



THE DATASHEET OF ST2044BD

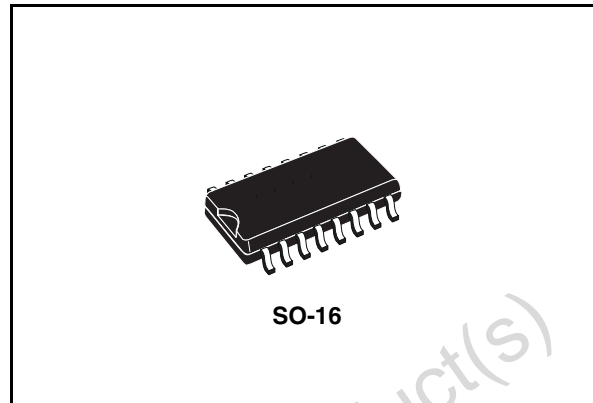


Features

- 80mΩ high-side MOSFET switch
- 500mA continuous current per channel
- independent thermal and short-circuit protection with overcurrent logic output
- Operating range from 2.7V to 5.5V
- CMOS- and TTL-compatible enable inputs
- 10ms OC_N fault blanking
- 2.5ms typical rise time
- Under voltage lock out
- 20μA maximum standby supply current
- Ambient temperature range, -40°C to 85°C
- ESD protection

Description

The ST2044 power distribution switches is intended for application where heavy capacitive loads and short circuits are likely to be encountered. These devices incorporate 80mΩ N-channel MOSFET high-side power switches for power-distribution systems that require multiple power switches in a single package. Each switch is controlled by an independent logic enable input. Gate drive is provided by an internal charge pump designed to control the power-switch rise times and fall times to minimize current surges during switching. The charge pump requires no external components and allows operation from supplies as low as 2.7 V.



When the output load exceeds the current-limit threshold or a short is present, these devices limit the output current to a safe level by switching into a constant-current mode, pulling the overcurrent (OCx) logic output low. A 10ms deglitching circuit provides fault-blanking feature, preventing the OC_N pin to be asserted during hot-insertion or short spikes of overcurrent conditions.

When continuous heavy overloads and short circuits increase the power dissipation in the switch, causing the junction temperature to rise, a thermal protection circuit shuts off the switch to prevent damage. Recovery from a thermal shutdown is automatic once the device has cooled sufficiently. Internal circuitry ensures the switch remains off until valid input voltage is present. These power-distribution switches are designed to current limit at 0.9 A.

Table 1. Device summary

| Part number | Package | Packaging |
|-------------|---------|--|
| ST2044BD | SO-16 | Tube (50 parts per tube, 40 tube per box) |
| ST2044BDR | SO-16 | Tape and reel (2500 parts per reel) |

