National Semiconductor

March 1993

54AC/74AC378
Parallel D Register with Enable

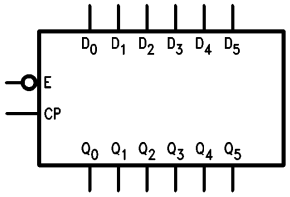
General Description

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



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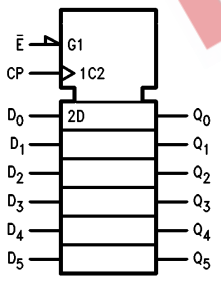
IEEE/IEC



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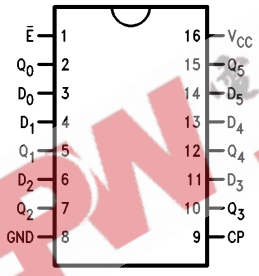
Connection Diagrams

Pin Assignment for DIP, SOIC and Flatpak



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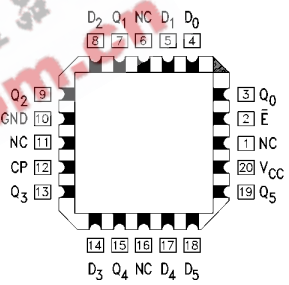
Pin Assignment for LCC



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Pin Names	Description
$\overline{E}$	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 inputs. The Clock (CP) and Enable ($\overline{E}$) inputs are common to all flip-flops.

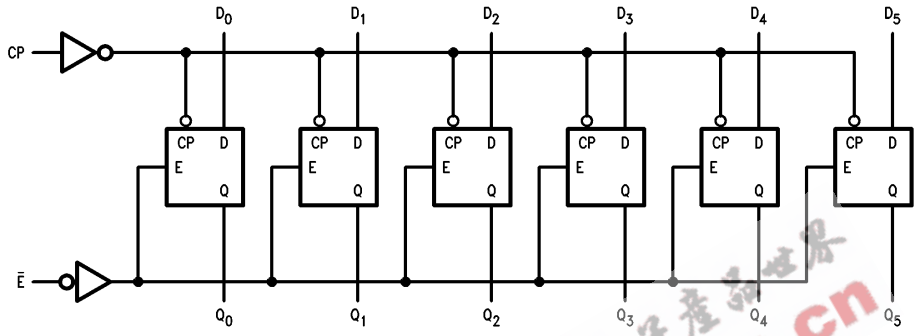
When the $\overline{E}$ input is LOW, new data is entered into the register on the LOW-to-HIGH transition of the CP input. When the $\overline{E}$ input is HIGH the register will retain the present data independent of the CP input.

Truth Table

Inputs			Output
$\overline{E}$	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



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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)	±50 mA
DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND})	±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})	
'AC	2.0V to 6.0V
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 (ΔV/Δt)	
'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 T_A = +25°C	74AC T_A = −55°C to +125°C	54AC T_A = −40°C to +85°C	Units	Conditions
			Typ	Guaranteed Limits			
V_{IH}	Minimum High Level Input Voltage	3.0	1.5	2.1	2.1	V	V_{OUT} = 0.1V or V_{CC} − 0.1V
		4.5	2.25	3.15	3.15		
		5.5	2.75	3.85	3.85		
V_{IL}	Maximum Low Level Input Voltage	3.0	1.5	0.9	0.9	V	V_{OUT} = 0.1V or V_{CC} − 0.1V
		4.5	2.25	1.35	1.35		
		5.5	2.75	1.65	1.65		
V_{OH}	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9	V	I_{OUT} = −50 μA
		4.5	4.49	4.4	4.4		
		5.5	5.49	5.4	5.4		
		3.0		2.56	2.4	V	*V_{IN} = V_{IL} or V_{IH} I_{OH} −12 mA
		4.5		3.86	3.7		I_{OH} −24 mA
		5.5		4.86	4.7		−24 mA
V_{OL}	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1	V	I_{OUT} = 50 μA
		4.5	0.001	0.1	0.1		
		5.5	0.001	0.1	0.1		
		3.0		0.36	0.5	V	*V_{IN} = V_{IL} or V_{IH} I_{OL} 12 mA
		4.5		0.36	0.5		I_{OL} 24 mA
		5.5		0.36	0.5		24 mA
I_{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0	μA	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_{CC} (V)	74AC T_A = +25°C		54AC T_A = −55°C to +125°C	74AC T_A = −40°C to +85°C	Units	Conditions
			Typ	Guaranteed Limits				
I_{OLD}	†Minimum Dynamic Output Current	5.5			50	75	mA	V_{OLD} = 1.65V Max
I_{OHD}		5.5			−50	−75	mA	V_{OHD} = 3.85V Min
I_{CC}	Maximum Quiescent Supply Current	5.5		4.0	80.0	40.0	μA	V_{IN} = V_{CC} or GND

