

# DATA SHEET

**74F269**

8-bit bidirectional binary counter

Product specification

1996 Jan 05

IC15 Data Handbook

# 8-bit bidirectional binary counter

# 74F269

## FEATURES

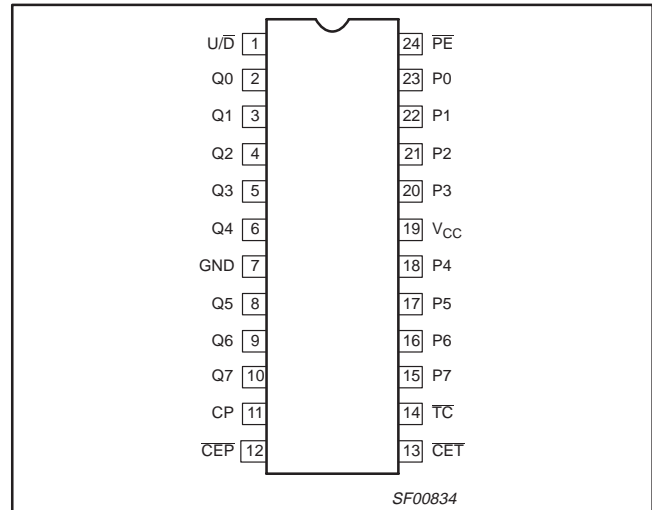
- Synchronous counting and loading
- Built-in look-ahead carry capability
- Count frequency 115MHz typ
- Supply current 95mA typ

## DESCRIPTION

The 74F269 is a fully synchronous 8-stage Up/Down Counter featuring a preset capability for programmable operation, carry look-ahead for easy cascading and a U/D input to control the direction of counting. All state changes, whether in counting or parallel loading, are initiated by the rising edge of the clock.

TYPE	TYPICAL f <sub>MAX</sub>	TYPICAL SUPPLY CURRENT (TOTAL)
74F269	115MHz	95mA

## PIN CONFIGURATION



## ORDERING INFORMATION

DESCRIPTION	COMMERCIAL RANGE V <sub>CC</sub> = 5V ±10%, T <sub>amb</sub> = 0°C to +70°C	PKG DWG #
24-Pin Plastic Slim DIP (300mil)	N74F269N	SOT222-1
24-Pin Plastic SOL	N74F269D	SOT137-1
24-Pin Plastic SSOP type II	N74F269DB	SOT340-1

## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74F(U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
P0 - P7	Parallel Data inputs	1.0/1.0	20µA/0.6mA
PE	Parallel Enable input (active Low)	1.0/1.0	20µA/0.6mA
U/D	Up/Down count control input	1.0/1.0	20µA/0.6mA
CEP	Count Enable Parallel input (active Low)	1.0/1.0	20µA/0.6mA
CET	Count Enable Trickle input (active Low)	1.0/1.0	20µA/0.6mA
CP	Clock input	1.0/1.0	20µA/0.6mA
TC	Terminal Count output (active Low)	50/33	1.0mA/20mA
Q0 - Q7	Flip-flop outputs	50/33	1.0mA/20mA

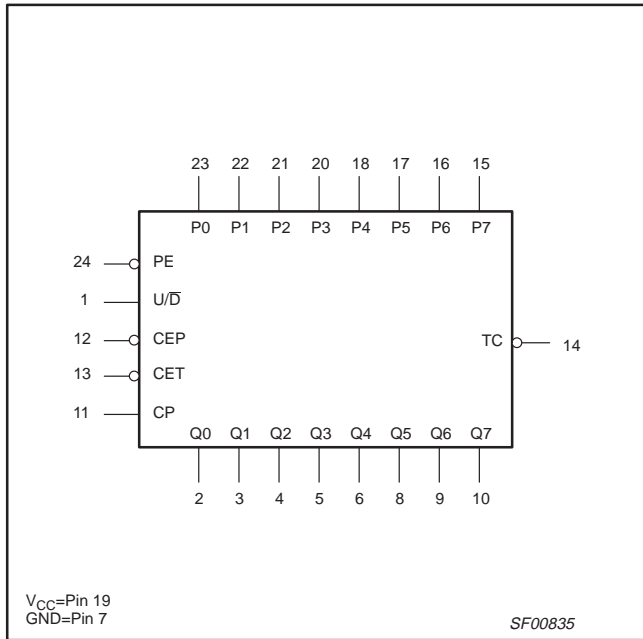
### NOTE:

One (1.0) FAST Unit Load is defined as: 20µA in the High state and 0.6mA in the Low state.

