

Emitter Controlled Rapid-1 Diode in Advanced Isolation with fully isolated package

Features

- $V_{RRM} = 650\text{ V}$
- $I_F = 2 \times 40\text{ A}$
- 650 V emitter controlled technology
- Temperature stable behaviour of key parameters
- Low forward voltage (V_F)
- Low reverse recovery charge (Q_{rr})
- Low reverse recovery current (I_{rrm})
- Maximum junction temperature $T_{vjmax} = 175^\circ\text{C}$
- 2500 V_{RMS} electrical isolation, 50/60 Hz, $t = 1\text{ min}$
- 100% tested isolated mounting surface
- Pb-free lead plating
- RoHS compliant

Potential applications

- Air conditioning
- General purpose drives (GPD)
- Industrial SMPS

Product validation

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

Description

- Pin 1 – anode (A1)
- Pin 2 – cathode (C)
- Pin 3 – anode (A2)



Fully isolated package TO-247



Lead-free



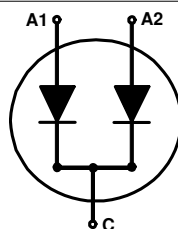
Green



Halogen-free



RoHS



Type	Package	Marking
IDFW80C65D1	PG-TO247-3-AI	C80ED1



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1 Package

Table 1 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Isolation test voltage RMS ¹⁾	V_{isol}				2500	V
Internal emitter inductance measured 5 mm (0.197 in.) from case	L_E			13.0		nH
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature		wave soldering 1.6mm (0.063in.) from case for 10s			260	°C
Mounting torque	M	M3 screw Maximum of mounting process: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				65	K/W

1) For a proper handling and assembly of the advanced isolation device in the application refer to the note at the package drawing.

2 Diode

Table 2 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} \geq 25\text{ °C}$		650	V
Diode forward current, limited by T_{vjmax}	I_F		$T_h = 25\text{ °C}$	74	A
			$T_h = 65\text{ °C}$	59	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}			160	A
Diode surge non repetitive forward current, sine halfwave	I_{FSM}	$T_h = 25\text{ °C}$, $t_p = 10\text{ ms}$		320	A
Power dissipation	P_{tot}		$T_h = 25\text{ °C}$	112	W
			$T_h = 65\text{ °C}$	82	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 40\text{ A}$	$T_{vj} = 25\text{ °C}$		1.45	1.7	V
			$T_{vj} = 175\text{ °C}$		1.39		
Reverse leakage current ¹⁾	I_R	$V_R = 650\text{ V}$	$T_{vj} = 25\text{ °C}$			40	μA
			$T_{vj} = 175\text{ °C}$		1200		

(table continues...)

Table 3 (continued) **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode reverse recovery time	t_{rr}	$V_R = 400\text{ V}$	$T_{vj} = 25\text{ °C}$, $I_F = 40\text{ A}$, $-di_F/dt = 820\text{ A/}\mu\text{s}$		73		ns
			$T_{vj} = 150\text{ °C}$, $I_F = 40\text{ A}$, $-di_F/dt = 820\text{ A/}\mu\text{s}$		120		
Diode reverse recovery charge	Q_{rr}	$V_R = 400\text{ V}$	$T_{vj} = 25\text{ °C}$, $I_F = 40\text{ A}$, $-di_F/dt = 820\text{ A/}\mu\text{s}$		1.1		μC
			$T_{vj} = 150\text{ °C}$, $I_F = 40\text{ A}$, $-di_F/dt = 820\text{ A/}\mu\text{s}$		2.62		
Diode peak reverse recovery current	I_{rrm}	$V_R = 400\text{ V}$	$T_{vj} = 25\text{ °C}$, $I_F = 40\text{ A}$, $-di_F/dt = 820\text{ A/}\mu\text{s}$		23.5		A
			$T_{vj} = 150\text{ °C}$, $I_F = 40\text{ A}$, $-di_F/dt = 820\text{ A/}\mu\text{s}$		36		
Diode peak rate of fall of reverse recovery current	di_{rr}/dt	$V_R = 400\text{ V}$	$T_{vj} = 25\text{ °C}$, $I_F = 40\text{ A}$, $-di_F/dt = 820\text{ A/}\mu\text{s}$		1500		A/ μs
			$T_{vj} = 150\text{ °C}$, $I_F = 40\text{ A}$, $-di_F/dt = 820\text{ A/}\mu\text{s}$		1250		
Diode thermal resistance, junction - heatsink ²⁾	R_{thjh}				1.14	1.34	K/W
Operating junction temperature	T_{vj}			-40		175	°C

1) Reverse leakage current per leg specified for operating conditions with zero voltage applied to the other leg.

