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# PC MAIN CLOCK - CK540

9UMS9001

## Recommended Application:

Calistoga Based Ultra-Mobile PC (UMPC)

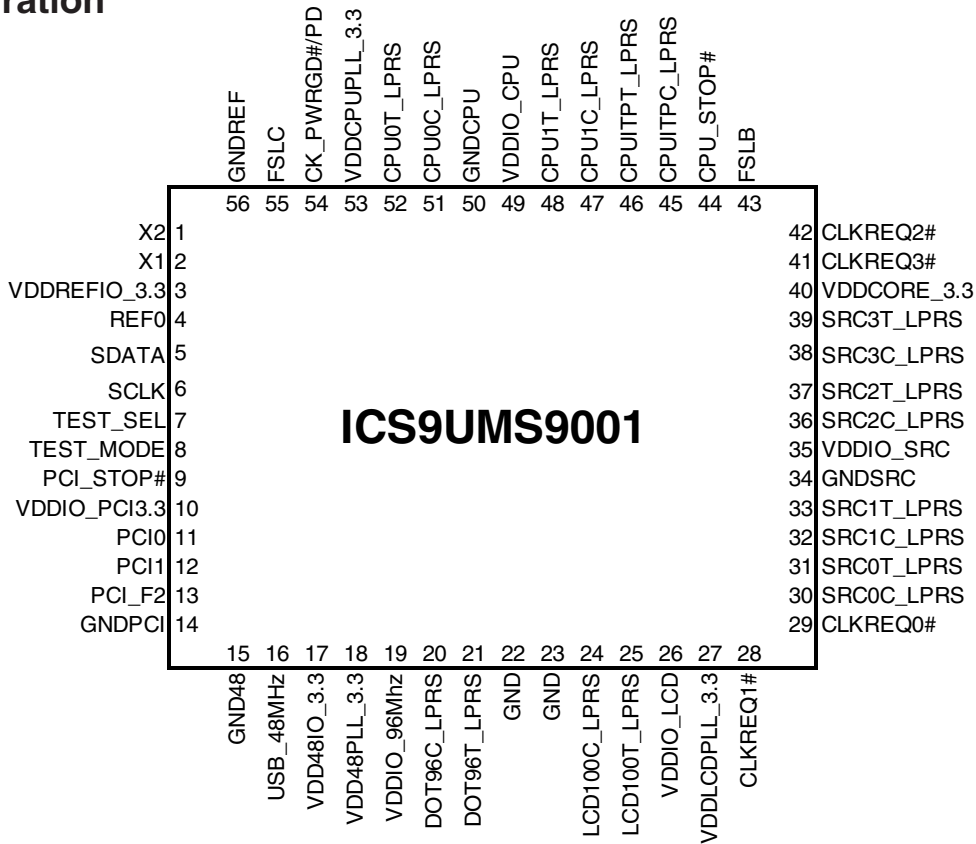
## Output Features:

- 2 - CPU Low Power differential push-pull pairs
- 1 - ITP low power differential push-pull pair
- 4 - SRC low power differential push-pull pairs
- 1 - LCD100 SSCD low power differential push-pull pair
- 1 - DOT96 low power differential push-pull pair
- 3 - PCI, 33MHz
- 1 - USB, 48MHz
- 1 - REF, 14.31818MHz

## Features/Benefits:

- Supports Dothan ULV CPUs with 100 and 133 MHz CPU outputs
- Dedicated TEST/SEL and TEST/MODE pins saves isolation resistors on pins
- PCI\_SRC and CPU STOP inputs for power managment
- Fully integrated Vreg
- Integrated series resistors on differential outputs
- Supports split rail operation for maximum power savings
- Also runs from single 3.3V rail
- 1.05V-3.3V support for differential VDDIO

