SL19800BZ

ReadyClock™ Generator with SSCG Option

Key Features

- Low power dissipation
  - 9.0mA-typ at 66MHz and VDD=3.3V
  - 8.0mA-typ at 66MHz and VDD=2.5V
- Wide 2.5V to 3.3V +/-10% power supply range
- REFOUT and CLKOUT (with SSC option) outputs
- Low CCJ and PJ
- 24, 25, 27 and 48MHz crystal or clock input
- 8 to 200 MHz external clock range
- Integrated internal voltage regulator
- PD# and SSON# functions
- Center Spread Modulation
- 32kHz SSC modulation frequency

Applications

- Printers, MFPs
- Digital Copiers
- NBPCs and LCD Monitors
- Routers, Servers and Switchers
- Line Cards
- HDTV and DVD-R/W
- VOIP
- Digital Embeded Systems

Description

The Ready Clock™ family of SL19800BZ products are low jitter and low power dissipation clock generators with a Spread Spectrum Clock (SSC) option. The products are ready to ship from inventory.

The products are designed using SpectraLinear's proprietary, programmable phase-locked loop (PLL) and Spread Spectrum Clock (SSC) technology to synthesize and modulate the output clock. The modulated clock can significantly reduce the measured EMI levels, and leading to the compliance with regulatory agency requirements.

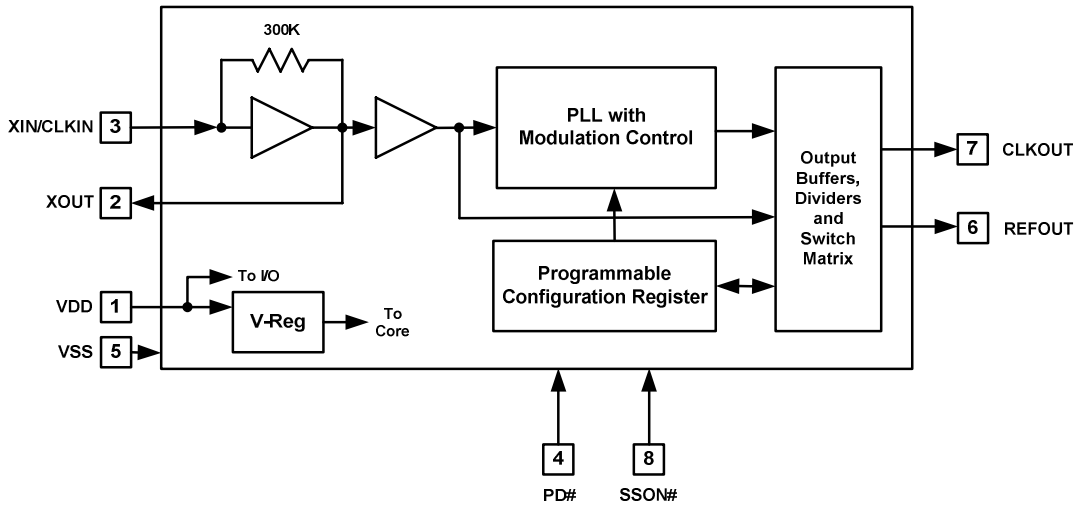
Two independent frequencies are available at REFOUT and CLKOUT pins based on a wide range of the most frequently used frequencies. Refer to product selection Table 1 on page 6 for available frequencies.

The SL19800BZ operates from 2.5V to 3.3V power supply voltage range. The product is offered in an 8-pin TSSOP package with commercial and industrial grades.

Benefits

- Peak EMI reduction of 8 to 16 dB
- Fast time-to-market
- Cost Reduction
- Reduction of PCB layers
- Eleminates the need for higher order crystals (Xtals) and crystal oscillators (XOs)

Block Diagram



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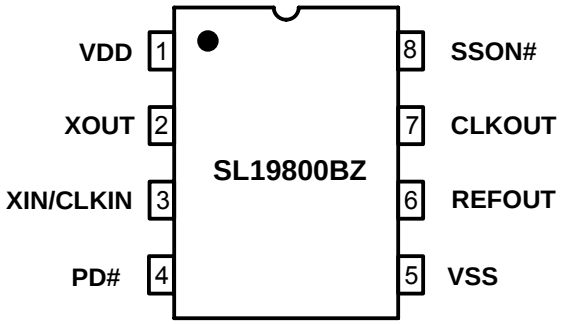
Pin Configuration



