



### 12 Output Buffer for 2 DDR and 3 SRAM DIMMS

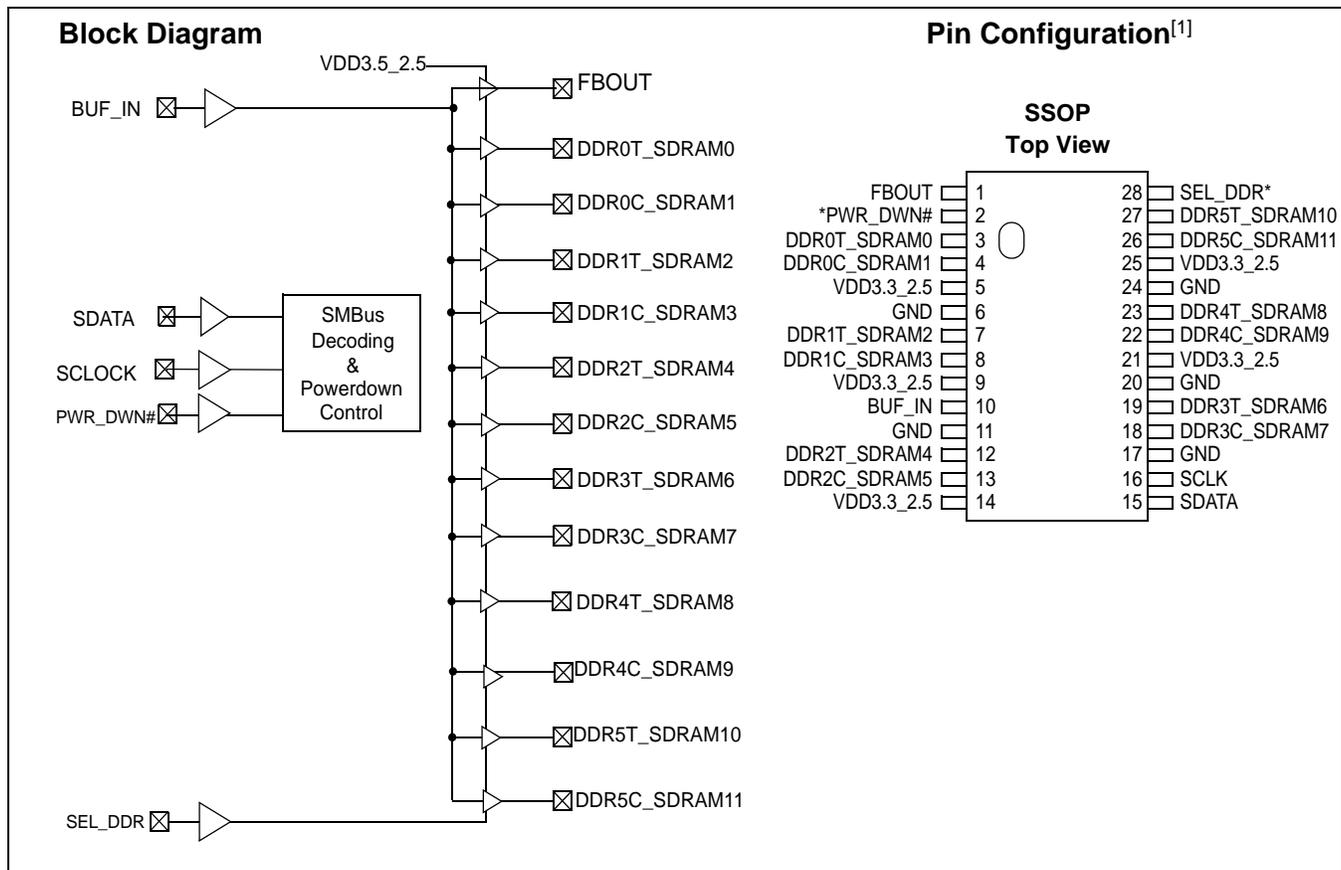
#### Features

- One input to 12 output buffer/drivers
- Supports up to 2 DDR DIMMs or 3 SDRAM DIMMS
- One additional output for feedback
- SMBus interface for individual output control
- Low skew outputs (< 100 ps)
- Supports 266 MHz and 333 MHz DDR SDRAM
- Dedicated pin for power management support
- Space-saving 28-pin SSOP package

#### Functional Description

The W256 is a 3.3V/2.5V buffer designed to distribute high-speed clocks in PC applications. The part has 12 outputs. Designers can configure these outputs to support 3 unbuffered standard SDRAM DIMMs and 2 DDR DIMMs. The W256 can be used in conjunction with the W250-02 or similar clock synthesizer for the VIA Pro 266 chipset.

