

# DATA SHEET

## PCK2010RA CK98R (100/133MHz) RCC spread spectrum system clock generator

Product specification

2001 Apr 02

Supersedes data of 2000 Dec 01

ICL03 — PC Motherboard ICs; Logic Products Group

# CK98R (100/133MHz) RCC spread spectrum system clock generator

PCK2010RA

## FEATURES

- Mixed 2.5 V and 3.3 V operation
- Four CPU clocks at 2.5 V
- Eight PCI clocks at 3.3 V, one free-running (synchronous with CPU clocks)
- Four 3.3 V fixed clocks @ 66 MHz
- Two 2.5 V CPUDIV2 clocks @  $1/2$  CPU clock frequency
- Three 2.5 V IOAPIC clocks @ 16.67 MHz
- One 3.3 V 48 MHz USB clock
- Two 3.3 V reference clocks @ 14.318 MHz
- Reference 14.31818 MHz Xtal oscillator input
- 133 MHz or 100 MHz operation, 133.01 MHz in 133 mode
- Power management control input pins
- CPU clock jitter  $\leq$  250 ps cycle-cycle
- CPU clock skew  $\leq$  175 ps pin-pin
- 0.0 ns – 1.5 ns CPU–3V66 delay
- 1.5 ns – 3.5 ns 3V66–PCI delay
- 1.5 ns – 4.0 ns CPU–IOAPIC delay
- 1.5 ns – 4.0 ns CPU–PCI delay
- Available in 56-pin SSOP package
- $\pm 0.6\%$  center spread spectrum capability via select pins
- $-0.6\%$  down spread spectrum capability via select pins

## DESCRIPTION

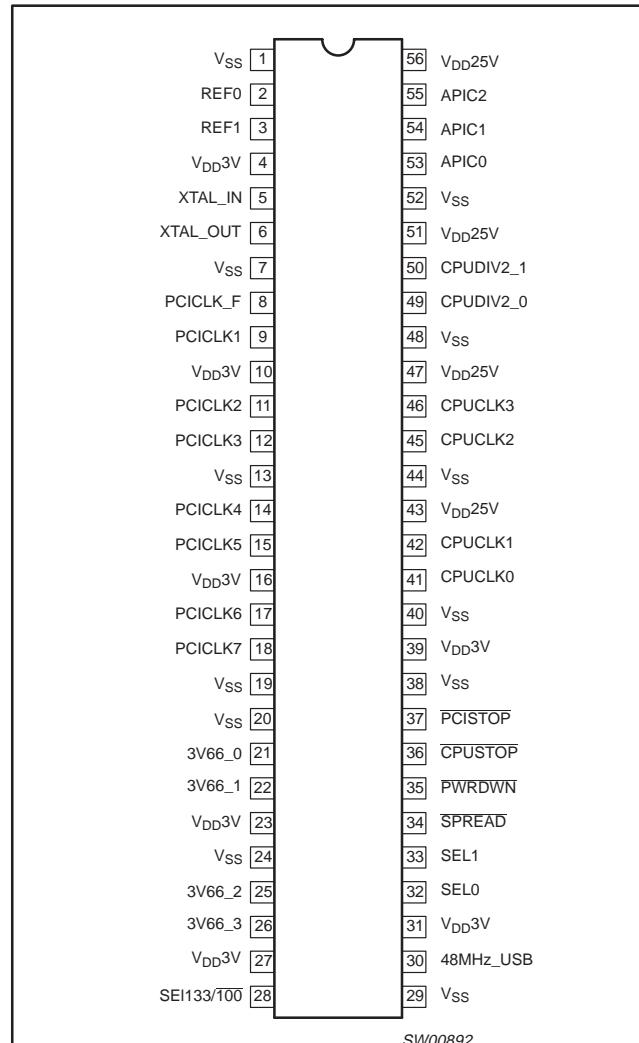
The PCK2010RA is a clock generator (frequency synthesizer) chip for a Pentium II and other similar processors.

The PCK2010RA has four CPU clock outputs at 2.5 V, two CPUDIV2 clock outputs running at  $1/2$  CPU clock frequency (66 MHz or 50 MHz depending on the state of SEL133/100) and four 3V66 clocks running at 66MHz. There are eight PCI clock outputs running at 33 MHz. One of the PCI clock outputs is free-running. Additionally, the part has three 2.5 V IOAPIC clock outputs at 16.67 MHz and two 3.3 V reference clock outputs at 14.318 MHz. All clock outputs meet Intel's drive strength, rise/fall time, jitter, accuracy, and skew requirements.

The part possesses dedicated power-down, CPUSTOP, and PCISTOP input pins for power management control. These inputs are synchronized on-chip and ensure glitch-free output transitions. When the CPUSTOP input is asserted, the CPU clock outputs and 3V66 clock outputs are driven LOW. When the PCISTOP input is asserted, the PCI clock outputs are driven LOW.

Finally, when the PWRDWN input pin is asserted, the internal reference oscillator and PLLs are shut down, and all outputs are driven LOW.

## PIN CONFIGURATION



## ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	ORDER CODE	DRAWING NUMBER
56-Pin plastic SSOP	0 to +70 °C	PCK2010RADL	SOT371-1

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# CK98R (100/133MHz) RCC spread spectrum system clock generator

PCK2010RA

## PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
2,3	REF [0-1]	3.3 V 14.318 MHz clock output
5	XTAL_IN	14.318 MHz crystal input
6	XTAL_OUT	14.318 MHz crystal output
8	PCICLK_F	3.3 V free running PCI clock
9, 11, 12, 14, 15, 17, 18	PCICLK [1-7]	3.3 V PCI clock outputs
21, 22, 25, 26	3V66 [0-3]	3.3 V fixed 66 MHz clock outputs
28	SEL133/100	Select input pin for enabling 133 MHz or 100 MHz CPU outputs. H = 133 MHz, L = 100 MHz
30	48 MHz USB	3.3 V fixed 48 MHz clock output
32, 33	SEL [0-1]	Logic select pins. TTL levels.
34	SPREAD	3.3 V LVTTL input. Enables spread spectrum mode when held LOW.
35	PWRDWN	3.3 V LVTTL input. Device enters powerdown mode when held LOW.
36	CPUSTOP	3.3 V LVTTL input. Stops all CPU clocks and 3V66 clocks when held LOW. CPUDIV_2 output remains on all the time.
37	PCISTOP	3.3 V LVTTL input. Stops all PCI clocks except PCICLK_F when held LOW.
41, 42, 45, 46	CPUCLK [0-3]	2.5 V CPU output. 133 MHz or 100MHz depending on state of input pin SEL133/100.
49, 50	CPUDIV_2 [0-1]	2.5 V output running at 1/2 CPU clock frequency. 66 MHz or 50 MHz depending on state of input pin SEL133/100.
53, 54, 55	IOAPIC [0-2]	2.5 V clock outputs running divide synchronous with the CPU clock frequency. Fixed 16.67 MHz limit.
4, 10, 16, 23, 27, 31, 39 <sup>2</sup>	V <sub>DD3V</sub>	3.3 V power supply.
1, 7, 13, 19, 20, 24, 29, 38, 40, 44, 48, 52	V <sub>SS</sub>	Ground
43, 47, 51, 56	V <sub>DD25V</sub>	2.5 V power supply

