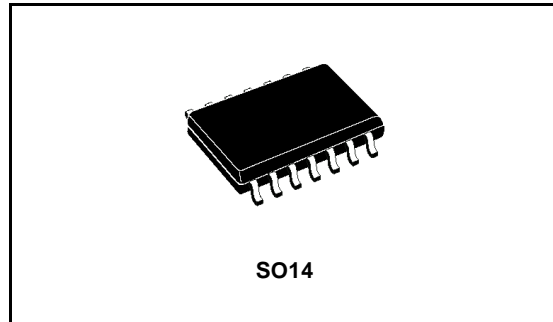


Features

- Supply Voltage +4 to +36V
- Supply Current < 1.2mA
- Loss Resistance 5 to 50kΩ
- Oscillator Frequency < 1MHz
- Output Transistors $I = 20\text{mA}$, $V_{CE(sat)} \leq 1.1\text{V}$

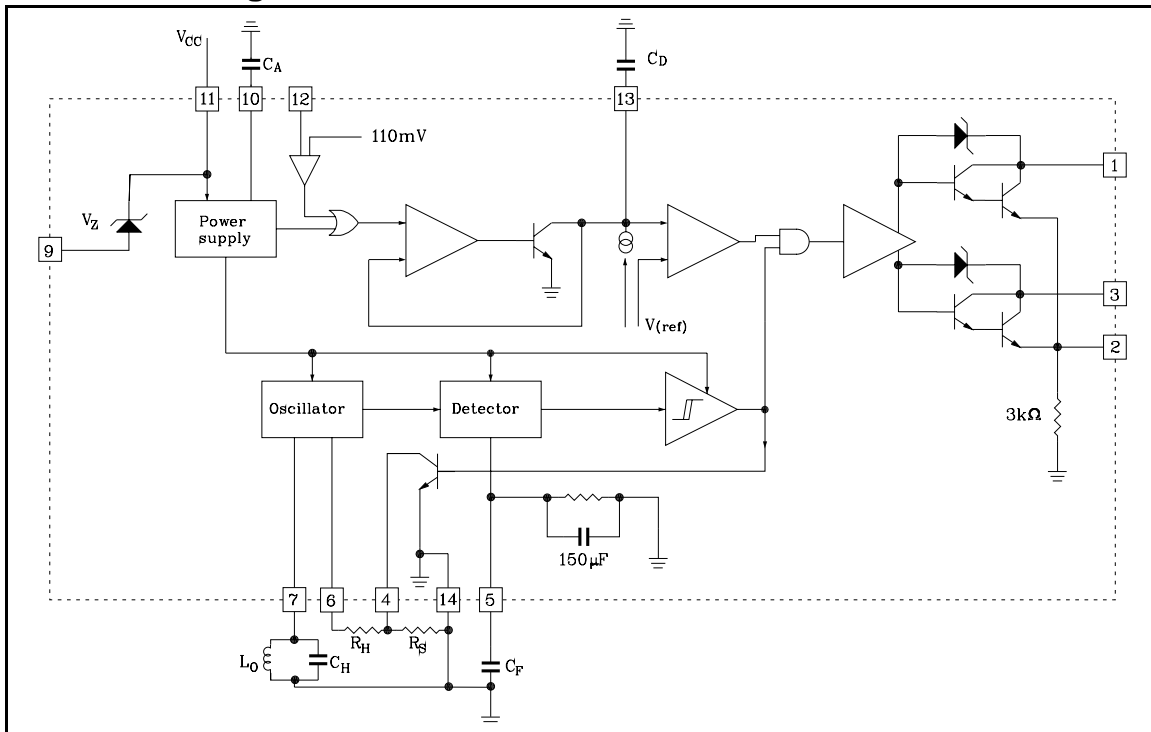


Description

The TDE0160 is designed to detect metal bodies by the effect of Eddy currents on the HF losses of a coil. It has two complementary open collector outputs with peak limiting. Hysteresis is adjustable, and an electronic switching circuit is incorporated for disabling both outputs.

An internal zener diode maintains the supply voltage to the circuit in "dipole" operation.

