DATA SHEET

MB2241
16-bit buffer/line driver (3-State)

Product specification
Supersedes data of 1993 Aug 18
IC23 Data Handbook

1998 Jan 16

Philips
Semiconductors

PHILIPS

16-bit buffer/line driver (3-State) MB2241

FEATURES

- 16–bit bus interface
- Power 3-State
- Multiple V_{CC} and GND pins minimize switching noise
- 3-State buffers
- Output capability: +64mA/–32mA
- Latch-up protection exceeds 500mA per Jedec Std 17
- ESD protection exceeds 2000 V per MIL STD 883 Method 3015 and 200 V per Machine Model
- Inputs are disabled during 3-State mode

DESCRIPTION

The MB2241 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The MB2241 device is a 16-bit buffer that is ideal for driving bus lines. The device features four Output Enables ($1\overline{OE}$, 2OE, $3\overline{OE}$, 4OE), each controlling four of the 3-State outputs.

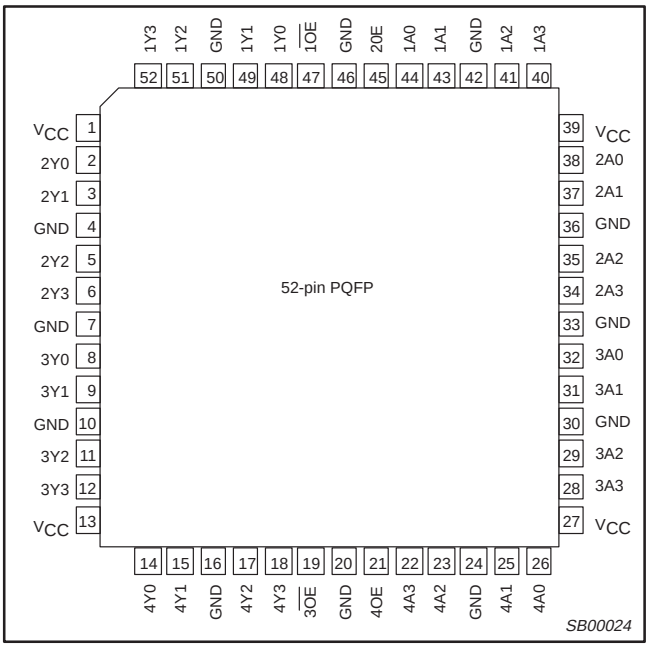
QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS T_{amb} = 25°C; GND = 0V	TYPICAL	UNIT
t_{PLH} t_{PHL}	Propagation delay nAx to nYx	C_L = 50pF; V_{CC} = 5V	3.0 3.1	ns
C_{IN}	Input capacitance	V_I = 0V or V_{CC}	4	pF
C_{OUT}	Output capacitance	V_O = 0V or $V_{CC;}$ 3-State	7	pF
I_{CCZ}	Total supply current	Outputs disabled; V_{CC} = 5.5V	65	µA

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
52–pin plastic Quad Flat Pack	–40°C to +85°C	MB2241 BB	MB2241 BB	SOT379-1

