEsat}$	$I_C = 120\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$	1.65	2	V
			$T_{vj} = 175\text{ °C}$	2		

(table continues...)

**Table 3 (continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Gate-emitter threshold voltage	$V_{GEth}$	$I_C = 2.34 \text{ mA}, V_{CE} = V_{GE}$	5.1	5.7	6.5	V
Zero gate-voltage collector current	$I_{CES}$	$V_{CE} = 1200 \text{ V}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$		20	$\mu\text{A}$
			$T_{vj} = 175 \text{ }^\circ\text{C}$		10400	
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0 \text{ V}, V_{GE} = 20 \text{ V}$			100	nA
Transconductance	$g_{fs}$	$I_C = 120 \text{ A}, V_{CE} = 20 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}$		51		S
Short-circuit collector current	$I_{SC}$	$V_{CC} \leq 600 \text{ V}, V_{GE} = 15 \text{ V}, t_{SC} \leq 8 \text{ } \mu\text{s}$ , Allowed number of short circuits < 1000, Time between short circuits $\geq 1.0 \text{ s}$ , $T_{vj} = 150 \text{ }^\circ\text{C}$		720		A
Input capacitance	$C_{ies}$	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$		17.3		nF
Output capacitance	$C_{oes}$	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$		325		pF
Reverse transfer capacitance	$C_{res}$	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 100 \text{ kHz}$		80		pF
Gate charge	$Q_G$	$I_C = 120 \text{ A}, V_{GE} = 15 \text{ V}, V_{CC} = 960 \text{ V}$		710		nC
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 600 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 1.3 \text{ } \Omega, R_{G(off)} = 1.3 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 120 \text{ A}$		44	ns
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 120 \text{ A}$		42	
Rise time (inductive load)	$t_r$	$V_{CC} = 600 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 1.3 \text{ } \Omega, R_{G(off)} = 1.3 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 120 \text{ A}$		34	ns
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 120 \text{ A}$		35	
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 600 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 1.3 \text{ } \Omega, R_{G(off)} = 1.3 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 120 \text{ A}$		215	ns
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 120 \text{ A}$		256	
Fall time (inductive load)	$t_f$	$V_{CC} = 600 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 1.3 \text{ } \Omega, R_{G(off)} = 1.3 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 120 \text{ A}$		106	ns
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 120 \text{ A}$		200	
Turn-on energy	$E_{on}$	$V_{CC} = 600 \text{ V}, V_{GE} = 0/15 \text{ V}, R_{G(on)} = 1.3 \text{ } \Omega, R_{G(off)} = 1.3 \text{ } \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 120 \text{ A}$		10.3	mJ
			$T_{vj} = 175 \text{ }^\circ\text{C}, I_C = 120 \text{ A}$		12.6	

**(table continues...)**

**Table 3 (continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Turn-off energy	$E_{off}$	$V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 1.3\ \Omega,$ $R_{G(off)} = 1.3\ \Omega$	$T_{vj} = 25\text{ }^\circ\text{C},$ $I_C = 120\text{ A}$		5.72		mJ
			$T_{vj} = 175\text{ }^\circ\text{C},$ $I_C = 120\text{ A}$		9.5		
Total switching energy	$E_{ts}$	$V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 1.3\ \Omega,$ $R_{G(off)} = 1.3\ \Omega$	$T_{vj} = 25\text{ }^\circ\text{C},$ $I_C = 120\text{ A}$		16.1		mJ
			$T_{vj} = 175\text{ }^\circ\text{C},$ $I_C = 120\text{ A}$		22.1		
Operating junction temperature	$T_{vj}$		-40		175	$^\circ\text{C}$	

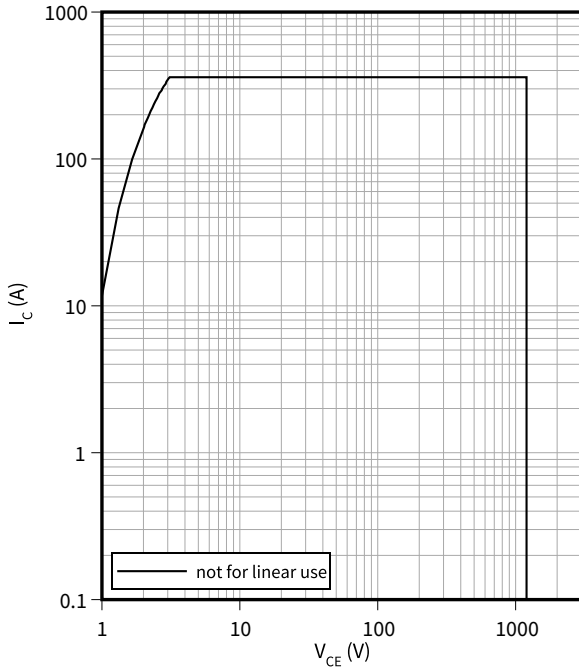
*Note: Electrical Characteristic, at  $T_{vj} = 25^\circ\text{C}$ , unless otherwise specified.  
 For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.  
 Dynamic test circuit, parasitic inductance  $L_\sigma = 30\text{ nH}$ ,  $C_\sigma = 18\text{ pF}$ . Energy losses include “tail” and diode (IKQ120N120CS7) reverse recovery*

