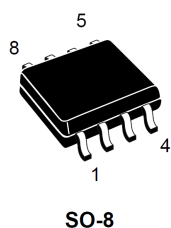


## Intelligent power switch



### Features

- 0.5 A output current
- Low-side or high-side switch configuration
- Supply voltage range from 6 V to 48 V
- Overload and short-circuit protections
- Internal voltage clamping
- Supply and output reversal protection
- Thermal shutdown
- GND and  $V_S$  open wire protection
- Adjustable delay at switch-on
- Indicator status LED driver
- +5 V regulated AUX voltage
- High burst immunity

### Application

- Industrial PC peripheral input/output
- Numerical control machines

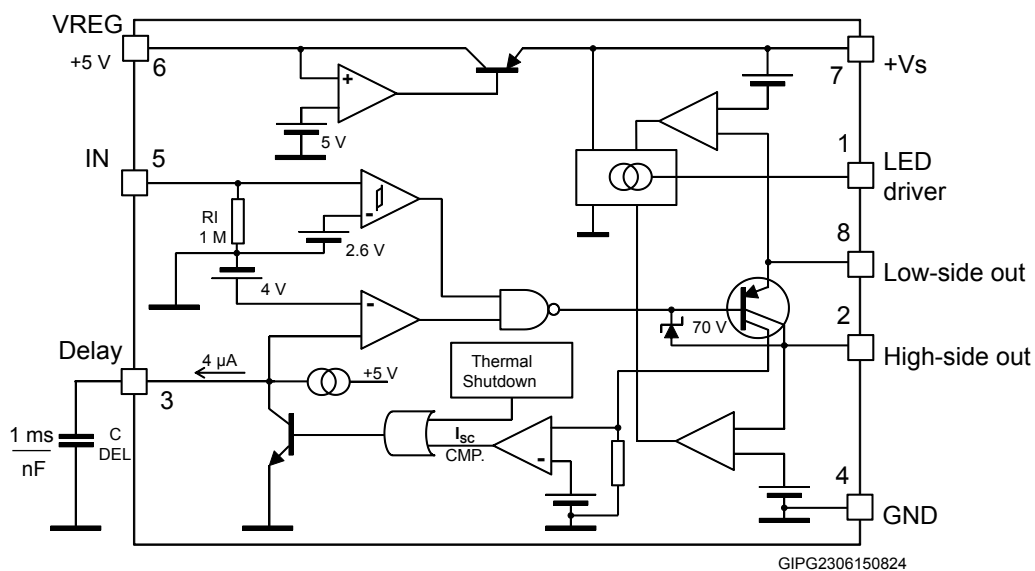
### Description

The TDE1707BFP and TDE1707CFP are 0.5 A integrated power switches with up to 48 V power supply capability. Two output configurations are possible. The former is the load to GND (high-side mode) and the latter is the load to  $V_S$  (low-side mode). This device is dedicated to proximity detectors; its internal +5 V supply can be used to supply external circuits (please refer to AN495 and AN1213 on [www.st.com](http://www.st.com)). A signal is internally generated to block the IN signal, and prevent the output switch, as long as an abnormal condition is detected. The power-on transition, as well as the chip overtemperature and the output overcurrent, generate this signal. A minimum delay of 25  $\mu$ s (typ. value) is added to the trailing edge of this signal to ensure that a stable normal situation is present when the signal disappears. The delay (the disappearance of block signal) can be further increased by connecting a capacitor between pin 3 and ground. It can drive resistive or inductive loads.

| Product status link                                                                 |
|-------------------------------------------------------------------------------------|
| TDE1707                                                                             |
| Product label                                                                       |
|  |

