

BYQ28 series E and ED

Rectifier diodes ultrafast, rugged

Rev. 05 — 23 September 2016

Product data sheet

1. Product profile

1.1 General description

Ultrafast, dual common cathode, epitaxial rectifier diodes in a SOT78 (TO-220AB) and a TO252 (DPAK) plastic package.

1.2 Features

- Fast switching
- Soft recovery characteristic
- Reverse surge capability
- Low thermal resistance
- Low forward voltage drop
- High thermal cycling performance

1.3 Applications

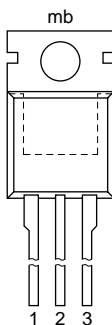
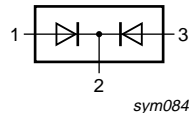
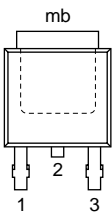
- Output rectifiers in high-frequency switched-mode power supplies

1.4 Quick reference data

- $V_{RRM} \leq 200$ V
- $V_F \leq 0.895$ V
- $I_{O(AV)} \leq 10$ A
- $t_{rr} = 10$ ns (typ)

2. Pinning information

Table 1. Pinning

| Pin | Description | Simplified outline | Symbol |
|-----|-----------------------------|--|--|
| 1 | anode 1 |  |  <i>sym084</i> |
| 2 | cathode [1] | | |
| 3 | anode 2 | | |
| mb | mounting base; cathode |  TO252 (DPAK) | |

SOT78 (3-lead TO-220AB)

[1] It is not possible to connect to pin 2 of the TO252 package.

3. Ordering information

Table 2. Ordering information

| Type number | Package | | Version |
|-------------|----------|--|---------|
| | Name | Description | |
| BYQ28E-200 | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78 |
| BYQ28ED-200 | DPAK | plastic single-ended surface-mounted package (DPAK); 3-leads (one lead cropped) | TO252 |

4. Limiting values

Table 3. Limiting values

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|--------------------------------|-------------------------------------|--|-----|------|------------------|
| V_{RRM} | repetitive peak reverse voltage | | - | 200 | V |
| V_{RWM} | crest working reverse voltage | | - | 200 | V |
| V_R | reverse voltage | square waveform; $\delta = 1.0$ | - | 200 | V |
| $I_{O(AV)}$ | average output current | square waveform; $\delta = 0.5$; $T_{mb} \leq 119\text{ }^\circ\text{C}$; both diodes conducting | - | 10 | A |
| I_{FRM} | repetitive peak forward current | $t_p = 25\text{ }\mu\text{s}$; square waveform; $\delta = 0.5$; $T_{mb} \leq 119\text{ }^\circ\text{C}$; per diode | - | 10 | A |
| I_{FSM} | non-repetitive peak forward current | $t = 10\text{ ms}$; sinusoidal waveform; per diode | - | 50 | A |
| | | $t = 8.3\text{ ms}$; sinusoidal waveform; per diode | - | 55 | A |
| I_{RM} | peak reverse recovery current | $t_p = 2\text{ }\mu\text{s}$; $\delta = 0.001$ | - | 0.2 | A |
| I_{RSM} | non-repetitive peak reverse current | $t_p = 100\text{ }\mu\text{s}$ | - | 0.2 | A |
| T_{stg} | storage temperature | | -40 | +150 | $^\circ\text{C}$ |
| T_j | junction temperature | | - | 150 | $^\circ\text{C}$ |
| Electrostatic discharge | | | | | |
| V_{ESD} | electrostatic discharge voltage | all pins; human body model; $C = 250\text{ pF}$; $R = 1.5\text{ k}\Omega$ | - | 8 | kV |

5. Thermal characteristics

Table 4. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|---|---|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | with heatsink compound; per diode; see Figure 1 | - | - | 4.5 | K/W |
| | | with heatsink compound; both diodes conducting | - | - | 3 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | in free air; SOT78 | - | 60 | - | K/W |
| | | TO252 | [1] | 50 | - | K/W |

