

56-pin CK505 for Embedded Intel Systems

ICS9EPRS525

Recommended Application:

56-pin CK505 compatible clock, w/fully integrated Vreg and series resistors on differential outputs for embedded applications

Output Features:

- 2 - CPU differential low power push-pull pairs
- 7 - SRC differential push-pull pairs
- 1 - CPU/SRC selectable differential low power push-pull pair
- 1 - SRC/DOT selectable differential low power push-pull pair
- 1 - SRC/SE selectable differential push-pull pair/Single-ended outputs
- 5 - PCI, 33MHz
- 1 - USB, 48MHz
- 1 - REF, 14.318MHz

Key Specifications:

- CPU outputs cycle-cycle jitter < 85ps
- SRC output cycle-cycle jitter < 125ps
- PCI outputs cycle-cycle jitter < 250ps
- +/- 100ppm frequency accuracy on all outputs
- SRC outputs meet PCIe Gen2 when sourced from PLL3

Features/Benefits:

- Supports spread spectrum modulation, 0 to -0.5% down spread
- Supports CPU clks up to 400MHz
- Uses external 14.318MHz crystal, external crystal load caps are required for frequency tuning

Table 1: CPU Frequency Select Table

| FS _L C ² B0b7 | FS _L B ¹ B0b6 | FS _L A ¹ B0b5 | CPU MHz | SRC MHz | PCI MHz | REF MHz | USB MHz | DOT MHz |
|--|--|--|------------|------------|------------|------------|------------|------------|
| 0 | 0 | 0 | 266.66 | 100.00 | 33.33 | 14.318 | 48.00 | 96.00 |
| 0 | 0 | 1 | 133.33 | | | | | |
| 0 | 1 | 0 | 200.00 | | | | | |
| 0 | 1 | 1 | 166.66 | | | | | |
| 1 | 0 | 0 | 333.33 | | | | | |
| 1 | 0 | 1 | 100.00 | | | | | |
| 1 | 1 | 0 | 400.00 | | | | | |
| 1 | 1 | 1 | Reserved | | | | | |

1. FS_LA and FS_LB are low-threshold inputs. Please see V_{IL,FS} and V_{IH,FS} specifications in the Input/Supply/Common Output Parameters Table for correct values. Also refer to the Test Clarification Table.

2. FS_LC is a three-level input. Please see the V_{IL,FS} and V_{IH,FS} specifications in the Input/Supply/Common Output Parameters Table for correct values.

Pin Configuration

| | | | |
|-----------------------|----|----|-------------------------|
| PCI0/CR#_A | 1 | 56 | SCLK |
| VDDPCI | 2 | 55 | SDATA |
| PCI1/CR#_B | 3 | 54 | REF0/FSLC/TEST_SEL |
| PCI2/TME | 4 | 53 | VDDREF |
| PCI3/CFG0 | 5 | 52 | X1 |
| PCI4/SRC5_EN | 6 | 51 | X2 |
| PCI_F5/ITP_EN | 7 | 50 | GNDREF |
| GNDPCI | 8 | 49 | FSLB/TEST_MODE |
| VDD48 | 9 | 48 | CK_PWRGD/PD# |
| USB_48MHz/FSLA | 10 | 47 | VDDCPU |
| GND48 | 11 | 46 | CPUT0_LRS |
| VDD96IO | 12 | 45 | CPUC0_LRS |
| DOTT_96_LRS/SRCT0_LRS | 13 | 44 | GNDCPU |
| DOTC_96_LRS/SRCC0_LRS | 14 | 43 | CPUT1_F_LRS |
| GND | 15 | 42 | CPUC1_F_LRS |
| VDD | 16 | 41 | VDDCPUIO |
| SRCT1_LRS/SE1 | 17 | 40 | NC |
| SRCC1_LRS/SE2 | 18 | 39 | CPUT2_ITP_LRS/SRCT8_LRS |
| GND | 19 | 38 | CPUC2_ITP_LRS/SRCC8_LRS |
| VDDPLL3IO | 20 | 37 | VDDSRCIO |
| SRCT2_LRS/SATAT_LRS | 21 | 36 | SRCT7_LRS/CR#_F |
| SRCC2_LRS/SATAC_LRS | 22 | 35 | SRCC7_LRS/CR#_E |
| GNDSRC | 23 | 34 | GNDSRC |
| SRCT3_LRS/CR#_C | 24 | 33 | SRCT6_LRS |
| SRCC3_LRS/CR#_D | 25 | 32 | SRCC6_LRS |
| VDDSRCIO | 26 | 31 | VDDSRC |
| SRCT4_LRS | 27 | 30 | PCI_STOP#/SRCT5_LRS |
| SRCC4_LRS | 28 | 29 | CPU_STOP#/SRCC5_LRS |

56-TSSOP

Pin Description

| PIN # | PIN NAME | TYPE | DESCRIPTION |
|-------|-----------------------|------|---|
| 1 | PCI0/CR#_A | I/O | 3.3V PCI clock output or Clock Request control A for either SRC0 or SRC2 pair The power-up default is PCI0 output, but this pin may also be used as a Clock Request control of SRC pair 0 or SRC pair 2 via SMBus. Before configuring this pin as a Clock Request Pin, the PCI output must first be disabled in byte 2, bit 0 of SMBus address space . After the PCI output is disabled (high-Z), the pin can then be set to serve as a Clock Request pin for either SRC pair 2 or pair 0 using the CRA#_EN bit located in byte 5 of SMBUs address space. Byte 5, bit 7 0 = PCI0 enabled (default) 1= CRA# enabled. Byte 5, bit 6 controls whether CRA# controls SRC0 or SRC2 pair Byte 5, bit 6 0 = CRA# controls SRC0 pair (default), 1= CRA# controls SRC2 pair |
| 2 | VDDPCI | PWR | Power supply for PCI clocks, nominal 3.3V |
| 3 | PCI1/CR#_B | I/O | 3.3V PCI clock output/Clock Request control B for either SRC1 or SRC4 pair The power-up default is PCI1 output, but this pin may also be used as a Clock Request control of SRC pair 1 or SRC pair 4 via SMBus. Before configuring this pin as a Clock Request Pin, the PCI output must first be disabled in byte 2, bit 1 of SMBus address space . After the PCI output is disabled (high-Z), the pin can then be set to serve as a Clock Request pin for either SRC pair 1 or pair 4 using the CRB#_EN bit located in byte 5 of SMBUs address space. Byte 5, bit 5 0 = PCI1 enabled (default) 1= CRB# enabled. Byte 5, bit 6 controls whether CRB# controls SRC1 or SRC4 pair Byte 5, bit 4 0 = CRB# controls SRC1 pair (default) 1= CRB# controls SRC4 pair |
| 4 | PCI2/TME | I/O | 3.3V PCI clock output / Trusted Mode Enable(TME) Latched Input. This pin is sampled on power-up as follows 0=Overclocking of CPU and SRC allowed 1=Overclocking of CPU and SRC NOT allowed After being sampled on power-up, this pin becomes a 3.3V PCI Output |
| 5 | PCI3/CFG0 | I/O | 3.3V PCI clock output/Configuration Strap. See PCI3 Configuration Table for more information |
| 6 | PCI4/SRC5_EN | I/O | 3.3V PCI clock output / SRC5 pair or PCI_STOP#/CPU_STOP# enable strap. On powerup, the logic value on this pin determines if the SRC5 pair is enabled or if CPU_STOP#/PCI_STOP# is enabled (pins 29 and 30). The latched value controls the pin function on pins 29 and 30 as follows 0 = PCI_STOP#/CPU_STOP# 1 = SRC5/SRC5# |
| 7 | PCI_F5/ITP_EN | I/O | Free running PCI clock output and ITP/SRC8 enable strap. This output is not affected by the state of the PCI_STOP# pin. On powerup, the state of this pin determines whether pins 38 and 39 are an ITP or SRC pair. 0 =SRC8/SRC8# 1 = ITP/ITP# |
| 8 | GNDPCI | PWR | Ground pin for the PCI outputs |
| 9 | VDD48 | PWR | Power pin for the 48MHz output and PLL.3.3V |
| 10 | USB_48MHz/FSLA | I/O | 3.3V tolerant input for CPU frequency selection. Refer to input electrical characteristics for Vil_FS and Vih_FS values. / Fixed 48MHz USB clock output. 3.3V. |
| 11 | GND48 | PWR | Ground pin for the 48MHz outputs |
| 12 | VDD96IO | PWR | Power supply for DOT96 outputs, 1.05V to 3.3V. |
| 13 | DOTT_96_LRS/SRCT0_LRS | OUT | True clock of low power differential SRC or DOT96 with integrated 33 ohm Rs. The power-up default function is SRC0. After powerup, this pin function may be changed to DOT96 via SMBus Byte 1, bit 7 as follows: 0= SRC0 1=DOT96 |
| 14 | DOTC_96_LRS/SRCC0_LRS | OUT | Complement clock of low power differential SRC or DOT96 with integrated 33 ohm Rs. The power-up default function is SRC0#. After powerup, this pin function may be changed to DOT96# via SMBus Byte 1, bit 7 as follows 0= SRC0# 1=DOT96# |
| 15 | GND | PWR | Ground pin. |
| 16 | VDD | PWR | Power supply, nominal 3.3V |
| 17 | SRCT1_LRS/SE1 | OUT | True clock of low power differential SRC1 clock pair with integrated 33 ohm Rs. / 3.3V single-ended output. The powerup default is 100 MHz SRC, -0.5% downspread. The pin function may be changed via SMBus B1b[4:1] |
| 18 | SRCC1_LRS/SE2 | OUT | Complement clock of low power differential SRC1 clock pair with integrated 33 ohm Rs / 3.3V single-ended output. The powerup default is 100 MHz SRC, -0.5% downspread. The pin function may be changed via SMBus B1b[4:1] |
| 19 | GND | PWR | Ground pin. |
| 20 | VDDPLL3IO | PWR | Power supply for PLL3 outputs. 1.05V to 3.3V. |
| 21 | SRCT2_LRS/SATAT_LRS | OUT | True clock of low power differential SRC/SATA clock pair with integrated Rs. |
| 22 | SRCC2_LRS/SATAC_LRS | OUT | Complement clock of low power differential push-pull SRC/SATA clock pair with integrated 33 ohm Rs. |
| 23 | GNDSRC | PWR | Ground pin for the SRC outputs |
| 24 | SRCT3_LRS/CR#_C | I/O | True clock of low power differential SRC clock pair with integrated 33 ohm Rs./ Clock Request control C for either SRC0 or SRC2 pair. The power-up default is SRCCLK3 output, but this pin may also be used as a Clock Request control of SRC pair 0 or SRC pair 2 via SMBus. Before configuring this pin as a Clock Request Pin, the SRC output must first be disabled in byte 4, bit 7 of SMBus address space . After the SRC output is disabled, the pin can then be set to serve as a Clock Request pin for either SRC pair 2 or pair 0 using the CRC#_EN bit located in byte 5 of SMBUs address space. Byte 5, bit 3 0 = SRCCLK3 enabled (default) 1= CRC# enabled. Byte 5, bit 2 controls whether CRC# controls SRC0 or SRC2 pair Byte 5, bit 2 0 = CRC# controls SRC0 pair (default), 1= CRC# controls SRC2 pair |