8-Pin TSSOP

Pin Description

Pin Number	Pin Name	Pin Type	Pin Description
1	VDD	Power	3.3V to 2.5V positive power supply.
2	XOUT	Output	Crystal or ceramic resonator output pin. Leave this pin unconnected (floating) if external clock is used at Pin-3. Leave this pin unconnected if pin 3 is driven with clock input.
3	XIN/CLKIN	Input	Crystal, ceramic resonator or external clock input pin.
4	PD#	Input	Power Down control. This pin is weakly pulled high to VDD (150kΩ-typ).
5	VSS	Power	Power supply ground.
6	REFOUT	Output	Buffered crystal or clock input. Frequency at this pin is same as crystal or clock input without spread.
7	CLKOUT	Output	Synthesized (PLL) clock output with Spread Spectrum Clock (SSC) option.
8	SSON#	Input	Spread Spectrum Clock (CLKOUT only) control. If SSON#=0 then spread is OFF. If SSON#=1 then spread is ON. This pin is weakly pulled high to VDD (150kΩ-typ).

General Description

SL19800BZ ReadyClock™ family of products is defined to include the most commonly used set of frequencies. The electrical specifications of these products are also standard which enable users to select and order any one of these ReadyClock™ by inspecting a simple product selection frequency table to identify specific "dash" numbers given in the Table 1 of page 6.

These clocks also include an optional Spread Spectrum Clock (SSC) function which can be turned off if not needed.

The primary source of EMI from digital circuits is the system clock and all the other synchronous clocks and control signals derived from the system clock. The well know techniques of filtering (suppression) and shielding (containment), while effective, can cost money, board space and longer development time.

A more effective and efficient technique to reduce EMI is to use the Spread Spectrum Clock Generator (SSCG) technique. Instead of using a constant clock frequency, the SSCG technique modulates (spreads) the system clock with a much smaller frequency, to reduce EMI emissions at its source: The System Clock.

The SL19800BZ is designed using SpectraLinear proprietary low power and low jitter phase-locked loop (PLL) and Spread Spectrum Technologies (SST) to synthesize and modulate (spread) the system clock such that the energy is spread out over a wider bandwidth. This reduces the peak value of the radiated emissions at the fundamental and the harmonics. This reduction in radiated energy can significantly reduce the cost of complying with regulatory agency requirements and improve time-to-market without degrading system performance.

However, in systems where SSC can not be used, users can disable the SSC function by through the SSON# pin.

The SL19800BZ operates from 3.3V to 2.5V power supply range within +/-10% tolerance.

The SL19800BZ is available in an 8-pin TSSOP package with Commercial Temperature range of 0 to 70°C and Industrial Temperature range of –40 to 85°C.

Input Frequency Range

The input frequency range is from 8.0 to 48.0 MHz for crystals and ceramic resonators. If an external clock is used, the input frequency range is from 8 to 166 MHz.

REFOUT and CLKOUT Outputs

REFOUT is the buffered output of the input crystal or clock hence the same frequency as the input frequency without spread. The CLKOUT is synthesized from the input clock by using an internal PLL.

The SL19800 can synthesize using relatively inexpensive fundamental crystals, eliminating the need for higher order Crystals (Xtals) and Crystal Oscillators (XOs).

REFOUT and CLKOUT Rise and Fall Times

Refer to AC Specifications for rise and fall times based on available frequencies.

Crystal Specifications

SL19800BZ on-chip crystal oscillator is capable of working with fundamental AT cut crystals from 8 to 48MHz. Product dash numbers are currently defined using only 24, 25, 27 and 48MHz crystals.

Refer to the Recommended Crystal Specifications Table 5 for the details of these specifications.

Crystal Load (CL)

The SL19800BZ requires external crystal load capacitors. Refer to pages 6 and 7 for additional information and calculation of external CL1 and CL2 values.

If an external clock is used, CL1 and CL2 capacitors are not needed.

Modulation Frequency

If SSON#=Low (VSS), for all spread % values modulation frequency is set at 32kHz.

PD# and SSON# Functions

SSON# function is to enable or disable spread spectrum function. If this pin is pulled high (VDD); the spread is stopped and the frequency is the nominal value without spread. If low (GND); spread is on.