## Pin Configuration



56-pin MLF

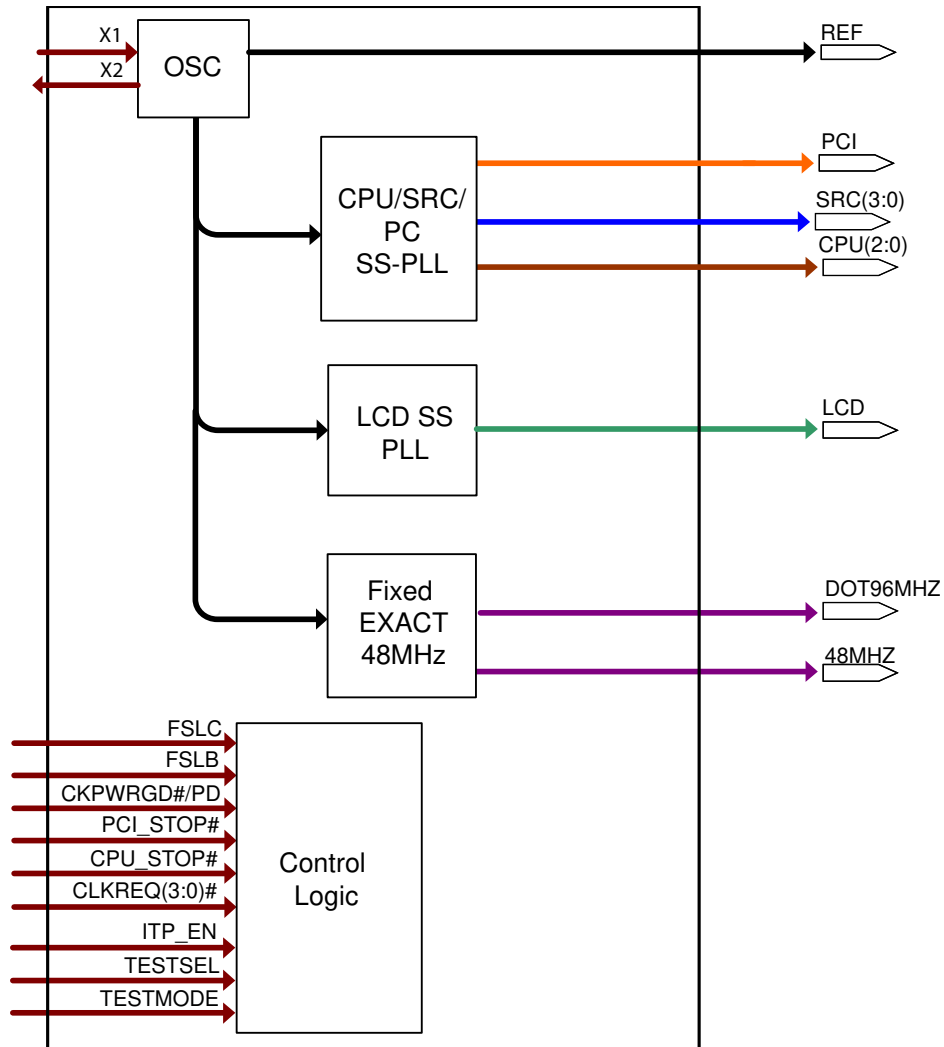
## Pin Description

PIN #	PIN NAME	TYPE	DESCRIPTION
1	X2	OUT	Crystal output, nominally 14.318MHz.
2	X1	IN	Crystal input, Nominally 14.318MHz.
3	VDDREFIO_3.3	PWR	Power pin for the REF output and crystal oscillator. 3.3V nominal.
4	REF0	OUT	3.3V 14.318MHz reference clock
5	SDATA	I/O	Data pin for SMBus circuitry, 5V tolerant.
6	SCLK	IN	Clock pin of SMBus circuitry, 5V tolerant.
7	TEST_SEL	IN	3.3V input that puts the part in test mode. This is a realtime input. See the Test Clarification Table for details.
8	TEST_MODE	IN	When Test mode is selected, this chooses either hi-Z or REF/N for the outputs.
9	PCI_STOP#	IN	3.3V tolerant input that stops all PCI and SRC clocks, except those set to be free running.
10	VDDIO_PCI3.3	PWR	3.3V power supply for the PCI outputs
11	PCI0	OUT	3.3V PCI clock output.
12	PCI1	OUT	3.3V PCI clock output.
13	PCI_F2	OUT	Free running 3.3V PCI clock output
14	GNDPCI	PWR	Ground for PCI output clocks.
15	GND48	PWR	Ground for the USB clock.
16	USB_48MHz	OUT	Fixed 3.3V 48MHz USB clock output
17	VDD48IO_3.3	PWR	3.3V Power supply for the 48MHz output
18	VDD48PLL_3.3	PWR	3.3V Power supply for the 48/96MHz PLL
19	VDDIO_96Mhz	PWR	Power supply for DOT96 output. VDD_IO = 1.05 to 3.3V +/-5%.
20	DOT96C_LPRS	OUT	Complement side of low-power CK505-type 96MHz differential clock. Rs is integrated (No external series resistor required).
21	DOT96T_LPRS	OUT	True side of low-power CK505-type 96MHz differential clock. Rs is integrated (No external series resistor required).
22	GND	PWR	Ground for 96MHz output
23	GND	PWR	Ground for LCD 100 MHz output.
24	LCD100C_LPRS	OUT	Complement side of low-power CK505-type LCD100MHz spreading differential clock. Rs is integrated (No external series resistor required).
25	LCD100T_LPRS	OUT	True side of low-power CK505-type LCD100MHz spreading differential clock. Rs is integrated (No external series resistor required).
26	VDDIO_LCD	PWR	Power supply for LCD100 output. VDD_IO = 1.05 to 3.3V +/-5%.
27	VDDLCDPLL_3.3	PWR	3.3V Power supply for the LCD100 Spreading PLL
28	CLKREQ1#	IN	Clock request input for SRC output pair 1. See the SRC, LCD, DOT Power Management Table for details

