

Reverse-Conducting IGBT with monolithic body diode

Features

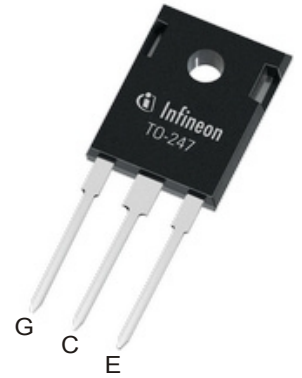
- $V_{CE} = 1600\text{ V}$
- $I_C = 30\text{ A}$
- Powerful monolithic body diode with low forward voltage
- Very tight parameter distribution
- High ruggedness, temperature stable behavior
- Low V_{CEsat}
- Easy parallel switching capability due to positive temperature coefficient in V_{CEsat}
- Low EMI
- Pb-free lead plating; RoHS compliant; halogen free (according IEC 61249-2-21)
- Complete product spectrum and PSpice Models: <http://www.infineon.com/igbt/>

Potential applications

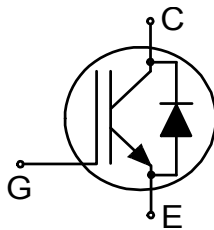
- Induction cooking
- Microwave ovens

Product validation

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



Description



Type	Package	Marking
IHW30N160R5	PG-TO247-3	H30SR5

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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			13.0		nH
Storage temperature	T_{stg}		-55		175	°C
Soldering temperature		wave soldering 1.6 mm (0.063 in.) from case for 10 s			260	°C
Mounting torque	M	M3 screw Maximum of mounting process: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W

2 IGBT

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Collector-emitter voltage	V_{CE}	$T_{vj} \geq 25\text{ °C}$	1600	V	
DC collector current, limited by T_{vjmax}	I_C		$T_c = 25\text{ °C}$	60	A
			$T_c = 100\text{ °C}$	39	
Pulsed collector current, t_p limited by T_{vjmax}	I_{Cpulse}		90	A	
Non repetitive peak collector current ¹⁾	I_{CSM}		200	A	
Turn-off safe operating area		$V_{CE} = 1600\text{ V}, t_p = 1\text{ }\mu\text{s}, T_{vj} \leq 175\text{ °C}$	90	A	
Gate-emitter voltage	V_{GE}		± 20	V	
Transient gate-emitter voltage	V_{GE}	$t_p \leq 10\text{ }\mu\text{s}, D < 0.01$	± 25	V	
Power dissipation	P_{tot}		$T_c = 25\text{ °C}$	263	W
			$T_c = 100\text{ °C}$	131.5	

1) capacitor charging saturation current limited by $T_{vjmax} < 175\text{ °C}$ and $t_p < 3\text{ }\mu\text{s}$

Table 3 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	V_{BRCES}	$I_C = 0.5\text{ mA}, V_{GE} = 0\text{ V}$	1600			V

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	V_{CEsat}	$I_C = 30\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$		1.85	2.15	V
			$T_{vj} = 125\text{ °C}$		2.2		
			$T_{vj} = 175\text{ °C}$		2.4		
Gate-emitter threshold voltage	V_{GETh}	$I_C = 0.75\text{ mA}, V_{CE} = V_{GE}$		4.5	5.1	5.8	V
Zero gate-voltage collector current	I_{CES}	$V_{CE} = 1600\text{ V}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$			100	μA
			$T_{vj} = 175\text{ °C}$		800		
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}$				100	nA
Transconductance	g_{fs}	$I_C = 30\text{ A}, V_{CE} = 20\text{ V}$			20.5		S
Input capacitance	C_{ies}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			1500		pF
Output capacitance	C_{oes}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			42		pF
Reverse transfer capacitance	C_{res}	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$			38		pF
Gate charge	Q_G	$I_C = 30\text{ A}, V_{GE} = 15\text{ V}, V_{CC} = 1280\text{ V}$			205		nC
Turn-off delay time	t_{doff}	$V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_{Gon} = 10\ \Omega, R_{Goff} = 10\ \Omega, L_\sigma = 175\text{ nH}, C_\sigma = 40\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 30\text{ A}$		290		ns
			$T_{vj} = 175\text{ °C}, I_C = 30\text{ A}$		330		
Fall time (inductive load)	t_f	$V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_{Gon} = 10\ \Omega, R_{Goff} = 10\ \Omega, L_\sigma = 175\text{ nH}, C_\sigma = 40\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 30\text{ A}$		47		ns
			$T_{vj} = 175\text{ °C}, I_C = 30\text{ A}$		81		
Turn-off energy	E_{off}	$V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_{Gon} = 10\ \Omega, R_{Goff} = 10\ \Omega, L_\sigma = 175\text{ nH}, C_\sigma = 40\text{ pF}$	$T_{vj} = 25\text{ °C}, I_C = 30\text{ A}$		2		mJ
			$T_{vj} = 175\text{ °C}, I_C = 30\text{ A}$		3		
Total switching energy	E_{ts}	$V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_{Gon} = 10\ \Omega, R_{Goff} = 10\ \Omega, L_\sigma = 175\text{ nH}, C_\sigma = 40\text{ pF}$	$I_C = 30\text{ A}$		0.35		mJ
			$I_C = 30\text{ A}$		1.27		
Soft turn-off energy	E_{off}	$V_{CC} = 600\text{ V}, dv/dt = 300\text{ V}/\mu\text{s}$	$T_{vj} = 25\text{ °C}$		0.35		mJ
			$T_{vj} = 175\text{ °C}$		1.27		
IGBT thermal resistance, junction to case	R_{thjc}					0.57	K/W
Operating junction temperature	T_{vj}			-40		175	$^{\circ}\text{C}$

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

3 Diode

Table 4 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} \geq 25^{\circ}\text{C}$	1600	V	
Diode forward current, limited by T_{vjmax}	I_F		$T_c = 25^{\circ}\text{C}$	55	A
			$T_c = 100^{\circ}\text{C}$	36	
Diode pulsed current, limited by T_{vjmax}	I_{Fpulse}		90	A	

