



# CLOCK GENERATOR FOR DESKTOP PC PLATFORMS

**IDTCV105E**

## FEATURES:

- 4 PLL architecture
- Linear frequency programming
- Independent frequency programming and SSC control
- Band-gap circuit for differential output
- High power-noise rejection ratio
- 66MHz to 533MHz CPU frequency
- VCO frequency up to 1.1G
- Support index block read/write, single cycle index block read
- Programmable REF, 3V66, PCI, 48MHz I/O drive strength
- Programmable 3V66 and PCI Skew
- Available in SSOP package

## DESCRIPTION:

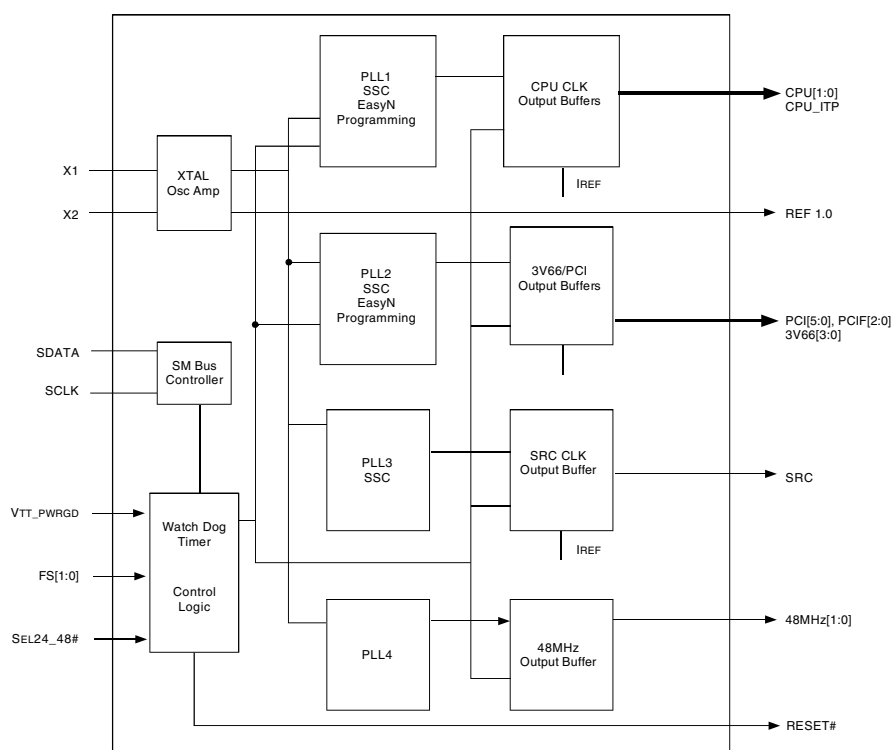
IDTCV105E is a 48 pin clock generation device for desktop PC platforms. This chip incorporates four PLLs to allow independent generation of CPU, AGP/PCI, SRC, and 48MHz clocks. The dedicated PLL for Serial ATA clock provides high accuracy frequency. This device also implements Band-gap referenced IREF to reduce the impact of V<sub>DD</sub> variation on differential outputs, which can provide more robust system performance.

Static PLL frequency divide error can be as low as 36 ppm, providing high accuracy output clock. Each CPU, AGP/PCI, SRC clock has its own Spread Spectrum selection.

## KEY SPECIFICATION:

- CPU/SRC CLK cycle to cycle jitter < 125ps
- SATA CLK cycle to cycle jitter < 125ps
- PCI CLK cycle to cycle jitter < 250ps
- Static PLL frequency divide error as low as 36 ppm

## FUNCTIONAL BLOCK DIAGRAM



## OUTPUT TABLE

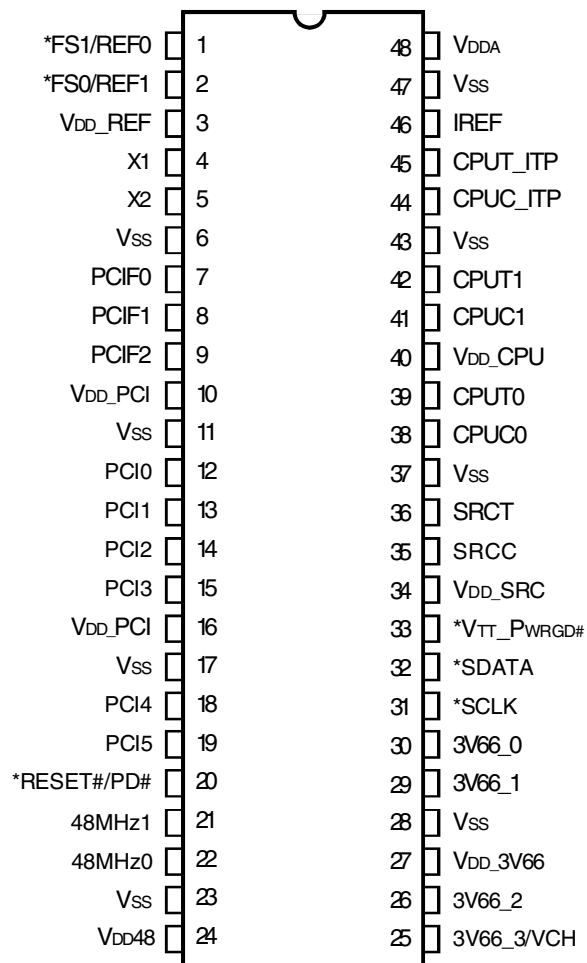
| CPU (Pair) | 3V66 | 3V66/VCH | PCI | PCIF | REF | 48MHz | 24 - 48MHz | SRC (Pair) | Reset# |
|------------|------|----------|-----|------|-----|-------|------------|------------|--------|
| 3          | 3    | 1        | 6   | 3    | 2   | 2     | 0          | 1          | 1      |

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**COMMERCIAL TEMPERATURE RANGE**

**JANUARY 2004**

## PIN CONFIGURATION



\* = ~ 130K $\Omega$  internal pull-up.

\*\* = ~ 130K $\Omega$  internal pull-down.

SSOP  
TOP VIEW

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

| Symbol   | Description                              | Min       | Max  | Unit |
|----------|------------------------------------------|-----------|------|------|
| VDDA     | 3.3V Core Supply Voltage                 |           | 4.6  | V    |
| VDDIN    | 3.3V Logic Input Supply Voltage          | GND - 0.5 | 4.6  | V    |
| TSTG     | Storage Temperature                      | -65       | +150 | °C   |
| TAMBIENT | Ambient Operating Temperature            | 0         | +70  | °C   |
| TCASE    | Case Temperature                         |           | +115 | °C   |
| ESD Prot | Input ESD Protection<br>Human Body Model | 2000      |      | V    |

### NOTE:

1. 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.

## HW FREQUENCY SELECTION

| FS1.0 | CPU    | AGP   | PCI  | N Resolution |
|-------|--------|-------|------|--------------|
| 00    | 100    | 66.66 | 33.3 | 0.223721591  |
| 01    | 200    | 66.66 | 33.3 | 0.447443181  |
| 10    | 133.33 | 66.66 | 33.3 | 0.298295454  |
| 11    | 166.67 | 66.66 | 33.3 | 0.397727272  |

## SW FREQUENCY SELECTION

BS[2:0] and WBS[2:0] are band selects. Whenever there is a band switch, the user has to issue a WD soft alarm (see Byte 32 and Byte 33).

In CPU N/M programming, CPU frequency = N \* resolution.

| CFS[3:0]        | WDBS[2:0] or<br>BS[2:0] = 000 | WDBS[2:0] or<br>BS[2:0] = 001 | WDBS[2:0] or<br>BS = 010 | WDBS[2:0] or<br>BS[2:0] = 011 | WDBS[2:0] or<br>BS[2:0] = 100 | WDBS[2:0] or<br>BS[2:0] = 101 | WDBS[2:0] or<br>BS[2:0] = 110 | WDBS[2:0] or<br>BS[2:0] = 111 |
|-----------------|-------------------------------|-------------------------------|--------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| 000             | 100                           | 200.01                        | 133.34                   | 166.65                        | 200.01                        | 400.01                        | 266.66                        | 333.3                         |
| 001             | 100.9                         | 201.8                         | 135.13                   | 167.84                        | 66.67                         | 401.8                         | 267.57                        | 334.89                        |
| 010             | 102.91                        | 204.93                        | 138.11                   | 169.83                        |                               |                               |                               |                               |
| 011             | 104.93                        | 209.85                        | 139.9                    | 173.01                        |                               |                               |                               |                               |
| 100             | 110.07                        | 215.22                        | 141.99                   | 175                           |                               |                               |                               |                               |
| 101             | 114.99                        | 220.14                        | 144.97                   | 178.18                        |                               |                               |                               |                               |
| 110             | 119.91                        | 225.06                        | 147.95                   | 180.17                        |                               |                               |                               |                               |
| 111             | 125.06                        | 229.99                        | 150.05                   | 184.94                        |                               |                               |                               |                               |
| N Resolution    | 0.223721591                   | 0.447443181                   | 0.298295454              | 0.397727272                   | 0.447443181                   | 0.894886363                   | 0.894886363                   | 0.795454544                   |
| Corresponding N | 447                           | 447                           | 447                      | 419                           | 447                           | 447                           | 298                           | 419                           |

## SPREAD SPECTRUM MAGNITUDE CONTROL (SMC)

| SMC[2:0] |         |
|----------|---------|
| 000      | Off     |
| 001      | - 0.25  |
| 010      | - 0.5   |
| 011      | - 0.75  |
| 100      | - 1     |
| 101      | ± 0.125 |
| 110      | ± 0.25  |
| 111      | ± 0.375 |

## AGP/PCI FREQUENCY SELECTION

In AGP/PCI N/M programming, AGP frequency = N \* 0.223721591

| AFS[2:0] | AGP   | PCI   | Corresponding N |
|----------|-------|-------|-----------------|
| 000      | 66.67 | 33.33 | 298             |
| 001      | 68.68 | 34.34 | 307             |
| 010      | 70.7  | 35.35 | 316             |
| 011      | 72.71 | 36.35 | 325             |
| 100      | 74.5  | 37.25 | 333             |
| 101      | 76.51 | 38.26 | 342             |
| 110      | 78.53 | 39.26 | 351             |
| 111      | 80.54 | 40.27 | 360             |

