

## 54AC/74AC378 Parallel D Register with Enable

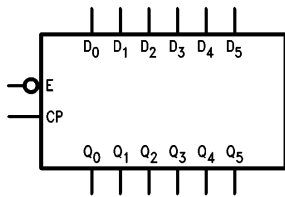
### General Description

The 'AC378 is a 6-bit register with a buffered common Enable. This device is similar to the 'AC174, but with common Enable rather than common Master Reset.

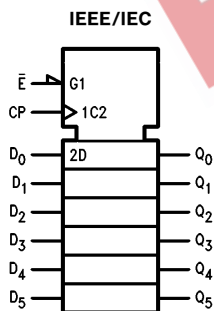
### Features

- 6-bit high-speed parallel register
- Positive edge-triggered D-type inputs
- Fully buffered common clock and enable inputs
- Input clamp diodes limit high-speed termination effects
- Standard Military Drawing (SMD) — 'AC378: 5962-91605

### Logic Symbols



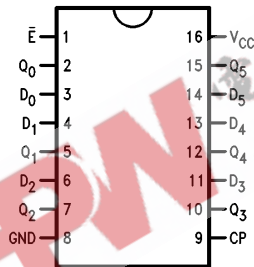
TL/F/10231-1



TL/F/10231-4

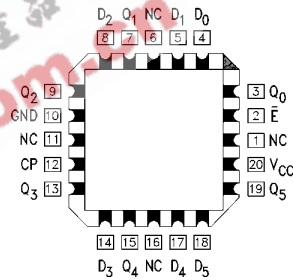
### Connection Diagrams

Pin Assignment for  
DIP, SOIC and Flatpak



TL/F/10231-2

Pin Assignment  
for LCC



TL/F/10231-3

Pin Names	Description
$\bar{E}$	Enable Input (Active LOW)
$D_0-D_5$	Data Inputs
CP	Clock Pulse Input (Active Rising Edge)
$Q_0-Q_5$	Outputs

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## Functional Description

The 'AC378 consists of six edge-triggered D-type flip-flops with individual D inputs and Q outputs. The Clock (CP) and Enable ( $\bar{E}$ ) inputs are common to all flip-flops.

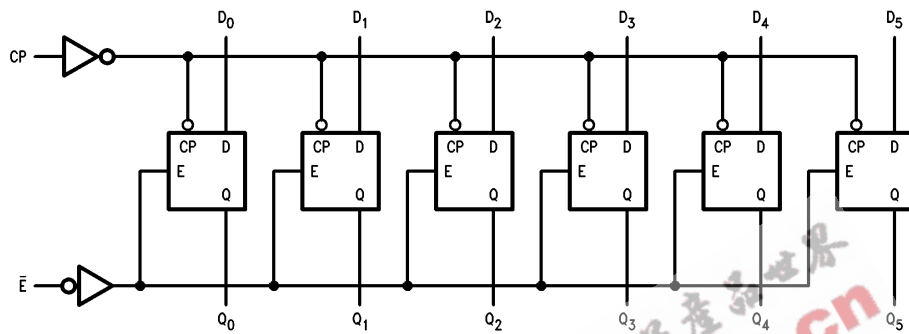
When the  $\bar{E}$  input is LOW, new data is entered into the register on the LOW-to-HIGH transition of the CP input. When the  $\bar{E}$  input is HIGH the register will retain the present data independent of the CP input.

## Truth Table

Inputs			Output
$\bar{E}$	CP	$D_n$	$Q_n$
H	↗	X	No Change
L	↗	H	H
L	↗	L	L

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Immaterial  
 ↗ = LOW-to-HIGH Clock Transition

## Logic Diagram



TL/F/10231-5

Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

### Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage ( $V_{CC}$ )	-0.5V to +7.0V
DC Input Diode Current ( $I_{IK}$ )	
$V_I = -0.5V$	-20 mA
$V_I = V_{CC} + 0.5V$	+20 mA
DC Input Voltage ( $V_I$ )	-0.5V to $V_{CC} + 0.5V$
DC Output Diode Current ( $I_{OK}$ )	
$V_O = -0.5V$	-20 mA
$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage ( $V_O$ )	-0.5V to $V_{CC} + 0.5V$
DC Output Source or Sink Current ( $I_O$ )	$\pm 50$ mA
DC $V_{CC}$ or Ground Current per Output Pin ( $I_{CC}$ or $I_{GND}$ )	$\pm 50$ mA
Storage Temperature ( $T_{STG}$ )	-65°C to +150°C
Junction Temperature ( $T_J$ )	
CDIP	175°C
PDIP	140°C

