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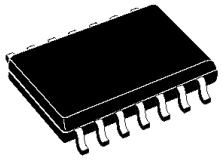
TDE0160

Proximity Detectors

Features

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



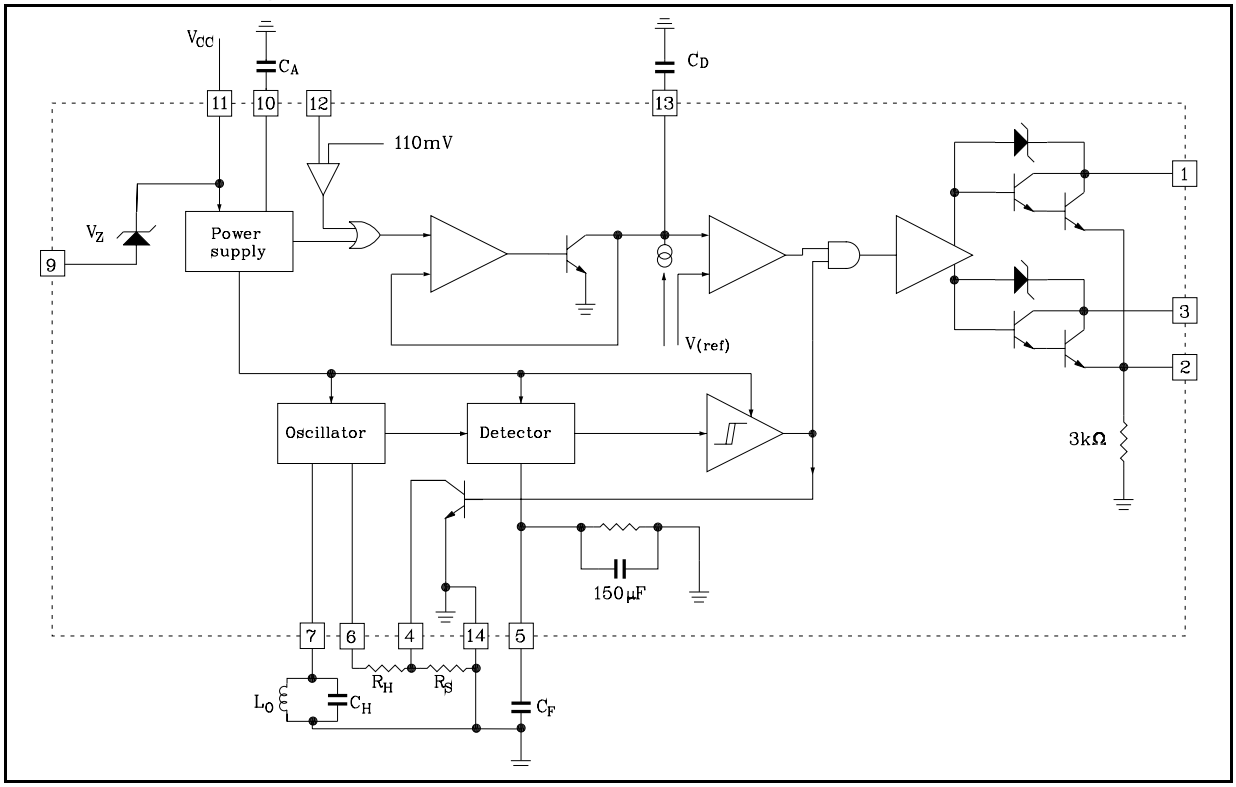
SO14

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.