Schematic Diagram

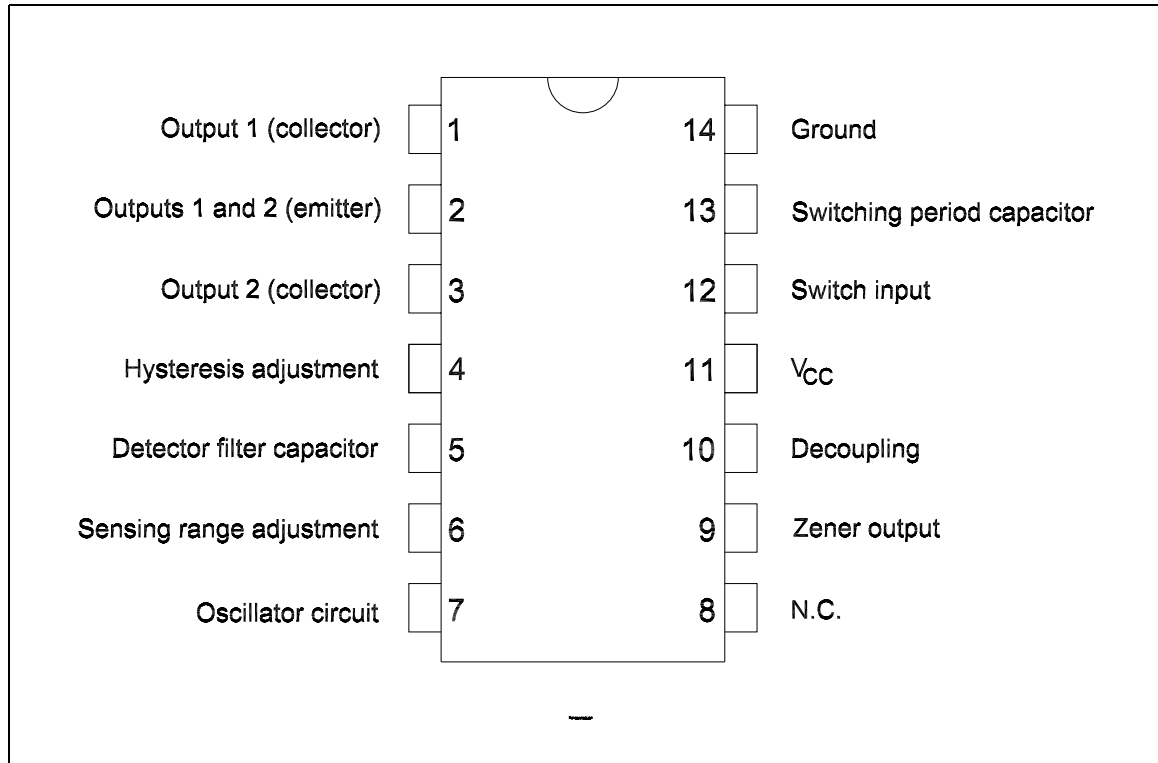


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1 Internal schematic diagram

Figure 1. Pin connection diagram (top view)



2 Electrical ratings

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|-------------------|--------------------------------|------------|------|
| V_{CC} | Supply Voltage | 36 | V |
| V_O | Output Voltage ⁽¹⁾ | 36 | V |
| $I_O (I_1 - I_3)$ | Output Current ($I_1 - I_3$) | 40 | mA |
| I_Z | Zener Current | 40 | mA |
| T_J | Junction Temperature | +150 | °C |
| T_{oper} | Ambient Temperature Range | -25 to 85 | °C |
| T_{stg} | Storage Temperature Range | -65 to 150 | °C |

1. Internal peak limiting to protect against transient voltage surges.

2.1 Electrical characteristics

$T_{amb} = +25^{\circ}\text{C}$, unless otherwise specified.

Table 2. Electrical Characteristics

| Symbol | Parameter | Test conditions | Pin | Min. | Typ. | Max. | Unit |
|------------|--------------------------------------|---|--------|-------------------------------|-------------------------|------|---------------|
| V_{CC} | Supply Voltage | | 11 | 4 | | 36 | V |
| V_Z | Zener Voltage | $I_Z = 20\text{mA}$ | 9 - 11 | 3 | | 4 | V |
| I_{CC} | Supply Current | | 11 | | | 1.2 | mA |
| V_{LIM} | Limiting | $I = 0.1\text{mA}$ | 1 or 3 | | 42 | | V |
| V_{SAT} | Output Transistor Saturation Voltage | I_1 or $I_3 = +20\text{mA}$ | 1 or 3 | | 0.9 | 1.1 | V |
| I_{LEAK} | Output Transistor Leakage Current | $V = +30\text{V}$ | 1 or 3 | | | 2 | μA |
| V_{TH} | Switching Threshold | | 12 | 90 | 110 | 130 | mV |
| R_n | Negative Resistance ⁽²⁾ | $5\text{k}\Omega < R_H < 50\text{k}\Omega$, $f = 100\text{kHz}$, $R_S = 0$ | | | $R_n = R_H$ | | |
| HYST | Inherent Hysteresis | $R_2 = 0$ | | | 1 | 2 | % |
| P_{HYST} | Programmed Hysteresis | $H < 15\%$ | | | $\frac{R_s}{R_s + R_H}$ | | % |
| f_{OSC} | Oscillation Frequency | | | | | 1 | MHz |
| F_{SW} | Switching Frequency | (with matched oscillator circuit) | | 750 | | | Hz |
| T_D | Switching Time-delay | | | $0.5C_d$ (μF) | | | s |
| T_{RE} | Switching Response Time | $C_d = 10\text{nF}$, $V_{CC} = +20\text{V}$ | | | 10 | | μs |

Note: 2. See Characteristics Curves

3 Operating Mode

If I_C exceeds $I_{CO} = V_{(ref)} / R_d$ the switch cuts off the output transistor and tests the value of current I_C , with time constant $0.5C_d$. On power up the internal start system cuts off the output transistors until V_{CC} reaches a value permitting normal operation of the circuit.