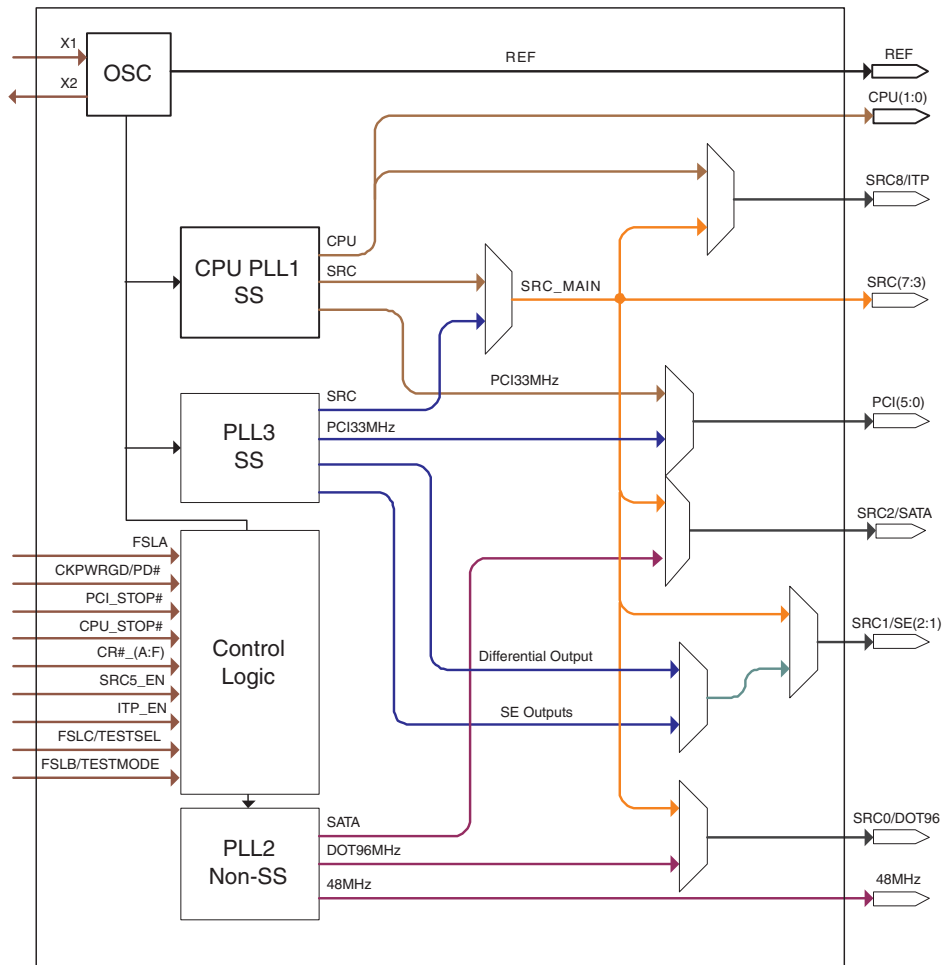
Pin Description (continued)

| PIN # | PIN NAME | TYPE | DESCRIPTION |
|-------|-------------------------|------|--|
| 25 | SRCC3_LRS/CR#_D | I/O | Complementary clock of low power differential SRC clock pair with integrated 33 ohm Rs/ Clock Request control D for either SRC1 or SRC4 pair. The power-up default is SRCLK3 output, but this pin may also be used as a Clock Request control of SRC pair 1 or SRC pair 4 via SMBus. Before configuring this pin as a Clock Request Pin, the SRC output must first be disabled in byte 4, bit 7 of SMBus address space. After the SRC output is disabled, the pin can then be set to serve as a Clock Request pin for either SRC pair 1 or pair 4 using the CRD#_EN bit located in byte 5 of SMBus address space. Byte 5, bit 1 0 = SRC3 enabled (default) 1 = CRD# enabled. Byte 5, bit 0 controls whether CRD# controls SRC1 or SRC4 pair Byte 5, bit 0 0 = CRD# controls SRC1 pair (default), 1 = CRD# controls SRC4 pair |
| 26 | VDDSRCIO | PWR | Power supply for SRC outputs. 1.05V to 3.3V. |
| 27 | SRCT4_LRS | OUT | True clock of low power differential SRC clock pair with integrated 33 ohm Rs. |
| 28 | SRCC4_LRS | OUT | Complement clock of low power differential SRC clock pair with 33 ohm integrated Rs. |
| 29 | CPU_STOP#/SRCC5_LRS | I/O | Stops all CPUCLK, except those set to be free running clocks / Complement clock of low power differential SRC pair with 33 ohm integrated Rs. |
| 30 | PCL_STOP#/SRCT5_LRS | I/O | Stops all PCICLKs at logic 0 level, when low. Free running PCICLKs are not effected by this input. / True clock of low power differential SRC pair with integrated 33 ohm Rs. |
| 31 | VDDSRC | PWR | Supply for SRC PLL, 3.3V nominal |
| 32 | SRCC6_LRS | OUT | Complement clock of low power differential SRC clock pair with 33 ohm integrated Rs. |
| 33 | SRCT6_LRS | OUT | True clock of low power differential SRC clock pair with integrated 33 ohm Rs. |
| 34 | GNDSRC | PWR | Ground pin for the SRC outputs |
| 35 | SRCC7_LRS/CR#_E | I/O | Complement clock of differential push-pull SRC clock pair with 33 ohm integrated Rs. / Clock Request control E for SRC6 pair. The power-up default is SRC7#, but this pin may also be used as a Clock Request control of SRC6 via SMBus. Before configuring this pin as a Clock Request Pin, the SRC7 output pair must first be disabled in byte 3, bit 3 of SMBus configuration space. After the SRC output is disabled (high-Z), the pin can then be set to serve as a Clock Request for SRC6 pair using byte 6, bit 7 of SMBus configuration space Byte 6, bit 7 0 = SRC7# enabled (default) 1 = CRE# enabled |
| 36 | SRCT7_LRS/CR#_F | I/O | True clock of differential push-pull SRC clock pair/ Clock Request control 8 for SRC8 pair The power-up default is SRC7, but this pin may also be used as a Clock Request control of SRC8 via SMBus. Before configuring this pin as a Clock Request Pin, the SR |
| 37 | VDDSRCIO | PWR | Power supply for SRC outputs. 1.05V to 3.3V. |
| 38 | CPUC2_ITP_LRS/SRCC8_LRS | OUT | Complement clock of low power differential CPU2/Complement clock of differential SRC pair. 33 ohm Rs is integrated. The function of this pin is determined by the latched input value on pin 7, PCIF5/ITP_EN on powerup. The function is as follows: Pin 7 latched input Value 0 = SRC8# 1 = ITP# |
| 39 | CPUT2_ITP_LRS/SRCT8_LRS | OUT | True clock of low power differential CPU2/True clock of differential SRC pair. 33 ohm Rs is integrated. The function of this pin is determined by the latched input value on pin 7, PCIF5/ITP_EN on powerup. The function is as follows: Pin 7 latched input Value 0 = SRC8 1 = ITP |
| 40 | NC | N/A | No Connect |
| 41 | VDDCPUIO | PWR | Power supply for CPU outputs, 1.05V to 3.3V. |
| 42 | CPUC1_F_LRS | OUT | Complementary clock of low power differential push-pull CPU output with integrated 33 ohm Rs. This CPU clock is free running during iAMT. |
| 43 | CPUT1_F_LRS | OUT | True clock of differential push-pull CPU clock pair with integrated 33 ohm Rs. This clock is free running during iAMT. |
| 44 | GNDCPU | PWR | Ground pin for the CPU outputs |
| 45 | CPUC0_LRS | OUT | Complement clock of low power differential CPU clock pair with integrated 33 ohm Rs. |
| 46 | CPUT0_LRS | OUT | True clock of low power differential CPU clock pair with integrated 33 ohm Rs. |
| 47 | VDDCPU | PWR | Supply for CPU PLL, 3.3V nominal |
| 48 | CK_PWRGD/PD# | IN | Notifies CK505 to sample latched inputs, or iAMT entry/exit, or PWRDWN# mode |
| 49 | FSLB/TEST_MODE | IN | 3.3V tolerant input for CPU frequency selection. Refer to input electrical characteristics for Vil_FS and Vih_FS values. TEST_MODE is a real time input to select between Hi-Z and REF/N divider mode while in test mode. Refer to Test Clarification Table. |
| 50 | GNDREF | PWR | Ground pin for the REF outputs. |
| 51 | X2 | OUT | Crystal output, Nominally 14.318MHz |
| 52 | X1 | IN | Crystal input, Nominally 14.318MHz. |
| 53 | VDDREF | PWR | Ref. XTAL power supply, nominal 3.3V |
| 54 | REF0/FSLC/TEST_SEL | I/O | 14.318 MHz reference clock./ 3.3V tolerant input for CPU frequency selection. Refer to input electrical characteristics for Vil_FS and Vih_FS values. /TEST_Sel: 3-level latched input to enable test mode. Refer to Test Clarification Table |
| 55 | SDATA | I/O | Data pin for SMBus circuitry, 5V tolerant. |
| 56 | SCLK | IN | Clock pin of SMBus circuitry, 5V tolerant. |

