

Final datasheet

The Soft 650 V Emitter Controlled Si Diode 7 offers improved reliability for both Industrial and Home Appliance applications

Features

- $V_{RRM} = 650\text{ V}$
- $I_F = 40\text{ A}$
- Low and temperature stable forward voltage (V_F)
- Very soft and fast recovery
- Low reverse recovery current (I_{rrm})
- Humidity robust design
- Cosmic ray ruggedness
- Maximum junction temperature $T_{vjmax} = 175^{\circ}\text{C}$
- Qualified according to JEDEC for target applications
- Pb-free lead plating; RoHS compliant
- Complete product spectrum and PSpice Models: <http://www.infineon.com/ec7/>

Potential applications

- String and micro inverter
- Datacenter UPS
- Offline UPS/Residential UPS
- Online UPS/Industrial UPS
- Residential aircon
- Welding

Product validation

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

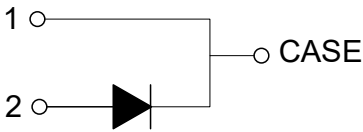
Description

Pin definition:

- Pin 1 and backside - Cathode
- Pin 2 - Anode



- Green
- Halogen-free
- Lead-free
- RoHS



Type	Package	Marking
IDWD40E65E7	PG-TO247-2-STD-NA8.8	E40EE7



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1 Package

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		nH
Storage temperature	T_{stg}		-55		150	°C
Soldering temperature	T_{sold}	wave soldering 1.6 mm (0.063 in.) from case for 10 s			260	°C
Mounting torque	M	M3 screw, Maximum of mounting processes: 3			0.6	Nm
Thermal resistance, junction-ambient	$R_{th(j-a)}$				40	K/W
Diode thermal resistance, junction-case	$R_{th(j-c)}$				0.95	K/W

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	limited by bondwire	$T_c = 25\text{ °C}$	50	A
			$T_c = 100\text{ °C}$	49	
Diode pulsed current, t_p limited by T_{vjmax}	I_{Fpulse}			160	A
Diode surge non repetitive forward current, sine halfwave	I_{FSM}	$t_p = 10\text{ ms}$	$T_c = 25\text{ °C}$	149	A
Power dissipation	P_{tot}		$T_c = 25\text{ °C}$	159	W
			$T_c = 100\text{ °C}$	79	

Table 3 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode forward voltage	V_F	$I_F = 40\text{ A}$	$T_{vj} = 25\text{ °C}$		1.65	2.1	V
			$T_{vj} = 125\text{ °C}$		1.6		
			$T_{vj} = 175\text{ °C}$		1.55		

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Reverse leakage current	I_R	$V_R = 650 \text{ V}$	$T_{vj} = 25 \text{ °C}$			20	μA
			$T_{vj} = 175 \text{ °C}$		309		
Diode reverse recovery time	t_{rr}	$V_R = 400 \text{ V}$	$T_{vj} = 25 \text{ °C}$, $I_F = 40 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		89		ns
			$T_{vj} = 25 \text{ °C}$, $I_F = 20 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		69.9		
			$T_{vj} = 175 \text{ °C}$, $I_F = 40 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		146		
			$T_{vj} = 175 \text{ °C}$, $I_F = 20 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		110		
Diode reverse recovery charge	Q_{rr}	$V_R = 400 \text{ V}$	$T_{vj} = 25 \text{ °C}$, $I_F = 40 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		0.86		μC
			$T_{vj} = 25 \text{ °C}$, $I_F = 20 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		0.6		
			$T_{vj} = 175 \text{ °C}$, $I_F = 40 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		2.37		
			$T_{vj} = 175 \text{ °C}$, $I_F = 20 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		1.73		
Diode peak reverse recovery current	I_{rrm}	$V_R = 400 \text{ V}$	$T_{vj} = 25 \text{ °C}$, $I_F = 40 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		15.7		A
			$T_{vj} = 25 \text{ °C}$, $I_F = 20 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		14.5		
			$T_{vj} = 175 \text{ °C}$, $I_F = 40 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		26.9		
			$T_{vj} = 175 \text{ °C}$, $I_F = 20 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		24.7		

(table continues...)

