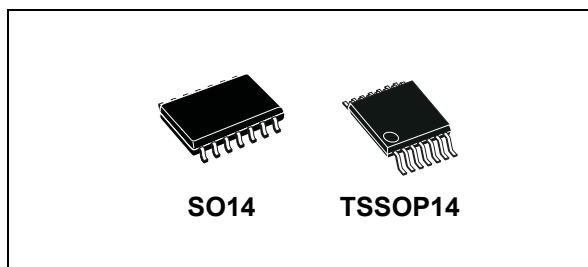


## Hex Schmitt inverter

Datasheet - production data



- Wide operating voltage range:  
 $V_{CC} \text{ (opr)} = 2 \text{ to } 6 \text{ V}$
- Pin and function compatible with 74 series 14
- ESD performance
  - CDM: 1 kV
  - HBM: 2 kV
  - MM: 200 V

### Features

- High speed:  
 $t_{PD} = 12 \text{ ns (typ.) at } V_{CC} = 6 \text{ V}$
- Low power dissipation:  
 $I_{CC} = 1 \mu\text{A (max.) at } T_A = 25 \text{ }^\circ\text{C}$
- High noise immunity:  
 $V_H = 1.2 \text{ V (typ.) at } V_{CC} = 6 \text{ V}$
- Symmetrical output impedance:  
 $|I_{OH}| = I_{OL} = 4 \text{ mA (min.)}$
- Balanced propagation delays:  
 $t_{PLH} \cong t_{PHL}$

### Description

The M74HC14 is a high speed CMOS hex Schmitt inverter fabricated with silicon gate C<sup>2</sup>MOS technology. Pin configuration and functions are the same as those of the M74HC04 but all inputs have a 20 %  $V_{CC}$  hysteresis level.

This, together with the Schmitt trigger function, allows the device to be used on line receivers with slow rise/fall input signals.

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

**Table 1. Device summary**

Order code	Temperature range	Package	Packing	Marking
M74HC14RM13TR	-55 °C to +125 °C	SO14	Tape and reel	74HC14
M74HC14YRM13TR <sup>(1)</sup>	-40 °C to +125 °C	SO14 (automotive grade)		74HC14Y
M74HC14TTR	-55 °C to +125 °C	TSSOP14		HC14
M74HC14YTTR <sup>(1)</sup>	-40 °C to +125 °C	TSSOP14 (automotive grade)		HC14Y

