MC10H136

Universal Hexadecimal Counter

The MC10H136 is a high speed synchronous hexadecimal counter. This 10H part is a functional/pinout duplication of the standard MECL 10K family part, with 100% improvement in counting frequency and no increase in power-supply current.

- Counting Frequency, 250 MHz Minimum
- Power Dissipation, 625 mW Typical
- Improved Noise Margin 150 mV
  (Over Operating Voltage and Temperature Range)
- Voltage Compensated
- MECL 10K-Compatible

ON Semiconductor

http://onsemi.com

MARKING DIAGRAMS

CDIP–16
L SUFFIX
CASE 620

16
MC10H136L
AWLYYWW
1

PDIP–16
P SUFFIX
CASE 648

16
MC10H136P
AWLYYWW
1

PLCC–20
FN SUFFIX
CASE 775

1
10H136
AWLYYWW
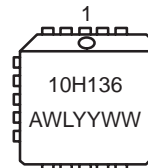
A   = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week

FUNCTION SELECT TABLE

$\overline{CIN}$	S1	S2	Operating Mode
X	L	L	Preset (Program)
L	L	H	Increment (Count Up)
H	L	H	Hold Count
L	H	L	Decrement (Count Down)
H	H	L	Hold Count
X	H	H	Hold (Stop Count)

SEQUENTIAL TRUTH TABLE *

INPUTS								OUTPUTS				
S1	S2	D0	D1	D2	D3	Carry $\overline{In}$	Clock **	Q0	Q1	Q2	Q3	Carry $\overline{Out}$
L	L	L	L	H	H	X	H	L	L	H	H	L
L	H	X	X	X	X	L	H	H	L	H	H	H
L	H	X	X	X	X	L	H	L	H	H	H	H
L	H	X	X	X	X	L	H	H	H	H	H	L
L	H	X	X	X	X	H	L	H	H	H	H	H
L	H	X	X	X	X	H	H	H	H	H	H	H
H	H	X	X	X	X	X	H	H	H	H	H	H
L	L	H	H	L	L	X	H	H	H	L	L	L
H	L	X	X	X	X	L	H	L	H	L	L	H
H	L	X	X	X	X	L	H	H	L	L	L	H
H	L	X	X	X	X	L	H	L	L	L	L	L
H	L	X	X	X	X	L	H	H	H	H	H	H

* Truth table shows logic states assuming inputs vary in sequence shown from top to bottom.
** A clock H is defined as a clock input transition from a low to a high logic level.

DIP PIN ASSIGNMENT

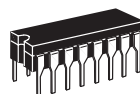|			
V$_{CC1}$	1	16	V$_{CC2}$
Q2	2	15	Q1
Q3	3	14	Q0
$\overline{C_{OUT}}$	4	13	CLOCK
D3	5	12	D0
D2	6	11	D1
S2	7	10	$\overline{C_{IN}}$
V$_{EE}$	8	9	S1

Pin assignment is for Dual–in–Line Package.
For PLCC pin assignment, see the Pin Conversion Tables on page 18
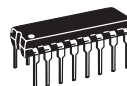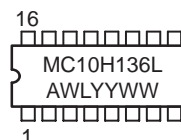of the ON Semiconductor MECL Data Book (DL122/D).

ORDERING INFORMATION

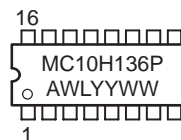| Device	Package	Shipping
MC10H136L	CDIP–16	25 Units/Rail
MC10H136P	PDIP–16	25 Units/Rail
MC10H136FN	PLCC–20	46 Units/Rail

MAXIMUM RATINGS

Symbol	Characteristic	Rating	Unit
V_{EE}	Power Supply (V_{CC} = 0)	−8.0 to 0	Vdc
V_I	Input Voltage (V_{CC} = 0)	0 to V_{EE}	Vdc
I_{out}	Output Current – Continuous – Surge	50 100	mA
T_A	Operating Temperature Range	0 to +75	°C
T_{stg}	Storage Temperature Range – Plastic – Ceramic	−55 to +150 −55 to +165	°C °C

ELECTRICAL CHARACTERISTICS (V_{EE} = −5.2 V ±5%) (See Note 1.)