Table 5 Characteristic values

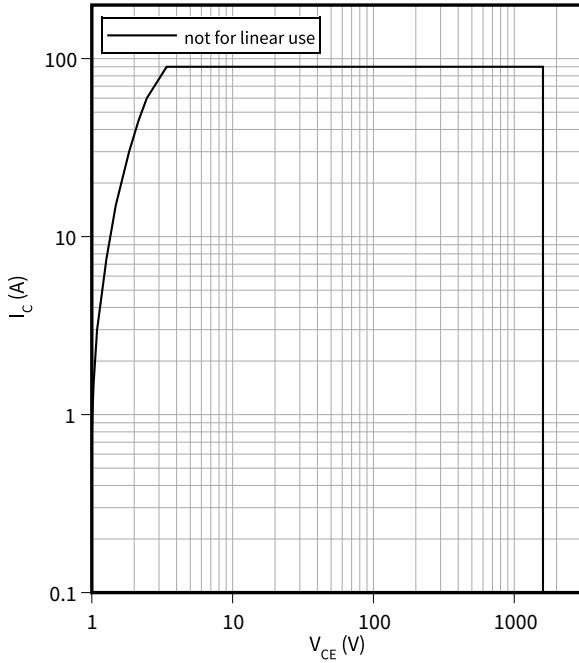
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 30\text{ A}$	$T_{vj} = 25^{\circ}\text{C}$	2	2.3	V
			$T_{vj} = 125^{\circ}\text{C}$	2.4		
			$T_{vj} = 175^{\circ}\text{C}$	2.6		
Diode thermal resistance, junction to case	R_{thjc}				0.57	K/W
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.

4 Characteristics diagrams

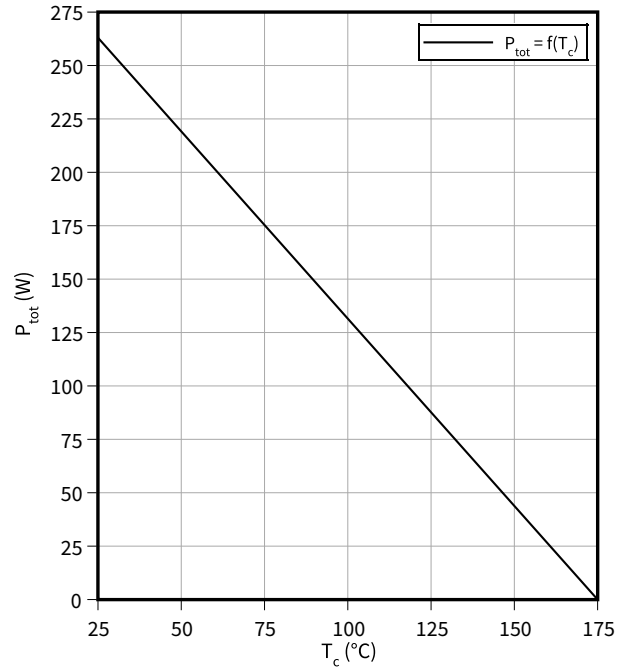
Reverse bias safe operating area

$I_C = f(V_{CE})$
 $D = 0, T_{vj} \leq 175\text{ °C}, V_{GE} = 15\text{ V}, T_c = 25\text{ °C}$



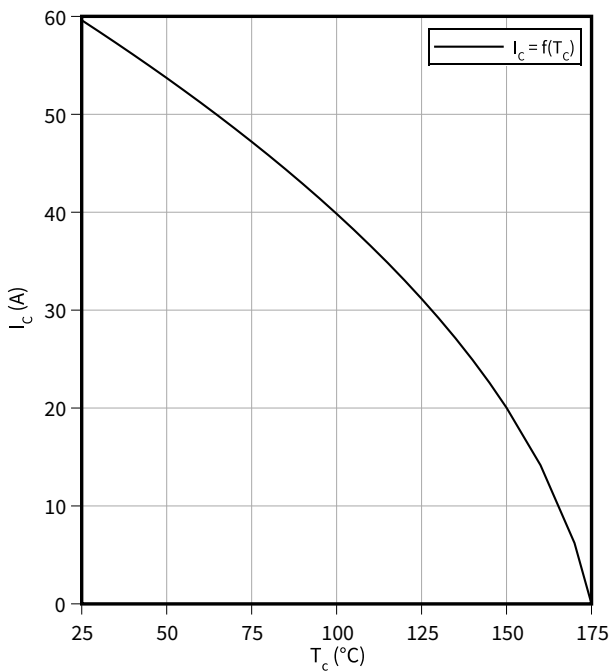
Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$
 $T_{vj} \leq 175\text{ °C}$



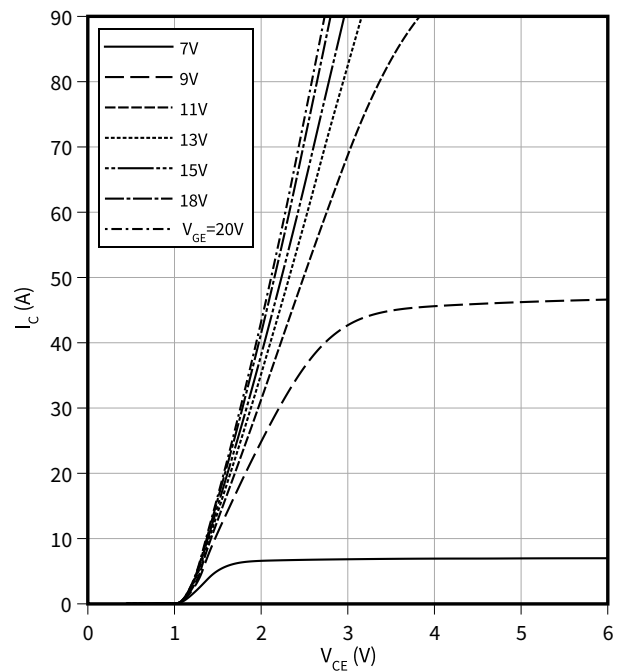
Collector current as a function of heatsink temperature

