1. General description

High power density, hyperfast switching time recovery rectifier with high-efficiency planar technology, encapsulated in a CFP15B (SOT1289B) power and flat lead Surface-Mounted Device (SMD) plastic package.

2. Features and benefits

- Reverse voltage: $V_R \leq 200 \text{ V}$
- Forward current: $I_F \leq 6 \text{ A}$
- Switching time: $t_{rr} \leq 30 \text{ ns}$
- Pt doped life time control
- Low inductance
- Power and flat lead SMD plastic package
- Package height typical 0.95 mm
- High power capability due to clip-bond technology
- Planar die design

3. Applications

- General-purpose rectification
- Reverse polarity protection
- Hyperfast switching
- Freewheeling applications
- Engine Control Unit (ECU)

4. Quick reference data

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{F(AV)}$</td>
<td>average forward current</td>
<td>$\delta = 0.5; f = 20 \text{ kHz}; \text{square wave}; T_{sp} \leq 170 \text{ °C}$</td>
<td>-</td>
<td>-</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>$V_R$</td>
<td>reverse voltage</td>
<td>$T_j = 25 \text{ °C}$</td>
<td>-</td>
<td>-</td>
<td>200</td>
<td>V</td>
</tr>
<tr>
<td>$V_{RRM}$</td>
<td>repetitive peak reverse voltage</td>
<td>-</td>
<td>-</td>
<td>200</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_F$</td>
<td>forward voltage</td>
<td>$I_F = 6 \text{ A}; T_j = 25 \text{ °C}$</td>
<td>[1]</td>
<td>-</td>
<td>880</td>
<td>940</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_F = 6 \text{ A}; T_j = 125 \text{ °C}$</td>
<td>[1]</td>
<td>-</td>
<td>740</td>
<td>800</td>
</tr>
<tr>
<td>$I_R$</td>
<td>reverse current</td>
<td>$V_R = 200 \text{ V}; T_j = 25 \text{ °C}$</td>
<td>[1]</td>
<td>-</td>
<td>1</td>
<td>$\mu$A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_R = 200 \text{ V}; T_j = 125 \text{ °C}$</td>
<td>[1]</td>
<td>-</td>
<td>2</td>
<td>15</td>
</tr>
</tbody>
</table>

[1] Very short pulse, in order to maintain a stable junction temperature.
5. Pinning information

Table 2. Pinning information

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
<th>Simplified outline</th>
<th>Graphic symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A1</td>
<td>anode 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>A2</td>
<td>anode 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>K</td>
<td>cathode</td>
<td>CFP15B (SOT1289B)</td>
<td></td>
</tr>
</tbody>
</table>

6. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package</th>
<th>Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNE20060EPE</td>
<td>CFP15B</td>
<td>plastic, thermal enhanced ultra thin SMD package; 3 leads; 2.13 mm pitch; 5.8 x 4.3 x 0.95 mm body</td>
<td>SOT1289B</td>
<td></td>
</tr>
</tbody>
</table>

7. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNE20060EPE</td>
<td>200E</td>
</tr>
<tr>
<td></td>
<td>106E</td>
</tr>
</tbody>
</table>

