

Final datasheet

Soft and ultra-fast recovery 1200 V Emitter controlled 7 diode for both Industrial and Home Appliance applications

Features

- $V_{RRM} = 1200\text{ V}$
- $I_F = 40\text{ A}$
- 1200 V emitter controlled technology
- Maximum junction temperature  $T_{vjmax} = 175^{\circ}\text{C}$
- Low forward voltage ( $V_F$ )
- Low reverse recovery charge
- Ultrafast recovery times
- Soft recovery characteristics
- Pb-free lead plating; RoHS compliant
- Humidity robust design

Potential applications

- String inverter
- EV-Charging
- Heat pump

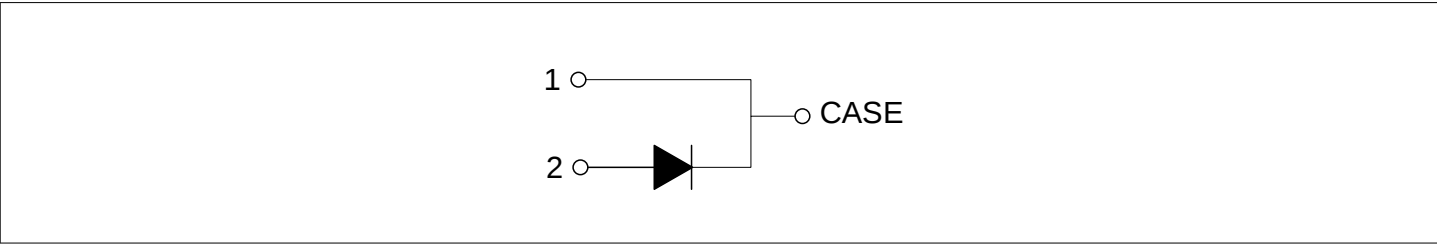
Product validation

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

Description

Pin definition:

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



| Type         | Package              | Marking |
|--------------|----------------------|---------|
| IDWD40E120D7 | PG-TO247-2-STD-NA8.8 | E40MD7  |



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## 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                         | $R_{th(j-c)}$ |                                                      |        | 0.6  | 0.78 | K/W  |

## 2 Diode

**Table 2** Maximum rated values

| Parameter                                                           | Symbol       | Note or test condition     |                       | Values | Unit |
|---------------------------------------------------------------------|--------------|----------------------------|-----------------------|--------|------|
| Repetitive peak reverse voltage                                     | $V_{RRM}$    | $T_{vj} \geq 25\text{ °C}$ |                       | 1200   | V    |
| Diode forward current, limited by $T_{vjmax}$                       | $I_F$        |                            | $T_c = 25\text{ °C}$  | 67     | A    |
|                                                                     |              |                            | $T_c = 100\text{ °C}$ | 42     |      |
| Diode pulsed current, $t_p$ limited by $T_{vjmax}$                  | $I_{Fpulse}$ |                            |                       | 160    | A    |
| Diode surge non repetitive forward current, sine halfwave           | $I_{FSM}$    | $t_p = 10\text{ ms}$       | $T_c = 25\text{ °C}$  | 185    | A    |
| Diode surge repetitive forward current, sine halfwave <sup>1)</sup> | $I_{FRM}$    | $t_p = 10\text{ ms}$       | $T_c = 25\text{ °C}$  | 120    | A    |
| Power dissipation                                                   | $P_{tot}$    |                            | $T_c = 25\text{ °C}$  | 193    | W    |
|                                                                     |              |                            | $T_c = 100\text{ °C}$ | 97     |      |

1) Not subject to production test. The test was performed with 20k pulses (half-wave rectified sine with 10 ms period).

