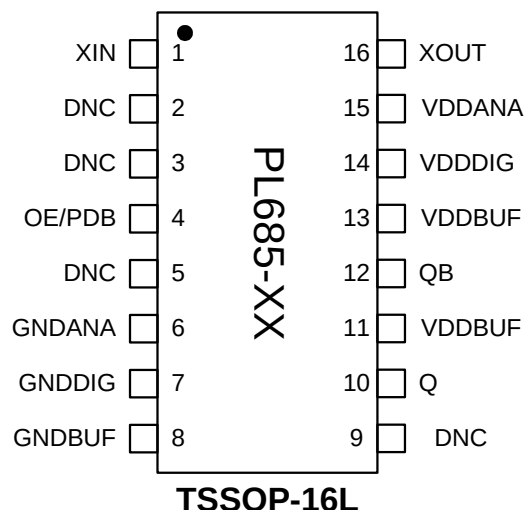


19MHz to 800MHz Low Phase-Noise XO PIN CONFIGURATION

FEATURES

- < 0.5ps RMS phase jitter (12kHz to 20MHz) at 622.08MHz
- 30ps max peak to peak period jitter
- Ultra Low-Power Consumption
 - < 90 mA @622MHz PECL output
 - <10 μ A at Power Down (PDB) Mode
- Input Frequency:
 - Fundamental Crystal: 19MHz to 44MHz
- Output Frequency:
 - 19MHz to 800MHz output.
- Output types: PECL.
- Programmable OE input polarity selection.
- Power Supply: 3.3V, $\pm$ 10%
- Operating Temperature Ranges:
 - Commercial: 0°C to 70°C
 - Industrial: -40°C to 85°C
- Available in Die or Wafer



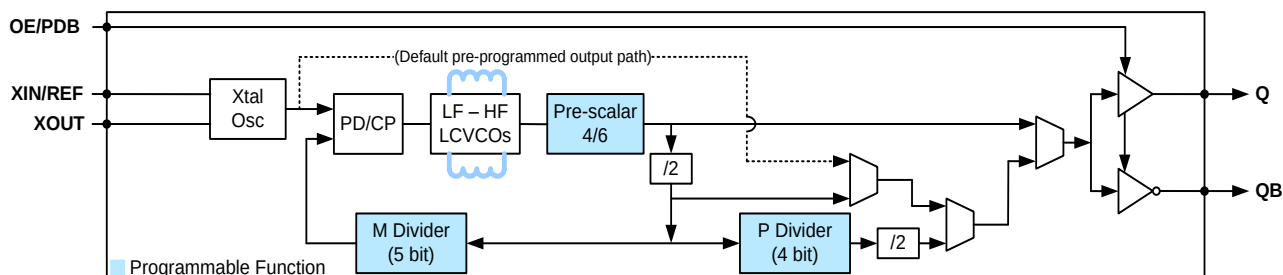
DESCRIPTION

The PL685 is a Dual LC core monolithic IC clock, capable of maintaining sub-1ps RMS phase jitter, while covering a wide frequency output range up to 800MHz, without the use of external components. The high performance and high frequency output is achieved using a low cost fundamental crystal of between 19MHz and 44 MHz. The PL685 family is designed to address the demanding requirements of high performance applications such as Fiber Channel, serial ATA, Ethernet, SAN, SONET/SDH, etc.

OUTPUT ENABLE CONTROL

OE Select (Programmable)	OE	State
0	0 (Default)	Output enabled
	1	Tri-state
1 (Default)	0	Tri-state
	1 (Default)	Output enabled

BLOCK DIAGRAM



19MHz to 800MHz Low Phase-Noise XO
PIN ASSIGNMENT

Name	Pin #	Type	Description
XIN	1	I	Crystal input connection.
DNC	2, 3, 5, 9	-	Do Not Connect.
OE/PDB	4	I	This pin may be programmed as output enable (OE), or power-down (PDB) pin. This pin incorporates an Internal pull-up resistor of 60KΩ for OE, and PDB, operations.
GND_ANA	6	P	GND connection for analog circuitry.
GND_DIG	7	P	GND connection for digital circuitry.
GND_BUF	8	P	GND connection for buffer circuitry.
Q	10	O	True Output buffer.
QB	12	O	Complementary Output buffer.
VDD_BUF	11, 13	P	VDD connection for buffer circuitry.
VDD_DIG	14	P	VDD connection for digital circuitry.
VDD_ANA	15	P	VDD connection for analog circuitry.
XOUT	16	P	Output connection to crystal.