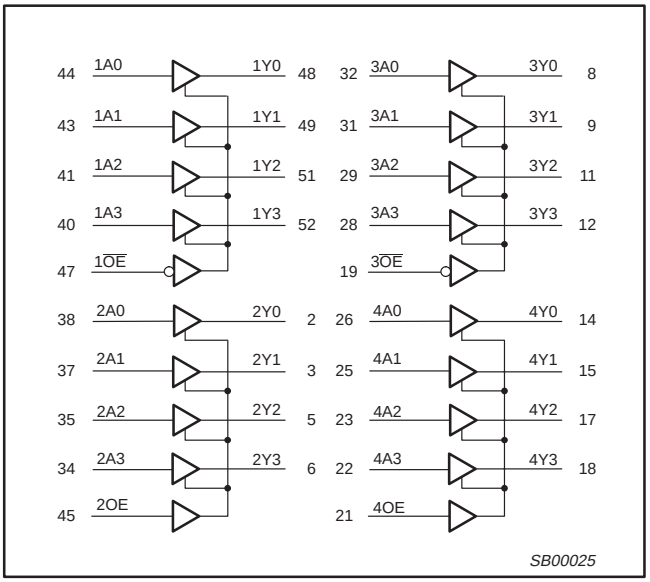
PIN CONFIGURATION



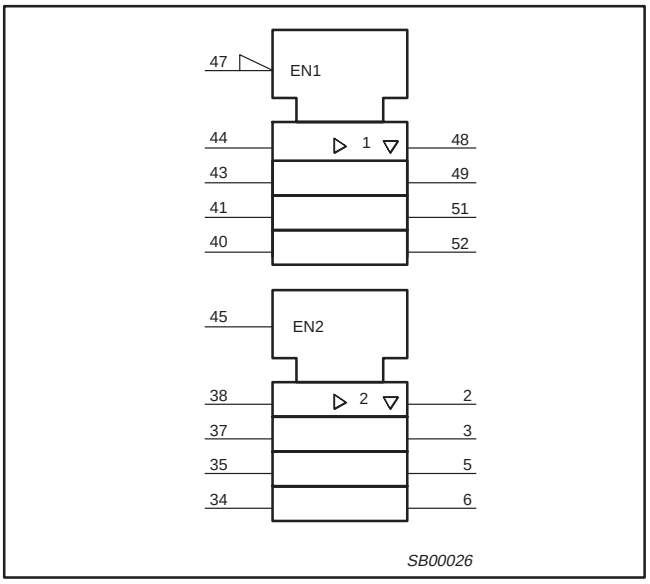
PIN DESCRIPTION

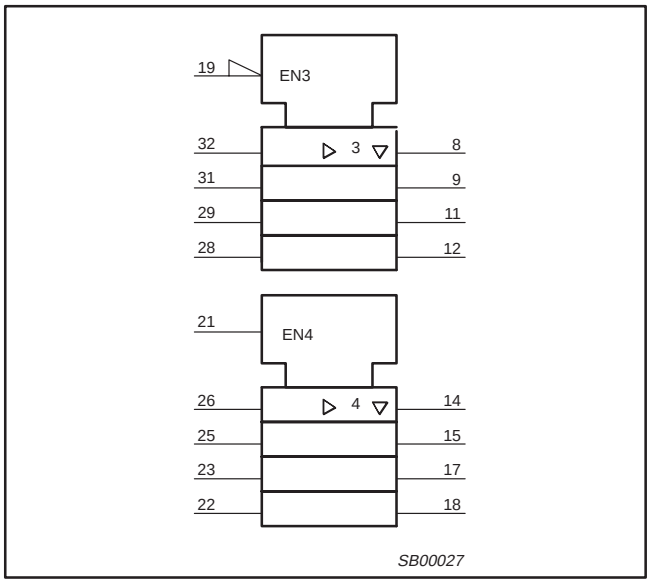
PIN NUMBER	SYMBOL	NAME AND FUNCTION
44, 43, 41, 40, 38, 37, 35, 34, 32, 31, 29, 28, 26, 25, 23, 22	1A0 – 1A3, 2A0 – 2A3, 3A0 – 3A3, 4A0 – 4A3	Data inputs
14, 15, 17, 18, 8, 9, 11, 12, 2, 3, 5, 6, 48, 49, 51, 52	4Y0 – 4Y3, 3Y0 – 3Y3, 2Y0 – 2Y3, 1Y0 – 1Y3	Data outputs
47, 45, 21, 19	$1\overline{OE}$, 2OE, $3\overline{OE}$, 4OE	Output enables
4, 7, 10, 16, 20, 24, 30, 33, 36, 42, 46, 50	GND	Ground (0V)
1, 13, 27, 39	V_{CC}	Positive supply voltage

LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)





FUNCTION TABLE

INPUTS				OUTPUTS	
1$\overline{OE}$ or 3$\overline{OE}$	**1An or 3An**	**2OE or 4OE**	**2An or 4An**	**1Yn or 3Yn**	**2Yn or 4Yn**
L	L	H	L	L	L
L	H	H	H	H	H
H	X	L	X	Z	Z

H = High voltage level
L = Low voltage level
Z = High voltage level-impedance ”OFF” state

ABSOLUTE MAXIMUM RATINGS[1, 2]

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V_{CC}	DC supply voltage		–0.5 to +7.0	V
I_{IK}	DC input diode current	$V_I < 0$	–18	mA
V_I	DC input voltage[3]		–1.2 to +7.0	V
I_{OK}	DC output diode current	$V_O < 0$	–50	mA
V_{OUT}	DC output voltage[3]	output in Off or High state	–0.5 to +5.5	V
I_{OUT}	DC output current	output in Low state	128	mA
T_{stg}	Storage temperature range		–65 to 150	°C

NOTES:
1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
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.
3. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS		UNIT
		Min	Max	
V_{CC}	DC supply voltage	4.5	5.5	V
V_I	Input voltage	0	V_{CC}	V
V_{IH}	High-level input voltage	2.0		V
V_{IL}	Low-level Input voltage		0.8	V
I_{OH}	High-level output current		–32	mA
I_{OL}	Low-level output current		64	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	0	10	ns/V
T_{amb}	Operating free-air temperature range	–40	+85	°C

