

Short circuit rugged 1200 V TRENCHSTOP™ IGBT 7 technology

Features

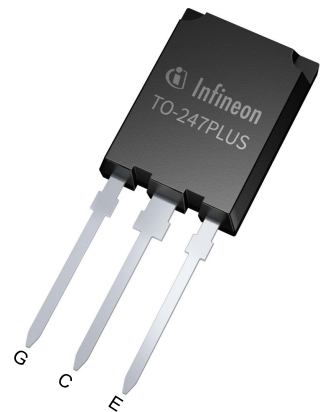
- $V_{CE} = 1200\text{ V}$
- $I_C = 120\text{ A}$
- Low saturation voltage $V_{CEsat} = 2.0\text{ V}$ at $T_{vj} = 175^\circ\text{C}$
- Short circuit ruggedness $8\ \mu\text{s}$
- Wide range of dv/dt controllability
- Complete product spectrum and PSpice Models: <http://www.infineon.com/igbt/>

Potential applications

- Industrial power supplies
- Solar

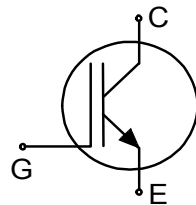
Product validation

- 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}		± 20	V	
Transient gate-emitter voltage	V_{GE}	$t_p \leq 0.5\text{ }\mu\text{s}, D < 0.001$	± 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	μs	
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	μA
			$T_{vj} = 175 \text{ }^\circ\text{C}$		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}	$V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 1.3\ \Omega,$ $R_{G(off)} = 1.3\ \Omega$	$T_{vj} = 25\ ^\circ\text{C},$ $I_C = 120\text{ A}$		5.72		mJ
			$T_{vj} = 175\ ^\circ\text{C},$ $I_C = 120\text{ A}$		9.5		
Total switching energy	E_{ts}	$V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V},$ $R_{G(on)} = 1.3\ \Omega,$ $R_{G(off)} = 1.3\ \Omega$	$T_{vj} = 25\ ^\circ\text{C},$ $I_C = 120\text{ A}$		16.1		mJ
			$T_{vj} = 175\ ^\circ\text{C},$ $I_C = 120\text{ A}$		22.1		
Operating junction temperature	T_{vj}		-40		175	$^\circ\text{C}$	

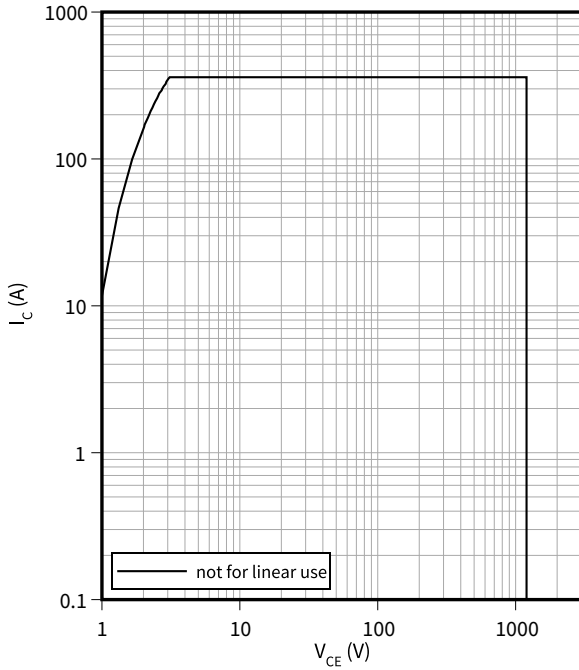
*Note: Electrical Characteristic, at $T_{vj} = 25\ ^\circ\text{C}$, unless otherwise specified.
 For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.
 Dynamic test circuit, parasitic inductance $L_\sigma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

3 Characteristics diagrams

Reverse bias safe operating area

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

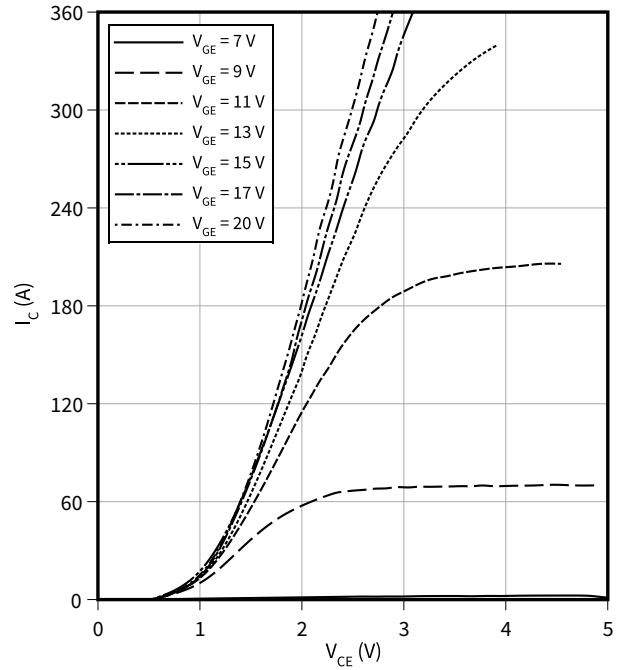
$$T_{vj} \leq 175\text{ °C}, V_{CE} \leq 1200\text{ V}$$



