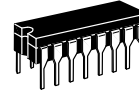


# Universal Hexadecimal Counter

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
  - Voltage Compensated
  - MECL 10K-Compatible
- (Over Operating Voltage and Temperature Range)

## MC10H136



**L SUFFIX**  
CERAMIC PACKAGE  
CASE 620-10



**P SUFFIX**  
PLASTIC PACKAGE  
CASE 648-08



**FN SUFFIX**  
PLCC  
CASE 775-02

### MAXIMUM RATINGS

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

### ELECTRICAL CHARACTERISTICS ( $V_{EE} = -5.2 V \pm 5\%$ ) (See Note)

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

### AC PARAMETERS

Propagation Delay Clock to Q Clock to Carry Out Carry in to Carry Out	$t_{pd}$	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
Set-up Time Data (D0 to C) Select (S to C) Carry In ( $C_{in}$ to C) (C to $C_{in}$ )	$t_{set}$	2.0 3.5 2.0 0	— — — —	2.0 3.5 2.0 0	— — — —	2.0 3.5 2.0 0	— — — —	ns
Hold Time Data (C to D0) Select (C to S) Carry In (C to $C_{in}$ ) ( $C_{in}$ to C)	$t_{hold}$	0 -0.5 0 2.2	— — — —	0 -0.5 0 2.2	— — — —	0 -0.5 0 2.2	— — — —	ns
Counting Frequency	$f_{count}$	250	—	250	—	250	—	MHz
Rise Time	$t_r$	0.5	2.3	0.5	2.4	0.5	2.5	ns
Fall Time	$t_f$	0.5	2.3	0.5	2.4	0.5	2.5	ns

**NOTE:**

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.

### FUNCTION SELECT TABLE

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)

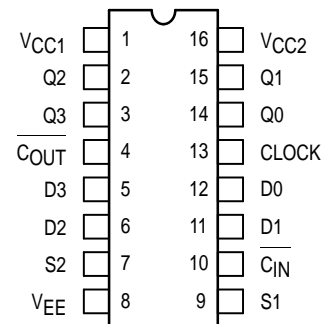
### SEQUENTIAL TRUTH TABLE \*

INPUTS								OUTPUTS				
S1	S2	D0	D1	D2	D3	Carry In	Clock **	Q0	Q1	Q2	Q3	Carry Out
L	L	L	L	H	H	X	H	L	L	H	H	L
L	L	L	L	X	X	X	L	H	L	H	H	L
L	L	L	X	X	X	X	L	H	L	H	H	L
L	L	X	X	X	X	X	L	H	H	H	H	L
L	H	X	X	X	X	X	H	L	H	H	H	H
L	H	X	X	X	X	X	H	H	H	H	H	H
H	L	X	X	X	X	X	X	H	H	H	H	H
L	L	H	H	L	L	L	X	H	H	H	L	L
H	L	X	X	X	X	X	L	H	H	L	L	L
H	L	X	X	X	X	X	L	H	L	L	L	L
H	L	X	X	X	X	X	L	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.

