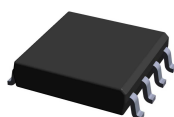
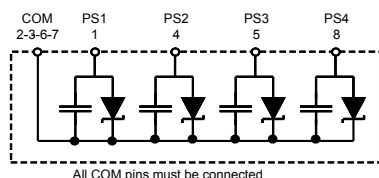


## Quad 58 V TVS for PoE supplies in SO-8



SO-8



### Features

- Peak pulse power: up to 2.7 kW (8/20  $\mu$ s)
- Stand-off voltage: 58 V
- 4 unidirectional Transils and 4 decoupling capacitances
- Low clamping voltage: 100 V
- Low leakage current:
  - 0.2  $\mu$ A at 25 °C
  - 1  $\mu$ A at 85 °C
- Operating  $T_j$  max.: 150 °C
- JEDEC registered package outline

### Complies with the following standards

- IEC61000-4-2 level
  - $\pm 15$  kV (air discharge)
  - $\pm 8$  kV (contact discharge)
- IEC61000-4-5 level 2
  - $\pm 1$  kV 42  $\Omega$
- IEEE 802.3af-2003
- IEEE 802.3at-2008

#### Product status link

PEP01-5841

### Description

The PEP01-5841 has been designed to protect power over Ethernet PSE equipment against line overvoltages. It embeds 4 decoupling capacitors to stabilize power supplies.

It is compatible with IEEE 802.3af-2003 and IEEE 802.3at-2008 requirements and it allows PoE based systems to be protected against both electrical overstress (EOS) and electrostatic discharges (ESD) according to IEC61000-4-5 and IEC61000-4-2.

The low clamping voltage (100 V) makes it compatible with PMOS and PSE controller technologies. Developed in Planar technology, it provides high reliability level.

Packaged in SO-8, it minimizes PCB consumption (footprint in accordance with the IPC 7531 standard).

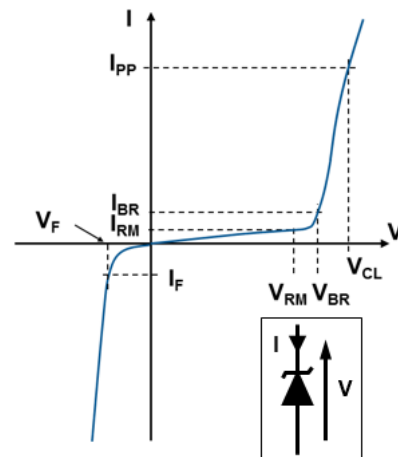
## 1 Characteristics

**Table 1. Absolute maximum ratings ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )**

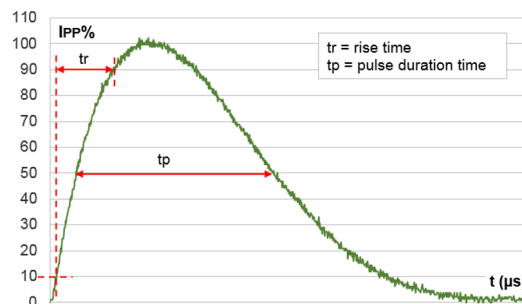
| Symbol    | Parameter  |   | Value       | Unit               |
|-----------|--|---|-------------|--------------------|
| $V_{PP}$  | Peak pulse voltage                                 | Peak pulse voltage (IEC61000-4-2 contact discharge) | 30          | kV                 |
| $P_{PP}$  | Peak pulse power dissipation                       | $T_j \text{ initial} = T_{amb}$                     | 2700        | W                  |
| $T_{stg}$ | Storage temperature range                          |   | -65 to +150 | $^{\circ}\text{C}$ |
| $T_j$     | Operating junction temperature range               |   | -55 to +150 | $^{\circ}\text{C}$ |
| $T_L$     | Maximum lead temperature for soldering during 10 s |   | 260         | $^{\circ}\text{C}$ |

**Figure 1. Electrical characteristics - parameter definitions**

$V_{RM}$  Maximum stand-off voltage  
 $I_{RM}$  Maximum leakage current @  $V_{RM}$   
 $V_R$  Stand-off voltage  
 $I_R$  Leakage current @  $V_R$   
 $V_{BR}$  Breakdown voltage @  $I_{BR}$   
 $I_{BR}$  Breakdown current  
 $V_{CL}$  Clamping voltage @  $I_{PP}$   
 $I_{PP}$  Peak pulse current  
 $R_D$  Dynamic resistance  
 $V_F$  Forward voltage drop @  $I_F$   
 $I_F$  Forward current  
 $\alpha T$  Voltage temperature coefficient