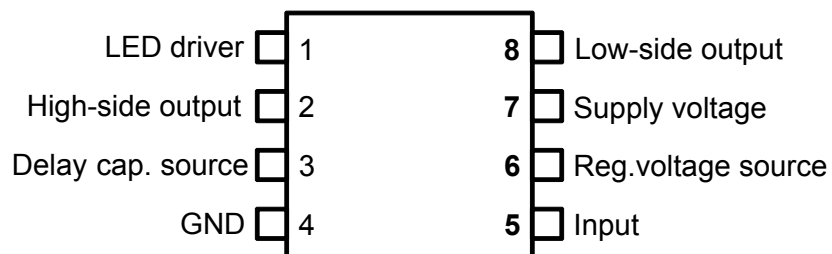
# 1 Block diagram

Figure 1. Block diagram



## 2 Pin configuration

**Figure 2.** Pin connections (top view)



GIPG230615900LM

**Table 1.** Pin description

| Pin | Function                 |
|-----|--------------------------|
| 1   | LED driver               |
| 2   | High-side output         |
| 3   | Delay cap. source        |
| 4   | GND                      |
| 5   | Input                    |
| 6   | Regulator voltage source |
| 7   | Supply voltage           |
| 8   | Low-side output          |

### 3 Maximum ratings

**Table 2. Absolute maximum ratings**

| Symbol             | Parameter                            | Value              | Unit |
|--------------------|--------------------------------------|--------------------|------|
| V <sub>S</sub>     | Supply voltage                       | 50                 | V    |
|                    | Supply reverse voltage               | 50                 | V    |
| I <sub>O</sub>     | Output current                       | Internally limited | mA   |
| V <sub>REG</sub>   | Regulated pin voltage                | 0 to 7             | V    |
| V <sub>delay</sub> | Delay cap. source pin                | 0 to 5             | V    |
| V <sub>O</sub>     | Output voltage                       | 55                 | V    |
| V <sub>IN</sub>    | Input voltage                        | -10 to 50          | V    |
| T <sub>STG</sub>   | Storage temperature range            | -55 to 150         | °C   |
| T <sub>J</sub>     | Operating junction temperature range | -25 to 85          | °C   |
| P <sub>tot</sub>   | Power dissipation                    | Internally limited | W    |
| E <sub>i</sub>     | Energy inductive load                | 150                | mJ   |

**Table 3. Thermal data**

| Symbol              | Parameter                           | Value (TDE1707BFP) | Value (TDE1707CFP) | Unit |
|---------------------|-------------------------------------|--------------------|--------------------|------|
| R <sub>th(JC)</sub> | Thermal resistance junction-case    | 15                 | 15                 | °C/W |
| R <sub>th(JA)</sub> | Thermal resistance junction-ambient | 150                | 130                |      |

## 4 Electrical characteristics

$V_S = 24\text{ V}$ ,  $T_J = -25\text{ to }+85\text{ }^\circ\text{C}$  unless otherwise stated