Table 3 Characteristic values

| Parameter                     | Symbol   | Note or test condition |                                                                                                  | Values |      |      | Unit          |
|-------------------------------|----------|------------------------|--------------------------------------------------------------------------------------------------|--------|------|------|---------------|
|                               |          |                        |                                                                                                  | Min.   | Typ. | Max. |               |
| Diode forward voltage         | $V_F$    | $I_F = 40 \text{ A}$   | $T_{vj} = 25 \text{ °C}$                                                                         |        | 2.5  | 3    | V             |
|                               |          |                        | $T_{vj} = 150 \text{ °C}$                                                                        |        | 2.35 |      |               |
|                               |          |                        | $T_{vj} = 175 \text{ °C}$                                                                        |        | 2.3  |      |               |
| Reverse leakage current       | $I_R$    | $V_R = 1200 \text{ V}$ | $T_{vj} = 25 \text{ °C}$                                                                         |        |      | 20   | $\mu\text{A}$ |
|                               |          |                        | $T_{vj} = 175 \text{ °C}$                                                                        |        | 480  |      |               |
| Diode reverse recovery time   | $t_{rr}$ | $V_R = 800 \text{ V}$  | $T_{vj} = 25 \text{ °C}$ ,<br>$I_F = 40 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$  |        | 155  |      | ns            |
|                               |          |                        | $T_{vj} = 25 \text{ °C}$ ,<br>$I_F = 20 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$  |        | 115  |      |               |
|                               |          |                        | $T_{vj} = 175 \text{ °C}$ ,<br>$I_F = 40 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$ |        | 175  |      |               |
|                               |          |                        | $T_{vj} = 175 \text{ °C}$ ,<br>$I_F = 20 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$ |        | 135  |      |               |
| Diode reverse recovery charge | $Q_{rr}$ | $V_R = 800 \text{ V}$  | $T_{vj} = 25 \text{ °C}$ ,<br>$I_F = 40 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$  |        | 1.15 |      | $\mu\text{C}$ |
|                               |          |                        | $T_{vj} = 25 \text{ °C}$ ,<br>$I_F = 20 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$  |        | 0.8  |      |               |
|                               |          |                        | $T_{vj} = 175 \text{ °C}$ ,<br>$I_F = 40 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$ |        | 2.4  |      |               |
|                               |          |                        | $T_{vj} = 175 \text{ °C}$ ,<br>$I_F = 20 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$ |        | 1.7  |      |               |

(table continues...)

Table 3 (continued) Characteristic values

| Parameter                                           | Symbol       | Note or test condition |                                                                                                                | Values |      |      | Unit               |
|-----------------------------------------------------|--------------|------------------------|----------------------------------------------------------------------------------------------------------------|--------|------|------|--------------------|
|                                                     |              |                        |                                                                                                                | Min.   | Typ. | Max. |                    |
| Diode peak reverse recovery current                 | $I_{rrm}$    | $V_R = 800 \text{ V}$  | $T_{vj} = 25 \text{ }^{\circ}\text{C}$ ,<br>$I_F = 40 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$  |        | 19   |      | A                  |
|                                                     |              |                        | $T_{vj} = 25 \text{ }^{\circ}\text{C}$ ,<br>$I_F = 20 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$  |        | 16   |      |                    |
|                                                     |              |                        | $T_{vj} = 175 \text{ }^{\circ}\text{C}$ ,<br>$I_F = 40 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$ |        | 28   |      |                    |
|                                                     |              |                        | $T_{vj} = 175 \text{ }^{\circ}\text{C}$ ,<br>$I_F = 20 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$ |        | 26   |      |                    |
| Diode peak rate of fall of reverse recovery current | $di_{rr}/dt$ | $V_R = 800 \text{ V}$  | $T_{vj} = 25 \text{ }^{\circ}\text{C}$ ,<br>$I_F = 40 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$  |        | 160  |      | A/ $\mu\text{s}$   |
|                                                     |              |                        | $T_{vj} = 25 \text{ }^{\circ}\text{C}$ ,<br>$I_F = 20 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$  |        | 180  |      |                    |
|                                                     |              |                        | $T_{vj} = 175 \text{ }^{\circ}\text{C}$ ,<br>$I_F = 40 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$ |        | 190  |      |                    |
|                                                     |              |                        | $T_{vj} = 175 \text{ }^{\circ}\text{C}$ ,<br>$I_F = 20 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$ |        | 260  |      |                    |
| Reverse recovery energy                             | $E_{rec}$    | $V_R = 800 \text{ V}$  | $T_{vj} = 25 \text{ }^{\circ}\text{C}$ ,<br>$I_F = 40 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$  |        | 0.45 |      | mJ                 |
|                                                     |              |                        | $T_{vj} = 25 \text{ }^{\circ}\text{C}$ ,<br>$I_F = 20 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$  |        | 0.25 |      |                    |
|                                                     |              |                        | $T_{vj} = 175 \text{ }^{\circ}\text{C}$ ,<br>$I_F = 40 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$ |        | 0.85 |      |                    |
|                                                     |              |                        | $T_{vj} = 175 \text{ }^{\circ}\text{C}$ ,<br>$I_F = 20 \text{ A}$ ,<br>$-di_F/dt = 1000 \text{ A}/\mu\text{s}$ |        | 0.6  |      |                    |
| 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.*