## Pin Description (continued)

PIN #	PIN NAME	TYPE	DESCRIPTION
29	CLKREQ0#	IN	Clock request input for SRC output pair 0. See the SRC, LCD, DOT Power Management Table for details
30	SRC0C_LPRS	OUT	Complement side of low-power CK505-type SRC0 differential clock. Rs is integrated (No external series resistor required).
31	SRC0T_LPRS	OUT	True side of low-power CK505-type SRC0 differential clock. Rs is integrated (No external series resistor required).
32	SRC1C_LPRS	OUT	Complement side of low-power CK505-type SRC1 differential clock. Rs is integrated (No external series resistor required).
33	SRC1T_LPRS	OUT	True side of low-power CK505-type SRC1 differential clock. Rs is integrated (No external series resistor required).
34	GNSRC	PWR	Ground for SRC clocks
35	VDDIO_SRC	PWR	Power supply for SRC outputs. VDD_IO = 1.05 to 3.3V +/-5%.
36	SRC2C_LPRS	OUT	Complement side of low-power CK505-type SRC2 differential clock. Rs is integrated (No external series resistor required).
37	SRC2T_LPRS	OUT	True side of low-power CK505-type SRC2 differential clock. Rs is integrated (No external series resistor required).
38	SRC3C_LPRS	OUT	Complement side of low-power CK505-type SRC3 differential clock. Rs is integrated (No external series resistor required).
39	SRC3T_LPRS	OUT	True side of low-power CK505-type SRC3 differential clock. Rs is integrated (No external series resistor required).
40	VDDCORE_3.3	PWR	3.3V Power supply for 3.3V core
41	CLKREQ3#	IN	Clock request input for SRC output pair 3. See the SRC, LCD, DOT Power Management Table for details
42	CLKREQ2#	IN	Clock request input for SRC output pair 2. See the SRC, LCD, DOT Power Management Table for details
43	FSLB	IN	Low threshold Frequency Select input. See Table 1: CPU Frequency Select Table and the Vih_fs and Vil_fs specifications.
44	CPU_STOP#	IN	Stops all CPU clocks except those set to be free running.
45	CPUITPC_LPRS	OUT	Complement side of low-power CK505-type CPUITP differential clock. Rs is integrated (No external series resistor required). Note that this pin is NOT muxed with an SRC output.
46	CPUITPT_LPRS	OUT	True side of low-power CK505-type CPUITP differential clock. Rs is integrated (No external series resistor required).
47	CPU1C_LPRS	OUT	Complement side of low-power CK505-type CPU1 differential clock. Rs is integrated (No external series resistor required). Note that this pin is NOT muxed with an SRC output.
48	CPU1T_LPRS	OUT	True side of low-power CK505-type CPU1 differential clock. Rs is integrated (No external series resistor required).
49	VDDIO_CPU	PWR	Power supply for CPU outputs. VDD_IO = 1.05 to 3.3V +/-5%.
50	GNDCPU	PWR	Ground Pin for CPU Outputs
51	CPU0C_LPRS	OUT	Complement side of low-power CK505-type CPU1 differential clock. Rs is integrated (No external series resistor required). Note that this pin is NOT muxed with an SRC output.
52	CPU0T_LPRS	OUT	True side of low-power CK505-type CPU1 differential clock. Rs is integrated (No external series resistor required).
53	VDDCPUPLL_3.3	PWR	3.3V Power Supply for CPU PLL.
54	CK_PWRGD#/PD	IN	Notifies 9UMS9001 to sample latched inputs or enter power down mode. 1 = Power down mode Falling Edge = Sample latched inputs 0 = Normal operation
55	FSLC	IN	Low threshold Frequency Select input. See Table 1: CPU Frequency Select Table and the Vih_fs and Vil_fs specifications.
56	GNDREF	PWR	Ground pin for crystal oscillator circuit and REF output

## Functional Block Diagram



## Power Groups

Pin Number			Description
VDD3.3V	VDDIO 1.05~3.3V	GND	
	49	50	CPUCLK
53			Low power outputs
			Analog
53			Master Clock, Analog
	35	34	SRCCLK
40			Low power outputs
			Analog
	26	23	LCDCLK
27			Low power outputs
			PLL
	19	22	DOT 96Mhz
			Low power outputs
17, 18		15	USB 48
3		56	Xtal, REF
10		14	PCICLK

**Table 1: CPU Frequency Select Table**

FS <sub>L</sub> C <sup>1</sup> B0b7	FS <sub>L</sub> B <sup>1</sup> B0b6	CPU MHz	SRC MHz	PCI MHz	REF MHz	USB MHz	DOT MHz
0	0	133.33	100.00	33.33	14.318	48.00	96.00
0	1	Reserved					
1	0	100.00	100.00	33.33	14.318	48.00	96.00
1	1	200.00					

1. FS<sub>L</sub>C is a low-threshold input. Please see V<sub>IL\_FS</sub> and V<sub>IH\_FS</sub> specifications in the Input/Supply/Common Output Parameters Table for correct values. Also refer to the Test Clarification Table.