[1] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

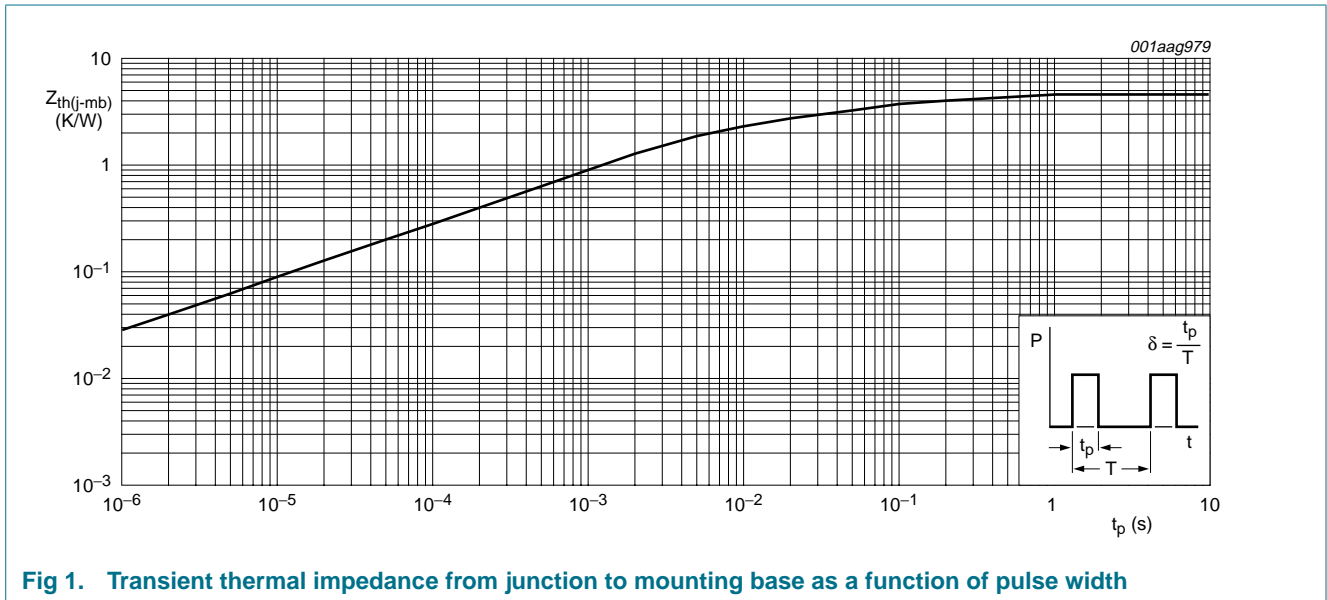


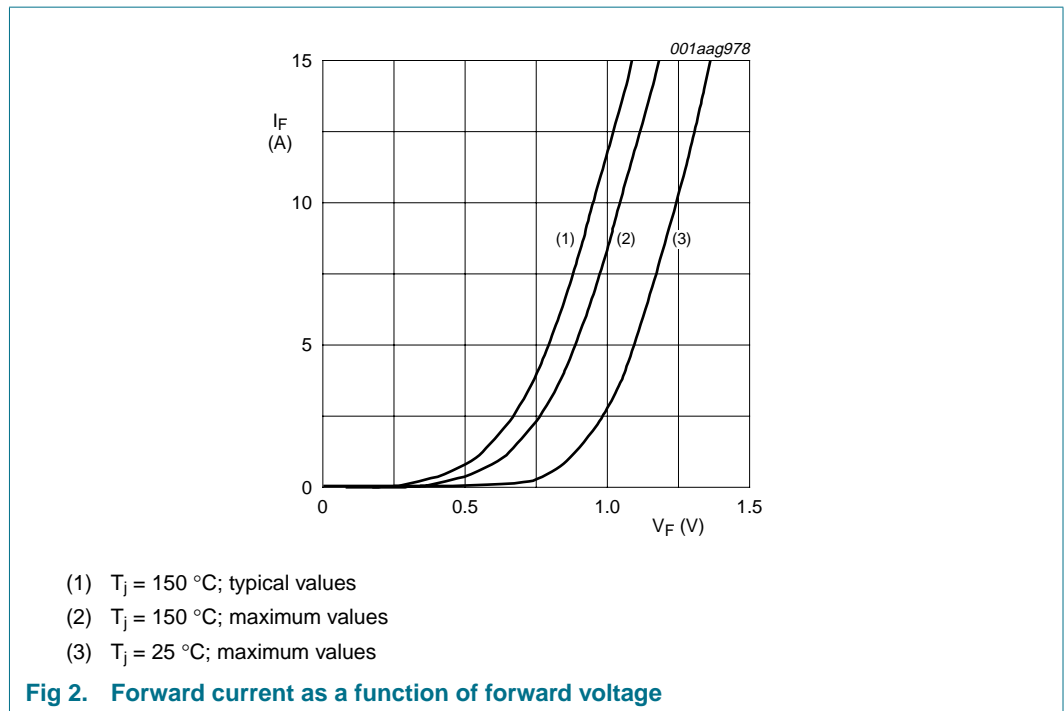
Fig 1. Transient thermal impedance from junction to mounting base as a function of pulse width