General Description

ICS9EPRS525 is compliant Intel CK505 Yellow Cover specification. This clock synthesizer provides a single chip solution for Intel desktop chipsets. ICS9EPRS525 is driven with a 14.318MHz crystal. It also provides a tight ppm accuracy output for Serial ATA and PCI-Express support.

Block Diagram



Power Groups

| Pin Number | | Description |
|------------|--------|----------------------|
| VDD | GND | |
| 41, 47 | 44 | CPUCLK |
| 16 | 15 | Master Clock, Analog |
| 26, 31, 37 | 23, 34 | SRCCLK |
| 20 | 19 | PLL3/SE |
| 12 | 11 | DOT 96Mhz |
| 9 | 11 | USB 48 |
| 53 | 50 | Xtal, REF |
| 2 | 8 | PCICLK |

Absolute Maximum Ratings - DC Parameters

| PARAMETER | SYMBOL | CONDITIONS | MIN | MAX | UNITS | Notes |
|------------------------|-----------------|-------------------------------------|-----------|-----|-------|-------|
| Maximum Supply Voltage | VDDxxx | Supply Voltage | | 4.6 | V | 7 |
| Maximum Supply Voltage | VDDxxx_IO | Low-Voltage Differential I/O Supply | | 3.8 | V | 7 |
| Maximum Input Voltage | V _{IH} | 3.3V Inputs | | 4.6 | V | 4,5,7 |
| Minimum Input Voltage | V _{IL} | Any Input | GND - 0.5 | | V | 4,7 |
| Storage Temperature | T _s | - | -65 | 150 | °C | 4,7 |
| Input ESD protection | ESD prot | Human Body Model | 2000 | | V | 6,7 |

¹Guaranteed by design and characterization, not 100% tested in production.

²Operation under these conditions is neither implied, nor guaranteed.

³Maximum input voltage is not to exceed VDD

Electrical Characteristics - Input/Supply/Common Output DC Parameters

| PARAMETER | SYMBOL | CONDITIONS | MIN | MAX | UNITS | Notes |
|---|-------------------------|---|-----------------------|-----------------------|-------|-------|
| Ambient Operating Temp | T _{ambient} | - | 0 | 70 | °C | |
| Supply Voltage | VDDxxx | Supply Voltage | 3.135 | 3.465 | V | |
| Supply Voltage | VDDxxx_IO | Low-Voltage Differential I/O Supply | 0.9975 | 3.465 | V | 10 |
| Input High Voltage | V _{IHSE} | Single-ended 3.3V inputs | 2 | V _{DD} + 0.3 | V | 3 |
| Input Low Voltage | V _{ILSE} | Single-ended 3.3V inputs | V _{SS} - 0.3 | 0.8 | V | 3 |
| Low Threshold Input- High Voltage | V _{IH_FS_TEST} | 3.3 V +/-5% | 2 | VDD + 0.3 | V | 8 |
| Low Threshold Input- FSC = '1' Voltage | V _{IH_FS_FSC} | 3.3 V +/-5% | 0.7 | 1.5 | V | 8 |
| Low Threshold Input- FSA,FSB = '1' Voltage | V _{IH_FS_FSAB} | 3.3 V +/-5% | 0.7 | VDD+0.3 | V | |
| Low Threshold Input-Low Voltage | V _{IL_FS} | 3.3 V +/-5% | V _{SS} - 0.3 | 0.35 | V | |
| PCI3/CFG0 Input | V _{IL_CFGHI} | Optional input, 2.75V typ. | 2.4 | VDD+0.3 | V | 9, 10 |
| PCI3/CFG0 Input | V _{IL_CFGMID} | Optional input, 1.65V typ. | 1.3 | 2 | V | 9, 10 |
| PCI3/CFG0 Input | V _{IL_CFGLO} | Optional input, 0.55V typ. | V _{SS} - 0.3 | 0.9 | V | 9, 10 |
| Input Leakage Current | I _{IN} | V _{IN} = V _{DD} , V _{IN} = GND | -5 | 5 | uA | 2 |
| Input Leakage Current | I _{INRES} | Inputs with pull up or pull down resistors V _{IN} = V _{DD} , V _{IN} = GND | -200 | 200 | uA | |
| Output High Voltage | V _{OHSE} | Single-ended outputs, I _{OH} = -1mA | 2.4 | | V | 1 |
| Output Low Voltage | V _{OLSE} | Single-ended outputs, I _{OL} = 1 mA | | 0.4 | V | 1 |
| Operating Supply Current | I _{DDOP3.3} | Full Active, C _L = Full load; I _{dd} 3.3V | | 115 | mA | |
| | I _{DDOPIO} | Full Active, C _L = Full load; IDD IO | | 55 | mA | 10 |
| iAMT Mode Current | I _{DDIAMT3.3} | M1 mode, 3.3V Rail | | 36 | mA | |
| | I _{DDIAMTIO} | M1 Mode, IO Rail | | 10 | mA | |
| Powerdown Current | I _{DDPD3.3} | Power down mode, 3.3V Rail | | 5 | mA | |
| | I _{DDPDIO} | Power down mode, IO Rail | | 0.1 | mA | 10 |
| Input Frequency | F _i | V _{DD} = 3.3 V | | 15 | MHz | |
| Pin Inductance | L _{pin} | | | 7 | nH | |
| Input Capacitance | C _{IN} | Logic Inputs | 1.5 | 5 | pF | |
| | C _{OUT} | Output pin capacitance | | 6 | pF | |
| | C _{INX} | X1 & X2 pins | | 6 | pF | |
| Clk Stabilization | T _{STAB} | From VDD Power-Up or de-assertion of PD to 1st clock | | 1.8 | ms | |
| Tdrive_CR_off | T _{DRCROFF} | Output stop after CR deasserted | | 400 | ns | |
| Tdrive_CR_on | T _{DRCRON} | Output run after CR asserted | | 0 | us | |
| Tdrive_CPU | T _{DRSRC} | CPU output enable after PCI_STOP# de-assertion | | 10 | ns | |
| Tfall_SE | T _{FALL} | Fall/rise time of all 3.3V control inputs from 20-80% | | 10 | ns | |
| Trise_SE | T _{RISE} | | | 10 | ns | |
| SMBus Voltage | V _{DD} | | 2.7 | 5.5 | V | |
| Low-level Output Voltage | V _{OLSMB} | @ I _{PULLUP} | | 0.4 | V | |
| Current sinking at V _{OLSMB} = 0.4 V | I _{PULLUP} | SMB Data Pin | 4 | | mA | |
| SCLK/SDATA Clock/Data Rise Time | T _{RI2C} | (Max V _{IL} - 0.15) to (Min V _{IH} + 0.15) | | 1000 | ns | |
| SCLK/SDATA Clock/Data Fall Time | T _{FI2C} | (Min V _{IH} + 0.15) to (Max V _{IL} - 0.15) | | 300 | ns | |
| Maximum SMBus Operating Frequency | F _{SMBUS} | | | 100 | kHz | |
| Spread Spectrum Modulation Frequency | f _{SSMOD} | Triangular Modulation | 30 | 33 | kHz | |

ICS9EPRS525 56-pin CK505 for Embedded Systems

NOTES on Input/Supply/Common Output DC Parameters: (unless otherwise noted, guaranteed by design and characterization, not 100% tested in production).