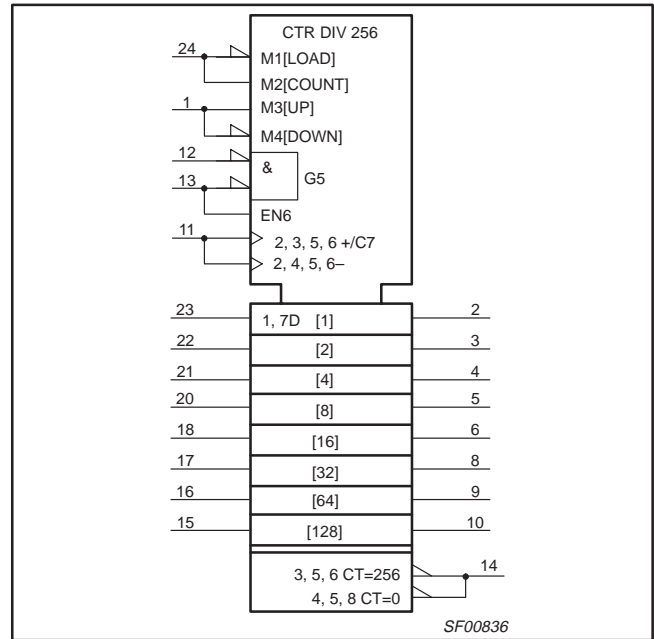
# 8-bit bidirectional binary counter

74F269

## LOGIC SYMBOL



## LOGIC SYMBOL (IEEE/IEC)



## APPLICATION

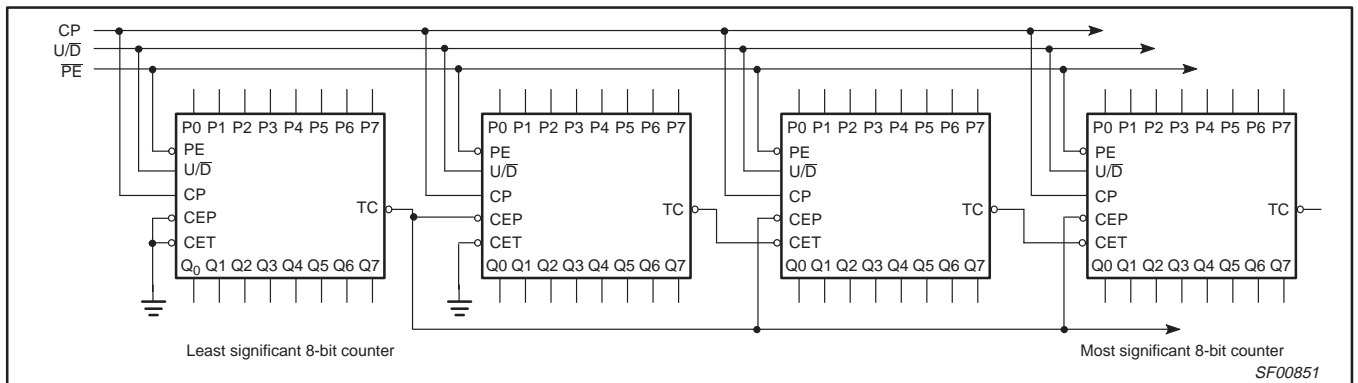


Figure 1. Synchronous Multistage Counting Scheme

## MODE SELECT FUNCTION TABLE

INPUTS						OUTPUTS		OPERATING MODE
CP	U/D	CEP	CET	PE	$P_n$	$Q_n$	TC	
↑	X	X	X	l	l	L	(a)	Parallel load
↑	X	X	X	l	h	H	(a)	
↑	h	l	l	h	X	Count Up	(a)	Count Up
↑	l	l	l	h	X	Count Down	(a)	Count Down
↑	X	h	l	h	X	$q_n$	(a)	Hold (do nothing)
↑	X	X	h	h	X	$q_n$	H	

H = High voltage level

h = High voltage level one setup prior to the Low-to-High clock transition

L = Low voltage level

l = Low voltage level one setup time prior to the Low-to-High clock transition

q = Lower case letters indicate the state of the referenced output prior to the Low-to-High clock transition