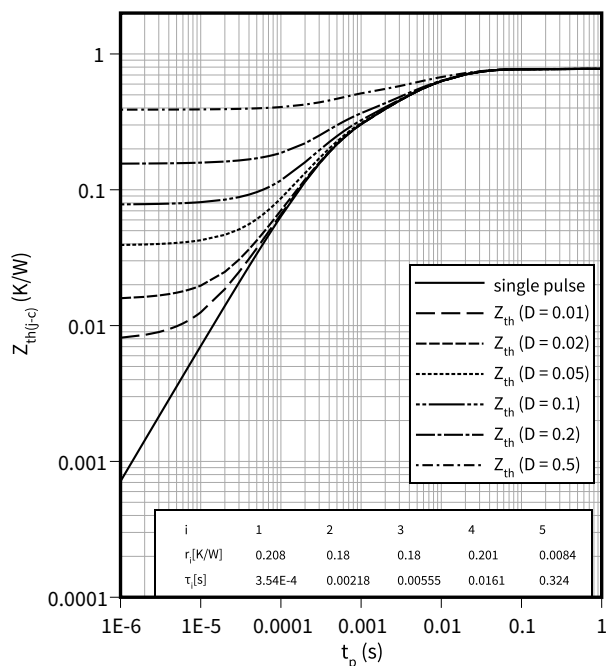
*Dynamic test circuit, parasitic inductance  $L_{\sigma} = 27 \text{ nH}$ , parasitic capacitor  $C_{\sigma} = 12 \text{ pF}$  from Fig. E, IKZA40N120CH7 was used as IGBT.*