Table 3 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Diode peak rate of fall of reverse recovery current	di_{rr}/dt	$V_R = 400 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$, $I_F = 40 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		656		$\text{A}/\mu\text{s}$
			$T_{vj} = 25 \text{ }^\circ\text{C}$, $I_F = 20 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		847		
			$T_{vj} = 175 \text{ }^\circ\text{C}$, $I_F = 40 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		418		
			$T_{vj} = 175 \text{ }^\circ\text{C}$, $I_F = 20 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		650		
Reverse recovery energy	E_{rec}	$V_R = 400 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$, $I_F = 40 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		0.141		mJ
			$T_{vj} = 25 \text{ }^\circ\text{C}$, $I_F = 20 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		0.099		
			$T_{vj} = 175 \text{ }^\circ\text{C}$, $I_F = 40 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		0.49		
			$T_{vj} = 175 \text{ }^\circ\text{C}$, $I_F = 20 \text{ A}$, $-di_F/dt = 1000 \text{ A}/\mu\text{s}$		0.35		
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.

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

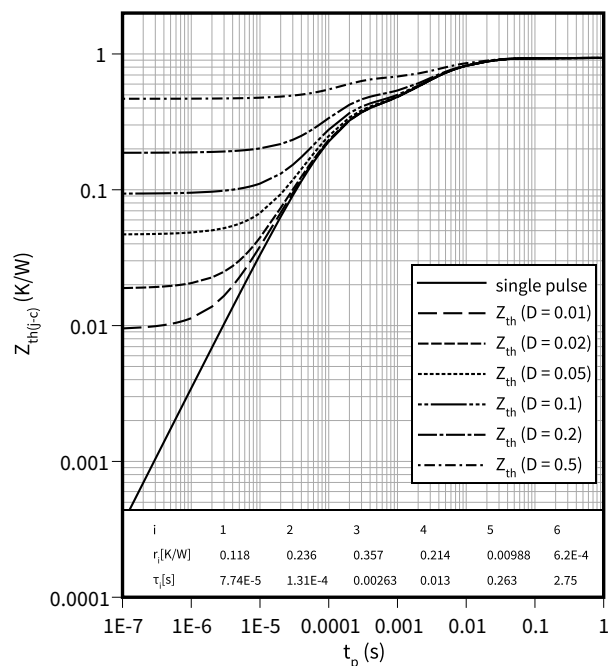
Dynamic test circuit, parasitic inductance $L_\sigma = 30 \text{ nH}$, parasitic capacitor $C_\sigma = 18 \text{ pF}$ from Fig. E.

