DATA SHEET

74F777

Triple bidirectional latched bus transceiver (3-State + open collector)

Product specification

1992 May 19

IC15 Data Handbook

Philips
Semiconductors

PHILIPS

Triple bidirectional latched bus transceiver (3–State + Open Collector) 74F777

FEATURES

- Latching transceiver
- High drive Open Collector output current with minimum output swing
- Compatible with Test Mode (TM) bus specification
- Controlled output ramp
- Multiple package options
- Industrial temperature range available (–40°C to +85°C)

DESCRIPTION

The 74F777 is a triple bidirectional latched bus transceiver and is intended to provide the electrical interface to a high performance wired–OR bus. This bus has a loaded characteristics impedance range of 20 to 50 ohms and is terminated on each end with a 30 to 40 ohm resistor.

The 74F777 is a triple bidirectional transceiver with Open Collector B and 3–State A port output drivers. A latch function is provided for the A port signals. The B port output driver is designed to sink 100mA from 2 volts to minimize crosstalk and ringing on the bus.

A separate output threshold clamp voltage (V_X) is provided to prevent the A port output High level from exceeding future high density processor supply voltage levels. For 5 volt systems, V_X is simply tied to V_{CC}.

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT(TOTAL)
74F777	7.0ns	45mA

ORDERING INFORMATION

DESCRIPTION	ORDER CODE		PKG DWG #
	COMMERCIAL RANGE V_{CC} = 5V ±10%, T_{amb} = 0°C to +70°C	INDUSTRIAL RANGE V_{CC} = 5V ±10%, T_{amb} = –40°C to +85°C	
20–pin plastic DIP (300 mil)	N74F777N	I74F777N	SOT146-1
20–pin PLCC	N74F777A	I74F777A	SOT380-1

INPUT AND OUTPUT LOADING AND FAN OUT TABLE

PINS	DESCRIPTION	74F (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
A0 – A2	PNP latched inputs	3.5/0.117	70µA/70µA
B0 – B2	Data inputs with threshold circuitry	5.0/0.167	100µA/100µA
OEA0 – OEA2	A output enable inputs (active–High)	1.0/0.033	20µA/20µA
$\overline{OEB}$0 – $\overline{OEB}$2	B output enable inputs (active–Low)	1.0/0.033	20µA/20µA
$\overline{LE}$0 – $\overline{LE}$2	Latch enable inputs (active–Low)	1.0/0.033	20µA/20µA
A0 – A2	3–State outputs	150/40	3mA/24mA
B0 – B2	Open Collector outputs	OC/166.7	OC/100mA

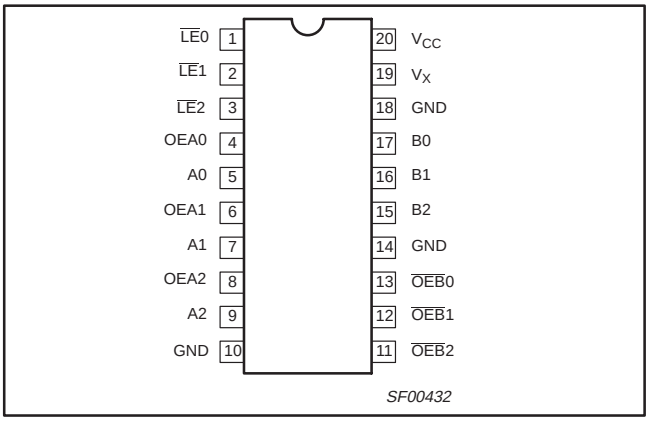
Note to input and output loading and fan out table

One (1.0) FAST unit load is defined as: 20µA in the High state and 0.6mA in the Low state.
OC = Open Collector.

