

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



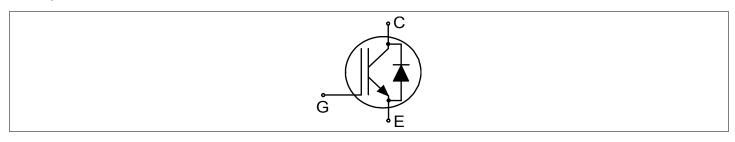








Description



Туре	Package	Marking
IHW30N160R5	PG-T0247-3	H30SR5

Reverse-Conducting IGBT



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Reverse-Conducting IGBT

1 Package



1 Package

Table 1 Characteristic values

Parameter	Symbol	mbol Note or test condition		Values		
			Min.	Тур.	Max.	
Internal emitter inductance measured 5 mm (0.197 in) from case	L _E			13.0		nH
Storage temperature	$T_{\rm stg}$		-55		175	°C
Soldering temperature		wave soldering 1.6 mm (0.063 in.) from case for 10 s			260	°C
Mounting torque	М	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}	<i>T</i> _{vi} ≥ 25 °C		1600	V
DC collector current,	I _C		T _c = 25 °C	60	А
limited by T _{vjmax}			T _c = 100 °C	39	
Pulsed collector current, t _p limited by T _{vjmax}	I _{Cpulse}			90	А
Non repetitive peak collector current ¹⁾	I _{CSM}			200	А
Turn-off safe operating area		$V_{\rm CE} = 1600 \text{V}, t_{\rm p} = 1 \mu \text{s}, T_{\rm vj}$	≤ 175 °C	90	А
Gate-emitter voltage	V_{GE}			±20	V
Transient gate-emitter voltage	V_{GE}	$t_{\rm p} \le 10 \; \mu {\rm s}, D < 0.01$		±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 $T_{vjmax}\!<\!175^{\circ}\text{C}$ and $t_{p}\!<\!3~\mu\text{s}$

Table 3 Characteristic values

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

(table continues...)

