

4-Bit Arithmetic Logic Unit/ Function Generator

The MC10181 is a high-speed arithmetic logic unit capable of performing 16 logic operations and 16 arithmetic operations on two four-bit words. Full internal carry is incorporated for ripple through operation.

Arithmetic logic operations are selected by applying the appropriate binary word to the select inputs (S0 through S3) as indicated in the tables of arithmetic/logic functions. Group carry propagate (PG) and carry generate (GG) are provided to allow fast operations on very long words using a second order look ahead. The internal carry is enabled by applying a low level voltage to the mode control input (M).

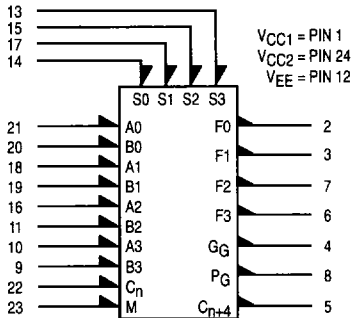
$P_D = 600$ mW typ/pkg (No Load)
 t_{pd} (typ): A1 to F = 6.5 ns
 C_n to $C_n + 4 = 3.1$ ns
A1 to PG = 5.0 ns
A1 to GG = 4.5 ns
A1 to $C_n + 4 = 5.0$

MC10181

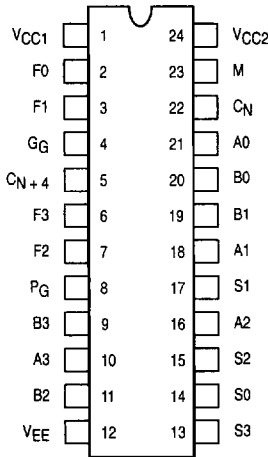


L SUFFIX
CERAMIC PACKAGE
CASE 623-05

LOGIC DIAGRAM

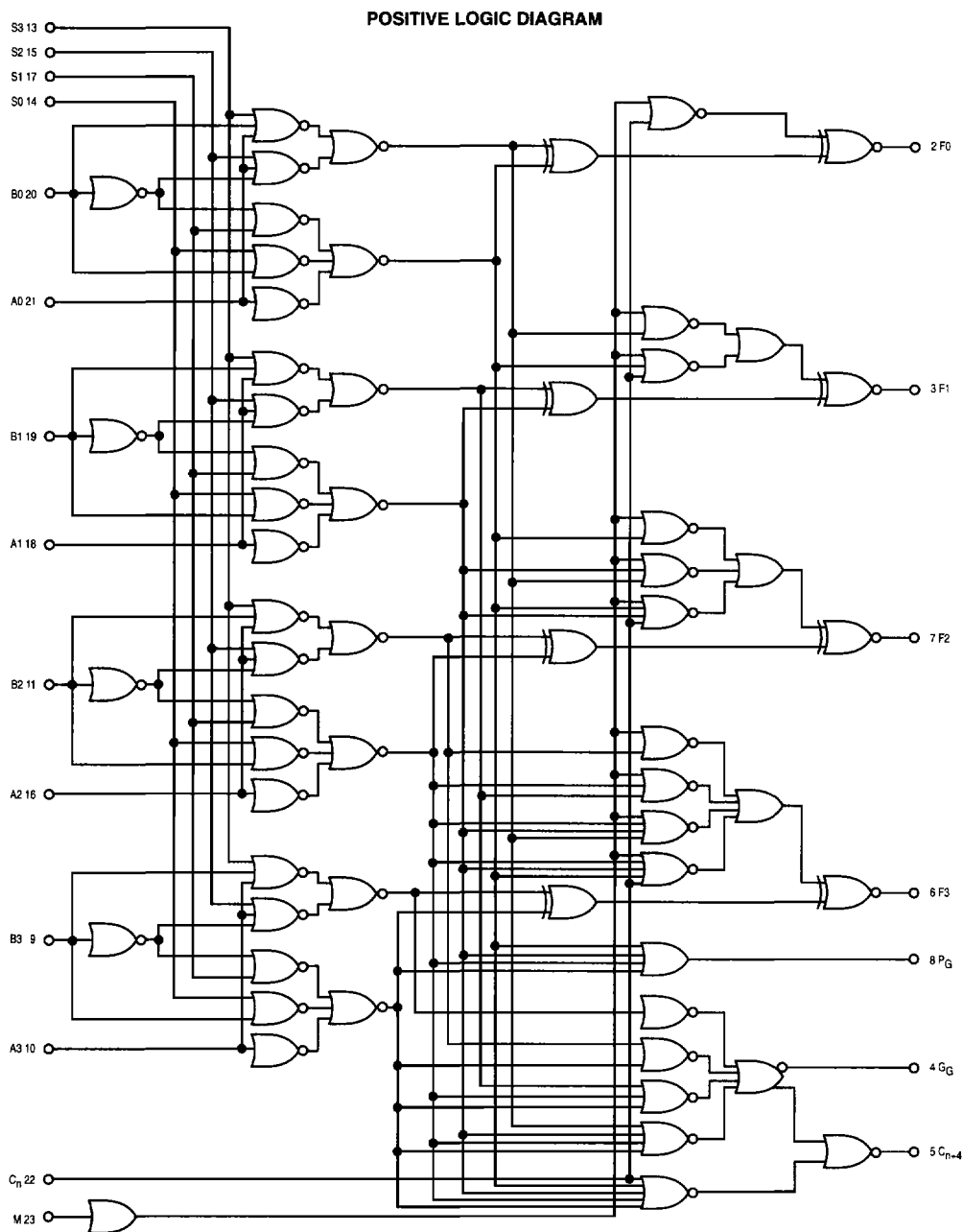


PIN ASSIGNMENT