### 3 Characteristics diagrams

#### Reverse bias safe operating area

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

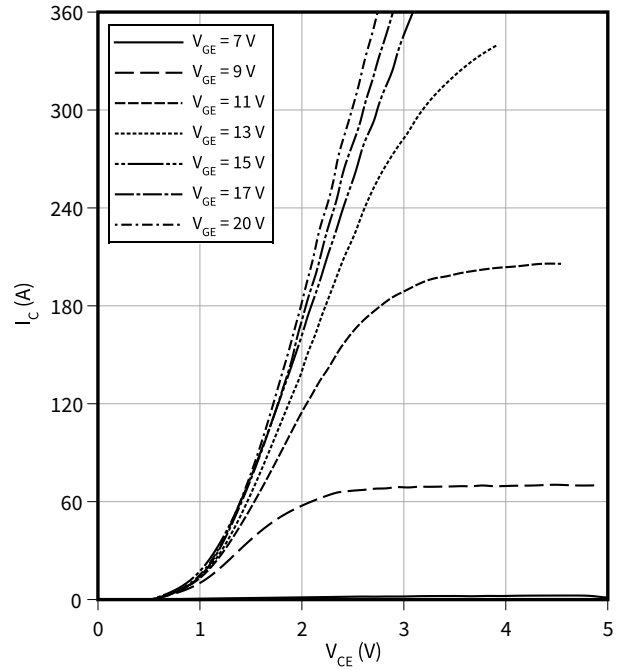
$$T_{vj} \leq 175\text{ °C}, V_{CE} \leq 1200\text{ V}$$