2) At force on body $F = 500\text{ N}$, $T_a = 25\text{ °C}$

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

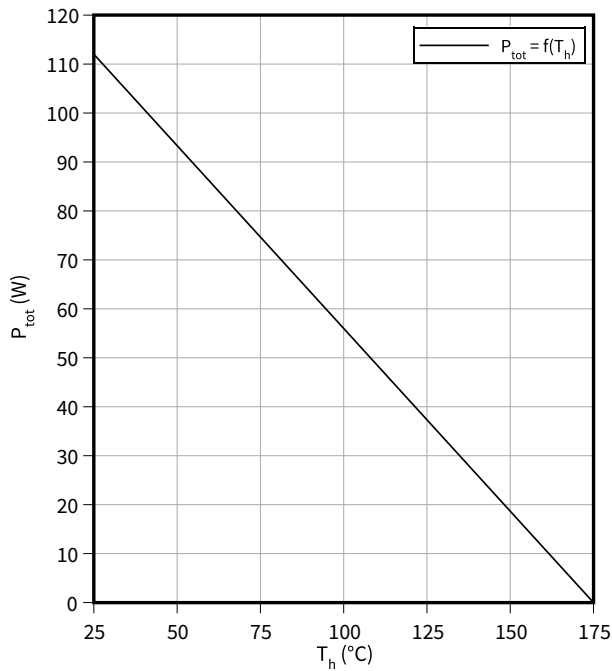
Electrical Characteristic (per leg) at $T_{vj} = 25\text{ °C}$, unless otherwise specified.

Dynamic test circuit, $L_\sigma = 30\text{ nH}$, $C_\sigma = 40\text{ pF}$, switch IKW40N65ES5.

3 Characteristics diagrams

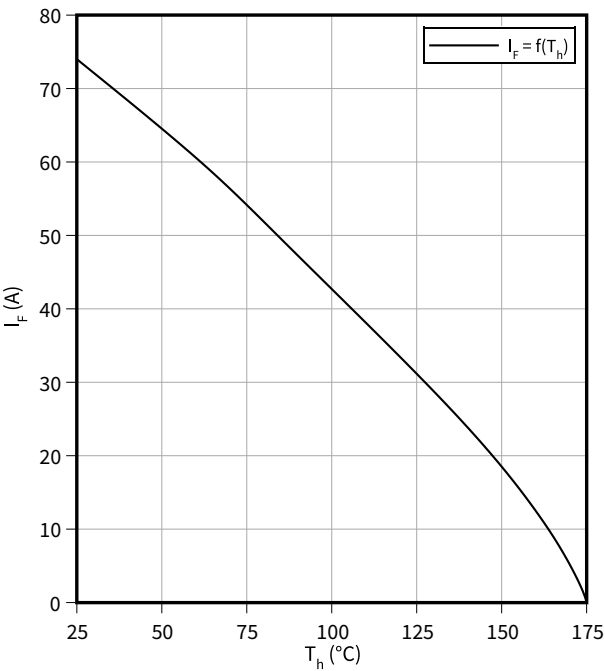
Power dissipation per leg as a function of heatsink temperature

