

# MC10H180

## Dual 2-Bit Adder/Subtractor

### Description

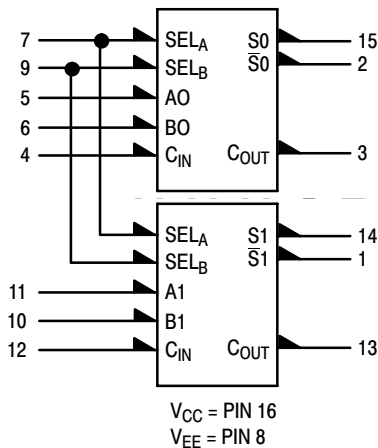
The MC10H180 is a high-speed, low-power, general-purpose adder/subtractor. It is designed to be used in special purpose adders/subtractors or in high-speed multiplier arrays.

Inputs for each adder are Carry-in, Operand A, and Operand B; outputs are Sum,  $\bar{\text{Sum}}$  and Carry-out. The common select inputs serve as a control line to Invert A for subtract, and a control line to Invert B.

### Features

- Propagation Delay, 1.8 ns Typical, Operand and Select to Output
- Power Dissipation, 360 mW Typical MC10H180
- Improved Noise Margin 150 mV (Over Operating Voltage and Temperature Range)
- Voltage Compensated
- MECL 10K™ Compatible
- Pb-Free Packages are Available\*

### LOGIC DIAGRAM



POSITIVE LOGIC ONLY

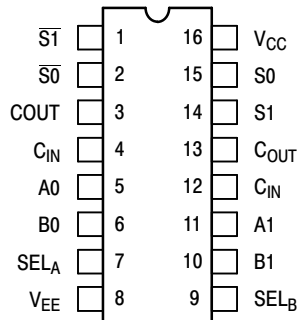
$$A' = \bar{A} \oplus \text{SELA} = A \odot \text{SELA}$$

$$B' = \bar{B} \oplus \text{SELB} = B \odot \text{SELB}$$

$$S = \bar{C}_{IN} (\bar{A}' B' + A' \bar{B}') + C_{IN} (A' B' + \bar{A}' \bar{B}')$$

$$C_{OUT} = C_{IN} A' + C_{IN} B' + A' B'$$

### DIP PIN ASSIGNMENT



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).

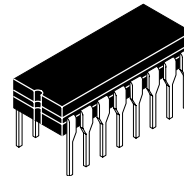
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



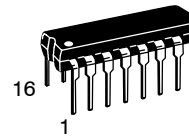
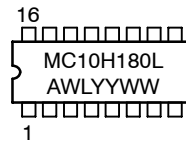
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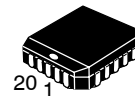
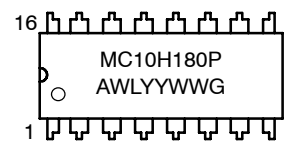
### MARKING DIAGRAMS\*



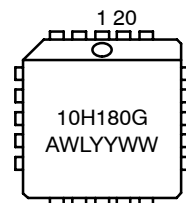
CDIP-16  
L SUFFIX  
CASE 620A



PDIP-16  
P SUFFIX  
CASE 648



PLCC-20  
FN SUFFIX  
CASE 775



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

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

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

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**Table 1. MAXIMUM RATINGS**

Symbol	Characteristic	Rating	Unit
V <sub>EE</sub>	Power Supply (V <sub>CC</sub> = 0)	-8.0 to 0	Vdc
V <sub>I</sub>	Input Voltage (V <sub>CC</sub> = 0)	0 to V <sub>EE</sub>	Vdc
I <sub>out</sub>	Output Current – Continuous – Surge	50 100	mA
T <sub>A</sub>	Operating Temperature Range	0 to +75	°C
T <sub>stg</sub>	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.

**Table 2. ELECTRICAL CHARACTERISTICS** (V<sub>EE</sub> = -5.2 V ±5%) (Note 1)

Symbol	Characteristic	0°		25°		75°		Unit
		Min	Max	Min	Max	Min	Max	
I <sub>E</sub>	Power Supply Current	-	95	-	86	-	95	mA
I <sub>inH</sub>	Input Current High							μA
	Pins 4, 12	-	665	-	417	-	417	
	Pins 7, 9	-	515	-	320	-	320	
	Pins 5, 6, 10, 11	-	410	-	255	-	255	
I <sub>inL</sub>	Input Current Low	0.5	-	0.5	-	0.3	-	μA
V <sub>OH</sub>	High Output Voltage	-1.02	-0.84	-0.98	-0.81	-0.92	-0.735	Vdc
V <sub>OL</sub>	Low Output Voltage	-1.95	-1.63	-1.95	-1.63	-1.95	-1.60	Vdc
V <sub>IH</sub>	High Input Voltage (1)	-1.17	-0.84	-1.13	-0.81	-1.07	-0.735	Vdc
V <sub>IL</sub>	Low Input Voltage (1)	-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 lfm is maintained. Outputs are terminated through a 50 Ω resistor to -2.0 V.

