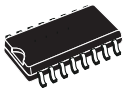
74VHCT257A

Quad 2 channel multiplexer (3-state)

Datasheet −production data

Features

- High speed: t_{PD} = 4.8 ns (typ.) at V_{CC} = 5 V
- Low power dissipation
  I_{CC} = 4 µA (max.) at T_A = 25 °C
- Compatible with TTL outputs
  V_{IH} = 2 V (min.), V_{IL} = 0.8 V (max.)
- Power-down protection on inputs and outputs
- Symmetrical output impedance
  $|I_{OH}| = I_{OL}$ = 8 mA (min.)
- Balanced propagation delays: $t_{PLH} \cong t_{PHL}$
- Operating voltage range: $V_{CC(opr)}$ = 4.5 to 5.5 V
- Pin and function compatible with 74 series 257
- Improved latch-up immunity
- Low noise: V_{OLP} = 0.8 V (max.)



SO-16

Table 1. Order code

Package	Tape and reel
SO-16	74VHCT257AMTR

Description

The 74VHCT257A is an advanced high-speed CMOS quad 2 channel multiplexer (3-state) fabricated with sub-micron silicon gate and double-layer metal wiring C^2MOS technology.

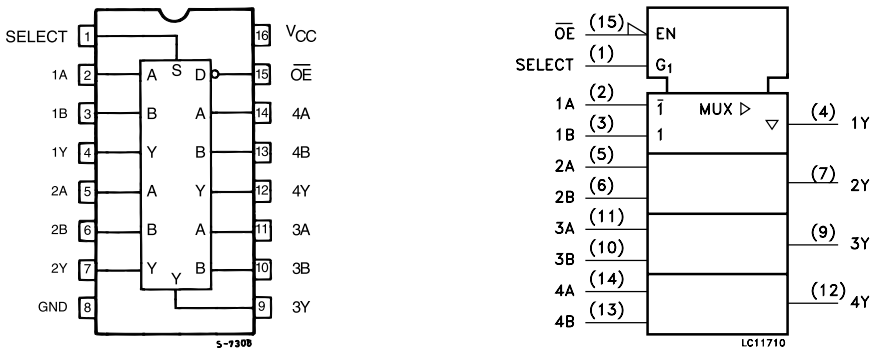
It is composed of four independent 2 channel multiplexers with common select and enable input ($\overline{OE}$). The VHCT257A is a non-inverting multiplexer.

When the enable input is held “high”, all outputs become high impedance state. If the select input is held “low”, “A” data is selected, when select input is “high”, “B” data is chosen.

Power-down protection is provided on all inputs and outputs and 0 to 7 V can be accepted on inputs with no regard to the supply voltage. This device can be used to interface 5 V to 3 V since all inputs are equipped with TTL threshold.

All inputs and outputs are equipped with protection circuits against static discharge, giving them 2 KV ESD immunity and transient excess voltage.

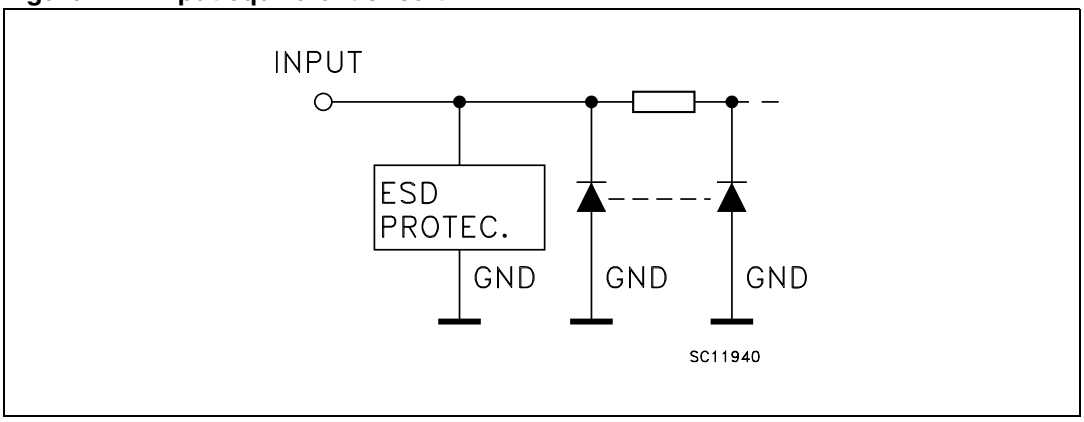
Figure 1. Pin connection and IEC logic symbols