Typical output characteristic

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

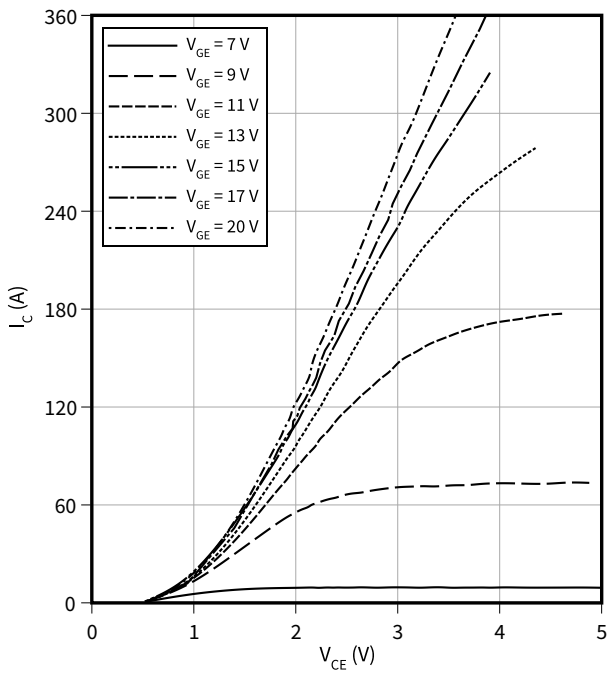
$$T_{vj} = 25\text{ °C}$$



Typical output characteristic

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

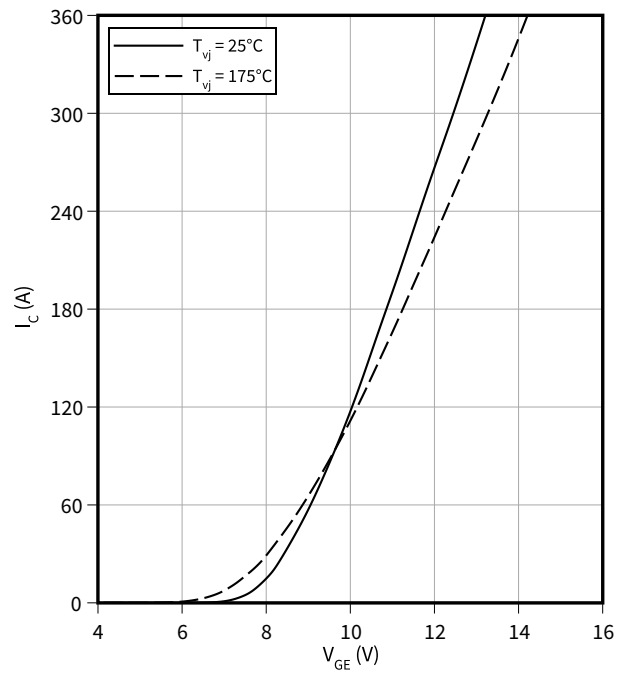
$$T_{vj} = 175\text{ °C}$$



Typical transfer characteristic

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

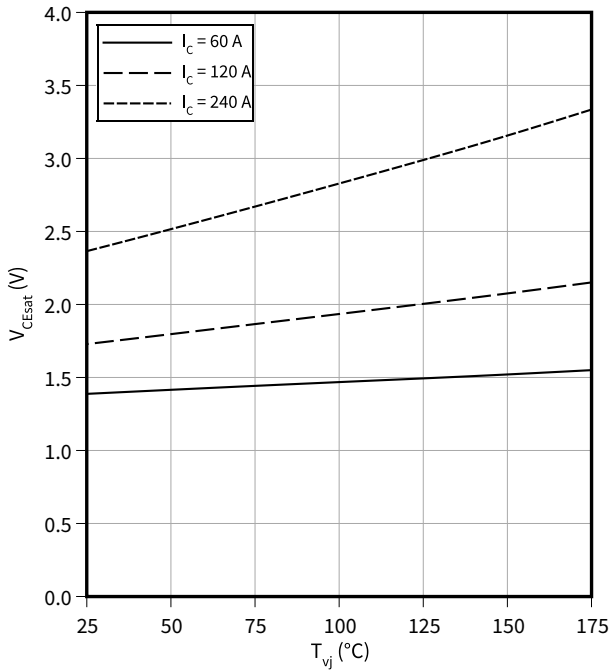
$$V_{CE} = 20\text{ V}$$



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

