

## 1. General description

Ultrafast, epitaxial rectifier diode in a SOD113 (TO-220F) plastic package.

## 2. Features and benefits

- Fast switching
- Low thermal resistance
- Soft recovery characteristic
- Isolated package
- Low forward voltage drop
- High thermal cycling performance

## 3. Applications

- Output rectifiers in high frequency switched-mode power supplies
- Discontinuous Current Mode (DCM) Power Factor Correction (PFC)

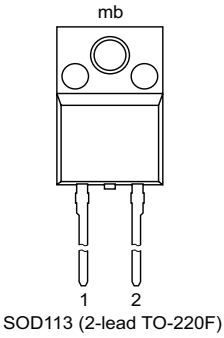
## 4. Quick reference data

Table 1. Quick reference data

| Symbol                  | Parameter                           | Conditions                                                                                                                    | Values |     |      |      | Unit |
|-------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------|-----|------|------|------|
| Absolute maximum rating |                                     |                                                                                                                               |        |     |      |      |      |
| V <sub>RRM</sub>        | repetitive peak reverse voltage     |                                                                                                                               | 600    |     |      |      | V    |
| I <sub>F(AV)</sub>      | average forward current             | δ = 0.5 ; square-wave pulse; T <sub>h</sub> ≤ 85 °C; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a> | 9      |     |      |      | A    |
| I <sub>FRM</sub>        | repetitive peak forward current     | δ = 0.5 ; t <sub>p</sub> = 25 μs; T <sub>h</sub> ≤ 85 °C; square-wave pulse                                                   | 18     |     |      |      | A    |
| I <sub>FSM</sub>        | non-repetitive peak forward current | t <sub>p</sub> = 10 ms; T <sub>j(init)</sub> = 25 °C; sine-wave pulse; <a href="#">Fig. 4</a>                                 | 91     |     |      |      | A    |
|                         |                                     | t <sub>p</sub> = 8.3 ms; T <sub>j(init)</sub> = 25 °C; sine-wave pulse                                                        | 100    |     |      |      | A    |
| Symbol                  | Parameter                           | Conditions                                                                                                                    |        | Min | Typ  | Max  | Unit |
| Static characteristics  |                                     |                                                                                                                               |        |     |      |      |      |
| V <sub>F</sub>          | forward voltage                     | I <sub>F</sub> = 8 A; T <sub>J</sub> = 25 °C; <a href="#">Fig. 6</a>                                                          |        | -   | 1.12 | 1.26 | V    |
|                         |                                     | I <sub>F</sub> = 8 A; T <sub>J</sub> = 125 °C                                                                                 |        | -   | 1.03 | -    | V    |
|                         |                                     | I <sub>F</sub> = 8 A; T <sub>J</sub> = 150 °C; <a href="#">Fig. 6</a>                                                         |        | -   | 0.97 | 1.11 | V    |
| Dynamic characteristics |                                     |                                                                                                                               |        |     |      |      |      |
| t <sub>rr</sub>         | reverse recovery time               | I <sub>F</sub> = 1 A; V <sub>R</sub> = 30 V; dI <sub>F</sub> /dt = 100 A/μs; T <sub>i</sub> = 25 °C; <a href="#">Fig. 7</a>   |        | -   | 32   | 60   | ns   |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description             | Simplified outline                                                                                                | Graphic symbol                                                                      |
|-----|--------|-------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | K      | cathode                 |  <p>SOD113 (2-lead TO-220F)</p> |  |
| 2   | A      | anode                   |                                                                                                                   |                                                                                     |
| mb  | mb     | mounting base; isolated |                                                                                                                   |                                                                                     |

6. Ordering information

Table 3. Ordering information

| Type number | Package |                                                                                                     |         |
|-------------|---------|-----------------------------------------------------------------------------------------------------|---------|
|             | Name    | Description                                                                                         | Version |
| BYV29X-600  | TO-220F | plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 2-lead TO-220 'full pack' | SOD113  |

