

XC7SH125

Bus buffer/line driver; 3-state

Rev. 01 — 4 September 2009

Product data sheet

1. General description

XC7SH125 is a high-speed Si-gate CMOS device. It provides one non-inverting buffer/line driver with 3-state output. The 3-state output is controlled by the output enable input (\overline{OE}). A HIGH at \overline{OE} causes the output to assume a high-impedance OFF-state.

2. Features

- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- SOT353-1, SOT753, SOT886, and SOT891 package options
- ESD protection:
 - ◆ HBM JESD22-A114E: exceeds 2000 V
 - ◆ MM JESD22-A115-A: exceeds 200 V
 - ◆ CDM JESD22-C101C: exceeds 1000 V
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
XC7SH125GW	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
XC7SH125GV	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SC-74A	plastic surface-mounted package; 5 leads	SOT753
XC7SH125GM	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body $1 \times 1.45 \times 0.5$ mm	SOT886
XC7SH125GF	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body $1 \times 1 \times 0.5$ mm	SOT891

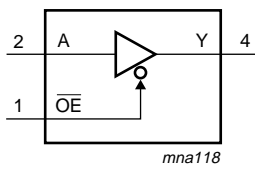
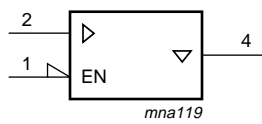
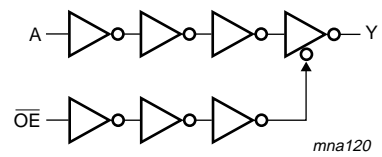
4. Marking

Table 2. Marking codes

Type number	Marking ^[1]
XC7SH125GW	fM
XC7SH125GV	f25
XC7SH125GM	fM
XC7SH125GF	fM

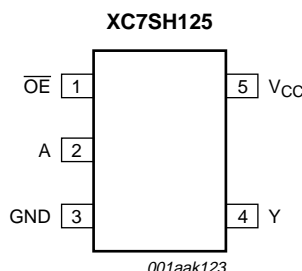
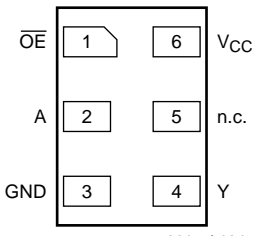
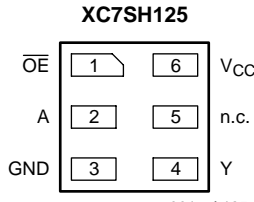
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram

 <p><i>mna118</i></p>	 <p><i>mna119</i></p>	 <p><i>mna120</i></p>
Fig 1. Logic symbol	Fig 2. IEC logic symbol	Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

 <p><i>001aak123</i></p>	<p>XC7SH125</p>  <p><i>001aak124</i></p> <p>Transparent top view</p>	<p>XC7SH125</p>  <p><i>001aak125</i></p> <p>Transparent top view</p>
Fig 4. Pin configuration SOT353-1 and SOT753	Fig 5. Pin configuration SOT886	Fig 6. Pin configuration SOT891

6.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT353-1/SOT753	SOT886/SOT891	
\overline{OE}	1	1	output enable input
A	2	2	data input
GND	3	3	ground (0 V)
Y	4	4	data output
n.c.	-	5	not connected
V_{CC}	5	6	supply voltage

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state

Inputs		Output	
\overline{OE}	A	Y	
L	L	L	
L	H	H	
H	X	Z	

8. Limiting values

Table 5. 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	+7.0	V
V_I	input voltage		-0.5	+7.0	V
I_{IK}	input clamping current	$V_I < -0.5$ V	[1] -20	-	mA
I_{OK}	output clamping current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V	[1] -	± 20	mA
I_O	output current	-0.5 V $< V_O < V_{CC} + 0.5$ V	-	± 25	mA
I_{CC}	supply current		-	75	mA
I_{GND}	ground current		-75	-	mA
T_{stg}	storage temperature		-65	+150	°C
P_{tot}	total power dissipation	$T_{amb} = -40$ °C to +125 °C	[2] -	250	mW

