74LVC139

Dual 2-to-4 line decoder/demultiplexer Rev. 5 — 19 October 2011

Product data sheet

1. **General description**

The 74LVC139 is a dual 2-to-4 line decoder/demultiplexer. It has two independent decoders, each accepting two binary weighted inputs (nA0 and nA1) and providing four mutually exclusive outputs (nY0 to nY3) that are LOW when selected. Each decoder has an active LOW input (nE). When nE is HIGH, every output is forced HIGH. The enable input can be used as the data input for a 1-to-4 demultiplexer application.

Features and benefits 2.

- Wide supply voltage range from 1.2 V to 3.6 V
- Inputs accept voltages up to 5.5 V
- CMOS low power consumption
- Direct interface with TTL levels
- Demultiplexing capability
- Two independent 2-to-4 decoders
- Multifunction capability
- Mutually exclusive outputs
- Output drive capability 50 Ω transmission lines at 125 °C
- Complies with JEDEC standard:
 - ◆ JESD8-7A (1.65 V to 1.95 V)
 - ◆ JESD8-5A (2.3 V to 2.7 V)
 - ◆ JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-B exceeds 200 V
 - CDM JESD22-C101E exceeds 1000 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C



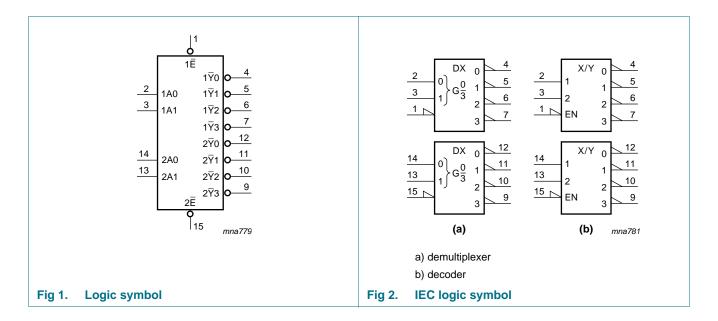
Dual 2-to-4 line decoder/demultiplexer

3. Ordering information

Table 1. Ordering information

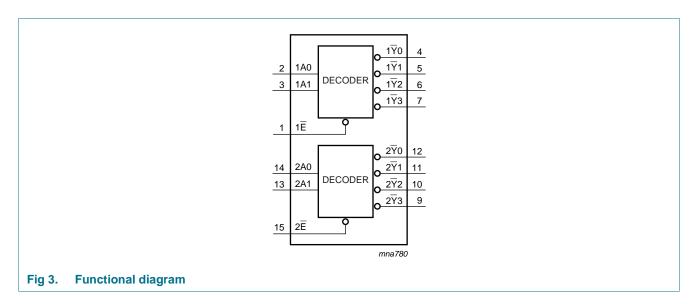
Type number	Package	Package									
	Temperature range	Name	Description	Version							
74LVC139D	–40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1							
74LVC139DB	–40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1							
74LVC139PW	–40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1							
74LVC139BQ	–40 °C to +125 °C	DHVQFN16	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 \times 3.5 \times 0.85 mm	SOT763-1							

4. Functional diagram



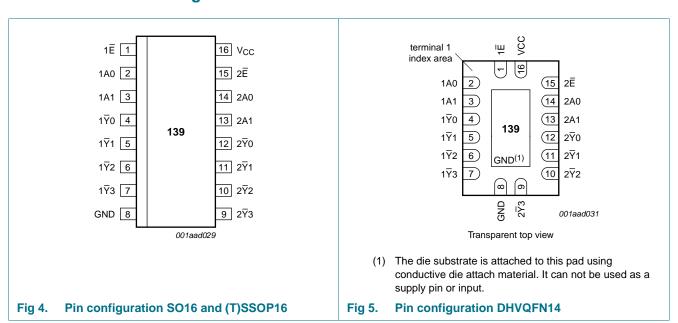
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Pinning information 5.

Pinning 5.1



5.2 Pin description

Pin description Table 2.

