## 1. General description

The 74HC4514; 74HCT4514 is a 4-to-16 line decoder/demultiplexer having four binary weighted address inputs (A0 to A3), with latches, a latch enable input (LE), an enable input ( $\overline{E}$ ) and 16 outputs (Q0 to Q15). When LE is HIGH, the selected output is determined by the data on An. When LE goes LOW, the last data present at An are stored in the latches and the outputs remain stable. When  $\overline{E}$  is LOW, the selected output, determined by the contents of the latch, is HIGH. At  $\overline{E}$  HIGH, all outputs are LOW. The enable input  $\overline{E}$  does not affect the state of the latch. When the device is used as a demultiplexer,  $\overline{E}$  is the data input and A0 to A3 are the address inputs. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

The 74HCT4514 features reduced input threshold levels to allow interfacing to TTL logic levels.

#### 2. Features and benefits

- Wide supply voltage range from 2.0 to 6.0 V
- · CMOS low power dissipation
- High noise immunity
- Input levels:
  - For 74HC4514: CMOS level
  - For 74HCT4514: TTL level
- 16-line demultiplexing capability
- Decodes 4 binary-coded inputs into 16 mutually-exclusive outputs
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

# 3. Applications

- · Digital multiplexing
- Address decoding
- Hexadecimal/BCD decoding

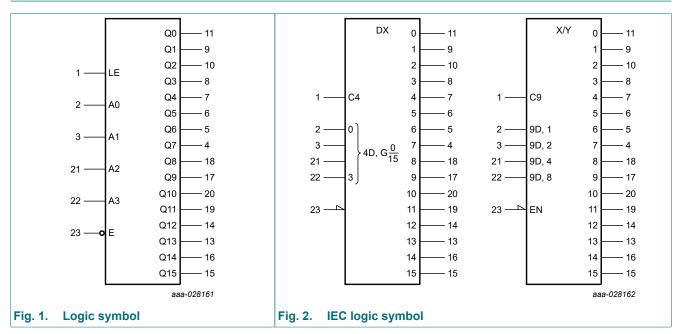


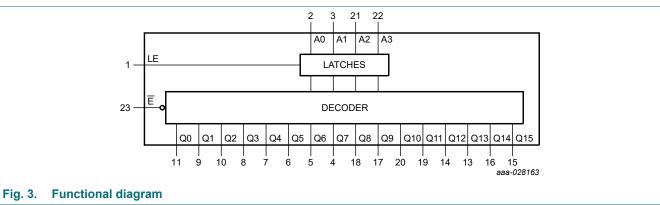
# 4. Ordering information

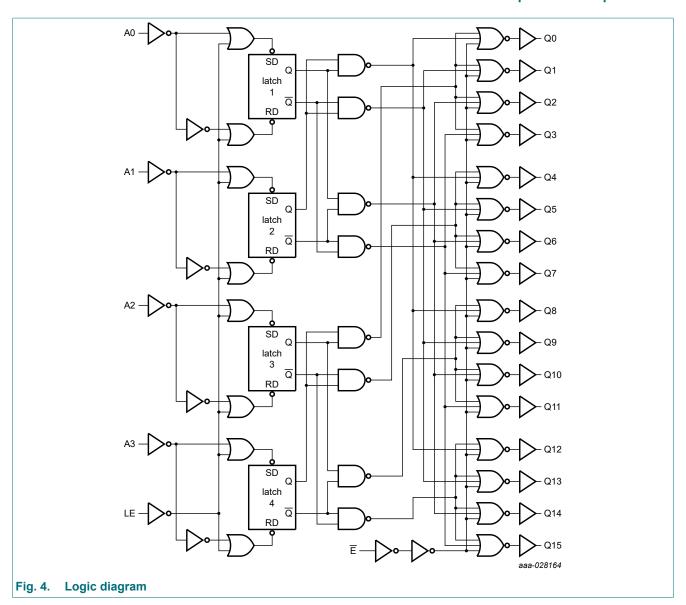
**Table 1. Ordering information** 

Type number	Package											
	Temperature range Name Description											
74HC4514D	-40 °C to +125 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	<u>SOT137-1</u>								
74HC4514PW 74HCT4514PW	-40 °C to +125 °C	TSSOP24	plastic thin shrink small outline package; 24 leads; body width 4.4 mm	SOT355-1								