AM00465

1 Input equivalent circuit

Figure 2. Input equivalent circuit



2 Pin settings

Table 2. Pin description

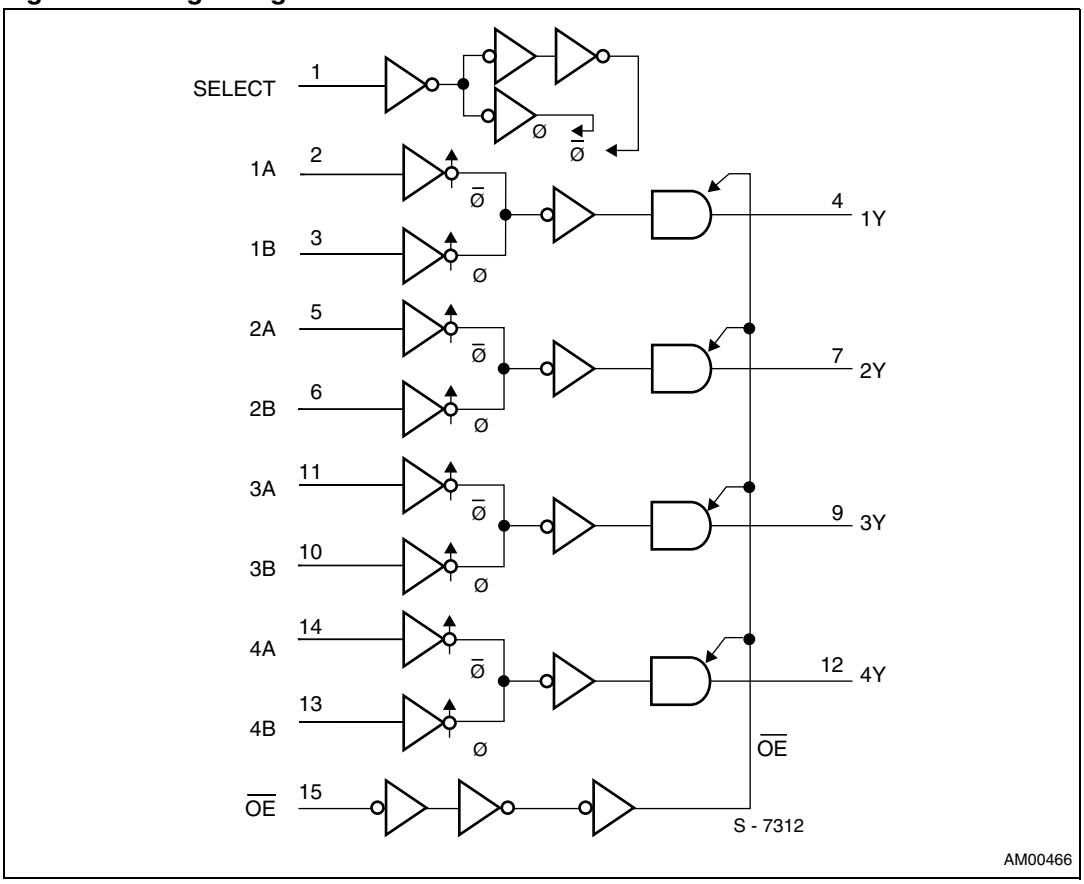
Pin No	Symbol	Name and function
1	SELECT	Common data select inputs
2, 5, 11, 14	1A to 4A	Data inputs from source A
3, 6, 10, 13	1B to 4B	Data inputs from source B
4, 7, 9, 12	1Y to 4Y	3-state multiplexer outputs
15	$\overline{OE}$	3-state output enable inputs (active LOW)
8	GND	Ground (0 V)
16	V_{CC}	Positive supply voltage

Table 3. Truth table

Inputs				Output
$\overline{OE}$	SELECT	A	B	Y
H	X(1)	X(1)	X(1)	Z(2)
L	L	L	X(1)	L
L	L	H	X(1)	H
L	H	X(1)	L	L
L	H	X(1)	H	H

1. “Don’t care”.
2. High impedance.