¹Signal is required to be monotonic in this region.

²input leakage current does not include inputs with pull-up or pull-down resistors

³ 3.3V referenced inputs are: PCI_STOP#, CPU_STOP#, TME, SRC5_EN, ITP_EN, SCLKL, SDATA, TESTMODE, TESTSEL, CKPWRGD and CR# inputs if selected.

⁴ Intentionally blank

⁵ Maximum VIH is not to exceed VDD

⁶ Human Body Model

⁷ Operation under these conditions is neither implied, nor guaranteed.

⁸ Frequency Select pins which have tri-level input

⁹ PCI3/CFG0 is optional

¹⁰ If present. Not all parts have this feature.

AC Electrical Characteristics - Low Power Differential Outputs

| PARAMETER | SYMBOL | CONDITIONS | MIN | MAX | UNITS | NOTES |
|----------------------------|-----------|--------------------------|------|------|-------|-------|
| Rising Edge Slew Rate | tSLR | Averaging on | 2.5 | 4 | V/ns | 2, 3 |
| Falling Edge Slew Rate | tFLR | Averaging on | 2.5 | 4 | V/ns | 2, 3 |
| Slew Rate Variation | tSLVAR | Averaging on | | 20 | % | 1, 10 |
| Differential Voltage Swing | VSWING | Averaging off | 300 | | mV | 2 |
| Crossing Point Voltage | VXABS | Averaging off | 300 | 550 | mV | 1,4,5 |
| Crossing Point Variation | VXABSVAR | Averaging off | | 140 | mV | 1,4,9 |
| Maximum Output Voltage | VHIGH | Averaging off | | 1150 | mV | 1,7 |
| Minimum Output Voltage | VLOW | Averaging off | -300 | | mV | 1,8 |
| Duty Cycle | DCYC | Averaging on | 45 | 55 | % | 2 |
| CPU[1:0] Skew | CPUSKEW10 | Differential Measurement | | 100 | ps | 1 |
| CPU[2..ITP:0] Skew | CPUSKEW20 | Differential Measurement | | 150 | ps | 1 |
| SRC[10:0] Skew | SRCSEW | Differential Measurement | | 3000 | ps | 1,6 |

NOTES on DIF Output AC Specs: (unless otherwise noted, guaranteed by design and characterization, not 100% tested in production).

¹Measurement taken for single ended waveform on a component test board (not in system)

² Measurement taken from differential waveform on a component test board. (not in system)

³ Slew rate emasured through V_swing voltage range centered about differential zero

⁴ Vcross is defined at the voltage where Clock = Clock#, measured on a component test board (not in system)

⁵ Only applies to the differential rising edge (Clock rising, Clock# falling)

⁶ Total distributed intentional SRC to SRC skew. Maximum allowable interpair skew is 150 ps.

⁷ The max voltage including overshoot.

⁸ The min voltage including undershoot.

⁹ The total variation of all Vcross measurements in any particular system. Note this is a subset of V_cross min/mas (V_Cross absolute) allowed. The intent is to limit Vcross induced modulation by setting C_cross_delta to be smaller than V_Cross absolute

¹⁰ Matching applies to rising edge rate for Clock and falling edge rate for Clock#. It is measured using a +/-75mV window centered on the average cross point where Clock rising meets Clock# falling. The median cross point is used to calculate the voltage

Clock Jitter Specs - Low Power Differential Outputs

| PARAMETER | SYMBOL | CONDITIONS | MIN | MAX | UNITS | NOTES |
|-----------------------------|---------|--------------------------|-----|-----|-------|-------|
| CPU Jitter - Cycle to Cycle | CPUJC2C | Differential Measurement | | 85 | ps | 1 |
| SRC Jitter - Cycle to Cycle | SRCJC2C | Differential Measurement | | 125 | ps | 1 |
| DOT Jitter - Cycle to Cycle | DOTJC2C | Differential Measurement | | 250 | ps | 1 |

NOTES on DIF Output Jitter: (unless otherwise noted, guaranteed by design and characterization, not 100% tested in production).

¹Jitter specs are specified as measured on a clock characterization board. System designers need to take special care not to use these numbers, as the in-system performance will be somewhat degraded. The receiver EMTS (chispet or CPU) will have the receiver

Differential Clock Tolerances

| | CPU | SRC | DOT96 | | |
|-----------------------|--------|--------|-------|--|-----|
| PPM tolerance | 100 | 100 | 100 | | ppm |
| Cycle to Cycle Jitter | 85 | 125 | 250 | | ps |
| Spread | -0.50% | -0.50% | 0 | | % |

Clock Periods - Differential Outputs with Spread Spectrum Disabled

| SSC OFF | Center Freq. MHz | Measurement Window | | | | | | | Units | Notes |
|----------|------------------|------------------------|-----------------------------|-----------------------------|----------------------|-----------------------------|-----------------------------|------------------------|-------|-------|
| | | 1 Clock | 1us | 0.1s | 0.1s | 0.1s | 1us | 1 Clock | | |
| | | -c2c jitter AbsPer Min | -SSC Short-Term Average Min | - ppm Long-Term Average Min | 0 ppm Period Nominal | + ppm Long-Term Average Max | +SSC Short-Term Average Max | +c2c jitter AbsPer Max | | |
| CPU | 100.00 | 9.91400 | | 9.99900 | 10.00000 | 10.00100 | | 10.08600 | ns | 1,2 |
| | 133.33 | 7.41425 | | 7.49925 | 7.50000 | 7.50075 | | 7.58575 | ns | 1,2 |
| | 166.67 | 5.91440 | | 5.99940 | 6.00000 | 6.00060 | | 6.08560 | ns | 1,2 |
| | 200.00 | 4.91450 | | 4.99950 | 5.00000 | 5.00050 | | 5.08550 | ns | 1,2 |
| | 266.67 | 3.66462 | | 3.74962 | 3.75000 | 3.75037 | | 3.83537 | ns | 1,2 |
| | 333.33 | 2.91470 | | 2.99970 | 3.00000 | 3.00030 | | 3.08530 | ns | 1,2 |
| | 400.00 | 2.41475 | | 2.49975 | 2.50000 | 2.50025 | | 2.58525 | ns | 1,2 |
| SRC/SATA | 100.00 | 9.87400 | 9.99900 | 10.00000 | 10.00100 | 10.12600 | ns | 1,2 | | |
| DOT96 | 96.00 | 10.16563 | 10.41563 | 10.41667 | 10.41771 | 10.66771 | ns | 1,2 | | |

Clock Periods - Differential Outputs with Spread Spectrum Enabled

| SSC ON | Center Freq. MHz | Measurement Window | | | | | | | Units | Notes |
|--------|------------------|------------------------|-----------------------------|-----------------------------|----------------------|-----------------------------|-----------------------------|------------------------|-------|-------|
| | | 1 Clock | 1us | 0.1s | 0.1s | 0.1s | 1us | 1 Clock | | |
| | | -c2c jitter AbsPer Min | -SSC Short-Term Average Min | - ppm Long-Term Average Min | 0 ppm Period Nominal | + ppm Long-Term Average Max | +SSC Short-Term Average Max | +c2c jitter AbsPer Max | | |
| CPU | 99.75 | 9.91406 | 9.99906 | 10.02406 | 10.02506 | 10.02607 | 10.05107 | 10.13607 | ns | 1,2 |
| | 133.00 | 7.41430 | 7.49930 | 7.51805 | 7.51880 | 7.51955 | 7.53830 | 7.62330 | ns | 1,2 |
| | 166.25 | 5.91444 | 5.99944 | 6.01444 | 6.01504 | 6.01564 | 6.03064 | 6.11564 | ns | 1,2 |
| | 199.50 | 4.91453 | 4.99953 | 5.01203 | 5.01253 | 5.01303 | 5.02553 | 5.11053 | ns | 1,2 |
| | 266.00 | 3.66465 | 3.74965 | 3.75902 | 3.75940 | 3.75977 | 3.76915 | 3.85415 | ns | 1,2 |
| | 332.50 | 2.91472 | 2.99972 | 3.00722 | 3.00752 | 3.00782 | 3.01532 | 3.10032 | ns | 1,2 |
| | 399.00 | 2.41477 | 2.49977 | 2.50602 | 2.50627 | 2.50652 | 2.51277 | 2.59777 | ns | 1,2 |
| SRC | 99.75 | 9.87406 | 9.99906 | 10.02406 | 10.02506 | 10.02607 | 10.05107 | 10.17607 | ns | 1,2 |

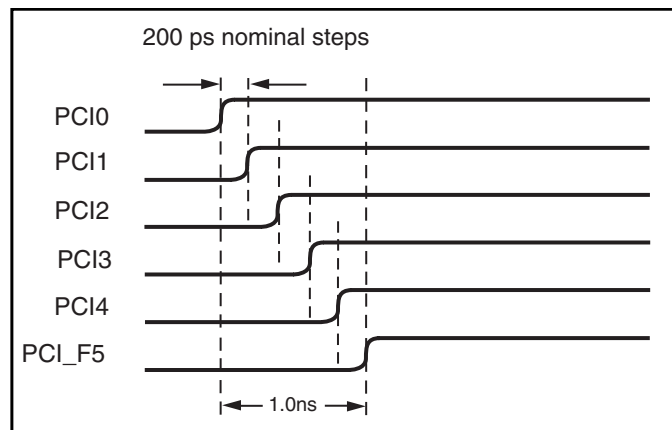
¹Guaranteed by design and characterization, not 100% tested in production.