Triple bidirectional latched bus transceiver (3–State + Open Collector)

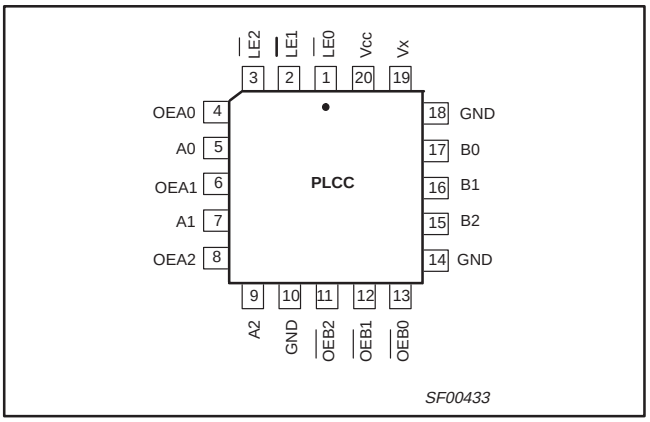
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PIN CONFIGURATION



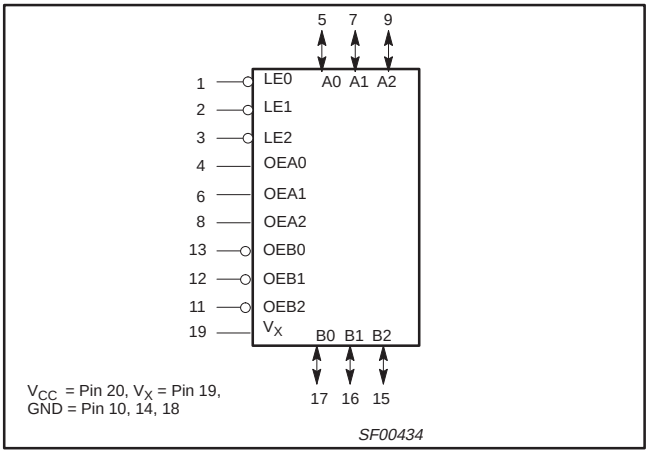
SF00432

PIN CONFIGURATION PLCC



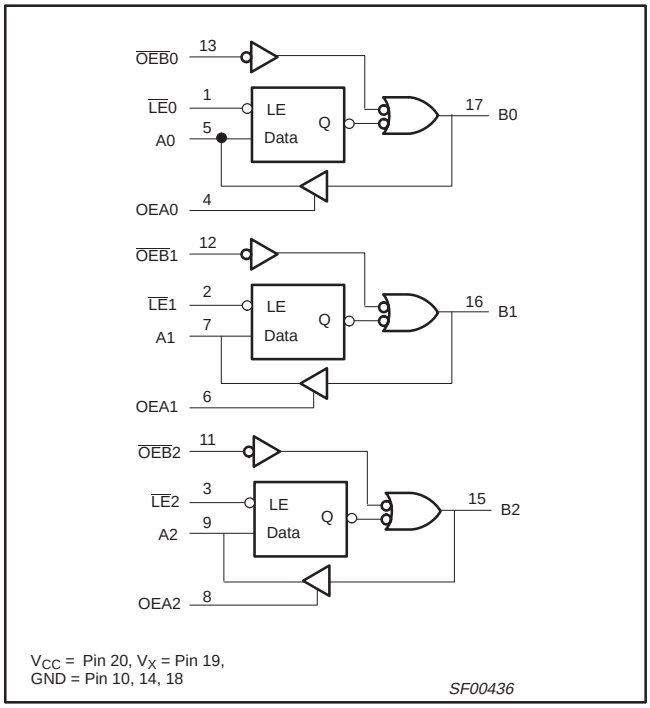
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LOGIC SYMBOL



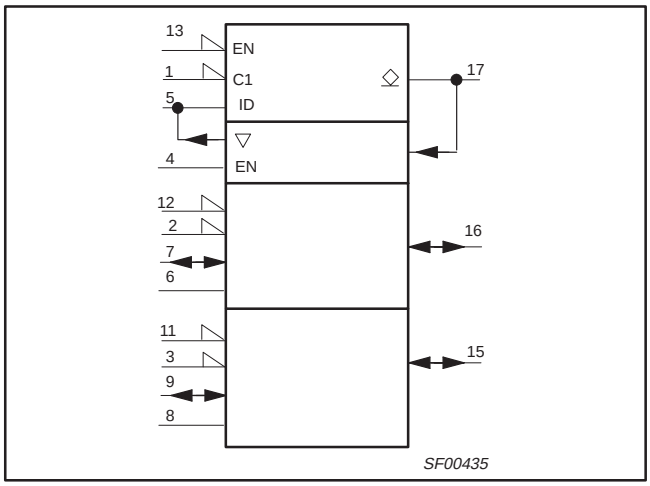
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LOGIC DIAGRAM



