

## Programmable Timing Control Hub™ for P4™ processor

### Recommended Application:

SIS 645/650 style chipsets.

### Output Features:

- 2 - Pairs of differential CPUCLKs (differential current mode)
- 1 - SDRAM @ 3.3V
- 8 - PCI @3.3V
- 2 - AGP @ 3.3V
- 2 - ZCLKs @ 3.3V
- 1- 48MHz, @3.3V fixed.
- 1- 24/48MHz, @3.3V selectable by I<sup>2</sup>C (Default is 24MHz)
- 3- REF @3.3V, 14.318MHz.

### Features/Benefits:

- Programmable output frequency, divider ratios, output rise/falltime, output skew.
- Programmable spread percentage for EMI control.
- Watchdog timer technology to reset system if system malfunctions.
- Programmable watch dog safe frequency.
- Support I<sup>2</sup>C Index read/write and block read/write operations.
- For PC133 SDRAM system use the ICS9179-06 as the memory buffer.
- For DDR SDRAM system use the ICS93705 or ICS93722 as the memory buffer.
- Uses external 14.318MHz crystal.

### Key Specifications:

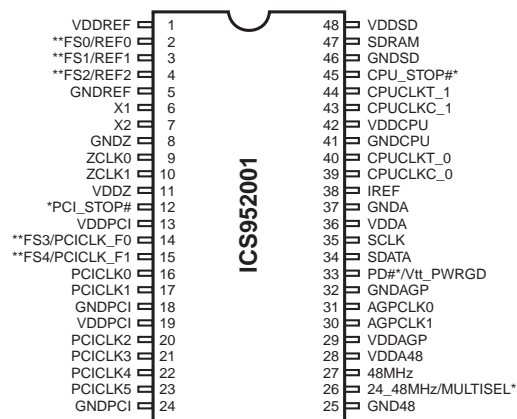
- PCI - PCI output skew: < 500ps
- CPU - SDRAM output skew: < 1ns
- AGP - AGP output skew: <150ps

### Functionality

| Bit 2 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | CPU    | SDRAM  | ZCLK  | AGP   |
|-------|-------|-------|-------|-------|--------|--------|-------|-------|
| FS4   | FS3   | FS2   | FS1   | FS0   | (MHz)  | (MHz)  | (MHz) | (MHz) |
| 0     | 0     | 0     | 0     | 0     | 66.67  | 66.67  | 66.67 | 66.67 |
| 0     | 0     | 0     | 0     | 1     | 100.00 | 100.00 | 66.67 | 66.67 |
| 0     | 0     | 0     | 1     | 0     | 100.00 | 200.00 | 66.67 | 66.67 |
| 0     | 0     | 0     | 1     | 1     | 100.00 | 133.33 | 66.67 | 66.67 |
| 0     | 0     | 1     | 0     | 0     | 100.00 | 150.00 | 60.00 | 60.00 |
| 0     | 0     | 1     | 0     | 1     | 100.00 | 125.00 | 62.50 | 62.50 |
| 0     | 0     | 1     | 1     | 0     | 100.00 | 160.00 | 66.67 | 66.67 |
| 0     | 0     | 1     | 1     | 1     | 100.00 | 133.33 | 80.00 | 66.67 |
| 0     | 1     | 0     | 0     | 0     | 100.00 | 200.00 | 66.67 | 66.67 |
| 0     | 1     | 0     | 0     | 1     | 100.00 | 166.67 | 62.50 | 62.50 |
| 0     | 1     | 0     | 1     | 0     | 100.00 | 166.67 | 71.43 | 83.33 |
| 0     | 1     | 0     | 1     | 1     | 80.00  | 133.33 | 66.67 | 66.67 |
| 0     | 1     | 1     | 0     | 0     | 80.00  | 133.33 | 66.67 | 66.67 |
| 0     | 1     | 1     | 0     | 1     | 95.00  | 95.00  | 63.33 | 63.33 |
| 0     | 1     | 1     | 1     | 0     | 95.00  | 126.67 | 63.33 | 63.33 |
| 0     | 1     | 1     | 1     | 1     | 66.67  | 66.67  | 50.00 | 50.00 |

Note: For additional margin testing frequencies, refer to Byte 4

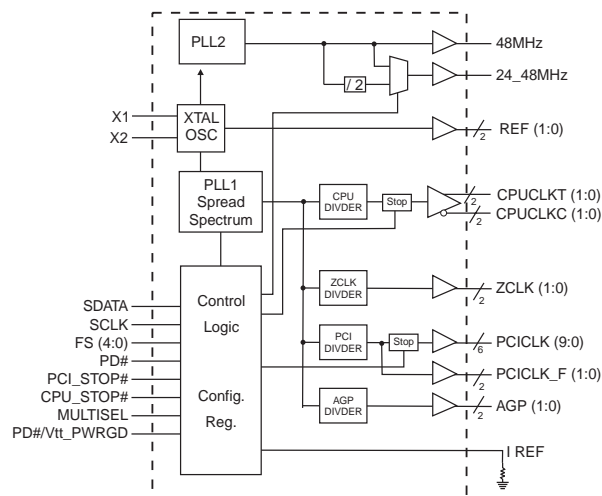
### Pin Configuration



### 48-Pin 300-mil SSOP and TSSOP

- \* These inputs have a 120K pull up to VDD.
- \*\* These inputs have a 120K pull down to GND.

### Block Diagram



### Power Groups

- VDDCPU = CPU
- VDDPCI = PCICLK\_F, PCICLK
- VDDSD = SDRAM
- AVDD48 = 48MHz, 24MHz, fixed PLL
- AVDD = Analog Core PLL
- VDDAGP = AGP
- VDDREF = Xtal, REF
- VDDZ = ZCLK

## General Description

The **ICS952001** is a two chip clock solution for desktop designs using SIS 645/650 style chipsets. When used with a zero delay buffer such as the ICS9179-06 for PC133 or the ICS93705 for DDR applications it provides all the necessary clocks signals for such a system.

The **ICS952001** is part of a whole new line of ICS clock generators and buffers called TCH™ (Timing Control Hub). ICS is the first to introduce a whole product line which offers full programmability and flexibility on a single clock device. Employing the use of a serially programmable I<sup>2</sup>C interface, this device can adjust the output clocks by configuring the frequency setting, the output divider ratios, selecting the ideal spread percentage, the output skew, the output strength, and enabling/disabling each individual output clock. TCH also incorporates ICS's Watchdog Timer technology and a reset feature to provide a safe setting under unstable system conditions. M/N control can configure output frequency with resolution up to 0.1MHz increment.