**Table 4. Electrical characteristics**

| Symbol        | Parameter                          | Test conditions                                                                               | Min. | Typ. | Max. | Unit          |
|---------------|------------------------------------|-----------------------------------------------------------------------------------------------|------|------|------|---------------|
| $V_S$ 7       | Supply voltage                     |                                                                                               | 6    |      | 48   | V             |
| $I_{SR}$ 7    | Supply reverse current             | $V_{SR} = -48\text{ V}$                                                                       |      |      | 1.5  | mA            |
| $I_q$ 7       | Quiescent current                  | $I_{REG} = I_{LED} = 0\text{ mA}$ ;<br>$V_I < 2\text{ V}$ ; $V_S = 6\text{ V to }48\text{ V}$ |      |      | 1.5  | mA            |
| $I_O$ 8/2     | Output current                     | $V_S = 6\text{ V to }32\text{ V}$                                                             |      |      | 500  | mA            |
|               |                                    | $V_S = 32\text{ V to }48\text{ V}$                                                            |      |      | 300  | mA            |
| $V_{SAT}$ 8/2 | Output voltage drop <sub>8-2</sub> | $I_O = 500\text{ mA}$                                                                         |      | 1.1  | 1.6  | V             |
|               |                                    | $I_O = 300\text{ mA}$                                                                         |      |      | 1.5  | V             |
| $I_{SC}$ 8/2  | Short-circuit current              |                                                                                               | 0.7  |      | 1.5  | A             |
| $V_{CL}$ 8/2  | Internal voltage clamp             | $I_{CL} = 10\text{ mA}$                                                                       | 55   |      | 70   | V             |
| $I_{OLK}$ 8/2 | Output leakage                     | $V_I < 2\text{ V}$ ; $V_O = 0\text{ to }V_S$ (Pin 2)                                          |      | 100  | 300  | $\mu\text{A}$ |
|               |                                    | $V_I < 2\text{ V}$ ; $V_O = 0\text{ to }V_S$ (Pin 8)                                          |      |      | 100  |               |
| $V_{ith}$ 5   | Input voltage threshold            |                                                                                               | 2    |      | 3    | V             |
| $V_{ihys}$ 5  | Input threshold hysteresis         |                                                                                               |      | 300  |      | mV            |
| $I_{lk}$ 5    | Input current                      | $V_I = 5\text{ V}$                                                                            |      | 2    | 5    | $\mu\text{A}$ |
| $V_{REG}$ 6   | Regulated output voltage           | $I_{REG} < 5\text{ mA}$                                                                       | 4.5  | 5    | 5.5  | V             |
| $I_{scr}$ 6   | Short-circuit regulated            |                                                                                               | 6    | 30   | 50   | mA            |
| $I_{REG}$ 6   | Output regulator current           | $V_S = 35\text{ V}$                                                                           |      |      | 6    | mA            |
|               |                                    | $V_S = 48\text{ V}$                                                                           |      |      | 4    | mA            |
| $I_{OLD}$ 1   | Current source sink LED driver     | Output ON ( $\pm$ )                                                                           | 2    | 3    | 4    | mA            |
| $V_{OLD}$ 1   | Voltage drop LED driver            | $I_{OS} = 2\text{ mA}$ ( $\pm$ )                                                              |      | 1.2  | 1.6  | V             |
| $O_{ldlk}$ 1  | LED driver off leakage             | $V_I < 2\text{ V}$ ; $R_L < 1\text{ k}\Omega$                                                 |      |      | 10   | $\mu\text{A}$ |
| $I_{dch}$ 3   | Delay cap. charge current          | $T_J = 25\text{ }^\circ\text{C}$                                                              | 2    | 4    | 6    | $\mu\text{A}$ |
| $V_{dth}$ 3   | Delay voltage trigger              | $T_J = 25\text{ }^\circ\text{C}$                                                              |      | 4    |      | V             |