**Figure 2. Pulse definition for electrical characteristics**



**Table 2. Electrical characteristics - parameter values ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)**

| Type       | $I_{RM}$ max at $V_{RM}$ |                       |    | $V_{BR}$ at $I_{BR}^{(1)}$ |      |      |    | 8 / 20 $\mu$ s    |          |          | C    | $\alpha T$                 |
|------------|--------------------------|-----------------------|----|----------------------------|------|------|----|-------------------|----------|----------|------|----------------------------|
|            |                          |                       |    |                            |      |      |    | $V_{CL}^{(2)(3)}$ | $I_{PP}$ | $R_D$    |      |                            |
|            | 25 $^{\circ}\text{C}$    | 85 $^{\circ}\text{C}$ |    | Min.                       | Typ. | Max. |    | Max.              |          | Max.     | Typ. | Max.                       |
|            | $\mu\text{A}$            |                       | V  | V                          |      |      | mA | V                 | A        | $\Omega$ | pF   | $10^{-4}/^{\circ}\text{C}$ |
| PEP01-5841 | 0.2                      | 1                     | 58 | 64.4                       | 67.8 | 71.2 | 1  | 100               | 24       | 1.2      | 55   | 10.4                       |

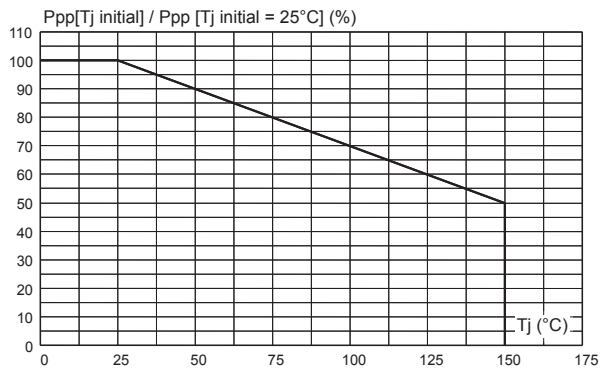
1. To calculate  $V_{BR}$  versus  $T_j$ :  $V_{BR}$  at  $T_j = V_{BR}$  at 25  $^{\circ}\text{C} \times (1 + \alpha T \times (T_j - 25))$

2. To calculate  $V_{CL}$  versus  $T_j$ :  $V_{CL}$  at  $T_j = V_{CL}$  at 25  $^{\circ}\text{C} \times (1 + \alpha T \times (T_j - 25))$

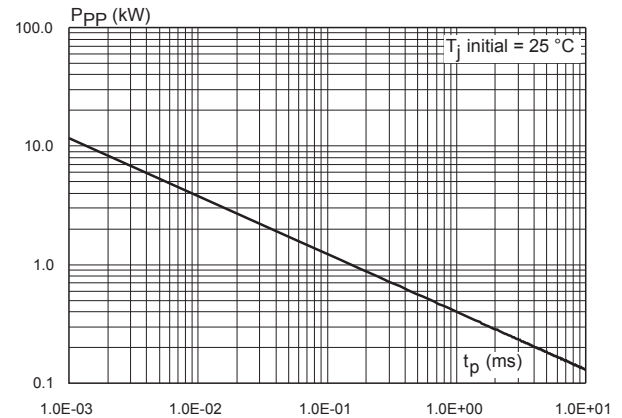
3. To calculate  $V_{CL}$  max versus  $I_{PPappli}$ :  $V_{CLmax} = V_{BRmax} + R_D \times I_{PPappli}$

## 1.1 Characteristics (curves)

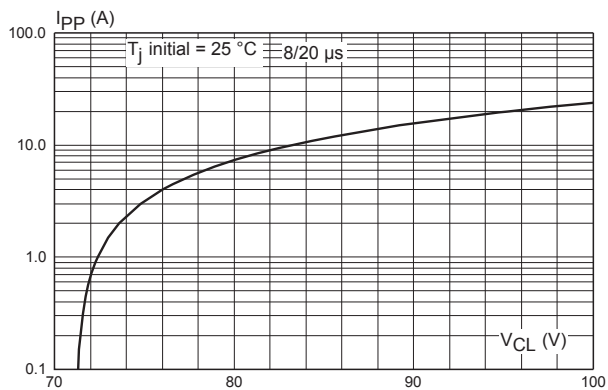
**Figure 3. Peak power dissipation versus initial junction temperature**



