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VersaClock® Programmable Clock Generator 5P35021

DATASHEET

General Description

The 5P35021 is the latest VersaClock programmable clock generator and is designed for low-power, consumer, and high-performance PCI Express applications. The 5P35021 device is a 3 PLLs architecture design; each PLL is individually programmable and allows up to 3 unique frequency outputs.

The 5P35021 has built-in unique features such as Proactive Power Saving (PPS), Performance-Power Balancing (PPB), Overshot Reduction Technology (ORT) and Extreme Low Power DCO. An internal OTP memory allows the user to store the configuration in the device. After power up, the user can change the device register settings through the I^2C interface when I2C mode is selected. It also has programmable VCO and PLL source selection to allow the user to do power-performance optimization based on the application requirements.

The device provides one single-ended output and two pairs of differential outputs that support LVCMOS, LVPECL, LVDS and LPHCSL. The Low Power 32.768KHZ clock is supported with only less than 2uA current consumption for system RTC reference clock.

Recommended Application

- PCIe Gen1/2/3 clock generator
- Consumer application crystal replacements
- SmartDevice, Handheld, Computing and Consumer applications

Features/Benefits

- Configurable OE pin function as OE, PD#, PPS or DFC control function
- Configurable PLL bandwidth/minimizes jitter peaking
- PPS: Proactive Power Saving features save power during the end device power down mode
- PPB: Performance- Power Balancing feature allow user to minimum power consumption base on required performance
- DFC: Dynamic Frequency Control feature allows user to program up to 4 difference frequencies and switch dynamically
- Spread Spectrum clock support to lower system EMI
- Store user configuration into OTP memory
- I^2C interface

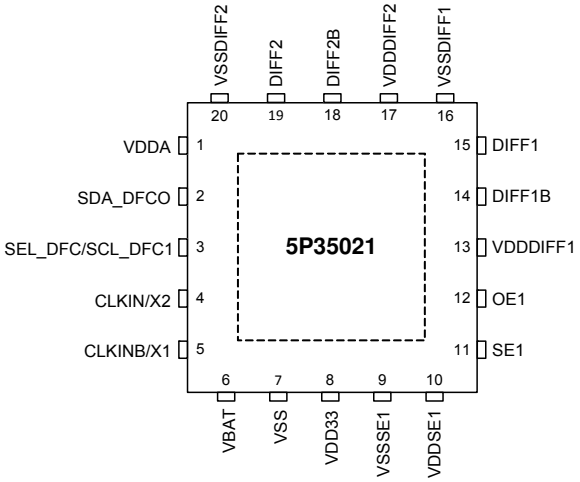
Key Specifications

- PCIe clocks phase jitter: PCIe Gen3
- Differential clocks <3 ps rms jitter integer range 12KHz~20MHz
- <2 µA DCO to generate 32.768kHz clock

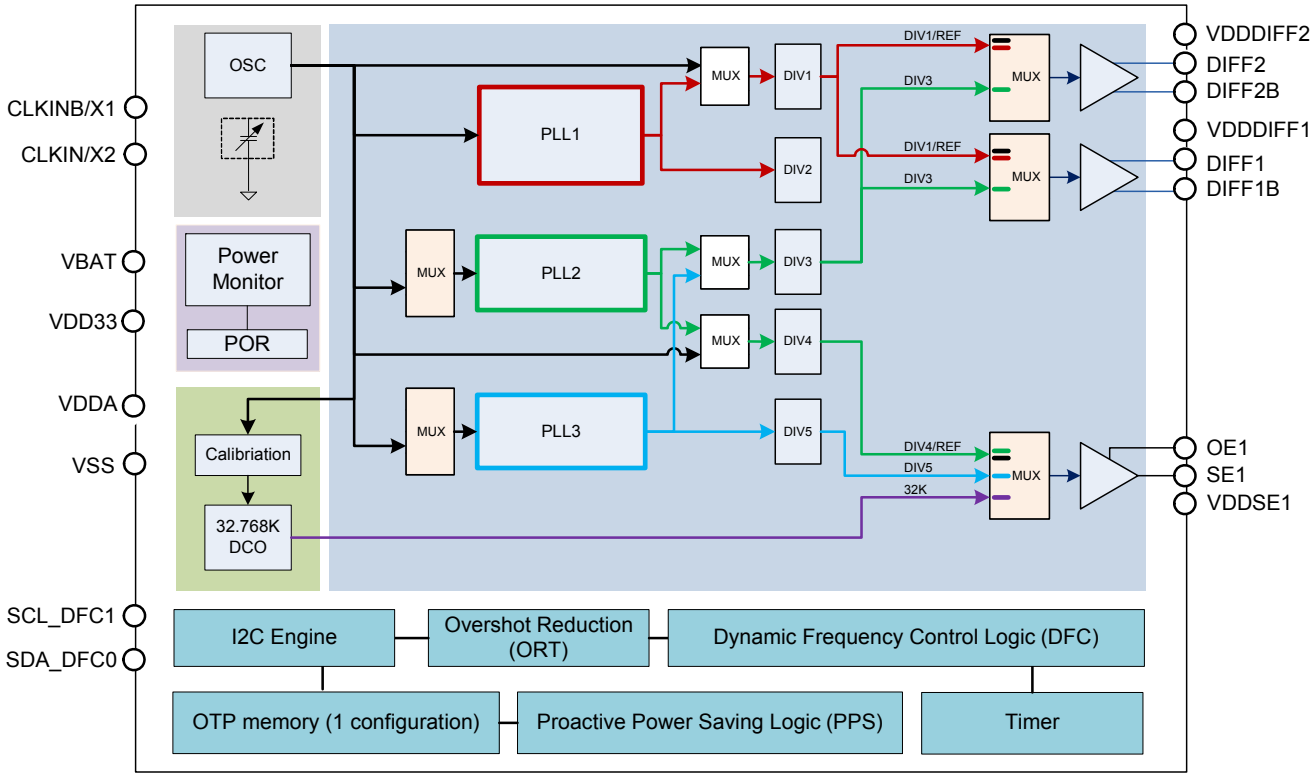
Output Features

- 2 – DIFF outputs with configurable LPHSCL, LVDS, LVPECL, LVCMOS output pairs. 1MHz~500MHz (160MHz/ with LVCMOS mode)
- 1 – LVCMOS output, 1MHz~160MHz
- Maximum 5 LVCMOS outputs as 1* SE + 2*DIFF_T/C as LVCMOS
- Low Power 32.768kHz clock supported on SE1

Pin Assignment



Functional Block Diagram



Power Group

Power supply table								
	SE	**DIFF**	**DIV**	**MUX**	**PLL**	**DCO**	**REF**	**Xtal**
VDDSE1	SE1							
VDDDIFF1		DIFF1	DIV3/4	MUXPLL2	PLL2			
VDDDIFF2		DIFF2	DIV1	MUXPLL1				
VDD33			DIV5		PLL3	DCO	REF	Xtal
VBAT						DCO		Xtal
VDDA			DIV2		PLL1			

* VDDSEx for non 32KHz outputs should be OFF when VDDA/VDD3 turn OFF, VBAT mode only support 32.768KHz outputs from SE1~3

*** Vbat power ramp up should be same or earlier than other Vdd power rail**

Output Source Table

Source:	**Outputs:**		
	SE1	**DIFF1**	**DIFF2**
Xtal REF	**Xtal REF**	**Xtal REF**	**Xtal REF**
32.768KHz	**32.768KHz**		
PLL1		**PLL1**	**PLL1**
PLL2	**PLL2**	**PLL2**	**PLL2**
PLL3	**PLL3**	**PLL3**	**PLL3**

Output Source Selection Register Setting Table

SE1	B36<4>	B36<3>	B31<1>	B29<3>
From 32K	0	1	0	0
From PLL3 + Divider 5	1	0	0	0
From PLL2 + Divider 4	1	1	1	0
From REF + Divider 4	1	1	0	1

DIFF1	B34<7>	B0<3>
From PLL1 + Divider 1	0	0
From PLL2 + Divider 3	1	0
From REF + Divider 1	0	1

DIFF2	B35<7>	B0<3>
From PLL1 + Divider 1	0	0
From PLL2 + Divider 3	1	0
From REF + Divider 1	0	1

Glossary of Features

Term	Function Description	Apply to
DFC	Dynamic Frequency Control, from selected PLL to support four VCO frequencies, means two different output frequencies by assign H/W pin state changes	PLL2
ORT	Over Shot Reduction, when the DFC dynamic frequency change is functional, the VCO change frequency smoothly to target frequency without overshoot or under shoot.	PLL2
OE	Output Enable function, each output can be controlled by assigned OE pin, the dedicated OE pin can be OTP programmable as Global Power Down function (PD#) or Output enable (OE) or proactive power saving function (PPS) or RESET pin function.	OE1
SS	Spread Spectrum clock	PLL1/PLL2
Slew Rate	LVCMOS outputs with slew rate control - slow and fast.	LVCMOS
PPS	Proactive Power Saving, utilize OE pin as monitor pin for end device X2 clock status, details see PPS function description	SE1