Figure 3. Logic diagram



1. This logic diagram has not be used to estimate propagation delays.

3 Maximum ratings

Table 4. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	-0.5 to +7.0	V
V_I	DC input voltage	-0.5 to +7.0	V
V_O	DC output voltage(1)	-0.5 to +7.0	V
V_O	DC output voltage(2)	-0.5 to V_{CC} + 0.5	V
I_{IK}	DC input diode current	- 20	mA
I_{OK}	DC output diode current	±20	mA
I_O	DC output current	±25	mA
I_{CC} or I_{GND}	DC V_{CC} or ground current	±50	mA
T_{stg}	Storage temperature	-65 to +150	°C
T_L	Lead temperature (10 sec.)	300	°C

1. Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied: output in OFF state.
2. Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied: high or low state.

Table 5. Recommended operating conditions

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	4.5 to 5.5	V
V_I	Input voltage	0 to 5.5	V
V_O	Output voltage(1)	0 to 5.5	V
V_O	Output voltage (2)	0 to V_{CC}	V
T_{op}	Operating temperature	-55 to 125	°C
dt/dv	Input rise and fall time(3) (V_{CC} = 5.0 ±0.5 V)	0 to 20	ns/V

1. Output in OFF state.
2. High or low state.
3. V_{IN} from 0.8 V to 2 V.

4 Electrical characteristics

Table 6. DC specifications

Symbol	Parameter	Test condition		Value							Unit
		V_{CC} (V)		T_A = 25 °C			-40 to 85 °C		-55 to 125 °C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{IH}	High level input voltage	4.5 to 5.5		2			2		2		V
V_{IL}	Low level input voltage	4.5 to 5.5				0.8		0.8		0.8	V
V_{OH}	High level output voltage	4.5	I_O = -50 µA	4.4	4.5		4.4		4.4		V
		4.5	I_O = -8 mA	3.94			3.8		3.7		
V_{OL}	Low level output voltage	4.5	I_O = 50 µA		0.0	0.1		0.1		0.1	V
		4.5	I_O = 8 mA			0.36		0.44		0.55	
I_{OZ}	High impedance output leakage current	5.5	$V_I = V_{IH}$ or V_{IL} V_O = 0 V to 5.5 V			±0.25		±2.5		±2.5	µA
I_I	Input leakage current	0 to 5.5	V_I = 5.5 V or GND			±0.1		±1.0		±1.0	µA
I_{CC}	Quiescent supply current	5.5	$V_I = V_{CC}$ or GND			4		40		40	µA
$+I_{CC}$	Additional worst case supply current	5.5	One input at 3.4 V, other input at V_{CC} or GND			1.35		1.5		1.5	mA
I_{OPD}	Output leakage current	0	V_{OUT} = 5.5 V			0.5		5.0		5.0	µA

Table 7. AC electrical characteristics (input $t_r = t_f = 3$ ns)

Symbol	Parameter	Test condition		Value							Unit
		V_{CC}[1] (V)	C_L (pF)	T_A = 25 °C			-40 to 85 °C		-55 to 125 °C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{PLH} t_{PHL}	Propagation delay time A, B, to Y	5.0	15		4.8	7.0	1.0	8.0	1.0	8.0	ns
		5.0	50		5.5	8.0	1.0	9.0	1.0	9.0	
t_{PLH} t_{PHL}	Propagation delay time SELECT to Y	5.0	15		6.0	6.8	1.0	8.0	1.0	8.0	ns
		5.0	50		7.0	8.8	1.0	10.0	1.0	10.0	
t_{PZL} t_{PZH}	Output enable time	5.0	15		5.8	6.8	1.0	8.0	1.0	8.0	ns
		5.0	50		6.5	8.8	1.0	10.0	1.0	10.0	
t_{PLZ} t_{PHZ}	Output disable time	5.0	50		5.7	7.9	1.0	9.0	1.0	9.0	ns