X = Don't care

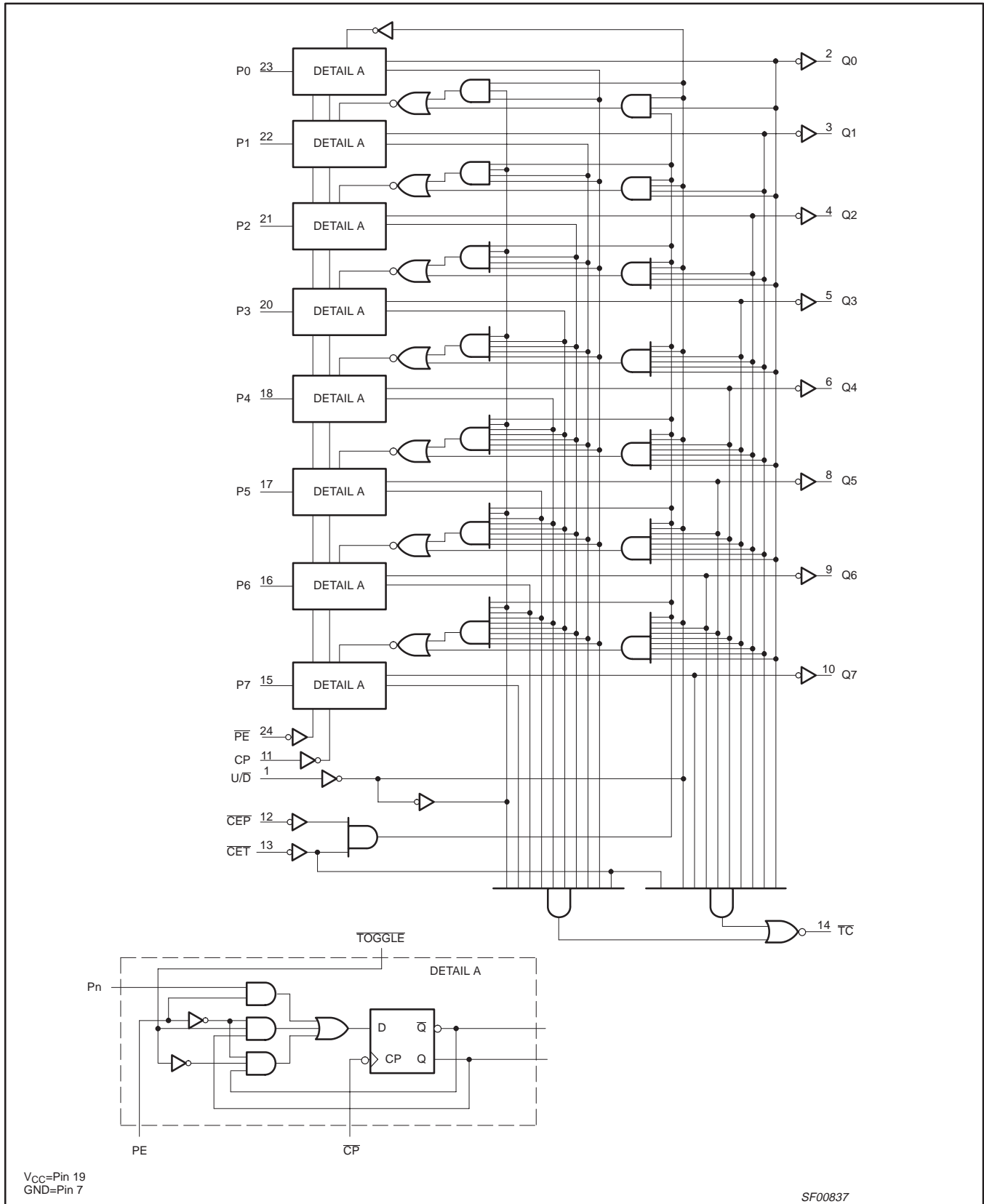
↑ = Low-to-High clock transition

(a) = TC is Low when CET is Low and the counter is at Terminal Count. Terminal Count Up is with all  $Q_n$  outputs High and Terminal Count Down is with all  $Q_n$  outputs Low.

# 8-bit bidirectional binary counter

74F269

## LOGIC DIAGRAM



## 8-bit bidirectional binary counter

74F269

**ABSOLUTE MAXIMUM RATINGS**

(Operation beyond the limits 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	-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

**DC ELECTRICAL CHARACTERISTICS**

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

SYMBOL	PARAMETER	TEST CONDITIONS <sup>NO TAG</sup>	LIMITS			UNIT	
			MIN	TYP NO TAG	MAX		
V <sub>OH</sub>	High-level output voltage	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX	±10%V <sub>CC</sub>	2.5		V	
		V <sub>IH</sub> = MIN, I <sub>OH</sub> = MAX	±5%V <sub>CC</sub>	2.7	3.4		
V <sub>OL</sub>	Low-level output voltage	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX	±10%V <sub>CC</sub>		0.30	V	
		V <sub>IH</sub> = MIN, I <sub>OL</sub> = MAX	±5%V <sub>CC</sub>		0.30		
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>			-0.73	V	
I <sub>I</sub>	Input current at maximum input voltage	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V			100	μA	
I <sub>IH</sub>	High-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V			20	μA	
I <sub>IL</sub>	Low-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5V			-0.6	mA	
I <sub>OS</sub>	Short-circuit output current <sup>NO TAG</sup>	V <sub>CC</sub> = MAX		-60		mA	
I <sub>CC</sub>	Supply current (total)	I <sub>CCH</sub>	V <sub>CC</sub> = MAX	PE=CET=CEP=U/D=GND, Pn=4.5V, CP=↑	93	120	mA
		I <sub>CCL</sub>			98	125	mA

**NOTES:**

- For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
- All typical values are at V<sub>CC</sub> = 5V, T<sub>amb</sub> = 25°C.
- 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.

