

MC10H136

Universal Hexadecimal Counter

Description

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.

Features

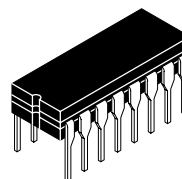
- Counting Frequency, 250 MHz Minimum
- Power Dissipation, 625 mW Typical
- Improved Noise Margin 150 mV (Over Operating Voltage and Temperature Range)
- Voltage Compensated
- MECL 10K Compatible
- Pb-Free Packages are Available*



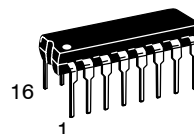
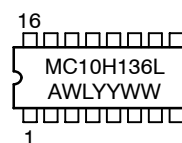
ON Semiconductor®

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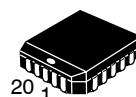
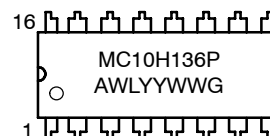
MARKING DIAGRAMS*



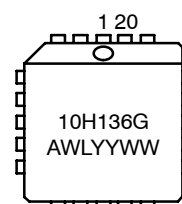
**CDIP-16
L SUFFIX
CASE 620A**



**PDIP-16
P SUFFIX
CASE 648**



**PLLC-20
FN SUFFIX
CASE 775**



A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week
G = Pb-Free Package

*For additional marking information, refer to Application Note AND8002/D.

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

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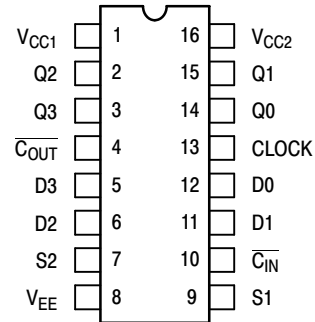
Table 1. FUNCTION SELECT TABLE

| C $\overline{I}N$ | 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) |

Table 2. 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 | 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 | L | L | L | L | L | |
| H | L | X | X | X | X | L | H | L | L | L | L | L | |

* 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.



Pin assignment is for Dual-in-Line Package.

Figure 1. Pin Assignment

Table 3. 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 |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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Table 4. ELECTRICAL CHARACTERISTICS ($V_{EE} = -5.2 \text{ V} \pm 5\%$) (Note 1)

| Symbol | Characteristic | 0° | | 25° | | 75° | | Unit |
|-----------|-----------------------|-------|-------|-------|-------|-------|--------|---------------|
| | | Min | Max | Min | Max | Min | Max | |
| I_E | Power Supply Current | – | 165 | – | 150 | – | 165 | mA |
| I_{inH} | Input Current High | | | | | | | μA |
| | Pins 5, 6, 11, 12, 13 | – | 430 | – | 275 | – | 275 | |
| | Pin 9 | – | 670 | – | 420 | – | 420 | |
| | Pin 7 | – | 535 | – | 335 | – | 335 | |
| | Pin 10 | – | 380 | – | 240 | – | 240 | |
| 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 |

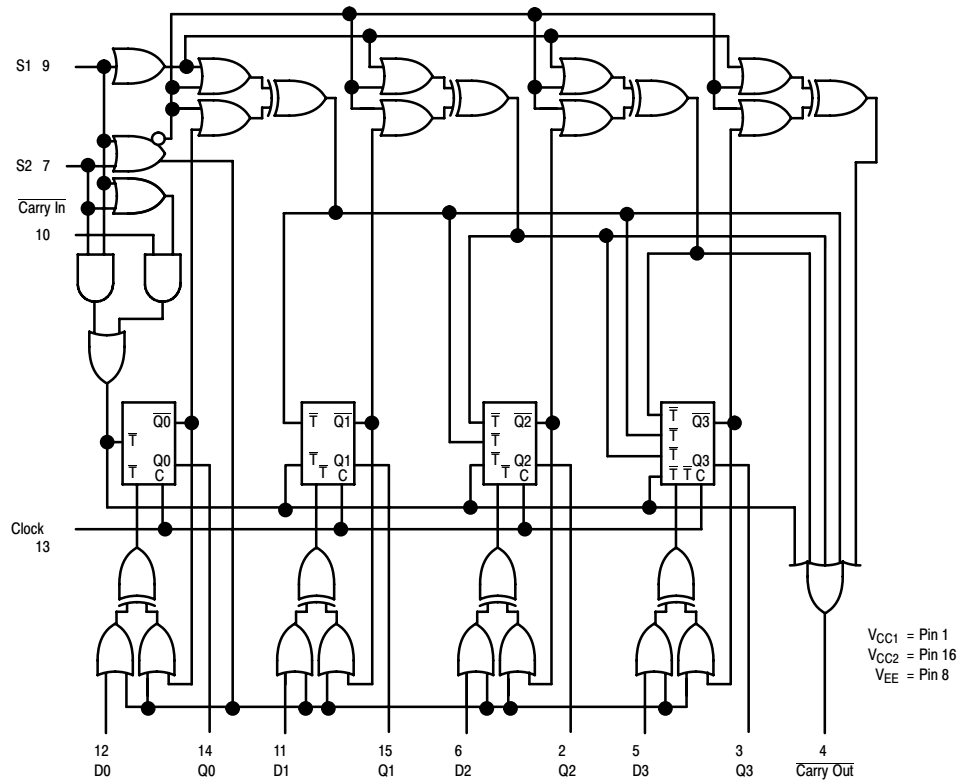
1. Each MECL 10H™ series circuit has been designed to meet the dc specifications shown in the test table, after thermal equilibrium has been established. The circuit is in a test socket or mounted on a printed circuit board and transverse air flow greater than 500 linear fpm is maintained. Outputs are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