Pin Descriptions

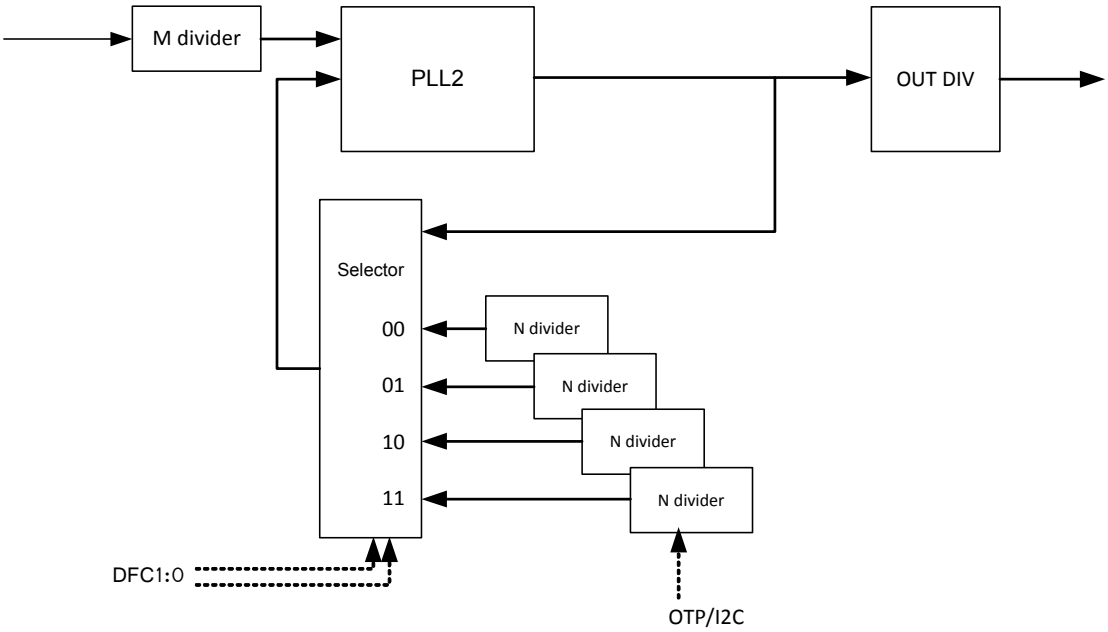
Number	Name	Type	Description
1	VDDA	Power	VDD 3.3V
2	SDA_DFC0	I/O	I2C DATA pin, can be setup become DFC0 by OTP programming
3	SEL_DFC/SCL_DFC1	Input	I2C CLK pin, SEL_DFC is a latch input pin during the power up High on power on: I2C mode as SCLK function, Low on power on: SCL and SDA as DFC function pins.
4	CLKIN/X2	I/O	Crystal Oscillator interface output or Differential clock input pin (CLKIN)
5	CLKINB/X1	Input	Crystal Oscillator interface input or Differential clock input pin (CLKINB)
6	VBAT	Power	Power supply pin for 32.768KHz DCO, usually connect to coin cell battery, 2.5~3.3V
7	VSS	Power	Connect to ground.
8	VDD33	Power	VDD 3.3V
9	VSSSE1	Power	Connect to ground.
10	VDDSE1	Power	Output power supply. Connect to 1.8 to 3.3V. Sets output voltage levels for SE1.
11	SE1	Output	Output Clock SE1.
12	OE1	Input	OE1's function selected from OTP preprogram register bits. OE1 pull to 6.5V when burn OTP registers. Refer to OE function table for details
13	VDDDIFF1	Power	Output power supply. Connect to 2.5 to 3.3V. Sets output voltage levels for DIFF1.
14	DIFF1B	Output	Differential clock output 1_Complement, can be OTP pre-program to LVCMOS/LPHCSL/LVDS/LVPECL output type
15	DIFF1	Output	Differential clock output 1_True, can be OTP pre-program to LVCMOS/LPHCSL/LVDS/LVPECL output type
16	VSSDIFF1	Power	Connect to ground.
17	VDDDIFF2	Power	Output power supply. Connect to 2.5 to 3.3V. Sets output voltage levels for DIFF2.
18	DIFF2B	Output	Differential clock output 2_Complement, can be OTP pre-program to LVCMOS/LPHCSL/LVDS/LVPECL output type
19	DIFF2	Output	Differential clock output 2_True, can be OTP pre-program to LVCMOS/LPHCSL/LVDS/LVPECL output type
20	VSSDIFF2	Power	Connect to ground.
21	ePAD	Power	Connect to ground.

Device Feature and Function

DFC–Dynamic Frequency Control

- OTP program (Only) setup 4 different feedback fractional divider (4 VCO frequencies) that apply to PLL2
- ORT (over shoot reduction) function will be applied automatically during the VCO frequency change
- Smooth frequency incremental or decremental from current VCO to targeted VCO base on DFC hardware pins selection

DFC Block Diagram



DFC Function Priority Table

DFC_EN bit(W32[4])	OE1_fun_sel (W30[6:5])	*OE3_fun_sel (W30[3:2])	SCL_DFC1	DFC[1:0]	Notes
0	x	x	x	0	DFC disable
1	11 (DFC)	00~10 (DFC)	x	[0,OE1]	One pin DFC - OE1
1	11 (DFC)	11 (DFC)	x	[OE3,OE1]	Two pin DFC - OE3,OE1
1	00~10	11	x	Not permit	Not supported
1	00~10	00~10	0	[SCL_DFC1, SDA_DFC0]	I2C pin as DFC control pins mode
1	00~10	00~10	1	W30[1:0]	I2C control DFC mode

* 5P35021 has only OE1 pin for DFC function hardware pin selection. For OE1/OE3 two pins DFC control, use 5P35023 QFN24 package device.

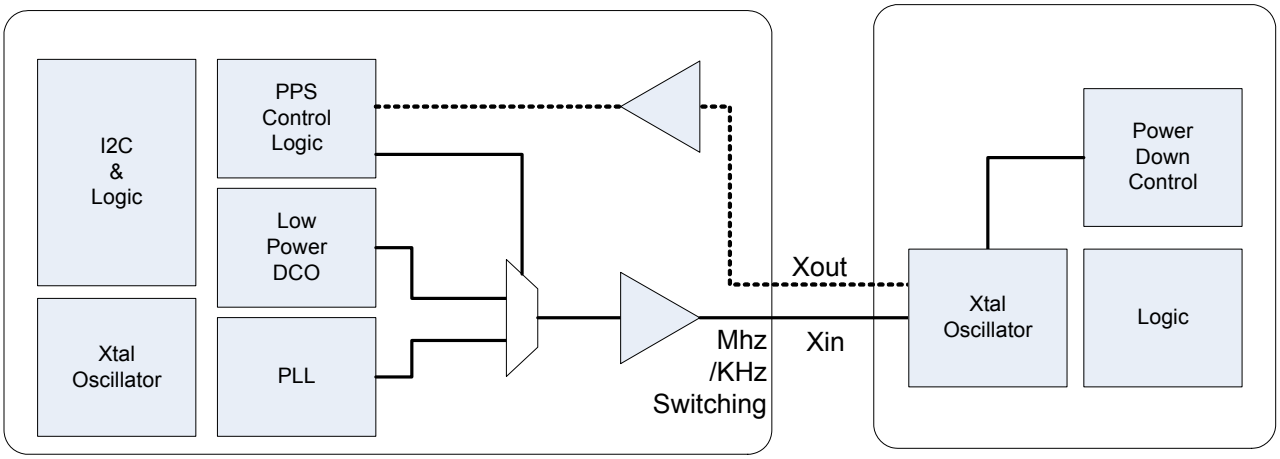
DFC Function Programming

- Register B63b3:2 select DFC00~DFC11 configuration
- Byte16~19 are the register for PLL2 VCO setting, base on B63b3:2 configuration selection, the data write to B16~19 will be store in selected configuration OTP memory
- Refer to DFC function priority table, select proper control pin(s) to activate DFC function
- Note the DFC function can also be controlled by I2C access

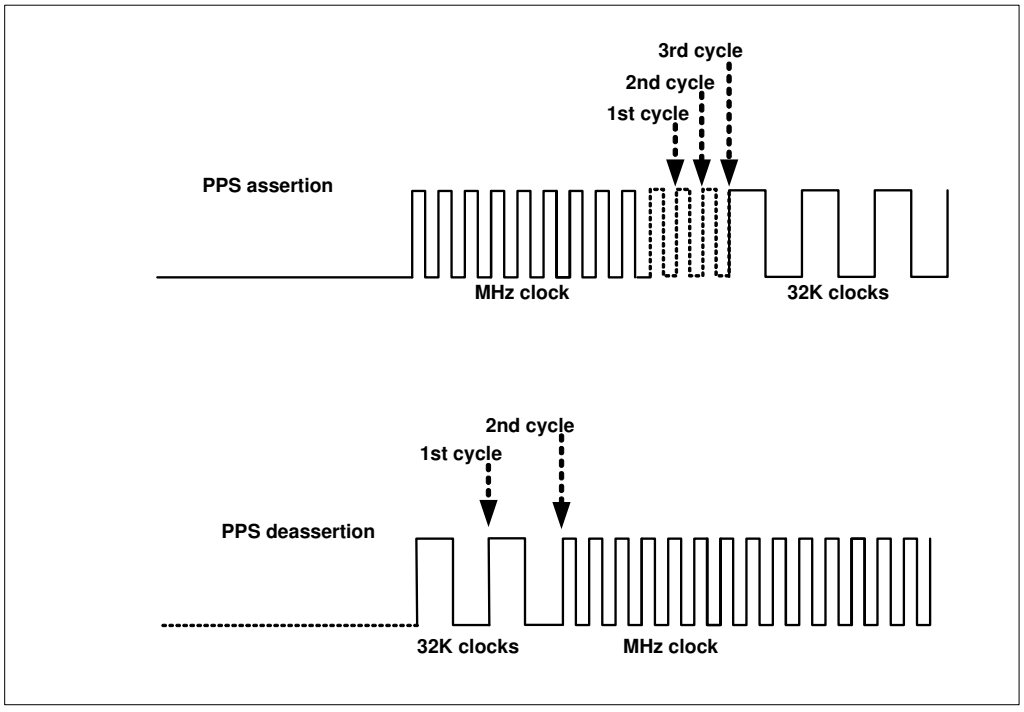
PPS–Proactive Power Saving Function

PPS Proactive Power Saving is an IDT patented unique design for the clock generator that proactively detects end device power down state and then switches output clocks between the normal operation clock frequency and the low power mode 32KHz clock that only consume <2uA current. The system could save power when the device goes into power down or sleep mode. The PPS function diagram is shown below.