6. Characteristics

Table 5. Characteristics

$T_j = 25\text{ °C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|-------------------------------|---|-----|------|-------|---------------|
| Static characteristics | | | | | | |
| V_F | forward voltage | $I_F = 5\text{ A}$; $T_j = 150\text{ °C}$; see Figure 2 | - | 0.8 | 0.895 | V |
| | | $I_F = 5\text{ A}$; see Figure 2 | - | 0.95 | 1.1 | V |
| | | $I_F = 10\text{ A}$; see Figure 2 | - | 1.1 | 1.25 | V |
| I_R | reverse current | $V_R = 200\text{ V}$ | - | 2 | 10 | μA |
| | | $V_R = 200\text{ V}$; $T_j = 100\text{ °C}$ | - | 0.1 | 0.2 | mA |
| Dynamic characteristics | | | | | | |
| Q_r | recovered charge | $I_F = 2\text{ A}$ to $V_R \geq 30\text{ V}$; $di_F/dt = 20\text{ A}/\mu\text{s}$; see Figure 3 | - | 4 | 9 | nC |
| t_{rr} | reverse recovery time | ramp recovery; $I_F = 1\text{ A}$ to $V_R \geq 30\text{ V}$; $di_F/dt = 100\text{ A}/\mu\text{s}$; see Figure 3 | - | 15 | 25 | ns |
| | | step recovery; when switched from $I_F = 0.5\text{ A}$ to $I_R = 1\text{ A}$; measured at $I_R = 0.25\text{ A}$ | - | 10 | 20 | ns |
| I_{RM} | peak reverse recovery current | $I_F = 5\text{ A}$ to $V_R \geq 30\text{ V}$; $di_F/dt = 50\text{ A}/\mu\text{s}$; see Figure 3 | - | 0.5 | 0.7 | A |
| V_{FR} | forward recovery voltage | $I_F = 1\text{ A}$; $di_F/dt = 10\text{ A}/\mu\text{s}$; see Figure 4 | - | 1 | - | V |