## Pin Description

| PIN NUMBER                       | PIN NAME      | TYPE | DESCRIPTION   |
|----------------------------------|---------------|------|---|
| 1, 11, 13, 19, 29, 42, 48        | VDD           | PWR  | Power supply for 3.3V   |
| 2                                | FS0           | IN   | Frequency select pin.   |
|                                  | REF0          | OUT  | 14.318 MHz reference clock.   |
| 3                                | FS1           | IN   | Frequency select pin.   |
|                                  | REF1          | OUT  | 14.318 MHz reference clock.   |
| 4                                | FS2           | IN   | Frequency select pin.   |
|                                  | REF2          | OUT  | 14.318 MHz reference clock.   |
| 5, 8, 18, 24, 25, 32, 37, 41, 46 | GND           | PWR  | Ground pin for 3V outputs.  |
| 6                                | X1            | IN   | Crystal input, nominally 14.318MHz.   |
| 7                                | X2            | OUT  | Crystal output, nominally 14.318MHz.  |
| 10, 9                            | ZCLK(1:0)     | OUT  | Hyperzip clock outputs.   |
| 12                               | PCI_STOP#     | IN   | Stops all PCICLKs besides the PCICLK_F clocks at logic 0 level, when MODE pin is in Mobile mode   |
| 14                               | FS3           | IN   | Frequency select pin.   |
|                                  | PCICLK_F0     | OUT  | PCI clock output, not affected by PCI_STOP#   |
| 15                               | FS4           | IN   | Frequency select pin.   |
|                                  | PCICLK_F1     | OUT  | PCI clock output, not affected by PCI_STOP#   |
| 23, 22, 21, 20, 17, 16           | PCICLK (5:0)  | OUT  | PCI clock outputs.  |
| 26                               | MULTISEL      | IN   | 3.3V LVTTTL input for selecting the current multiplier for CPU outputs.   |
|                                  | 24_48MHz      | OUT  | Clock output for super I/O/USB default is 24MHz   |
| 27                               | 48MHz         | OUT  | 48MHz output clock  |
| 28, 36                           | AVDD          | PWR  | Analog power supply 3.3V  |
| 30, 31                           | AGPCLK (1:0)  | OUT  | AGP outputs defined as 2X PCI. These may not be stopped.  |
| 33                               | PD#           | IN   | Asynchronous active low input pin used to power down the device into a low power state. The internal clocks are disabled and the VCO and the crystal are stopped. The latency of the power down will not be greater than 3ms. |
|                                  | Vtt_PWRGD     | IN   | This pin acts as a dual function input pin for Vtt_PWRGD and PD# signal. When Vtt_PWRGD goes high the frequency select will be latched at power on thereafter the pin is an asynchronous active low power down pin.           |
| 34                               | SDATA         | I/O  | Data pin for I <sup>2</sup> C circuitry 5V tolerant   |
| 35                               | SCLK          | IN   | Clock pin of I <sup>2</sup> C circuitry 5V tolerant   |
| 38                               | I REF         | OUT  | This pin establishes the reference current for the CPUCLK pairs. This pin requires a fixed precision resistor tied to ground in order to establish the appropriate current.   |
| 43, 39                           | CPUCLKC (1:0) | OUT  | "Complementary" clocks of differential pair CPU outputs. These clocks are 180° out of phase with SDRAM clocks. These open drain outputs need an external 1.5V pull-up.  |
| 44, 40                           | CPUCLKT (1:0) | OUT  | "True" clocks of differential pair CPU outputs. These clocks are in phase with SDRAM clocks. These open drain outputs need an external 1.5V pull up.  |
| 45                               | CPU_STOP#     | IN   | Stops all CPUCLKs clocks at logic 0 level, when MODE pin is in Mobile mode  |
| 47                               | SDRAM         | OUT  | SDRAM clock output.   |

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## CPUCLK Swing Select Functions

| MULTSEL0 | Byte 23<br>Bit 7 | Board Target<br>Trace/Term Z | Reference R,<br>Iref=<br>Vdd/(3*Rr) | Output<br>Current | Voh @ Z,<br>Iref=2.32mA |
|----------|------------------|------------------------------|-------------------------------------|-------------------|-------------------------|
| 0        | 0                | 60 ohms                      | Rr = 475 1%<br>Iref = 2.32mA        | Ioh = 5*Iref      | 0.71V @ 60              |
| 0        | 0                | 50 ohms                      | Rr = 475 1%<br>Iref = 2.32mA        | Ioh = 5*Iref      | 0.59V @ 50              |
| 0        | 1                | 60 ohms                      | Rr = 475 1%<br>Iref = 2.32mA        | Ioh = 4*Iref      | 0.56V @ 60              |
| 0        | 1                | 50 ohms                      | Rr = 475 1%<br>Iref = 2.32mA        | Ioh = 4*Iref      | 0.47V @ 50              |
| 1        | 0                | 60 ohms                      | Rr = 475 1%<br>Iref = 2.32mA        | Ioh = 6*Iref      | 0.85V /2 60             |
| 1        | 0                | 50 ohms                      | Rr = 475 1%<br>Iref = 2.32mA        | Ioh = 6*Iref      | 0.71V @ 50              |
| 1        | 1                | 60 ohms                      | Rr = 475 1%<br>Iref = 2.32mA        | Ioh = 7*Iref      | 0.99V @ 60              |
| 1        | 1                | 50 ohms                      | Rr = 475 1%<br>Iref = 2.32mA        | Ioh = 7*Iref      | 0.82V @ 50              |
| 0        | 0                | 30 (DC equiv)                | Rr = 221 1%<br>Iref = 5mA           | Ioh = 5*Iref      | 0.75V @ 30              |
| 0        | 0                | 25 (DC equiv)                | Rr = 221 1%<br>Iref = 5mA           | Ioh = 5*Iref      | 0.62V @ 20              |
| 0        | 1                | 30 (DC equiv)                | Rr = 221 1%<br>Iref = 5mA           | Ioh = 4*Iref      | 0.60 @ 20               |
| 0        | 1                | 25 (DC equiv)                | Rr = 221 1%<br>Iref = 5mA           | Ioh = 4*Iref      | 0.5V @ 20               |
| 1        | 0                | 30 (DC equiv)                | Rr = 221 1%<br>Iref = 5mA           | Ioh = 6*Iref      | 0.90V @ 30              |
| 1        | 0                | 25 (DC equiv)                | Rr = 221 1%<br>Iref = 5mA           | Ioh = 6*Iref      | 0.75V @ 20              |
| 1        | 1                | 30 (DC equiv)                | Rr = 221 1%<br>Iref = 5mA           | Ioh = 7*Iref      | 1.05V @ 30              |
| 1        | 1                | 25 (DC equiv)                | Rr = 221 1%<br>Iref = 5mA           | Ioh = 7*Iref      | 0.84V @ 20              |

## General I<sup>2</sup>C serial interface information for the ICS952001

### How to Write:

- Controller (host) sends a start bit.
- Controller (host) sends the write address D2<sub>(H)</sub>
- ICS clock will **acknowledge**
- Controller (host) sends the beginning byte location = N
- ICS clock will **acknowledge**
- Controller (host) sends the data byte count = X
- ICS clock will **acknowledge**
- Controller (host) starts sending **Byte N through Byte N + X - 1**  
(see Note 2)
- ICS clock will **acknowledge** each byte **one at a time**
- Controller (host) sends a Stop bit

| Index Block Write Operation     |           |                      |
|---------------------------------|-----------|----------------------|
| Controller (Host)               |           | ICS (Slave/Receiver) |
| T                               | starT bit |                      |
| Slave Address D2 <sub>(H)</sub> |           |                      |
| WR                              | WRite     |                      |
|                                 |           | ACK                  |
| Beginning Byte = N              |           |                      |
|                                 |           | ACK                  |
| Data Byte Count = X             |           |                      |
|                                 |           | ACK                  |
| Beginning Byte N                |           | X Byte               |
| ○                               |           |                      |
| ○                               |           |                      |
| ○                               |           |                      |
| Byte N + X - 1                  |           |                      |
|                                 |           | ACK                  |
| P                               | stoP bit  |                      |

### How to Read:

- Controller (host) will send start bit.
- Controller (host) sends the write address D2<sub>(H)</sub>
- ICS clock will **acknowledge**
- Controller (host) sends the beginning byte location = N
- ICS clock will **acknowledge**
- Controller (host) will send a separate start bit.
- Controller (host) sends the read address D3<sub>(H)</sub>
- ICS clock will **acknowledge**
- ICS clock will send the data byte count = X
- ICS clock sends **Byte N + X - 1**
- ICS clock sends **Byte 0 through byte X (if X<sub>(H)</sub> was written to byte 8)**.
- Controller (host) will need to acknowledge each byte
- Controller (host) will send a not acknowledge bit
- Controller (host) will send a stop bit

| Index Block Read Operation      |                 |                      |
|---------------------------------|-----------------|----------------------|
| Controller (Host)               |                 | ICS (Slave/Receiver) |
| T                               | starT bit       |                      |
| Slave Address D2 <sub>(H)</sub> |                 |                      |
| WR                              | WRite           |                      |
|                                 |                 | ACK                  |
| Beginning Byte = N              |                 |                      |
|                                 |                 | ACK                  |
| RT                              | Repeat starT    |                      |
| Slave Address D3 <sub>(H)</sub> |                 |                      |
| RD                              | ReaD            |                      |
|                                 |                 | ACK                  |
|                                 |                 | Data Byte Count = X  |
| ACK                             |                 |                      |
|                                 |                 | X Byte               |
| ACK                             |                 |                      |
| ○                               |                 |                      |
| ○                               |                 |                      |
| ○                               |                 |                      |
|                                 |                 | Byte N + X - 1       |
| N                               | Not acknowledge |                      |
| P                               | stoP bit        |                      |

\*See notes on the following page.