## 3V66-PCI/F SKEW

| Skew[2:0] |                              |
|-----------|------------------------------|
| 000       | normal, 3V66 leads PCI 2.5ns |
| 001       | move forward 200ps           |
| 010       | move forward 400ps           |
| 011       | move forward 600ps           |
| 100       | move backward 200ps          |
| 101       | move backward 400ps          |
| 110       | move backward 600ps          |
| 111       | move backward 800ps          |

## AGP/PCI STRENGTH

| Str[1:0] |                   |
|----------|-------------------|
| 0, 0     | 2H <sup>(1)</sup> |
| 0, 1     | 1L <sup>(2)</sup> |
| 1, 0     | 1H <sup>(2)</sup> |
| 1, 1     | 2L <sup>(1)</sup> |

### NOTES:

1. Recommended for multiple load.
2. Recommended for single load.

## REF STRENGTH

| REF Str[1:0] |                   |
|--------------|-------------------|
| 0, 0         | 2L <sup>(1)</sup> |
| 0, 1         | 1H <sup>(2)</sup> |
| 1, 0         | 2H <sup>(1)</sup> |
| 1, 1         | 1L <sup>(2)</sup> |

### NOTES:

1. Recommended for multiple load.
2. Recommended for single load.

## PIN DESCRIPTION

| Pin Number | Name                    | Type | Description                                                                                                                                              |
|------------|-------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1          | FS1/REF0                | I/O  | Frequency select latch input 3.3V input HIGH/LOW voltage/ 14.318MHz reference clock output <sup>(1)</sup>                                                |
| 2          | FS0/REF1                | I/O  | Frequency select latch input 2.5V input HIGH/LOW voltage/ 14.318MHz reference clock output <sup>(1)</sup>                                                |
| 3          | V <sub>DD</sub> _REF    | PWR  | 3.3V                                                                                                                                                     |
| 4          | X1                      | IN   | Xtal input                                                                                                                                               |
| 5          | X2                      | OUT  | Xtal output                                                                                                                                              |
| 6          | V <sub>SS</sub>         | GND  | GND                                                                                                                                                      |
| 7          | PCIF0                   | I/O  | Frequency select latch input 3.3V input HIGH/LOW voltage/ PCI free running clock <sup>(2)</sup>                                                          |
| 8          | PCIF1                   | OUT  | PCI free running clock                                                                                                                                   |
| 9          | PCIF2                   | OUT  | PCI free running clock                                                                                                                                   |
| 10         | V <sub>DD</sub> _PCI    | PWR  | 3.3V                                                                                                                                                     |
| 11         | V <sub>SS</sub>         | GND  | GND                                                                                                                                                      |
| 12         | PCI0                    | OUT  | PCI clock                                                                                                                                                |
| 13         | PCI1                    | OUT  | PCI clock                                                                                                                                                |
| 14         | PCI2                    | OUT  | PCI clock                                                                                                                                                |
| 15         | PCI3                    | OUT  | PCI clock                                                                                                                                                |
| 16         | V <sub>DD</sub> _PCI    | PWR  | 3.3V                                                                                                                                                     |
| 17         | V <sub>SS</sub>         | GND  | GND                                                                                                                                                      |
| 18         | PCI4                    | OUT  | PCI clock                                                                                                                                                |
| 19         | PCI5                    | OUT  | PCI clock                                                                                                                                                |
| 20         | RESET#/PD#              | OUT  | Reset output signal from watchdog circuit, active LOW/ power down control input. Mode selectable through SM bus, power on is RESET# mode. <sup>(1)</sup> |
| 21         | 48MHz1                  | OUT  | 48MHz clock output                                                                                                                                       |
| 22         | 48MHz0                  | OUT  | 48MHz clock output. Phase is 180 different with 24_48, 48MHz1, and VCH. Output drive strength can be doubled through SM programming.                     |
| 23         | V <sub>SS</sub>         | GND  | GND                                                                                                                                                      |
| 24         | V <sub>DD</sub> 48      | PWR  | 3.3V                                                                                                                                                     |
| 25         | 3V66_3/VCH              | OUT  | 66MHz or 48MHz clock output. Selectable by SMBus. Power on is 66MHz.                                                                                     |
| 26         | 3V66_2                  | OUT  | 66MHz clock output                                                                                                                                       |
| 27         | V <sub>DD</sub> _3V66   | PWR  | 3.3V                                                                                                                                                     |
| 28         | V <sub>SS</sub>         | GND  | GND                                                                                                                                                      |
| 29         | 3V66_1                  | OUT  | 66MHz clock output                                                                                                                                       |
| 30         | 3V66_0                  | OUT  | 66MHz clock output                                                                                                                                       |
| 31         | SCLK                    | IN   | SMBus clock <sup>(1)</sup>                                                                                                                               |
| 32         | SDATA                   | I/O  | SMBus data <sup>(1)</sup>                                                                                                                                |
| 33         | V <sub>TT</sub> _PWRGD# | IN   | Used for power on latch, active LOW <sup>(1)</sup>                                                                                                       |
| 34         | V <sub>DD</sub> _SRC    | PWR  | 3.3V                                                                                                                                                     |
| 35         | SRCC                    | OUT  | SATA 0.7V current mode differential clock output                                                                                                         |
| 36         | SRCT                    | OUT  | SATA 0.7V current mode differential clock output                                                                                                         |
| 37         | V <sub>SS</sub>         | GND  | GND                                                                                                                                                      |
| 38         | CPUC0                   | OUT  | Hosts 0.7V current mode differential clock output                                                                                                        |
| 39         | CPUT0                   | OUT  | Hosts 0.7V current mode differential clock output                                                                                                        |
| 40         | V <sub>DD</sub> _CPU    | PWR  | 3.3V                                                                                                                                                     |

### NOTES:

1. ~ 130K $\Omega$  internal pull-up.
2. ~ 130K $\Omega$  internal pull-down.

## PIN DESCRIPTION (CONT.)

| Pin Number | Name                 | Type | Description                                       |
|------------|----------------------|------|---------------------------------------------------|
| 41         | CPUC1                | OUT  | Hosts 0.7V current mode differential clock output |
| 42         | CPUT1                | OUT  | Hosts 0.7V current mode differential clock output |
| 43         | V <sub>SS</sub>      | GND  | GND                                               |
| 44         | CPUC_I <sub>TP</sub> | OUT  | Hosts 0.7V current mode differential clock output |
| 45         | CPUT_I <sub>TP</sub> | OUT  | Hosts 0.7V current mode differential clock output |
| 46         | IREF                 | OUT  | Reference current for differential output         |
| 47         | V <sub>SS</sub>      | GND  | GND                                               |
| 48         | V <sub>DDA</sub>     | PWR  | 3.3V                                              |

## SMBUS PROTOCOL

### INDEX BLOCK WRITE PROTOCOL

| Bit   | # of bits | From   | Description                                               |
|-------|-----------|--------|-----------------------------------------------------------|
| 1     | 1         | Master | Start                                                     |
| 2-9   | 8         | Master | D2h                                                       |
| 10    | 1         | Slave  | Acknowledge                                               |
| 11-18 | 8         | Master | Register offset byte (starting byte)                      |
| 19    | 1         | Slave  | Acknowledge                                               |
| 20-27 | 8         | Master | Byte count N (0 is not a valid byte count) <sup>(1)</sup> |
| 28    | 1         | Slave  | Acknowledge                                               |
| 29-36 | 8         | Master | First data byte                                           |
| 37    | 1         | Slave  | Acknowledge                                               |
| 38-45 | 8         | Master | Second data byte                                          |
| 46    | 1         | Slave  | Acknowledge                                               |
|       |           |        | :                                                         |
|       |           |        | Nth data byte                                             |
|       |           |        | Stop                                                      |

#### NOTE:

1. Bit [21:27] = byte count.  
Bit 20 = 1, bit [21:27] will be stored into SMBus table, Byte 8. SMBus Byte 8 is read byte count register, power on default is 0FH.  
Bit 20 = 0, normal SM bus operation.

### INDEX BLOCK READ PROTOCOL

| Bit   | # of bits | From   | Description                                                              |
|-------|-----------|--------|--------------------------------------------------------------------------|
| 1     | 1         | Master | Start                                                                    |
| 2-9   | 8         | Master | D2h                                                                      |
| 10    | 1         | Slave  | Acknowledge                                                              |
| 11-18 | 8         | Master | Register offset byte (starting byte)                                     |
| 19    | 1         | Slave  | Acknowledge                                                              |
| 20    | 1         | Master | Repeated start                                                           |
| 21-28 | 8         | Master | D3h                                                                      |
| 29    | 1         | Slave  | Acknowledge                                                              |
| 30-37 | 8         | Slave  | Byte count, N, SMBus table byte 8 value.<br>Power on default is 0FH[15]. |
| 38    | 1         | Master | Acknowledge                                                              |
| 39-46 | 8         | Slave  | Offset data byte, specified by bit 11-18                                 |
| 47    | 1         | Master | Acknowledge                                                              |
| 48-55 | 8         | Slave  | Offset + 1 data byte                                                     |
|       |           |        | :                                                                        |
|       |           | Slave  | Offset + N-2                                                             |
|       |           | Master | Acknowledge                                                              |
|       |           | Slave  | Offset + N-1                                                             |
|       |           |        | Not acknowledge                                                          |
|       |           |        | Stop                                                                     |

### ONECYCLE™ INDEX BLOCK READ

| Bit   | # of bits | From   | Description                                                                                    |
|-------|-----------|--------|------------------------------------------------------------------------------------------------|
| 1     | 1         | Master | Start                                                                                          |
| 2-9   | 8         | Master | D2h                                                                                            |
| 10    | 1         | Slave  | Acknowledge                                                                                    |
| 11-18 | 8         | Master | Register offset byte (starting byte)                                                           |
| 19    | 1         | Slave  | Acknowledge                                                                                    |
| 20-27 | 8         | Master | 1xxxxxxx. Bit[20] = 1, followed with byte count, which will be stored into SMBus table byte 8. |
| 28    | 1         | Slave  | Acknowledge                                                                                    |
| 29    | 1         | Master | Repeated start                                                                                 |
| 30-37 | 8         | Master | D3h                                                                                            |
| 38    | 1         | Slave  | Acknowledge                                                                                    |
| 39-46 | 8         | Slave  | Byte count, N, SMBus table byte 8 value.<br>Power on default is 0FH[15].                       |
| 47    | 1         | Master | Acknowledge                                                                                    |
| 48-55 | 8         | Slave  | Offset data byte, specified by bit[11:18]                                                      |
| 56    | 1         | Master | Acknowledge                                                                                    |
| 57-64 | 8         | Slave  | Offset + 1 data byte                                                                           |
|       |           |        | :                                                                                              |
|       |           | Slave  | Offset + N-2                                                                                   |
|       |           | Master | Acknowledge                                                                                    |
|       |           | Slave  | Offset + N-1                                                                                   |
|       |           |        | Not acknowledge                                                                                |
|       |           |        | Stop                                                                                           |

### BYTE WRITE METHODS:

- Setting bit[11:18] = starting address, bit [20:27] = 01H.