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

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# 1 Pin information

Figure 1. Pin connections and IEC logic symbols

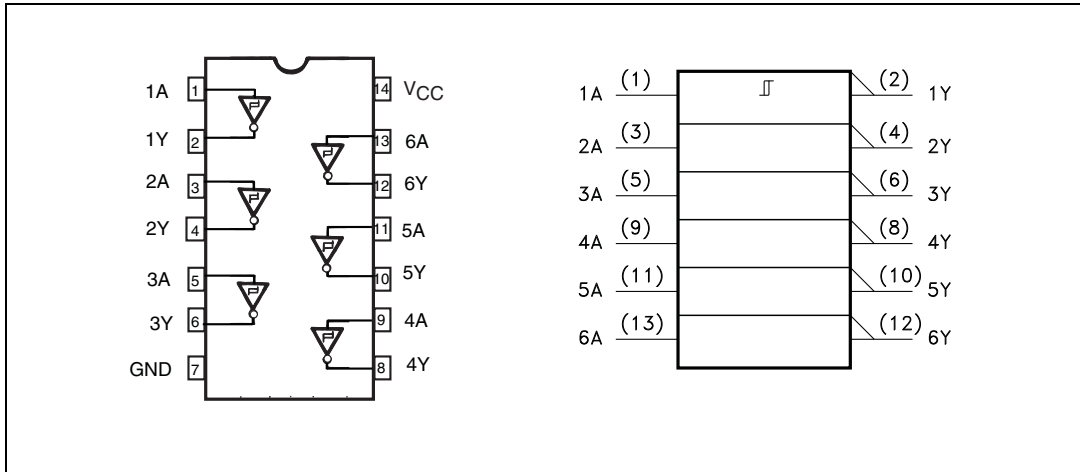


Table 2. Pin description

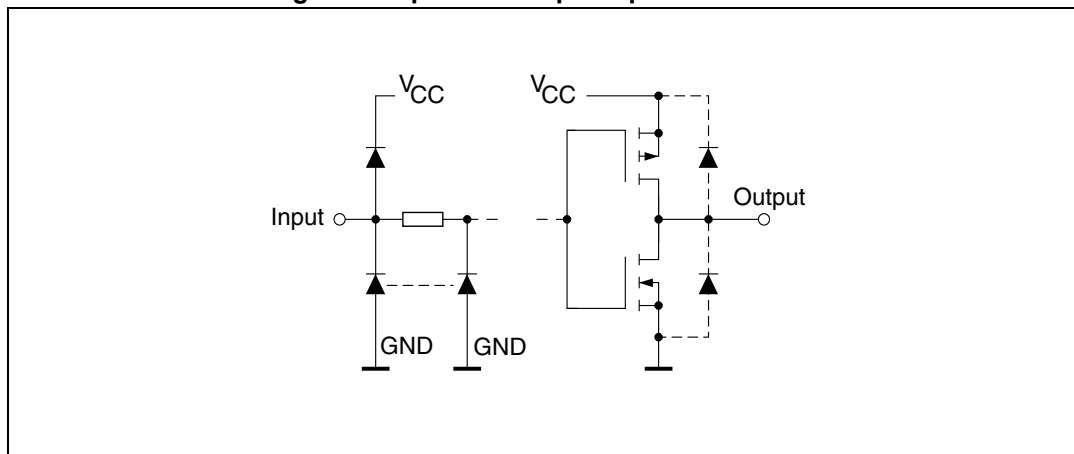
Pin number	Symbol	Name and function
1, 3, 5, 9, 11, 13	1A to 6A	Data inputs
2, 4, 6, 8, 10, 12	1Y to 6Y	Data outputs
7	GND	Ground (0 V)
14	V <sub>CC</sub>	Positive supply voltage

## 2 Functional description

Table 3. Truth table

A	Y
L	H
H	L

Figure 2. Input and output equivalent circuit



### 3 Electrical characteristics

Stressing the device above the ratings 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 are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Please refer to the STMicroelectronics SURE Program and other relevant quality documents.

**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	$\pm 25$	
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or ground current	$\pm 50$	
$P_D$	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

Table 6. DC specifications

Sym.	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>t+</sub>	High level input voltage	2.0		1.0	1.28	1.5	1.0	1.5	1.0	1.5	V
		4.5		2.3	2.8	3.15	2.3	3.15	2.3	3.15	
		6.0		3.0	3.7	4.2	3.0	4.2	3.0	4.2	
V <sub>t-</sub>	Low level input voltage	2.0		0.3	0.74	0.9	0.3	0.9	0.3	0.9	
		4.5		1.13	1.8	2.0	1.13	2.0	1.13	2.0	
		6.0		1.5	2.4	2.6	1.5	2.6	1.5	2.6	
V <sub>H</sub>	Hysteresis voltage	2.0		0.3	0.54	1.0	0.3	1.0	0.3	1.0	
		4.5		0.6	1.0	1.4	0.6	1.4	0.6	1.4	
		6.0		0.8	1.3	1.4	0.8	1.7	0.8	1.7	
V <sub>OH</sub>	High level output voltage	2.0	I <sub>O</sub> = -20 μA	1.9	2.0		1.9		1.9		
		4.5		4.4	4.5		4.4		4.4		
		6.0		5.9	6.0		5.9		5.9		
		4.5	I <sub>O</sub> = -4.0 mA	4.18	4.31		4.13		4.10		
		6.0	I <sub>O</sub> = -5.2 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	
		4.5			0.0	0.1		0.1		0.1	
		6.0			0.0	0.1		0.1		0.1	
		4.5	I <sub>O</sub> = -4.0 mA		0.17	0.26		0.33		0.40	
		6.0	I <sub>O</sub> = -5.2 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>CC</sub>	Quiescent supply current					1		10		20	