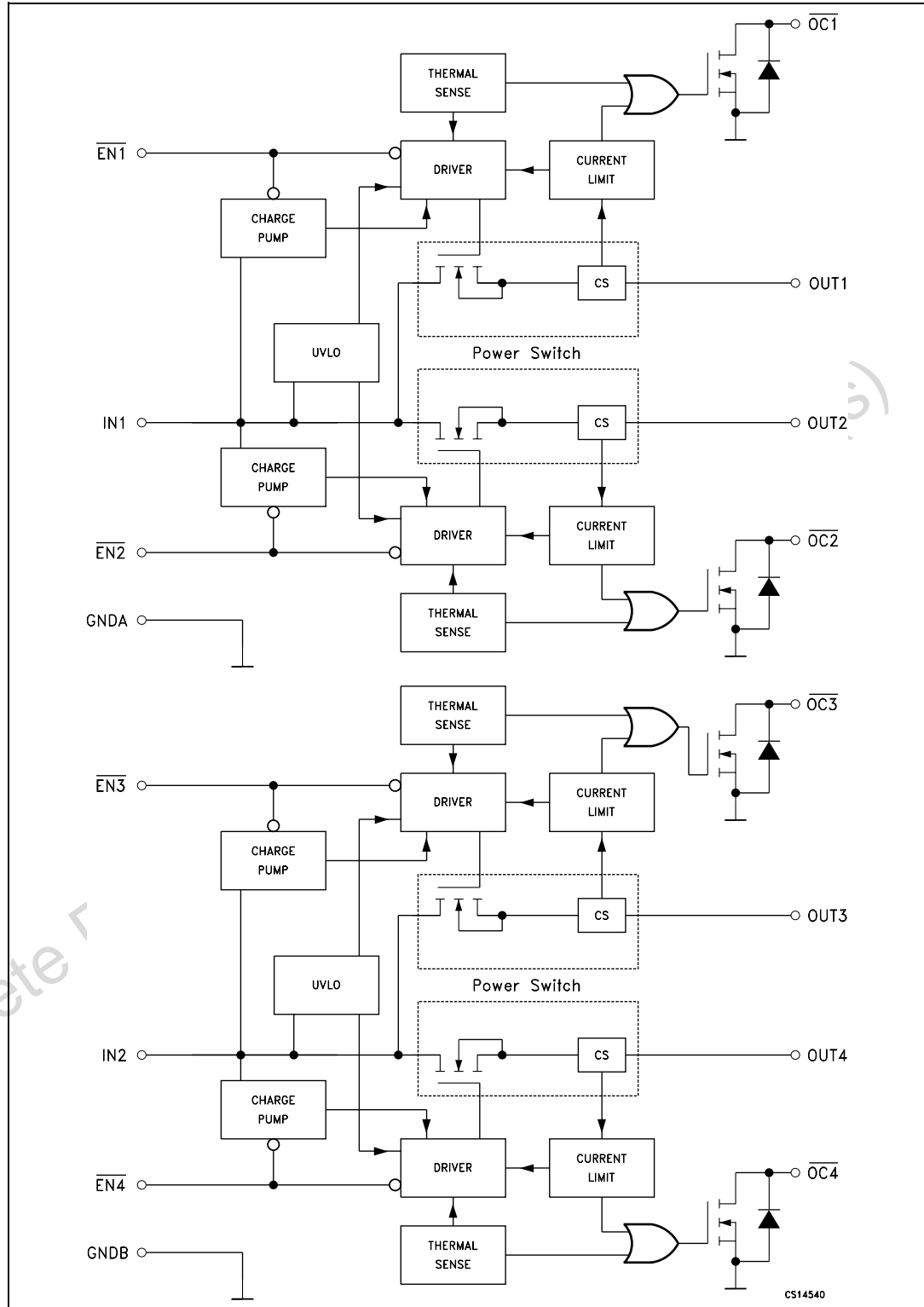
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1 Block diagram

Figure 1. Block diagram



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2 Pin connections

Figure 2. Pin connections (top view)

