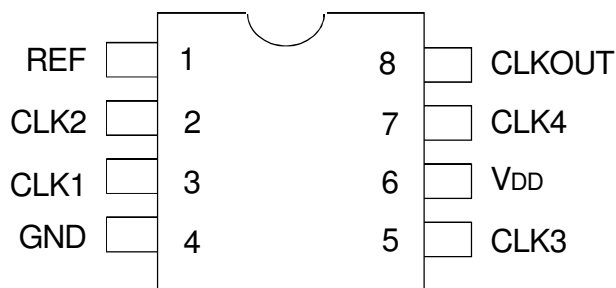




## PIN CONFIGURATION



## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Symbol	Rating	Max.	Unit
V <sub>DD</sub>	Supply Voltage Range	-0.5 to +4.6	V
V <sub>I</sub> <sup>(2)</sup>	Input Voltage Range (REF)	-0.5 to +5.5	V
V <sub>I</sub>	Input Voltage Range (except REF)	-0.5 to V <sub>DD</sub> +0.5	V
I <sub>IK</sub> (V <sub>I</sub> < 0)	Input Clamp Current	-50	mA
I <sub>O</sub> (V <sub>O</sub> = 0 to V <sub>DD</sub> )	Continuous Output Current	±50	mA
V <sub>DD</sub> or GND	Continuous Current	±100	mA
T <sub>A</sub> = 55°C (in still air) <sup>(3)</sup>	Maximum Power Dissipation	0.7	W
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C
Operating Temperature	Commercial Temperature Range	0 to +70	°C
Operating Temperature	Industrial Temperature Range	-40 to +85	°C

### NOTES:

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.
- The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

## APPLICATIONS:

- SDRAM
- Telecom
- Datacom
- PC Motherboards/Workstations
- Critical Path Delay Designs

## PIN DESCRIPTION

Pin Name	Pin Number	Type	Functional Description
REF <sup>(1)</sup>	1	IN	Input reference clock, 5 Volt tolerant input
CLK2 <sup>(2)</sup>	2	Out	Output clock
CLK1 <sup>(2)</sup>	3	Out	Output clock
GND	4	Ground	Ground
CLK3 <sup>(2)</sup>	5	Out	Output clock
V <sub>DD</sub>	6	PWR	3.3V Supply
CLK4 <sup>(2)</sup>	7	Out	Output clock
CLKOUT <sup>(2)</sup>	8	Out	Output clock, internal feedback on this pin

### NOTES:

- Weak pull down.
- Weak pull down on all outputs.

**OPERATING CONDITIONS - COMMERCIAL**

Symbol	Parameter	Min.	Max.	Unit
V <sub>DD</sub>	Supply Voltage	3	3.6	V
T <sub>A</sub>	Operating Temperature (Ambient Temperature)	0	70	°C
C <sub>L</sub>	Load Capacitance < 100MHz	—	30	pF
	Load Capacitance 100MHz - 133MHz	—	10	
C <sub>IN</sub>	Input Capacitance	—	7	pF

**DC ELECTRICAL CHARACTERISTICS - COMMERCIAL**

Symbol	Parameter	Conditions		Min.	Max.	Unit
V <sub>IL</sub>	Input LOW Voltage Level			—	0.8	V
V <sub>IH</sub>	Input HIGH Voltage Level			2	—	V
I <sub>IL</sub>	Input LOW Current	V <sub>IN</sub> = 0V		—	50	μA
I <sub>IH</sub>	Input HIGH Current	V <sub>IN</sub> = V <sub>DD</sub>		—	100	μA
V <sub>OL</sub>	Output LOW Voltage	Standard Drive	I <sub>OL</sub> = 8mA	—	0.4	V
		High Drive	I <sub>OL</sub> = 12mA (-1H)			
V <sub>OH</sub>	Output HIGH Voltage	Standard Drive	I <sub>OH</sub> = -8mA	2.4	—	V
		High Drive	I <sub>OH</sub> = -12mA (-1H)			
I <sub>DD_PD</sub>	Power Down Current	REF = 0MHz		—	12	μA
I <sub>DD</sub>	Supply Current	Unloaded Outputs at 66.66MHz		—	32	mA