PD# function is active if this pin low (VSS) and device is turned of and clock outputs are high-Z. If high (VDD) the device is active.

Additional Important Information

If a different spread values or a frequency set is required contact SpectraLinear.

We will immediately issue a new dash number, deliver new samples with a revised datasheet immediately. This new product will be the part of Ready Clock™ family.

Only the following information is required:

Parameter	Enter Data	Comments
REFOUT(MHz)	TBD	8 to 48MHz, same as Xtal
CLKOUT(MHz)	TBD	1 to 200MHz
Spread %	TBD	CLKOUT Only, 0 to 6%, down or center spread

Absolute Maximum Ratings

Description	Condition	Min	Max	Unit
Supply voltage, VDD		-0.5	4.6	V
All Inputs and Outputs		-0.5	VDD+0.5	V
Ambient Operating Temperature	In operation, C-Grade	0	70	°C
Ambient Operating Temperature	In operation, I-Grade	-40	85	°C
Storage Temperature	No power is applied	-65	150	°C
Junction Temperature	In operation, power is applied	-	125	°C
Soldering Temperature		-	260	°C
ESD Rating (Human Body Model)	JEDEC22-A114D	-4,000	4,000	V
ESD Rating (Charge Device Model)	JEDEC22-C101C	-1,500	1,500	V
ESD Rating (Machine Model)	JEDEC22-A115D	-250	250	V

DC Electrical Characteristics (C and I-Grade)

Unless otherwise stated VDD= 3.3V to 2.5V +/- 10%, CL=15pF

Description	Symbol	Condition	Min	Typ	Max	Unit
Operating Voltage	VDD	3.3V to 2.5V, +/-10%	2.25	2.5/3.3	3.63	V
Input Low Voltage	VIL	PD# and SSON# pins	0	-	0.3VDD	V
Input High Voltage	VIH	PD# and SSON# pins	0.7VDD	-	VDD	V
Output High Voltage	VOH1	IOL=8mA, CLKOUT and REFOUT pins	VDD-0.5	-	-	V
Output Low Voltage	VOL1	IOL=8mA, CLKOUT and REFOUT pins	-	-	0.5	V
Input High Current	IIH	PD# and SSON# pins	-10	-	10	µA
Input Low Current	IIL	PD# and SSON# pins	-10	-	10	µA
Pull-up or Down Resistor	RPU/D	PD# and SSON# pins	90	150	250	kΩ
Operating Supply Current	IDD1	CLKOUT 20 to 40MHz PD#=0 and SSON#0 or 1, CL=0	-	8	12	mA
Operating Supply Current	IDD2	CLKOUT= 40+MHz to 80MHz PD#=0 and SSON#0 or 1, CL=0	-	9	14	mA
Operating Supply Current	IDD3	CLKOUT= 80+MHz to 120MHz PD#=0 and SSON#0 or 1, CL=0	-	10	15	mA
Operating Supply Current	IDD4	CLKOUT=120+MHz to 200MHz PD#=0 and SSON#0 or 1, CL=0	-	12	18	mA
Standby Current	ISBC	PD#=GND	-	70	120	µA
Input Capacitance	CIN1	XIN/CLKIN and OUT pins	-	6	-	pF
Input Capacitance	CIN2	PD# and SSON# pins	-	4	6	pF
Load Capacitance	CL	CLKOUT and REFOUT pins	-	-	15	pF

AC Electrical Characteristics (C and I-Grade)