²All Long Term Accuracy specifications are guaranteed with the assumption that the crystal input is tuned to exactly 14.31818MHz.

Electrical Characteristics - PCICLK/PCICLK_F

| PARAMETER | SYMBOL | CONDITIONS | MIN | MAX | UNITS | NOTES |
|------------------------------|-----------------------|--|----------|----------|-------|-------|
| Long Accuracy | ppm | see T _{period} min-max values | -100 | 100 | ppm | 1,2 |
| Clock period | T _{period} | 33.33MHz output no spread | 29.99700 | 30.00300 | ns | 2 |
| | | 33.33MHz output spread | 30.08421 | 30.23459 | ns | 2 |
| Absolute min/max period | T _{abs} | 33.33MHz output no spread | 29.49700 | 30.50300 | ns | 2 |
| | | 33.33MHz output nominal/spread | 29.56617 | 30.58421 | ns | 2 |
| Output High Voltage | V _{OH} | I _{OH} = -1 mA | 2.4 | | V | 1 |
| Output Low Voltage | V _{OL} | I _{OL} = 1 mA | | 0.55 | V | 1 |
| Output High Current | I _{OH} | V _{OH} @ MIN = 1.0 V | -33 | | mA | 1 |
| | | V _{OH} @ MAX = 3.135 V | | -33 | mA | 1 |
| Output Low Current | I _{OL} | V _{OL} @ MIN = 1.95 V | 30 | | mA | 1 |
| | | V _{OL} @ MAX = 0.4 V | | 38 | mA | 1 |
| Rising Edge Slew Rate | t _{SLR} | Measured from 0.8 to 2.0 V | 1 | 4 | V/ns | 1 |
| Falling Edge Slew Rate | t _{FLR} | Measured from 2.0 to 0.8 V | 1 | 4 | V/ns | 1 |
| Pin to Pin Skew | t _{skew} | V _T = 1.5 V | | 250 | ps | 2 |
| Intentional PCI to PCI delay | t _{skew} | V _T = 1.5 V | 100 | 200 | ps | 2 |
| Duty Cycle | d _{t1} | V _T = 1.5 V | 45 | 55 | % | 2 |
| Jitter, Cycle to cycle | t _{JCYC-cyc} | V _T = 1.5 V | | 500 | ps | 2 |

Intentional PCI Clock to Clock Delay



Electrical Characteristics - USB48MHz

| PARAMETER | SYMBOL | CONDITIONS | MIN | MAX | UNITS | NOTES |
|-------------------------|-----------------------|--|----------|----------|-------|-------|
| Long Accuracy | ppm | see T _{period} min-max values | -100 | 100 | ppm | 2,4 |
| Clock period | T _{period} | 48.00MHz output nominal | 20.83125 | 20.83542 | ns | 2,3 |
| Absolute min/max period | T _{abs} | 48.00MHz output nominal | 20.48125 | 21.18542 | ns | 2 |
| CLK High Time | T _{HIGH} | | 8.216563 | 11.15198 | V | |
| CLK Low time | T _{LOW} | | 7.816563 | 10.95198 | V | |
| Output High Voltage | V _{OH} | I _{OH} = -1 mA | 2.4 | | V | |
| Output Low Voltage | V _{OL} | I _{OL} = 1 mA | | 0.55 | V | |
| Output High Current | I _{OH} | V _{OH} @ MIN = 1.0 V | -29 | | mA | |
| | | V _{OH} @ MAX = 3.135 V | | -23 | mA | |
| Output Low Current | I _{OL} | V _{OL} @ MIN = 1.95 V | 29 | | mA | |
| | | V _{OL} @ MAX = 0.4 V | | 27 | mA | |
| Rising Edge Slew Rate | t _{SLR} | Measured from 0.8 to 2.0 V | 1 | 2 | V/ns | 1 |
| Falling Edge Slew Rate | t _{FLR} | Measured from 2.0 to 0.8 V | 1 | 2 | V/ns | 1 |
| Duty Cycle | d _{t1} | V _T = 1.5 V | 45 | 55 | % | 2 |
| Jitter, Cycle to cycle | t _{JCYC-cyc} | V _T = 1.5 V | | 350 | ps | 2 |

Electrical Characteristics - REF-14.318MHz

| PARAMETER | SYMBOL | CONDITIONS | MIN | MAX | UNITS | Notes |
|-------------------------|------------|--|----------|----------|-------|-------|
| Long Accuracy | ppm | see Tperiod min-max values | -100 | 100 | ppm | 2, 4 |
| Clock period | Tperiod | 14.318MHz output nominal | 69.82033 | 69.86224 | ns | 2, 3 |
| Absolute min/max period | Tab | 14.318MHz output nominal | 69.83400 | 70.84800 | ns | 2 |
| CLK High Time | THIGH | | 29.97543 | 38.46654 | V | |
| CLK Low time | TLOW | | 29.57543 | 38.26654 | V | |
| Output High Voltage | VOH | IOH = -1 mA | 2.4 | | V | |
| Output Low Voltage | VOL | IOL = 1 mA | | 0.4 | V | |
| Output High Current | IOH | VOH @MIN = 1.0 V, VOH@MAX = 3.135 V | -33 | -33 | mA | |
| Output Low Current | IOL | VOL @MIN = 1.95 V, VOL @MAX = 0.4 V | 30 | 38 | mA | |
| Rising Edge Slew Rate | tSLR | Measured from 0.8 to 2.0 V | 1 | 4 | V/ns | 1 |
| Falling Edge Slew Rate | tFLR | Measured from 2.0 to 0.8 V | 1 | 4 | V/ns | 1 |
| Duty Cycle | dt1 | VT = 1.5 V | 45 | 55 | % | 2 |
| Jitter, Cycle to cycle | tjycyc-cyc | VT = 1.5 V | | 1000 | ps | 2 |

NOTES on SE outputs: (unless otherwise noted, guaranteed by design and characterization, not 100% tested in production).

¹Edge rate in system is measured from 0.8V to 2.0V.

²Duty cycle, Period and Jitter are measured with respect to 1.5V

³The average period over any 1us period of time

⁴Using frequency counter with the measurement interval equal or greater than 0.15s, target frequencies are 14.318180 MHz, 33.333333MHz and 48.000000MHz

Table 1: CPU Frequency Select Table

| FS _L C ² B0b7 | FS _L B ¹ B0b6 | FS _L A ¹ B0b5 | CPU MHz | SRC MHz | PCI MHz | REF MHz | USB MHz | DOT MHz |
|--|--|--|------------|------------|------------|------------|------------|------------|
| 0 | 0 | 0 | 266.66 | 100.00 | 33.33 | 14.318 | 48.00 | 96.00 |
| 0 | 0 | 1 | 133.33 | | | | | |
| 0 | 1 | 0 | 200.00 | | | | | |
| 0 | 1 | 1 | 166.66 | | | | | |
| 1 | 0 | 0 | 333.33 | | | | | |
| 1 | 0 | 1 | 100.00 | | | | | |
| 1 | 1 | 0 | 400.00 | | | | | |
| 1 | 1 | 1 | Reserved | | | | | |

1. FS_LA and FS_LB are low-threshold inputs. Please see V_{IL_FS} and V_{IH_FS} specifications in the Input/Supply/Common Output Parameters Table for correct values.
Also refer to the Test Clarification Table.
2. FS_LC is a three-level input. Please see the V_{IL_FS} and V_{IH_FS} specifications in the Input/Supply/Common Output Parameters Table for correct values.