#### Typical output characteristic

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

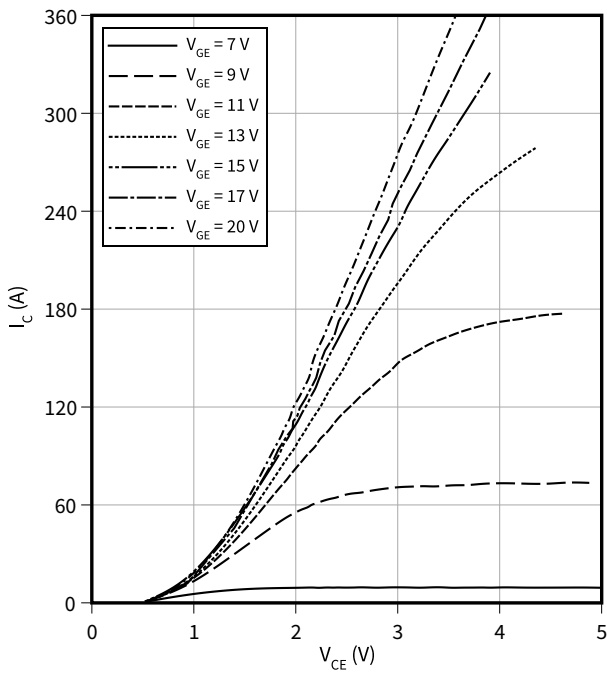
$$T_{vj} = 25\text{ °C}$$



#### Typical output characteristic

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

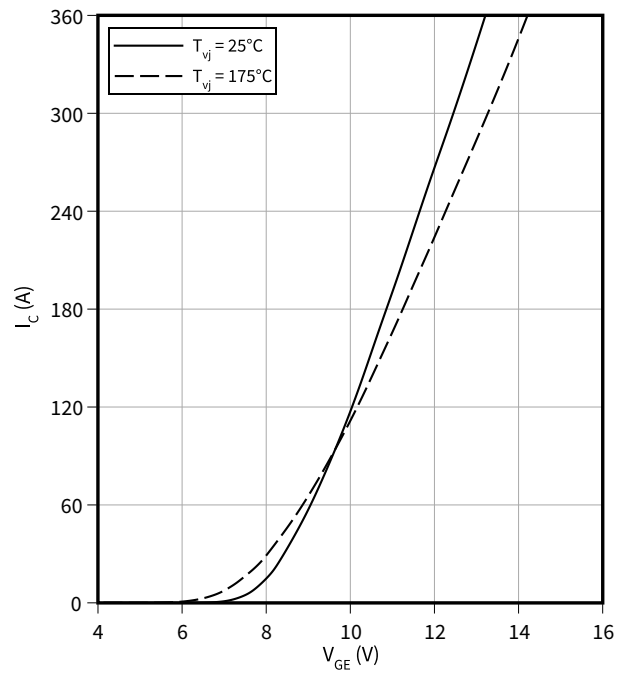
$$T_{vj} = 175\text{ °C}$$



#### Typical transfer characteristic

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

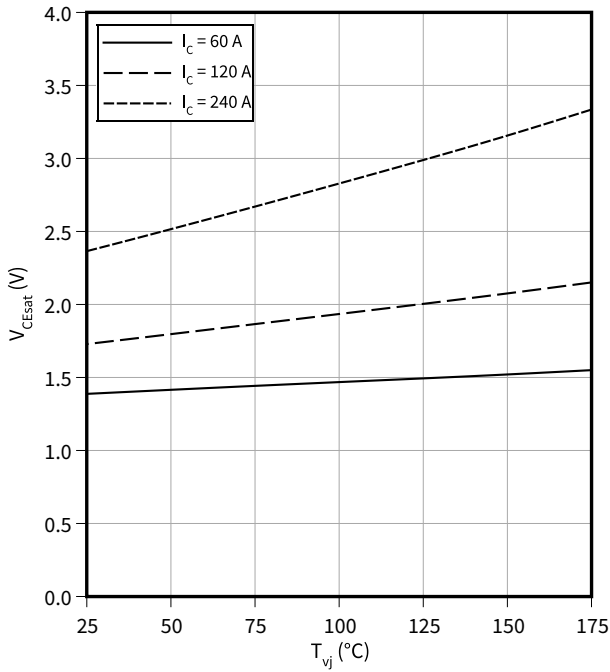
$$V_{CE} = 20\text{ V}$$



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

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

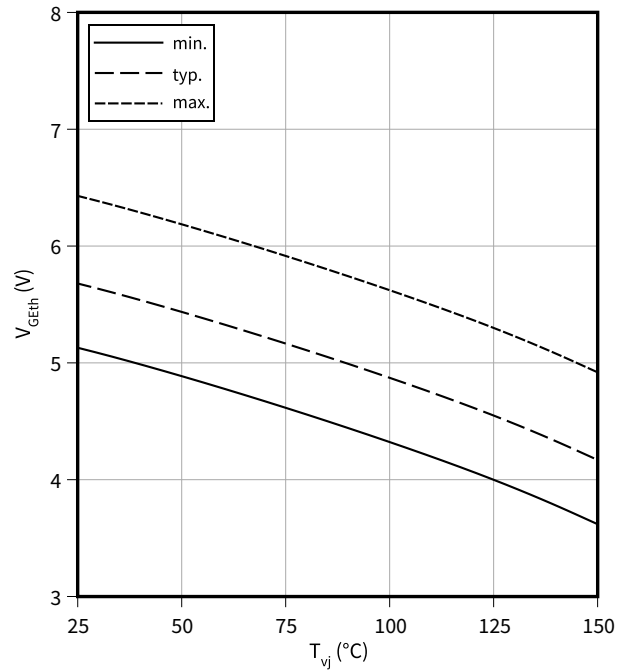
$$V_{GE} = 15 \text{ V}$$



**Gate-emitter threshold voltage as a function of junction temperature**

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

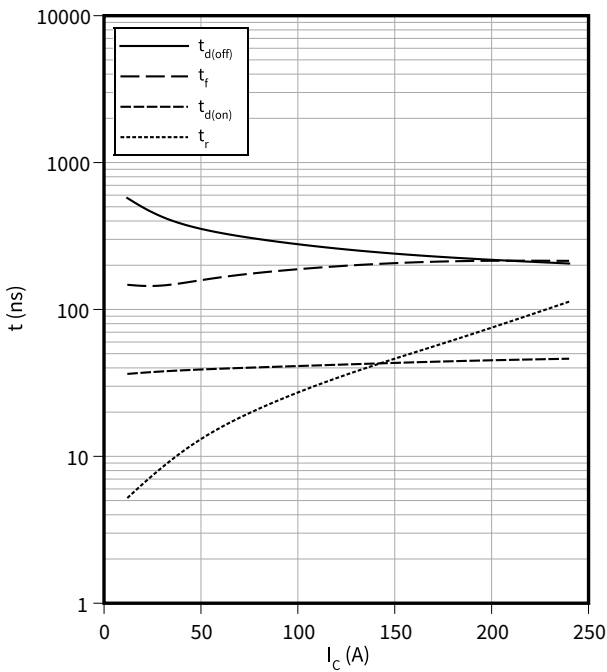
$$I_C = 2.34 \text{ mA}$$



