GigaBit Logic

10G181
ADVANCE

4-Bit Arithmetic Logic Unit/Function Generator
2.0 ns Add Time
10G PicoLogic™ Family

DISTINCTIVE CAPABILITIES

- 150 ps typical output rise and fall times
- 700 mw typical power dissipation
- ECL and 10G PicoLogic compatible I/O
- VBB reference input for improved threshold tracking over temperature and power supply variation
- On chip VBBS (-1.2V) reference voltage supply
- 2.0 ns add time
- Available in leaded, leadless chip carrier or dice form
- Packages contain internal decoupling capacitors for optimum high frequency performance

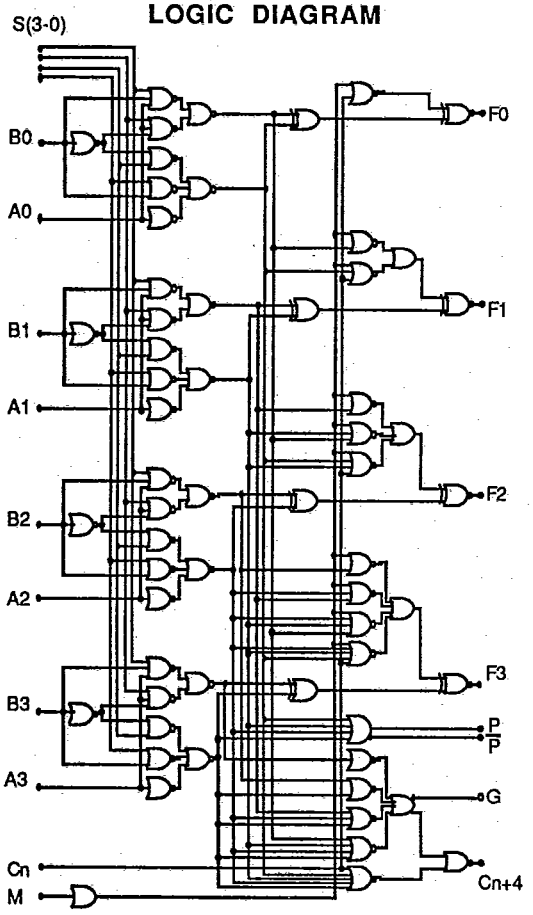
FUNCTIONAL DESCRIPTION

The 10G181 is an ECL or PicoLogic compatible ultra fast arithmetic logic unit capable of performing 16 logic functions and 16 arithmetic operations on two 4-bit words. The 10G181 performs a 4 bit add function with carry in 2.0 ns and exhibits 700 mW power dissipation.

The mode control input, M, selects the logic or arithmetic mode operation for the two 4 bit inputs, A(0-3) and B(0-3). The desired function can be selected applying the appropriate binary pattern on the select, S(0-3), inputs. When the mode control input is high, all the internal carries are inhibited and the device performs logical operations on the individual bits as listed. The device incorporates full internal carry look ahead & provides for both ripple carry using the Cn+4 output or for carry look ahead between packages using the carry propagate P, carry propagate complement $\overline{P}$, and carry generate G, signals.

The 10G181 is fabricated using GigaBit's production proven GaAs MESFET process technology.

LOGIC DIAGRAM



10G181 ORDERING INFORMATION

PACKAGE TYPE	DELAY (Max. @ 25°C)
	2.0 ns
Leaded Chip Carrier	10G181-2C
Leadless Chip Carrier	10G181-2L
Dice	10G181-2X

