74LCX16245

Low voltage CMOS 16-bit bus transceiver (3-state) with 5V tolerant inputs and outputs

Features

- 5V tolerant inputs and outputs
- High speed:
  – t_{PD} = 4.5ns (Max) at V_{CC} = 3V
- Power down protection on inputs and outputs
- Symmetrical output impedance:
  – $|I_{OH}|$ = I_{OL} = 24mA (Min) at V_{CC} = 3V
- PCI bus levels guaranteed at 24mA
- Balanced propagation delays:
  – $t_{PLH} \cong t_{PHL}$
- Operating voltage range:
  – V_{CC} (Opr) = 2.0V to 3.6V
- Pin and function compatible with 74 series 16245
- Latch-up performance exceeds 500mA (JESD 17)
- ESD performance:
  – HBM > 2000V
    (MIL STD 883 method 3015); MM > 200V

TSSOP48

Description

The 74LCX16245 is a low voltage CMOS 16 bit bus transceiver (3-state) fabricated with sub-micron silicon gate and double-layer metal wiring C^2MOS technology. It is ideal for low power and high speed 3.3V applications; it can be interfaced to 5V signal environment for both inputs and outputs.

This IC is intended for two-way asynchronous communication between data buses; the direction of data transmission is determined by DIR input.

The two enable inputs $n\overline{G}$ can be used to disable the device so that the buses are effectively isolated.

It has same speed performance at 3.3V than 5V AC/ACT family, combined with a lower power consumption.

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

All floating bus terminals during High Z State must be held HIGH or LOW.