PPS Function Block Diagram



PPS Assertion/Deassertion Timing Chart

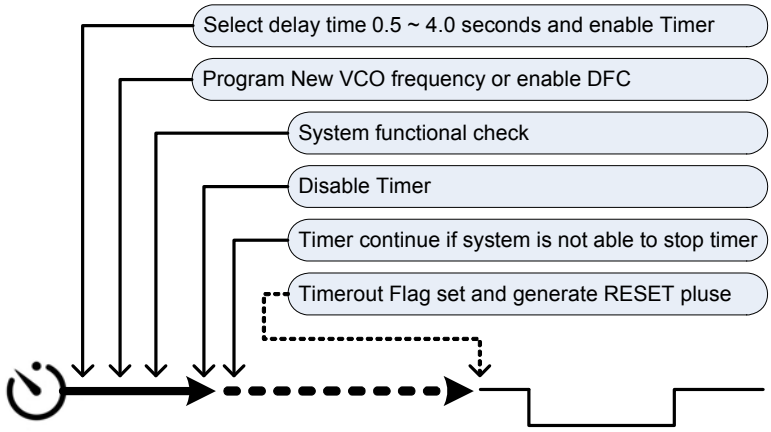


PPS Function Programming

- Refer to OE_pin_fucntion_table to have proper PPS function selected for OE pin(s), please note that register default is set to Output enable (OE)
- Have proper setup to Byte 30 and 32 for OE1~OE3 function selection, for PPS function, select 10 to control register bits

Timer Function Description

1. The timer function can be used together with the DFC -Dynamic Frequency Control function or with another PLL frequency programming.
2. The timer provides 4 different delay times as 0.5 sec - 1 sec - 2 sec - 4 sec by two bits selection.
3. The timeout flag will be set when timer times out, and the flag can be cleared by writing 0 to timer enable bit.
4. When timer times out, RESET pin (available in 5P35023) can generate a 250ms pulse signal if RESET control bit is enabled.
5. When timer times out, DFC stage will switch back to DFC00 setting if DFC function is enabled and DFC function will be disabled after RESET.



OE Pin Function

OE pins in the 5P35021 have multiple functions. The OE pins can be configured as output enable control (OE) or chip power down control (PD#) or Proactive Power Saving function (PPS). Furthermore, the OE pins can be configured as single or two pin dynamic Frequency control (DFC), or the RESET out function that is associated with the Timer function.

OE Pin Function Table

Function	Pin		
	OE1	OE2 (Not available in 5P35021)	OE3(Not available in 5P35021)
SE output enable/disable	SE1 (Default)	SE2 (Default)	SE3(Deafult)
DIFF outut enable/disable	-	DIFF1/DIFF2	-
Global Power Down (PD#)	PD#	-	-
Proactive Power Saving input	SE1_PPS	SE2_PPS	SE3_PPS
DOC control (Only PLL2)	DFC0	-	DFC1
RESET OUT	-	RESET OUT	-

OE Pin Function Summary (Note: OE2, OE3 and SE2, SE3 pins are only available in 5P35023)

OE1: SE1	OE1 only control SE1 enable/disable, other outputs are not affected by this pin status
** OE2: SE2*	*OE2 only control SE2 enable/disable, other outputs are not affected by this pin status*
** OE2: SE3*	*OE3 only control SE3 enable/disable, other outputs are not affected by this pin status*
** OE2: DIFF1/DIFF2*	*OE2 control Differential outputs 1 and 2 only, other SE outputs are not affected by this pin status*
OE1: PD#	OE1 control chip global power down (PD#) except 32.768KHz on OE1 (when 32K is enabled),
OE1: SE1_PPS	Config OE1 as SE1_PPS (Proactive Power Saving) funciton pin
** OE1: SE2_PPS*	*Config OE2 as SE2_PPS (Proactive Power Saving) function pin*
** OE1: SE3_PPS*	*Config OE3 as SE3_PPS (Proactive Power Saving) function pin*
OE1:DFC0	Config OE1 as DFC0 control pin0
** OE3/DFC1*	*Config OE3 as DFC1 control pin1*

PD# Priority Table

PD#	I2C_OE_EN_bit	SE1, DIFF1/DIFF2 SE1_PPS	Output	Notes
0	x	x	stop	32KHz free run
1	0	x	stop	
1	1	0	stop	
1	1	1	running	

Reference Input and Selection

The 5P35021 accepts crystal input or LVCMOS/Differential clocks input by external AC coupling. See below reference circuit for details

Crystal Input (X1/X2)

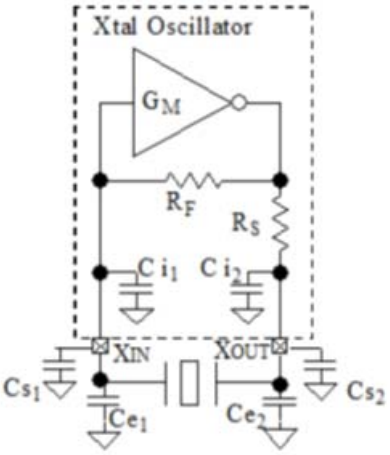
The crystal oscillators should be fundamental mode quartz crystals; overtone crystals are not suitable. Crystal frequency should be specified for parallel resonance with 40MHz maximum.

A crystal manufacturer will calibrate its crystals to the nominal frequency with a certain load capacitance value. When the oscillator load capacitance matches the crystal load capacitance, the oscillation frequency will be accurate as 0 PPM. When the oscillator load capacitance is lower than the crystal load capacitance, the oscillation frequency will be higher than nominal. In order to get an accurate oscillation frequency, the matching the oscillator load capacitance with the crystal load capacitance is required.

To set the oscillator load capacitance, 5P35021 has built-in two programmable tuning capacitors inside the chip, one at XIN and one at XOUT. They can be adjusted independently. The value of each capacitor is composed of a fixed capacitance amount plus a variable capacitance amount set with the XTAL[7:0] register. Adjustment of the crystal tuning capacitors allows for maximum flexibility to accommodate crystals from various manufacturers. The range of tuning capacitor values available are in accordance with the following table.

Programmable Tuning Caps Table

Parameter	Bits	Range	Min (pF)	Max (pF)
Xtal [7:0]	4*2	+1/+2/+4/+8 pF	0	15pF



XTAL[4:0] = (XTAL CL - 7pF) *2 (Eq.1)

Equation 1 and the table of XTAL[7:0] tuning capacitor characteristics show that the parallel tuning capacitance can be set between 4.5pF to 12.5pF with a resolution of 0.25 pF.

For a crystal CL= 8pF, where CL is the parallel capacity specified by the crystal vendor that sets the crystal frequency to the nominal value. Under the assumptions that the stray capacity between the crystal leads on the circuit board is zero and that no external tuning caps are placed on the crystal leads, then the internal parallel tuning capacity is equal to the load capacity presented to the crystal by the device.

The internal load capacitors are true parallel-plate capacitors for ultra-linear performance. Parallel-plate capacitors were chosen to reduce the frequency shift that occurs when non-linear load capacitance interacts with load, bias, supply, and temperature changes. External non-linear crystal load capacitors should not be used for applications that are sensitive to absolute frequency requirements.

Spread Spectrum

The 5P35021 supports spread spectrum clocks from PLL1 and PLL2; the PLL1 built-in with Analog spread spectrum and PLL2 has Digital spread spectrum.

Analog Spread Spectrum

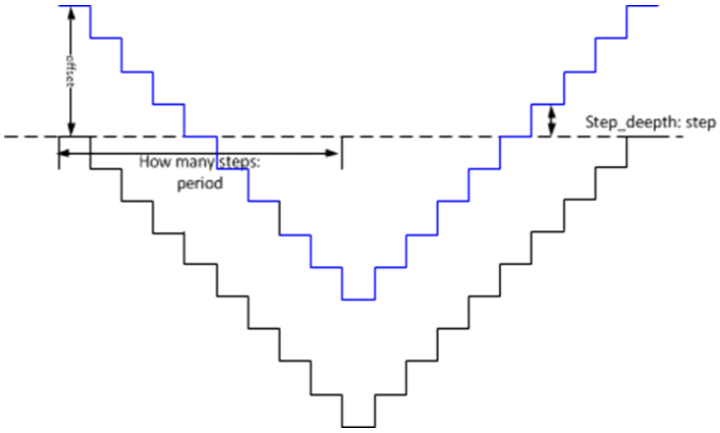
Please refer to programming guide.