7. Marking

Table 4. Marking codes

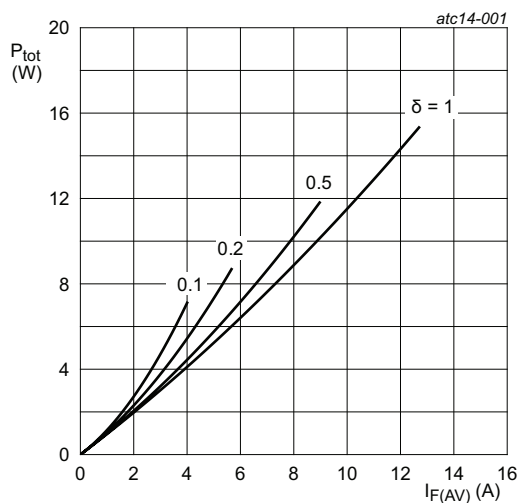
| Type number | Marking codes |
|-------------|---------------|
| BYV29X-600  | BYV29X-600    |

## 8. Limiting values

**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

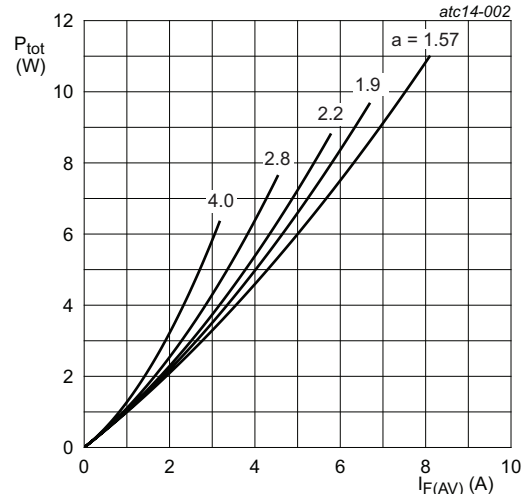
| Symbol      | Parameter                           | Conditions                                                                                                                                    | Values     | Unit             |
|-------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------|
| $V_{RRM}$   | repetitive peak reverse voltage     |                                                                                                                                               | 600        | V                |
| $V_{RWM}$   | crest working reverse voltage       |                                                                                                                                               | 600        | V                |
| $V_R$       | reverse voltage                     | DC                                                                                                                                            | 600        | V                |
| $I_{F(AV)}$ | average forward current             | $\delta = 0.5$ ; square-wave pulse; $T_h \leq 85^\circ\text{C}$ ;<br><a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a> | 9          | A                |
| $I_{FRM}$   | repetitive peak forward current     | $\delta = 0.5$ ; $t_p = 25\ \mu\text{s}$ ; $T_h \leq 85^\circ\text{C}$ ;<br>square-wave pulse                                                 | 18         | A                |
| $I_{FSM}$   | non-repetitive peak forward current | $t_p = 10\ \text{ms}$ ; $T_{j(\text{init})} = 25^\circ\text{C}$ ; sine-wave pulse;<br><a href="#">Fig. 4</a>                                  | 91         | A                |
|             |                                     | $t_p = 8.3\ \text{ms}$ ; $T_{j(\text{init})} = 25^\circ\text{C}$ ; sine-wave pulse                                                            | 100        | A                |
| $T_{stg}$   | storage temperature                 |                                                                                                                                               | -40 to 150 | $^\circ\text{C}$ |
| $T_j$       | junction temperature                |                                                                                                                                               | 150        | $^\circ\text{C}$ |