3 Characteristics diagrams

Diode transient thermal impedance as a function of pulse width

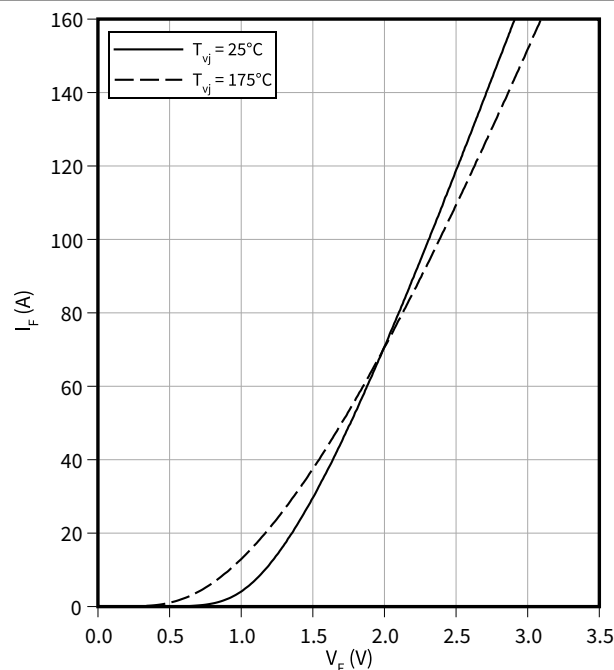
$$Z_{th(j-c)} = f(t_p)$$

$$D = t_p / T$$



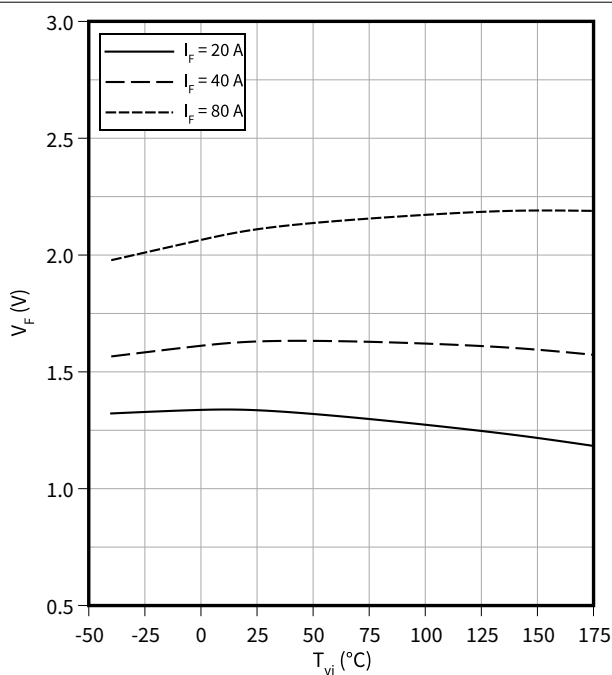
Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$