### BYTE READ METHODS (CHOOSE ONE):

- Use IDT OneCycle Index Block Read, bit[20:27] = 10000001.  
Notice that byte count register (byte 8) will be changed to 01H.
- Use Index Block Write protocol to change byte count (byte 8) to 1. After that, use Index Block Read.

### TO CHANGE BYTE 8 VALUE:

- Use IDT OneCycle Index Block Read, as above
- Use Index Block Write protocol to change byte 8 value.

## BYTE 0: DUMMY BYTE

### BYTE 1

| Bit | Output(s) Affected | Description/Function   | 0        | 1      | Type | Power On |
|-----|--------------------|------------------------|----------|--------|------|----------|
| 7   | Reserve            |                        |          |        |      | 0        |
| 6   | Reserve            |                        |          |        |      | 0        |
| 5   | SS_EN              | Spread spectrum enable | On       | Off    | RW   | 1        |
| 4   | Reserve            |                        |          |        |      | 0        |
| 3   | SRCT, SRCC         | Output enable          | Tristate | Enable | RW   | 1        |
| 2   | CPUT_ITP, CPUC_ITP | Output enable          | Tristate | Enable | RW   | 1        |
| 1   | CPUT1, CPUC1       | Output enable          | Tristate | Enable | RW   | 1        |
| 0   | CPUT0, CPUC0       | Output enable          | Tristate | Enable | RW   | 1        |

### BYTE 2

| Bit | Output(s) Affected | Description/Function      | 0                    | 1                      | Type | Power On |
|-----|--------------------|---------------------------|----------------------|------------------------|------|----------|
| 7   | SRCT               | SRCT Powerdown drive mode | Driven in power down | Tristate in power down | RW   | 0        |
| 6   | Reserve            |                           |                      |                        |      | 0        |
| 5   | CPUT1, 0           | CPUT Powerdown drive mode | Driven in power down | Tristate in power down | RW   | 0        |
| 4   | Reserve            |                           |                      |                        |      | 0        |
| 3   | 3V66_2             | Output enable             | Tristate             | Enable                 | RW   | 1        |
| 2   | Reserve            |                           |                      |                        |      | 1        |
| 1   | Reserve            |                           |                      |                        |      | 1        |
| 0   | Reserve            |                           |                      |                        |      | 1        |

### BYTE 3

| Bit | Output(s) Affected | Description/Function | 0        | 1      | Type | Power On | Recommended |
|-----|--------------------|----------------------|----------|--------|------|----------|-------------|
| 7   | Reserve            |                      |          |        |      | 0        |             |
| 6   | Reserve            |                      |          |        | RW   | 1        | 0           |
| 5   | PCI5               | Output enable        | Tristate | Enable | RW   | 1        |             |
| 4   | PCI4               | Output enable        | Tristate | Enable | RW   | 1        |             |
| 3   | PCI3               | Output enable        | Tristate | Enable | RW   | 1        |             |
| 2   | PCI2               | Output enable        | Tristate | Enable | RW   | 1        |             |
| 1   | PCI1               | Output enable        | Tristate | Enable | RW   | 1        |             |
| 0   | PCI0               | Output enable        | Tristate | Enable | RW   | 1        |             |

## BYTE 4

| Bit | Output(s) Affected | Description/Function | 0         | 1      | Type | Power On | Recommended |
|-----|--------------------|----------------------|-----------|--------|------|----------|-------------|
| 7   | 48MHz0             | Drive strength       | 2 * DRIVE | Normal | RW   | 0        | 1           |
| 6   | SRCFS0             | SRC frequency select | 100MHz    | 200MHz | RW   | 0        |             |
| 5   | Reserve            |                      |           |        | RW   | 1        | 0           |
| 4   | 3V66_1             | Output enable        | Tristate  | Enable | RW   | 1        |             |
| 3   | 3V66_0             | Output enable        | Tristate  | Enable | RW   | 1        |             |
| 2   | PCIF2              | Output enable        | Tristate  | Enable | RW   | 1        |             |
| 1   | PCIF1              | Output enable        | Tristate  | Enable | RW   | 1        |             |
| 0   | PCIF0              | Output enable        | Tristate  | Enable | RW   | 1        |             |

## BYTE 5

| Bit | Output(s) Affected | Description/Function   | 0                | 1               | Type | Power On |
|-----|--------------------|------------------------|------------------|-----------------|------|----------|
| 7   | 3V66_3/VCH         | 3V66_3/VCH mode select | 3V66 mode, 66MHz | VCH mode, 48MHz | RW   | 0        |
| 6   | Reserve            |                        |                  |                 |      | 0        |
| 5   | Reserve            |                        |                  |                 |      | 0        |
| 4   | 3V66_3/VCH         | Output enable          | Tristate         | Enable          | RW   | 1        |
| 3   | Reserve            |                        |                  |                 |      | 0        |
| 2   | Reserve            |                        |                  |                 |      | 0        |
| 1   | Reserve            |                        |                  |                 |      | 0        |
| 0   | Reserve            |                        |                  |                 |      | 0        |

## BYTE 6: DUMMY BYTE

## BYTE 7

| Bit | Output(s) Affected | Description/Function | 0 | 1 | Type | Power On |
|-----|--------------------|----------------------|---|---|------|----------|
| 7   | RID3               |                      |   |   |      | x        |
| 6   | RID2               |                      |   |   |      | x        |
| 5   | RID1               |                      |   |   |      | x        |
| 4   | RID0               |                      |   |   |      | x        |
| 3   | VID3               |                      |   |   |      | 0        |
| 2   | VID2               |                      |   |   |      | 1        |
| 1   | VID1               |                      |   |   |      | 0        |
| 0   | VID0               |                      |   |   |      | 1        |



## BYTE 8 (READ BYTE COUNT REGISTER)

| Bit | Output(s) Affected | Description/Function | 0 | 1 | Type | Power On |
|-----|--------------------|----------------------|---|---|------|----------|
| 7   | Reserve            |                      |   |   |      | 0        |
| 6   | BC6                | See note 1           |   |   |      | 0        |
| 5   | BC5                |                      |   |   |      | 0        |
| 4   | BC4                |                      |   |   |      | 0        |
| 3   | BC3                |                      |   |   |      | 1        |
| 2   | BC2                |                      |   |   |      | 0        |
| 1   | BC1                |                      |   |   |      | 0        |
| 0   | BC0                |                      |   |   |      | 1        |

### NOTE:

1. Can be written by index block write or OneCycle block read. See SMBUS PROTOCOL tables.

## BYTES 9-20: DUMMY BYTES

### BYTE 21

| Bit | Output(s) Affected | Description/Function   | 0 | 1 | Type | Power On |
|-----|--------------------|------------------------|---|---|------|----------|
| 7   | PCIFStr1           | AGP/PCI STRENGTH table |   |   |      | 1        |
| 6   | PCIFStr0           | AGP/PCI STRENGTH table |   |   |      | 1        |
| 5   | Reserve            |                        |   |   |      | 1        |
| 4   | Reserve            |                        |   |   |      | 1        |
| 3   | Reserve            |                        |   |   |      | 1        |
| 2   | Reserve            |                        |   |   |      | 1        |
| 1   | 3V66Str1           | AGP/PCI STRENGTH table |   |   |      | 1        |
| 0   | 3V66Str0           | AGP/PCI STRENGTH table |   |   |      | 1        |

### BYTE 22

| Bit | Output(s) Affected | Description/Function                              | 0 | 1 | Type | Power On | Recommended |
|-----|--------------------|---------------------------------------------------|---|---|------|----------|-------------|
| 7   | REFStr1            | REF STRENGTH table                                |   |   |      | 1        |             |
| 6   | REFStr0            | REF STRENGTH table                                |   |   |      | 0        |             |
| 5   | PCIStrC1           | PCI[7:5] strength control, AGP/PCI STRENGTH table |   |   |      | 1        | 1           |
| 4   | PCIStrC0           | PCI[7:5] strength control, AGP/PCI STRENGTH table |   |   |      | 1        | 0           |
| 3   | PCIStrB1           | PCI[4:2] strength control, AGP/PCI STRENGTH table |   |   |      | 1        | 1           |
| 2   | PCIStrB0           | PCI[4:2] strength control, AGP/PCI STRENGTH table |   |   |      | 1        | 0           |
| 1   | PCIStrA1           | PCI[1:0] strength control, AGP/PCI STRENGTH table |   |   |      | 1        | 1           |
| 0   | PCIStrA0           | PCI[1:0] strength control, AGP/PCI STRENGTH table |   |   |      | 1        | 0           |