Reverse-Conducting IGBT





Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit	
				Min.	Тур.	Тур. Мах.	
Collector-emitter	V _{CEsat}	$I_{\rm C}$ = 30 A, $V_{\rm GE}$ = 15 V	T _{vj} = 25 °C		1.85	2.15	V
saturation voltage			T _{vj} = 125 °C		2.2		
			T _{vj} = 175 °C		2.4		1
Gate-emitter threshold voltage	V_{GEth}	$I_{\rm C}$ = 0.75 mA, $V_{\rm CE}$ = $V_{\rm GE}$		4.5	5.1	5.8	V
Zero gate-voltage collector	I_{CES} $V_{CE} = 1600 \text{ V}, V_{CE}$	V _{CE} = 1600 V, V _{GE} = 0 V	T _{vj} = 25 °C			100	μΑ
current			T _{vj} = 175 °C		800		1
Gate-emitter leakage current	I _{GES}	$V_{\text{CE}} = 0 \text{ V}, V_{\text{GE}} = 20 \text{ V}$				100	nA
Transconductance	g_{fs}	$I_{\rm C}$ = 30 A, $V_{\rm CE}$ = 20 V			20.5		S
Input capacitance	C _{ies}	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 10$	0 kHz		1500		pF
Output capacitance	C_{oes}	$V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}, f = 10$	0 kHz		42		pF
Reverse transfer capacitance	C _{res}	$V_{\text{CE}} = 25 \text{ V}, V_{\text{GE}} = 0 \text{ V}, f = 10$	$V_{\text{CE}} = 25 \text{ V}, V_{\text{GE}} = 0 \text{ V}, f = 100 \text{ kHz}$		38		pF
Gate charge	Q_{G}	$I_{\rm C}$ = 30 A, $V_{\rm GE}$ = 15 V, $V_{\rm CC}$ = 1280 V			205		nC
Turn-off delay time	$t_{\rm doff}$ $V_{\rm CC} = 600 \text{V}, V_{\rm GE} = 0/15 \text{V}$ $R_{\rm Gon} = 10 \Omega, R_{\rm Goff} = 10 \Omega$ $L_{\sigma} = 175 \text{nH}, C_{\sigma} = 40 \text{pF}$,		290		ns	
		$L_{\sigma} = 175 \text{ nH}, C_{\sigma} = 40 \text{ pF}$	$T_{\rm vj} = 175 ^{\circ}\text{C},$ $I_{\rm C} = 30 \text{A}$		330		
Fall time (inductive load)	t _f	$V_{\rm CC} = 600 \text{ V}, V_{\rm GE} = 0/15 \text{ V},$ $R_{\rm Gon} = 10 \Omega, R_{\rm Goff} = 10 \Omega,$	$T_{\rm vj} = 25 ^{\circ}\text{C},$ $I_{\rm C} = 30 \text{A}$		47		ns
		$L_{\sigma} = 175 \text{ nH}, C_{\sigma} = 40 \text{ pF}$	$T_{\rm vj} = 175 ^{\circ}\text{C},$ $I_{\rm C} = 30 \text{A}$		81		
Turn-off energy	E _{off}	E_{off} $V_{\text{CC}} = 600 \text{ V}, V_{\text{GE}} = 0/15 \text{ V},$ $R_{\text{Gon}} = 10 \Omega, R_{\text{Goff}} = 10 \Omega,$	$T_{vj} = 25 ^{\circ}\text{C},$ $I_{C} = 30 \text{A}$		2		mJ
		$L_{\sigma} = 175 \text{ nH}, C_{\sigma} = 40 \text{ pF}$	$T_{\rm vj} = 175 ^{\circ}\text{C},$ $I_{\rm C} = 30 \text{A}$		3		
Total switching energy	E _{ts}	$V_{\rm CC} = 600 \text{V}, V_{\rm GE} = 0/15 \text{V},$	I _C = 30 A		0.35		mJ
		$R_{\text{Gon}} = 10 \Omega, R_{\text{Goff}} = 10 \Omega,$ $L_{\sigma} = 175 \text{ nH}, C_{\sigma} = 40 \text{ pF}$	I _C = 30 A		1.27		
Soft turn-off energy	E _{off}		T _{vj} = 25 °C		0.35		mJ
		$dv/dt = 300 \text{ V/}\mu\text{s}$	T _{vj} = 175 °C		1.27		
IGBT thermal resistance, junction to case	R _{thjc}					0.57	K/W
Operating junction temperature	$T_{\rm vj}$			-40		175	°C

Reverse-Conducting IGBT



3 Diode

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}	<i>T</i> _{vj} ≥ 25 °C		1600	V
Diode forward current,	I _F		T _c = 25 °C	55	А
limited by T _{vjmax}			T _c = 100 °C	36	
Diode pulsed current, limited by T _{vjmax}	I _{Fpulse}			90	А

Table 5 Characteristic values

Parameter Diode forward voltage	Symbol	Note or test condition			Values		
				Min.	Тур.	Max.	
	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	$T_{\rm vj}$			-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.

Reverse-Conducting IGBT

4 Characteristics diagrams

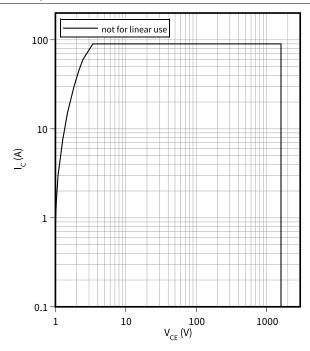


4 Characteristics diagrams

Reverse bias safe operating area

 $I_C = f(V_{CE})$

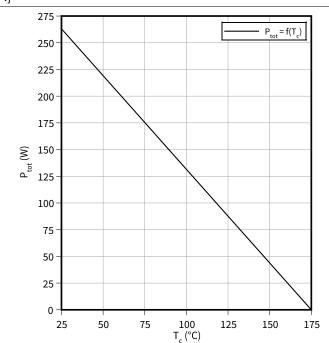
$$D = 0$$
 , $T_{vj} \le 175$ °C, $V_{GE} = 15$ V, $T_c = 25$ °C