$P_{\text{tot}} = f(T_h)$
 $T_{vj} \leq 175\text{ }^{\circ}\text{C}$



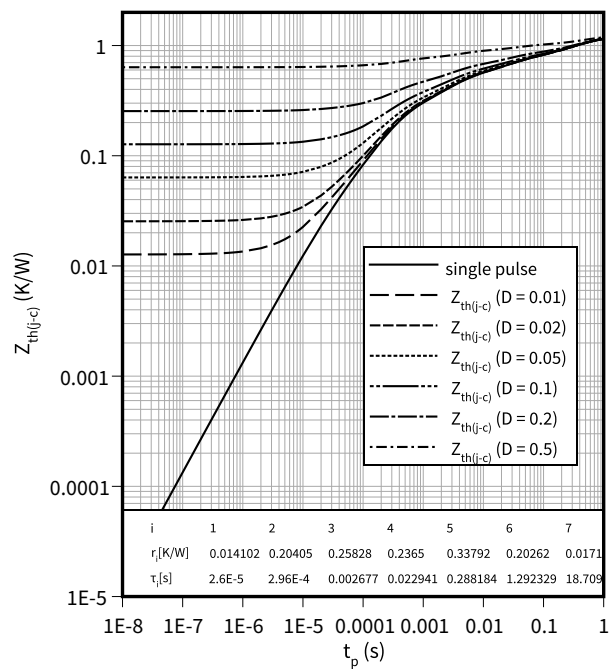
Diode forward current per leg as a function of heatsink temperature

$I_F = f(T_h)$



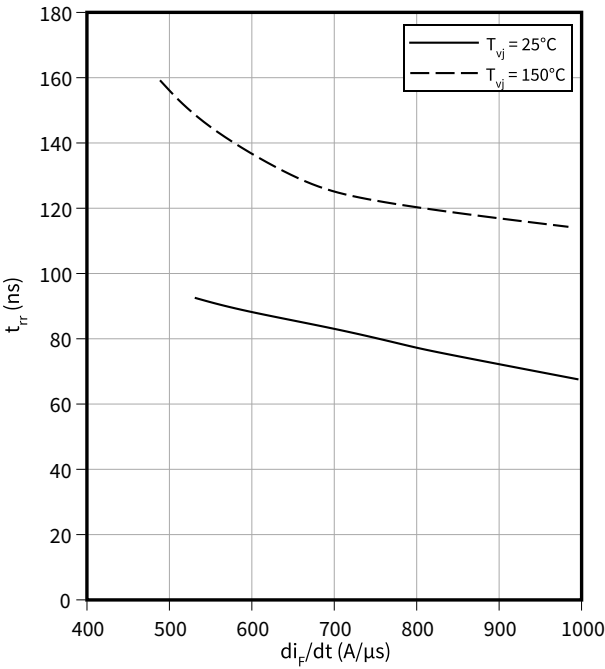
Diode transient thermal impedance per leg as a function of pulse width