8. Limiting values

Table 5. Limiting values

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_R$</td>
<td>reverse voltage</td>
<td>$T_j = 25 , ^\circ C$</td>
<td>-</td>
<td>200</td>
<td>V</td>
</tr>
<tr>
<td>$V_{RRM}$</td>
<td>repetitive peak reverse voltage</td>
<td></td>
<td>-</td>
<td>200</td>
<td>V</td>
</tr>
<tr>
<td>$V_{(RMS)lim}$</td>
<td>limiting RMS reverse voltage</td>
<td></td>
<td>-</td>
<td>140</td>
<td>V</td>
</tr>
<tr>
<td>$I_F$</td>
<td>forward current</td>
<td>$\delta = 1; T_{sp} \leq 150 , ^\circ C$</td>
<td>-</td>
<td>8.5</td>
<td>A</td>
</tr>
<tr>
<td>$I_{F(AV)}$</td>
<td>average forward current</td>
<td>$\delta = 0.5; f = 20 , kHz; square wave; T_{sp} \leq 170 , ^\circ C$</td>
<td>-</td>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>$I_{FSM}$</td>
<td>non-repetitive peak forward current</td>
<td>$t_p = 8.3 , ms; single half sine wave (applied at rated load condition); $T_{j(init)} = 25 , ^\circ C$</td>
<td>-</td>
<td>150</td>
<td>A</td>
</tr>
<tr>
<td>$P_{tot}$</td>
<td>total power dissipation</td>
<td>$T_{amb} \leq 25 , ^\circ C$</td>
<td>[1]</td>
<td>1.75</td>
<td>W</td>
</tr>
<tr>
<td>$T_j$</td>
<td>junction temperature</td>
<td></td>
<td>[2]</td>
<td>2.15</td>
<td>W</td>
</tr>
<tr>
<td>$T_{amb}$</td>
<td>ambient temperature</td>
<td></td>
<td>-55</td>
<td>175</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>storage temperature</td>
<td></td>
<td>-65</td>
<td>175</td>
<td>°C</td>
</tr>
</tbody>
</table>

9. Thermal characteristics

Table 6. Thermal characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th(j-a)}$</td>
<td>thermal resistance from junction to ambient in free air</td>
<td>[1]</td>
<td>-</td>
<td>-</td>
<td>85</td>
<td>K/W</td>
</tr>
<tr>
<td>$R_{th(j-sp)}$</td>
<td>thermal resistance from junction to solder point</td>
<td>[2]</td>
<td>-</td>
<td>-</td>
<td>70</td>
<td>K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[3]</td>
<td>-</td>
<td>-</td>
<td>1.2</td>
<td>K/W</td>
</tr>
</tbody>
</table>


Fig. 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values

Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values
10. Characteristics

Table 7. Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{(BR)R}$</td>
<td>reverse breakdown voltage</td>
<td>$I_R = 100 \mu A; T_j = 25 \degree C$</td>
<td>200</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_F$</td>
<td>forward voltage</td>
<td>$I_F = 6 A; T_j = 25 \degree C$</td>
<td>880</td>
<td>940</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_F = 6 A; T_j = 125 \degree C$</td>
<td>740</td>
<td>800</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>$I_R$</td>
<td>reverse current</td>
<td>$V_R = 200 V; T_j = 25 \degree C$</td>
<td>2</td>
<td>15</td>
<td>µA</td>
<td></td>
</tr>
<tr>
<td>$C_d$</td>
<td>diode capacitance</td>
<td>$V_R = 4 V; f = 1 MHz; T_j = 25 \degree C$</td>
<td>65</td>
<td>-</td>
<td>pF</td>
<td></td>
</tr>
<tr>
<td>$t_{rr}$</td>
<td>reverse recovery time step recovery</td>
<td>$I_F = 0.5 A; I_R = 1 A; I_R(meas) = 0.25 A; T_j = 25 \degree C$</td>
<td>14</td>
<td>30</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>reverse recovery time ramp recovery</td>
<td>$dI_F/dt = 50 A/\mu s; I_F = 1 A; V_R = 30 V; T_j = 25 \degree C$</td>
<td>17</td>
<td>-</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>$V_{FRM}$</td>
<td>peak forward recovery voltage</td>
<td>$I_F = 1 A; dI_F/dt = 50 A/\mu s; T_j = 25 \degree C$</td>
<td>740</td>
<td>-</td>
<td>mV</td>
<td></td>
</tr>
</tbody>
</table>

[1] Very short pulse, in order to maintain a stable junction temperature.