Power dissipation as a function of case temperature

 $P_{tot} = f(T_c)$

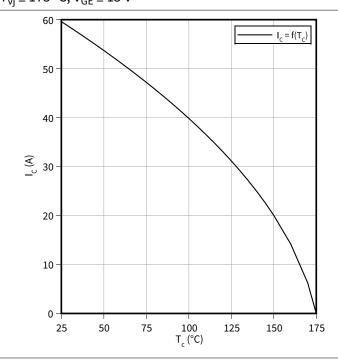
$$T_{vj} \le 175 \,^{\circ}C$$



Collector current as a function of heatsink temperature

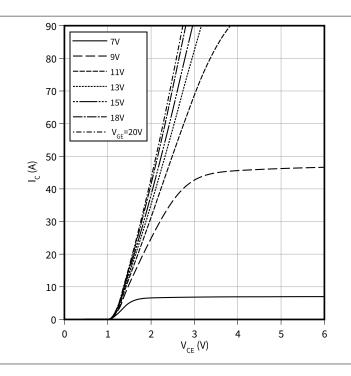
 $I_C = f(T_c)$

$$T_{vj} \le 175 \,^{\circ}\text{C}, V_{GE} \ge 15 \,^{\circ}\text{V}$$

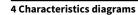


Typical output characteristic

 $I_C = f(V_{CE})$



Reverse-Conducting IGBT

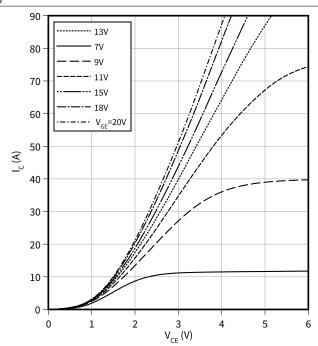




Typical output characteristic

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

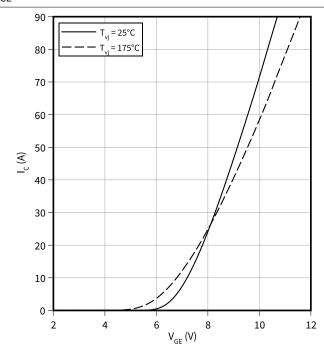
$$T_{vj} = 150 \,^{\circ}\text{C}$$



Typical transfer characteristic

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

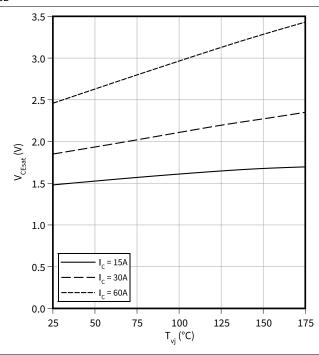
$$V_{CE} = 20 \text{ V}$$



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

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

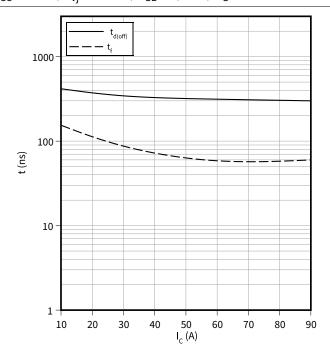
$$V_{GE} = 15 V$$



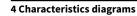
Typical switching times as a function of collector current

