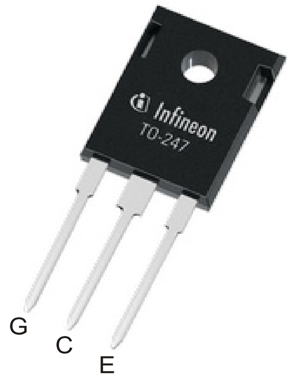
Reverse-Conducting IGBT with monolithic body diode



Features

- V_{CE} = 1600 V
- I_C = 30 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

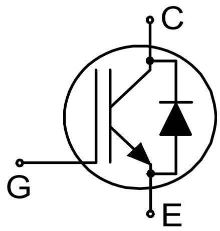
- Induction cooking
- Microwave ovens

Product validation

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

Lead-Free
Green
Halogen-Free
RoHS

Description



Type	Package	Marking
IHW30N160R5	PG-TO247-3	H30SR5

Table of contents

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}	$T_{vj} \geq 25$ °C		1600	V
DC collector current, limited by T_{vjmax}	I_C		$T_c = 25$ °C	60	A
			$T_c = 100$ °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		$V_{CE} = 1600$ V, $t_p = 1$ µs, $T_{vj} \leq 175$ °C		90	A
Gate-emitter voltage	V_{GE}			±20	V
Transient gate-emitter voltage	V_{GE}	$t_p \leq 10$ µs, $D < 0.01$		±25	V
Power dissipation	P_{tot}		$T_c = 25$ °C	263	W
			$T_c = 100$ °C	131.5	

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

Table 3 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter breakdown voltage	V_{BRCES}	$I_C = 0.5$ mA, $V_{GE} = 0$ 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 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.85	2.15	V
			T_{vj} = 125 °C		2.2		
			T_{vj} = 175 °C		2.4		
Gate-emitter threshold voltage	V_{GEth}	I_C = 0.75 mA, V_{CE} = V_{GE}		4.5	5.1	5.8	V
Zero gate-voltage collector current	I_{CES}	V_{CE} = 1600 V, V_{GE} = 0 V	T_{vj} = 25 °C			100	µA
			T_{vj} = 175 °C		800		
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V				100	nA
Transconductance	g_{fs}	I_C = 30 A, V_{CE} = 20 V			20.5		S
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			1500		pF
Output capacitance	C_{oes}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			42		pF
Reverse transfer capacitance	C_{res}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz			38		pF
Gate charge	Q_G	I_C = 30 A, V_{GE} = 15 V, V_{CC} = 1280 V			205		nC
Turn-off delay time	t_{doff}	V_{CC} = 600 V, V_{GE} = 0/15 V, R_{Gon} = 10 Ω, R_{Goff} = 10 Ω, $L_σ$ = 175 nH, $C_σ$ = 40 pF	T_{vj} = 25 °C, I_C = 30 A		290		ns
			T_{vj} = 175 °C, I_C = 30 A		330		
Fall time (inductive load)	t_f	V_{CC} = 600 V, V_{GE} = 0/15 V, R_{Gon} = 10 Ω, R_{Goff} = 10 Ω, $L_σ$ = 175 nH, $C_σ$ = 40 pF	T_{vj} = 25 °C, I_C = 30 A		47		ns
			T_{vj} = 175 °C, I_C = 30 A		81		
Turn-off energy	E_{off}	V_{CC} = 600 V, V_{GE} = 0/15 V, R_{Gon} = 10 Ω, R_{Goff} = 10 Ω, $L_σ$ = 175 nH, $C_σ$ = 40 pF	T_{vj} = 25 °C, I_C = 30 A		2		mJ
			T_{vj} = 175 °C, I_C = 30 A		3		
Total switching energy	E_{ts}	V_{CC} = 600 V, V_{GE} = 0/15 V, R_{Gon} = 10 Ω, R_{Goff} = 10 Ω, $L_σ$ = 175 nH, $C_σ$ = 40 pF	I_C = 30 A		0.35		mJ
			I_C = 30 A		1.27		
Soft turn-off energy	E_{off}	V_{CC} = 600 V, dv/dt = 300 V/µs	T_{vj} = 25 °C		0.35		mJ
			T_{vj} = 175 °C		1.27		
IGBT thermal resistance, junction to case	R_{thjc}					0.57	K/W
Operating junction temperature	T_{vj}			-40		175	°C

Note: *Electrical Characteristic, at T_{vj} = 25°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}	$T_{vj} \geq 25$ °C		1600	V
Diode forward current, limited by T_{vjmax}	I_F		$T_c = 25$ °C	55	A
			$T_c = 100$ °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	$I_F = 30$ A	$T_{vj} = 25$ °C		2	2.3	V
			$T_{vj} = 125$ °C		2.4		
			$T_{vj} = 175$ °C		2.6		
Diode thermal resistance, junction to case	R_{thjc}					0.57	K/W
Operating junction temperature	T_{vj}			-40		175	°C

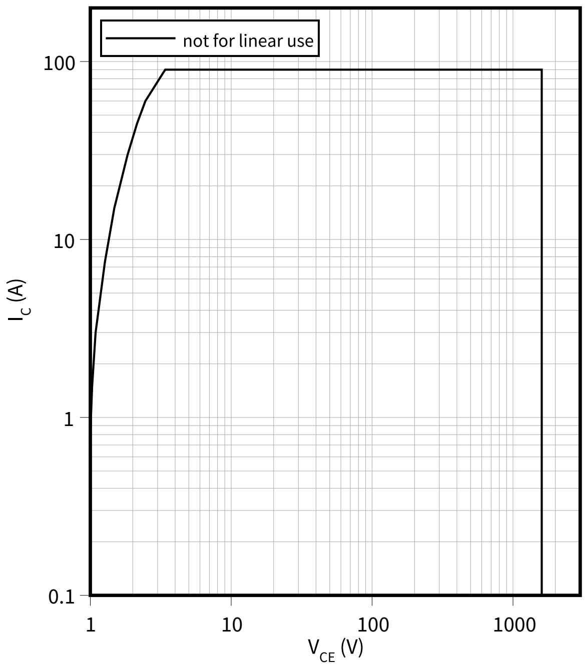
Note: *For optimum lifetime and reliability, Infineon recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.*