## BYTE 23

| Bit | Output(s) Affected | Description/Function | 0        | 1      | Type | Power On | Recommended |
|-----|--------------------|----------------------|----------|--------|------|----------|-------------|
| 7   | 48MHz0             | Output enable        | Tristate | Enable | RW   | 1        |             |
| 6   |                    | Output enable        | Tristate | Enable | RW   | 1        | 0           |
| 5   | REF1               | Output enable        | Tristate | Enable | RW   | 1        |             |
| 4   | REF0               | Output enable        | Tristate | Enable | RW   | 1        |             |
| 3   | Reserve            |                      |          |        |      | 1        | 0           |
| 2   | 48MHz1             | Output enable        | Tristate | Enable | RW   | 1        |             |
| 1   |                    | Output enable        | Tristate | Enable | RW   | 1        | 0           |
| 0   | Reserve            |                      |          |        |      | 0        |             |

## BYTE 24

| Bit | Output(s) Affected | Description/Function           | 0 | 1 | Type | Power On |
|-----|--------------------|--------------------------------|---|---|------|----------|
| 7   | WDHRB              | WD hard alarm status read back |   |   | R    |          |
| 6   | WDSRB              | WD soft alarm status read back |   |   | R    |          |
| 5   |                    |                                |   |   |      |          |
| 4   |                    |                                |   |   |      |          |
| 3   |                    |                                |   |   |      |          |
| 2   |                    |                                |   |   |      | 0        |
| 1   | FSR1               | HW FS1 read back               |   |   | R    | HW FS1   |
| 0   | FSR0               | HW FS0 read back               |   |   | R    | HW FS0   |

## BYTE 25: CPU PLL CONTROL

| Bit | Output(s) Affected               | Description/Function                                                              | 0       | 1      | Type | Power On |
|-----|----------------------------------|-----------------------------------------------------------------------------------|---------|--------|------|----------|
| 7   | CPU frequency band source select | 0 = selected by HW latched FS[1:0], CFS[2:0]<br>1 = selected by BS[2:0], CFS[2:0] | HW      | SW     | RW   | 0        |
| 6   | BS2, Band select 2               | BS[2:0] CFS[2:0] select CPU frequency <sup>(1)</sup>                              |         |        | RW   | 0        |
| 5   | BS1, Band select 1               | BS[2:0] CFS[2:0] select CPU frequency <sup>(1)</sup>                              |         |        | RW   | 0        |
| 4   | BS0, Band select 0               | BS[2:0] CFS[2:0] select CPU frequency <sup>(1)</sup>                              |         |        | RW   | 0        |
| 3   | CFS2                             | BS[2:0] CFS[2:0] select CPU frequency <sup>(1)</sup>                              |         |        | RW   | 0        |
| 2   | CFS1                             | BS[2:0] CFS[2:0] select CPU frequency <sup>(1)</sup>                              |         |        | RW   | 0        |
| 1   | CFS0                             | BS[2:0] CFS[2:0] select CPU frequency <sup>(1)</sup>                              |         |        | RW   | 0        |
| 0   | CPU N Programming Enable         | CPU N Programming Enable                                                          | Disable | Enable | RW   | 0        |

### NOTES:

1. See SW FREQUENCY SELECTION table.

## BYTE 26: CPU PLL CONTROL

| Bit | Output(s) Affected | Description/Function                                                                                                                 | 0 | 1 | Type | Power On |
|-----|--------------------|--------------------------------------------------------------------------------------------------------------------------------------|---|---|------|----------|
| 7   | WDBS2              | At the event of WD hard alarm time out,<br>If Byte 32 bit 7 = 1, CPU frequency is<br>selected by WDBS[2:0] WDCFS[2:0] <sup>(1)</sup> |   |   | RW   | 1        |
| 6   | WDBS1              |                                                                                                                                      |   |   | RW   | 0        |
| 5   | WDBS0              |                                                                                                                                      |   |   | RW   | 0        |
| 4   | CSMC2              | CPU SMC2, SMC table                                                                                                                  |   |   | RW   | 0        |
| 3   | CSMC1              | CPU SMC1, SMC table                                                                                                                  |   |   | RW   | 1        |
| 2   | CSMC0              | CPU SMC0, SMC table                                                                                                                  |   |   | RW   | 0        |
| 1   | CPN9               | CPU PLL N9                                                                                                                           |   |   | RW   | 0        |
| 0   | CPN8               | CPU PLL N8                                                                                                                           |   |   | RW   | 1        |

### NOTE:

1. See SW FREQUENCY SELECTION table.

## BYTE 27: CPU PLL N PROGRAMMING

In CPU N programming mode, CPU frequency = CPN[9:0] \* band resolution. CPN0 has to be written for the CPN[9:0] to be loaded into PLL N divider. See SW FREQUENCY SELECTION table.

| Bit | Output(s) Affected | Description/Function | 0 | 1 | Type | Power On |
|-----|--------------------|----------------------|---|---|------|----------|
| 7   | CPN7               | CPU PLL N7           |   |   | RW   | 0        |
| 6   | CPN6               | CPU PLL N6           |   |   | RW   | 0        |
| 5   | CPN5               | CPU PLL N5           |   |   | RW   | 1        |
| 4   | CPN4               | CPU PLL N4           |   |   | RW   | 0        |
| 3   | CPN3               | CPU PLL N3           |   |   | RW   | 1        |
| 2   | CPN2               | CPU PLL N2           |   |   | RW   | 0        |
| 1   | CPN1               | CPU PLL N1           |   |   | RW   | 1        |
| 0   | CPN0               | CPU PLL N0           |   |   | RW   | 0        |

## BYTE 28: AGP/PCI PLL CONTROL

| Bit | Output(s) Affected | Description/Function                               | 0 | 1 | Type | Power On |
|-----|--------------------|----------------------------------------------------|---|---|------|----------|
| 7   | AFS2               | See AGP/PCI FREQUENCY SELECTION table              |   |   | RW   | 0        |
| 6   | AFS1               | See AGP/PCI FREQUENCY SELECTION table              |   |   | RW   | 0        |
| 5   | AFS0               | See AGP/PCI FREQUENCY SELECTION table              |   |   | RW   | 0        |
| 4   | WDAFS2             | AGP/PCI WD hard alarm time out frequency selection |   |   | RW   | 0        |
| 3   | WDAFS1             | AGP/PCI WD hard alarm time out frequency selection |   |   | RW   | 0        |
| 2   | WDAFS0             | AGP/PCI WD hard alarm time out frequency selection |   |   | RW   | 0        |
| 1   | APN9               | AGP/PCI PLL N9                                     |   |   | RW   | 0        |
| 0   | APN8               | AGP/PCI PLL N8                                     |   |   | RW   | 1        |

## BYTE 29: AGP/PCI N PROGRAMMING

In AGP/PCI N programming mode, AGP/PCI frequency =  $APN[9:0] * 0.223721591$ . APN0 has to be written for the APN[9:0] to be loaded into PLL N divider.

| Bit | Output(s) Affected | Description/Function | 0 | 1 | Type | Power On |
|-----|--------------------|----------------------|---|---|------|----------|
| 7   | APN7               | AGP/PCI PLL N7       |   |   | RW   | 0        |
| 6   | APN6               | AGP/PCI PLL N6       |   |   | RW   | 0        |
| 5   | APN5               | AGP/PCI PLL N5       |   |   | RW   | 1        |
| 4   | APN4               | AGP/PCI PLL N4       |   |   | RW   | 0        |
| 3   | APN3               | AGP/PCI PLL N3       |   |   | RW   | 1        |
| 2   | APN2               | AGP/PCI PLL N2       |   |   | RW   | 0        |
| 1   | APN1               | AGP/PCI PLL N1       |   |   | RW   | 1        |
| 0   | APN0               | AGP/PCI PLL N0       |   |   | RW   | 0        |

## BYTE 30: AGP/PCI SRC CONTROL

| Bit | Output(s) Affected                | Description/Function                                          | 0        | 1      | Type | Power On |
|-----|-----------------------------------|---------------------------------------------------------------|----------|--------|------|----------|
| 7   | AGP/PCI N Programming Mode Enable | AGP/PCI N Programming Enable                                  | Disable  | Enable | RW   | 0        |
| 6   | AGP/PCI Frequency Source Select   | 0 = fixed 66/33MHz<br>1 = selected by AFS[2:0] <sup>(1)</sup> | 66/33MHz |        | RW   | 0        |
| 5   | AGP SMC 2                         | AGP/PCI SSC magnitude control <sup>(2)</sup>                  |          |        | RW   | 0        |
| 4   | AGP SMC 1                         | AGP/PCI SSC magnitude control <sup>(2)</sup>                  |          |        | RW   | 1        |
| 3   | AGP SMC 0                         | AGP/PCI SSC magnitude control <sup>(2)</sup>                  |          |        | RW   | 0        |
| 2   | 3V66-PCI/F skew 2                 | Adjust 3V66 and PCI/F skew <sup>(3)</sup>                     |          |        | RW   | 0        |
| 1   | 3V66-PCI/F skew 1                 | Adjust 3V66 and PCI/F skew <sup>(3)</sup>                     |          |        | RW   | 0        |
| 0   | 3V66-PCI/F skew 0                 | Adjust 3V66 and PCI/F skew <sup>(3)</sup>                     |          |        | RW   | 0        |

### NOTES:

1. See AGP/PCI FREQUENCY SELECTION table.
2. See SMC table.
3. See 3V66 AND PCI/F SKEW table.

## BYTE 31: WATCHDOG TIMER

| Bit | Output(s) Affected    | Description/Function                                                                                                         | 0 | 1 | Type | Power On |
|-----|-----------------------|------------------------------------------------------------------------------------------------------------------------------|---|---|------|----------|
| 7   | WD Hard Alarm timer 7 | Specify WD Hard Alarm time out waiting time.<br>Time Out time = WD Hard Alarm timer[7:0] * 290ms<br>Default is 11*290 = 3.2s |   |   | RW   | 0        |
| 6   | WD Hard Alarm timer 6 |                                                                                                                              |   |   | RW   | 0        |
| 5   | WD Hard Alarm timer 5 |                                                                                                                              |   |   | RW   | 0        |
| 4   | WD Hard Alarm timer 4 |                                                                                                                              |   |   | RW   | 0        |
| 3   | WD Hard Alarm timer 3 |                                                                                                                              |   |   | RW   | 1        |
| 2   | WD Hard Alarm timer 2 |                                                                                                                              |   |   | RW   | 0        |
| 1   | WD Hard Alarm timer 1 |                                                                                                                              |   |   | RW   | 1        |
| 0   | WD Hard Alarm timer 0 |                                                                                                                              |   |   | RW   | 1        |