Order codes

Part number	Package	Packaging
74LCX16245TTR	TSSOP48	Tape and reel

Contents

1   Logic symbols and I/O equivalent circuit
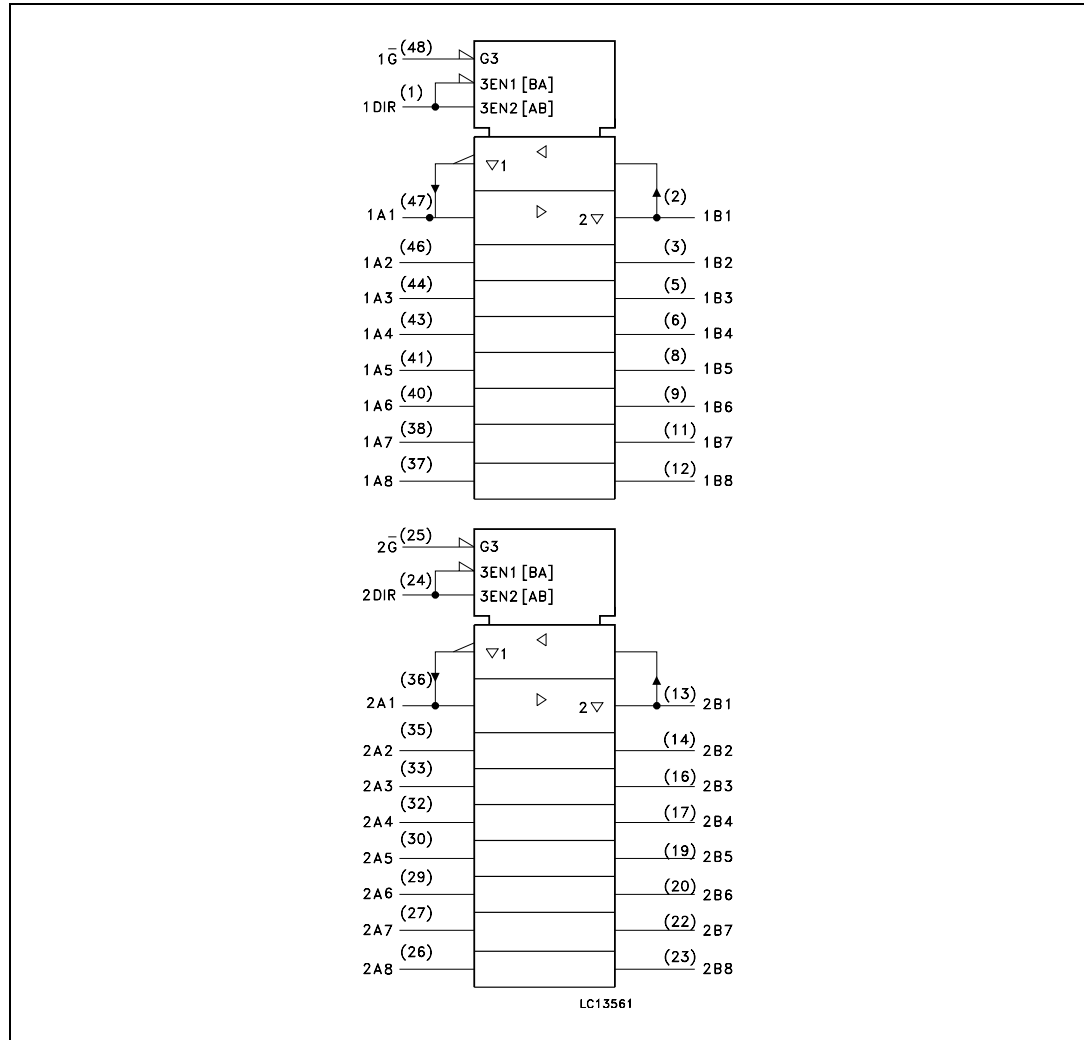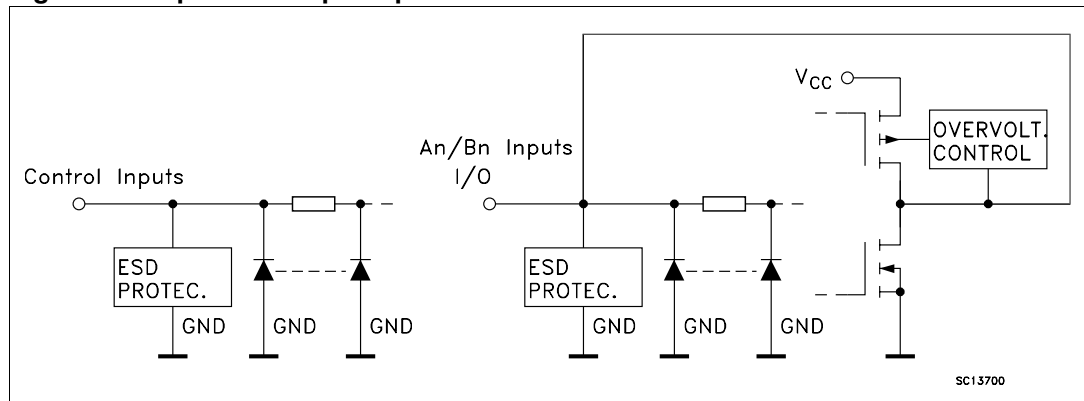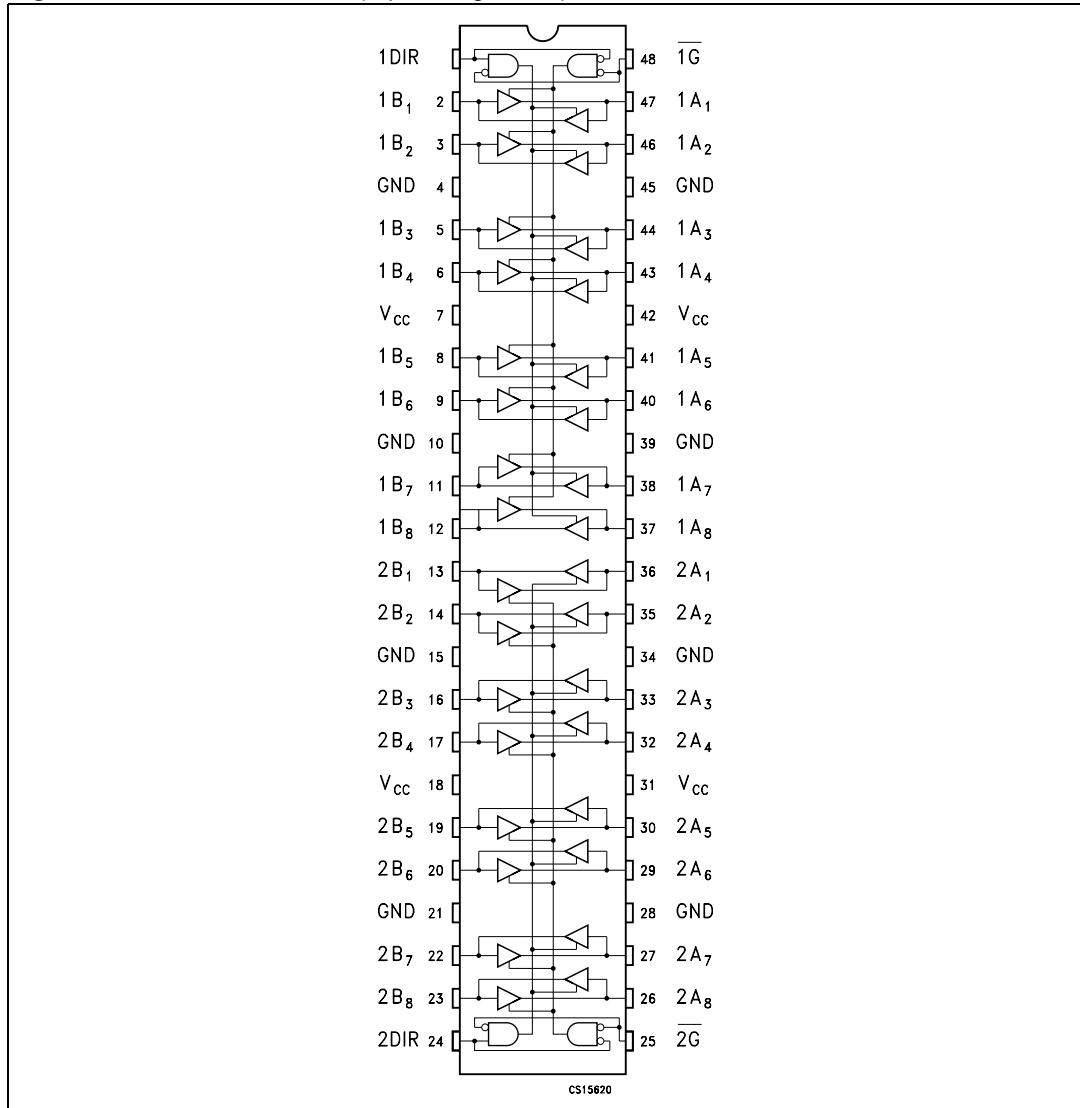
Figure 1.   IEC logic symbols