$I_C = f(T_c)$
 $T_{vj} \leq 175\text{ °C}, V_{GE} \geq 15\text{ V}$



Typical output characteristic

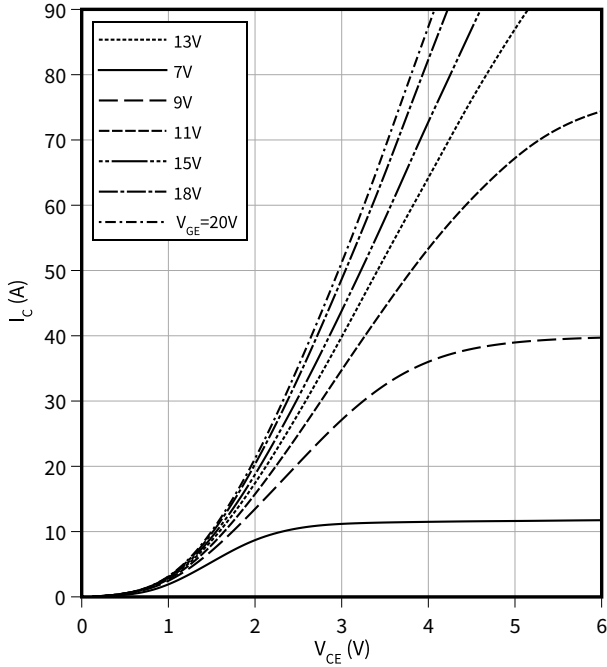
$I_C = f(V_{CE})$
 $T_{vj} = 25\text{ °C}$



4 Characteristics diagrams

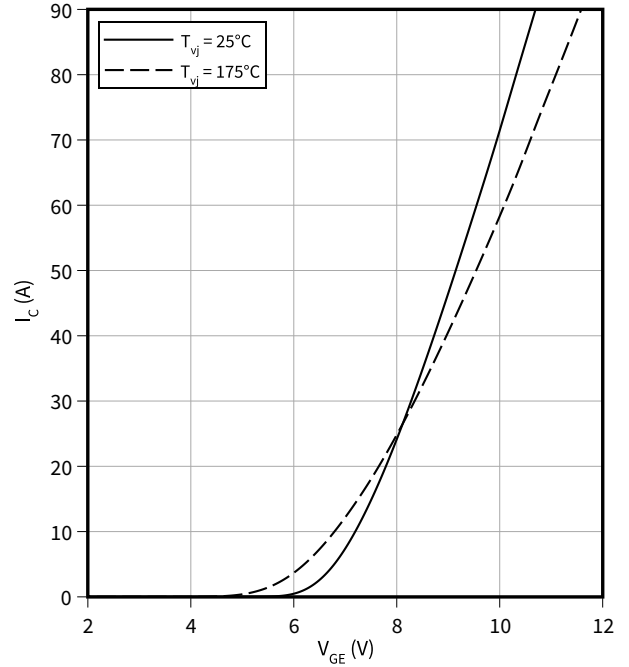
Typical output characteristic

$I_C = f(V_{CE})$
 $T_{vj} = 150\text{ °C}$



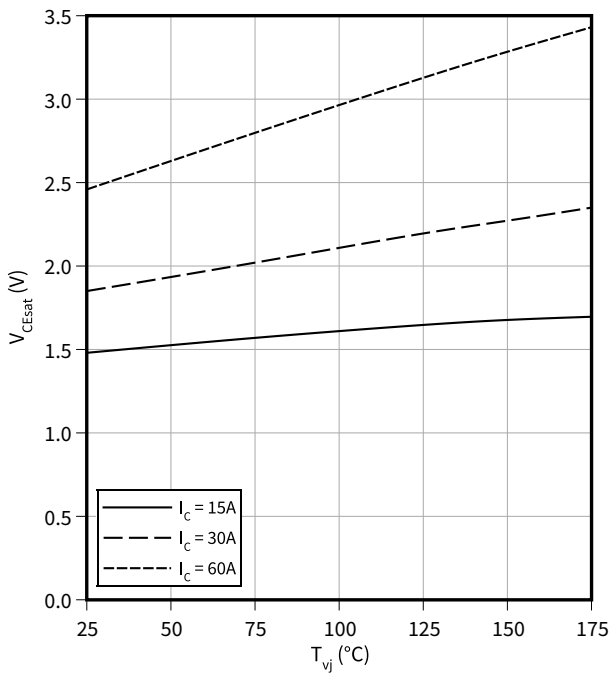
Typical transfer characteristic

$I_C = f(V_{GE})$
 $V_{CE} = 20\text{ V}$



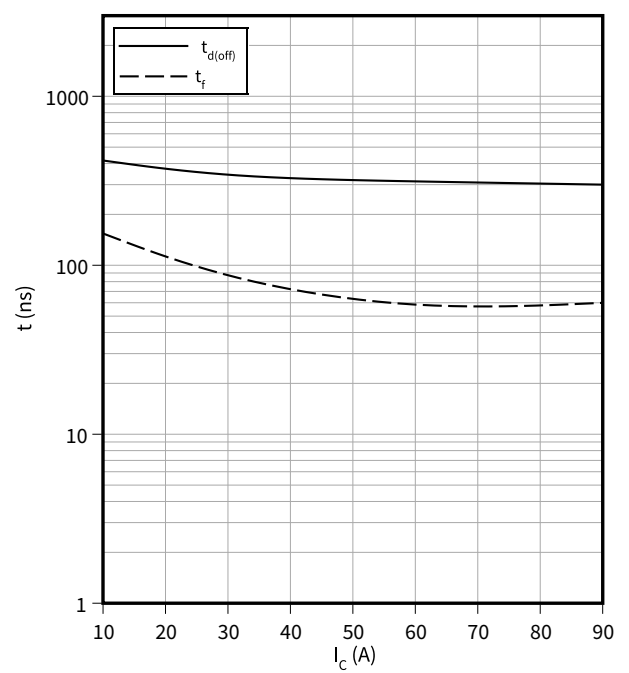
Typical collector-emitter saturation voltage as a function of junction temperature