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

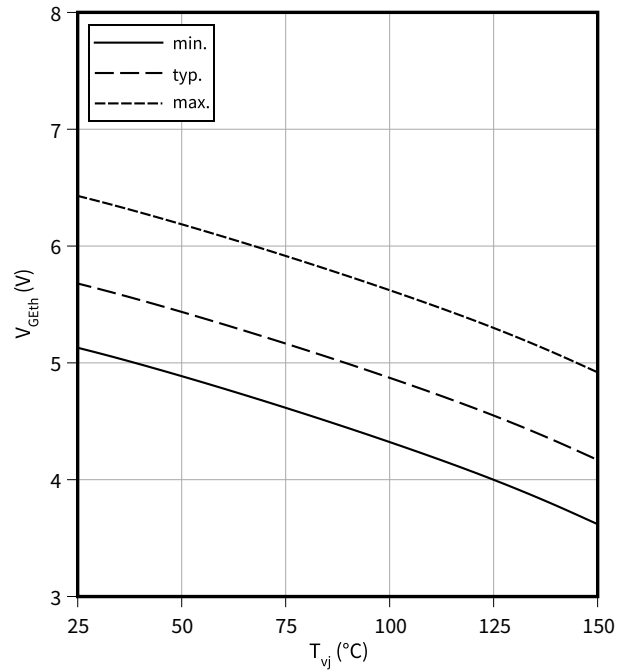
$V_{GE} = 15 \text{ V}$



Gate-emitter threshold voltage as a function of junction temperature

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

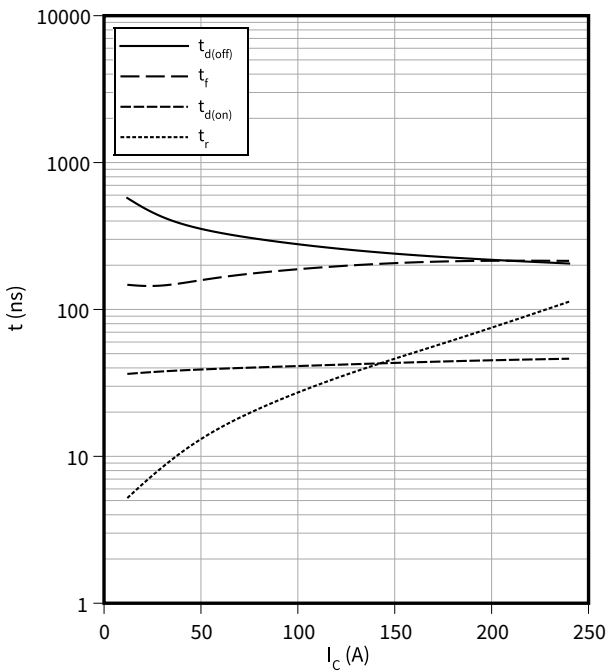
$I_c = 2.34 \text{ mA}$



Typical switching times as a function of collector current

$t = f(I_c)$

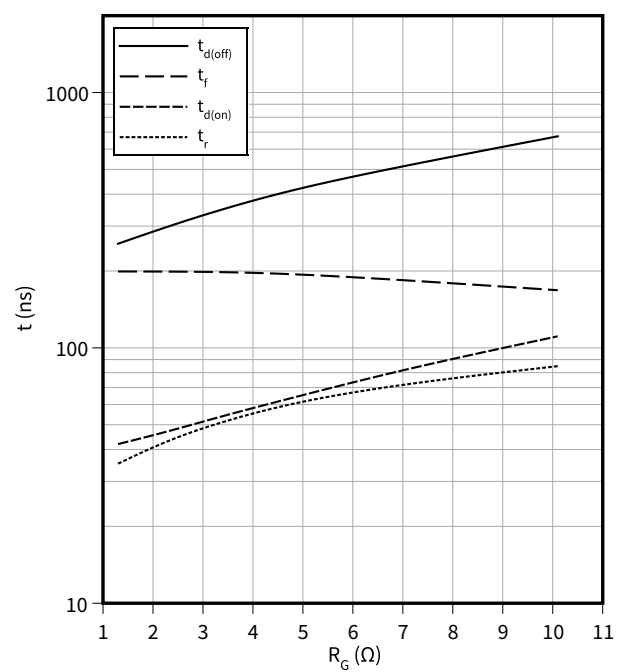
$V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}, R_G = 1.3 \text{ } \Omega$