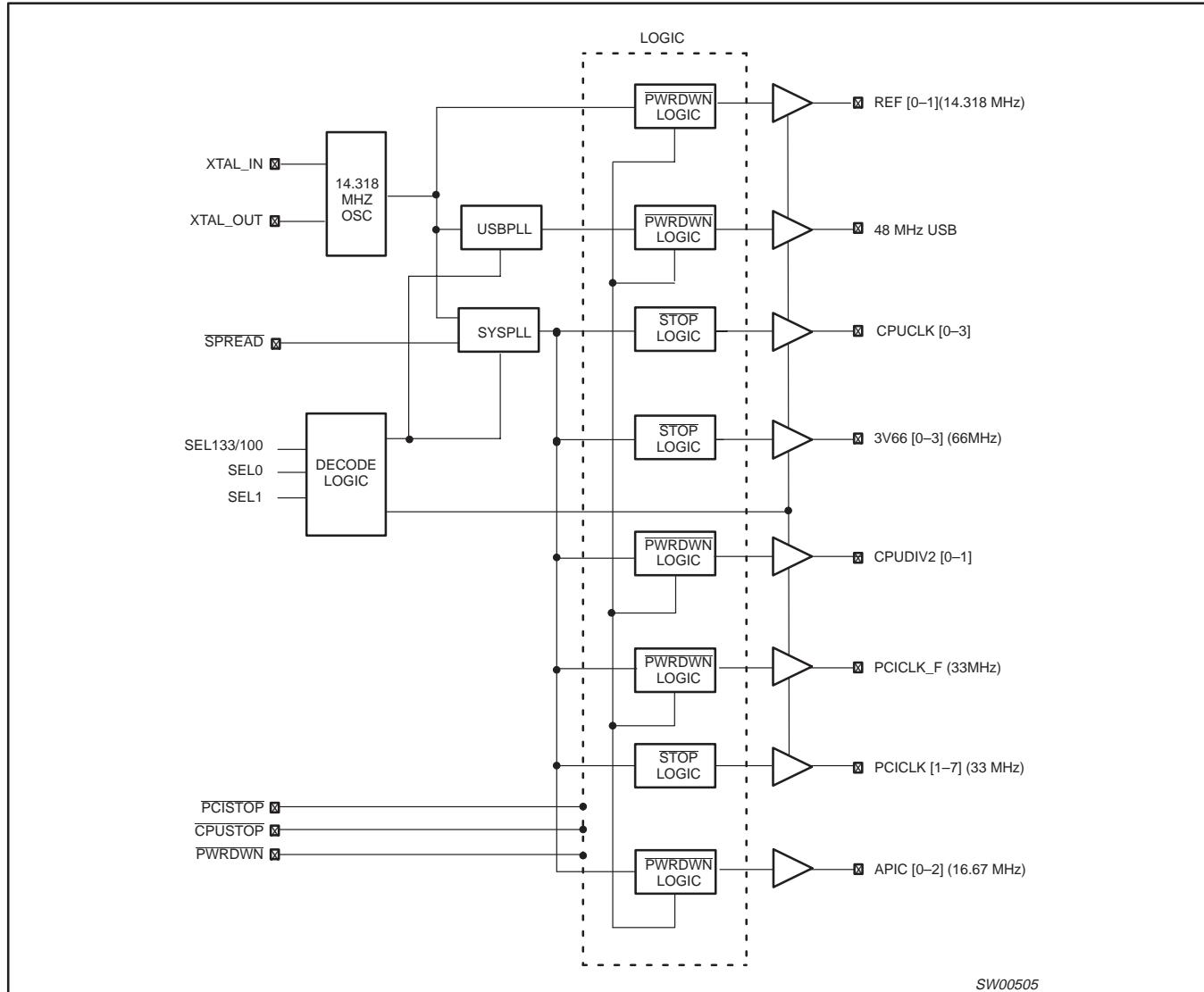
### NOTE:

1. V<sub>DD3V</sub>, V<sub>DD25V</sub> and V<sub>SS</sub> in the above table reflects a likely internal POWER and GROUND partition to reduce the effects of internal noise on the performance of the device. In reality, the platform will be configured with the V<sub>DD25V</sub> pins tied to a 2.5 V supply, all remaining V<sub>DD</sub> pins tied to a common 3.3 V supply and all V<sub>SS</sub> pins being common.
2. Pin 39 should have a pi or equivalent filter to reduce the effect of noise on the analog portions of the device.

# CK98R (100/133MHz) RCC spread spectrum system clock generator

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## BLOCK DIAGRAM



# CK98R (100/133MHz) RCC spread spectrum system clock generator

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## FUNCTION TABLE

SEL 133/100	SEL1	SEL0	CPU	CPUDIV2	3V66	PCI	48 MHz	REF	IOAPIC	NOTES
0	0	0	HI-Z	HI-Z	HI-Z	HI-Z	HI-Z	HI-Z	HI-Z	1
0	0	1	100 MHz	50 MHz	66 MHz	33 MHz	48 MHz	14.318 MHz	16.67 MHz	2
0	1	0	100 MHz	50 MHz	66 MHz	33 MHz	HI-Z	14.318 MHz	16.67 MHz	3
0	1	1	100 MHz	50 MHz	66 MHz	33 MHz	48 MHz	14.318 MHz	16.67 MHz	4, 7, 8
1	0	0	TCLK/2	TCLK/4	TCLK/4	TCLK/8	TCLK/2	TCLK	TCLK/16	5, 6
1	0	1	133 MHz	66 MHz	66 MHz	33 MHz	48 MHz	14.318 MHz	16.67 MHz	2
1	1	0	133 MHz	66 MHz	66 MHz	33 MHz	HI-Z	14.318 MHz	16.67 MHz	3
1	1	1	133 MHz	66 MHz	66 MHz	33 MHz	48 MHz	14.318 MHz	16.67 MHz	4, 7, 8

### NOTES:

- Required for board level "bed-of-nails" testing.
- Philips center spread mode.
- 48 MHz PLL disabled to reduce component jitter. 48 MHz outputs to be held HI-Z instead of driven to LOW state.
- "Normal" mode of operation.
- TCLK is a test clock over driven on the XTALIN input during test mode. TCLK mode is based on 133 MHz CPU select logic.
- Required for DC output impedance verification.
- Frequency accuracy of 48 MHz must be +167 PPM to match USB default.
- Range of reference frequency allowed is MIN = 14.316 MHz, NOMINAL = 14.31818 MHz, MAX = 14.32 MHz.