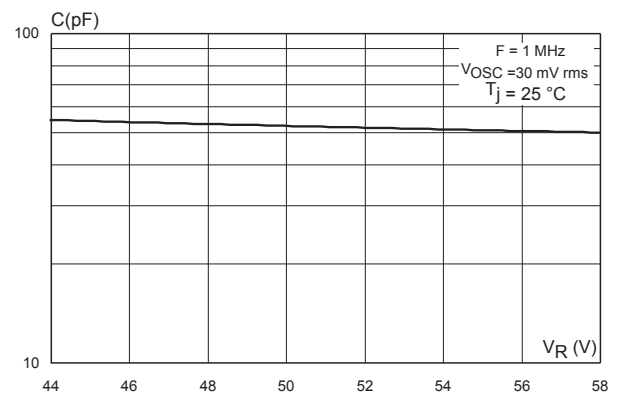
**Figure 4. Peak pulse power versus exponential pulse duration ( $T_j$  initial = 25 °C)**



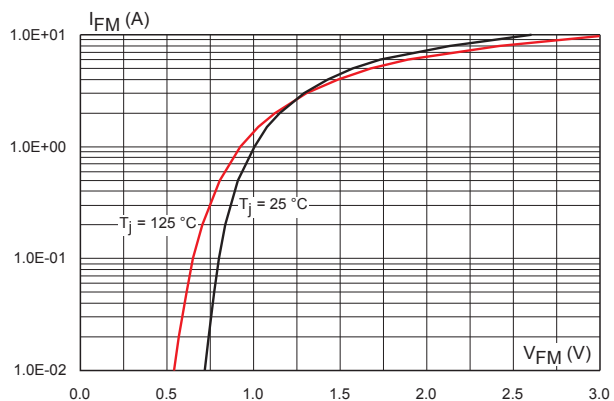
**Figure 5. Clamping voltage versus peak pulse current (exponential waveform, maximum values)**



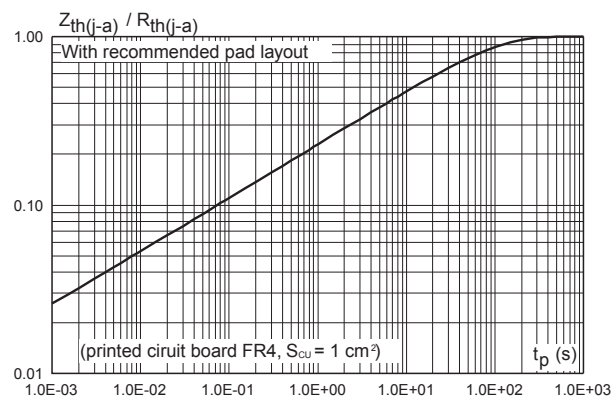
**Figure 6. Capacitance versus voltage**