The W256 also includes an SMBus interface which can enable or disable each output clock. On power-up, all output clocks are enabled (internal pull-up).



#### Note:

1. Internal 100K pull-up resistors present on inputs marked with \*. Design should not rely solely on internal pull-up resistor to set I/O pins HIGH.

**Pin Summary**

Name	Pins	Description
SEL_DDR	28	<b>Input to configure for DDR-ONLY mode or STANDARD SDRAM mode.</b> 1 = DDR-ONLY mode. 0 = STANDARD SDRAM mode. When SEL_DDR is pulled HIGH or configured for DDR-ONLY mode, all the buffers will be configured as DDR outputs. Connect VDD3.3_2.5 to a 2.5V power supply in DDR-ONLY mode. When SEL_DDR is pulled LOW or configured for STANDARD SDRAM output, all the buffers will be configured as STANDARD SDRAM outputs. Connect VDD3.3_2.5 to a 3.3V power supply in STANDARD SDRAM mode.
SCLK	16	<b>SMBus clock input.</b>
SDATA	15	<b>SMBus data input.</b>
BUF_IN	10	<b>Reference input from chipset.</b> 2.5V input for DDR-ONLY mode; 3.3V input for STANDARD SDRAM mode.
FBOUT	1	<b>Feedback clock for chipset.</b> Output voltage depends on VDD3.3_2.5V.
PWR_DWN#	2	<b>Active LOW input to enable Power Down mode; all outputs will be pulled LOW.</b>
DDR[0:5]T_SDRAM [0,2,4,6,8,10]	3, 7, 12, 19, 23, 27	<b>Clock outputs.</b> These outputs provide copies of BUF_IN. Voltage swing depends on VDD3.3_2.5 power supply.
DDR[0:5]C_SDRAM [1,3,5,7,9, 11]	4, 8, 13, 18, 22, 26	<b>Clock outputs.</b> These outputs provide complementary copies of BUF_IN when SEL_DDR is active. These outputs provide copies of BUF_IN when SEL_DDR is inactive. Voltage swing depends on VDD3.3_2.5 power supply.
VDD3.3_2.5	5, 9, 14, 21, 25	<b>Connect to 2.5V power supply when W256 is configured for DDR-ONLY mode.</b> Connect to 3.3V power supply, when W256 is configured for standard SDRAM mode.
GND	6, 11, 17, 20, 24	<b>Ground.</b>

**Serial Configuration Map**

- The Serial bits will be read by the clock driver in the following order:
  - Byte 0 — Bits 7, 6, 5, 4, 3, 2, 1, 0
  - Byte 1 — Bits 7, 6, 5, 4, 3, 2, 1, 0
  - ...
  - Byte N — Bits 7, 6, 5, 4, 3, 2, 1, 0
- Reserved and unused bits should be programmed to “0”.
- SMBus Address for the W256 is:

**Table 1.**

A6	A5	A4	A3	A2	A1	A0	R/W
1	1	0	1	0	0	1	—

**Byte 6: Outputs Active/Inactive Register  
(1 = Active, 0 = Inactive), Default = Active**

Bit	Pin #	Description	Default
Bit 7	—	Reserved, drive to 0	0
Bit 6	—	Reserved, drive to 0	0
Bit 5	—	Reserved, drive to 0	0
Bit 4	1	FBOUT	1
Bit 3	27, 26	DDR5T_SDRAM10, DDR5C_SDRAM11	1
Bit 2	—	Reserved, drive to 0	1
Bit 1	23, 22	DDR4T_SDRAM8, DDR4C_SDRAM9	1
Bit 0	—	Reserved, drive to 0	1

**Byte 7: Outputs Active/Inactive Register  
(1 = Active, 0 = Inactive), Default = Active**

Bit	Pin #	Description	Default
Bit 7	—	Reserved, drive to 0	1
Bit 6	19, 18	DDR3T_SDRAM6, DDR3C_SDRAM7	1
Bit 5	12, 13	DDR2T_SDRAM4, DDR2C_SDRAM5	1
Bit 4	—	Reserved, drive to 0	1
Bit 3	—	Reserved, drive to 0	1
Bit 2	7, 8	DDR1T_SDRAM2, DDR1C_SDRAM3	1
Bit 1	—	Reserved, drive to 0	1
Bit 0	3, 4	DDR0T_SDRAM0, DDR0C_SDRAM1	1