4 Characteristics diagrams

Reverse bias safe operating area

$I_C = f(V_{CE})$

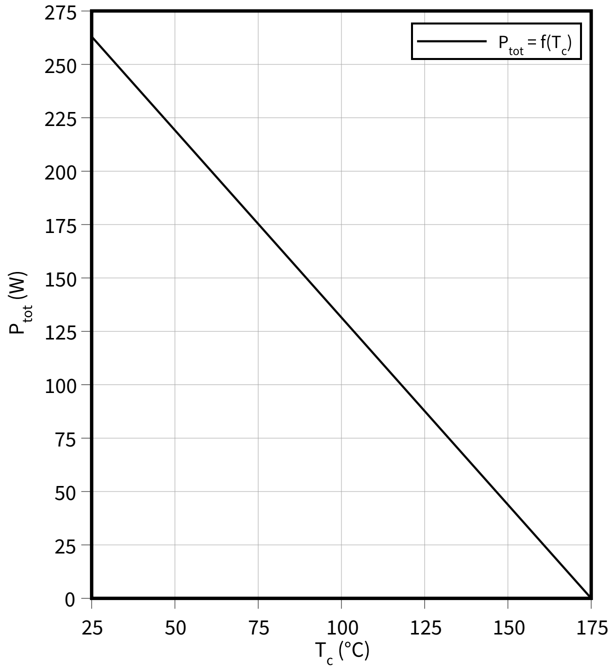
$D = 0$, $T_{vj} \leq 175$ °C, $V_{GE} = 15$ V, $T_c = 25$ °C



Power dissipation as a function of case temperature

$P_{tot} = f(T_c)$

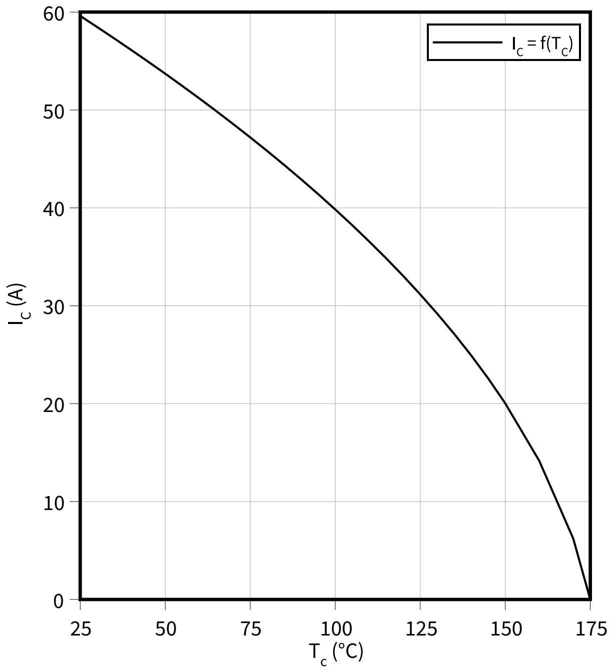
$T_{vj} \leq 175$ °C



Collector current as a function of heatsink temperature

$I_C = f(T_c)$

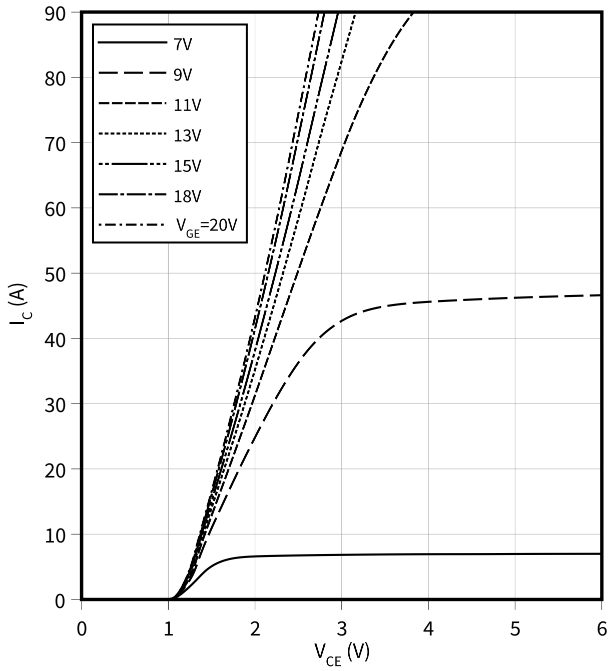
$T_{vj} \leq 175$ °C, $V_{GE} \geq 15$ V