Unless otherwise stated VDD= 3.3V to 2.5V +/- 10%, CL=15pF

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Frequency Range	FIN1	Crystal or Ceramic Resonator, pins 2/3, refer to product selection table	8	-	48	MHz
Input Frequency Range	FIN2	External Clock, pin 3, refer to product selection table	8	-	48	MHz
Output Frequency Range	FOUT1	REFOUT, pin 6, refer to product selection table	8	-	200	MHz
Output Frequency Range	FOUT2	CLKOUT, pin 7, refer to product selection table	1	-	200	MHz
Output Duty Cycle	DC1	REFOUT, CL=15pF	45	50	55	%
Output Duty Cycle	DC2	CLKOUT, CL=15pF	45	50	55	%
Input Duty Cycle	DC3	Clock Input, Pin 3	30	50	70	%
Output Rise/Fall Time	tr/f1	CLKOUT/REFOUT 20 to 40MHz PD#=0 and SSON#0 or 1, CL=15pF	-	1.4	2.0	ns
Output Rise/Fall Time	tr/f2	CLKOUT/REFOUT 40+MHz to 80MHz PD#=0 and SSON#0 or 1, CL=15pF	-	1.1	1.6	ns
Output Rise/Fall Time	tr/f3	CLKOUT= 80+MHz to 120MHz PD#=0 and SSON#0 or 1, CL=15pF	-	0.9	1.4	ns
Output Rise/Fall Time	tr/f4	CLKOUT=120+MHz to 200MHz PD#=0 and SSON#0 or 1, CL=15pF	-	0.8	1.2	ns
Cycle-to-Cycle Jitter	CCJ1	REFOUT 20 to 30MHz, CL=15pF	-	90	-	ps
Cycle-to-Cycle Jitter	CCJ2	REFOUT 30+ to 48MHz, CL=15pF	-	85	-	ps
Cycle-to-Cycle Jitter	CCJ3	CLKOUT 20 to 40MHz, CL=15pF	-	80	-	ps
Cycle-to-Cycle Jitter	CCJ4	CLKOUT 40+ to 80MHz, CL=15pF	-	75	-	ps
Cycle-to-Cycle Jitter	CCJ5	CLKOUT 80+ to 120MHz, CL=15pF	-	70	-	ps
Cycle-to-Cycle Jitter	CCJ6	CLKOUT 120+ to 200MHz, CL=15pF	-	65	-	ps
Power-up Time	tPU	Time from 0.9VDD to valid frequency at outputs, REFOUT and CLKOUT	-	7.5	10.0	ms
Modulation Frequency	FMOD	CLKOUT, SSON#=0 (when SSC available)	30	32	34	kHz

Product Selection Table

Dash Number	(Xtal or CLK) Pin-3/2 (MHz)	REFOUT Pin-6 (MHz)	CLKOUT Pin-7 (MHz)	CLKOUT SS% Pin-7 SSON#=0	CLKOUT SS% Pin-7 SSON#=1
-1A	25.000	25.000	125.000	+/-0.25%	No Spread
-2A	25.000	25.000	150.000	+/-0.25%	No Spread
-3A	25.000	25.000	75.000	+/-0.25%	No Spread
-4A	25.000	25.000	62.500	+/-0.25%	No Spread
-5A	25.000	25.000	48.000	+/-0.25%	No Spread
-6A	25.000	25.000	24.000	+/-0.25%	No Spread
-7A	25.000	25.000	12.000	+/-0.25%	No Spread
-8A	25.000	25.000	100.000	+/-0.75%	No Spread
-9A	25.000	25.000	80.000	+/-0.75%	No Spread
-10A	25.000	25.000	50.000	+/-0.75%	No Spread
-11A	25.000	25.000	133.333	+/-0.75%	No Spread
-12A	25.000	25.000	66.666	+/-0.75%	No Spread
-13A	25.000	25.000	33.333	+/-0.75%	No Spread
-14A	25.000	25.000	24.576	No Spread	No Spread
-15A	27.000	27.000	125.000	+/-0.25%	No Spread
-16A	27.000	27.000	48.000	+/-0.25%	No Spread
-17A	27.000	27.000	24.000	+/-0.25%	No Spread
-18A	27.000	27.000	12.000	+/-0.25%	No Spread
-19A	27.000	27.000	100.000	+/-0.75%	No Spread
-20A	27.000	27.000	80.000	+/-0.75%	No Spread
-21A	27.000	27.000	50.000	+/-0.75%	No Spread
-22	27.000	27.000	133.333	+/-0.75%	No Spread
-23A	27.000	27.000	66.666	+/-0.75%	No Spread
-24A	27.000	27.000	33.333	+/-0.75%	No Spread
-25A	27.000	27.000	24.576	No Spread	No Spread
-26A	24.000	24.000	125.000	+/-0.25%	No Spread
-27A	24.000	24.000	100.000	+/-0.75%	No Spread
-28A	24.000	24.000	80.000	+/-0.75%	No Spread
-29A	24.000	24.000	50.000	+/-0.75%	No Spread
-30A	24.000	24.000	133.333	+/-0.75%	No Spread
-31A	24.000	24.000	66.666	+/-0.75%	No Spread
-32A	24.000	24.000	33.333	+/-0.75%	No Spread
-33A	24.000	24.000	24.576	No Spread	No Spread
-34A	48.000	48.000	125.000	+/-0.25%	No Spread
-35A	48.000	48.000	100.000	+/-0.75%	No Spread
-36A	48.000	48.000	80.000	+/-0.75%	No Spread
-37A	48.000	48.000	50.000	+/-0.75%	No Spread
-38A	48.000	48.000	133.333	+/-0.75%	No Spread
-39A	48.000	48.000	66.666	+/-0.75%	No Spread
-40A	48.000	48.000	33.333	+/-0.75%	No Spread
-41A	48.000	48.000	24.576	No Spread	No Spread

