

# Look-ahead carry generator

# 74F182

## FEATURES

- Provides carry look-ahead across a group of four ALUs
- Multi-level look-ahead for high speed arithmetic operation over long word lengths

## DESCRIPTION

The 74F182 is a high speed carry look-ahead generator. It accepts up to four pairs of active-Low Carry Propagate ( $\overline{P}0, \overline{P}1, \overline{P}2, \overline{P}3$ ) and Carry Generate ( $\overline{G}0, \overline{G}1, \overline{G}2, \overline{G}3$ ) signals and an active-High Carry input ( $C_n$ ) and provides anticipated active-High carries ( $C_{n+x}, C_{n+y}, C_{n+z}$ ) across four groups of binary adders. The 74F182 also has active-Low Carry Propagate ( $\overline{P}$ ) Carry Generate ( $\overline{G}$ ) outputs which may be used for further levels of look-ahead.

The logic equations provided at the outputs are:

$$C_{n+x} = G_0 + P_0 C_n$$

$$C_{n+y} = G_1 + P_1 G_0 + P_1 P_0 C_n$$

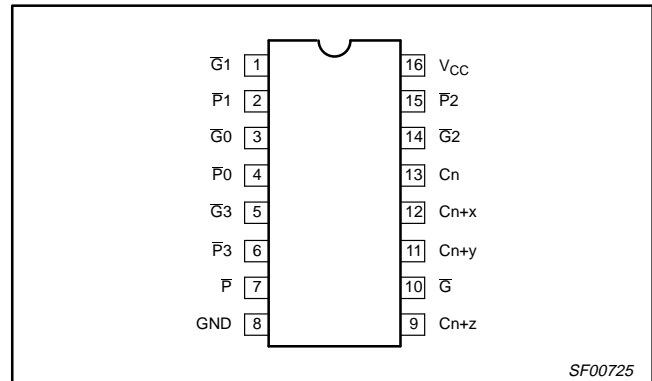
$$C_{n+z} = G_2 + P_2 G_1 + P_2 P_1 G_0 + P_2 P_1 P_0 C_n$$

$$\overline{G} = \overline{G}_3 + P_3 \overline{G}_2 + P_3 P_2 \overline{G}_1 + P_3 P_2 P_1 \overline{G}_0$$

$$\overline{P} = P_3 P_2 P_1 P_0$$

The 74F182 can also be used with binary ALUs in an active-Low or active-High input operand mode. The connections to and from the ALU to the carry look-ahead generator are identical in both cases.

## PIN CONFIGURATION



TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74F182	5.0ns	21mA

## ORDERING INFORMATION

DESCRIPTION	ORDER CODE
	COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$ , $T_{amb} = 0^\circ C$ to $+70^\circ C$
16-pin plastic DIP	N74F182N
16-pin plastic SO	N74F182D

## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74FAST (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
$C_n$	Carry input	2.5/2.0	50 $\mu$ A/1.2mA
$\overline{G}0, \overline{G}2$	Carry generate inputs (active-Low)	2.5/14.0	50 $\mu$ A/8.4mA
$\overline{G}1$	Carry generate input (active-Low)	2.5/16.0	50 $\mu$ A/9.6mA
$\overline{G}3$	Carry generate input (active-Low)	2.5/8.0	50 $\mu$ A/4.8mA
$\overline{P}0, \overline{P}1$	Carry propagate inputs (active-Low)	2.5/8.0	50 $\mu$ A/4.8mA
$\overline{P}2$	Carry propagate input (active-Low)	2.5/6.0	50 $\mu$ A/3.6mA
$\overline{P}3$	Carry propagate input (active-Low)	2.5/4.0	50 $\mu$ A/2.4mA
$C_{n+x} - C_{n+z}$	Carry outputs	50/33	1.0mA/20mA
$\overline{G}$	Carry generate output (active-Low)	50/33	1.0mA/20mA
$\overline{P}$	Carry propagate output (active-Low)	50/33	1.0mA/20mA

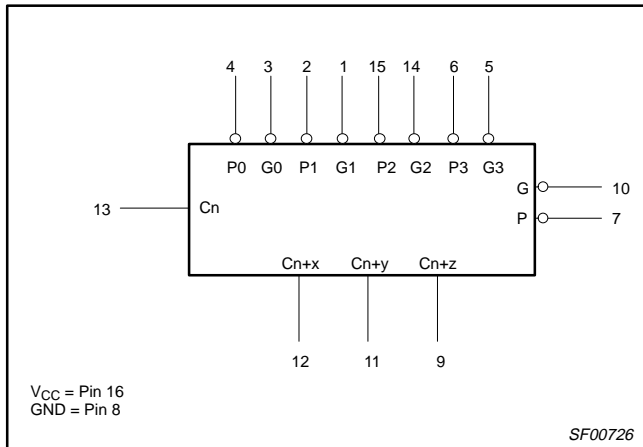
### NOTE:

One (1.0) FAST unit load is defined as: 20 $\mu$ A in the High state and 0.6mA in the Low state.