## Maximum Ratings

Supply Voltage to Ground Potential .....-0.5 to +7.0V  
 DC Input Voltage (except BUF\_IN) .....-0.5V to  $V_{DD}+0.5$   
 Storage Temperature .....-65°C to +150°C  
 Static Discharge Voltage .....>2000V  
 (per MIL-STD-883, Method 3015)

## Operating Conditions<sup>[2]</sup>

Parameter	Description	Min.	Typ.	Max.	Unit
$V_{DD3.3}$	Supply Voltage	3.135		3.465	V
$V_{DD2.5}$	Supply Voltage	2.375		2.625	V
$T_A$	Operating Temperature (Ambient Temperature)	0		70	°C
$C_{OUT}$	Output Capacitance		6		pF
$C_{IN}$	Input Capacitance		5		pF

## Electrical Characteristics Over the Operating Range

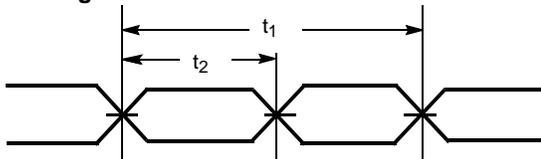
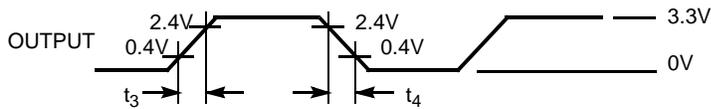
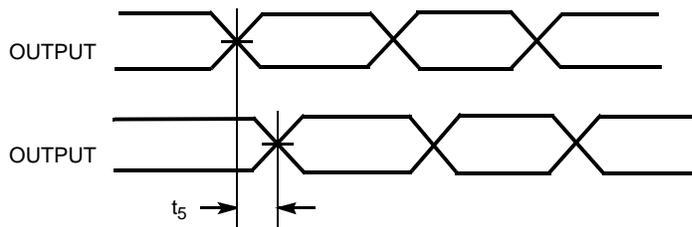
Parameter	Description	Test Conditions	Min.	Typ.	Max.	Unit
$V_{IL}$	Input LOW Voltage	For all pins except SMBus			0.8	V
$V_{IH}$	Input HIGH Voltage		2.0			V
$I_{IL}$	Input LOW Current	$V_{IN} = 0V$			50	μA
$I_{IH}$	Input HIGH Current	$V_{IN} = V_{DD}$			50	μA
$I_{OH}$	Output HIGH Current	$V_{DD} = 2.375V$ $V_{OUT} = 1V$	-18	-32		mA
$I_{OL}$	Output LOW Current	$V_{DD} = 2.375V$ $V_{OUT} = 1.2V$	26	35		mA
$V_{OL}$	Output LOW Voltage <sup>[3]</sup>	$I_{OL} = 12\text{ mA}$ , $V_{DD} = 2.375V$			0.6	V
$V_{OH}$	Output HIGH Voltage <sup>[3]</sup>	$I_{OH} = -12\text{ mA}$ , $V_{DD} = 2.375V$	1.7			V
$I_{DD}$	Supply Current <sup>[3]</sup> (DDR-Only mode)	Unloaded outputs, 133 MHz			400	mA
$I_{DD}$	Supply Current (DDR-Only mode)	Loaded outputs, 133 MHz			500	mA
$I_{DDS}$	Supply Current	$PWR\_DWN\# = 0$			100	μA
$V_{OUT}$	Output Voltage Swing	See Test Circuitry (Refer to Figure 1)	0.7		$V_{DD} + 0.6$	V
$V_{OC}$	Output Crossing Voltage		$(V_{DD}/2) - 0.1$	$V_{DD}/2$	$(V_{DD}/2) + 0.1$	V
$I_{DC}$	Input Clock Duty Cycle		48		52	%

### Notes:

- Multiple Supplies: The voltage on any input or I/O pin cannot exceed the power pin during power-up. Power supply sequencing is NOT required.
- Parameter is guaranteed by design and characterization. Not 100% tested in production.