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## Serial Configuration Command Bitmap

Bytes 0-3: Are reserved for external clock buffer.

Byte4: Functionality and Frequency Select Register (default = 0)

| Bit              | Description  |       |       |       |       |        |        |        |       |       |                         | PWD                     |  |
|------------------|--|-------|-------|-------|-------|--------|--------|--------|-------|-------|-------------------------|-------------------------|--|
| Bit 2<br>Bit 7:4 | Bit 2  | Bit 7 | Bit 6 | Bit 5 | Bit 4 |        |        |        |       |       |                         |                         |  |
|                  | FS4  | FS3   | FS2   | FS1   | FS0   | CPU    | SDRAM  | ZCLK   | AGP   | PCI   | Spread Percentage       |                         |  |
|                  | 0  | 0     | 0     | 0     | 0     | 0      | 66.67  | 66.67  | 66.67 | 66.67 | 33.33                   | 0 to -0.5% Down Spread  |  |
|                  | 0  | 0     | 0     | 0     | 1     | 1      | 100.00 | 100.00 | 66.67 | 66.67 | 33.33                   | 0 to -0.5% Down Spread  |  |
|                  | 0  | 0     | 0     | 1     | 0     | 0      | 100.00 | 200.00 | 66.67 | 66.67 | 33.33                   | 0 to -0.5% Down Spread  |  |
|                  | 0  | 0     | 0     | 1     | 1     | 0      | 100.00 | 133.33 | 66.67 | 66.67 | 33.33                   | 0 to -0.5% Down Spread  |  |
|                  | 0  | 0     | 1     | 0     | 0     | 0      | 100.00 | 150.00 | 60.00 | 60.00 | 30.00                   | +/- 0.25% Center Spread |  |
|                  | 0  | 0     | 1     | 0     | 1     | 0      | 100.00 | 125.00 | 62.50 | 62.50 | 31.25                   | +/- 0.25% Center Spread |  |
|                  | 0  | 0     | 1     | 1     | 0     | 0      | 100.00 | 160.00 | 66.67 | 66.67 | 33.33                   | +/- 0.25% Center Spread |  |
|                  | 0  | 0     | 1     | 1     | 1     | 0      | 100.00 | 133.33 | 80.00 | 66.67 | 33.33                   | 0 to -0.5% Down Spread  |  |
|                  | 0  | 1     | 0     | 0     | 0     | 0      | 100.00 | 200.00 | 66.67 | 66.67 | 33.33                   | +/- 0.25% Center Spread |  |
|                  | 0  | 1     | 0     | 0     | 1     | 0      | 100.00 | 166.67 | 62.50 | 62.50 | 31.25                   | 0 to -0.5% Down Spread  |  |
|                  | 0  | 1     | 0     | 1     | 0     | 0      | 100.00 | 166.67 | 71.43 | 83.33 | 41.67                   | +/- 0.25% Center Spread |  |
|                  | 0  | 1     | 0     | 1     | 1     | 0      | 80.00  | 133.33 | 66.67 | 66.67 | 33.33                   | +/- 0.25% Center Spread |  |
|                  | 0  | 1     | 1     | 0     | 0     | 0      | 80.00  | 133.33 | 66.67 | 66.67 | 33.33                   | +/- 0.25% Center Spread |  |
|                  | 0  | 1     | 1     | 0     | 1     | 0      | 95.00  | 95.00  | 63.33 | 63.33 | 31.67                   | +/- 0.25% Center Spread |  |
|                  | 0  | 1     | 1     | 1     | 0     | 0      | 95.00  | 126.67 | 63.33 | 63.33 | 31.67                   | +/- 0.25% Center Spread |  |
|                  | 0  | 1     | 1     | 1     | 1     | 0      | 66.67  | 66.67  | 50.00 | 50.00 | 25.00                   | +/- 0.25% Center Spread |  |
|                  | 1  | 0     | 0     | 0     | 0     | 0      | 105.00 | 140.00 | 70.00 | 70.00 | 35.00                   | +/- 0.25% Center Spread |  |
|                  | 1  | 0     | 0     | 0     | 1     | 0      | 100.90 | 100.90 | 67.27 | 67.27 | 33.63                   | +/- 0.25% Center Spread |  |
|                  | 1  | 0     | 0     | 1     | 0     | 0      | 108.00 | 144.00 | 72.00 | 72.00 | 36.00                   | +/- 0.25% Center Spread |  |
|                  | 1  | 0     | 0     | 1     | 1     | 0      | 100.90 | 134.53 | 67.27 | 67.27 | 33.63                   | +/- 0.25% Center Spread |  |
|                  | 1  | 0     | 1     | 0     | 0     | 0      | 112.00 | 149.33 | 74.67 | 74.67 | 37.33                   | +/- 0.25% Center Spread |  |
|                  | 1  | 0     | 1     | 0     | 1     | 0      | 133.33 | 100.00 | 66.67 | 66.67 | 33.33                   | 0 to -0.5% Down Spread  |  |
|                  | 1  | 0     | 1     | 1     | 0     | 0      | 133.33 | 133.33 | 66.67 | 66.67 | 33.33                   | +/- 0.25% Center Spread |  |
|                  | 1  | 0     | 1     | 1     | 1     | 0      | 133.33 | 166.67 | 66.67 | 66.67 | 33.33                   | +/- 0.25% Center Spread |  |
|                  | 1  | 1     | 0     | 0     | 0     | 0      | 100.00 | 133.00 | 80.00 | 66.67 | 33.33                   | +/- 0.25% Center Spread |  |
|                  | 1  | 1     | 0     | 0     | 1     | 0      | 100.00 | 100.00 | 80.00 | 66.67 | 33.33                   | +/- 0.25% Center Spread |  |
| 1                | 1  | 0     | 1     | 0     | 0     | 100.00 | 166.67 | 83.33  | 62.50 | 31.25 | +/- 0.25% Center Spread |                         |  |
| 1                | 1  | 0     | 1     | 1     | 0     | 133.33 | 160.00 | 80.00  | 66.67 | 33.33 | +/- 0.25% Center Spread |                         |  |
| 1                | 1  | 1     | 0     | 0     | 0     | 100.00 | 133.00 | 100.00 | 66.67 | 33.33 | +/- 0.25% Center Spread |                         |  |
| 1                | 1  | 1     | 0     | 1     | 0     | 100.00 | 100.00 | 100.00 | 66.67 | 33.33 | +/- 0.25% Center Spread |                         |  |
| 1                | 1  | 1     | 1     | 0     | 0     | 100.00 | 133.00 | 100.00 | 66.67 | 33.33 | +/- 0.25% Center Spread |                         |  |
| 1                | 1  | 1     | 1     | 1     | 0     | 100.00 | 166.67 | 100.00 | 62.50 | 31.25 | +/- 0.25% Center Spread |                         |  |
| 1                | 1  | 1     | 1     | 1     | 1     | 133.33 | 160.00 | 100.00 | 66.67 | 33.33 | +/- 0.25% Center Spread |                         |  |
| Bit 3            | 0 - Frequency is selected by hardware select, Latched Inputs<br>1 - Frequency is selected by Bit , 2 7:4 |       |       |       |       |        |        |        |       |       |                         | 0                       |  |
| Bit 1            | 0 - Normal<br>1 - Spread Spectrum Enabled  |       |       |       |       |        |        |        |       |       |                         | 0                       |  |
| Bit 0            | 0 - Running<br>1- Tristate all outputs   |       |       |       |       |        |        |        |       |       |                         | 0                       |  |

00000  
Note1

**Note1:**

Default at power-up will be for latched logic inputs to define frequency, as displayed by Bit 3.