# 5. Functional diagram

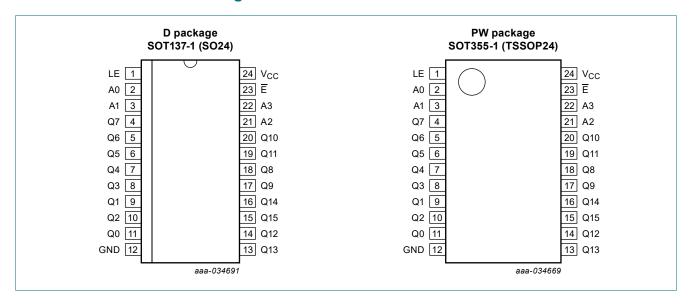






## 6. Pinning information

#### 6.1. Pinning



### 6.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
LE	1	latch enable input (active HIGH)
Ē	23	enable input (active LOW)
Q0, Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14, Q15	11, 9, 10, 8, 7, 6, 5, 4, 18, 17, 20, 19, 14, 13, 16, 15	multiplexer outputs (active HIGH)
A0, A1, A2, A3	2, 3, 21, 22	address inputs
GND	12	ground (0 V)
Vcc	24	supply voltage

# 7. Functional description

#### Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care. Input LE = HIGH.

Inpu	ts				Outp	outs														
E	A0	A1	A2	А3	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
Н	Х	Х	Х	Х	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
L	L	L	L	L	Н	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
L	Н	L	L	L	L	Н	L	L	L	L	L	L	L	L	L	L	L	L	L	L
L	L	Н	L	L	L	L	Н	L	L	L	L	L	L	L	L	L	L	L	L	L
L	Н	Н	L	L	L	L	L	Н	L	L	L	L	L	L	L	L	L	L	L	L
L	L	L	Н	L	L	L	L	L	Н	L	L	L	L	L	L	L	L	L	L	L
L	Н	L	Н	L	L	L	L	L	L	Н	L	L	L	L	L	L	L	L	L	L
L	L	Н	Н	L	L	L	L	L	L	L	Н	L	L	L	L	L	L	L	L	L
L	Н	Н	Н	L	L	L	L	L	L	L	L	Н	L	L	L	L	L	L	L	L
L	L	L	L	Н	L	L	L	L	L	L	L	L	Н	L	L	L	L	L	L	L
L	Н	L	L	Н	L	L	L	L	L	L	L	L	L	Н	L	L	L	L	L	L
L	L	Н	L	Н	L	L	L	L	L	L	L	L	L	L	Н	L	L	L	L	L
L	Н	Н	L	Н	L	L	L	L	L	L	L	L	L	L	L	Н	L	L	L	L
L	L	L	Н	Н	L	L	L	L	L	L	L	L	L	L	L	L	Н	L	L	L
L	Н	L	Н	Н	L	L	L	L	L	L	L	L	L	L	L	L	L	Н	L	L
L	L	Н	Н	Н	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Н	L
L	Н	Н	Н	Н	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Н

# 8. Limiting values

#### **Table 4. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		-0.5	+7	V
I <sub>IK</sub>	input clamping current	$V_{I} < -0.5 \text{ V or } V_{I} > V_{CC} + 0.5 \text{ V}$	-	±20	mA
I <sub>OK</sub>	output clamping current	$V_{O} < -0.5 \text{ V or } V_{O} > V_{CC} + 0.5 \text{ V}$	-	±20	mA
Io	output current	-0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V	-	±25	mA
I <sub>CC</sub>	supply current		-	50	mA
I <sub>GND</sub>	ground current		-50	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	[1]	-	500	mW

<sup>[1]</sup> For SOT137-1 (SO24) package: P<sub>tot</sub> derates linearly with 16.2 mW/K above 119 °C. For SOT355-1 (TSSOP24) package: P<sub>tot</sub> derates linearly with 12.4 mW/K above 110 °C.