DC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			T_{amb} = +25°C			T_{amb} = –40°C to +85°C		
			Min	Typ	Max	Min	Max	
V_{IK}	Input clamp voltage	V_{CC} = 4.5V; I_{IK} = –18mA		–0.9	–1.2		–1.2	V
V_{OH}	High-level output voltage	V_{CC} = 4.5V; I_{OH} = –3mA; V_I = V_{IL} or V_{IH}	2.5	2.9		2.5		V
		V_{CC} = 5.0V; I_{OH} = –3mA; V_I = V_{IL} or V_{IH}	3.0	3.4		3.0		V
		V_{CC} = 4.5V; I_{OH} = –32mA; V_I = V_{IL} or V_{IH}	2.0	2.4		2.0		V
V_{OL}	Low-level output voltage	V_{CC} = 4.5V; I_{OL} = 64mA; V_I = V_{IL} or V_{IH}		0.42	0.55		0.55	V
I_I	Input leakage current	V_{CC} = 5.5V; V_I = GND or 5.5V		±0.01	±1.0		±1.0	µA
I_{OFF}	Power-off leakage current	V_{CC} = 0.0V; V_O or $V_I \leq$ 4.5V		±5.0	±100		±100	µA
I_{PU}/I_{PU}	Power-up/down 3-State output current	V_{CC} = 2.0V; V_O = 0.5V; V_I = GND or V_{CC}; V_{OE} = V_{CC}; V_{OE} = GND		±5.0	±50		±50	µA
I_{OZH}	3-State output High current	V_{CC} = 5.5V; V_O = 2.7V; V_I = V_{IL} or V_{IH}		5.0	50		50	µA
I_{OZL}	3-State output Low current	V_{CC} = 5.5V; V_O = 0.5V; V_I = V_{IL} or V_{IH}		–5.0	–50		–50	µA
I_{CEX}	Output high leakage current	V_{CC} = 5.5V; V_O = 5.5V; V_I = GND or V_{CC}		5.0	50		50	µA
I_O	Output current[1]	V_{CC} = 5.5V; V_O = 2.5V	–50	–70	–180	–50	–180	mA
I_{CCH}	Quiescent supply current	V_{CC} = 5.5V; Outputs High, V_I = GND or V_{CC}		65	250		250	µA
I_{CCL}		V_{CC} = 5.5V; Outputs Low, V_I = GND or V_{CC}		48	60		60	mA
I_{CCZ}		V_{CC} = 5.5V; Outputs 3-State; V_I = GND or V_{CC}		65	250		250	µA
ΔI_{CC}	Additional supply current per input pin[2]	Outputs enabled, one input at 3.4V, other inputs at V_{CC} or GND; V_{CC} = 5.5V		0.5	1.5		1.5	mA

NOTES:
1. Not more than one output should be tested at a time, and the duration of the test should not exceed one second.
2. This is the increase in supply current for each input at 3.4V.