### 3 Characteristics diagrams

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

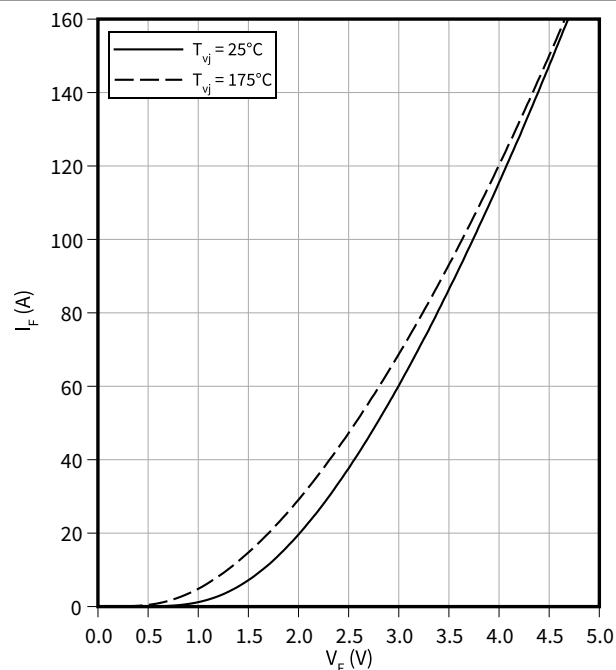
$$Z_{th(j-c)} = f(t_p)$$

$$D = t_p / T$$



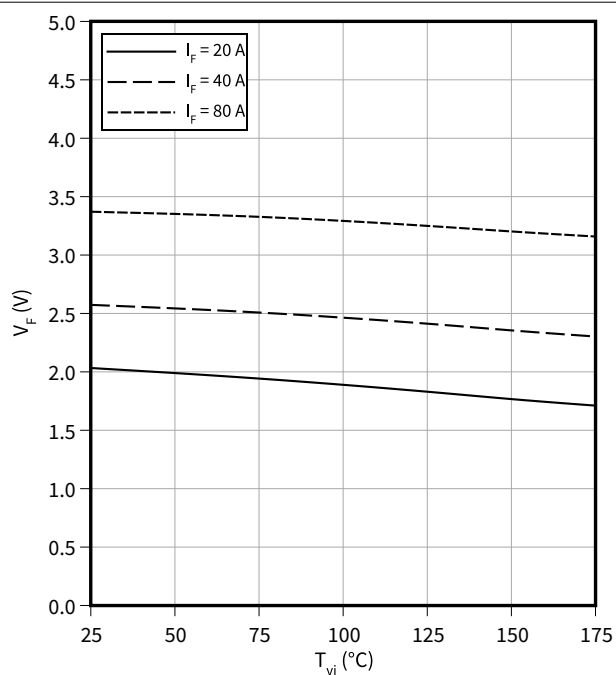
#### Typical diode forward current as a function of forward voltage

$$I_F = f(V_F)$$



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

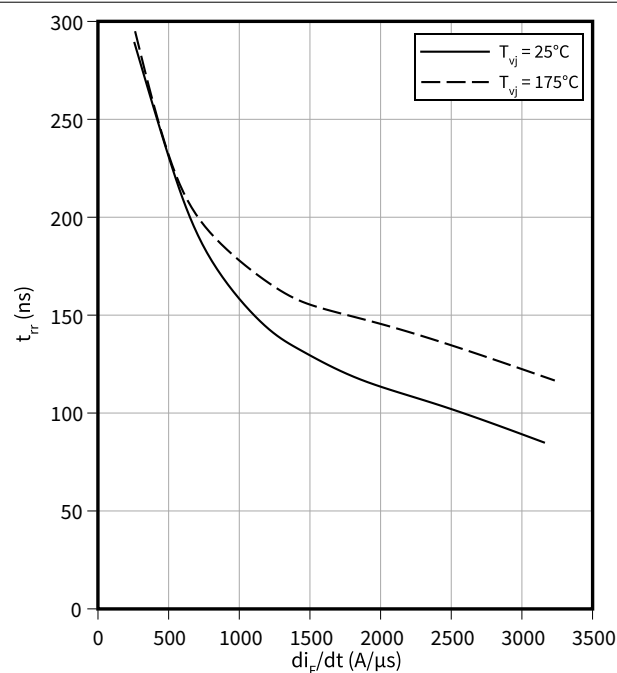
$$V_F = f(T_{vj})$$



#### Typical reverse recovery time as a function of diode current slope

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

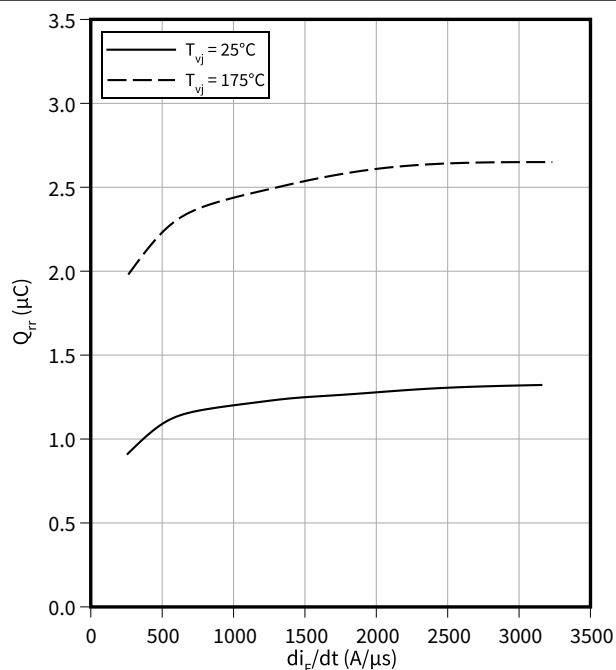
$$V_R = 800 \text{ V}, I_F = 40 \text{ A}$$