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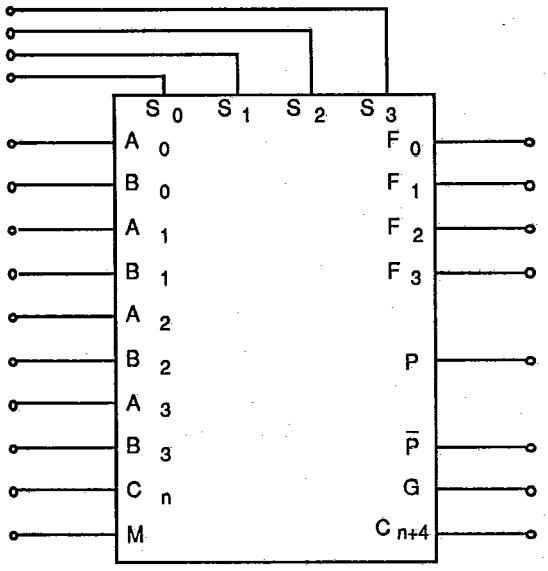
BLOCK DIAGRAM



Positive logic: High level = '1'

FUNCTIONAL DESCRIPTION (cont.)

When the mode control input is low, the carries are enabled and the device performs arithmetic opeations. Note that the functional truth table shows P, $\overline{P}$, and G are not affected by carry-in.

For most applications where Gallium Arsenide is required, the carry look ahead unit, 10G101 should be used to fully utilize the capabilities of the technology. The 10G101 can support up to four 10G181's.

The function table lists the arithmetic operations without carry in. An incoming carry, Cn, adds one to each operation. For example, with carry in, Cn = 1, the output function, F = A - 1 becomes F = A - 1 + 1 = A - 0. All subtraction is carried out in complementary addition (1's complement). A carry out, Cn+4, means borrow; thus a carry out is generated (Cn+4 = 1) when there is under flow.

In the add mode, P indicates that F is 15, while G indicates F is 16 or more. In the subtract mode, P indicates that F is zero, while G indicates F is less than zero.

FUNCTIONAL TRUTH TABLE

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

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PIN DESCRIPTIONS

S(0-3)	Function select pins
M	Mode select
A(0-3)	A word operand inputs
B(0-3)	B word operand inputs
Cn	Carry input
Cn+4	Carry output
P	Carry look ahead propagate
$\overline{P}$	Carry look ahead propagate complement
G	Carry look ahead generate
F(0-3)	Function outputs
VEE	- 5.2 V. Power supply
VSS	- 3.4 V. Power supply

VTTC	Internal VDDO decoupling capacitor return pin. VTTC is bought into the 10G181 package as the AC return lead for the VDDO output driver decoupling capacitor. It is not brought on to the 10G181 die: VTTC is typically tied to VTT (-2.0V).
VBB	Input to the 10G181 input threshold tracking circuit. Connect to threshold voltage supplied from ECL if driven by ECL. Connect to VBBS when 10G181 is driven by PicoLogic™.
VBBS	Nominal -1.2V threshold reference output supply voltage (40Ω source impedence). Connect to VBB when 10G181 is driven by PicoLogic™.
VDDO	Ground connection for output drivers.
VDDL	Ground connection for input buffers & internal switching logic.

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10G181 AC CHARACTERISTICS

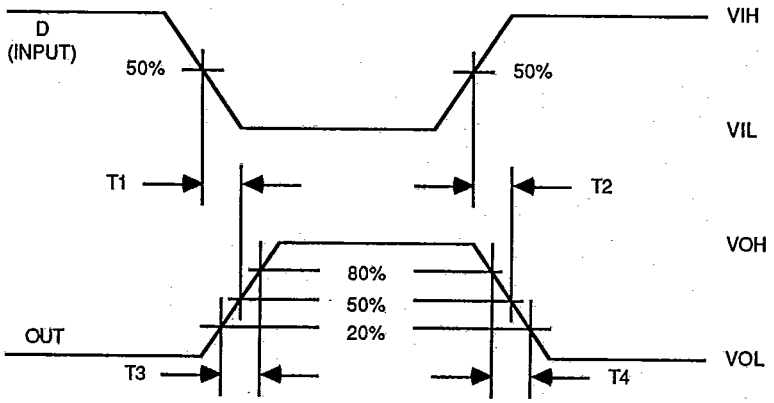
VSS = - 3.5V to- 3.3V, VEE = -5.5V to - 5.1V, VDDL = VDDO = Gnd., unless otherwise indicated