$$I_{F(AV)} = I_{F(RMS)} \times \sqrt{\delta}$$

$$V_o = 0.943\ \text{V}; R_s = 0.0208\ \Omega$$

**Fig. 1. Forward power dissipation as a function of average forward current; square waveform; maximum values**



$$a = \text{form factor} = I_{F(RMS)} / I_{F(AV)}$$

$$V_o = 0.943\ \text{V}; R_s = 0.0208\ \Omega$$

**Fig. 2. Forward power dissipation as a function of average forward current; sinusoidal waveform; maximum values**

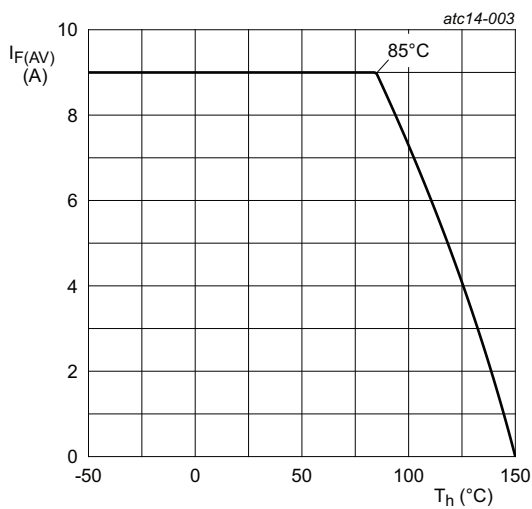


Fig. 3. Forward current as a function of heatsink temperature; maximum values

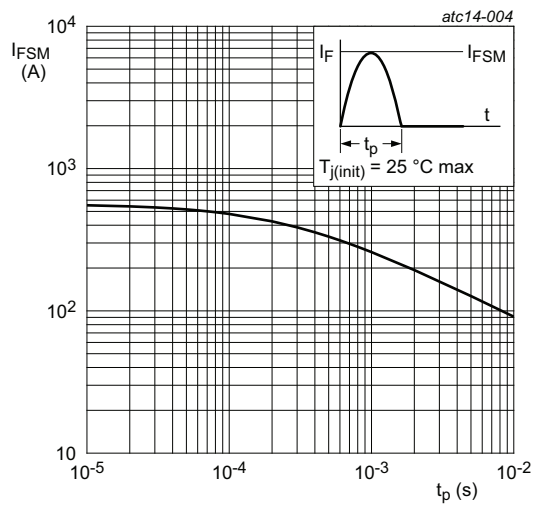


Fig. 4. Non-repetitive peak forward current as a function of pulse width; sinusoidal waveform; maximum values

9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol        | Parameter                                            | Conditions                                     | Min | Typ | Max | Unit |
|---------------|------------------------------------------------------|------------------------------------------------|-----|-----|-----|------|
| $R_{th(j-h)}$ | thermal resistance from junction to heatsink         | with heatsink compound; <a href="#">Fig. 5</a> | -   | -   | 5.5 | K/W  |
|               |                                                      | without heatsink compound                      | -   | -   | 5.9 | K/W  |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient free air | in free air                                    | -   | 55  | -   | K/W  |

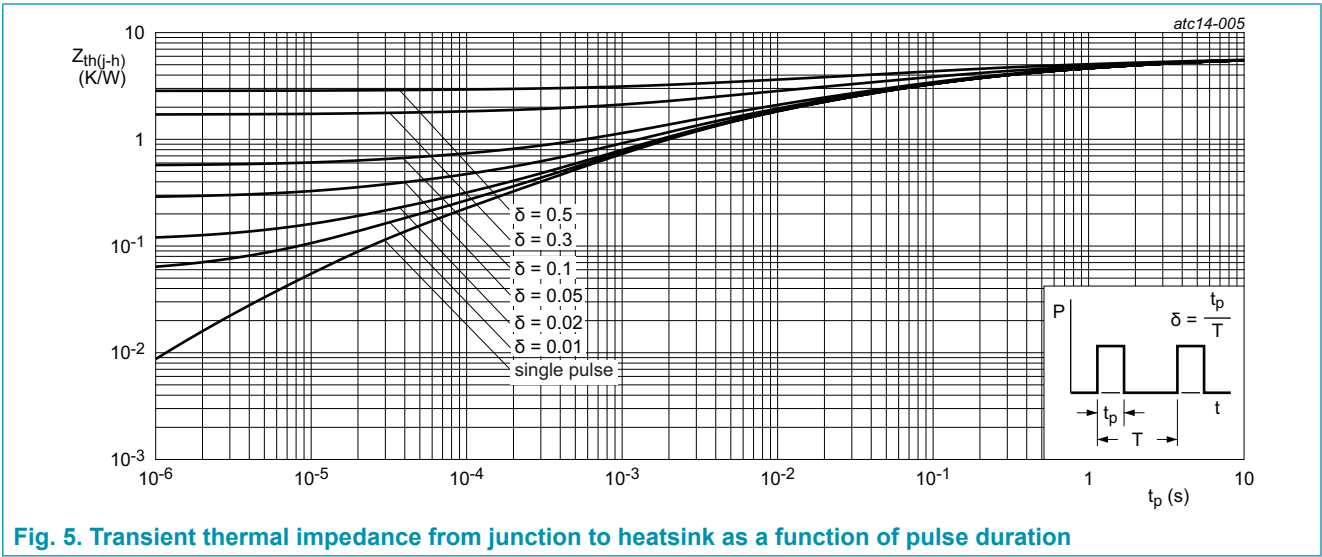


Fig. 5. Transient thermal impedance from junction to heatsink as a function of pulse duration