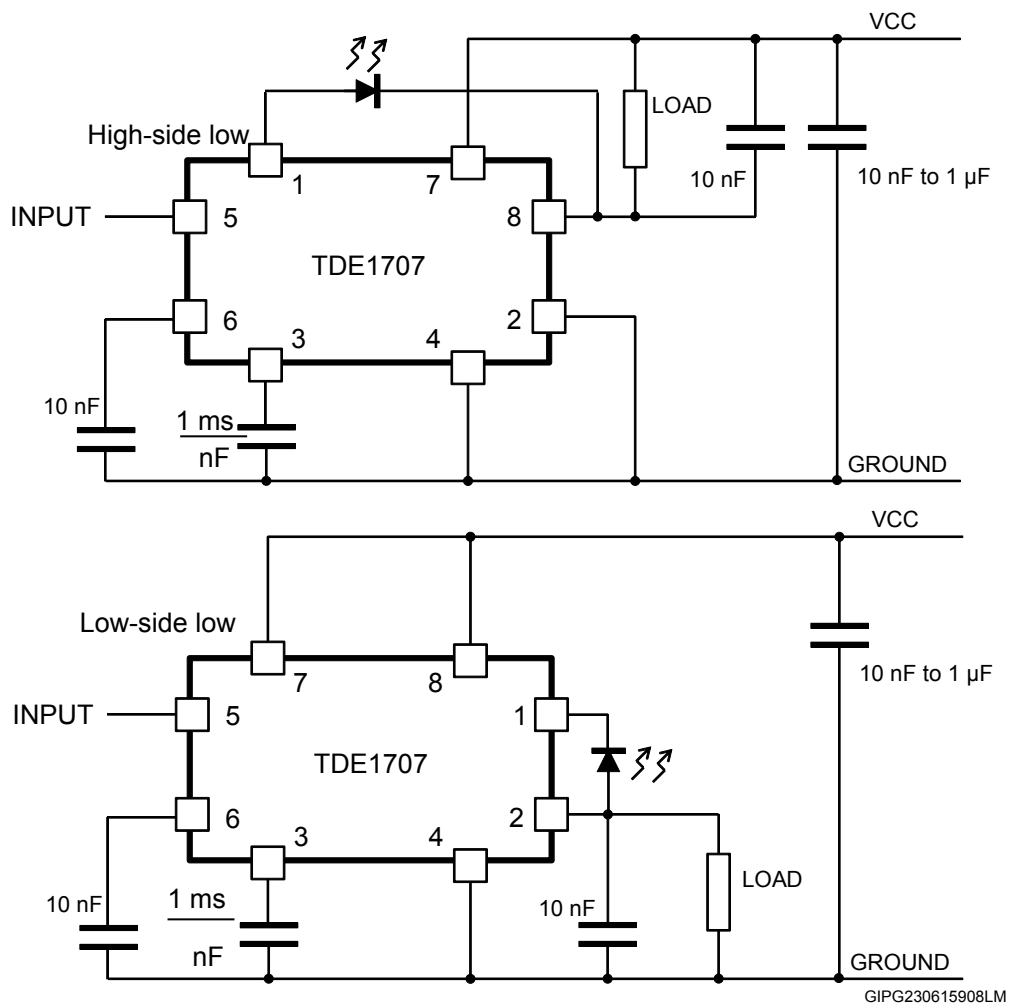
## 5 Application information

The LED driver reports the output status. It can source or sink current ( $I_{OLD}$  typ. = 3 mA), according to the output configuration chosen. The thresholds, represented by the output comparator in the block diagram, are set from 1.5 V to 2 V. For instance, in high-side load case of the application circuit, when the voltage on pin 8 differs from  $V_{CC}$  less than 1.5 V, the output is sensed in "OFF" state and the LED driver is disabled. If instead pin 8 differs from  $V_{CC}$  more than 3 V (the output comparator threshold value plus the drop voltage on the LED), then the output is sensed "ON" and the driver forces the current on the LED.

**Table 5. Dynamic characteristics**

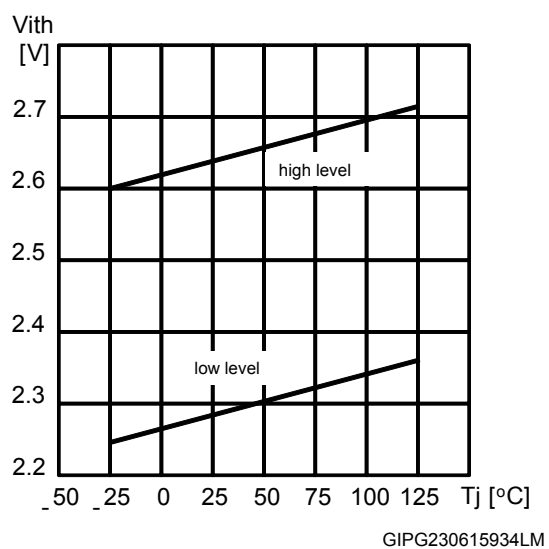
| Symbol     | Parameter                                      | Test conditions  | Min. | Typ. | Max. | Unit    |
|------------|------------------------------------------------|------------------|------|------|------|---------|
| $t_{on}$   | Propagation turn-on time                       | $V_I = 0$ to 5 V |      | 15   |      | $\mu s$ |
| $t_{off}$  | Propagation turn-off time                      | $V_I = 5$ to 0 V |      | 15   |      | $\mu s$ |
| $t_{don}$  | Delayed turn-on time / nF delay capacitor      |                  | 0.65 | 1    | 2    | ms      |
| $t_{dmin}$ | Minimum delayed $t_{on}$ , delay capacitor = 0 |                  |      | 25   |      | $\mu s$ |