**Note 1:** Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of FACT™ circuits outside databook specifications.

### Recommended Operating Conditions

Supply Voltage ( $V_{CC}$ )	2.0V to 6.0V
'AC	
Input Voltage ( $V_I$ )	0V to $V_{CC}$
Output Voltage ( $V_O$ )	0V to $V_{CC}$
Operating Temperature ( $T_A$ )	
74AC	-40°C to +85°C
54AC	-55°C to +125°C
Minimum Input Edge Rate ( $\Delta V/\Delta t$ )	
'AC Devices	
$V_{IN}$ from 30% to 70% of $V_{CC}$	
$V_{CC}$ @ 3.3V, 4.5V, 5.5V	125 mV/ns

### DC Characteristics for 'AC Family Devices

Symbol	Parameter	$V_{CC}$ (V)	74AC			54AC	74AC	Units	Conditions
			$T_A = +25^\circ C$			$T_A = -55^\circ C$ to $+125^\circ C$	$T_A = -40^\circ C$ to $+85^\circ C$		
			Typ	Guaranteed Limits					
$V_{IH}$	Minimum High Level Input Voltage	3.0	1.5	2.1	2.1	2.1	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		4.5	2.25	3.15	3.15	3.15			
		5.5	2.75	3.85	3.85	3.85			
$V_{IL}$	Maximum Low Level Input Voltage	3.0	1.5	0.9	0.9	0.9	V	$V_{OUT} = 0.1V$ or $V_{CC} - 0.1V$	
		4.5	2.25	1.35	1.35	1.35			
		5.5	2.75	1.65	1.65	1.65			
$V_{OH}$	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9	2.9	V	$I_{OUT} = -50 \mu A$	
		4.5	4.49	4.4	4.4	4.4			
		5.5	5.49	5.4	5.4	5.4			
			3.0		2.56	2.4	2.46	V	* $V_{IN} = V_{IL}$ or $V_{IH}$ -12 mA $I_{OH}$ -24 mA -24 mA
			4.5		3.86	3.7	3.76		
			5.5		4.86	4.7	4.76		
$V_{OL}$	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1	0.1	V	$I_{OUT} = 50 \mu A$	
		4.5	0.001	0.1	0.1	0.1			
		5.5	0.001	0.1	0.1	0.1			
			3.0		0.36	0.5	0.44	V	* $V_{IN} = V_{IL}$ or $V_{IH}$ 12 mA $I_{OL}$ 24 mA 24 mA
			4.5		0.36	0.5	0.44		
			5.5		0.36	0.5	0.44		
$I_{IN}$	Maximum Input Leakage Current	5.5		$\pm 0.1$	$\pm 1.0$	$\pm 1.0$	$\mu A$	$V_I = V_{CC}, GND$	

\*All outputs loaded; thresholds on input associated with output under test.

## DC Characteristics for 'AC Family Devices (Continued)

Symbol	Parameter	V <sub>CC</sub> (V)	74AC		54AC		74AC		Units	Conditions
			T <sub>A</sub> = +25°C		T <sub>A</sub> = -55°C to +125°C		T <sub>A</sub> = -40°C to +85°C			
			Typ	Guaranteed Limits						
I <sub>OLD</sub>	†Minimum Dynamic Output Current	5.5			50		75		mA	V <sub>OLD</sub> = 1.65V Max
I <sub>OHD</sub>		5.5			-50		-75		mA	V <sub>OHD</sub> = 3.85V Min
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5		4.0	80.0		40.0		μA	V <sub>IN</sub> = V <sub>CC</sub> or GND

†Maximum test duration 2.0 ms, one output loaded at a time.

**Note:** I<sub>IN</sub> and I<sub>CC</sub> @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V<sub>CC</sub>.

I<sub>CC</sub> for 54AC @ 25°C is identical to 74AC @ 25°C.

## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> * (V)	74AC			54AC		74AC		Units
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		
			Min	Typ	Max	Min	Max	Min	Max	
f <sub>max</sub>	Maximum Clock Frequency	3.3 5.0	125 160	160 200		95 95		110 145	MHz	
t <sub>PLH</sub>	Propagation Delay CP to Q <sub>n</sub>	3.3 5.0	2.5 1.5	8.5 6.0	11.0 8.0	1.5 1.5	12.0 9.0	2.5 1.5	12.5 9.0	ns
t <sub>PHL</sub>	Propagation Delay CP to Q <sub>n</sub>	3.3 5.0	2.5 1.5	8.0 5.5	10.5 7.5	1.5 1.5	12.0 9.0	2.5 1.5	11.0 8.0	ns

\*Voltage Range 3.3 is 3.3V ±0.3V

Voltage Range 5.0 is 5.0V ±0.5V

## AC Operating Requirements

Symbol	Parameter	V <sub>CC</sub> * (V)	74AC		54AC		74AC		Units
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF		T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF		
			Typ	Guaranteed Minimum					
t <sub>s</sub>	Setup Time, HIGH or LOW D <sub>n</sub> to CP	3.3 5.0	1.5 1.0	3.0 2.0		4.0 4.0		3.5 2.5	ns
t <sub>h</sub>	Hold Time, HIGH or LOW D <sub>n</sub> to CP	3.3 5.0	1.0 1.0	2.0 2.0		4.0 4.0		2.0 2.0	ns
t <sub>s</sub>	Setup Time, HIGH or LOW, $\bar{E}$ to CP	3.3 5.0	0 0	2.0 2.0		2.5 2.5		2.0 2.0	ns
t <sub>h</sub>	Hold Time, HIGH or LOW, $\bar{E}$ to CP	3.3 5.0	1.0 1.0	2.0 2.0		4.0 4.0		2.0 2.0	ns
t <sub>w</sub>	CP Pulse Width HIGH or LOW	3.3 5.0	3.0 2.0	4.5 3.5		6.5 6.5		5.5 4.0	ns

\*Voltage Range 3.3 is 3.3V ±0.3V

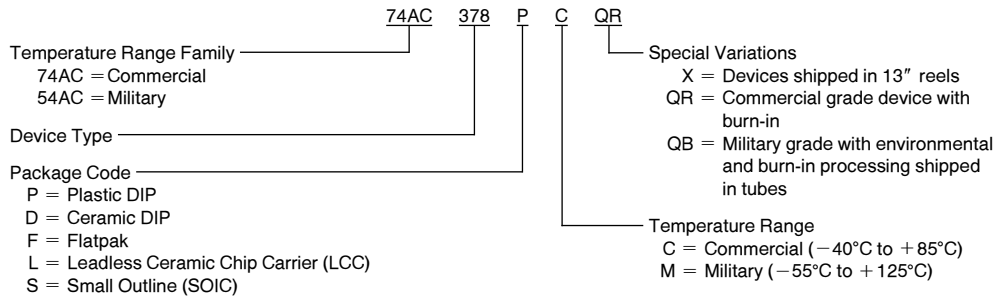
Voltage Range 5.0 is 5.0V ±0.5V

## Capacitance

Symbol	Parameter	Typ	Units	Conditions
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = OPEN
C <sub>PD</sub>	Power Dissipation Capacitance	28	pF	V <sub>CC</sub> = 5.0V

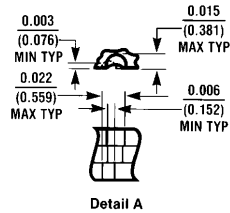
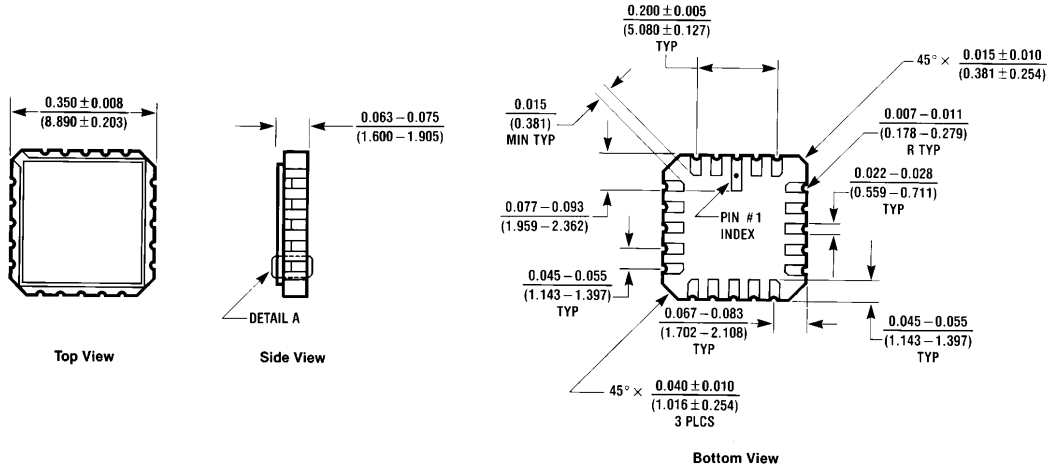
## Ordering Information