**Table 3. AC PARAMETERS**

Symbol	Characteristic	0°		25°		75°		Unit
		Min	Max	Min	Max	Min	Max	
t <sub>pd</sub>	Propagation Delay							ns
	Operand to Output	0.6	2.4	0.7	2.5	0.8	2.8	
	Select to Output	0.6	2.2	0.7	2.3	0.8	2.6	
	Carry-in to Output	0.4	1.6	0.4	1.7	0.4	1.8	
t <sub>r</sub>	Rise Time	0.5	2.0	0.5	2.1	0.5	2.2	ns
t <sub>f</sub>	Fall Time	0.5	2.0	0.5	2.1	0.5	2.2	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.

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**Table 4. FUNCTION SELECT TABLE**

Sel <sub>A</sub>	Sel <sub>B</sub>	Func- tion
H	H	S = A plus B
H	L	S = A minus B
L	H	S = B minus A
L	L	S = 0 minus A minus B

**Table 5. TRUTH TABLE**

FUNCTION	INPUTS							
	Sel <sub>A</sub>	Sel <sub>B</sub>	A <sub>0</sub>	B <sub>0</sub>	C <sub>in</sub>	S <sub>0</sub>	S <sub>0</sub>	C <sub>out</sub>
ADD	H	H	L	L	L	L	H	L
	H	H	L	L	L	H	L	L
	H	H	L	L	L	H	L	L
	H	H	L	L	L	H	L	L
	H	H	L	L	L	H	L	L
	H	H	L	L	L	H	L	L
	H	H	L	L	L	H	L	L
	H	H	L	L	L	H	L	L
SUBTRACT	H	L	L	L	L	H	L	L
	H	L	L	L	L	H	L	L
	H	L	L	L	L	H	L	L
	H	L	L	L	L	H	L	L
	H	L	L	L	L	H	L	L
	H	L	L	L	L	H	L	L
	H	L	L	L	L	H	L	L
	H	L	L	L	L	H	L	L
FUNCTION	INPUTS							
	Sel <sub>A</sub>	Sel <sub>B</sub>	A <sub>0</sub>	B <sub>0</sub>	C <sub>in</sub>	S <sub>0</sub>	S <sub>0</sub>	C <sub>out</sub>
REVERSE SUBTRACT	L	H	L	L	L	H	L	L
	L	H	L	L	L	H	L	L
	L	H	L	L	L	H	L	L
	L	H	L	L	L	H	L	L
	L	H	L	L	L	H	L	L
	L	H	L	L	L	H	L	L
	L	H	L	L	L	H	L	L
	L	H	L	L	L	H	L	L
REVERSE SUBTRACT	L	L	L	L	L	L	H	H
	L	L	L	L	L	L	H	H
	L	L	L	L	L	L	H	H
	L	L	L	L	L	L	H	H
	L	L	L	L	L	L	H	H
	L	L	L	L	L	L	H	H
	L	L	L	L	L	L	H	H
	L	L	L	L	L	L	H	H

## ORDERING INFORMATION

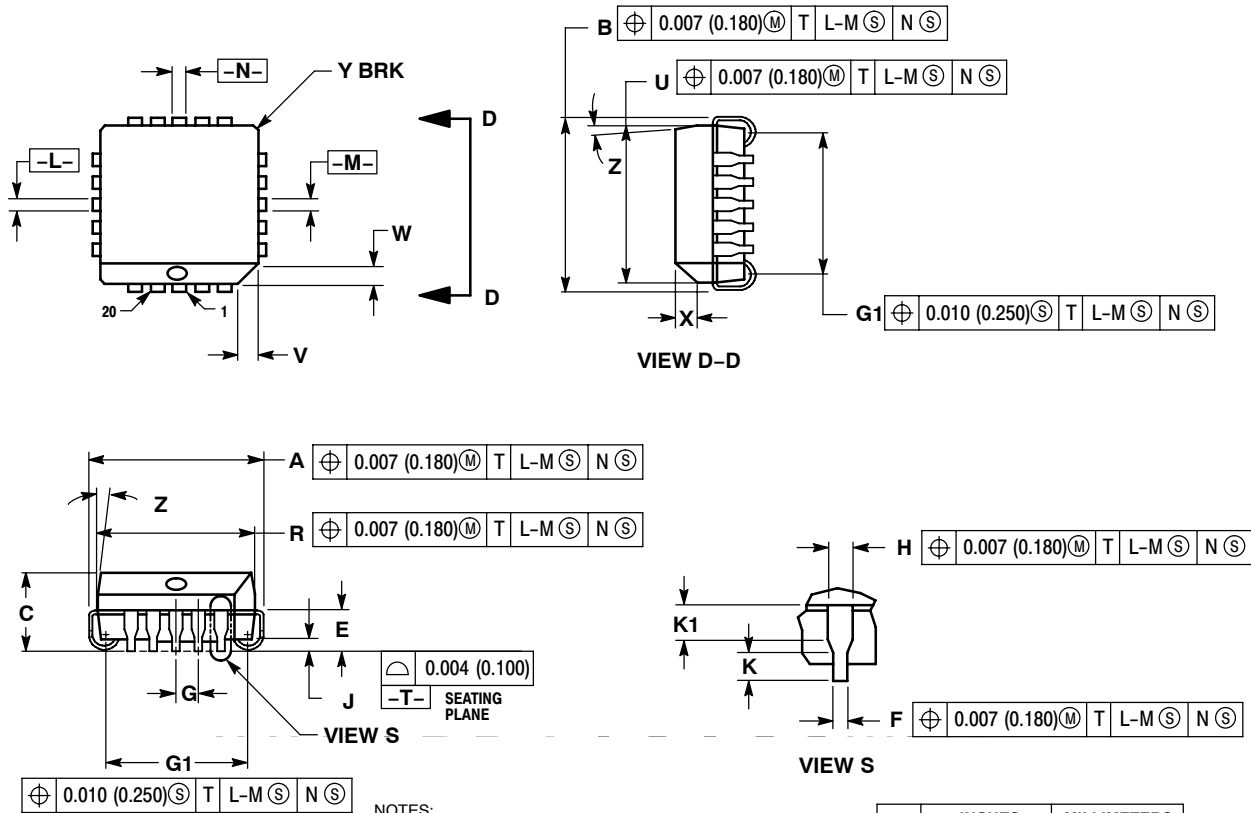
Device	Package	Shipping <sup>†</sup>
MC10H180FN	PLLC-20	46 Units / Rail
MC10H180FNG	PLLC-20 (Pb-Free)	46 Units / Rail
MC10H180L	CDIP-16	25 Unit / Rail
MC10H180P	PDIP-16	25 Unit / Rail
MC10H180PG	PDIP-16 (Pb-Free)	25 Unit / Rail