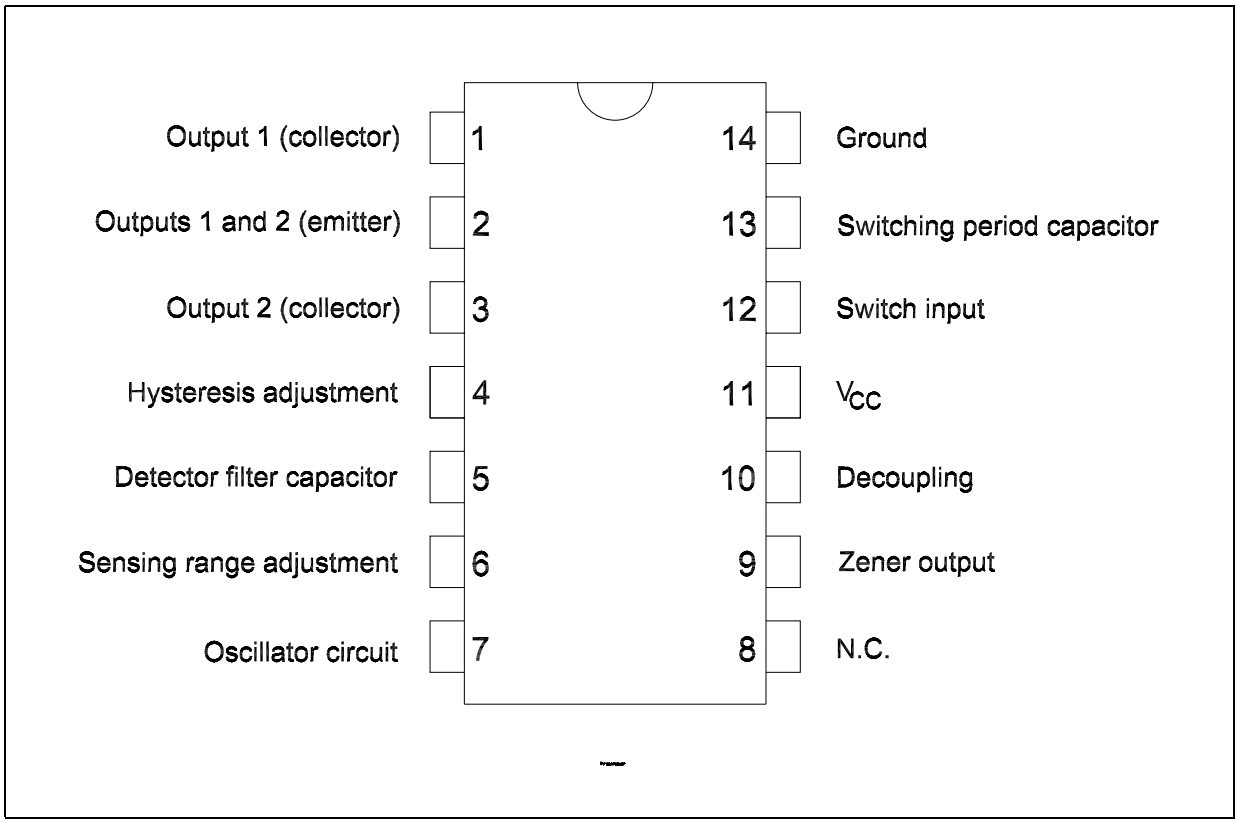
Schematic Diagram



Contents

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°C, unless otherwise specified.

Table 2. Electrical Characteristcs

Symbol	Parameter	Test conditions	Pin	Min.	Typ.	Max.	Unit
V_{CC}	Supply Voltage		11	4		36	V
V_Z	Zener Voltage	I_Z = 20mA	9 - 11	3		4	V
I_{CC}	Supply Current		11			1.2	mA
V_{LIM}	Limiting	I = 0.1mA	1 or 3		42		V
V_{SAT}	Output Transistor Saturation Voltage	I_1 or I_3 = +20mA	1 or 3		0.9	1.1	V
I_{LEAK}	Output Transistor Leakage Current	V = +30V	1 or 3			2	µA
V_{TH}	Switching Threshold		12	90	110	130	mV
R_n	Negative Resistance (2)	5kΩ < R_H < 50kΩ, f = 100kHz, 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 = 10nF, V_{CC} = +20V			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 costant $0.5C_d$ 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

