MC10H180

Dual 2-Bit Adder/Subtractor

ON Semiconductor®

http://onsemi.com

Description

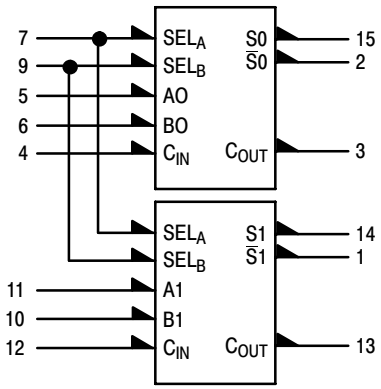
The MC10H180 is a high−speed, low−power, general−purpose adder/ subtractor. It is designed to be used in special purpose adders/subtractors or in high−speed multiplier arrays.

Inputs for each adder are Carry−in, Operand A, and Operand B; outputs are Sum, $\overline{\text{Sum}}$ 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

$A' = \overline{A \oplus SEL_A} = A \odot SEL_A$

$B' = \overline{B \oplus SEL_B} = B \odot SEL_B$

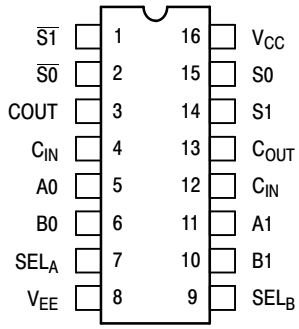
$S = \overline{C}_{IN}(\overline{A}'B' + A'\overline{B}') + C_{IN}(A'B' + \overline{A}'\overline{B}')$

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

V_{CC} = PIN 16

V_{EE} = PIN 8

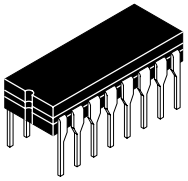
DIP PIN ASSIGNMENT

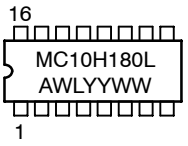


Pin assignment is for Dual−in−Line Package.
For PLCC pin assignment, see the Pin Conversion Tables on page 18 of the ON Semiconductor MECL Data Book (DL122/D).

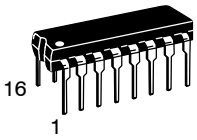
*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

MARKING DIAGRAMS*

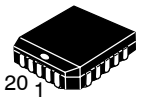


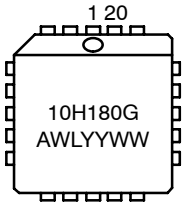


CDIP−16
L SUFFIX
CASE 620A



PDIP−16
P SUFFIX
CASE 648





PLLC−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.

Table 1. 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.

Table 2. ELECTRICAL CHARACTERISTICS (V_{EE} = −5.2 V ±5%) (Note 1)

		0°		25°		75°		
Symbol	Characteristic	Min	Max	Min	Max	Min	Max	Unit
I_E	Power Supply Current	–	95	–	86	–	95	mA
I_{inH}	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_{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)	−1.17	−0.84	−1.13	−0.81	−1.07	−0.735	Vdc
V_{IL}	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 lfpm is maintained. Outputs are terminated through a 50 Ω resistor to −2.0 V.

Table 3. AC PARAMETERS

		0°		25°		75°		
Symbol	Characteristic	Min	Max	Min	Max	Min	Max	Unit
t_{pd}	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_r	Rise Time	0.5	2.0	0.5	2.1	0.5	2.2	ns
t_f	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 lfpm. 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.

Table 4. FUNCTION SELECT TABLE

Sel_A	Sel_B	Function
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_A	Sel_B	A0	B0	C_{in}	S0	$\overline{S0}$	C_{out}
ADD	H	H	L	L	L	L	H	L
	H	H	L	L	H	H	L	L
	H	H	L	H	L	H	L	H
	H	H	L	H	H	L	H	L
	H	H	H	L	L	H	L	H
	H	H	H	L	H	L	H	L
	H	H	H	H	L	L	H	H
	H	H	H	H	H	H	L	H
SUBTRACT	H	L	L	L	L	H	L	L
	H	L	L	L	H	L	H	H
	H	L	L	H	L	H	L	L
	H	L	L	H	H	L	H	H
	H	L	H	L	L	H	L	L
	H	L	H	L	H	L	H	H
	H	L	H	H	L	H	L	H
	H	L	H	H	H	L	H	L