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

[2] For TSSOP5 and SC-74A packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.
For XSON6 packages: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		2.0	5.0	5.5	V
V_I	input voltage		0	-	5.5	V
V_O	output voltage		0	-	V_{CC}	V
T_{amb}	ambient temperature		-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$	-	-	100	ns/V
		$V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	-	-	20	ns/V

10. Static characteristics

Table 7. Static characteristics

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
V_{IH}	HIGH-level input voltage	$V_{CC} = 2.0 \text{ V}$	1.5	-	-	1.5	-	1.5	-	V
		$V_{CC} = 3.0 \text{ V}$	2.1	-	-	2.1	-	2.1	-	V
		$V_{CC} = 5.5 \text{ V}$	3.85	-	-	3.85	-	3.85	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 2.0 \text{ V}$	-	-	0.5	-	0.5	-	0.5	V
		$V_{CC} = 3.0 \text{ V}$	-	-	0.9	-	0.9	-	0.9	V
		$V_{CC} = 5.5 \text{ V}$	-	-	1.65	-	1.65	-	1.65	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}								
		$I_O = -50 \mu\text{A}$; $V_{CC} = 2.0 \text{ V}$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -50 \mu\text{A}$; $V_{CC} = 3.0 \text{ V}$	2.9	3.0	-	2.9	-	2.9	-	V
		$I_O = -50 \mu\text{A}$; $V_{CC} = 4.5 \text{ V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -4.0 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$	2.58	-	-	2.48	-	2.40	-	V
	$I_O = -8.0 \text{ mA}$; $V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.8	-	3.70	-	V	
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}								
		$I_O = 50 \mu\text{A}$; $V_{CC} = 2.0 \text{ V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu\text{A}$; $V_{CC} = 3.0 \text{ V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu\text{A}$; $V_{CC} = 4.5 \text{ V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 4.0 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
	$I_O = 8.0 \text{ mA}$; $V_{CC} = 4.5 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V	
I_{OZ}	OFF-state output current	$V_I = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	0.25	-	2.5	-	10	μA
I_I	input leakage current	$V_I = 5.5 \text{ V}$ or GND; $V_{CC} = 0 \text{ V}$ to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0 \text{ A}$; $V_{CC} = 5.5 \text{ V}$	-	-	1.0	-	10	-	40	μA
C_I	input capacitance		-	1.5	10	-	10	-	10	pF