**Figure 3. Application circuit**

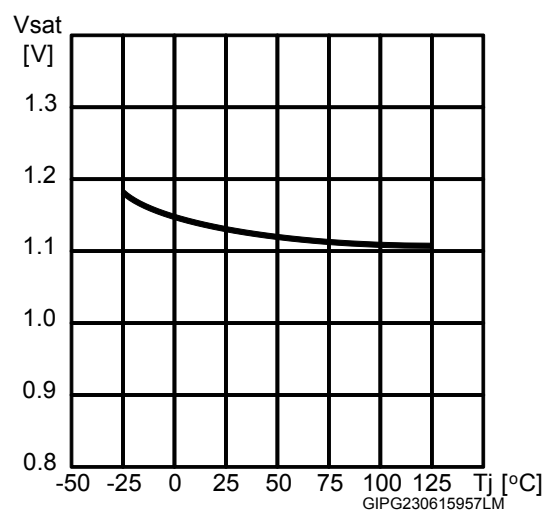


## 6 Thermal behavior

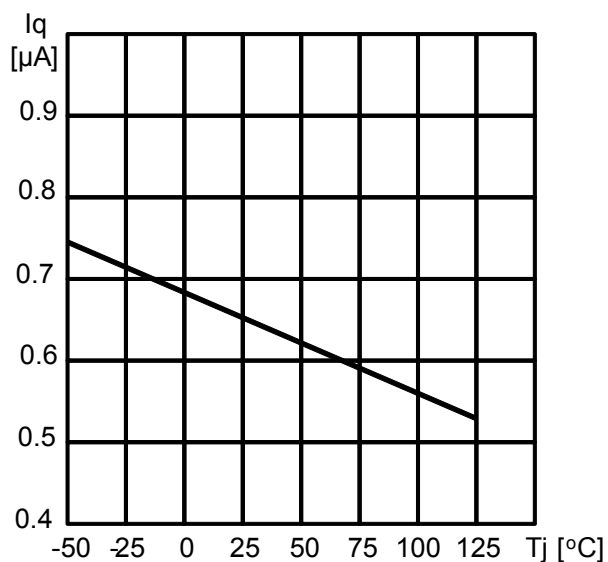
**Figure 4. Input threshold voltage vs. temperature**  
 ( $V_S = 24\text{ V}$ )



