

## Reverse-Conducting IGBT with monolithic body diode

### Features

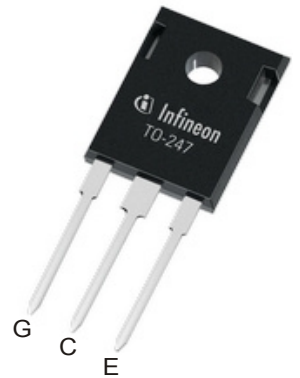
- $V_{CE} = 1600\text{ V}$
- $I_C = 30\text{ A}$
- Powerful monolithic body diode with low forward voltage
- Very tight parameter distribution
- High ruggedness, temperature stable behavior
- Low  $V_{CEsat}$
- Easy parallel switching capability due to positive temperature coefficient in  $V_{CEsat}$
- 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

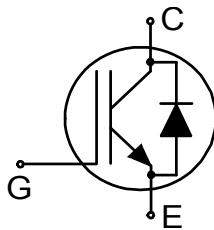
- Induction cooking
- Microwave ovens

### Product validation

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



### Description



Type	Package	Marking
IHW30N160R5	PG-TO247-3	H30SR5

## Table of contents

	<b>Description</b> .....	1
	<b>Features</b> .....	1
	<b>Potential applications</b> .....	1
	<b>Product validation</b> .....	1
	<b>Table of contents</b> .....	2
<b>1</b>	<b>Package</b> .....	3
<b>2</b>	<b>IGBT</b> .....	3
<b>3</b>	<b>Diode</b> .....	5
<b>4</b>	<b>Characteristics diagrams</b> .....	6
<b>5</b>	<b>Package outlines</b> .....	12
<b>6</b>	<b>Testing conditions</b> .....	13
	<b>Revision history</b> .....	14
	<b>Disclaimer</b> .....	15

## 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 <sup>1)</sup>	$I_{CSM}$		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	$\mu\text{A}$
			$T_{vj} = 175\text{ °C}$		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

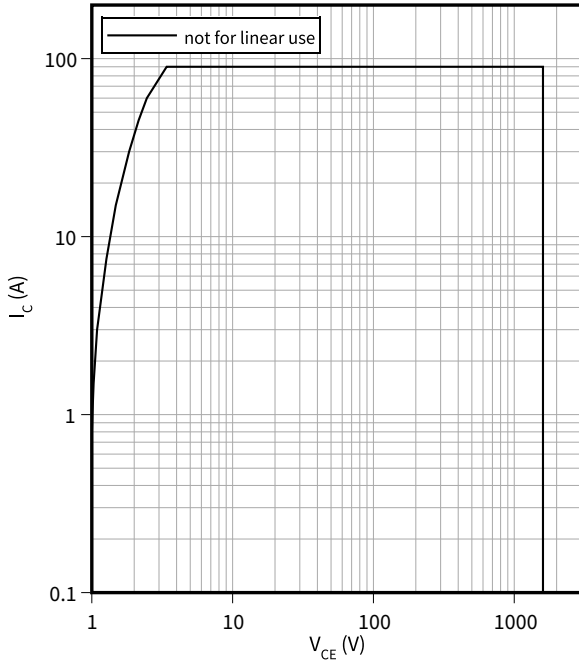
Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Diode forward voltage	$V_F$	$I_F = 30\text{ A}$	$T_{vj} = 25^{\circ}\text{C}$		2	2.3	V
			$T_{vj} = 125^{\circ}\text{C}$		2.4		
			$T_{vj} = 175^{\circ}\text{C}$		2.6		
Diode thermal resistance, junction to case	$R_{thjc}$			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

