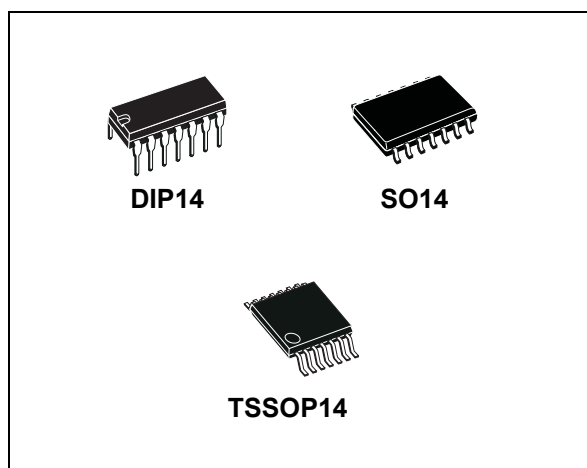


Hex Schmitt inverter

Datasheet - production data



- Balanced propagation delays:
 $t_{PLH} \cong t_{PHL}$
- 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

Description

The M74HC14 is a high speed CMOS hex Schmitt inverter fabricated with silicon gate C²MOS 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.

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:
 $|I_{OH}| = I_{OL} = 4 \text{ mA (min.)}$

Table 1. Device summary

Order code	Package	Packaging
M74HC14B1R	DIP14	Tube
M74HC14RM13TR	SO14	Tape and reel
M74HC14YRM13TR ⁽¹⁾	SO14 (automotive grade)	
M74HC14TTR	TSSOP14	
M74HC14YTTR ⁽¹⁾	TSSOP14 (automotive grade)	

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

Contents

1	Pin information	3
2	Functional description	4
3	Electrical characteristics	5
4	Package information	9
	4.1 DIP14 package information	9
	4.2 SO14 package information	10
	4.3 TSSOP14 package information	12
5	Ordering information	14
6	Revision history	15