Figure 2.   Input and output equivalent circuit

2 Pin settings

2.1 Pin connection

Figure 3. **Pin connection** (top through view)

2.2   Pin description

Table 1. Pin description

Pin N°	Symbol	Name and function
1	1DIR	Directional control
2, 3, 5, 6, 8, 9, 11, 12	1B1 to 1B8	Data inputs/outputs
13, 14, 16, 17, 19, 20, 22, 23	2B1 to 2B8	Data inputs/outputs
24	2DIR	Directional control
25	2$\overline{\text{G}}$	Output enable input
36, 35, 33, 32, 30, 29, 27, 26	2A1 to 2A8	Data inputs/outputs
47, 46, 44, 43, 41, 40, 38, 38	1A1 to 1A8	Data inputs/outputs
48	1$\overline{\text{G}}$	Output enable input
4, 10, 15, 21, 28, 34, 39, 45	GND	Ground (0V)
7, 18, 31, 42	V_{CC}	Positive supply voltage

3   Logic states

3.1   Truth table

Table 2. Truth table

Inputs		Function		Output
$\overline{\text{G}}$	DIR	A BUS	B BUS	Yn
L	L	Output	Input	A = B
L	H	Input	Output	B = A
H	X	Z	Z	Z

Note: X : Do not care

Z : High impedance

4 Maximum rating

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_{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 (OFF state)	-0.5 to +7.0	V
V_O	DC output voltage (high or low state) [1]	-0.5 to V_{CC} + 0.5	V
I_{IK}	DC input diode current	-50	mA
I_{OK}	DC output diode current [2]	-50	mA
I_O	DC output current	±50	mA
I_{CC}	DC supply current per supply pin	$\pm$ 100	mA
I_{GND}	DC ground current per supply pin	$\pm$ 100	mA
T_{stg}	Storage temperature	-65 to +150	°C
T_L	Lead temperature (10 sec)	300	°C