Name	Pin	Description	
1Ē	1	enable input (active LOW)	
2E	15	enable input (active LOW)	
1A[0:1]	2, 3	address input	
2A[0:1]	14, 13	address input	
1 Y [0:3]	4, 5, 6, 7	output	
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Table 2. Pin description ...continued

Name	Pin	Description
2 Y [0:3]	12, 11, 10, 9	output
GND	8	ground (0 V)
V _{CC}	16	positive supply voltage

6. Functional description

Table 3. Function table[1]

Input			Output	Output					
nE	nA0	nA1	nY0	nY1	nY2	nY3			
Н	X	X	Н	Н	Н	Н			
L	L	L	L	Н	Н	Н			
L	Н	L	Н	L	Н	Н			
L	L	Н	Н	Н	L	Н			
L	Н	Н	Н	Н	Н	L			

^[1] H = HIGH voltage level; L = LOW voltage level; X = don't care

7. 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	+6.5	V
I _{IK}	input clamping current	V _I < 0	-50	-	mA
VI	input voltage		<u>[1]</u> –0.5	+6.5	V
I _{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0 V$	-	±50	mA
Vo	output voltage		<u>[2]</u> –0.5	$V_{CC} + 0.5$	V
Io	output current	$V_O = 0 V \text{ to } V_{CC}$	-	±50	mA
I _{CC}	supply current		-	100	mA
I_{GND}	ground current		-100	-	mA
T _{stg}	storage temperature		–65	+150	°C
P _{tot}	total power dissipation	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$	[3] _	500	mW

^[1] The minimum input voltage ratings may be exceeded if the input current ratings are observed.

^[2] The output voltage ratings may be exceeded if the output current ratings are observed.

^[3] For SO16 packages: above 70 °C derate linearly with 8 mW/K.
For SSOP16 and TSSOP16 packages: above 60 °C derate linearly with 5.5 mW/K.
For DHVQFN16 packages: above 60 °C derate linearly with 4.5 mW/K.

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8. Recommended operating conditions

Table 5. Recommended operating conditions

Parameter	Conditions	Min	Тур	Max	Unit
supply voltage		1.65	-	3.6	V
	functional	1.2	-	-	V
input voltage		0	-	5.5	V
output voltage		0	-	V_{CC}	V
ambient temperature	in free air	-40		+125	°C
input transition rise and fall	$V_{CC} = 1.65 \text{ V to } 2.7 \text{ V}$	0	-	20	ns/V
rate	V _{CC} = 2.7 V to 3.6 V	0	-	10	ns/V
	input voltage output voltage ambient temperature input transition rise and fall	supply voltage functional input voltage output voltage ambient temperature in free air input transition rise and fall V _{CC} = 1.65 V to 2.7 V	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$

9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions	-40	°C to +8	35 °C	-40 °C to	+125 °C	Unit
			Min	Typ[1]	Max	Min	Max	
V _{IH}	HIGH-level	V _{CC} = 1.2 V	1.08	-	-	1.08	-	٧
	input voltage	V _{CC} = 1.65 V to 1.95 V	$0.65 \times V_{CC}$	-	-	$0.65 \times V_{CC}$	-	٧
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
V_{IL}	LOW-level	V _{CC} = 1.2 V	-	-	0.12	-	0.12	V
	input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	$0.35 \times V_{CC}$	-	$0.35 \times V_{CC}$	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
V _{OH}	HIGH-level	$V_I = V_{IH}$ or V_{IL}						
output voltage	$I_O = -100 \mu A;$ $V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	V _{CC} - 0.2	-	-	$V_{CC}-0.3$	-	V	
	$I_O = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	-	-	1.05	-	V	
		$I_{O} = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.8	-	-	1.65	-	V
		$I_{O} = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	-	-	2.05	-	٧
		$I_{O} = -18 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.4	-	-	2.25	-	V
		$I_{O} = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.2	-	-	2.0	-	V
V _{OL}	LOW-level	$V_I = V_{IH}$ or V_{IL}						
	output voltage	$I_O = 100 \mu A;$ $V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	-	-	0.2	-	0.3	V
		$I_O = 4 \text{ mA}$; $V_{CC} = 1.65 \text{ V}$	-	-	0.45	-	0.65	٧
		$I_O = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.6	-	0.8	V
		$I_O = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.4	-	0.6	V
		$I_O = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	-	0.8	V
l _l	input leakage current	V_{CC} = 3.6 V; V_I = 5.5 V or GND	-	±0.1	±5	-	±20	μΑ

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Table 6. Static characteristics ... continued