Figure 2. Switching Operation

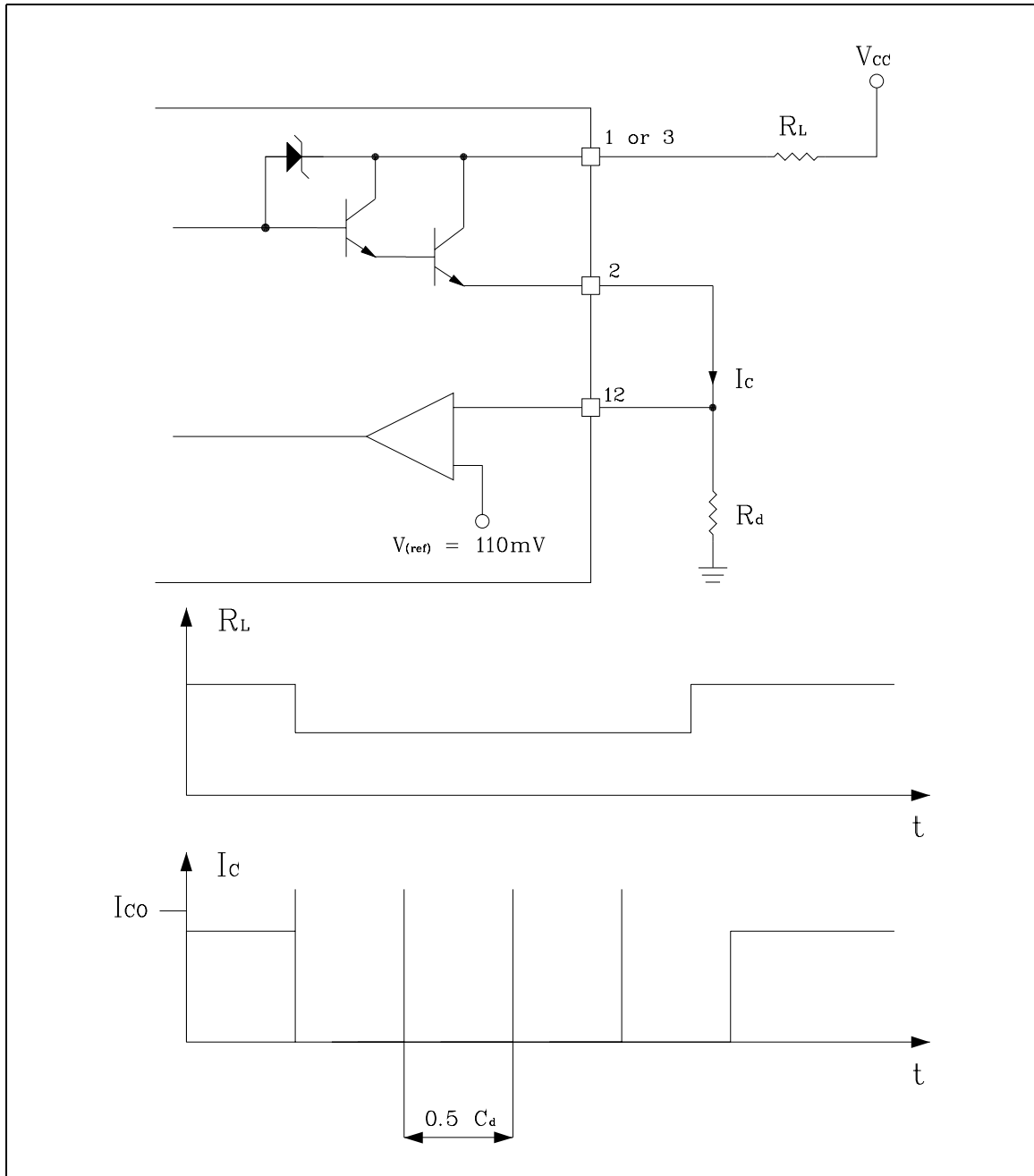


Figure 3. Negative resistance vs Frequency

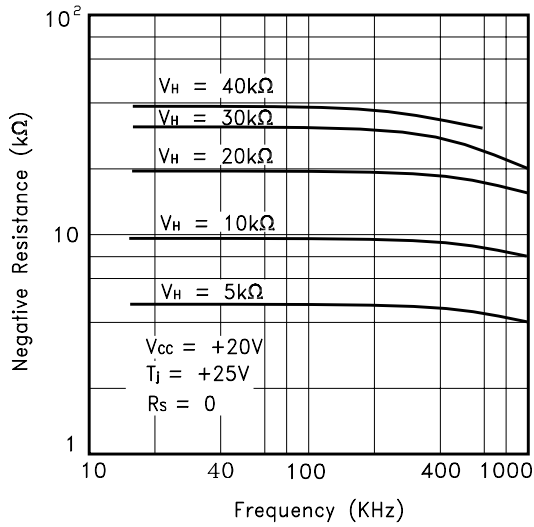


Figure 4. Zener voltage vs Junction Temp.

