

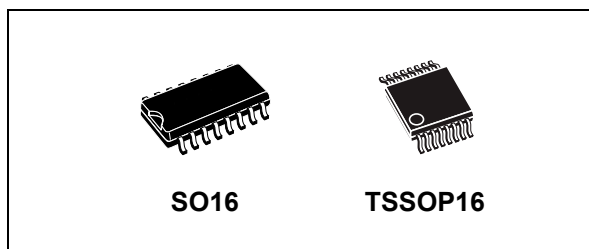


# THE DATASHEET OF M74HC365TTR



## Hex bus buffer with 3-state outputs (non-inverting)

Datasheet - production data



- Pin and function compatible with 74 series 365
- ESD performance
  - HBM: 2 kV
  - MM: 200 V
  - CDM: 1 kV

### Description

The M74HC365 is an advanced high-speed CMOS hex bus buffer (3-state) fabricated with silicon gate C<sup>2</sup>MOS technology.

All six buffers are controlled by the combination of two enable inputs (G1 and G2). All outputs of these buffers are enabled only when both G1 and G2 inputs are held low. Under all other conditions these outputs are disabled in a high-impedance state.

The M74HC365 has non-inverting outputs.

All inputs are equipped with protection circuits against static discharge and transient excess voltage.

### Features

- High-speed:  
 $t_{PD} = 10 \text{ ns (typ.) at } V_{CC} = 6 \text{ V}$
- Low power dissipation:  
 $I_{CC} = 4 \mu\text{A (max.) at } T_A = 25 \text{ }^\circ\text{C}$
- High noise immunity:  
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (min)}$
- Symmetrical output impedance:  
 $|I_{OH}| = I_{OL} = 6 \text{ mA (min.)}$
- Balanced propagation delays:  
 $t_{PLH} \cong t_{PHL}$
- Wide operating voltage range:  
 $V_{CC} \text{ (opr)} = 2 \text{ V to } 6 \text{ V}$

Table 1. Device summary

Order code	Temp. range	Package	Packing	Marking
M74HC365RM13TR	-55 °C to 125 °C	S016	Tape and reel	74HC365
M74HC365YRM13TR <sup>(1)</sup>	-40 °C to 125 °C	SO16 (automotive grade)		74HC365Y
M74HC365TTR	-55 °C to 125 °C	TSSOP16		HC365
M74HC365YTTR <sup>(1)</sup>	-40 °C to 125 °C	TSSOP16 (automotive grade)		HC365Y

1. Qualification and characterization according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 and Q002 or equivalent.

# Contents

<b>1</b>	<b>Pin information</b> .....	<b>3</b>
<b>2</b>	<b>Functional description</b> .....	<b>4</b>
<b>3</b>	<b>Electrical characteristics</b> .....	<b>5</b>
<b>4</b>	<b>Package information</b> .....	<b>10</b>
	4.1 SO16 package information .....	11
	4.2 TSSOP16 package information .....	12
<b>5</b>	<b>Ordering information</b> .....	<b>13</b>
<b>6</b>	<b>Revision history</b> .....	<b>13</b>

