B9660

SMBUS System Clock Buffer for Mobile Applications

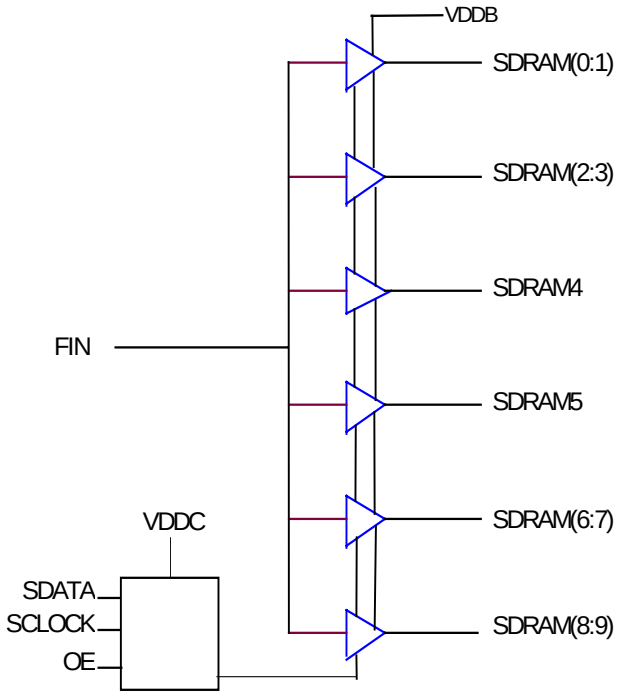
Product Features

- 10 output buffers for high clock fanout applications
- Each output can be disabled through SMBUS
- 3.3Volts typical operation supply
- Frequency range 10 Mhz to 166.6 Mhz
- < 250ps skew between output clocks
- 28-pin SSOP package for minimum board space
- Tri-state enable for system testing.

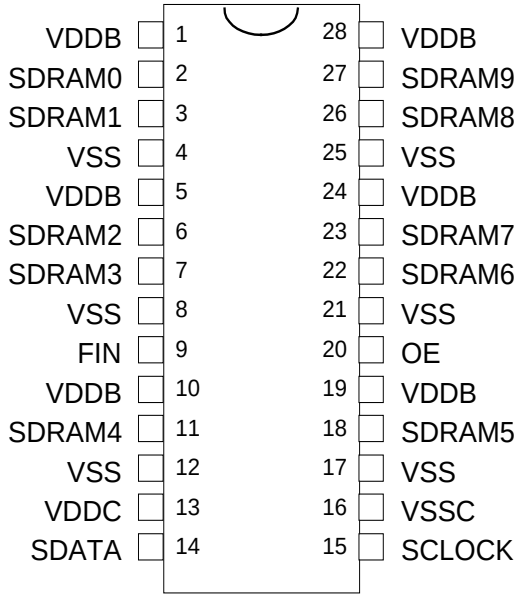
Product Description

The Cypress B9660 is a high fanout system clock buffer. Its primary application is to create the large quantity of clocks needed to support a wide range of applications that requires those clock loads signal that are referenced to a single existing clock. Loads of up to 30 pF are supported. The main application of this component is to redistribute SDRAM clocks from their generating devices, typically the 440BX chipset to their loads, the SDRAM modules. The creation of EMI and the degradation of waveform rise and fall times is greatly reduced by running a single reference clock trace to this device and then using it to regenerate the clock that drives shorter traces. Using these devices EMI is therefore minimized and board layout is simplified.

Block Diagram



Pin Configuration



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Pin Description

PIN No.	Pin Name	PWR	I/O	TYPE	Description
9	**FIN**	-	I	PAD	This pin is connected to the input reference clock. This clock must be in the range of 10.0 to 166.6 Mhz.
2,3,6,7,11,18,22,23,26,27	**SDRAM(0:9)**	VDDB	O	BUF1	Low skew output clocks .
20	**OE**	-	I	PAD	Buffer Output Enable pin. This pin is low it is used to place all output clocks (CLK1:10) in a tri state condition. This feature facilitates in production board level testing to be easily implemented for the clocks that this device produces. Has internal pull-up resistor, typically 250KΩ
14	**SDATA**	VDD	I	PAD	Serial Data for SMBUS control interface. This pin receives data streams from the SMBUS bus and outputs an acknowledge for valid data, internally pulled up, typically 250KΩ resistor
15	**SCLOCK**	VDD	I	PAD	Serial Clock for SMBUS control interface, internally pulled-up, typically 250KΩ resistor.
4, 8, 12, 16, 17, 21, 25	**VSS**		PWR	-	Ground pins for clock output buffers. These pins must be returned to the same potential to reduce output clock skew.
1, 5, 10, 19, 24, 28	**VDDB**	-	PWR	-	Power for output clock buffers.
13	**VDDC**	-	PWR	-	Pin for device core logic.

