

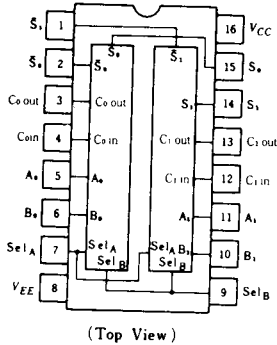
# HD10180

## Dual 2-bit Adders/Subtractors

The HD10180 is a high speed, low power, general-purpose adder/subtractor. 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.

### PIN ARRANGEMENT



### FUNCTION SELECT TABLE

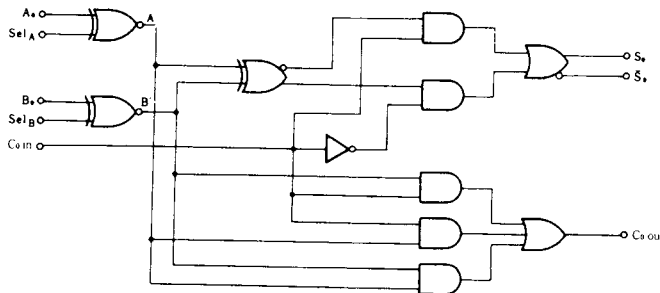
Sel <sub>A</sub>	Sel <sub>B</sub>	Function
H	H	S = A + B
H	L	S = A - B
L	H	S = B - A
L	L	S = 0 - A - B

### FUNCTION TABLE

Function	Inputs					Outputs		
	Sel <sub>A</sub>	Sel <sub>B</sub>	A <sub>0</sub>	B <sub>0</sub>	C <sub>in</sub>	S <sub>0</sub>	$\overline{S_0}$	C <sub>out</sub>
ADD	H	H	L	L	L	L	H	L
	H	H	L	L	H	H	L	L
	H	H	L	H	L	H	L	L
	H	H	L	H	H	L	H	H
	H	H	H	L	L	H	L	L
	H	H	H	L	H	L	H	H
	H	H	H	H	L	L	H	H
	H	H	H	H	H	H	L	L
SUBTRACT	H	L	L	L	L	H	L	L
	H	L	L	L	H	L	H	H
	H	L	L	H	L	L	H	L
	H	L	L	H	H	H	L	L
	H	L	H	L	L	L	H	H
	H	L	H	L	H	H	L	H
	H	L	H	H	L	H	L	L
	H	L	H	H	H	L	H	H

Function	Inputs					Outputs		
	Sel <sub>A</sub>	Sel <sub>B</sub>	A <sub>0</sub>	B <sub>0</sub>	C <sub>in</sub>	S <sub>0</sub>	$\overline{S_0}$	C <sub>out</sub>
REVERSE SUBTRACT	L	H	L	L	L	H	L	L
	L	H	L	L	H	L	H	H
	L	H	L	H	L	L	H	H
	L	H	L	H	H	H	L	H
	L	H	H	L	L	L	H	L
	L	H	H	L	H	H	L	L
	L	H	H	H	L	H	L	L
	L	H	H	H	H	L	H	H
	L	L	L	L	L	L	H	H
	L	L	L	L	H	H	L	H
	L	L	L	H	L	L	H	L
	L	L	L	H	H	L	H	H
	L	L	H	L	L	H	L	L
	L	L	H	L	H	L	H	H
	L	L	H	H	L	L	H	L
	L	L	H	H	H	H	L	L

### BLOCK DIAGRAM



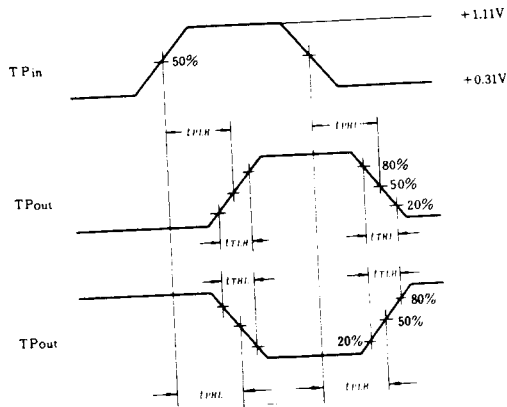
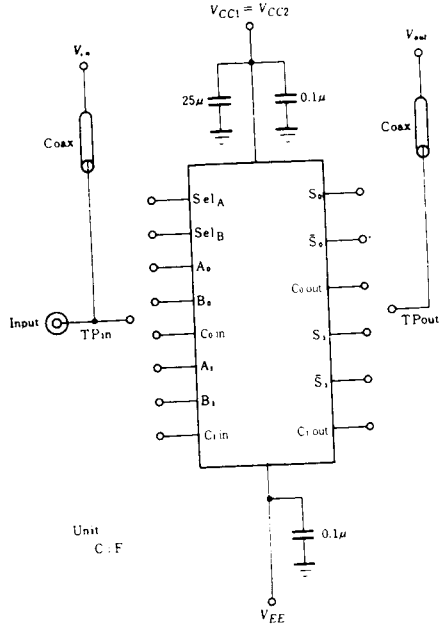
**■ DC CHARACTERISTICS** ( $V_{EE} = -5.2\text{V}$ ,  $T_a = -30 \sim +85^\circ\text{C}$ )