Typical diode forward voltage as a function of junction temperature

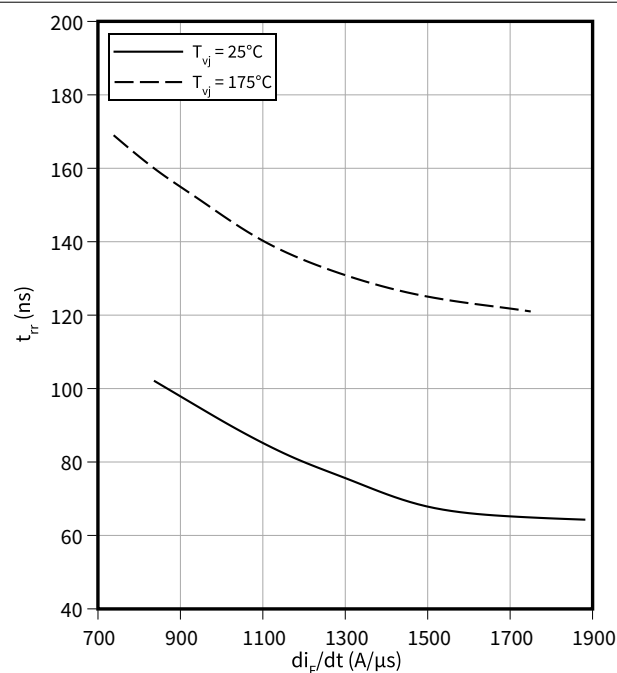
$$V_F = f(T_{vj})$$



Typical reverse recovery time as a function of diode current slope

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

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

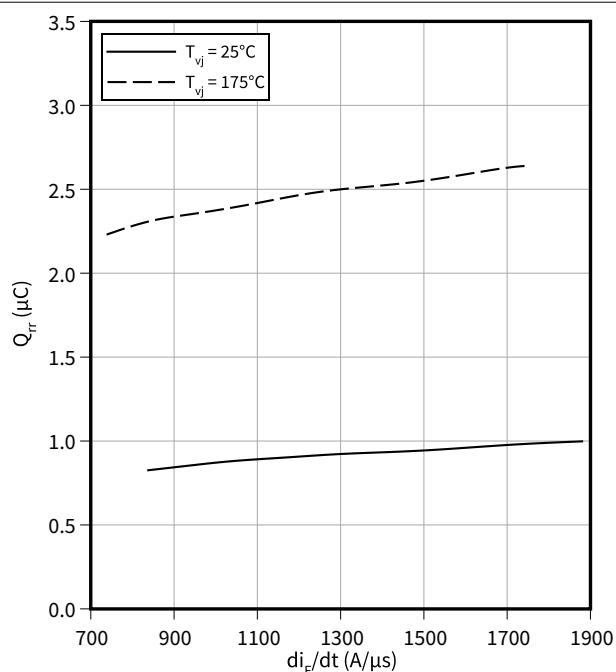


3 Characteristics diagrams

Typical reverse recovery charge as a function of diode current slope

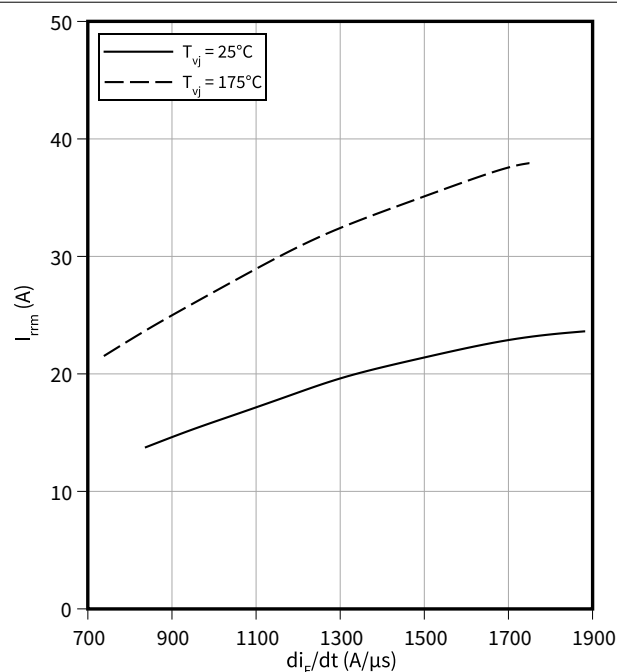