2 Wire SMBUS Control Interface

The 2-wire control interface implements a write only slave interface. The device cannot be read back. Sub-addressing is not supported, thus all preceding bytes must be sent in order to change one of the control bytes. The 2-wire control interface allows each clock output to be individually enabled or disabled.

During normal data transfer, the SDATA signal only changes when the SDCLK signal is low, and is stable when SDCLK is high. There are two exceptions to this. A high to low transition on SDATA while SDCLK is high is used to indicate the start of a data transfer cycle. A low to high transition on SDATA while SDCLK is high indicates the end of a data transfer cycle. Data is always sent as complete 8-bit bytes, after which an acknowledge is generated. The first byte of a transfer cycle is a 7-bit address with a Read/Write bit as the LSB. Data is transferred MSB first.

The device will respond to writes to 10 bytes (max) of data to address **D2** by generating the acknowledge (low) signal on the SDATA wire following reception of each byte. The device will not respond to any other control interface conditions. Previously set control registers are retained.

Serial Control Registers

NOTE: The Pin# column lists the affected pin number where applicable. The @Pup column gives the state at true power up. Bytes are set to the values shown only on true power up, and not when the PWR_DWN# pin is activated.

Following the acknowledge of the Address Byte (D2), two additional bytes must be sent:
1) "**Command Code** " byte, and
2) "**Byte Count**" byte.
Although the data (bits) in these two bytes are considered "don't care", they must be sent and will be acknowledged.

After the Command Code and the Count bytes have been acknowledged, the below described sequence (Byte 0, Byte 1, Byte2, ...) will be valid and acknowledged.

Byte 0: Clock Output Select Register (1 = enable, 0 = Stopped)

Bit	@Pup	Pin#	Description
7	0	-	Reserved
6	0	-	Reserved
5	0	-	Reserved
4	0	-	Reserved
3	1	7	SDRAM3 (Active = 1, Forced low = 0)
2	1	6	SDRAM2 (Active = 1, Forced low = 0)
1	1	3	SDRAM1 (Active = 1, Forced low = 0)
0	1	2	SDRAM0 (Active = 1, Forced low = 0)

Serial Control Registers (Cont.)

Byte 1: Clock Output Select Register (1 = enable, 0 = Stopped)

Bit	@Pup	Pin#	Description
7	1	27	SDRAM9 (Active = 1, Forced low = 0)
6	1	26	SDRAM8 (Active = 1, Forced low = 0)
5	1	23	SDRAM7 (Active = 1, Forced low = 0)
4	1	22	SDRAM6 (Active = 1, Forced low = 0)
3	0	-	Reserved
2	0	-	Reserved
1	0	-	Reserved
0	0	-	Reserved

Byte 2: Clock Output Select Register (1 = enable, 0 = Stopped)

Bit	@Pup	Pin#	Description
7	1	18	SDRAM5 (Active = 1, Forced low = 0)
6	1	11	SDRAM4 (Active = 1, Forced low = 0)
5	0	-	Not Used
4	0	-	Not Used
3	0	-	Not Used
2	0	-	Not Used
1	0	-	Not Used
0	0	-	Not Used

Maximum Ratings

Maximum Input Voltage Relative to VSS: VSS - 0.3V
Maximum Input Voltage Relative to VDD:VDD + 0.3V
Storage Temperature: -65ºC to + 150ºC
Operating Temperature: 0ºC to +85ºC
Maximum ESD protection 2000V
Maximum Power Supply: 5.5V

This device contains circuitry to protect the inputs against damage due to high static voltages or electric field; however, precautions should be taken to avoid application of any voltage higher than the maximum rated voltages to this circuit. For proper operation, Vin and Vout should be constrained to the range:

VSS<(Vin or Vout)<VDD

Unused inputs must always be tied to an appropriate logic voltage level (either VSS or VDD).

DC Parameters

Characteristic	Symbol	Min	Typ	Max	Units	Conditions
Input Low Voltage	VIL1	-	-	1.0	Vdc	Applicable to OE input
Input High Voltage	VIH1	2.0	-	-	Vdc	
Input Low Voltage	VIL2	-	-	1.0	Vdc	Applicable to I²C's SDATA and SCLK inputs
Input High Voltage	VIH2	2.2	-	-	Vdc	
Input Low Current (@VIL = VSS)	IIL	-66		-5	µA	For internal Pull up resistors, Note 1
Input High Current (@VIL = VDD)	IIH			5	µA	
Tri-State leakage Current	Ioz	-	-	10	µA	
Dynamic Supply Current	Idd133	-	-	160	mA	Input clock=133MHz, all outputs ON and w/30pF
Dynamic Supply Current	Idd100	-	-	90	mA	Input clock=100MHz, all outputs ON and w/30pF
Static Supply Current	Isdd	-	-	400	µA	All outputs disabled, no input clock
Input pin capacitance	Cin	-	-	5	pF	
Output pin capacitance	Cout	-	-	6	pF	
Pin Inductance	Lpin	-	-	7	nH	
VDDB = VDDC = 3.3V ±5%, TA = 0ºC to +70ºC						