Typical output characteristic

$I_C = f(V_{CE})$

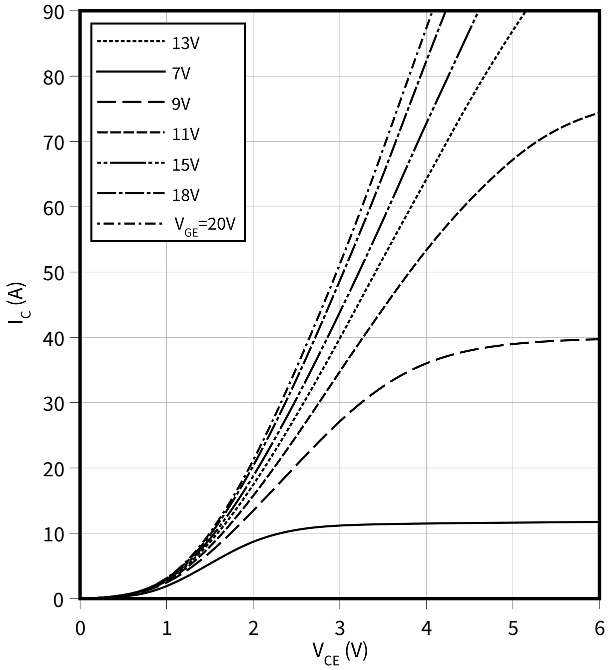
$T_{vj} = 25$ °C



Typical output characteristic

$I_C = f(V_{CE})$

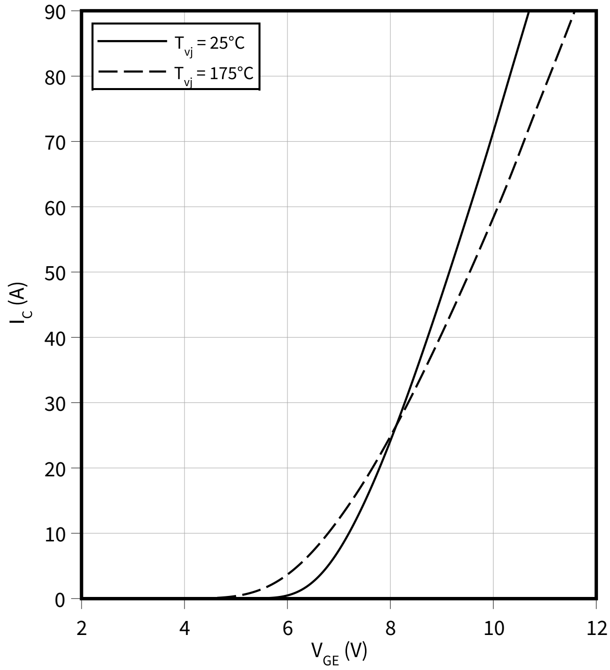
$T_{vj} = 150\ °C$



Typical transfer characteristic

$I_C = f(V_{GE})$

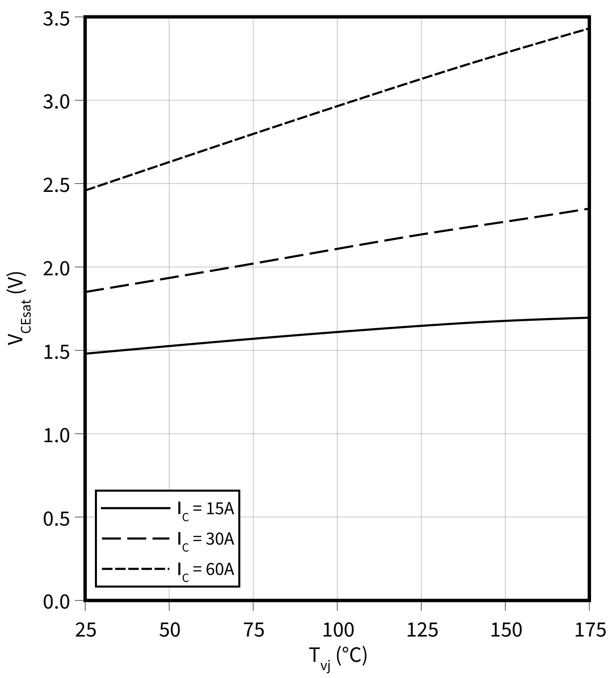
$V_{CE} = 20\ V$



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

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

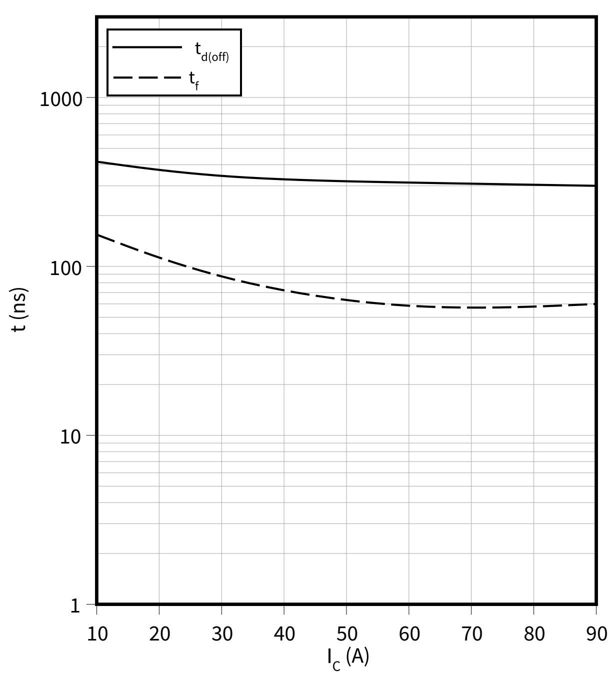
$V_{GE} = 15\ V$



Typical switching times as a function of collector current

$t = f(I_C)$

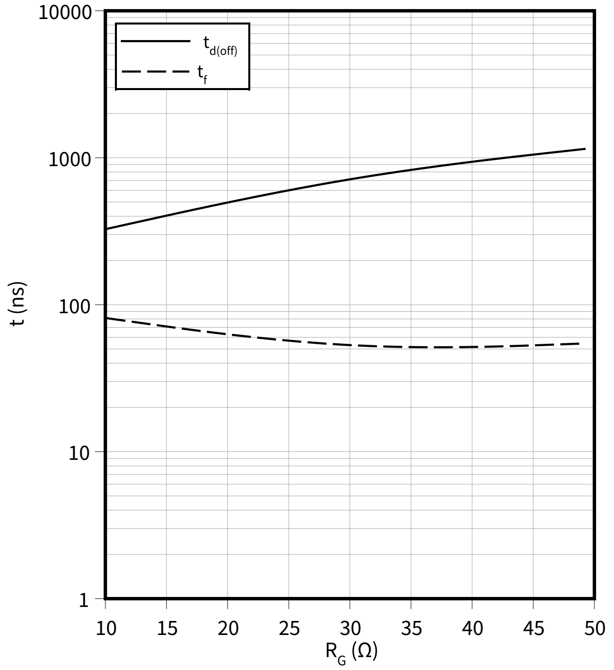
$V_{CC} = 600\ V$, $T_{vj} = 175\ °C$, $V_{GE} = 0/15\ V$, $R_G = 10\ \Omega$