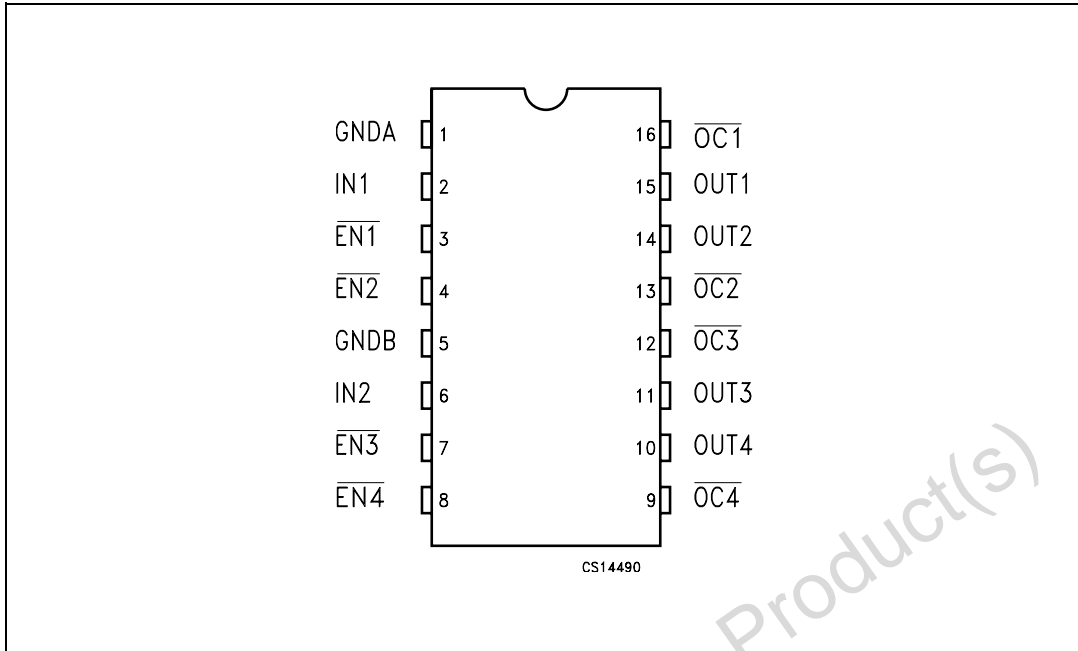


Table 2. Pin functions

| Pin N° | Symbol | Description |
|--------|------------------|---|
| 1 | GNDA | Ground |
| 2 | IN1 | Input voltage |
| 3 | $\overline{EN1}$ | Enable input. logic low turns on power switch IN-OUT1 |
| 4 | $\overline{EN2}$ | Enable input. logic low turns on power switch IN-OUT2 |
| 5 | GNDB | Ground |
| 6 | IN2 | Input voltage |
| 7 | $\overline{EN3}$ | Enable input. logic low turns on power switch IN-OUT3 |
| 8 | $\overline{EN4}$ | Enable input. logic low turns on power switch IN-OUT4 |
| 9 | $\overline{OC4}$ | Overcurrent. logic output active low IN-OUT4 |
| 10 | OUT4 | Power switch output |
| 11 | OUT3 | Power switch output |
| 12 | $\overline{OC3}$ | Overcurrent. logic output active low IN-OUT3 |
| 13 | $\overline{OC2}$ | Overcurrent. logic output active low IN-OUT2 |
| 14 | OUT2 | Power switch output |
| 15 | OUT1 | Power switch output |
| 16 | $\overline{OC1}$ | Overcurrent. logic output active low IN-OUT1 |

3 Electrical ratings

3.1 Absolute maximum ratings

Stressing the device above the rating listed in the “Absolute Maximum Ratings” table may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in the Operating sections of this specification is not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability. Refer also to the STMicroelectronics SURE Program and other relevant quality documents.

Table 3. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|------------|-------------------------------------|------------------------|------|
| V_I | Input voltage range ⁽¹⁾ | -0.3 - 6 | V |
| V_O | Output voltage range ⁽¹⁾ | -0.3 - ($V_I + 0.3$) | V |
| V_{IENX} | EN Input voltage range | -0.3 to 6 | V |
| I_O | Continuous output current | Internally Limited | |
| ESD | Electrostatic discharge | 2 | kV |
| T_J | Junction Operating Temperature | -40 to 125 | C |

1. All voltage are referred to GND

3.2 Recommended operating conditions

Table 4. Recommended operating conditions

| Symbol | Parameter | Min | Typ | Max | Unit |
|--------|--|-----|-----|-----|------|
| V_I | Input voltage range ⁽¹⁾ | 2.7 | | 5.5 | V |
| V_O | Output voltage range ⁽¹⁾ | 0 | | 5.5 | V |
| I_O | Continuous output current (Per switch) | 0 | | 500 | mA |

1. All voltage are referred to GND

4 Electrical characteristics

$V_I = 5.5V$, $I_O =$ rated current, $V_{\overline{IEN}} = 0V$, $T_J = 25^\circ C$, unless otherwise specified. (See [Note 1](#))

Table 5. Power switch electrical characteristics

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|--------------|---|--|--------------------------|-----|-----|------|
| $R_{DS(on)}$ | Static drain-source ON-state resistance | $V_I = 5V$ $I_O = 0.5A$ | | 80 | 100 | mΩ |
| | | $V_I = 5V$ $I_O = 0.5A, T_J = 85^\circ C$ | | 90 | 120 | |
| | | $V_I = 5V$ $I_O = 0.5A, T_J = 125^\circ C$ | | 100 | 135 | |
| | | $V_I = 3.3V$ $I_O = 0.5A$ | | 90 | 125 | |
| | | $V_I = 3.3V$ $I_O = 0.5A, T_J = 85^\circ C$ | | 110 | 145 | |
| | | $V_I = 3.3V$ $I_O = 0.5A, T_J = 125^\circ C$ | | 120 | 160 | |
| t_r | Output rise time | $V_I = 5.5V$ | $R_L = 10, C_L = 1\mu F$ | 2.5 | | ms |
| | | $V_I = 2.7V$ | | 3 | | |
| t_f | Output fall time | $V_I = 5.5V$ | | 0.3 | | ms |
| | | $V_I = 2.7V$ | | 0.2 | | |