OPTION SELECTION TABLE

PL685 is a fully programmable clock IC. However, for ordering convenience, the following part numbers have been created for when simple multiplication is used, for your convenience. When other features of the IC are exercised (i.e. reverse polarity on OE, power down, etc.), another 3-digit code is used to identify the functionality.

Input Crystal Frequency Range (MHz)	Multiplication Factor	Output Frequency Range (MHz)		Part #
		Low Limit	High Limit	
33.750000 ~ 40.000000	X20	675.00	800.00	PL685-P8-020
33.333333 ~ 42.187500	X16	533.33	675.00	PL685-P8-168
32.142857 ~ 38.095238	X14	450.00	533.33	PL685-P8-148
33.333333 ~ 37.500000	X12	400.00	450.00	PL685-P8-128
33.750000 ~ 40.000000	X10	337.50	400.00	PL685-P8-108
33.333333 ~ 42.187500	X8	266.67	337.50	PL685-P8-088
32.142857 ~ 38.095238	X7	225.00	266.67	PL685-P8-078
33.333333 ~ 37.500000	X6	200.00	225.00	PL685-P8-068
33.750000 ~ 40.000000	X5	168.75	200.00	PL685-P8-058
33.333333 ~ 42.187500	X4	133.33	168.75	PL685-P8-048
32.142857 ~ 38.095238	X3.5	112.50	133.33	PL685-P8-358
33.333333 ~ 37.500000	X3	100.00	112.50	PL685-P8-038
33.750000 ~ 40.000000	X2.5	84.375	100.00	PL685-P8-258
32.812500 ~ 42.187500	X2	65.625	84.375	PL685-P8-028

Common functionality for packaged parts in the above table:

- OE function active high polarity.
- Crystal Load is 12pF.

Please inform your Sales representative for active low OE functionality.

19MHz to 800MHz Low Phase-Noise XO**FUNCTIONAL DESCRIPTION**

PL685 family of products is an advanced, programmable LCVCO clock IC that is designed to meet the most stringent performance specifications for phase noise, jitter, and power consumption.

There are two main types of VCOs, a) Ring Oscillator, b) LC Tank oscillator. An LCVCO is made up of LC tank oscillator. Although a Ring Oscillator has very good performance, and has a good tuning range, its phase noise and jitter performance, in particular at higher frequencies, degrades.

On the other hand, an LCVCO has an outstanding phase noise and jitter performance, even at higher frequencies. PL685 family of products takes advantage of this state of the art technology, and incorporates the LC tank on-chip, for optimal performance.

PL685 family exhibit very low phase noise/phase jitter and peak to peak jitter, wide tuning range, and very low-power. All members of the PL685 family accept a low-cost fundamental crystal input of 19MHz to 44MHz or a reference clock input of up to 800MHz and its flexible core is capable of producing any output frequency between 19MHz to 800MHz.

PLL Programming

The PLL in the PL685 family is fully programmable. The PLL is equipped with a Prescaler to divide down the VCO frequency, and a 5-bit VCO frequency feedback loop divider (M-Counter). The output of the PLL is transferred to a 4-bit post VCO divider (P-Counter), to achieve the desired output frequency.

OE (Output Enable)

The OE pin in PL685 family, through programming, can be configured to support OE pin activation with a logic '1' or logic '0', to provide you with the desired enable polarity.

OE Select (Programmable)	OE	State
0	0 (Default)	Output enabled
	1	Tri-state
1 (Default)	0	Tri-state
	1 (Default)	Output enabled

The OE pin incorporates a 60K Ω resistor to either pull-up or pull-down to the default state when the OE pin is left open.

19MHz to 800MHz Low Phase-Noise XO
ELECTRICAL SPECIFICATIONS
1. ABSOLUTE MAXIMUM RATINGS

PARAMETERS	SYMBOL	MIN	MAX	UNITS
Supply Voltage	V_{DD}		4.6	V
Input Voltage, dc	V_I	-0.5	$V_{DD}+0.5$	V
Output Voltage, dc	V_O	-0.5	$V_{DD}+0.5$	V
Storage Temperature	T_S	-65	150	°C
Ambient Operating Temperature (industrial temperature)*	T_{AI}	-40	85	°C
Ambient Operating Temperature (commercial temperature)	T_{AC}	0	70	°C
Junction Temperature	T_J		125	°C
ESD Protection, Machine Model		200		V
ESD Protection, Human Body Model		2		kV

Exposure of the device under conditions beyond the limits specified by Maximum Ratings for extended periods may cause permanent damage to the device and affect product reliability. These conditions represent a stress rating only, and functional operations of the device at these or any other conditions above the operational limits noted in this specification is not implied. *Operating temperature is guaranteed by design. Parts are tested to commercial grade only.