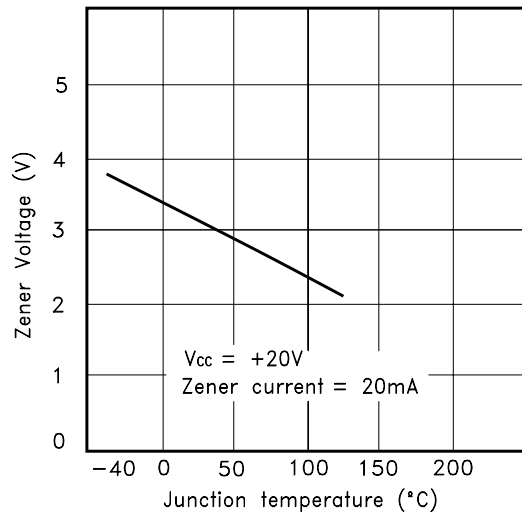


Figure 5. Switching threshold vs Junction temperature

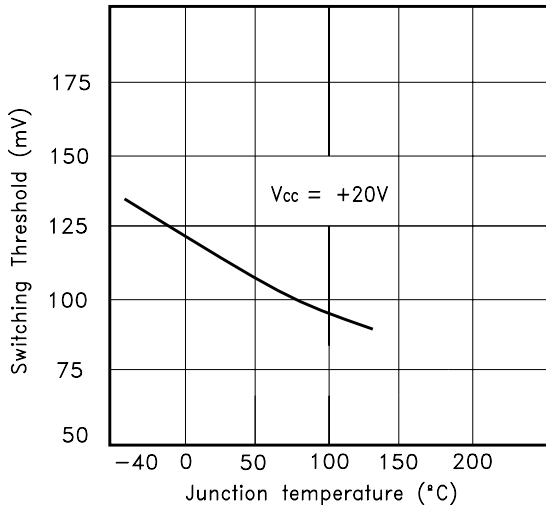


Figure 6. Negative resistance vs Junction temperature

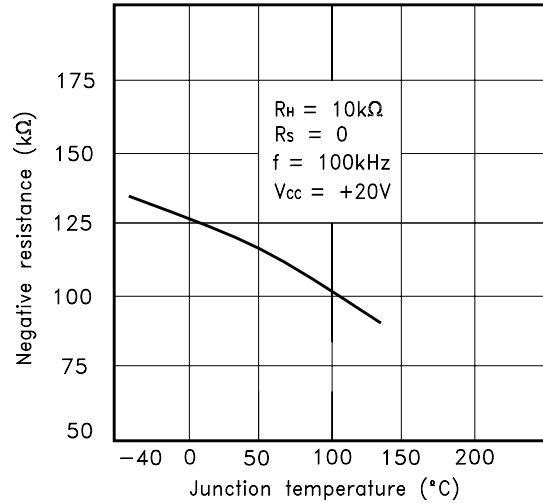


Figure 7. Loss resistance vs Detection Range

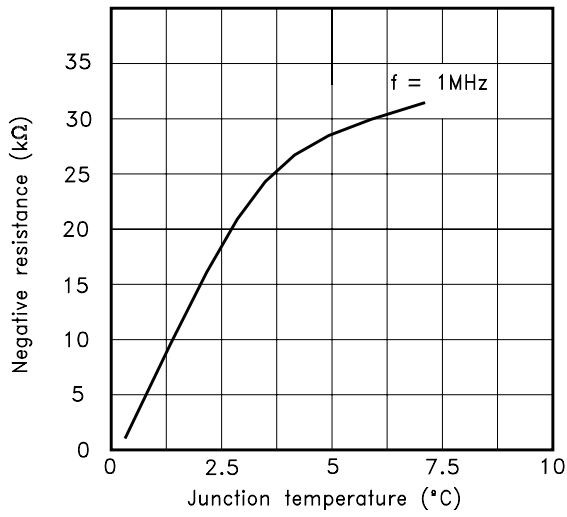
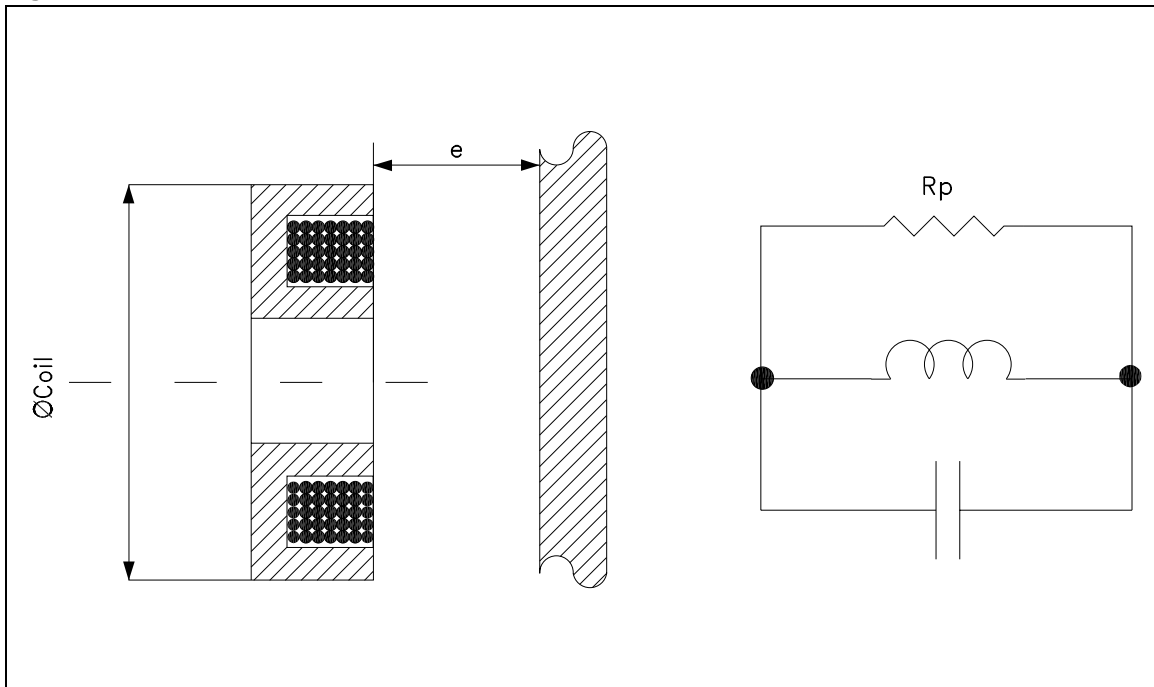


Figure 8. MILD Steel



4 Typical Applications

Table 3. Component Values (see figures 9, 10, 11)

| Symbol | Value | Unit |
|--------------|--------------------|------------|
| C_A | 10 | nF |
| C_f | 1 | nF |
| C_d | 10 | nF |
| C_O | 390 | pF |
| L_O | 65 μ H to 1MHz | |
| R_d | 10 | k Ω |
| R_H | 15 | k Ω |
| R_S | 3 | k Ω |
| R_L | 2.5 | k Ω |
| V_{CC} | 20 | V |
| f_O | ~1 | MHz |
| e_{mean} | 2.5 | mm |
| Φ coil | 14 | mm |
| Core COFELEC | 432FP | |
| Straded wire | 15 x 5/100 | |

Figure 9. Application Scheme (A)