10. Isolation characteristics

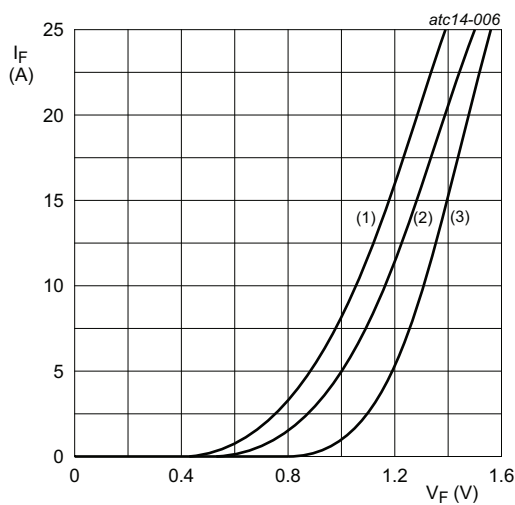
Table 6. Isolation characteristics

| Symbol          | Parameter             | Conditions                                                                                                              | Min | Typ | Max  | Unit |
|-----------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------|-----|-----|------|------|
| $V_{isol(RMS)}$ | RMS isolation voltage | 50 Hz $\leq f \leq$ 60 Hz; RH $\leq$ 65 %; from all pins to external heatsink; sinusoidal waveform; clean and dust free | -   | -   | 2500 | V    |
| $C_{isol}$      | isolation capacitance | from cathode to external heatsink                                                                                       | -   | 10  | -    | PF   |

## 11. Characteristics

Table 7. Characteristics

| Symbol                  | Parameter                                     | Conditions                                                                                                                    |  | Min | Typ  | Max  | Unit |
|-------------------------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--|-----|------|------|------|
| Static characteristics  |                                               |                                                                                                                               |  |     |      |      |      |
| V <sub>F</sub>          | forward current                               | I <sub>F</sub> = 8 A; T <sub>j</sub> = 25 °C; <a href="#">Fig. 6</a>                                                          |  | -   | 1.12 | 1.26 | V    |
|                         |                                               | I <sub>F</sub> = 8 A; T <sub>j</sub> = 125 °C                                                                                 |  | -   | 1.03 | -    | V    |
|                         |                                               | I <sub>F</sub> = 8 A; T <sub>j</sub> = 150 °C; <a href="#">Fig. 6</a>                                                         |  | -   | 0.97 | 1.11 | V    |
| I <sub>R</sub>          | reverse current                               | V <sub>R</sub> = 600 V; T <sub>j</sub> = 25 °C                                                                                |  | -   | 2    | 50   | μA   |
|                         |                                               | V <sub>R</sub> = 600 V; T <sub>j</sub> = 100 °C                                                                               |  | -   | 0.3  | -    | mA   |
|                         |                                               | V <sub>R</sub> = 600 V; T <sub>j</sub> = 125 °C                                                                               |  | -   | -    | 3    | mA   |
| Dynamic characteristics |                                               |                                                                                                                               |  |     |      |      |      |
| Q <sub>r</sub>          | reverse charge                                | I <sub>F</sub> = 1 A; V <sub>R</sub> = 30 V; dI <sub>F</sub> /dt = 100 A/μs; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>   |  | -   | 37   | -    | nC   |
| t <sub>rr</sub>         | reverse recovery time                         |                                                                                                                               |  | -   | 32   | 60   | ns   |
| I <sub>RM</sub>         | peak reverse recovery current                 |                                                                                                                               |  | -   | 2.3  | -    | A    |
| dI <sub>rr</sub> /dt    | peak rate of fall of reverse recovery current |                                                                                                                               |  | -   | 297  | -    | A/μs |
| Q <sub>r</sub>          | reverse charge                                | I <sub>F</sub> = 8 A; V <sub>R</sub> = 400 V; dI <sub>F</sub> /dt = 500 A/μs; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>  |  | -   | 220  | -    | nC   |
| t <sub>rr</sub>         | reverse recovery time                         |                                                                                                                               |  | -   | 43   | -    | ns   |
| I <sub>RM</sub>         | peak reverse recovery current                 |                                                                                                                               |  | -   | 10   | -    | A    |
| dI <sub>rr</sub> /dt    | peak rate of fall of reverse recovery current |                                                                                                                               |  | -   | 655  | -    | A/μs |
| Q <sub>r</sub>          | reverse charge                                | I <sub>F</sub> = 8 A; V <sub>R</sub> = 400 V; dI <sub>F</sub> /dt = 200 A/μs; T <sub>j</sub> = 25 °C; <a href="#">Fig. 7</a>  |  | -   | 165  | -    | nC   |
| t <sub>rr</sub>         | reverse recovery time                         |                                                                                                                               |  | -   | 59   | -    | ns   |
| I <sub>RM</sub>         | peak reverse recovery current                 |                                                                                                                               |  | -   | 5.6  | -    | A    |
| dI <sub>rr</sub> /dt    | peak rate of fall of reverse recovery current |                                                                                                                               |  | -   | 215  | -    | A/μs |
| Q <sub>r</sub>          | reverse charge                                | I <sub>F</sub> = 8 A; V <sub>R</sub> = 400 V; dI <sub>F</sub> /dt = 500 A/μs; T <sub>j</sub> = 125 °C; <a href="#">Fig. 7</a> |  | -   | 425  | -    | nC   |
| t <sub>rr</sub>         | reverse recovery time                         |                                                                                                                               |  | -   | 57   | -    | ns   |
| I <sub>RM</sub>         | peak reverse recovery current                 |                                                                                                                               |  | -   | 15   | -    | A    |
| dI <sub>rr</sub> /dt    | peak rate of fall of reverse recovery current |                                                                                                                               |  | -   | 1661 | -    | A/μs |
| Q <sub>r</sub>          | reverse charge                                | I <sub>F</sub> = 8 A; V <sub>R</sub> = 400 V; dI <sub>F</sub> /dt = 200 A/μs; T <sub>j</sub> = 125 °C; <a href="#">Fig. 7</a> |  | -   | 315  | -    | nC   |
| t <sub>rr</sub>         | reverse recovery time                         |                                                                                                                               |  | -   | 70   | -    | ns   |
| I <sub>RM</sub>         | peak reverse recovery current                 |                                                                                                                               |  | -   | 9    | -    | A    |
| dI <sub>rr</sub> /dt    | peak rate of fall of reverse recovery current |                                                                                                                               |  | -   | 1181 | -    | A/μs |