Typical switching times as a function of gate resistor

$t = f(R_G)$

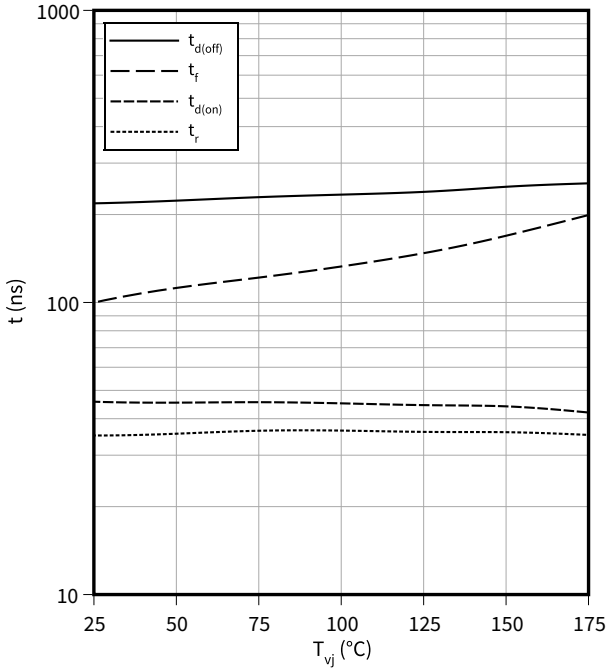
$I_c = 120 \text{ A}, V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}$



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

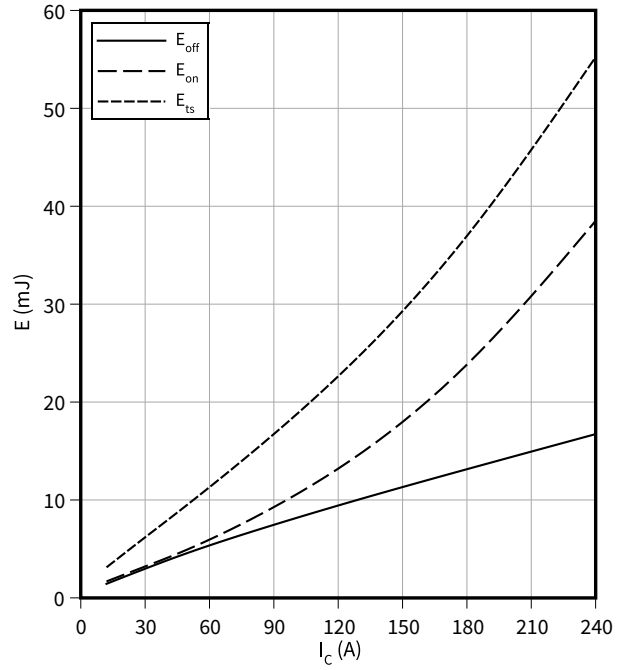
$I_C = 120 \text{ A}, V_{CC} = 600 \text{ V}, V_{GE} = 0/15 \text{ V}, R_G = 1.3 \Omega$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

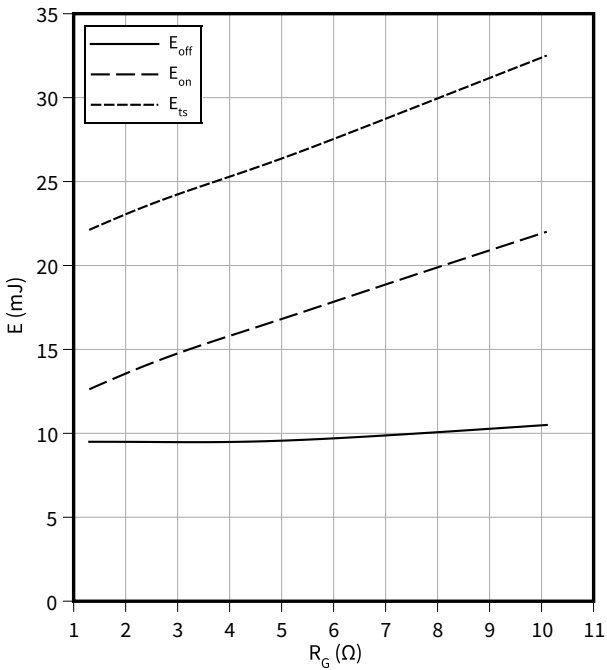
$V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}, R_G = 1.3 \Omega$