Table 1. SL19800 Dash Number Product Selection Table

External Components & Design Considerations

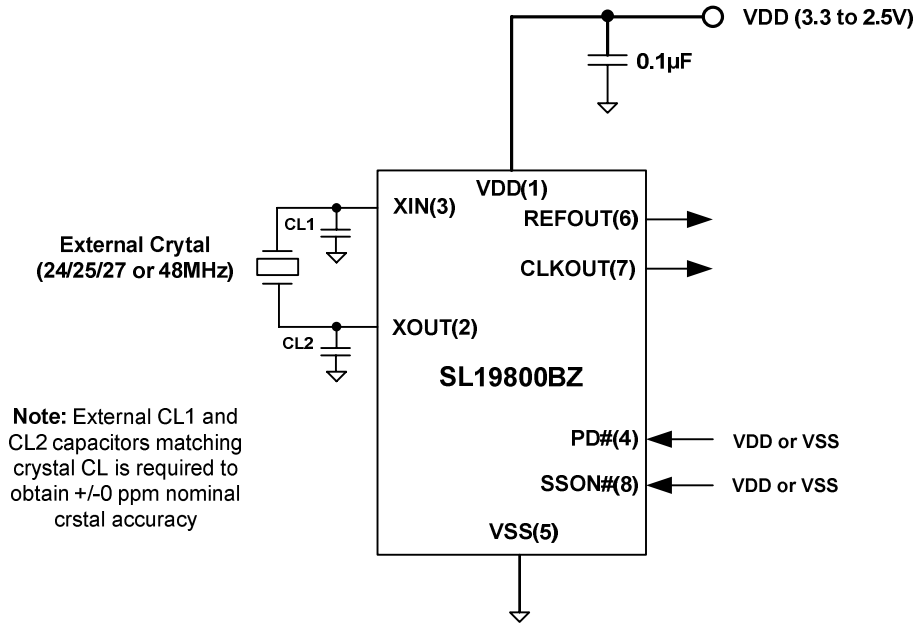


Figure 1. Typical Application Schematic

Comments and Recommendations

Decoupling Capacitor: A decoupling capacitor of 0.1µF must be used between VDD and VSS on the pins 1 and 5. Place the capacitor on the component side of the PCB as close to the VDD pin as possible. The PCB trace to the VDD pin and to the GND via should be kept as short as possible Do not use vias between the decoupling capacitor and the VDD pin.

Series Termination Resistor: A series termination resistor is recommended if the distance between the outputs (CLKOUT or REFOUT pins) and the load is over 1 ½ inch. The nominal impedance of the clock outputs are about 30 Ω. Use 20 Ω resistor in series with the output to terminate 50Ω trace impedance and place 20 Ω resistor as close to the clock outputs as possible.

Crystal and Crystal Load: Use only parallel resonant fundamental crystals. DO NOT USE higher overtone crystals. To meet the crystal accuracy specification (in ppm); external crystal load capacitors CL1 and CL2 as shown on Figure are required. These values are given by the formula below:

$$CL1(pF) = CL2(pF) = [(CL(pF) - ((Cp(pF)+Cpcb(pF))/2] \times 2$$

Where CL is crystal load capacitor as given by the crystal datasheet and Cp(pF) is the parasitic capacitance at XIN or XOUT pins per SL19800 datasheet and Cpcb is parasitic PCB capacitance at XIN or XOUT pins.

As an example; if a crystal with CL=16pF is used, Cp=6p and Cpcb=2pF; by using the above formula

CL1=CL2=[(18-(6+2)/2] x 2 = 24pF.