Digital Spread Spectrum

$$N = \frac{Fvco}{2 * Fout}$$

$$period = \frac{Fpfd}{2 * Fss}$$

$$step = \frac{N * SSamout}{period}$$



Down spread or Spread off
N = Fvco/Fpfd
Center Spread
N = Nssoff + N*SSamount/2

N: include integer and fraction
Fvco: vco's frequency
Fpfd: PLL's pfd frequency
Fss: spread modulation rate
SSamout: spread percentage

The black line is for the down spread,N will decrease to make the center frequency is lower than spread off.
The blue line is for the center spread, there is a offset put on divider ratio to make the center frequency keep same as spread off.

example: 0.5% down spread @ 32KHz modulation rate

VBAT

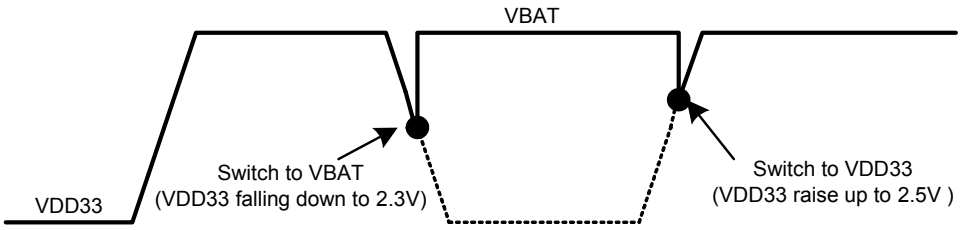
The 5P35021 supports Low Power operation 32.768kHz RTC clock with only coin cell battery supply. The coin cell battery power capacitance is usually 170mAhr or higher, with less than 2µA* low-power DCO operation mode will support application up to few years clock source for date/time keeping circuit (RTC).

When there is main power exist like VDD33 and VDDA, the 5P35021 will switch DCO power source to main power to save battery power. VBAT should be powered earlier or at same time with other VDD power up.

VBAT Switching Threshold

VDD33	VBAT	DCO power source
>2.5V	--	VDD33
<2.3V	--	VBAT

***VBAT needs to be 3.0V~3.3V**



ORT–VCO Over-shoot Reduction Technology

The 5P35021 supports innovate the VCO over-shoot reduction technology (ORT) to prevent an output clock frequency spike when the device is changing frequency on the fly or doing DFC (Dynamic Frequency Control) function. The VCO frequency changes are under control instead of free-run to targeted frequency.

PLL Features and Descriptions

Output divider 1 table **Output Divider bits<3:2>**

Output Divider bits<1:0>	OO	O1	1O	11
OO	1	2	4	8
O1	4	8	16	32
1O	5	10	20	40
11	6	12	24	48

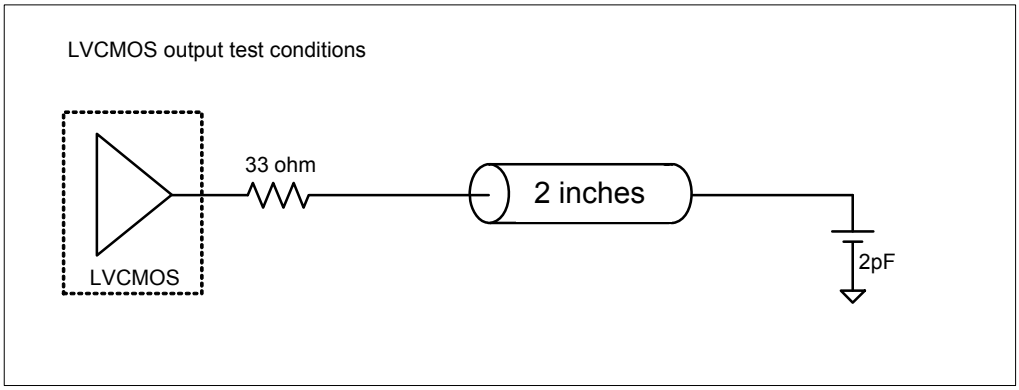
Output 2,4,5 divider table **Output Divider bits<3:2>**

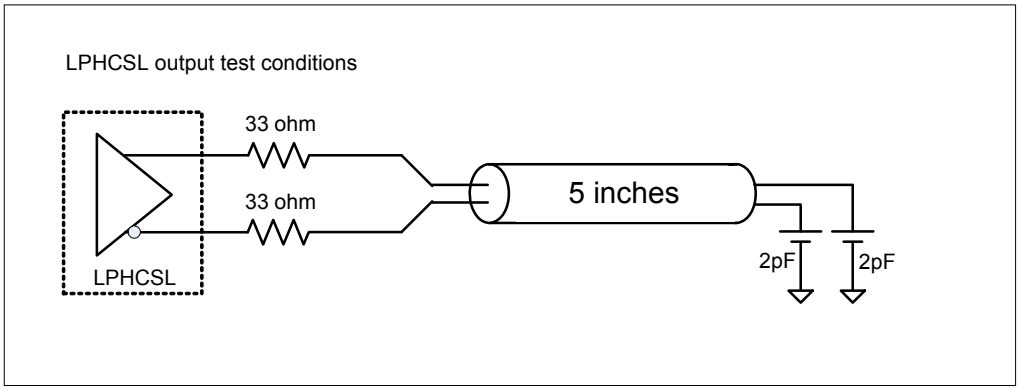
Output Divider bits<1:0>	OO	O1	1O	11
OO	1	2	4	5
O1	3	6	12	15
1O	5	10	20	25
11	10	20	40	50

Output 3 divider table **Output Divider bits<3:2>**

Output Divider bits<1:0>	OO	O1	1O	11
OO	1	2	4	8
O1	3	6	12	24
1O	5	10	20	40
11	10	20	40	80

Output Clock Test Conditions





Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the 5P35021. These ratings, which are standard values for IDT commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range.

Item	Rating
Supply Voltage, VDDA, VDD33, VDDSE,VDDDIFF	3.465V
Supply Voltage, VBAT	3.465V
Inputs	
XIN/CLKIN	0V to 3.3V voltage swing for both LVCMOS or DIFF CLK
Other inputs	-0.5V to VDD33/VDDSEx
Outputs, VDDSEx (LVCMOS)	-0.5V to VDDSEx/VDDDIFF+ 0.5V
Outputs, IO (SDA)	10mA
Package Thermal Impedance, ΘJA	42°C/W (0 mps)
Package Thermal Impedance, ΘJC	41.8°C/W (0 mps)
Storage Temperature, TSTG	-65°C to 150°C
ESD Human Body Model,	2500V
ESD Charge Device Model,	1000V
Junction Temperature	125°C

Recommended Operating Conditions

Symbol	Parameter	Min	Typ	Max	Unit
VDDSEx	Power supply voltage for supporting 1.8V outputs	1.71	1.8	1.89	V
	Power supply voltage for supporting 2.5V outputs	2.375	2.5	2.625	V
	Power supply voltage for supporting 3.3V outputs	3.135	3.3	3.465	V
VDD33	Power supply voltage for core logic functions.	3.135	3.3*	3.465	V
VDDA	Analog power supply voltage. Use filtered analog power supply if available.	2.375		3.465	V
VBAT	Battery power supply voltage.	2.8*	3*	3.465	V
	Operating temperature, ambient	-40		85	°C
CLOAD_OUT	Maximum load capacitance (3.3V LVCMOS only)		5		pF
FIN	External reference crystal	8		40	MHz
	External reference crystal with DCO used	12		38	
	External single-ended reference clock CLKINB	1		125	
	External differential reference clock CLKIN, CLKINB	8		125	
tPU	Power up time for all VDDs to reach minimum specified voltage (power ramps must be monotonic),	0.05		3	ms

* Power up Sequence Conditions

* VDDSEx for non 32KHz outputs should be OFF when VDDA/VDD3 turn OFF, VBAT mode only support 32.768KHz outputs from SE1~3

*** Vbat power ramp up should be same or earlier than other Vdd power rail**

* When use single-ended clock to CLKINB pin within differential clockin mode, CLKIN pin needs to be grounded and minimum input frequency should be higher than 8MHz

Input Capacitance, LVCMOS Output Impedance, and Internal Pull-down Resistance

(TA = +25 °C)

Symbol	Parameter	Min	Typ	Max	Unit
CIN	Input Capacitance (CLKIN, CLKINB, OE, SDA, SCL, DFC1:0)		3	7	pF
Pull-down Resistor	OE		200		kΩ
ROUT	LVCMOS Output Driver Impedance (VDDSE = 1.8V)		22		
	LVCMOS Output Driver Impedance (VDDSE = 2.5V)		22		
	LVCMOS Output Driver Impedance (VDDSE = 3.3V)		22		Ω
X1, X2	Programmable input capacitance at X1 or X2	0		15	pF

Crystal Characteristics

Parameter	Test Conditions	Min	Typ	Max	Units
Mode of Oscillation		Fundamental			
Frequency		8		40	MHz
Frequency when 32.768K DCO is used		12		38	MHz
Equivalent Series Resistance (ESR)			10	100	Ω
Shunt Capacitance			2	7	pF
Load Capacitance (CL)		6	8	10	pF
Maximum Crystal Drive Level (CL=8pF)				100	µW