<sup>†</sup>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



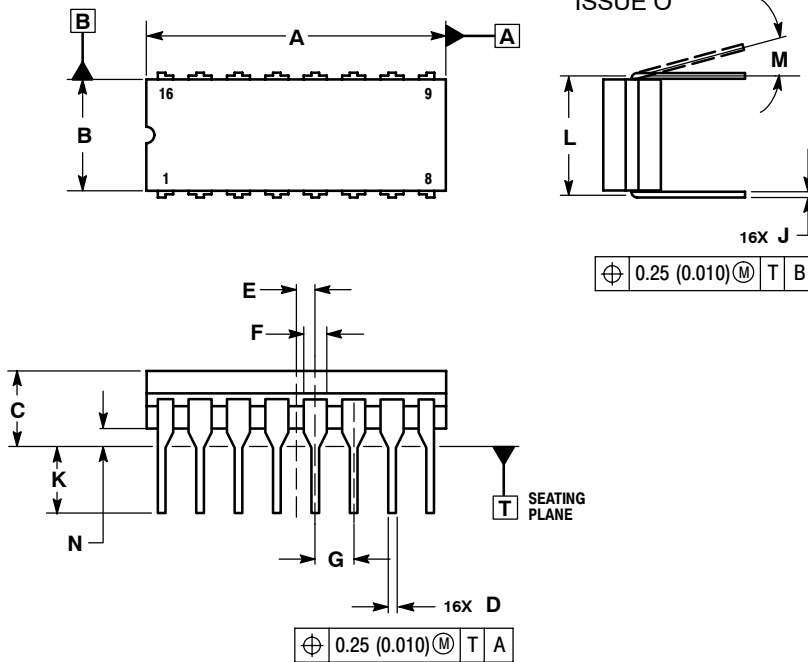
- NOTES:
1. DIMENSIONS AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. DIMENSIONS IN INCHES.
  3. DATUMS -L-, -M-, AND -N- DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
  4. DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
  5. DIMENSIONS R AND U DO 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	----

# MC10H180

## PACKAGE DIMENSIONS

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

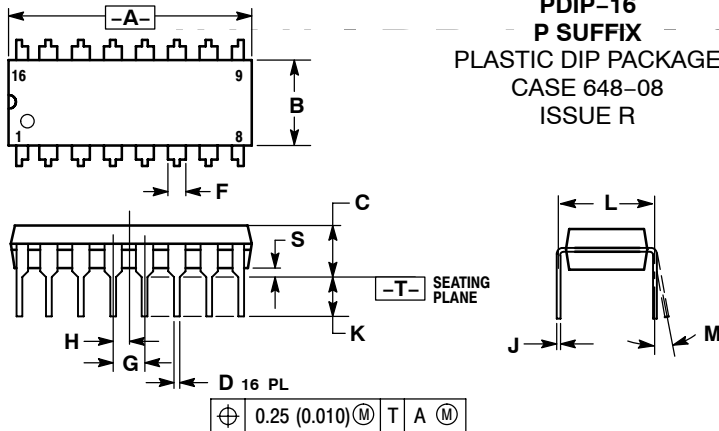


#### NOTES:

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.

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

### 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		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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