## 8-bit bidirectional binary counter

74F269

## AC ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS					UNIT
			T <sub>amb</sub> = +25°C V <sub>CC</sub> = +5V C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω			T <sub>amb</sub> = 0°C to +70°C V <sub>CC</sub> = +5V ± 10% C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω		
			MIN	TYP	MAX	MIN	MAX	
f <sub>MAX</sub>	Maximum clock frequency	Waveform 1	100	115		85		MHz
t <sub>PLH</sub> t <sub>pPHL</sub>	Propagation delay CP to Q <sub>n</sub> (Load, $\overline{PE}$ = Low)	Waveform 1	3.0 4.0	6.0 6.5	8.5 8.5	3.0 4.0	9.0 9.0	ns ns
t <sub>PLH</sub> t <sub>pHL</sub>	Propagation delay CP to Q <sub>n</sub> (Count, $\overline{PE}$ = High)	Waveform 1	3.0 4.5	6.0 7.0	9.0 10.0	3.0 4.0	10.0 10.5	ns ns
t <sub>PLH</sub> t <sub>pHL</sub>	Propagation delay CP to $\overline{TC}$	Waveform 1	4.5 5.0	6.5 6.5	9.5 9.5	4.0 5.0	10.5 10.0	ns ns
t <sub>PLH</sub> t <sub>pHL</sub>	Propagation delay $\overline{CET}$ to $\overline{TC}$	Waveform 2	3.5 3.0	6.0 6.5	9.0 9.0	3.0 3.0	10.0 10.0	ns ns
t <sub>PLH</sub> t <sub>pHL</sub>	Propagation delay U/D to $\overline{TC}$	Waveform 3	4.5 4.5	7.0 7.0	9.0 9.5	4.0 4.0	10.0 10.0	ns ns

