

I²C System Clock Buffer

Preliminary

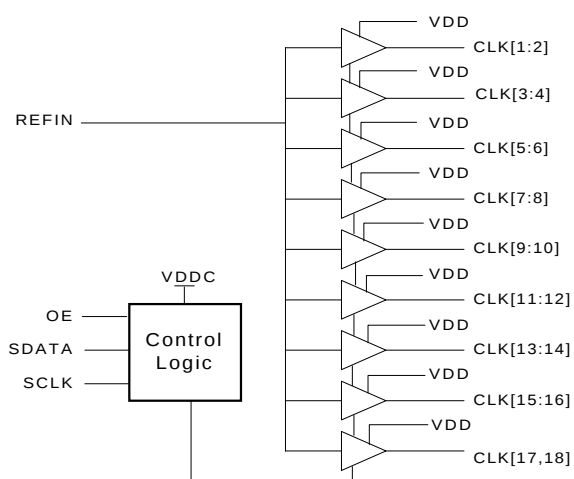
Product Features

- 18 output buffer for high clock fanout applications
- Each output can be disabled Through I²C
- 3.3Volts typical operation supply
- Frequency range 10 Mhz to 166.6 Mhz
- < 250ps skew between output clocks
- 48-pin SSOP package
- Tri-state enable for system testing.

Product Description

The IMI B9680 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

NC	1	48	NC
NC	2	47	NC
VDD	3	46	VDD
CLK1	4	45	CLK18
CLK2	5	44	CLK17
VSS	6	43	VSS
VDD	7	42	VDD
CLK3	8	41	CLK16
CLK4	9	40	CLK15
VSS	10	39	VSS
REFIN	11	38	OE
VDD	12	37	VDD
CLK5	13	36	CLK14
CLK6	14	35	CLK13
VSS	15	34	VSS
VDD	16	33	VDD
CLK7	17	32	CLK12
CLK8	18	31	CLK11
VSS	19	30	VSS
VDD	20	29	VDD
CLK9	21	28	CLK10
VSS	22	27	VSS
VDDC	23	26	VSSC
SDATA	24	25	SCLOCK

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Pin Description

PIN No.	Pin Name	PWR	I/O	TYPE	Description
11	REFIN	VDD	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.
4,5,8,9,13,14,17,18,21,28,31,32,35,36,40,41,44,45	CLK(1:18)	VDD	O	BUF1	Low skew output clock
38	OE	-	I	PAD	Buffer Output Enable pin. When forced to a logic low level this pin is used to place all output clocks (CLK1:18} 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 250K Ω
24	SDATA	VDDC	I	PAD	Serial data of I ² C 2-wire control interface. Has internal pull-up resistor, typically 250K Ω
25	SDCLK	VDDC	I	PAD	Serial clock of I ² C 2-wire control interface. Has internal pull-up resistor, typically 250K Ω
6, 10, 15, 19, 22, 27, 30, 34, 39, 43	VSS		PWR	-	Ground pins for clock output buffers. These pins must be returned to the same potential to reduce output clock skew.
3, 7, 12, 16, 20, 29, 33, 37, 42, 46	VDD	-	PWR	-	Power for output clock buffers.
23	VDDC	-	PWR	-	Power for core logic.
26	VSSC	-	PWR	-	Ground supply pins for internal core logic.
1,2,47,48	NC				No connection.

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2-Wire I²C 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, Byte 2,) will be valid and acknowledged.

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

Bit	@Pup	Pin#	Description
7	1	18	CLK8 (Active = 1, Forced low = 0)
6	1	17	CLK7 (Active = 1, Forced low = 0)
5	1	14	CLK6 (Active = 1, Forced low = 0)
4	1	13	CLK5 (Active = 1, Forced low = 0)
3	1	9	CLK4 (Active = 1, Forced low = 0)
2	1	8	CLK3 (Active = 1, Forced low = 0)
1	1	5	CLK2 (Active = 1, Forced low = 0)
0	1	4	CLK1 (Active = 1, Forced low = 0)

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Serial Control Registers (Cont.)