**Note:** PWD = Power-Up Default



**Byte 5: Control Register**  
(1 = enable, 0 = disable)

| Bit   | Pin# | PWD | Description                       |
|-------|------|-----|-----------------------------------|
| Bit 7 | 30   | 1   | AGPCLK1                           |
| Bit 6 | 31   | 1   | AGPCLK1                           |
| Bit 5 | 26   | 0   | SEL24_48MHz<br>(1=24MHz, 0=48MHz) |
| Bit 4 | 15   | X   | FS4 Read Back                     |
| Bit 3 | 14   | X   | FS3 Read Back                     |
| Bit 2 | 4    | X   | FS2 Read Back                     |
| Bit 1 | 3    | X   | FS1 Read Back                     |
| Bit 0 | 2    | X   | FS0 Read Back                     |

**Byte 6: Output Control Register**  
(1 = enable, 0 = disable)

| Bit   | Pin#   | PWD | Description   |
|-------|--------|-----|---|
| Bit 7 | 10     | 1   | ZCLK1   |
| Bit 6 | 9      | 1   | ZCLK0   |
| Bit 5 | 14     | 0   | PCICLK_F0 stop control<br>0 = Free Running; 1 = Stop  |
| Bit 4 | 15     | 0   | PCICLK_F1 stop control<br>0 = Free Running; 1 = Stop  |
| Bit 3 | 40, 39 | 1   | CPUCLKT/C0 stop control<br>0 = Free Running; 1 = Stop |
| Bit 2 | 44, 43 | 1   | CPUCLKT/C1 stop control<br>0 = Free Running; 1 = Stop |
| Bit 1 | 39, 40 | 1   | CPUCLKT/C0 output control                             |
| Bit 0 | 43, 44 | 1   | CPUCLKT/C1 output control                             |

**Byte 7: Output Control Register**  
(1 = enable, 0 = disable)

| Bit   | Pin# | PWD | Description |
|-------|------|-----|-------------|
| Bit 7 | 15   | 1   | PCICLK_F1   |
| Bit 6 | 14   | 1   | PCICLK_F0   |
| Bit 5 | 23   | 1   | PCICLK5     |
| Bit 4 | 22   | 1   | PCICLK4     |
| Bit 3 | 21   | 1   | PCICLK3     |
| Bit 2 | 20   | 1   | PCICLK2     |
| Bit 1 | 17   | 1   | PCICLK1     |
| Bit 0 | 16   | 1   | PCICLK0     |

**Byte 8: Byte Count Read Back Register**

| Bit   | Name  | PWD | Description   |
|-------|-------|-----|---|
| Bit 7 | Byte7 | 0   | Note: Writing to this register will configure byte count and how many bytes will be read back, default is 0F <sub>H</sub> = 15 bytes. |
| Bit 6 | Byte6 | 0   |   |
| Bit 5 | Byte5 | 0   |   |
| Bit 4 | Byte4 | 0   |   |
| Bit 3 | Byte3 | 1   |   |
| Bit 2 | Byte2 | 1   |   |
| Bit 1 | Byte1 | 1   |   |
| Bit 0 | Byte0 | 1   |   |



**Byte 9: Watchdog Timer Count Register**

| Bit   | Name | PWD | Description  |
|-------|------|-----|--|
| Bit 7 | WD7  | 0   | The decimal representation of these 8 bits correspond to $X \cdot 290\text{ms}$ the watchdog timer will wait before it goes to alarm mode and reset the frequency to the safe setting. Default at power up is $16 \cdot 290\text{ms} = 4.6$ seconds. |
| Bit 6 | WD6  | 0   |  |
| Bit 5 | WD5  | 0   |  |
| Bit 4 | WD4  | 1   |  |
| Bit 3 | WD3  | 0   |  |
| Bit 2 | WD2  | 0   |  |
| Bit 1 | WD1  | 0   |  |
| Bit 0 | WD0  | 0   |  |

**Byte 10: Programming Enable bit 8 Watchdog Control Register**

| Bit   | Name           | PWD | Description   |
|-------|----------------|-----|---|
| Bit 7 | Program Enable | 0   | Programming Enable bit<br>0 = no programming. Frequencies are selected by HW latches or Byte0<br>1 = enable all I <sup>2</sup> C programming. |
| Bit 6 | WD Enable      | 0   | Watchdog Enable bit   |
| Bit 5 | WD Alarm       | 0   | Watchdog Alarm Status 0 = normal 1= alarm status  |
| Bit 4 | SF4            | 0   | Watchdog safe frequency bits. Writing to these bits will configure the safe frequency corresponding to Byte 0 Bit 2, 7:4 table                |
| Bit 3 | SF3            | 0   |   |
| Bit 2 | SF2            | 0   |   |
| Bit 1 | SF1            | 0   |   |
| Bit 0 | SF0            | 1   |   |

**Byte 11: VCO Frequency M Divider (Reference divider) Control Register**

| Bit   | Name   | PWD | Description   |
|-------|--------|-----|---|
| Bit 7 | Ndiv 8 | X   | N divider bit 8   |
| Bit 6 | Mdiv 6 | X   | The decimal representation of Mdiv (6:0) correspond to the reference divider value. Default at power up is equal to the latched inputs selection. |
| Bit 5 | Mdiv 5 | X   |   |
| Bit 4 | Mdiv 4 | X   |   |
| Bit 3 | Mdiv 3 | X   |   |
| Bit 2 | Mdiv 2 | X   |   |
| Bit 1 | Mdiv 1 | X   |   |
| Bit 0 | Mdiv 0 | X   |   |

**Byte 12: VCO Frequency N Divider (VCO divider) Control Register**

| Bit   | Name   | PWD | Description  |
|-------|--------|-----|--|
| Bit 7 | Ndiv 7 | X   | The decimal representation of Ndiv (8:0) correspond to the VCO divider value. Default at power up is equal to the latched inputs selection. Notice Ndiv 8 is located in Byte 11. |
| Bit 6 | Ndiv 6 | X   |  |
| Bit 5 | Ndiv 5 | X   |  |
| Bit 4 | Ndiv 4 | X   |  |
| Bit 3 | Ndiv 3 | X   |  |
| Bit 2 | Ndiv 2 | X   |  |
| Bit 1 | Ndiv 1 | X   |  |
| Bit 0 | Ndiv 0 | X   |  |



**Byte 13: Spread Spectrum Control Register**

| Bit   | Name | PWD | Description  |
|-------|------|-----|--|
| Bit 7 | SS 7 | X   | The Spread Spectrum (12:0) bit will program the spread percentage. Spread percent needs to be calculated based on the VCO frequency, spreading profile, spreading amount and spread frequency. It is recommended to use ICS software for spread programming. Default power on is latched FS divider. |
| Bit 6 | SS 6 | X   |  |
| Bit 5 | SS 5 | X   |  |
| Bit 4 | SS 4 | X   |  |
| Bit 3 | SS 3 | X   |  |
| Bit 2 | SS 2 | X   |  |
| Bit 1 | SS 1 | X   |  |
| Bit 0 | SS 0 | X   |  |

**Byte 14: Spread Spectrum Control Register**

| Bit   | Name     | PWD | Description            |
|-------|----------|-----|------------------------|
| Bit 7 | Reserved | X   | Reserved               |
| Bit 6 | Reserved | X   | Reserved               |
| Bit 5 | Reserved | X   | Reserved               |
| Bit 4 | SS 12    | X   | Spread Spectrum Bit 12 |
| Bit 3 | SS 11    | X   | Spread Spectrum Bit 11 |
| Bit 2 | SS 10    | X   | Spread Spectrum Bit 10 |
| Bit 1 | SS 9     | X   | Spread Spectrum Bit 9  |
| Bit 0 | SS 8     | X   | Spread Spectrum Bit 8  |

**Byte 15: Output Divider Control Register**

| Bit   | Name      | PWD | Description   |
|-------|-----------|-----|---|
| Bit 7 | SD Div 3  | X   | SDRAM clock divider ratio can be configured via these 4 bits individually. For divider selection table refer to Table 1. Default at power up is latched FS divider.     |
| Bit 6 | SD Div 2  | X   |   |
| Bit 5 | SD Div 1  | X   |   |
| Bit 4 | SD Div 0  | X   |   |
| Bit 3 | CPU Div 3 | X   | CPUCLKT/C clock divider ratio can be configured via these 4 bits individually. For divider selection table refer to Table 1. Default at power up is latched FS divider. |
| Bit 2 | CPU Div 2 | X   |   |
| Bit 1 | CPU Div 1 | X   |   |
| Bit 0 | CPU Div 0 | X   |   |