Typical switching times as a function of gate resistor

$t = f(R_G)$

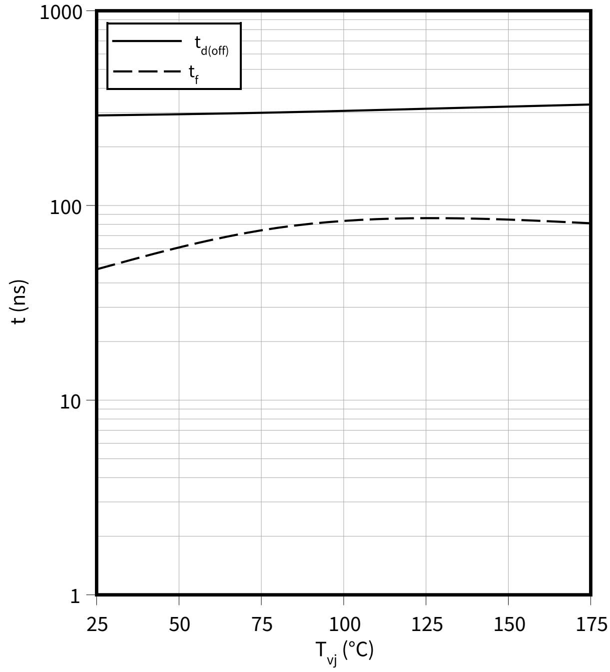
$I_C = 30$ A, $V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching times as a function of junction temperature

$t = f(T_{vj})$

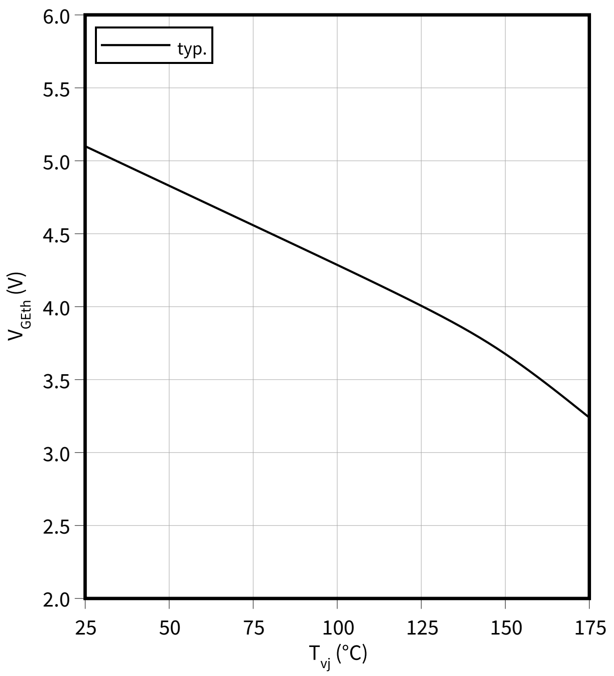
$I_C = 30$ A, $V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 10$ Ω



Gate-emitter threshold voltage as a function of junction temperature

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

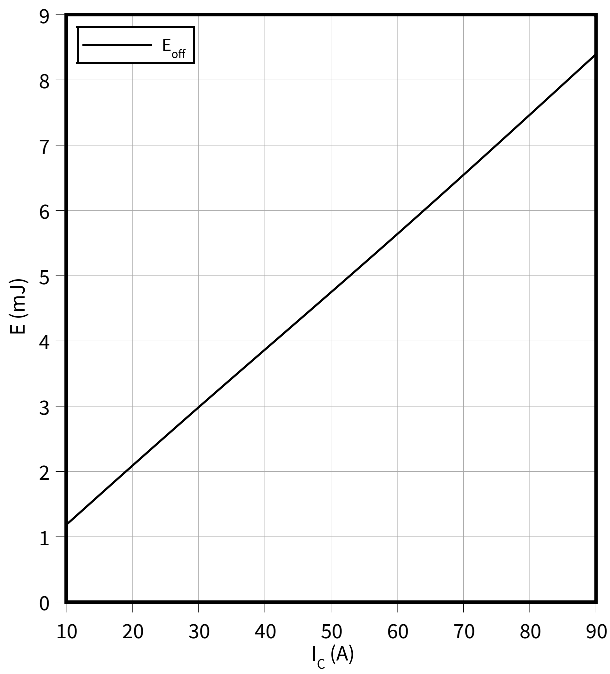
$I_C = 0.75$ mA



Typical switching energy losses as a function of collector current

$E = f(I_C)$

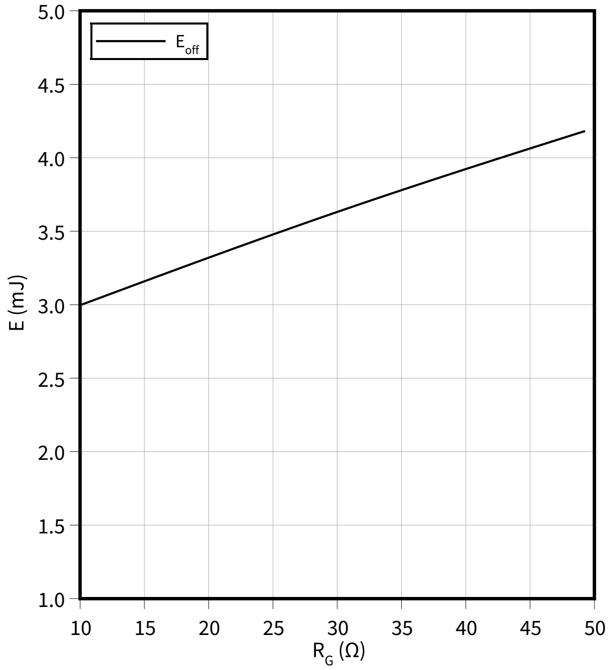
$V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 10$ Ω