Using CL1=CL2=24pF assures that this crystal sees an equivalent load of 16pF. Failing to meet crystal load specification could cause an increase or decrease in frequency accuracy in ppm. Refer to the Table 5 for the recommended crystal specifications.

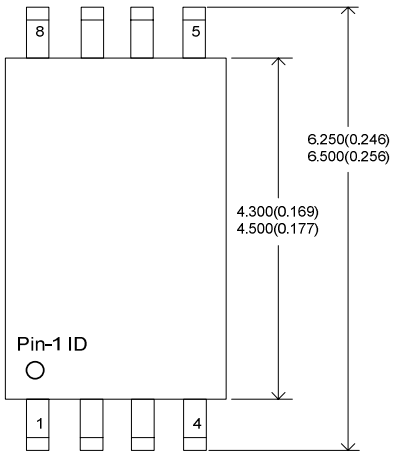
Recommended External Crystal Specifications

Parameter	Description	Min	Typ	Max	Unit	Comments
FNOM	Nominal Crystal Frequency Range		24.000		MHz	Fundamental Mode – AT Cut
FNOM	Nominal Crystal Frequency Range		25.000		MHz	Fundamental Mode – AT Cut
FNOM	Nominal Crystal Frequency Range		27.000		MHz	Fundamental Mode – AT Cut
FNOM	Nominal Crystal Frequency Range		48.000		MHz	Fundamental Mode – AT Cut
CL	Nominal Crystal Load	8	12	18	pF	Load for +/-0 ppm Fo resonance value
R1,1	Equivalent Series Resistance	20	40	100	Ohm	F-Range: 8.0 to 12.999 MHz
R1,2	Equivalent Series Resistance	12.5	25	60	Ohm	F-Range: 13.0 to 19.999 MHz
R1,3	Equivalent Series Resistance	10	20	50	Ohm	F-Range: 20.0 to 48.000 MHz
DL1,1	Crystal Drive Level	-	-	200	µW	F-Range: 8.0 to 19.999 MHz
DL1,2	Crystal Drive Level	-	-	150	µW	F-Range: 20.0 to 48.000 MHz
Co1	Shunt Capacitance	-	4	5.4	pF	SMD Xtals
Co2	Shunt Capacitance	-	5	7.2	pF	Through Hole (Leaded) Xtals

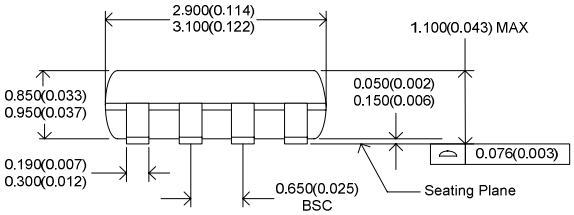
Table 2. Recommended Crystal Specifications

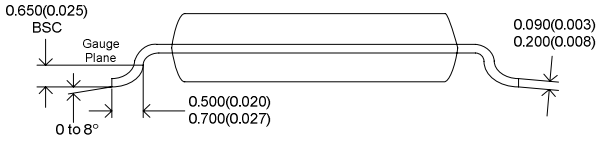
Package Outline and Package Dimensions

8-Pin TSSOP Package (173 Mil)



Dimensions are in milimeters(inches).
Top line: (MIN) and Bottom line: (Max)





Thermal Characteristics

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Thermal Resistance Junction to Ambient	θ JA	Still air	-	110	-	°C/W
	θ JA	1m/s air flow	-	100	-	°C/W
	θ JA	3m/s air flow	-	80	-	°C/W
Thermal Resistance Junction to Case	θ JC	Independent of air flow	-	35	-	°C/W

Ordering Information [1]

Ordering Number [2]	Marking	Shipping Package	Package	Temperature
SL19800BZC-XXX	**SL19800BZC-XXX**	Tube	8-pin TSSOP	0 to 70°C
SL19800BZC-XXX	**SL19800BZC-XXX**	Tape and Reel	8-pin TSSOP	0 to 70°C
SL19800BZI-XXXT	**SL19800BZI-XXX**	Tube	8-pin TSSOP	-40 to 85°C
SL19800BZI-XXXT	**SL19800BZI-XXX**	Tape and Reel	8-pin TSSOP	-40 to 85°C

Notes:

1. All SLI products are RoHS compliant.
2. Refer to the Table 1 for “XXX” product selection “Dash” numbers