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

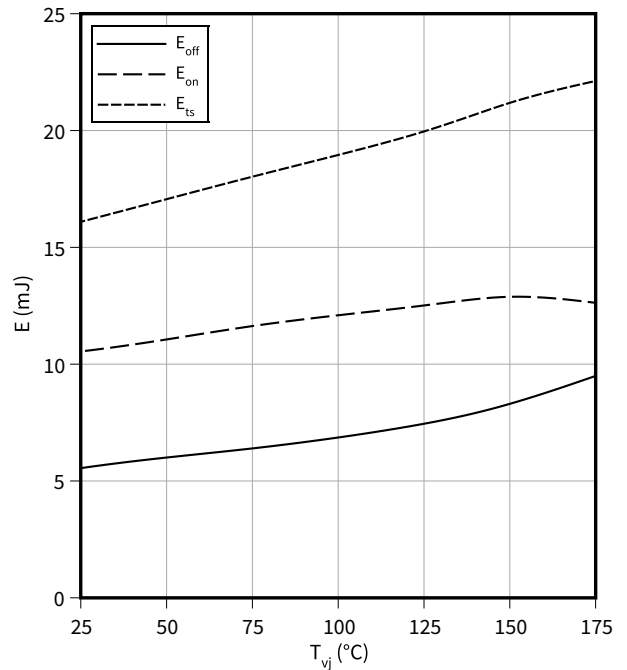
$I_C = 120 \text{ A}, V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ °C}, V_{GE} = 0/15 \text{ V}$



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

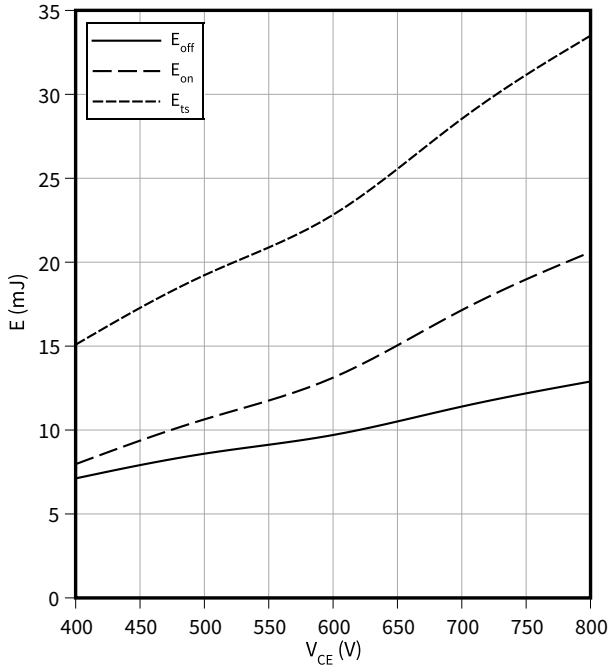
$I_C = 120 \text{ A}, V_{CC} = 600 \text{ V}, V_{GE} = 0/15 \text{ V}, R_G = 1.3 \Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

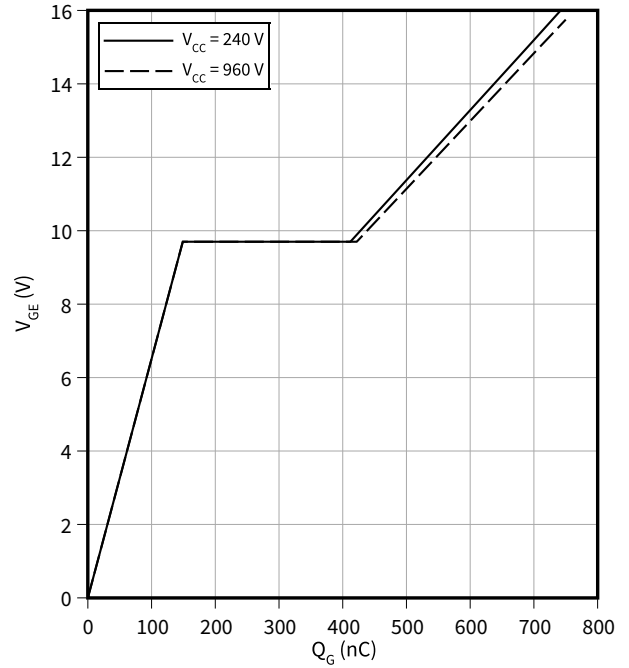
$I_C = 120\text{ A}$, $T_{vj} = 175\text{ °C}$, $V_{GE} = 0/15\text{ V}$, $R_G = 1.3\text{ }\Omega$