DC Electrical Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Iddcore	Core Supply Current	VDD=VDDSE=VDD33=3.3V, Xtal=25Mhz, PLL2/3 OFF, No Output - PLLs disabled		5		mA
Idd_PLL1[3]	PLL1 Supply Current	VDD=VDDSE=VDD33=3.3V, Xtal=25Mhz, PLL2/3 OFF, No Output - PLL1= 600MHz		13		mA
		VDD=VDDSE=VDD33=2.5V, Xtal=25Mhz, PLL2/3 OFF, No Output - PLL1= 600MHz		13		mA
Idd_PLL2[3]	PLL2 Supply Current	VDD=VDDSE=VDD33=3.3V, Xtal=25Mhz, PLL1/3 OFF, No Output - PLL2=1GHz		11		mA
		VDD=VDDSE=VDD33=2.5V, Xtal=25Mhz, PLL1/3 OFF, No Output - PLL2=1GHz		11		mA
Idd_PLL3[3]	PLL3 Supply Current	VDD=VDDSE=VDD33=3.3V, Xtal=25Mhz, PLL1/2 OFF, No Output - PLL3=480		4		mA
Iddox	Output Buffer Supply Current	LVPECL, 500 MHz, 3.3V VDDDIFF (DIFF1,2)		39		mA
		LVPECL, 156.25 MHz, 2.5V VDDDIFF (DIFF1,2)		33		mA
		LVDS, 500 MHz, 3.3V VDDDIFF (DIFF1,2)		13		mA
		LVDS, 250 MHz, 2.5V VDDDIFF (DIFF1,2)		8		mA
		LPHCSL, 125MHz, 3.3V VDDDIFF, 2 pF load (DIFF1,2)		7		mA
		LPHCSL, 100 MHz, 2.5V VDDDIFF, 2 pF load		8		mA
		LVCMOS, 8 MHz, 3.3V, VDDSE [1,2] (SE1)		1		mA
		LVCMOS, 8 MHz, 2.5V, VDDSE [1,2] (SE1)		1		mA
		LVCMOS, 8 MHz, 1.8V, VDDSE [1,2] (SE1)		1		mA
		LVCMOS, 160 MHz, 3.3V VDDSEx1 (SE1)		9.5		mA
		LVCMOS, 160 MHz, 2.5V VDDSEx1,2 (SE1)		5.0		mA
		LVCMOS, 160 MHz, 1.8V VDDSEx1,2 (SE1)		6.0		mA
Iddpd	Power Down Current	PD asserted with VDDA, VDD33 and VDDSE ON, I2C Programming, 32K running		3.5		mA
Iddsuspend - VDD33	Iddsuspend-VBAT	Only VBAT=3.3V and VDDSEn is powered		1.1		µA
Iddsuspend - SEn 3.3V	Iddsuspend - VDDSEn 3.3V	Only VBAT=3.3V and VDDSEn is powered with 3.3V		3.4		µA
Iddsuspend - SEn 2.5V	Iddsuspend - VDDSEn 2.5V	Only VBAT =3.3Vand VDDSEn is powered with 2.5V		2.5		µA
Iddsuspend - SEn 1.8V	Iddsuspend - VDDSEn 1.8V	Only VBAT=3.3V and VDDSEn is powered with 1.8V		1.8		µA

1. Single CMOS driver active.
2. SE1~3 current measured with 2 inches transmission line and 2 pF load, DIFF clock current measured with 5 inches transmission line with 2 pF loads.
3. Iddcore = IddA+ IddD, no loads.

Power Consumption of 32.768kHz Output Only Operation

Unless stated otherwise, Supply Voltage VDDSE = 1.8V ~ 3.3V ±5%, TA = -40°C to +85°C

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
I_VBAT	Vbat=3.3V power input current			1.1		uA
I_VDDSEx	VDDSEx=1.8V current	0.5 inch, no load, one output		0.4		uA
I_VDDSEx	VDDSEx=1.8V current	2.0 inch, no load, one output		1.0		uA
I_VDDSEx	VDDSEx=1.8V current	5.0 inch, no load, one output		2.3		uA
I_VDDSEx	VDDSEx=2.5V current	0.5 inch, no load, one output		0.6		uA
I_VDDSEx	VDDSEx=2.5V current	2.0 inch, no load, one output		1.5		uA
I_VDDSEx	VDDSEx=2.5V current	5.0 inch, no load, one output		3.1		uA
I_VDDSEx	VDDSEx=3.3V current	0.5 inch, no load, one output		0.8		uA
I_VDDSEx	VDDSEx=3.3V current	2.0 inch, no load, one output		1.9		uA
I_VDDSEx	VDDSEx=3.3V current	5.0 inch, no load, one output		4.2		uA

Electrical Characteristics – Input Parameters [1,2]

Unless stated otherwise, Supply Voltage VDDD33 = 3.3V ±5%, TA = -40°C to +85°C

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
VIH	Input High Voltage - CLKIN	Single-ended input	2.4		3.345	V
VIL	Input Low Voltage - CLKIN	Single-ended input	GND - 0.3		0.8	V
VSWING	Input Amplitude - CLKIN	Differential Input	325		3300	mV
dv/dt	Input Slew Rate - CLKIN	Differential Input	0.4		8	V/ns
VCM	Input Common Mode Voltage	Differential Input	200mV		2500	mV
IIL	Input Leakage Low Current for OE1	VIN = GND @ OE1 pin	-150		5	µA
IIL	Input Leakage Low Current for OE2/3	VIN = GND			5	µA
IIH	Input Leakage High Current for OE1/2/3	VIN = 3.465			20	µA
dTIN	Input Duty Cycle	Measurement from differential waveform	45		55	%

1. Guaranteed by design and characterization, not 100% tested in production.
2. Slew rate measured through ±75mV window centered around differential zero.

DC Electrical Characteristics for 3.3V LVCMOS

Unless stated otherwise, VDDSE = 3.3V±5%, TA = -40°C to +85°C

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
VOH	Output HIGH Voltage	IOH = -15mA	2.4		VDDSE	V
VOL	Output LOW Voltage	IOL = 15mA			0.4	V
IOZDD	Output Leakage Current	Tri-state outputs, VDDSE = 3.465V			3	µA
VIH	Input HIGH Voltage	Single-ended inputs - CLKSEL, OE, SDA, SCL	2		VDDSE + 0.3	V
VIL	Input LOW Voltage	Single-ended inputs - CLKSEL, OE, SDA, SCL	GND - 0.3		0.8	V
VIH	Input HIGH Voltage	Single-ended input - XIN/CLKIN	2.4		VDD33	V
VIL	Input LOW Voltage	Single-ended input - XIN/CLKIN	GND - 0.3		0.8	V

DC Electrical Characteristics for 2.5V LVCMOS

Unless stated otherwise, VDDSE = 2.5V±5%, TA = -40°C to +85°C

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
VOH	Output HIGH Voltage	IOH = -12mA	0.7xVDDSE		VDDSE	V
VOL	Output LOW Voltage	IOL = 12mA			0.4	V
IOZDD	Output Leakage Current	Tri-state outputs, VDDSE = 2.625V			3	µA
VIH	Input HIGH Voltage	Single-ended inputs - CLKSEL, OE, SDA, SCL	1.7		VDDSE + 0.3	V
VIL	Input LOW Voltage	Single-ended inputs - CLKSEL, OE, SDA, SCL	GND - 0.3		0.8	V

DC Electrical Characteristics for 1.8V LVCMOS

Unless stated otherwise, VDDSE = 1.8V±5%, TA = -40°C to +85°C

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
VOH	Output HIGH Voltage	IOH = -8mA	0.7 xVDDSE		VDDSE	V
VOL	Output LOW Voltage	IOL = 8mA			0.25 x VDDSE	V
IOZDD	Output Leakage Current	Tri-state outputs, VDDSE = 1.89V			3	µA
VIH	Input HIGH Voltage	Single-ended inputs - OE, SDA, SCL	0.65 * VDDSE		VDDSE + 0.3	V
VIL	Input LOW Voltage	Single-ended inputs - OE, SDA, SCL	GND - 0.3		0.35 * VDDSE	V

Electrical Characteristics–DIF 0.7V LPHCSL Differential Outputs

Unless stated otherwise, **VDDDIFF = 3.3 V ±5%or 2.5V ±5%**, TA= -40° to +85°C

Symbol	Parameter	Notes	Min	Typ	Max	Units
dV/dt	Slew Rate	1,2,3,8	1	2.5	4	V/ns
ΔdV/dt	Slew Rate mismatch	1,2,3,8, at <=200MHz			20	%
VHIGH	Voltage High	1,6,7,8	660	800	1150	mV
VLOW	Voltage Low	1,6	-150	0	150	mV
VMAX	Maximum Voltage	1			1150	mV
VMIN	Minimum Voltage	1	-300			mV
VSWING	Voltage Swing	1,2,6	300			mV
VCROSS	Crossing Voltage Value	1,4,6	250	360	550	mV
ΔVCROSS	Crossing Voltage variation	1,5			140	mV
Jitter-Cy/Cy	Cycle to cycle jitter	1,2		10		pS
Jitter-STJ	Jitter - Period Jitter	1,2		70		pS
Duty Cycle	Duty Cycle	1,2	45		55	%
Measured Frequency	LVHCSL at differential output	1,2			500	MHz

* differential clock amplitude setting 00.