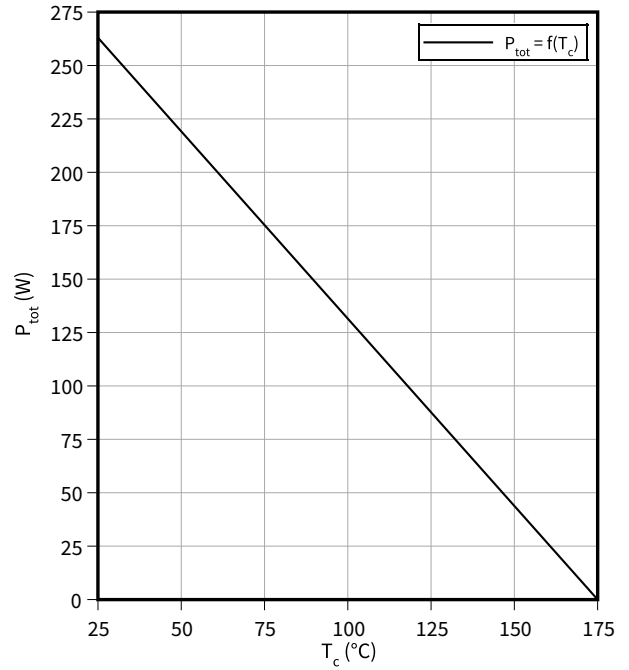
### Reverse bias safe operating area

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



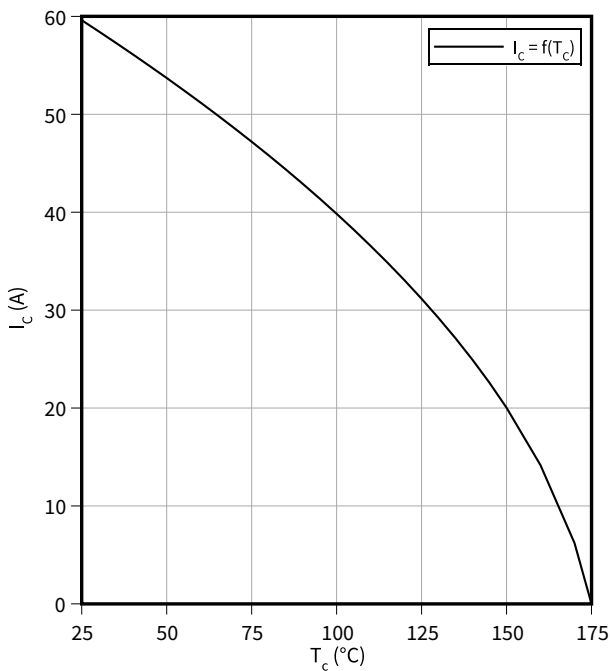
### Power dissipation as a function of case temperature

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



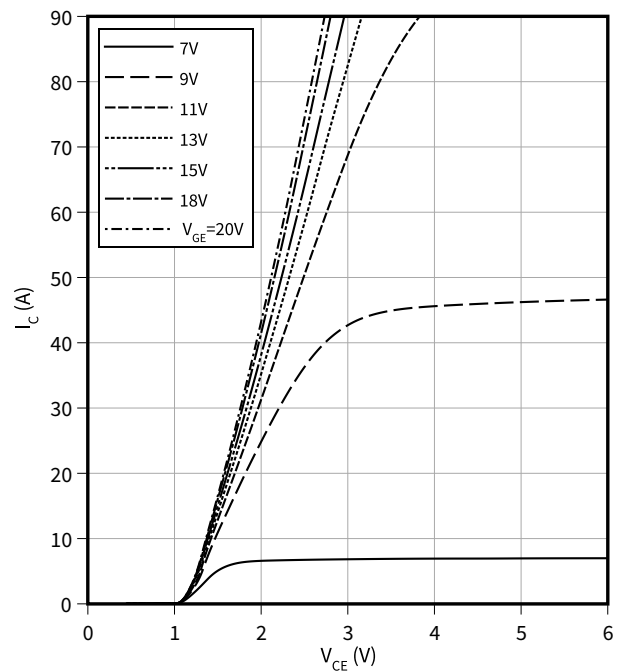
### Collector current as a function of heatsink temperature

