

## Spread Spectrum Clock Generator

### Features

- Generates four 4x low EMI spread spectrum clocks
- Input frequency: 10MHz - 25MHz
- Output frequency: 40MHz - 100MHz
- Internal loop filter minimizes external components and board space
- Selectable Centre Spread frequency deviation:  $\pm 0.5\%$ ,  $\pm 0.75\%$ ,  $\pm 1.0\%$ ,  $\pm 1.25\%$ ,  $\pm 1.5\%$ ,  $\pm 1.75\%$   $\pm 2.0\%$
- Supply Voltage : $3.3V \pm 0.3V$
- Commercial and Industrial temperature range
- 16-pin TSSOP Package
- Advanced low power CMOS process

output. PCS3P2191A offers seven selectable centre spread options of  $\pm 0.5\%$  to  $\pm 2.0\%$ , and a no spread option. (Refer Spread Deviation Selection Table). PCS3P2191A reduces electromagnetic interference (EMI) at the clock source, allowing system wide reduction of EMI of all clock dependent signals. The PCS3P2191A allows significant system cost savings by reducing the number of circuit board layers, ferrite beads, and shielding that are traditionally required to pass EMI regulations. The PCS3P2191A uses the most efficient and optimized modulation profile approved by the FCC and is implemented in a proprietary all digital method. The Device is available in 16 Pin TSSOP package, in Commercial and Industrial temperature range.

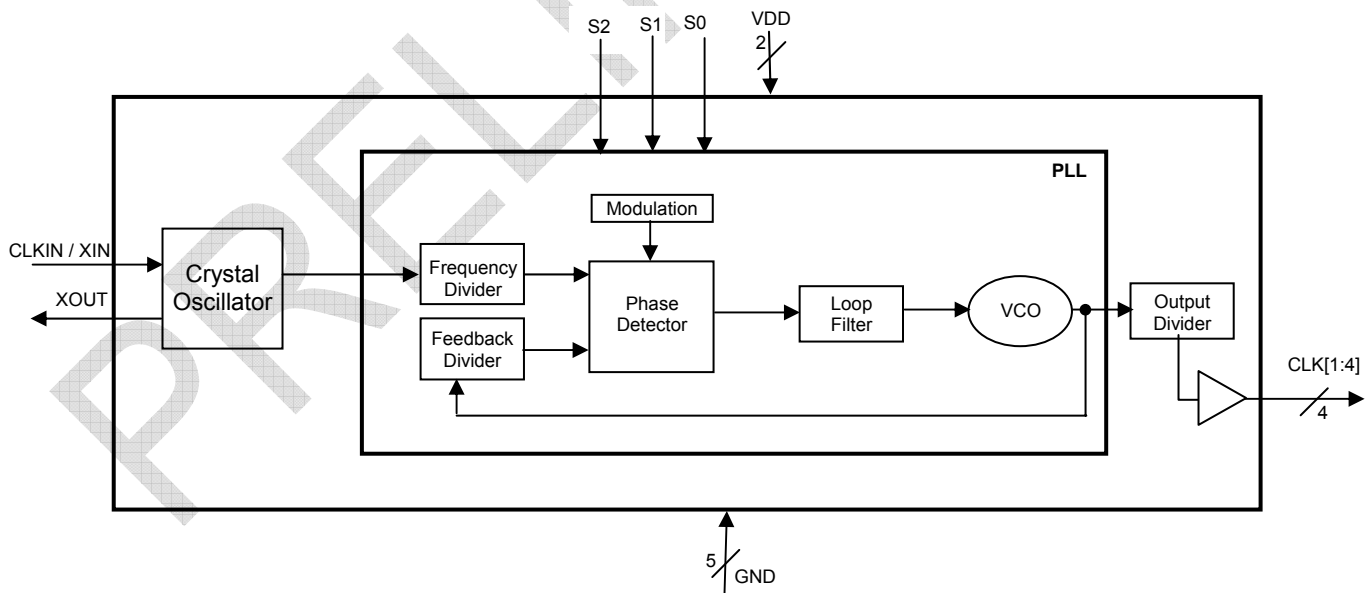
### Product Description

PCS3P2191A is a versatile spread spectrum frequency modulator that generates four low EMI 4x clocks at the