# 1 Pin information

Figure 1. Pin connection and IED logic symbols

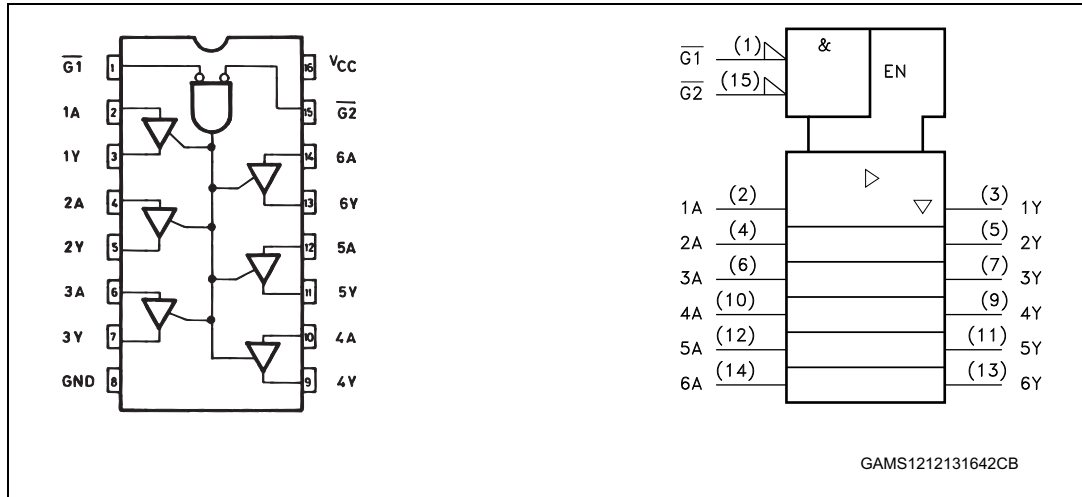


Table 2. Pin description

Pin no	Symbol	Name and function
1, 15	$\overline{G1}, \overline{G2}$	Output enable inputs
2, 4, 6, 10, 12, 14	1A to 6A	Data inputs
3, 5, 7, 9, 11, 13	1Y to 6Y	Data outputs
8	GND	Ground (0 V)
16	$V_{CC}$	Positive supply voltage

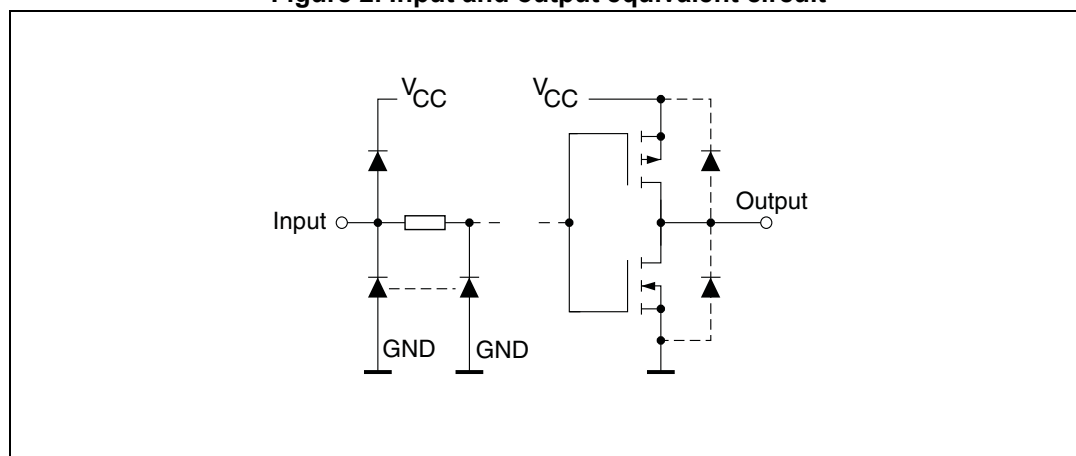
## 2 Functional description

Table 3. Truth table

Inputs			Outputs
$\overline{G1}$	$\overline{G2}$	An	Y
L	L	L	L
L	L	H	H
H	X <sup>(2)</sup>	X <sup>(2)</sup>	Z <sup>(1)</sup>
X <sup>(2)</sup>	H	X <sup>(2)</sup>	Z <sup>(1)</sup>

1. Z = high impedance
2. X = don't care

Figure 2. Input and output equivalent circuit



### 3 Electrical characteristics

“Absolute maximum ratings” are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

**Table 4. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply voltage	-0.5 to +7	V
$V_I$	DC input voltage	-0.5 to $V_{CC} + 0.5$	
$V_O$	DC output voltage		
$I_{IK}$	DC input diode current	$\pm 20$	mA
$I_{OK}$	DC output diode current		
$I_O$	DC output current	$\pm 35$	
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or ground current	$\pm 70$	
$P_D$	Power dissipation	500 <sup>(1)</sup>	mW
$T_{stg}$	Storage temperature	-65 to +150	°C
$T_L$	Lead temperature (10 sec)	300	

1. 500 mW at 65 °C; derate to 300 mW by 10 mW/°C from 65 °C to 85 °C

**Table 5. Recommended operating conditions**

Symbol	Parameter	Value	Unit	
$V_{CC}$	Supply voltage	2 to 6	V	
$V_I$	Input voltage	0 to $V_{CC}$		
$V_O$	Output voltage			
$T_{op}$	Operating temperature	-55 to 125	°C	
$t_r, t_f$	Input rise and fall time	$V_{CC} = 2.0\text{ V}$	0 to 1000	ns
		$V_{CC} = 4.5\text{ V}$	0 to 500	
		$V_{CC} = 6.0\text{ V}$	0 to 400	