Function Select				Logic Functions M is High C = D.C. F	Arithmetic Operation M is Low Cn is low F
S3	S2	S1	S0		
L	L	L	L	$F = \bar{A}$	$F = A$
L	L	L	H	$F = \bar{A} + \bar{B}$	$F = A \text{ plus } (A \cdot \bar{B})$
L	L	H	L	$F = \bar{A} + B$	$F = A \text{ plus } (A \cdot B)$
L	L	H	H	$F = \text{Logical "1"}$	$F = A \text{ times } 2$
L	H	L	L	$F = \bar{A} \cdot \bar{B}$	$F = (A + B) \text{ plus } 0$
L	H	L	H	$F = \bar{B}$	$F = (A + B) \text{ plus } (A \cdot \bar{B})$
L	H	H	L	$F = A \odot B$	$F = A \text{ plus } B$
L	H	H	H	$F = A + \bar{B}$	$F = A \text{ plus } (A + B)$
H	L	L	L	$F = \bar{A} \cdot B$	$F = (A + B) \text{ plus } 0$
H	L	L	H	$F = A \oplus B$	$F = A \text{ minus } B \text{ minus } 1$
H	L	H	L	$F = B$	$F = (A + \bar{B}) \text{ plus } (A \cdot B)$
H	L	H	H	$F = A + B$	$F = A \text{ plus } (A + \bar{B})$
H	H	L	L	$F = \text{Logical "0"}$	$F = \text{minus } 1 \text{ (two's complement)}$
H	H	L	H	$F = \bar{A} \cdot \bar{B}$	$F = (A \cdot \bar{B}) \text{ minus } 1$
H	H	H	L	$F = \bar{A} \cdot B$	$F = (A \cdot B) \text{ minus } 1$
H	H	H	H	$F = A$	$F = A \text{ minus } 1$