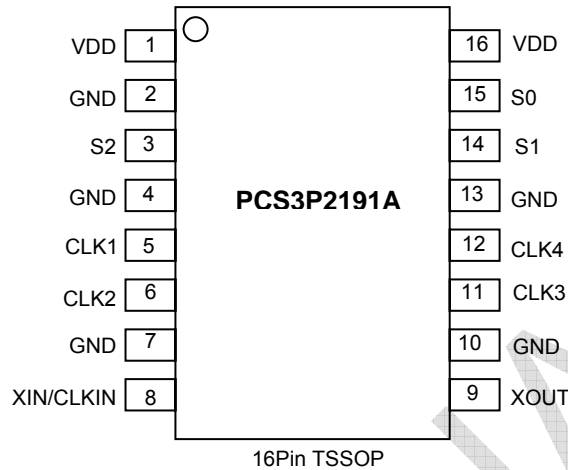
### Application

PCS3P2191A is targetted for LCD panel application

### Block Diagram



Pin Configuration



Pin Description

Pin#	Pin Name	Type	Description
1	V <sub>DD</sub>	P	Power Supply Voltage Pin. Connect to +3.3V.
2	GND	P	Ground Connection. Connect to system ground.
3	S2	I	Spread range select. Digital logic input used to select frequency deviation (Refer <i>Spread Deviation Table</i> ). This pin has an internal pull-up resistor.
4	GND	P	Ground Connection. Connect to system ground.
5	CLK1	O	Low EMI 4x clock output.
6	CLK2	O	Low EMI 4x clock output.
7	GND	P	Ground Connection. Connect to system ground.
8	XIN/CLKIN	I	Crystal connection or external reference clock input
9	XOUT	O	Crystal connection. If using an external reference, this pin must be left unconnected.
10	GND	P	Ground Connection. Connect to system ground.
11	CLK3	O	Low EMI 4x clock output.
12	CLK4	O	Low EMI 4x clock output.
13	GND	P	Ground Connection. Connect to system ground.
14	S1	I	Spread range select. Digital logic input used to select frequency deviation (Refer <i>Spread Deviation Table</i> ). This pin has an internal pull-up resistor.
15	S0	I	Spread range select. Digital logic input used to select frequency deviation (Refer <i>Spread Deviation Table</i> ). This pin has an internal pull-up resistor.
16	V <sub>DD</sub>	P	Power Supply Voltage Pin. Connect to +3.3V.

**Spread Deviation Selection Table**

(For an Input CLK=15MHz)

S2	S1	S0	Deviation (± %)
0	0	0	OFF
0	0	1	0.5
0	1	0	0.75
0	1	1	1.0
1	0	0	1.25
1	0	1	1.5
1	1	0	1.75
1	1	1	2.0

**Absolute Maximum Ratings**

Symbol	Parameter	Rating	Unit
V <sub>DD</sub>	Supply Voltage pin with respect to Ground	-0.5 to +4.6	V
V <sub>IN</sub>	Input Voltage pin with respect to Ground	VSS-0.5 to VDD+0.5	V
V <sub>OUT</sub>	Output Voltage pin with respect to Ground	VSS-0.5 to VDD+0.5	V
T <sub>STG</sub>	Storage temperature	-55 to +125	°C
T <sub>s</sub>	Max. Soldering Temperature (10 sec)	260	°C
T <sub>J</sub>	Junction Temperature	150	°C
T <sub>DV</sub>	Static Discharge Voltage(As per JEDEC STD22- A114-B)	2	KV

Note: These are stress ratings only and are not implied for functional use. Exposure to absolute maximum ratings for prolonged periods of time may affect device reliability.