**Figure 7. Peak forward voltage drop versus peak forward current**



**Figure 8. Relative variation of thermal impedance junction to ambient versus pulse duration**



**Figure 9. Leakage current versus junction temperature**

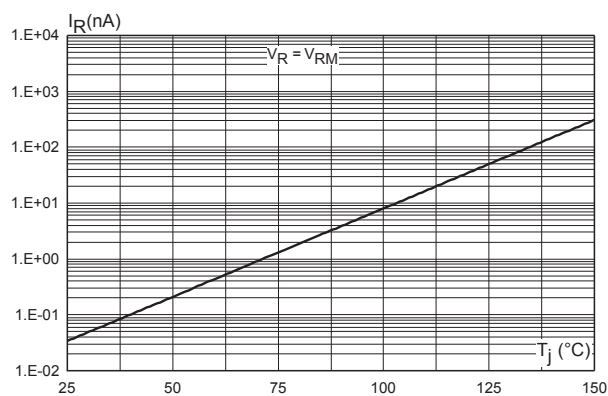




Figure 11. Typical application circuit with external PMOS

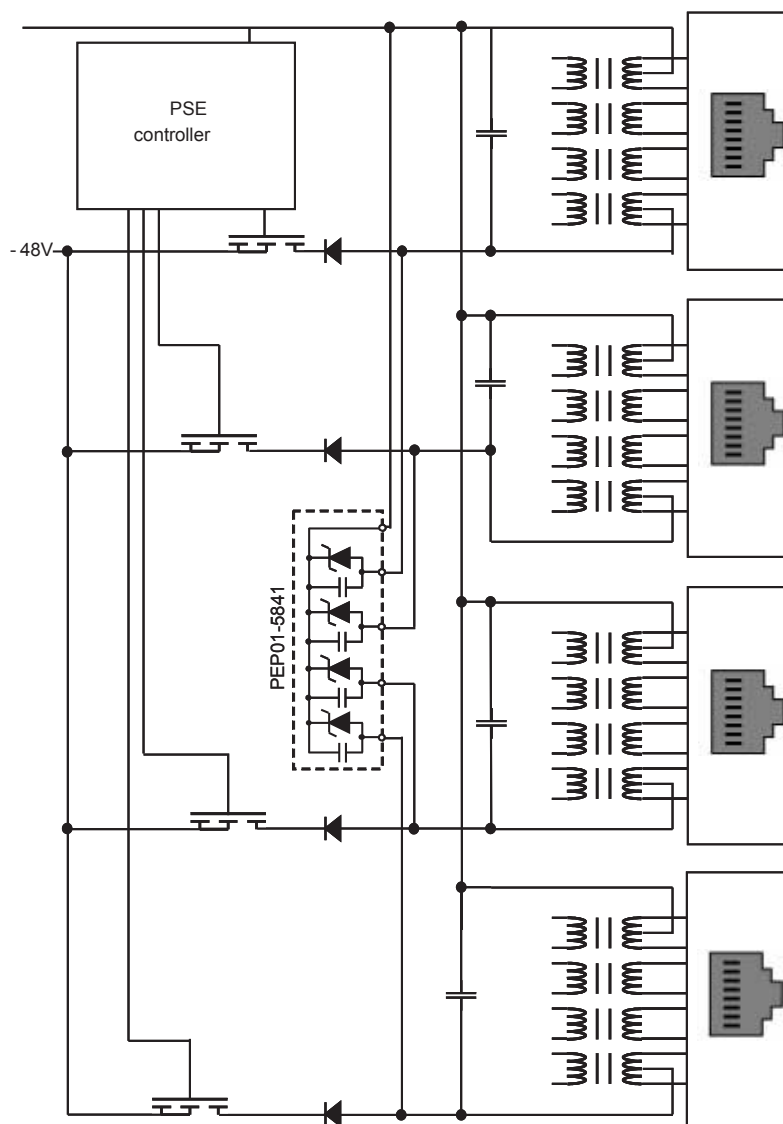
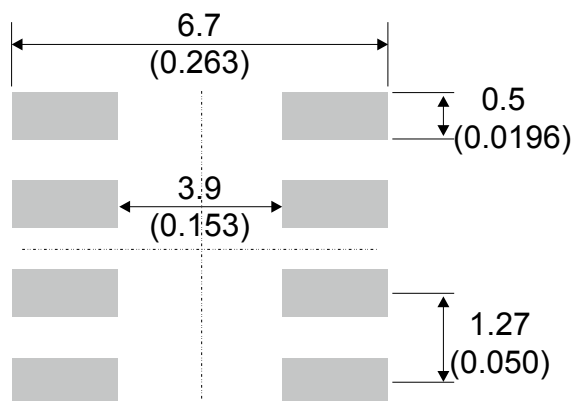


Figure 10. Typical application circuit with PMOS integrated in PSE controller and Figure 11. Typical application circuit with external PMOS show typical application schematics of PoE network. Power sourcing equipment (PSE) allows communication and power sourcing for several power devices (PD). The number of ways is generally a multiple of 4, this optimizes the PEP01-5841 for track layout and crosstalk, as well as PCB surface occupation. This protection device has been studied to comply with the latest IEEE 802.3af-2003 requirements and to withstand the surge defined in the IEC 61000-4-5 level 2 requirements.

### 3 Technical information

Figure 12. Footprint recommendation for improved clearance dimensions in mm (inches)



On top of the recommended SO-8 footprint described in Figure 14. Footprint recommendations, dimensions in mm (inches), the above footprint offers a better clearance for voltage higher than 50 V.