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



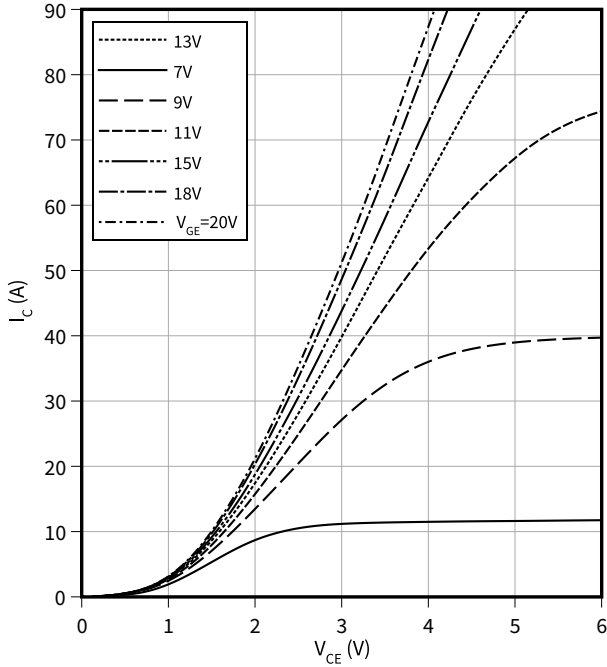
### Typical output characteristic

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



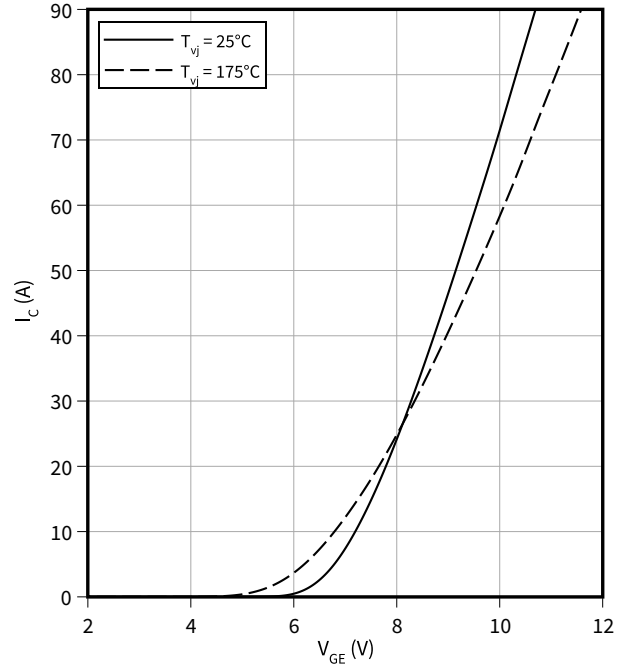
**Typical output characteristic**

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



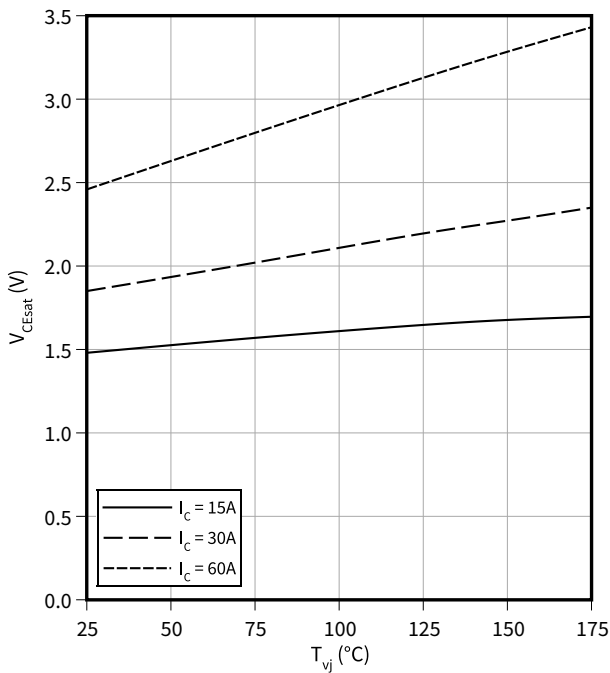
**Typical transfer characteristic**

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



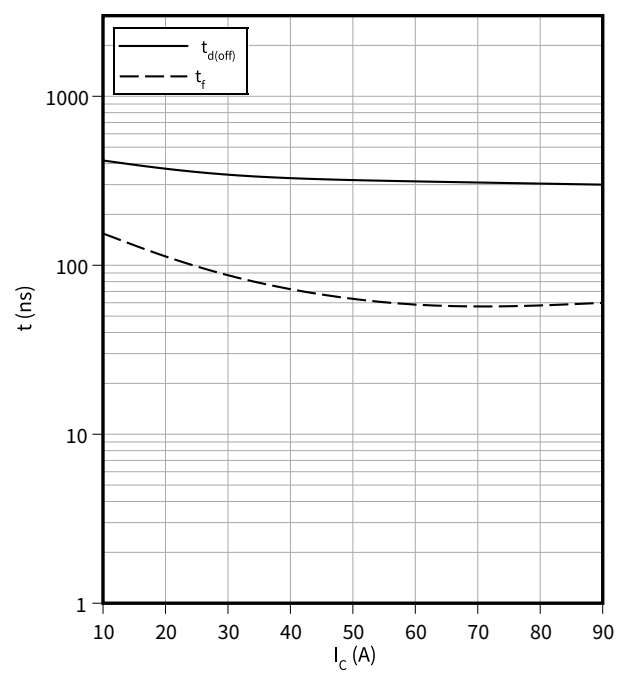
**Typical collector-emitter saturation voltage as a function of junction temperature**

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



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

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

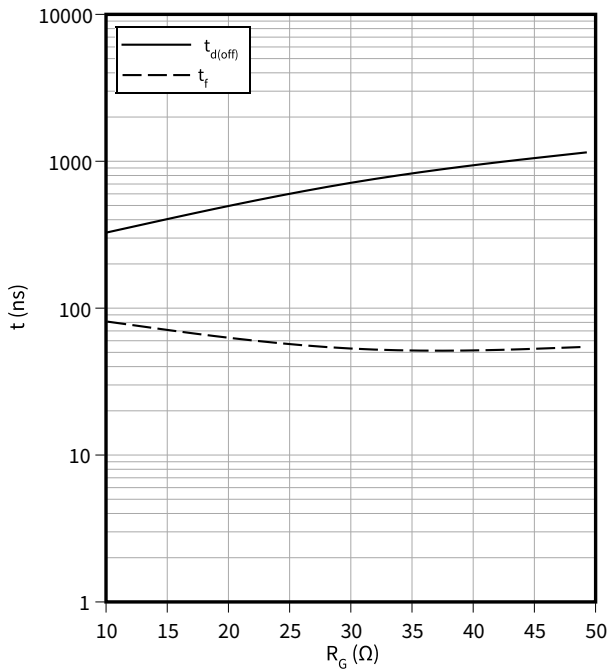


4 Characteristics diagrams

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

$t = f(R_G)$

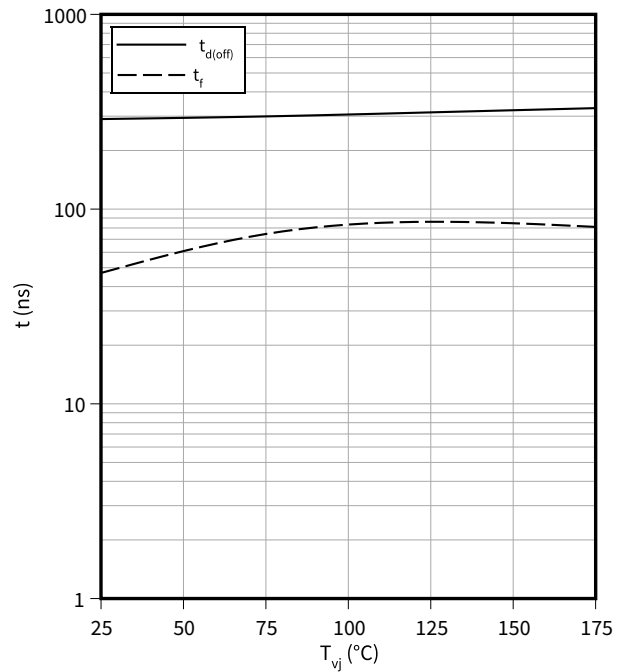
$I_C = 30\text{ A}$ ,  $V_{CC} = 600\text{ V}$ ,  $T_{vj} = 175\text{ °C}$ ,  $V_{GE} = 0/15\text{ V}$