Table 6. DC specifications

Symbol	Parameter	Test condition		Value						Unit	
		V <sub>CC</sub> (V)		T <sub>A</sub> = 25 °C			-40 to 85 °C		-55 to 125 °C		
				Min.	Typ.	Max.	Min.	Max.	Min.		Max.
V <sub>IH</sub>	High level input voltage	2.0		1.5			1.5		1.5		V
		4.5		3.15			3.15		3.15		
		6.0		4.2			4.2		4.2		
V <sub>IL</sub>	Low level input voltage	2.0				0.5		0.5		0.5	V
		4.5				1.35		1.35		1.35	
		6.0				1.8		1.8		1.8	
V <sub>OH</sub>	High level output voltage	2.0	I <sub>O</sub> = -20 μA	1.9	2.0		1.9		1.9		V
		4.5	I <sub>O</sub> = -20 μA	4.4	4.5		4.4		4.4		
		6.0	I <sub>O</sub> = -20 μA	5.9	6.0		5.9		5.9		
		4.5	I <sub>O</sub> = -6.0 mA	4.18	4.31		4.13		4.10		
		6.0	I <sub>O</sub> = -7.8 mA	5.68	5.8		5.63		5.60		
V <sub>OL</sub>	Low level output voltage	2.0	I <sub>O</sub> = 20 μA		0.0	0.1		0.1		0.1	V
		4.5	I <sub>O</sub> = 20 μA		0.0	0.1		0.1		0.1	
		6.0	I <sub>O</sub> = 20 μA		0.0	0.1		0.1		0.1	
		4.5	I <sub>O</sub> = 6.0 mA		0.17	0.26		0.33		0.40	
		6.0	I <sub>O</sub> = 7.8 mA		0.18	0.26		0.33		0.40	
I <sub>I</sub>	Input leakage current	6.0	V <sub>I</sub> = V <sub>CC</sub> or GND			±0.1		±1		±1	μA
I <sub>OZ</sub>	High impedance output leakage current	6.0	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>O</sub> = V <sub>CC</sub> or GND			±0.5		±5		±10	μA
I <sub>CC</sub>	Quiescent supply current	6.0	V <sub>I</sub> = V <sub>CC</sub> or GND			4		40		80	μA

**Table 7. AC electrical characteristics**  
( $C_L = 50$  pF, Input  $t_r = t_f = 6$  ns)

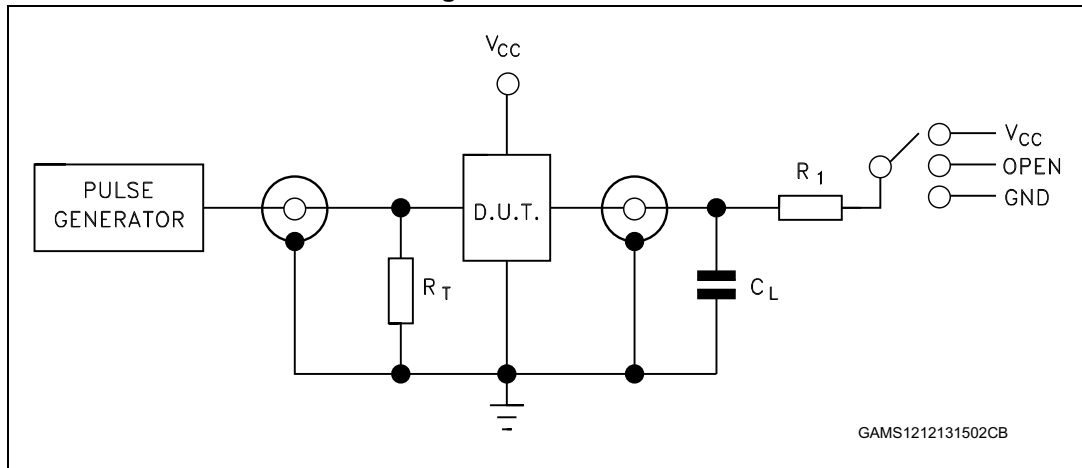
Symbol	Parameter	Test condition			Value								Unit
		$V_{CC}$ (V)	$C_L$ (pF)		$T_A = 25\text{ }^\circ\text{C}$			$-40\text{ to }85\text{ }^\circ\text{C}$		$-55\text{ to }125\text{ }^\circ\text{C}$			
					Min.	Typ.	Max.	Min.	Max.	Min.	Max.		
$t_{TLH}, t_{THL}$	Output transition time	2.0	50			25	60		75		90	ns	
		4.5			7	12		19		18			
		6.0			6	10		13		15			
$t_{PLH}, t_{PHL}$	Propagation delay time	2.0	50			38	90		115		135	ns	
		4.5			12	18		23		27			
		6.0			10	15		20		23			
		2.0	150			51	130		165		195	ns	
		4.5			17	26		33		39			
		6.0			14	22		28		33			
$t_{PZL}, t_{PZH}$	High impedance output enable time	2.0	50	$R_L = 1\text{ k}\Omega$		64	130		165		195	ns	
		4.5				16	26		33		39		
		6.0				14	22		28		33		
		2.0	150				76	150		190		225	ns
		4.5				19	30		38		45		
		6.0				16	26		32		38		
$t_{PLZ}, t_{PHZ}$	High impedance output disable time	2.0	50	$R_L = 1\text{ k}\Omega$		42	130		165		195	ns	
		4.5				18	26		33		39		
		6.0				15	22		28		33		