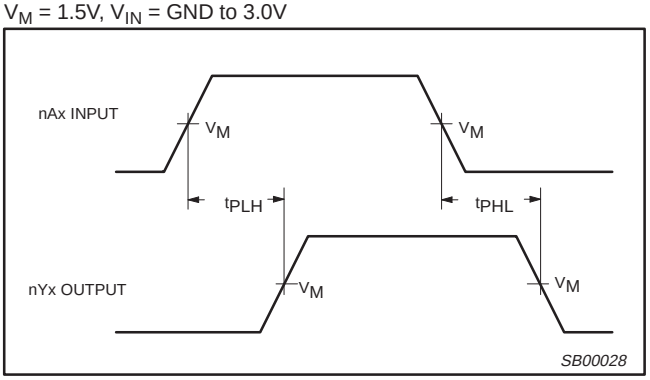
AC CHARACTERISTICS

GND = 0V; $t_R = t_F$ = 2.5ns; C_L = 50pF, R_L = 500Ω

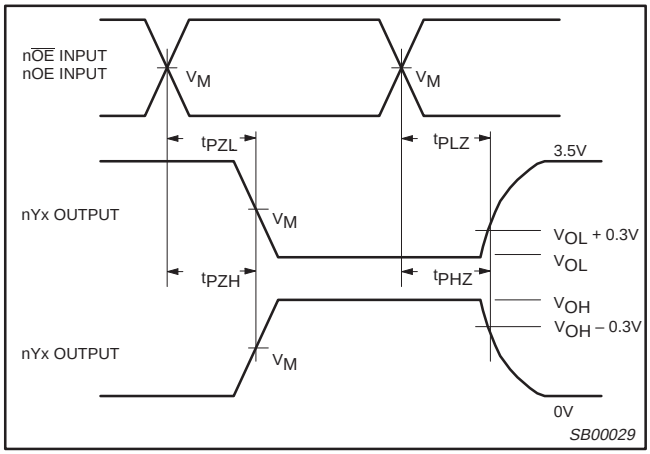
SYMBOL	PARAMETER	WAVEFORM	LIMITS					UNIT
			T_{amb} = +25°C V_{CC} = +5.0V			T_{amb} = –40°C to +85°C V_{CC} = +5.0V ±0.5V		
			Min	Typ	Max	Min	Max	
t_{PLH} t_{PHL}	Propagation delay nAx to nYx	1	1.2 1.2	3.0 3.1	4.5 4.5	1.2 1.2	5.1 5.1	ns
t_{PZH} t_{PZL}	Output enable time to High and Low level	2	1.3 1.8	3.7 4.8	6.3 6.8	1.3 1.8	6.9 7.4	ns
t_{PHZ} t_{PLZ}	Output disable time from High and Low level	2	1.3 1.2	3.9 3.4	5.9 5.2	1.3 1.2	6.7 5.8	ns

AC WAVEFORMS

V_M = 1.5V, V_{IN} = GND to 3.0V

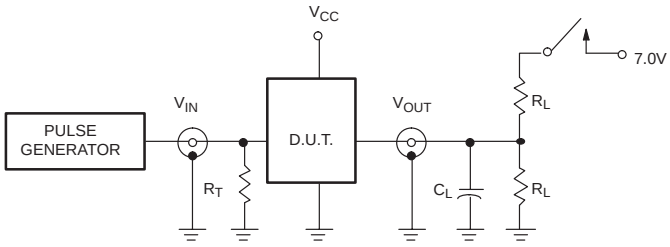


Waveform 1. Waveforms Showing the Input (nAx) to Output (nYx) Propagation Delays

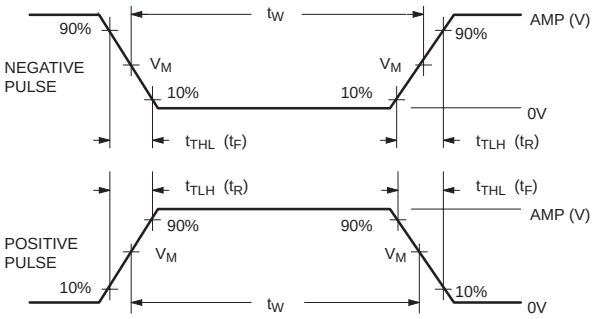


Waveform 2. Waveforms Showing the 3-State Output Enable and Disable Times

TEST CIRCUIT AND WAVEFORMS



Test Circuit for 3-State Outputs



V_M = 1.5V
Input Pulse Definition

SWITCH POSITION

TEST	SWITCH
t_{PLZ}	closed
t_{PZL}	closed
All other	open

DEFINITIONS

R_L = Load resistor; see AC CHARACTERISTICS for value.

C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	t_W	t_R	t_F
MB	3.0V	1MHz	500ns	2.5ns	2.5ns

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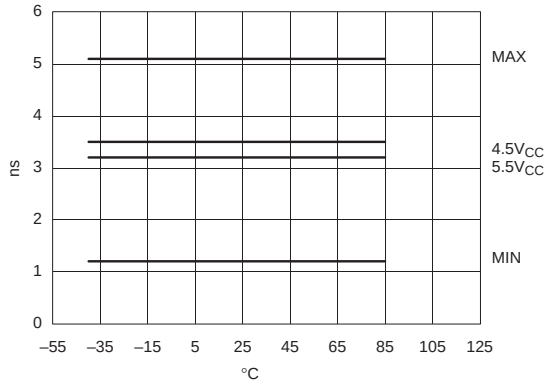
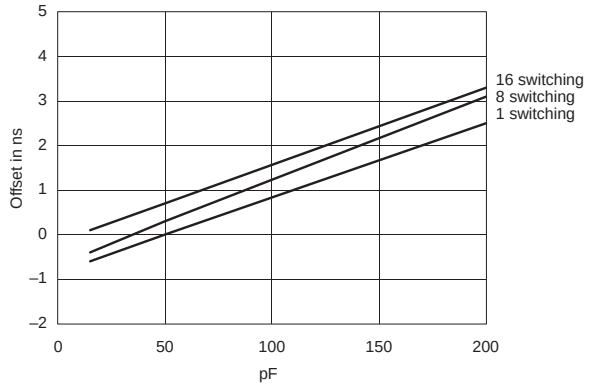
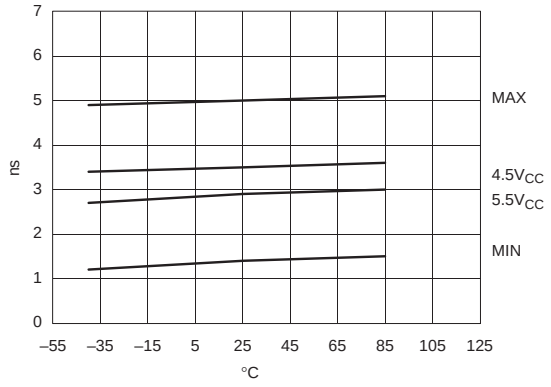
t_{PLH} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
nAx to nYx