1. Voltage range is 5.0 V ± 0.5 V.

Table 8. Capacitive characteristics

Symbol	Parameter	Test condition	Value							Unit
			T_A = 25 °C			-40 to 85 °C		-55 to 125 °C		
			Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
C_{IN}	Input capacitance			4	10		10		10	pF
C_{OUT}	Output capacitance			6						pF
C_{PD}	Power dissipation capacitance[1]			23						pF

1. CPD is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to *Figure 5: Test circuit*). Average operating current can be obtained by equation: $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$ (per channel).

Table 9. Dynamic switching characteristics

Symbol	Parameter	Test condition		Value							Unit
		V_{CC} (V)		T_A = 25 °C			-40 to 85 °C		-55 to 125 °C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{OLP}	Dynamic low voltage quiet output[1],[2]	5.0	C_L = 50 pF		0.3	0.8					V
V_{OLV}				-0.8	-0.3						
V_{IHD}	Dynamic high voltage input[1],[3]	5.0		2.0							
V_{ILD}	Dynamic low voltage input[1],[3]	5.0				0.8					

1. Worst case package.
2. Max. number of outputs defined as (n). Data inputs are driven 0 V to 3.0 V, (n-1) outputs switching and one output at GND.
3. Max. number of data inputs (n) switching. (n-1) switching 0 V to 3.0 V. Inputs under test switching: 3.0 V to threshold (V_{ILD}), 0 V to threshold (V_{IHD}), f = 1 MHz.

5 Test circuit

Figure 4. Test circuit

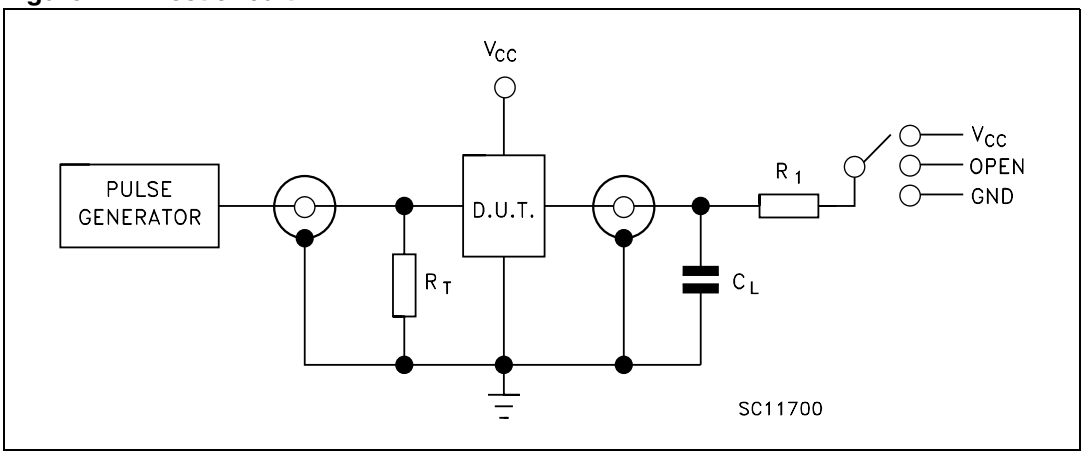


Table 10. Switch configuration

Type	Input		Load		Switch position		
	V_I	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
74VHCT257	3 V	6 ns	50 pF	1 kΩ	Open	GND	V_{CC}

C_L = 15/ 50 pF or equivalent (includes jig and probe capacitance).

$R_L = R_1$ = 1 KΩ or equivalent.

$R_T = Z_{OUT}$ of pulse generator (typically 50 Ω).