Table 6. Enable Input \overline{ENx} characteristics

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|-----------|--------------------------|-------------------------------------|------|-----|-----|------|
| V_{IH} | High level input voltage | $V_I = 2.7V$ to $5.5V$ | 2 | | | V |
| V_{IL} | Low level input voltage | $V_I = 4.5V$ to $5.5V$ | | | 0.8 | V |
| | | $V_I = 2.7V$ to $4.5V$ | | | 0.4 | |
| I_I | Input current | $V_{\overline{IENx}} = 0V$ or V_I | -0.5 | | 0.5 | μA |
| t_{on} | Turn-on time | $R_L = 10\Omega$ $C_L = 100\mu F$ | | | 20 | ms |
| t_{off} | Turn-off time | $R_L = 10\Omega$ $C_L = 100\mu F$ | | | 40 | ms |

Table 7. Current limit characteristics

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|----------|------------------------------|--|-----|-----|-----|------|
| I_{OS} | Short circuit output current | $V_I = 5V$, OUT connected to GND, device enabled into short circuit | 0.7 | 1 | 1.3 | A |

Table 8. Supply current characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------------|--------------------------|---|------|------|------|------|
| I _{SOL} | Current low level output | V _{IENX} = V _I , No Load, | | 0.05 | 2 | μA |
| | | V _{IENX} = V _I , No Load, T _J = -40 to 125°C | | | 20 | |
| I _{SOH} | Current low high output | V _{IENX} = 0, No Load, | | 140 | 180 | μA |
| | | V _{IENX} = 0, No Load, T _J = -40 to 125°C | | | 200 | |
| I _L | Output leakage current | V _{IENX} = V _I , Output connected to GND, T _J = -40 to 125°C | | | 20 | μA |

Table 9. Undervoltage characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------------|-------------------------|-----------------|------|------|------|------|
| V _{IL} | Low level input voltage | | 2 | | 2.5 | V |
| V _{HYS} | Hysteresis | | | 100 | | mV |

Table 10. Overcurrent (OC) characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------------|-----------------------|--|------|------|------|------|
| I _{SINK} | Sink current | V _O = 5V | 10 | | | mA |
| V _O | Output low voltage | I _O = 5mA | | | 0.5 | V |
| I _{OFF} | OFF-state current | V _O = 5V V _O = 3.3V | | | 1 | μA |
| T _{FB} | Fault-blanking period | V _I = 5.5V, T _J = 25°C (See Note 2 and 3) | 2 | 10 | | ms |

Note: 1 Pulse testing techniques maintain junction temperature close to ambient temperature: thermal effect must be taken into account separately.