CLOCK OUTPUT	TARGET FREQUENCY (MHz)	ACTUAL FREQUENCY (MHz)	PPM
USBCLK <sup>7</sup>	48.0	48.008	167

## CLOCK ENABLE CONFIGURATION

CPUSTOP	PWRDWN	PCISTOP	CPUCLK	CPUDIV2	APIC	3V66	PCI	PCI_F	REF / 48 MHz	OSC	VCOS
X	0	X	LOW	LOW	LOW	LOW	LOW	LOW	LOW	OFF	OFF
0	1	0	LOW	ON	ON	LOW	LOW	ON	ON	ON	ON
0	1	1	LOW	ON	ON	LOW	ON	ON	ON	ON	ON
1	1	0	ON	ON	ON	ON	LOW	ON	ON	ON	ON
1	1	1	ON	ON	ON	ON	ON	ON	ON	ON	ON

### NOTES:

- LOW means outputs held static LOW as per latency requirement below
- ON means active.
- PWRDWN pulled LOW, impacts all outputs including REF and 48 MHz outputs.
- All 3V66 clocks as well as CPU clocks should stop cleanly when CPUSTOP is pulled LOW.
- CPUDIV2, IOAPIC, REF, 48 MHz signals are not controlled by the CPUSTOP functionality and are enabled all in all conditions except when PWRDWN is LOW.

## POWER MANAGEMENT REQUIREMENTS

SIGNAL	SIGNAL STATE	LATENCY	
		NO. OF RISING EDGES OF FREE RUNNING PCICLK	
CPUSTOP	0 (DISABLED)	1	
	1 (ENABLED)	1	
PCISTOP	0 (DISABLED)	1	
	1 (ENABLED)	1	
PWRDWN	1 (NORMAL OPERATION)	3 ms	
	0 (POWER DOWN)	2 MAX	

### NOTES:

- Clock ON/OFF latency is defined as the number of rising edges of free running PCICLKs between the clock disable goes HIGH/LOW to the first valid clock that comes out of the device.
- Power up latency is when PWRDWN goes inactive (HIGH) to when the first valid clocks are driven from the device.

# CK98R (100/133MHz) RCC spread spectrum system clock generator

PCK2010RA

## ABSOLUTE MAXIMUM RATINGS<sup>1, 2</sup>

In accordance with the Absolute Maximum Rating System (IEC 134).  
 Voltages are referenced to V<sub>SS</sub> (V<sub>SS</sub> = 0 V).

SYMBOL	PARAMETER	CONDITION	LIMITS		UNIT
			MIN	MAX	
V <sub>DD3</sub>	DC 3.3 V core supply voltage		-0.5	+4.6	V
V <sub>DDQ3</sub>	DC 3.3 V I/O supply voltage		-0.5	+4.6	V
V <sub>DDQ2</sub>	DC 2.5 V I/O supply voltage		-0.5	+3.6	V
I <sub>IK</sub>	DC input diode current	V <sub>I</sub> < 0		-50	mA
V <sub>I</sub>	DC input voltage	Note 2	-0.5	5.5	V
I <sub>OK</sub>	DC output diode current	V <sub>O</sub> > V <sub>CC</sub> or V <sub>O</sub> < 0		±50	mA
V <sub>O</sub>	DC output voltage	Note 2	-0.5	V <sub>CC</sub> + 0.5	V
I <sub>O</sub>	DC output source or sink current	V <sub>O</sub> = 0 to V <sub>CC</sub>		±50	mA
T <sub>stg</sub>	Storage temperature range		-65	+150	°C
P <sub>tot</sub>	Power dissipation per package plastic medium-shrink (SSOP)	For temperature range: -40 to +125 °C above +55 °C derate linearly with 11.3 mW/K		850	mW

### NOTES:

1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
V <sub>DD3V</sub>	DC 3.3 V core supply voltage		3.135	3.465	V
V <sub>DD25V</sub>	DC 2.5 V I/O supply voltage		2.375	2.625	V
C <sub>L</sub>	Capacitive load on:				
	CPUCLK	1 device load, possible 2 loads	10	20	pF
	PCICLK	Must meet PCI 2.1 requirements	10	30	pF
	CPUDIV2	1 device load, possible 2 loads	10	20	pF
	3V66	1 device load, possible 2 loads	10	30	pF
	48 MHz clock USB	1 device load	10	20	pF
	REF	1 device load	10	20	pF
IOAPIC		1 device load	10	20	pF
V <sub>I</sub>	DC input voltage range		0	V <sub>DD3V</sub>	V
V <sub>O</sub>	DC output voltage range		0	V <sub>DD25V</sub> V <sub>DD3V</sub>	V
f <sub>REF</sub>	Reference frequency, oscillator nominal value		14.31818	14.31818	MHz
T <sub>amb</sub>	Operating ambient temperature range in free air		0	+70	°C

## POWER MANAGEMENT

CK133 CONDITION	MAXIMUM 2.5 V SUPPLY CONSUMPTION MAXIMUM DISCRETE CAP LOADS, V <sub>DD25V</sub> = 2.625 V ALL STATIC INPUTS = V <sub>DD3V</sub> OR V <sub>SS</sub>	MAXIMUM 3.3 V SUPPLY CONSUMPTION MAXIMUM DISCRETE CAP LOADS, V <sub>DD25V</sub> = 3.465 V ALL STATIC INPUTS = V <sub>DD3V</sub> OR V <sub>SS</sub>
Power-down mode (PWRDWN = 0)	100 µA	200 µA
Full active 100 MHz SEL133/100# = 0 SEL1, 0 = 1 1 CPUSTOP, PCISTOP = 1	80 mA	160 mA
Full active 133 MHz SEL133/100# = 1 SEL1, 0 = 1 1 CPUSTOP, PCISTOP = 1	90 mA	160 mA