$V_{CEsat} = f(T_{vj})$
 $V_{GE} = 15\text{ V}$



Typical switching times as a function of collector current

$t = f(I_C)$
 $V_{CC} = 600\text{ V}, T_{vj} = 175\text{ °C}, V_{GE} = 0/15\text{ V}, R_G = 10\text{ }\Omega$

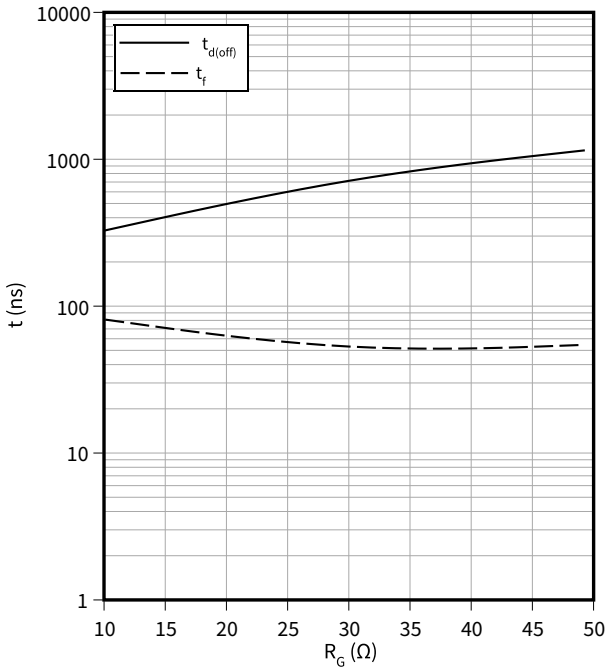


4 Characteristics diagrams

Typical switching times as a function of gate resistor

$t = f(R_G)$

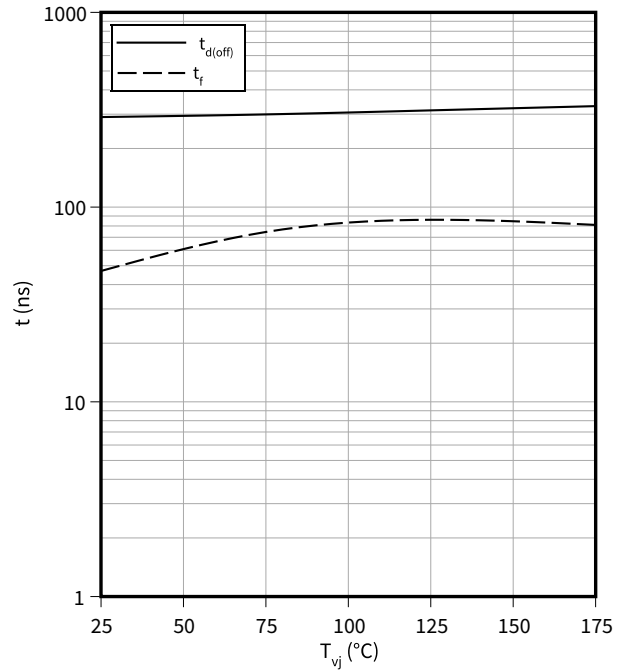
$I_C = 30\text{ A}, V_{CC} = 600\text{ V}, T_{vj} = 175\text{ }^\circ\text{C}, V_{GE} = 0/15\text{ V}$



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

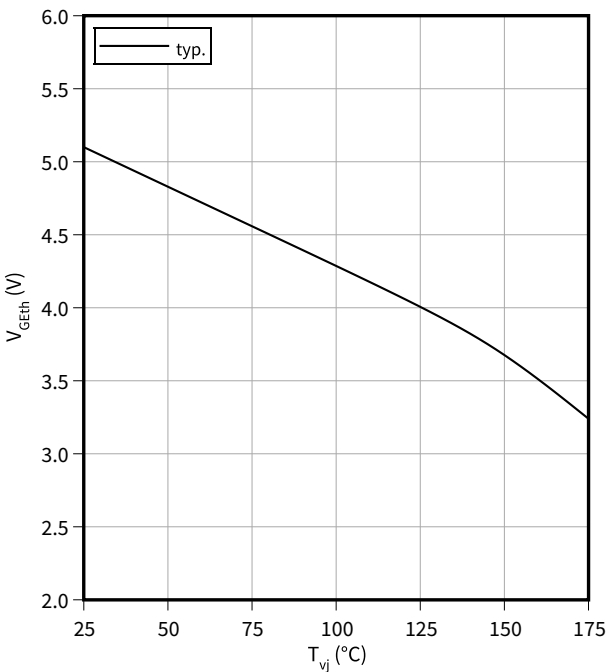
$I_C = 30\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_G = 10\text{ } \Omega$



Gate-emitter threshold voltage as a function of junction temperature

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

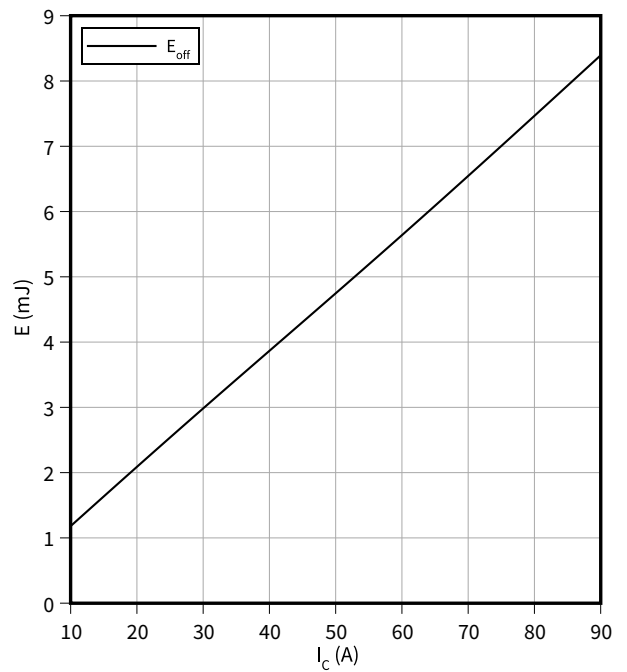
$I_C = 0.75\text{ mA}$



Typical switching energy losses as a function of collector current

$E = f(I_C)$

$V_{CC} = 600\text{ V}, T_{vj} = 175\text{ }^\circ\text{C}, V_{GE} = 0/15\text{ V}, R_G = 10\text{ } \Omega$