3

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Pin Under Test	Test Limits							Unit	
			-30°C		+25°C			+85°C			
			Min	Max	Min	Typ	Max	Min	Max		
Power Supply Drain Current	I _E	12		159			145		159	mAdc	
Input Current	I _{inH}	9		390			245		245	μAdc	
		10		350			220		220		
		11		390			245		245		
		13		320			200		200		
		14		425			265		265		
		15		425			265		265		
		16		350			220		220		
		17		425			265		265		
		18		350			220		220		
		19		390			245		245		
		20		390			245		245		
		21		350			220		220		
		22		460			290		290		
23		320			200		200				
Input Leakage Current	I _{inL}	9	0.5		0.5			0.3		μAdc	
		10	0.5		0.5			0.3			
		11	0.5		0.5			0.3			
		13	0.5		0.5			0.3			
		14	0.5		0.5			0.3			
		15	0.5		0.5			0.3			
		16	0.5		0.5			0.3			
		17	0.5		0.5			0.3			
		18	0.5		0.5			0.3			
		19	0.5		0.5			0.3			
		20	0.5		0.5			0.3			
		21	0.5		0.5			0.3			
		22	0.5		0.5			0.3			
23	0.5		0.5			0.3					
Output Voltage	Logic 1	V _{OH}	*	-1.060	-0.890	-0.960		-0.810	-0.890	-0.700	Vdc
Output Voltage	Logic 0	V _{OL}	*	-2.000	-1.675	-1.990		-1.650	-1.920	-1.615	Vdc
Threshold Voltage	Logic 1	V _{OHA}	*	-1.080		-0.980			-0.910		Vdc
Threshold Voltage	Logic 0	V _{OLA}	*		-1.655			-1.630		-1.595	Vdc

* Test all input-output combinations according to Function Table.

** For threshold level test, apply threshold input level to only one input pin at a time.

ELECTRICAL CHARACTERISTICS (continued)

@ Test Temperature -30°C +25°C +85°C			TEST VOLTAGE VALUES (Volts)					(V _{CC}) Gnd
			V _{IHmax}	V _{ILmin}	V _{IHAmin}	V _{ILAmax}	V _{EE}	
			-0.890	-1.890	-1.205	-1.500	-5.2	
			-0.810	-1.850	-1.105	-1.475	-5.2	
Characteristic	Symbol	Pin Under Test	TEST VOLTAGE APPLIED TO PINS LISTED BELOW					(V _{CC}) Gnd
			V _{IHmax}	V _{ILmin}	V _{IHAmin}	V _{ILAmax}	V _{EE}	
Power Supply Drain Current	I _E	12					12	1, 24
Input Current	I _{inH}	9	9				12	1, 24
		10	10				12	1, 24
		11	11				12	1, 24
		13	13				12	1, 24
		14	14				12	1, 24
		15	15				12	1, 24
		16	16				12	1, 24
		17	17				12	1, 24
		18	18				12	1, 24
		19	19				12	1, 24
		20	20				12	1, 24
		21	21				12	1, 24
		22	22				12	1, 24
		23	23				12	1, 24
Input Leakage Current	I _{inL}	9		9			12	1, 24
		10		10			12	1, 24
		11		11			12	1, 24
		13		13			12	1, 24
		14		14			12	1, 24
		15		15			12	1, 24
		16		16			12	1, 24
		17		17			12	1, 24
		18		18			12	1, 24
		19		19			12	1, 24
		20		20			12	1, 24
		21		21			12	1, 24
		22		22			12	1, 24
		23		23			12	1, 24
Output Voltage	Logic 1	V _{OH}	*	*	*		12	1, 24
Output Voltage	Logic 0	V _{OL}	*	*	*		12	1, 24
Threshold Voltage	Logic 1	V _{OHA}	*		**	**	12	1, 24
Threshold Voltage	Logic 0	V _{OLA}	*		**	**	12	1, 24

* Test all input-output combinations according to Function Table.

** For threshold level test, apply threshold input level to only one input pin at a time.

Each MECL 10,000 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. Test procedures are shown for only one gate. The other gates are tested in the same manner.