6 Waveforms

Figure 5. Waveform - propagation delays for inverting conditions (f = 1 mhz; 50% duty cycle)

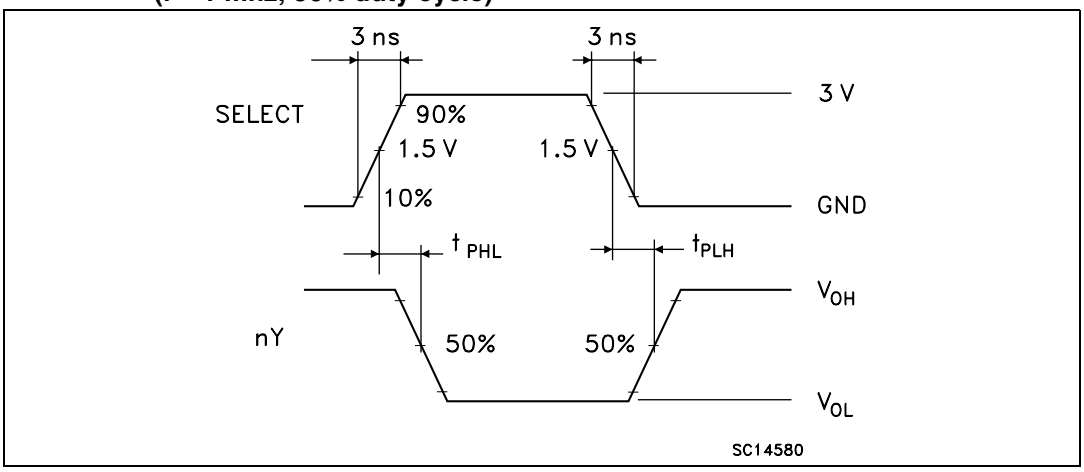


Figure 6. Waveform - propagation delays for non-inverting conditions (f = 1 MHz; 50% duty cycle)

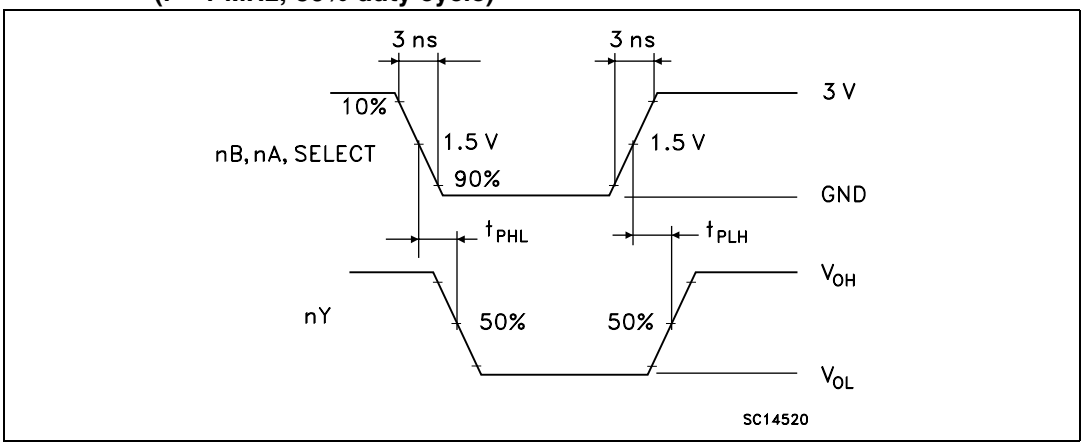
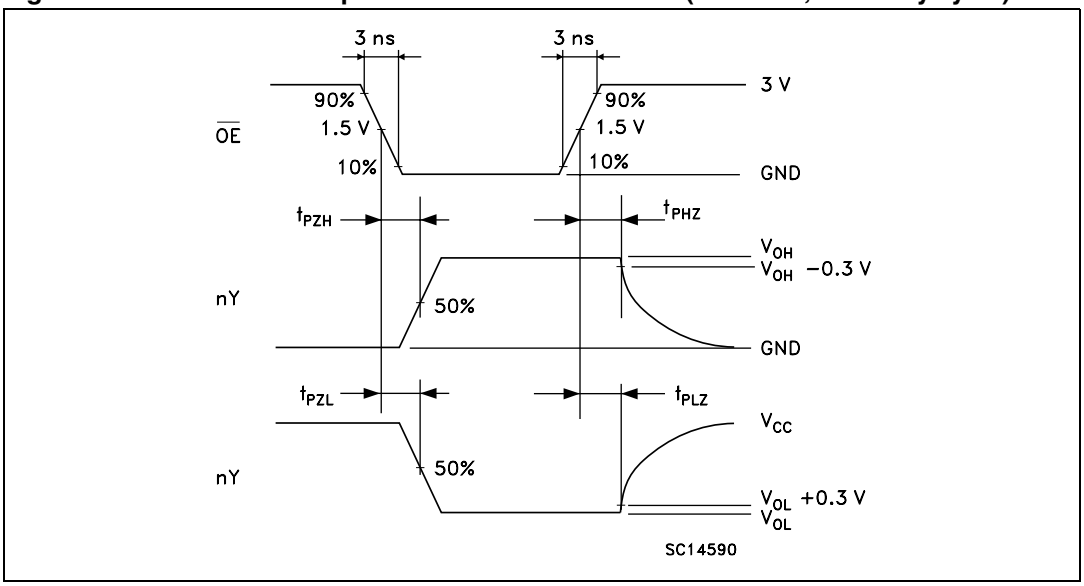