**SWITCHING CHARACTERISTICS (23S05-1) - COMMERCIAL<sup>(1,2)</sup>**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
t <sub>f</sub>	Output Frequency	10pF Load	10	—	133	MHz
		30pF Load	10	—	100	
	Duty Cycle = t <sub>2</sub> ÷ t <sub>1</sub>	Measured at 1.4V, F <sub>OUT</sub> = 66.66MHz	40	50	60	%
t <sub>r</sub>	Rise Time	Measured between 0.8V and 2V	—	—	2.5	ns
t <sub>f</sub>	Fall Time	Measured between 0.8V and 2V	—	—	2.5	ns
t <sub>s</sub>	Output to Output Skew	All outputs equally loaded	—	—	250	ps
t <sub>d</sub>	Delay, REF Rising Edge to CLKOUT Rising Edge	Measured at V <sub>DD</sub> /2	—	0	±350	ps
t <sub>r</sub>	Device-to-Device Skew	Measured at V <sub>DD</sub> /2 on the CLKOUT pins of devices	—	0	700	ps
t <sub>j</sub>	Cycle-to-Cycle Jitter, pk - pk	Measured at 66.66MHz, loaded outputs	—	—	200	ps
t <sub>LOCK</sub>	PLL Lock Time	Stable power supply, valid clock presented on REF pin	—	—	1	ms

**NOTES:**

1. REF Input has a threshold voltage of V<sub>DD</sub>/2.
2. All parameters specified with loaded outputs.

## SWITCHING CHARACTERISTICS (23S05-1H) - COMMERCIAL <sup>(1,2)</sup>

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
t <sub>f</sub>	Output Frequency	10pF Load	10	—	133	MHz
		30pF Load	10	—	100	
	Duty Cycle = t <sub>2</sub> ÷ t <sub>1</sub>	Measured at 1.4V, F <sub>OUT</sub> = 66.66MHz	40	50	60	%
	Duty Cycle = t <sub>2</sub> ÷ t <sub>1</sub>	Measured at 1.4V, F <sub>OUT</sub> < 50MHz	45	50	55	%
t <sub>r</sub>	Rise Time	Measured between 0.8V and 2V	—	—	1.5	ns
t <sub>f</sub>	Fall Time	Measured between 0.8V and 2V	—	—	1.5	ns
t <sub>s</sub>	Output to Output Skew	All outputs equally loaded	—	—	250	ps
t <sub>d</sub>	Delay, REF Rising Edge to CLKOUT Rising Edge	Measured at V <sub>DD</sub> /2	—	0	±350	ps
t <sub>r</sub>	Device-to-Device Skew	Measured at V <sub>DD</sub> /2 on the CLKOUT pins of devices	—	0	700	ps
t <sub>s</sub>	Output Slew Rate	Measured between 0.8V and 2V using Test Circuit #2	1	—	—	V/ns
t <sub>j</sub>	Cycle-to-Cycle Jitter, pk - pk	Measured at 66.66MHz, loaded outputs	—	—	200	ps
t <sub>LOCK</sub>	PLL Lock Time	Stable power supply, valid clock presented on REF pin	—	—	1	ms

### NOTES:

1. REF Input has a threshold voltage of V<sub>DD</sub>/2.
2. All parameters specified with loaded outputs.

## OPERATING CONDITIONS - INDUSTRIAL

Symbol	Parameter	Min.	Max.	Unit
V <sub>DD</sub>	Supply Voltage	3	3.6	V
T <sub>A</sub>	Operating Temperature (Ambient Temperature)	-40	+85	°C
C <sub>L</sub>	Load Capacitance < 100MHz	—	30	pF
	Load Capacitance 100MHz - 133MHz	—	10	
C <sub>IN</sub>	Input Capacitance	—	7	pF

## DC ELECTRICAL CHARACTERISTICS - INDUSTRIAL

Symbol	Parameter	Conditions		Min.	Max.	Unit
V <sub>IL</sub>	Input LOW Voltage Level			—	0.8	V
V <sub>IH</sub>	Input HIGH Voltage Level			2	—	V
I <sub>IL</sub>	Input LOW Current	V <sub>IN</sub> = 0V		—	50	μA
I <sub>IH</sub>	Input HIGH Current	V <sub>IN</sub> = V <sub>DD</sub>		—	100	μA
V <sub>OL</sub>	Output LOW Voltage	Standard Drive	I <sub>OL</sub> = 8mA	—	0.4	V
		High Drive	I <sub>OL</sub> = 12mA (-1H)			
V <sub>OH</sub>	Output HIGH Voltage	Standard Drive	I <sub>OH</sub> = -8mA	2.4	—	V
		High Drive	I <sub>OH</sub> = -12mA (-1H)			
I <sub>DD_PD</sub>	Power Down Current	REF = 0MHz		—	25	μA
I <sub>DD</sub>	Supply Current	Unloaded Outputs at 66.66MHz		—	35	mA