**Typical switching times as a function of collector current**

$$t = f(I_C)$$

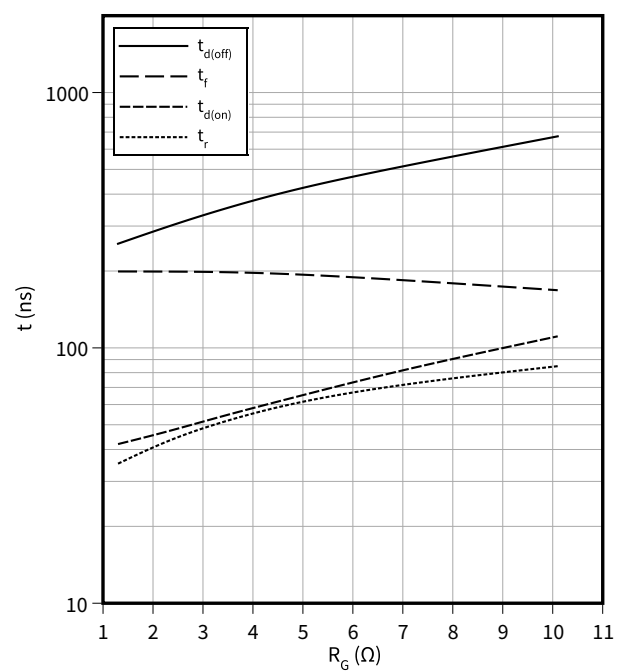
$$V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}, V_{GE} = 0/15 \text{ V}, R_G = 1.3 \text{ } \Omega$$



**Typical switching times as a function of gate resistor**

$$t = f(R_G)$$

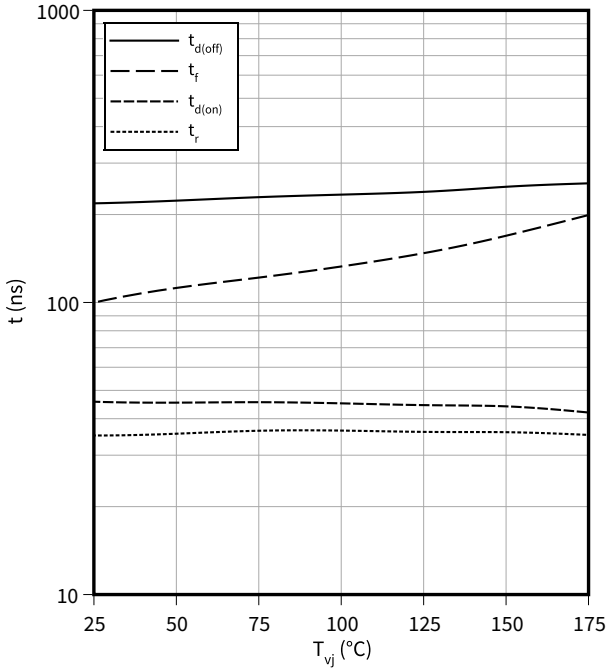
$$I_C = 120 \text{ A}, V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}, V_{GE} = 0/15 \text{ V}$$



**Typical switching times as a function of junction temperature**

$t = f(T_{vj})$

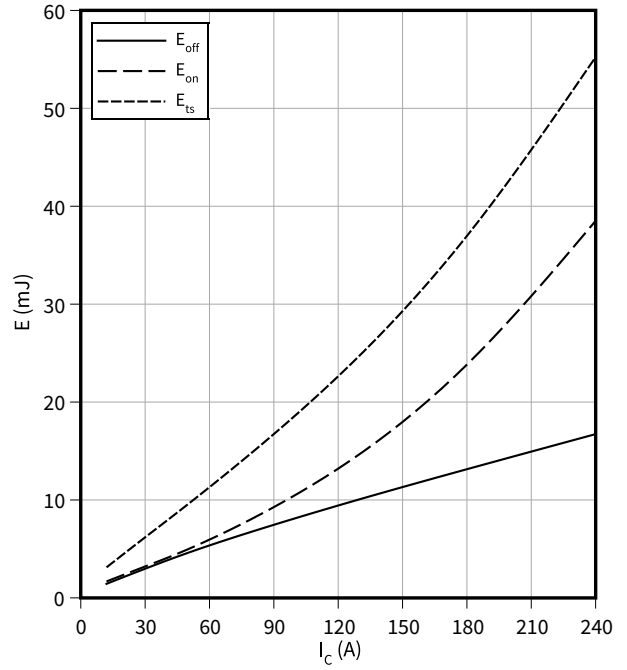
$I_C = 120\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_G = 1.3\ \Omega$



**Typical switching energy losses as a function of collector current**

$E = f(I_C)$

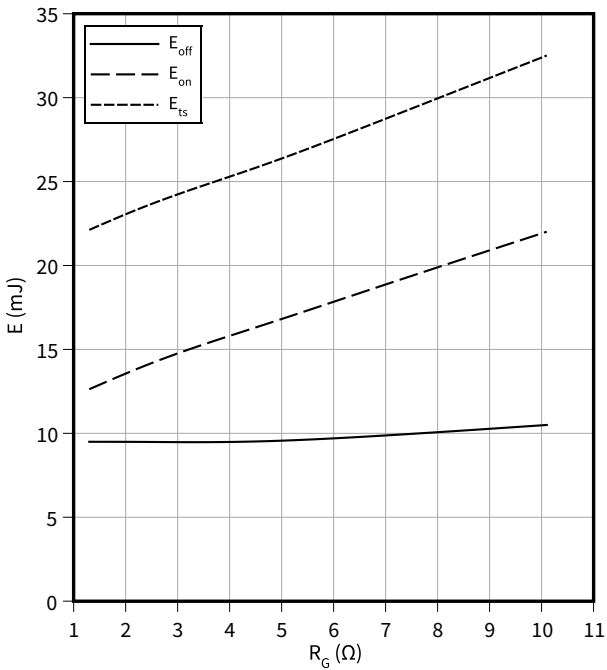
$V_{CC} = 600\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}, R_G = 1.3\ \Omega$