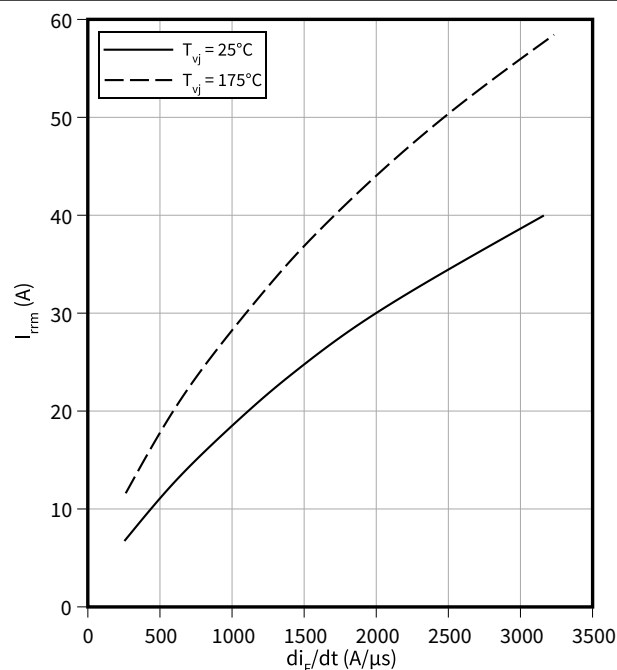
## 3 Characteristics diagrams

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

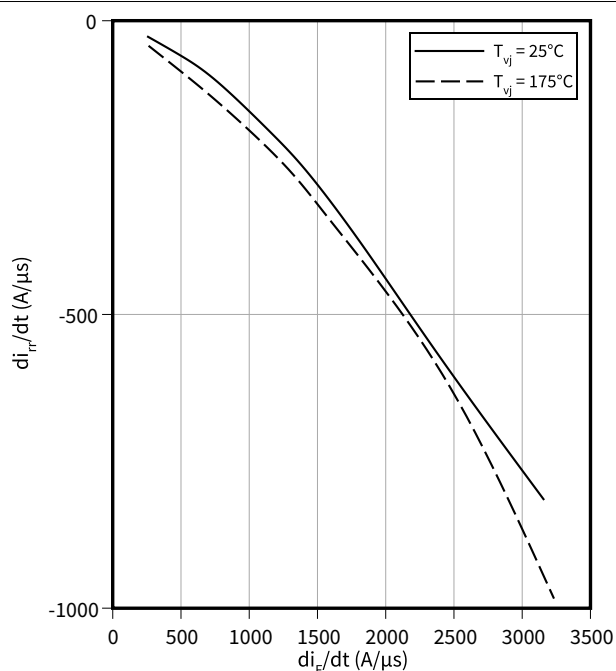
$$Q_{rr} = f(di_F/dt)$$

 $V_R = 800 \text{ V}, I_F = 40 \text{ A}$ 
**Typical reverse recovery current as a function of diode current slope**