Typical switching energy losses as a function of gate resistor

$E = f(R_G)$

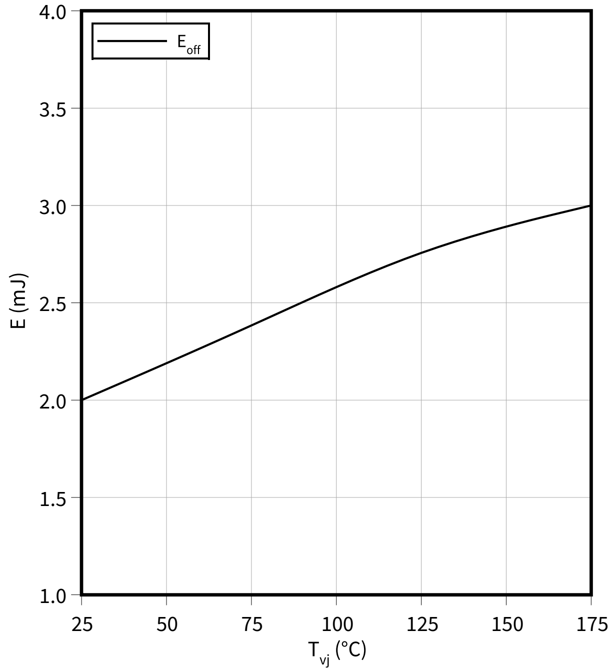
$I_C = 30$ A, $V_{CC} = 600$ V, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V



Typical switching energy losses as a function of junction temperature

$E = f(T_{vj})$

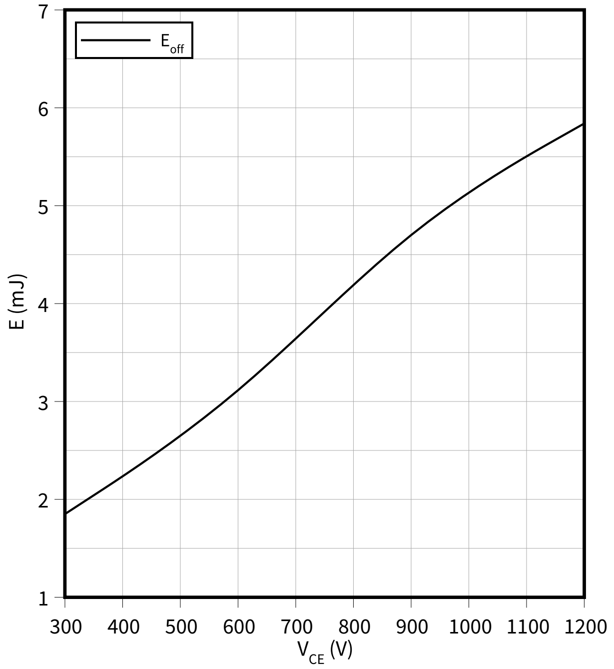
$I_C = 30$ A, $V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 10$ Ω



Typical switching energy losses as a function of collector emitter voltage

$E = f(V_{CE})$

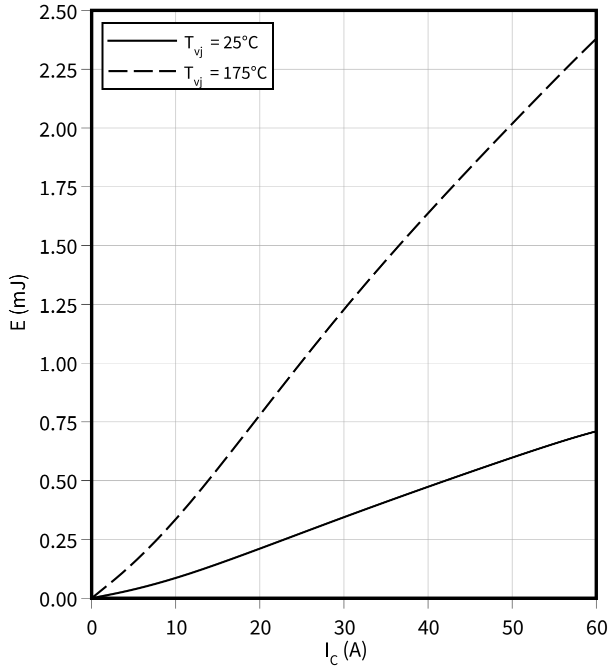
$I_C = 30$ A, $T_{vj} = 175$ °C, $V_{GE} = 0/15$ V, $R_G = 10$ Ω



Typical resonant switching energy losses as a function of collector current

$E = f(I_C)$

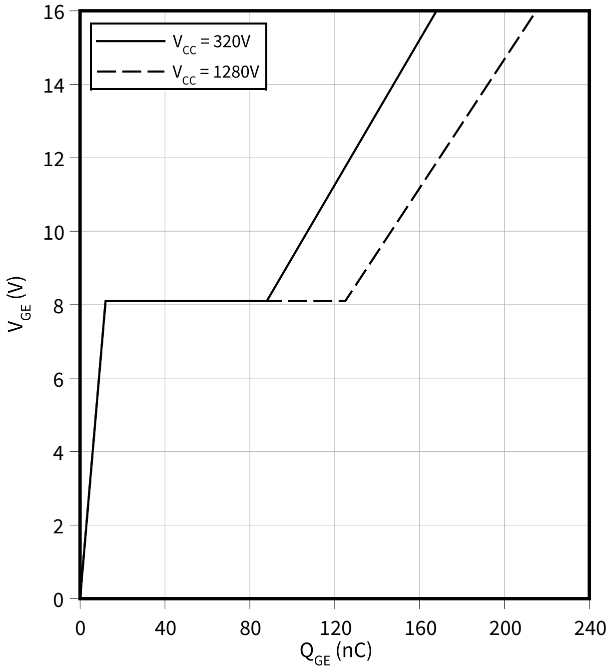
$V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 10$ Ω