The device number is used to form part of a simplified purchasing code where a package type and temperature range are defined as follows:



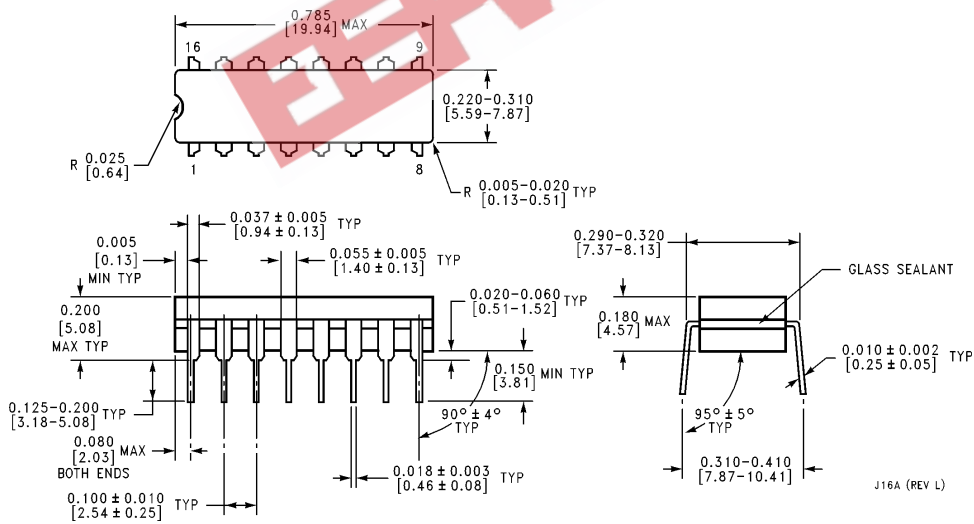
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**Physical Dimensions** inches (millimeters)



**20-Terminal Ceramic Leadless Chip Carrier (L)**  
 NS Package Number E20A

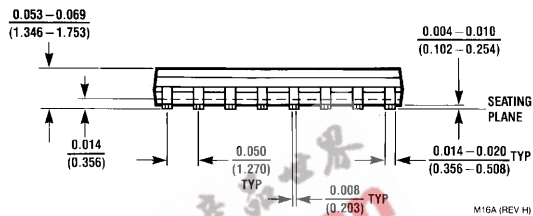
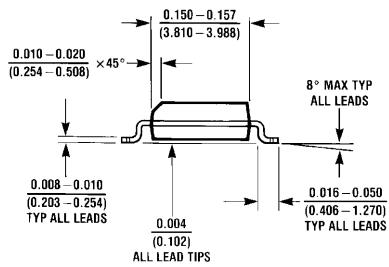
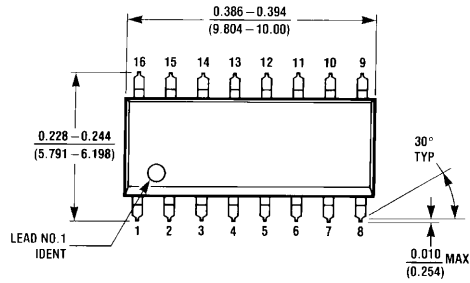
E20A (REV D)



**16-Lead Ceramic Dual-In-Line Package (D)**  
 NS Package Number J16A

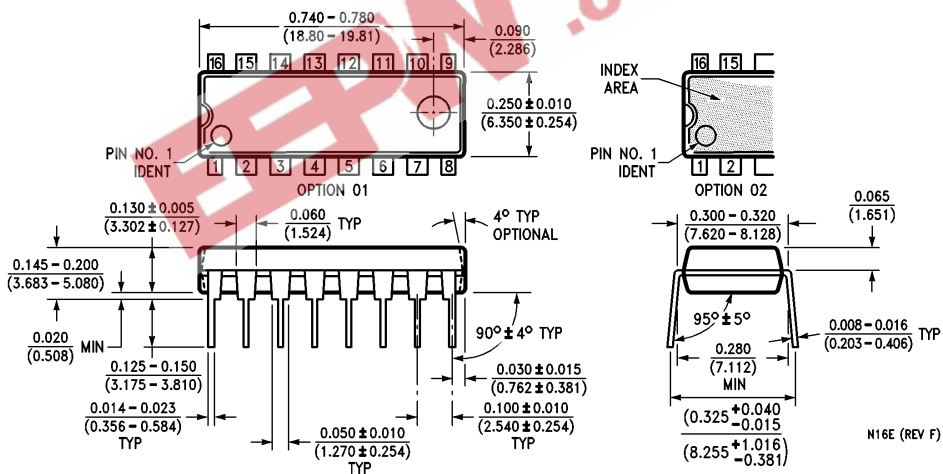
J16A (REV L)