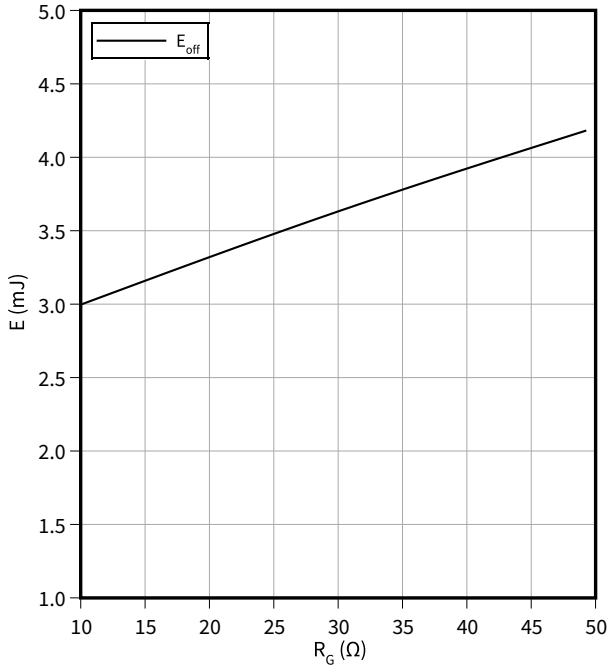


4 Characteristics diagrams

Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

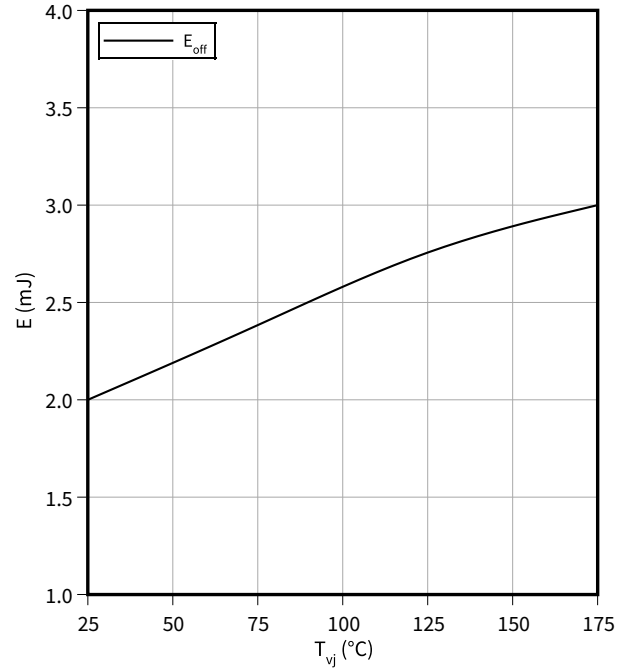
$I_C = 30\text{ A}, V_{CC} = 600\text{ V}, T_{vj} = 175\text{ }^\circ\text{C}, V_{GE} = 0/15\text{ V}$



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

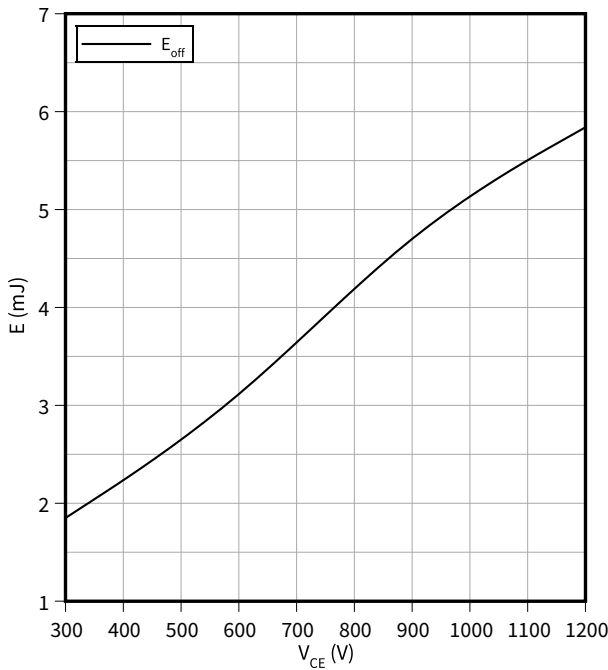
$I_C = 30\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_G = 10\text{ }\Omega$



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

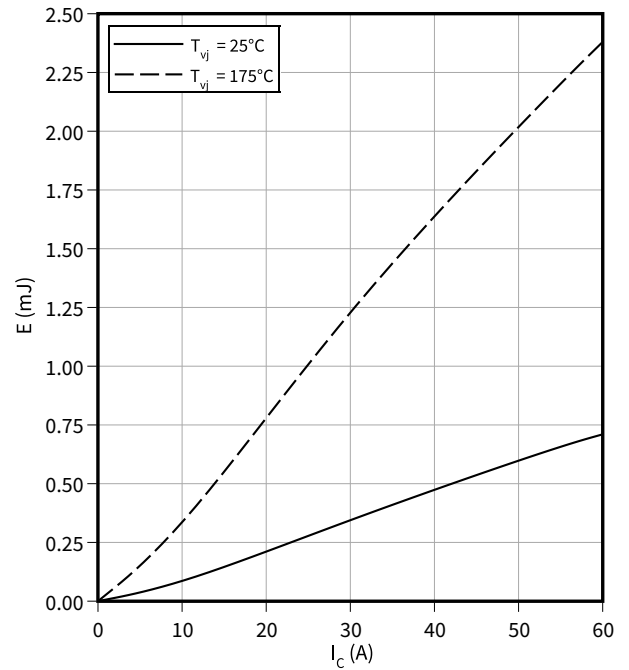
$I_C = 30\text{ A}, T_{vj} = 175\text{ }^\circ\text{C}, V_{GE} = 0/15\text{ V}, R_G = 10\text{ }\Omega$



