Hex Inverter with Schmitt-Trigger Input

Features

- Wide Supply Voltage Range from 2.0 V to 6.0 V
- I/O Tolerance Inputs to 6.0 V
- All Inputs with Schmitt-Trigger Input
- CMOS Low Power Dissipation
- I_{OFF} Supports Partial Power-down Protection
- ESD Protection: ±4-kV HBM Model, ±1-kV CDM Model
- Latch-up Performance Exceeds 100 mA per JESD 78, Class II

Applications

- Computing
- Tablet PC
- Television
- Wearable Device
- Server
- Industrial Equipment

Description

The T74A14 is a hex inverter with the V_{CC} supply from 2 V to 6 V. Schmitt-Trigger input allows inputs with slower rise-and-fall times and better noise immunity. I_{OFF} circuits can prevent backflow current during power-down, thus supporting partial power-down protection.

The T74A14 is available in TSSOP14 and SOP14 packages and is characterized from –40°C to 125°C.

Device Table

Device	Package	Body Size
T74A14-TS2R	TSSOP14	5 mm x 4.4 mm
T74A14-SO2R	SOP14	8.65 mm x 3.9 mm

Typical Application Circuit

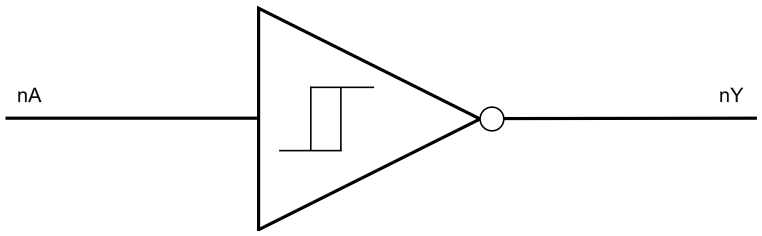


Table of Contents

Revision History

Date	Revision	Notes
2025-02-14	Rev.Pre.0	Initial version.
2025-11-09	Rev.A.0	Released version.

Pin Configuration and Functions

T74A14
TSSOP14/SOP14
Top View

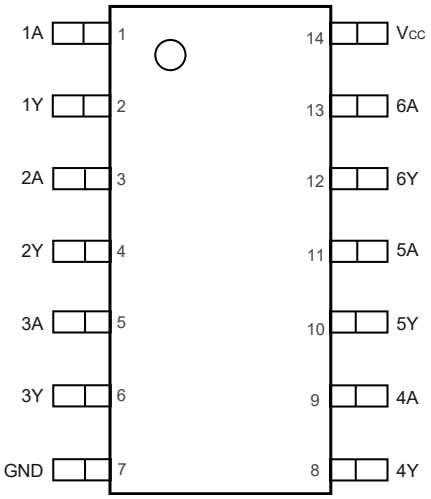


Table 1. Pin Functions

Pin No.	Name	I/O	Description
1, 3, 5, 9, 11, 13	1A, 2A, 3A, 4A, 5A, 6A	I	Input nA
2, 4 ,6, 8, 10, 12	1Y, 2Y, 3Y, 4Y, 5Y, 6Y	O	Output nY
7	GND	Power	Ground
14	V_{CC}	Power	Supply pin

Function Table

Table 2. Truth Table

Input	Output
nA	**nY**
L	H
H	L

(1) H = High voltage level.
(2) L = Low voltage level.
(3) X = Don't care.

Specifications

Absolute Maximum Ratings (1)

Parameter		Min	Max	Unit
V_{CC}	Supply Voltage	–0.5	7	V
V_I	Input Voltage (2)	–0.5	7	V
I_O	Continuous Output Current	−25	25	mA
I_{IK}	Input Clamp Current, $V_I < 0$	−20		mA
I_{OK}	Output Clamp Current, $V_O < 0$	−20		mA
	Continuous Current through V_{CC} or GND	−75	75	mA
T_J	Junction Temperature		150	°C
T_{STG}	Storage Temperature	–65	150	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.