$$t = f(I_C)$$

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



Reverse-Conducting IGBT

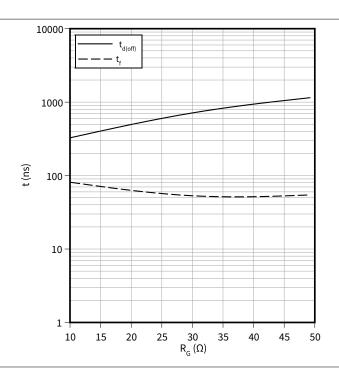




Typical switching times as a function of gate resistor

$$t = f(R_G)$$

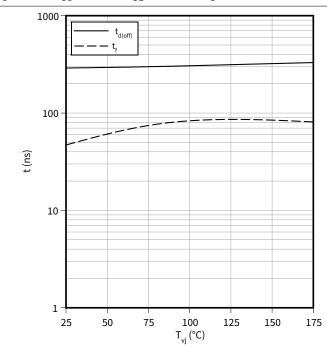
$$I_C = 30 \text{ A}, V_{CC} = 600 \text{ V}, T_{vi} = 175 \,^{\circ}\text{C}, V_{GE} = 0/15 \text{ V}$$



Typical switching times as a function of junction temperature

$$t = f(T_{vi})$$

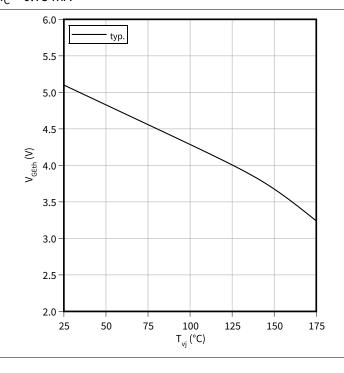
$$I_C = 30$$
 Å, $V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 10$ Ω



Gate-emitter threshold voltage as a function of junction temperature

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

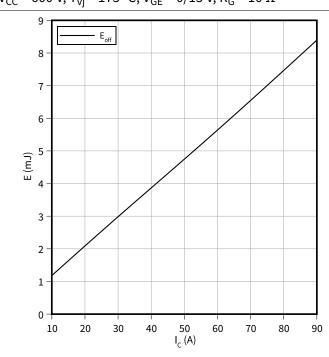
$$I_C = 0.75 \text{ mA}$$



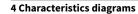
Typical switching energy losses as a function of collector current

$$E = f(I_C)$$

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



Reverse-Conducting IGBT

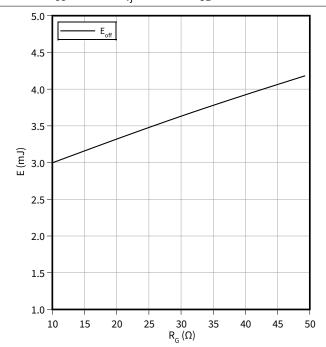




Typical switching energy losses as a function of gate resistor

 $E = f(R_G)$

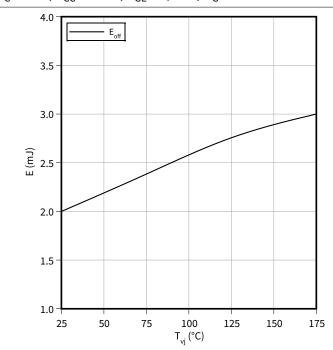
$$I_C = 30 \text{ A}, V_{CC} = 600 \text{ V}, T_{vj} = 175 \,^{\circ}\text{C}, V_{GE} = 0/15 \text{ V}$$



Typical switching energy losses as a function of junction temperature

 $E = f(T_{vi})$

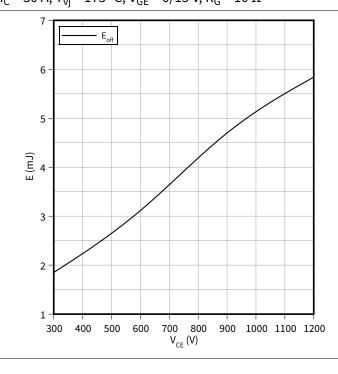
$$I_C = 30$$
 Å, $V_{CC} = 600$ V, $V_{GE} = 0/15$ V, $R_G = 10$ Ω