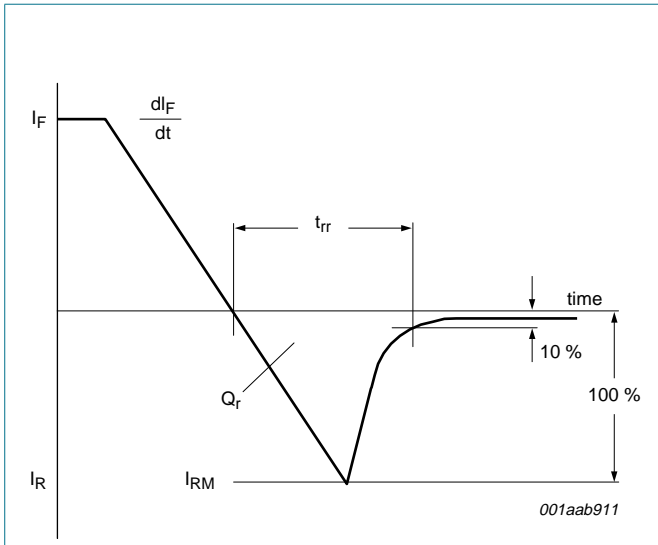


Fig 3. Reverse recovery definitions

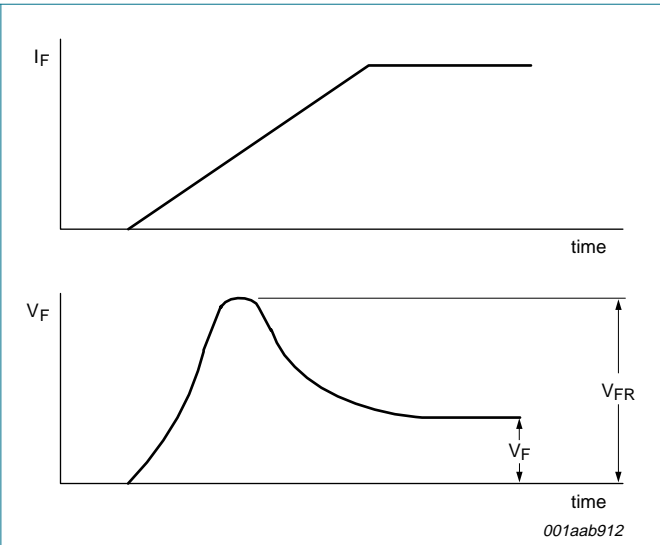


Fig 4. Forward recovery definitions

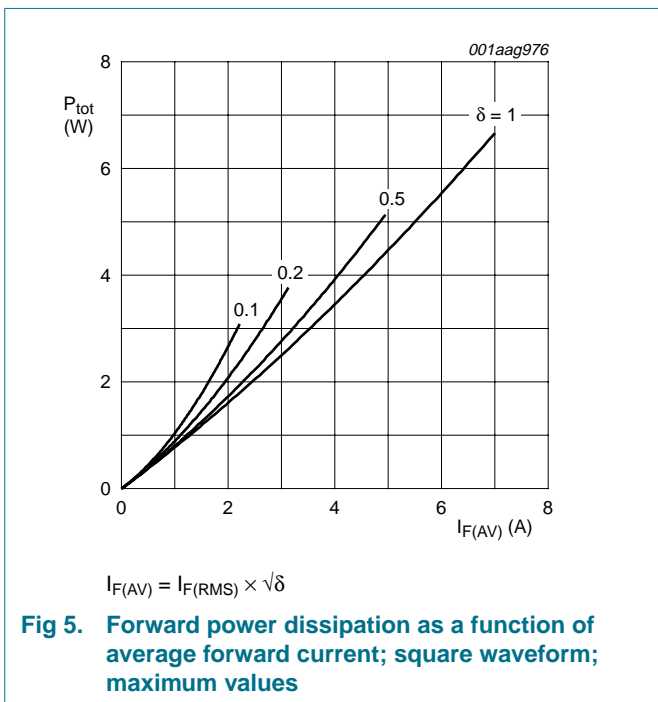


Fig 5. Forward power dissipation as a function of average forward current; square waveform; maximum values

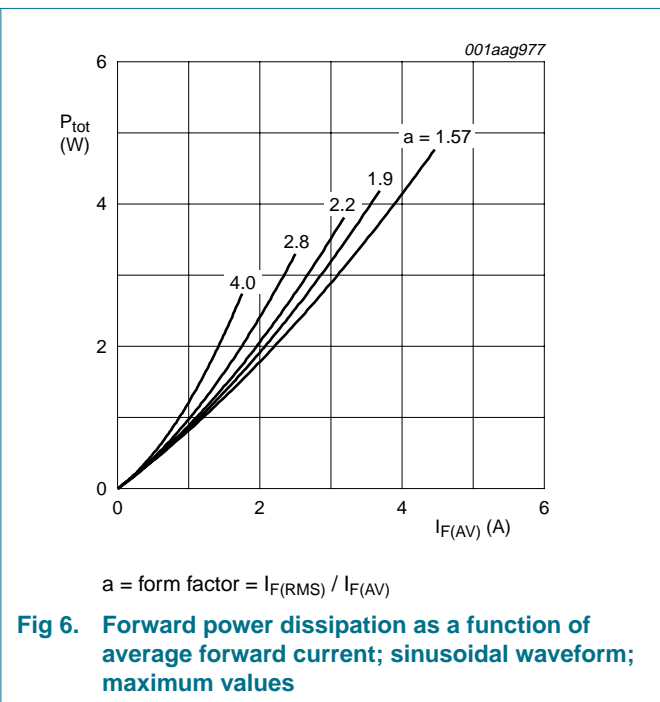


Fig 6. Forward power dissipation as a function of average forward current; sinusoidal waveform; maximum values

7. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78

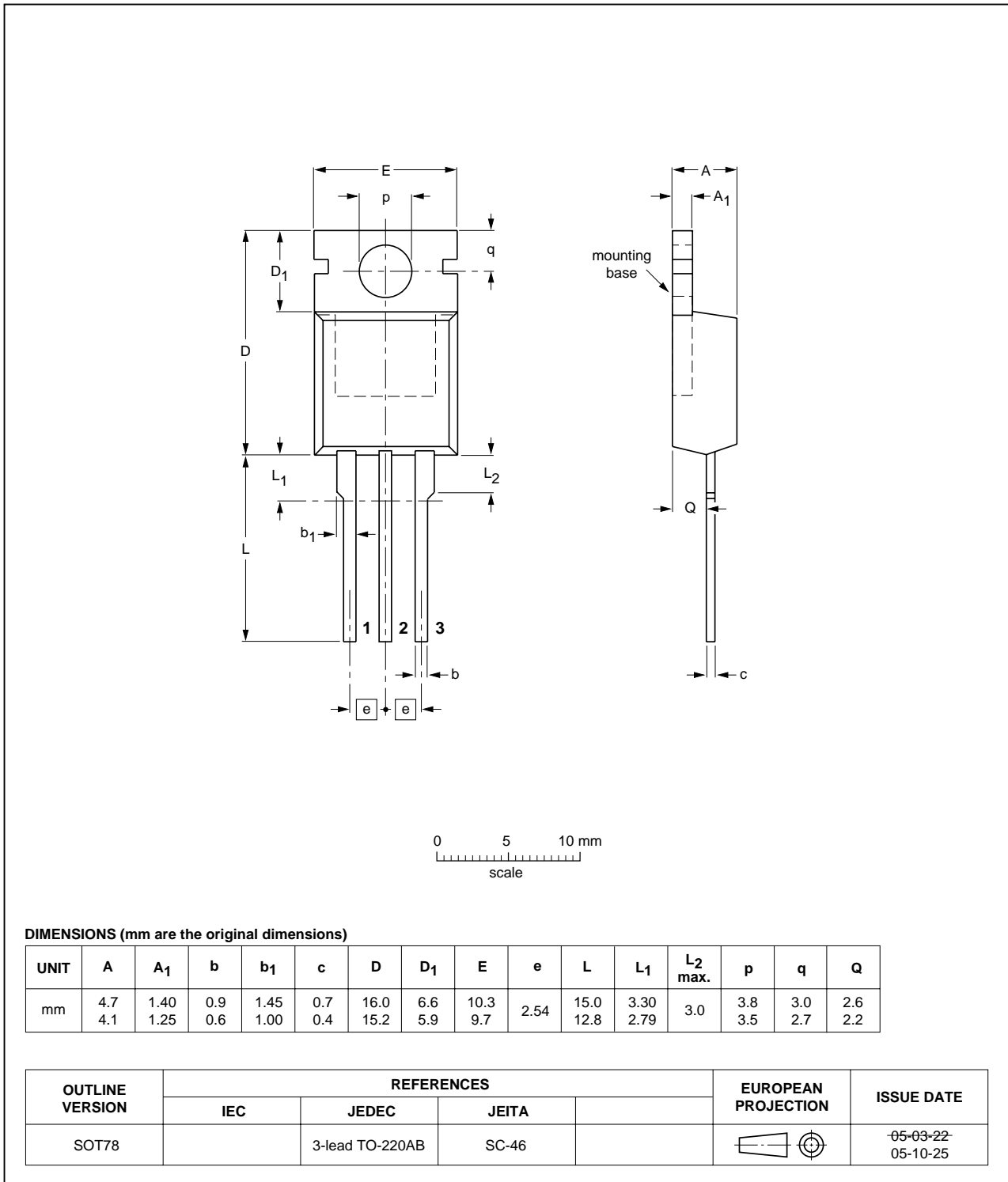
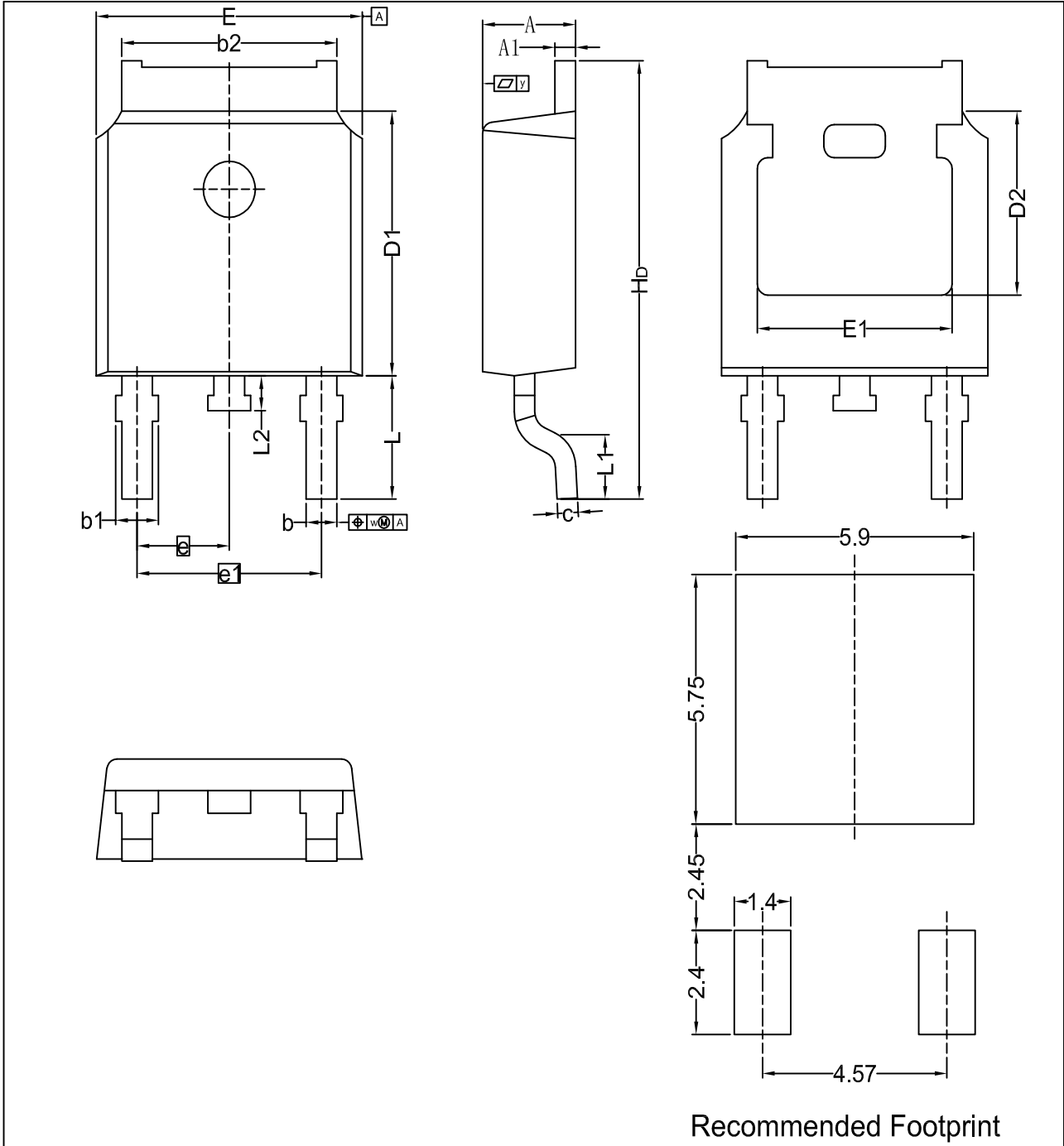