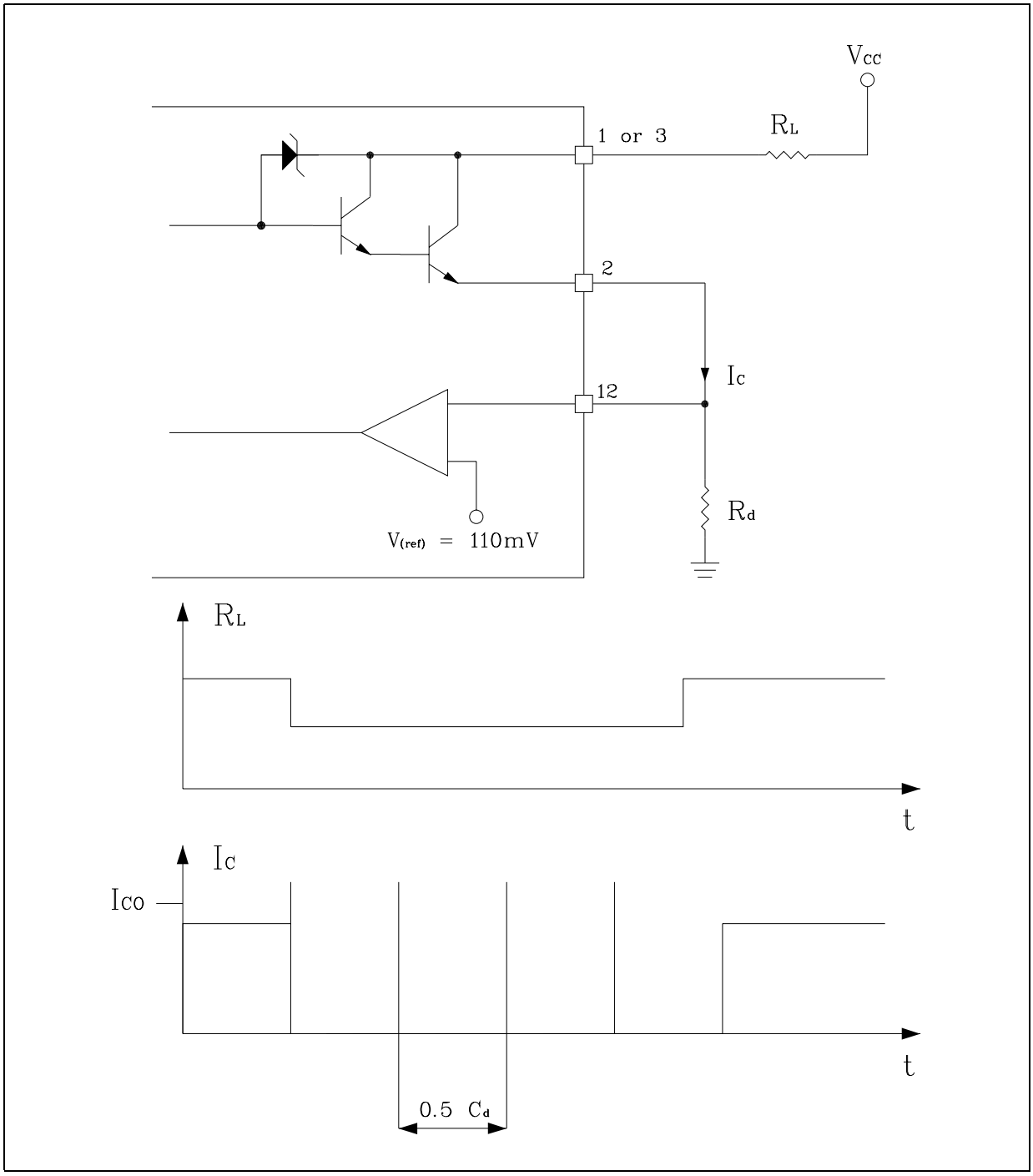


Figure 3. Negative resistence vs Frequency

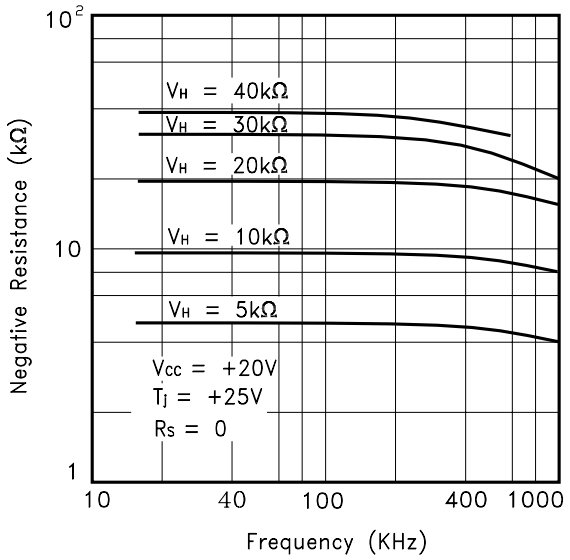


Figure 4. Zener voltage vs Junction Temp.