Typical switching energy losses as a function of collector emitter voltage

 $E = f(V_{CF})$

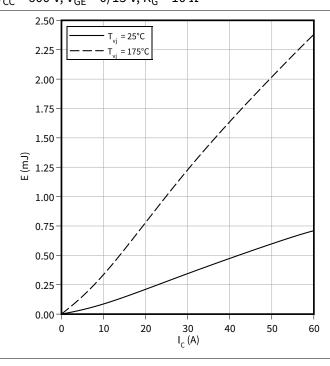
$$I_C = 30 \text{ A}, T_{vi} = 175 \,^{\circ}\text{C}, V_{GE} = 0/15 \,\text{V}, R_G = 10 \,\Omega$$



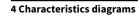
Typical resonant switching energy losses as a function of collector current

 $E = f(I_C)$

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



Reverse-Conducting IGBT

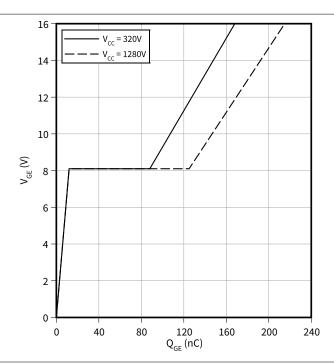




Typical gate charge

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

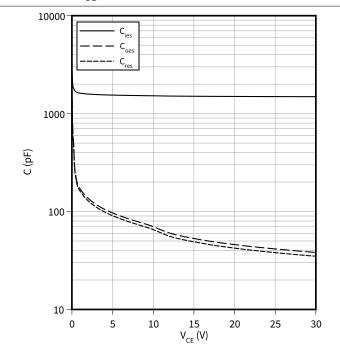
$$I_{C} = 30 \text{ A}$$



Typical capacitance as a function of collector-emitter voltage

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

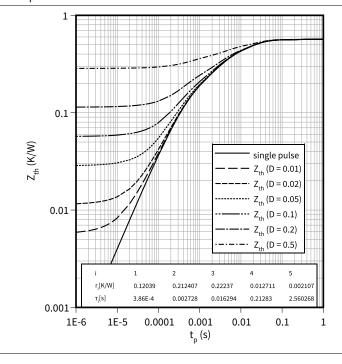
$$f = 1000 \text{ kHz}, V_{GE} = 0 \text{ V}$$



IGBT transient thermal impedance as a function of pulse width

$$Z_{th} = f(t_p)$$

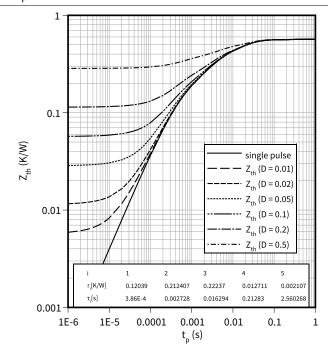
$$D = t_p/T$$



Diode transient thermal impedance as a function of pulse width

$$Z_{th} = f(t_p)$$

$$D = t_p/T$$



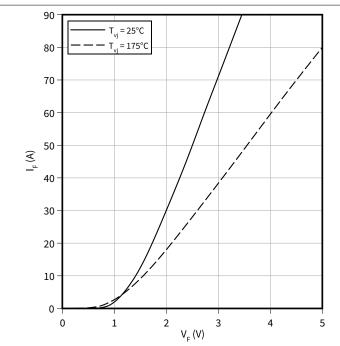
Reverse-Conducting IGBT



4 Characteristics diagrams

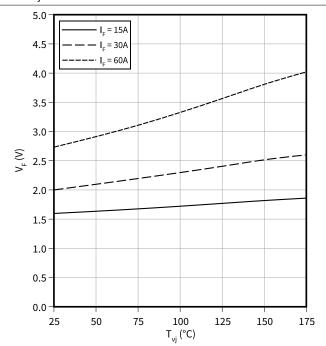
Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$