ESD, Electrostatic Discharge Protection

Symbol	Parameter	Condition	Minimum Level	Unit
HBM	Human Body Model ESD	ANSI/ESDA/JEDEC JS-001, all pins (1)	±4,000	V
CDM	Charged Device Model ESD	ANSI/ESDA/JEDEC JS-002, all pins (2)	±1,000	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Recommended Operating Conditions

All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

Parameter		Min	Typ	Max	Unit
V_{CC}	Supply Voltage	2		6	V
V_I	Input Voltage	0		6	V
V_O	Output Voltage	0		V_{CC}	V
T_A	Ambient Temperature	−40		125	℃

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
TSSOP14	145.8	71.2	℃/W
SOP14	123.9	56.7	℃/W

Electrical Characteristics – DC Parameter

All test conditions: T_A = −40℃ to 125℃, all typical values are measured at T_A = 25℃, unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IH}	High-Level Input Voltage	V_{CC} = 3 V	2.2			V
		V_{CC} = 4.5 V	3.15			V
		V_{CC} = 5.5 V	3.85			V
		V_{CC} = 6 V	4.2			V
V_{IL}	Low-Level Input Voltage	V_{CC} = 3 V			0.9	V
		V_{CC} = 4.5 V			1.35	V
		V_{CC} = 5.5 V			1.65	V
		V_{CC} = 6 V			1.8	V
V_{OH}	High-Level Output Voltage	I_{OH} = −50 μA; V_{CC} = 2 V	1.9			V
		I_{OH} = −50 μA; V_{CC} = 3 V	2.9			V
		I_{OH} = −50 μA; V_{CC} = 4.5 V	4.4			V
		I_{OH} = −4 mA; V_{CC} = 3 V	2.4			V
		I_{OH} = −8 mA; V_{CC} = 4.5 V	3.7			V
		I_{OH} = −8 mA; V_{CC} = 6 V	5.2			V
V_{OL}	Low-Level Output Voltage	I_{OL} = 50 μA; V_{CC} = 2 V			0.1	V
		I_{OL} = 50 μA; V_{CC} = 3 V			0.1	V
		I_{OL} = 50 μA; V_{CC} = 4.5 V			0.1	V
		I_{OL} = 4 mA; V_{CC} = 3 V			0.55	V
		I_{OL} = 8 mA; V_{CC} = 4.5 V			0.55	V
		I_{OL} = 8 mA; V_{CC} = 6 V			0.55	V
I_I	Input Leakage Current	V_I = GND to 6 V; V_{CC} = 0 V to 6 V	−2	±0.1	2	μA
I_{OFF}	Power-off Leakage Current	V_I or V_O = 0 V to 6 V; V_{CC} = 0 V	−2	±0.1	2	μA
I_{CC}	Supply Current	V_I = GND or V_{CC}; I_O = 0 A; V_{CC} = 6 V		0.1	10	μA
C_I (1)	Input Capacitance	V_I = V_{CC} or GND;		2.1		pF

(1) Spec limit is based on bench characterization and design simulation, not tested in production.

Electrical Characteristics – AC Parameter

All test conditions: T_A = −40℃ to 125℃, all typical values are measured at T_A = 25℃, unless otherwise noted.