1. I_O absolute maximum rating must be observed

2. V_O < GND

4.1 Recommended operating conditions

Table 4. Recommended operating conditions

Symsbol	Parameter	Value	Unit
V_{CC}	Supply voltage [1]	2.0 to 3.6	V
V_I	Input voltage	0 to 5.5	V
V_O	Output voltage (OFF state)	0 to 5.5	V
V_O	Output voltage (high or low state)	0 to V_{CC}	V
I_{OH}, I_{OL}	High or low level output current (V_{CC} = 3.0 to 3.6V)	$\pm$ 24	mA
I_{OH}, I_{OL}	High or low level output current (V_{CC} = 2.7V)	$\pm$ 12	mA
T_{op}	Operating temperature	-40 to 85	°C
dt/dv	Input rise and fall time [2]	0 to 10	ns/V

1. Truth table guaranteed: 1.5V to 3.6V

2. V_{IN} from 0.8V to 2V at V_{CC} = 3.0V

5   Electrical characteristics

Table 5. DC specifications

Symbol	Parameter	Test condition		Value		Unit
		V_{CC} (V)		-40 to 85°C		
				Min	Max	
V_{IH}	High level input voltage	2.7 to 3.6		2.0		V
V_{IL}	Low level input voltage				0.8	V
V_{OH}	High level output voltage	2.7 to 3.6	$I_O = -100\mu A$	V_{CC}-0.2		V
		2.7	$I_O = -12mA$	2.2		
		3.0	$I_O = -18mA$	2.4		
			$I_O = -24mA$	2.2		
V_{OL}	Low level output voltage	2.7 to 3.6	$I_O = 100\mu A$		0.2	V
		2.7	$I_O = 12mA$		0.4	
		3.0	$I_O = 16mA$		0.4	
			$I_O = 24mA$		0.55	
I_I	Input leakage current	2.7 to 3.6	$V_I = 0$ to 5.5V		± 5	μA
I_{off}	Power OFF leakage current	0	V_I or $V_O = 5.5V$		10	μA
I_{OZ}	High impedance output leakage current	2.7 to 3.6	$V_I = V_{IH}$ or V_{IL} $V_O = 0$ to V_{CC}		± 5	μA
I_{CC}	Quiescent supply current	2.7 to 3.6	$V_I = V_{CC}$ or GND		20	μA
			V_I or $V_O = 3.6$ to 5.5V		± 20	
ΔI_{CC}	I incr. per Input	2.7 to 3.6	$V_{IH} = V_{CC} - 0.6V$		500	μA

Table 6. Dynamic switching characteristics

Symbol	Parameter	Test condition		Value			Unit
		V_{CC} (V)		$T_A = 25$ °C			
				Min	Typ	Max	
V_{OLP}	Dynamic low level quiet output [1]	3.3	$C_L = 50pF$ $V_{IL} = 0V, V_{IH} = 3.3V$		0.8		V
V_{OLV}					-0.8		

1. Number of outputs defined as "n". Measured with "n-1" outputs switching from HIGH to LOW or LOW to HIGH. The remaining output is measured in the LOW state.

Table 7. AC electrical characteristics

Symbol	Parameter	Test condition				Value		Unit
		V_{CC} (V)	C_L (pF)	R_L (Ω)	$t_s = t_r$ (ns)	-40 to 85 °C		
						Min	Max	
t_{PLH} t_{PHL}	Propagation delay time	2.7	50	500	2.5	1.5	5.2	ns
		3.0 to 3.6				1.5	4.5	
t_{PZL} t_{PZH}	Output enable time	2.7	50	500	2.5	1.5	7.2	ns
		3.0 to 3.6				1.5	6.5	
t_{PLZ} t_{PHZ}	Output disable time	2.7	50	500	2.5	1.5	6.9	ns
		3.0 to 3.6				1.5	6.4	
t_{OSLH} t_{OSHL}	Output to output skew time [1] [2]	3.0 to 3.6	50	500	2.5		1.0	ns

1. Skew is defined as the absolute value of the difference between the actual propagation delay for any two outputs of the same device switching in the same direction, either HIGH or LOW (t_{OSLH} = | t_{PLHm} - t_{PLHn}|, t_{OSHL} = | t_{PHLm} - t_{PHLn}|)