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

Sym.	Parameter	Test condition		Value				Unit
		$V_{CC}$ (V)		$T_A = 25^\circ\text{C}$		$-40 \text{ to } 85^\circ\text{C}$	$-55 \text{ to } 125^\circ\text{C}$	
				Typ	Max	Max	Max	
$t_{TLH}$ $t_{THL}$	Output transition time	2.0		30	75	95	110	ns
		4.5		8	15	19	22	
		6.0		7	13	16	19	
$t_{PLH}$ $t_{PHL}$	Propagation delay time	2.0		42	125	155	190	
		4.5		14	25	31	38	
		6.0		12	21	16	32	

**Table 8. Capacitive characteristics**

Sym	Parameter	Test condition		Value				Unit
		$V_{CC}$ (V)		$T_A = 25^\circ\text{C}$		$-40 \text{ to } 85^\circ\text{C}$	$-55 \text{ to } 125^\circ\text{C}$	
				Typ	Max	Max	Max	
$C_{IN}$	Input capacitance	5.0		5	10	10	10	pF
$C_{PD}$	Power dissipation capacitance <sup>(1)</sup>		$f_{IN} = 10 \text{ MHz}$	28				

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

**Figure 3. Test circuit**

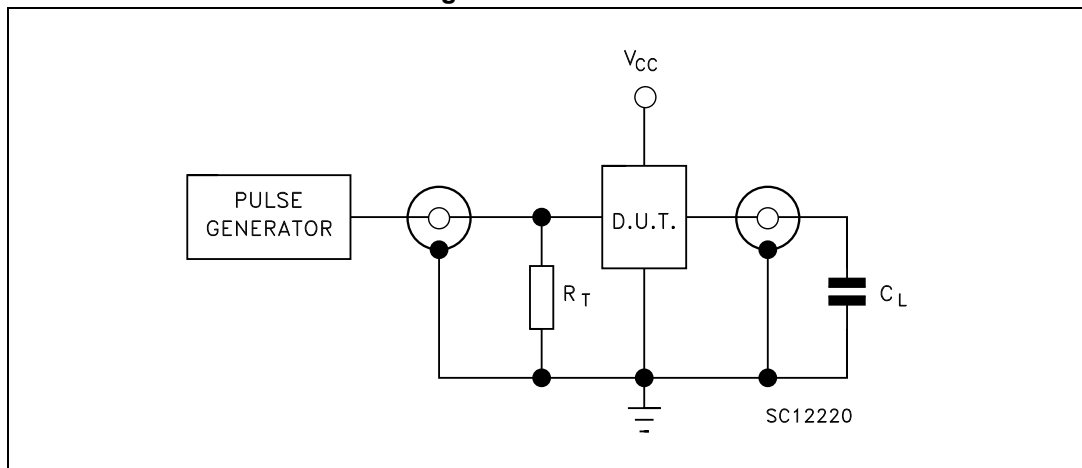
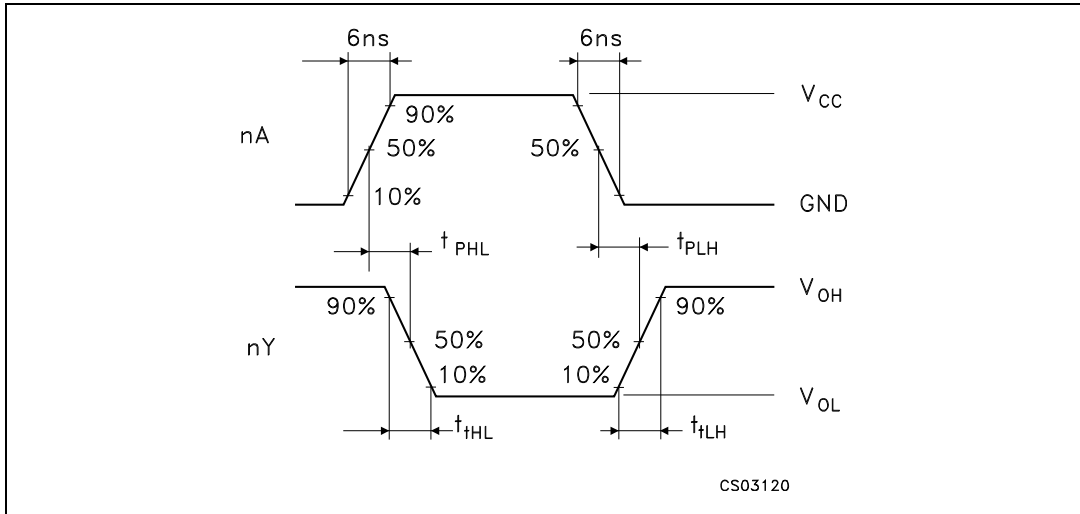