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

Symbol	Parameter	Conditions	-40	°C to +8	85 °C	-40 °C to	+125 °C	Unit
			Min	Typ[1]	Max	Min	Max	
I _{CC}	supply current	$V_{CC} = 3.6 \text{ V}; V_I = V_{CC} \text{ or GND};$ $I_O = 0 \text{ A}$	-	0.1	10	-	40	μΑ
ΔI_{CC}	additional supply current	per input pin ; V_{CC} = 2.7 V to 3.6 V; V_I = V_{CC} - 0.6 V; I_O = 0 A	-	5	500	-	5000	μΑ
Cı	input capacitance	$V_{CC} = 0 \text{ V to } 3.6 \text{ V};$ $V_I = \text{GND to } V_{CC}$	-	5.0	-	-	-	pF

^[1] All typical values are measured at V_{CC} = 3.3 V (unless stated otherwise) and T_{amb} = 25 °C.

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Figure 8.

Symbol	Parameter	Conditions		-40	°C to +8	5 °C	-40 °C to	+125 °C	Unit
				Min	Typ[1]	Max	Min	Max	
t_{pd}	propagation delay	nAn to Yn; see Figure 6	[2]						
		V _{CC} = 1.2 V		-	14	-	-	-	ns
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		0.5	4.7	10.4	0.5	11.3	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		1.0	2.8	5.9	1.0	6.5	ns
		$V_{CC} = 2.7 \text{ V}$		1.0	3.0	6.3	1.0	8.0	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		1.0	2.5	5.3	1.0	7.0	ns
		nE to Yn; see Figure 7	[2]						
		V _{CC} = 1.2 V		-	14	-	-	-	ns
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.5	4.5	9.8	1.5	10.7	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		2.1	2.7	5.6	2.1	6.1	ns
		$V_{CC} = 2.7 \text{ V}$		1.0	2.8	5.4	1.0	7.0	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		1.0	2.4	5.0	1.0	6.5	ns
t _{sk(o)}	output skew time	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[3]	-	-	1.0	-	1.5	ns
C_{PD}	power dissipation	$V_I = GND$ to V_{CC}	<u>[4]</u>						
	capacitance	$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		-	5.6	-	-	-	pF
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		-	11.3	-	-	-	pF
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		-	16.4	-	-	-	pF

^[1] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.2 V, 1.8 V, 2.5 V, 2.7 V, and 3.3 V respectively.

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

 f_i = input frequency in MHz; f_o = output frequency in MHz

C_L = output load capacitance in pF

V_{CC} = supply voltage in V

N = number of inputs switching,

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^[2] t_{pd} is the same as t_{PLH} and t_{PHL} .

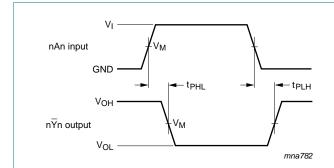
^[3] Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

^[4] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

Dual 2-to-4 line decoder/demultiplexer

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

11. Waveforms

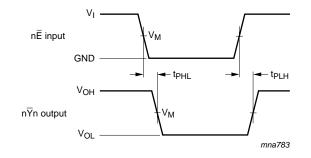


 V_M = 1.5 V at $V_{CC} \geq 2.7$ V.

 $V_M = 0.5 \times V_{CC}$ at $V_{CC} < 2.7 \ V.$

 V_{OL} and V_{OH} are the typical output voltage levels that occur with the output load.

Fig 6. Input (nAn) to output $(n\overline{Y}n)$ propagation delays



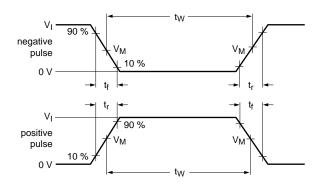
 V_M = 1.5 V at $V_{CC} \ge 2.7$ V.

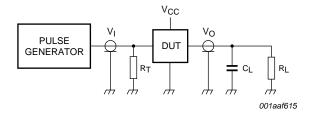
 V_M = 0.5 \times V_{CC} at V_{CC} < 2.7 V.

 $V_{\mbox{\scriptsize OL}}$ and $V_{\mbox{\scriptsize OH}}$ are the typical output voltage levels that occur with the output load.

Fig 7. Enable input (nE) to output (nYn) propagation delays

Dual 2-to-4 line decoder/demultiplexer





Test data is given in Table 8.

Definitions for test circuit:

 R_L = Load resistance.

 C_L = Load capacitance including jig and probe capacitance.