Fig. 3. Forward current as a function of forward voltage; typical values

Fig. 4. Reverse current as a function of reverse voltage; typical values
Nexperia

PNE20060EPE

200 V, 6 A hyperfast recovery rectifier

f = 1 MHz; $T_{\text{amb}} = 25$ °C

Fig. 5. Diode capacitance as a function of reverse voltage; typical values

$T_J = 175$ °C
(1) $\delta = 0.1$
(2) $\delta = 0.2$
(3) $\delta = 0.5$
(4) $\delta = 0.8$
(5) $\delta = 1$; DC

Fig. 6. Average forward power dissipation as a function of average forward current; typical values

$T_J = 175$ °C
(1) $\delta = 1$; DC
(2) $\delta = 0.9$
(3) $\delta = 0.8$
(4) $\delta = 0.5$
(5) $\delta = 0.2$
(6) $\delta = 0.1$

Fig. 7. Average reverse power dissipation as a function of reverse voltage; typical values

FR4 PCB, standard footprint
$T_J = 175$ °C
(1) $\delta = 1$; DC
(2) $\delta = 0.5$; $f = 20$ kHz
(3) $\delta = 0.2$; $f = 20$ kHz
(4) $\delta = 0.1$; $f = 20$ kHz

Fig. 8. Average forward current as a function of ambient temperature; typical values
200 V, 6 A hyperfast recovery rectifier

**Fig. 9.** Average forward current as a function of ambient temperature; typical values

- FR4 PCB, mounting pad for cathode 1 cm²

- $T_j = 175 \, ^\circ C$

- (1) $\delta = 1$; DC

- (2) $\delta = 0.5$; $f = 20$ kHz

- (3) $\delta = 0.2$; $f = 20$ kHz

- (4) $\delta = 0.1$; $f = 20$ kHz

**Fig. 10.** Average forward current as a function of solder point temperature; typical values

- $T_j = 175 \, ^\circ C$

- (1) $\delta = 1$; DC

- (2) $\delta = 0.5$; $f = 20$ kHz

- (3) $\delta = 0.2$; $f = 20$ kHz

- (4) $\delta = 0.1$; $f = 20$ kHz

**Fig. 11.** Derated maximum reverse voltage as a function of junction temperature; typical values

- FR4 PCB, standard footprint

- $R_{th} = 85 \, K/W$

**Fig. 12.** Derated maximum reverse voltage as a function of junction temperature; typical values

- FR4 PCB, mounting pad for cathode 1 cm²

- $R_{th} = 70 \, K/W$
Soldering point of cathode tab

\[ R_{th} = 1.2 \text{ K/W} \]

Fig. 13. Derated maximum reverse voltage as a function of junction temperature; typical values

11. Test information

Fig. 14. Reverse recovery definition; step recovery

Fig. 15. Reverse recovery definition; ramp recovery
The current ratings for the typical waveforms are calculated according to the equations:

\[ I_{F(AV)} = I_M \times \delta \text{ with } I_M \text{ defined as peak current} \]

\[ I_{RMS} = I_{F(AV)} \text{ at DC, and } I_{RMS} = I_M \times \sqrt{\delta} \]

with \( I_{RMS} \) defined as RMS current.

12. Package outline

Fig. 18. Package outline CFP15B (SOT1289B)
13. Soldering

Footprint information for reflow soldering of CFP15B package

<table>
<thead>
<tr>
<th>Occupied area</th>
<th>Solder lands</th>
<th>Solder resist</th>
<th>Solder paste</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3</td>
<td>1.07</td>
<td>1.36</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Dimensions in mm

Issue date: 19-06-13 20-02-05

Recommended stencil thickness: 0.1 mm

Fig. 19. Reflow soldering footprint for CFP15B (SOT1289B)
14. Revision history

Table 8. Revision history

<table>
<thead>
<tr>
<th>Data sheet ID</th>
<th>Release date</th>
<th>Data sheet status</th>
<th>Change notice</th>
<th>Supersedes</th>
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<tbody>
<tr>
<td>PNE20060EPE v.1</td>
<td>20211116</td>
<td>Product data sheet</td>
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<td>-</td>
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</table>
15. Legal information

Data sheet status

<table>
<thead>
<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Preliminary [short] data sheet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Product [short] data sheet</td>
</tr>
</tbody>
</table>

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term "short data sheet" is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com

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