74F656A

Octal buffer/driver with parity; non-inverting; 3-state

Rev. 6 — 14 December 2011 Product data sheet

1. General description

The 74F656A is an octal buffer and line driver with parity generation/checking. The 74F656A can be used as memory address driver, clock driver and bus-oriented transmitter/receiver. The inclusion of parity generation/checking improves PCB density.

2. Features and benefits

- Combines 74F244 and 74F280A functions in one device
- High impedance NPN base inputs for reduced input current (40 μA in HIGH and LOW states)
- I_{IL} = 20 μA compared to 600 μA in FAST family specification
- For applications with high output drive and light bus loading
- Non-inverting
- 3-state output sink capability I_{OL} = 64 mA and source I_{OH} = 15 mA
- Inputs and outputs on separate sides simplifies board layout
- Combined functions reduce part count and enhance system performance
- Industrial temperature range available (−40 °C to +85 °C)

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
N74F656AD	0 °C to 70 °C	SO24	plastic small outline package; 24 leads; body width 7.5 mm	SOT137-1
I74F656AD	−40 °C to +85 °C			

4. Functional diagram

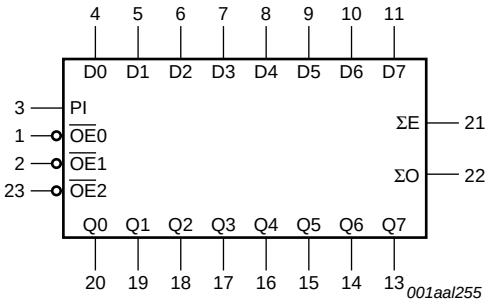


Fig 1. Logic symbol

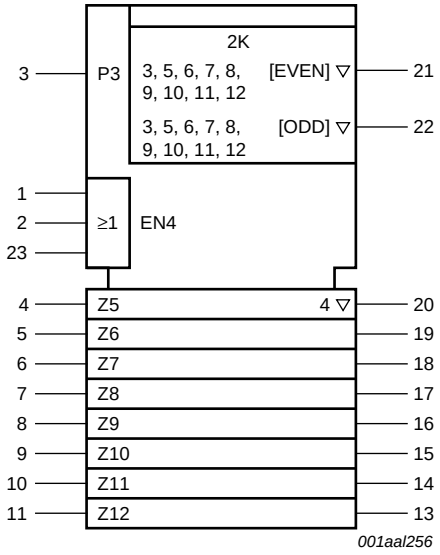


Fig 2. IEC logic symbol

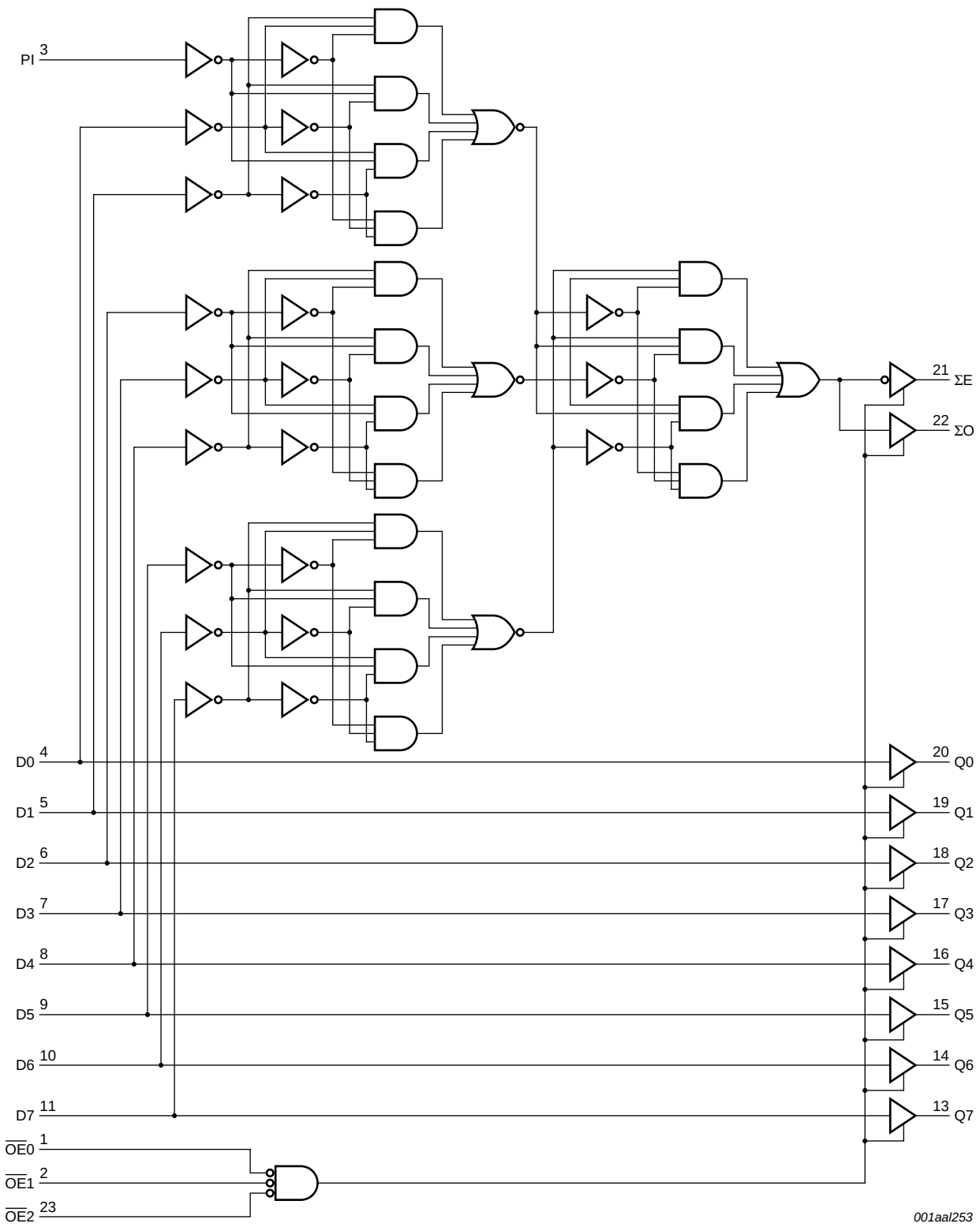


Fig 3. Logic diagram

5. Pinning information