# 9. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	-	74HC4514	4	7	4HCT451	4	Unit
			Min	Тур	Max	Min	Тур	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
VI	input voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
Vo	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 2.0 V	-	-	625	-	-	-	ns/V
		V <sub>CC</sub> = 4.5 V	-	1.67	139	-	1.67	139	ns/V
		V <sub>CC</sub> = 6.0 V	-	-	83	-	-	-	ns/V
T <sub>amb</sub>	ambient temperature		-40	-	+125	-40	-	+125	°C

## 10. Static characteristics

#### **Table 6. Static characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		+25 °C		−40 °C t	o +85 °C	-40 °C to	Unit	
			Min	Тур	Max	Min	Max	Min	Max	
74HC45	14			'	'					
V <sub>IH</sub>	HIGH-level	V <sub>CC</sub> = 2.0 V	1.5	1.2	-	1.5	-	1.5	-	V
	input voltage	V <sub>CC</sub> = 4.5 V	3.15	2.4	-	3.15	-	3.15	-	V
		V <sub>CC</sub> = 6.0 V	4.2	3.2	-	4.2	-	4.2	-	V
$V_{IL}$	LOW-level	V <sub>CC</sub> = 2.0 V	-	0.8	0.5	-	0.5	-	0.5	V
	input voltage	V <sub>CC</sub> = 4.5 V	-	2.1	1.35	-	1.35	-	1.35	V
		V <sub>CC</sub> = 6.0 V	-	2.8	1.8	-	1.8	-	1.8	V
V <sub>OH</sub>	HIGH-	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
	level output voltage	I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
	voitage	I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	6.0	-	5.9	-	5.9	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V	3.98	4.32	-	3.84	-	3.7	-	V
		I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V	5.48	5.81	-	5.34	-	5.2	-	V
$V_{OL}$	LOW-level	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>								
	output voltage	I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
	Voltage	I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.26	-	0.33	-	0.4	V
l <sub>l</sub>	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 6.0 \text{ V}$	-	-	±0.1	-	±1.0	-	±1.0	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 6.0 \text{ V}$	-	-	8.0	-	80	-	160	μΑ
Cı	input capacitance		-	3.5	-	-	-	-	-	pF

Symbol	Parameter	Conditions		+25 °C		-40 °C t	o +85 °C	-40 °C t	o +125 °C	Unit
			Min	Тур	Max	Min	Max	Min	Max	
74HCT4	514						'		1	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	1.2	0.8	-	0.8	-	0.8	V
V <sub>OH</sub>	HIGH-	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5 V$								
	level output voltage	Ι <sub>Ο</sub> = -20 μΑ	4.4	4.5	-	4.4	-	4.4	-	٧
	voltage	I <sub>O</sub> = -4 mA	3.98	4.32	-	3.84	-	3.7	-	٧
V <sub>OL</sub>	LOW-level	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 4.5 V$								
	output voltage	Ι <sub>Ο</sub> = 20 μΑ	-	0	0.1	-	0.1	-	0.1	V
	voltage	I <sub>O</sub> = 4.0 mA	-	0.15	0.26	-	0.33	-	0.4	٧
I <sub>I</sub>	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	±0.1	-	±1.0	-	±1.0	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5$ V; $I_O = 0$ A	-	-	8.0	-	80	-	160	μΑ
ΔI <sub>CC</sub>	additional supply current	per input pin; $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V;}$ $V_{I} = V_{CC} - 2.1 \text{ V;}$ other inputs at $V_{CC}$ or GND; $I_{O} = 0 \text{ A}$								
		An	-	65	234	-	292.5	-	318.5	μΑ
		LE	-	140	504	-	630	-	686	μΑ
		Ē	-	100	360	-	450	-	490	μΑ
Cı	input capacitance		-	3.5	-	-	-	-	-	pF

# 11. Dynamic characteristics

#### **Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V);  $C_L$  = 50 pF unless otherwise specified; for test circuit, see Fig. 7.