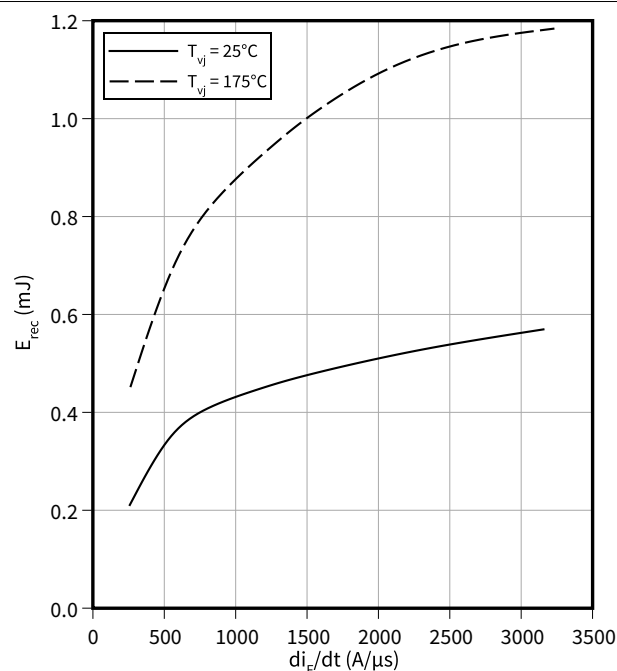
$$I_{rrm} = f(di_F/dt)$$

 $V_R = 800 \text{ V}, I_F = 40 \text{ A}$ 
**Typical diode peak rate of fall of reverse recovery current as a function of diode current slope**

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

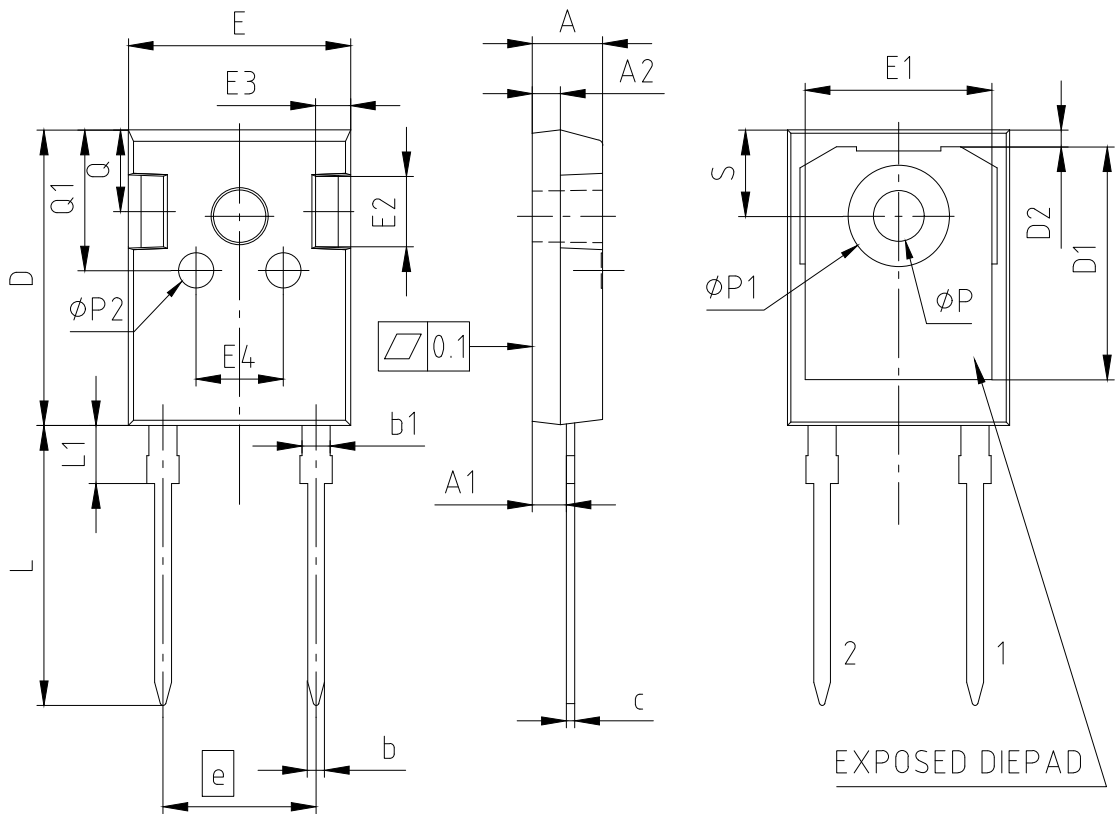
 $V_R = 800 \text{ V}, I_F = 40 \text{ A}$ 
**Typical reverse energy losses as a function of diode current slope**