1 Pin information

Figure 1. Pin connections and IEC logic symbols

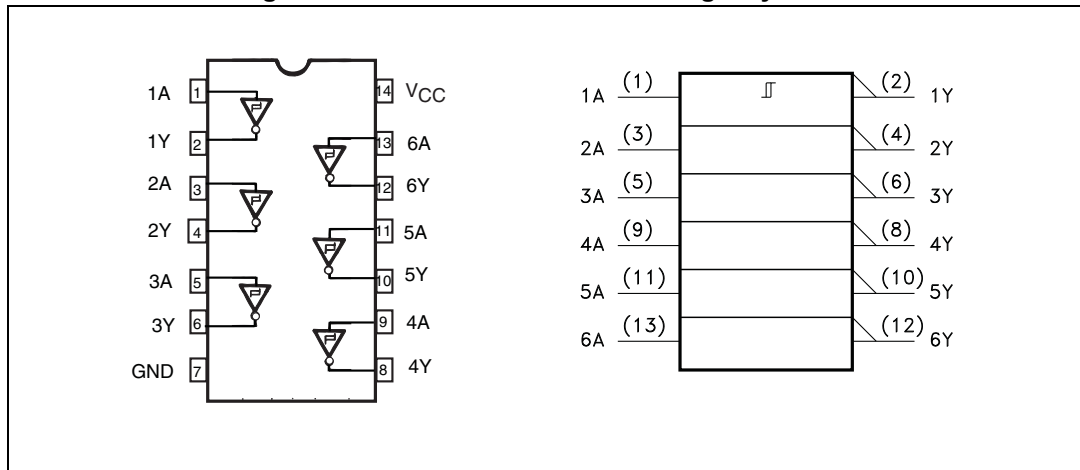


Table 2. Pin description

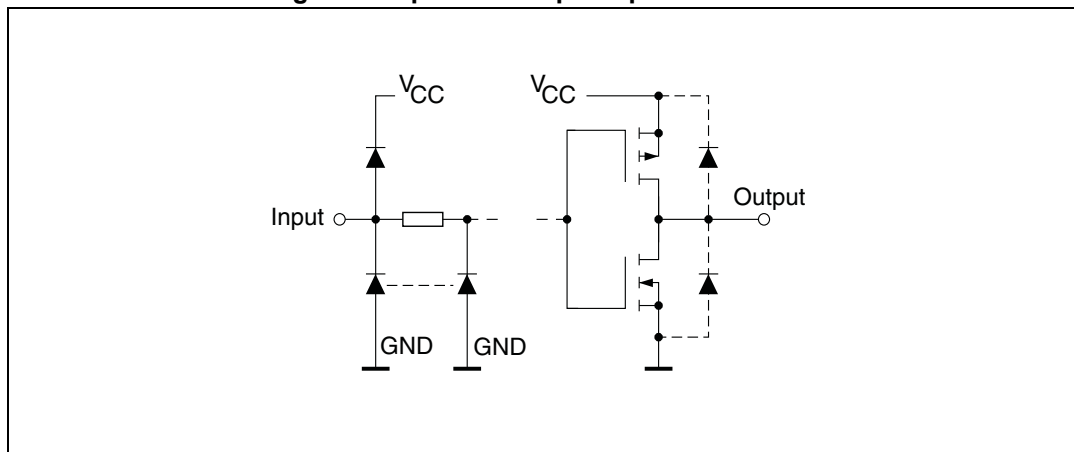
Pin number	Symbol	Name and function
1, 3, 5, 9, 11, 13	1A to 6A	Data inputs
2, 4, 6, 8, 10, 12	1Y to 6Y	Data outputs
7	GND	Ground (0 V)
14	V _{CC}	Positive supply voltage

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	± 20	mA
I_{OK}	DC output diode current		
I_O	DC output current	± 25	
I_{CC} or I_{GND}	DC V_{CC} or ground current	± 50	
P_D	Power dissipation	500 ⁽¹⁾	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 _{CC} (V)		T _A = 25 °C			-40 to 85 °C		-55 to 125 °C		
				Min	Typ	Max	Min	Max	Min		Max
V _{t+}	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 _{t-}	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 _H	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 _{OH}	High level output voltage	2.0	I _O = -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 _O = -4.0 mA	4.18	4.31		4.13		4.10		
		6.0	I _O = -5.2 mA	5.68	5.8		5.63		5.60		
V _{OL}	Low level output voltage	2.0	I _O = -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 _O = -4.0 mA		0.17	0.26		0.33		0.40	
		6.0	I _O = -5.2 mA		0.18	0.26		0.33		0.40	
I _I	Input leakage current	6.0	V _I = V _{CC} or GND			±0.1		±1		±1	μA
I _{CC}	Quiescent supply current					1		10		20	

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

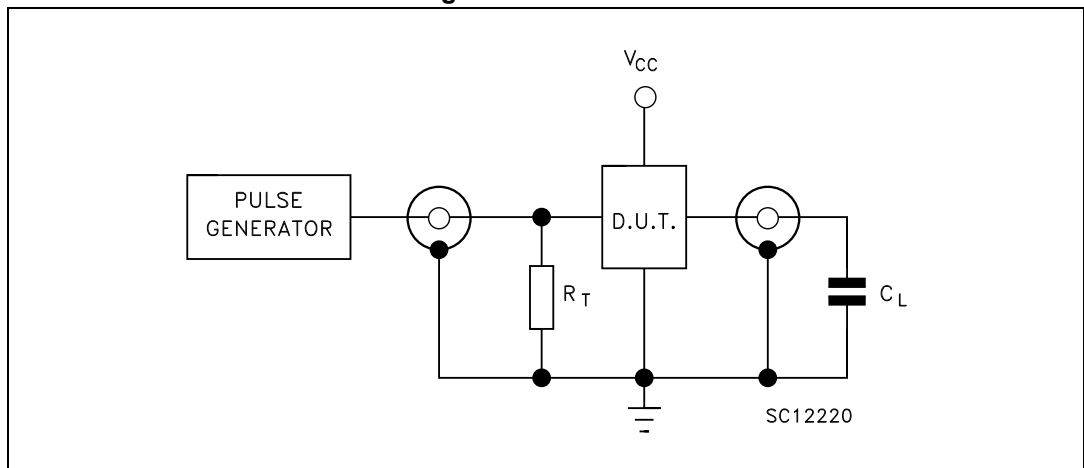
Sym.	Parameter	Test condition		Value				Unit
		V_{CC} (V)		$T_A = 25 \text{ }^\circ\text{C}$		$-40 \text{ to } 85 \text{ }^\circ\text{C}$	$-55 \text{ to } 125 \text{ }^\circ\text{C}$	
				Typ	Max	Max	Max	
t_{TLH} t_{THL}	Output transition time	2.0		30	75	95	110	ns
		4.5		8	15	19	22	
		6.0		7	13	16	19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