**Figure 5. Saturation voltage vs. temperature** ( $V_S = 24\text{ V}$ ;  $I_O = 500\text{ mA}$ )



**Figure 6. Quiescent current vs. temperature** ( $V_S = 24\text{ V}$ )

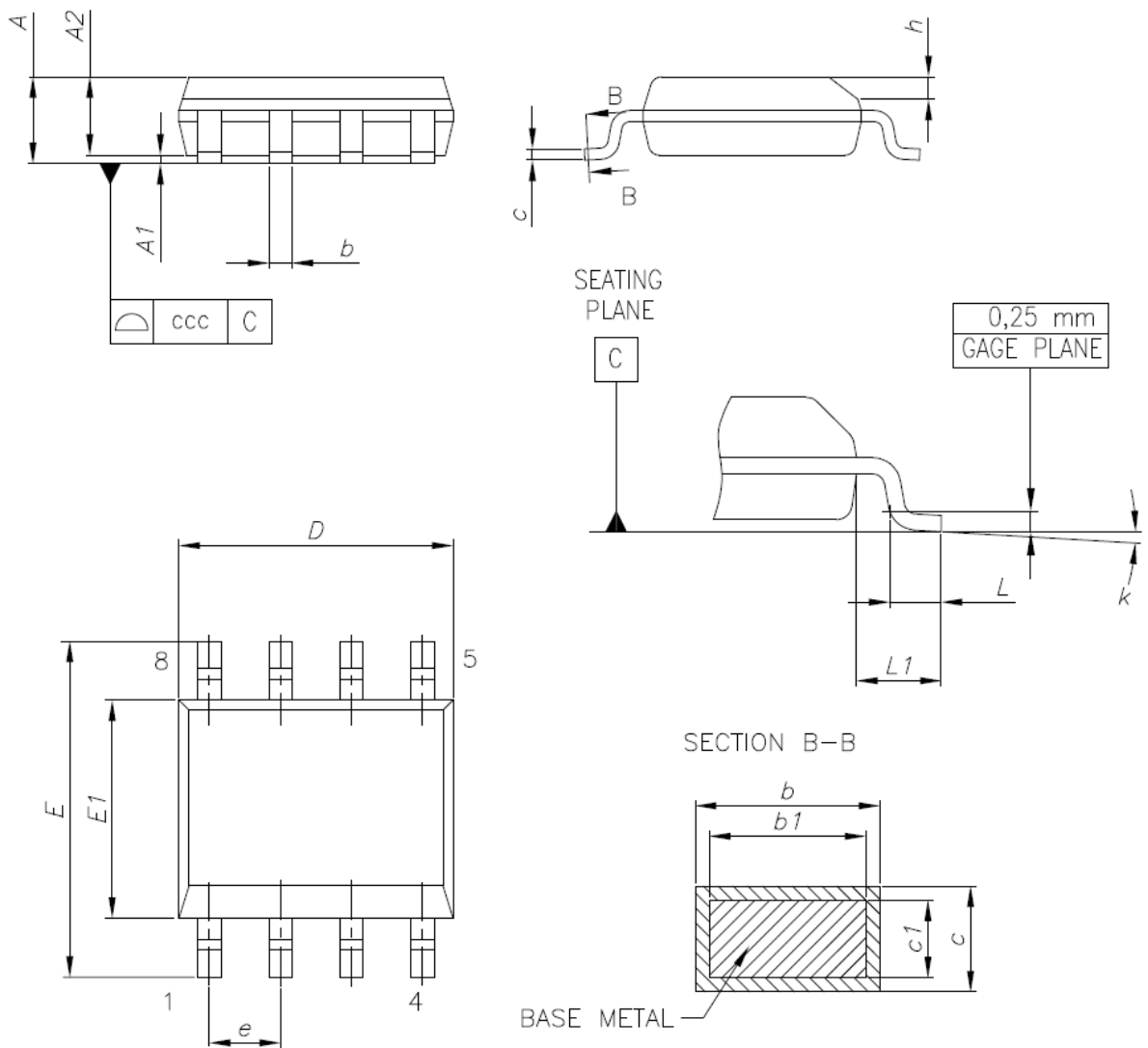


## 7 Package information

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.