## BYTE 32: WD SOFT RESET TIMER

WD Soft Alarm timer has to be shorter than WD Hard Alarm timer. WDE and WD Soft Alarm bits, Byte 33 bit 7 and bit 5, have to be enabled for this Soft Alarm function.

| Bit | Output(s) Affected                              | Description/Function                                                                                       | 0      | 1             | Type | Power On |
|-----|-------------------------------------------------|------------------------------------------------------------------------------------------------------------|--------|---------------|------|----------|
| 7   | CPU WD Hard Alarm<br>safe frequency mode select | 0 = frequency select controlled by Byte 25 bit 7<br>1 = CPU frequency specified<br>by WDBS[2:0] WDCFS[2:0] | HW/I2C | WDBS<br>WDCFS | RW   | 0        |
| 6   | WDCFS2                                          | CPU WD time out safe frequency select <sup>(1)</sup>                                                       |        |               | RW   | 0        |
| 5   | WDCFS1                                          |                                                                                                            |        |               | RW   | 0        |
| 4   | WDCFS0                                          |                                                                                                            |        |               | RW   | 0        |
| 3   | WD soft alarm timer 3                           | Specify WD Soft Alarm Time Out time<br>Time Out time = WD Soft Alarm Timer[3:0]*290ms                      |        |               | RW   | 0        |
| 2   | WD soft alarm timer 2                           |                                                                                                            |        |               | RW   | 0        |
| 1   | WD soft alarm timer 1                           |                                                                                                            |        |               | RW   | 1        |
| 0   | WD soft alarm timer 0                           |                                                                                                            |        |               | RW   | 0        |

### NOTE:

1. See SW FREQUENCY SELECTION table.

## BYTE 33: WD CONTROL

| Bit | Output(s) Affected                                           | Description/Function                                                                                                                     | 0       | 1      | Type | Power On |
|-----|--------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|---------|--------|------|----------|
| 7   | WDE                                                          | Watchdog enable                                                                                                                          | Disable | Enable | RW   | 0        |
| 6   | WD FS relatch                                                | Relatch HW FS2, 1, 0<br>in event of WD Hard Alarm time out                                                                               | Disable | Enable | RW   | 0        |
| 5   | WD Soft Alarm enable                                         | WD Soft Alarm enable                                                                                                                     | Disable | Enable | RW   | 0        |
| 4   | AGP/PCI WD Hard Alarm<br>time out safe frequency mode select | In event of WD Hard Alarm time out<br>0 = AGP/PCI frequency controlled by Byte 30 bit 6<br>1 = AGP/PCI frequency specified by WDAFS[2:0] | HW/I2C  | WDAFS  | RW   | 0        |
| 3   | SRC SMC 2                                                    | SRC SSC magnitude control <sup>(1)</sup>                                                                                                 |         |        |      | 1        |
| 2   | SRC SMC 1                                                    | SRC SSC magnitude control <sup>(1)</sup>                                                                                                 |         |        |      | 0        |
| 1   | SRC SMC 0                                                    | SRC SSC magnitude control <sup>(1)</sup>                                                                                                 |         |        |      | 1        |
| 0   | Reserve                                                      |                                                                                                                                          |         |        |      | 0        |

### NOTE:

1. See SMC table.

## BYTE 34

| Bit | Output(s) Affected           | Description/Function                                | 0          | 1                      | Type | Power On |
|-----|------------------------------|-----------------------------------------------------|------------|------------------------|------|----------|
| 7   | SW 24_48MHz control override | 0 = controlled by hardware, 1 = controlled by bit 6 | HW control | controlled by<br>bit 6 | RW   | 0        |
| 6   | 24_48MHz select              |                                                     | 48MHz      | 24MHz                  | RW   | 0        |
| 5   | Reset#/PD#                   | Reset#/PD# mode select                              | Reset#     | PD#                    | RW   | 0        |
| 4   |                              |                                                     |            |                        |      | 0        |
| 3   |                              |                                                     |            |                        |      | 0        |
| 2   |                              |                                                     |            |                        |      |          |
| 1   |                              |                                                     |            |                        |      |          |
| 0   |                              |                                                     |            |                        |      |          |

## CPU AND AGP CLOCK FREQUENCY SELECTION

Band switch will take effect only when WD Soft Alarm time out is issued, which means there is a RESET issued. Even if the user changed BS[2:0], if there is no WD Soft Alarm, CPU PLL still uses the old band.

CPN[9:0] and APN[9:0] will be loaded into PLL only when CPN0 and APN0 are written respectively.

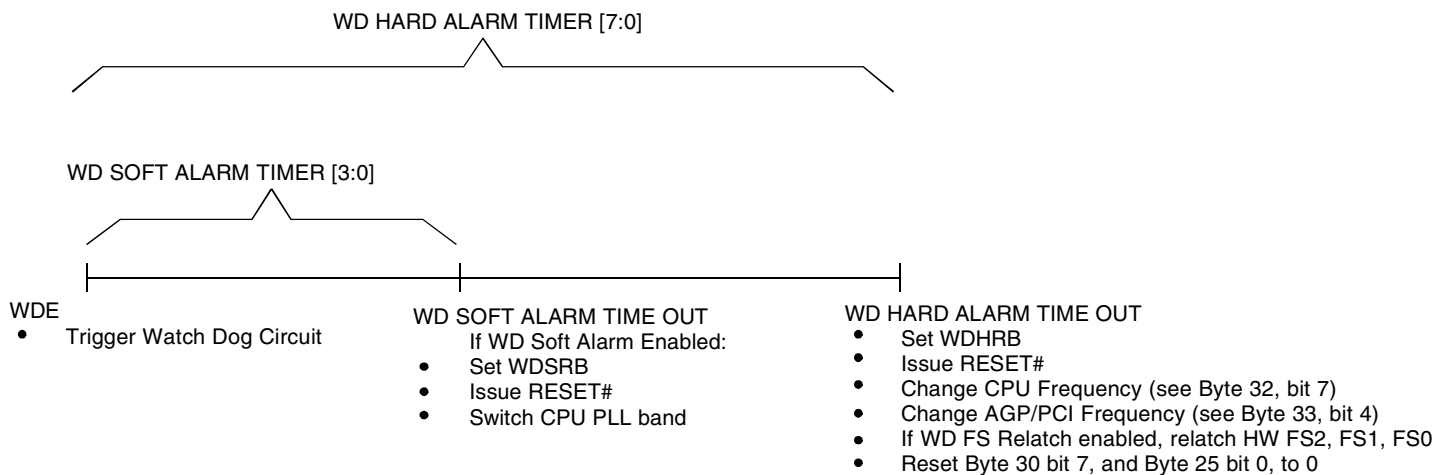
### CPU FREQUENCY

| Byte 25 bit 0, bit 7 | CPU Frequency Selected by: |
|----------------------|----------------------------|
| 00                   | HW FS[1:0]                 |
| 01                   | BS[2:0], CFS[2:0], Byte 25 |
| 10                   | CPN[9:0] * Band Resolution |
| 11                   | CPN[9:0] * Band Resolution |

### AGP/PCI FREQUENCY

| Byte 30 bit 7, bit 6 | AGP/PCI Frequency Selected by: |
|----------------------|--------------------------------|
| 00                   | 66/33                          |
| 01                   | AFS[2:0], Byte 28              |
| 10                   | APN[9:0] * 0.223721591         |
| 11                   | APN[9:0] * 0.223721591         |

## WD SOFT AND HARD ALARM/TIME OUT OPERATION



User only uses WD Soft Alarm when there is a band switch. It can be from HW to SW select, or in the SW select with band change. Soft Alarm Timer has to be shorter than Hard Alarm Timer.

At the event of WD Hard Alarm time out, CPU Safe return frequency is decided by two bits: Byte 32 bit 7 and Byte 25 bit 7. AGP/PCI Safe Return Frequency is decided by Byte 33 bit 4 and Byte 30 bit 6. Byte 30 bit 7, and Byte 25 bit 0, will be reset to 0.

| Byte 32 bit 7,<br>Byte 25 bit 7 | CPU WD Hard Alarm Time Out Frequency Select: |
|---------------------------------|----------------------------------------------|
| 00                              | Latched HW FS[1:0]                           |
| 01                              | BS[2:0], CFS[2:0], Byte 25                   |
| 10                              | WDBS[2:0], WDCFS[2:0], Byte 26 and Byte 32   |
| 11                              | WDBS[2:0], WDCFS[2:0], Byte 26 and Byte 32   |

| Byte 33 bit 4,<br>Byte 30 bit 6 | AGP/PCI Hard Alarm Time Out Frequency Select: |
|---------------------------------|-----------------------------------------------|
| 00                              | 66/33MHz                                      |
| 01                              | AFS[2:0], Byte 28                             |
| 10                              | WDAFS, Byte 28                                |
| 11                              | WDAFS, Byte 28                                |

## ELECTRICAL CHARACTERISTICS - INPUT / SUPPLY / COMMON OUTPUT PARAMETERS

Following Conditions Apply Unless Otherwise Specified:

Operating Condition:  $T_A = 0^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ , Supply Voltage:  $V_{DD} = 3.3\text{V} \pm 5\%$

| Symbol        | Parameter                            | Test Conditions                                              | Min.           | Typ.     | Max.           | Unit          |
|---------------|--------------------------------------|--------------------------------------------------------------|----------------|----------|----------------|---------------|
| $V_{IH}$      | 3.3V Input HIGH Voltage              | $3.3\text{V} \pm 5\%$                                        | 2              | —        | $V_{DD} + 0.3$ | V             |
| $V_{IL}$      | 3.3V Input LOW Voltage               | $3.3\text{V} \pm 5\%$                                        | $V_{SS} - 0.3$ | —        | 0.8            | V             |
| $I_{IH}$      | Input HIGH Current                   | $V_{IN} = V_{DD}$                                            | -5             | —        | 5              | $\mu\text{A}$ |
| $I_{IL1}$     | Input LOW Current                    | $V_{IN} = 0\text{V}$ , inputs with no pull-up resistors      | -5             | —        | —              | $\mu\text{A}$ |
| $I_{IL2}$     | Input LOW Current                    | $V_{IN} = 0\text{V}$ , inputs with pull-up resistors         | -200           | —        | —              | $\mu\text{A}$ |
| $I_{DD3.3OP}$ | Operating Supply Current             | Full active, $C_L$ = full load                               | —              | —        | 400            | mA            |
| $I_{DD3.3PD}$ | Powerdown Current                    | All differential pairs driven                                | —              | —        | 70             | mA            |
|               |                                      | All differential pairs tri-stated                            | —              | —        | 12             |               |
| $F_I$         | Input Frequency <sup>(2)</sup>       | $V_{DD} = 3.3\text{V}$                                       | —              | 14.31818 | —              | MHz           |
| $L_{PIN}$     | Pin Inductance <sup>(3)</sup>        |                                                              | —              | —        | 7              | nH            |
| $C_{IN}$      | Input Capacitance <sup>(3)</sup>     | Logic inputs                                                 | —              | —        | 5              | pF            |
| $C_{OUT}$     |                                      | Output pin capacitance                                       | —              | —        | 6              |               |
| $C_{INX}$     |                                      | X1 and X2 pins                                               | —              | —        | 5              |               |
| $T_{STAB}$    | Clock Stabilization <sup>(3,4)</sup> | From $V_{DD}$ power-up or de-assertion of PD# to first clock | —              | —        | 1.8            | ms            |
|               | Modulation Frequency <sup>(3)</sup>  | Triangular modulation                                        | 30             | —        | 33             | KHz           |
|               | $T_{DRIVE\_SRC}^{(3)}$               | SRC output enable after PCI_Stop# de-assertion               | —              | —        | 15             | ns            |
|               | $T_{DRIVE\_PD\#}^{(3)}$              | CPU output enable after PD# de-assertion                     | —              | —        | 300            | us            |
|               | $T_{FALL\_PD\#}^{(3)}$               | Fall time of PD#                                             | —              | —        | 5              | ns            |
|               | $T_{RISE\_PD\#}^{(4)}$               | Rise time of PD#                                             | —              | —        | 5              | ns            |
|               | $T_{DRIVE\_CPU\_Stop\#}^{(3)}$       | CPU output enable after CPU_Stop# de-assertion               | —              | —        | 10             | us            |
|               | $T_{FALL\_CPU\_Stop\#}^{(3)}$        | Fall time of PD#                                             | —              | —        | 5              | ns            |
|               | $T_{RISE\_CPU\_Stop\#}^{(4)}$        | Rise time of PD#                                             | —              | —        | 5              | ns            |

### NOTES:

1. Available to CV104, CV105, CV107, and CV109.
2. Input frequency should be measured at the REF output pin and tuned to ideal 14.31818MHz to meet ppm frequency accuracy on PLL outputs.
3. This parameter is guaranteed by design, but not 100% production tested.
4. See TIMING DIAGRAMS for timing requirements.

# ELECTRICAL CHARACTERISTICS - CPU AND SRC 0.7 CURRENT MODE DIFFERENTIAL PAIR<sup>(1)</sup>

Following Conditions Apply Unless Otherwise Specified:

Operating Condition:  $T_A = 0^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ , Supply Voltage:  $V_{DD} = 3.3\text{V} \pm 5\%$ ;  $C_L = 2\text{pF}$

| Symbol           | Parameter                                      | Test Conditions                                                                 | Min.   | Typ. | Max.        | Unit     |
|------------------|------------------------------------------------|---------------------------------------------------------------------------------|--------|------|-------------|----------|
| $Z_O$            | Current Source Output Impedance <sup>(2)</sup> | $V_O = V_X$                                                                     | 3000   | —    | —           | $\Omega$ |
| $V_{OVS}$        | Maximum Voltage (Overshoot)                    |                                                                                 | —      | —    | $V_H + 0.3$ | V        |
| $V_{UDS}$        | Minimum Voltage (Undershoot)                   |                                                                                 | -0.3   | —    | —           | V        |
| $V_{HIGH}$       | Voltage HIGH <sup>(2)</sup>                    | Statistical measurement on single-ended signal using oscilloscope math function | 660    | —    | 850         | mV       |
| $V_{LOW}$        | Voltage LOW <sup>(2)</sup>                     |                                                                                 | -150   | —    | 150         |          |
| $V_{OVS}$        | Max Voltage <sup>(2)</sup>                     | Measurement on single-ended signal using absolute value                         | —      | —    | 1150        | mV       |
| $V_{UDS}$        | Min Voltage <sup>(2)</sup>                     |                                                                                 | -300   | —    | —           |          |
| $V_{CROSS(ABS)}$ | Crossing Voltage (abs) <sup>(2)</sup>          |                                                                                 | 250    | —    | 550         | mV       |
| $d - V_{CROSS}$  | Crossing Voltage (var) <sup>(2)</sup>          | Variation of crossing over all edges                                            | —      | —    | 140         | mV       |
| ppm              | Long Accuracy <sup>(2,3)</sup>                 | See $T_{PERIOD}$ Min. - Max. values                                             | -300   | —    | 300         | ppm      |
| $T_{PERIOD}$     | Average Period <sup>(3)</sup>                  | 400MHz nominal, no Intel spec                                                   | 2.4993 | —    | 2.5008      | ns       |
|                  |                                                | 333.33MHz nominal, no Intel spec                                                | 2.9991 | —    | 3.0009      |          |
|                  |                                                | 266.66MHz nominal, no Intel spec                                                | 3.7489 | —    | 3.7511      |          |
|                  |                                                | 200MHz nominal                                                                  | 4.9985 | —    | 5.0015      |          |
|                  |                                                | 166.66MHz nominal                                                               | 5.9982 | —    | 6.0018      |          |
|                  |                                                | 133.33MHz nominal                                                               | 7.4978 | —    | 7.5023      |          |
|                  |                                                | 100MHz nominal                                                                  | 9.997  | —    | 10.003      |          |
| $T_{PERIOD}$     | Average Period <sup>(3)</sup>                  | 400MHz spread, no Intel spec                                                    | 2.4993 | —    | 2.5008      | ns       |
|                  |                                                | 333.33MHz spread, no Intel spec                                                 | 2.9991 | —    | 3.0009      |          |
|                  |                                                | 266.66MHz spread, no Intel spec                                                 | 3.7489 | —    | 3.7511      |          |
|                  |                                                | 200MHz spread                                                                   | 4.9985 | —    | 5.0266      |          |
|                  |                                                | 166.66MHz spread                                                                | 5.9982 | —    | 6.032       |          |
|                  |                                                | 133.33MHz spread                                                                | 7.4978 | —    | 7.54        |          |
|                  |                                                | 100MHz spread                                                                   | 9.997  | —    | 10.0533     |          |
| $t_R$            | Rise Time <sup>(2)</sup>                       | $V_{OL} = 0.175\text{V}$ , $V_{OH} = 0.525\text{V}$                             | 175    | —    | 700         | ps       |
| $t_F$            | Fall Time <sup>(2)</sup>                       | $V_{OL} = 0.175\text{V}$ , $V_{OH} = 0.525\text{V}$                             | 175    | —    | 700         | ps       |
| $d-t_R$          | Rise Time Variation <sup>(2)</sup>             |                                                                                 | —      | —    | 125         | ps       |
| $d-t_F$          | Fall Time Variation <sup>(2)</sup>             |                                                                                 | —      | —    | 125         | ps       |
| $dt_3$           | Duty Cycle <sup>(2)</sup>                      | Measurement from differential waveform                                          | 45     | —    | 55          | %        |
| $tsk_3$          | Skew <sup>(2)</sup>                            | $V_T = 50\%$                                                                    | —      | —    | 100         | ps       |
| $t_{CYC-CYC}$    | Jitter, Cycle to Cycle <sup>(2)</sup>          | Measurement from differential waveform                                          | —      | —    | 85          | ps       |

## NOTES:

- SRC clock outputs run only at 100MHz or 200MHz. Specs for 133.33 and 166.66 do not apply to SRC clock pair.
- This parameter is guaranteed by design, but not 100% production tested.
- All long term accuracy and clock period specifications are guaranteed with the assumption that the REF output is at 14.31818MHz.