5.1 Pinning

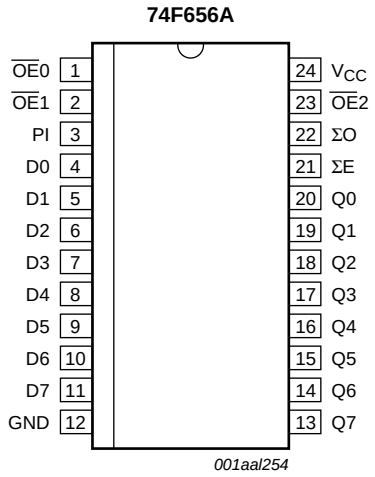


Fig 4. Pin configuration

5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description	Unit load HIGH/LOW	Load value[1] HIGH/LOW
$\overline{OE}0$	1	output enable input (active LOW)	1.0/0.033	20 μA/20 μA
$\overline{OE}1$	2	output enable input (active LOW)	1.0/0.033	20 μA/20 μA
PI	3	parity input	1.0/0.033	20 μA/20 μA
D0 to D7	4, 5, 6, 7, 8, 9, 10, 11	data input	2.0/0.066	40 μA/40 μA
GND	12	ground (0 V)		
Q0 to Q7	20, 19, 18, 17, 16, 15, 14, 13	data output	750/106.7	15 mA/64 mA
ΣE	21	even parity output	750/106.7	15 mA/64 mA
ΣO	22	odd parity output	750/106.7	15 mA/64 mA
$\overline{OE}2$	23	output enable input (active LOW)	1.0/0.033	20 μA/20 μA
V_{CC}	24	supply voltage		

[1] One FAST Unit Load (UL) is defined as 20 μA in HIGH state, 0.6 μA in LOW state.

6. Functional description

6.1 Function table

Table 3. Function selection[1]

Input				Output	Status
$\overline{OE0}$	$\overline{OE1}$	$\overline{OE2}$	Dn	Qn	
L	L	L	L	L	transparent
L	L	L	H	H	
H	X	X	X	Z	disabled
X	H	X	X	Z	
X	X	H	X	Z	

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

Table 4. Function parity outputs[1]

Inputs	State	Parity output	
		ΣE	ΣO
Even number of inputs (0, 2, 4, 6, 8)	H	H	L
Odd number of inputs (1, 3, 5, 7, 9)	H	L	H
Any $\overline{OE}$n	H	Z	Z

[1] H = HIGH voltage level;
L = LOW voltage level;
Z = high-impedance OFF-state.

7. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CC}	supply voltage			–0.5	+7.0	V
V_I	input voltage		[1]	–0.5	+7.0	V
V_O	output voltage	output in HIGH-state	[1]	–0.5	V_{CC}	V
I_{IK}	input clamping current	V_I < 0 V		–30	+5	mA
I_O	output current	output in LOW-state		-	128	mA
T_{amb}	ambient temperature	in free-air	[2]			
		commercial		0	70	°C
		industrial		–40	+85	°C
T_{stg}	storage temperature			–65	+150	°C

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

[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150 °C.

8. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		4.5	5.0	5.5	V
V_{IH}	HIGH-level input voltage		2.0	-	-	V
V_{IL}	LOW-level input voltage		-	-	0.8	V
I_{IK}	input clamping current		-	-	–18	mA
I_{OH}	HIGH-level output current		–15	-	-	mA
I_{OL}	LOW-level output current		-	-	64	mA

9. Static characteristics

Table 7. Static characteristics

Symbol	Parameter	Conditions	25 °C			–40 °C to +85 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V_{IK}	input clamping voltage	V_{CC} = 4.5 V; I_{IK} = –18 mA	–1.2	–0.73	-	–1.2	-	V
V_{OH}	HIGH-level output voltage	V_{CC} = 4.5 V; V_{IL} = 0.8 V; V_{IH} = 2.0 V						
		I_{OH} = –3 mA						
		V_{CC} = ±10 %	-	-	-	2.4	-	V
		V_{CC} = ±5 %	-	3.3	-	2.7	-	V
		I_{OH} = –15 mA						
		V_{CC} = ±10 %	-	-	-	2.0	-	V

Table 7. Static characteristics *...continued*

Symbol	Parameter	Conditions	25 °C			–40 °C to +85 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V_{OL}	LOW-level output voltage	V_{CC} = 4.5 V; V_{IL} = 0.8 V; V_{IH} = 2.0 V						
		I_{OL} = 64 mA						
		V_{CC} = ±10 %	-	-	-	-	0.55	V
		V_{CC} = ±5 %	-	0.42	-	-	0.55	V
I_I	input leakage current	V_{CC} = 0 V; V_I = 7.0 V	-	-	-	-	100	µA
I_{IH}	HIGH-level input current	V_{CC} = 5.5 V; V_I = 2.7 V; commercial						
		pin Dn	-	-	-	-	40	µA
		pin PI, $\overline{OE}$n	-	-	-	-	20	µA
		V_{CC} = 5.5 V; V_I = 2.7 V; industrial						
		pin Dn	-	-	-	-	80	µA
		pin PI, $\overline{OE}$n	-	-	-	-	40	µA
I_{IL}	LOW-level input current	V_{CC} = 5.5 V; V_I = 0.5 V						
		pin Dn	-	-	-	-	–40	µA
		pin PI, $\overline{OE}$n	-	-	-	-	–20	µA
I_{OZ}	OFF-state output current	V_{CC} = 5.5 V						
		V_O = 2.7 V	-	-	-	-	50	µA
		V_O = 0.5 V	-	-	-	-	–50	µA
I_O	output current	V_{CC} = 5.5 V [2]	-	-	-	–100	–225	mA
I_{CC}	supply current	V_{CC} = 5.5 V; V_I = GND or V_{CC}						
		outputs HIGH-state	-	50	-	-	80	mA
		outputs LOW-state	-	78	-	-	110	mA
		outputs OFF-state	-	83	-	-	90	mA

[1] All typical values are measured at V_{CC} = 5 V.

[2] Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

10. Dynamic characteristics

Table 8. Dynamic characteristics

GND = 0 V; for test circuit, see Figure 7.

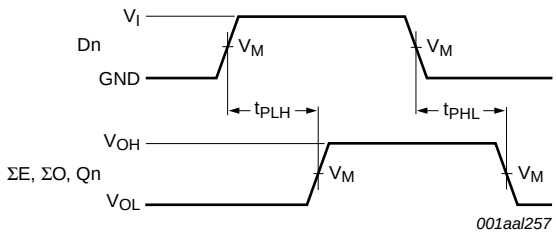
Symbol	Parameter	Conditions	25 °C; V_{CC} = 5.0 V			0 °C to 70 °C; V_{CC} = 5.0 V ± 0.5 V		–40 °C to +85 °C; V_{CC} = 5.0 V ± 0.5 V		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t_{PLH}	LOW to HIGH propagation delay	Dn to Qn; see Figure 5	2.0	4.0	6.5	2.0	7.0	2.0	8.0	ns
		Dn to ΣE, ΣO; see Figure 5	5.5	10.0	13.0	5.5	14.0	4.5	16.5	ns
t_{PHL}	HIGH to LOW propagation delay	Dn to Qn; see Figure 5	2.5	5.5	7.0	2.5	7.5	2.5	9.0	ns
		Dn to ΣE, ΣO; see Figure 5	5.5	11.0	14.5	5.5	16.5	5.5	18.0	ns
t_{PZH}	OFF-state to HIGH propagation delay	$\overline{OE}$n to Qn; see Figure 6	3.5	7.0	10.5	3.5	11.5	3.0	13.0	ns

Table 8. Dynamic characteristics *...continued*

GND = 0 V; for test circuit, see Figure 7.