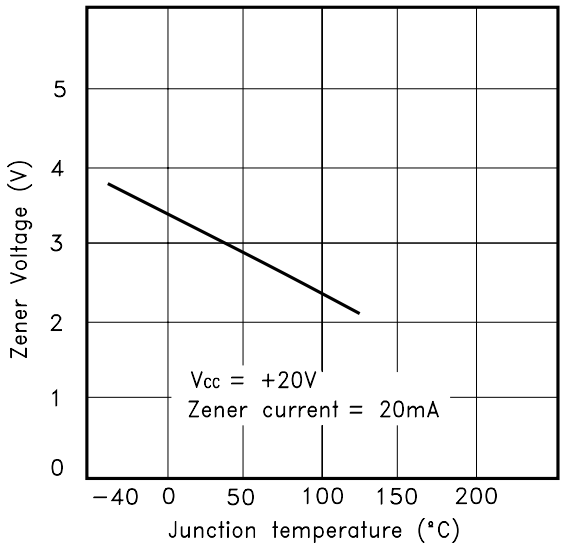


Figure 5. Switching threshold vs Junction temperature

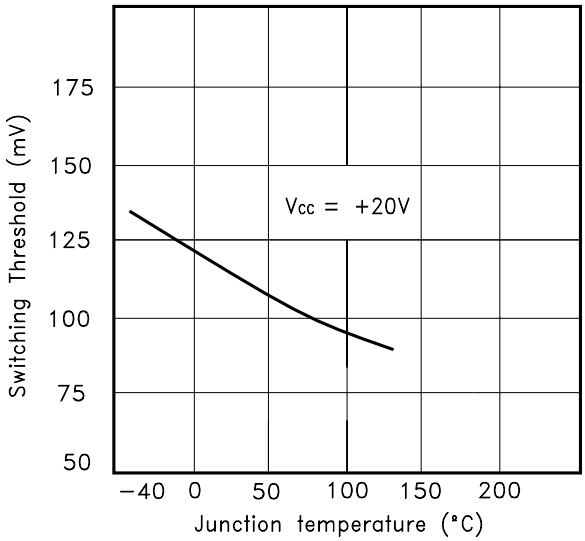


Figure 6. Negative resistance vs Junction temperature

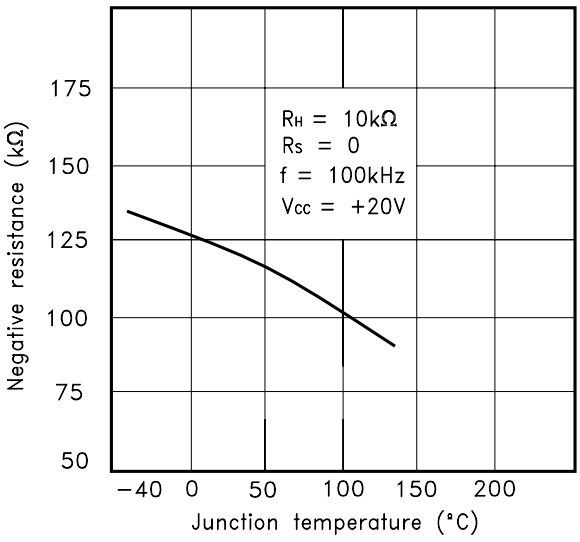


Figure 7. Loss resistance vs Detection Range

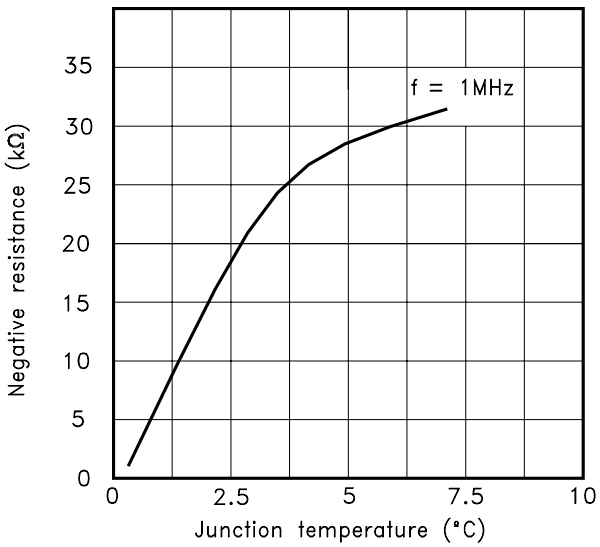
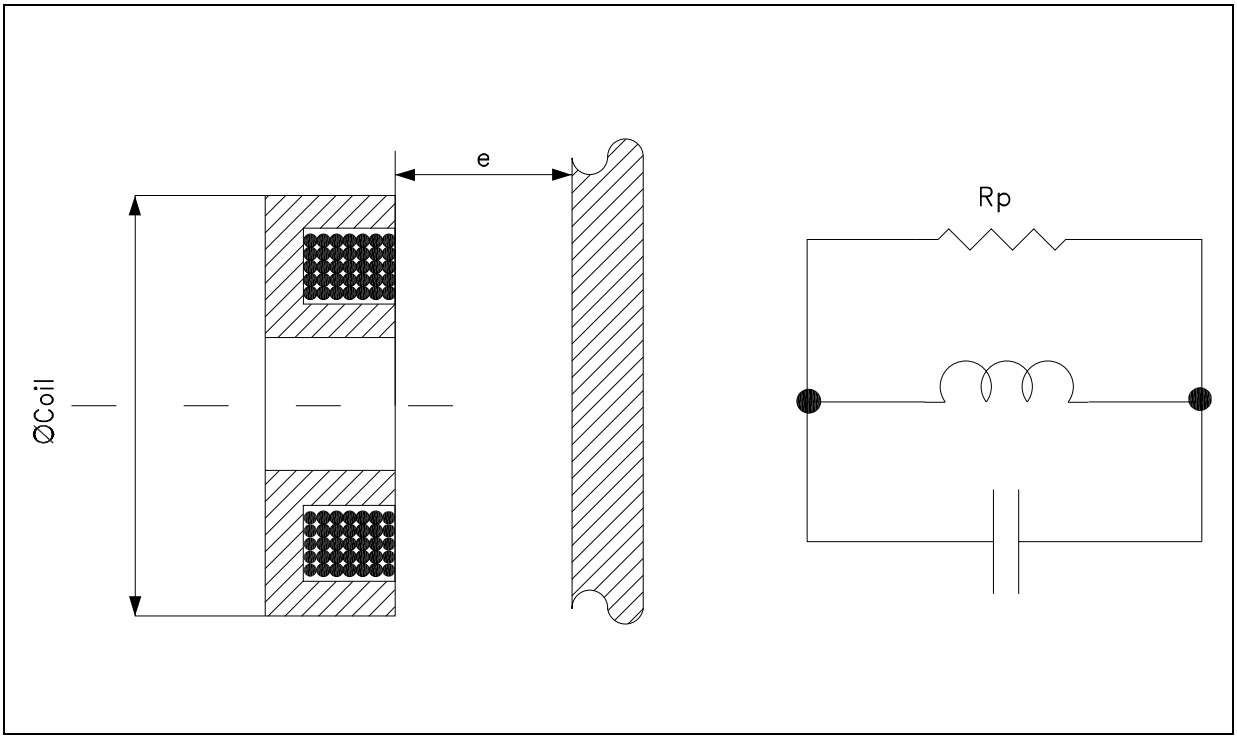


Figure 8. MILD Steel



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	65µH to 1MHz	
R_d	10	kΩ
R_H	15	kΩ
R_S	3	kΩ
R_L	2.5	kΩ
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)