Symbol	Characteristic	0° Min	0° Max	25° Min	25° Max	75° Min	75° Max	Unit
I_E	Power Supply Current	−	165	−	150	−	165	mA
I_{inH}	Input Current High Pins 5, 6, 11, 12, 13 Pin 9 Pin 7 Pin 10	− − − −	430 670 535 380	− − − −	275 420 335 240	− − − −	275 420 335 240	µA
I_{inL}	Input Current Low	0.5	−	0.5	−	0.3	−	µA
V_{OH}	High Output Voltage	−1.02	−0.84	−0.98	−0.81	−0.92	−0.735	Vdc
V_{OL}	Low Output Voltage	−1.95	−1.63	−1.95	−1.63	−1.95	−1.60	Vdc
V_{IH}	High Input Voltage	−1.17	−0.84	−1.13	−0.81	−1.07	−0.735	Vdc
V_{IL}	Low Input Voltage	−1.95	−1.48	−1.95	−1.48	−1.95	−1.45	Vdc

AC PARAMETERS

Symbol	Characteristic	0° Min	0° Max	25° Min	25° Max	75° Min	75° Max	Unit
t_{pd}	Propagation Delay Clock to Q Clock to Carry Out Carry in to Carry Out	0.7 1.0 0.7	2.3 4.8 2.5	0.7 1.0 0.7	2.4 4.9 2.6	0.7 1.0 0.7	2.5 5.0 2.7	ns
t_{set}	Set-up Time Data (D0 to C) Select (S to C) Carry In (C_{in} to C) (C to C_{in})	2.0 3.5 2.0 0	− − − −	2.0 3.5 2.0 0	− − − −	2.0 3.5 2.0 0	− − − −	ns
t_{hold}	Hold Time Data (C to D0) Select (C to S) Carry In (C to C_{in}) (C_{in} to C)	0 −0.5 0 2.2	− − − −	0 −0.5 0 2.2	− − − −	0 −0.5 0 2.2	− − − −	ns
f_{count}	Counting Frequency	250	−	250	−	250	−	MHz
t_r	Rise Time	0.5	2.3	0.5	2.4	0.5	2.5	ns
t_f	Fall Time	0.5	2.3	0.5	2.4	0.5	2.5	ns

1. Each MECL 10H series circuit has been designed to meet the dc specifications shown in the test table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 linear fpm is maintained. Outputs are terminated through a 50-ohm resistor to −2.0 volts.

MC10H136

LOGIC DIAGRAM
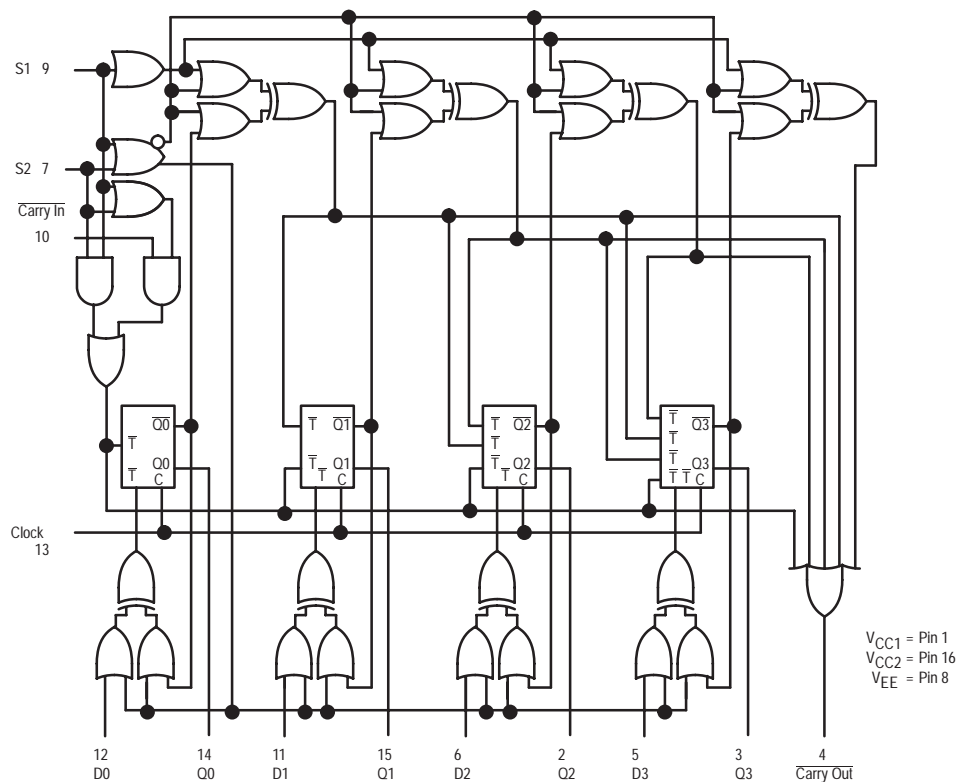
NOTE: FLIP-FLOPS WILL TOGGLE WHEN ALL $\overline{T}$ INPUTS ARE LOW.