## 4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

### 4.1 SO-8 package information

Figure 13. SO-8 package outline

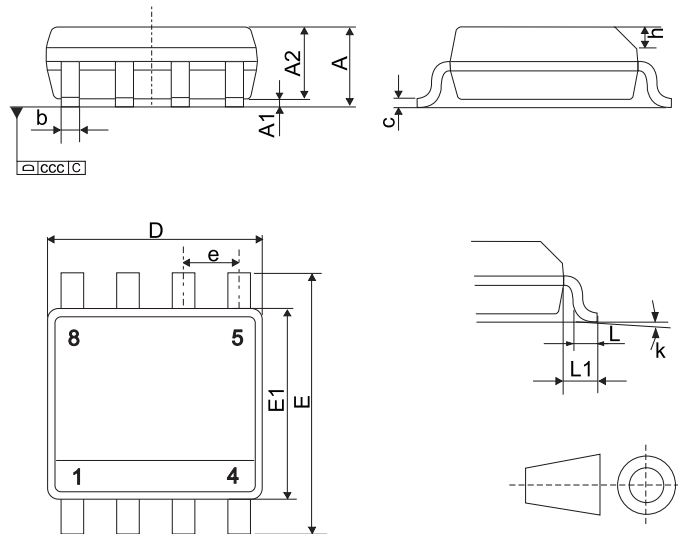
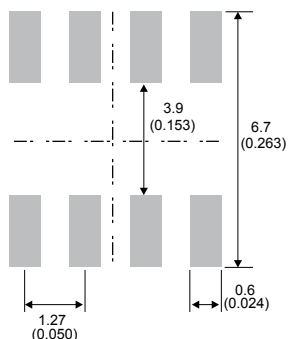


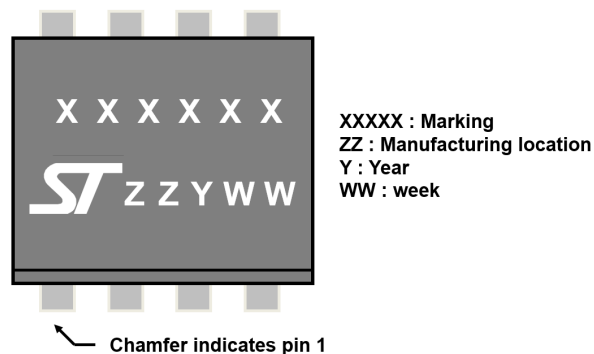
Table 3. SO-8 package mechanical data

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    |             |      | 1.75 |        |       | 0.069 |
| A1   | 0.1         |      | 0.25 | 0.004  |       | 0.010 |
| A2   | 1.25        |      |      | 0.049  |       |       |
| b    | 0.31        |      | 0.51 | 0.012  |       | 0.020 |
| c    | 0.10        |      | 0.25 | 0.004  |       | 0.010 |
| D    | 4.80        | 4.90 | 5.00 | 0.189  | 0.193 | 0.197 |
| E    | 5.80        | 6.00 | 6.20 | 0.228  | 0.236 | 0.244 |
| E1   | 3.80        | 3.90 | 4.00 | 0.150  | 0.154 | 0.157 |
| e    |             | 1.27 |      |        | 0.050 |       |
| h    | 0.25        |      | 0.50 | 0.010  |       | 0.020 |
| L    | 0.40        |      | 1.27 | 0.016  |       | 0.05  |
| L1   |             | 1.04 |      |        | 0.041 |       |
| k°   | 0           |      | 8    | 0      |       | 8     |
| ccc  |             |      | 0.10 |        |       | 0.004 |

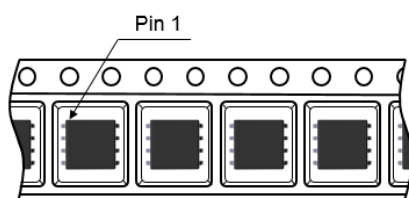
**Figure 14. Footprint recommendations, dimensions in mm (inches)**