SF00436

IEC/IEEE SYMBOL



SF00435

FUNCTION TABLE

INPUTS					LATCH	OUTPUTS		OPERATING MODE
An	Bn*	$\overline{LE}$n	OEAn	$\overline{OEB}$n	STATE	An	Bn	
H	X	L	L	L	H	Z	H**	A 3-State, data from A to B
L	X	L	L	L	L	Z	L	
X	X	H	L	L	Qn	Z	Qn	A 3-State, latched data to B
–	–	L	H	L	(1)	(1)	(1)	Feedback: A to B, B to A
–	H	H	H	L	H (2)	H	Z(2)	Preconditioned latch enabling
–	L	H	H	L	H (2)	L	Z(2)	data transfer from B to A
–	–	H	H	L	Qn	Qn	Qn	Latch state to A and B
H	X	L	L	H	H	Z	Z	B and A 3–State
L	X	L	L	H	L	Z	Z	
X	X	H	L	H	Qn	Z	Z	
–	H	L	H	H	H	H	Z	B 3-State, data from B to A
–	L	L	H	H	L	L	Z	
–	H	H	H	H	Qn	H	Z	
–	L	H	H	H	Qn	L	Z	

Qn

Notes to function table

H = High voltage level
L = Low voltage level
X = Don't care
– = Input not externally driven
Z = High impedance (off) state
Q_n = High or Low voltage level one setup time prior to the Low–to–High $\overline{LE}$ transition.
(1) = Condition will cause a feedback loop path: A to B and B to A.
(2) = The latch must be preconditioned such that B inputs may assume a High or Low level while $\overline{OEB}$0 and $\overline{OEB}$1 are Low and $\overline{LE}$ is High.
B_n* =Precaution should be taken to insure the B inputs do not float. If they do they are equal to Low state.
H**= Goes to level of pull-up voltage.
Each latch is independent. The latches may be run in any combination of modes.

ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limit set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free air temperature range.)

SYMBOL	PARAMETER		RATING	UNIT
V_{CC}	Supply voltage		–0.5 to +7.0	V
V_X	Threshold control		–0.5 to +7.0	V
V_{IN}	Input voltage	$\overline{OEB}$n, OEAn, $\overline{LE}$n	–0.5 to +7.0	V
		A0 – A2, B0 – B2	–0.5 to +5.5	V
I_{IN}	Input current		–30 to +5	mA
V_{OUT}	Voltage applied to output in High output state		–0.5 to V_{CC}	V
I_{OUT}	Current applied to output in	A0 – A2	48	mA
	Low output state	B0 – B2	200	mA
T_{amb}	Operating free air	Commercial range	0 to +70	°C
	temperature range	Industrial range	–40 to +85	°C
T_{stg}	Storage temperature range		–65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER		LIMITS			UNIT
			MIN	NOM	MAX	
V_{CC}	Supply voltage		4.5	5.0	5.5	V
V_{IH}	High–level input voltage	Except B0 – B2	2.0			V
		B0 – B2	1.6			V
V_{IL}	Low–level input voltage	Except B0 – B2			0.8	V
		B0 – B2			1.43	V
I_{Ik}	Input clamp current	Except A0 – A2			–18	mA
		A0 – A2			–40	mA
I_{OH}	High–level output current	Except A0 – A2			–3	mA
I_{OL}	Low–level output current	A0 – A2			24	mA
		B0 – B2			100	mA
T_{amb}	Operating free–air temperature range	Commercial range	0		+70	°C
		Industrial range	–40		+85	°C

DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER		TEST CONDITIONS[1]		LIMITS MIN	LIMITS TYP[2]	LIMITS MAX	UNIT
I_{OH}	High–level output current	B0 – B2	V_{CC} = MAX, V_{IL} = MAX, V_{IH} = MIN, V_{OH} = 2.1V				100	µA
I_{OFF}	Power–off output current	B0 – B2	V_{CC} = 0.0V, V_{IL} = MAX, V_{IH} = MIN, V_{OH} = 2.1V				100	µA
V_{OH}	High-level output voltage	A0 – A2[4]	V_{CC} = MIN, V_{IL} = MAX, V_{IH} = MIN	I_{OH} = –3mA, V_X =V_{CC}	2.5		V_{CC}	V
				I_{OH} = –4mA, V_X = 3.13V and 3.47V	2.5		V_X	V
V_{OL}	Low-level output voltage	A0 – A2[4]	V_{CC} = MIN, V_{IL} = MAX, V_{IH} = MIN	I_{OL} = 20mA, V_X = V_{cc}			0.50	V
		B0 – B2		I_{OL} = 100mA			1.15	V
				I_{OL} = 4mA	0.40			V
V_{IK}	Input clamp voltage	A0 – A2	V_{CC} = MIN, I_I = I_{IK}				-0.5	V
		Except A0 – A2	V_{CC} = MIN, I_I = I_{IK}				-1.2	V
I_I	Input current at maximum input voltage	$\overline{OEB}$n, OEAn, $\overline{LE}$n	V_{CC} = MAX, V_I = 7.0V				100	µA
		A0 – A2, B0 – B2	V_{CC} = MAX, V_I = 5.5V				1	mA
I_{IH}	High–level input current	$\overline{OEB}$n, OEAn, $\overline{LE}$n	V_{CC} = MAX, V_I = 2.7V, Bn – An = 0V				20	µA
		B0 – B2	V_{CC} = MAX, V_I = 2.1V				100	µA
I_{IL}	Low–level input current	$\overline{OEB}$n, OEAn $\overline{LE}$n	V_{CC} = MAX, V_I = 0.5V				–20	µA
		B0 – B2	V_{CC} = MAX, V_I = 0.3V				–100	µA
I_{OZH} + I_{IH}	Off–state output current, High level voltage applied	A0 – A2	V_{CC} = MAX, V_O = 2.7V				70	µA
I_{OZL} + I_{IL}	Off–state output current, Low level voltage applied	A0 – A2	V_{CC} = MAX, V_I = 0.5V				–70	µA
I_X	High level control current		V_{CC} = MAX, V_X = V_{CC}, $\overline{LE}$ = OEAn = $\overline{OEB}$n = 2.7V, A0 – A2 = 2.7V, B0 – B2 = 2.0V,		–100		100	µA
			V_{CC} = MAX, V_X = 3.13 & 3.47V, $\overline{LE}$ = OEAn = 2.7V, $\overline{OEB}$n = A0 – A2 = 2.7V, B0 – B2 = 2.0V		–10		10	µA
I_{OS}	Short circuit output current[3]	A0 – A2 only	V_{CC} = MAX, Bn = 1.8V, OEAn = 2.0V, $\overline{OEB}$n = 2.7V		-60		-150	mA
I_{CC}	Supply current (total)	I_{CCH}	V_{CC} = MAX			40	60	mA
		I_{CCL}	V_{CC} = MAX, V_{IL} = 0.5V			55	80	mA
		I_{CCZ}	V_{CC} = MAX, V_{IL} = 0.5V			45	67	mA

Notes to DC electrical characteristics

1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type. Unless otherwise specified, V_X =V_{CC} for all test condition.
2. All typical values are at V_{CC} = 5V, T_{amb} = 25°C.
3. Not more than one output should be shorted at a time. For testing I_{OS}, the use of high-speed test apparatus and/or sample-and-hold techniques are preferable in order to minimize internal heating and more accurately reflect operational values. Otherwise, prolonged shorting of a high output may raise the chip temperature well above normal and thereby cause invalid readings in other parameter tests. In any sequence of parameter tests, I_{OS} tests should be performed last.
4. Due to test equipment limitations, actual test conditions are for V_{IH} =1.8v and V_{IL} = 1.3V.