Figure 4. Waveform: propagation delay times  
(f = 1 MHz; 50% duty cycle)





## 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 SO14 package information

Figure 5. SO14 package mechanical drawing

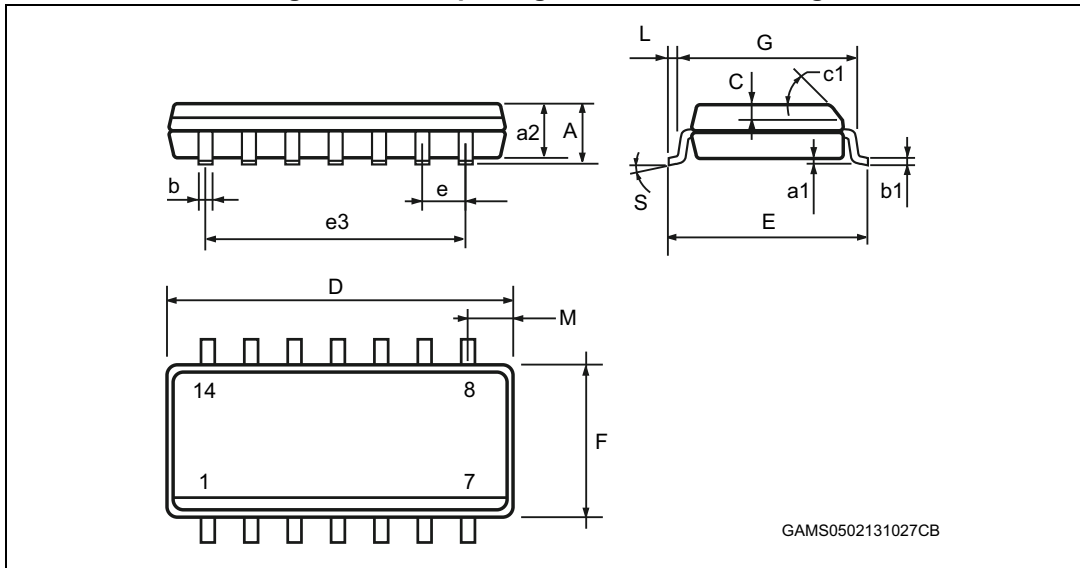
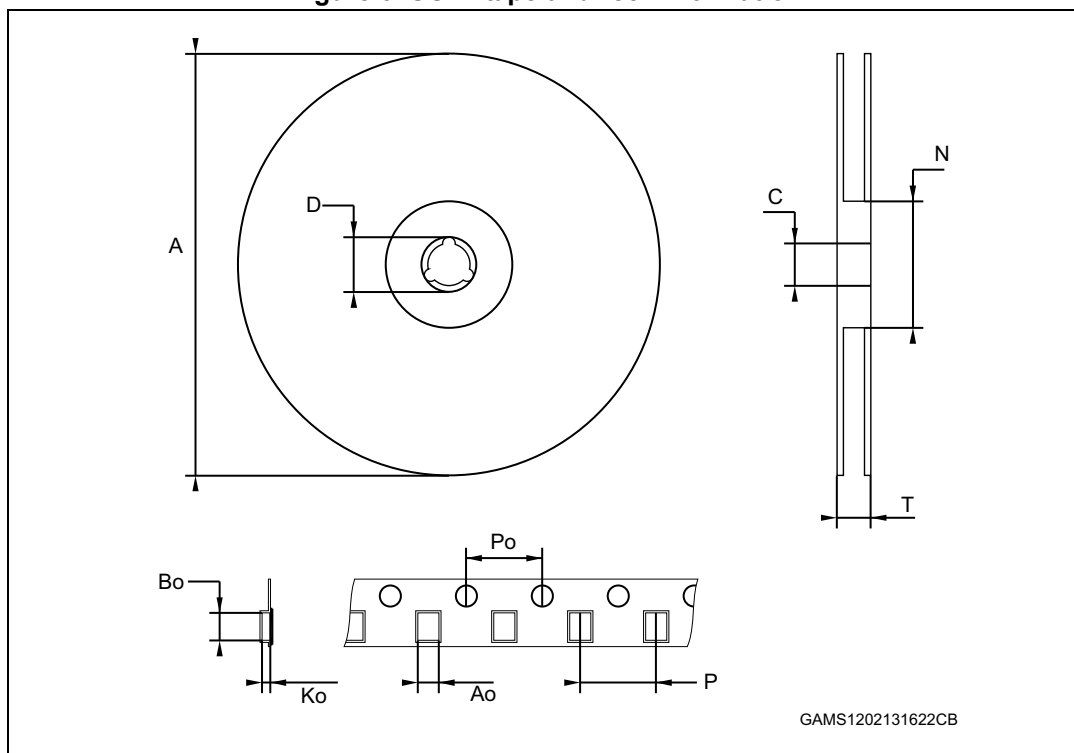