**Typical switching energy losses as a function of gate resistor**

$E = f(R_G)$

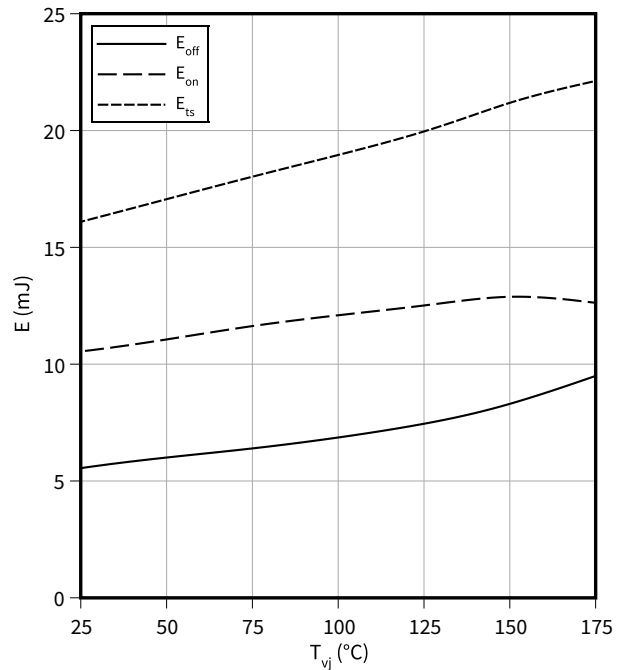
$I_C = 120\text{ A}, V_{CC} = 600\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}$



**Typical switching energy losses as a function of junction temperature**

$E = f(T_{vj})$

$I_C = 120\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_G = 1.3\ \Omega$

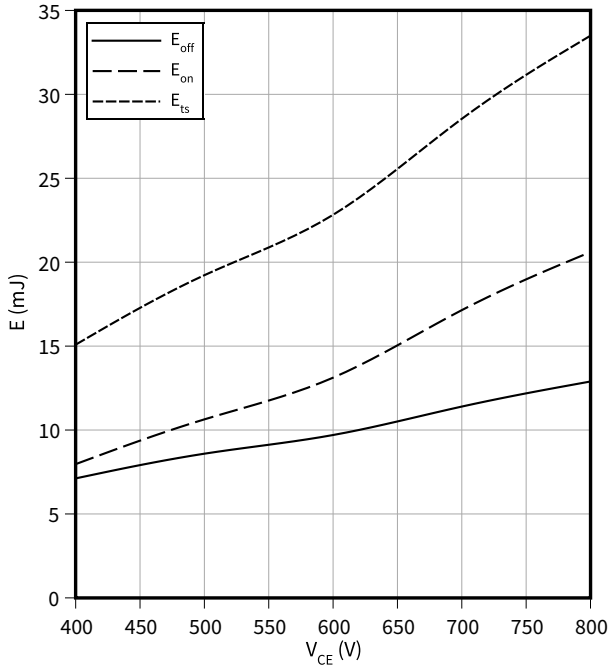




**Typical switching energy losses as a function of collector emitter voltage**

$E = f(V_{CE})$

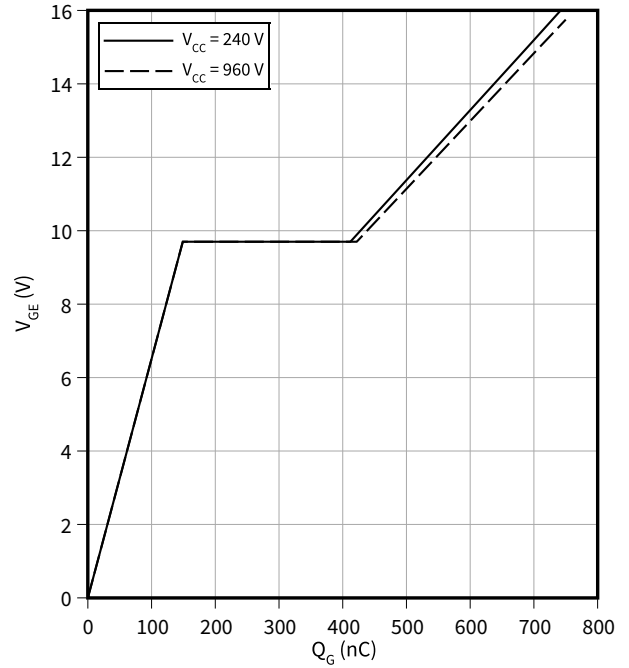
$I_C = 120\text{ A}$ ,  $T_{vj} = 175\text{ °C}$ ,  $V_{GE} = 0/15\text{ V}$ ,  $R_G = 1.3\text{ }\Omega$