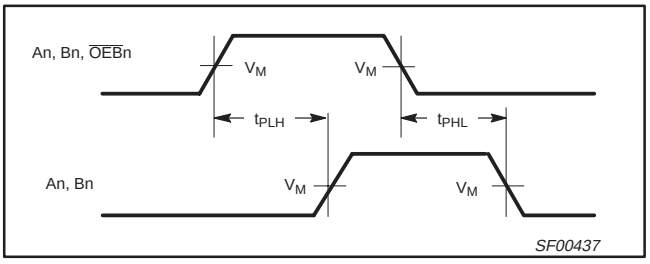
AC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITION	A PORT LIMITS							UNIT
			T_{amb} = +25°C, V_{CC} = +5.0V, C_L = 30pF, R_L = 9Ω			T_{amb} = 0°C to +70°C, V_{CC} = +5.0V ±10%, C_L = 30pF, R_L = 9Ω		T_{amb} = –40°C to +85°C, V_{CC} = +5.0V ±10%, C_L = 30pF, R_L = 9Ω		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay Bn to An	Waveform 1	8.5 7.5	10.5 9.5	13.0 12.0	8.0 7.5	14.5 12.5	8.0 7.5	14.5 12.5	ns
t_{PZH} t_{PZL}	Output enable time to High or Low OEAn to An	Waveform 3, 4	8.0 9.0	10.0 11.0	13.0 14.0	7.0 8.0	14.5 15.5	7.0 8.0	14.5 15.5	ns
t_{PHZ} t_{PLZ}	Output Disable time from High or Low OEAn to An	Waveform 3, 4	1.5 1.5	3.0 3.0	6.0 6.0	1.0 1.0	6.5 6.0	1.0 1.0	6.5 6.0	ns
SYMBOL	**PARAMETER**	**TEST CONDITION**	**B PORT LIMITS**							**UNIT**
			T_{amb} = +25°C, V_{CC} = +5.0V, C_D= 30pF, R_U = 9Ω			T_{amb} = 0°C to +70°C, V_{CC} = +5.0V ± 10%, C_D = 30pF, R_U = 9Ω		T_{amb} = –40°C to +85°C, V_{CC} = +5.0V ±10%, C_D= 30pF, R_U = 9Ω		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH} t_{PHL}	Propagation delay An to Bn	Waveform 1	3.0 5.0	4.5 6.5	7.0 9.0	2.5 4.5	8.0 10.0	2.5 4.5	8.0 10.0	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{LE}$n to Bn	Waveform 1	3.5 5.5	5.5 7.5	8.0 10.5	3.0 5.0	9.0 11.5	3.0 5.0	9.0 11.5	ns
t_{PLH} t_{PHL}	Enable/disable time $\overline{OEB}$n to An	Waveform 1	3.0 6.0	5.0 8.0	7.5 10.5	3.0 5.5	8.0 12.0	3.0 5.5	8.0 12.0	ns
t_{TLH} t_{THL}	Transition time, B port 1.3V to 1.7V, 1.7V to 1.3V	Test Circuits and Waveforms	0.5 0.5	4.0 2.0	4.5 4.5	0.5 0.5	7.0 4.5	0.5 0.5	7.0 4.5	ns

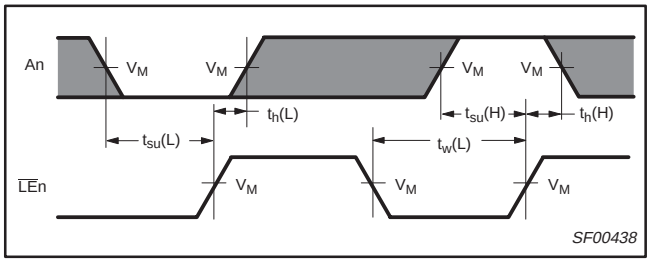
AC SETUP REQUIREMENTS

SYMBOL	PARAMETER	TEST CONDITION	LIMITS							UNIT
			T_{amb} = +25°C, V_{CC} = +5.0V, C_D= 30pF, R_U = 9Ω			T_{amb} = 0°C to +70°C, V_{CC} = +5.0V ± 10%, C_D = 30pF, R_U = 9Ω		T_{amb} = –40°C to +85°C, V_{CC} = +5.0V ±10%, C_D= 30pF, R_U = 9Ω		
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{su} (H) t_{su} (L)	Setup time An to $\overline{LE}$n	Waveform 2	4.0 4.5			4.5 4.5		4.5 4.5		ns
t_h (H) t_h (L)	Hold time An to $\overline{LE}$n	Waveform 2	0.0 0.0			0.0 0.0		0.0 0.0		ns
t_w (L)	$\overline{LE}$n pulse width, Low	Waveform 2	5.5			6.5		6.5		ns