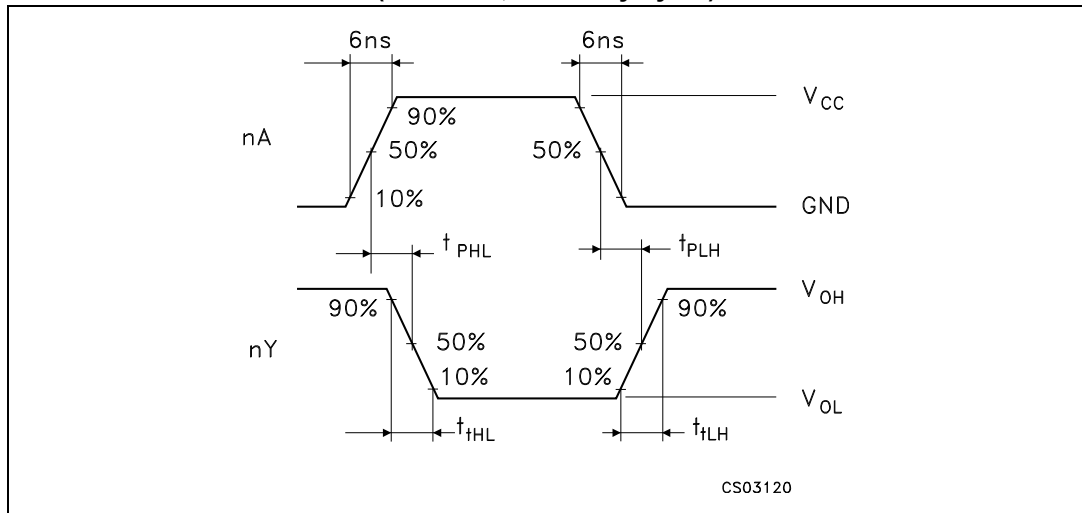
Sym	Parameter	Test condition		Value				Unit
		V_{CC} (V)		$T_A = 25 \text{ }^\circ\text{C}$		$-40 \text{ to } 85 \text{ }^\circ\text{C}$	$-55 \text{ to } 125 \text{ }^\circ\text{C}$	
				Typ	Max	Max	Max	
C_{IN}	Input capacitance	5.0		5	10	10	10	pF
C_{PD}	Power dissipation capacitance ⁽¹⁾		$f_{IN} = 10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

4.1 DIP14 package information

Figure 5. DIP14 package mechanical drawing

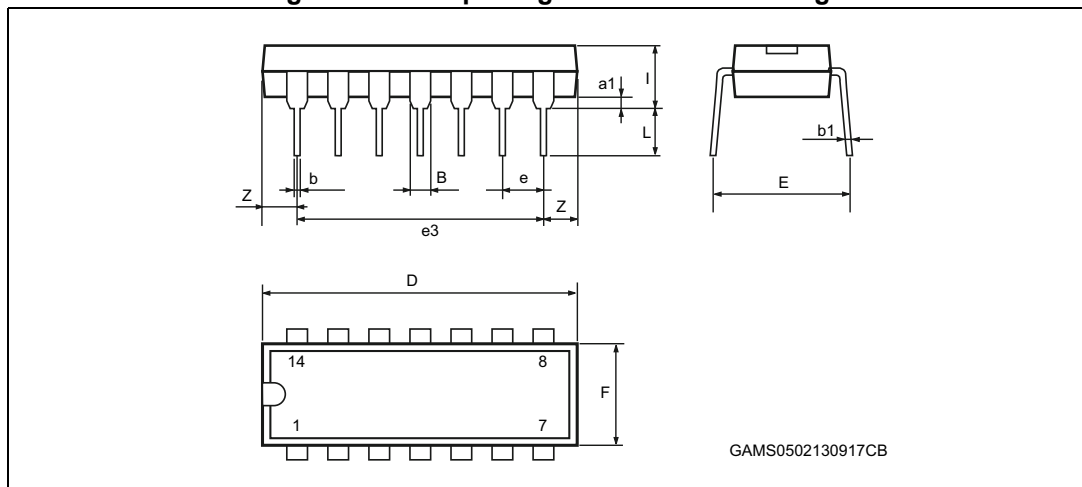


Table 9. DIP14 package mechanical data

Ref	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
l			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100

