

## Features

- Excellent Matching
- TPR86xxA: 0.0125% Matching at  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- TPR86xx: 0.025% Matching at  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- Matching Temperature Drift: 0.1ppm/ $^{\circ}\text{C}$
- Operation Temperature Range:  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$

## Applications

- Instrumentation
- Industrial Control
- Building Block for the Precision Amplifier Circuit
- Precision Divider for Voltage Reference

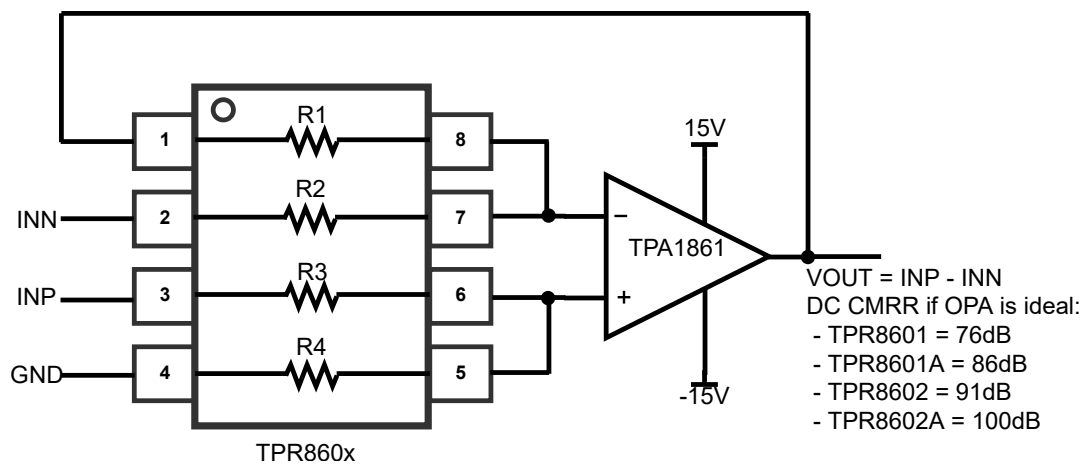
## Description

The TPR86xx is a matched resistor network that consists of four matched resistors. The device has excellent matching specifications over the operating temperature range. Matching is specified by gain and CMRR.

All four resistors can be used independently, making the device the best choice for any application that can benefit from matched resistors. These resistor networks provide precise ratio metric stability required in difference amplifiers, instrumentation amplifiers, dividers, or inverters for voltage references.

The device is available in the MSOP8 and ESOP8 packages.

## Typical Application Circuit



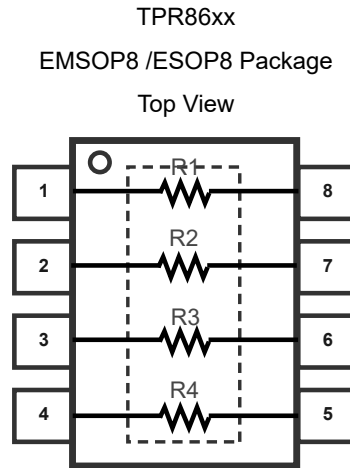
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## Revision History

| Date       | Revision | Notes                                                                                                                                                                                                                                                                                                                                       |
|------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2022-05-20 | Rev.A.0  | Initial version.                                                                                                                                                                                                                                                                                                                            |
| 2023-08-17 | Rev.A.1  | Added a part number: TPR8600-EV1R.<br>Updated status of part numbers to released: TPR8602-EV1R, TPR8603-EV1R.<br>Updated specification of TPR8603-EV1R.                                                                                                                                                                                     |
| 2023-09-29 | Rev.A.2  | Added part numbers: TPR8600-EV1R-S, TPR8601-EV1R-S, TPR8601A-EV1R-S, TPR8602-EV1R-S.<br>Added typical values in Electrical Characteristics.                                                                                                                                                                                                 |
| 2024-02-26 | Rev.A.3  | Updated specification in Electrical Characteristics.                                                                                                                                                                                                                                                                                        |
| 2025-03-19 | Rev.A.4  | Added part numbers:<br>TPR8606,TPR8607,TPR8608,TPR8609,TPR8610,TPR8611,TPR8612,TPR8613,TPR8620,TPR8621,TPR8622.<br>Updated specification in Electrical Characteristics.                                                                                                                                                                     |
| 2025-04-23 | Rev.A.5  | Corrected handwriting errors.                                                                                                                                                                                                                                                                                                               |
| 2025-10-09 | Rev.A.6  | The following updates are all about the new datasheet formats or typos,and the actual product remains unchanged: <ul style="list-style-type: none"><li>• Updated the value of Matching Temperature Drift in the Features.</li><li>• Added part number: TPR8602-EV1R ,TPR8609-ES1R-S,TPR8614-EV1R-S.</li><li>• Updated ESD values.</li></ul> |