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

Bit	@Pup	Pin#	Description
7	1	45	CLK18 (Active = 1, Forced low = 0)
6	1	44	CLK17 (Active = 1, Forced low = 0)
5	1	41	CLK16 (Active = 1, Forced low = 0)
4	1	40	CLK15 (Active = 1, Forced low = 0)
3	1	36	CLK14 (Active = 1, Forced low = 0)
2	1	35	CLK13 (Active = 1, Forced low = 0)
1	1	32	CLK12 (Active = 1, Forced low = 0)
0	1	31	CLK11 (Active = 1, Forced low = 0)

Byte 2: Clock Output Register (1 = enable, 0 = Stopped, Default=C0)

Bit	@Pup	Pin#	Description
7	1	28	CLK10 (Active = 1, Forced low = 0)
6	1	21	CLK9 (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: -65°C to +150°C
 Operating Temperature: 0°C to +85°C
 Maximum ESD protection: 2KV
 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:

$$VSS < (V_{in} \text{ or } V_{out}) < VDD$$

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

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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 I ² C'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	
VDD = VDDC = 3.3V ±5%, TA = 0°C to +70°C						

Note 1: Applicable to 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	tSKEW	-	-	250	pS	30 pF Load Measured at 1.5V
Buffer input to output Delay	tDLY	1.0	-	5.0	nS	
Jitter Cycle to Cycle*	TJCC			100	pS	@ 30 pF loading, 133MHz clock
Jitter Absolute (Peak to Peak)*	TJabs			150	pS	@ 30 pF loading, 133.3MHz clock
VDD=VDDC = 3.3V ±5%, TA = 0°C to +70°C						

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

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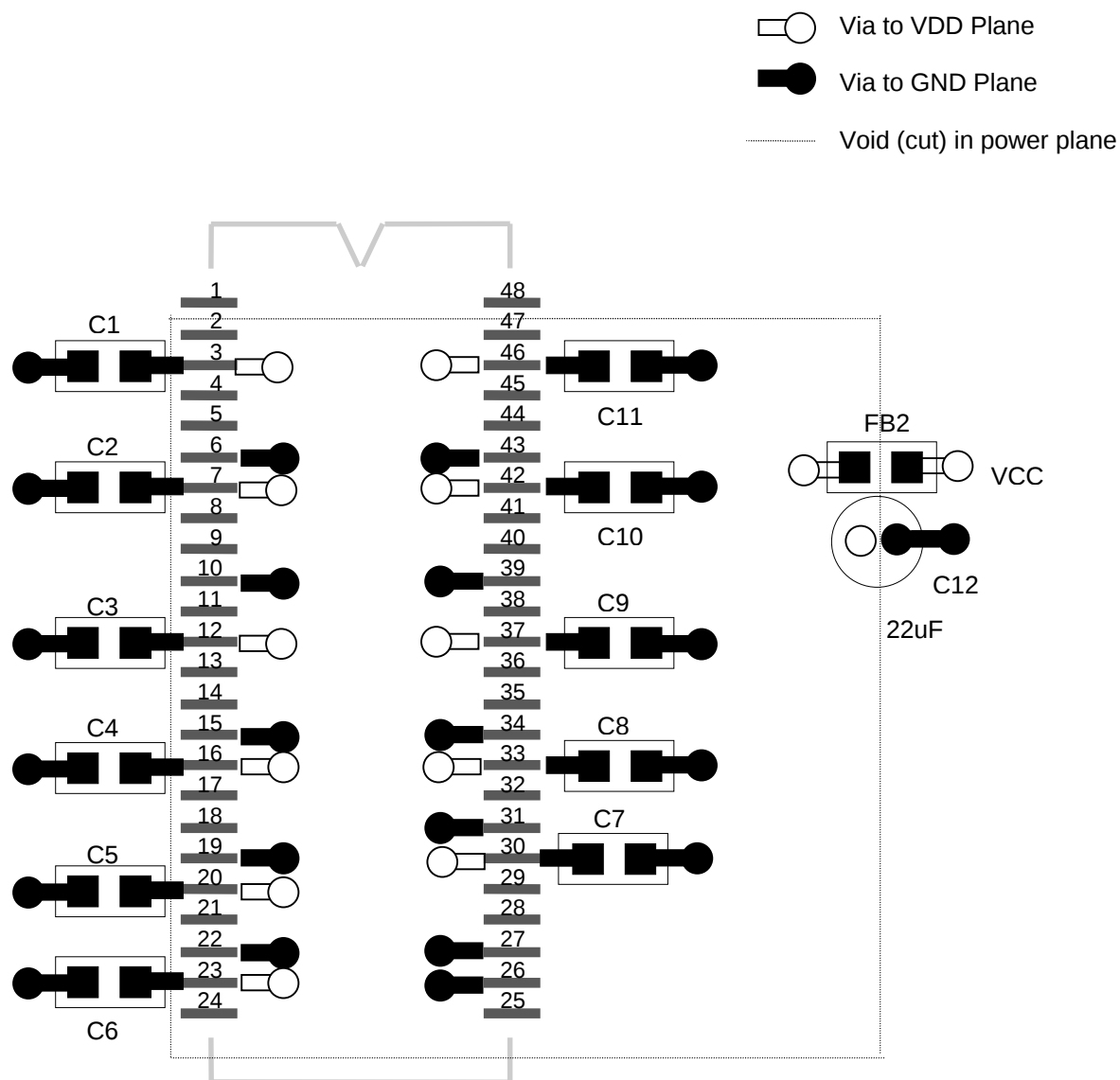
SDRAM Type Buffer Characteristics (All Clock Outputs)