Typical gate charge

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

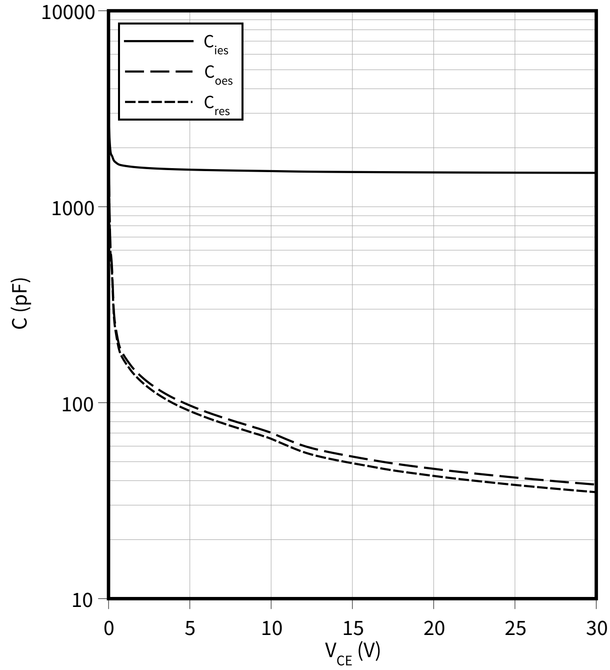
$I_C = 30$ A



Typical capacitance as a function of collector-emitter voltage

$C = f(V_{CE})$

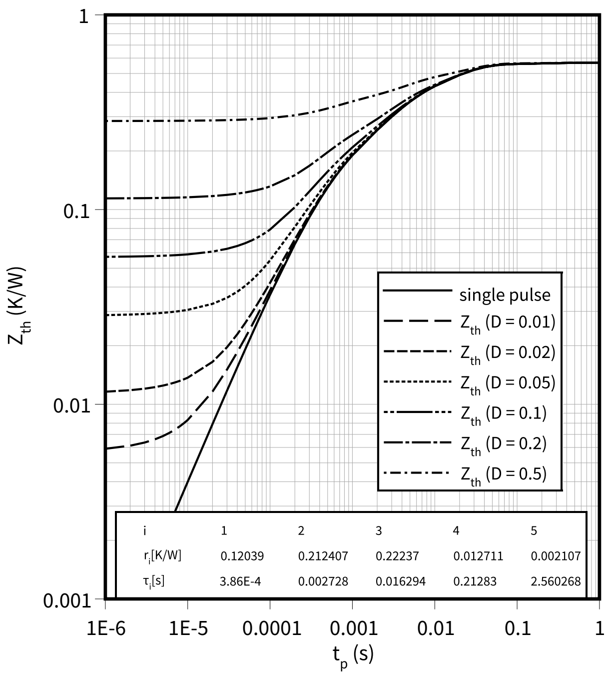
$f = 1000$ kHz, $V_{GE} = 0$ V



IGBT transient thermal impedance as a function of pulse width

$Z_{th} = f(t_p)$

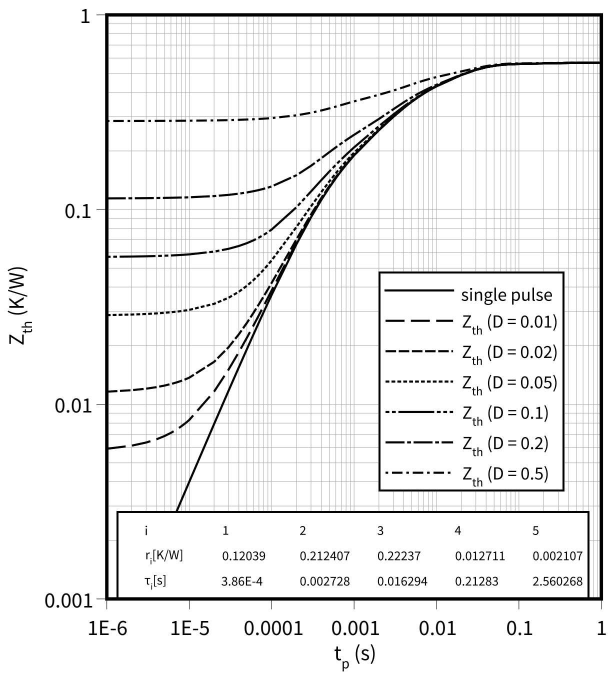
$D = t_p/T$



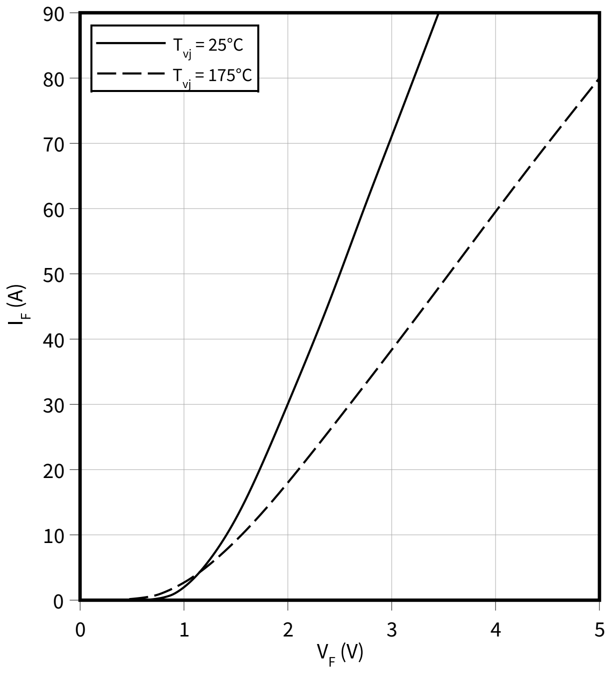
Diode transient thermal impedance as a function of pulse width