Symbol	Parameter	Conditions		+25 °C		-40 °C t	o +85 °C	−40 °C to	Unit	
			Min	Тур	Max	Min	Max	Min	Max	
74HC45	14						1		'	
t <sub>pd</sub>	propagation	An to Qn; see Fig. 5 [1]								
	delay	V <sub>CC</sub> = 2.0 V	-	74	230	-	290	-	345	ns
		V <sub>CC</sub> = 4.5 V	-	27	46	-	58	-	69	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF	-	23	-	-	-	-	-	ns
		V <sub>CC</sub> = 6.0 V	-	22	39	-	49	-	59	ns
		LE to Qn; see Fig. 5								
		V <sub>CC</sub> = 2.0 V	-	74	230	-	290	-	345	ns
		V <sub>CC</sub> = 4.5 V	-	27	46	-	58	-	69	ns
		V <sub>CC</sub> = 6.0 V	-	22	39	-	49	-	59	ns
		E to Qn; see Fig. 5								
		V <sub>CC</sub> = 2.0 V	-	41	175	-	220	-	265	ns
		V <sub>CC</sub> = 4.5 V	-	15	35	-	44	-	53	ns
		V <sub>CC</sub> = 6.0 V	-	12	30	-	37	-	45	ns
t <sub>t</sub>	transition	Qn; see <u>Fig. 5</u> [2]								
time	time	V <sub>CC</sub> = 2.0 V	-	19	75	-	95	-	110	ns
		V <sub>CC</sub> = 4.5 V	-	7	15	-	19	-	22	ns
		V <sub>CC</sub> = 6.0 V	-	6	13	-	16	-	19	ns
t <sub>W</sub>	pulse witdh	LE HIGH; see Fig. 6								
		V <sub>CC</sub> = 2.0 V	80	14	-	100	-	120	-	ns
		V <sub>CC</sub> = 4.5 V	16	5	-	20	-	24	-	ns
		V <sub>CC</sub> = 6.0 V	14	4	-	17	-	20	-	ns
t <sub>su</sub>	set-up time	An to LE; see Fig. 6								
		V <sub>CC</sub> = 2.0 V	90	25	-	115	-	135	-	ns
		V <sub>CC</sub> = 4.5 V	18	9	-	23	-	27	-	ns
		V <sub>CC</sub> = 6.0 V	15	7	-	20	-	23	-	ns
t <sub>h</sub>	hold time	An to LE; see Fig. 6								
		V <sub>CC</sub> = 2.0 V	1	-11	-	1	-	1	-	ns
		V <sub>CC</sub> = 4.5 V	1	-4	-	1	-	1	-	ns
		V <sub>CC</sub> = 6.0 V	1	-3	-	1	-	1	-	ns
C <sub>PD</sub>	power dissipation capacitance	per package; [3] V <sub>I</sub> = GND to V <sub>CC</sub>	-	44	-	-	-	-	-	pF

Symbol	Parameter	Conditions			+25 °C		-40 °C t	o +85 °C	-40 °C to	+125 °C	Unit
				Min	Тур	Max	Min	Max	Min	Max	1
74HCT4	514										-
t <sub>pd</sub>	propagation	An to Qn; see Fig. 5	[1]								
	delay	V <sub>CC</sub> = 4.5 V		-	30	55	-	69	-	83	ns
		V <sub>CC</sub> = 5 V; C <sub>L</sub> = 15 pF		-	26	-	-	-	-	-	ns
		LE to Qn; V <sub>CC</sub> = 4.5 V; see <u>Fig. 5</u>		-	29	50	-	63	-	75	ns
		E to Qn; V <sub>CC</sub> = 4.5 V; see <u>Fig. 5</u>		-	17	40	-	50	-	60	ns
t <sub>t</sub>	transition time	Qn; V <sub>CC</sub> = 4.5 V; see <u>Fig. 5</u>	[2]	-	7	15	-	19	-	22	ns
t <sub>W</sub>	pulse witdh	LE HIGH; V <sub>CC</sub> = 4.5 V; see <u>Fig. 6</u>		16	4	-	20	-	24	-	ns
t <sub>su</sub>	set-up time	An to LE; $V_{CC} = 4.5 \text{ V}$ ; see Fig. 6		18	9	-	23	-	27	-	ns
t <sub>h</sub>	hold time	An to LE; $V_{CC} = 4.5 \text{ V}$ ; see Fig. 6		3	-3	-	3	-	3	-	ns
C <sub>PD</sub>	power dissipation capacitance	per package; V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V	[3]	-	45	-	-	-	-	-	pF

- $t_{\text{pd}}$  is the same as  $t_{\text{PLH}}$  and  $t_{\text{PHL}}$
- [2]
- $t_t$  is the same as  $t_{TLH}$  and  $t_{THL}$   $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu W$ ).

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

 $f_i$  = input frequency in MHz;

fo = output frequency in MHz;

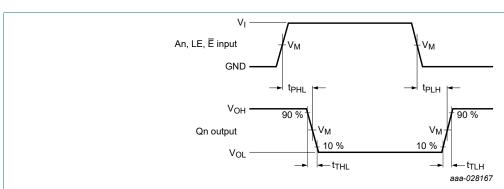
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of load switching outputs;

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

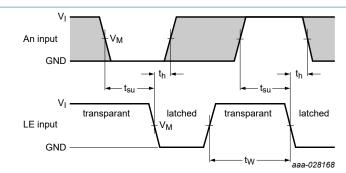
#### 11.1. Waveforms and test circuit



Measurement points are given in Table 8.