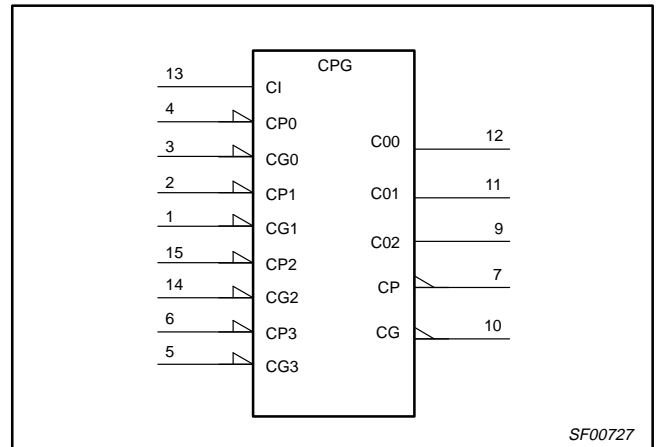
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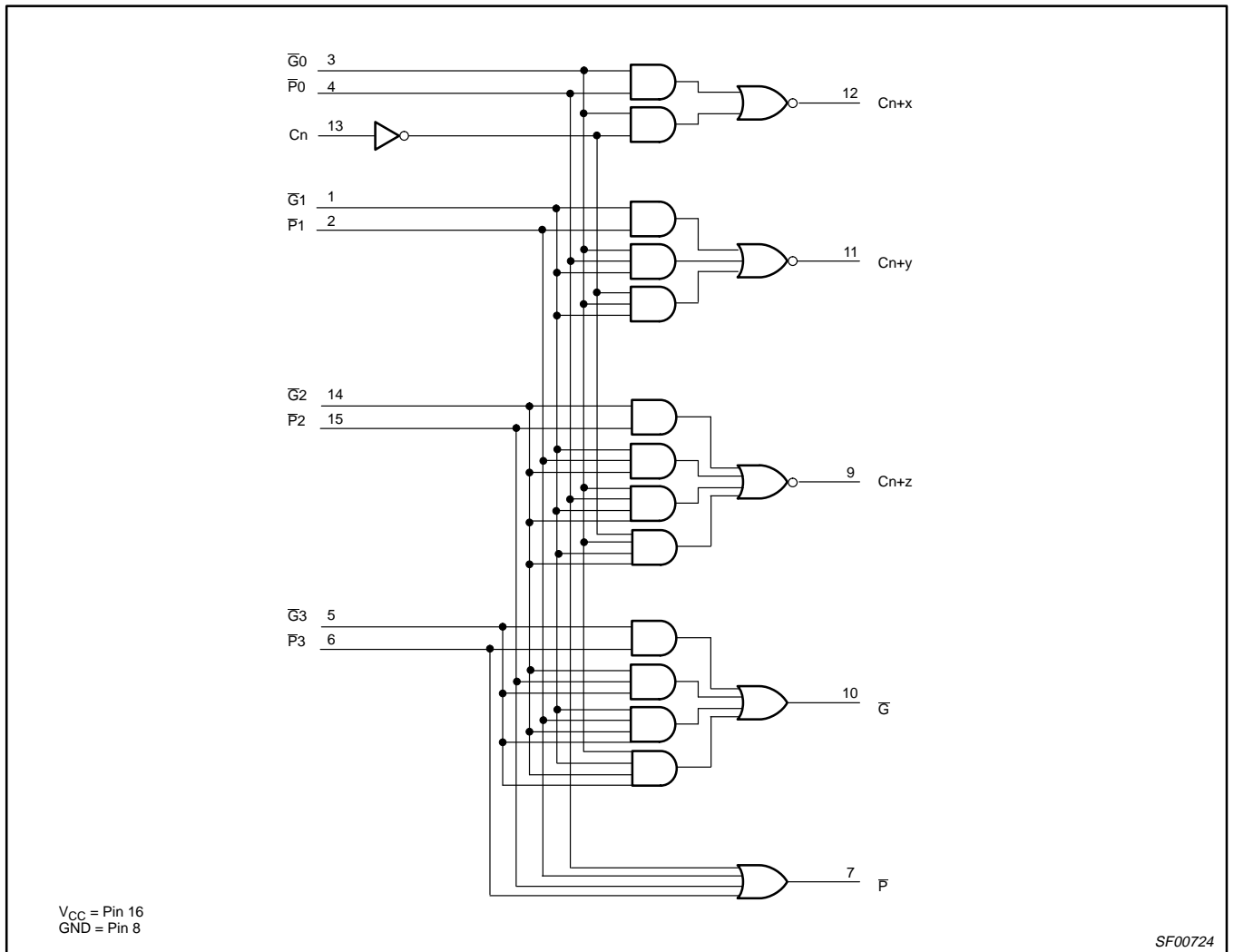
## LOGIC SYMBOL