Typical diode forward voltage as a function of junction temperature

$$V_F = f(T_{vj})$$



5 Package outlines



Package outlines 5

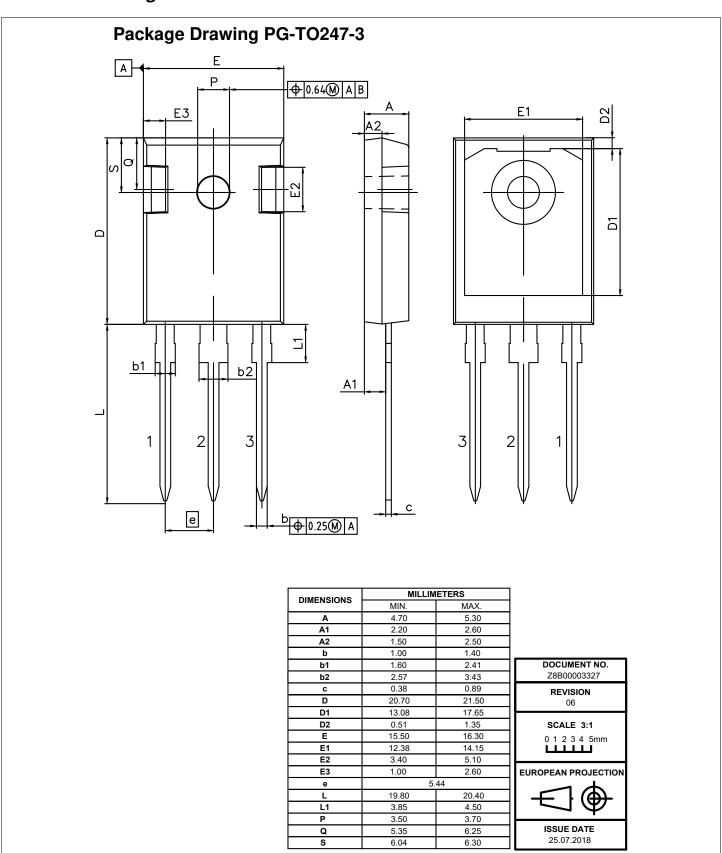


Figure 1

6 Testing conditions



Testing conditions 6

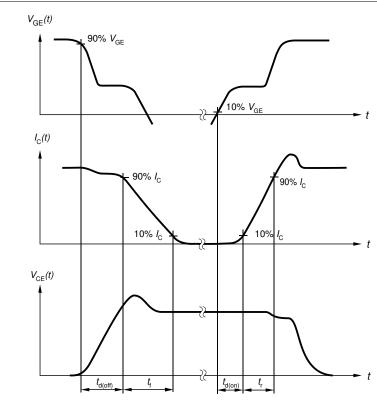


Figure A. Definition of switching times

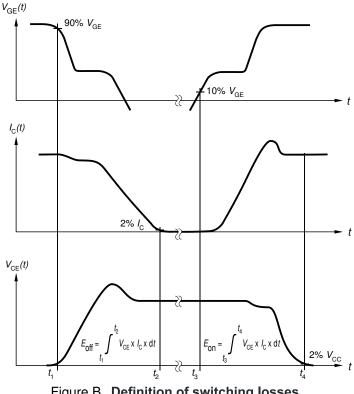


Figure B. Definition of switching losses

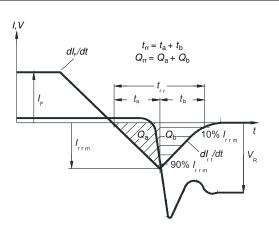


Figure C. Definition of diode switching characteristics

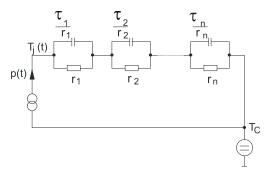


Figure D. Thermal equivalent circuit

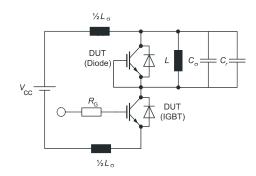


Figure E. Dynamic test circuit Parasitic inductance L_{σ} , parasitic capacitor C_{σ} , relief capacitor C_r, (only for ZVT switching)

Figure 2





Revision history

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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