4.2 SO14 package information

Figure 6. SO14 package mechanical drawing

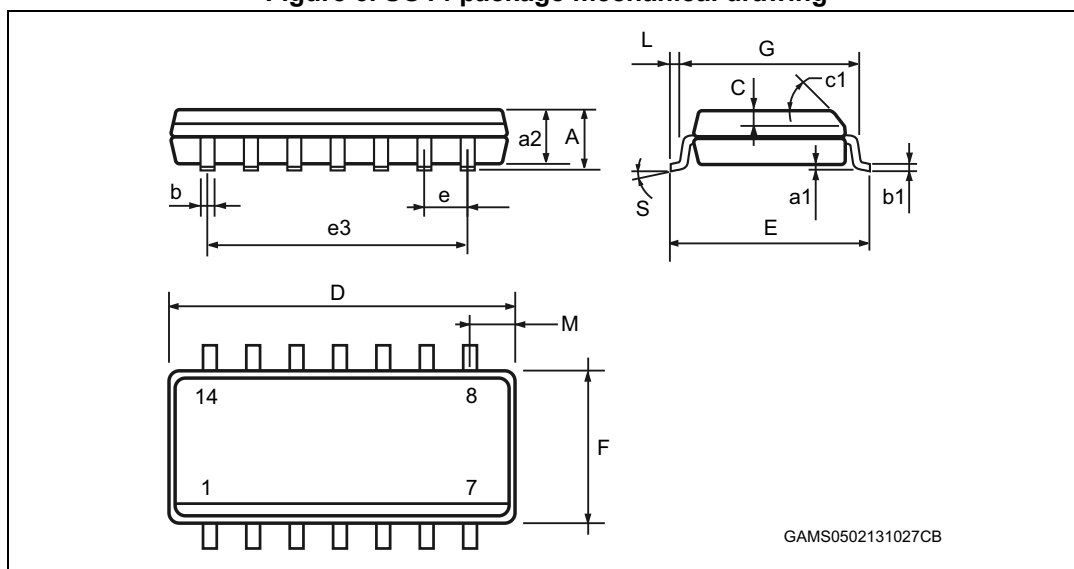
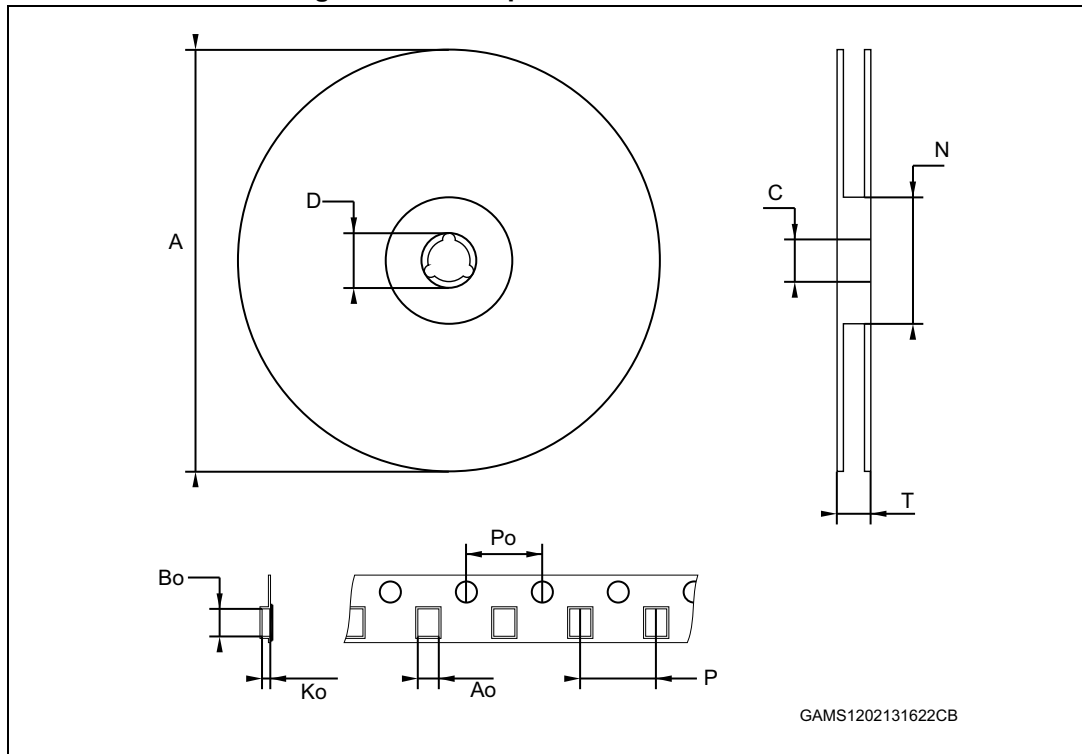


Table 10. SO14 package mechanical data

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 7. SO14 tape and reel information