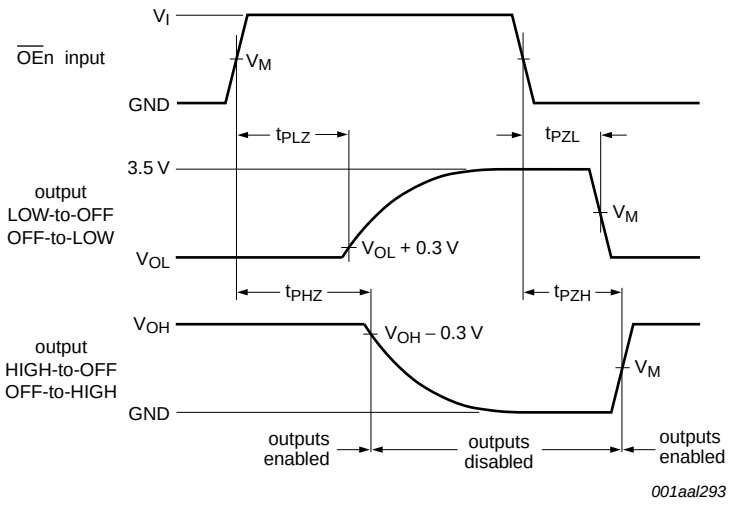
Symbol	Parameter	Conditions	25 °C; V_{CC} = 5.0 V			0 °C to 70 °C; V_{CC} = 5.0 V ± 0.5 V		–40 °C to +85 °C; V_{CC} = 5.0 V ± 0.5 V		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t_{PZL}	OFF-state to LOW propagation delay	$\overline{OE}$n to Qn; see Figure 6	4.0	8.0	11.0	4.5	12.0	4.0	13.5	ns
t_{PHZ}	HIGH to OFF-state propagation delay	$\overline{OE}$n to Qn; see Figure 6	1.5	4.5	8.0	1.5	9.0	1.5	10.0	ns
t_{PLZ}	LOW to OFF-state propagation delay	$\overline{OE}$n to Qn; see Figure 6	2.0	5.0	8.0	2.0	9.0	1.5	10.0	ns

11. Waveforms



V_M = 1.5 V

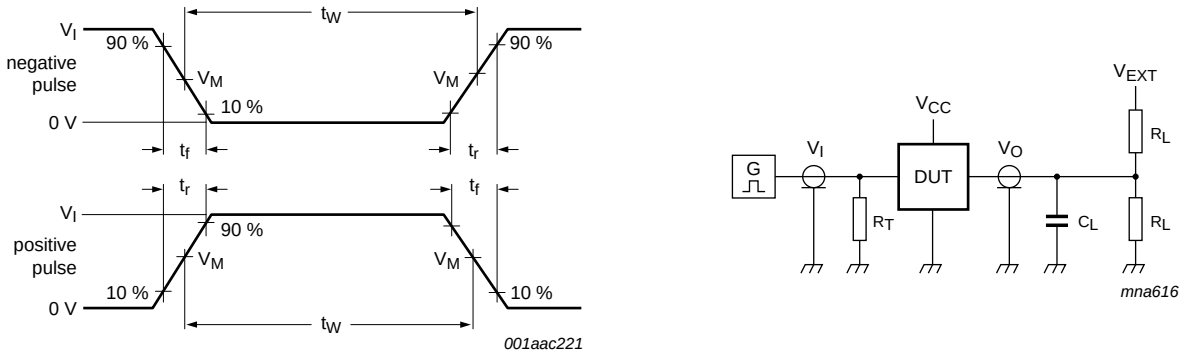
Fig 5. Propagation delay input Dn to output Qn, ΣE, ΣO



V_M = 1.5 V

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

Fig 6. 3-state output enable and disable times



a. Input pulse definition

b. Test circuit

Test data and V_{EXT} levels are given in Table 9.

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.

V_{EXT} = Test voltage for switching times.