**Table 2: LCD Quick Configuration**

B1b3	B1b2	B1b1	B1b0	Pin 24/25	Spread	Comment
				MHz	%	
0	0	0	0	100.00	0.25% Down Spread	LCDCLK
0	0	0	1	100.00	0.5% Down Spread	LCDCLK
0	0	1	0	100.00	1% Down Spread	LCDCLK
0	0	1	1	100.00	1.25% Down Spread	LCDCLK
0	1	0	0	100.00	1.5% Down Spread	LCDCLK
0	1	0	1	100.00	2% Down Spread	LCDCLK
0	1	1	0	100.00	2.5% Down Spread	LCDCLK
0	1	1	1	100.00	3.0% Down Spread	LCDCLK
1	0	0	0	100.00	0.25% Center Spread	LCDCLK
1	0	0	1	100.00	0.5% Center Spread	LCDCLK
1	0	1	0	100.00	1% Center Spread	LCDCLK
1	0	1	1	100.00	1.25% Center Spread	LCDCLK
1	1	0	0	100.00	1.5% Center Spread	LCDCLK
1	1	0	1	100.00	2% Center Spread	LCDCLK
1	1	1	0	100.00	2.5% Center Spread	LCDCLK
1	1	1	1	100.00	3.0% Center Spread	LCDCLK

**Table 3: IO Vout select table**

B5b2	B5b1	B5b0	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

### Absolute Maximum Ratings

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNITS	Notes
Maximum Supply Voltage	VDDxxx_3.3	Supply Voltage		4.6	V	1,7
Maximum Supply Voltage	VDDxxx_1.8	Supply Voltage		2.3	V	1,7
Maximum Supply Voltage	VDDxxx_IO	Low-Voltage Differential I/O Supply		3.8	V	1,7
Maximum Input Voltage	V <sub>IH</sub>	3.3V LVCMOS Inputs		4.6	V	1,7,8
Minimum Input Voltage	V <sub>IL</sub>	Any Input	GND - 0.5		V	1,7
Storage Temperature	T <sub>s</sub>	-	-65	150	°C	1,7
Input ESD protection	ESD prot	Human Body Model	2000		V	1,7

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

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNITS	Notes
Ambient Operating Temp	T <sub>ambient</sub>	-	0	70	°C	1
Supply Voltage	VDDxxx_3.3	Supply Voltage	3.135	3.465	V	1
Supply Voltage	VDDxxx_1.8	Supply Voltage	1.71	1.89	V	1
Supply Voltage	VDDxxx_IO	Low-Voltage Differential I/O Supply	1.05	3.465	V	1
Input High Voltage	V <sub>IHSE</sub>	Single-ended inputs	2	V <sub>DD</sub> + 0.3	V	1
Input Low Voltage	V <sub>ILSE</sub>	Single-ended inputs	V <sub>SS</sub> - 0.3	0.8	V	1
Input Leakage Current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>DD</sub> , V <sub>IN</sub> = GND	-5	5	uA	1
Input Leakage Current	I <sub>INRES</sub>	Inputs with pull or pull down resistors V <sub>IN</sub> = V <sub>DD</sub> , V <sub>IN</sub> = GND	-200	200	uA	1
Output High Voltage	V <sub>OHSE</sub>	Single-ended outputs, I <sub>OH</sub> = -1mA	2.4		V	1
Output Low Voltage	V <sub>OLSE</sub>	Single-ended outputs, I <sub>OL</sub> = 1 mA		0.4	V	1
Output High Voltage	V <sub>OHDF</sub>	Differential Outputs	0.7	0.9	V	1
Output Low Voltage	V <sub>OLDIF</sub>	Differential Outputs		0.4	V	1
Low Threshold Input-High Voltage (Test Mode)	V <sub>IH_FS_TEST</sub>	3.3 V +/-5%	2	V <sub>DD</sub> + 0.3	V	1
Low Threshold Input-High Voltage	V <sub>IH_FS</sub>	3.3 V +/-5%	0.7	1.5	V	1
Low Threshold Input-Low Voltage	V <sub>IL_FS</sub>	3.3 V +/-5%	V <sub>SS</sub> - 0.3	0.35	V	1
Operating Supply Current	I <sub>DD_DEFAULT</sub>	3.3V supply, LCDPLL off		80	mA	1
	I <sub>DD_LCDEN</sub>	3.3V supply, LCDPLL enabled		100	mA	1
	I <sub>DD_IO</sub>	0.8V supply, Differential IO current, all outputs enabled		25	mA	1
Power Down Current	I <sub>DD_PD3.3</sub>	3.3V supply, Power Down Mode		1	mA	1
	I <sub>DD_PDIO</sub>	0.8V IO supply, Power Down Mode		0.1	mA	1
Input Frequency	F <sub>i</sub>	V <sub>DD</sub> = 3.3 V		15	MHz	2
Pin Inductance	L <sub>pin</sub>			7	nH	1
Input Capacitance	C <sub>IN</sub>	Logic Inputs	1.5	5	pF	1
	C <sub>OUT</sub>	Output pin capacitance		6	pF	1
	C <sub>INX</sub>	X1 & X2 pins		7	pF	1
Spread Spectrum Modulation Frequency	f <sub>SSMOD</sub>	Triangular Modulation	30	33	kHz	1