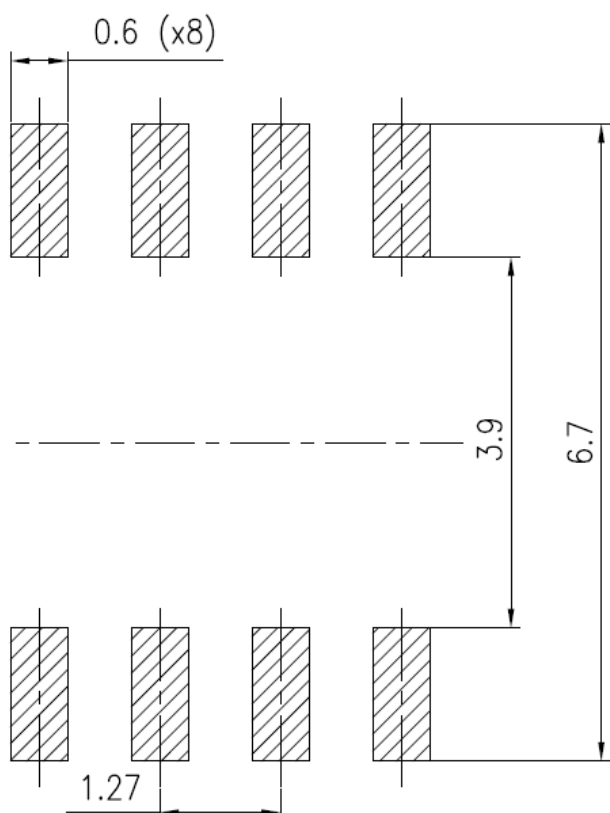
### 7.1 SO-8 package information

**Figure 7. SO-8 mechanical data**



**Table 6. SO-8 mechanical data**

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    |      |      | 1.75 |
| A1   | 0.10 |      | 0.25 |
| A2   | 1.25 |      |      |
| b    | 0.31 |      | 0.51 |
| b1   | 0.28 |      | 0.48 |
| c    | 0.10 |      | 0.25 |
| c1   | 0.10 |      | 0.23 |
| D    | 4.80 | 4.90 | 5.00 |
| E    | 5.80 | 6.00 | 6.20 |
| E1   | 3.80 | 3.90 | 4.00 |
| e    |      | 1.27 |      |
| h    | 0.25 |      | 0.50 |
| L    | 0.40 |      | 1.27 |
| L1   |      | 1.04 |      |
| L2   |      | 0.25 |      |
| k    | 0°   |      | 8°   |
| ccc  |      |      | 0.10 |