**Physical Dimensions** inches (millimeters) (Continued)



**16-Lead Small Outline Integrated Circuit (S)**  
NS Package Number M16A

M16A (REV H)

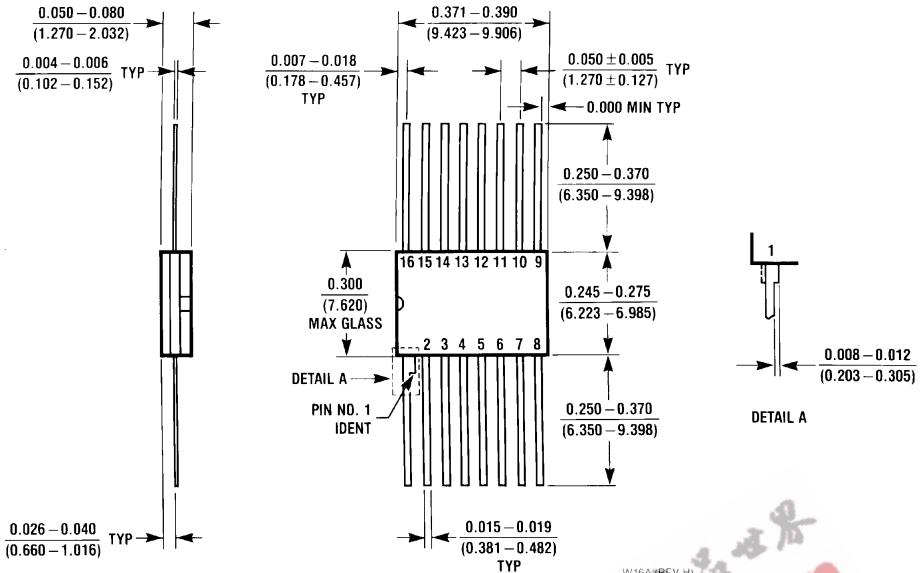


**16-Lead Plastic Dual-In-Line Package (P)**  
NS Package Number N16E

N16E (REV F)

**Physical Dimensions** inches (millimeters) (Continued)

Lit. # 114805



**16-Lead Ceramic Flatpak (F)  
NS Package Number W16A**

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**National Semiconductor Corporation**  
2900 Semiconductor Drive  
P.O. Box 58090  
Santa Clara, CA 95052-8090  
Tel: 1 (800) 272-9959  
TWX: (910) 339-9240

**National Semiconductor GmbH**  
Livvy-Gargan-Str. 10  
D-82256 Fürstfeldbruck  
Germany  
Tel: (81-41) 35-0  
Telex: 527649  
Fax: (81-41) 35-1

**National Semiconductor Japan Ltd.**  
Sumitomo Chemical  
Engineering Center  
Bldg. 7F  
1-7-1, Nakase, Mihama-Ku  
Chiba-City,  
Chiba Prefecture 261  
Tel: (043) 299-2300  
Fax: (043) 299-2500

**National Semiconductor Hong Kong Ltd.**  
13th Floor, Straight Block,  
Ocean Centre, 5 Canton Rd.  
Tsimshatsui, Kowloon  
Hong Kong  
Tel: (852) 2737-1600  
Fax: (852) 2736-9960

**National Semiconductores Do Brazil Ltda.**  
Rue Deputado Lacorda Franco  
120-3A  
Sao Paulo-SP  
Brazil 05418-000  
Tel: (55-11) 212-5066  
Telex: 391-1131931 NSBR BR  
Fax: (55-11) 212-1181

**National Semiconductor (Australia) Pty, Ltd.**  
Building 16  
Business Park Drive  
Monash Business Park  
Nottingham, Melbourne  
Victoria 3168 Australia  
Tel: (3) 558-9889  
Fax: (3) 558-9998

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