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



Typical reverse recovery time per leg as a function of diode current slope

$t_{rr} = f(di_F/dt)$
 $V_R = 400\text{ V}, I_F = 40\text{ A}$

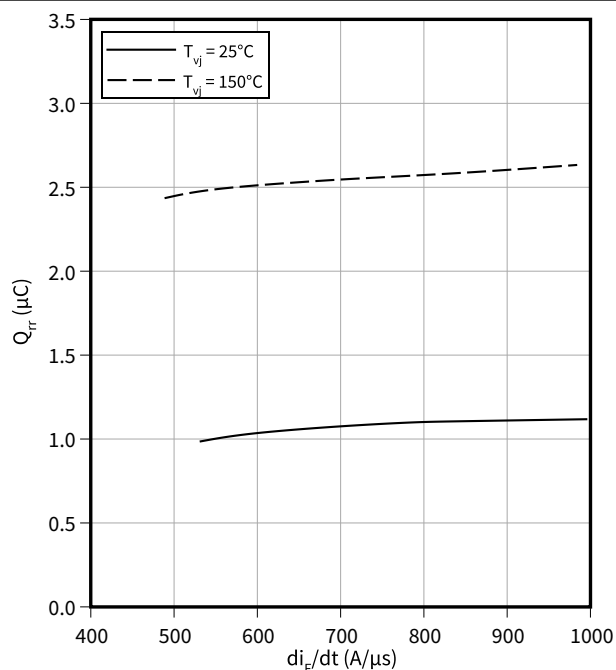


3 Characteristics diagrams

Typical reverse recovery charge per leg as a function of diode current slope

$$Q_{rr} = f(di_F/dt)$$

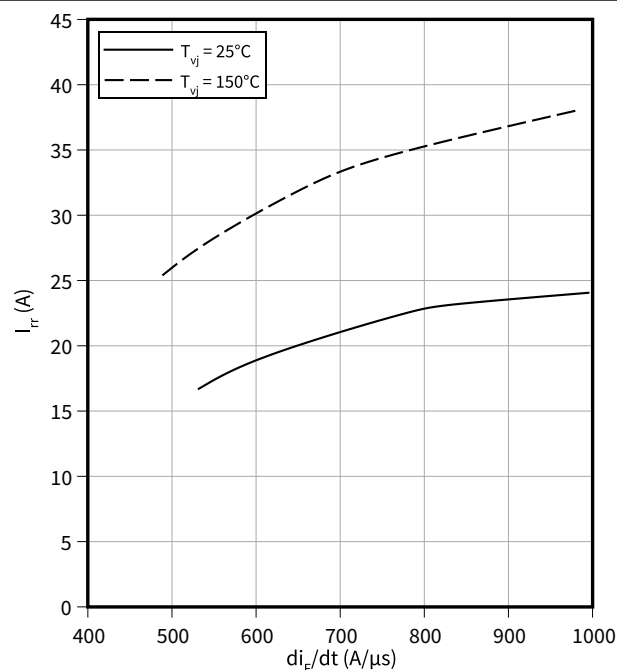
$$V_R = 400 \text{ V}, I_F = 40 \text{ A}$$



Typical reverse recovery current per leg as a function of diode current slope

$$I_{rr} = f(di_F/dt)$$

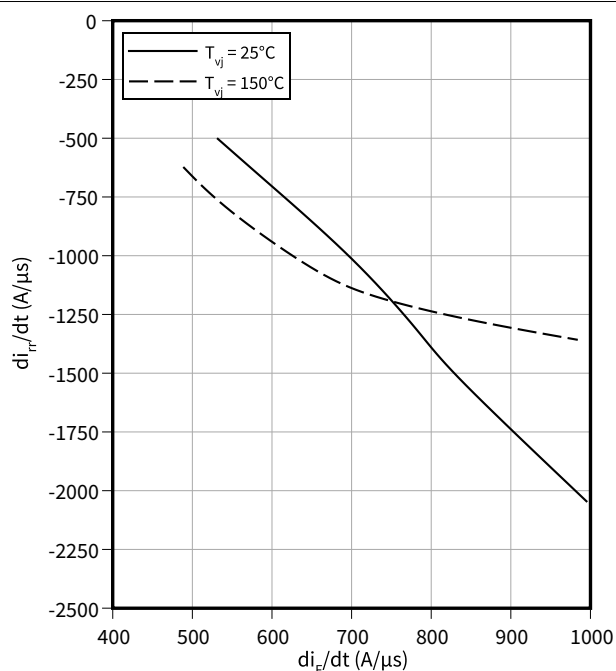
$$V_R = 400 \text{ V}, I_F = 40 \text{ A}$$



Typical diode peak rate of fall of reverse recovery current per leg as a function of diode current slope