## IEC/IEEE SYMBOL



## LOGIC DIAGRAM



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## FUNCTION TABLE

INPUTS									OUTPUTS				
Cn	G0	P0	G1	P1	G2	P2	G3	P3	Cn+x	Cn+y	Cn+z	G	P
X	H	H							L				
L	H	X							L				
X	L	X							H				
H	X	L							H				
X	X	X	H	H						L			
X	H	H	H	X						L			
L	H	X	H	X						L			
X	X	X	L	X						H			
X	L	X	X	L						H			
H	X	L	X	L						H			
X	X	X	X	X	H	H					L		
X	X	X	H	H	H	X					L		
X	H	H	H	X	H	X					L		
L	H	X	H	X	H	X					L		
X	X	X	X	X	L	X					H		
X	X	X	L	X	X	L					H		
X	L	X	X	L	X	L					H		
H	X	L	X	L	X	L					H		
	X		X	X	X	X	H	H				H	
	X		X	X	H	H	H	X				H	
	X		H	H	H	X	H	X				H	
	H		H	X	H	X	H	X				H	
	X		X	X	X	X	L	X				L	
	X		X	X	L	X	X	L				L	
	X		L	X	X	L	X	L				L	
	L		X	L	X	L	X	L				L	
		H		X		X		X					H
		X		H		X		X					H
		X		X		H		X					H
		X		X		X		H					H
		L		L		L		L					L