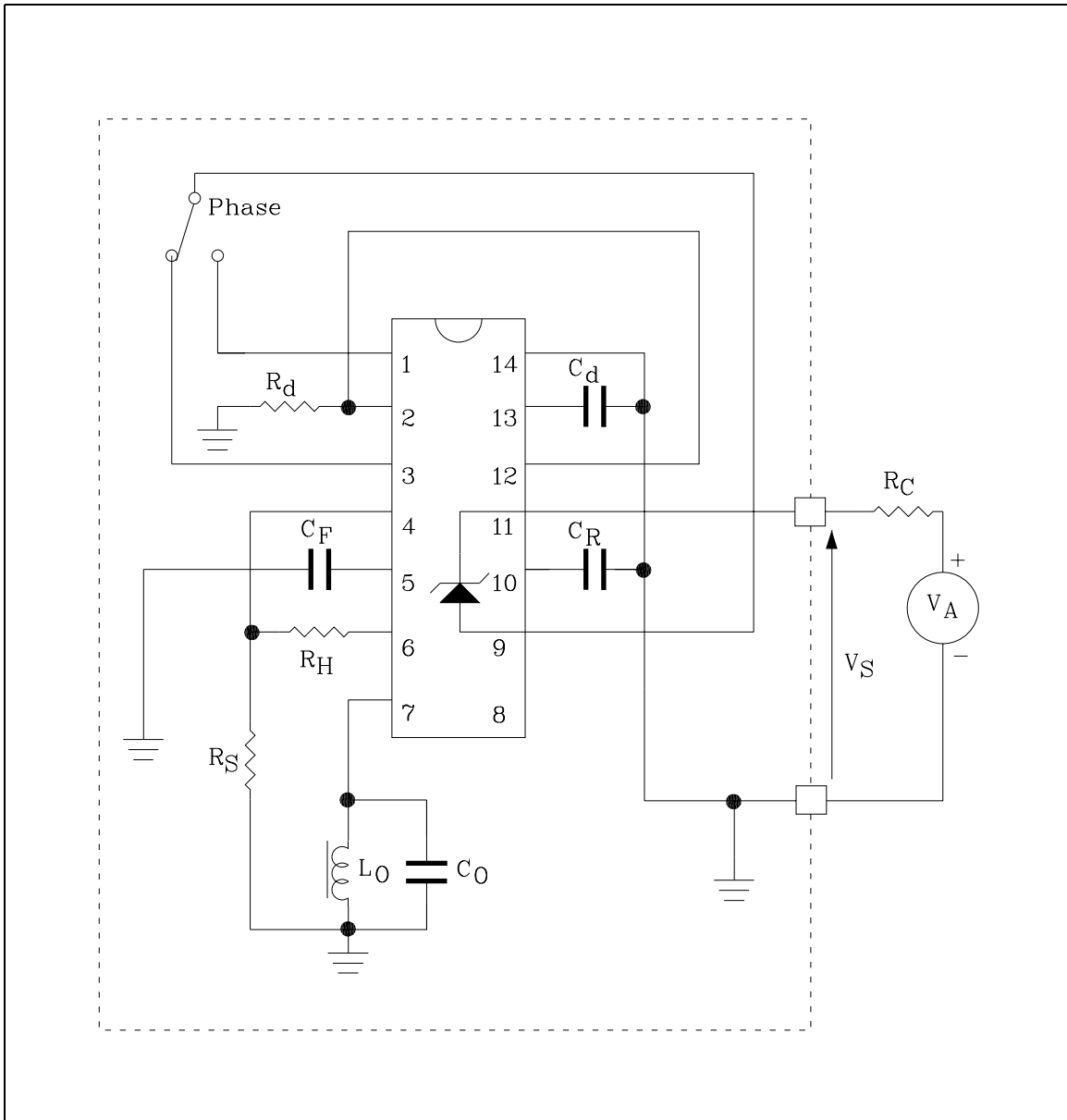


Figure 10. Application Scheme (B)