$V_o = 0.943 \text{ V}$ ;  $R_s = 0.0208 \Omega$   
(1)  $T_j = 150 \text{ }^\circ\text{C}$ ; typical values  
(2)  $T_j = 150 \text{ }^\circ\text{C}$ ; maximum values  
(3)  $T_j = 25 \text{ }^\circ\text{C}$ ; maximum values

Fig. 6. Forward current as a function of forward voltage

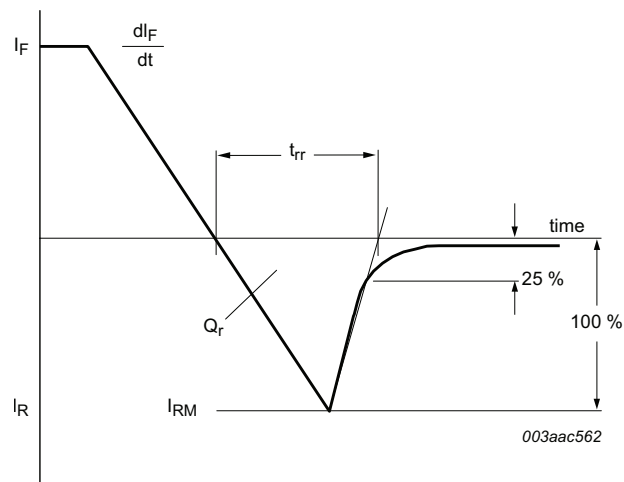
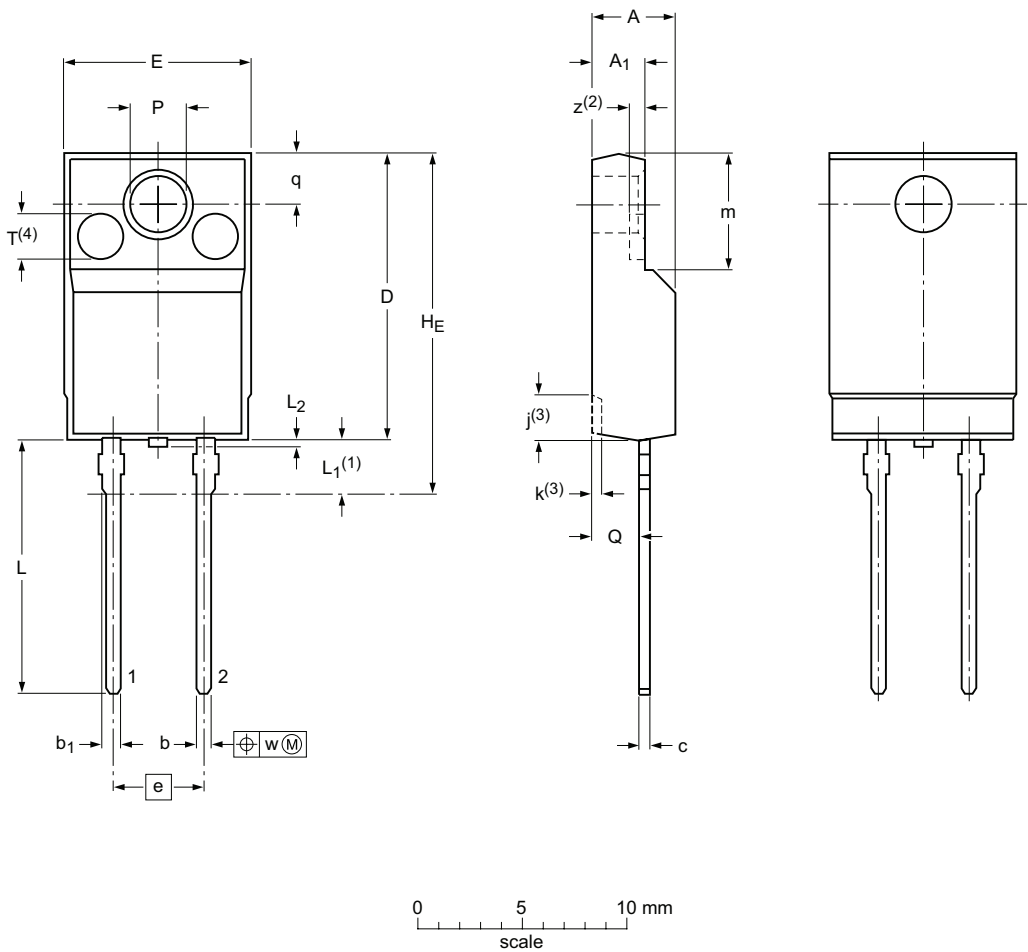


Fig. 7. Reverse recovery definitions; ramp recovery

12. Package outline

Plastic single-ended package; isolated heatsink mounted;  
1 mounting hole; 2-lead TO-220 `full pack`

SOD113



Dimensions (mm are the original dimensions)

| Unit | A   | A <sub>1</sub> | b   | b <sub>1</sub> | c   | D    | E    | e    | H <sub>E</sub><br>max | j <sup>(3)</sup> | k <sup>(3)</sup> | L    | L <sub>1</sub> <sup>(1)</sup> | L <sub>2</sub><br>max | m   | P   | Q   | q   | T <sup>(4)</sup> | w   | z <sup>(2)</sup> |
|------|-----|----------------|-----|----------------|-----|------|------|------|-----------------------|------------------|------------------|------|-------------------------------|-----------------------|-----|-----|-----|-----|------------------|-----|------------------|
| max  | 4.6 | 2.9            | 0.9 | 1.1            | 0.7 | 15.8 | 10.3 |      |                       | 2.7              | 0.6              | 14.4 | 3.3                           |                       | 6.5 | 3.2 | 2.6 |     |                  |     |                  |
| nom  |     |                |     |                |     |      |      | 5.08 | 19.0                  |                  |                  |      |                               | 0.5                   |     |     |     | 2.6 | 2.55             | 0.4 | 0.8              |
| min  | 4.0 | 2.5            | 0.7 | 0.9            | 0.4 | 15.2 | 9.7  |      |                       | 1.7              | 0.4              | 13.5 | 2.8                           |                       | 6.3 | 3.0 | 2.3 |     |                  |     |                  |

- Notes
- 1. Terminals are uncontrolled within zone L1.
  - 2. z is depth of T.
  - 3. Dot lines area designs may vary.
  - 4. Eject pin mark is for reference only.

sod113\_po

| Outline version | References |                |       |  | European projection | Issue date           |
|-----------------|------------|----------------|-------|--|---------------------|----------------------|
|                 | IEC        | JEDEC          | JEITA |  |                     |                      |
| SOD113          |            | 2-lead TO-220F |       |  |                     | 07-06-08<br>15-08-28 |

## 13. Legal information

### Data sheet status

| Document status [1][2]         | Product status [3] | Definition                                                                            |
|--------------------------------|--------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

- [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".
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