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

$t = f(T_{vj})$

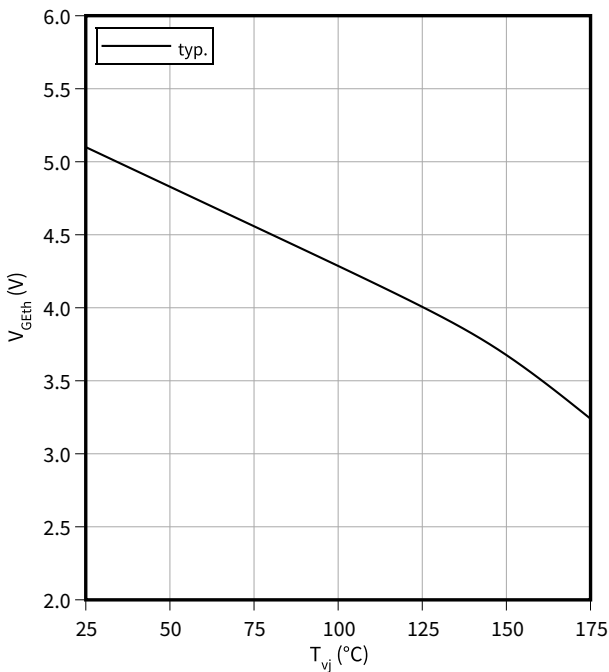
$I_C = 30\text{ A}$ ,  $V_{CC} = 600\text{ V}$ ,  $V_{GE} = 0/15\text{ V}$ ,  $R_G = 10\text{ Ω}$