Characteristic	Symbol	Min	Typ	Max	Units	Conditions
Pull-Up Current , spec.1	IOH ₁	30	40	85	mA	Vout = VDD - 0.5V
Pull-Up Current , spec.2	IOH ₂	64	103	177	mA	Vout = VDD/2
Pull-Down Current Min	IOL ₁	23	34	53	mA	Vout = 0.4 V
Pull-Down Current Max	IOL 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
VDD=VDDC = 3.3V ±5%, TA = 0°C to +70°C						

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PCB Layout Suggestion

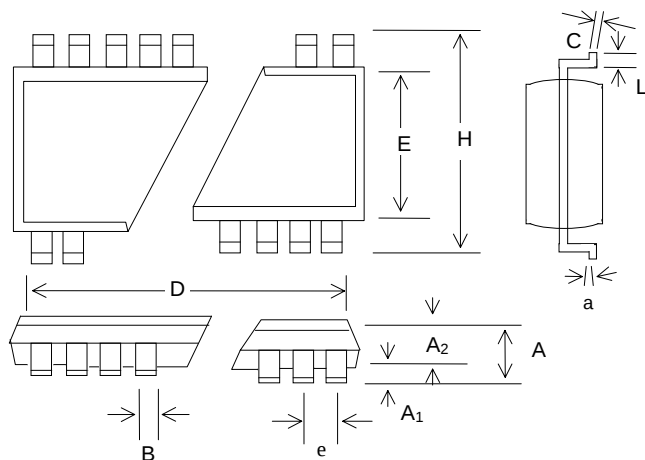


This is only a layout recommendation for best performance and lower EMI. the designer may choose a different approach but C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, and C11 (all are 0.1 uf) should always be used and placed as close to their VDD pins as is physically possible.

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Package Drawing and Dimensions



48 Pin SSOP Outline Dimensions

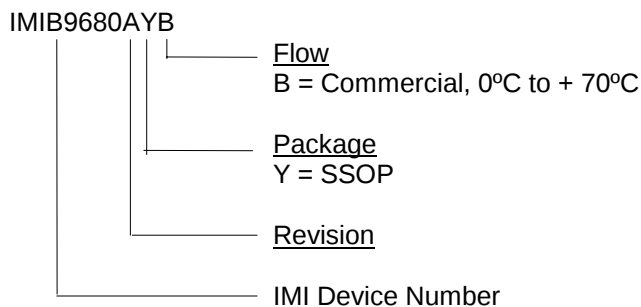
SYMBOL	INCHES			MILLIMETERS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.095	0.102	0.110	2.41	2.59	2.79
A ₁	0.008	0.012	0.016	0.20	0.31	0.41
A ₂	0.085	0.090	0.095	2.16	2.29	2.41
B	0.008	0.010	0.0135	0.203	0.254	0.343
c	0.005	.008	0.010	0.127	0.20	0.254
D	0.620	0.625	0.637	15.75	15.88	16.18
E	0.291	0.295	0.299	7.39	7.49	7.59
e	0.0256 BSC			0.640 BSC		
H	0.395	0.408	0.420	10.03	10.36	10.67
L	0.024	0.030	0.040	0.61	0.76	1.02
a	0°	4°	8°	0°	4°	8°

Ordering Information

Part Number	Package Type	Production Flow
IMIB9680AYB	48 PIN SSOP	Commercial, 0°C to +70°C

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

Marking: Example: IMI
B9680AYB
Date Code, Lot #



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