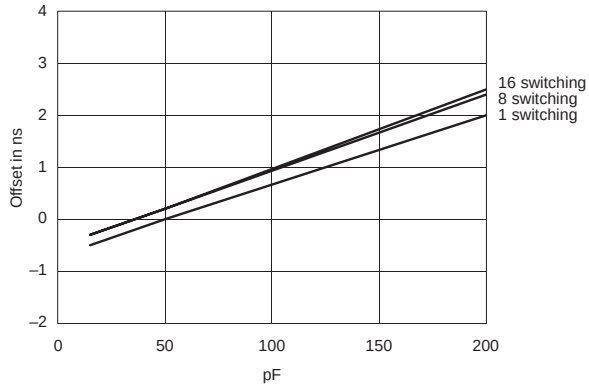
Adjustment of t_{PLH} for
Load Capacitance and # of Outputs Switching
nAx to nYx



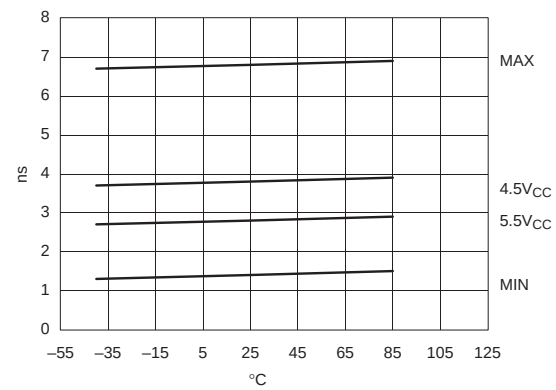
t_{PHL} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
nAx to nYx



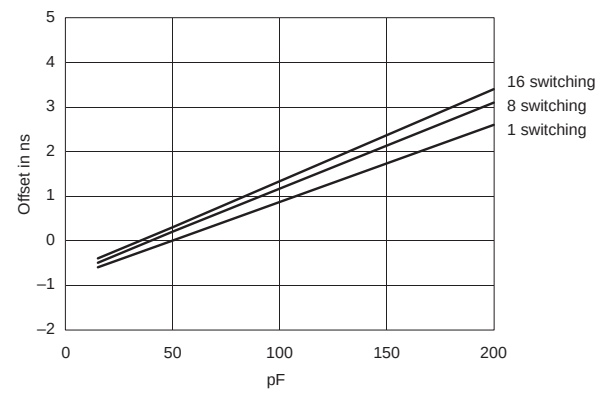
Adjustment of t_{PHL} for
Load Capacitance and # of Outputs Switching
nAx to nYx



t_{PZH} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
n$\overline{OE}$ to nYx



Adjustment of t_{PZH} for
Load Capacitance and # of Outputs Switching
n$\overline{OE}$ to nYx