Note 1: Guaranteed by design and characterization. Not 100% tested in production

Note 2: Measured from differential waveform.

Note 3: Slew rate is measured through the VSWING voltage range centered around differential 0V. This results in a +/-150mV window around differential 0V.

Note 4: VCROSS is defined as voltage where Clock = Clock# measured on a component test board and only applies to the differential rising edge (i.e. Clock rising and Clock# falling).

Note 5: the total variation of all VCROSS measurements in any particular system. Note that this is a subset of VCROSS min/max (VCROSS absolute) allowed. The intent is to limit VCROSS induced modulation by setting ΔVCROSS to be smaller than VCROSS absolute.

Note 6: Measured from single-ended waveform.

Note 7. Measured with scope averaging off, using statistics function. Variation is difference between min. and max

Note 8. Scope average ON

DC Electrical Characteristics for LVDS

Unless stated otherwise, **VDDDIFF = 3.3 V ±5%or 2.5V ±5%**, TA= -40° to +85°C

Symbol	Parameter	Notes	Min	Typ	Max	Unit
VOT (+)	Differential Output Voltage for the TRUE binary state		247		454	mV
VOT (-)	Differential Output Voltage for the FALSE binary state		-247		-454	mV
ΔVOT	Change in VOT between Complimentary Output States				50	mV
VOS	Output Common Mode Voltage (Offset Voltage)		1.125	1.25	1.375	V
ΔVOS	Change in VOS between Complimentary Output States				50	mV
IOS	VDDDIFF			9	24	mA
IOSD	VOUT-			6	12	mA
Jitter-Cy/Cy	Cycle to cycle jitter	1,2		20		pS
Jitter-STJ	Jitter - ST	1,2		100		pS
Duty Cycle	Duty Cycle	1,2	45		55	%
Measured Frequency	LVDS at differential output	1,2			500	MHz

* differential clock amplitude setting 01.

DC Electrical Characteristics for LVPECL

Unless stated otherwise, **VDDDIFF = 3.3 V ±5%or 2.5V ±5%**, TA= -40° to +85°C

Symbol	Parameter	Notes	Min	Typ	Max	Unit
VOH	Output Voltage HIGH, terminated through 50Ω tied to VDDDIFF-2 V		VDDDIFF - 1.19		VDDDIFF - 0.69	V
VOL	Output Voltage LOW, terminated through 50Ω tied to VDDDIFF-2 V		VDDDIFF - 1.94		VDDDIFF - 1.4	V
VSWING	Peak-to-Peak Output Voltage Swing		0.55		0.993	V
Jitter-Cy/Cy	Cycle to cycle jitter	1,2		20		pS
Jitter-STJ	Jitter - ST	1,2		100		pS
Duty Cycle	Duty Cycle	1,2	45		55	%
Measured Frequency	LVPECL at differential output	1,2			500	MHz

* differential clock amplitude setting 01.

AC Electrical Characteristics

Unless stated otherwise, **VDDSE = 3.3 V ±5%or 2.5V ±5% or 1.8V ±5%**, TA= -40° to +85°C (Spread Spectrum OFF)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
fIN 1	Input Frequency	Input frequency limit (XIN)	8		40	MHz
		Input frequency limit (XIN) when enable DCO	12		38	MHz
		Input frequency limit (Differential CLKIN)	8		125	MHz
		Input frequency limit (LVCMOS to X1)	1		125	MHz
fOUT	Output Frequency	Single ended clock output limit (LVCMOS)	1	<125	160	MHz
		Differential clock output limit (LPHCSL)	1	<333	500	MHz
		Differential clock output limit (LVDS)	1	<333	500	MHz
		Differential clock output limit (LVPECL)	1		500	MHz
fVCO1	VCO frequency range of PLL1	VCO operating frequency range	300		600	MHz
fVCO2	VCO frequency range of PLL2	VCO operating frequency range	400		1200	MHz
fVCO3	VCO frequency range of PLL3	VCO operating frequency range	300		800	MHz
t2	Input Duty Cycle	Duty Cycle	45		55	%
t3	Output Duty Cycle	LVCMOS and Differential clock <333MHz , Crossing point measurements	45		55	%
t3	Output Duty Cycle	LVCMOS and Differential clock >333MHz , Crossing point measurements	40		60	%
t3	Output Duty Cycle_REF	Reference clock output or SE1~3 fan out clock	40		60	%
t4	Rise/Fall, SLEW[0] = 1	Single-ended LVCMOS output clock rise and fall time, 20% to 80% of VDDSE1.8V~3.3V		1.0		nS
	Rise/Fall, SLEW[0] = 0	Single-ended LVCMOS output clock rise and fall time, 20% to 80% of VDDSE1.8V~3.3V		1.1		
t5	Rise Times	LVDS, 20% to 80%		300		ps
	Fall Times	LVDS, 80% to 20%		300		
	Rise Times	LVPECL, 20% to 80%		300		
	Fall Times	LVPECL, 80% to 20%		300		
t6	Clock Jitter	Cycle-to-Cycle jitter (Peak-to-Peak), multiple output frequencies switching, differential outputs (1.8V to 3.3V nominal output voltage) SE1=25MHz *SE2=100MHz *SE3=100MHz DIFF1/2=100MHz		50		ps
		RMS Phase Jitter (12kHz to 20MHz integration range) differential output, VDDSE = 3.465V, 25MHz crystal, SE1=25MHz *SE2=100MHz *SE3=100MHz DIFF1/2=100MHz		1.1		ps
t7	Output Skew	Skew between the same frequencies, with outputs using the same driver format		75		ps
t8 2	Lock Time	PLL lock time from power-up			20	ms
t9	Lock Time	32.768KHz clock Low Power power-up Time		10	100	ms
t9 3	Lock Time	PLL lock time from shutdown mode		0.1	2	ms

1. Practical lower frequency is determined by loop filter settings.
2. Includes loading the configuration bits from EPROM to PLL registers. It does not include EPROM programming/write time.
3. Actual PLL lock time depends on the loop configuration.
4. * SE2/SE3 are not available in 5P35021, only available in 5P35023 QFN24 device
5. t4 Rise/Fall time measurements are based on 5pF load
6. t5 Rise/Fall time measurements are based on 2pF load

PCI Express Jitter Specifications

Unless stated otherwise, **VDDDIFF = 3.3 V ±5% or 2.5V ±5%**, TA= -40° to +85°C

Symbol	Parameter	Conditions	Min	Typ	Max	PCIe Industry Specification	Units	Notes
tJ (PCIe Gen1)	Phase Jitter Peak-to-Peak	ƒ = 100MHz/125MHz, 25MHz Crystal Input Evaluation Band: 0Hz - Nyquist (clock frequency/2)		30		86	ps	1,4
tREFCLK_HF_RMS (PCIe Gen2)	Phase Jitter RMS	ƒ = 100MHz/125MHz, 25MHz Crystal Input High Band: 1.5MHz - Nyquist (clock frequency/2)		2.56		3.10	ps	2,4
tREFCLK_LF_RMS (PCIe Gen2)	Phase Jitter RMS	ƒ = 100MHz/125MHz, 25MHz Crystal Input Low Band: 10kHz - 1.5MHz		0.27		3.0	ps	2,4
tREFCLK_RMS (PCIe Gen3)	Phase Jitter RMS	ƒ = 100MHz/125MHz, 25MHz Crystal Input Evaluation Band: 0Hz - Nyquist (clock frequency/2)		0.8		1.0	ps	3,4

Note: Electrical parameters are guaranteed over the specified ambient operating temperature range, which is established when the device is mounted in a test socket with maintained transverse airflow greater than 500 lfpm. The device will meet specifications after thermal equilibrium has been reached under these conditions.

1. Peak-to-Peak jitter after applying system transfer function for the Common Clock Architecture. Maximum limit for PCI Express Gen 1.

2. RMS jitter after applying the two evaluation bands to the two transfer functions defined in the Common Clock Architecture and reporting the worst case results for each evaluation band. Maximum limit for PCI Express Generation 2 is 3.1ps RMS for tREFCLK_HF_RMS (High Band) and 3.0ps RMS for tREFCLK_LF_RMS (Low Band).

3. RMS jitter after applying system transfer function for the common clock architecture. This specification is based on the PCI_Express_Base_r3.0 10 Nov, 2010 specification, and is subject to change pending the final release version of the specification.