**SWITCHING CHARACTERISTICS (23S05-1) - INDUSTRIAL** <sup>(1,2)</sup>

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
f <sub>t</sub>	Output Frequency	10pF Load	10	—	133	MHz
		30pF Load	10	—	100	
	Duty Cycle = t <sub>2</sub> ÷ t <sub>1</sub>	Measured at 1.4V, F <sub>OUT</sub> = 66.66MHz	40	50	60	%
t <sub>3</sub>	Rise Time	Measured between 0.8V and 2V	—	—	2.5	ns
t <sub>4</sub>	Fall Time	Measured between 0.8V and 2V	—	—	2.5	ns
t <sub>5</sub>	Output to Output Skew	All outputs equally loaded	—	—	250	ps
t <sub>6</sub>	Delay, REF Rising Edge to CLKOUT Rising Edge	Measured at V <sub>DD</sub> /2	—	0	±350	ps
t <sub>7</sub>	Device-to-Device Skew	Measured at V <sub>DD</sub> /2 on the CLKOUT pins of devices	—	0	700	ps
t <sub>J</sub>	Cycle-to-Cycle Jitter, pk - pk	Measured at 66.66MHz, loaded outputs	—	—	200	ps
t <sub>LOCK</sub>	PLL Lock Time	Stable power supply, valid clock presented on REF pin	—	—	1	ms

**NOTES:**

1. REF Input has a threshold voltage of V<sub>DD</sub>/2.
2. All parameters specified with loaded outputs.

**SWITCHING CHARACTERISTICS (23S05-1H) - INDUSTRIAL** <sup>(1,2)</sup>

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
f <sub>t</sub>	Output Frequency	10pF Load	10	—	133	MHz
		30pF Load	10	—	100	
	Duty Cycle = t <sub>2</sub> ÷ t <sub>1</sub>	Measured at 1.4V, F <sub>OUT</sub> = 66.66MHz	40	50	60	%
	Duty Cycle = t <sub>2</sub> ÷ t <sub>1</sub>	Measured at 1.4V, F <sub>OUT</sub> < 50MHz	45	50	55	%
t <sub>3</sub>	Rise Time	Measured between 0.8V and 2V	—	—	1.5	ns
t <sub>4</sub>	Fall Time	Measured between 0.8V and 2V	—	—	1.5	ns
t <sub>5</sub>	Output to Output Skew	All outputs equally loaded	—	—	250	ps
t <sub>6</sub>	Delay, REF Rising Edge to CLKOUT Rising Edge	Measured at V <sub>DD</sub> /2	—	0	±350	ps
t <sub>7</sub>	Device-to-Device Skew	Measured at V <sub>DD</sub> /2 on the CLKOUT pins of devices	—	0	700	ps
t <sub>8</sub>	Output Slew Rate	Measured between 0.8V and 2V using Test Circuit #2	1	—	—	V/ns
t <sub>J</sub>	Cycle-to-Cycle Jitter, pk - pk	Measured at 66.66MHz, loaded outputs	—	—	200	ps
t <sub>LOCK</sub>	PLL Lock Time	Stable power supply, valid clock presented on REF pin	—	—	1	ms