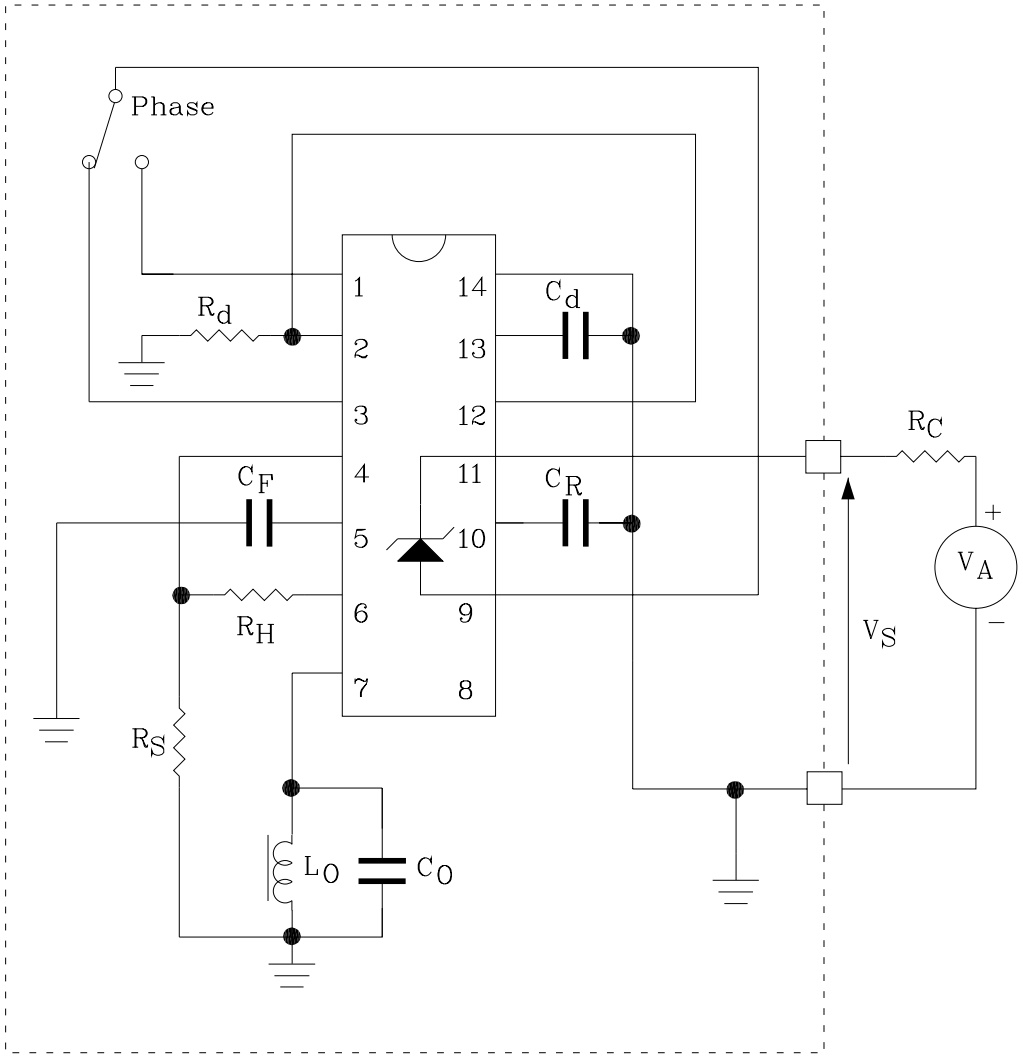


Figure 10. Application Scheme (B)