## Pin Configuration and Functions



The E-PAD can be left floating or connected to any voltage in the range of working voltage.

| Product            | A Group, R2 = R3            |                       |                                | B Group, R1 = R4            |                       |                                | Resistor Ratio |
|--------------------|-----------------------------|-----------------------|--------------------------------|-----------------------------|-----------------------|--------------------------------|----------------|
|                    | Resistor Value ( $\Omega$ ) | Working Voltage ( V ) | Absolute Maximum Voltage ( V ) | Resistor Value ( $\Omega$ ) | Working Voltage ( V ) | Absolute Maximum Voltage ( V ) |                |
| TPR8600<br>TPR8601 | 10k                         | 60                    | 80                             | 10k                         | 60                    | 80                             | 1:1            |
| TPR8602            | 10k                         | 60                    | 80                             | 100k                        | 60                    | 80                             | 1:10           |
| TPR8603            | 300k                        | 60                    | 80                             | 300k                        | 60                    | 80                             | 1:1            |
| TPR8606            | 1k                          | 10                    | 20                             | 1k                          | 10                    | 20                             | 1:1            |
| TPR8607            | 1k                          | 10                    | 20                             | 5k                          | 10                    | 20                             | 1:5            |
| TPR8608            | 1k                          | 10                    | 20                             | 9k                          | 36                    | 50                             | 1:9            |
| TPR8609            | 100k                        | 150                   | 155                            | 100k                        | 150                   | 155                            | 1:1            |
| TPR8610            | 1.25k                       | 15                    | 25                             | 5k                          | 35                    | 50                             | 1:4            |
| TPR8611            | 30k                         | 60                    | 65                             | 60k                         | 100                   | 105                            | 1:2            |
| TPR8612            | 10k                         | 60                    | 65                             | 100k                        | 136                   | 140                            | 1:10           |
| TPR8613            | 1M                          | 150                   | 155                            | 1M                          | 150                   | 155                            | 1:1            |
| TPR8614            | 30k                         | 20                    | 40                             | 60k                         | 40                    | 80                             | 1:2            |
| TPR8620            | 1k                          | 12                    | 20                             | 3k                          | 12                    | 20                             | 1:3            |
| TPR8621            | 10k                         | 30                    | 40                             | 200k                        | 150                   | 155                            | 1:20           |
| TPR8622            | 10k                         | 30                    | 40                             | 1M                          | 150                   | 155                            | 1:100          |

## Specifications

### Absolute Maximum Ratings <sup>(1)</sup>

| Parameter        |                                         | Min  | Max | Unit |
|------------------|-----------------------------------------|------|-----|------|
|                  | Maximum Voltage between Any PIN to EPAD | -205 | 205 | V    |
| T <sub>J</sub>   | Maximum Junction Temperature            |      | 150 | °C   |
| T <sub>A</sub>   | Operating Temperature Range             | -40  | 125 | °C   |
| T <sub>STG</sub> | Storage Temperature Range               | -65  | 150 | °C   |
| T <sub>L</sub>   | Lead Temperature (Soldering 10 sec)     |      | 260 | °C   |

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

### ESD, Electrostatic Discharge Protection

| Symbol | Parameter                | Condition                             | Part Number                                                               | Minimum Level | Unit |
|--------|--------------------------|---------------------------------------|---------------------------------------------------------------------------|---------------|------|
| HBM    | Human Body Model ESD     | ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup> | TPR8600<br>TPR8601<br>TPR8602<br>TPR8603<br>TPR8607<br>TPR8610<br>TPR8620 | 500           | V    |
|        |                          |                                       | TPR8606<br>TPR8612<br>TPR8621                                             | 1000          | V    |
|        |                          |                                       | TPR8608<br>TPR8609<br>TPR8611<br>TPR8613<br>TPR8614<br>TPR8622<br>TPR8680 | 1500          | V    |
| CDM    | Charged Device Model ESD | ANSI/ESDA/JEDEC JS-002 <sup>(2)</sup> | All Part Numbers                                                          | 1500          | V    |