### AC Electrical Characteristics - Input/Common Parameters

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNITS	Notes
Clk Stabilization	$T_{STAB}$	From VDD Power-Up or de-assertion of PD# to 1st clock		1.8	ms	1
Tdrive_SRC	$T_{DRSRC}$	SRC output enable after PCI_STOP# de-assertion		15	ns	1
Tdrive_PD#	$T_{DRPD}$	Differential output enable after PD# de-assertion		300	us	1
Tdrive_CPU	$T_{DRSRC}$	CPU output enable after CPU_STOP# de-assertion		10	ns	1
Tfall_PD#	$T_{FALL}$	Fall/rise time of PD#, PCI_STOP# and CPU_STOP# inputs		5	ns	1
Trise_PD#	$T_{RISE}$			5	ns	1

### AC Electrical Characteristics - Low Power Differential Outputs

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNITS	NOTES
Rising Edge Slew Rate	$t_{SLR}$	Differential Measurement	1	4	V/ns	1,2
Falling Edge Slew Rate	$t_{FLR}$	Differential Measurement	1	4	V/ns	1,2
Rise/Fall Time Variation	$t_{SLVAR}$	Single-ended Measurement		125	ps	1
Maximum Output Voltage	$V_{HIGH}$	Includes overshoot		1150	mV	1
Minimum Output Voltage	$V_{LOW}$	Includes undershoot	-300		mV	1
Differential Voltage Swing	$V_{SWING}$	Differential Measurement	300		mV	1
Crossing Point Voltage	$V_{XABS}$	Single-ended Measurement	300	550	mV	1,3,4
Crossing Point Variation	$V_{XABSVAR}$	Single-ended Measurement		140	mV	1,3,5
Duty Cycle	$D_{CYC}$	Differential Measurement	45	55	%	1
CPU Jitter - Cycle to Cycle	$CPUJ_{C2C}$	Differential Measurement		85	ps	1
SRC Jitter - Cycle to Cycle	$SRCJ_{C2C}$	Differential Measurement		125	ps	1
DOT Jitter - Cycle to Cycle	$DOTJ_{C2C}$	Differential Measurement		250	ps	1
CPU[1:0] Skew	$CPU_{SKEW10}$	Differential Measurement		100	ps	1
CPU[2_ITP:0] Skew	$CPU_{SKEW20}$	Differential Measurement		150	ps	1
SRC[3:0] Skew	$SRC_{SKEW}$	Differential Measurement		250	ps	1

### Electrical Characteristics - PCICLK/PCICLK\_F

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNITS	NOTES
Long Accuracy	ppm	see Tperiod min-max values	-300	300	ppm	1,6
Clock period	$T_{period}$	33.33MHz output nominal	29.99100	30.00900	ns	6
		33.33MHz output spread		30.15980	ns	6
Absolute min/max period	$T_{abs}$	33.33MHz output nominal/spread	29.49100	30.65980	ns	6
Output High Voltage	$V_{OH}$	$I_{OH} = -1 \text{ mA}$	2.4		V	1
Output Low Voltage	$V_{OL}$	$I_{OL} = 1 \text{ mA}$		0.4	V	1
Output High Current	$I_{OH}$	$V_{OH} @ \text{MIN} = 1.0 \text{ V}$	-33		mA	1
		$V_{OH} @ \text{MAX} = 3.135 \text{ V}$		-33	mA	1
Output Low Current	$I_{OL}$	$V_{OL} @ \text{MIN} = 1.95 \text{ V}$	30		mA	1
		$V_{OL} @ \text{MAX} = 0.4 \text{ V}$		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
Duty Cycle	$d_{t1}$	$V_T = 1.5 \text{ V}$	45	55	%	1
Skew	$t_{skew}$	$V_T = 1.5 \text{ V}$		250	ps	1
Intentional PCI-PCI delay	$t_{delay}$	$V_T = 1.5 \text{ V}$	0 nominal		ps	1,9
Jitter, Cycle to cycle	$t_{cyc-cyc}$	$V_T = 1.5 \text{ V}$		500	ps	1