## ELECTRICAL CHARACTERISTICS - 3V66

Following Conditions Apply Unless Otherwise Specified:

Operating Condition:  $T_A = 0^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ , Supply Voltage:  $V_{DD} = 3.3\text{V} \pm 5\%$ ;  $C_L = 10 - 30\text{pF}$

| Symbol    | Parameter                      | Test Conditions                | Min.    | Typ. | Max.    | Unit |
|-----------|--------------------------------|--------------------------------|---------|------|---------|------|
| ppm       | Long Accuracy <sup>(1,2)</sup> | See Tperiod Min. - Max. values | -300    | —    | 300     | ppm  |
| VOH       | Output HIGH Voltage            | $I_{OH} = -1\text{mA}$         | 2.4     | —    | —       | V    |
| VOL       | Output LOW Voltage             | $I_{OL} = 1\text{mA}$          | —       | —    | 0.55    | V    |
| TPERIOD   | Clock Period <sup>(2)</sup>    | 66MHz output nominal           | 14.9955 | —    | 15.0045 | ns   |
|           |                                | 66MHz output spread            | 14.9955 | —    | 15.0799 |      |
| IOH       | Output HIGH Current            | VOH at Min. = 1V               | -33     | —    | —       | mA   |
|           |                                | VOH at Max. = 3.135V           | —       | —    | -33     |      |
| IOL       | Output LOW Current             | VOL at Min. = 1.95V            | 30      | —    | —       | mA   |
|           |                                | VOL at Max. = 0.4V             | —       | —    | 38      |      |
|           | Edge Rate <sup>(1)</sup>       | Rising/Falling edge rate       | 1       | —    | 4       | V/ns |
| tR1       | Rise Time <sup>(1)</sup>       | VOL = 0.4V, VOH = 2.4V         | 0.5     | —    | 2       | ns   |
| tF1       | Fall Time <sup>(1)</sup>       | VOL = 0.4V, VOH = 2.4V         | 0.5     | —    | 2       | ns   |
| tsk1      | Skew <sup>(1)</sup>            | $V_T = 1.5\text{V}$            | —       | —    | 250     | ps   |
| dT1       | Duty Cycle <sup>(1)</sup>      | $V_T = 1.5\text{V}$            | 45      | —    | 55      | %    |
| tJCYC-CYC | Jitter <sup>(1)</sup>          | $V_T = 1.5\text{V}$ , 3V66     | —       | —    | 250     | ps   |

### NOTES:

1. This parameter is guaranteed by design, but not 100% production tested.
2. All long term accuracy and clock period specifications are guaranteed with the assumption that the REF output is at 14.31818MHz.

## ELECTRICAL CHARACTERISTICS - PCICLK / PCICLK\_F

Following Conditions Apply Unless Otherwise Specified:

Operating Condition:  $T_A = 0^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ , Supply Voltage:  $V_{DD} = 3.3\text{V} \pm 5\%$ ;  $C_L = 10 - 30\text{pF}$

| Symbol    | Parameter                      | Test Conditions                | Min.   | Typ. | Max.    | Unit |
|-----------|--------------------------------|--------------------------------|--------|------|---------|------|
| ppm       | Long Accuracy <sup>(1,2)</sup> | See Tperiod Min. - Max. values | —      | —    | 300     | ppm  |
| TPERIOD   | Clock Period <sup>(2)</sup>    | 33.33MHz output nominal        | 29.991 | —    | 30.009  | ns   |
|           |                                | 33.33MHz output spread         | 29.991 | —    | 30.1598 |      |
| VOH       | Output HIGH Voltage            | $I_{OH} = -1\text{mA}$         | 2.4    | —    | —       | V    |
| VOL       | Output LOW Voltage             | $I_{OL} = 1\text{mA}$          | —      | —    | 0.55    | V    |
| IOH       | Output HIGH Current            | VOH at Min. = 1V               | -33    | —    | —       | mA   |
|           |                                | VOH at Max. = 3.135V           | —      | —    | -33     |      |
| IOL       | Output LOW Current             | VOL at Min. = 1.95V            | 30     | —    | —       | mA   |
|           |                                | VOL at Max. = 0.4V             | —      | —    | 38      |      |
|           | Edge Rate <sup>(1)</sup>       | Rising edge rate               | 1      | —    | 4       | V/ns |
|           | Edge Rate <sup>(1)</sup>       | Falling edge rate              | 1      | —    | 4       | V/ns |
| tR1       | Rise Time <sup>(1)</sup>       | VOL = 0.4V, VOH = 2.4V         | 0.5    | —    | 2       | ns   |
| tF1       | Fall Time <sup>(1)</sup>       | VOL = 0.4V, VOH = 2.4V         | 0.5    | —    | 2       | ns   |
| dT1       | Duty Cycle <sup>(1)</sup>      | $V_T = 1.5\text{V}$            | 45     | —    | 55      | %    |
| tsk1      | Skew <sup>(1)</sup>            | $V_T = 1.5\text{V}$            | —      | —    | 500     | ps   |
| tJCYC-CYC | Jitter <sup>(1)</sup>          | $V_T = 1.5\text{V}$            | —      | —    | 250     | ps   |

### NOTES:

1. This parameter is guaranteed by design, but not 100% production tested.
2. All long term accuracy and clock period specifications are guaranteed with the assumption that the REF output is at 14.31818MHz.

## ELECTRICAL CHARACTERISTICS, 48MHZ, USB AND V<sub>CH</sub>

Following Conditions Apply Unless Otherwise Specified:

Operating Condition: T<sub>A</sub> = 0°C to +70°C, Supply Voltage: V<sub>DD</sub> = 3.3V ± 5%; C<sub>L</sub> = 10 - 20pF

| Symbol                | Parameter                      | Test Conditions                                | Min.    | Typ. | Max.    | Unit |
|-----------------------|--------------------------------|------------------------------------------------|---------|------|---------|------|
| ppm                   | Long Accuracy <sup>(1,2)</sup> | See Tperiod Min. - Max. values                 | —       | —    | 300     | ppm  |
| T <sub>PERIOD</sub>   | Clock Period <sup>(2)</sup>    | 48MHz output nominal                           | 20.8271 | —    | 20.8396 | ns   |
| V <sub>OH</sub>       | Output HIGH Voltage            | I <sub>OH</sub> = -1mA                         | 2.4     | —    | —       | V    |
| V <sub>OL</sub>       | Output LOW Voltage             | I <sub>OL</sub> = 1mA                          | —       | —    | 0.55    | V    |
| I <sub>OH</sub>       | Output HIGH Current            | V <sub>OH</sub> at Min. = 1V                   | -33     | —    | —       | mA   |
|                       |                                | V <sub>OH</sub> at Max. = 3.135V               | —       | —    | -33     |      |
| I <sub>OL</sub>       | Output LOW Current             | V <sub>OL</sub> at Min. = 1.95V                | 30      | —    | —       | mA   |
|                       |                                | V <sub>OL</sub> at Max. = 0.4V                 | —       | —    | 38      |      |
|                       | Edge Rate <sup>(1)</sup>       | Rising edge rate                               | 1       | —    | 2       | V/ns |
|                       | Edge Rate <sup>(1)</sup>       | Falling edge rate                              | 1       | —    | 2       | V/ns |
| t <sub>R1</sub>       | Rise Time <sup>(1)</sup>       | V <sub>OL</sub> = 0.4V, V <sub>OH</sub> = 2.4V | 1       | —    | 2       | ns   |
| t <sub>F1</sub>       | Fall Time <sup>(1)</sup>       | V <sub>OL</sub> = 0.4V, V <sub>OH</sub> = 2.4V | 1       | —    | 2       | ns   |
| d <sub>T1</sub>       | Duty Cycle <sup>(1)</sup>      | V <sub>T</sub> = 1.5V                          | 45      | —    | 55      | %    |
| t <sub>JCYC-CYC</sub> | Jitter <sup>(1)</sup>          |                                                | —       | —    | 350     | ps   |

### NOTES:

1. This parameter is guaranteed by design, but not 100% production tested.
2. All long term accuracy and clock period specifications are guaranteed with the assumption that the REF output is at 14.31818MHz.

## ELECTRICAL CHARACTERISTICS, DOT 48MHZ

Following Conditions Apply Unless Otherwise Specified:

Operating Condition: T<sub>A</sub> = 0°C to +70°C, Supply Voltage: V<sub>DD</sub> = 3.3V ± 5%; C<sub>L</sub> = 10 - 20pF

| Symbol                | Parameter                      | Test Conditions                                | Min.    | Typ. | Max.    | Unit |
|-----------------------|--------------------------------|------------------------------------------------|---------|------|---------|------|
| ppm                   | Long Accuracy <sup>(1,2)</sup> | See Tperiod Min. - Max. values                 | —       | —    | 300     | ppm  |
| T <sub>PERIOD</sub>   | Clock Period <sup>(2)</sup>    | 48MHz output nominal                           | 20.8271 | —    | 20.8396 | ns   |
| V <sub>OH</sub>       | Output HIGH Voltage            | I <sub>OH</sub> = -1mA                         | 2.4     | —    | —       | V    |
| V <sub>OL</sub>       | Output LOW Voltage             | I <sub>OL</sub> = 1mA                          | —       | —    | 0.55    | V    |
| I <sub>OH</sub>       | Output HIGH Current            | V <sub>OH</sub> at Min. = 1V                   | -33     | —    | —       | mA   |
|                       |                                | V <sub>OH</sub> at Max. = 3.135V               | —       | —    | -33     |      |
| I <sub>OL</sub>       | Output LOW Current             | V <sub>OL</sub> at Min. = 1.95V                | 30      | —    | —       | mA   |
|                       |                                | V <sub>OL</sub> at Max. = 0.4V                 | —       | —    | 38      |      |
|                       | Edge Rate <sup>(1)</sup>       | Rising edge rate                               | 2       | —    | 4       | V/ns |
|                       | Edge Rate <sup>(1)</sup>       | Falling edge rate                              | 2       | —    | 4       | V/ns |
| t <sub>R1</sub>       | Rise Time <sup>(1)</sup>       | V <sub>OL</sub> = 0.4V, V <sub>OH</sub> = 2.4V | 0.5     | —    | 1       | ns   |
| t <sub>F1</sub>       | Fall Time <sup>(1)</sup>       | V <sub>OL</sub> = 0.4V, V <sub>OH</sub> = 2.4V | 0.5     | —    | 1       | ns   |
| d <sub>T1</sub>       | Duty Cycle <sup>(1)</sup>      | V <sub>T</sub> = 1.5V                          | 45      | —    | 55      | %    |
| t <sub>JCYC-CYC</sub> | Jitter <sup>(1)</sup>          |                                                | —       | —    | 350     | ps   |

### NOTES:

1. This parameter is guaranteed by design, but not 100% production tested.
2. All long term accuracy and clock period specifications are guaranteed with the assumption that the REF output is at 14.31818MHz.