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

**Thermal Information**

| Package Type | $\theta_{JA}$ | $\theta_{JC}$ | Unit |
|--------------|---------------|---------------|------|
| EMSOP8       | 60            | 20            | °C/W |
| ESOP8        | 32            | 44            | °C/W |

## Electrical Characteristics

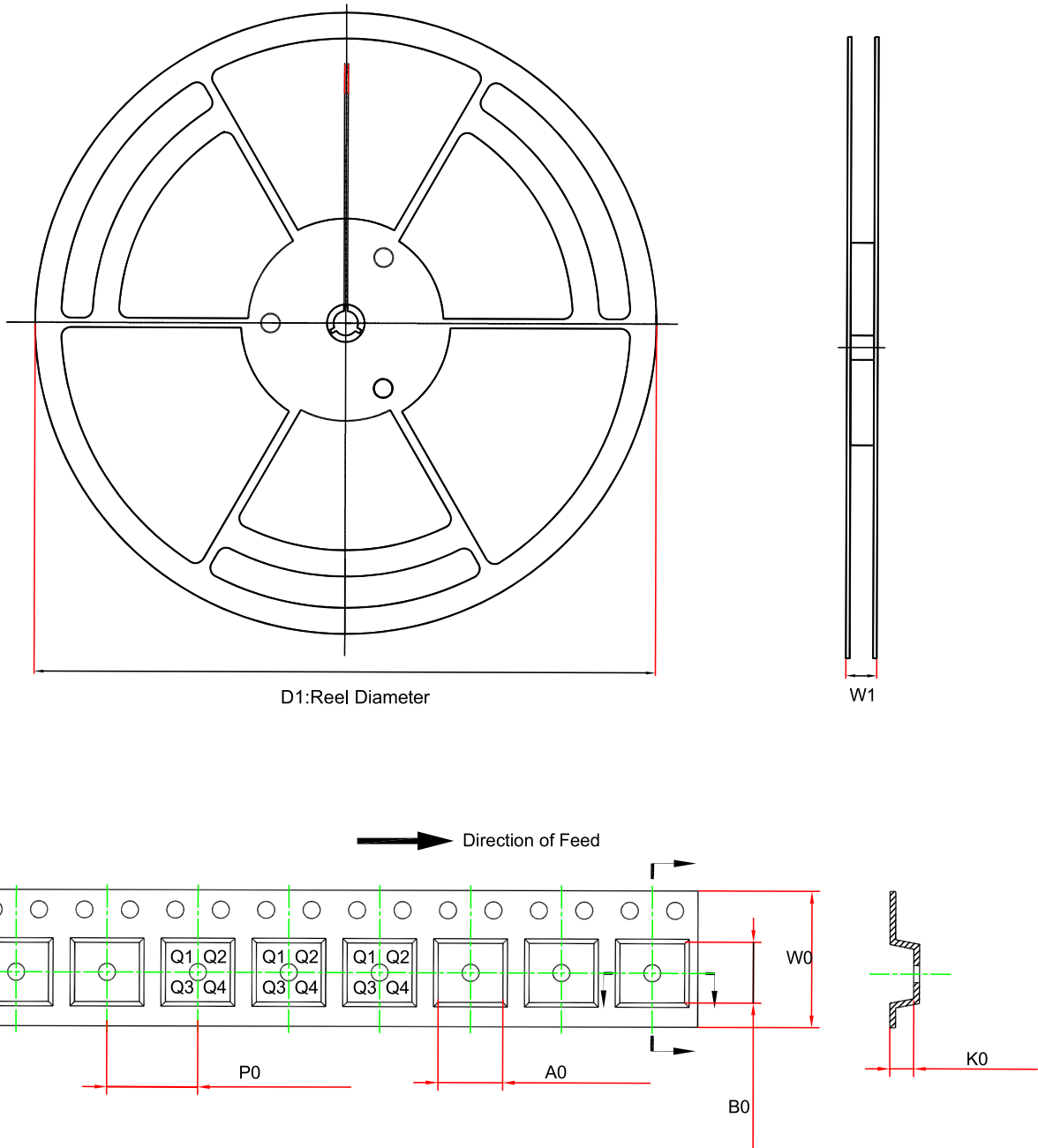
All test condition is  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