### Electrical Characteristics - USB48MHz

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNITS	NOTES
Long Accuracy	ppm	see Tperiod min-max values	-100	100	ppm	1,2
Clock period	$T_{period}$	48.00MHz output nominal	20.83125	20.83542	ns	2
Absolute min/max period	$T_{abs}$	48.00MHz output nominal	20.48130	21.18540	ns	2
Output High Voltage	$V_{OH}$	$I_{OH} = -1$ mA	2.4		V	1
Output Low Voltage	$V_{OL}$	$I_{OL} = 1$ mA		0.4	V	1
Output High Current	$I_{OH}$	$V_{OH} @ MIN = 1.0$ V	-29		mA	1
		$V_{OH} @ MAX = 3.135$ V		-23	mA	1
Output Low Current	$I_{OL}$	$V_{OL} @ MIN = 1.95$ V	29		mA	1
		$V_{OL} @ MAX = 0.4$ V		27	mA	1
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	$d_{11}$	$V_T = 1.5$ V	45	55	%	1
Jitter, Cycle to cycle	$t_{jcy-cyc}$	$V_T = 1.5$ V		350	ps	1

### Electrical Characteristics - SMBus Interface

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNITS	Notes
SMBus Voltage	$V_{DD}$		2.7	5.5	V	1
Low-level Output Voltage	$V_{OLSMB}$	@ $I_{PULLUP}$		0.4	V	1
Current sinking at $V_{OLSMB} = 0.4$ V	$I_{PULLUP}$	SMB Data Pin	4		mA	1
SCLK/SDATA Clock/Data Rise Time	$T_{RI2C}$	(Max VIL - 0.15) to (Min VIH + 0.15)		1000	ns	1
SCLK/SDATA Clock/Data Fall Time	$T_{FI2C}$	(Min VIH + 0.15) to (Max VIL - 0.15)		300	ns	1
Maximum SMBus Operating Frequency	$F_{SMBUS}$	Block Mode		100	kHz	1

## Electrical Characteristics - REF-14.318MHz

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNITS	Notes
Long Accuracy	ppm	see T <sub>period</sub> min-max values	-300	300	ppm	1,2
Clock period	T <sub>period</sub>	14.318MHz output nominal	69.8203	69.8622	ns	2
Absolute min/max period	T <sub>abs</sub>	14.318MHz output nominal	69.8203	70.86224	ns	2
Output High Voltage	V <sub>OH</sub>	I <sub>OH</sub> = -1 mA	2.4		V	1
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = 1 mA		0.4	V	1
Output High Current	I <sub>OH</sub>	V <sub>OH</sub> @ MIN = 1.0 V, V <sub>OH</sub> @ MAX = 3.135 V	-33	-33	mA	1
Output Low Current	I <sub>OL</sub>	V <sub>OL</sub> @ MIN = 1.95 V, V <sub>OL</sub> @ MAX = 0.4 V	30	38	mA	1
Rising Edge Slew Rate	t <sub>SLR</sub>	Measured from 0.8 to 2.0 V	1	4	V/ns	1
Falling Edge Slew Rate	t <sub>FLR</sub>	Measured from 2.0 to 0.8 V	1	4	V/ns	1
Duty Cycle	d <sub>t1</sub>	V <sub>T</sub> = 1.5 V	45	55	%	1
Jitter	t <sub>jcy-cyc</sub>	V <sub>T</sub> = 1.5 V		1000	ps	1

### Notes on Electrical Characteristics:

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

<sup>2</sup>Slew rate measured through V<sub>swing</sub> centered around differential zero

<sup>3</sup>V<sub>xabs</sub> is defined as the voltage where CLK = CLK#

<sup>4</sup>Only applies to the differential rising edge (CLK rising and CLK# falling)

<sup>5</sup>Defined as the total variation of all crossing voltages of CLK rising and CLK# falling. Matching applies to rising edge rate of CLK and falling edge of CLK#. It is measured using a +/-75mV window centered on the average cross point where CLK meets CLK#. The average cross point is used to calculate the voltage thresholds the oscilloscope is to use for the edge rate calculations

<sup>6</sup>All Long Term Accuracy and Clock Period specifications are guaranteed assuming that REFOUT is at 14.31818MHz

<sup>7</sup>Operation under these conditions is neither implied, nor guaranteed.

<sup>8</sup>Maximum input voltage is not to exceed maximum VDD

<sup>9</sup>See PCI Clock-to-Clock Delay Figure

## General I<sup>2</sup>C serial interface information for the 9UMS9001

### How to Write:

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

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

### How to Read:

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

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

**Byte 0 FS Readback, SS Enable, STOP Control Register**

Bit	Pin	Name	Description	Type	0	1	Default
7	-	FSLC	CPU Freq. Sel. Bit MSB	RW	See Frequency Select Table		Latch
6		FSLB	CPU Freq. Sel. Bit LSB	RW			Latch
5		CPU_SS_EN	Spread spectrum enable for CPU/SRC/PCI outputs	RW	SS Disabled	SS Enabled	1
4		LCD_Enable	Turns On LCD PLL	RW	Off	On	1
3		SRC3_STOP	SRC 3 Stop Control	RW	Free Running	Stops with PCI_STOP# Assertion	0
2		SRC2_STOP	SRC 2 Stop Control	RW			0
1		SRC1_STOP	SRC 1 Stop Control	RW			0
0		SRC0_STOP	SRC 0 Stop Control	RW			0