Symbol (1)	Parameter	Conditions	Min	Typ	Max	Unit
t_{PD} (2)	Propagation Delay	C_{LOAD} = 15 pF; V_{CC} = 3 V to 3.6 V	1.8	4.2	7.2	ns
		C_{LOAD} = 50 pF; V_{CC} = 3 V to 3.6 V	3.3	5.9	10.2	ns
		C_{LOAD} = 15 pF; V_{CC} = 4.5 V to 5.5 V	1.5	3.6	5.7	ns
		C_{LOAD} = 50 pF; V_{CC} = 4.5 V to 5.5 V	2.6	4.5	7.8	ns
C_{PD} (3)	Power Dissipation Capacitance	f = 1 MHz; V_I = GND to V_{CC}		7.7		pF

(1) Spec limit is based on bench characterization and design simulation, not tested in production.
(2) t_{PD} is the same as t_{PLH} and t_{PHL}.
(3) C_{PD} is used to determine the dynamic power dissipation (PD in μW).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$

Where:

f_i = Input frequency in MHz;

f_o = Output frequency in MHz;

C_L = Output load capacitance in pF;

V_{CC} = Supply voltage in Volts;

N = Number of inputs switching;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = Sum of the outputs.

Parameter Measurement Waveforms

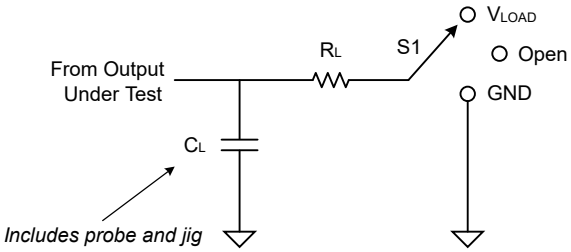


Figure 1. Timing Measurement Load Circuit

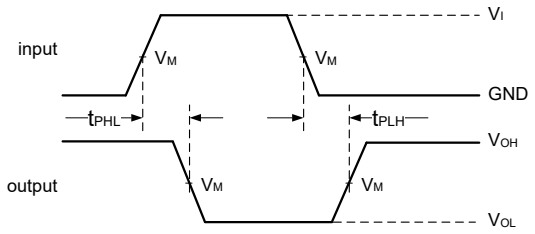


Figure 2. Propagation Delay Times

Table 3. Test Data

V_{CC}	Inputs		C_L	R_L	V_M	S1
	V_I	t_r/t_f				t_{PHL}/t_{PLH}
3 V to 3.6 V	V_{CC}	≤ 3 ns	15 pF, 50 pF	1 kΩ	$0.5V_{CC}$	Open
4.5 V to 5.5 V	V_{CC}	≤ 3 ns	15 pF, 50 pF	1 kΩ	$0.5V_{CC}$	Open

Application and Implementation

> Note
>
> Information in the following application sections is not part of the 3PEAK's component specification and 3PEAK does not warrant its accuracy or completeness. 3PEAK's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

Typical Application

Figure 3 shows the typical application schematic.