3

Characteristic	Symbol	Input	Output	Conditions†	AC Switching Characteristics								Unit
					-30°C *		+25°C			+85°C *			
					Min	Max	Min	Typ	Max	Min	Max		
Propagation Delay	t _{PH} , t _{PL}	C _n	C _{n+4}	A0, A1, A2, A3	1.0	5.1	1.1	3.1	5.0	1.1	5.4	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	C _n	C _{n+4}	A0, A1, A2, A3	1.0	3.2	1.0	2.0	3.0	1.0	3.2	ns	
Propagation Delay	t _{PH} , t _{PL}	C _n	F1	A0	1.7	7.2	2.0	4.5	7.0	2.0	7.5	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	C _n	F1	A0	1.7	7.2	2.0	4.5	7.0	2.0	7.5	ns	
	t _{PH} , t _{PL}	C _n	F1	A0	1.3	5.3	1.5	3.0	5.0	1.5	5.3	ns	
Propagation Delay	t _{PH} , t _{PL}	A1	F1	—	2.6	10.4	3.0	6.5	10	3.0	10.8	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	A1	F1	—	2.6	10.4	3.0	6.5	10	3.0	10.8	ns	
	t _{PH} , t _{PL}	A1	F1	—	1.3	5.4	1.5	3.0	5.0	1.5	5.3	ns	
Propagation Delay	t _{PH} , t _{PL}	A1	P _G	S0, S3	1.6	7.0	2.0	5.0	6.5	2.0	7.0	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	A1	P _G	S0, S3	0.8	3.7	1.1	2.0	3.5	1.1	3.8	ns	
Propagation Delay	t _{PH} , t _{PL}	A1	G _G	A0, A2, A3, C _n	1.1	7.4	2.0	4.5	7.0	1.3	7.7	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	A1	G _G	A0, A2, A3, C _n	1.2	5.1	1.5	4.0	5.0	1.2	5.3	ns	
Propagation Delay	t _{PH} , t _{PL}	A1	C _{n+4}	A0, A2, A3, C _n	1.7	7.3	2.0	5.0	7.0	2.0	7.8	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	A1	C _{n+4}	A0, A2, A3, C _n	1.0	3.1	1.0	2.0	3.0	1.0	3.2	ns	
Propagation Delay	t _{PH} , t _{PL}	B1	F1	S3, C _n	2.7	11.3	3.0	8.0	11	3.0	11.9	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	B1	F1	S3, C _n	1.2	5.3	1.5	3.5	5.0	1.5	5.3	ns	
Propagation Delay	t _{PH} , t _{PL}	B1	P _G	S0, A1	1.6	7.7	2.0	6.0	7.5	2.0	8.0	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	B1	P _G	S0, A1	1.0	3.6	1.1	2.0	3.5	1.1	3.9	ns	
Propagation Delay	t _{PH} , t _{PL}	B1	G _G	S3, C _n	1.7	8.2	2.0	6.0	8.0	2.0	8.6	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	B1	G _G	S3, C _n	1.4	5.2	1.5	3.0	5.0	1.2	5.4	ns	
Propagation Delay	t _{PH} , t _{PL}	B1	C _{n+4}	S3, C _n	1.8	8.2	2.0	6.0	8.0	2.0	8.7	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	B1	C _{n+4}	S3, C _n	0.9	3.1	1.0	2.0	3.0	1.0	3.2	ns	
Propagation Delay	t _{PH} , t _{PL}	M	F1	—	2.4	10.3	3.0	6.5	10	3.0	10.8	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	M	F1	—	1.1	5.1	1.5	4.0	5.0	1.5	5.3	ns	
Propagation Delay	t _{PH} , t _{PL}	S1	F1	A1, B1	2.5	10.7	3.0	6.5	10	3.0	10.8	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	S1	F1	A1, B1	1.0	5.4	1.5	3.0	5.0	1.5	5.4	ns	
Propagation Delay	t _{PH} , t _{PL}	S1	P _G	A3, B3	1.7	8.3	2.0	6.0	8.0	2.0	8.4	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	S1	P _G	A3, B3	0.8	5.1	1.1	3.0	5.0	1.1	5.2	ns	
Propagation Delay	t _{PH} , t _{PL}	S1	C _{n+4}	A3, B3	1.6	9.3	2.0	6.0	9.0	2.0	9.9	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	S1	C _{n+4}	A3, B3	0.9	5.3	1.1	3.0	5.0	1.0	5.2	ns	
Propagation Delay	t _{PH} , t _{PL}	S1	G _G	A3, B3	1.5	9.6	2.0	6.0	9.0	1.9	9.7	ns	
Rise Time, Fall Time	t _{PH} , t _{PL}	S1	G _G	A3, B3	0.8	6.2	0.8	3.0	6.0	0.8	6.5	ns	

† Logic high level (+1.11 Vdc) applied to pins listed. All other input pins are left floating or tied to +0.31 Vdc.

V_{CC1} = V_{CC2} = +2.0 Vdc, V_{EE} = -3.2 Vdc

* L Suffix Only