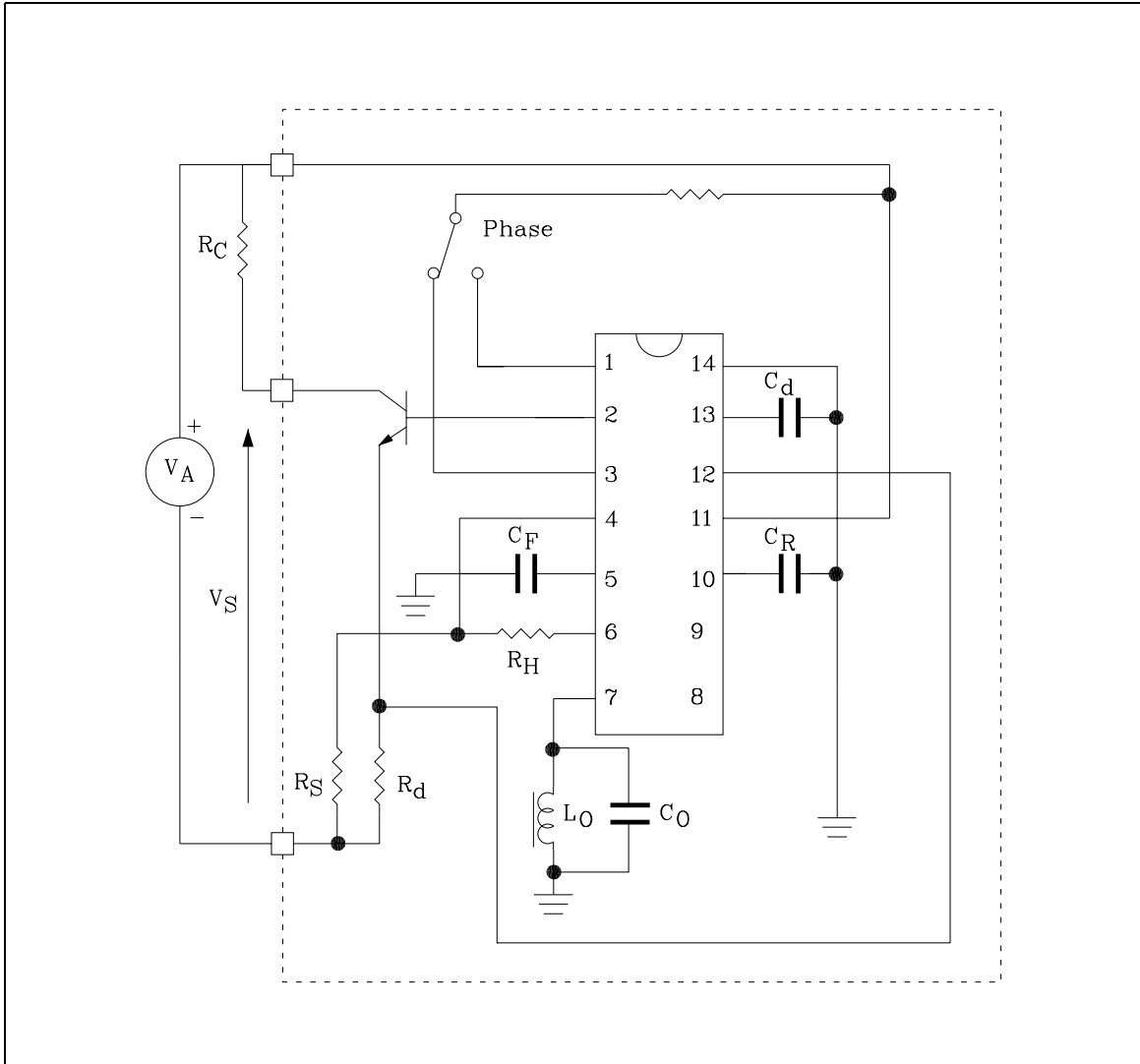
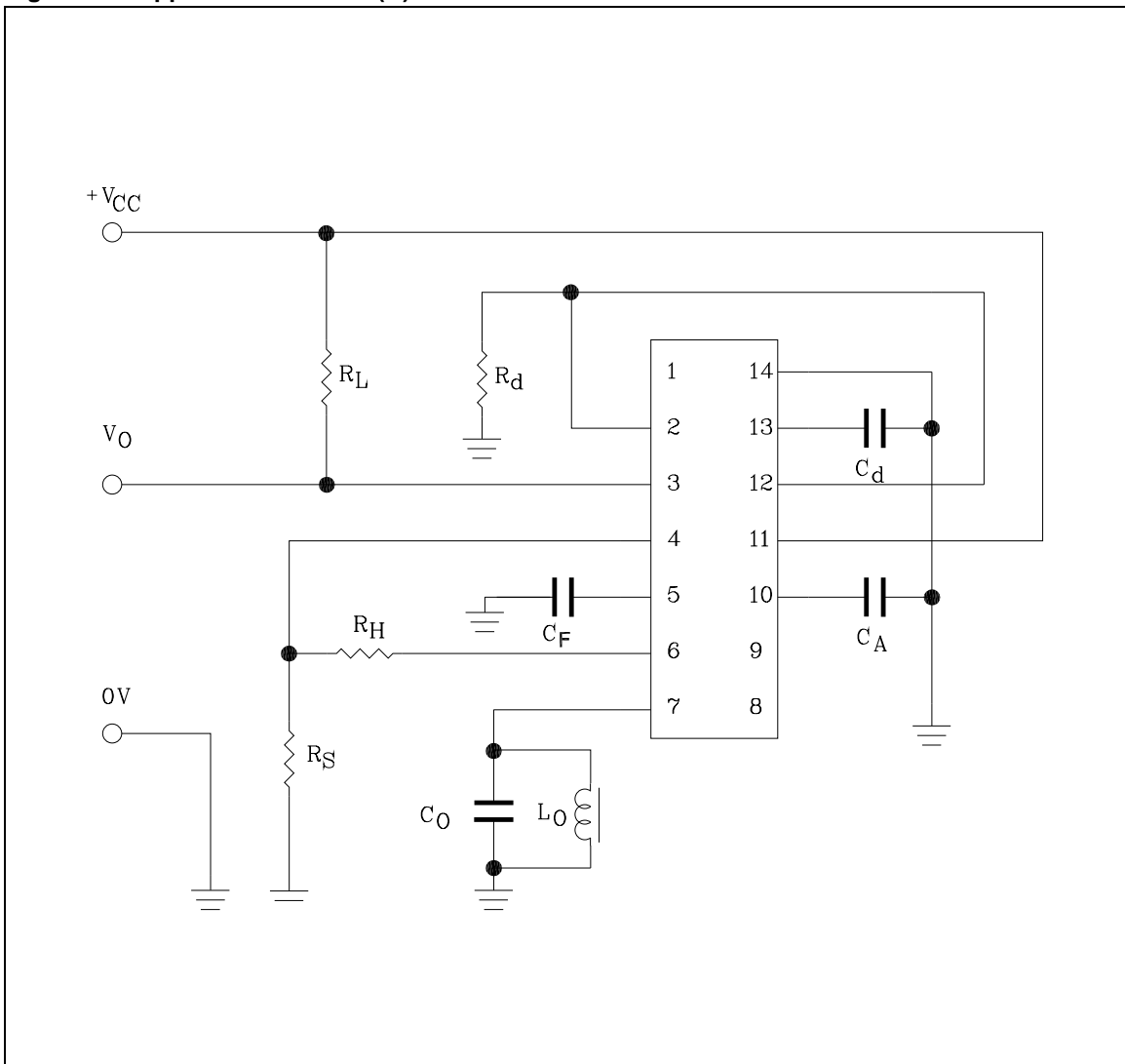