CK98R (100/133MHz) RCC spread spectrum  
system clock generator

PCK2010RA

## DC CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITIONS		LIMITS			UNIT	
		V <sub>DD</sub> (V)	OTHER		T <sub>amb</sub> = 0 to +70°C			
			MIN	TYP	MAX			
V <sub>IH</sub>	HIGH level input voltage	3.135 to 3.465		V <sub>DD25V</sub> = 2.5 V ±5%	2.0	V <sub>DD</sub> + 0.3	V	
V <sub>IL</sub>	LOW level input voltage	3.135 to 3.465		V <sub>DD3V</sub> = 3.3 V ±5%	V <sub>SS</sub> - 0.3	0.8	V	
V <sub>OH2</sub>	2.5 V output HIGH voltage CPUCLK, IOAPIC, CPUDIV2	2.375 to 2.625	I <sub>OH</sub> = -1 mA		2.0	-	V	
V <sub>OL2</sub>	2.5 V output LOW voltage CPUCLK, IOAPIC, CPUDIV2	2.375 to 2.625	I <sub>OL</sub> = 1 mA		-	0.4	V	
V <sub>OH3</sub>	3.3 V output HIGH voltage REF, 48 MHz USB	3.135 to 3.465	I <sub>OH</sub> = -1 mA		2.0	-	V	
V <sub>OL3</sub>	3.3 V output LOW voltage REF, 48 MHz USB	3.135 to 3.465	I <sub>OL</sub> = 1 mA		-	0.4	V	
V <sub>OH3</sub>	3.3 V output HIGH voltage PCI, 3V66	3.135 to 3.465	I <sub>OH</sub> = -1 mA		2.4	-	V	
V <sub>OL3</sub>	3.3 V output LOW voltage PCI, 3V66	3.135 to 3.465	I <sub>OL</sub> = 1 mA		-	0.55	V	
I <sub>OH</sub>	CPUCLK output HIGH current	2.375	V <sub>OUT</sub> = 1.0 V		-27	-	mA	
		2.625	V <sub>OUT</sub> = 2.375 V		-	-27		
I <sub>OH</sub>	48 MHz USB, REF output HIGH current	3.135	V <sub>OUT</sub> = 1.0 V		-29	-	mA	
		3.465	V <sub>OUT</sub> = 3.135 V		-	-23		
I <sub>OH</sub>	PCI, 3V66 output HIGH current	3.135	V <sub>OUT</sub> = 1.0 V		-33	-	mA	
		3.465	V <sub>OUT</sub> = 3.135 V		-	-33		
I <sub>OL</sub>	CPUCLK output LOW current	2.375	V <sub>OUT</sub> = 1.2 V		27	-	mA	
		2.625	V <sub>OUT</sub> = 0.3 V		-	30		
I <sub>OL</sub>	48 MHz USB, REF output LOW current	3.135	V <sub>OUT</sub> = 1.95 V		29	-	mA	
		3.465	V <sub>OUT</sub> = 0.4 V		-	27		
I <sub>OL</sub>	PCI, 3V66 output LOW current	3.135	V <sub>OUT</sub> = 1.95 V		30	-	mA	
		3.465	V <sub>OUT</sub> = 0.4 V		-	38		
±I <sub>I</sub>	Input leakage current	3.465			-	5	µA	
±I <sub>OZ</sub>	3-State output OFF-State current	3.465	V <sub>OUT</sub> = V <sub>dd</sub> or GND	I <sub>O</sub> = 0	-	10	µA	
C <sub>in</sub>	Input pin capacitance					5	pF	
C <sub>xtal</sub>	Xtal pin capacitance, as seen by external crystal				18		pF	
C <sub>out</sub>	Output pin capacitance					6	pF	

# CK98R (100/133MHz) RCC spread spectrum system clock generator

PCK2010RA

## AC CHARACTERISTICS

$V_{DD3V} = 3.3 \text{ V} \pm 5\%$ ;  $V_{DDAPIC} = V_{DD25V} = 2.5 \text{ V} \pm 5\%$ ;  $f_{\text{crystal}} = 14.31818 \text{ MHz}$

### CPU CLOCK OUTPUTS, CPU(0-3) (LUMP CAPACITANCE TEST LOAD = 20 pF)

SYMBOL	PARAMETER	LIMITS $T_{\text{amb}} = 0 \text{ to } +70 \text{ }^{\circ}\text{C}$		LIMITS $T_{\text{amb}} = 0 \text{ to } +70 \text{ }^{\circ}\text{C}$		UNIT	NOTES		
		133 MHz MODE		100 MHz MODE					
		MIN	MAX	MIN	MAX				
$T_{\text{HKP}}$	CPUCLK period	7.5	7.65	10.0	10.3	ns	2, 9		
$T_{\text{HKHPabsmin}}$	Absolute minimum period	7.35	n/a	9.85	n/a	ns	2, 9		
$T_{\text{HKH}}$	CPUCLK HIGH time	1.87	n/a	3.0	n/a	ns	5, 10		
$T_{\text{HKL}}$	CPUCLK LOW time	1.67	n/a	2.8	n/a	ns	6, 10		
$T_{\text{HRISE}}$	CPUCLK rise time	0.4	1.6	0.4	1.6	ns	8		
$T_{\text{HFALL}}$	CPUCLK fall time	0.4	1.6	0.4	1.6	ns	8		
$T_{\text{JITTER}}$	CPUCLK cycle-cycle jitter		250		250	ps			
DUTY CYCLE	Output Duty Cycle	45	55	45	55	%	1		
$T_{\text{HSKW}}$	CPUCLK pin-pin skew		175		175	ps	2		

### CPUDIV2 CLOCK OUTPUTS, CPUDIV2 (0-1) (LUMP CAPACITANCE TEST LOAD = 20 pF)

SYMBOL	PARAMETER	LIMITS $T_{\text{amb}} = 0 \text{ to } +70 \text{ }^{\circ}\text{C}$		LIMITS $T_{\text{amb}} = 0 \text{ to } +70 \text{ }^{\circ}\text{C}$		UNIT	NOTES		
		133 MHz MODE		100 MHz MODE					
		MIN	MAX	MIN	MAX				
$T_{\text{HKP}}$	CPUDIV2 CLK period	15.0	15.3	20.0	20.6	ns	2, 9		
$T_{\text{HKH}}$	CPUDIV2 CLK HIGH time	5.25	n/a	7.5	n/a	ns	5, 10		
$T_{\text{HKL}}$	CPUDIV2 CLK LOW time	5.05	n/a	7.3	n/a	ns	6, 10		
$T_{\text{HRISE}}$	CPUDIV2 CLK rise time	0.4	1.6	0.4	1.6	ns	8		
$T_{\text{HFALL}}$	CPUDIV2 CLK fall time	0.4	1.6	0.4	1.6	ns	8		
$T_{\text{JITTER}}$	CPUDIV2 CLK cycle-cycle jitter		250		250	ps			
DUTY CYCLE	CPUDIV2 CLK Duty Cycle	45	55	45	55	%	1		
$T_{\text{HSKW}}$	CPUDIV2 CLK pin-pin skew		175		175	ps	2		

### PCI CLOCK OUTPUTS, PCI(0-7) (LUMP CAPACITANCE TEST LOAD = 30 pF)

SYMBOL	PARAMETER	LIMITS $T_{\text{amb}} = 0 \text{ to } +70 \text{ }^{\circ}\text{C}$		LIMITS $T_{\text{amb}} = 0 \text{ to } +70 \text{ }^{\circ}\text{C}$		UNIT	NOTES		
		133 MHz MODE		100 MHz MODE					
		MIN	MAX	MIN	MAX				
$T_{\text{HKP}}$	PCICLK period	30.0	n/a	30.0	n/a	ns	2, 9		
$T_{\text{HKH}}$	PCICLK HIGH time	12.0	n/a	12.0	n/a	ns	5, 10		
$T_{\text{HKL}}$	PCICLK LOW time	12.0	n/a	12.0	n/a	ns	6, 10		
$T_{\text{HRISE}}$	PCICLK rise time	0.5	2.0	0.5	2.0	ns	8		
$T_{\text{HFALL}}$	PCICLK fall time	0.5	2.0	0.5	2.0	ns	8		
$T_{\text{JITTER}}$	PCICLK cycle-cycle jitter		500		500	ps			
DUTY CYCLE	PCICLK Duty Cycle	45	55	45	55	%	1		
$T_{\text{HSKW}}$	PCICLK pin-pin skew		500		500	ps	2		