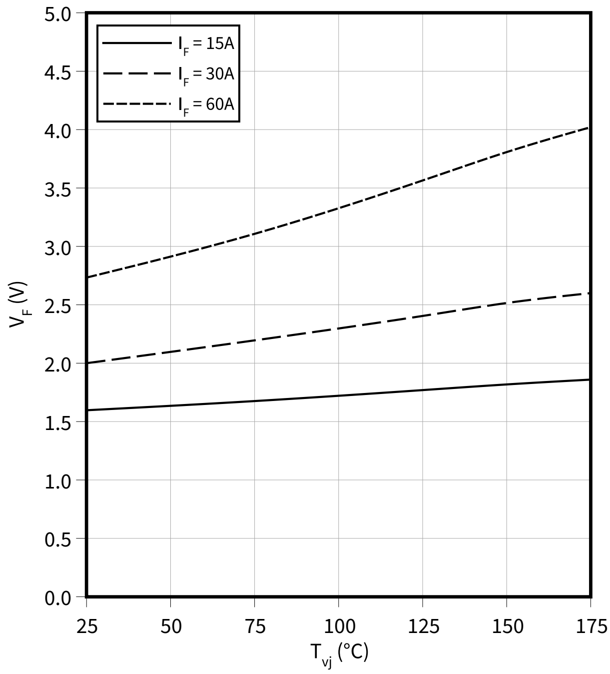
$Z_{th} = f(t_p)$

$D = t_p/T$



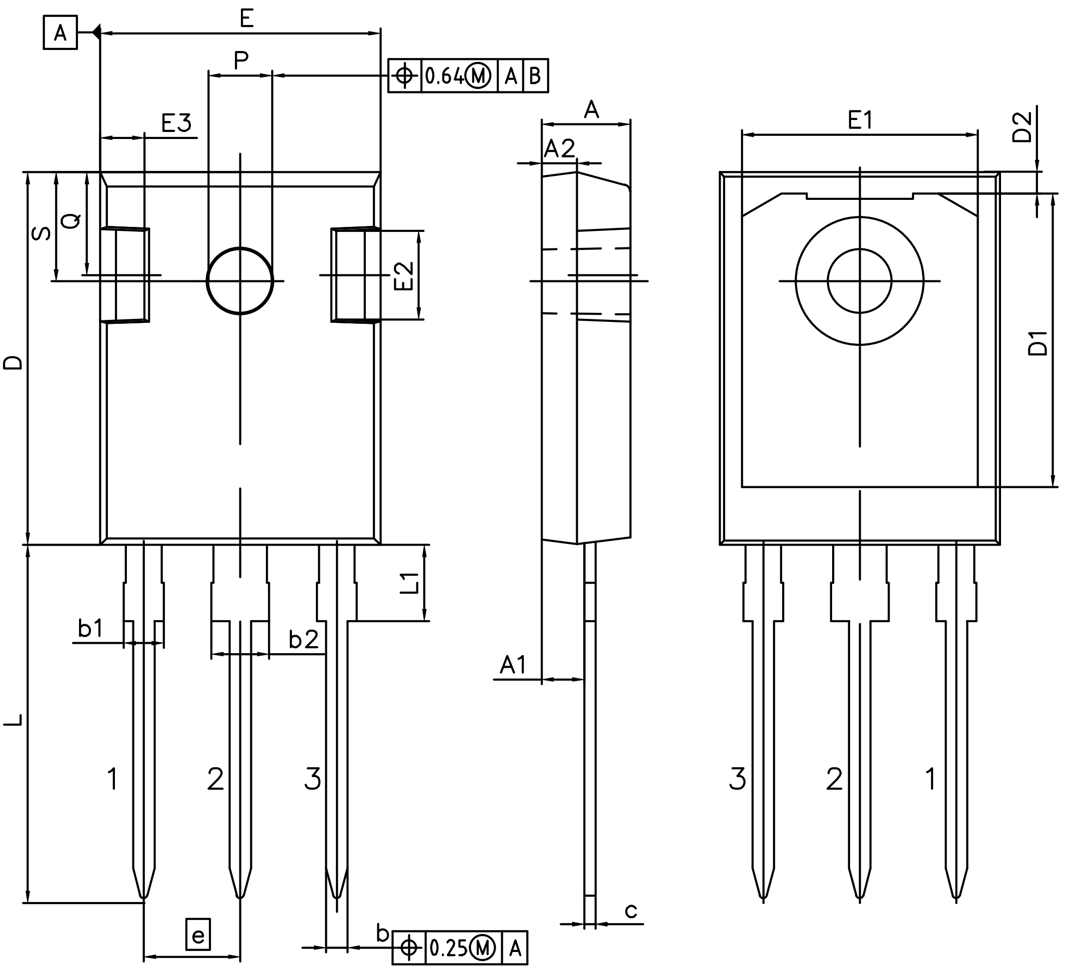
Typical diode forward current as a function of forward voltage $I_F = f(V_F)$	Typical diode forward voltage as a function of junction temperature $V_F = f(T_{vj})$





5 Package outlines

Package Drawing PG-TO247-3



DIMENSIONS	MILLIMETERS	
	MIN.	MAX.
A	4.70	5.30
A1	2.20	2.60
A2	1.50	2.50
b	1.00	1.40
b1	1.60	2.41
b2	2.57	3.43
c	0.38	0.89
D	20.70	21.50
D1	13.08	17.65
D2	0.51	1.35
E	15.50	16.30
E1	12.38	14.15
E2	3.40	5.10
E3	1.00	2.60
e	5.44	
L	19.80	20.40
L1	3.85	4.50
P	3.50	3.70
Q	5.35	6.25
S	6.04	6.30

