MOTOROLA

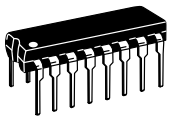
MC74AC378
MC74ACT378

Parallel D Register with Enable

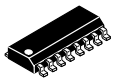
PARALLEL D REGISTER WITH ENABLE

The MC74AC378/74ACT378 is a 6-bit register with a buffered common Enable. This device is similar to the MC74AC174/74ACT174, but with common Enable rather than common Master Reset.

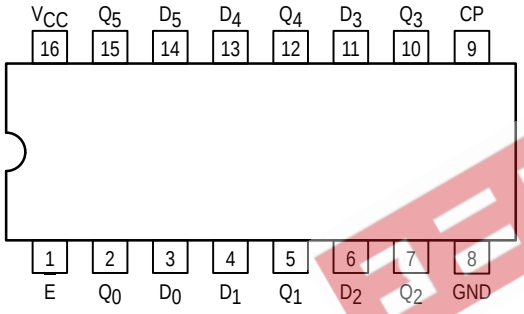
- 6-Bit High-Speed Parallel Register
- Positive Edge-Triggered D-Type Inputs
- Fully Buffered Common Clock and Enable Inputs
- Outputs Source/Sink 24 mA
- ′ACT378 Has TTL Compatible Inputs



N SUFFIX
CASE 648-08
PLASTIC



D SUFFIX
CASE 751B-05
PLASTIC



PIN NAMES

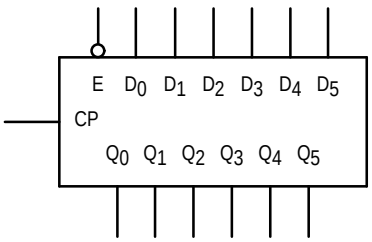
$\overline{E}$	Enable Input
D_0–D_5	Data Inputs
CP	Clock Pulse Input
Q_0–Q_5	Outputs

TRUTH TABLE

Inputs			Outputs
$\overline{E}$	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 Transition

LOGIC SYMBOL

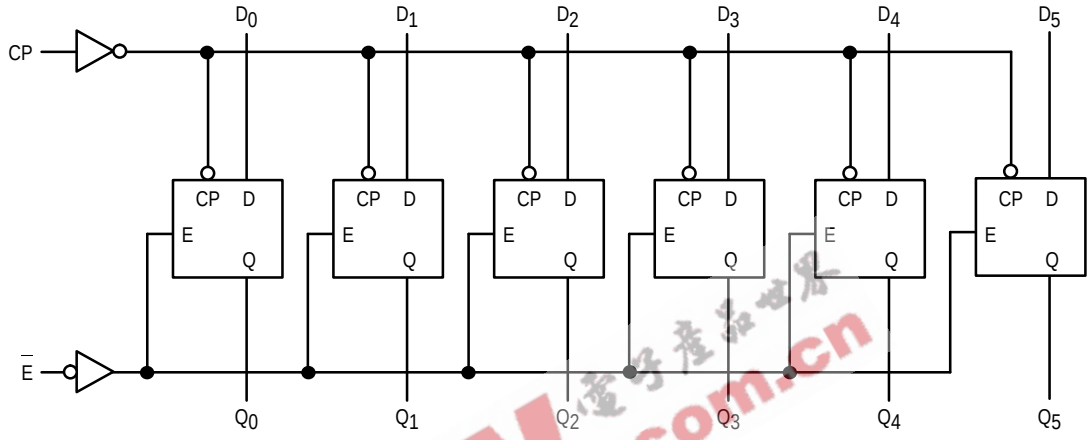


FUNCTIONAL DESCRIPTION

The MC74AC378/74ACT378 consists of six edge-triggered D-type flip-flops with individual D inputs and Q outputs. The Clock (CP) and Enable (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 E input is HIGH, the register will retain the present data independent of the CP input.