**NOTES:**

1. REF Input has a threshold voltage of V<sub>DD</sub>/2.
2. All parameters specified with loaded outputs.

## **ZERO DELAY AND SKEW CONTROL**

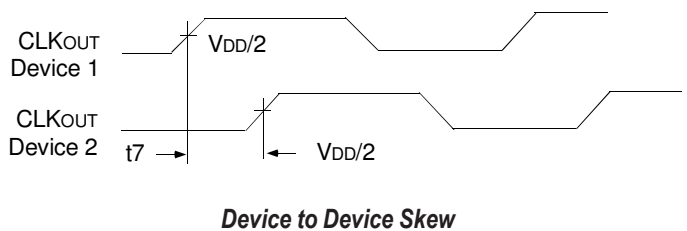
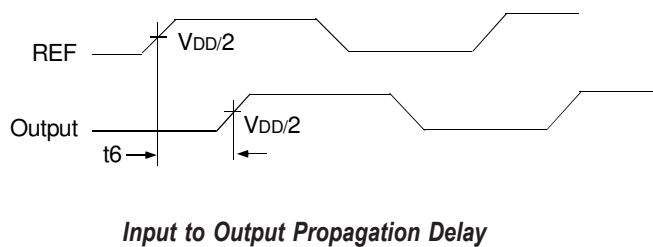
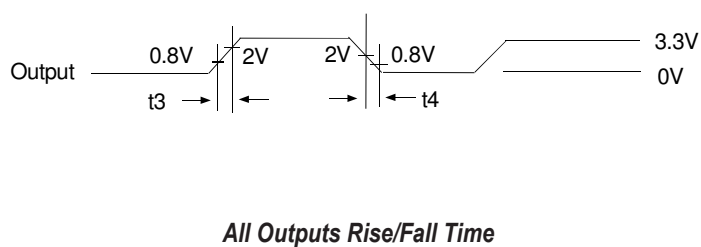
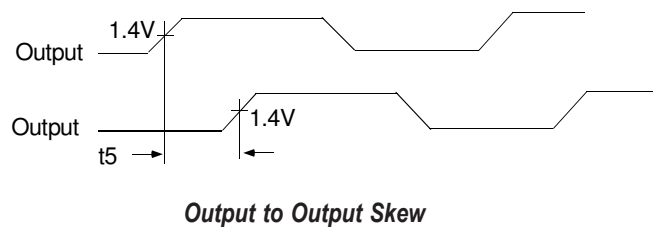
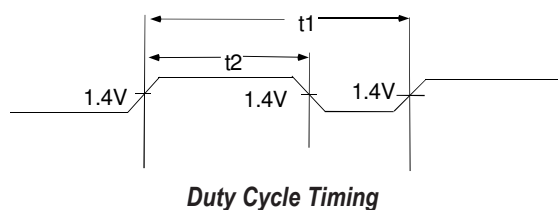
All outputs should be uniformly loaded in order to achieve Zero I/O Delay. Since the CLKOUT pin is the internal feedback for the PLL, its relative loading can affect and adjust the input/output delay.

For designs utilizing zero I/O Delay, all outputs including CLKOUT must be equally loaded. Even if the output is not used, it must have a capacitive load equal to that on the other outputs in order to obtain true zero I/O Delay. If I/O Delay adjustments are needed, use the Output Load Difference diagram to calculate loading differences between the CLKOUT pin and other outputs. For zero output-to-output skew, all outputs must be loaded equally.

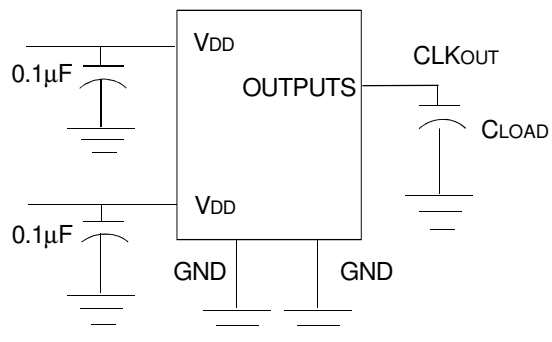
## **SPREAD SPECTRUM COMPATIBLE**

Many systems being designed now use a technology called Spread Spectrum Frequency Timing Generation. This product is designed not to filter off the Spread Spectrum feature of the reference input, assuming it exists. When a zero delay buffer is not designed to pass the Spread Spectrum feature through, the result is a significant amount of tracking skew, which may cause problems in systems requiring synchronization.