**Byte 1 LCD Quick Config and CPU Stop Control Register**

Bit	Pin	Name	Description	Type	0	1	Default
7		CPU_ITP_STOP	CPU ITP Stop Control	RW	Free Running	Stops with CPU_STOP# assertion	0
6		CPU1_STOP	CPU1 Stop Control	RW			1
5		CPU0_STOP	CPU0 Stop Control	RW			1
4		LCD_SS_EN	Turns on SS for LCD PLL	RW	Off	On	1
3		LCD_SSC_SEL	Select down or center SSC	RW	Down spread	Center spread	0
2		LCD_CF2	PLL3 Quick Config Bit 2	RW	See Table 2: LCD Quick Configuration		0
1		LCD_CF1	PLL3 Quick Config Bit 1	RW			0
0		LCD_CF0	PLL3 Quick Config Bit 0	RW			1

**Byte 2 Output Enable and Stop Control Register**

Bit	Pin	Name	Description	Type	0	1	Default
7		PCI_F2_STOP	Free running PCI Stop Control	RW	Free Running	Stops with PCI_STOP# assertion	0
6		PCI1_STOP	PCI1 Stop Control	RW			1
5		PCI0_STOP	PCI 0 Stop Control	RW			1
4		REF_OE	Output enable for REF	RW	Output Disabled	Output Enabled	1
3		USB_OE	Output enable for USB	RW	Output Disabled	Output Enabled	1
2		PCIF2_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		PCI0_OE	Output enable for PCI0	RW	Output Disabled	Output Enabled	1

**Byte 3 Output Enable Register**

Bit	Pin	Name	Description	Type	0	1	Default
7		CPU_ITP_OE	Output enable for CPU ITP	RW	Output Disabled	Output Enabled	1
6		CPU1_OE	Output enable for CPU1	RW	Output Disabled	Output Enabled	1
5		CPU0_OE	Output enable for CPU0	RW	Output Disabled	Output Enabled	1
4		Reserved	Reserved	RW			0
3		SRC3_OE	Output enable for SRC4	RW	Output Disabled	Output Enabled	1
2		SRC2_OE	Output enable for SRC4	RW	Output Disabled	Output Enabled	1
1		SRC1_OE	Output enable for SRC4	RW	Output Disabled	Output Enabled	1
0		SRC0_OE	Output enable for SRC4	RW	Output Disabled	Output Enabled	1

**Byte 4 Output Enable and CLKREQ# Control Register**

Bit	Pin	Name	Description	Type	0	1	Default
7		DOT96_OE	Output enable for DOT96	RW	Output Disabled	Output Enabled	1
6		LCD100_OE	Output enable for LCD100	RW	Output Disabled	Output Enabled	1
5		Reserved	Reserved	RW			0
4		Reserved	Reserved	RW			0
3		SRC3_CR	SRC3 CLKREQ3# Enable	RW	Not controlled by CLKREQ#	Controlled by CLKREQ#	0
2		SRC2_CR	SRC2 CLKREQ2# Enable	RW			0
1		SRC1_CR	SRC1 CLKREQ1# Enable	RW			0
0		SRC0_CR	SRC0 CLKREQ0# Enable	RW			0

**Byte 5 Drive Strength Control Register**

Bit	Pin	Name	Description	Type	0	1	Default
7		PCI_F2 Strength	Sets the PCI_F2 output drive strength	RW	1 Load	2 Loads	1
6		PCI1 Strength	Sets the PCI1 output drive strength	RW			1
5		PCI0 Strength	Sets the PCI0 output drive strength	RW			1
4		48MHz Strength	Sets the 48MHz output drive strength	RW			1
3		REF Strength	Sets the REF output drive strength	RW	2 Loads	3 Loads	1
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 6 Reserved Register**

Bit	Pin	Name	Description	Type	0	1	Default
7		Reserved	Reserved	RW			0
6		Reserved	Reserved	RW			0
5		Reserved	Reserved	RW			0
4		Reserved	Reserved	RW			0
3		Reserved	Reserved	RW			0
2		Reserved	Reserved	RW			0
1		Reserved	Reserved	RW			0
0		Reserved	Reserved	RW			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 Register**

Bit	Pin	Name	Description	Type	0	1	Default
7		Device_ID3	Package ID code	R	Device ID = 0011 Hex 56-pin QFN		0
6		Device_ID2		R			0
5		Device_ID1		R			1
4		Device_ID0		R			1
3		Reserved	Reserved	RW			0
2		Reserved	Reserved	RW			0
1		Reserved	Reserved	RW			0
0		Reserved	Reserved	RW			1