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

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

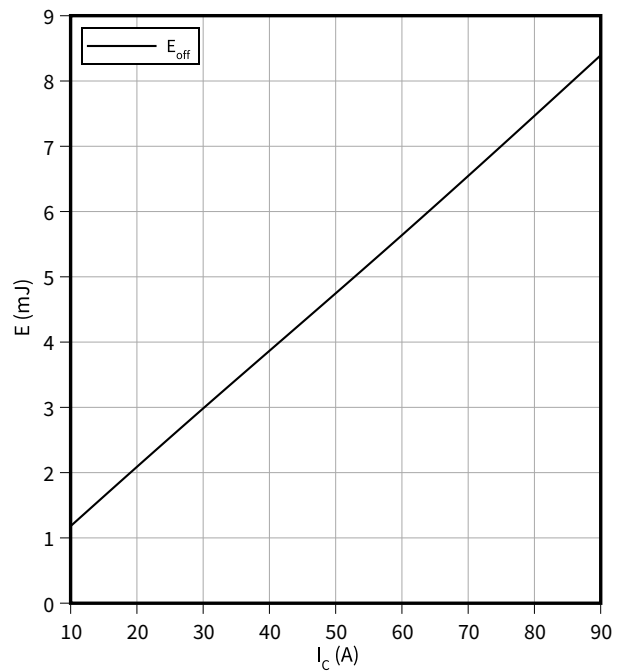
$I_C = 0.75\text{ mA}$



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

$E = f(I_C)$

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

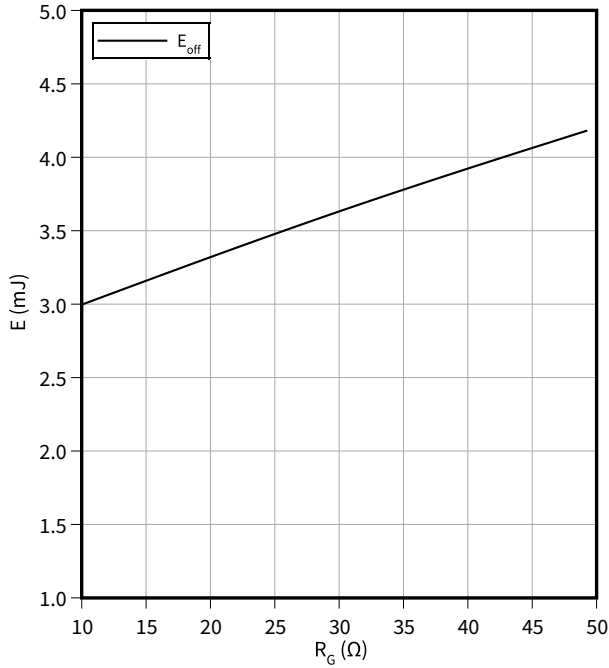


4 Characteristics diagrams

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

$E = f(R_G)$

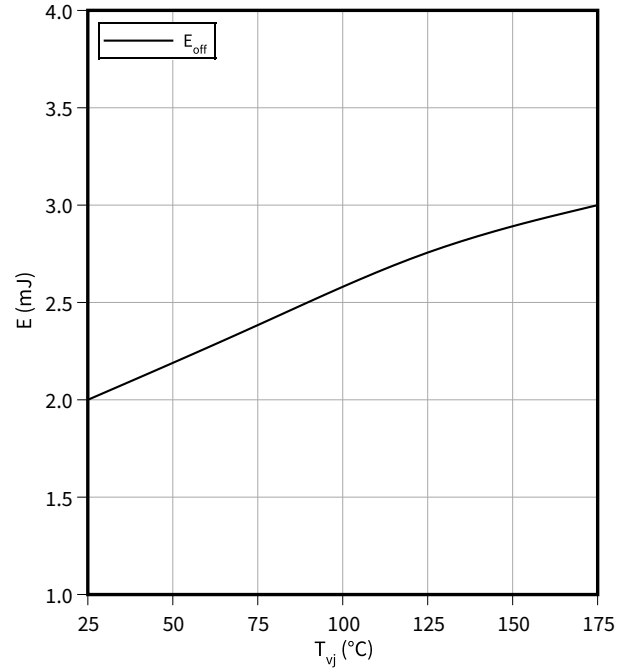
$I_C = 30\text{ A}, V_{CC} = 600\text{ V}, T_{vj} = 175\text{ }^\circ\text{C}, V_{GE} = 0/15\text{ V}$



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

$E = f(T_{vj})$

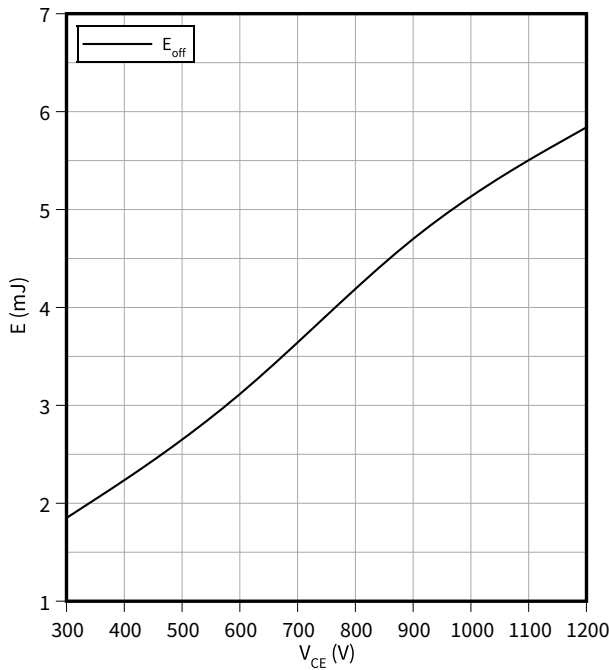
$I_C = 30\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = 0/15\text{ V}, R_G = 10\text{ }\Omega$



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

$E = f(V_{CE})$

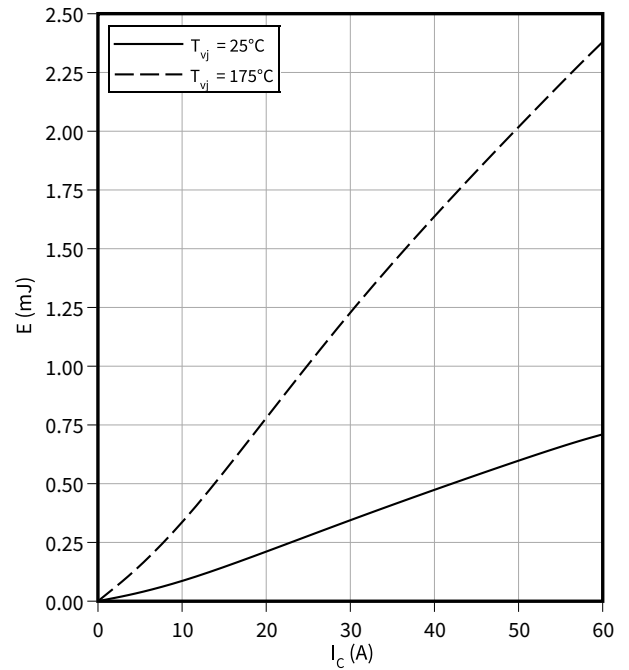
$I_C = 30\text{ A}, T_{vj} = 175\text{ }^\circ\text{C}, V_{GE} = 0/15\text{ V}, R_G = 10\text{ }\Omega$