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

Note: I_{IN} and I_{CC} @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V_{CC}.
I_{CC} for 54AC @ 25°C is identical to 74AC @ 25°C.

AC Electrical Characteristics

Symbol	Parameter	V_{CC}* (V)	74AC T_A = +25°C, C_L = 50 pF			54AC T_A = −55°C to +125°C, C_L = 50 pF		74AC T_A = −40°C to +85°C, C_L = 50 pF		Units
			Min	Typ	Max	Min	Max	Min	Max	
f_{max}	Maximum Clock Frequency	3.3 5.0	125 160	160 200		95 95		110 145		MHz
t_{PLH}	Propagation Delay CP to Q_n	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_{PHL}	Propagation Delay CP to Q_n	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_{CC}* (V)	74AC T_A = +25°C, C_L = 50 pF		54AC T_A = −55°C to +125°C, C_L = 50 pF	74AC T_A = −40°C to +85°C, C_L = 50 pF	Units
			Typ	Guaranteed Minimum			
t_s	Setup Time, HIGH or LOW D_n to CP	3.3 5.0	1.5 1.0	3.0 2.0	4.0 4.0	3.5 2.5	ns
t_h	Hold Time, HIGH or LOW D_n to CP	3.3 5.0	1.0 1.0	2.0 2.0	4.0 4.0	2.0 2.0	ns
t_s	Setup Time, HIGH or LOW, $\overline{E}$ to CP	3.3 5.0	0 0	2.0 2.0	2.5 2.5	2.0 2.0	ns
t_h	Hold Time, HIGH or LOW, $\overline{E}$ to CP	3.3 5.0	1.0 1.0	2.0 2.0	4.0 4.0	2.0 2.0	ns
t_w	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

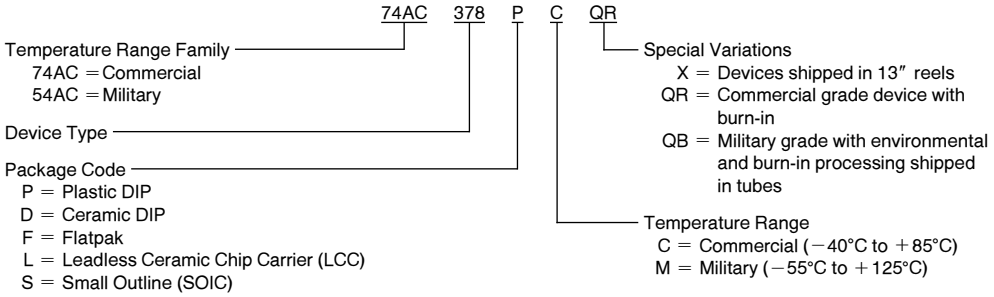
*Voltage Range 3.3 is 3.3V ±0.3V
Voltage Range 5.0 is 5.0V ±0.5V