2 Specified by design, not production tested.

3 Guaranteed by design.

Figure 3. Test circuit

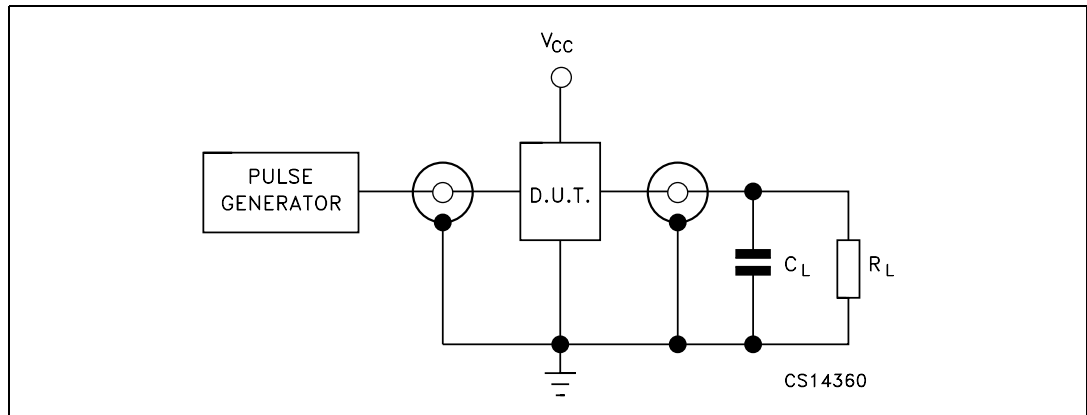
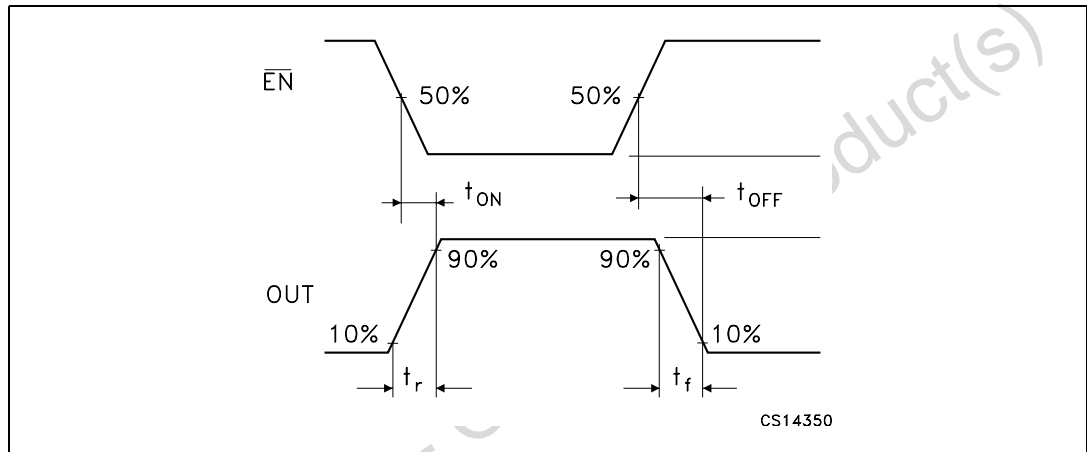


Figure 4. Waveform - propagation delays ($f=1\text{MHz}$; 50% duty cycle)



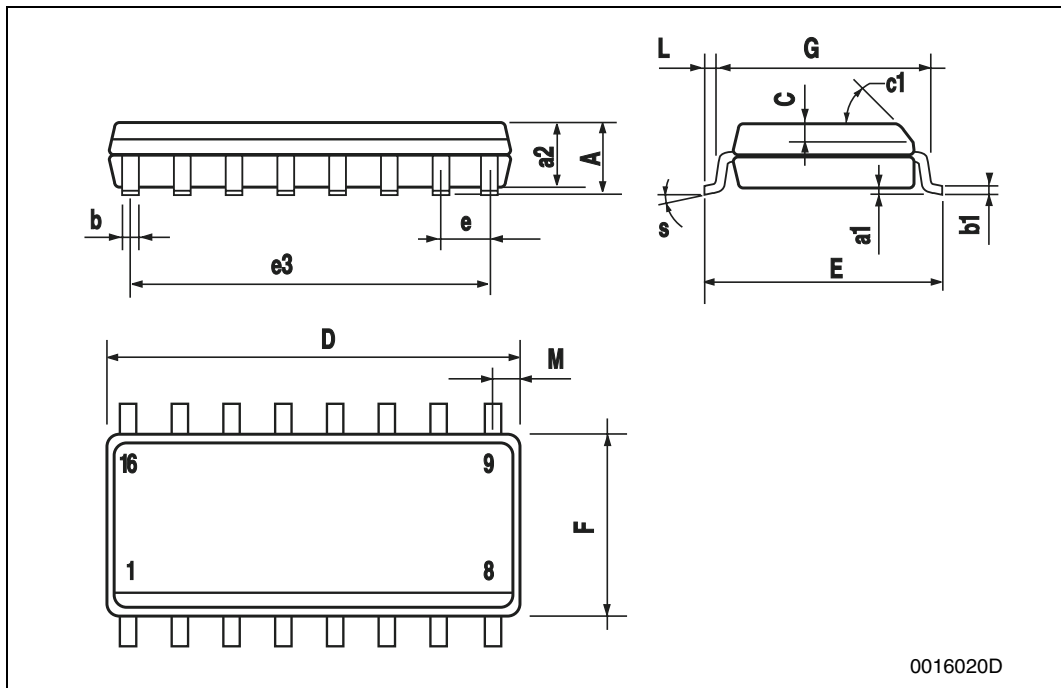
5 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