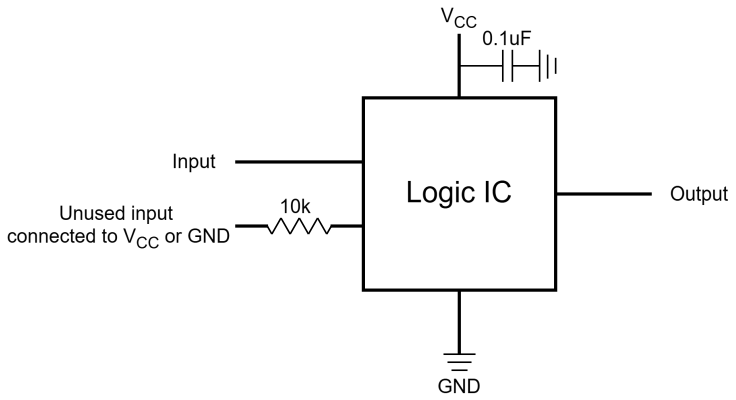
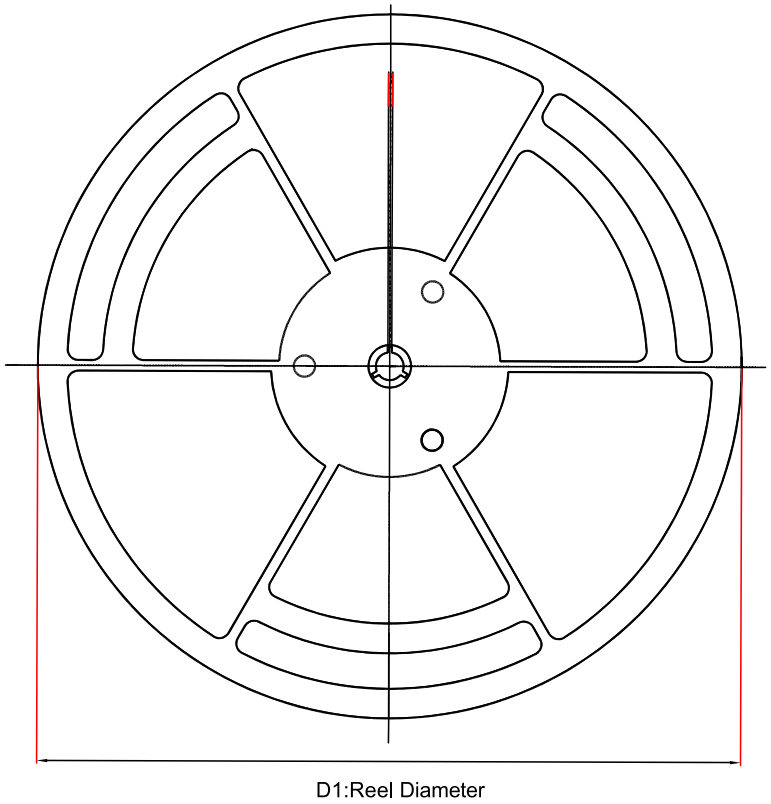
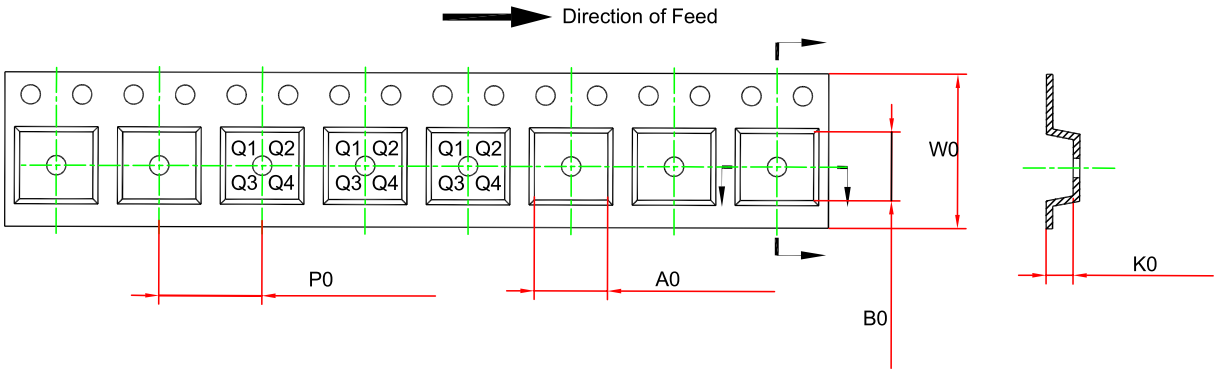