2. GENERAL ELECTRICAL SPECIFICATIONS

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Current, Dynamic	I_{DDQ}	LVPECL, 622.08MHz, 3.3V			90	mA
Supply Current, Dynamic PDB Enabled		PDB = 0, 3.3V			10	uA
Output Enable Time	t_{OE}	OE logic 0 to logic 1, $T_a=25^\circ\text{C}$. Add one clock period to this measurement for a usable clock output.			50	ns
Power Up Time	T_{PU}	PDB logic 0 to logic 1, $T_a=25^\circ\text{C}$			10	ms
Operating Voltage	V_{DD}	LVPECL	2.97		3.63	V
Power Up Ramp Rate	t_{PU}	Time for V_{DD} to reach 90% V_{DD} . Power ramp must be monotonic.	0.1		100	ms
Auto-Calibration Time	t_{AC}	At power up			10	ms
Output Clock Duty Cycle		@ 50% of output waveform	45	50	55	%

19MHz to 800MHz Low Phase-Noise XO

4. CRYSTAL SPECIFICATIONS

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Crystal Resonator Frequency	F_{XIN}	Parallel Fundamental Mode	19		44	MHz
Crystal Cload	$C_{L_Crystal}$	$V_{DD} = 3.3V$, programmable	8		12	pF
Shunt Capacitance	$C_{0_Crystal}$				3.5	pF
Recommended ESR	R_E	AT cut , up to 40MHz			50	Ω
		AT cut , up to 44MHz			45	Ω

5. JITTER SPECIFICATIONS

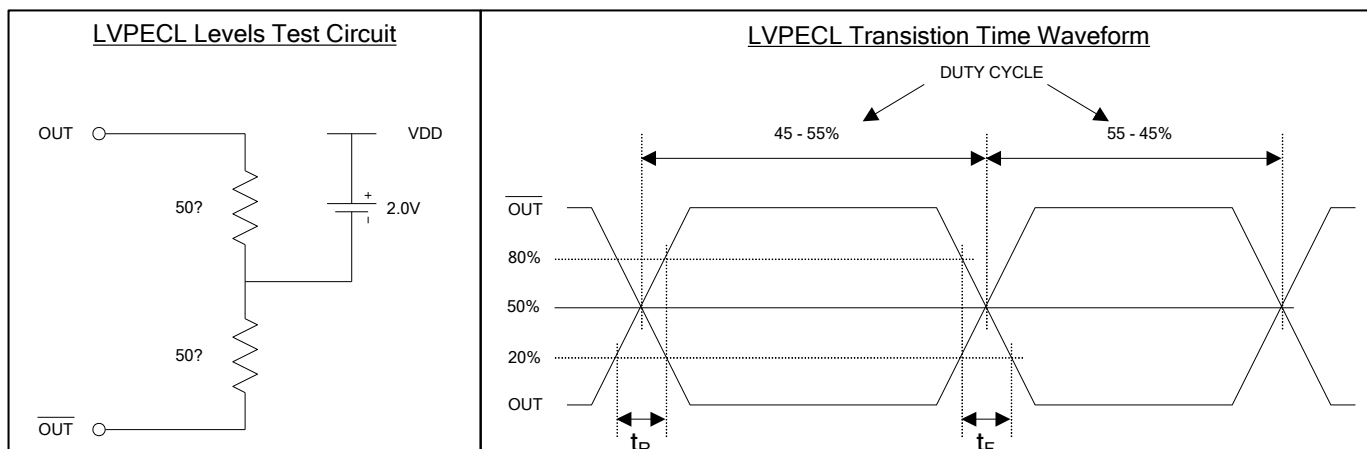
PARAMETERS	FREQUENCY	CONDITIONS	MIN	TYP	MAX	UNITS
RMS Phase Jitter	622.08MHz	12kHz to 20MHz, $XIN=38.88MHz$			0.5	ps
Period Jitter, Pk-to-Pk	622.08MHz	10K cycles, $XIN=38.88MHz$			30	ps