LOGIC DIAGRAM



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

MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V_{CC}	DC Supply Voltage (Referenced to GND)	–0.5 to +7.0	V
V_{in}	DC Input Voltage (Referenced to GND)	–0.5 to V_{CC} +0.5	V
V_{out}	DC Output Voltage (Referenced to GND)	–0.5 to V_{CC} +0.5	V
I_{in}	DC Input Current, per Pin	±20	mA
I_{out}	DC Output Sink/Source Current, per Pin	±50	mA
I_{CC}	DC V_{CC} or GND Current per Output Pin	±50	mA
T_{stg}	Storage Temperature	–65 to +150	°C

* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Typ	Max	Unit
V_{CC}	Supply Voltage	′AC	2.0	5.0	6.0	V
		′ACT	4.5	5.0	5.5	
V_{in}, V_{out}	DC Input Voltage, Output Voltage (Ref. to GND)		0		V_{CC}	V
t_r, t_f	Input Rise and Fall Time (Note 1) ′AC Devices except Schmitt Inputs	V_{CC} @ 3.0 V		150		ns/V
		V_{CC} @ 4.5 V		40		
		V_{CC} @ 5.5 V		25		
t_r, t_f	Input Rise and Fall Time (Note 2) ′ACT Devices except Schmitt Inputs	V_{CC} @ 4.5 V		10		ns/V
		V_{CC} @ 5.5 V		8.0		
T_J	Junction Temperature (PDIP)				140	°C
T_A	Operating Ambient Temperature Range		–40	25	85	°C
I_{OH}	Output Current — High				–24	mA
I_{OL}	Output Current — Low				24	mA

1. V_{in} from 30% to 70% V_{CC}; see individual Data Sheets for devices that differ from the typical input rise and fall times.
2. V_{in} from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

DC CHARACTERISTICS

Symbol	Parameter	V_{CC} (V)	74AC T_A = +25°C	74AC T_A = –40°C to +85°C		Unit	Conditions
			Typ	Guaranteed Limits			
V_{IH}	Minimum High Level Input Voltage	3.0 4.5 5.5	1.5 2.25 2.75	2.1 3.15 3.85	2.1 3.15 3.85	V	V_{OUT} = 0.1 V or V_{CC} – 0.1 V
V_{IL}	Maximum Low Level Input Voltage	3.0 4.5 5.5	1.5 2.25 2.75	0.9 1.35 1.65	0.9 1.35 1.65	V	V_{OUT} = 0.1 V or V_{CC} – 0.1 V
V_{OH}	Minimum High Level Output Voltage	3.0 4.5 5.5	2.99 4.49 5.49	2.9 4.4 5.4	2.9 4.4 5.4	V	I_{OUT} = –50 µA
		3.0 4.5 5.5		2.56 3.86 4.86	2.46 3.76 4.76	V	*V_{IN} = V_{IL} or V_{IH} –12 mA I_{OH} –24 mA –24 mA
V_{OL}	Maximum Low Level Output Voltage	3.0 4.5 5.5	0.002 0.001 0.001	0.1 0.1 0.1	0.1 0.1 0.1	V	I_{OUT} = 50 µA
		3.0 4.5 5.5		0.36 0.36 0.36	0.44 0.44 0.44	V	*V_{IN} = V_{IL} or V_{IH} 12 mA I_{OL} 24 mA 24 mA
I_{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0	µA	V_I = V_{CC}, GND
I_{OLD}	†Minimum Dynamic Output Current	5.5			75	mA	V_{OLD} = 1.65 V Max
I_{OHD}		5.5			–75	mA	V_{OHD} = 3.85 V Min
I_{CC}	Maximum Quiescent Supply Current	5.5		8.0	80	µA	V_{IN} = V_{CC} or GND

* All outputs loaded; thresholds on input associated with output under test.
† Maximum test duration 2.0 ms, one output loaded at a time.
Note: I_{IN} and I_{CC} @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V_{CC}.

AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

Symbol	Parameter	V_{CC}* (V)	74AC T_A = +25°C, C_L = 50 pF			74AC T_A = –40°C to +85°C, C_L = 50 pF		Unit	Fig. No.
			Min	Typ	Max	Min	Max		
f_{max}	Maximum Clock Frequency	3.3 5.0	125 160			110 145		MHz	3-3
t_{PLH}	Propagation Delay CP to Q_n	3.3 5.0	2.5 1.5		11 8.0	2.5 1.5	12.5 9.0	ns	3-6
t_{PHL}	Propagation Delay CP to Q_n	3.3 5.0	2.5 1.5		10.5 7.5	2.5 1.5	11 8.0	ns	3-6

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

AC OPERATING REQUIREMENTS

Symbol	Parameter	V_{CC}* (V)	74AC T_A = +25°C, C_L = 50 pF		74AC T_A = –40°C to +85°C, C_L = 50 pF	Unit	Fig. No.
			Typ	Guaranteed Minimum			
t_s	Setup Time, HIGH or LOW D_n to CP	3.3 5.0		3.0 2.0	3.5 2.5	ns	3-9
t_h	Hold Time, HIGH or LOW D_n to CP	3.3 5.0		2.0 2.0	2.0 2.0	ns	3-9
t_s	Setup Time, HIGH or LOW $\overline{E}$ to CP	3.3 5.0		2.0 2.0	2.0 2.0	ns	3-9
t_h	Hold Time, HIGH or LOW $\overline{E}$ to CP	3.3 5.0		2.0 2.0	2.0 2.0	ns	3-9
t_w	CP Pulse Width HIGH or LOW	3.3 5.0		4.5 3.5	5.5 4.0	ns	3-6

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

DC CHARACTERISTICS

Symbol	Parameter	V_{CC} (V)	74ACT T_A = +25°C	74ACT T_A = –40°C to +85°C		Unit	Conditions
			Typ	Guaranteed Limits			
V_{IH}	Minimum High Level Input Voltage	4.5 5.5	1.5 1.5	2.0 2.0	2.0 2.0	V	V_{OUT} = 0.1 V or V_{CC} – 0.1 V
V_{IL}	Maximum Low Level Input Voltage	4.5 5.5	1.5 1.5	0.8 0.8	0.8 0.8	V	V_{OUT} = 0.1 V or V_{CC} – 0.1 V
V_{OH}	Minimum High Level Output Voltage	4.5 5.5	4.49 5.49	4.4 5.4	4.4 5.4	V	I_{OUT} = –50 μA
		4.5 5.5		3.86 4.86	3.76 4.76	V	*V_{IN} = V_{IL} or V_{IH} I_{OH} –24 mA –24 mA
V_{OL}	Maximum Low Level Output Voltage	4.5 5.5	0.001 0.001	0.1 0.1	0.1 0.1	V	I_{OUT} = 50 μA
		4.5 5.5		0.36 0.36	0.44 0.44	V	*V_{IN} = V_{IL} or V_{IH} I_{OL} 24 mA 24 mA
I_{IN}	Maximum Input Leakage Current	5.5		±0.1	±1.0	μA	V_I = V_{CC}, GND
ΔI_{CCT}	Additional Max. I_{CC}/Input	5.5	0.6		1.5	mA	V_I = V_{CC} – 2.1 V
I_{OLD}	†Minimum Dynamic Output Current	5.5			75	mA	V_{OLD} = 1.65 V Max
I_{OHD}		5.5			–75	mA	V_{OHD} = 3.85 V Min
I_{CC}	Maximum Quiescent Supply Current	5.5		8.0	80	μA	V_{IN} = V_{CC} or GND

* All outputs loaded; thresholds on input associated with output under test.
† Maximum test duration 2.0 ms, one output loaded at a time.

AC CHARACTERISTICS (For Figures and Waveforms — See Section 3)

Symbol	Parameter	V_{CC}* (V)	74ACT T_A = +25°C, C_L = 50 pF			74ACT T_A = –40°C to +85°C, C_L = 50 pF		Unit	Fig. No.
			Min	Typ	Max	Min	Max		
f_{max}	Maximum Clock Frequency	5.0	140			120		MHz	3-3
t_{PLH}	Propagation Delay CP to O_n	5.0	2.0		10	1.5	11	ns	3-6
t_{PHL}	Propagation Delay CP to O_n	5.0	2.0		11	1.5	12	ns	3-6

* Voltage Range 5.0 V is 5.0 V ±0.5 V.