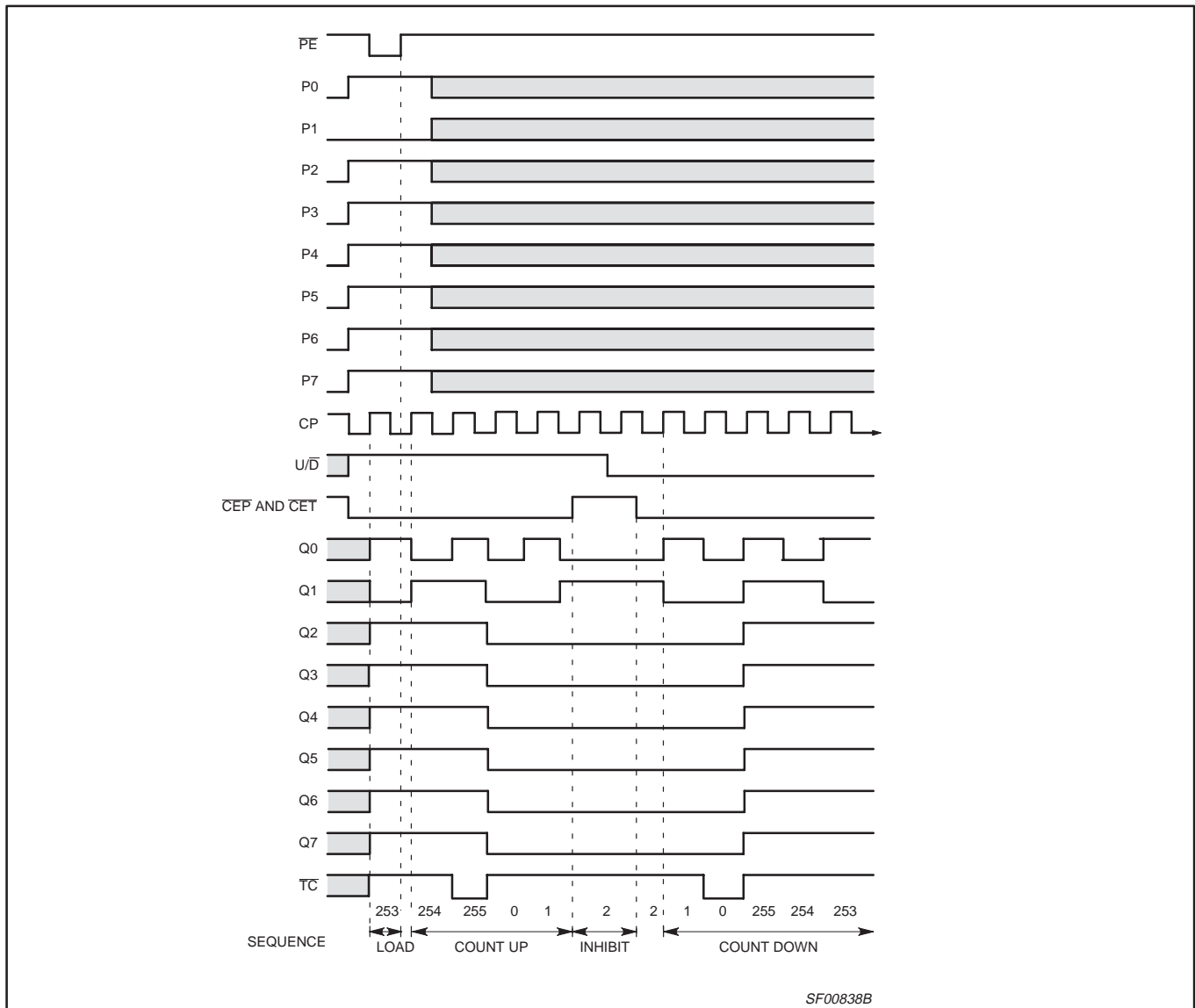
## AC SETUP REQUIREMENTS

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS				UNIT
			T <sub>amb</sub> = +25°C V <sub>CC</sub> = +5V C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω		T <sub>amb</sub> = 0°C to +70°C V <sub>CC</sub> = +5V ± 10% C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω		
			MIN	TYP	MIN	MAX	
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup time, High or Low P <sub>n</sub> to CP	Waveform 4	3.5 3.5		2.5 2.5		ns ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold time, High or Low P <sub>n</sub> to CP	Waveform 4	1.0 1.0		0 1.0		ns ns
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup time, High or Low $\overline{PE}$ to CP	Waveform 4	5.5 6.5		5.5 6.5		ns ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold time, High or Low $\overline{PE}$ to CP	Waveform 4	0 0		0 0		ns ns
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup time, High or Low $\overline{CEP}$ or $\overline{CET}$ to CP	Waveform 5	6.0 8.0		5.0 6.5		ns ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold time, High or Low $\overline{CEP}$ or $\overline{CET}$ to CP	Waveform 5	0 0		0 0		ns ns
t <sub>s</sub> (H) t <sub>s</sub> (L)	Setup time, High or Low U/D to CP	Waveform 6	8.0 6.5		6.5 6.5		ns ns
t <sub>h</sub> (H) t <sub>h</sub> (L)	Hold time, High or Low U/D to CP	Waveform 6	0 0		0 0		ns ns
t <sub>w</sub> (H) t <sub>w</sub> (L)	$\overline{CP}$ Pulse width High or Low	Waveform 1	4.0 4.5		4.0 5.0		ns ns

# 8-bit bidirectional binary counter

74F269

## TIMING DIAGRAM



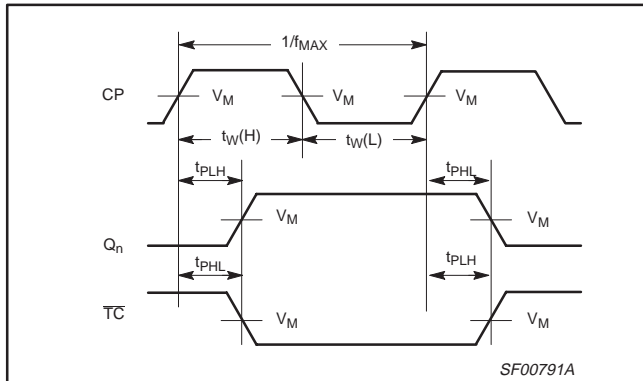
# 8-bit bidirectional binary counter

74F269

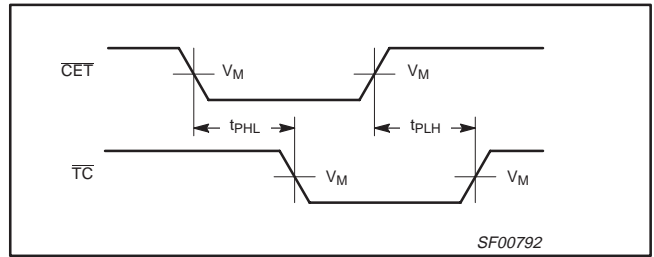
## AC WAVEFORMS

For all waveforms,  $V_M = 1.5V$ .

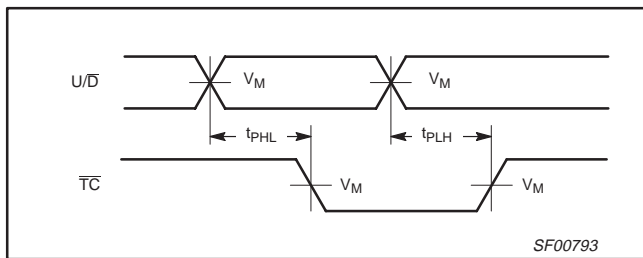
The shaded areas indicate when the input is permitted to change for predictable output performance.