CK98R (100/133MHz) RCC spread spectrum  
system clock generator

PCK2010RA

## APIC(0-1) CLOCK OUTPUT (LUMP CAPACITANCE TEST LOAD = 20 pF)

SYMBOL	PARAMETER	LIMITS $T_{amb} = 0$ to $+70$ °C		LIMITS $T_{amb} = 0$ to $+70$ °C		UNIT	NOTES		
		133 MHz MODE		100 MHz MODE					
		MIN	MAX	MIN	MAX				
$T_{HKP}$	IOAPIC CLK period	60.0	61.2	60.0	61.2	ns	2, 9		
$T_{HKH}$	IOAPIC CLK HIGH time	25.5	n/a	25.5	n/a	ns	5, 10		
$T_{HKL}$	IOAPIC CLK LOW time	25.3	n/a	25.3	n/a	ns	6, 10		
$T_{HRISE}$	IOAPIC CLK rise time	0.4	1.6	0.4	1.6	ns	8		
$T_{HFALL}$	IOAPIC CLK fall time	0.4	1.6	0.4	1.6	ns	8		
$T_{JITTER}$	IOAPIC CLK cycle-cycle jitter		500		500	ps			
DUTY CYCLE	IOAPIC CLK Duty Cycle	45	55	45	55	%	1		
$T_{HSKW}$	IOAPIC CLK pin-pin skew		250		250	ps	2		

## 3V66 CLOCK OUTPUT, 3V66 (0-3) (LUMP CAPACITANCE TEST LOAD = 30 pF)

SYMBOL	PARAMETER	LIMITS $T_{amb} = 0$ to $+70$ °C		LIMITS $T_{amb} = 0$ to $+70$ °C		UNIT	NOTES		
		133 MHz MODE		100 MHz MODE					
		MIN	MAX	MIN	MAX				
$T_{HKP}$	3V66 CLK period	15.0	15.3	15.0	15.3	ns	2, 9, 4		
$T_{HKH}$	3V66 CLK HIGH time	4.95	n/a	4.95	n/a	ns	5, 10		
$T_{HKL}$	3V66 CLK LOW time	4.55	n/a	4.55	n/a	ns	6, 10		
$T_{HRISE}$	3V66 CLK rise time	0.5	2.0	0.5	2.0	ns	8		
$T_{HFALL}$	3V66 CLK fall time	0.5	2.0	0.5	2.0	ns	8		
$T_{JITTER}$	3V66 CLK cycle-cycle jitter		500		500	ps			
DUTY CYCLE	3V66 CLK Duty Cycle	45	55	45	55	%	1		
$T_{HSKW}$	3V66 CLK pin-pin skew		250		250	ps	2		

## 48MHz(0-1) CLOCK OUTPUT (LUMP CAPACITANCE TEST LOAD = 20 pF)

SYMBOL	PARAMETER	LIMITS $T_{amb} = 0$ to $+70$ °C		LIMITS $T_{amb} = 0$ to $+70$ °C		UNIT	NOTES		
		133 MHz MODE		100 MHz MODE					
		MIN	MAX	MIN	MAX				
$T_{HKP}$	48 MHz clock period	20.829	20.83	20.829	20.83	ns	2		
$T_{HKH}$	48 MHz clock HIGH time	7.57	n/a	7.57	n/a	ns			
$T_{HKL}$	48 MHz clock LOW time	7.17	n/a	7.17	n/a	ns			
$T_{HRISE}$ ( $t_R$ )	Output rise edge rate	1	4	1	4	ns			
$T_{HFALL}$ ( $t_F$ )	Output fall edge rate	1	4	1	4	ns			
DUTY CYCLE ( $t_D$ )	Duty Cycle	45	55	45	55	%			
$T_{JITTER}$	CLK cycle-cycle jitter		500		500	ps			
$T_{HSTB}$ ( $f_{ST}$ )	Frequency stabilization from Power-up (cold start)				3	ms			

## NOTES:

1. See Figure 5 for measure points.
2. Average period over 1  $\mu$ s.

# CK98R (100/133MHz) RCC spread spectrum system clock generator

PCK2010RA

## AC CHARACTERISTICS (Continued)

SYMBOL	PARAMETER	TEST CONDITIONS		LIMITS $T_{amb} = 0$ to $+70$ °C			UNIT	NOTES
		Measurement loads (lumped)	Measure points	MIN	TYP	MAX		
$T_{HPOFFSET}$	CPUCLK to 3V66 CLK, CPU leads	CPU@20 pF, 3V66@30 pF	CPU@1.25 V, 3V66@1.5 V	0.0	0.45	1.5	ns	1
$T_{HPOFFSET}$	3V66 CLK to PCICLK, 3V66 leads	3V66@30 pF, PCI@30 pF	3V66@1.5 V, PCI@1.5 V	1.5	2.0	3.5	ns	1
$T_{HPOFFSET}$	CPUCLK to IOAPIC, CPU leads	CPU@20 pF, IOAPIC@20 pF	3CPU@1.25 V, IOAPIC@1.25 V	1.5	2.4	4.0	ns	1
$T_{HPOFFSET}$	CPUCLK to PCICLK, CPU leads	CPU@20 pF PCI@30 pF	CPU@1.25 V PCI@1.5 V	1.5	2.7	4.0	ns	

### NOTES:

1. Output drivers must have monotonic rise/fall times through the specified  $V_{OL}/V_{OH}$  levels.
2. Period, jitter, offset and skew measured on rising edge @1.25 V for 2.5 V clocks and @ 1.5 V for 3.3 V clocks.
3. The PCICLK is the CPUCLK divided by four at CPUCLK = 133 MHz. The 3V66 CLK is internal VCO frequency divided by three at CPUCLK = 100 MHz.
4. 3V66 CLK is internal VCO frequency divided by two at CPUCLK = 133 MHz. The 3V66 CLK is internal VCO frequency divided by three at CPUCLK = 100 MHz.
5.  $T_{HKH}$  is measured at 2.0 V for 2.5 V outputs, 2.4 V for 3.3 V outputs as shown in Figure 4.
6.  $T_{HKL}$  is measured at 0.4 V for all outputs as shown in Figure 4.
7. The time is specified from when  $V_{DDQ}$  achieves its nominal operating level (typical condition  $V_{DDQ} = 3.3$  V) until the frequency output is stable and operating within specification.
8.  $T_{HRISE}$  and  $T_{HFALL}$  are measured as a transition through the threshold region  $V_{OL} = 0.4$  V and  $V_{OH} = 2.4$  V for 3 V outputs (1 mA) JEDEC specification.  $T_{HRISE}$  and  $T_{HFALL}$  are measured as a transition through the threshold region  $V_{OL} = 0.4$  V and  $V_{OH} = 2.0$  V for 2.5 V outputs (1 mA) JEDEC specification.
9. The average period over any 1  $\mu$ s period of time must be greater than the minimum specified period.
10. Calculated at minimum edge-rate (1V/ns) to guarantee 45/55% duty-cycle. Pulse width is required to be wider at faster edge-rate to ensure duty-cycle specification is met.
11. Output (see Figure 5 for measure points).