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

$E = f(I_C)$

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

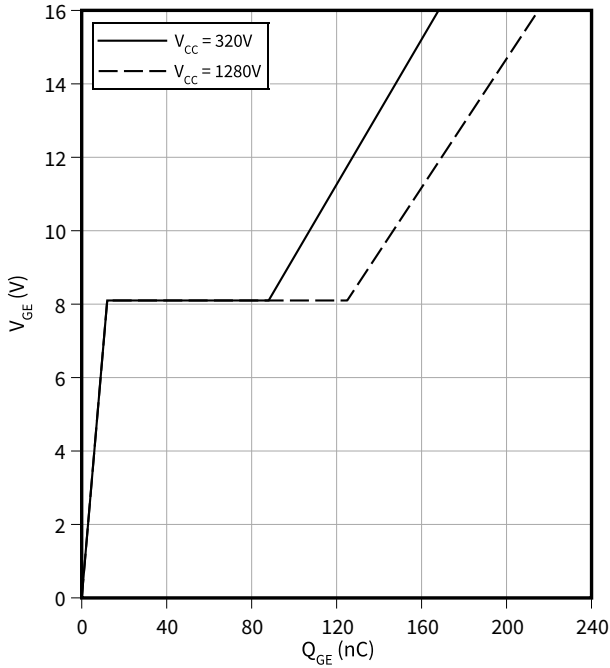


4 Characteristics diagrams

**Typical gate charge**

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

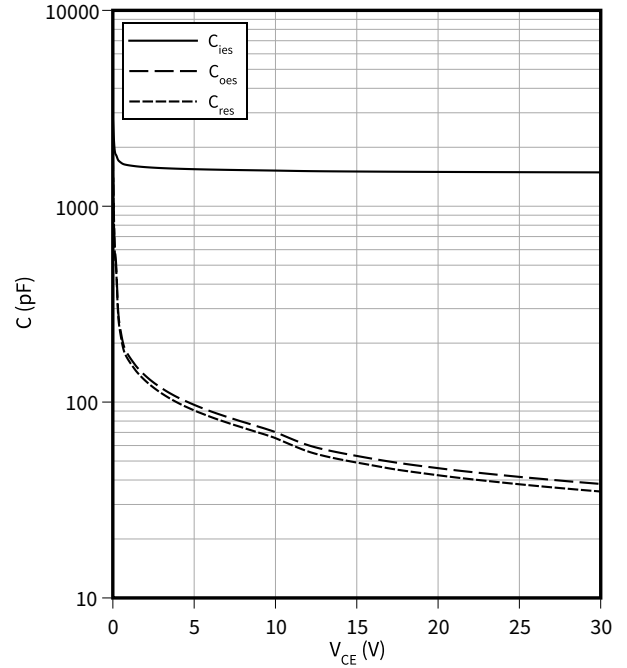
$I_C = 30\text{ A}$



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

$C = f(V_{CE})$

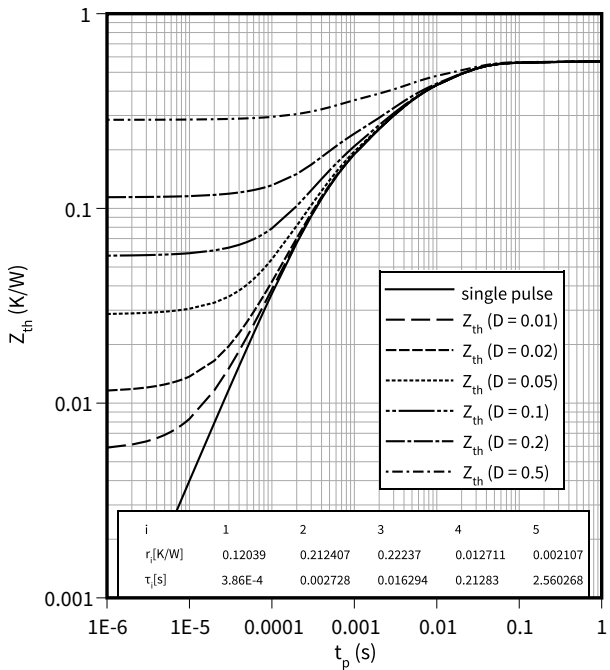
$f = 1000\text{ kHz}, V_{GE} = 0\text{ V}$