**Switching Characteristics<sup>[4]</sup>**

Parameter	Name	Test Conditions	Min.	Typ.	Max.	Unit
–	Operating Frequency		66		180	MHz
–	Duty Cycle <sup>[4,5]</sup> = $t_2 \div t_1$	Measured at 1.4V for 3.3V outputs Measured at VDD/2 for 2.5V outputs.	$I_{NDC}$ –5%		$I_{NDC} + 5\%$	%
$t_3$	SDRAM Rising Edge Rate <sup>[4]</sup>	Measured between 0.4V and 2.4V	1.0		2.50	V/ns
$t_4$	SDRAM Falling Edge Rate <sup>[4]</sup>	Measured between 2.4V and 0.4V	1.0		2.50	V/ns
$t_{3d}$	DDR Rising Edge Rate <sup>[4]</sup>	Measured between 20% to 80% of output (Refer to <i>Figure 1</i> )	0.5		1.50	V/ns
$t_{4d}$	DDR Falling Edge Rate <sup>[4]</sup>	Measured between 20% to 80% of output (Refer to <i>Figure 1</i> )	0.5		1.50	V/ns
$t_5$	Output to Output Skew <sup>[4]</sup>	All outputs equally loaded			100	ps
$t_6$	Output t4o Output Skew for SDRAM <sup>[2]</sup>	All outputs equally loaded			150	ps
$t_7$	SDRAM Buffer HH Prop. Delay <sup>[4]</sup>	Input edge greater than 1 V/ns	5		10	ns
$t_8$	SDRAM Buffer LL Prop. Delay <sup>[4]</sup>	Input edge greater than 1 V/ns	5		10	ns

**Switching Waveforms**
**Duty Cycle Timing**

**All Outputs Rise/Fall Time**

**Output-Output Skew**

**Notes:**

4. All parameters specified with loaded outputs.
5. Duty cycle of input clock is 50%. Rising and falling edge rate is greater than 1V/ns.

**Switching Waveforms** (continued)

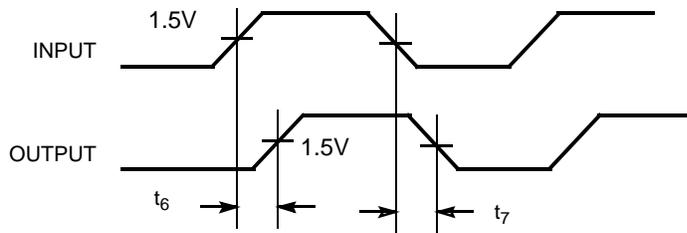
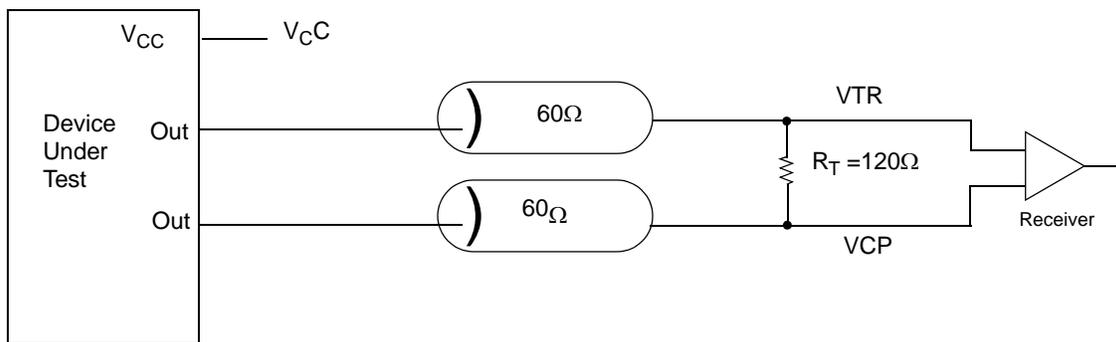
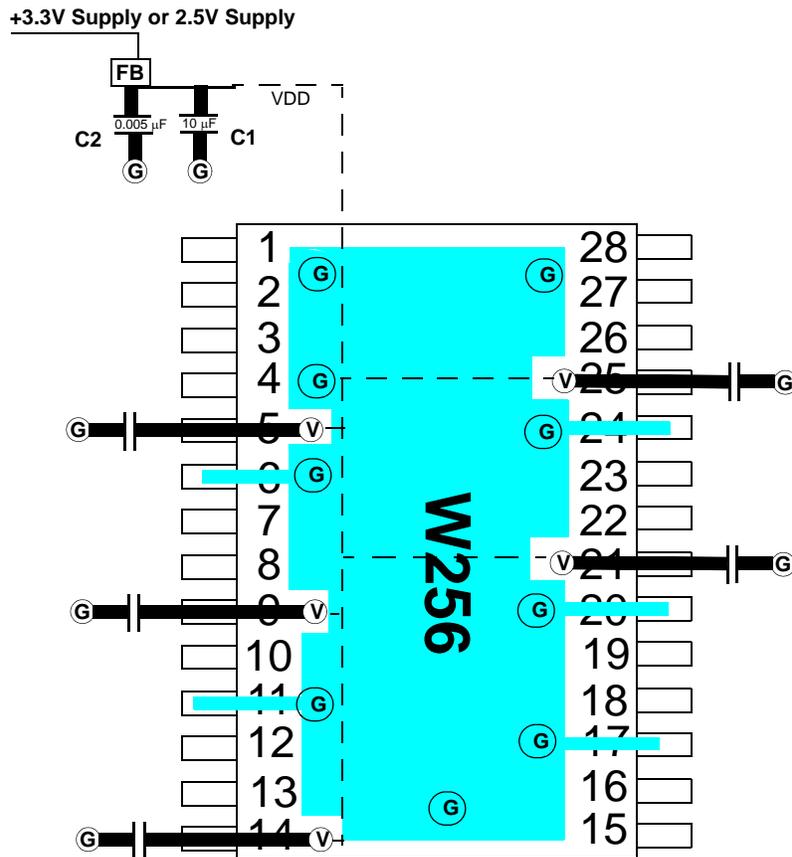
**SDRAM Buffer HH and LL Propagation Delay**