AC OPERATING REQUIREMENTS

Symbol	Parameter	V_{CC}* (V)	74ACT		74ACT	Unit	Fig. No.
			T_A = +25°C C_L = 50 pF		T_A = –40°C to +85°C C_L = 50 pF		
			Typ	Guaranteed Minimum			
t_s	Setup Time, HIGH or LOW D_n to CP	5.0	–0.5	1.0	1.0	ns	3-9
t_h	Hold Time, HIGH or LOW D_n to CP	5.0	1.0	1.5	1.5	ns	3-9
t_s	Setup Time, HIGH or LOW E to CP	5.0	–0.5	1.0	1.0	ns	3-9
t_h	Hold Time, HIGH or LOW E to CP	5.0	2.5	3.5	4.0	ns	3-9
t_w	CP Pulse Width HIGH or LOW	5.0		3.0	3.5	ns	3-6

* Voltage Range 5.0 V is 5.0 V ±0.5 V.

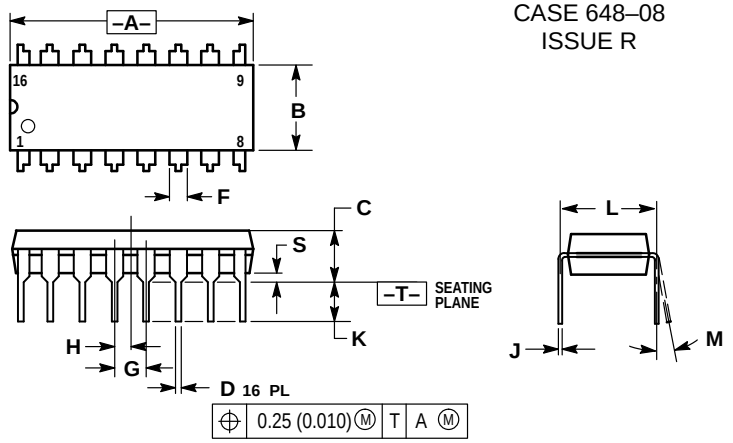
CAPACITANCE

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

MC74AC378 MC74ACT378

OUTLINE DIMENSIONS

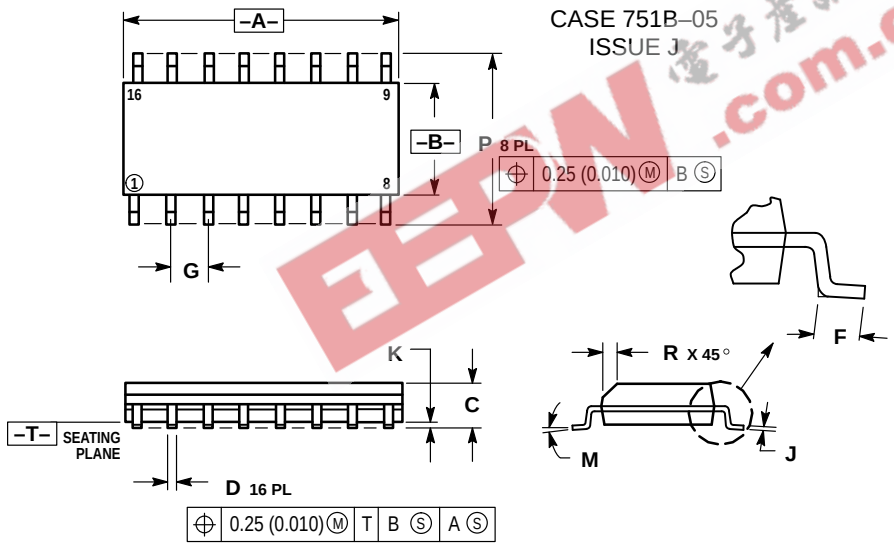
N SUFFIX
PLASTIC DIP PACKAGE
CASE 648–08
ISSUE R



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0 °	10 °	0 °	10 °
S	0.020	0.040	0.51	1.01

D SUFFIX
PLASTIC SOIC PACKAGE
CASE 751B–05
ISSUE J



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0 °	7 °	0 °	7 °
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

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