Typical resonant switching energy losses as a function of collector current

$E = f(I_C)$

$V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_G = 10\text{ }\Omega$

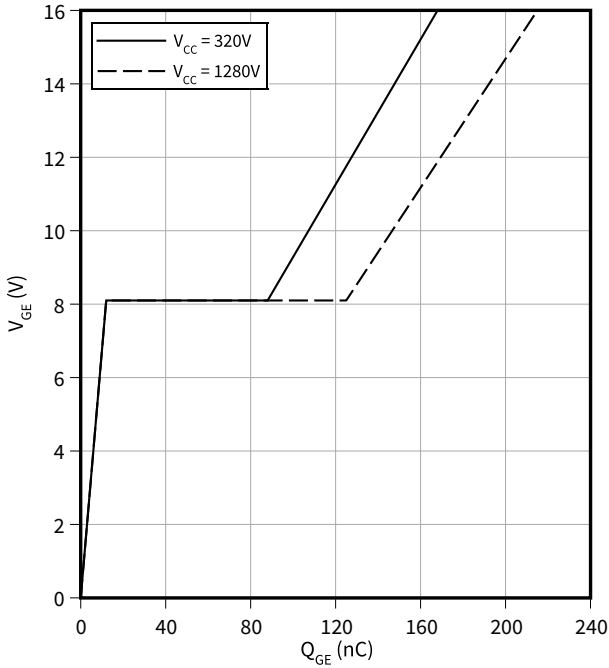


4 Characteristics diagrams

Typical gate charge

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

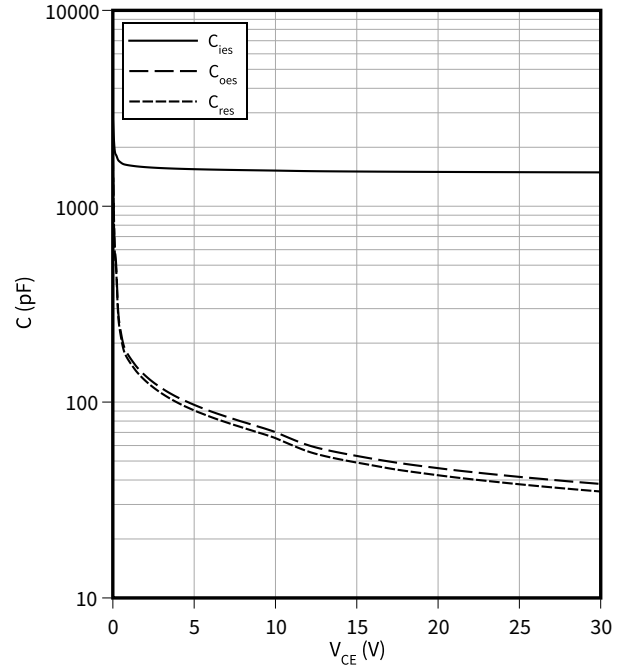
$I_C = 30\text{ A}$



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

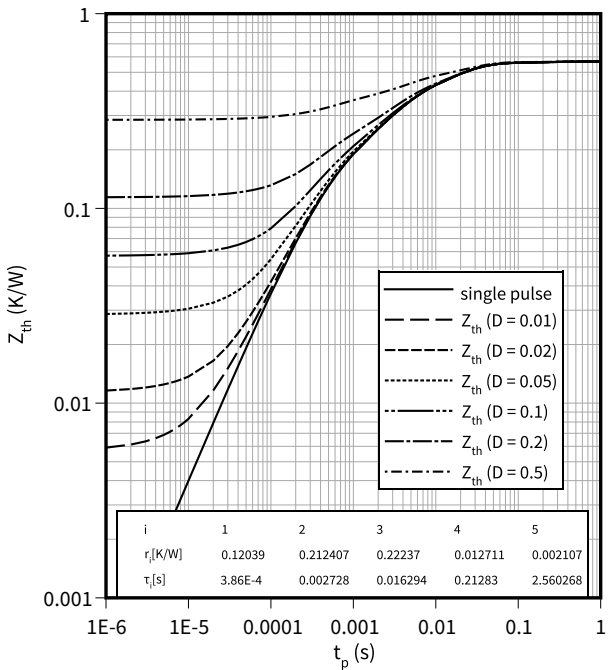
$f = 1000\text{ kHz}, V_{GE} = 0\text{ V}$