Figure 3. Typical Application Circuit

Tape and Reel Information



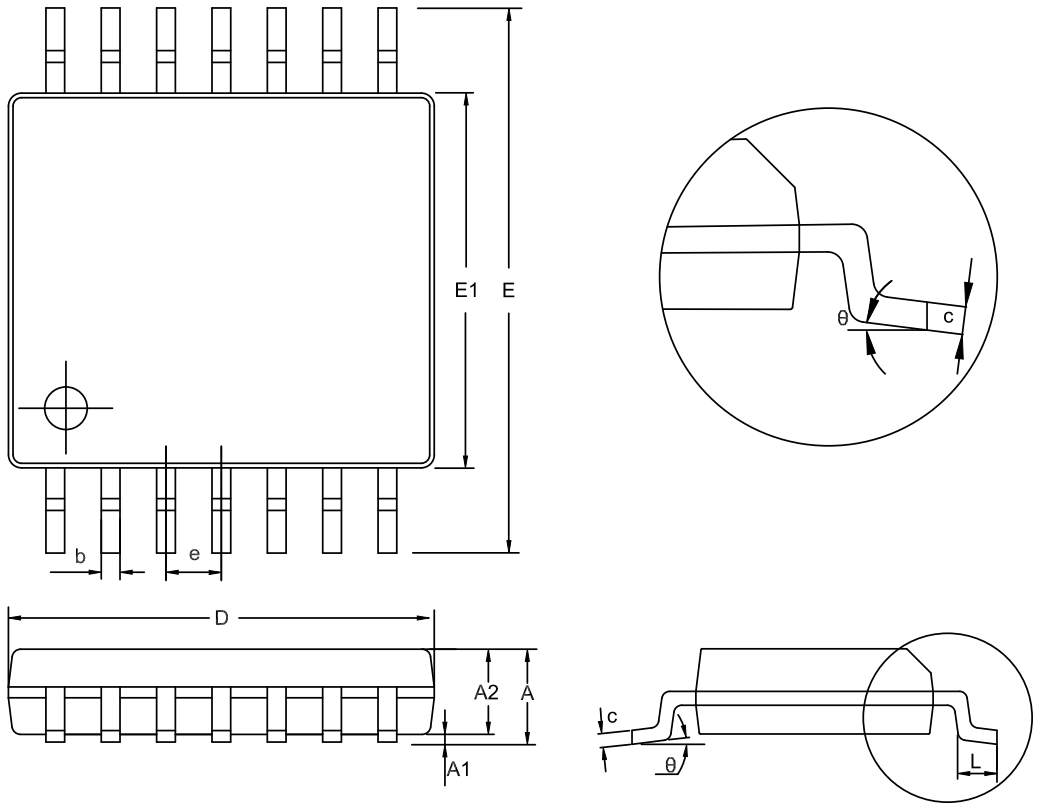


Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
T74A14-TS2R	TSSOP14	330	17.6	6.8	5.5	1.5	8	12	Q1
T74A14-SO2R	SOP14	330	21.6	6.5	9.3	2.1	8	16	Q1

Package Outline Dimensions

TSSOP14

Package Outline Dimensions TS2(TSSOP-14-A)



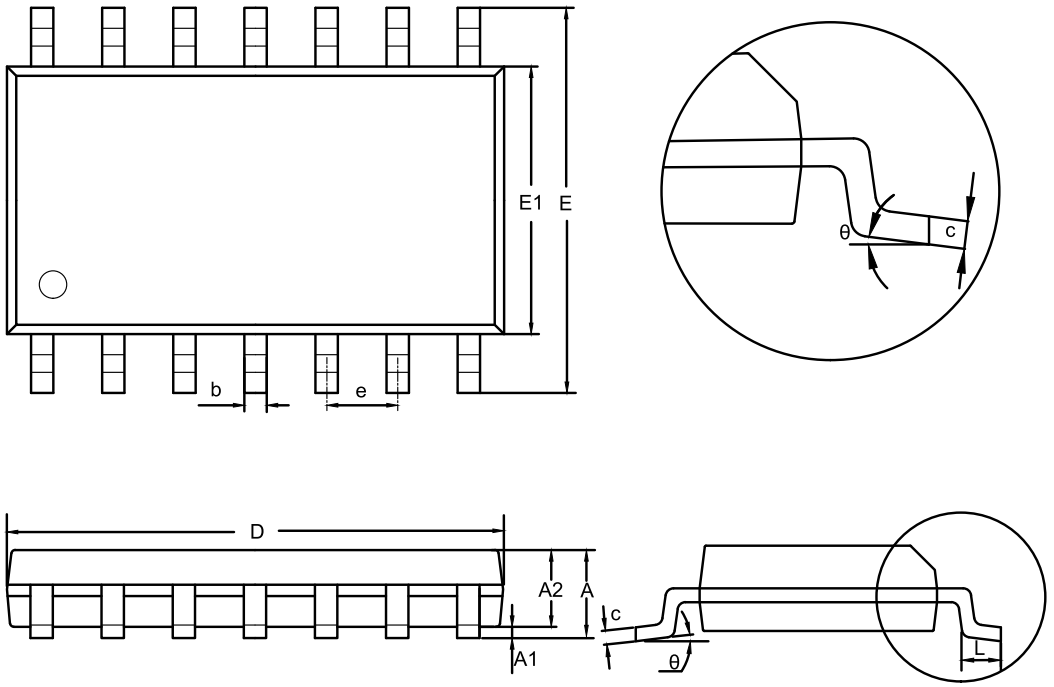
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.900	1.200	0.035	0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.900	5.100	0.193	0.201
E	6.200	6.600	0.244	0.260
E1	4.300	4.500	0.169	0.177
e	0.650 BSC		0.026 BSC	
L	0.450	0.750	0.018	0.030
θ	0	8°	0	8°

NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

SOP14

Package Outline Dimensions SO2(SOP-14-A)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.050	0.250	0.002	0.010
A2	1.250	1.650	0.049	0.065
b	0.310	0.510	0.012	0.020
c	0.100	0.250	0.004	0.010
D	8.450	8.850	0.333	0.348
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
e	1.270 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0	8°	0	8°

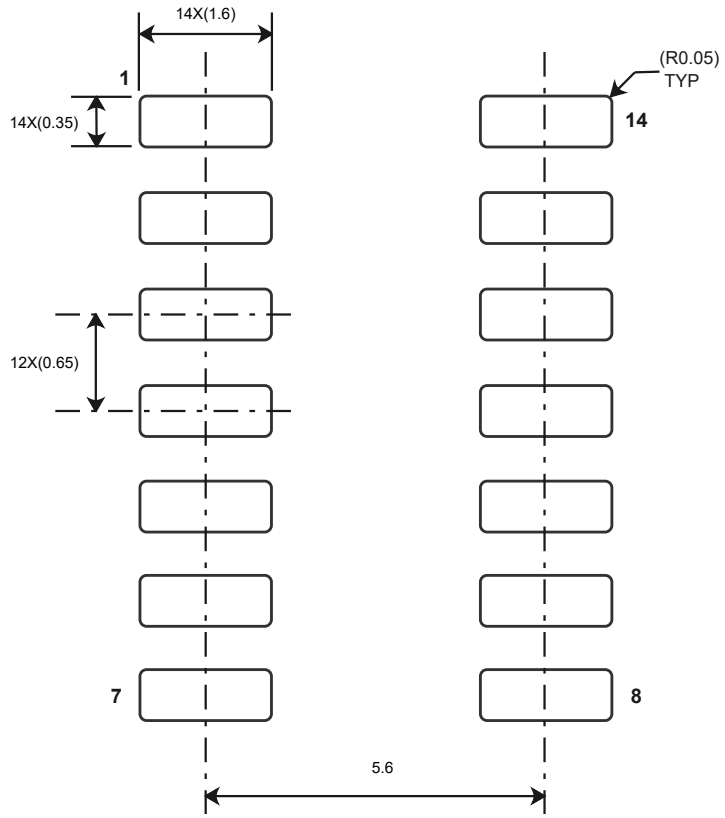
NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