**Figure 8. SO-8 recommended footprint (dimensions are in mm)**


## 7.2 SO-8 packing information

Figure 9. SO-8 tape and reel dimensions

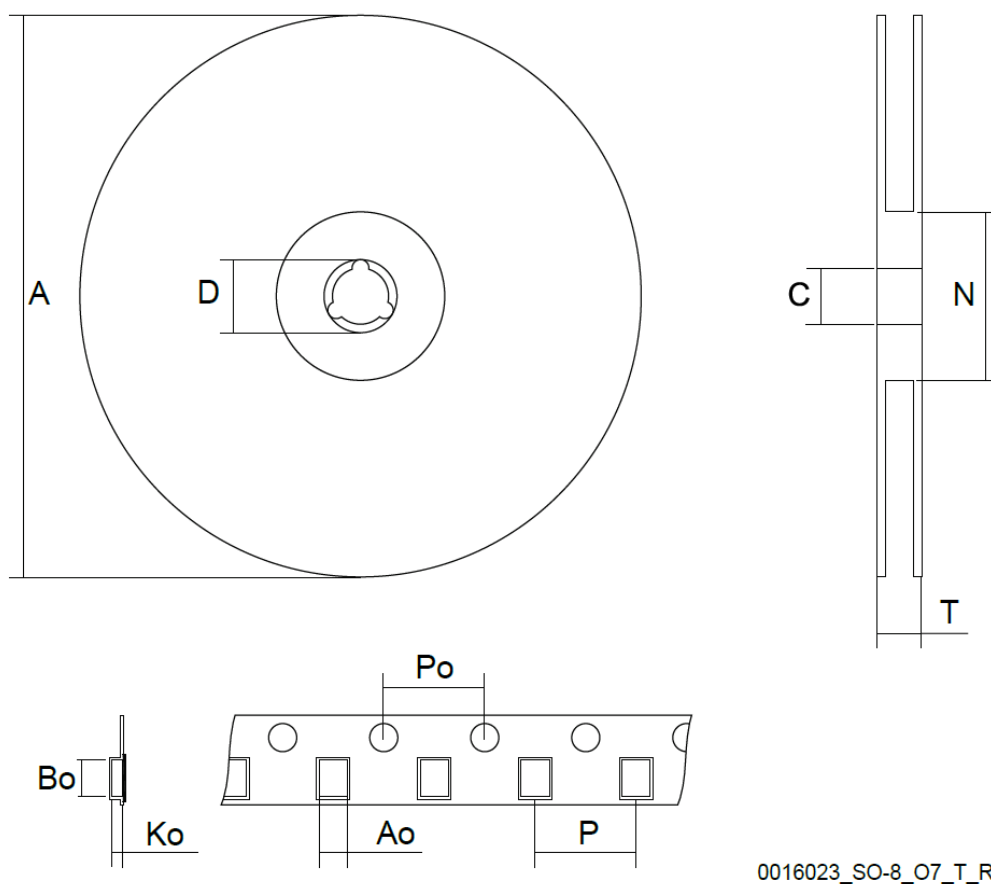
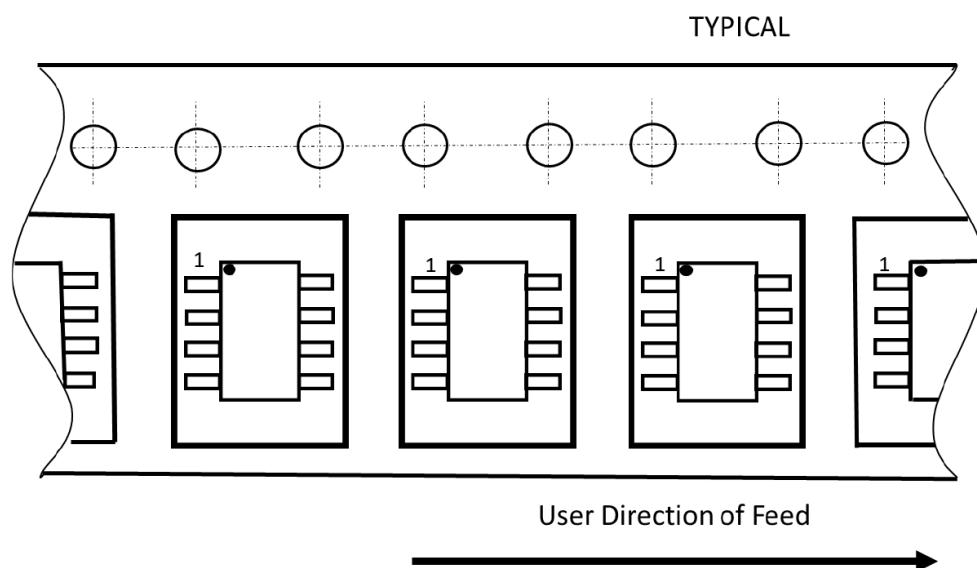


Figure 10. Tape orientation



**Table 7. SO-8 tape and reel mechanical data**

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    |      | -    | 330  |
| C    | 12.8 |      | 13.2 |
| D    | 20.2 |      |      |
| N    | 60   |      |      |
| T    |      |      | 22.4 |
| Ao   | 6.5  |      | 6.7  |
| Bo   | 5.4  |      | 5.6  |
| Ko   | 2.0  |      | 2.2  |
| Po   | 3.9  |      | 4.1  |
| P    | 7.9  |      | 8.1  |

## 8 Ordering information

**Table 8. Ordering information**

| Order code  | Package | Packing       |
|-------------|---------|---------------|
| TDE1707BFP  | SO-8    | Tube          |
| TDE1707BFPT |         | Tape and reel |
| TDE1707CFP  |         | Tube          |
| TDE1707CFPT |         | Tape and reel |

## Revision history

**Table 9. Document revision history**

| Date        | Version | Changes          |
|-------------|---------|------------------|
| 03-Dec-2021 | 1       | Initial release. |

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