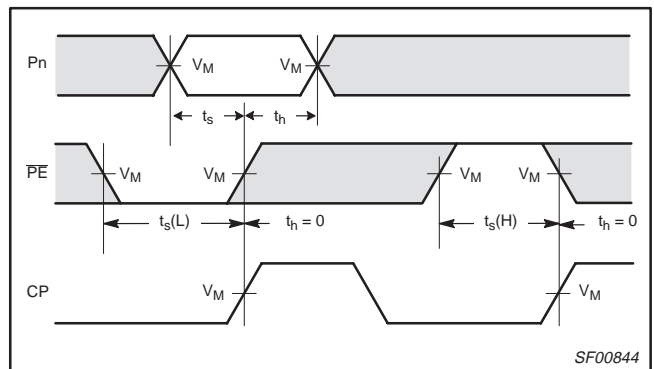
**Waveform 1. Propagation Delay, Clock Input to Output, Clock Pulse Width, and Maximum Clock Frequency**



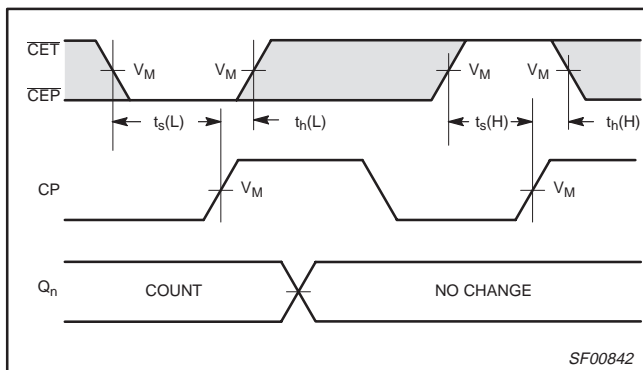
**Waveform 2. Propagation Delay, CET Input to Terminal Count Output**



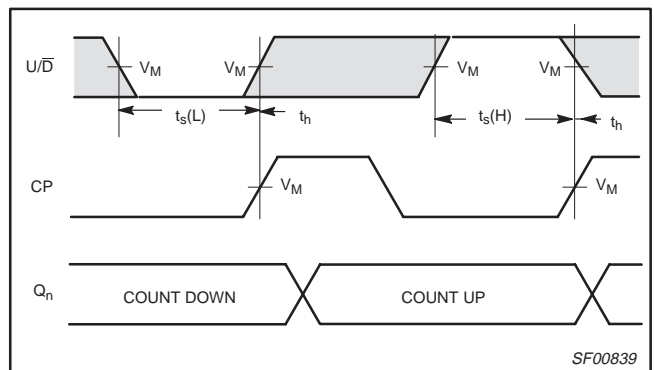
**Waveform 3. Propagation Delay, Up/Down Count Control Input to Terminal Count Output**



**Waveform 4. Parallel Data and Parallel Enable Setup and Hold Times**



**Waveform 5. Count Enables Setup and Hold Times**

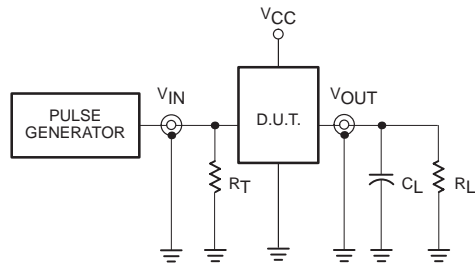


**Waveform 6. Up/Down Count Control Setup and Hold Times**

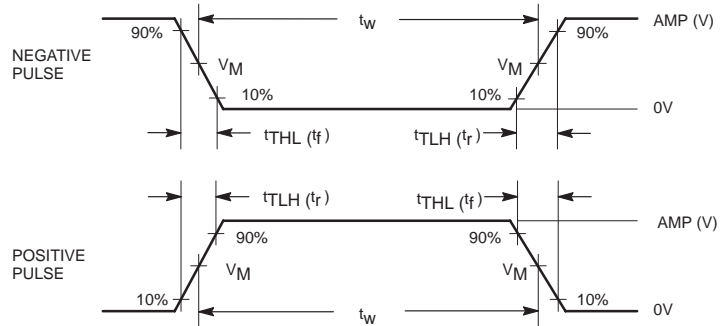
# 8-bit bidirectional binary counter

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## 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