IGBT transient thermal impedance as a function of pulse width

$Z_{th} = f(t_p)$

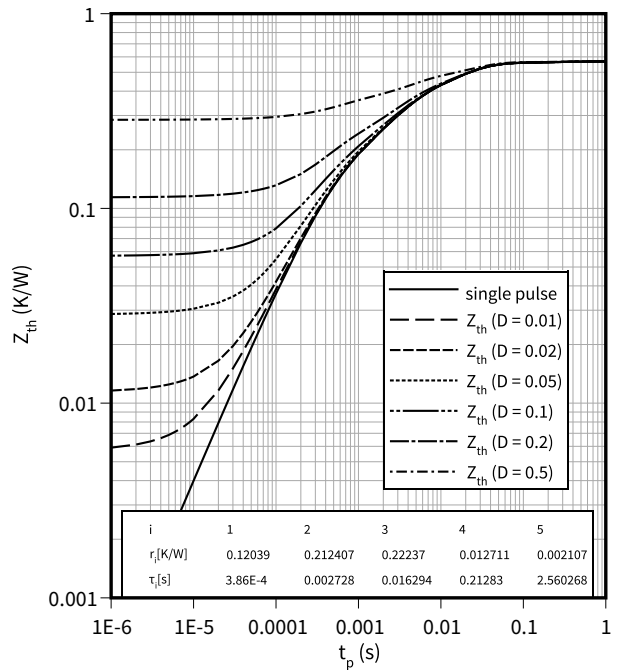
$D = t_p/T$



Diode transient thermal impedance as a function of pulse width

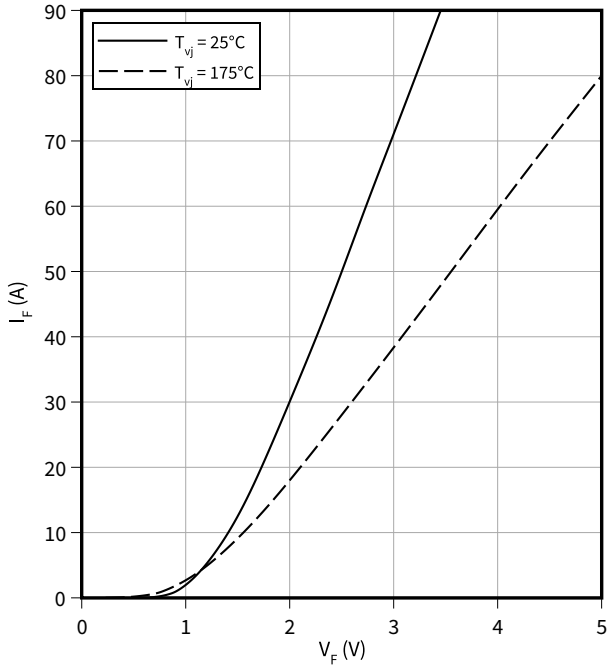
$Z_{th} = f(t_p)$

$D = t_p/T$



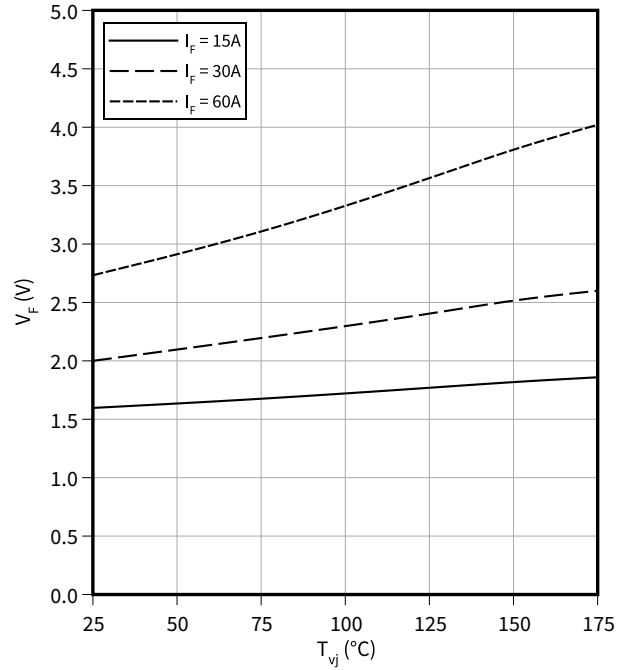
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