**Byte 9 Test Mode Register**

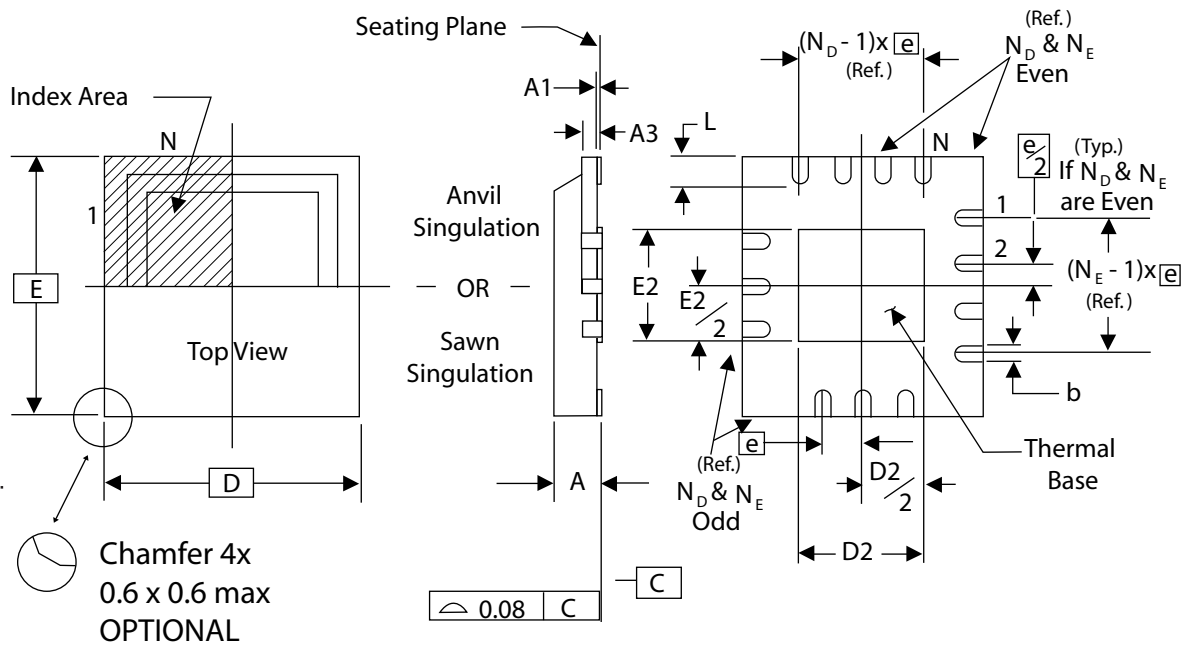
Bit	Pin	Name	Description	Type	0	1	Default
7		LCD_STOP	LCD Stop Control	RW	Free Running	Stops with PCI_STOP# assertion	0
6		Reserved	Reserved	RW			0
5		Reserved	Reserved	RW			0
4		Test Mode Select	Allows test select, ignores Test Sel input pin	RW	Outputs HI-Z	Outputs = REF/N	0
3		Test Mode Entry	Enters into test mode, ignores input pin	RW	Normal operation	Test mode	0
2		Reserved	Reserved	RW			0
1		Reserved	Reserved	RW			0
0		PLL1_SS	PLL1 Spread Spectrum Mode	RW	Down-spread	Center-spread	0

### Test Clarification Table

Comments	HW		SW		OUTPUT
	TEST_SEL HW PIN	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 Cycle power to disable test mode TEST_MODE -->low Vth input TEST_MODE is a real time input	>2.0V	0	X	0	HI-Z
	>2.0V	0	X	1	REF/N
	>2.0V	1	X	0	REF/N
	>2.0V	1	X	1	REF/N
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)



THERMALLY ENHANCED, VERY THIN, FINE PITCH  
QUAD FLAT / NO LEAD PLASTIC PACKAGE

DIMENSIONS

SYMBOL	MIN.	MAX.
A	0.8	1.0
A1	0	0.05
A3	0.25 Reference	
b	0.18	0.3
e	0.50 BASIC	

DIMENSIONS

SYMBOL	ICS 56L TOLERANCE
N	56
N <sub>D</sub>	14
N <sub>E</sub>	14
D x E BASIC	8.00 x 8.00
D2 MIN. / MAX.	4.35 / 4.65
E2 MIN. / MAX.	5.05 / 5.35
L MIN. / MAX.	0.30 / 0.50

Ordering Information

Part / Order Number	Shipping Package	Package	Temperature
9UMS9001AKLF	Tubes	56-pin MLF	0 to +70° C
9UMS9001AKLFT	Tape and Reel	56-pin MLF	0 to +70° C

“LF” suffix to the part number are the Pb-Free configuration and are RoHS compliant.

“A” is the device revision designator (will not correlate with the datasheet revision).

## Revision History

Rev.	Issue Date	Who	Description	Page #
A	8/28/2008	RDW	1. Removed CK505 reference is Device ID byte of SMBus 2. Moved SMBus AFTER electrical characteristics 3. Made Data sheet Rev A device. 4. Move to Final	8, 9, 10
B	7/19/2010	RDW	1. Corrected Pin type for Pins 8, 21, 23.	2
C	6/16/2011	RDW	1. Corrected typo in pin name for pin 29. 2. Corrected typo in pin description for pin 41.	1, 2, 3

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