**Typical gate charge**

$V_{GE} = f(Q_G)$

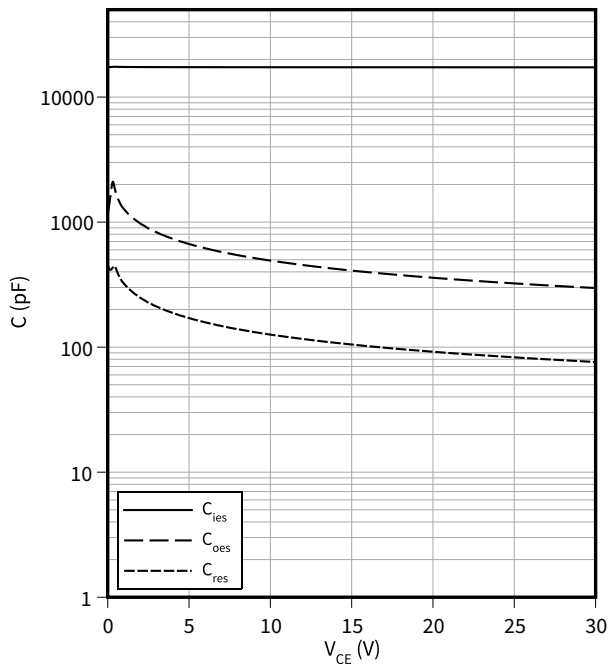
$I_C = 120\text{ A}$



**Typical capacitance as a function of collector-emitter voltage**

$C = f(V_{CE})$

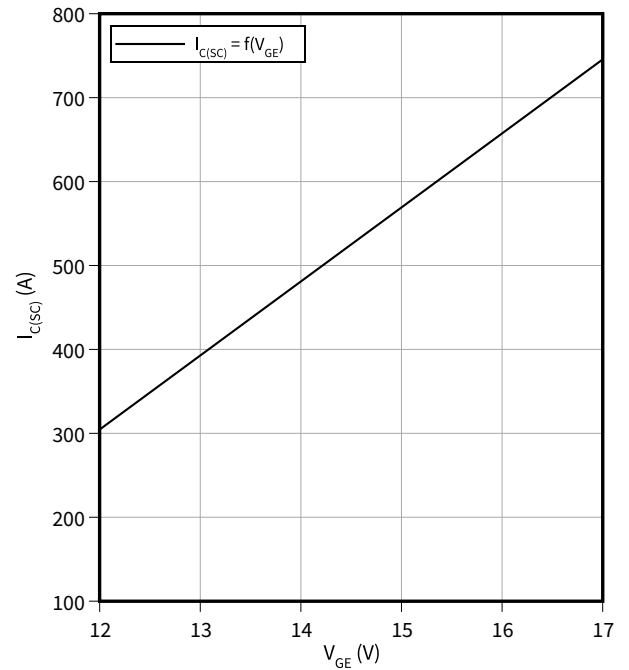
$f = 100\text{ kHz}$ ,  $V_{GE} = 0\text{ V}$



**Typical short circuit collector current as a function of gate-emitter voltage**

$I_{C(SC)} = f(V_{GE})$

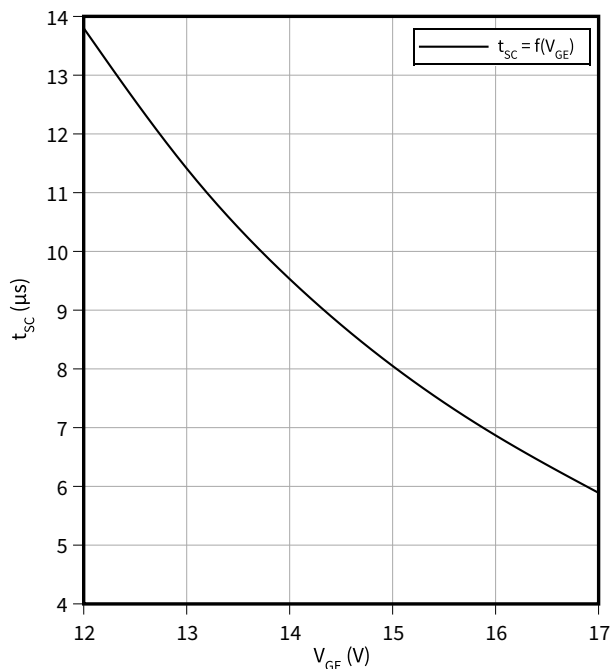
$T_{vj} = 150\text{ °C}$ ,  $V_{CC} \leq 600\text{ V}$