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SO-16 MECHANICAL DATA

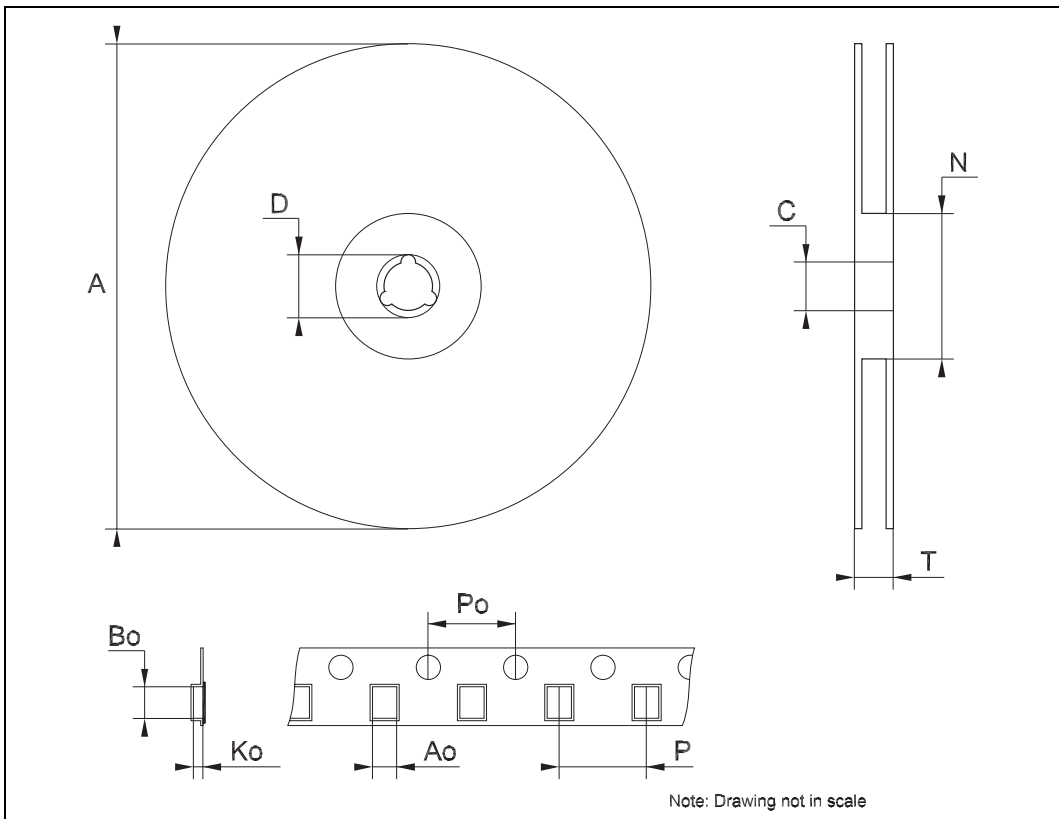
| DIM. | mm. | | | inch | | |
|------|------------|------|------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.25 | 0.004 | | 0.010 |
| a2 | | | 1.64 | | | 0.063 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.019 | |
| c1 | 45° (typ.) | | | | | |
| D | 9.8 | | 10 | 0.385 | | 0.393 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 8.89 | | | 0.350 | |
| F | 3.8 | | 4.0 | 0.149 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.208 |
| L | 0.5 | | 1.27 | 0.019 | | 0.050 |
| M | | | 0.62 | | | 0.024 |
| S | 8° (max.) | | | | | |



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Tape & Reel SO-16 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|------|-----|------|-------|------|--------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | | | 330 | | | 12.992 |
| C | 12.8 | | 13.2 | 0.504 | | 0.519 |
| D | 20.2 | | | 0.795 | | |
| N | 60 | | | 2.362 | | |
| T | | | 22.4 | | | 0.882 |
| Ao | 6.45 | | 6.65 | 0.254 | | 0.262 |
| Bo | 10.3 | | 10.5 | 0.406 | | 0.414 |
| Ko | 2.1 | | 2.3 | 0.082 | | 0.090 |
| Po | 3.9 | | 4.1 | 0.153 | | 0.161 |
| P | 7.9 | | 8.1 | 0.311 | | 0.319 |



6 Revision history

¹
Table 11. Revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 13-Jul-2005 | 4 | Add bullet on pag. 1, add paragraph in the description on pag. 1 and add row T_{FB} on Table 10. |
| 29-May-2007 | 5 | Updated features in cover page, document reformatted |

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