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Table 5. AC CHARACTERISTICS

| Symbol | Characteristic | 0° | | 25° | | 75° | | Unit |
|-------------|---|------|-----|------|-----|------|-----|------|
| | | Min | Max | Min | Max | Min | Max | |
| t_{pd} | Propagation Delay | | | | | | | ns |
| | Clock to Q | 0.7 | 2.3 | 0.7 | 2.4 | 0.7 | 2.5 | |
| | Clock to Carry Out | 1.0 | 4.8 | 1.0 | 4.9 | 1.0 | 5.0 | |
| | Carry in to Carry Out | 0.7 | 2.5 | 0.7 | 2.6 | 0.7 | 2.7 | |
| t_{set} | Set-up Time | | | | | | | ns |
| | Data (D0 to C) | 2.0 | - | 2.0 | - | 2.0 | - | |
| | Select (S to C) | 3.5 | - | 3.5 | - | 3.5 | - | |
| | Carry In (C_{in} to C) (C to C_{in}) | 2.0 | - | 2.0 | - | 2.0 | - | |
| t_{hold} | Hold Time | | | | | | | ns |
| | Data (C to D0) | 0 | - | 0 | - | 0 | - | |
| | Select (C to S) | -0.5 | - | -0.5 | - | -0.5 | - | |
| | Carry In (C to C_{in}) (C_{in} to C) | 0 | - | 0 | - | 0 | - | |
| 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 |

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.



NOTE: FLIP-FLOPS WILL TOGGLE WHEN ALL T INPUTS ARE LOW.

Figure 2. Logic Diagram

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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.

ORDERING INFORMATION

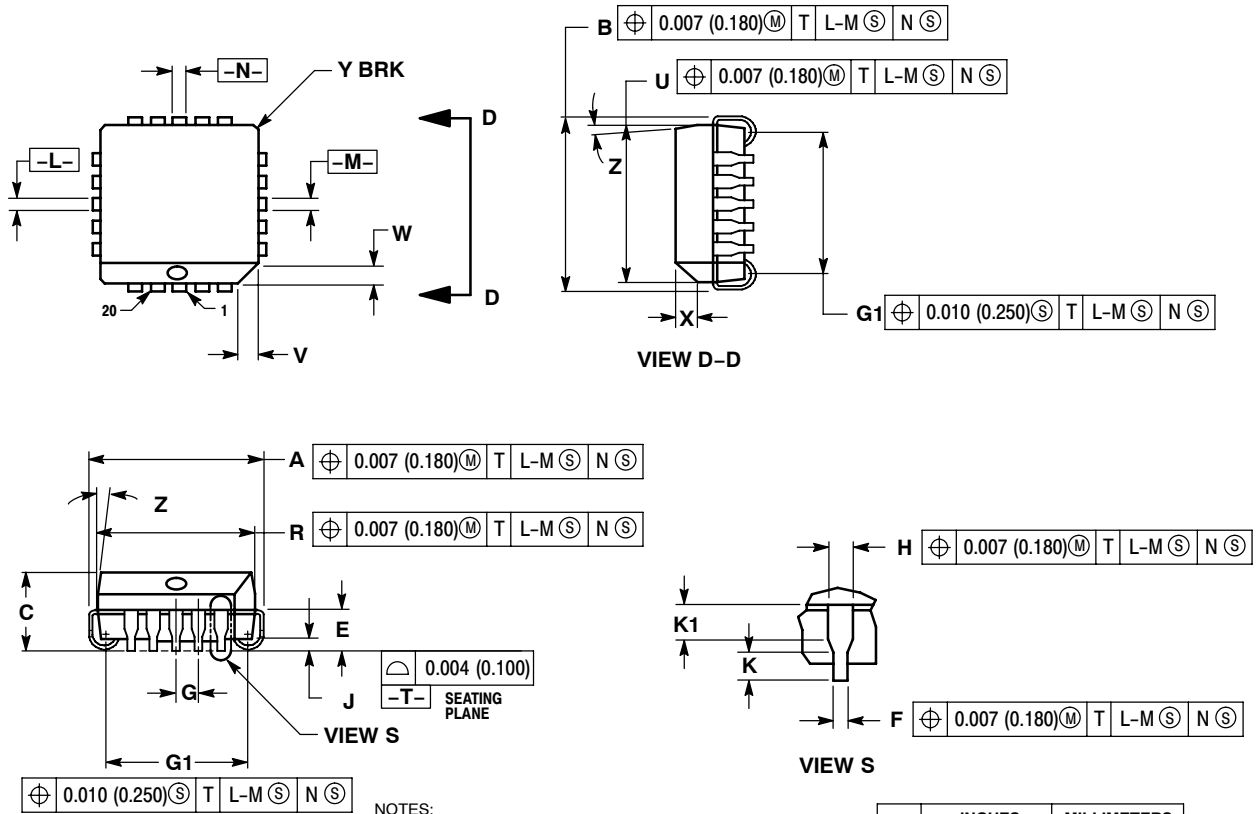
| Device | Package | Shipping [†] |
|---------------|----------------------|-----------------------|
| MC10H136FN | PLLC-20 | 46 Units / Rail |
| MC10H136FNG | PLLC-20 (Pb-Free) | 46 Units / Rail |
| MC10H136FNR2 | PLLC-20 | 500 / Tape & Reel |
| MC10H136FNR2G | PLLC-20 (Pb-Free) | 500 / Tape & Reel |
| MC10H136L | CDIP-16 | 25 Unit / Rail |
| MC10H136P | PDIP-16 | 25 Unit / Rail |
| MC10H136PG | PDIP-16 (Pb-Free) | 25 Unit / Rail |