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

$Z_{th} = f(t_p)$

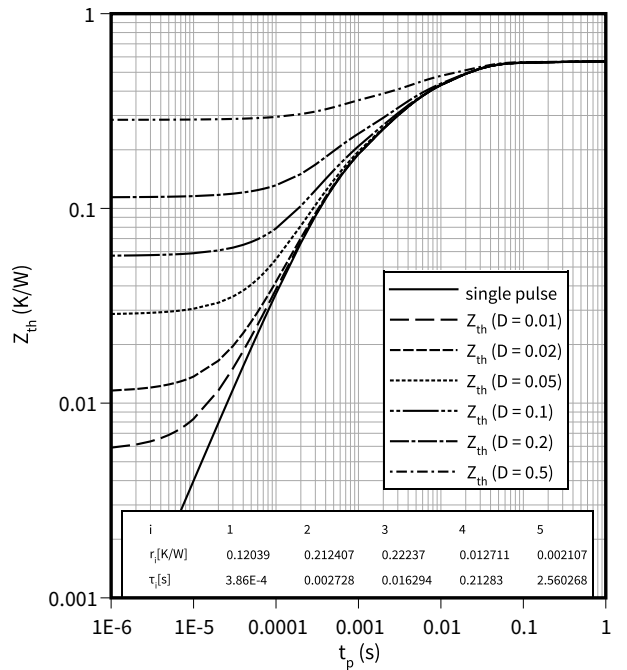
$D = t_p/T$



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

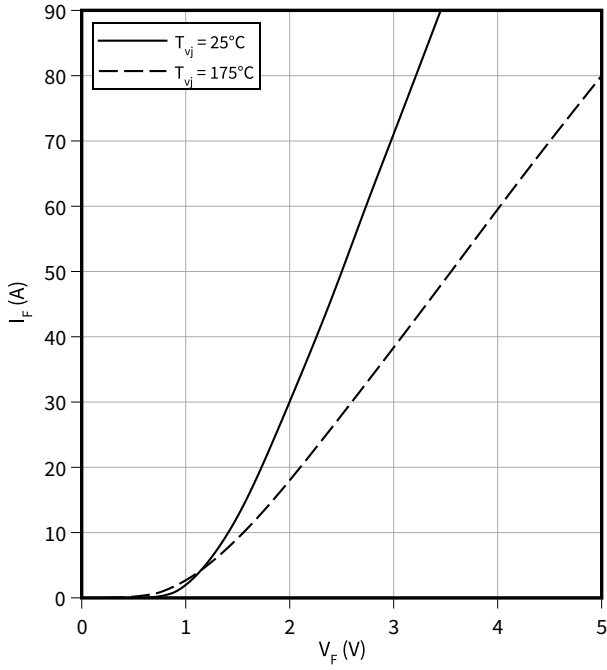
$Z_{th} = f(t_p)$

$D = t_p/T$



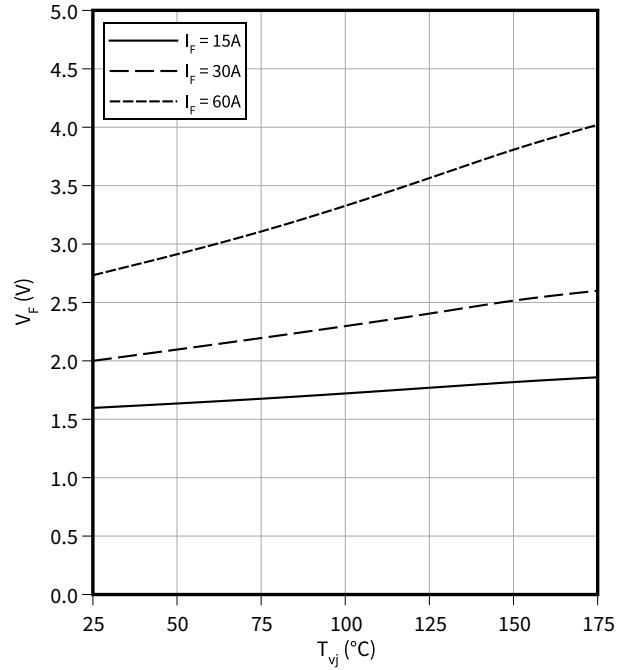
**Typical diode forward current as a function of forward voltage**