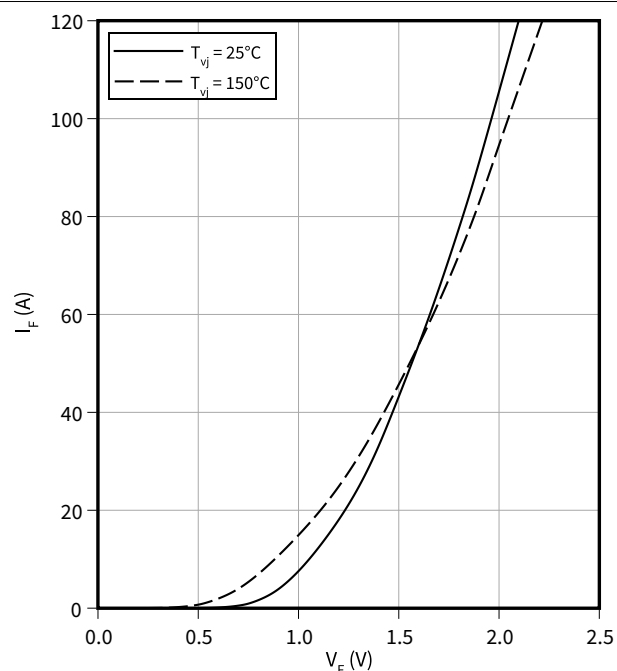
$$di_{rr}/dt = f(di_F/dt)$$

$$V_R = 400 \text{ V}, I_F = 40 \text{ A}$$



Typical diode forward current per leg as a function of forward voltage

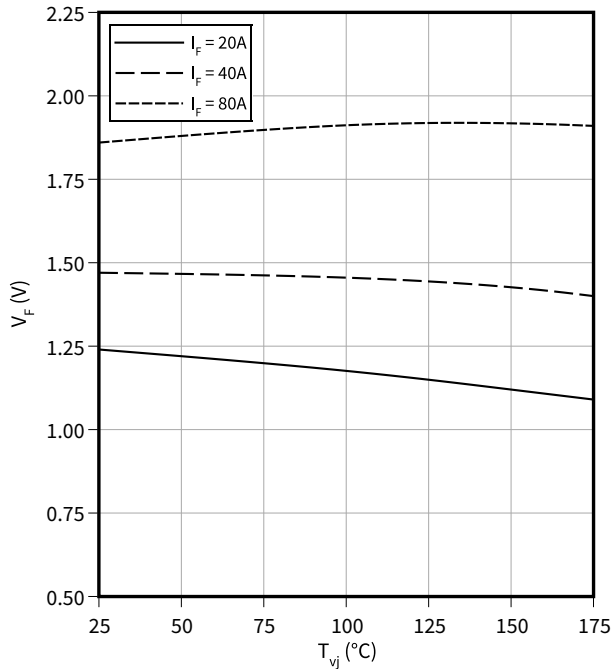
$$I_F = f(V_F)$$



3 Characteristics diagrams

Typical diode forward voltage per leg as a function of junction temperature

$V_F = f(T_{vj})$



4 Package outlines

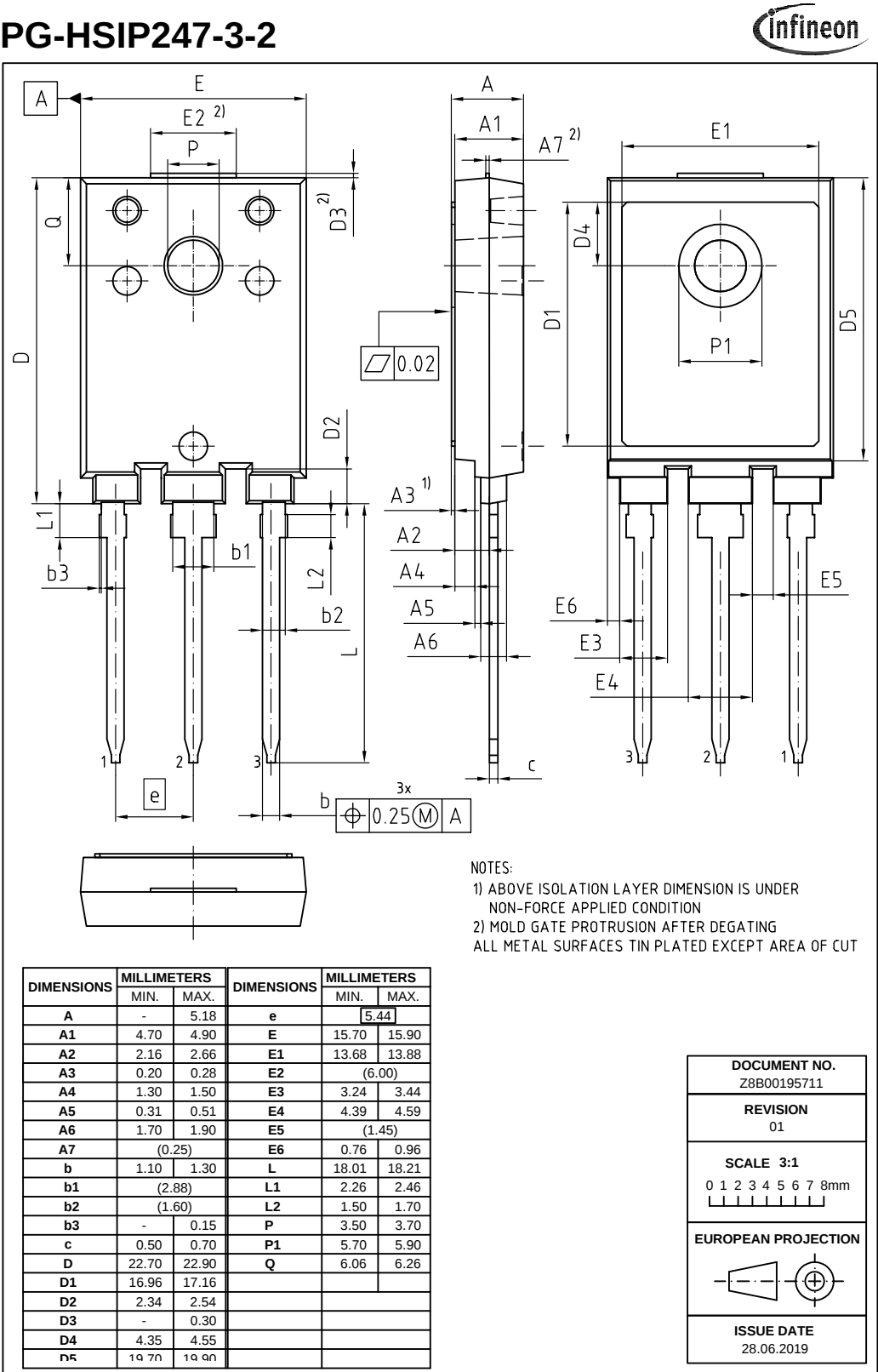


Figure 1