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

 $V_R = 800 \text{ V}, I_F = 40 \text{ A}$ 


4 Package outlines

PG-TO247-2-STD-NA8.8



|                         |             |                |     |       |       |
|-------------------------|-------------|----------------|-----|-------|-------|
| PACKAGE - GROUP NUMBER: |             | PG-TO247-2-U01 |     |       |       |
| DIMENSIONS              | MILLIMETERS |                |     |       |       |
|                         | MIN.        | MAX.           |     |       |       |
| A                       | 4.90        | 5.10           | L   | 19.80 | 20.10 |
| A1                      | 2.31        | 2.51           | L1  | ---   | 4.30  |
| A2                      | 1.90        | 2.10           | øP  | 3.50  | 3.70  |
| b                       | 1.16        | 1.26           | øP1 | 7.00  | 7.40  |
| b1                      | 1.96        | 2.06           | øP2 | 2.40  | 2.60  |
| c                       | 0.59        | 0.66           | Q   | 5.60  | 6.00  |
| D                       | 20.90       | 21.10          | Q1  | 9.80  | 10.20 |
| D1                      | 16.25       | 16.85          | S   | 6.05  | 6.25  |
| D2                      | 1.05        | 1.35           |     |       |       |
| E                       | 15.70       | 15.90          |     |       |       |
| E1                      | 13.10       | 13.50          |     |       |       |
| E2                      | 4.90        | 5.10           |     |       |       |
| E3                      | 2.40        | 2.60           |     |       |       |
| E4                      | 6.00        | 6.40           |     |       |       |
| e                       | 10.88       |                |     |       |       |
| N                       | 2           |                |     |       |       |

ALL DIMENSIONS DO NOT INCLUDE  
MOLD FLASH OR PROTRUSIONS.