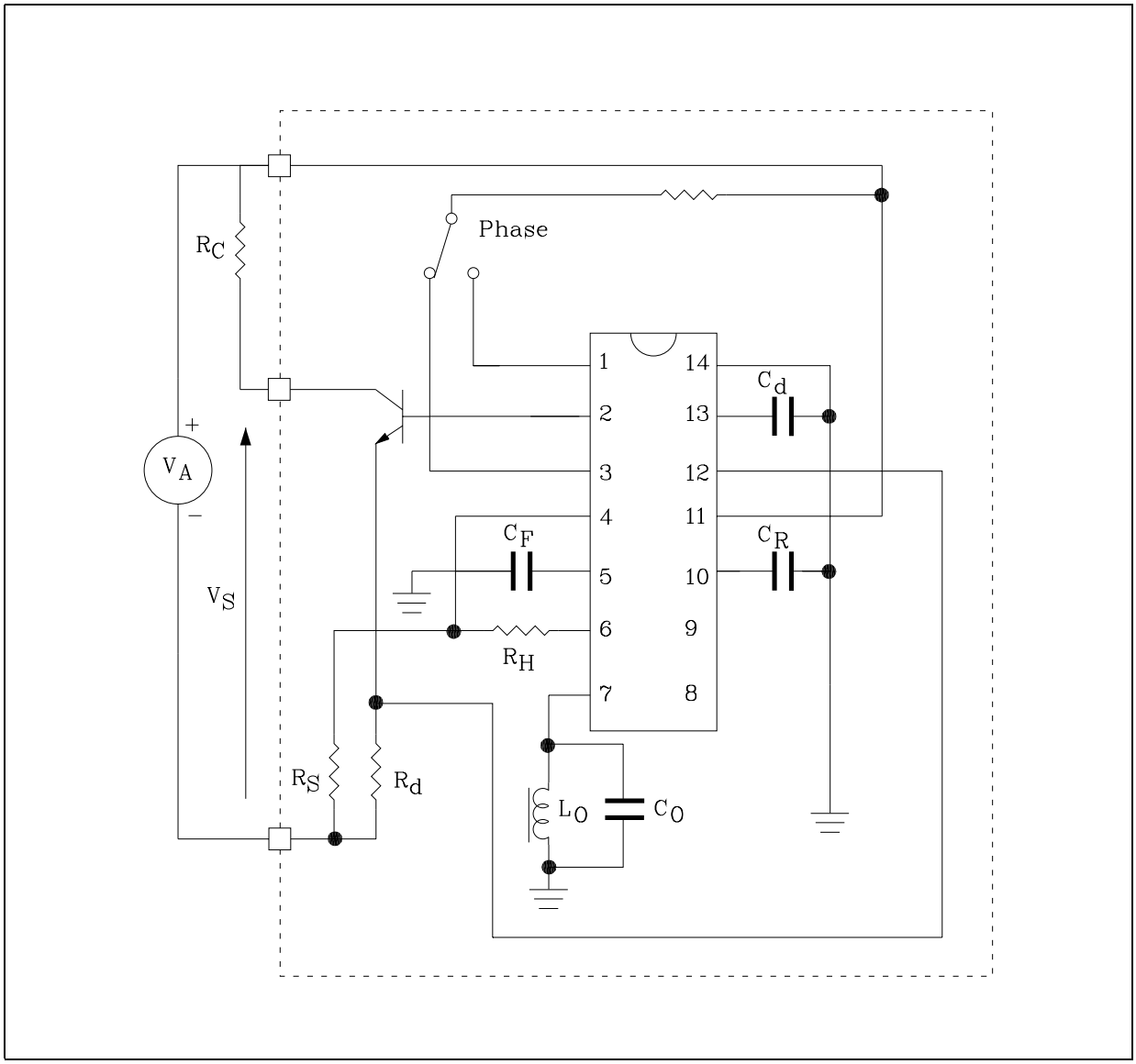
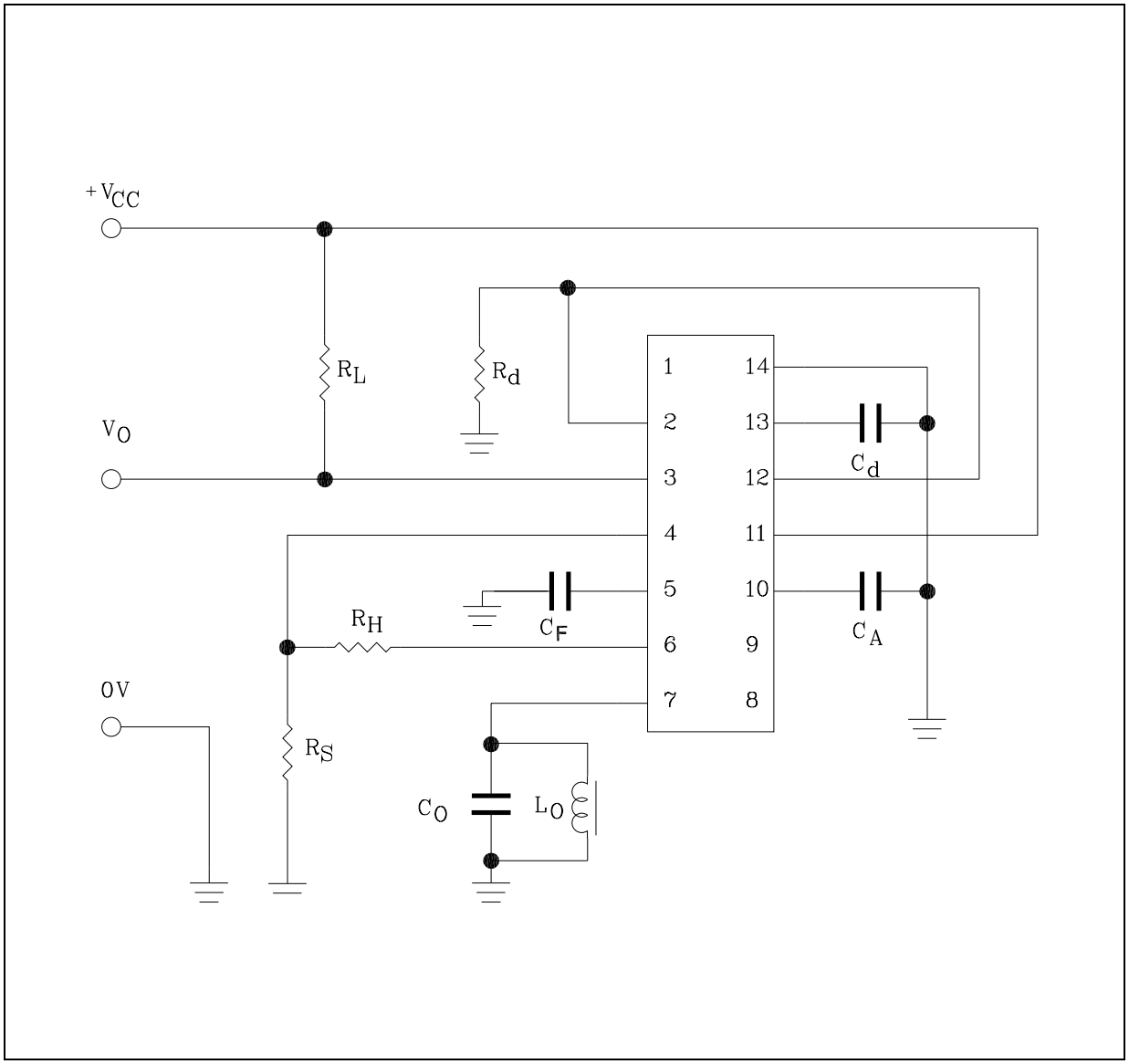


Figure 11. Application Scheme (C)