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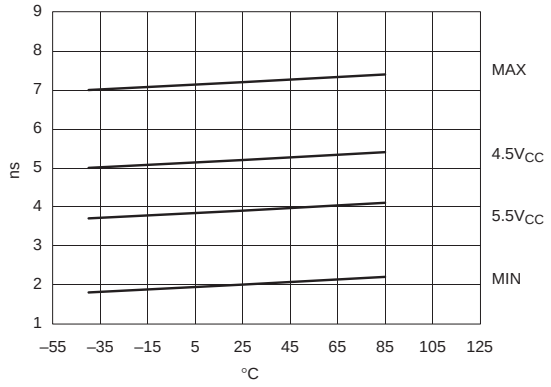
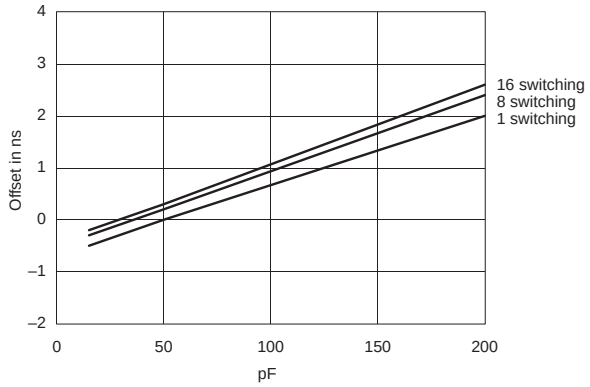
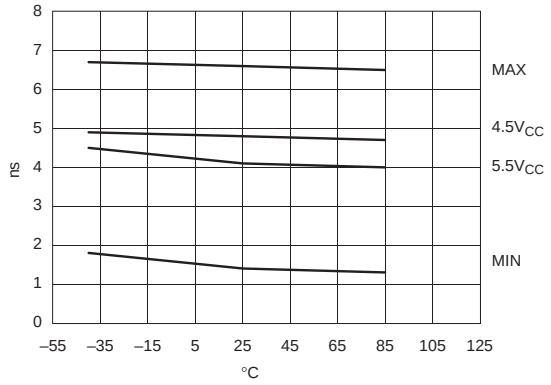
t_{PZL} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
n$\overline{OE}$ to nYx



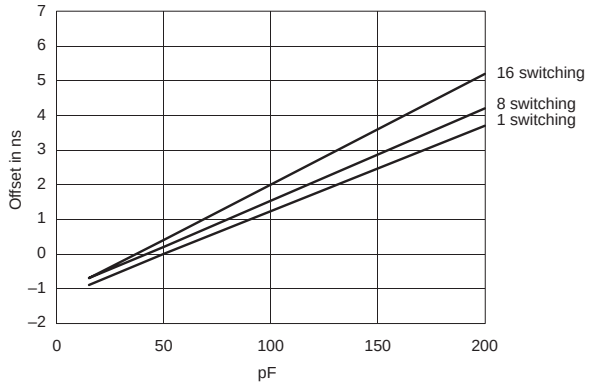
Adjustment of t_{PZL} for
Load Capacitance and # of Outputs Switching
n$\overline{OE}$ to nYx



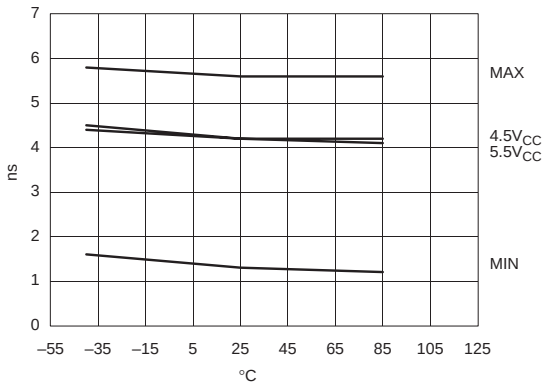
t_{PHZ} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
n$\overline{OE}$ to nYx



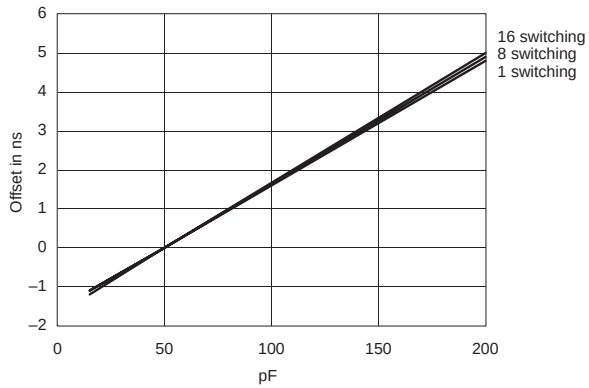
Adjustment of t_{PHZ} for
Load Capacitance and # of Outputs Switching
n$\overline{OE}$ to nYx



t_{PLZ} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching
n$\overline{OE}$ to nYx

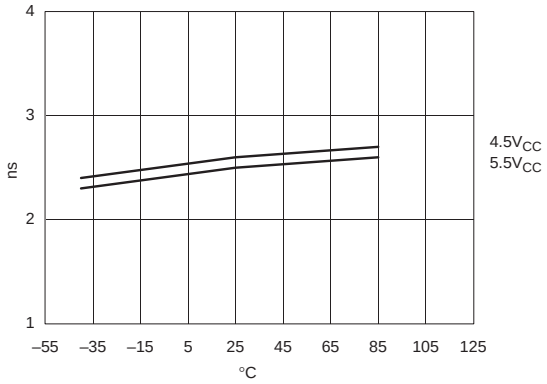


Adjustment of t_{PLZ} for
Load Capacitance and # of Outputs Switching
n$\overline{OE}$ to nYx