Figure 11. Application Scheme (C)

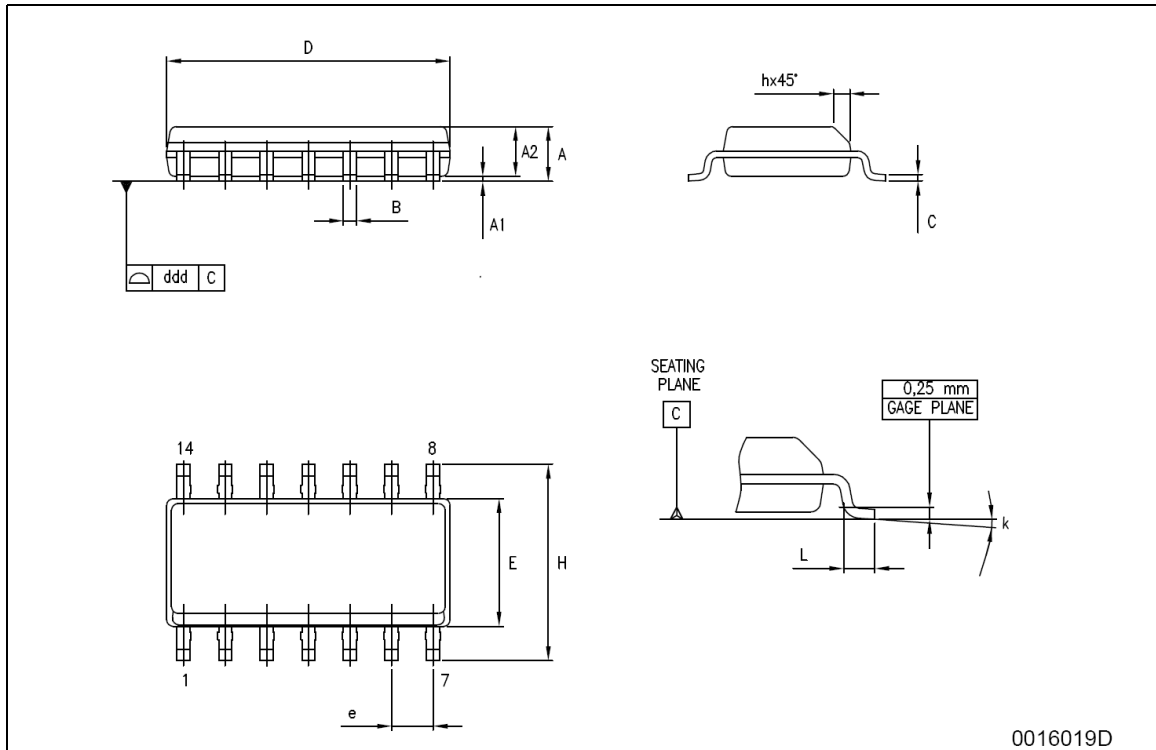


5 Package Mechanical Data

Table 4. SO14 Mechanical Data

| Dim. | mm. | | | inch | | |
|------|------|------|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 1.35 | | 1.75 | 0.053 | | 0.069 |
| A1 | 0.1 | | 0.25 | 0.004 | | 0.010 |
| A2 | 1.10 | | 1.65 | 0.043 | | 0.065 |
| B | 0.33 | | 0.51 | 0.013 | | 0.020 |
| C | 0.19 | | 0.25 | 0.007 | | 0.010 |
| D | 8.55 | | 8.75 | 0.337 | | 0.344 |
| E | 3.8 | | 4.0 | 0.150 | | 0.157 |
| e | | 1.27 | | | 0.050 | |
| H | 5.8 | | 6.2 | 0.228 | | 0.244 |
| h | 0.25 | | 0.50 | 0.010 | | 0.020 |
| L | 0.4 | | 1.27 | 0.016 | | 0.050 |
| k | 0° | | 8° | 0° | | 8° |
| ddd | | | 0.100 | | | 0.004 |

Figure 12. Package Dimension



0016019D

Table 5. Tube Shipment Information

| Tube Mechanical Data | | |
|----------------------|------------|--------------|
| | mm. | inch. |
| A | 6.60 ±0.10 | 0.260 ±0.004 |
| B | 1.90 ±0.10 | 0.075 ±0.004 |
| C | 0.60 ±0.10 | 0.024 ±0.004 |
| D | 7.80 ±0.10 | 0.307 ±0.004 |
| E | 4.30 ±0.10 | 0.169 ±0.004 |
| BASE QUANTITY | 100 pcs. | |
| BULK QUANTITY | 2000 pcs. | |

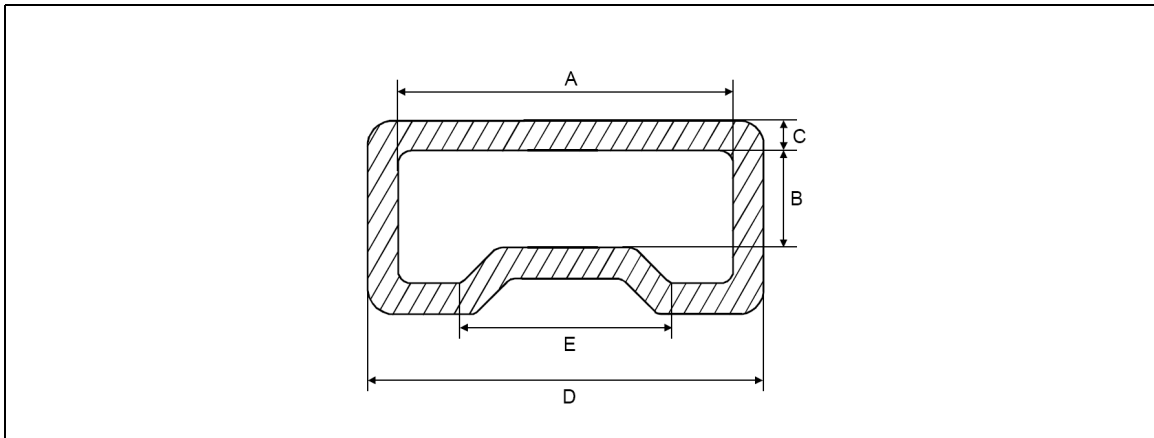
Figure 13. Tube Dimension

Table 6. Tape & Reel Shipment Information

| TAPE MECHANICAL DATA | | |
|----------------------|-----------------------|-------------------------|
| | mm. | inch |
| D | 1.50 +0.1/0 | 0.059 +0.004/0 |
| E | 1.75 ±0.1 | 0.069 ±0.004 |
| Po | 4.00 ±0.1 | 0.157 ±0.004 |
| T max. | 0.40 | 0.016 |
| D1 min. | 1.50 | 0.059 |
| F | 7.5 ±0.05 | 0.295 ±0.002 |
| K max. | 6.50 | 0.256 |
| P2 | 2.00 ±0.05 | 0.079 ±0.002 |
| R | 40 | 1.575 |
| W | 16.00 ±0.30 | 0.630 ±0.012 |
| P1 | 12.00 | 0.472 |
| Ao, Bo, Ko | 0.05 min to 0.90 max. | 0.002 min to 0.035 max. |