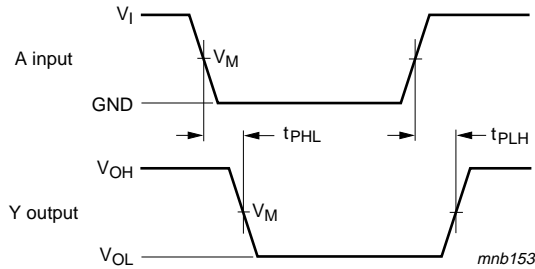
11. Dynamic characteristics

Table 8. Dynamic characteristics
GND = 0 V; For test circuit see Figure 9.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t _{pd}	propagation delay	A to Y; see Figure 7 [1]								
		V _{CC} = 3.0 V to 3.6 V [2]								
		C _L = 15 pF	-	4.7	8.0	1.0	9.5	1.0	11.5	ns
		C _L = 50 pF	-	6.6	11.5	1.0	13.0	1.0	14.5	ns
		V _{CC} = 4.5 V to 5.5 V [3]								
		C _L = 15 pF	-	3.4	5.5	1.0	6.5	1.0	7.0	ns
t _{en}	enable time	OE to Y; see Figure 8 [1]								
		V _{CC} = 3.0 V to 3.6 V [2]								
		C _L = 15 pF	-	5.0	8.0	1.0	9.5	1.0	11.5	ns
		C _L = 50 pF	-	6.9	11.5	1.0	13.0	1.0	14.5	ns
		V _{CC} = 4.5 V to 5.5 V [3]								
		C _L = 15 pF	-	3.6	5.1	1.0	6.0	1.0	6.5	ns
t _{dis}	disable time	OE to Y; see Figure 8 [1]								
		V _{CC} = 3.0 V to 3.6 V [2]								
		C _L = 15 pF	-	6.0	9.7	1.0	11.5	1.0	12.5	ns
		C _L = 50 pF	-	8.3	13.2	1.0	15.0	1.0	16.5	ns
		V _{CC} = 4.5 V to 5.5 V [3]								
		C _L = 15 pF	-	4.1	6.8	1.0	8.0	1.0	8.5	ns
C _{PD}	power dissipation capacitance	per buffer; [4]	-	9	-	-	-	-	-	pF
		C _L = 50 pF; f = 1 MHz; V _I = GND to V _{CC}								

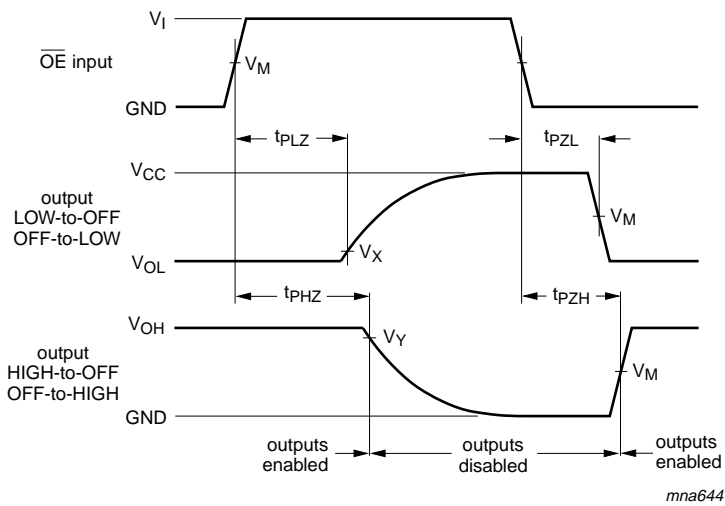
- [1] t_{pd} is the same as t_{PLH} and t_{PHL}.
t_{en} is the same as t_{PZL} and t_{PZH}.
t_{dis} is the same as t_{PLZ} and t_{PHZ}.
- [2] Typical values are measured at V_{CC} = 3.3 V.
- [3] Typical values are measured at V_{CC} = 5.0 V.
- [4] C_{PD} is used to determine the dynamic power dissipation P_D (μW).
P_D = C_{PD} × V_{CC}² × f_i + Σ(C_L × V_{CC}² × 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.

12. Waveforms



Measurement points are given in [Table 9](#).
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 7. Input (A) to output (Y) propagation delays



Measurement points are given in [Table 9](#).
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 8. Enable and disable times

Table 9. Measurement points

Type	Input	Output		
	V_M	V_M	V_X	V_Y
XC7SH125	$0.5V_{CC}$	$0.5V_{CC}$	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$



Test data is given in [Table 10](#).

Definitions test circuit:

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

C_L = Load capacitance including jig and probe capacitance.

R_L = Load resistance.

S1 = Test selection switch.

Fig 9. Test circuit for measuring switching times

Table 10. Test data

Type	Input		Load		S1 position		
	V_I	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
XC7SH125	V_{CC}	≤ 3 ns	15 pF, 50 pF	1 k Ω	open	GND	V_{CC}

13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1



Fig 10. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753



Fig 11. Package outline SOT753 (SC-74A)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

SOT886



Fig 12. Package outline SOT886 (XSON6)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm

SOT891



Fig 13. Package outline SOT891 (XSON6)

14. Abbreviations

Table 11. Abbreviations

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

15. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
XC7SH125_1	20090904	Product data sheet	-	-

16. Legal information

16.1 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".

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