Note 1: Applicable to Sel48#, SDATA, and SCLK inputs. The pull-up resistor has a typical value of 250KΩ, but may vary between 200KΩ to 500KΩ

AC Parameters

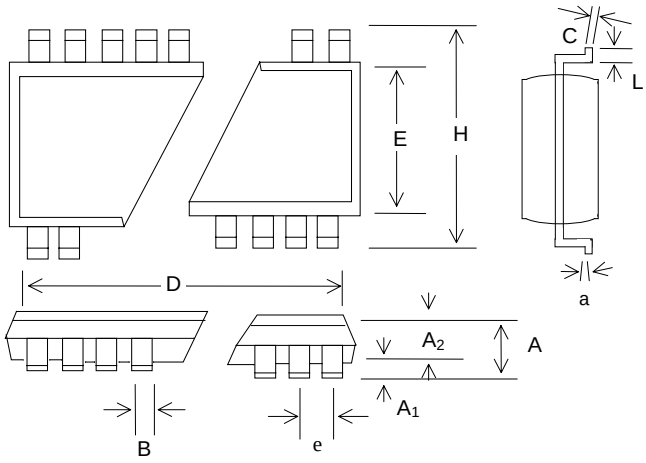
Characteristic	Symbol	Min	Typ	Max	Units	Conditions
Output Duty Cycle	-	45	50	55	%	Measured at 1.5V (50/50 in)
Buffer out/out Skew All Buffer Outputs	t_{SKEW}	-	-	250	pS	30 pF Load Measured at 1.5V
Buffer input to output Delay	t_{DLY}	1.0	-	5.0	nS	
Jitter Cycle to Cycle*	T_{JCC}			100	pS	@ 30 pF loading, 133MHz clock
Jitter Absolute (Peak to Peak)*	T_{Jabs}			150	pS	@ 30 pF loading, 133.3MHz clock
VDDB = VDDC = 3.3V ±5%, TA = 0ºC to +70ºC						

*This jitter is additive to the input clock's jitter.

SDRAM Type Buffer Characteristics (All Clock Outputs)

Characteristic	Symbol	Min	Typ	Max	Units	Conditions
Pull-Up Current , spec.1	I_{OH_1}	30	40	85	mA	Vout = VDD - 0.5V
Pull-Up Current , spec.2	I_{OH_2}	64	103	177	mA	Vout = VDD/2
Pull-Down Current Min	I_{OL_1}	23	34	53	mA	Vout = 0.4 V
Pull-Down Current Max	I_{OL_2}	64	100	175	mA	Vout = VDD/2
Buffer Output Impedance	Z_O	10	-	24	Ohms	100-133.3 MHz
Rise/Fall Time Min Between 0.4 V and 2.4 V	T_R T_F	0.5	-	1.33	nS	30 pF Load
VDDB=VDDC = 3.3V ±5%, TA = 0ºC to +70ºC						

Package Drawing and Dimensions



28 Pin SSOP Outline Dimensions

	INCHES			MILLIMETERS		
SYMBOL	MIN	NOM	MAX	MIN	NOM	MAX
A	0.068	0.073	0.078	1.73	1.86	1.99
A_1	0.002	0.005	0.008	0.05	0.13	0.21
A2	0.066	0.068	0.070	1.68	1.73	1.78
B	0.010	0.012	0.015	0.25	0.30	0.38
C	0.005	0.006	0.009	0.13	0.15	0.22
D	0.397	0.402	0.407	10.07	10.20	10.33
E	0.205	0.209	0.212	5.20	5.30	5.38
e	0.256 BSC			0.65 BSC		
H	0.301`	0.307	0.311	7.65	7.80	7.90
a	0°	4°	8°	0°	4°	8°
L	0.022	0.030	0.037	0.55	0.75	0.95

Ordering Information

Part Number	Package Type	Production Flow
B9660AYB	28 PIN SSOP	Commercial, -40ºC to +85ºC

Note: The ordering part number is formed by a combination of device number, device revision, package style, and screening as shown below.

Marking: Example: Cypress
B9660AYB
Date Code, Lot #

B9660AYB

- Flow
  B = Commercial, -40ºC to + 85ºC
- Package
  Y = SSOP
- Revision
- Device Number

Notice

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Rev.	**ECN No.**	**Issue Date**	**Orig. of Change**	**Description of Change**
**	107109	06/06/01	IKA	Convert from IMI to Cypress