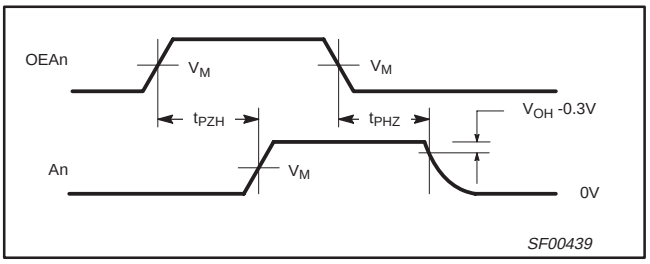
AC WAVEFORMS



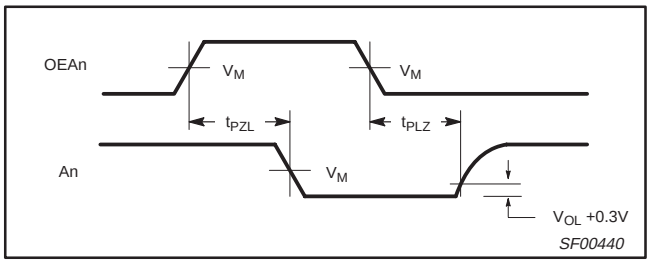
Waveform 1. Propagation delay, data to output and enable/disable time $\overline{OEB}$n to Bn



Waveform 2. Data set-up and hold times and $\overline{LE}$ pulse width



Waveform 3. 3-State output enable time to High level and output disable time from High level



Waveform 4. 3-State output enable time to Low level and output disable time from Low level

Notes to AC waveforms

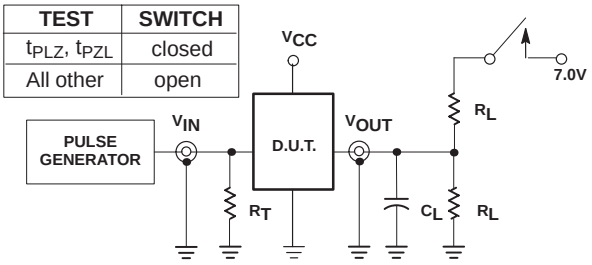
For all waveforms, V_M = 1.5V.

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

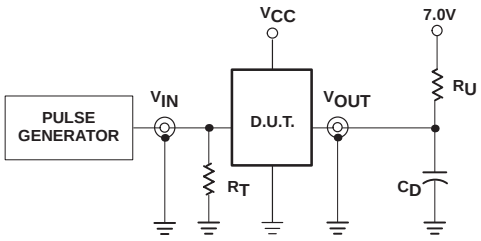
TEST CIRCUITS AND WAVEFORMS

SWITCH POSITION

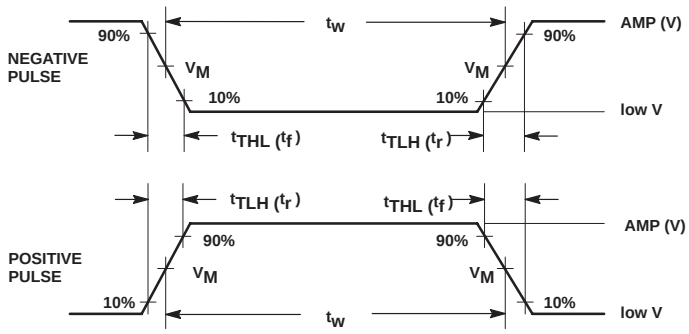
TEST	SWITCH
t_{PLZ}, t_{PZL}	closed
All other	open