2. Parameter guaranteed by design

Table 8. Capacitive characteristics

Symbol	Parameter	Test condition		Value			Unit
		V_{CC} (V)		T_A = 25 °C			
				Min	Typ	Max	
C_{IN}	Input capacitance	3.3	V_{IN} = 0 to V_{CC}		7		pF
C_{OUT}	Output capacitance	3.3	V_{IN} = 0 to V_{CC}		8		pF
C_{PD}	Power dissipation capacitance [1]	3.3	f_{IN} = 10MHz V_{IN} = 0 or V_{CC}		20		pF

1. C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(opr)}$ = C_{PD} x V_{CC} x f_{IN} + I_{CC}/16 (per circuit)
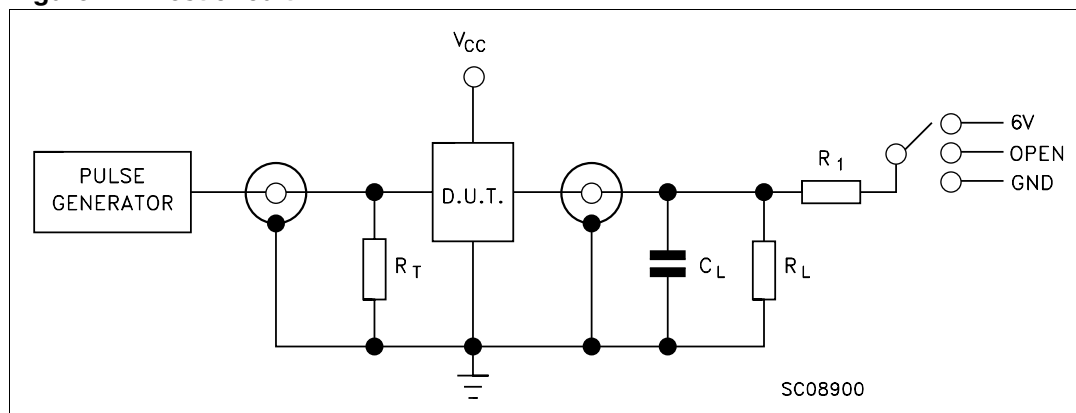
6 Test circuit

Figure 4. Test circuit

Figure 5. Test circuit

Test	Switch
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	6V
t_{PZH}, t_{PHZ}	GND