V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage levels that occur with the output load.

Fig. 5. The inputs (An, LE, E) to output (Qn) propagation delays and the output transition times



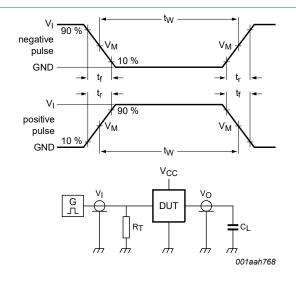
Measurement points are given in Table 8.

The shaded areas indicate when the input is permitted to change for predictable output performance.

Fig. 6. Data set-up and hold times for An input to LE input and LE input pulse width

**Table 8. Measurement points** 

Туре	Input	Output	
	V <sub>I</sub>	V <sub>M</sub>	V <sub>M</sub>
74HC4514	GND to V <sub>CC</sub>	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>
74HCT4514	GND to 3 V	1.3 V	1.3 V



Test data is given in Table 9.

Definitions for test circuit:

R<sub>T</sub> = Termination resistance; should be equal to output impedance Z<sub>o</sub> of the pulse generator;

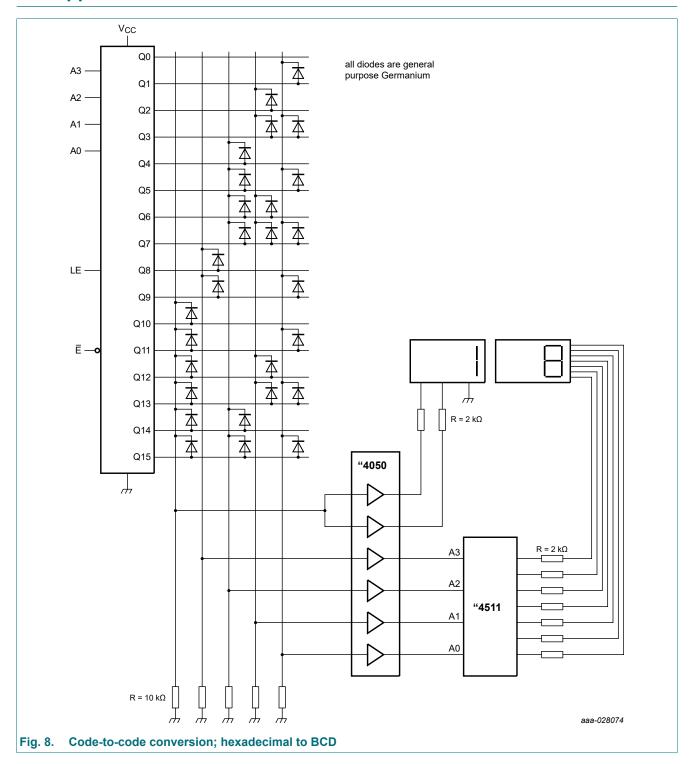
 $C_L$  = Load capacitance including jig and probe capacitance

Fig. 7. Test circuit for measuring switching times

Table 9. Test data

Туре	Input	Load	
	V <sub>I</sub>	t <sub>r</sub> , t <sub>f</sub>	CL
74HC4514	GND to V <sub>CC</sub>	6 ns	15 pF, 50 pF
74HCT4514	GND to 3 V	6 ns	15 pF, 50 pF