**NOTES:**

- H = High voltage level
- L = Low voltage level
- X = Don't care

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## APPLICATION

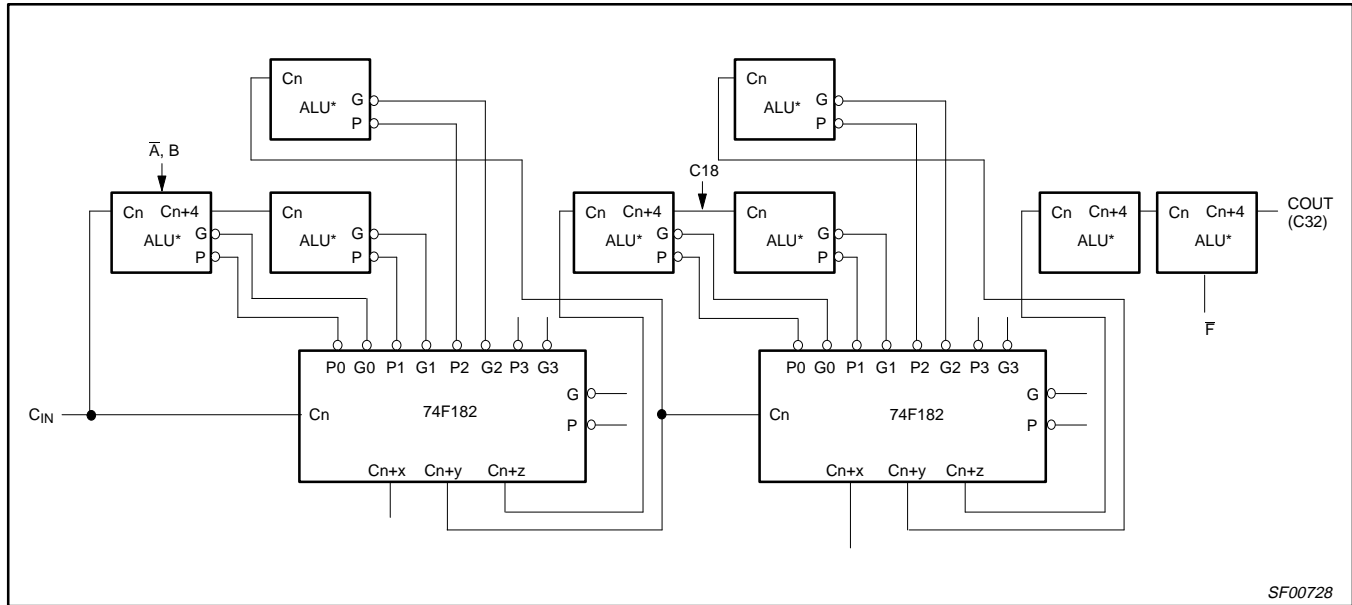


Figure 1. 32-Bit ALU with Ripple Carry Between 16-Bit Look-Ahead ALUs (\*ALUs may be either 74F181 or 74F381)

## 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 <sub>CC</sub>	Supply voltage	-0.5 to +7.0	V
V <sub>IN</sub>	Input voltage	-0.5 to +7.0	V
I <sub>IN</sub>	Input current	-30 to +5	mA
V <sub>OUT</sub>	Voltage applied to output in High output state	-0.5 to V <sub>CC</sub>	V
I <sub>OUT</sub>	Current applied to output in Low output state	40	mA
T <sub>amb</sub>	Operating free-air temperature range	0 to +70	°C
T <sub>stg</sub>	Storage temperature range	-65 to +150	°C

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5.0	5.5	V
V <sub>IH</sub>	High-level input voltage	2.0			V
V <sub>IL</sub>	Low-level input voltage			0.8	V
I <sub>IK</sub>	Input clamp current			-18	mA
I <sub>OH</sub>	High-level output current			-1	mA
I <sub>OL</sub>	Low-level output current			20	mA
T <sub>amb</sub>	Operating free-air temperature range	0		70	°C

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## DC ELECTRICAL CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS <sup>1</sup>		LIMITS			UNIT	
				MIN	TYP <sup>2</sup>	MAX		
V <sub>OH</sub>	High-level output voltage	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN	I <sub>OH</sub> = MAX	±10%V <sub>CC</sub>	2.5		V	
				±5%V <sub>CC</sub>	2.7	3.4	V	
V <sub>OL</sub>	Low-level output voltage	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN	I <sub>OL</sub> = MAX	±10%V <sub>CC</sub>		0.30	0.50	V
				±5%V <sub>CC</sub>		0.30	0.50	V
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>			-0.73	-1.2	V	
I <sub>I</sub>	Input current at maximum input voltage	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V				250	μA	
I <sub>IH</sub>	High-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V				250	μA	
I <sub>IL</sub>	Low-level input current	C <sub>n</sub> G <sub>0</sub> , G <sub>2</sub> G <sub>1</sub> G <sub>3</sub> , P <sub>0</sub> , P <sub>1</sub> P <sub>2</sub> P <sub>3</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5V			-1.2	mA	
						-8.4	mA	
						-9.6	mA	
						-4.8	mA	
						-3.6	mA	
						-2.4	mA	
I <sub>OS</sub>	Short-circuit output current <sup>3</sup>	V <sub>CC</sub> = MAX			-60	-150	mA	
I <sub>CC</sub>	Supply current (total)	I <sub>CCH</sub>	V <sub>CC</sub> = MAX		18	28	mA	
		I <sub>CCL</sub>			24	36	mA	

**NOTES:**

1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at V<sub>CC</sub> = 5V, T<sub>amb</sub> = 25°C.
3. Not more than one output should be shorted at a time. For testing I<sub>OS</sub>, 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<sub>OS</sub> tests should be performed last.