Table 2: PLL3 Quick Configuration (only applies in Mode 0, see Table 6)

| B1b4 | B1b3 | B1b2 | B1b1 | Pin 17 | Pin 18 | Spread | Comment |
|------|------|------|------|----------------|--------|------------------|------------------------------------|
| | | | | MHz | MHz | % | |
| 0 | 0 | 0 | 0 | PLL 3 disabled | | | |
| 0 | 0 | 0 | 1 | 100.00 | 100.00 | 0.5% Down Spread | SRC clocks from SRC_MAIN |
| 0 | 0 | 1 | 0 | 100.00 | 100.00 | 0.5% Down Spread | Only SRCCLK1 from PLL3 |
| 0 | 0 | 1 | 1 | 100.00 | 100.00 | 1% Down Spread | Only SRCCLK1 from PLL3 |
| 0 | 1 | 0 | 0 | 100.00 | 100.00 | 1.5% Down Spread | Only SRCCLK1 from PLL3 |
| 0 | 1 | 0 | 1 | 100.00 | 100.00 | 2% Down Spread | Only SRCCLK1 from PLL3 |
| 0 | 1 | 1 | 0 | 100.00 | 100.00 | 2.5% Down Spread | Only SRCCLK1 from PLL3 |
| 0 | 1 | 1 | 1 | N/A | N/A | N/A | N/A |
| 1 | 0 | 0 | 0 | 24.576 | 24.576 | None | 24.576Mhz on SE1 and SE2 |
| 1 | 0 | 0 | 1 | 24.576 | 98.304 | None | 24.576Mhz on SE1, 98.304Mhz on SE2 |
| 1 | 0 | 1 | 0 | 98.304 | 98.304 | None | 98.304Mhz on SE1 and SE2 |
| 1 | 0 | 1 | 1 | 27.000 | 27.000 | None | 27Mhz on SE1 and SE2 |
| 1 | 1 | 0 | 0 | 25.000 | 25.000 | None | 25Mhz on SE1 and SE2 |
| 1 | 1 | 0 | 1 | N/A | N/A | N/A | N/A |
| 1 | 1 | 1 | 0 | N/A | N/A | N/A | N/A |
| 1 | 1 | 1 | 1 | N/A | N/A | N/A | N/A |

Table 3: IO_Vout select table

| B9b2 | B9b1 | B9b0 | IO_Vout |
|------|------|------|---------|
| 0 | 0 | 0 | 0.3V |
| 0 | 0 | 1 | 0.4V |
| 0 | 1 | 0 | 0.5V |
| 0 | 1 | 1 | 0.6V |
| 1 | 0 | 0 | 0.7V |
| 1 | 0 | 1 | 0.8V |
| 1 | 1 | 0 | 0.9V |
| 1 | 1 | 1 | 1.0V |

Table 4: Device ID table

| B8b7 | B8b6 | B8b5 | B8b4 | Comment |
|------|------|------|------|--------------|
| 0 | 0 | 0 | 0 | 56 pin TSSOP |

Table 5: Slew Rate Selection Table

| Bit 1 | Bit 0 | Slew Rate |
|-------|-------|-----------------|
| 0 | 0 | HI-Z |
| 0 | 1 | 0.7X (1.4V/ns) |
| 1 | 0 | 0.8X (1.6 V/ns) |
| 1 | 1 | 1X (2.0 V/ns) |

Table 6. PCI3 Configuration Table

| PCI3/CFG0 HW Strap | PCI2/TME HW Strap | Note: 2 bits are needed since CFG0 is tri-level input | | SRC_Main_SE L (Byte 0, bit 2) | Config Mode |
|-----------------------|----------------------|--|-------------------------------|-------------------------------------|-------------|
| | | PCI3_CFG1 (Byte 11, bit 7) | PCI3_CFG0 (Byte 11, bit 6) | | |
| Low | 0 or 1 | 0 | 0 | 0 | 0 = Default |
| Mid | 0 or 1 | 0 | 1 | 1 | 1 |
| High | TME=0 | 1 | 0 | 1 | 2 |
| High | TME=1 | 1 | 1 | 1 | 3 |

Table 7. PLL Modes for PCI3 Configurations

| Config Mode | PLL1 | | PLL2 | | PLL3 | | SRC1 | PLL Source |
|----------------|-----------------|--------|-----------|-----|---------|------|----------|------------------------------|
| | Outputs | SSC | Outputs | SSC | Outputs | SSC | | |
| 0 = Default | CPU/SRC/ PCI | Down | USB | NA | - | - | 100MHz | PLL1 (Table 2 applies) |
| 1 | CPU | Down | USB | NA | SRC/PCI | Down | 100MHz | PLL3 |
| 2 | CPU | Center | USB | NA | SRC/PCI | Down | 100MHz | PLL3 |
| 3 | CPU | Center | USB/LAN25 | NA | SRC/PCI | Down | 25MHz SE | PLL2* |

*Note: In Mode 3, Byte 8, bit (1:0) must be set to '1' to enable pin 17,18

Table 8. ME Clock Selection Table

| PCIF5/ ITP_EN | iAMT_EN | CPU2_AMT_EN | CPU1_AMT_EN | Description |
|------------------|---------|-------------|-------------|-------------------------------------|
| x | 1 | 0 | 0 | Reserved |
| x | 1 | 0 | 1 | Default, CPU1 = iAMT Clock |
| 1 | 1 | 1 | 0 | CPU2 = iAMT Clock |
| 1 | 1 | 1 | 1 | CPU1 and CPU2 both run in iAMT mode |

PCI_STOP# Power Management

| SMBus OE Bit | PCI_STOP# | Single-ended Clocks | | Differential Clocks (Except CPU) | |
|--------------|-----------|---------------------|--------------|-------------------------------------|--------------|
| | | Stoppable | Free running | Stoppable | Free running |
| Enable | 1 | Running | Running | Running | Running |
| | 0 | Low | Low | CK= High CK# = Low | Running |
| | | | | CK= Pull down CK# = Low | Running |
| Disable | X | Low | | CK= Pull down, CK# = Low | |

CPU_STOP# Power Management

| SMBus OE Bit | PCI_STOP# | Differential Clocks | |
|--------------|-----------|----------------------------|--------------|
| | | Stoppable | Free running |
| Enable | 1 | Running | Running |
| | 0 | CK= High CK# = Low | Running |
| | | CK= Pull down CK# = Low | Running |
| Disable | X | Low | |

CR# Power Management

| SMBus OE Bit | CR# | Differential Clocks | |
|--------------|-----|---------------------------|--------------|
| | | Stoppable | Free running |
| Enable | 1 | Running | Running |
| | 0 | CK= Pull down, CK# = Low | |
| Disable | X | CK = Pull down, CK# = Low | |

PD# Power Management

| Device State | Single-ended Clocks | | Differential Clocks (Except CPU1) | CPU1 |
|--|---------------------|-----------------|--------------------------------------|----------------------------|
| | w/o Latched input | w/Latched input | | |
| Latches Open | Low | Hi-Z | CK= Pull down, CK# = Low | CK= Pull down, CK# = Low |
| Power Down | | | CK= Pull down CK# = Low | CK= Pull down CK# = Low |
| M1 | | | CK= Pull down CK# = Low | Running |
| Virtual Power Cycle to Latches Open | | | CK= Pull down, CK# = Low | CK= Pull down, CK# = Low |

General SMBus serial interface information for the ICS9EPRS525

How to Write:

- Controller (host) sends a start bit.
- Controller (host) sends the write address $D2_{(H)}$
- 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**
- ICS clock will **acknowledge** each byte **one at a time**
- Controller (host) sends a Stop bit

How to Read:

- Controller (host) will send start bit.
- Controller (host) sends the write address $D2_{(H)}$
- 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 $D3_{(H)}$
- 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 $X_{(H)}$ 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 Write Operation | | |
|-----------------------------|-----------|----------------------|
| Controller (Host) | | ICS (Slave/Receiver) |
| T | starT bit | |
| Slave Address $D2_{(H)}$ | | |
| 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 | |

| Index Block Read Operation | | |
|----------------------------|-----------------|----------------------|
| Controller (Host) | | ICS (Slave/Receiver) |
| T | starT bit | |
| Slave Address $D2_{(H)}$ | | |
| WR | WRite | |
| | | ACK |
| Beginning Byte = N | | |
| | | ACK |
| RT | Repeat starT | |
| Slave Address $D3_{(H)}$ | | |
| RD | ReaD | |
| | | ACK |
| | | Data Byte Count = X |
| ACK | | X Byte |
| ACK | | |
| ○ | | |
| ○ | | |
| ○ | | |
| | | Byte N + X - 1 |
| N | Not acknowledge | |
| P | stoP bit | |

Byte 0 FS Readback and PLL Selection Register

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-----|--------------|--|------|--|---------------------|---------|
| 7 | - | FSLC | CPU Freq. Sel. Bit (Most Significant) | R | See Table 1 : CPU Frequency Select Table | | Latch |
| 6 | - | FSLB | CPU Freq. Sel. Bit | R | | | Latch |
| 5 | - | FSLA | CPU Freq. Sel. Bit (Least Significant) | R | | | Latch |
| 4 | - | iAMT_EN | Set via SMBus or dynamically by CK505 if detects dynamic M1 | RW | Legacy Mode | iAMT Enabled | 0 |
| 3 | | Reserved | Reserved | RW | | | 0 |
| 2 | - | SRC_Main_SEL | Select source for SRC Main | RW | SRC Main = PLL1 | SRC Main = PLL3 | Latch |
| 1 | - | SATA_SEL | Select source for SATA clock | RW | SATA = SRC_Main | SATA = PLL2 | 0 |
| 0 | - | PD_Restore | 1 = on Power Down de-assert return to last known state 0 = clear all SMBus configurations as if cold power-on and go to latches open state This bit is ignored and treated at '1' if device is in iAMT mode. | RW | Configuration Not Saved | Configuration Saved | 1 |