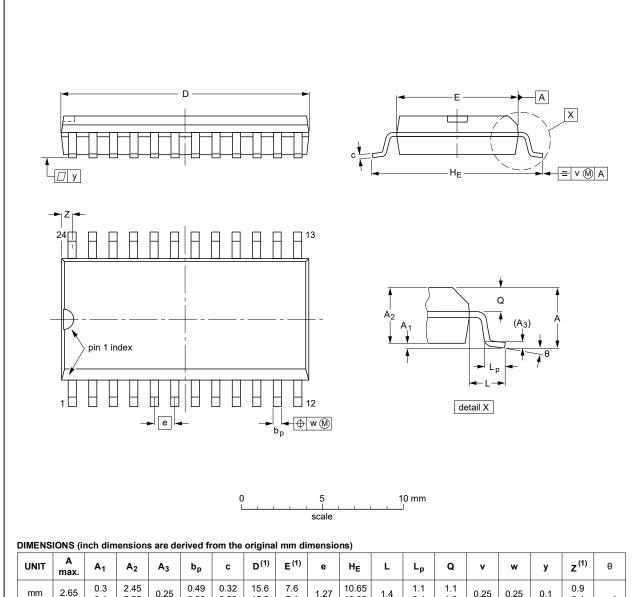
# 12. Application information



# 13. Package outline

#### SO24: plastic small outline package; 24 leads; body width 7.5 mm

SOT137-1



UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	bp	С	D <sup>(1)</sup>	E <sup>(1)</sup>	е	HE	L	Lp	Q	v	w	у	z <sup>(1)</sup>	θ
mm	2.65	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	15.6 15.2	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8°
inches	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.61 0.60	0.30 0.29	0.05	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	0°

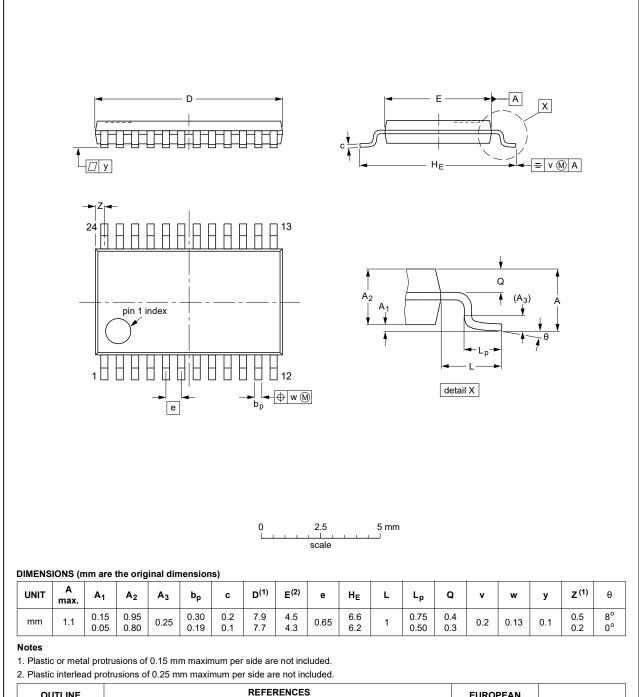
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

	OUTLINE	REFERENCES			EUROPEAN	ISSUE DATE	
	VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
	SOT137-1	075E05	MS-013				<del>99-12-27</del> 03-02-19

Fig. 9. Package outline SOT137-1 (SO24)

TSSOP24: plastic thin shrink small outline package; 24 leads; body width 4.4 mm

SOT355-1



OUTLINE VERSION	REFERENCES			EUROPEAN	ISSUE DATE	
	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT355-1		MO-153				<del>99-12-27</del> 03-02-19

Fig. 10. Package outline SOT355-1 (TSSOP24)

## 14. Abbreviations

#### **Table 10. Abbreviations**

Acronym	Description
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

# 15. Revision history

#### **Table 11. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT4514 v.5	20240507	Product data sheet	-	74HC_HCT4514 v.4
Modifications:	Type number 74HCT4514D (SOT137-1/SO24) removed.			
74HC_HCT4514 v.4	20210715	Product data sheet	-	74HC_HCT4514 v.3
Modifications:	<ul> <li>Type number 74HC4514DB (SOT340-1/SSOP24) removed.</li> <li>Section 2 updated.</li> <li>Section 8: Derating values for P<sub>tot</sub> total power dissipation updated.</li> </ul>			
74HC_HCT4514 v.3	20180220	Product data sheet	-	74HC_HCT4514 v.2
Modifications:	<ul> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>			
74HC_HCT4514 v.2	19930901	Product specification	-	74HC_HCT4514 v.1

## 16. Legal information

#### **Data sheet status**

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

- Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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#### 4-to-16 line decoder/demultiplexer with input latches

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## **Contents**

1. General description	1
2. Features and benefits	1
3. Applications	1
4. Ordering information	2
5. Functional diagram	2
6. Pinning information	
6.1. Pinning	∠
6.2. Pin description	
7. Functional description	
8. Limiting values	
9. Recommended operating conditions	
10. Static characteristics	
11. Dynamic characteristics	
11.1. Waveforms and test circuit	
12. Application information	
13. Package outline	
14. Abbreviations	
15. Revision history	
16. Legal information	

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