| Parameter               |                                                          | Conditions                                                                                                 | $T_A$                                      | Min     | Typ         | Max    | Unit                  |
|-------------------------|----------------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------|---------|-------------|--------|-----------------------|
| VCM                     | Common-mode Voltage                                      | Voltage between any pin to EPAD                                                                            |                                            | -200    |             | 200    | V                     |
| $\Delta R/R$            | Resistor Matching Ratio                                  | TPR8600<br>TPR8601<br>TPR8602<br>TPR8606<br>TPR8607<br>TPR8608<br>TPR8610<br>TPR8611<br>TPR8612<br>TPR8614 | $-40^\circ\text{C}$ to $125^\circ\text{C}$ | -0.025  | $\pm 0.005$ | 0.025  | %                     |
|                         |                                                          | TPR8603<br>TPR8609<br>TPR8613                                                                              | $-40^\circ\text{C}$ to $125^\circ\text{C}$ | -0.03   | $\pm 0.005$ | 0.03   | %                     |
|                         |                                                          | TPR8620                                                                                                    | $-40^\circ\text{C}$ to $125^\circ\text{C}$ | -0.05   | $\pm 0.01$  | 0.05   | %                     |
|                         |                                                          | TPR8621<br>TPR8622                                                                                         | $-40^\circ\text{C}$ to $125^\circ\text{C}$ | -0.1    | $\pm 0.02$  | 0.1    | %                     |
|                         |                                                          | TPR86xxA                                                                                                   |                                            | -0.01   | $\pm 0.005$ | 0.01   | %                     |
|                         |                                                          |                                                                                                            | $-40^\circ\text{C}$ to $125^\circ\text{C}$ | -0.0125 |             | 0.0125 | %                     |
|                         |                                                          |                                                                                                            |                                            |         |             |        |                       |
|                         |                                                          |                                                                                                            |                                            |         |             |        |                       |
|                         |                                                          |                                                                                                            |                                            |         |             |        |                       |
|                         |                                                          |                                                                                                            |                                            |         |             |        |                       |
| $(\Delta R/R)/\Delta T$ | Resistor Matching Ratio Temperature Drift <sup>(1)</sup> |                                                                                                            | $-40^\circ\text{C}$ to $125^\circ\text{C}$ | -1      | $\pm 0.1$   | 1      | ppm/ $^\circ\text{C}$ |
|                         | Matching for CMRR = $1/2 * (R2/R1 - R3/R4) * (R1/R2)$    | TPR8600<br>TPR8601<br>TPR8602<br>TPR8606<br>TPR8607<br>TPR8608<br>TPR8609<br>TPR8610<br>TPR8613<br>TPR8614 | $-40^\circ\text{C}$ to $125^\circ\text{C}$ | -0.015  | $\pm 0.005$ | 0.015  | %                     |
|                         |                                                          | TPR8603                                                                                                    | $-40^\circ\text{C}$ to $125^\circ\text{C}$ | -0.02   | $\pm 0.005$ | 0.02   | %                     |
|                         |                                                          | TPR8620<br>TPR8621                                                                                         | $-40^\circ\text{C}$ to $125^\circ\text{C}$ | -0.025  | $\pm 0.005$ | 0.025  | %                     |
|                         |                                                          | TPR8622                                                                                                    | $-40^\circ\text{C}$ to $125^\circ\text{C}$ | -0.04   | $\pm 0.01$  | 0.04   | %                     |
|                         |                                                          | TPR8611<br>TPR8612<br>TPR86xxA                                                                             | $-40^\circ\text{C}$ to $125^\circ\text{C}$ | -0.005  | $\pm 0.002$ | 0.005  | %                     |
|                         |                                                          |                                                                                                            |                                            |         |             |        |                       |
|                         |                                                          |                                                                                                            |                                            |         |             |        |                       |
|                         |                                                          |                                                                                                            |                                            |         |             |        |                       |
|                         |                                                          |                                                                                                            |                                            |         |             |        |                       |
|                         |                                                          |                                                                                                            |                                            |         |             |        |                       |

| Parameter           |                                                          | Conditions | T <sub>A</sub> | Min | Typ | Max | Unit   |
|---------------------|----------------------------------------------------------|------------|----------------|-----|-----|-----|--------|
| $\Delta R$          | Absolute Resistor Tolerance                              |            | -40°C to 125°C | -15 | ±2  | 15  | %      |
| $\Delta R/\Delta T$ | Absolute Resistor Value Temperature Drift <sup>(1)</sup> |            | -40°C to 125°C | -20 | ±5  | 20  | ppm/°C |

(1) Provided by bench test and design simulation.