Capacitance

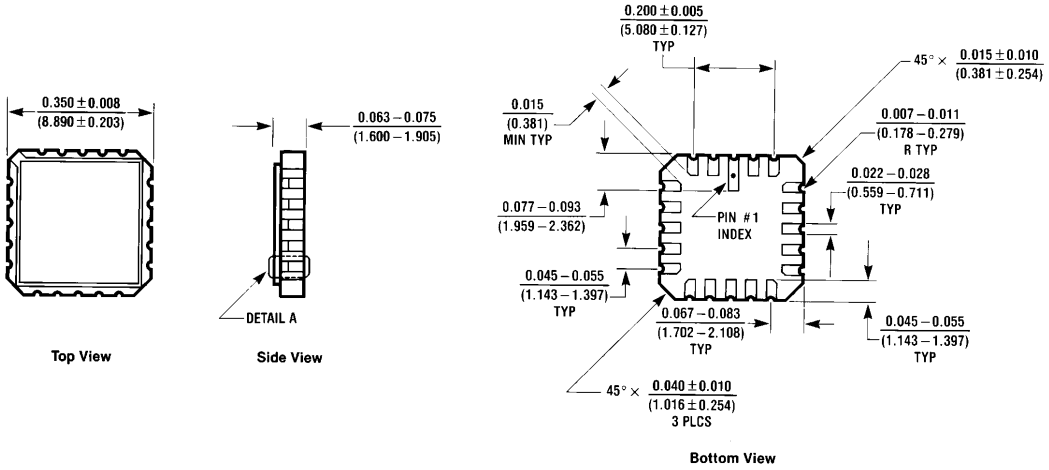
Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Capacitance	4.5	pF	V_{CC} = OPEN
C_{PD}	Power Dissipation Capacitance	28	pF	V_{CC} = 5.0V

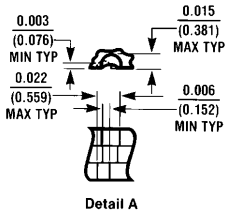
Ordering Information

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



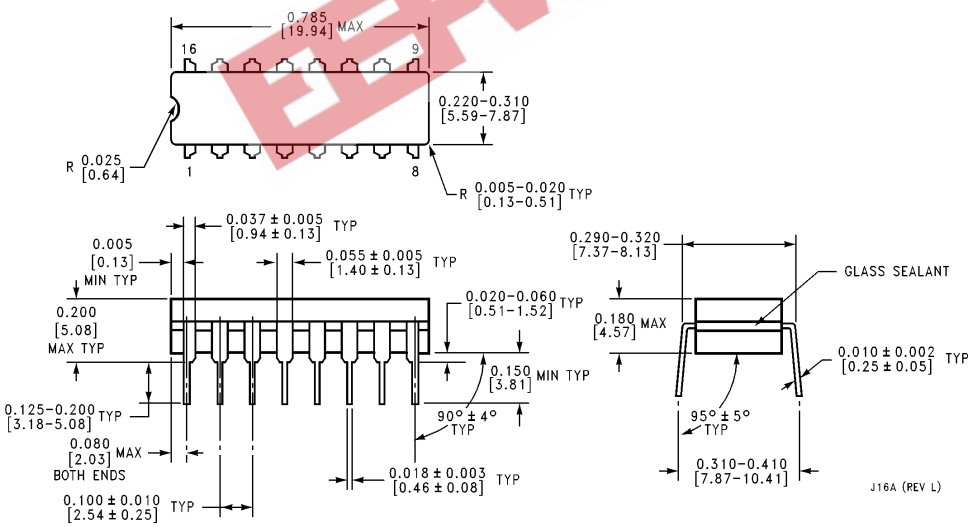
Physical Dimensions inches (millimeters)





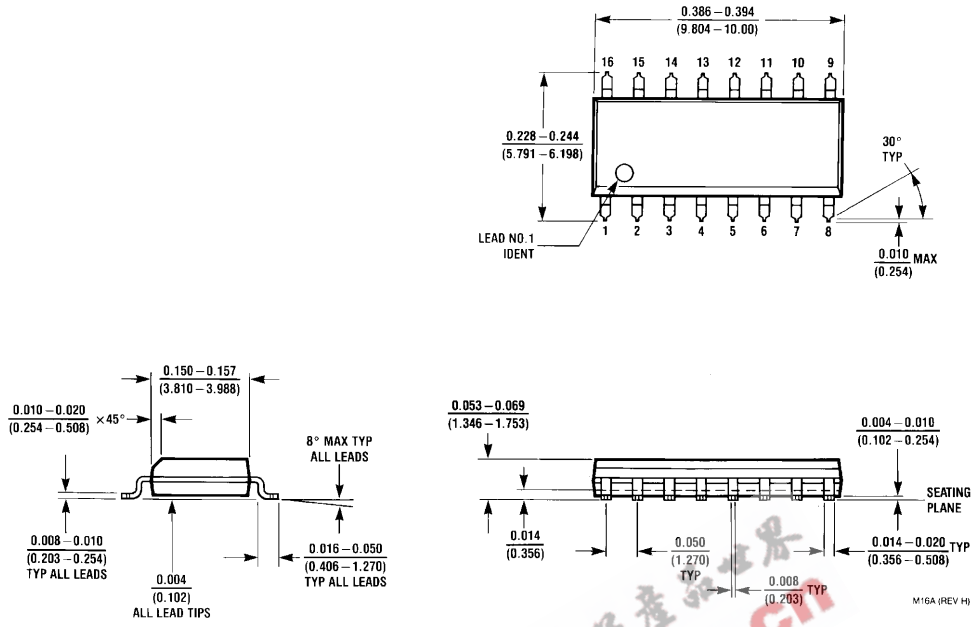
E20A (REV D)