$$Q_{rr} = f(di_F/dt)$$

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

**Typical reverse recovery current as a function of diode current slope**

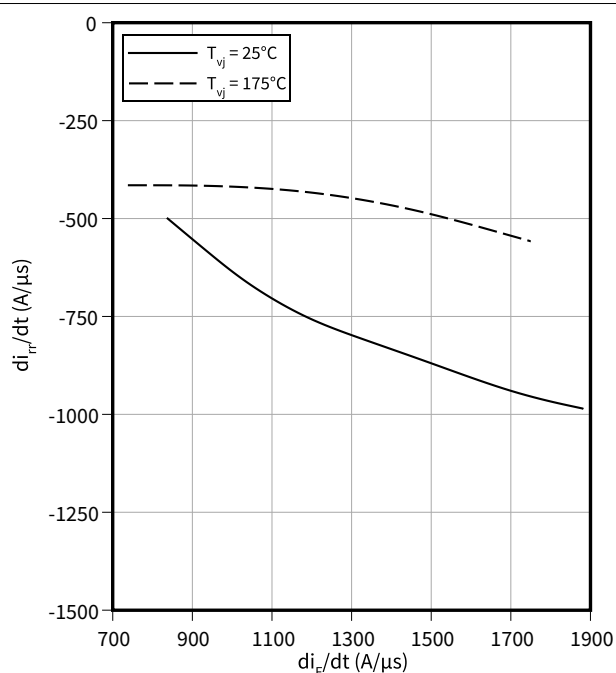
$$I_{rrm} = f(di_F/dt)$$

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

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

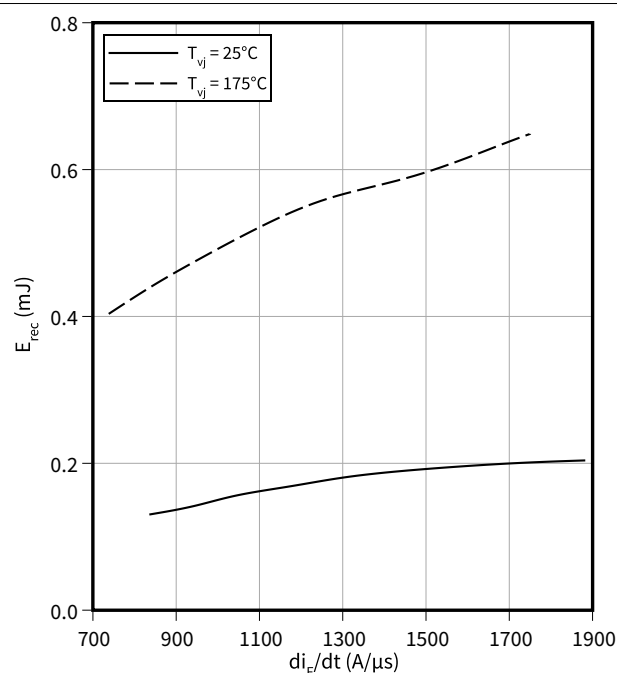
$$di_{rr}/dt = f(di_F/dt)$$

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

**Typical reverse energy losses as a function of diode current slope**

$$E_{rec} = f(di_F/dt)$$