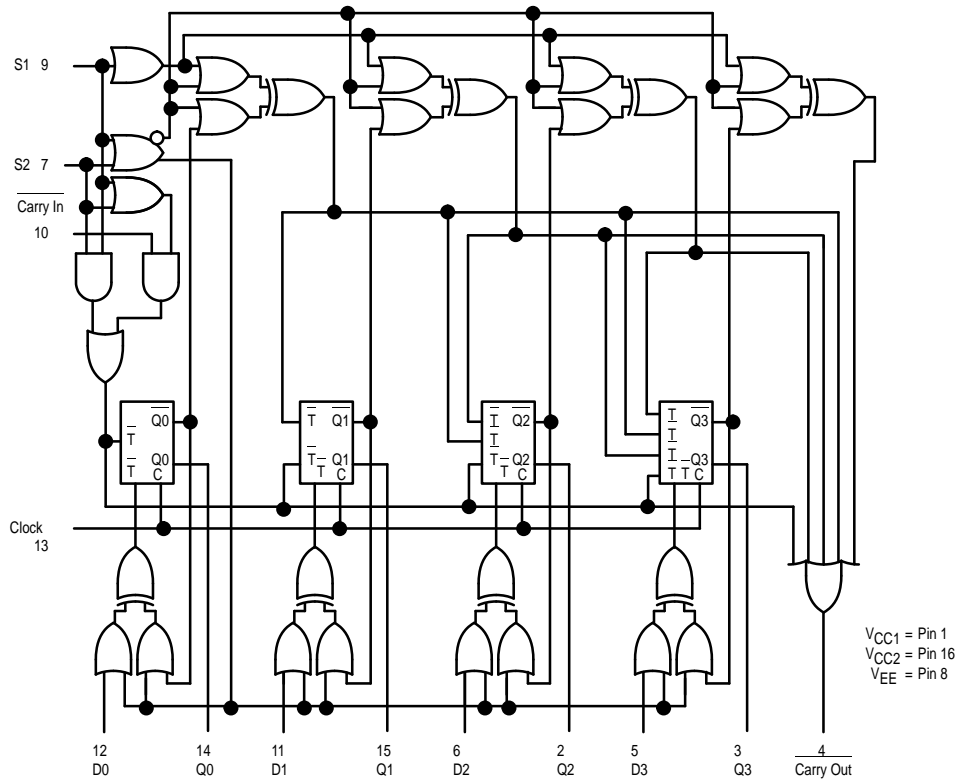
### DIP PIN ASSIGNMENT



Pin assignment is for Dual-In-Line Package. For PLCC pin assignment, see the Pin Conversion Tables on page 6-11 of the Motorola MECL Data Book (DL122/D).



**LOGIC DIAGRAM**



**NOTE:** FLIP-FLOPS WILL TOGGLE WHEN ALL  $\bar{T}$  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.

OUTLINE DIMENSIONS

FN SUFFIX  
 PLASTIC PLCC PACKAGE  
 CASE 775-02  
 ISSUE C

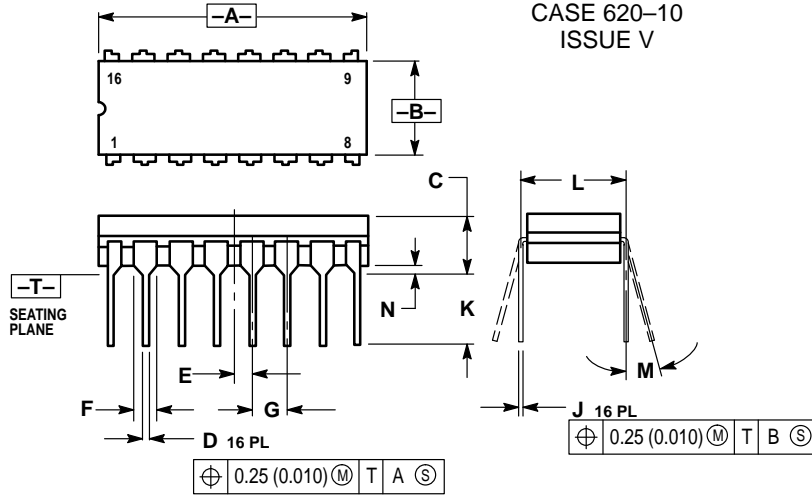


- NOTES:
- DATUMS -L-, -M-, AND -N- DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
  - DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
  - DIMENSIONS R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.
  - DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  - CONTROLLING DIMENSION: INCH.
  - 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.
  - 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	—

OUTLINE DIMENSIONS

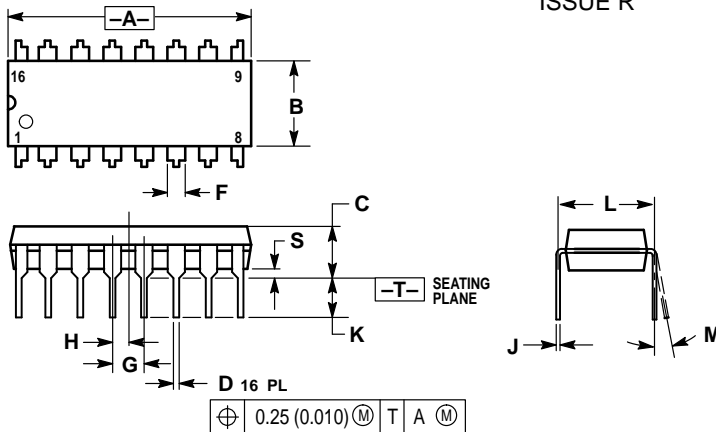
**L SUFFIX**  
**CERAMIC DIP PACKAGE**  
 CASE 620-10  
 ISSUE V



- 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		MILLIMETERS	
	MIN	MAX	MIN	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

**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		MILLIMETERS	
	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

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**USA/EUROPE/Locations Not Listed:** Motorola Literature Distribution; P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447 or 602-303-5454

**MFAX:** RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609  
**INTERNET:** http://Design-NET.com

**JAPAN:** Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, 6F Seibu-Butsuryu-Center, 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-81-3521-8315

**ASIA/PACIFIC:** Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park, 51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