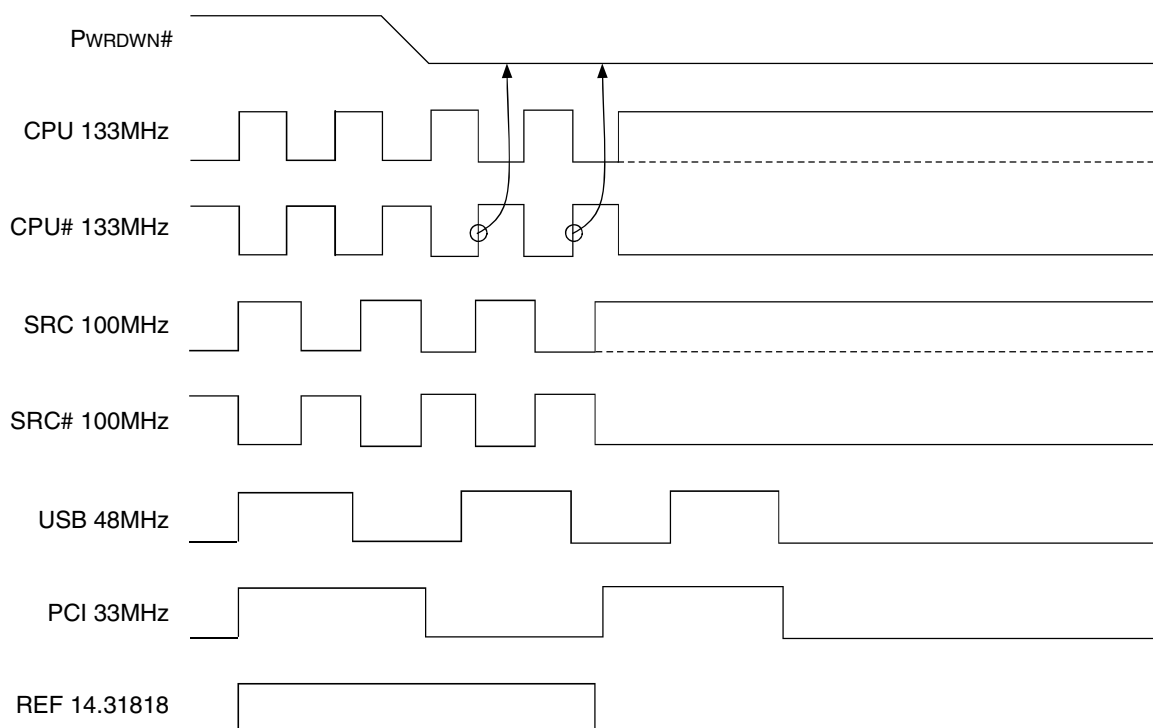
## PD#, POWER DOWN

PD# is an asynchronous active low input used to shut off all clocks cleanly prior to clock power. When PD# is asserted low all clocks will be driven low before turning off the VCO. In PD# de-assertion all clocks will start without glitches.

| PWRDWN# | CPU               | CPU#   | SRC               | SRC#   | PCIF/PCI | USB   | 3V66  | REF       |
|---------|-------------------|--------|-------------------|--------|----------|-------|-------|-----------|
| 1       | Normal            | Normal | Normal            | Normal | 33MHz    | 48MHz | 66MHz | 14.318MHz |
| 0       | IREF * 2 or float | Float  | IREF * 2 or float | Float  | Low      | Low   | Low   | Low       |

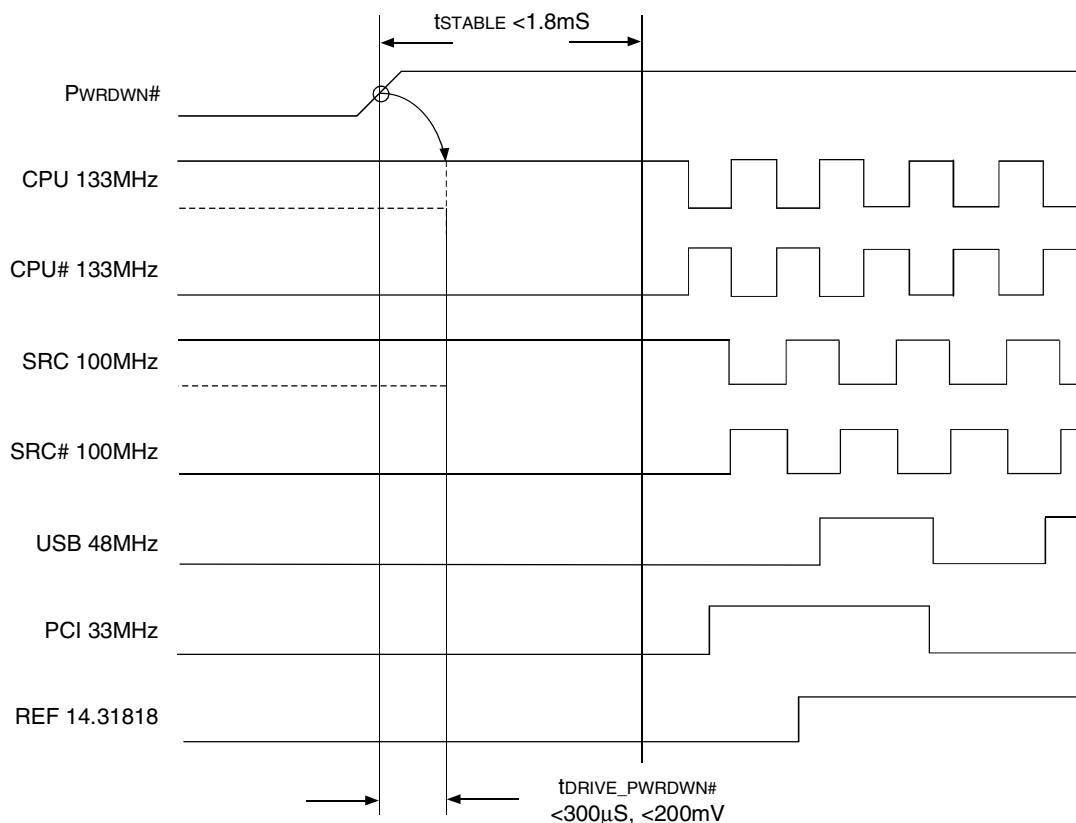
## PD# ASSERTION

PD# should be sampled low by two consecutive CPU# rising edges before stopping clocks. All single-ended clocks will be held low on their next high to low transition. All differential clocks will be held high on the next high to low transition of the complimentary clock. If the control register determining to drive mode is set to 'tri-state', the differential pair will be stopped in tri-state mode, undriven. When the drive mode but corresponding to the CPU or SRC clock of interest is set to '0' the true clock will be driven high at 2 x IREF and the complementary clock will be tristated. If the control register is programmed to '1' both clocks will be tristated.



## PD# DE-ASSERTION

The time from the de-assertion of PD# or until power supply ramps to get stable clocks will be less than 1.8ms. If the drive mode control bit for PD# tristate is programmed to '1' the stopped differential pair must first be driven high to a minimum of 200mV in less than 300µs of PD# deassertion.



## N PROGRAMMING JITTER MEASUREMENT

Tested on IDT test board, 10" trace, 10pF loading.

Measured at CPU0, differential active probe.

Data showed may vary due to CMOS process.

### 100MHz MODE

| N =         | Output Freq. (MHz) | CPU Jitter (ps) |
|-------------|--------------------|-----------------|
| 200h (512)  | 115                | 80              |
| 300h (768)  | 172                | 51              |
| 3FFh (1023) | 229                | 65              |

### 133MHz MODE

| N =         | Output Freq. (MHz) | CPU Jitter (ps) |
|-------------|--------------------|-----------------|
| 200h (512)  | 153                | 76              |
| 300h (768)  | 229                | 79              |
| 3FFh (1023) | 306                | 72              |

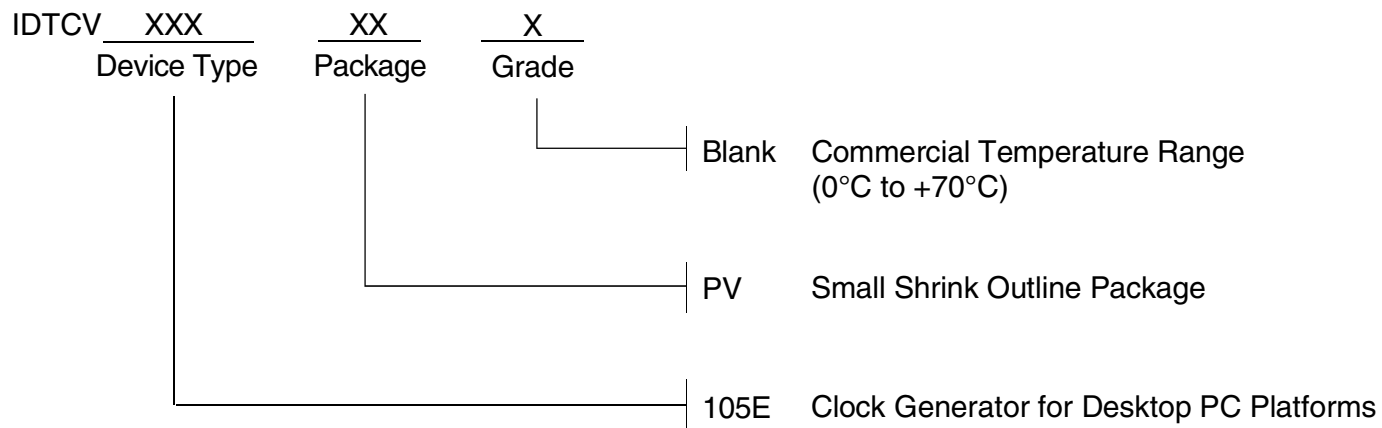
### 166MHz MODE

| N =         | Output Freq. (MHz) | CPU Jitter (ps) |
|-------------|--------------------|-----------------|
| 200h (512)  | 204                | 71              |
| 300h (768)  | 305                | 72              |
| 3FFh (1023) | 407                | 92              |

### 200MHz MODE

| N =         | Output Freq. (MHz) | CPU Jitter (ps) |
|-------------|--------------------|-----------------|
| 200h (512)  | 229                | 68              |
| 300h (768)  | 344                | 84              |
| 3FFh (1023) | 458                | 82              |

## ORDERING INFORMATION



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