1. Drawing is not to scale

Table 11. 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

4.3 TSSOP14 package information

Figure 8. TSSOP14 package mechanical drawing

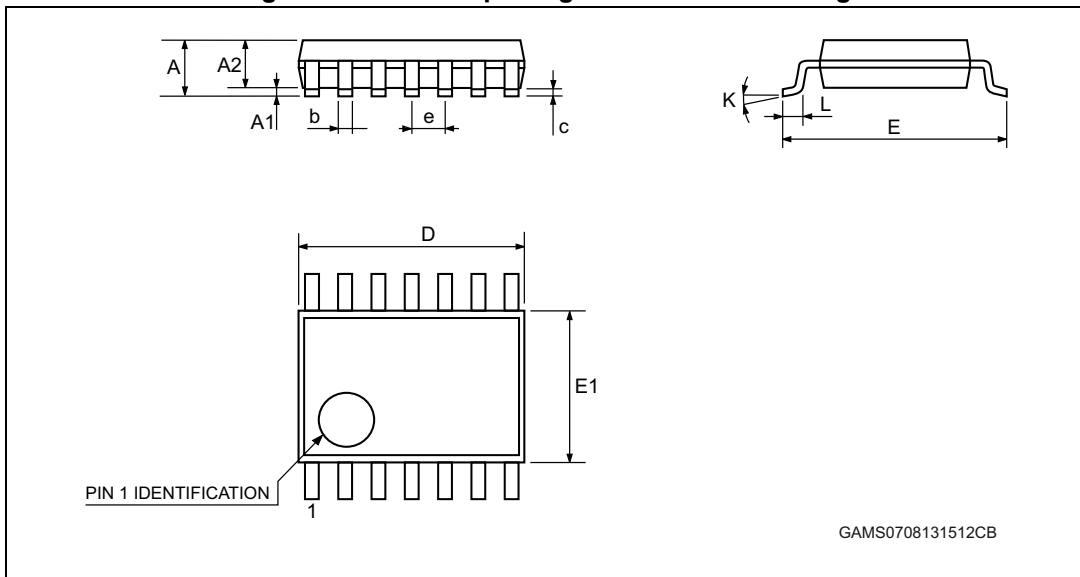
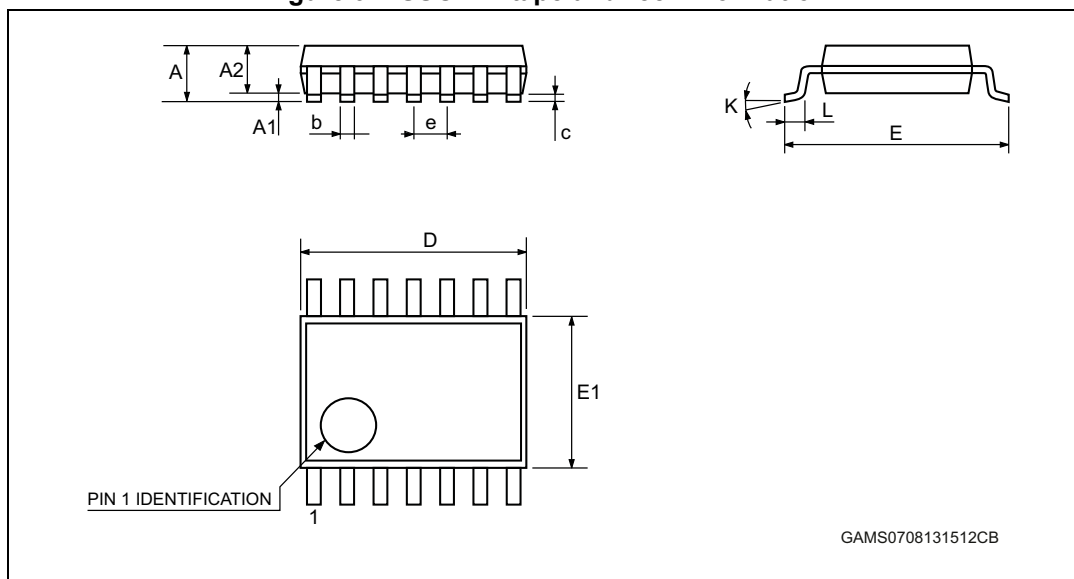


Table 12. TSSOP14 package mechanical data

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 9. TSSOP14 tape and reel information



1. Drawing is not to scale

Table 13. 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 14. Order codes

Order code	Package	Packaging
M74HC14B1R	DIP14	Tube
M74HC14RM13TR	S014	Tape and reel
M74HC14YRM13TR ⁽¹⁾	SO14 (automotive grade)	
M74HC14TTR	TSSOP14	
M74HC14YTTR ⁽¹⁾	TSSOP14 (automotive grade)	

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 15. 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> .

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