# CK98R (100/133MHz) RCC spread spectrum system clock generator

PCK2010RA

## SPREAD SPECTRUM FUNCTION TABLE

SPREAD#	SEL133/100#	SEL1	SEL0	Function	48 MHz PLL
pin 34	pin 28	pin 33	pin 32		
0 (active)	0 (100 MHz)	0	0	3-State to High Impedance	Inactive
0 (active)	0 (100 MHz)	0	1	100 MHz, Center Spread $\pm 0.6\%$	Active
0 (active)	0 (100 MHz)	1	0	100 MHz, Down Spread $-0.6\%$	Inactive
0 (active)	0 (100 MHz)	1	1	100 MHz, Down Spread $-0.6\%$	Active
0 (active)	1 (133 MHz)	0	0	Test Mode	Active
0 (active)	1 (133 MHz)	0	1	133 MHz, Center Spread $\pm 0.6\%$	Active
0 (active)	1 (133 MHz)	1	0	133 MHz, Down Spread $-0.6\%$	Inactive
0 (active)	1 (133 MHz)	1	1	133 MHz, Down Spread $-0.6\%$	Active
1 (inactive)	0 (100 MHz)	0	0	3-State to High Impedance	Inactive
1 (inactive)	0 (100 MHz)	0	1	100 MHz, No Spread Spectrum	Active
1 (inactive)	0 (100 MHz)	1	0	100 MHz, No Spread Spectrum	Inactive
1 (inactive)	0 (100 MHz)	1	1	100 MHz, No Spread Spectrum	Active
1 (inactive)	1 (133 MHz)	0	0	Test Mode	Active
1 (inactive)	1 (133 MHz)	0	1	133 MHz, No Spread Spectrum	Active
1 (inactive)	1 (133 MHz)	1	0	133 MHz, No Spread Spectrum	Inactive
1 (inactive)	1 (133 MHz)	1	1	133 MHz, No Spread Spectrum	Active

# CK98R (100/133MHz) RCC spread spectrum system clock generator

PCK2010RA

## AC WAVEFORMS

$V_M = 1.25 \text{ V} @ V_{DDQ2}$  and  $1.5 \text{ V} @ V_{DDQ3}$

$V_X = V_{OL} + 0.3 \text{ V}$

$V_Y = V_{OH} - 0.3 \text{ V}$

$V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load.