**Table 8. Capacitive characteristics**

Sym	Parameter	Test condition	Value								Unit
		$V_{CC}$ (V)	$T_A = 25\text{ }^\circ\text{C}$			$-40\text{ to }85\text{ }^\circ\text{C}$		$-55\text{ to }125\text{ }^\circ\text{C}$			
			Min	Typ	Max	Min	Max	Min	Max		
$C_{IN}$	Input capacitance	5.0	-	5	10	-	10	-	10	pF	
$C_{PD}$	Power dissipation capacitance <sup>(1)</sup>		-	27	-	-	-	-			

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:  
 $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/6$  (per gate).

Figure 3. Test circuit



- Legend:  
 $C_L = 50 \text{ pF}/150 \text{ pF}$  or equivalent (includes jig and probe capacitance).  
 $R_1 = 1 \text{ k}\Omega$  or equivalent.  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50 \Omega$ ).

Table 9. Propagation delay time configuration

Test	Switch
$t_{PLH}, t_{PHL}$	Open
$t_{PZL}, t_{PLZ}$	$V_{CC}$
$t_{PZH}, t_{PHZ}$	GND

Figure 4. Waveform 1: propagation delay times  
(f = 1 MHz; 50 % duty cycle)

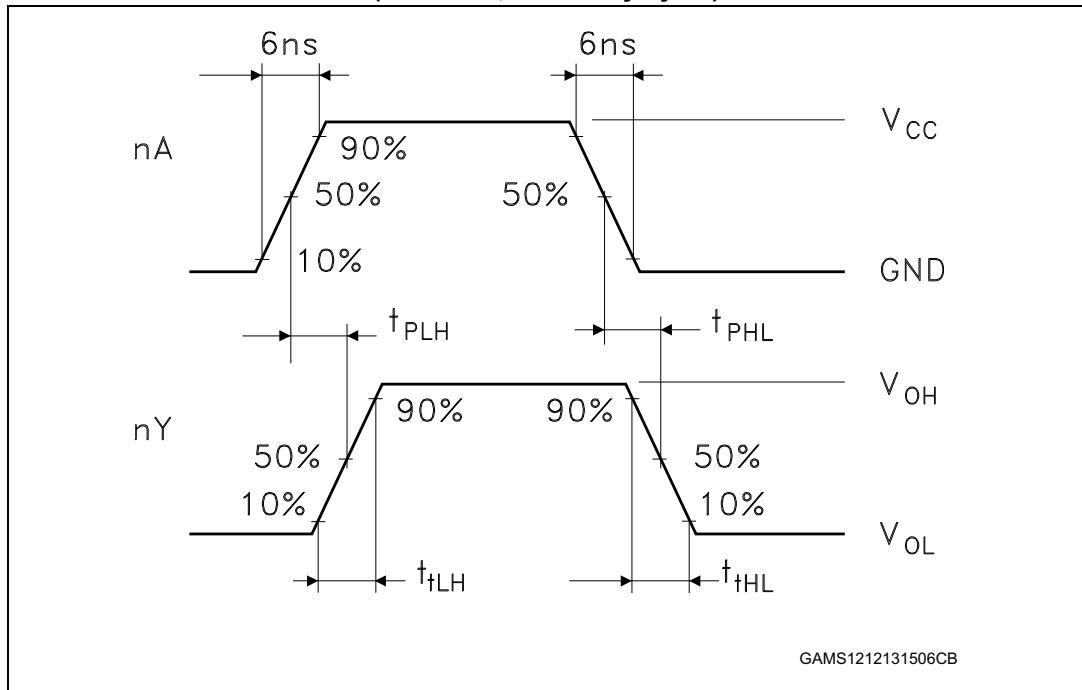
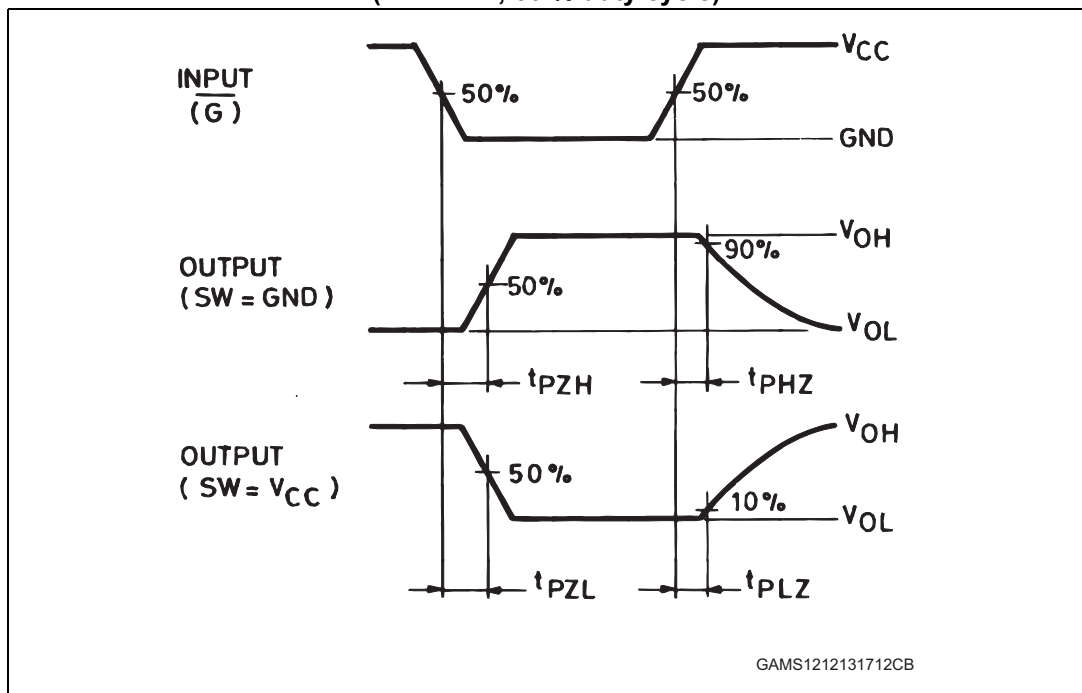


Figure 5. Waveform 2: Output enable and disable times  
(f = 1 MHz; 50 % duty cycle)