FUNCTION	INPUTS							
	Sel_A	Sel_B	A0	B0	C_{in}	S0	$\overline{S0}$	C_{out}
REVERSE SUBTRACT	L	H	L	L	L	H	L	L
	L	H	L	L	H	L	H	H
	L	H	L	H	L	H	L	L
	L	H	L	H	H	L	H	H
	L	H	H	L	L	H	L	L
	L	H	H	L	H	L	H	L
	L	H	H	H	L	H	L	H
	L	H	H	H	H	L	H	L
	L	L	L	L	L	H	L	H
	L	L	L	L	H	L	H	L
	L	L	L	H	L	H	L	H
	L	L	L	H	H	L	H	L
	L	L	H	L	L	H	L	H
	L	L	H	L	H	L	H	L
	L	L	H	H	L	H	L	H
	L	L	H	H	H	L	H	L

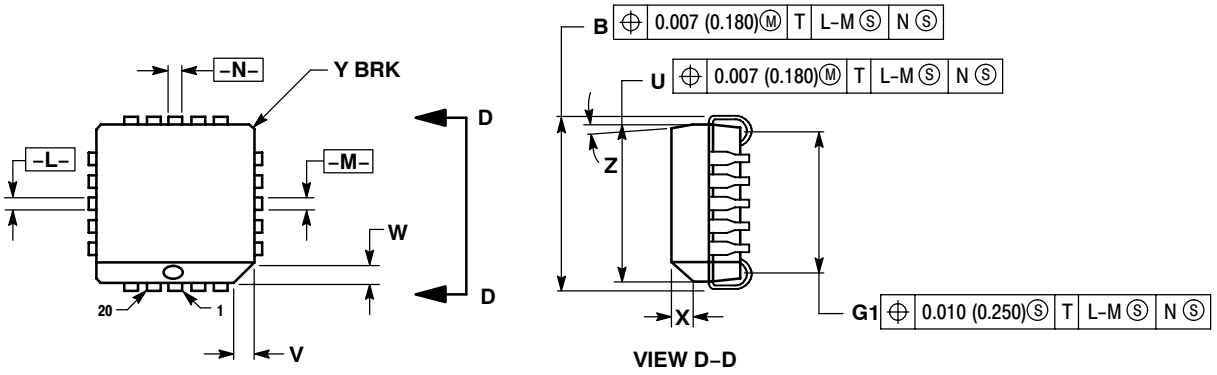
ORDERING INFORMATION

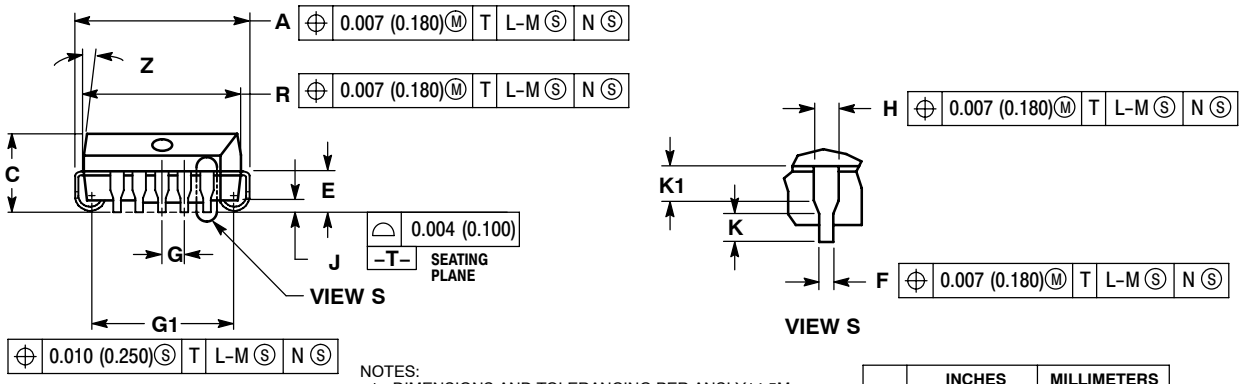
Device	Package	Shipping†
MC10H180FN	PLLC−20	46 Units / Rail
MC10H180FNG	PLLC−20 (Pb−Free)	46 Units / Rail
MC10H180L	CDIP−16	25 Unit / Rail
MC10H180P	PDIP−16	25 Unit / Rail
MC10H180PG	PDIP−16 (Pb−Free)	25 Unit / Rail

†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.