Byte 1 DOT96 Select and PLL3 Quick Config Register

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-------|--------------|--------------------------------|------|--|-------------------|---------|
| 7 | 13/14 | SRC0_SEL | Select SRC0 or DOT96 | RW | SRC0 | DOT96 | 0 |
| 6 | - | PLL1_SSC_SEL | Select 0.5% down or center SSC | RW | Down spread | Center spread | Latch |
| 5 | | PLL3_SSC_SEL | Select 0.5% down or center SSC | RW | Down spread | Center spread | 0 |
| 4 | | PLL3_CF3 | PLL3 Quick Config Bit 3 | RW | See Table 2: PLL3 Quick Configuration Only applies if Byte 0, bit 2 = 0. | | 0 |
| 3 | | PLL3_CF2 | PLL3 Quick Config Bit 2 | RW | | | 0 |
| 2 | | PLL3_CF1 | PLL3 Quick Config Bit 1 | RW | | | 0 |
| 1 | | PLL3_CF0 | PLL3 Quick Config Bit 0 | RW | | | 1 |
| 0 | | PCI_SEL | PCI_SEL | RW | PCI from PLL1 | PCI from SRC_MAIN | 1 |

Byte 2 Output Enable Register

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-----|----------|---|------|-----------------|----------------|---------|
| 7 | | REF_OE | Output enable for REF, if disabled output is tri-stated | RW | Output Disabled | Output Enabled | 1 |
| 6 | | USB_OE | Output enable for USB | RW | Output Disabled | Output Enabled | 1 |
| 5 | | PCIF5_OE | Output enable for PCI5 | RW | Output Disabled | Output Enabled | 1 |
| 4 | | PCI4_OE | Output enable for PCI4 | RW | Output Disabled | Output Enabled | 1 |
| 3 | | PCI3_OE | Output enable for PCI3 | RW | Output Disabled | Output Enabled | 1 |
| 2 | | PCI2_OE | Output enable for PCI2 | RW | Output Disabled | Output Enabled | 1 |
| 1 | | PCI1_OE | Output enable for PCI1 | RW | Output Disabled | Output Enabled | 1 |
| 0 | | PCIO_OE | Output enable for PCIO | RW | Output Disabled | Output Enabled | 1 |

Byte 3 Output Enable Register

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-----|-------------|-------------------------------|------|-----------------|----------------|---------|
| 7 | | Reserved | Reserved | RW | - | - | 1 |
| 6 | | Reserved | Reserved | RW | - | - | 1 |
| 5 | | Reserved | Reserved | RW | - | - | 1 |
| 4 | | SRC8/ITP_OE | Output enable for SRC8 or ITP | RW | Output Disabled | Output Enabled | 1 |
| 3 | | SRC7_OE | Output enable for SRC7 | RW | Output Disabled | Output Enabled | 1 |
| 2 | | SRC6_OE | Output enable for SRC6 | RW | Output Disabled | Output Enabled | 1 |
| 1 | | SRC5_OE | Output enable for SRC5 | RW | Output Disabled | Output Enabled | 1 |
| 0 | | SRC4_OE | Output enable for SRC4 | RW | Output Disabled | Output Enabled | 1 |

Byte 4 Output Enable and Spread Spectrum Disable Register

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-----|---------------|---------------------------------|------|-----------------|----------------|---------|
| 7 | | SRC3_OE | Output enable for SRC3 | RW | Output Disabled | Output Enabled | 1 |
| 6 | | SATA/SRC2_OE | Output enable for SATA/SRC2 | RW | Output Disabled | Output Enabled | 1 |
| 5 | | SRC1_OE | Output enable for SRC1 | RW | Output Disabled | Output Enabled | 1 |
| 4 | | SRC0/DOT96_OE | Output enable for SRC0/DOT96 | RW | Output Disabled | Output Enabled | 1 |
| 3 | | CPU1_OE | Output enable for CPU1 | RW | Output Disabled | Output Enabled | 1 |
| 2 | | CPU0_OE | Output enable for CPU0 | RW | Output Disabled | Output Enabled | 1 |
| 1 | | PLL1_SSC_ON | Enable PLL1's spread modulation | RW | Spread Disabled | Spread Enabled | 1 |
| 0 | | PLL3_SSC_ON | Enable PLL3's spread modulation | RW | Spread Disabled | Spread Enabled | 1 |

Byte 5 Clock Request Enable/Configuration Register

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-----|-----------|--|------|---------------|---------------|---------|
| 7 | | CR#_A_EN | Enable CR#_A (clk req), PCI0_OE must be = 1 for this bit to take effect | RW | Disable CR#_A | Enable CR#_A | 0 |
| 6 | | CR#_A_SEL | Sets CR#_A to control either SRC0 or SRC2 | RW | CR#_A -> SRC0 | CR#_A -> SRC2 | 0 |
| 5 | | CR#_B_EN | Enable CR#_B (clk req) | RW | Disable CR#_B | Enable CR#_B | 0 |
| 4 | | CR#_B_SEL | Sets CR#_B -> SRC1 or SRC4 | RW | CR#_B -> SRC1 | CR#_B -> SRC4 | 0 |
| 3 | | CR#_C_EN | Enable CR#_C (clk req) | RW | Disable CR#_C | Enable CR#_C | 0 |
| 2 | | CR#_C_SEL | Sets CR#_C -> SRC0 or SRC2 | RW | CR#_C -> SRC0 | CR#_C -> SRC2 | 0 |
| 1 | | CR#_D_EN | Enable CR#_D (clk req) | RW | Disable CR#_D | Enable CR#_D | 0 |
| 0 | | CR#_D_SEL | Sets CR#_D -> SRC1 or SRC4 | RW | CR#_D -> SRC1 | CR#_D -> SRC4 | 0 |

Byte 6 Clock Request Enable/Configuration and Stop Control Register

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-----|-------------------------|--|------|---------------|--------------------------------------|---------|
| 7 | | CR#_E_EN | Enable CR#_E (clk req) -> SRC6 | RW | Disable CR#_E | Enable CR#_E | 0 |
| 6 | | CR#_F_EN | Enable CR#_F (clk req) -> SRC8 | RW | Disable CR#_F | Enable CR#_F | 0 |
| 5 | | Reserved | Reserved | RW | - | - | 0 |
| 4 | | Reserved | Reserved | RW | - | - | 0 |
| 3 | | Reserved | Reserved | RW | - | - | 0 |
| 2 | | Reserved | Reserved | RW | - | - | 0 |
| 1 | | SSCD_STP_CRTL (SRC1) | If set, SSCD (SRC1) stops with PCI_STOP# | RW | Free Running | Stops with PCI_STOP# assertion | 0 |
| 0 | | SRC_STP_CRTL | If set, SRCs (except SRC1) stop with PCI_STOP# | RW | Free Running | Stops with PCI_STOP# assertion | 0 |

Byte 7 Vendor ID/ Revision ID

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-----|-----------------|----------------------------------|------|-----------------|---|---------|
| 7 | | Rev Code Bit 3 | Revision ID | R | Vendor specific | | X |
| 6 | | Rev Code Bit 2 | | R | | | X |
| 5 | | Rev Code Bit 1 | | R | | | X |
| 4 | | Rev Code Bit 0 | | R | | | X |
| 3 | | Vendor ID bit 3 | Vendor ID ICS is 0001, binary | R | | | 0 |
| 2 | | Vendor ID bit 2 | | R | | | 0 |
| 1 | | Vendor ID bit 1 | | R | | | 0 |
| 0 | | Vendor ID bit 0 | | R | | | 1 |

Byte 8 Device ID and Output Enable Register

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-----|------------|--|------|---------------|---------|---------|
| 7 | | Device_ID3 | Table of Device identifier codes, used for differentiating between CK505 package options, etc. | R | 56-pin device | | 0 |
| 6 | | Device_ID2 | | R | | | 0 |
| 5 | | Device_ID1 | | R | | | 0 |
| 4 | | Device_ID0 | | R | | | 0 |
| 3 | | Reserved | Reserved | RW | - | - | 0 |
| 2 | | Reserved | Reserved | RW | - | - | 0 |
| 1 | | SE1_OE | Output enable for SE1 | RW | Disabled | Enabled | 0 |
| 0 | | SE2_OE | Output enable for SE2 | RW | Disabled | Enabled | 0 |

Byte 9 Output Control Register

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-----|------------------|---|------|---|--------------------------------|---------|
| 7 | | PCIF5_STOP_EN | Allows control of PCIF5 with assertion of PCI_STOP# | RW | Free running | Stops with PCI_STOP# assertion | 0 |
| 6 | | TME_Readback | Trusted Mode Enable (TME) strap status | R | normal operation | no overclocking | Latch |
| 5 | | REF Strength | Sets the REF output drive strength | RW | 1X (2Loads) | 2X (3 Loads) | 1 |
| 4 | | Test Mode Select | Allows test select, ignores REF/FSC/TestSel | RW | Outputs HI-Z | Outputs = REF/N | 0 |
| 3 | | Test Mode Entry | Allows entry into test mode, ignores FSB/TestMode | RW | Normal operation | Test mode | 0 |
| 2 | | IO_VOUT2 | IO Output Voltage Select (Most Significant Bit) | RW | See Table 3: V_IO Selection (Default is 0.8V) | | 1 |
| 1 | | IO_VOUT1 | IO Output Voltage Select | RW | | | 0 |
| 0 | | IO_VOUT0 | IO Output Voltage Select (Least Significant Bit) | RW | | | 1 |