Typical gate charge

$V_{GE} = f(Q_G)$

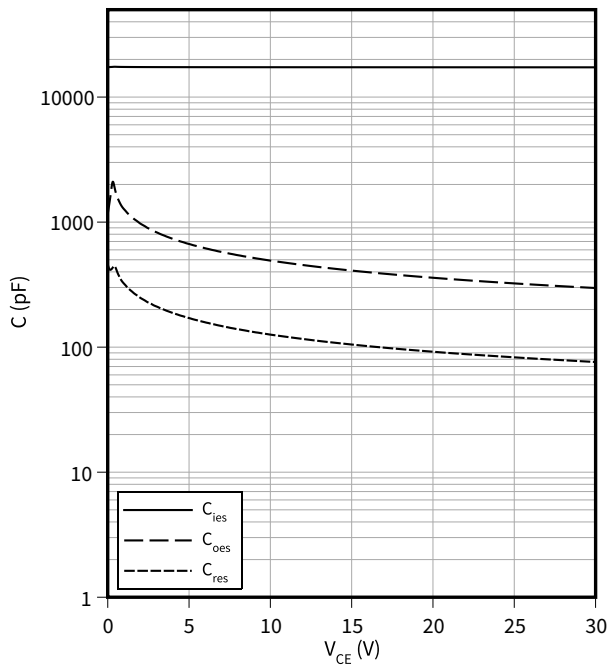
$I_C = 120\text{ A}$



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

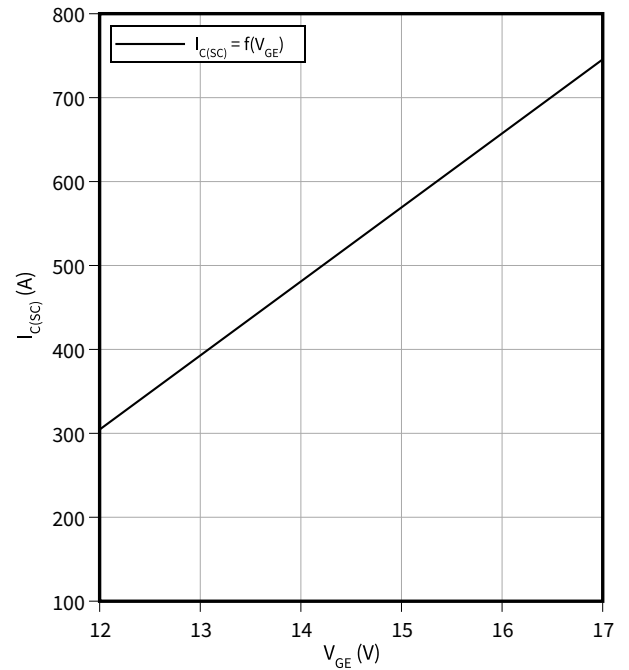
$f = 100\text{ kHz}$, $V_{GE} = 0\text{ V}$



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

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

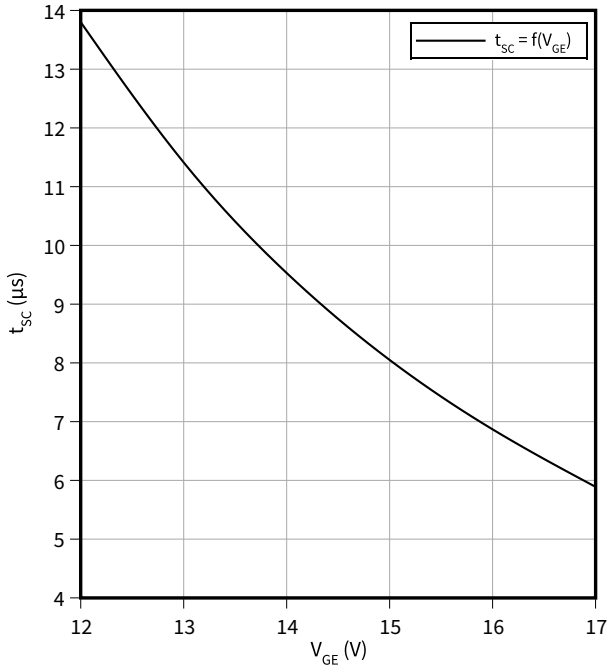
$T_{vj} = 150\text{ °C}$, $V_{CC} \leq 600\text{ V}$