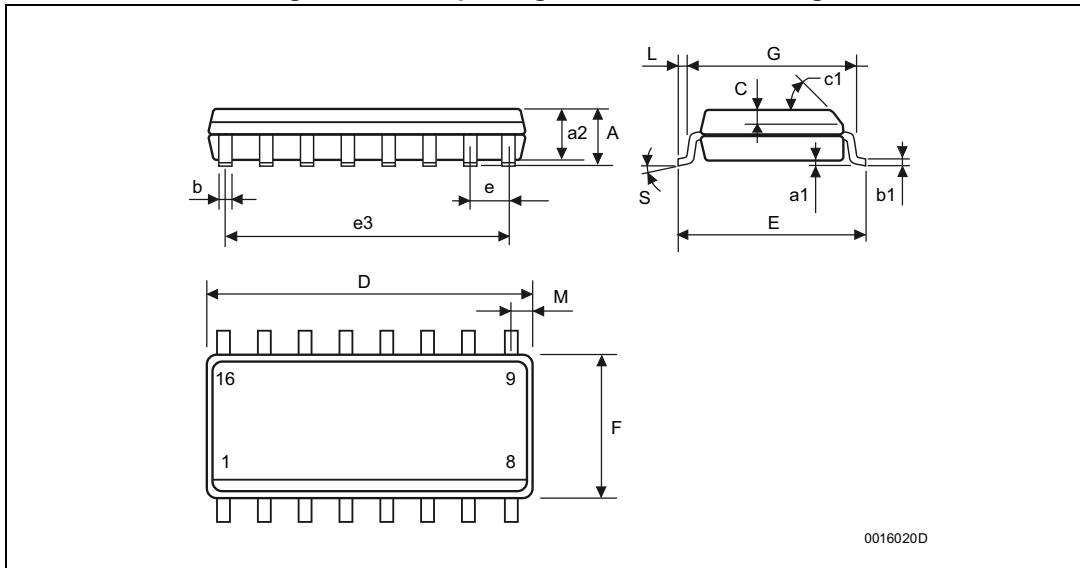


## 4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

### 4.1 SO16 package information

Figure 6. SO16 package mechanical drawing



0016020D

Table 10. SO16 package mechanical data

Symbol	Dimensions					
	mm			inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.068
a1	0.1		0.2	0.003		0.008
a2			1.65			0.064
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.)					

## 4.2 TSSOP16 package information

Figure 7. TSSOP16 package mechanical drawing

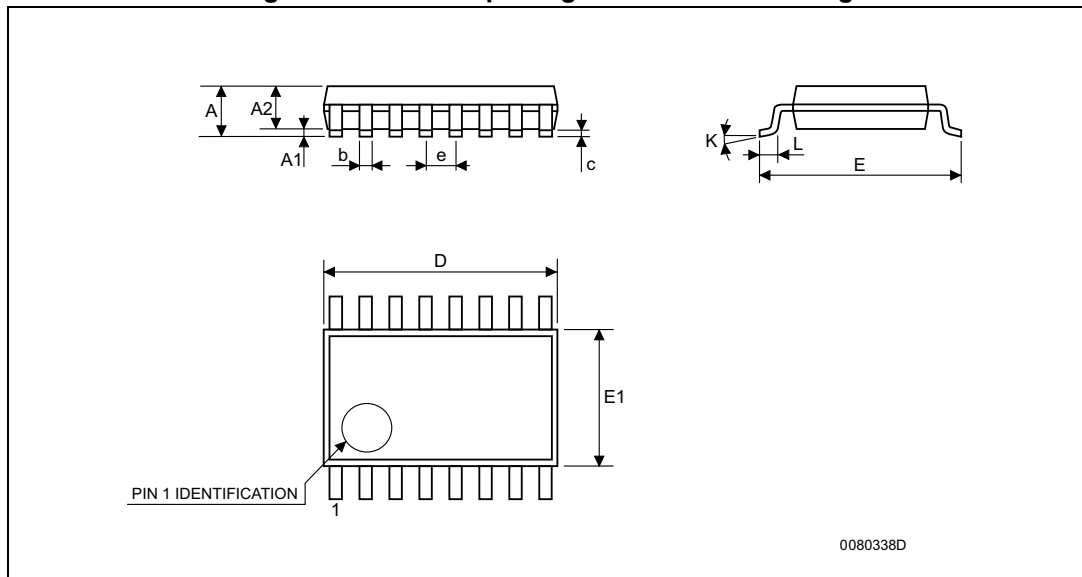


Table 11. TSSOP16 package mechanical data

Symbol	Dimensions					
	mm			inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0089
D	4.9	5	5.1	0.193	0.197	0.201
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65			0.0256	
K	0 °		8 °	0 °		8 °
L	0.45	0.60	0.75	0.018	0.024	0.030

## 5 Ordering information

Table 12. Order codes

Order code	Temp. range	Package	Packing	Marking
M74HC365RM13TR	-55 °C to 125 °C	S016	Tape and reel	74HC365
M74HC365YRM13TR <sup>(1)</sup>	-40 °C to 125 °C	SO16 (automotive grade)		74HC365Y
M74HC365TTR	-55 °C to 125 °C	TSSOP16		HC365
M74HC365YTTR <sup>(1)</sup>	-40 °C to 125 °C	TSSOP16 (automotive grade)		HC365Y

1. Qualification and characterization according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 and Q002 or equivalent.

## 6 Revision history

Table 13. Document revision history

Date	Revision	Changes
Aug-2001	1	Initial release.
13-Dec-2013	2	Removed DIP16 package <a href="#">Table 1: Device summary</a> : updated order codes, added automotive grade order codes, added temperature range and marking details. Added <a href="#">Section 5: Ordering information</a> .
13-Jan-2014	3	Added ESD data to <a href="#">Features</a>

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