**Figure 15. Marking layout (refer to ordering information table for marking)**

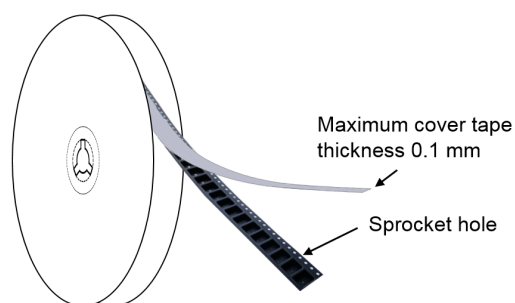


**Figure 16. Package orientation in reel**

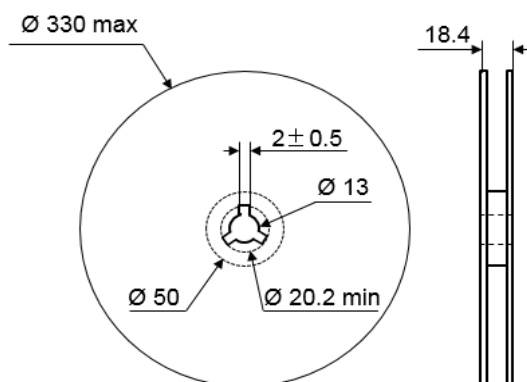


Taped according to EIA-481  
Note: Pocket dimensions are not on scale  
Pocket shape may vary depending on package

**Figure 17. Tape and reel orientation**



**Figure 18. Reel dimensions (mm)**



**Figure 19. Inner box dimensions (mm)**

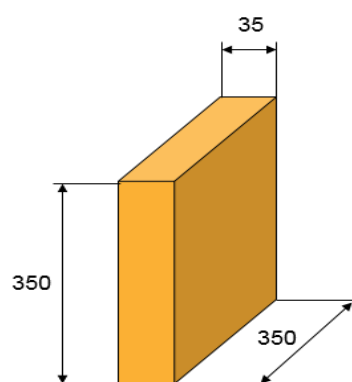
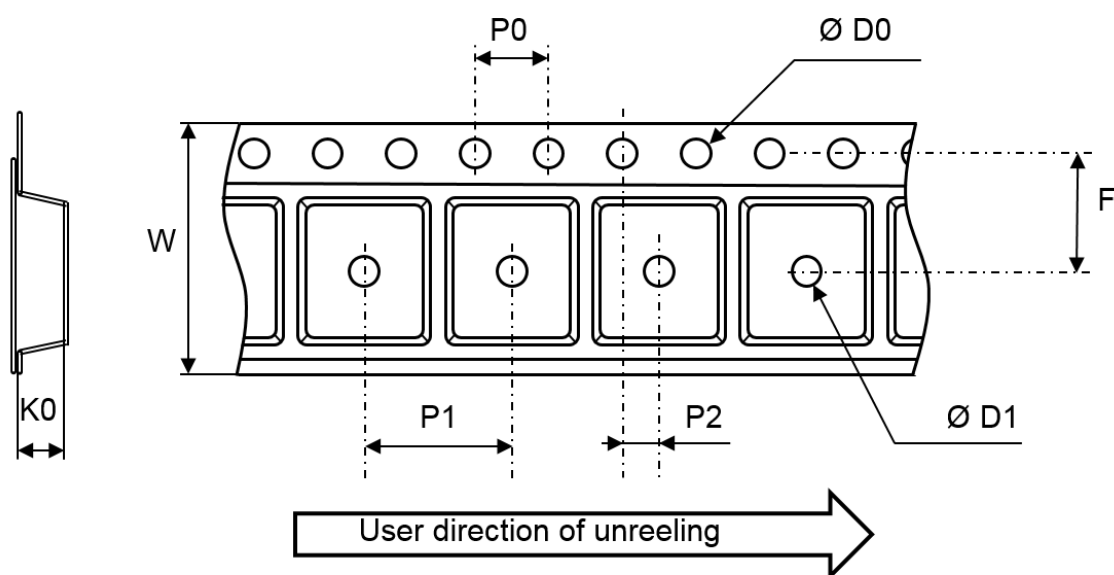


Figure 20. Tape and reel outline

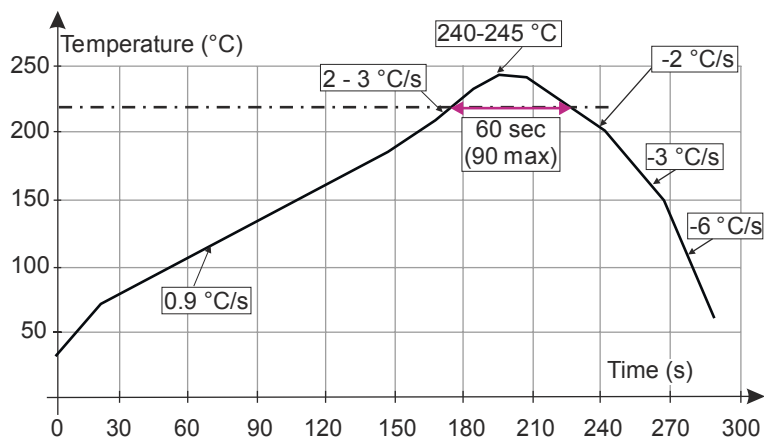


Note: Pocket dimensions are not on scale  
Pocket shape may vary depending on package