5 Testing conditions

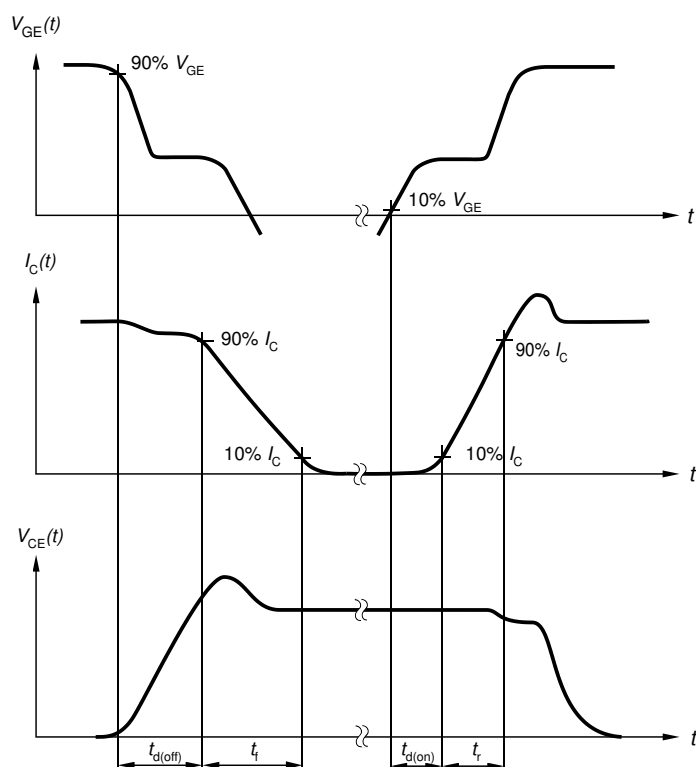


Figure A. Definition of switching times

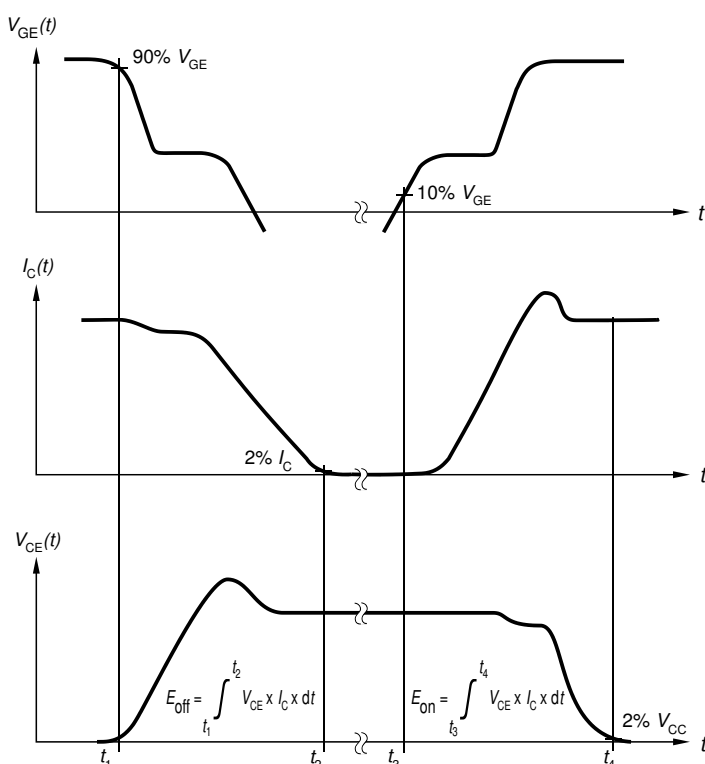


Figure B. Definition of switching losses

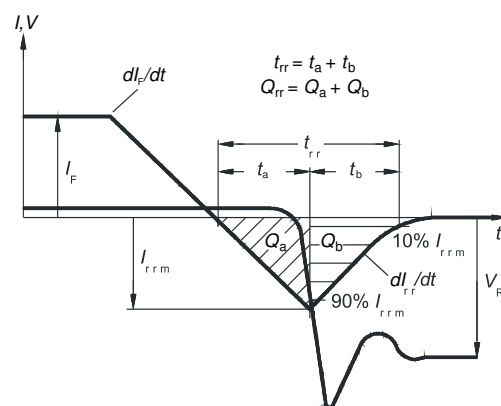


Figure C. Definition of diode switching characteristics

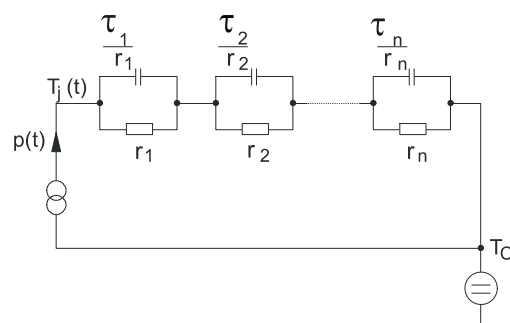


Figure D. Thermal equivalent circuit

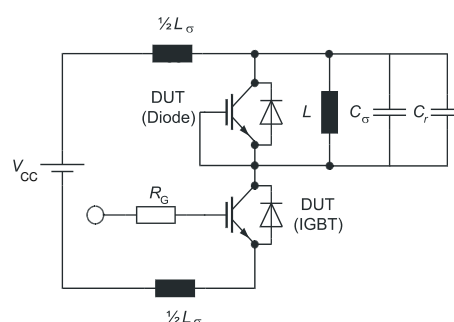


Figure E. **Dynamic test circuit**
 Parasitic inductance L_{σ} ,
 parasitic capacitor C_{σ} ,
 relief capacitor C_r ,
 (only for ZVT switching)

Figure 2

Revision history

Document revision	Date of release	Description of changes
V2.1	2020-07-09	Target datasheet
V2.2	2020-09-25	New marking description
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	2022-06-24	Correction of package outline drawing on page 8

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