**Recommended Operating Conditions**

Parameter	Description	Min	Typ	Max	Unit
V <sub>DD</sub>	Operating Voltage	3.0	3.3	3.6	V
T <sub>A</sub>	Operating Temperature	-40		+85	°C
C <sub>L</sub>	Load Capacitance			15	pF
C <sub>IN</sub>	Input Capacitance		5		pF

**DC Electrical Characteristics** (TA=-40°C to +85°C, V<sub>DD</sub>=3.3V ± 0.3V)

Symbol	Parameter		Min	Typ	Max	Unit
V <sub>IL</sub>	Input low voltage		VSS – 0.3		0.8	V
V <sub>IH</sub>	Input high voltage		2.0		V <sub>DD</sub> + 0.3	V
I <sub>IL</sub>	Input low current	(XIN / CLKIN)			-35	μA
I <sub>IH</sub>	Input high current				+35	
I <sub>IL</sub>	Input low current	(S0:S1:S2)			-50	μA
I <sub>IH</sub>	Input high current				+50	
V <sub>OL</sub>	Output low voltage	I <sub>OL</sub> = 12mA	VSS		0.4	V
V <sub>OH</sub>	Output high voltage	I <sub>OH</sub> = -12mA	2.4		V <sub>DD</sub>	V
I <sub>CC</sub>	Dynamic supply current ( Unloaded Outputs)		8	15	26	mA
I <sub>DD</sub>	Static supply current standby mode*				8	mA
V <sub>DD</sub>	Operating voltage		3.0	3.3	3.6	V
t <sub>ON</sub>	Power up time (first locked clock cycle after power up)**				5	mS
Z <sub>OUT</sub>	Clock output impedance			27		Ω
C <sub>IN</sub>	Input Capacitance			5		pF
C <sub>L</sub>	Load Capacitance				15	pF

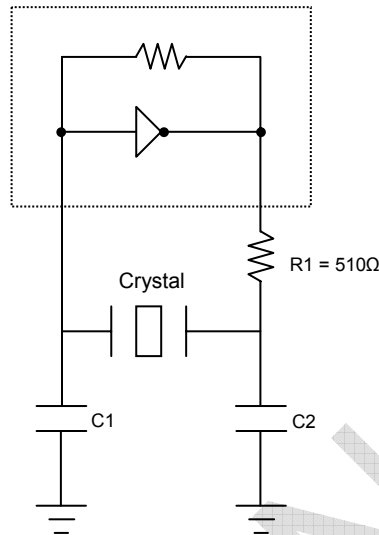
\*CLKIN pulled Low  
 \*\*V<sub>DD</sub> and CLKIN inputs are stable

**AC Electrical Characteristics** (TA=-40°C to +85°C, V<sub>DD</sub>=3.3V ± 0.3V)

Symbol	Parameter		Min	Typ	Max	Unit
XIN/ CLKIN	Input Clock frequency		10	15	25	MHz
CLKOUT	Output Clock frequency	(Pin 5,6,11,12)	40	60	100	MHz
F <sub>MOD</sub>	Spread Spectrum Modulation Rate		26	39	65	KHz
t <sub>LH</sub> *	Output rise time ( Measured from 20% to 80% )			1.5	2	nS
t <sub>HL</sub> *	Output fall time ( Measured from 80% to 20% )			1.0	1.5	nS
	Output frequency Synthesis error (With SSOFF)			0		ppm
t <sub>JC</sub> *	Cycle to Cycle Jitter			±250	±325	pS
t <sub>JP</sub> *	Period Jitter (With SSOFF)			±150	±200	
t <sub>D</sub> *	Output duty cycle		45	50	55	%