APPLICATION INFORMATION

The MC10H136 is a high speed synchronous counter that operates at 250 MHz. Counter operating modes include count up, count down, pre-set and hold count. This device allows the designer to use one basic counter for many applications.

The S1, S2, control lines determine the operating modes of the counter. In the pre-set mode, a clock pulse is necessary to load the counter with the information present on the data inputs (D0, D1, D2, and D3). Carry out goes low on the terminal count or when the counter is being pre-set.

MC10H136

PACKAGE DIMENSIONS

PLCC–20
FN SUFFIX
PLASTIC PLCC PACKAGE
CASE 775–02
ISSUE C

B ⊕ 0.007 (0.180) Ⓜ T L–M Ⓢ N Ⓢ

U ⊕ 0.007 (0.180) Ⓜ T L–M Ⓢ N Ⓢ

G1 ⊕ 0.010 (0.250) Ⓢ T L–M Ⓢ N Ⓢ

VIEW D–D

A ⊕ 0.007 (0.180) Ⓜ T L–M Ⓢ N Ⓢ

R ⊕ 0.007 (0.180) Ⓜ T L–M Ⓢ N Ⓢ

⊕ 0.004 (0.100)

–T– SEATING PLANE

VIEW S

⊕ 0.010 (0.250) Ⓢ T L–M Ⓢ N Ⓢ

H ⊕ 0.007 (0.180) Ⓜ T L–M Ⓢ N Ⓢ

F ⊕ 0.007 (0.180) Ⓜ T L–M Ⓢ N Ⓢ

VIEW S

NOTES:
1. DATUMS –L–, –M–, AND –N– DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
2. DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM –T–, SEATING PLANE.
3. DIMENSIONS R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
5. CONTROLLING DIMENSION: INCH.
6. THE PACKAGE TOP MAY BE SMALLER THAN THE PACKAGE BOTTOM BY UP TO 0.012 (0.300). DIMENSIONS R AND U ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY EXCLUSIVE OF MOLD FLASH, TIE BAR BURRS, GATE BURRS AND INTERLEAD FLASH, BUT INCLUDING ANY MISMATCH BETWEEN THE TOP AND BOTTOM OF THE PLASTIC BODY.
7. DIMENSION H DOES NOT INCLUDE DAMBAR PROTRUSION OR INTRUSION. THE DAMBAR PROTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE GREATER THAN 0.037 (0.940). THE DAMBAR INTRUSION(S) SHALL NOT CAUSE THE H DIMENSION TO BE SMALLER THAN 0.025 (0.635).