6. PHASE NOISE SPECIFICATIONS

PARAMETERS	FREQUENCY	@10Hz	@100Hz	@1kHz	@10kHz	@100kHz	UNITS
Phase Noise, relative to carrier (typical)	155.52MHz	-61	-90	-114	-123	-126	dBc/Hz
	622.08MHz	-46	-77	-101	-111	-114	

7. LVPECL OUTPUTS (Q, QB)

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output High Voltage	V_{OH}	Q, QB Standard LVPECL Termination, $V_{DD} = 3.3V$	2.275	2.350	2.420	V
Output Low Voltage	V_{OL}		1.490	1.600	1.680	V
Output Frequency	F_{out}	3.3V	19		800	MHz
Output Rise, Fall Times	t_r, t_f	20% - 80% of output waveform		300	500	ps
Output Voltage Swing	V_{pp}	Q, QB	550	800	930	mV



19MHz to 800MHz Low Phase-Noise XO

LAYOUT RECOMMENDATIONS

The following guidelines are to assist you with a performance optimized PCB design:

Signal Integrity and Termination Considerations

- Keep traces short!
- Trace = Inductor. With a capacitive load this equals ringing!
- Long trace = Transmission Line. Without proper termination this will cause reflections (looks like ringing).
- Design long traces (<1 inch) as “striplines” or “microstrips” with defined impedance.
- Match trace at one side to avoid reflections bouncing back and forth.

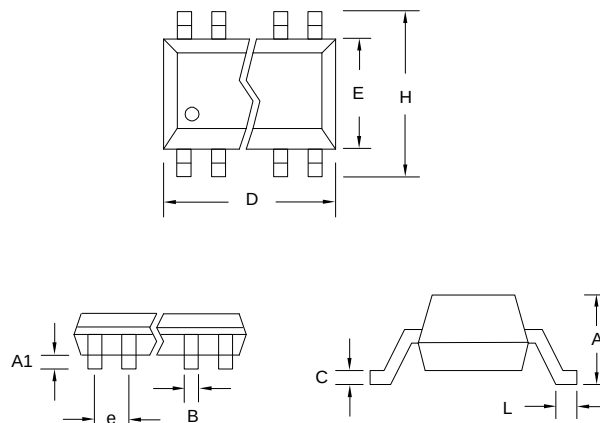
Decoupling and Power Supply Considerations

- Place decoupling capacitors as close as possible to the V_{DD} pin(s) to limit noise from the power supply
- Multiple V_{DD} pins should be decoupled separately for best performance.
- Addition of a ferrite bead in series with V_{DD} can help prevent noise from other board sources
- Value of decoupling capacitor is frequency dependant. Typical values to use are $0.1\mu\text{F}$ for designs using frequencies < 50MHz and $0.01\mu\text{F}$ for designs using frequencies > 50MHz.

PACKAGE DRAWINGS (GREEN PACKAGE COMPLIANT)

TSSOP-16L

Symbol	Dimension in MM	
	Min.	Max.
A	-	1.20
A1	0.05	0.15
b	0.19	0.30
C	0.09	0.20
D	4.90	5.10
E	4.30	4.50
H	6.20	6.60
L	0.45	0.75
e	0.65 BSC	



19MHz to 800MHz Low Phase-Noise XO**ORDERING INFORMATION**

For part ordering, please contact our Sales Department:

2180 Fortune Drive, San Jose, CA 95131, USA

Tel: (408) 944-0800 Fax: (408) 474-1000

PART NUMBER

The order number for this device is a combination of the following:
Part number, Package type, Thickness and Operating temperature range

Part Number PL685-XX-XXX XX

Programming Code _____

Packaging Option _____

O = TSSOP

Temperature Range
C=Commercial (0°C to 70°C)
I= Industrial (-45°C to +85°C)

Part Number/Order Number	Marking†	Package Option
PL685-XX-XXXOC	P685-XX XXX(I)	16-Pin TSSOP (Tube)
PL685-XX-XXXOC-R	LLLLL	16-Pin TSSOP (Tape and Reel)

† **Marking Notes:**

- 1) The "I" after the 3 digit programming code will be marked for Industrial Temperature grade products only. Commercial grade products will not have a character in this position.
- 2) LLLLL represents the production lot number

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