**Short circuit withstand time as a function of gate-emitter voltage**

$$t_{SC} = f(V_{GE})$$

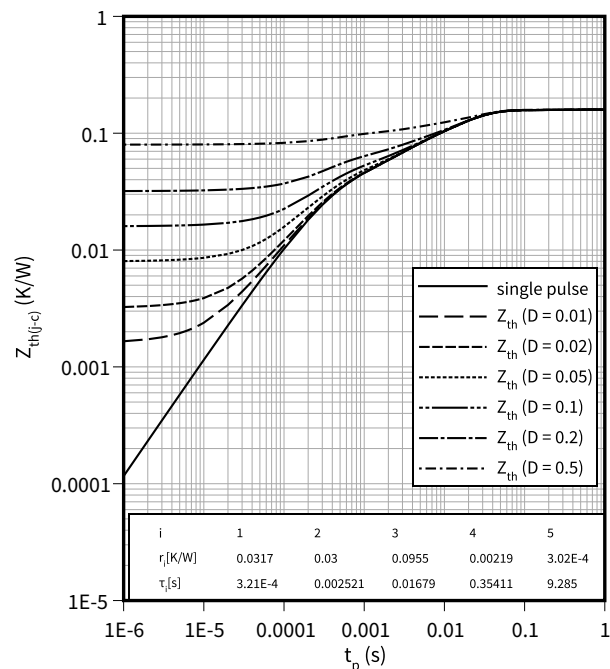
$T_{vj} \leq 150\text{ }^{\circ}\text{C}$ ,  $V_{CC} \leq 600\text{ V}$



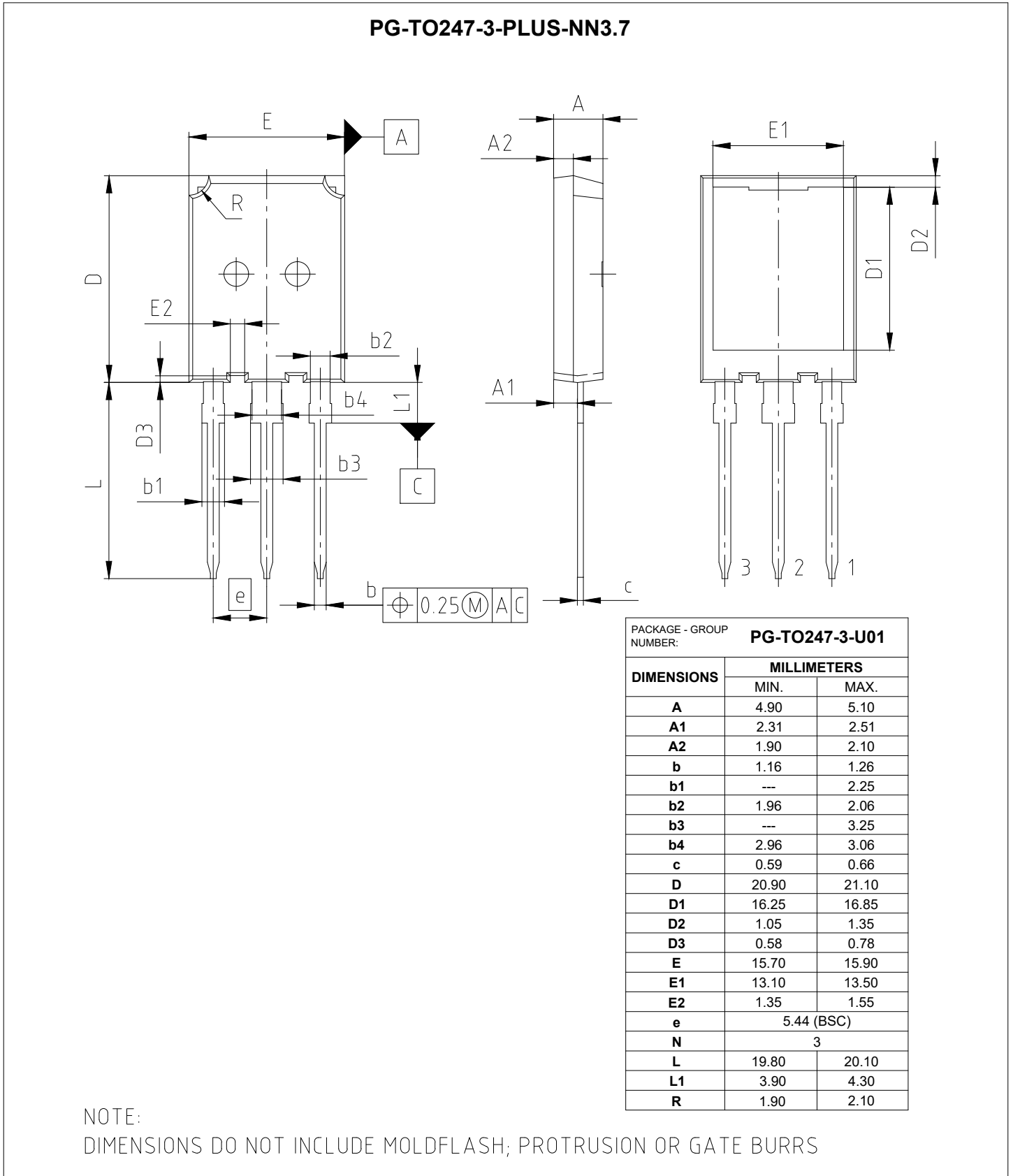
**IGBT transient thermal impedance as a function of pulse width**