Typical diode forward voltage as a function of junction temperature

$V_F = f(T_{vj})$



5 Package outlines

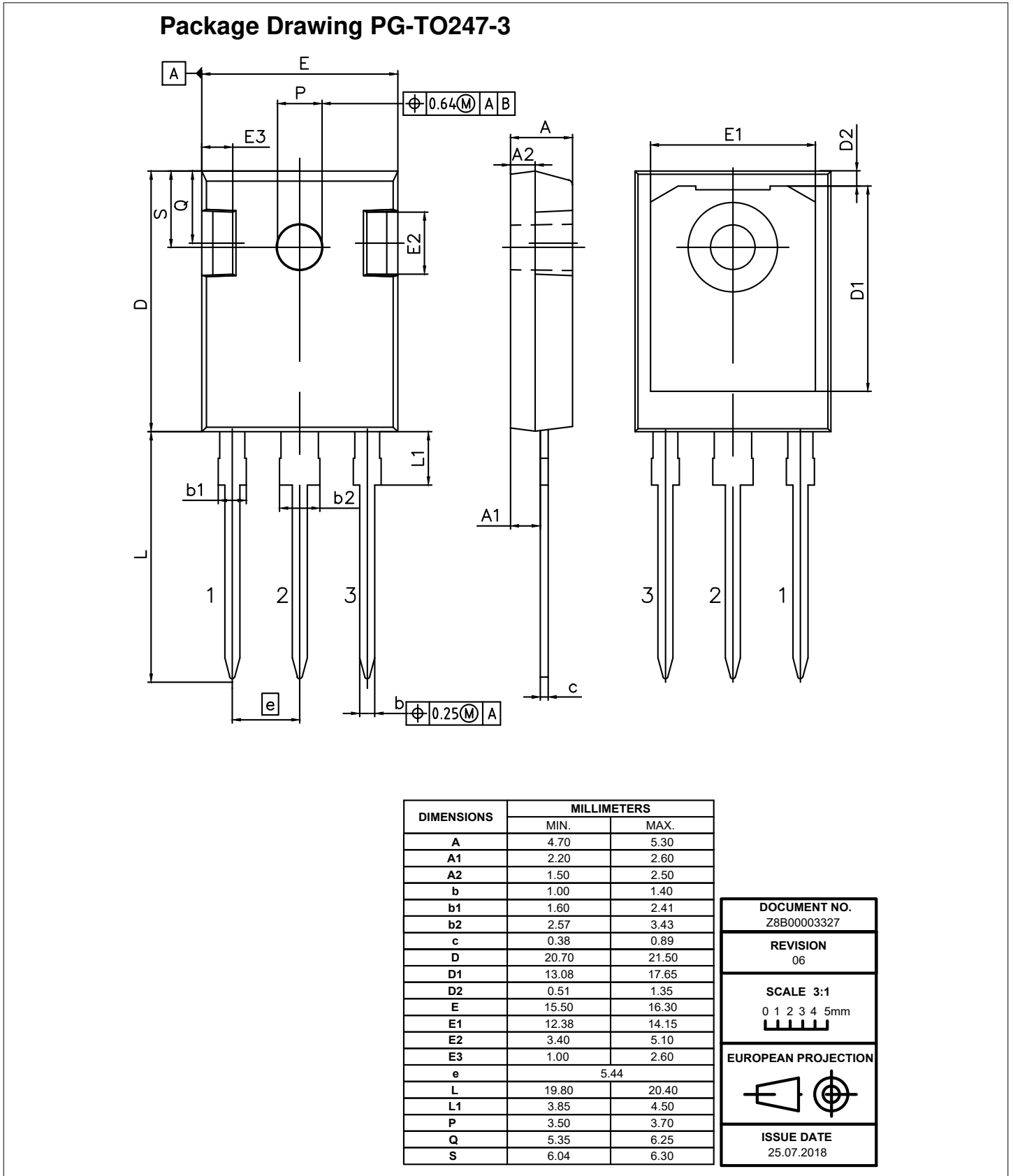


Figure 1

6 Testing conditions

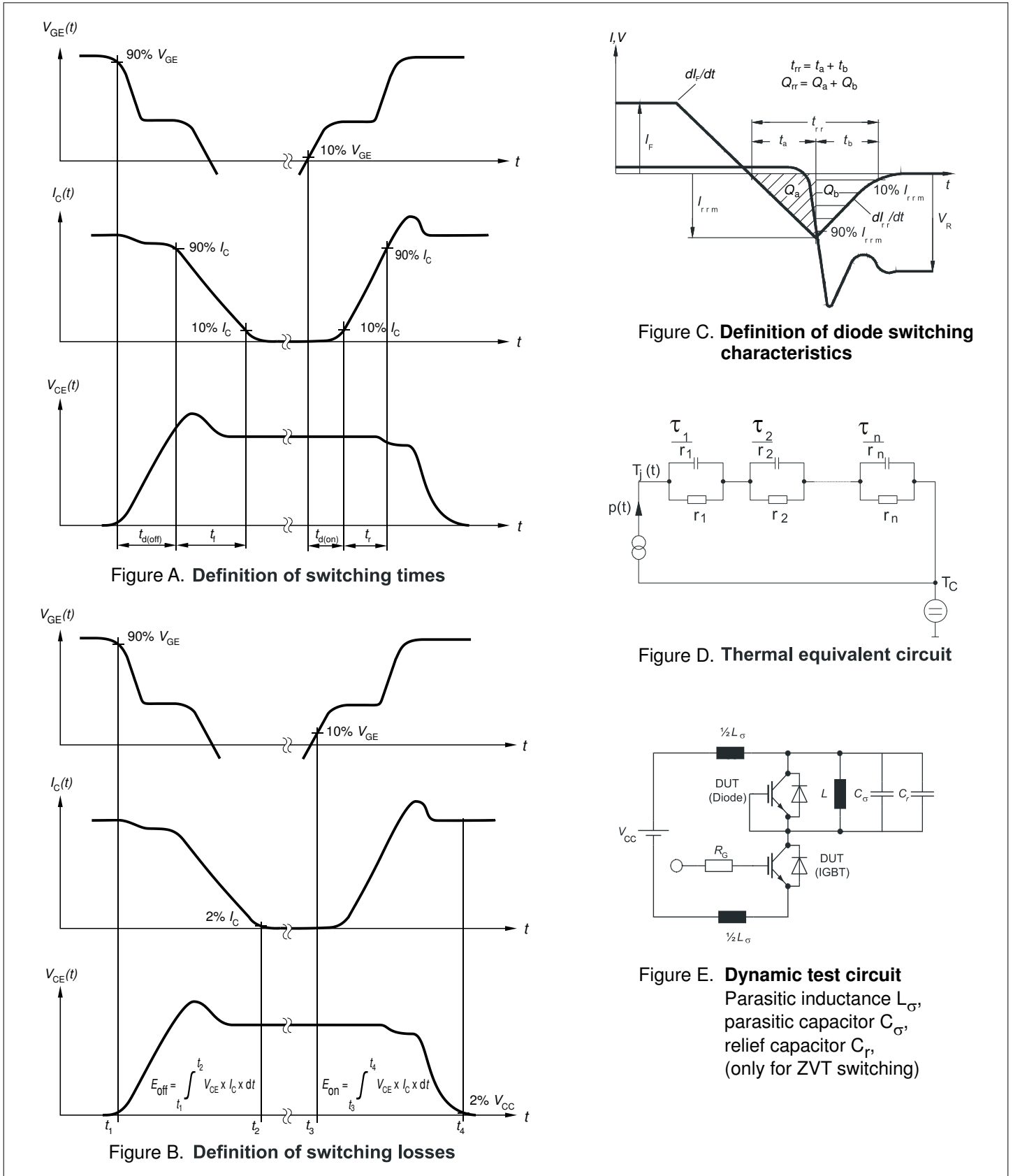


Figure 2

Revision history

Document revision	Date of release	Description of changes
V2.1	2018-08-28	Final Data Sheet
V2.2	2019-09-19	additional parameter in maximum ratings table: non repetitive peak collector current
n/a	2020-11-30	Datasheet migrated to a new system with a new layout and new revision number schema: target or preliminary datasheet = 0.xy; final datasheet = 1.xy
1.10	2022-04-05	“Forward bias safe operating area” diagram renamed to “Reverse bias safe operating area” T_{vj} condition in table “Maximum rated values ” of IGBT at “Turn off safe operating area” changed to 175°C

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