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

R_L = R_1 = 500Ω or equivalent

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

7   Waveforms
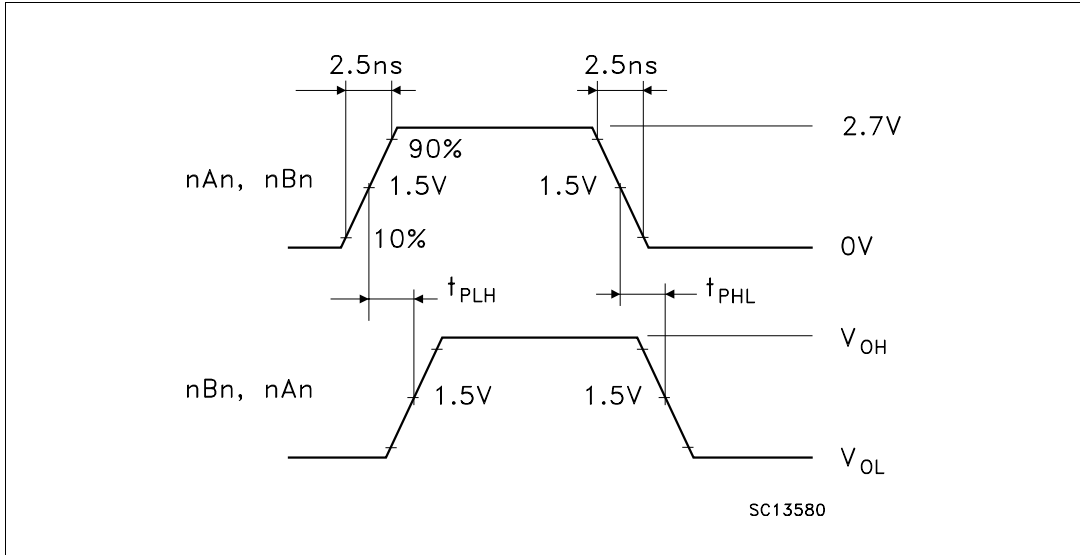
Figure 6.   Propagation delays (f = 1MHz; 50% duty cycle)
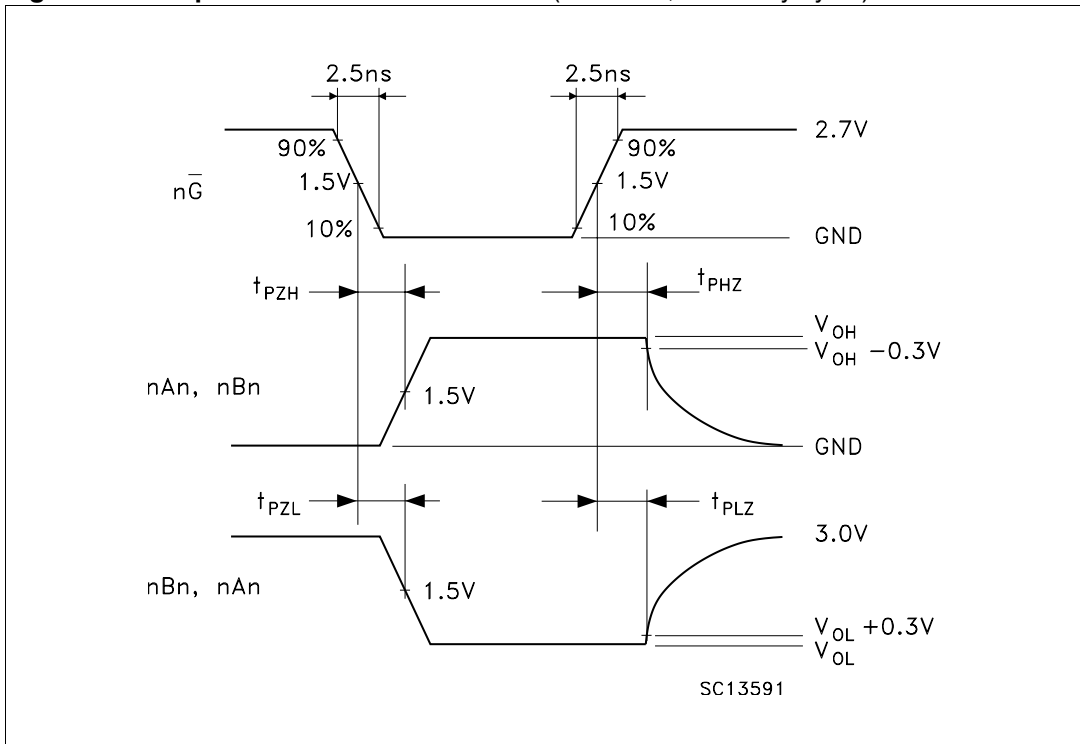

SC13580

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


SC13591

8   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

TSSOP48 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002		0.006
A2		0.9			0.035	
b	0.17		0.27	0.0067		0.011
c	0.09		0.20	0.0035		0.0079
D	12.4		12.6	0.488		0.496
E		8.1 BSC			0.318 BSC	
E1	6.0		6.2	0.236		0.244
e		0.5 BSC			0.0197 BSC	
K	0°		8°	0°		8°
L	0.45		0.75	0.018		0.030