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

$$D = t_p/T$$

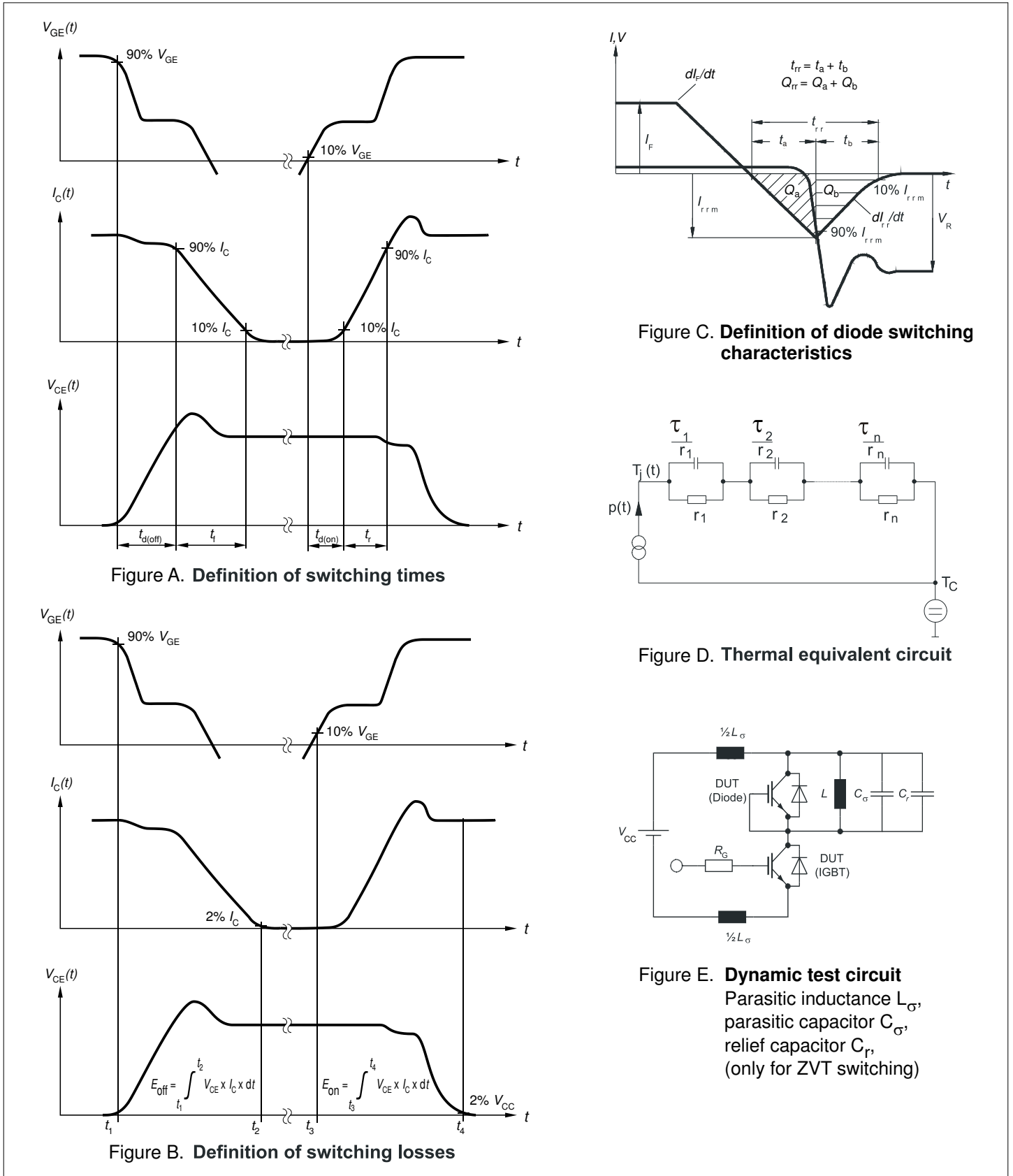


**4 Package outlines**



**Figure 1**

**5 Testing conditions**



**Figure 2**

## Revision history

Document revision	Date of release	Description of changes
0.10	2022-05-06	Target datasheet
1.00	2022-12-05	Final datasheet
1.10	2023-01-23	Correction of boundary condition of diagrams $I_{C(SC)} = f(V_{GE})$ and $t_{SC} = f(V_{GE})$ Change of product outline drawing on page 11

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**Email: [erratum@infineon.com](mailto:erratum@infineon.com)**

**Document reference**

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