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

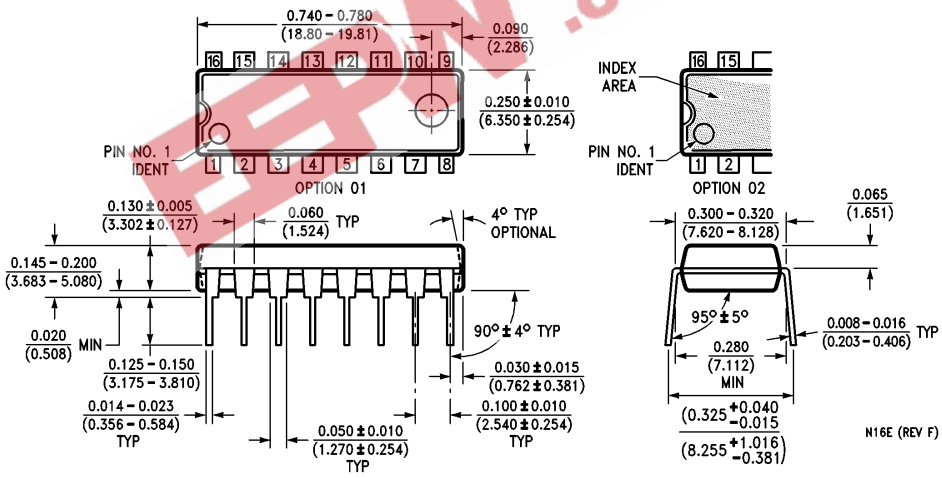


16-Lead Ceramic Dual-In-Line Package (D)
NS Package Number J16A

Physical Dimensions inches (millimeters) (Continued)



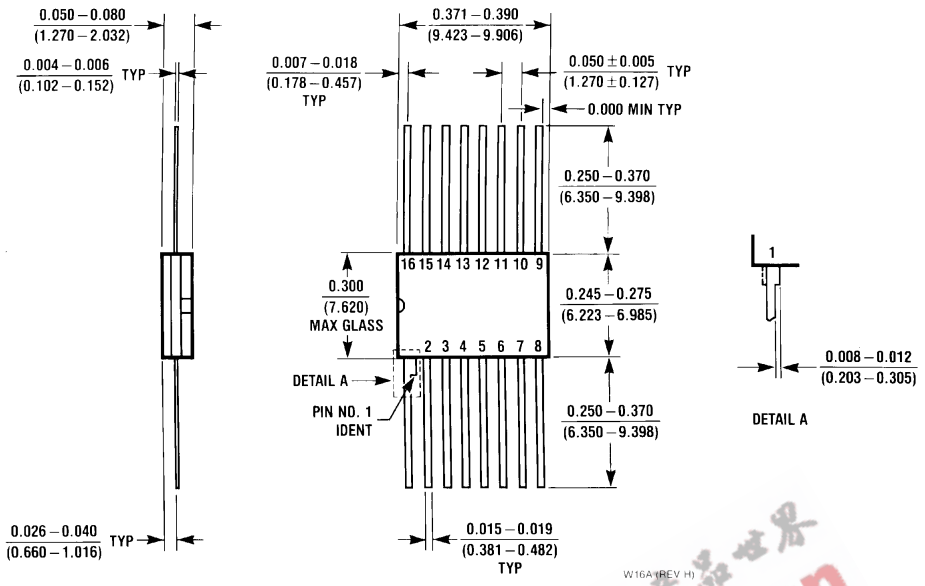
16-Lead Small Outline Integrated Circuit (S)
NS Package Number M16A



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

Physical Dimensions inches (millimeters) (Continued)

Lit. # 114805



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

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