PIN 1 IDENTIFICATION

7065588D
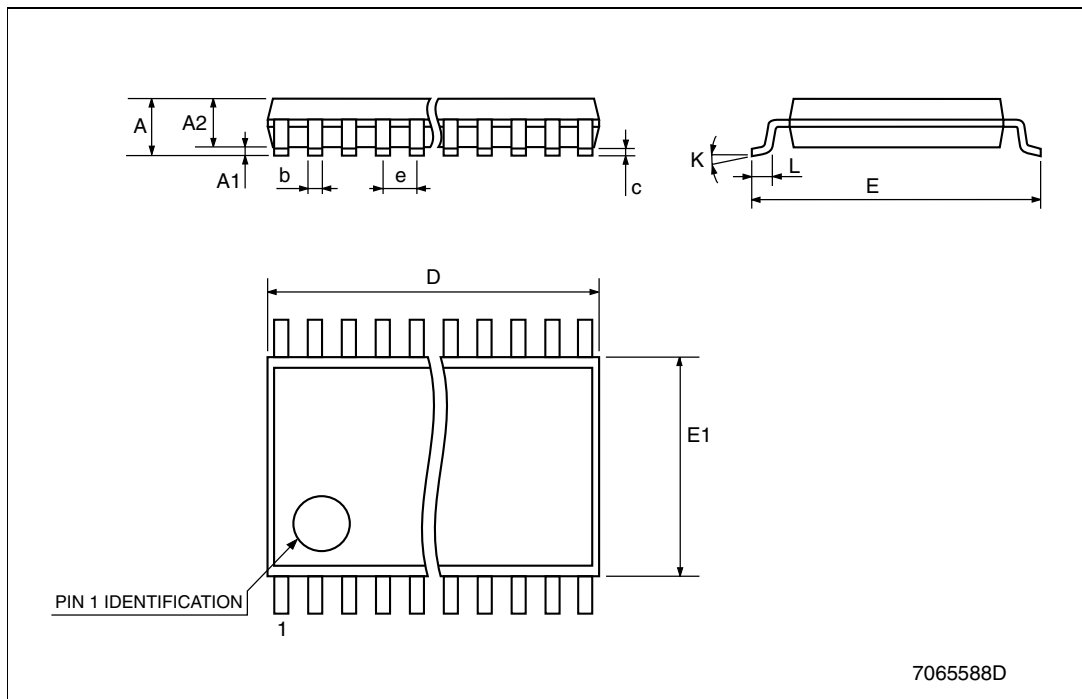
Tape & Reel TSSOP48 MECHANICAL DATA

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			30.4			1.197
Ao	8.7		8.9	0.343		0.350
Bo	13.1		13.3	0.516		0.524
Ko	1.5		1.7	0.059		0.067
Po	3.9		4.1	0.153		0.161
P	11.9		12.1	0.468		0.476
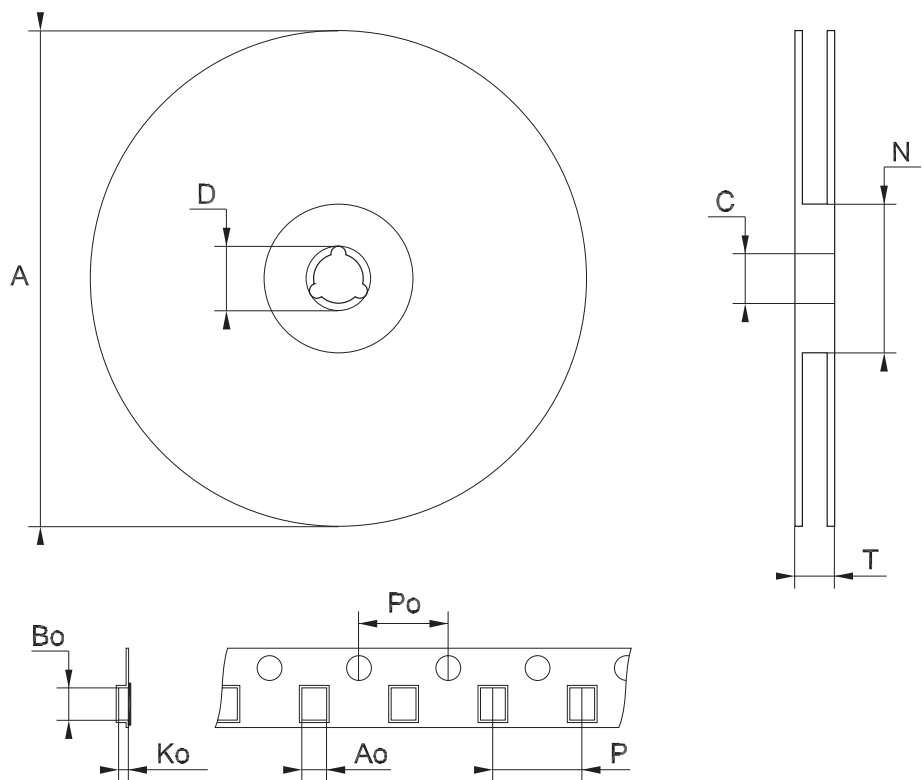
Note: Drawing not in scale

9   Revision history

Table 9. Revision history

Date	Revision	Changes
15-Sep-2004	6	Ordering Codes Revision - pag. 1.
06-Feb-2007	7	Document reformatted, temperature ranges updated

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com