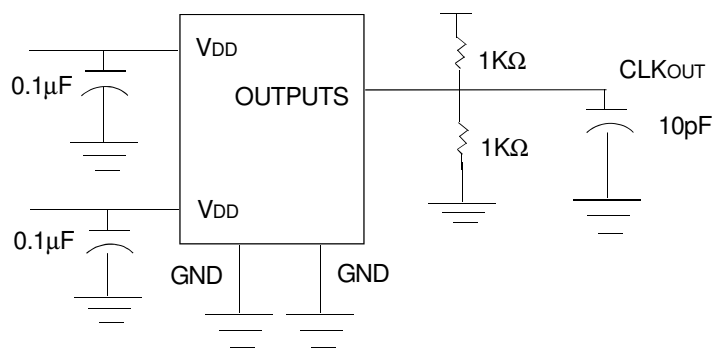
## SWITCHING WAVEFORMS



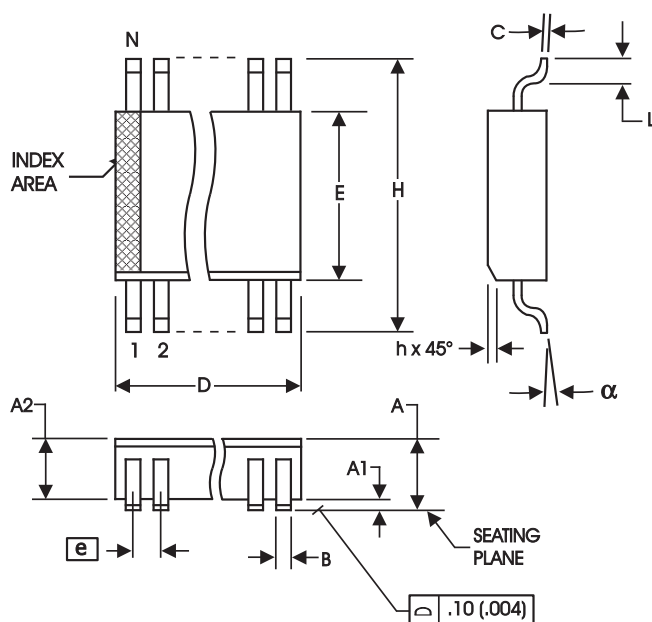
## TEST CIRCUITS



Test Circuit 1 (all Parameters Except  $t_8$ )



Test Circuit 2 ( $t_8$ , Output Slew Rate On -1H Devices)



150 mil (Narrow Body) SOIC

SYMBOL	In Millimeters COMMON DIMENSIONS		In Inches COMMON DIMENSIONS	
	MIN	MAX	MIN	MAX
A	1.35	1.75	.0532	.0688
A1	0.10	0.25	.0040	.0098
B	0.33	0.51	.013	.020
C	0.19	0.25	.0075	.0098
D	SEE VARIATIONS		SEE VARIATIONS	
E	3.80	4.00	.1497	.1574
e	1.27 BASIC		0.050 BASIC	
H	5.80	6.20	.2284	.2440
h	0.25	0.50	.010	.020
L	0.40	1.27	.016	.050
N	SEE VARIATIONS		SEE VARIATIONS	
a	0°	8°	0°	8°

VARIATIONS

N	D mm.		D (inch)	
	MIN	MAX	MIN	MAX
8	4.80	5.00	.1890	.1968

Reference Doc.: JEDEC Publication 95, MS-012



## ORDERING INFORMATION

IDT	XXXXX	XX	X		
Device Type	Package	Process			
			Blank	Commercial (0°C to +70°C)	
			I	Industrial (-40°C to +85°C)	
			DCG	SOIC - Green	
			23S05-1	Zero Delay Clock Buffer with	
			23S05-1H	High Drive, Spread Spectrum Compatible	

Part / Order Number	Shipping Packaging	Package	Temperature
23S05-1DCG	Tubes	8-pin SOIC	0° to +70° C
23S05-1DCG8	Tape and Reel	8-pin SOIC	0° to +70° C
23S05-1DCGI	Tubes	8-pin SOIC	-40° to +85° C
23S05-1DCGI8	Tape and Reel	8-pin SOIC	-40° to +85° C
23S05-1HDCG	Tubes	8-pin SOIC	0° to +70° C
23S05-1HDCG8	Tape and Reel	8-pin SOIC	0° to +70° C
23S05-1HDCGI	Tubes	8-pin SOIC	-40° to +85° C
23S05-1HDCGI8	Tape and Reel	8-pin SOIC	-40° to +85° C

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### Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

### Contact Information

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