**Byte 16: Output Divider Control Register**

| Bit   | Name       | PWD | Description  |
|-------|------------|-----|--|
| Bit 7 | AGP Div 3  | X   | AGP clock divider ratio can be configured via these 4 bits individually. For divider selection table refer to Table 1. Default at power up is latched FS divider.  |
| Bit 6 | AGP Div 2  | X   |  |
| Bit 5 | AGP Div 1  | X   |  |
| Bit 4 | AGP Div 0  | X   |  |
| Bit 3 | ZCLK Div 3 | X   | ZCLK clock divider ratio can be configured via these 4 bits individually. For divider selection table refer to Table 1. Default at power up is latched FS divider. |
| Bit 2 | ZCLK Div 2 | X   |  |
| Bit 1 | ZCLK Div 1 | X   |  |
| Bit 0 | ZCLK Div 0 | X   |  |





**Byte 17: Output Divider Control Register**

| Bit   | Name      | PWD | Description   |
|-------|-----------|-----|---|
| Bit 7 | AGP_INV   | 0   | AGP Phase Inversion bit   |
| Bit 6 | ZCLK_INV  | 0   | ZCLK Phase Inversion bit  |
| Bit 5 | SD_INV    | 0   | SDRAM Phase Inversion bit   |
| Bit 4 | CPU_INV   | 0   | CPUCLK Phase Inversion bit  |
| Bit 3 | PCI Div 3 | X   | PCI clock divider ratio can be configured via these 4 bits individually. For divider selection table refer to table 2. Default at power up is latched FS divider. |
| Bit 2 | PCI Div 2 | X   |   |
| Bit 1 | PCI Div 1 | X   |   |
| Bit 0 | PCI Div 0 | X   |   |

**Table 1**

| Div (3:2) | 00 | 01  | 10  | 11  |
|-----------|----|-----|-----|-----|
| Div (1:0) |    |     |     |     |
| 00        | /2 | /4  | /8  | /16 |
| 01        | /3 | /6  | /12 | /24 |
| 10        | /5 | /10 | /20 | /40 |
| 11        | /7 | /14 | /28 | /56 |

**Table 2**

| Div (3:2) | 00 | 01  | 10  | 11  |
|-----------|----|-----|-----|-----|
| Div (1:0) |    |     |     |     |
| 00        | /4 | /8  | /16 | /32 |
| 01        | /3 | /6  | /12 | /24 |
| 10        | /5 | /10 | /20 | /40 |
| 11        | /7 | /14 | /28 | /56 |

**Byte 18: Group Skew Control Register**

| Bit   | Name       | PWD | Description  |
|-------|------------|-----|--|
| Bit 7 | CPU_Skew 1 | 1   | These 2 bits delay the CPUCLKT/C (1:0) clocks with respect to all other clocks.<br>00 = 0ps 01 = 250ps 10 = 500ps 11 = 750ps |
| Bit 6 | CPU_Skew 0 | 0   |  |
| Bit 5 | SD_Skew 1  | 0   | These 2 bits delay the SDRAM with respect to CPUCLK<br>00 = 0ps 01 = 250ps 10 = 500ps 11 =750ps                              |
| Bit 4 | SD_Skew 0  | 1   |  |
| Bit 3 | (Reserved) | 1   | (Reserved)   |
| Bit 2 | (Reserved) | 1   |  |
| Bit 1 | (Reserved) | 1   |  |
| Bit 0 | (Reserved) | 1   |  |

**Byte 19: Group Skew Control Register**

| Bit   | Name                              | PWD | Programmable Delay Stop         |
|-------|-----------------------------------|-----|---------------------------------|
| Bit 7 | These 4bits control CPU-ZCLK(1:0) | 1   | 0 0 0 0 1.85ns 1 0 0 0 3.05ns   |
| Bit 6 |                                   | 0   | 0 0 0 0 1 2.00ns 1 0 0 1 3.20ns |
| Bit 5 |                                   | 0   | 0 0 0 1 0 2.15ns 1 0 1 0 3.35ns |
| Bit 4 |                                   | 0   | 0 0 0 1 1 2.30ns 1 0 1 1 3.50ns |
| Bit 3 | These 4 bits control CPU-AGP(1:0) | 1   | 0 1 0 0 2.45ns 1 1 0 0 3.65ns   |
| Bit 2 |                                   | 0   | 0 1 0 1 2.60ns 1 1 0 1 3.80ns   |
| Bit 1 |                                   | 0   | 0 1 1 0 2.75ns 1 1 1 0 3.95ns   |
| Bit 0 |                                   | 0   | 0 1 1 1 2.90ns 1 1 1 1 4.10ns   |



**Byte 20: Group Skew Control Register**

| Bit   | Name                                     | PWD | Programmable Delay Stop |   |   |   |        |   |   |   |   |        |
|-------|--|-----|-------------------------|---|---|---|--------|---|---|---|---|--------|
| Bit 7 | These 4bits control<br>CPU-PCICLK_F(1:0) | 0   | 0                       | 0 | 0 | 0 | 1.85ns | 1 | 0 | 0 | 0 | 3.05ns |
| Bit 6 |  | 1   | 0                       | 0 | 0 | 1 | 2.00ns | 1 | 0 | 0 | 1 | 3.20ns |
| Bit 5 |  | 0   | 0                       | 0 | 1 | 0 | 2.15ns | 1 | 0 | 1 | 0 | 3.35ns |
| Bit 4 |  | 0   | 0                       | 0 | 1 | 1 | 2.30ns | 1 | 0 | 1 | 1 | 3.50ns |
| Bit 3 | These 4 bits control<br>CPU-PCICLK(5:0)  | 0   | 0                       | 1 | 0 | 0 | 2.45ns | 1 | 1 | 0 | 0 | 3.65ns |
| Bit 2 |  | 1   | 0                       | 1 | 0 | 1 | 2.60ns | 1 | 1 | 0 | 1 | 3.80ns |
| Bit 1 |  | 0   | 0                       | 1 | 1 | 0 | 2.75ns | 1 | 1 | 1 | 0 | 3.95ns |
| Bit 0 |  | 0   | 0                       | 1 | 1 | 1 | 2.90ns | 1 | 1 | 1 | 1 | 4.10ns |

**Byte 21: Slew Rate Control Register**

| Bit   | Name       | PWD | Description  |
|-------|------------|-----|--|
| Bit 7 | 24/48_Slew | 0   | 24/48 MHz clock slew rate control bits.<br>01 = strong; 00, 11 = normal; 10 = weak |
| Bit 6 |            | 0   |  |
| Bit 5 | AGP_Slew   | 0   | AGP clock slew rate control bits.<br>01 = strong; 00, 11 = normal; 10 = weak       |
| Bit 4 |            | 0   |  |
| Bit 3 | ZCLK_Slew  | 0   | ZCLK clock slew rate control bits.<br>01 = strong; 00, 11 = normal; 10 = weak      |
| Bit 2 |            | 0   |  |
| Bit 1 | REF_Slew   | 0   | REF clock slew rate control bits.<br>01 = strong; 00, 11 = normal; 10 = weak       |
| Bit 0 |            | 0   |  |

**Byte 22: Slew Rate Control Register**

| Bit   | Name          | PWD | Description   |
|-------|---------------|-----|---|
| Bit 7 | SDRAM Slew    | 0   | SDRAM clock slew rate control bits.<br>01 = strong; 00, 11 = normal; 10 = weak    |
| Bit 6 |               | 0   |   |
| Bit 5 | (Reserved)    | X   | (Reserved)  |
| Bit 4 |               | X   |   |
| Bit 3 | PCICLK_F Slew | 0   | PCICLK_F clock slew rate control bits.<br>01 = strong; 00, 11 = normal; 10 = weak |
| Bit 2 |               | 0   |   |
| Bit 1 | PCICLK Slew   | 0   | PCICLK clock slew rate control bits.<br>01 = strong; 00, 11 = normal; 10 = weak   |
| Bit 0 |               | 0   |   |

**Byte 23: Output Control Register**

| Bit   | Pin# | PWD | Description         |
|-------|------|-----|---------------------|
| Bit 7 | -    | 0   | Iref Output Control |
| Bit 6 | -    | 1   | MULTISEL Readback   |
| Bit 5 | 47   | 1   | SDRAM               |
| Bit 4 | 27   | 1   | 48MHz               |
| Bit 3 | 26   | 1   | 24_48MHz            |
| Bit 2 | 4    | 1   | REF2                |
| Bit 1 | 3    | 1   | REF1                |
| Bit 0 | 2    | 1   | REF0                |

## Absolute Maximum Ratings

|                               |                                      |
|-------------------------------|--------------------------------------|
| Core Supply Voltage           | 4.6 V                                |
| I/O Supply Voltage            | 3.6V                                 |
| Logic Inputs                  | GND -0.5 V to V <sub>DD</sub> +0.5 V |
| Ambient Operating Temperature | 0°C to +70°C                         |
| Storage Temperature           | -65°C to +150°C                      |
| Case Temperature              | 115°C                                |

Stresses above those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These ratings are stress specifications only and functional operation of the device at these or any other conditions above those listed in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect product reliability.