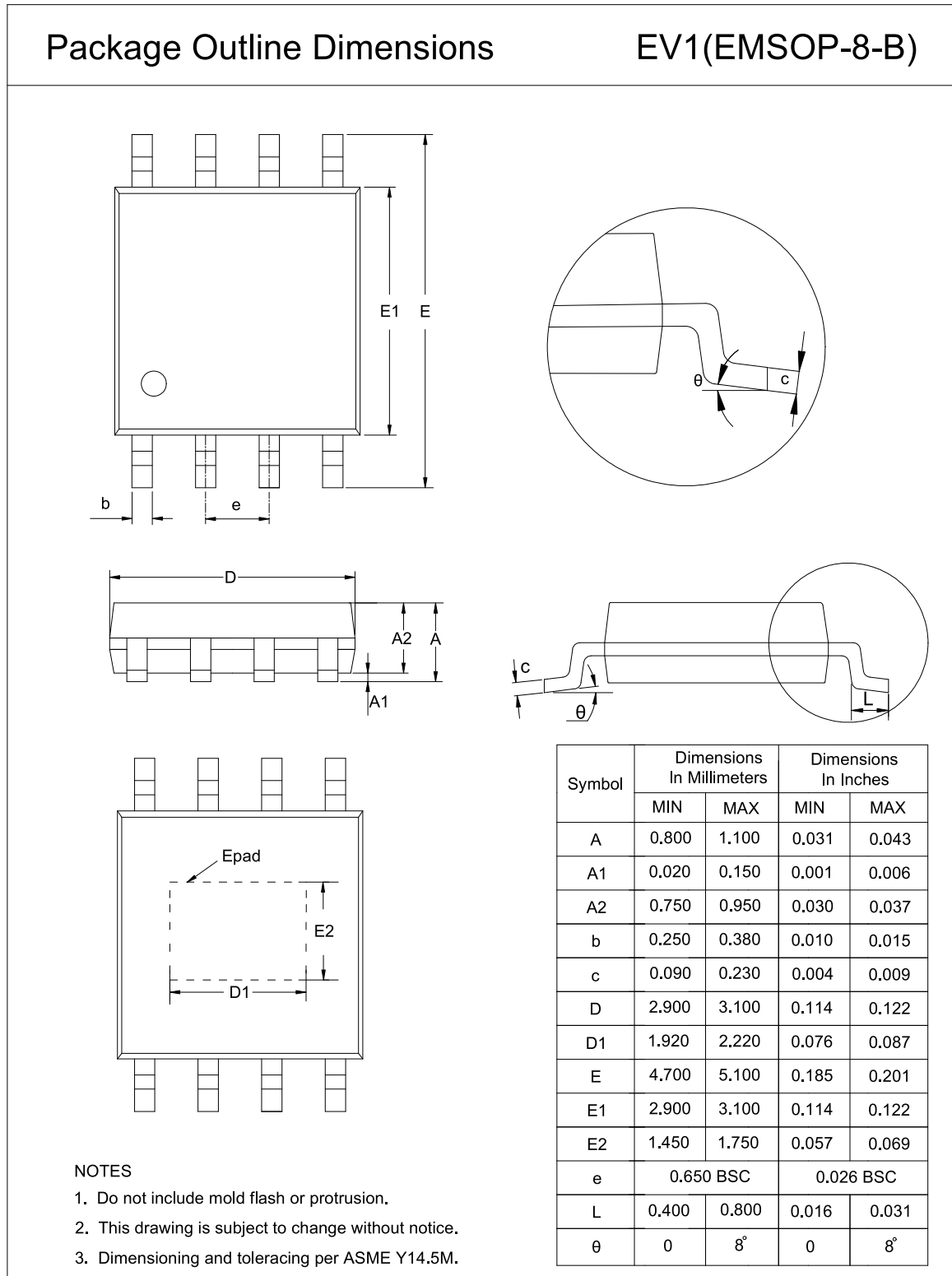
## Tape and Reel Information



| Order Number                   | Package | D1 (mm) | W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | W0 (mm) | Pin1 Quadrant |
|--------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|
| TPR86xx-EV1R<br>TPR86xx-EV1R-S | EMSOP8  | 330.0   | 17.6    | 5.25    | 3.25    | 1.25    | 8.0     | 12.0    | Q1            |
| TPR86xx-ES1R-S                 | ESOP8   | 330.0   | 17.6    | 6.6     | 5.5     | 2.1     | 8.0     | 12.0    | Q1            |

## Package Outline Dimensions

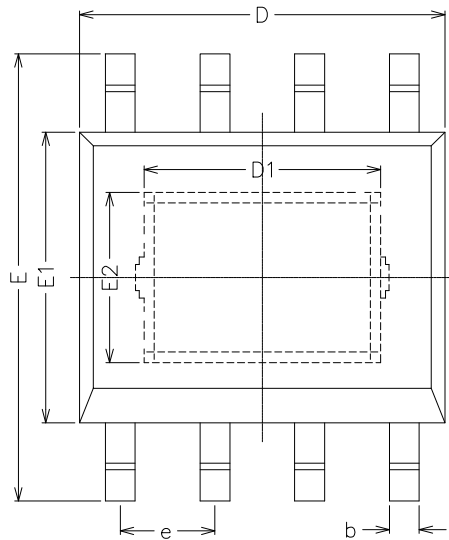
### EMSOP8



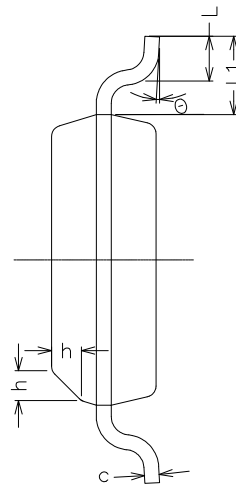
## ESOP8

## Package Outline Dimensions

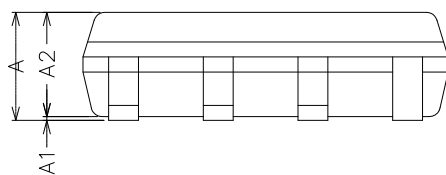
## ES1(ESOP-8-G)



TOP VIEW



SIDE VIEW



SIDE VIEW

## NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.
3. The many types of E-pad Pin1 signs may appear in the product.

| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 1.350                        | 1.650 | 0.053                   | 0.065 |
| A1     | 0.000                        | 0.150 | 0.000                   | 0.006 |
| A2     | 1.350                        | 1.500 | 0.053                   | 0.059 |
| b      | 0.380                        | 0.470 | 0.015                   | 0.019 |
| c      | 0.170                        | 0.250 | 0.007                   | 0.010 |
| D      | 4.800                        | 5.000 | 0.189                   | 0.197 |
| E      | 5.800                        | 6.200 | 0.228                   | 0.244 |
| D1     | 3.020                        | 3.320 | 0.119                   | 0.131 |
| E1     | 3.800                        | 4.000 | 0.150                   | 0.157 |
| E2     | 2.130                        | 2.430 | 0.084                   | 0.096 |
| e      | 1.170                        | 1.370 | 0.046                   | 0.054 |
| L      | 0.450                        | 0.800 | 0.018                   | 0.031 |
| L1     | 1.040 REF                    |       | 0.041 REF               |       |
| h      | 0.300                        | 0.500 | 0.012                   | 0.020 |
| θ      | 0°                           | 8°    | 0°                      | 8°    |