Test circuit for 3–State outputs on A port



Test circuit for outputs on B port



Input pulse definition

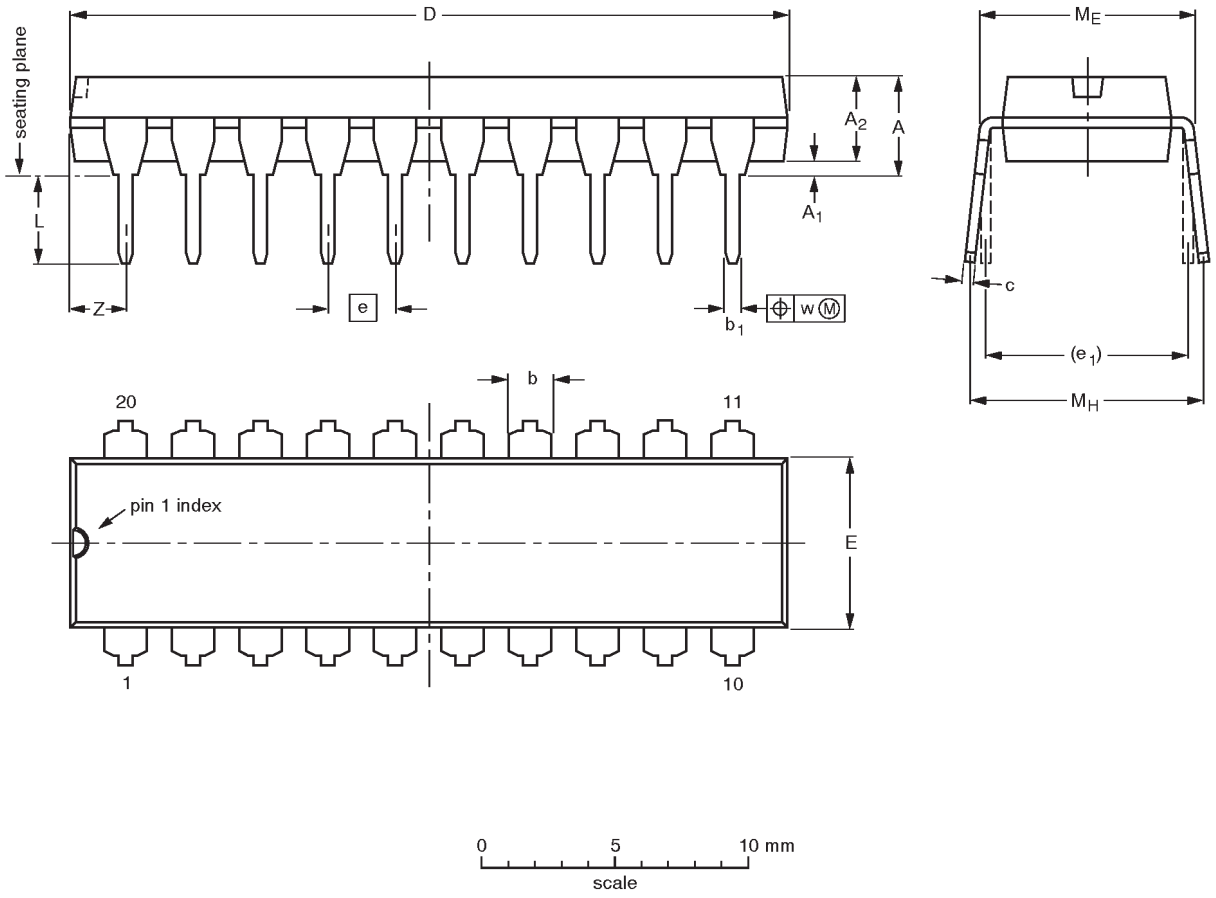
family	INPUT PULSE REQUIREMENTS						
	amplitude	Low V	V_M	rep. rate	t_w	t_{TLH}	t_{THL}
A port	3.0V	0.0V	1.5V	1MHz	500ns	2.5ns	2.5ns
B port	2.0V	1.0V	1.0V	1MHz	500ns	4.0ns	4.0ns

DEFINITIONS:

R_L = Load resistor; see AC electrical characteristics for value.
C_L = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.
R_U = Pull up resistor; see AC electrical characteristics for value.
C_D = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.
R_T = Termination resistance should be equal to Z_{OUT} of pulse generators.