Table 4. Tape and reel mechanical data

| Ref. | Dimensions  |      |      |
|------|-------------|------|------|
|      | Millimeters |      |      |
|      | Min.        | Typ. | Max. |
| P0   | 3.9         | 4    | 4.1  |
| P1   | 7.9         | 8    | 8.1  |
| P2   | 1.95        | 2    | 2.05 |
| ØD0  | 1.45        | 1.5  | 1.6  |
| ØD1  | 1.6         |      |      |
| F    | 5.45        | 5.5  | 5.55 |
| K0   | 2.5         | 2.6  | 2.7  |
| W    | 11.7        | 12   | 12.3 |

Figure 21. ST ECOPACK recommended soldering reflow profile for PCB mounting



**Note:** Minimize air convection currents in the reflow oven to avoid component movement. Maximum soldering profile corresponds to the latest IPC/JEDEC J-STD-020.

## 5 Ordering information

Figure 22. Ordering information scheme

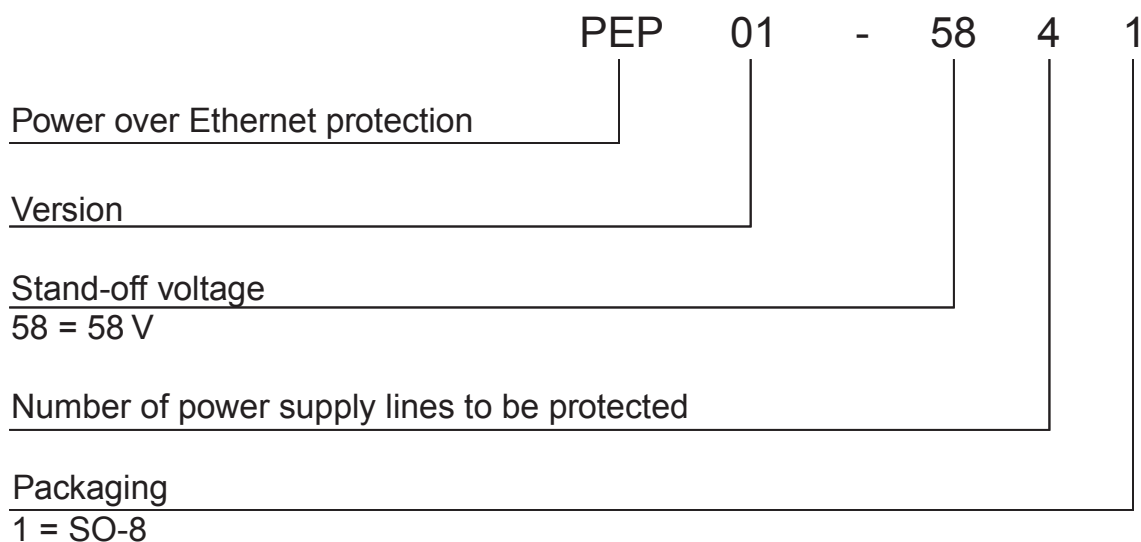


Table 5. Ordering information

| Order code | Marking | Package | Weight | Base qty. | Delivery mode |
|------------|---------|---------|--------|-----------|---------------|
| PEP01-5841 | 58E1    | SO-8    | 78 mg  | 2000      | Tape and reel |

## Revision history

**Table 6. Document revision history**

| Date        | Version | Changes  |
|-------------|---------|--|
| 06-May-2009 | 1       | Initial release.   |
| 14-May-2009 | 2       | Standards compliance updated.  |
| 17-Jan-2013 | 3       | Added note on GND pins in Figure 1 and added Figure 15.  |
| 13-Nov-2013 | 4       | Updated level 4 to level 2 under Figure 12.  |
| 15-May-2020 | 5       | Updated Figure 12. Footprint recommendation for improved clearance dimensions in mm (inches) and Figure 10. Typical application circuit with PMOS integrated in PSE controller.<br>Minor text change to improve the readability. |

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