\*t<sub>LH</sub> and t<sub>HL</sub> are measured with a capacitive load of 15pF

**Typical Crystal Oscillator Circuit**

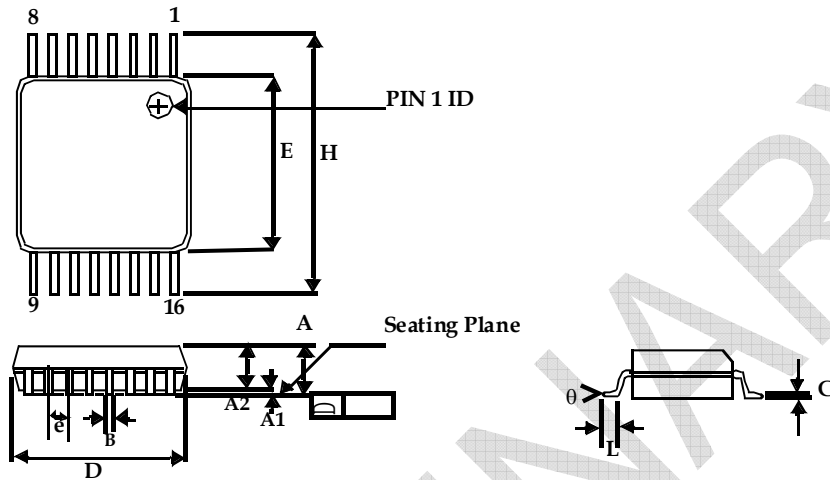


**Typical Crystal Specifications**

Fundamental AT cut parallel resonant crystal	
Nominal frequency	15MHz
Frequency tolerance	± 50 ppm or better at 25°C
Operating temperature range	-45°C to +90°C
Load capacitance	18pF
Shunt capacitance	7pF maximum
ESR	25Ω

Package Information

16-lead Thin Shrunken Small Outline Package (4.40-MM Body)



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A		0.043		1.20
A1	0.002	0.006	0.05	0.15
A2	0.031	0.041	0.80	1.05
B	0.007	0.012	0.19	0.30
C	0.004	0.008	0.09	0.20
D	0.193	0.201	4.90	5.10
E	0.169	0.177	4.30	4.50
e	0.026 BSC		0.65 BSC	
H	0.252 BSC		6.40 BSC	
L	0.020	0.030	0.50	0.75
$\theta$	0°	8°	0°	8°

Ordering Code

Part Number	Marking	Package Type	Temperature
PCS3P2191AG-16TT	3P2191AG	16-Pin TSSOP, TUBE, Green	Commercial
PCS3P2191AG-16TR	3P2191AG	16-Pin TSSOP, TAPE & REEL, Green	Commercial
PCS3P2191AF-16TT	3P2191AF	16-Pin TSSOP, TUBE, Pb Free	Commercial
PCS3P2191AF-16TR	3P2191AF	16-Pin TSSOP, TAPE & REEL, Pb Free	Commercial
PCS3I2191AG-16TT	3I2191AG	16-Pin TSSOP, TUBE, Green	Industrial
PCS3I2191AG-16TR	3I2191AG	16-Pin TSSOP, TAPE & REEL, Green	Industrial
PCS3I2191AF-16TT	3I2191AF	16-Pin TSSOP, TUBE, Pb Free	Industrial
PCS3I2191AF-16TR	3I2191AF	16-Pin TSSOP, TAPE & REEL, Pb Free	Industrial

Device Ordering Information

P C S 3 P 2 1 9 1 A G - 1 6 T R

R = Tape & Reel, T = Tube or Tray

O = TSOT23	U = MSOP	J=TSOT26
S = SOIC	E = TQFP	C=TDFN (2X2) COL
T = TSSOP	L = LQFP	
A = SSOP	U = MSOP	
V = TVSOP	P = PDIP	
B = BGA	D = QSOP	
O = OFN	X = SC-70	

DEVICE PIN COUNT

G = GREEN PACKAGE, LEAD FREE, and RoHS

PART NUMBER

X= Automotive (-40C to +125C)	I= Industrial (-40C to +85C)	P or n/c = Commercial (0C to +70C)
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1 = Clock Generator	6 = Power Management
2 = Non PLL based	7 = Power Management
3 = EMI Reduction	8 = Power Management
4 = DDR support products	9 = Hi Performance
5 = STD Zero Delay Buffer	0 = Reserved

PulseCore Semiconductor Mixed Signal Product

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Note: This product utilizes US Patent # 6,646,463 Impedance Emulator Patent issued to PulseCore Semiconductor, dated 11-11-2003  
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