Figure 1

## 5 Testing conditions

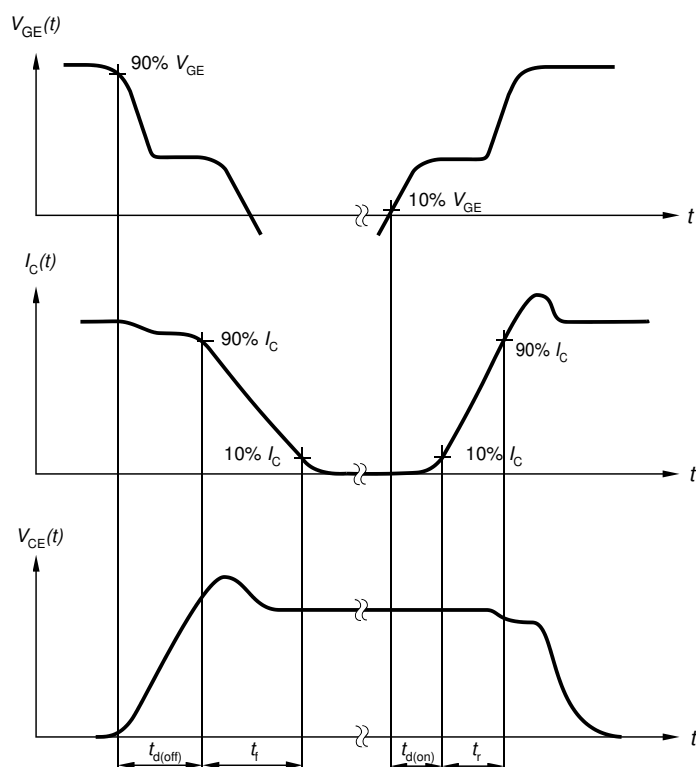


Figure A. Definition of switching times

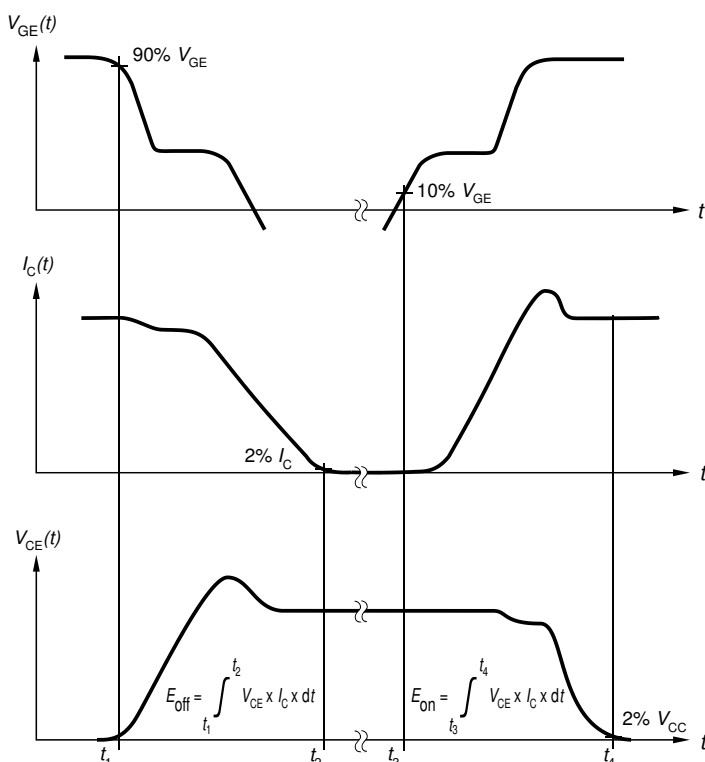


Figure B. Definition of switching losses

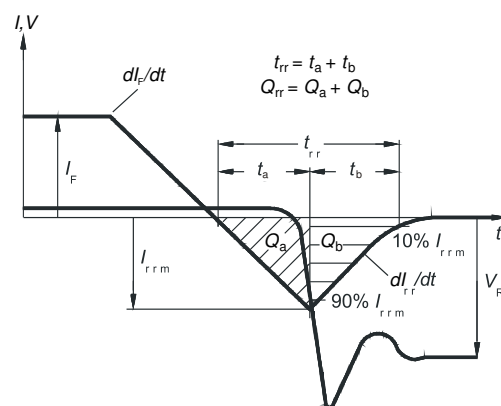


Figure C. Definition of diode switching characteristics

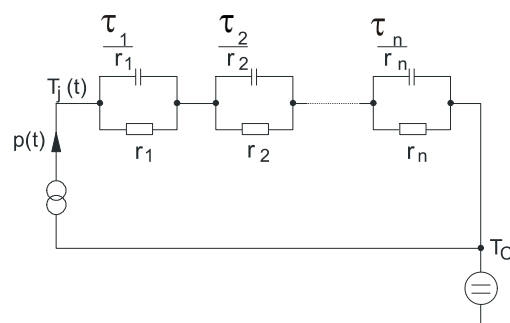


Figure D. Thermal equivalent circuit

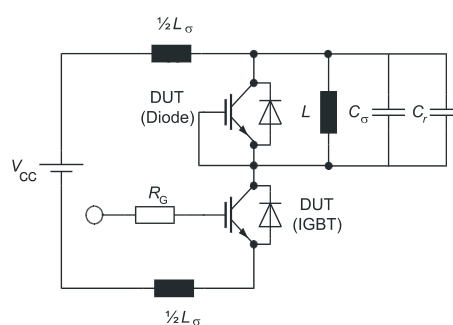


Figure E. **Dynamic test circuit**  
 Parasitic inductance  $L_{\sigma}$ ,  
 parasitic capacitor  $C_{\sigma}$ ,  
 relief capacitor  $C_r$ ,  
 (only for ZVT switching)

**Revision history**

| Document revision | Date of release | Description of changes |
|-------------------|-----------------|------------------------|
| 1.00              | 2023-12-15      | Final datasheet        |

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