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

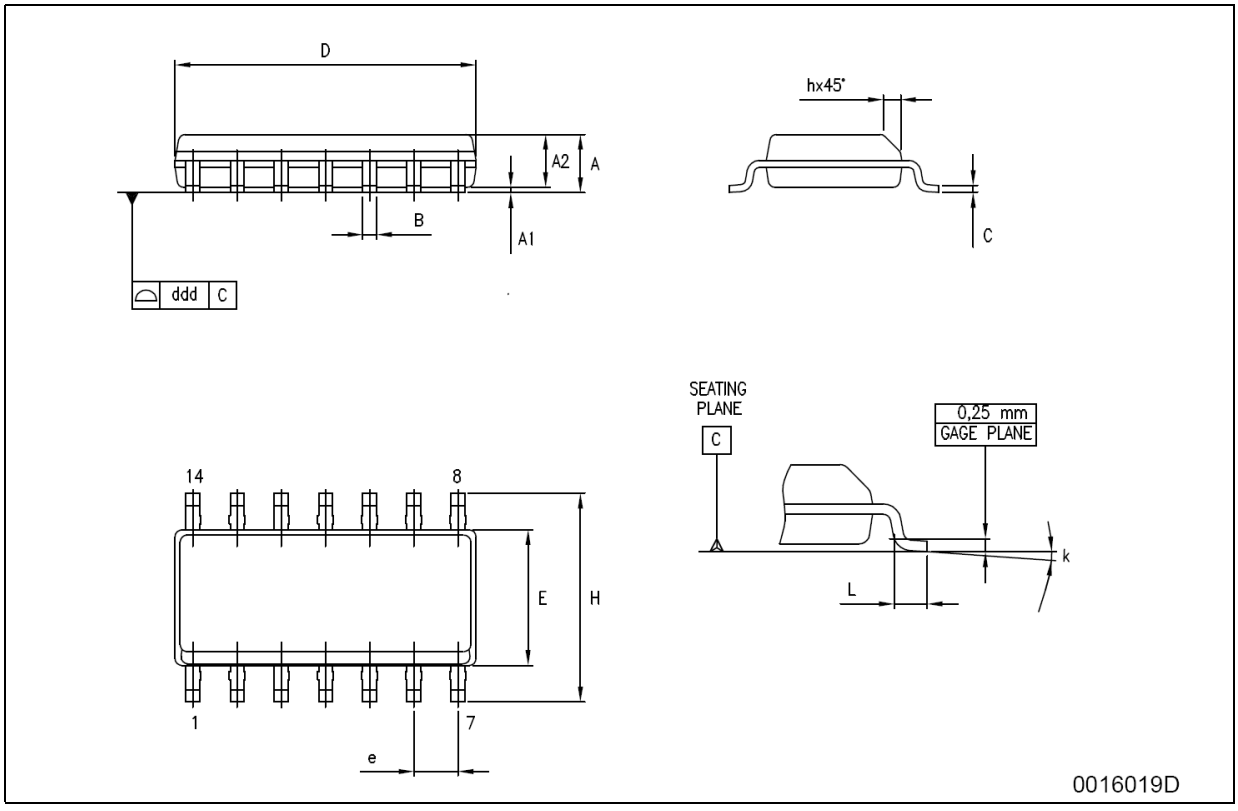


Table 5. Tube Shipment Information

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

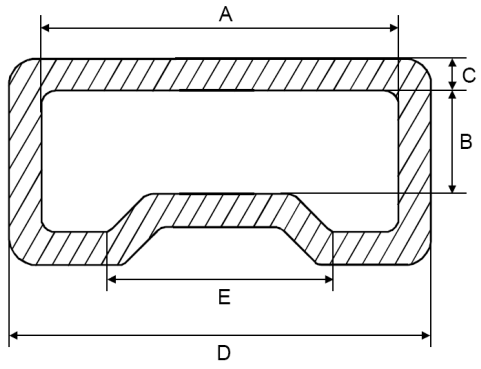