## Electrical Characteristics - Input/Supply/Common Output Parameters

T<sub>A</sub> = 0 - 70C; Supply Voltage V<sub>DD</sub> = 3.3 V ±5%, VDDL=2.5 V± 5%(unless otherwise stated)

| PARAMETER                      | SYMBOL                              | CONDITIONS  | MIN                  | TYP   | MAX                  | UNITS |
|--------------------------------|-------------------------------------|---|----------------------|-------|----------------------|-------|
| Input High Voltage             | V <sub>IH</sub>                     |   | 2                    |       | V <sub>DD</sub> +0.3 | V     |
| Input Low Voltage              | V <sub>IL</sub>                     |   | V <sub>SS</sub> -0.3 |       | 0.8                  | V     |
| Input High Current             | I <sub>IH</sub>                     | V <sub>IN</sub> = V <sub>DD</sub>                       | -5                   |       | 5                    | mA    |
| Input Low Current              | I <sub>IL1</sub>                    | V <sub>IN</sub> = 0 V; Inputs with no pull-up resistors | -5                   |       |                      | mA    |
| Input Low Current              | I <sub>IL2</sub>                    | V <sub>IN</sub> = 0 V; Inputs with pull-up resistors    | -200                 |       |                      | mA    |
| Operating Supply Current       | I <sub>DD3.3OP</sub>                | C <sub>L</sub> = 30 pF; CPU @ 133 MHz                   |                      |       | 280                  | mA    |
| Power Down Supply Current      | I <sub>DD3.3PD</sub>                | C <sub>L</sub> = 0 pF                                   |                      |       | 25                   | mA    |
| Input frequency                | F <sub>i</sub>                      | V <sub>DD</sub> = 3.3 V                                 |                      | 14.32 |                      | MHz   |
| Pin Inductance                 | L <sub>pin</sub>                    |   |                      |       | 7                    | nH    |
| Input Capacitance <sup>1</sup> | C <sub>IN</sub>                     | Logic Inputs  |                      |       | 5                    | pF    |
|                                | C <sub>out</sub>                    | Out put pin capacitance                                 |                      |       | 6                    | pF    |
|                                | C <sub>INX</sub>                    | X1 & X2 pins  | 27                   |       | 45                   | pF    |
| Transition Time <sup>1</sup>   | T <sub>trans</sub>                  | To 1st crossing of target Freq.                         |                      |       | 3                    | mS    |
| Settling Time <sup>1</sup>     | T <sub>s</sub>                      | From 1st crossing to 1% target Freq.                    |                      |       | 3                    | mS    |
| Clk Stabilization <sup>1</sup> | T <sub>STAB</sub>                   | From V <sub>DD</sub> = 3.3 V to 1% target Freq.         |                      |       | 3                    | mS    |
| Delay                          | t <sub>PZH</sub> , t <sub>PZH</sub> | output enable delay (all outputs)                       | 1                    |       | 10                   | nS    |
|                                | t <sub>PLZ</sub> , t <sub>PZH</sub> | output disable delay (all outputs)                      | 1                    |       | 10                   | nS    |

<sup>1</sup>Guaranteed by design, not 100% tested in production.

## Electrical Characteristics - CPU

$T_A = 0 - 70^\circ\text{C}$ ,  $V_{DDL} = 2.5 \text{ V} \pm 5\%$ ;  $C_L = 10 - 20 \text{ pF}$  (unless otherwise stated)

| PARAMETER           | SYMBOL          | CONDITIONS  | MIN  | TYP | MAX | UNITS    |
|---------------------|-----------------|---|------|-----|-----|----------|
| Output Impedance    | $R_{DSP2B}^1$   | $V_O = V_{DD}^*(0.5)$                                     | 13.5 |     | 45  | $\Omega$ |
| Output Impedance    | $R_{DSN2B}^1$   | $V_O = V_{DD}^*(0.5)$                                     | 13.5 |     | 45  | $\Omega$ |
| Output High Voltage | $V_{OH2B}$      | $I_{OH} = -1 \text{ mA}$                                  | 2    |     |     | V        |
| Output Low Voltage  | $V_{OL2B}$      | $I_{OL} = 1 \text{ mA}$                                   |      |     | 0.4 | V        |
| Output High Current | $I_{OH2B}$      | $V_{OH@MIN} = 1.0\text{V}$ , $V_{OH@MAX} = 2.375\text{V}$ | -27  |     | -27 | mA       |
| Output Low Current  | $I_{OL2B}$      | $V_{OL@MIN} = 1.2\text{V}$ , $V_{OL@MAX} = 0.3\text{V}$   | 27   |     | 30  | mA       |
| Rise Time           | $t_{r2B}^1$     | $V_{OL} = 0.4 \text{ V}$ , $V_{OH} = 2.0 \text{ V}$       | 0.4  |     | 1.6 | ns       |
| Fall Time           | $t_{f2B}^1$     | $V_{OH} = 0.4 \text{ V}$ , $V_{OL} = 2.0 \text{ V}$       | 0.4  |     | 1.6 | ns       |
| Duty Cycle          | $d_{r2B}^1$     | $V_T = 1.25 \text{ V}$                                    | 45   | 50  | 55  | ns       |
| Skew                | $t_{sk2B}^1$    | $V_T = 1.25 \text{ V}$                                    |      |     | 175 | ps       |
| Jitter              | $t_{jvc-cvc}^1$ | $V_T = 1.25 \text{ V}$                                    |      |     | 250 | ps       |

<sup>1</sup>Guaranteed by design, not 100% tested in production.

## Electrical Characteristics - PCI

$T_A = 0 - 70^\circ\text{C}$ ;  $V_{DD} = 3.3 \text{ V} \pm 5\%$ ;  $C_L = 30 \text{ pF}$  (unless otherwise stated)

| PARAMETER           | SYMBOL       | CONDITIONS  | MIN  | TYP | MAX  | UNITS    |
|---------------------|--------------|---|------|-----|------|----------|
| Output Impedance    | $R_{DSP1}^1$ | $V_O = V_{DD}^*(0.5)$                               | 12   |     | 55   | $\Omega$ |
| Output Impedance    | $R_{DSN1}^1$ | $V_O = V_{DD}^*(0.5)$                               | 12   |     | 55   | $\Omega$ |
| Output High Voltage | $V_{OH1}$    | $I_{OH} = -18 \text{ mA}$                           | 2.4  |     |      | V        |
| Output Low Voltage  | $V_{OL1}$    | $I_{OL} = 9.4 \text{ mA}$                           |      |     | 0.4  | V        |
| Output High Current | $I_{OH1}$    | $V_{OH} = 2.0 \text{ V}$                            |      |     | -22  | mA       |
| Output Low Current  | $I_{OL1}$    | $V_{OL} = 0.8 \text{ V}$                            | 25   |     |      | mA       |
| Rise Time           | $t_{r1}^1$   | $V_{OL} = 0.4 \text{ V}$ , $V_{OH} = 2.4 \text{ V}$ |      |     | 2.0  | ns       |
| Fall Time           | $t_{f1}^1$   | $V_{OH} = 2.4 \text{ V}$ , $V_{OL} = 0.4 \text{ V}$ |      |     | 2.0  | ns       |
| Duty Cycle          | $d_{t1}^1$   | $V_T = 1.5 \text{ V}$                               | 45.0 |     | 55.0 | %        |
| Skew Window         | $t_{sk1}^1$  | $V_T = 1.5 \text{ V}$                               |      |     | 500  | ps       |
| Jitter              | $t_{j1s1}^1$ | $V_T = 1.5 \text{ V}$                               |      |     | 250  | ps       |

<sup>1</sup>Guaranteed by design, not 100% tested in production.