4. This parameter is guaranteed by characterization. Not tested in production.

Spread Spectrum Generation Specifications

Symbol	Parameter	Description	Min	Typ	Max	Unit
fOUT	Output Frequency	Output Frequency Range	1		350	MHz
fMOD*	Mod Frequency	Modulation Frequency		30 to 63		kHz
fSPREAD	Spread Value	Amount of Spread Value (programmable) - Down Spread		-0.5% to -2%		%fOUT
%tolerance*1	Spread % value	Variation of spread range		+/-15%		%

* input frequency dependent, see programming guide

*1 design target

I2C Bus DC Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VIH	Input HIGH Level		0.7xVDD33			V
VIL	Input LOW Level				0.3xVDD33	V
VHYS	Hysteresis of Inputs		0.05xVDD33			V
IIN	Input Leakage Current				±1	µA
VOL	Output LOW Voltage	IOL = 3 mA			0.4	V

I2C Bus AC Characteristics

Symbol	Parameter		Min	Typ	Max	Unit
FSCLK	Serial Clock Frequency (SCL)			100	400	kHz
tBUF	Bus free time between STOP and START		1.3			µs
tSU:START	Setup Time, START		0.6			µs
tHD:START	Hold Time, START		0.6			µs
tSU:DATA	Setup Time, data input (SDA)		100			ns
tHD:DATA	Hold Time, data input (SDA) 1		0			µs
tOVD	Output data valid from clock				0.9	µs
CB	Capacitive Load for Each Bus Line				400	pF
tR	Rise Time, data and clock (SDA, SCL)		20 + 0.1xCB		300	ns
tF	Fall Time, data and clock (SDA, SCL)		20 + 0.1xCB		300	ns
tHIGH	HIGH Time, clock (SCL)		0.6			µs
tLOW	LOW Time, clock (SCL)		1.3			µs
tSU:STOP	Setup Time, STOP		0.6			µs

Note 1: A device must internally provide a hold time of at least 300 ns for the SDA signal (referred to the VIH(MIN) of the SCL signal) to bridge the undefined region of the falling edge of SCL.

General I2C Serial Interface Information

How to Write

- Controller (host) sends a start bit
- Controller (host) sends the write address
- IDT clock will **acknowledge**
- Controller (host) sends the beginning byte location = N
- IDT clock will **acknowledge**
- Controller (host) sends the byte count = X
- IDT clock will **acknowledge**
- Controller (host) starts sending Byte **N through Byte N+X-1**
- IDT clock will **acknowledg**e each byte **one at a time**
- Controller (host) sends a Stop bit

Index Block Write Operation			
Controller (Host)			IDT (Slave/Receiver)
T	starT bit		
Slave Address			
WR	WRite		
			ACK
Beginning Byte = N			
			ACK
Beginning Byte N		X Byte	
			ACK
O			
O			O
O			O
			O
Byte N + X - 1			
			ACK
P	stoP bit		

Note: SE2/SE3 function setting is not available on 5P35021 in QFN20 package, For full SE1~SE3 outputs requirements and functionality, please refer to the 5P35023 datasheet.

How to Read

- Controller (host) will send a start bit
- Controller (host) sends the write address
- IDT clock will **acknowledge**
- Controller (host) sends the beginning byte location = N
- IDT clock will **acknowledge**
- Controller (host) will send a separate start bit
- Controller (host) sends the read address
- IDT clock will **acknowledge**
- IDT clock will send the data byte count = X
- IDT clock sends Byte **N+X-1**
- IDT 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 Read Operation			
Controller (Host)			IDT (Slave/Receiver)
T	starT bit		
Slave Address			
WR	WRite		
			ACK
Beginning Byte = N			
			ACK
RT	Repeat starT		
Slave Address			
RD	ReaD		
			ACK
		X Byte	Beginning Byte N
ACK			
			O
O			O
O			O
O			
			Byte N + X - 1
N	Not acknowledge		
P	stoP bit		

Byte0: General Control

Byte 00h	Name	Control Function	Type	0	1	PWD
Bit 7	OTP_Burned	OTP memory programming indication	R/W	OTP memory non-programmed	OTP memory programmed	0
Bit 6	I2C_addr[1]	I2C address select bit 1	R/W	00: D0 / 01: D2		0
Bit 5	I2C_addr[0]	I2C address select bit 0	R/W	10: D4 / 11: D6		0
Bit 4	PLL1_SSEN	PLL1 Spread Spectrum enable	R/W	disable	enable	0
Bit 3	DIV1_src_sel	Divider 1 source clock select	R/W	PLL1	Xtal	0
Bit 2	PLL3_refin_sel	PLL3 source selection	R/W	Xtal	Seed (DIV2)	0
Bit 1	EN_CLKIN	enable CLKIN	R/W	disable	enable	0
Bit 0	OTP_protect	OTP memory protection	R/W	read/write	write locked	0

Byte1: Dash Code ID (optional)

Byte 01h	Name	Control Function	Type	0	1	PWD
Bit 7	DashCode ID[7]	Dash code ID	R/W	-	-	0
Bit 6	DashCode ID[6]	Dash code ID	R/W	-	-	0
Bit 5	DashCode ID[5]	Dash code ID	R/W	-	-	0
Bit 4	DashCode ID[4]	Dash code ID	R/W	-	-	0
Bit 3	DashCode ID[3]	Dash code ID	R/W	-	-	0
Bit 2	DashCode ID[2]	Dash code ID	R/W	-	-	0
Bit 1	DashCode ID[1]	Dash code ID	R/W	-	-	0
Bit 0	DashCode ID[0]	Dash code ID	R/W	-	-	0

Byte2: Crystal Cap setting

Byte 02h	Name	Control Function	Type	0	1	PWD
Bit 7	Xtal_Cap[7]	Xtal cap load trimming bits	R/W	x1 x2 x4 x8 total 15pf		0
Bit 6	Xtal_Cap[6]	Xtal cap load trimming bits	R/W			0
Bit 5	Xtal_Cap[5]	Xtal cap load trimming bits	R/W			0
Bit 4	Xtal_Cap[4]	Xtal cap load trimming bits	R/W			1
Bit 3	Xtal_Cap[3]	Xtal cap load trimming bits	R/W			0
Bit 2	Xtal_Cap[2]	Xtal cap load trimming bits	R/W			0
Bit 1	Xtal_Cap[1]	Xtal cap load trimming bits	R/W			0
Bit 0	Xtal_Cap[0]	Xtal cap load trimming bits	R/W			1

Byte3: PLL3 M Divider

Byte 03h	Name	Control Function	Type	0	1	PWD
Bit 7	PLL3_MDIV1	PLL3 source clock divider	R/W	disable MDIV1	bypadd divider (/1)	0
Bit 6	PLL3_MDIV2	PLL3 source clock divider	R/W	disable MDIV2	bypadd divider (/2)	0
Bit 5	PLL3 M_DIV[5]	PLL3 reference integer divider	R/W	3~64	default 25	0
Bit 4	PLL3 M_DIV[4]	PLL3 reference integer divider	R/W	-	-	1
Bit 3	PLL3 M_DIV[3]	PLL3 reference integer divider	R/W	-	-	1
Bit 2	PLL3 M_DIV[2]	PLL3 reference integer divider	R/W	-	-	0
Bit 1	PLL3 M_DIV[1]	PLL3 reference integer divider	R/W	-	-	0
Bit 0	PLL3 M_DIV[0]	PLL3 reference integer divider	R/W	-	-	1

Byte4: PLL3 N Divider

Byte 04h	Name	Control Function	Type	0	1	PWD
Bit 7	PLL3 N_DIV[7]	PLL3 VCO feedback integer divider bit7	R/W	12~2048, default VCO setting is 480MHz		1
Bit 6	PLL3 N_DIV[6]	PLL3 VCO feedback integer divider bit6	R/W			1
Bit 5	PLL3 N_DIV[5]	PLL3 VCO feedback integer divider bit5	R/W			1
Bit 4	PLL3 N_DIV[4]	PLL3 VCO feedback integer divider bit4	R/W			0
Bit 3	PLL3 N_DIV[3]	PLL3 VCO feedback integer divider bit3	R/W			0
Bit 2	PLL3 N_DIV[2]	PLL3 VCO feedback integer divider bit2	R/W			0
Bit 1	PLL3 N_DIV[1]	PLL3 VCO feedback integer divider bit1	R/W			0
Bit 0	PLL3 N_DIV[0]	PLL3 VCO feedback integer divider bit0	R/W			0

Byte5: PLL3 Loop filter setting and N Divider10:8

Byte 05h	Name	Control Function	Type	0	1	PWD
Bit 7	PLL3_R100K	PLL3 Loop filter resister 100Kohm	R/W	bypass	plus 100Kohm	0
Bit 6	PLL3_R50K	PLL3 Loop filter resister 50Kohm	R/W	bypass	plus 50Kohm	0
Bit 5	PLL3_R25K	PLL3 Loop filter resister 25Kohm	R/W	bypass	plus 25Kohm	0
Bit 4	PLL3_R12.5K	PLL3 Loop filter resister 12.5Kohm	R/W	bypass	plus 12.5Kohm	1
Bit 3	PLL3_R6K	PLL3 Loop filter resister 6Kohm	R/W	bypass	only 6Kohm applied	0
Bit 2	PLL3 N_DIV[10]	PLL3 VCO feedback integer divider bit10	R/W	12~2048, default VCO setting is 480MHz		0
Bit 1	PLL3 N_DIV[9]	PLL3 VCO feedback integer divider bit9	R/W			0
Bit 0	PLL3 N_DIV[8]	PLL3 VCO feedback integer divider bit8	R/W			1