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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PACKAGE DIMENSIONS

20 LEAD PLLC
CASE 775-02
ISSUE E



NOTES:

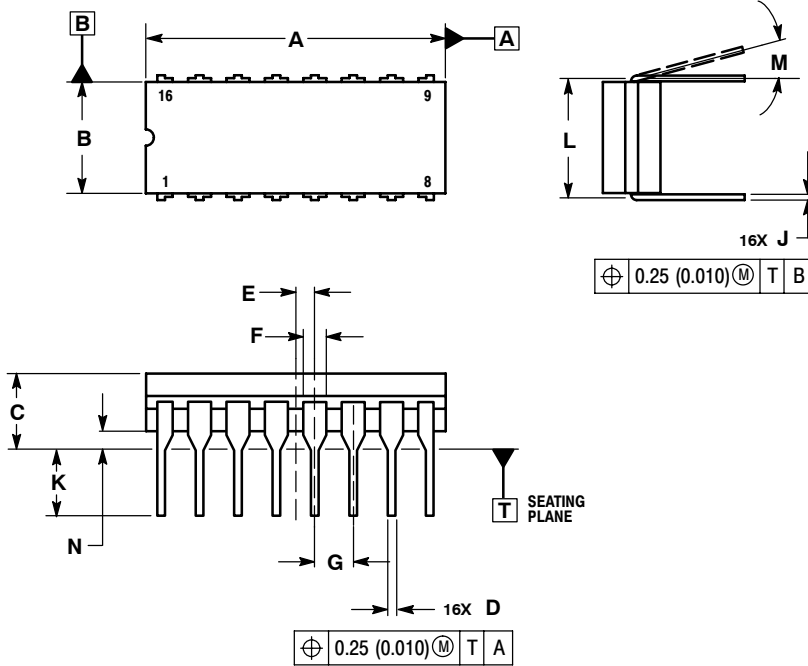
1. DIMENSIONS AND TOLERANCING PER ANSI Y14.5M, 1982.
2. DIMENSIONS IN INCHES.
3. DATUMS -L-, -M-, AND -N- DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
4. DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
5. DIMENSIONS R AND U DO NOT INCLUDE MOLD FLASH. ALLOWABLE MOLD FLASH IS 0.010 (0.250) PER SIDE.
6. DIMENSIONS IN 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 | --- |

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PACKAGE DIMENSIONS

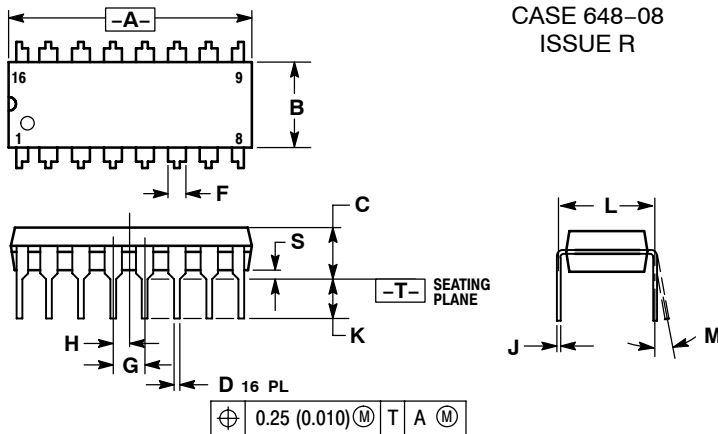
CDIP-16
L SUFFIX
 CERAMIC DIP PACKAGE
 CASE 620A-01
 ISSUE O



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
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.
5. THIS DRAWING REPLACES OBSOLETE CASE OUTLINE 620-10.

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.

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