## Electrical Characteristics - 24M, 48M, REF

$T_A = 0 - 70^\circ\text{C}$ ;  $V_{DD} = V_{DDL} = 3.3 \text{ V} \pm 5\%$ ;  $C_L = 20 \text{ pF}$  (unless otherwise stated)

| PARAMETER           | SYMBOL       | CONDITIONS                                       | MIN  | TYP | MAX  | UNITS    |
|---------------------|--------------|--|------|-----|------|----------|
| Output Impedance    | $R_{DSP5}^1$ | $V_O = V_{DD}^*(0.5)$                            | 20   |     | 60   | $\Omega$ |
| Output Impedance    | $R_{DSN5}^1$ | $V_O = V_{DD}^*(0.5)$                            | 20   |     | 60   | $\Omega$ |
| Output High Voltage | $V_{OH5}$    | $I_{OH} = -14 \text{ mA}$                        | 2.4  |     |      | V        |
| Output Low Voltage  | $V_{OL5}$    | $I_{OL} = 6.0 \text{ mA}$                        |      |     | 0.4  | V        |
| Output High Current | $I_{OH5}$    | $V_{OH} = 2.0 \text{ V}$                         |      |     | -20  | mA       |
| Output Low Current  | $I_{OL5}$    | $V_{OL} = 0.8 \text{ V}$                         | 10   |     |      | mA       |
| Rise Time           | $t_{r5}^1$   | $V_{OL} = 0.4 \text{ V}, V_{OH} = 2.4 \text{ V}$ |      |     | 4.0  | ns       |
| Fall Time           | $t_{f5}^1$   | $V_{OH} = 2.4 \text{ V}, V_{OL} = 0.4 \text{ V}$ |      |     | 4.0  | ns       |
| Duty Cycle          | $d_{t5}^1$   | $V_T = 1.5 \text{ V}$                            | 45.0 |     | 55.0 | %        |
| Jitter              | $t_{j1s5}^1$ | $V_T = 1.5 \text{ V}$                            |      |     | 500  | ps       |

<sup>1</sup>Guaranteed by design, not 100% tested in production.

## Electrical Characteristics - SDRAM

$T_A = 0 - 70^\circ\text{C}$ ;  $V_{DD} = V_{DDL} = 3.3 \text{ V} \pm 5\%$ ;  $C_L = 30 \text{ pF}$  (unless otherwise stated)

| PARAMETER           | SYMBOL        | CONDITIONS                                       | MIN | TYP | MAX   | UNITS    |
|---------------------|---------------|--|-----|-----|-------|----------|
| Output Impedance    | $R_{DSP2A}^1$ | $V_O = V_{DD}^*(0.5)$                            | 10  |     | 20    | $\Omega$ |
| Output Impedance    | $R_{DSN2A}^1$ | $V_O = V_{DD}^*(0.5)$                            | 10  |     | 20    | $\Omega$ |
| Output High Voltage | $V_{OH2A}$    | $I_{OH} = -28 \text{ mA}$                        | 2.4 |     |       | V        |
| Output Low Voltage  | $V_{OL2A}$    | $I_{OL} = 19 \text{ mA}$                         |     |     | 0.4   | V        |
| Output High Current | $I_{OH2A}$    | $V_{OH} = 2.0 \text{ V}$                         |     |     | -42   | mA       |
| Output Low Current  | $I_{OL2A}$    | $V_{OL} = 0.8 \text{ V}$                         | 33  |     |       | mA       |
| Rise Time           | $t_{r2A}^1$   | $V_{OL} = 0.4 \text{ V}, V_{OH} = 2.4 \text{ V}$ | 0.5 |     | 2.0   | ns       |
| Fall Time           | $t_{f2A}^1$   | $V_{OH} = 2.4 \text{ V}, V_{OL} = 0.4 \text{ V}$ | 0.5 |     | 2     | ns       |
| Duty Cycle          | $d_{t2A}^1$   | $V_T = 1.5 \text{ V}$                            | 45  |     | 55    | %        |
| Jitter <sup>1</sup> | $t_{cyc-cyc}$ | $V_T = 1.5 \text{ V}$                            |     |     | 250.0 | ps       |

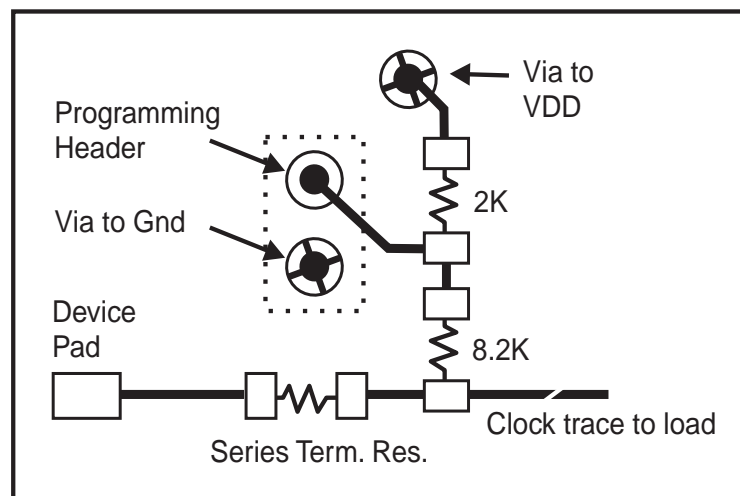
<sup>1</sup>Guaranteed by design, not 100% tested in production.

## Shared Pin Operation - Input/Output Pins

The I/O pins designated by (input/output) serve as dual signal functions to the device. During initial power-up, they act as input pins. The logic level (voltage) that is present on these pins at this time is read and stored into a 5-bit internal data latch. At the end of Power-On reset, (see AC characteristics for timing values), the device changes the mode of operations for these pins to an output function. In this mode the pins produce the specified buffered clocks to external loads.

To program (load) the internal configuration register for these pins, a resistor is connected to either the VDD (logic 1) power supply or the GND (logic 0) voltage potential. A 10 Kiloohm (10K) resistor is used to provide both the solid CMOS programming voltage needed during the power-up programming period and to provide an insignificant load on the output clock during the subsequent operating period. Figure 1 shows a means of implementing this function when

a switch or 2 pin header is used. With no jumper is installed the pin will be pulled high. With the jumper in place the pin will be pulled low. If programmability is not necessary, than only a single resistor is necessary. The programming resistors should be located close to the series termination resistor to minimize the current loop area. It is more important to locate the series termination resistor close to the driver than the programming resistor.

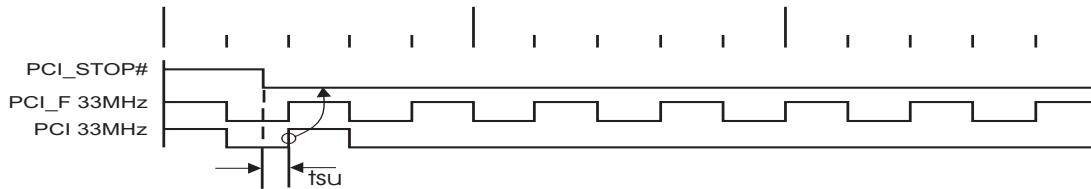


**Fig. 1**

**PCI\_STOP# - Assertion (transition from logic "1" to logic "0")**

The impact of asserting the PCI\_STOP# signal will be the following. All PCI and stoppable PCI\_F clocks will latch low in their next high to low transition. The PCI\_STOP# setup time  $t_{su}$  is 10 ns, for transitions to be recognized by the next rising edge.