Table 9. SO14 package mechanical data

Ref	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.068
a1	0.1		0.2	0.003		0.007
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 °			45 °	
D	8.55		8.75	0.336		0.344
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		7.62			0.300	
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			0.68			0.026
S			8 °			8 °

Figure 6. SO14 tape and reel information



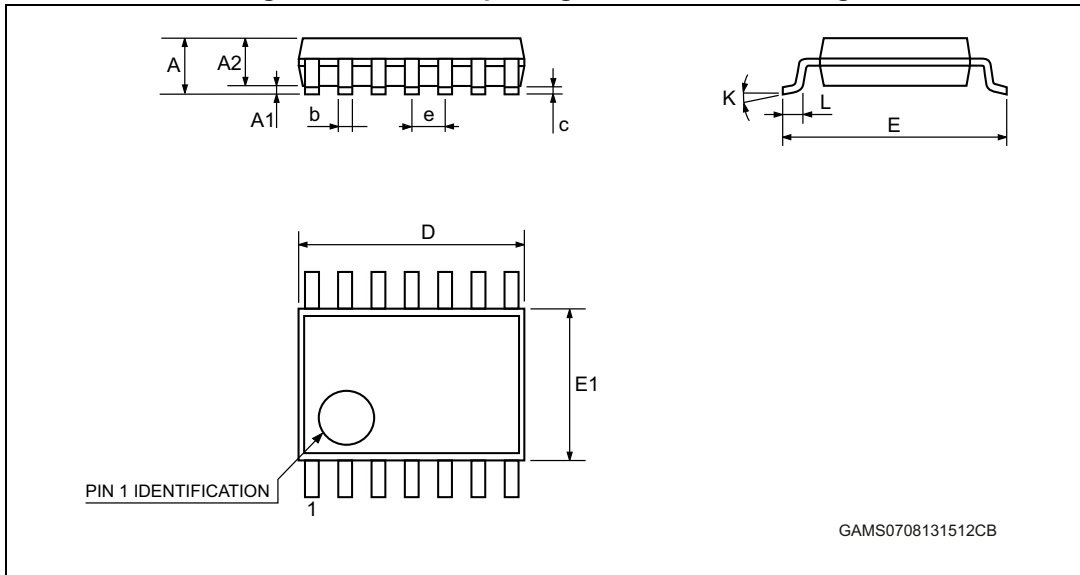
1. Drawing is not to scale

Table 10. SO14 tape and reel information

Ref	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	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	6.4	6.6	0.252	0.260
Bo	9	9.2	0.354	0.362
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