 R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

Fig 8. Load circuitry for switching times

Table 8. Test data

Supply voltage	Input		Load			
	V _I	t _r , t _f	C _L	R _L		
1.2 V	V _{CC}	≤ 2 ns	30 pF	1 kΩ		
1.65 V to 1.95 V	V _{CC}	≤ 2 ns	30 pF	1 kΩ		
2.3 V to 2.7 V	V _{CC}	≤ 2 ns	30 pF	500 Ω		
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω		
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω		

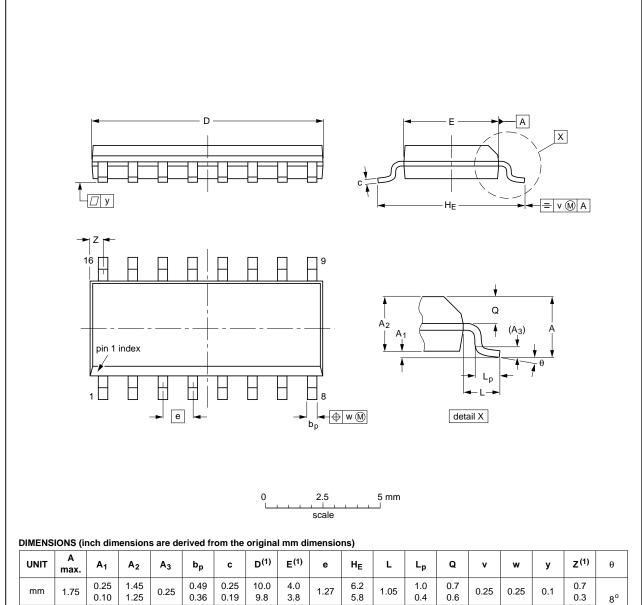
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Dual 2-to-4 line decoder/demultiplexer

12. Package outline

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1



UNIT	A max.	A ₁	A ₂	A ₃	bp	С	D ⁽¹⁾	E ⁽¹⁾	е	HE	L	Lp	ø	v	w	у	Z ⁽¹⁾	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8°
inches	0.069	0.010 0.004	0.057 0.049	0.01		0.0100 0.0075		0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016		0.01	0.01	0.004	0.028 0.012	0°

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

OUTLINE		REFER	ENCES	EUROPEAN	ISSUE DATE
VERSION	IEC	JEDEC	JEITA	PROJECTION	ISSUE DATE
SOT109-1	076E07	MS-012			99-12-27 03-02-19

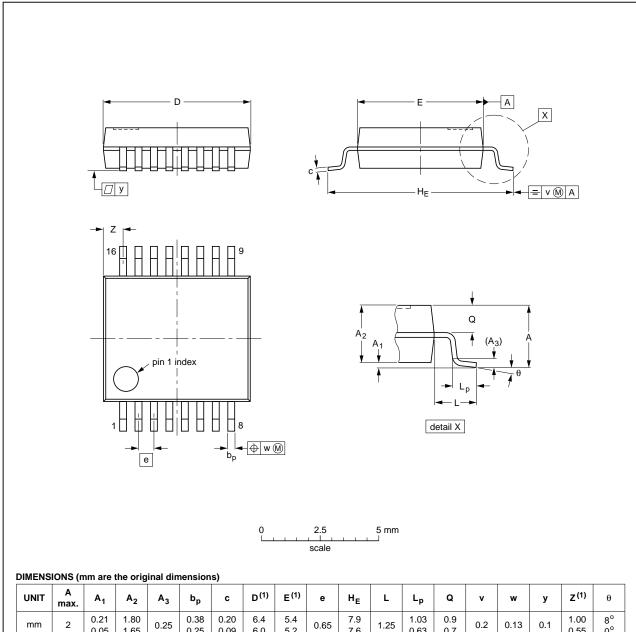
Fig 9. Package outline SOT109-1 (SO16)

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SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm

SOT338-1



UNIT	A max.	A ₁	A ₂	A ₃	b _p	С	D ⁽¹⁾	E ⁽¹⁾	e	HE	L	Lp	Q	v	w	у	Z ⁽¹⁾	θ
mm	2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.00 0.55	8° 0°

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE			
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
SOT338-1		MO-150				99-12-27 03-02-19	
					—	00 02 10	

Fig 10. Package outline SOT338-1 (SSOP16)