Land Pattern

TSSOP14

EXAMPLE BOARD LAYOUT **TSSOP14**

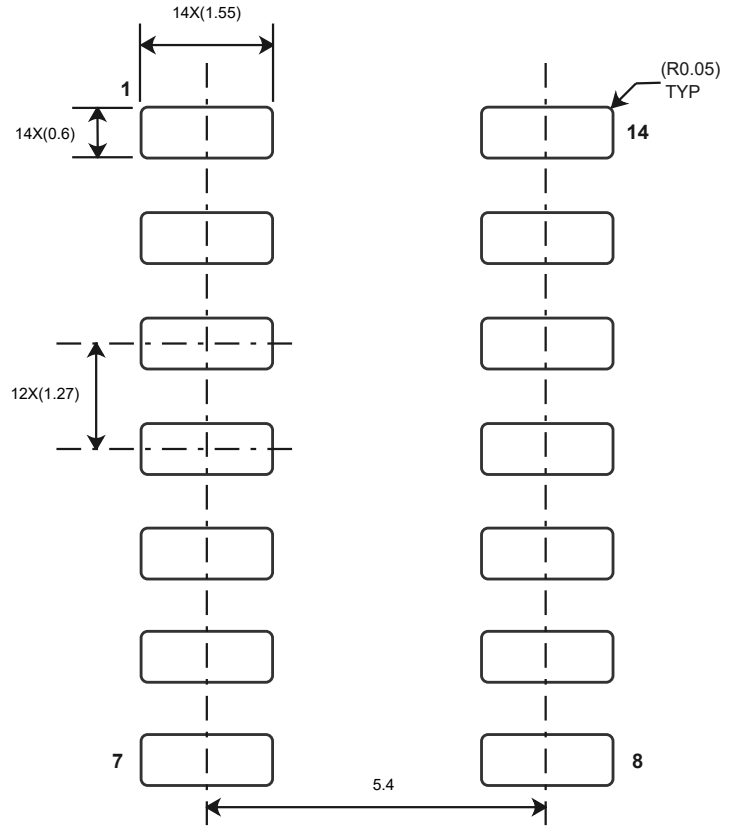


LAND PATTERN EXAMPLE

NOTES
1.All dimensions are in millimeters.
2.This drawing is for design reference only.
3.This drawing is subject to change without notice.

SOP14

EXAMPLE BOARD LAYOUT SOP14



LAND PATTERN EXAMPLE

NOTES
1.All dimensions are in millimeters.
2.This drawing is for design reference only.
3.This drawing is subject to change without notice.

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
T74A14-TS2R	−40 to 125℃	TSSOP14	AHC14	MSL3	Tape and Reel,3000	Green
T74A14-SO2R	−40 to 125℃	SOP14	AHC14	MSL3	Tape and Reel,2500	Green

Green: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

IMPORTANT NOTICE AND DISCLAIMER

Trademarks. Any of the 思瑞浦 or 3PEAK trade names, trademarks, graphic marks, and domain names contained in this document /material are the property of 3PEAK. You may NOT reproduce, modify, publish, transmit or distribute any Trademark without the prior written consent of 3PEAK.

Performance Information. Performance tests or performance range contained in this document/material are either results of design simulation or actual tests conducted under designated testing environment. Any variation in testing environment or simulation environment, including but not limited to testing method, testing process or testing temperature, may affect actual performance of the product.

Disclaimer. 3PEAK provides technical and reliability data (including data sheets), design resources (including reference designs), application or other design recommendations, networking tools, security information and other resources "As Is". 3PEAK makes no warranty as to the absence of defects, and makes no warranties of any kind, express or implied, including without limitation, implied warranties as to merchantability, fitness for a particular purpose or non-infringement of any third-party's intellectual property rights. Unless otherwise specified in writing, products supplied by 3PEAK are not designed to be used in any life-threatening scenarios, including critical medical applications, automotive safety-critical systems, aviation, aerospace, or any situations where failure could result in bodily harm, loss of life, or significant property damage. 3PEAK disclaims all liability for any such unauthorized use.

This page intentionally left blank