$I_F = f(V_F)$



**Typical diode forward voltage as a function of junction temperature**

$V_F = f(T_{vj})$



5 Package outlines

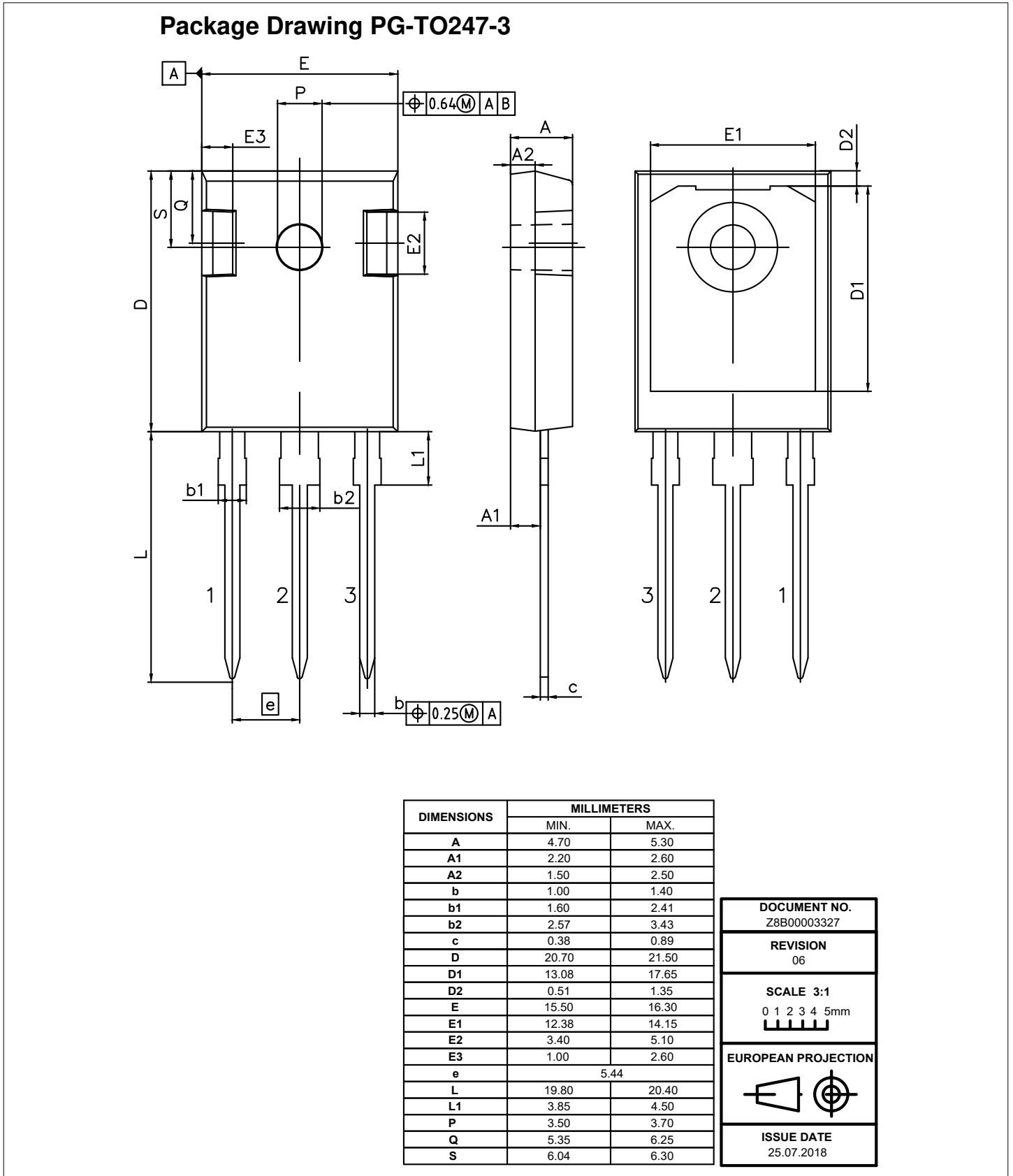


Figure 1

## 6 Testing conditions

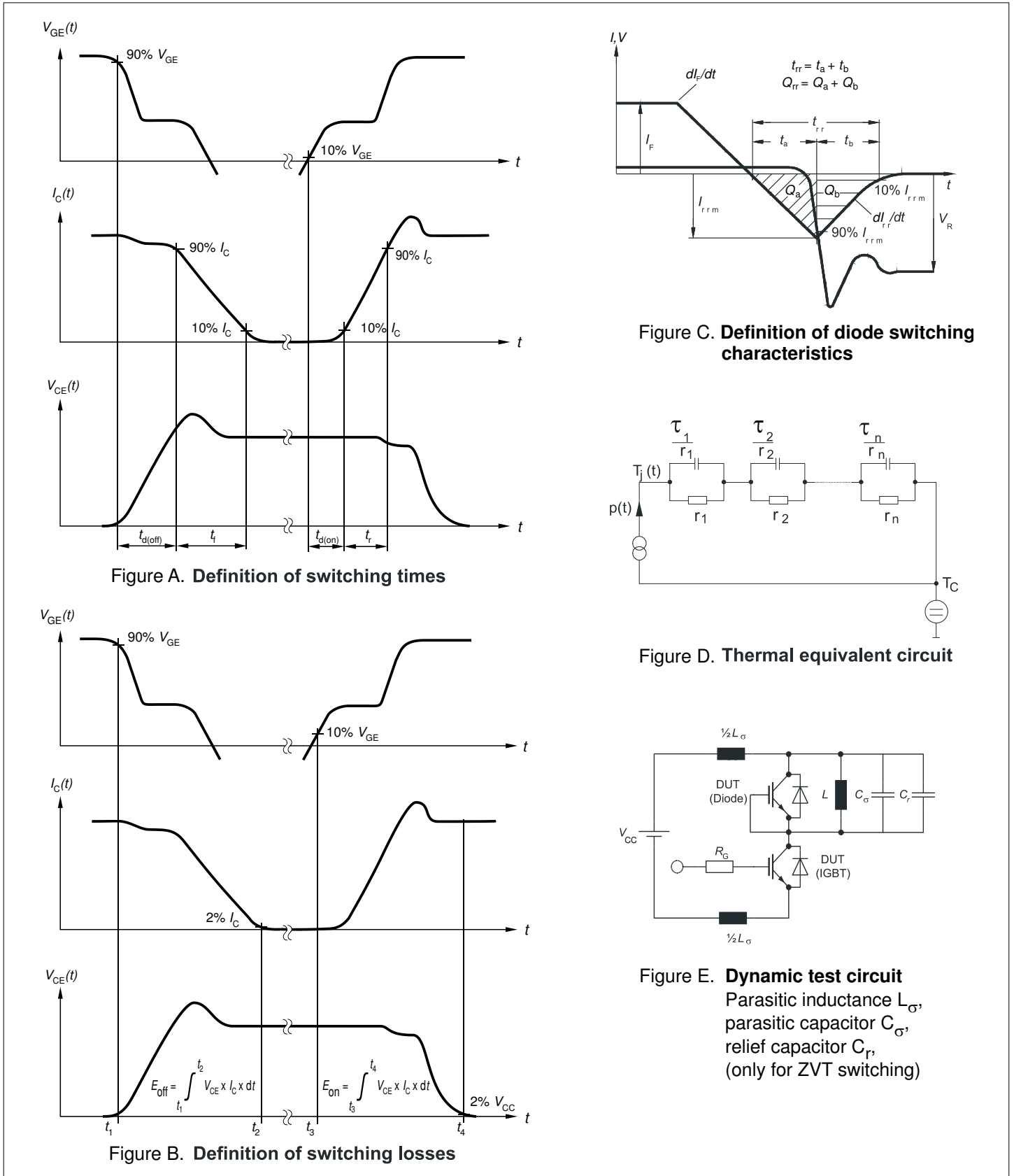


Figure 2

## 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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**Document reference**

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