Figure 1 shows the differential clock directly terminated by a 120  $\Omega$  resistor.



**Figure 1. Differential Signal Using Direct Termination Resistor**

**Layout Example Single Voltage**


**FB = Dale ILB1206 – 300 (300Ω @ 100 MHz)**

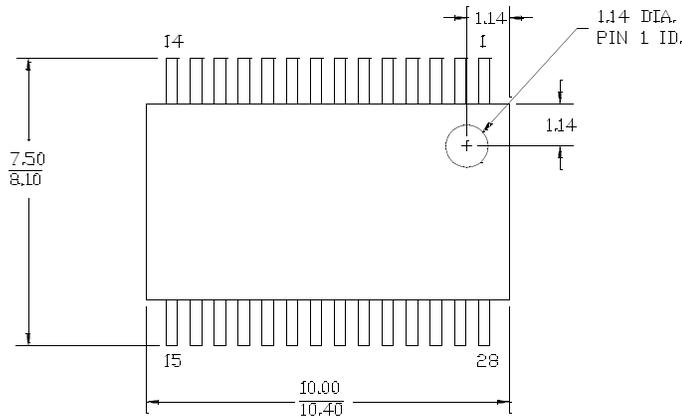
**Ceramic Caps C1 = 10–22 µF    C2 = 0.005 µF**

**ⓐ = VIA to GND plane layer    Ⓥ = VIA to respective supply plane layer**

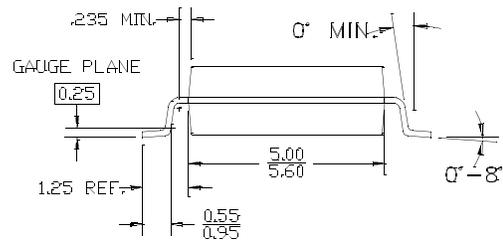
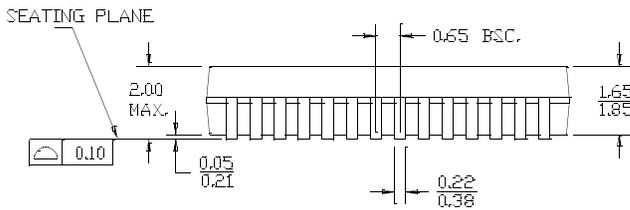
**Note: Each supply plane or strip should have a ferrite bead and capacitors  
All bypass caps = 0.1 µF ceramic**

**Ordering Information**

Ordering Code	Package Type	Operating Range
W256H	28-pin SSOP	Commercial
W256HT	28-pin SSOP – Tape and Reel	Commercial
<b>Lead Free</b>		
CYW256OXC	28-pin SSOP	Commercial
CYW256OXCT	28-pin SSOP – Tape and Reel	Commercial

**Package Drawings and Dimension**
**28-Lead (5.3 mm) Shrunk Small Outline Package O28**


DIMENSIONS IN MILLIMETERS    MIN.    MAX.



51-85079-°C

**Document History Page**

<b>Document Title: W256 12 Output Buffer for 2 DDR and 3 SRAM DIMMS</b>				
<b>Document Number: 38-07256</b>				
<b>REV.</b>	<b>ECN NO.</b>	<b>Issue Date</b>	<b>Orig. of Change</b>	<b>Description of Change</b>
**	110521	12/04/01	SZV	Change from Spec number: 38-01083 to 38-07256
*A	112153	03/01/02	IKA	Added 333 MHz for SDRAM
*B	122858	12/19/02	RBI	Added power requirements to operating conditions information.
*C	258671	See ECN	RGL	Added Lead Free Devices