Table 6. Tape & Reel Shipment Information

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

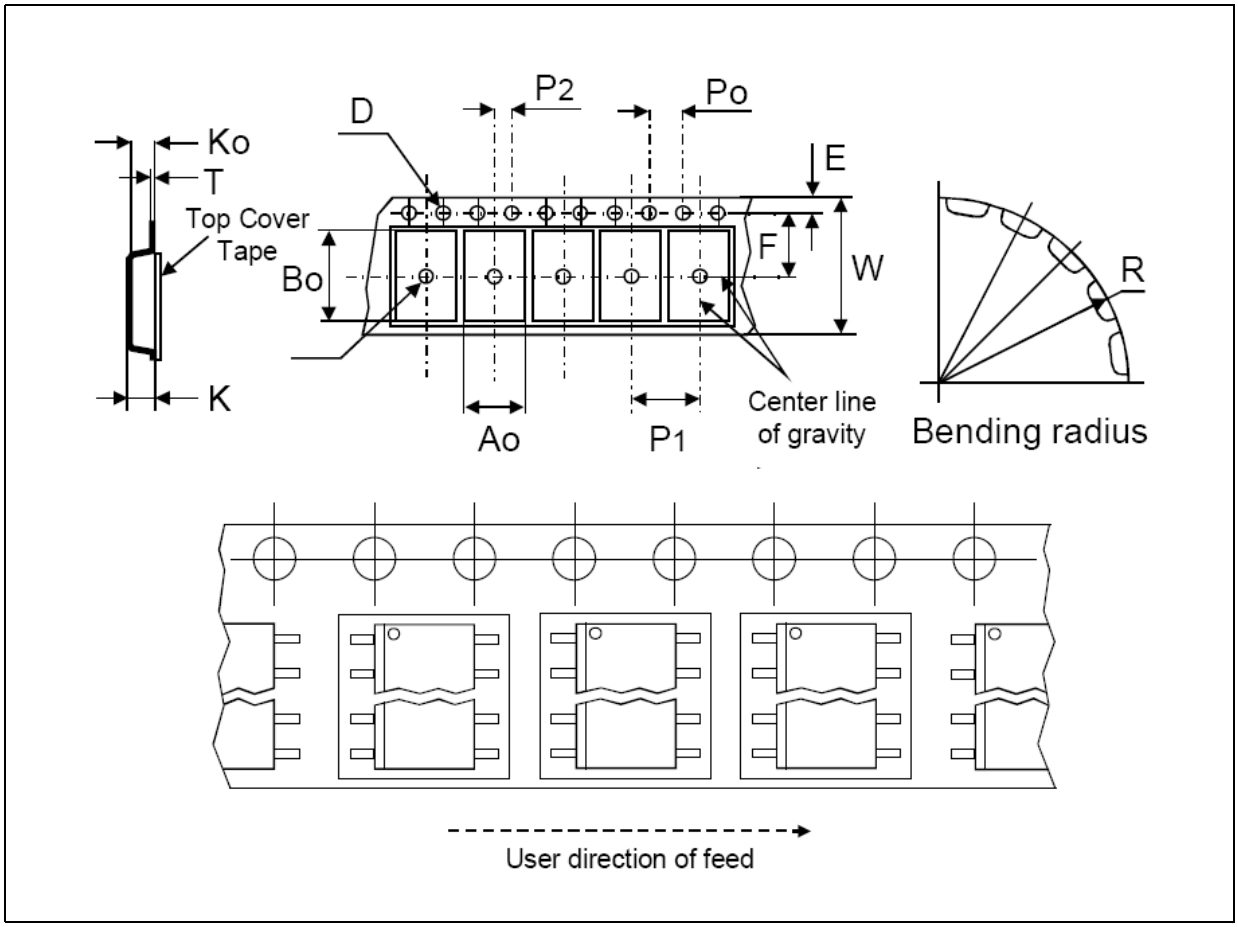
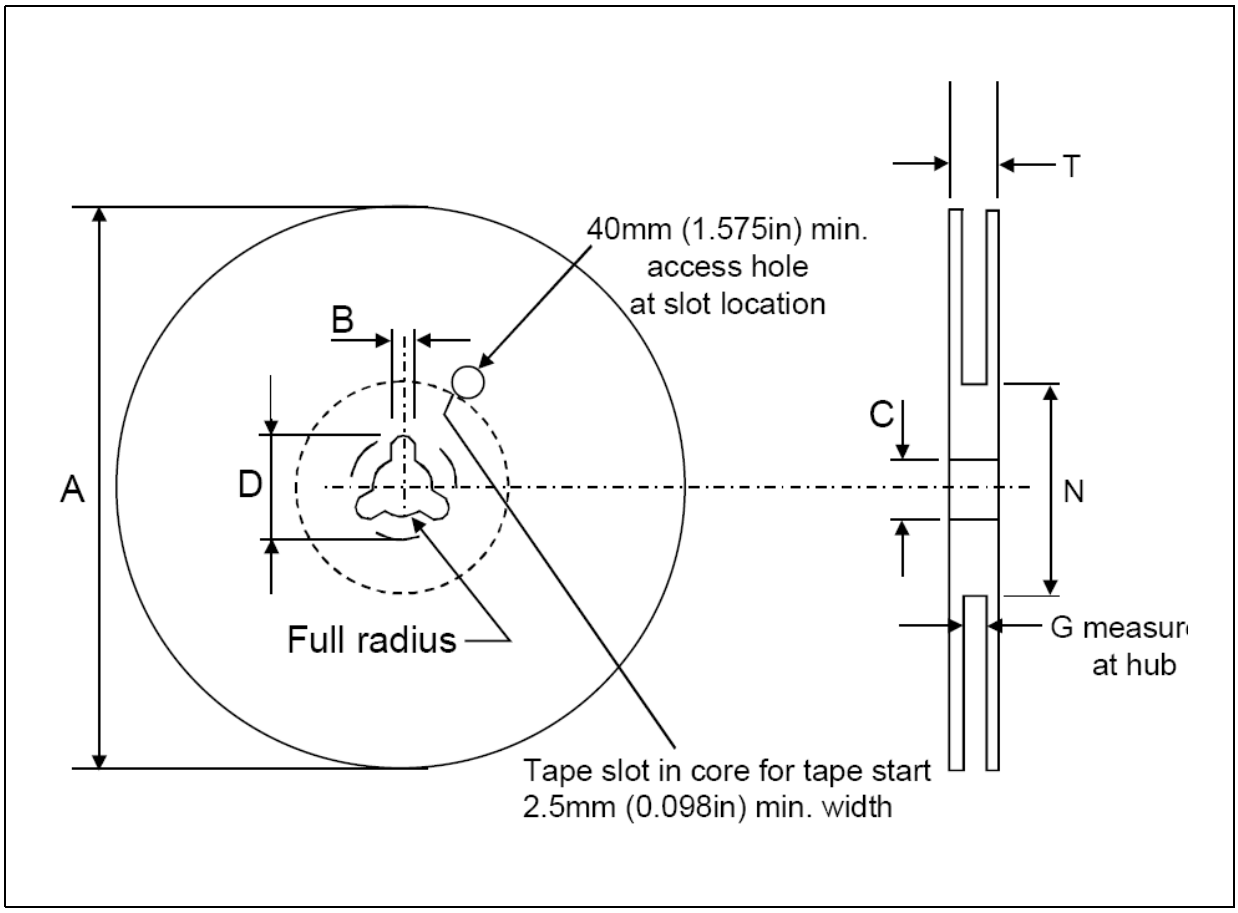


Table 7. Reel Mechanical Data

	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.