## AC ELECTRICAL CHARACTERISTICS

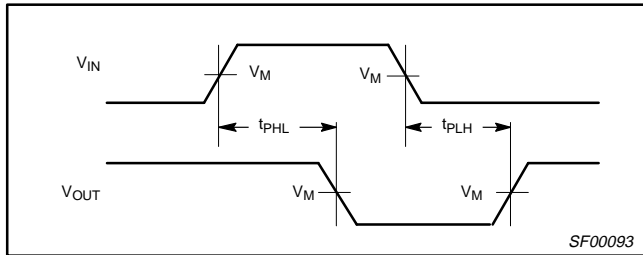
SYMBOL	PARAMETER	TEST CONDITION	LIMITS						UNIT
			V <sub>CC</sub> = +5.0V T <sub>amb</sub> = +25°C C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω			V <sub>CC</sub> = +5.0V ± 10% T <sub>amb</sub> = 0°C to +70°C C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω			
			MIN	TYP	MAX	MIN	MAX		
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay C <sub>n</sub> to C <sub>n+x</sub> , C <sub>n+y</sub> , C <sub>n+z</sub>	Waveform 2	2.5 2.5	5.0 5.0	8.0 7.5	2.5 2.5	8.5 8.5	ns	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay P <sub>0</sub> , P <sub>1</sub> , or P <sub>2</sub> to C <sub>n+x</sub> , C <sub>n+y</sub> , C <sub>n+z</sub>	Waveform 1	2.0 1.5	5.0 3.5	7.0 5.0	1.5 1.5	8.0 6.0	ns	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay G <sub>0</sub> , G <sub>1</sub> , or G <sub>2</sub> to C <sub>n+x</sub> , C <sub>n+y</sub> , C <sub>n+z</sub>	Waveform 1	1.5 1.5	4.0 3.0	7.5 5.0	1.5 1.5	8.5 5.5	ns	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay P <sub>1</sub> , P <sub>2</sub> , or P <sub>3</sub> to G	Waveform 2	2.0 3.0	7.0 5.0	10.0 7.0	1.5 2.5	11.0 8.0	ns	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay G <sub>n</sub> to G	Waveform 2	1.5 3.0	5.0 5.0	7.0 7.0	1.5 2.5	7.5 8.0	ns	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay P <sub>n</sub> to P	Waveform 2	1.5 2.5	3.5 4.0	6.0 6.0	1.5 2.5	7.5 6.5	ns	

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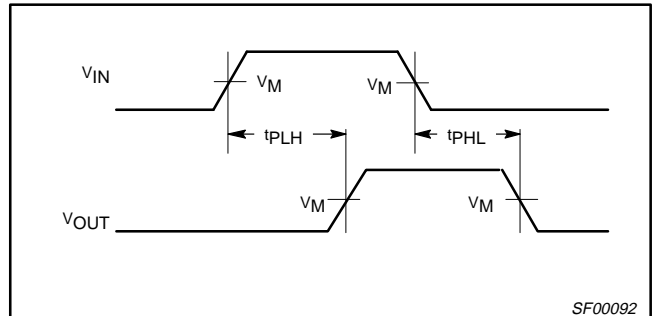
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## AC WAVEFORMS

For all waveforms,  $V_M = 1.5V$

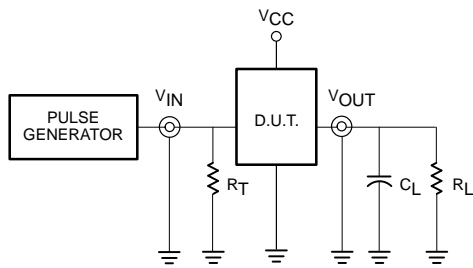


Waveform 1. Propagation Delay for Inverting Outputs

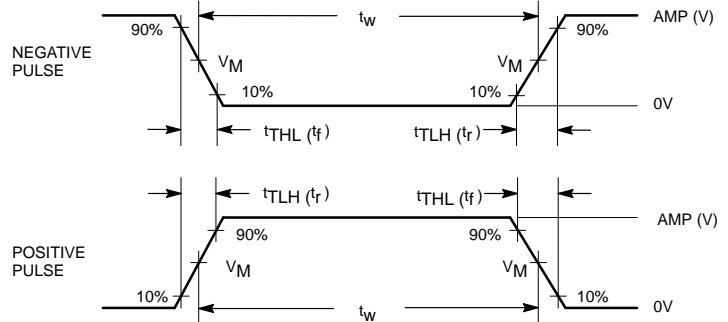


Waveform 2. Propagation Delay for Non-Inverting Outputs

## TEST CIRCUIT AND WAVEFORMS



Test Circuit for Totem-Pole Outputs



Input Pulse Definition

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

family	INPUT PULSE REQUIREMENTS					
	amplitude	$V_M$	rep. rate	$t_w$	$t_{TLH}$	$t_{THL}$
74F	3.0V	1.5V	1MHz	500ns	2.5ns	2.5ns

SF00006

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Datasheets for electronics components.