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.385	0.395	9.78	10.03
B	0.385	0.395	9.78	10.03
C	0.165	0.180	4.20	4.57
E	0.090	0.110	2.29	2.79
F	0.013	0.019	0.33	0.48
G	0.050 BSC		1.27 BSC	
H	0.026	0.032	0.66	0.81
J	0.020	----	0.51	----
K	0.025	----	0.64	----
R	0.350	0.356	8.89	9.04
U	0.350	0.356	8.89	9.04
V	0.042	0.048	1.07	1.21
W	0.042	0.048	1.07	1.21
X	0.042	0.056	1.07	1.42
Y	----	0.020	----	0.50
Z	2 °	10 °	2 °	10 °
G1	0.310	0.330	7.88	8.38
K1	0.040	----	1.02	----

MC10H136

PACKAGE DIMENSIONS
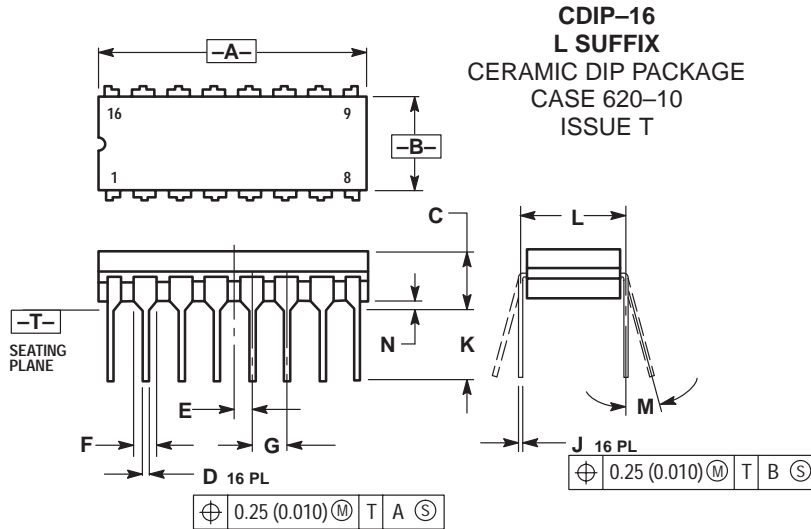
CDIP–16
L SUFFIX
CERAMIC DIP PACKAGE
CASE 620–10
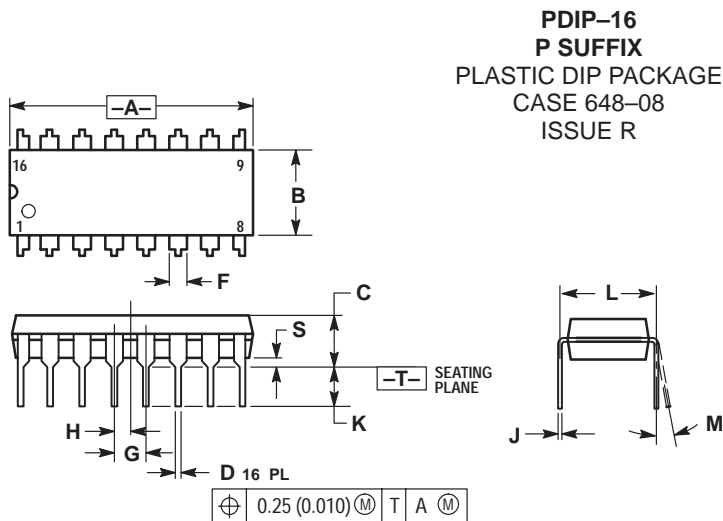ISSUE T

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.750	0.785	19.05	19.93
B	0.240	0.295	6.10	7.49
C	––––	0.200	––––	5.08
D	0.015	0.020	0.39	0.50
E	0.050 BSC		1.27 BSC	
F	0.055	0.065	1.40	1.65
G	0.100 BSC		2.54 BSC	
H	0.008	0.015	0.21	0.38
K	0.125	0.170	3.18	4.31
L	0.300 BSC		7.62 BSC	
M	0 °	15 °	0 °	15 °
N	0.020	0.040	0.51	1.01

PDIP–16
P 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.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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

<u>Notes</u>

Notes