Byte6: PLL3 charge pump control

Byte 06h	Name	Control Function	Type	0	1	PWD
Bit 7	OUTDIV 3 Source	Output divider 3 source clock selection	R/W	PLL2	PLL3	0
Bit 6	PLL3_CP_8X	PLL3 charge pump control	R/W	-	x8	1
Bit 5	PLL3_CP_4X	PLL3 charge pump control	R/W	-	x4	1
Bit 4	PLL3_CP_2X	PLL3 charge pump control	R/W	-	x2	0
Bit 3	PLL3_CP_1X	PLL3 charge pump control	R/W	-	x1	1
Bit 2	PLL3_CP_/24	PLL3 charge pump control	R/W	-	/24	1
Bit 1	PLL3_CP_/3	PLL3 charge pump control	R/W	-	/3	0
Bit 0	PLL3_SIREF	PLL3 SiRef current selection	R/W	10uA	20uA	0

Notes: Formula : (iRef (10uA) * (1+SIREF) *(1*1X+2*2X+4*4X+8*8X+16*16X))/((24*/24)+(3*/3))

Byte7: PLL1 Control and OUTDIV5 divider

Byte 07h	Name	Control Function	Type	0	1	PWD
Bit 7	PLL1_MDIV_Doubler	PLL1 reference clock doubler	R/W	disable	enable	0
Bit 6	PLL1_SIREF	PLL1 SiRef current selection	R/W	10.8uA	21.6uA	0
Bit 5	PLL1_EN_CH2	PLL1 output Channel 2 control	R/W	disable	enable	1
Bit 4	PLL1_EN_3rdpole	PLL1 3rd Pole control	R/W	disable	enable	0
Bit 3	OUTDIV5[3]	Output divider5 control bit 3	R/W	-	-	0
Bit 2	OUTDIV5[2]	Output divider5 control bit 2	R/W	-	-	0
Bit 1	OUTDIV5[1]	Output divider5 control bit 1	R/W	-	-	1
Bit 0	OUTDIV5[0]	Output divider5 control bit 0	R/W	-	-	1

Byte8: PLL1 M Divider

Byte 08h	Name	Control Function	Type	0	1	PWD
Bit 7	PLL1_MDIV1	PLL3 VCO referenceclock divider 1	R/W	disable M DIV1	bypass divider (/1)	0
Bit 6	PLL1_MDIV2	PLL3 VCO referenceclock divider 2	R/W	disable M DIV2	bypass divider (/2)	0
Bit 5	PLL1 M_DIV[5]	PLL1 reference clock divider control bit 5	R/W	3~64, default is 25		0
Bit 4	PLL1 M_DIV[4]	PLL1 reference clock divider control bit 4	R/W			1
Bit 3	PLL1 M_DIV[3]	PLL1 reference clock divider control bit 3	R/W			1
Bit 2	PLL1 M_DIV[2]	PLL1 reference clock divider control bit 2	R/W			0
Bit 1	PLL1 M_DIV[1]	PLL1 reference clock divider control bit 1	R/W			0
Bit 0	PLL1 M_DIV[0]	PLL1 reference clock divider control bit 0	R/W			1

Byte9: PLL1 VCO N divider

Byte 09h	Name	Control Function	Type	0	1	PWD
Bit 7	PLL1 N_DIV[7]	PLL1 VCO feedback divider control bit 7	R/W	12~2048, default is 600		0
Bit 6	PLL1 N_DIV[6]	PLL1 VCO feedback divider control bit 6	R/W			1
Bit 5	PLL1 N_DIV[5]	PLL1 VCO feedback divider control bit 5	R/W			0
Bit 4	PLL1 N_DIV[4]	PLL1 VCO feedback divider control bit 4	R/W			1
Bit 3	PLL1 N_DIV[3]	PLL1 VCO feedback divider control bit 3	R/W			1
Bit 2	PLL1 N_DIV[2]	PLL1 VCO feedback divider control bit 2	R/W			0
Bit 1	PLL1 N_DIV[1]	PLL1 VCO feedback divider control bit 1	R/W			0
Bit 0	PLL1 N_DIV[0]	PLL1 VCO feedback divider control bit 0	R/W			0

Byte10: PLL loop filterand N divider

Byte 0Ah	Name	Control Function	Type	0	1	PWD
Bit 7	PLL1_R100K	PLL1 Loop filter resister 100Kohm	R/W	bypass	plus 100Kohm	1
Bit 6	PLL1_R50K	PLL1 Loop filter resister 50Kohm	R/W	bypass	plus 50Kohm	0
Bit 5	PLL1_R25K	PLL1 Loop filter resister 25Kohm	R/W	bypass	plus 25Kohm	1
Bit 4	PLL1_R12.5K	PLL1 Loop filter resister 12.5Kohm	R/W	bypass	plus 12.5Kohm	1
Bit 3	PLL1_R1.0K	PLL1 Loop filter resister 1Kohm	R/W	bypass	only 1.0Kohm applied	0
Bit 2	PLL1 N_DIV[10]	PLL1 VCO feedback integer divider bit10	R/W	'12~2048, default is 600		0
Bit 1	PLL1 N_DIV[9]	PLL1 VCO feedback integer divider bit9	R/W			1
Bit 0	PLL1 N_DIV[8]	PLL1 VCO feedback integer divider bit8	R/W			0

Byte11: PLL1 charge pump

Byte 0Bh	Name	Control Function	Type	0	1	PWD
Bit 7	PLL1_CP_32X	PLL1 charge pump control	R/W	-	x32	0
Bit 6	PLL1_CP_16X	PLL1 charge pump control	R/W	-	x16	0
Bit 5	PLL1_CP_8X	PLL1 charge pump control	R/W	-	x8	0
Bit 4	PLL1_CP_4X	PLL1 charge pump control	R/W	-	x4	0
Bit 3	PLL1_CP_2X	PLL1 charge pump control	R/W	-	x2	0
Bit 2	PLL1_CP_1X	PLL1 charge pump control	R/W	-	x1	1
Bit 1	PLL1_CP_/24	PLL1 charge pump control	R/W	-	/24	1
Bit 0	PLL1_CP_/3	PLL1 charge pump control	R/W	-	/3	0

Byte12: PLL1 spread spectrum control

Byte 0Ch	Name	Control Function	Type	0	1	PWD
Bit 7	PLL1_SS_REFDIV23	PLL1 Spread Spectrum control- Ref divider 23	R/W	-	-	0
Bit 6	PLL1_SS_REFDIV[6]	PLL1 Spread Spectrum control- Ref divider 6	R/W	-	-	0
Bit 5	PLL1_SS_REFDIV[5]	PLL1 Spread Spectrum control- Ref divider 5	R/W	-	-	0
Bit 4	PLL1_SS_REFDIV[4]	PLL1 Spread Spectrum control- Ref divider 4	R/W	-	-	0
Bit 3	PLL1_SS_REFDIV[3]	PLL1 Spread Spectrum control- Ref divider 3	R/W	-	-	0
Bit 2	PLL1_SS_REFDIV[2]	PLL1 Spread Spectrum control- Ref divider 2	R/W	-	-	0
Bit 1	PLL1_SS_REFDIV[1]	PLL1 Spread Spectrum control- Ref divider 1	R/W	-	-	0
Bit 0	PLL1_SS_REFDIV[0]	PLL1 Spread Spectrum control- Ref divider 0	R/W	-	-	0

Byte13: PLL1 spread spectrum control

Byte 0Dh	Name	Control Function	Type	0	1	PWD
Bit 7	PLL1_SS_FBDIV[7]	PLL1 Spread Spectrum - feedback divider 7	R/W	-	-	0
Bit 6	PLL1_SS_FBDIV[6]	PLL1 Spread Spectrum - feedback divider 6	R/W	-	-	0
Bit 5	PLL1_SS_FBDIV[5]	PLL1 Spread Spectrum - feedback divider 5	R/W	-	-	0
Bit 4	PLL1_SS_FBDIV[4]	PLL1 Spread Spectrum - feedback divider 4	R/W	-	-	0
Bit 3	PLL1_SS_FBDIV[3]	PLL1 Spread Spectrum - feedback divider 3	R/W	-	-	0
Bit 2	PLL1_SS_FBDIV[2]	PLL1 Spread Spectrum - feedback divider 2	R/W	-	-	0
Bit 1	PLL1_SS_FBDIV[1]	PLL1 Spread Spectrum - feedback divider 1	R/W	-	-	0
Bit 0	PLL1_SS_FBDIV[0]	PLL1 Spread Spectrum - feedback divider 0	R/W	-	-	0

Byte14: PLL1 Spread spectrum control

Byte 0Eh	Name	Control Function	Type	0	1	PWD
Bit 7	PLL1_SS_FBDIV[15]	PLL1 Spread Spectrum - feedback divider 15	R/W	-	-	0
Bit 6	PLL1_SS_FBDIV[14]	PLL1 Spread Spectrum - feedback divider 14	R/W	-	-	0
Bit 5	PLL1_SS_FBDIV[13]	PLL1 Spread Spectrum - feedback divider 13	R/W	-	-	0
Bit 4	PLL1_SS_FBDIV[12]	PLL1 Spread Spectrum - feedback divider 12	R/W	-	-	0
Bit 3	PLL1_SS_FBDIV[11]	PLL1 Spread Spectrum - feedback divider 11	R/W	-	-	0
Bit 2	PLL1_SS_FBDIV[10]	PLL1 Spread Spectrum - feedback divider 10	R/W	-	-	0
Bit 1	PLL1_SS_FBDIV[09]	PLL1 Spread Spectrum - feedback divider 9	R/W	-	-	0
Bit 0	PLL1_SS_FBDIV[08]	PLL1 Spread Spectrum - feedback divider 8	R/W	-	-	0