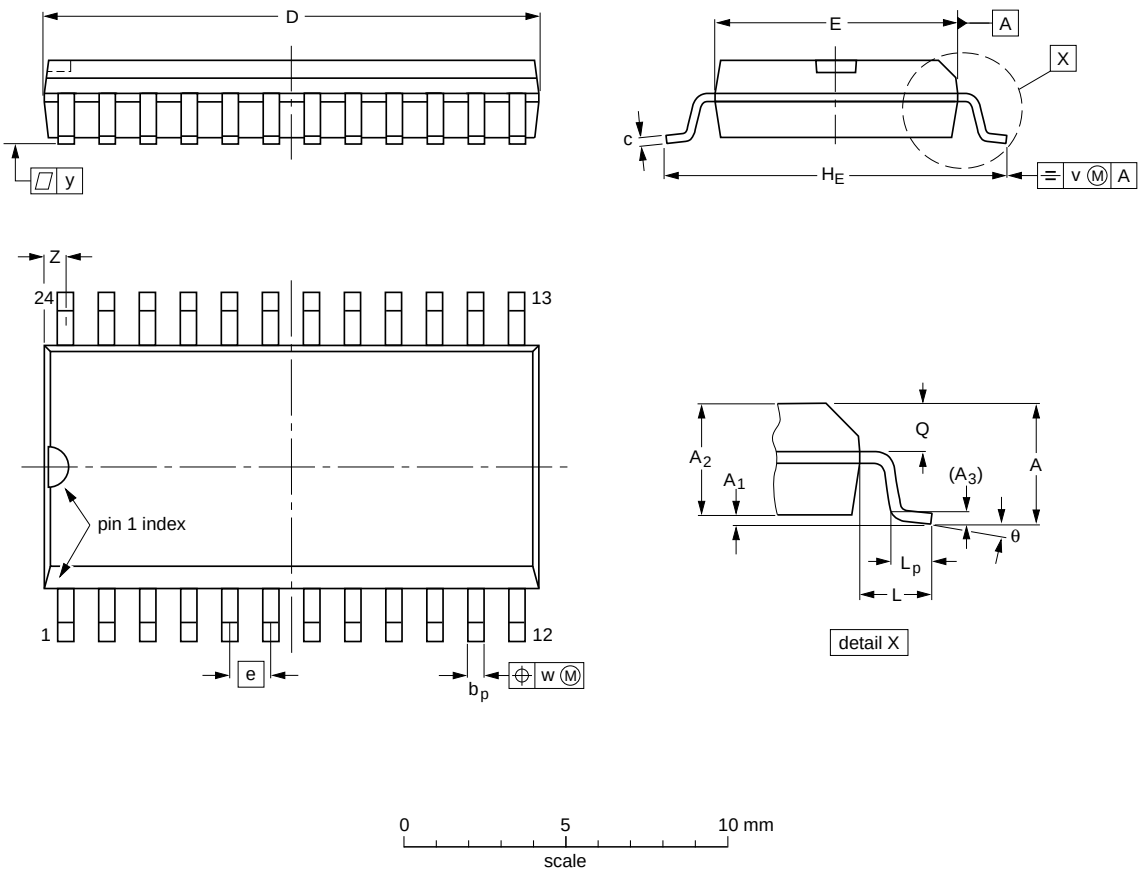
Fig 7. Test circuit for measuring switching times

Table 9. Test data

Input				Load		V_{EXT}		
V_I	f_I	t_W	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
3.0 V	1 MHz	500 ns	≤ 2.5 ns	50 pF	500 Ω	open	open	7.0 V

12. Package outline

SO24: plastic small outline package; 24 leads; body width 7.5 mm **SOT137-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	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^o 0^o
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	

Note

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

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

Fig 8. Package outline SOT137-1 (SO24)

13. Abbreviations

Table 10. Abbreviations

Acronym	Description
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
PCB	Printed-Circuit Board

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74F656A v.6	20111214	Product data sheet	-	74F656A v.5
Modifications:	• Legal pages updated.			
74F656A v.5	20100325	Product data sheet	-	74F656A v.4
74F656A v.4	20100205	Product data sheet	-	74F656A v.3
74F656A v.3	20000630	Product specification	-	74F656A v.2
74F656A v.2	19910717	Product specification	-	-

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.nxp.com.

15.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

15.3 Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors accepts no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nxp.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — Unless this data sheet expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

15.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

16. Contact information

For more information, please visit: **http://www.nxp.com**

For sales office addresses, please send an email to: **salesaddresses@nxp.com**

17. Contents

For more information, please visit: http://www.nxp.com
For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 14 December 2011
Document identifier: 74F656A