## 4.2 TSSOP14 package information

Figure 7. TSSOP14 package mechanical drawing

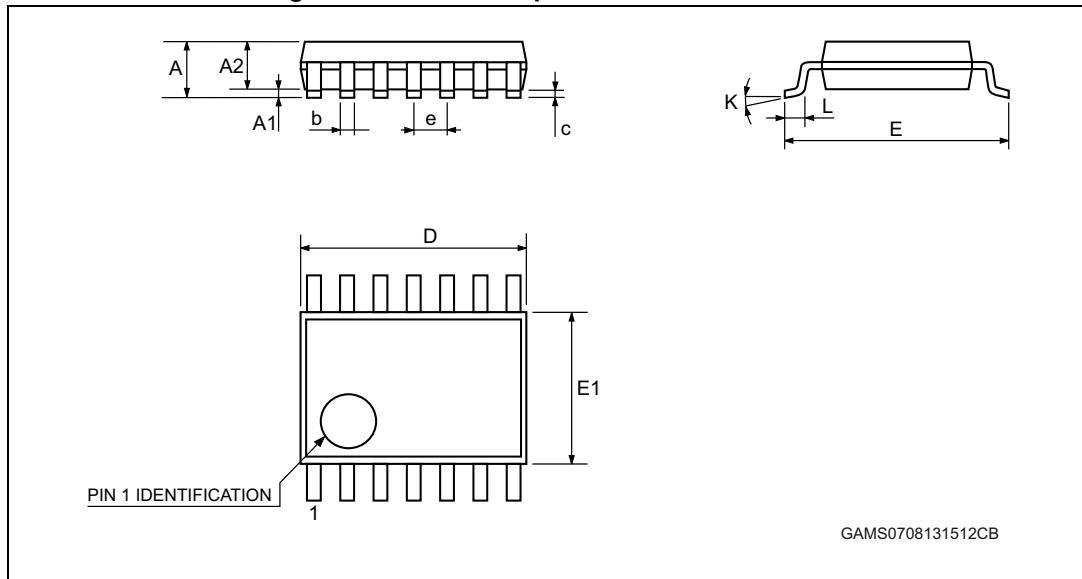


GAMS0708131512CB

Table 11. TSSOP14 package mechanical data

Ref	Dimensions					
	Millimeters			Inches		
	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

Figure 8. TSSOP14 tape and reel information



1. Drawing is not to scale

Table 12. TSSOP14 tape and reel information

Ref	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	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	6.7	6.9	0.264	0.272
Bo	5.3	5.5	0.209	0.217
Ko	1.6	1.8	0.063	0.071
Po	3.9	4.1	0.153	0.161
P	7.9	8.1	0.311	0.319

## 5 Ordering information

**Table 13. Order codes**

Order code	Temperature range	Package	Packing	Marking
M74HC14RM13TR	-55 °C to +125 °C	S014	Tape and reel	74HC14
M74HC14YRM13TR <sup>(1)</sup>	-40 °C to +125 °C	SO14 (automotive grade)		74HC14Y
M74HC14TTR	-55 °C to +125 °C	TSSOP14		HC14
M74HC14YTTR <sup>(1)</sup>	-40 °C to +125 °C	TSSOP14 (automotive grade)		HC14Y

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

## 6 Revision history

**Table 14. Document revision history**

Date	Revision	Changes
01-Jul-2001	1	Initial release.
23-May-2008	2	Document converted and restructured to new template. Removed: M74HC14M1R order code. Added: tape and reel specifications for SO-14 and TSSOP14 packages.
09-Aug-2013	3	<i>Features</i> : added ESD information <i>Table 1: Device summary</i> : added automotive grade order codes. Added <i>Section 5: Ordering information</i> .
13-Jan-2014	4	Removed DIP14 package <i>Table 1: Device summary</i> and <i>Table 13: Order codes</i> : added "Temperature range" and "Marking"; updated 1.

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