SF00431

DIP20: plastic dual in-line package; 20 leads (300 mil) **SOT146-1**



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

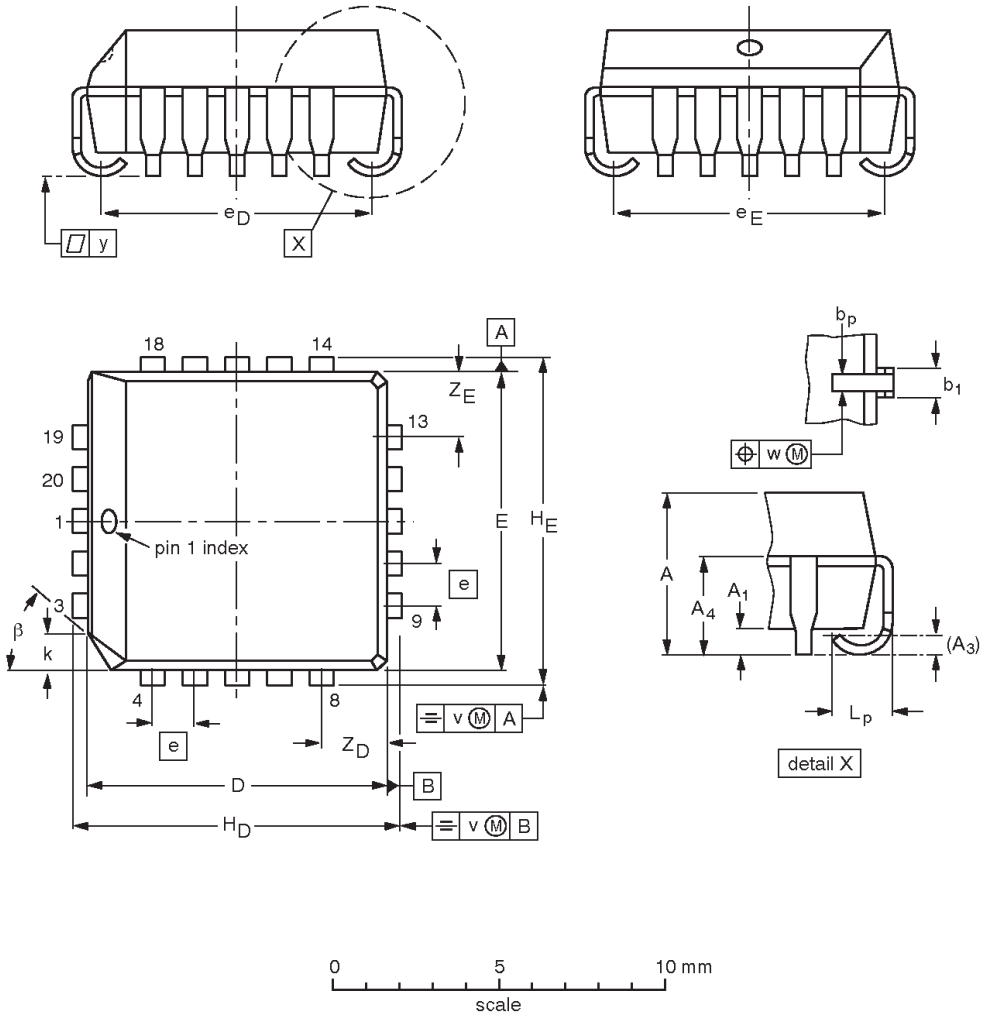
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	0.36 0.23	26.92 26.54	6.40 6.22	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	2.0
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.014 0.009	1.060 1.045	0.25 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.078

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			
SOT146-1			SC603			~~92-11-17~~ 95-05-24

PLCC20: plastic leaded chip carrier; 20 leads SOT380-1



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

UNIT	A	A_1 min.	A_3	A_4 max.	b_p	b_1	$D^{(1)}$	$E^{(1)}$	e	e_D	e_E	H_D	H_E	k	L_p	v	w	y	$Z_D^{(1)}$ max.	$Z_E^{(1)}$ max.	β
mm	4.57 4.19	0.51	0.25	3.05	0.53 0.33	0.81 0.66	9.04 8.89	9.04 8.89	1.27	8.38 7.37	8.38 7.37	10.03 9.78	10.03 9.78	1.22 1.07	1.44 1.02	0.18	0.18	0.10	2.16	2.16	45°
inches	0.180 0.165	0.020	0.01	0.12	0.021 0.013	0.032 0.026	0.356 0.350	0.356 0.350	0.05	0.330 0.290	0.330 0.290	0.395 0.385	0.395 0.385	0.048 0.042	0.057 0.040	0.007	0.007	0.004	0.085	0.085	

Note

1. Plastic or metal protrusions of 0.01 inches maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT380-1		MO-047AA				~~95-02-25~~ 97-12-16

NOTES

Triple bidirectional latched bus transceiver (3-State + open collector)

74F777

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.

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