Fig 7. Package outline SOT78 (TO-220AB)

Plastic single-ended surface-mounted package (DPAK); 3 leads (one lead cropped)

TO252



Recommended Footprint

| Unit | A | A1 | b | b1 | b2 | c | D1 | D2 | E | E1 | e | e1 | H _D | L | L1 | L2 | w | y |
|------|------|------|------|------|------|------|------|------|------|------|-------|------|----------------|----------------|------|------|------|------|
| min | 2.22 | 0.46 | 0.71 | 0.72 | 5.00 | 0.20 | 5.98 | 4.00 | 6.47 | 4.45 | 2.285 | 4.57 | 9.60 | 2.90 (Ref.) | 0.50 | 0.50 | 0.20 | |
| nom | | | | | | | | | | | | | | | | | | |
| max | 2.38 | 0.93 | 0.89 | 1.10 | 5.46 | 0.56 | 6.22 | --- | 6.73 | --- | | | 10.40 | --- | 0.90 | | 0.20 | 0.20 |

Fig. 8. Package outline DPAK (TO252N)

8. Revision history

Table 6. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|--------------------------------------|---|-----------------------|---------------|--------------------------------------|
| BYQ28_SER_E_ED_4 | 20071205 | Product data sheet | - | BYQ28E_SERIES_3 |
| Modifications: | <ul style="list-style-type: none"> • The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Limiting values table: some parameter descriptions amended to conform to latest standards; I_{FRM} conditions amended; V_{ESD} row added. • Characteristics: Q_{rr} changed to Q_r 'recovered charge'; t_{rr1} and t_{rr2} changed to t_{rr} with 'ramp recovery' and 'step recovery' added to conditions. | | | |
| BYQ28E_SERIES_3 | 19981001 | Product specification | - | BYQ28E_SERIES_2 |
| BYQ28E_SERIES_2 | 19980701 | Product specification | - | BYQ28E_SERIES_1; BYQ28EB_SERIES_1 |
| BYQ28E_SERIES_1; BYQ28EB_SERIES_1 | 19960801 | Product specification | - | - |

9. Legal information

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| 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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