Item	Symbol	Test Condition		min	typ	max	Unit	
Supply Current	$I_{IS}$			25°C	—	70	86 mA	
Input Current	$I_{IH}$	$V_{IH} = -0.810\text{V}$	Cin	25°C	—	—	370	$\mu\text{A}$
			A, B		—	—	220	
			Sel <sub>A</sub> , Sel <sub>B</sub>		—	—	290	
	$I_{II}$	$V_{II} = -1.850\text{V}$		25°C	0.5	—	$\mu\text{A}$	
Output Voltage	$V_{OH}$	$V_{IH} = -0.890\text{V}$ or $V_{II} = -1.890\text{V}$		-30°C	-1.060	—	-0.890	V
		$V_{IH} = -0.810\text{V}$ or $V_{II} = -1.850\text{V}$		25°C	-0.960	—	-0.810	
		$V_{IH} = -0.700\text{V}$ or $V_{II} = -1.825\text{V}$		85°C	-0.890	—	-0.700	
	$V_{OL}$	$V_{II} = -1.890\text{V}$ or $V_{IH} = -0.890\text{V}$		-30°C	-1.890	—	-1.675	V
		$V_{II} = -1.850\text{V}$ or $V_{IH} = -0.810\text{V}$		25°C	-1.850	—	-1.650	
		$V_{II} = -1.825\text{V}$ or $V_{IH} = -0.700\text{V}$		85°C	-1.825	—	-1.615	
Output Threshold Voltage	$V_{OHA}$	$V_{IHA} = -1.205\text{V}$ or $V_{ILA} = -1.500\text{V}$		-30°C	-1.080	—	—	V
		$V_{IHA} = -1.105\text{V}$ or $V_{ILA} = -1.475\text{V}$		25°C	-0.980	—	—	
		$V_{IHA} = -1.035\text{V}$ or $V_{ILA} = -1.440\text{V}$		85°C	-0.910	—	—	
	$V_{OLA}$	$V_{ILA} = -1.500\text{V}$ or $V_{IHA} = -1.205\text{V}$		30°C	—	—	-1.655	V
		$V_{ILA} = -1.475\text{V}$ or $V_{IHA} = -1.105\text{V}$		25°C	—	—	-1.630	
		$V_{ILA} = -1.440\text{V}$ or $V_{IHA} = -1.035\text{V}$		85°C	—	—	-1.595	

**■ AC CHARACTERISTICS** ( $V_{EE} = -3.2\text{V}$ ,  $V_{CC} = +2.0\text{V}$ ,  $T_a = -30 \sim +85^\circ\text{C}$ )

Item	Symbol	Input	Output	Test Condition	min	typ	max	Unit		
Propagation Delay Time	Operand	A <sub>0</sub>	S <sub>0</sub>	$R_I = 50\Omega$	-30°C	1.3	—	5.8	ns	
					25°C	1.3	—	5.4		
					85°C	1.1	—	5.8		
		B <sub>0</sub>	S <sub>0</sub>		-30°C	1.3	—	5.8		
					25°C	1.3	—	5.4		
					85°C	1.1	—	5.8		
	Cin	$t_{PLH}$ $t_{PHL}$	Cin		S <sub>0</sub>	30°C	1.0	—		3.4
						25°C	1.0	—		3.3
						85°C	0.9	—		3.6
			Cin		Cout	-30°C	1.0	—		3.4
						25°C	1.0	—		3.3
						85°C	0.9	—		3.6
	Select		Sel <sub>A</sub>		S <sub>0</sub>	-30°C	1.3	—		5.8
						25°C	1.3	—		5.4
						85°C	1.1	—		5.8
Sel <sub>B</sub>			S <sub>0</sub>	-30°C	1.3	—	5.8			
				25°C	1.3	—	5.4			
				85°C	1.1	—	5.8			
Rise Time	$t_{RLH}$	A <sub>0</sub>	S <sub>0</sub>	-30°C	1.0	—	3.8	ns		
25°C	1.1			—	3.7					
85°C	1.1			—	3.9					
Fall Time	$t_{FHL}$	A <sub>0</sub>	S <sub>0</sub>	-30°C	1.0	—	3.8	ns		
				25°C	1.1	—	3.7			
				85°C	1.1	—	3.9			

■ SWITCHING TIME TEST CIRCUIT



- Notes)
1. 50Ω termination to ground located in each scope channel input. All input and output cables to the scope are equal lengths of 50Ω coaxial cable.
  2. Wire length should be <6.35mm (1/4 inch) from TPin to input pin and TPOut to output pin.
  3. Unused outputs connected to a 50Ω resistor to ground.