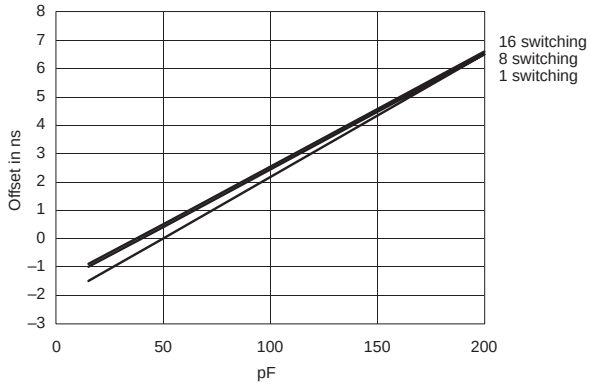


SB00031

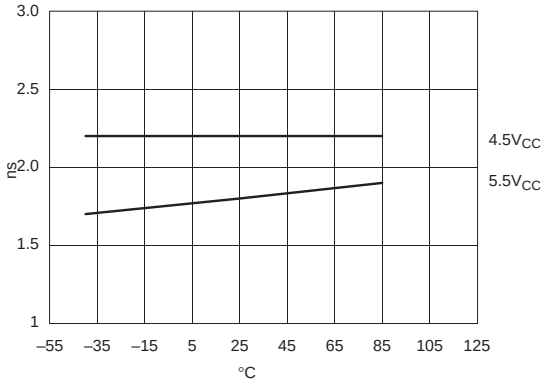
t_{TLH} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching



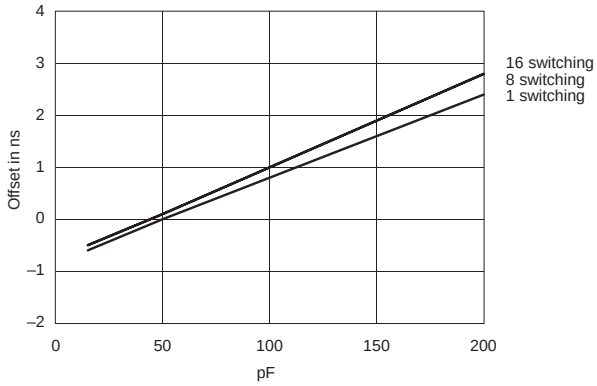
Adjustment of t_{TLH} for
Load Capacitance and # of Outputs Switching



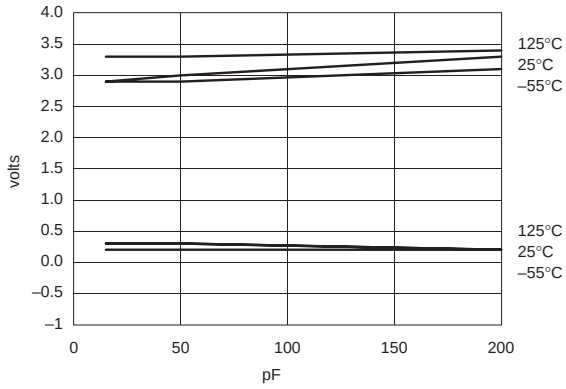
t_{THL} vs Temperature (T_{amb})
C_L = 50pF, 1 Output Switching



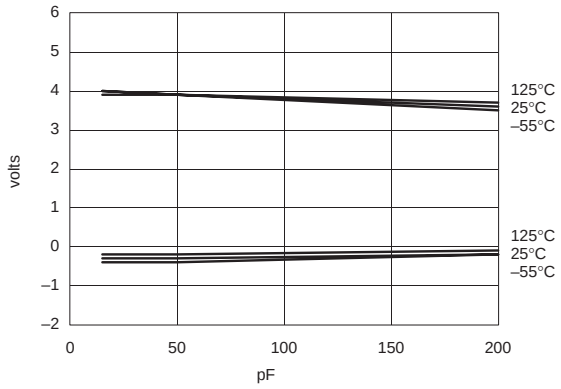
Adjustment of t_{THL} for
Load Capacitance and # of Outputs Switching