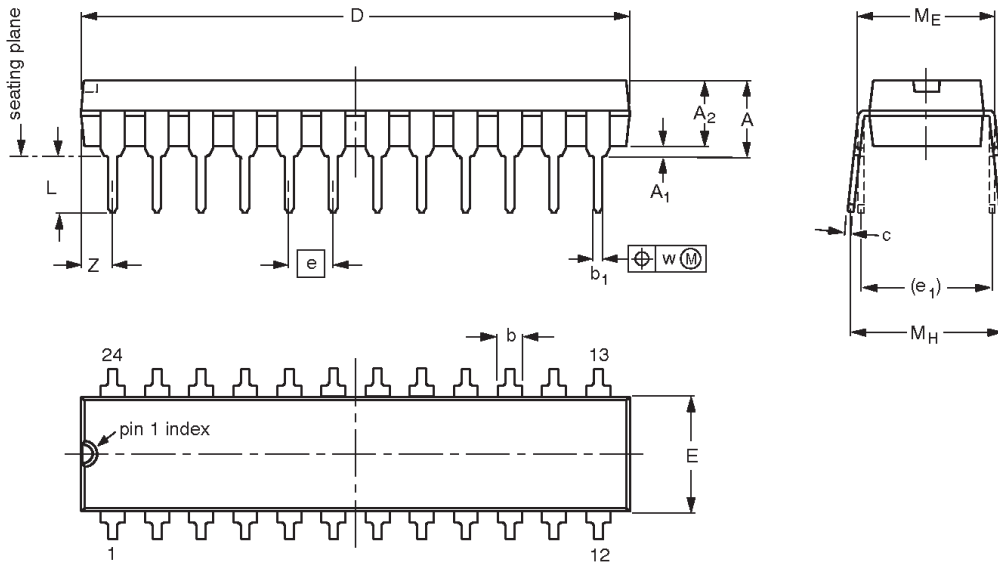
SF00006

# 8-bit bidirectional binary counter

74F269

DIP24: plastic dual in-line package; 24 leads (300 mil)

SOT222-1



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

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.70	0.38	3.94	1.63 1.14	0.56 0.43	0.36 0.25	31.9 31.5	6.73 6.48	2.54	7.62	3.51 3.05	8.13 7.62	10.03 7.62	0.25	2.05
inches	0.185	0.015	0.155	0.064 0.045	0.022 0.017	0.014 0.010	1.256 1.240	0.265 0.255	0.100	0.300	0.138 0.120	0.32 0.30	0.395 0.300	0.01	0.081

**Note**

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

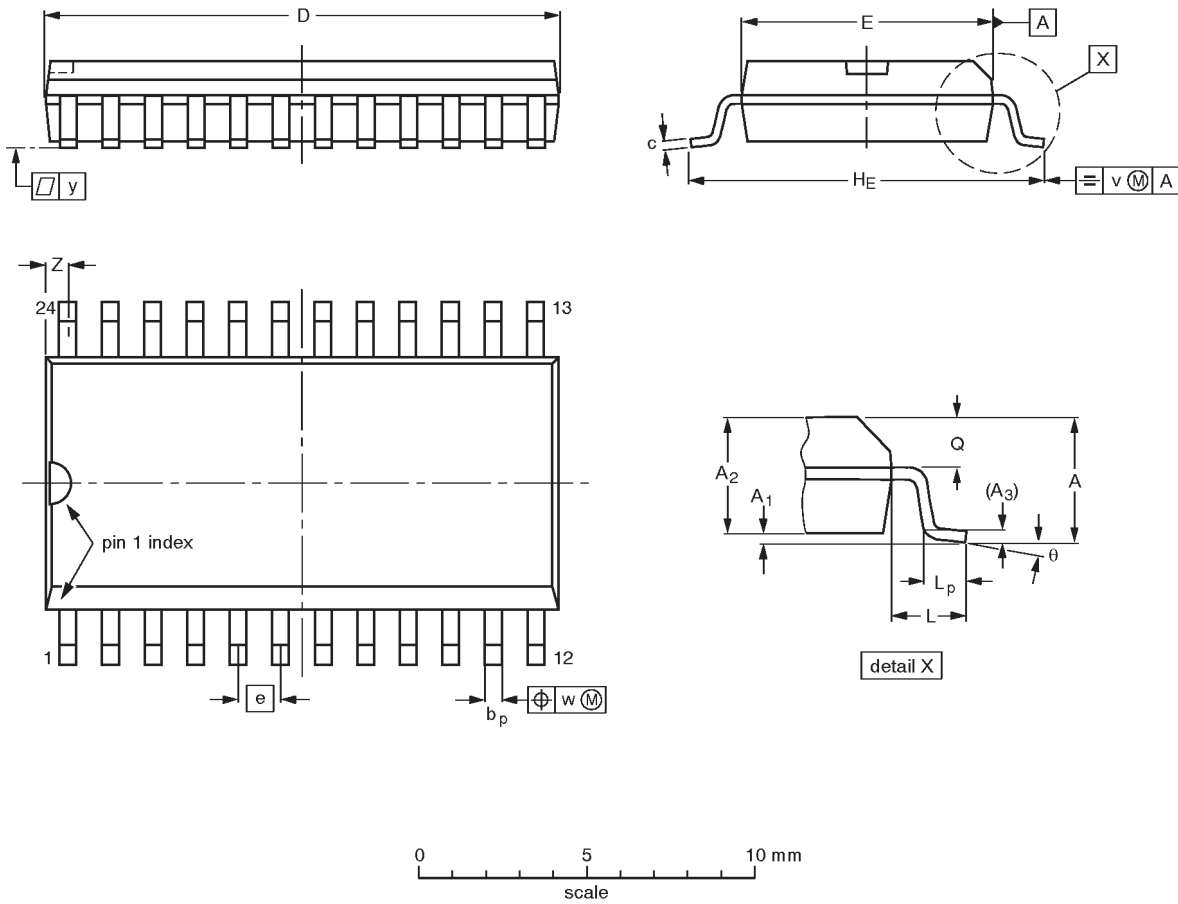
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT222-1		MS-001AF				95-03-11