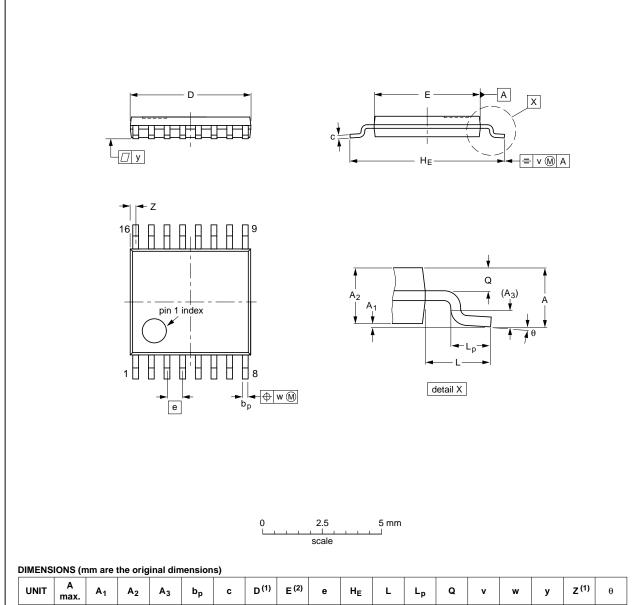
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Dual 2-to-4 line decoder/demultiplexer

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1



UNIT	A max.	A ₁	A ₂	A ₃	bp	C	D ⁽¹⁾	E ⁽²⁾	e	HE	L	Lp	Q	٧	w	у	Z ⁽¹⁾	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.40 0.06	8° 0°

Notes

- 1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT403-1		MO-153				99-12-27 03-02-18
501403-1		IVIO-153				<u> </u>

Fig 11. Package outline SOT403-1 (TSSOP16)

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DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 x 3.5 x 0.85 mm SOT763-1

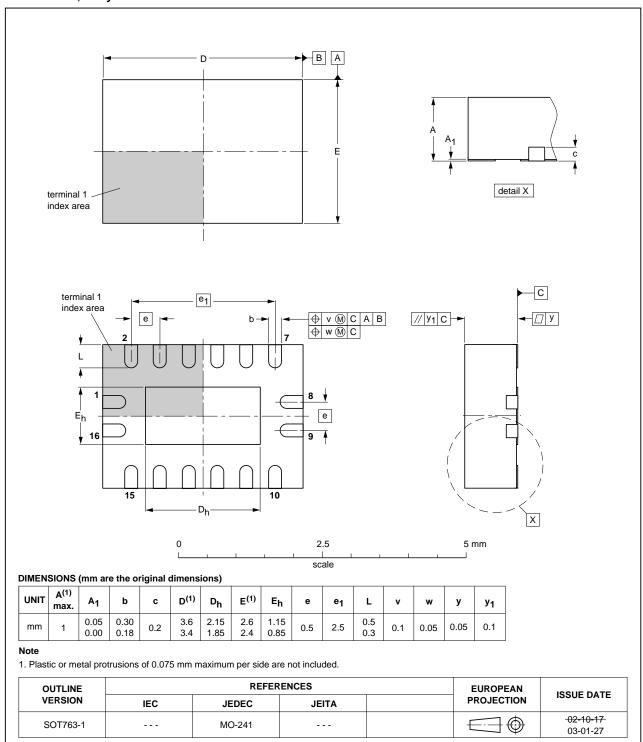


Fig 12. Package outline SOT763-1 (DHVQFN16)

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Dual 2-to-4 line decoder/demultiplexer

13. Abbreviations

Table 9. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

14. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes					
74LVC139 v.5	20111019	Product data sheet	-	74LVC139 v.4					
Modifications:	 The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. 								
	 Legal texts have been adapted to the new company name where appropriate. 								
	• Table 4, Table	5, <u>Table 6, Table 7</u> and <u>Tabl</u>	e 8: values added for lo	ower voltage ranges.					
74LVC139 v.4	040315	Product specification	-	74LVC139 v.3					
74LVC139 v.3	030519	Product specification	-	74LVC139 v.2					
74LVC139 v.2	980428	Product specification	-	74LVC139 v.1					
74LVC139 v.1	-	-	-	-					

Dual 2-to-4 line decoder/demultiplexer

15. Legal information

15.1 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.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions"
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nexperia.com.

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