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



4 Package outlines

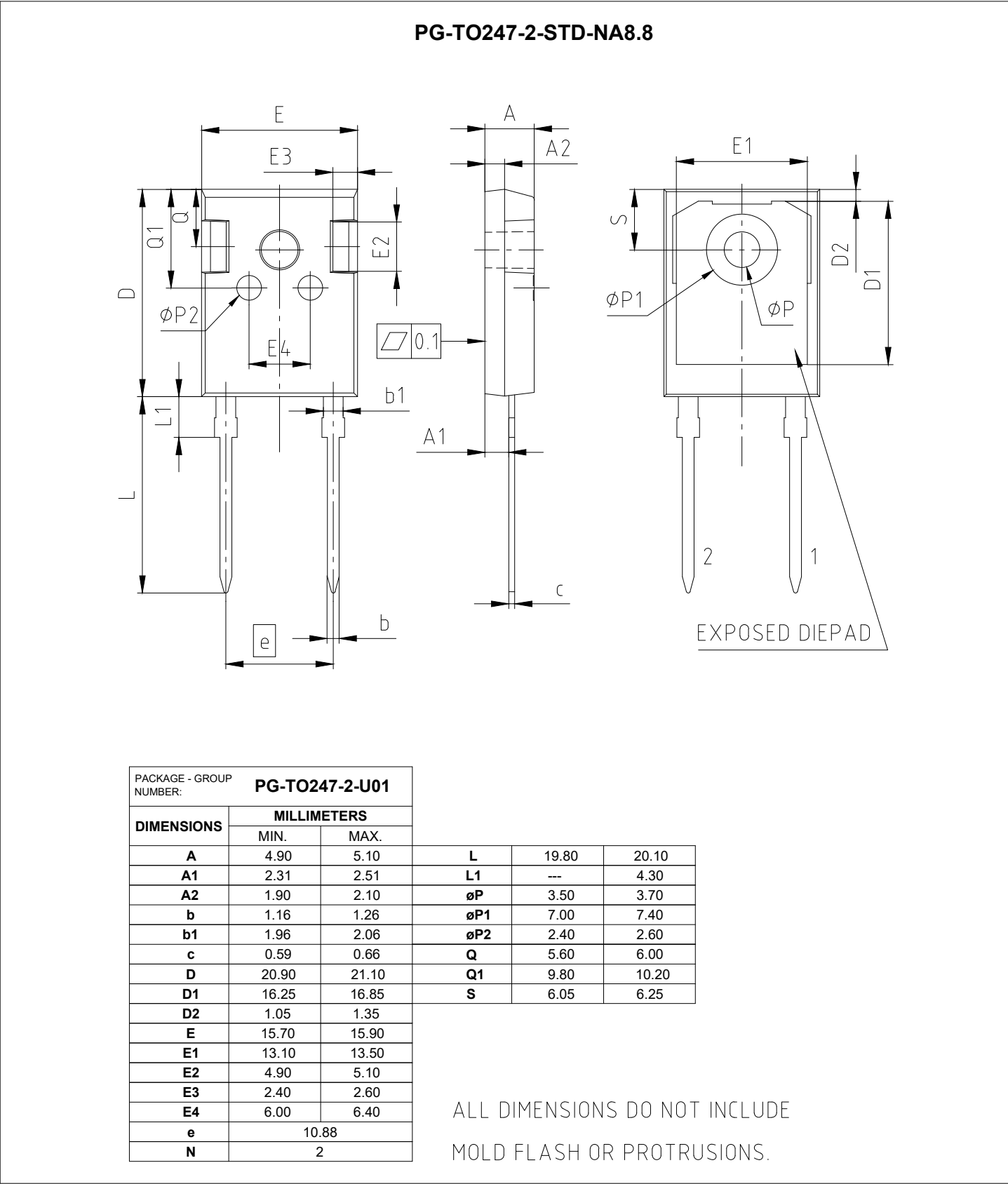


Figure 1

5 Testing conditions

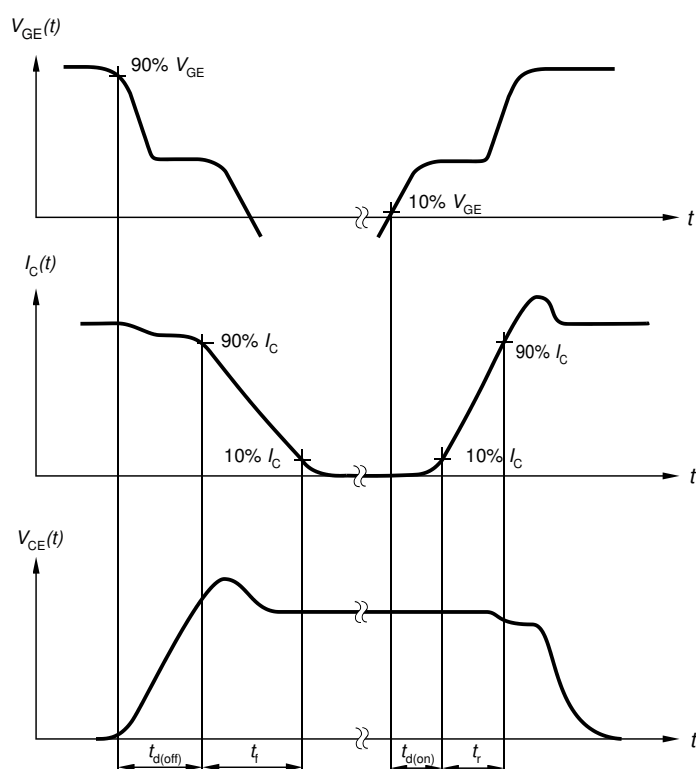


Figure A. Definition of switching times

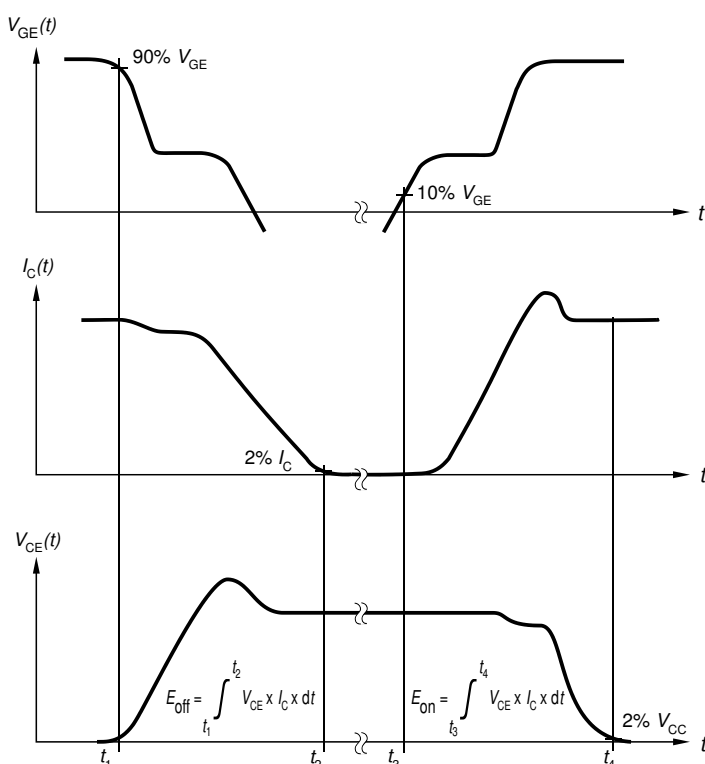


Figure B. Definition of switching losses

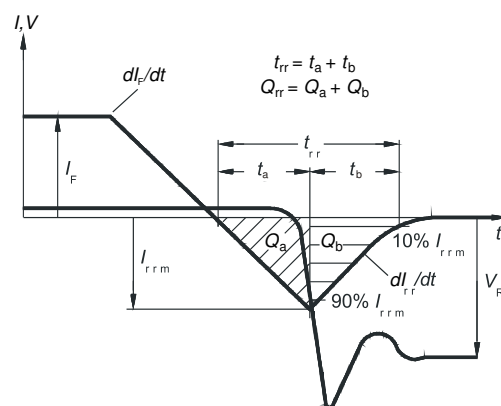


Figure C. Definition of diode switching characteristics

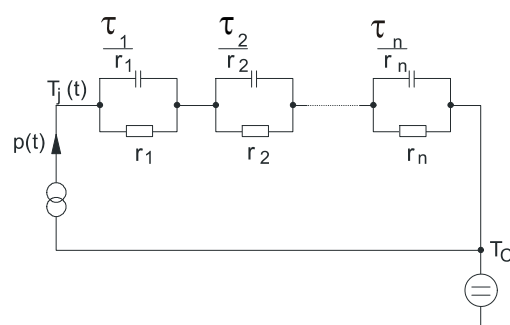


Figure D. Thermal equivalent circuit

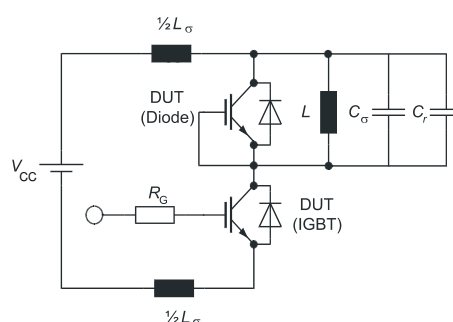


Figure E. **Dynamic test circuit**
 Parasitic inductance L_σ ,
 parasitic capacitor C_σ ,
 relief capacitor C_r ,
 (only for ZVT switching)

Revision history

Document revision	Date of release	Description of changes
0.10	2023-04-26	Preliminary datasheet
1.00	2023-05-02	Final datasheet
1.10	2023-11-09	Update of diode forward current I_F Update of graph on page 6

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