8-bit bidirectional binary counter

74F269

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 <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	$\theta$
mm	2.65	0.30 0.10	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° 0°
inches	0.10	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	0.050	0.42 0.39	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 maximum per side are not included.

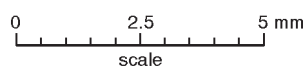
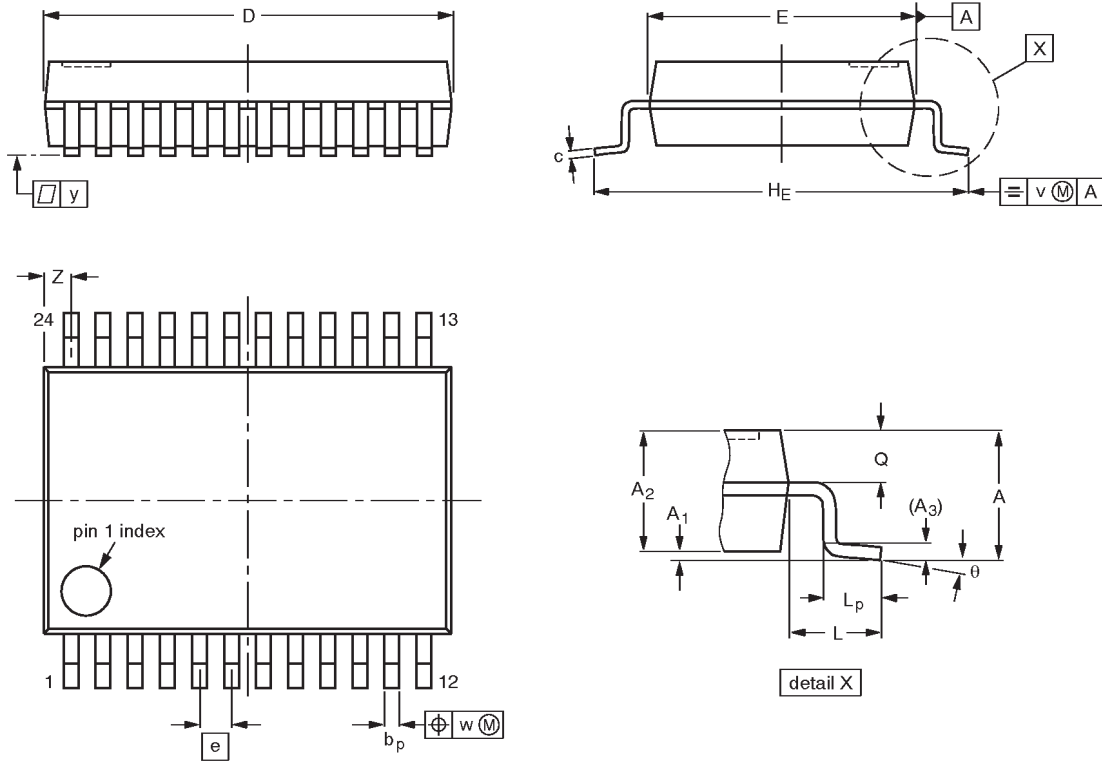
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT137-1	075E05	MS-013AD				-92-11-17 95-01-24

# 8-bit bidirectional binary counter

74F269

SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm

SOT340-1



**DIMENSIONS (mm are the original dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	$\theta$
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	8.4 8.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.8 0.4	8° 0°

**Note**

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT340-1		MO-150AG				93-09-08- 95-02-04

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8-bit bidirectional binary counter

74F269

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**NOTES**

## 8-bit bidirectional binary counter

74F269

## DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	<b>Formative or in Design</b>	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
<i>Preliminary Specification</i>	<b>Preproduction Product</b>	This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.
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Document order number:

9397-750-05112

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