Figure 7. Waveform - output enable and disable time (f = 1 MHz; 50% duty cycle)



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*. ECOPACK is an ST trademark.

Figure 8. SO-16 package outline

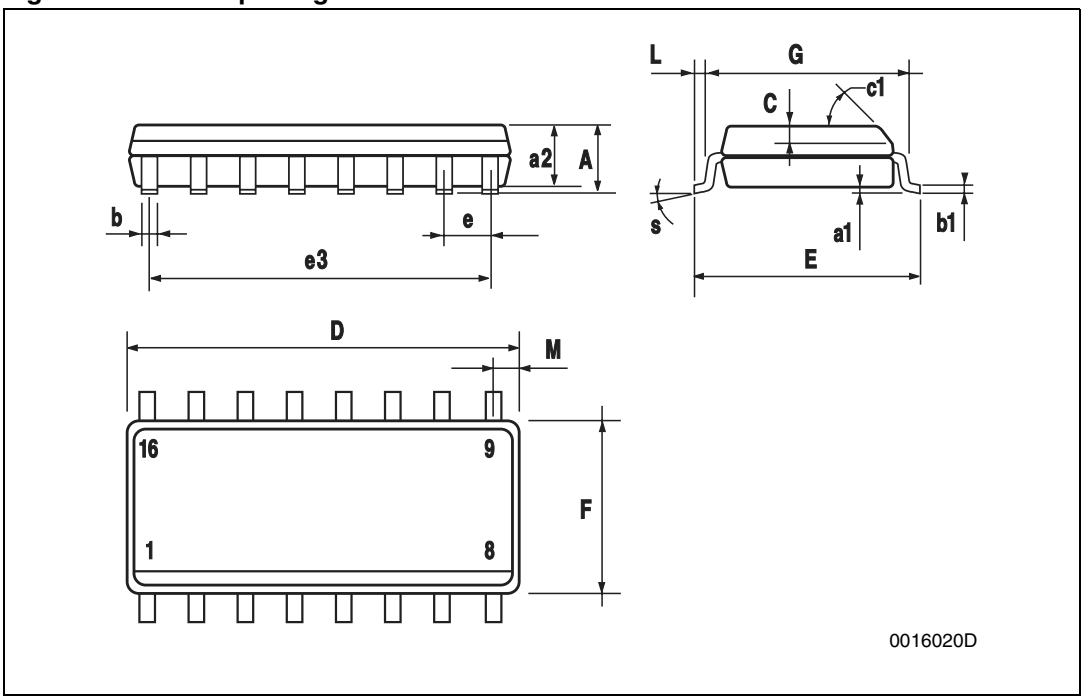
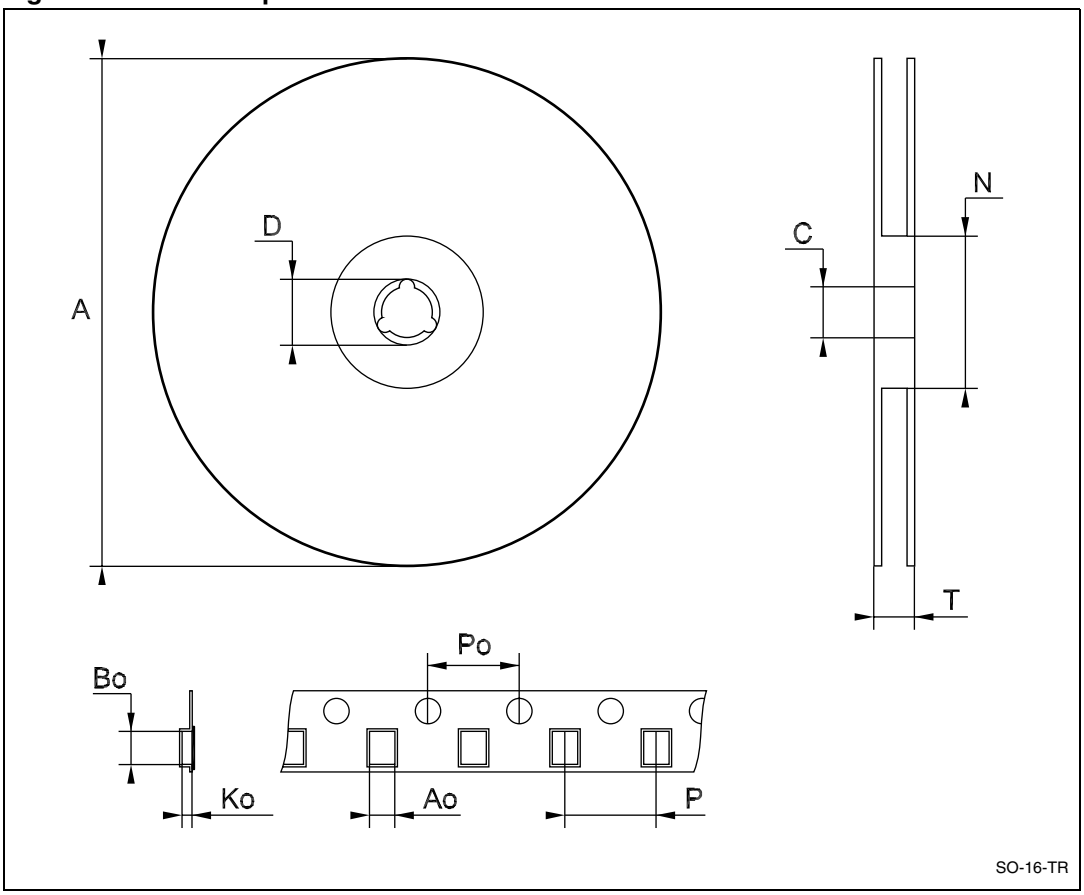


Table 11. SO-16 mechanical data

Symbol	Dimensions					
	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.)					

Figure 9. SO-16 tape and reel



1. drawing not in scale.

Table 12. SO-16 tape and reel mechanical data

Symbol	Dimensions					
	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

Revision history

Table 13. Document revision history

Date	Revision	Changes
16-Dec-2004	3	Order Codes Revision - pag. 1.
21-Nov-2012	4	Removed 74VHCT257ATTR device and TSSOP package from document. Replaced SOP by SO16 package on page 1. Added numbered headings to *Section 1: Input equivalent circuit* to *Section 7: Package information*. Updated *Table 10* (removed 74HC257 device, 74HCT257 replaced by 74VHCT257 device). Updated *Section 7: Package information*, added ECOPACK®. Minor text corrections throughout document.

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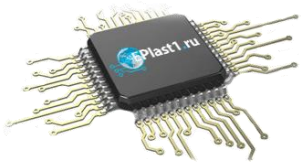

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