Byte 10 Stop Enable Register

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-----|-------------------|---|--|----------------------|--------------|-----------|
| 7 | | SRC5_EN Readback | Readback of SRC5 enable latch | R | CPU/PCI Stop Enabled | SRC5 Enabled | Latch |
| 6 | | Reserved | Reserved | RW | - | - | 0 |
| 5 | | Reserved | | RW | - | - | 0 |
| 4 | | Reserved | | RW | - | - | 0 |
| 3 | | Reserved | | RW | - | - | 0 |
| 2 | | Reserved | | RW | - | - | 0 |
| 1 | | CPU 1 Stop Enable | | Enables control of CPU1 with CPU_STOP# | RW | Free Running | Stoppable |
| 0 | | CPU 0 Stop Enable | Enables control of CPU 0 with CPU_STOP# | RW | Free Running | Stoppable | 1 |

Byte 11 iAMT Enable Register

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-----|-------------------|---|------|------------------------------|----------------------|---------|
| 7 | | PCI3_CFG1 | See PCI3 Configuration Table 28 | R | See PCI3 Configuration Table | | Latch |
| 6 | | PCI3_CFG0 | | R | | | Latch |
| 5 | | Reserved | Reserved | RW | - | - | 0 |
| 4 | | Reserved | Reserved | RW | - | - | 1 |
| 3 | | CPU2_AMT_EN | Determines if CPU2 runs in M1 mode. Only valid if ITP_EN=1. See Note. | RW | Does not Run | Runs | 0 |
| 2 | | CPU1_AMT_EN | Determines if CPU1 runs in M1 mode. See Note. | RW | Does not Run | Runs | 1 |
| 1 | | PCI-E_GEN2 | Determines if PCI-E Gen2 compliant | R | non-Gen2 | PCI-E Gen2 Compliant | 1 |
| 0 | | CPU 2 Stop Enable | Enables control of CPU 0 with CPU_STOP# | RW | Free Running | Stoppable | 1 |

NOTE: A value of '00' for Bit(3:2) in Byte 11 is reserved and not a valid configuration.

Byte 12 Byte Count Register

| Bit | Pin | Name | Description | Type | 0 | 1 | Default |
|-----|-----|----------|--|------|---|---|---------|
| 7 | | Reserved | | RW | | | 0 |
| 6 | | Reserved | | RW | | | 0 |
| 5 | | BC5 | Read Back byte count register, max bytes = 32 | RW | | | 0 |
| 4 | | BC4 | | RW | | | 0 |
| 3 | | BC3 | | RW | | | 1 |
| 2 | | BC2 | | RW | | | 1 |
| 1 | | BC1 | | RW | | | 0 |
| 0 | | BC0 | | RW | | | 1 |

Byte 13 to 28 Reserved**Byte 29 Slew Rate Control**

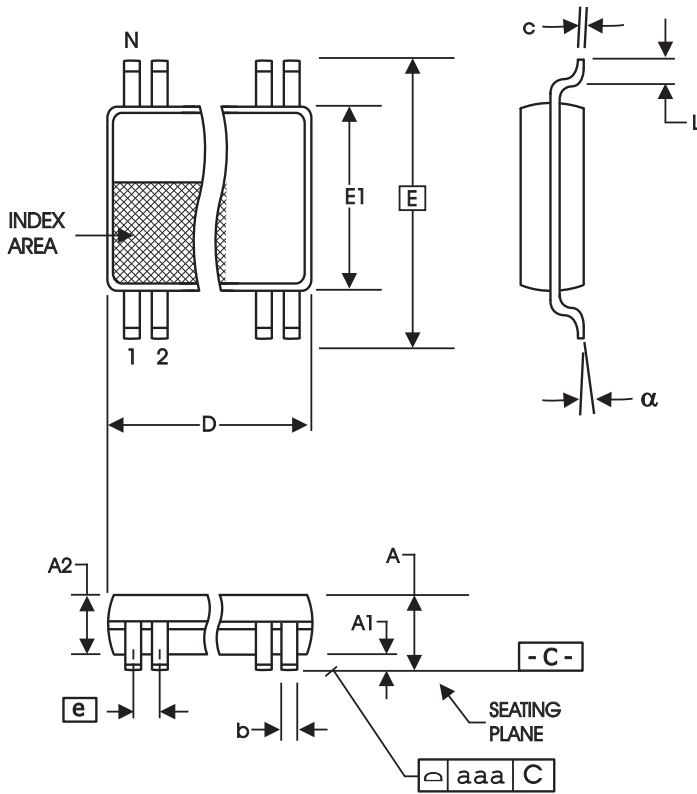
| Bit | Pin | Name | Description | RW | 0 | 1 | Default |
|-----|-----|---------------|-----------------------------|----|-------------------------------|---------|---------|
| 7 | | USB_Slew1 | USB Slew Rate Control (MSB) | RW | See Slew Rate Selection Table | | 1 |
| 6 | | USB_Slew0 | USB Slew Rate Control (LSB) | RW | | | 0 |
| 5 | | PCI_Slew1 | PCI Slew Rate Control (MSB) | RW | See Slew Rate Selection Table | | 1 |
| 4 | | PCI_Slew0 | PCI Slew Rate Control (LSB) | RW | | | 1 |
| 3 | | Reserved | | RW | | | 1 |
| 2 | | REF Slew Rate | Changes Ref Slew Rate | RW | 1.2V/ns | 2.2V/ns | 1 |
| 1 | | Reserved | | RW | | | 0 |
| 0 | | Reserved | | RW | | | 0 |

Test Clarification Table

| Comments | HW | | SW | | OUTPUT |
|--|-----------------------------|------------------------------|---------------------------|--------------------------|--------|
| | FSLC/ TEST_SEL HW PIN | FSLB/ TEST_MODE HW PIN | TEST ENTRY BIT B9b3 | REF/N or HI-Z B9b4 | |
| | <2.0V | X | 0 | 0 | NORMAL |
| Power-up w/ TEST_SEL = 1 to enter test mode | >2.0V | 0 | X | 0 | HI-Z |
| Cycle power to disable test mode | >2.0V | 0 | X | 1 | REF/N |
| FSLC./TEST_SEL -->3-level latched input | >2.0V | 1 | X | 0 | REF/N |
| If power-up w/ V>2.0V then use TEST_SEL | | | | | |
| If power-up w/ V<2.0V then use FSLC | | | | | |
| FSLB/TEST_MODE -->low Vth input | >2.0V | 1 | X | 1 | REF/N |
| TEST_MODE is a real time input | | | | | |
| If TEST_SEL HW pin is 0 during power-up, test mode can be invoked through B9b3. If test mode is invoked by B9b3, only B9b4 is used to select HI-Z or REF/N FSLB/TEST_Mode pin is not used. Cycle power to disable test mode, one shot control | <2.0V | X | 1 | 0 | HI-Z |
| | <2.0V | X | 1 | 1 | REF/N |

B9b3: 1= ENTER TEST MODE, Default = 0 (NORMAL OPERATION)

B9b4: 1= REF/N, Default = 0 (HI-Z)



56-Lead 6.10 mm. Body, 0.50 mm. Pitch TSSOP
(240 mil) (20 mil)

| SYMBOL | In Millimeters COMMON DIMENSIONS | | In Inches 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 BASIC | |
| E1 | 6.00 | 6.20 | .236 | .244 |
| e | 0.50 BASIC | | 0.020 BASIC | |
| L | 0.45 | 0.75 | .018 | .030 |
| N | SEE VARIATIONS | | SEE VARIATIONS | |
| alpha | 0° | 8° | 0° | 8° |
| aaa | -- | 0.10 | -- | .004 |

VARIATIONS

| N | D mm. | | D (inch) | |
|----|-------|-------|----------|------|
| | MIN | MAX | MIN | MAX |
| 56 | 13.90 | 14.10 | .547 | .555 |

Reference Doc.: JEDEC Publication 95, M O-153

10-0039

Ordering Information

| Part/Order Number | Shipping Packaging | Package | Temperature |
|-------------------|--------------------|--------------|---------------|
| 9EPRS525AGLFF | Tubes | 56-pin TSSOP | 0 to +70° C |
| 9EPRS525AGLFT | Tape and Reel | 56-pin TSSOP | 0 to +70° C |
| 9EPRS525AGILFF | Tubes | 56-pin TSSOP | -40 to +85° C |
| 9EPRS525AGILFT | Tape and Reel | 56-pin TSSOP | -40 to +85° C |

Parts that are ordered with a "LF" suffix to the part number are the Pb-Free configuration and are RoHS compliant. Due to package size constraints, actual top-side marking may differ from the full orderable part number.

Revision History

| Rev. | Issue Date | Description | Page # |
|------|------------|-----------------------------|--------|
| 0.1 | 7/31/2009 | Initial Release | - |
| A | 8/19/2009 | Released to final. | |
| B | 1/21/2010 | Updated Power Groups table. | 4 |
| | | | |
| | | | |
| | | | |

This product is protected by United States Patent NO. 7,342,420 and other patents.

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