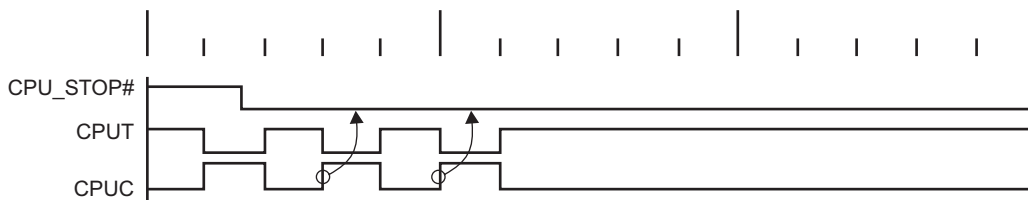
**Assertion of PCI\_STOP# Waveforms**



**CPU\_STOP# - Assertion (transition from logic "1" to logic "0")**

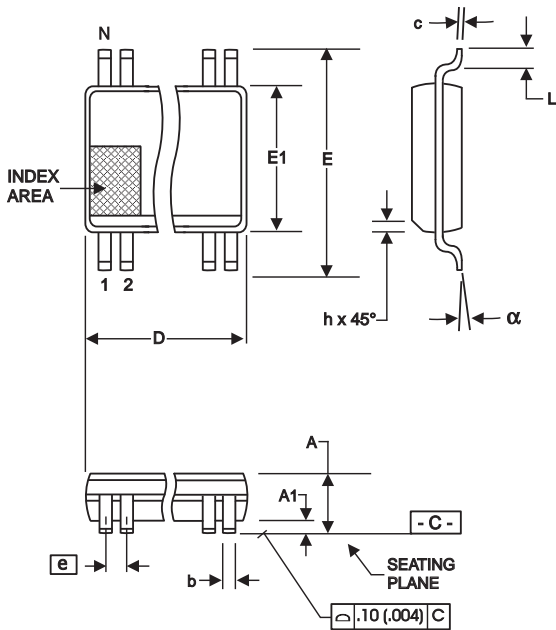
The impact of asserting the CPU\_STOP# pin is all CPU outputs that are set in the I<sup>2</sup>C configuration to be stoppable via assertion of CPU\_STOP# are to be stopped after their next transition following the two CPU clock edge sampling as shown. The final state of the stopped CPU signals is CPUT=High and CPUC=Low. There is to be no change to the output drive current values. The CPUT will be driven high with a current value equal to (MULTSEL0) X (I REF), the CPUC signal will not be driven.

**Assertion of CPU\_STOP# Waveforms**



**CPU\_STOP# Functionality**

| CPU_STOP# | CPUT        | CPUC   |
|-----------|-------------|--------|
| 1         | Normal      | Normal |
| 0         | iref * Mult | Float  |



| SYMBOL   | In Millimeters<br>COMMON DIMENSIONS |       | In Inches<br>COMMON DIMENSIONS |       |
|----------|-------------------------------------|-------|--------------------------------|-------|
|          | MIN                                 | MAX   | MIN                            | MAX   |
| A        | 2.41                                | 2.80  | .095                           | .110  |
| A1       | 0.20                                | 0.40  | .008                           | .016  |
| b        | 0.20                                | 0.34  | .008                           | .0135 |
| c        | 0.13                                | 0.25  | .005                           | .010  |
| D        | SEE VARIATIONS                      |       | SEE VARIATIONS                 |       |
| E        | 10.03                               | 10.68 | .395                           | .420  |
| E1       | 7.40                                | 7.60  | .291                           | .299  |
| e        | 0.635 BASIC                         |       | 0.025 BASIC                    |       |
| h        | 0.38                                | 0.64  | .015                           | .025  |
| L        | 0.50                                | 1.02  | .020                           | .040  |
| N        | SEE VARIATIONS                      |       | SEE VARIATIONS                 |       |
| $\alpha$ | 0°                                  | 8°    | 0°                             | 8°    |

| VARIATIONS |       |       |          |      |
|------------|-------|-------|----------|------|
| N          | D mm. |       | D (inch) |      |
|            | MIN   | MAX   | MIN      | MAX  |
| 48         | 15.75 | 16.00 | .620     | .630 |

Reference Doc.: JEDEC Publication 95, MO-118

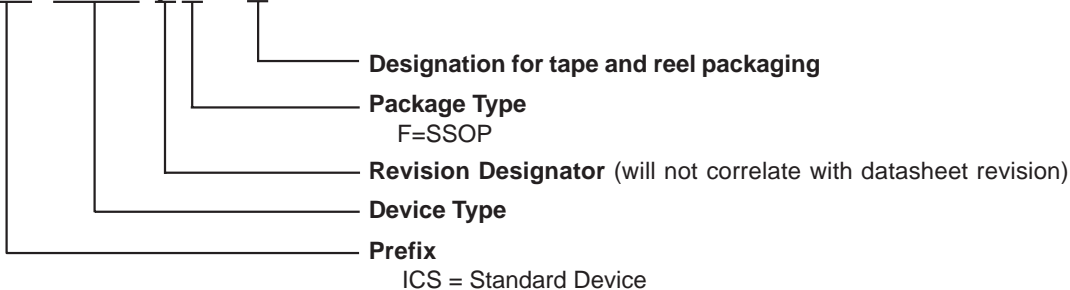
10-0034

## Ordering Information

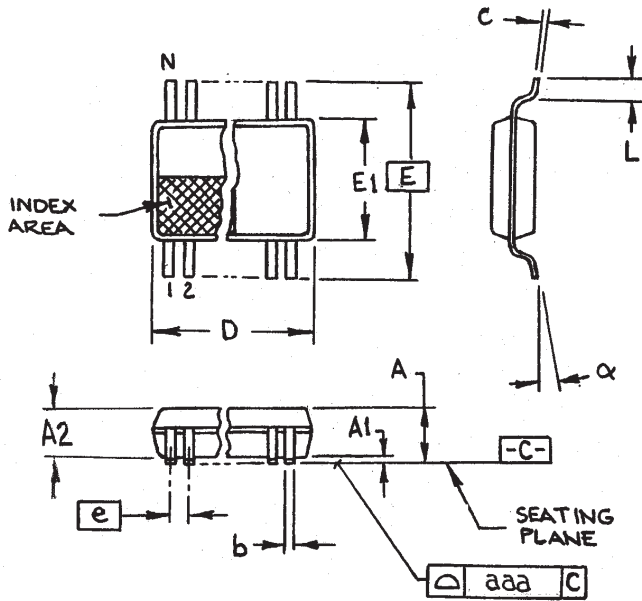
**ICS952001yFT**

Example:

**ICS XXXX y F - T**







| SYMBOL   | In Millimeters<br>COMMON DIMENSIONS |      | In Inches<br>COMMON DIMENSIONS |      |
|----------|-------------------------------------|------|--------------------------------|------|
|          | MIN                                 | MAX  | MIN                            | MAX  |
| A        | -                                   | 1.20 | -                              | .047 |
| A1       | 0.05                                | 0.15 | .002                           | .006 |
| A2       | 0.80                                | 1.05 | .032                           | .041 |
| b        | 0.17                                | 0.27 | .007                           | .011 |
| c        | 0.09                                | 0.20 | .0035                          | .008 |
| D        | SEE VARIATIONS                      |      | SEE VARIATIONS                 |      |
| E        | 8.10 BASIC                          |      | 0.319                          |      |
| E1       | 6.00                                | 6.20 | .236                           | .244 |
| e        | 0.50 BASIC                          |      | 0.020 BASIC                    |      |
| L        | 0.45                                | 0.75 | .018                           | .30  |
| N        | SEE VARIATIONS                      |      | SEE VARIATIONS                 |      |
| $\alpha$ | 0°                                  | 8°   | 0°                             | 8°   |
| aaa      | -                                   | 0.10 | -                              | .004 |

VARIATIONS

| N  | D mm. |       | D (inch) |      |
|----|-------|-------|----------|------|
|    | MIN   | MAX   | MIN      | MAX  |
| 48 | 12.40 | 12.60 | .488     | .496 |

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**Ordering Information**

ICS952001yFT

Example:

**ICS XXXX y G - PPP**

Pattern Number (2 or 3 digit number for parts with ROM code patterns)

Package Type  
G=TSSOP

Revision Designator

Device Type (consists of 3 or 4 digit numbers)

Prefix

ICS, AV = Standard Device

Registered Company



9001

For more information on Integrated Circuit Systems Inc. or any of our products please visit our web site at:  
<http://www.icst.com>