Figure 14. Tape Specification

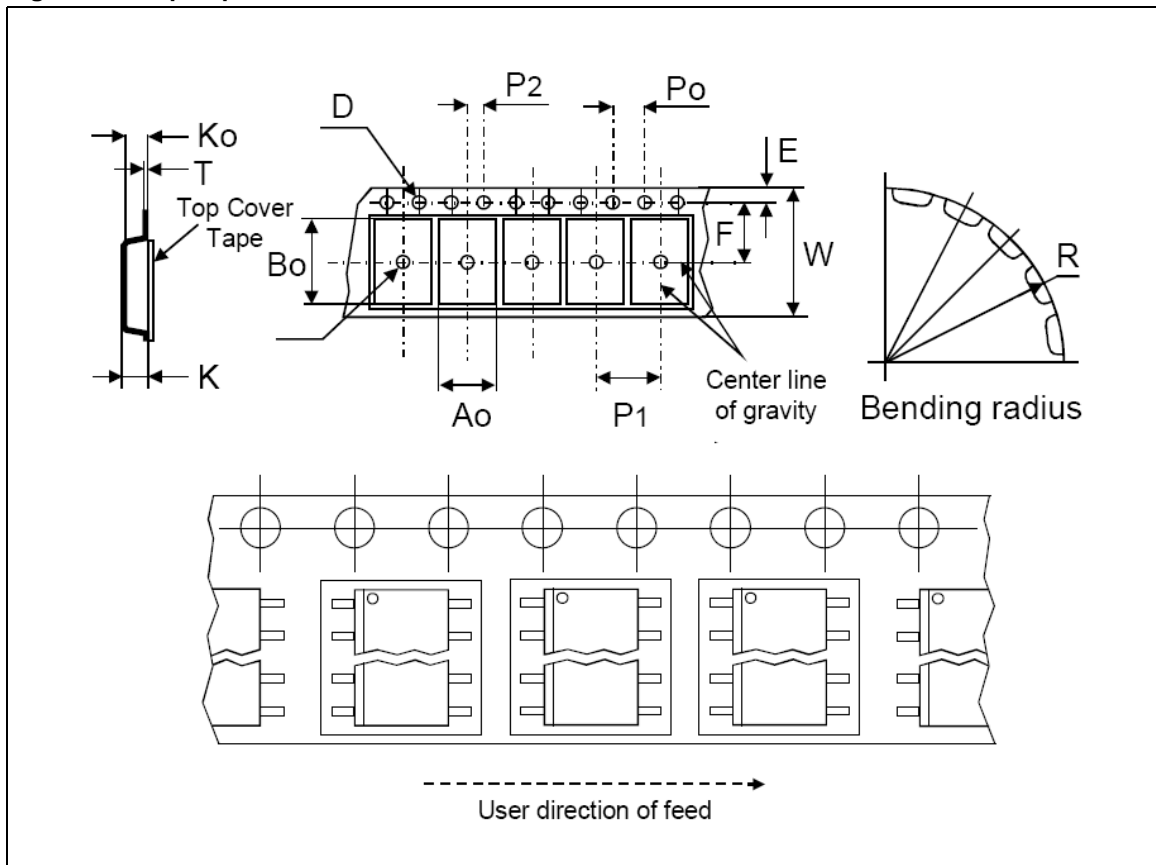
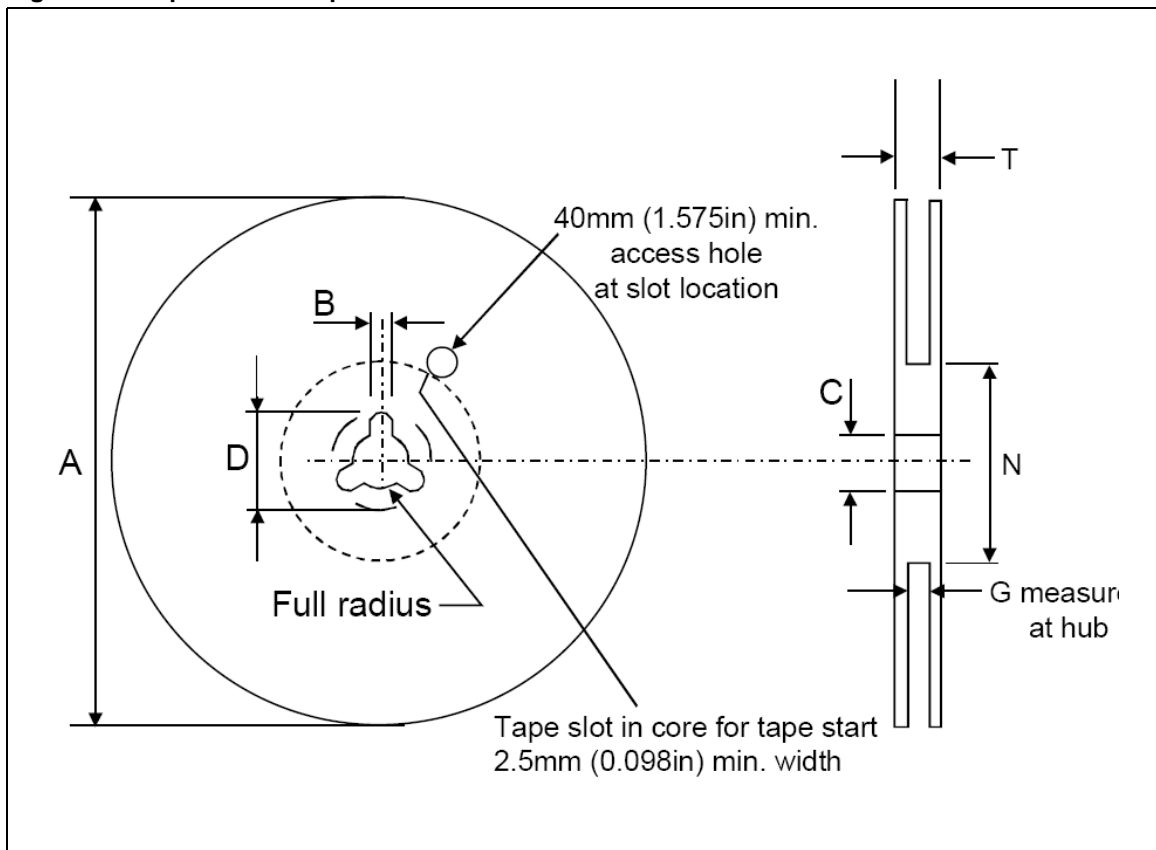


Table 7. Reel Mechanical Data

| | mm. | inch |
|-----------|------------|-----------------|
| Tape size | 16.0 ±0.30 | 0.630 ±0.012 |
| A max. | 330.0 | 12.992 |
| B min. | 1.5 | 0.059 |
| C | 13.0 ±0.20 | 0.512 ±0.008 |
| D min. | 20.2 | 0.795 |
| N min. | 60 | 2.362 |
| G | 16.4 +2/-0 | 0.646 +0.079/-0 |
| T max. | 22.4 | 0.882 |

Figure 15. Tape & Reel Shipment Information



6 Order codes

| Part number | Temp range | Package | Packing |
|-------------|------------|---------|---------------|
| TDE0160FP | 150°C | SO14 | Tube |
| TDE0160FPT | 150°C | SO14 | Tape and Reel |

7 Revision history

| Date | Revision | Changes |
|-------------|----------|----------------|
| 18-Nov-2005 | 2 | Final release. |

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