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

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

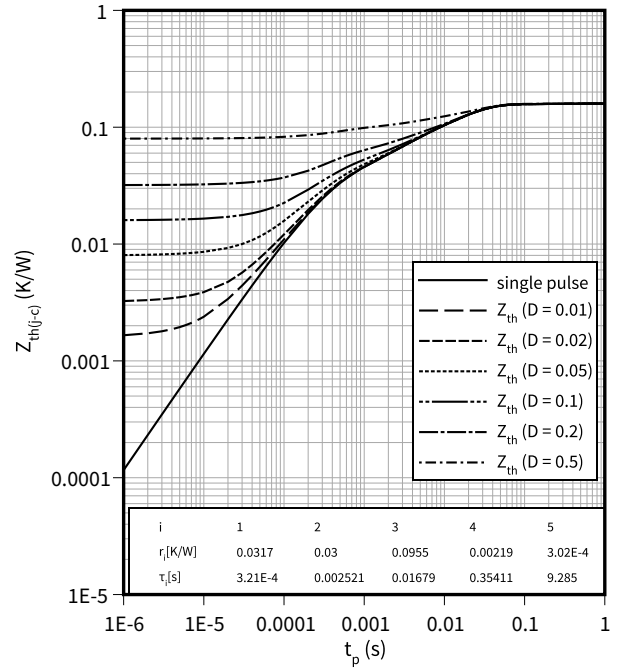
$T_{vj} \leq 150\text{ °C}, V_{CC} \leq 600\text{ V}$