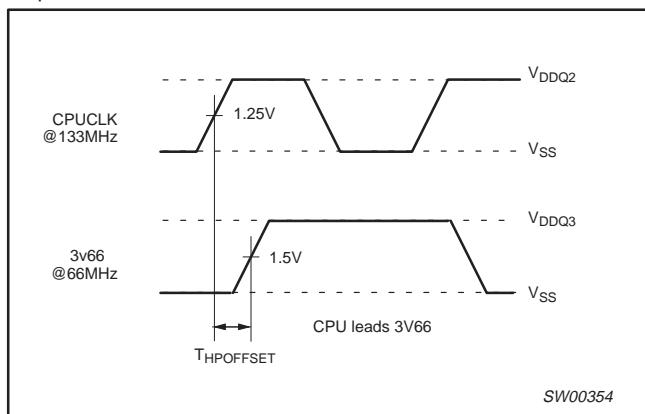


Figure 1. CPUCLK to 3V66 offset

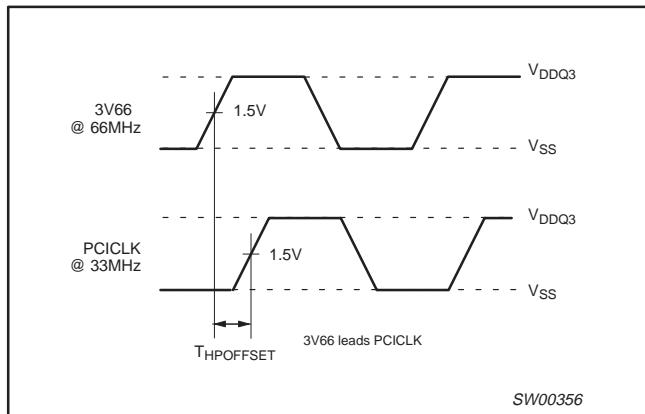


Figure 2. 3V66 to PCI offset

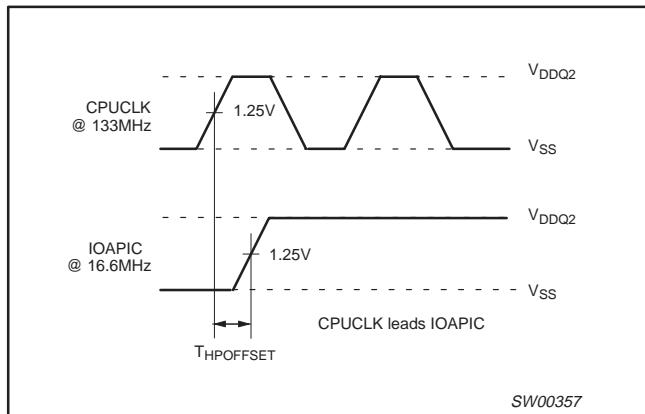


Figure 3. CPU to IOAPIC offset

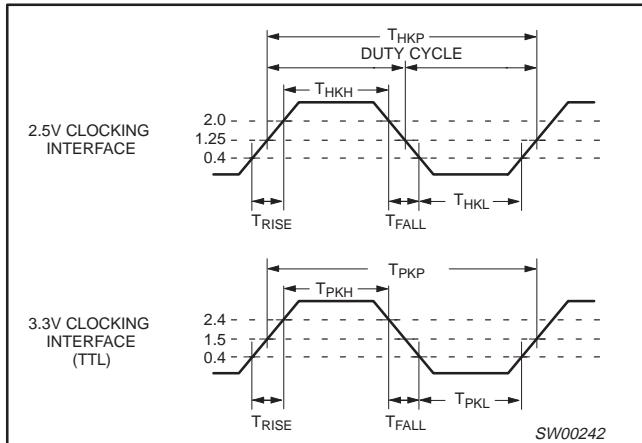


Figure 4. 2.5V/3.3V clock waveforms

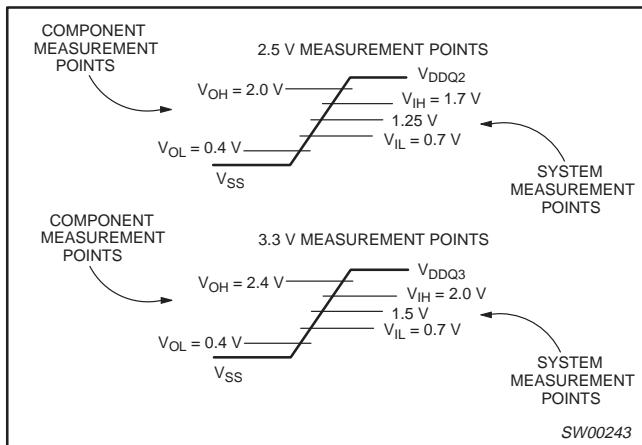


Figure 5. Component versus system measure points

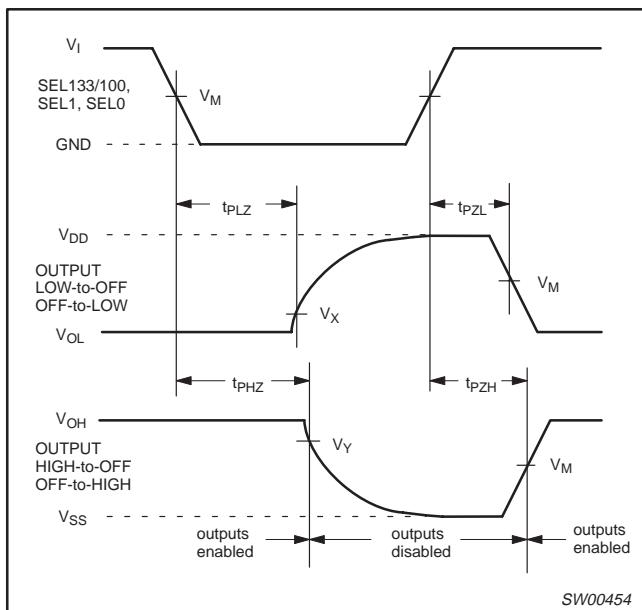


Figure 6. 3-State enable and disable times

# CK98R (100/133MHz) RCC spread spectrum system clock generator

PCK2010RA

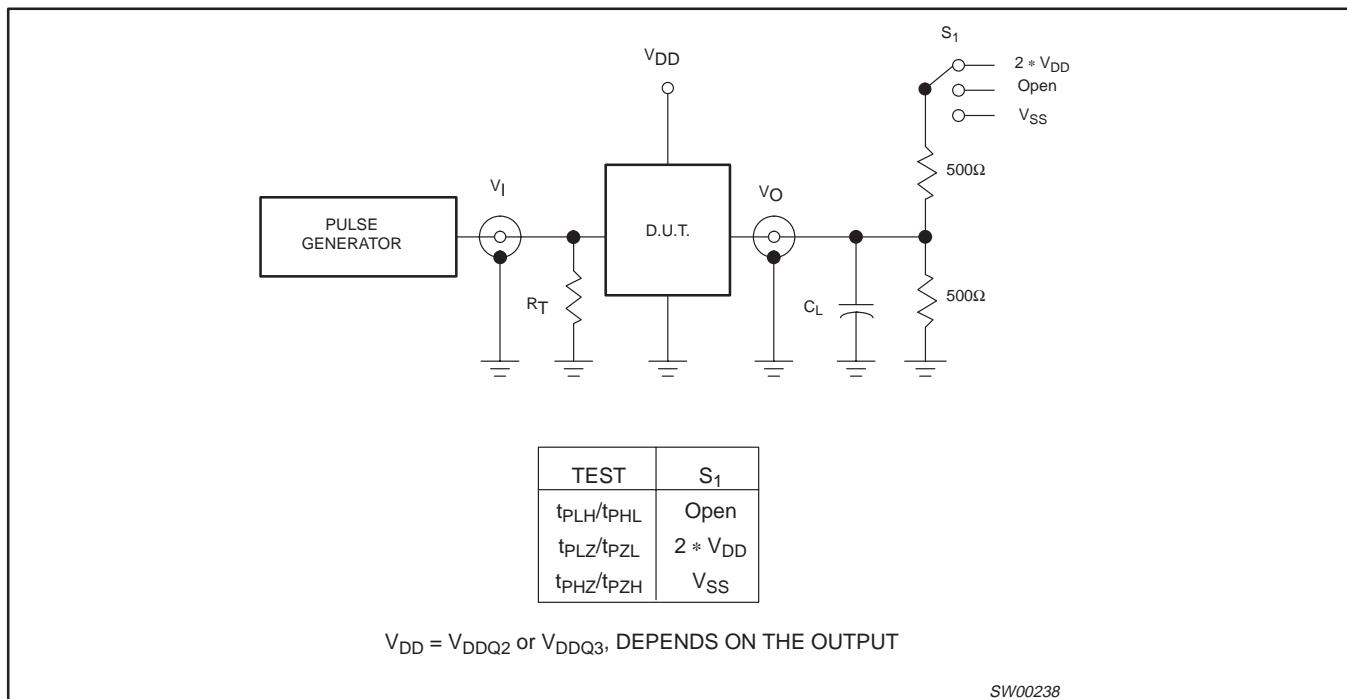


Figure 7. Load circuitry for switching times

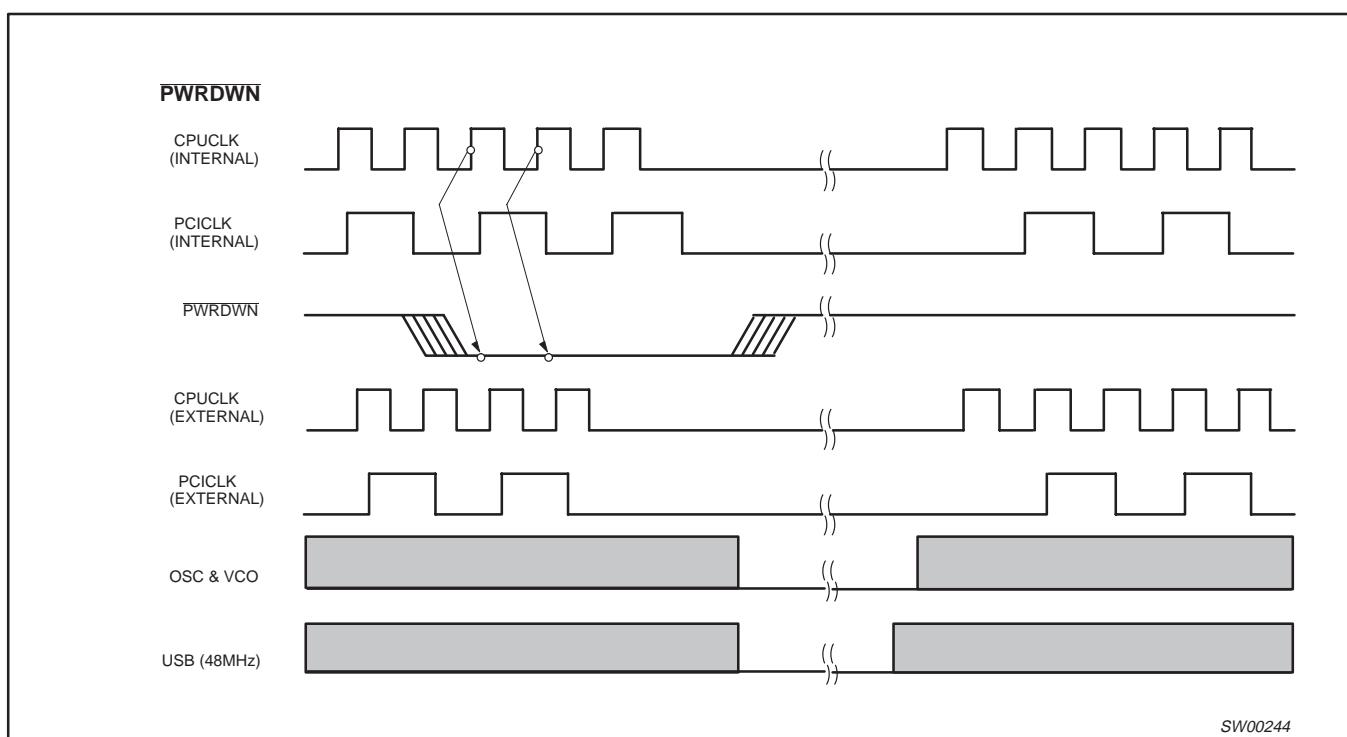


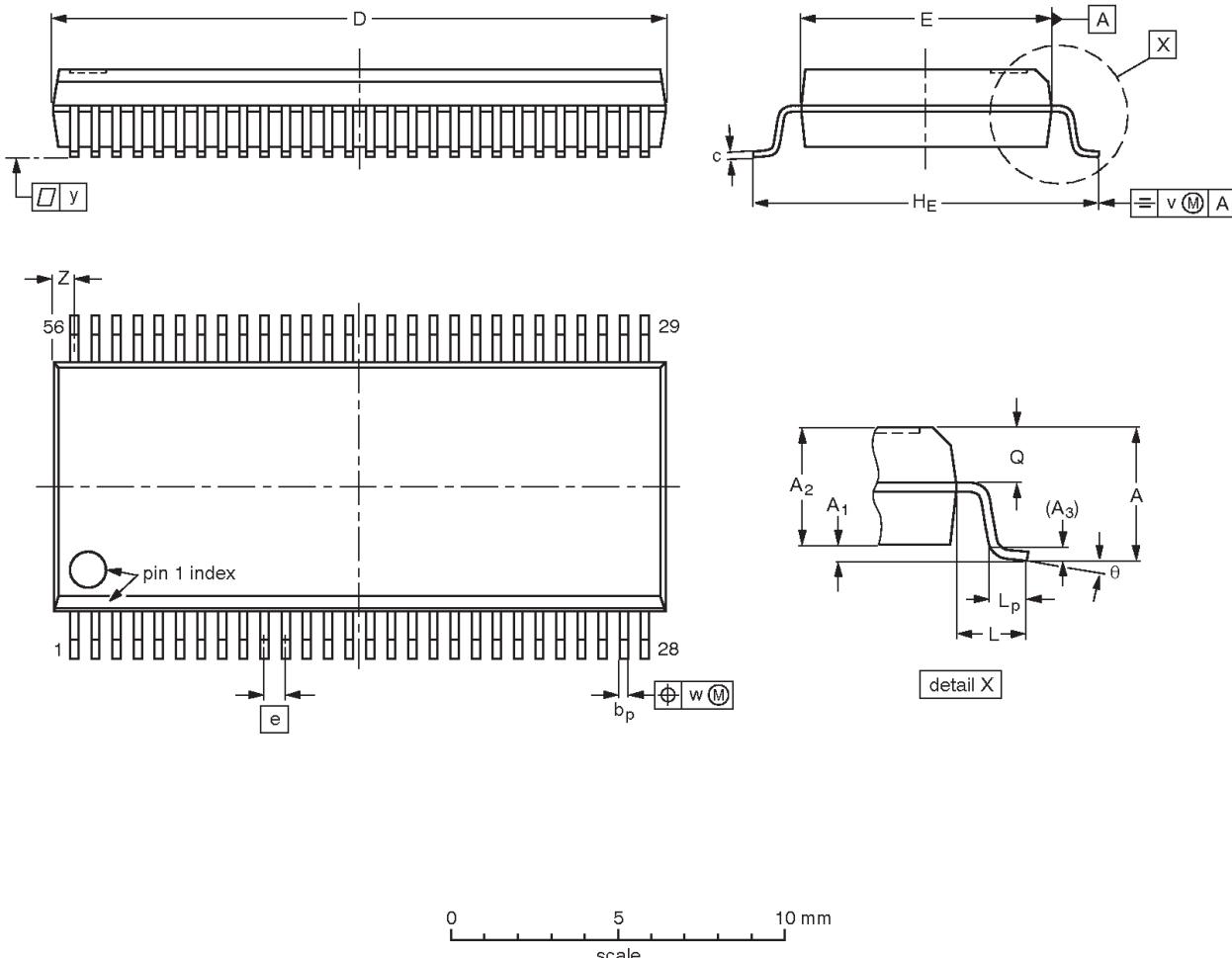
Figure 8. Power Management

CK98R (100/133MHz) RCC spread spectrum  
system clock generator

PCK2010RA

SSOP56: plastic shrink small outline package; 56 leads; body width 7.5 mm

SOT371-1



## DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	Z <sup>(1)</sup>	θ
mm	2.8 0.2	0.4 2.20	2.35	0.25	0.3 0.2	0.22 0.13	18.55 18.30	7.6 7.4	0.635	10.4 10.1	1.4	1.0 0.6	1.2 1.0	0.25	0.18	0.1	0.85 0.40	8° 0°

## Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT371-1		MO-118				95-02-04 99-12-27

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**CK98R (100/133MHz) RCC spread spectrum  
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**PCK2010RA**

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**NOTES**

# CK98R (100/133MHz) RCC spread spectrum system clock generator

PCK2010RA

## Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
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[1] Please consult the most recently issued datasheet before initiating or completing a design.

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Date of release: 04-01  
Document order number: 9397 750 08212

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