PACKAGE DIMENSIONS

20 LEAD PLLC
CASE 775–02
ISSUE E



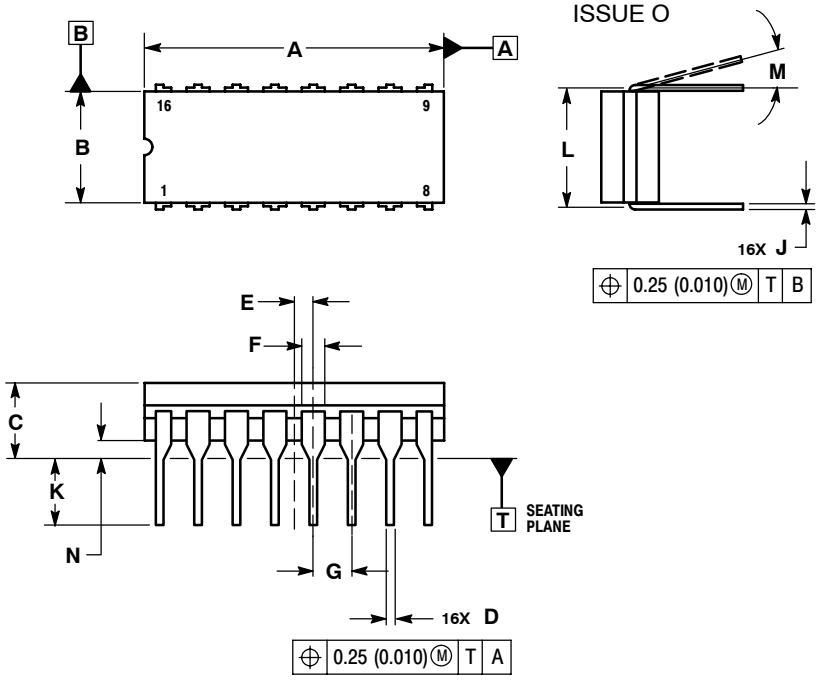


NOTES:
1. DIMENSIONS AND TOLERANCING PER ANSI Y14.5M, 1982.
2. DIMENSIONS IN INCHES.
3. DATUMS –L–, –M–, AND –N– DETERMINED WHERE TOP OF LEAD SHOULDER EXITS PLASTIC BODY AT MOLD PARTING LINE.
4. DIMENSION G1, TRUE POSITION TO BE MEASURED AT DATUM –T–, SEATING PLANE.
5. DIMENSIONS R AND U DO NOT INCLUDE 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).

	INCHES		MILLIMETERS	
DIM	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	---

PACKAGE DIMENSIONS

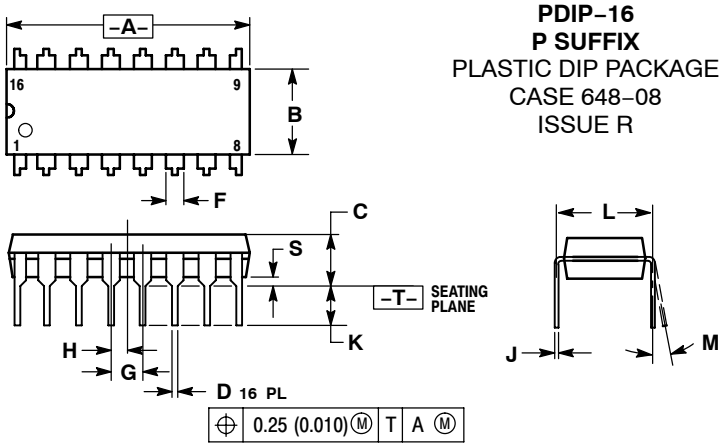
CDIP–16
L SUFFIX
CERAMIC DIP PACKAGE
CASE 620A–01
ISSUE O



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.

	INCHES		MILLIMETERS	
DIM	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.

	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

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PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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