IGBT transient thermal impedance as a function of pulse width

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

$D = t_p/T$



4 Package outlines

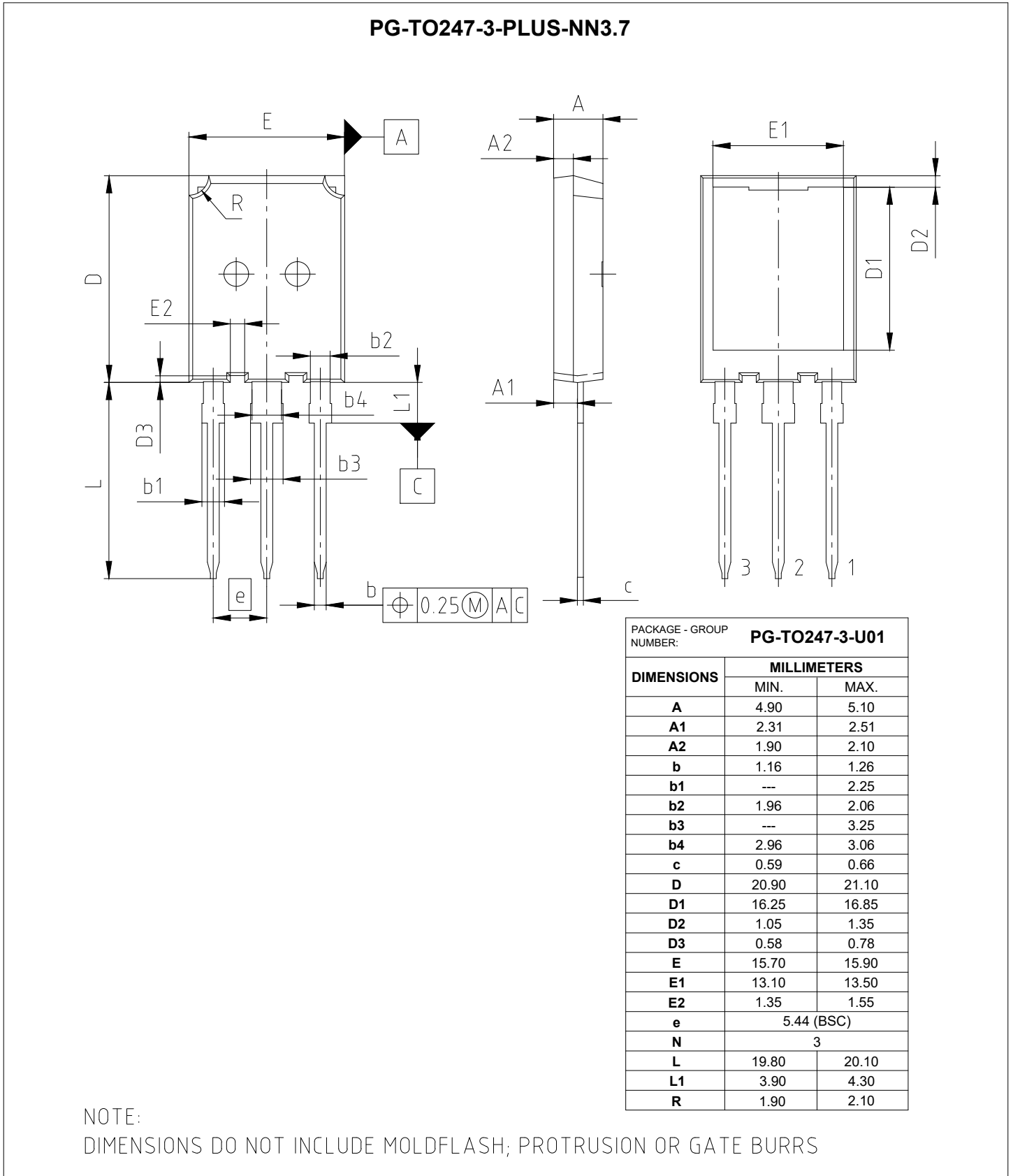


Figure 1

5 Testing conditions

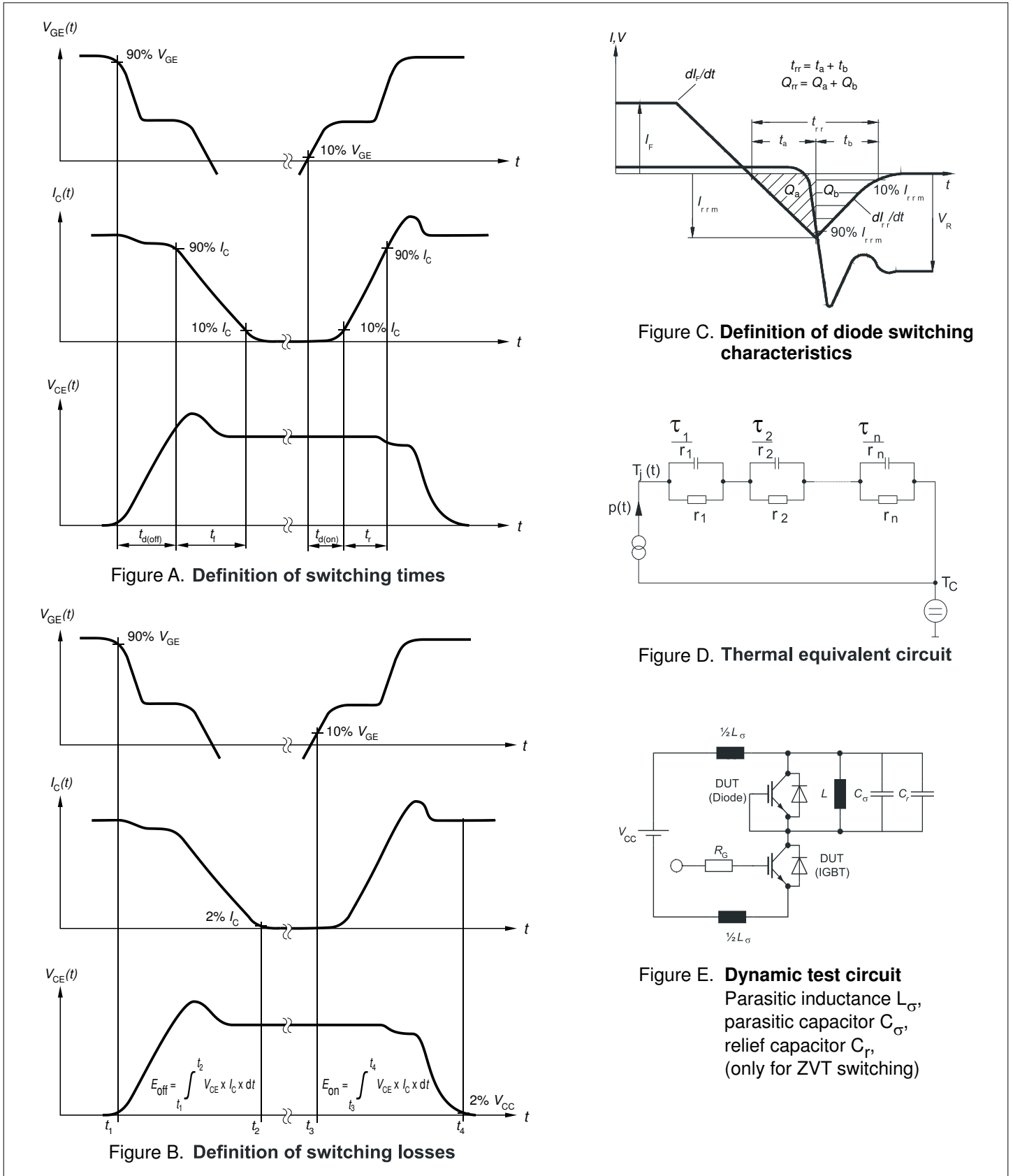


Figure 2

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