## Order Information

| Order Number                   | Operating Temperature Range | Package | Marking Information | MSL | Transport Media, Quantity | Eco Plan |
|--------------------------------|-----------------------------|---------|---------------------|-----|---------------------------|----------|
| TPR8600-EV1R-S <sup>(1)</sup>  | -40 to 125°C                | EMSOP8  | R8600               | 3   | Tape and Reel, 3000       | Green    |
| TPR8601-EV1R                   | -40 to 125°C                | EMSOP8  | R8601               | 3   | Tape and Reel, 3000       | Green    |
| TPR8601-EV1R-S                 | -40 to 125°C                | EMSOP8  | R8601               | 3   | Tape and Reel, 3000       | Green    |
| TPR8601A-EV1R-S                | -40 to 125°C                | EMSOP8  | R8601               | 3   | Tape and Reel, 3000       | Green    |
| TPR8602-EV1R                   | -40 to 125°C                | EMSOP8  | R8602               | 3   | Tape and Reel, 3000       | Green    |
| TPR8602-EV1R-S                 | -40 to 125°C                | EMSOP8  | R8602               | 3   | Tape and Reel, 3000       | Green    |
| TPR8602A-EV1R-S                | -40 to 125°C                | EMSOP8  | R8602               | 3   | Tape and Reel, 3000       | Green    |
| TPR8603-EV1R                   | -40 to 125°C                | EMSOP8  | R8603               | 3   | Tape and Reel, 3000       | Green    |
| TPR8606-EV1R-S                 | -40 to 125°C                | EMSOP8  | 8606                | 3   | Tape and Reel, 3000       | Green    |
| TPR8606A-EV1R-S                | -40 to 125°C                | EMSOP8  | 8606                | 3   | Tape and Reel, 3000       | Green    |
| TPR8607-EV1R-S                 | -40 to 125°C                | EMSOP8  | 8607                | 3   | Tape and Reel, 3000       | Green    |
| TPR8607A-EV1R-S                | -40 to 125°C                | EMSOP8  | 8607                | 3   | Tape and Reel, 3000       | Green    |
| TPR8608-EV1R-S                 | -40 to 125°C                | EMSOP8  | 8608                | 3   | Tape and Reel, 3000       | Green    |
| TPR8608A-EV1R-S                | -40 to 125°C                | EMSOP8  | 8608                | 3   | Tape and Reel, 3000       | Green    |
| TPR8609-EV1R-S                 | -40 to 125°C                | EMSOP8  | R8609               | 3   | Tape and Reel, 3000       | Green    |
| TPR8609-ES1R-S                 | -40 to 125°C                | ESOP8   | R8609               | 3   | Tape and Reel, 3000       | Green    |
| TPR8609A-EV1R-S                | -40 to 125°C                | EMSOP8  | R8609               | 3   | Tape and Reel, 3000       | Green    |
| TPR8610-EV1R-S                 | -40 to 125°C                | EMSOP8  | R8610               | 3   | Tape and Reel, 3000       | Green    |
| TPR8610A-EV1R-S <sup>(2)</sup> | -40 to 125°C                | EMSOP8  | R8610               | 3   | Tape and Reel, 3000       | Green    |
| TPR8611-EV1R-S                 | -40 to 125°C                | EMSOP8  | R8611               | 3   | Tape and Reel, 3000       | Green    |

| Order Number                   | Operating Temperature Range | Package | Marking Information | MSL | Transport Media, Quantity | Eco Plan |
|--------------------------------|-----------------------------|---------|---------------------|-----|---------------------------|----------|
| TPR8612-EV1R-S                 | -40 to 125°C                | EMSOP8  | R8612               | 3   | Tape and Reel, 3000       | Green    |
| TPR8613-EV1R-S                 | -40 to 125°C                | EMSOP8  | R8613               | 3   | Tape and Reel, 3000       | Green    |
| TPR8613A-EV1R-S <sup>(2)</sup> | -40 to 125°C                | EMSOP8  | R8613               | 3   | Tape and Reel, 3000       | Green    |
| TPR8614-EV1R-S                 | -40 to 125°C                | EMSOP8  | R8611               | 3   | Tape and Reel, 3000       | Green    |
| TPR8620-EV1R-S                 | -40 to 125°C                | EMSOP8  | R8620               | 3   | Tape and Reel, 3000       | Green    |
| TPR8620A-EV1R-S                | -40 to 125°C                | EMSOP8  | R8620               | 3   | Tape and Reel, 3000       | Green    |
| TPR8621-EV1R-S                 | -40 to 125°C                | EMSOP8  | R8621               | 3   | Tape and Reel, 3000       | Green    |
| TPR8622-EV1R-S                 | -40 to 125°C                | EMSOP8  | R8622               | 3   | Tape and Reel, 3000       | Green    |

(1) The reflow process is validated for the order number with "-S" suffix.

(2) For future products, contact the 3PEAK factory for more information and samples.

**Green:** 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

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