V_{OHV} and V_{OLP} vs Load Capacitance
V_{CC} = 5V, V_{IN} = 0 to 3V

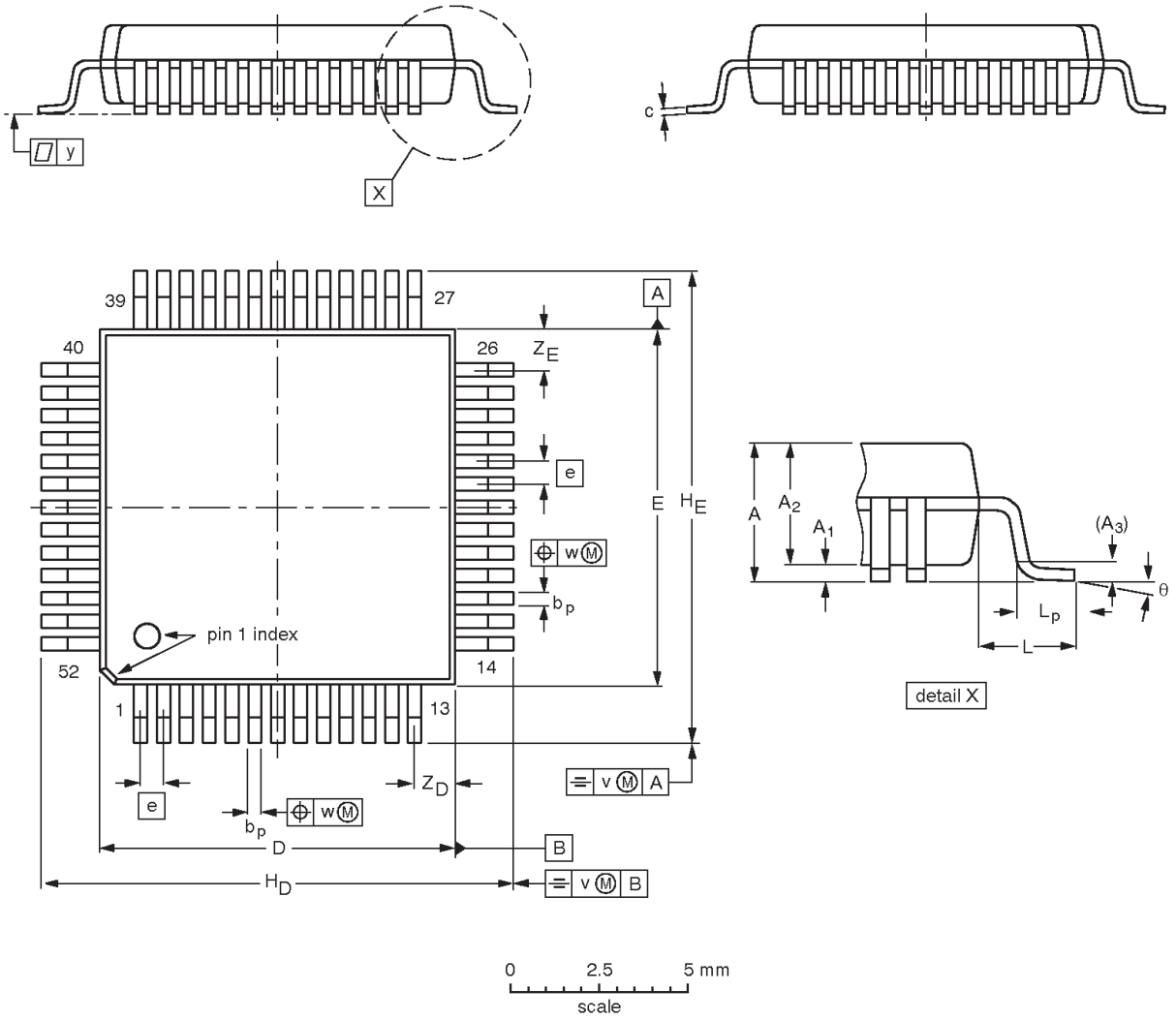


V_{OHP} and V_{OLV} vs Load Capacitance
V_{CC} = 5V, V_{IN} = 0 to 3V



SB00032

QFP52: plastic quad flat package; 52 leads (lead length 1.6 mm); body 10 x 10 x 2.0 mm SOT379-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_D	H_E	L	L_p	v	w	y	$Z_D^{(1)}$	$Z_E^{(1)}$	θ
mm	2.45	0.45 0.25	2.10 1.95	0.25	0.38 0.22	0.23 0.13	10.1 9.9	10.1 9.9	0.65	13.45 12.95	13.45 12.95	1.60	0.95 0.65	0.20	0.12	0.10	1.24 0.95	1.24 0.95	7^o 0^o

Note

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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT379-1		MO-108				~~95-02-04~~ 97-08-04

NOTES

Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
Preliminary specification	Qualification	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make chages at any time without notice in order to improve design and supply the best possible product.
Product specification	Production	This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.

[1] Please consult the most recently issued datasheet before initiating or completing a design.

Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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

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811 East Arques Avenue
P.O. Box 3409
Sunnyvale, California 94088–3409
Telephone 800-234-7381

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