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Figure 1

6 Testing conditions

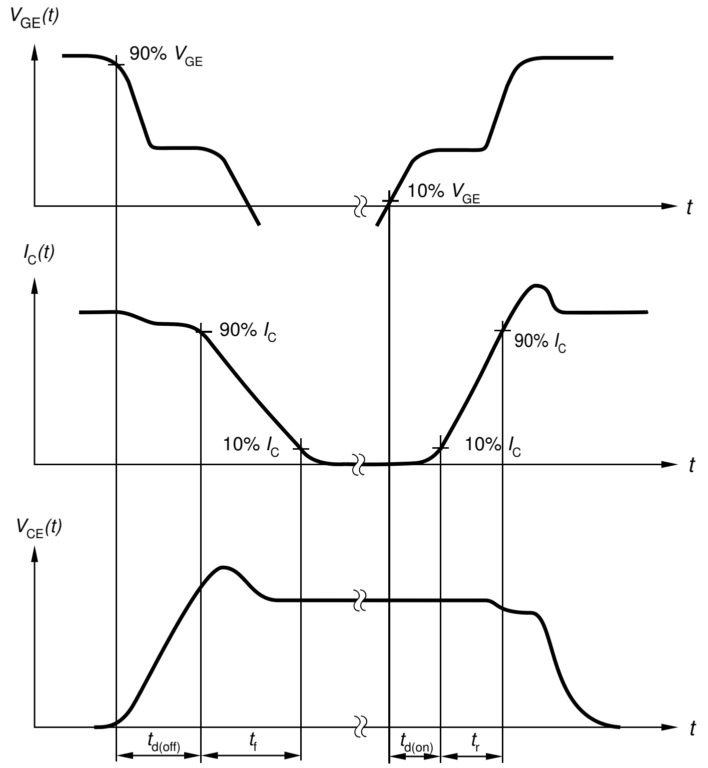

Figure A. **Definition of switching times**

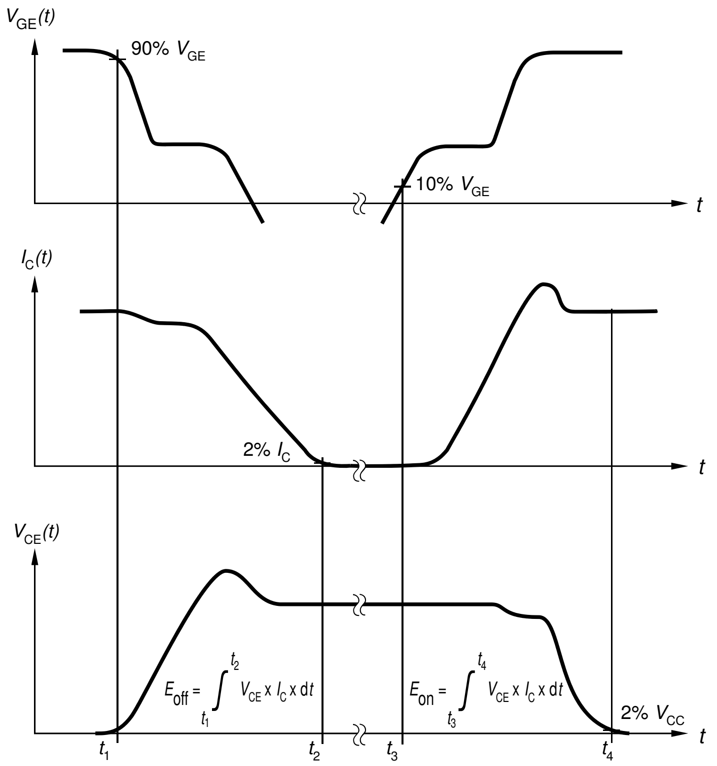

Figure B. **Definition of switching losses**

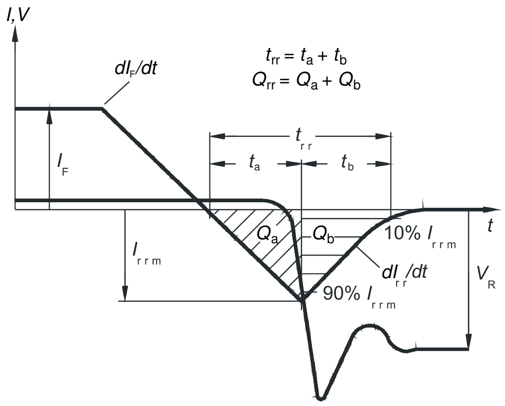

Figure C. **Definition of diode switching characteristics**

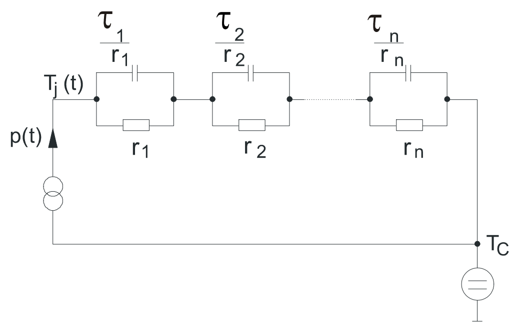

Figure D. **Thermal equivalent circuit**

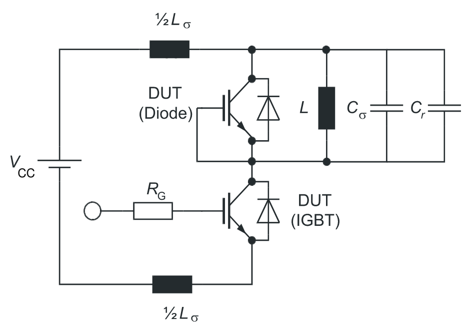

Figure E. **Dynamic test circuit**
Parasitic inductance L_σ,
parasitic capacitor C_σ,
relief capacitor C_r,
(only for ZVT switching)

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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