SYMBOL	PARAMETER	TC = 0°C		TC = +25°C			TC = 85°C		UNITS	NOTES
		Min	Max	Min	Typ	Max	Min	Max		
A(0-3) to F(0-3)	Propagation Delay				2.0				ns	
B(0-3) to F(0-3)	Propagation Delay				2.0				ns	
Cn to F(0-3)	Propagation Delay				TBD					
Cn to C n+4	Propagation Delay				TBD					
S(0-3) to F(0-3)	Propagation Delay				2.4				ns	
M to F(0-3)	Propagation Delay				1.6				ns	
B(0-3) to G	Propagation Delay				TBD					
A(0-3) to P	Propagation Delay				TBD					
A(0-3) to G	Propagation Delay				TBD					
B(0-3) to P	Propagation Delay				TBD					

Notes:

1. Test conditions (unless otherwise indicated):
   VBB = - 1.2V VIH = - 0.7V
   VTT = - 2.0V VIL = - 1.7V
   VTTC = VTT VOH ≥ - 0.7V
   RLOAD = 50Ω to - 2.0V VOL ≤ - 1.7V
   Input signal rise and fall time ≤ 150 ps
2. Rise and fall times are measured at the 20% and 80% points of the transition from VOL max to VOH min.

SWITCHING WAVEFORMS



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DC CHARACTERISTICS

Tc = 25°C, VSS = -3.5 V TO -3.3 V, VEE = -5.5 TO -5.1 V, VDDL = VDDO = Gnd, unless otherwise indicated

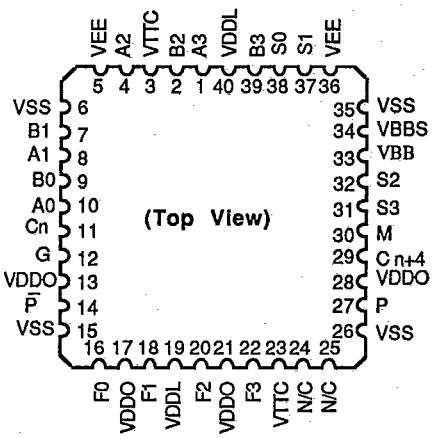
SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
VBBS	Threshold Reference Voltage		-1.2		V
ISS	Power Supply Current		165		mA
IEE	Power Supply Current		55		mA
PD	Power Dissipation		850		mW

NOTE:

The remaining DC Characteristics are specified in the 10G PicoLogic™ Family Electrical Characteristics Table at the beginning of this section. This table notes parameter deviations to Family Characteristics and provides specific supplementary characteristics only.

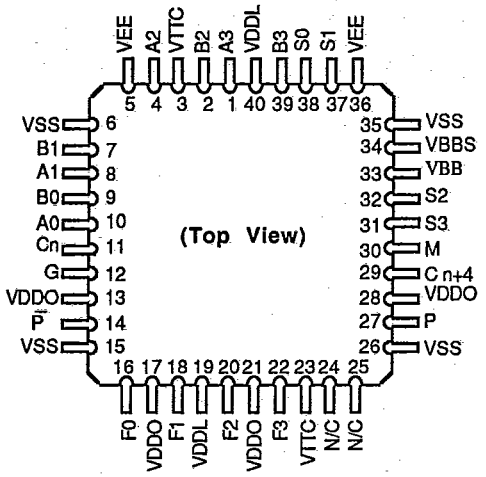
PACKAGE PINOUT DIAGRAMS

TYPE "L" PACKAGE



NOTES: Pin 1 is marked for orientation. N/C = No Connection.

TYPE "C" PACKAGE



NOTES: Pin 1 is marked for orientation. N/C = No Connection.