

## Preliminary Data Sheet

### VSC7927

SONET/SDH 2.5Gb/s Laser Diode Driver

### Features

- Rise Times of Less Than 100ps
- High Speed Operation (Up to 2.5 Gb/s NRZ Data)
- Differential or Single-Ended Inputs
- Single Supply
- ECL-Compatible Clock and Data Inputs
- Direct Access to Modulation and Bias FETs
- Data Density Monitors
- On-Chip Reclocking Register
- On-Chip Mux for Clocked or Non-clocked Applications
- On-Chip 50Ω Input Termination: Clock and Data

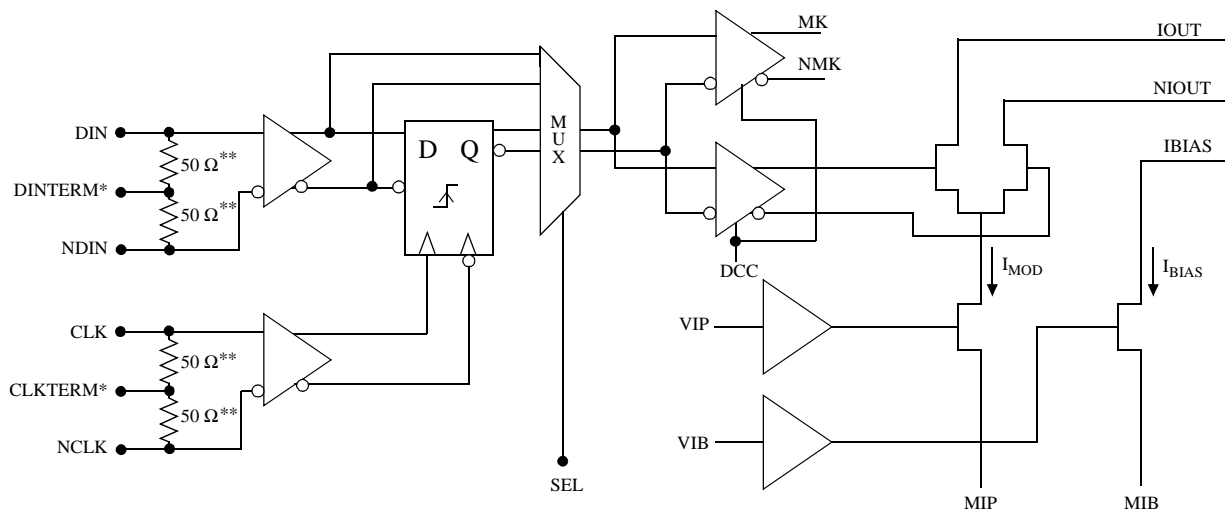
### General Description

The VSC7927 is a single 5V supply, 2.5 Gb/s laser diode driver with direct access to the laser modulation and bias FETs. Laser bias and modulation currents are set by external components allowing precision monitoring and setting of the current levels. Data density outputs are provided to allow the user to adjust the laser bias in high unbalanced data applications. Clock and data inputs are differentially terminated to 50Ω.

### Applications

- SDH/SONET @ 622Mb/s, 1.244Gb/s, 2.488Gb/s
- Full Speed Fibre Channel (1.062Gb/s)

### VSC7927 Block Diagram



\*Terminated to Off-chip Capacitor  
\*\*On Die Components

**Table 1: Signal Pin Reference**

Signal	Type	Level	# Pins	Description
DIN, NDIN	In	ECL	2	Data Input and Data Reference, On-chip 50Ω Termination
MK, NMK	Out	ECL	2	Data Density Differential Outputs
NIOUT	Out	—	1	Laser Modulation Current Output (Complementary)
IOUT	Out	—	1	Laser Modulation Current Output (to Laser Cathode)
VSS	Pwr	Pwr	2	Negative Voltage Rail
GND	Pwr	Pwr	5	Positive Voltage Rail
VIP	In	DC	1	Modulation Gate Node
MIP	In	DC	1	Modulation Source Node
VIB	In	DC	1	Bias Gate Node
MIB	In	DC	1	Bias Source Node
IBIAS	Out	DC	1	Laser Bias Output (To Laser Cathode)
CLK, NCLK	In	ECL	2	Clock Input and Clock Reference, On-chip 50Ω Termination
DINTERM	In	DC	1	Data Reference
CLKTERM	In	DC	1	Clock Reference
DCC	In	DC	1	Duty Cycle Control, Leave Floating
SEL	In	DC	1	Clk/Non-clk Data Select
Total Pins	—	—	24	

**Table 2: Mux Select Logic Table**

SEL	Mode Select
V <sub>SS</sub>	Clocked Data In
GND	Non-clocked Data In
N/C	Non-clocked Data In

**Table 3: Absolute Maximum Ratings**

Symbol	Rating	Limit
V <sub>SS</sub>	Negative Power Supply Voltage	V <sub>CC</sub> to -6.0V
T <sub>J</sub>	Maximum Junction Temperature	-55°C to +125°C
T <sub>STG</sub>	Storage Temperature	-65°C to +150°C

**Table 4: Recommended Operating Conditions**

Symbol	Parameter	Min	Typ	Max	Units	Conditions
GND	Positive Voltage Rail	—	0	—	V	
VSS	Negative Voltage Rail	-5.5	-5.2	-4.9	V	
T <sub>Cl</sub>	Operational Temperature <sup>(1)</sup>	-40	—	85 <sup>(2)</sup>	°C	Power dissipation = 1.3W
T <sub>J</sub>	Junction Temperature	—	—	125	°C	

NOTES: (1) Lower limit of specification is ambient temperature and upper limit is case temperature. (2) See section "Calculation of the Maximum Case Temperature" for detailed maximum temperature calculations.

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**Table 5: High Speed Inputs and ECL Outputs**

Symbol	Parameter	Min	Typ	Max	Units	Conditions
V <sub>IN</sub>	Single-ended Input Voltage Swing	300	—	1500	mVp-p	V <sub>CM</sub> = -2.0V
V <sub>CM</sub>	Differential Input Common Mode Range	-2.3	—	-1.3	V	V <sub>SS</sub> = -5.2V
V <sub>OH</sub>	ECL Output High Voltage	-1200	—	—	mV	50Ω to -2.0V
V <sub>OL</sub>	ECL Output Low Voltage	—	—	-1600	mV	50Ω to -2.0V
V <sub>IN</sub>	On-Chip Terminations	35	—	65	Ω	

**Table 6: Power Dissipation**

Symbol	Parameter	Min	Typ	Max	Units	Conditions
I <sub>VSS</sub>	Power Supply Current (VSS)	—	—	120	mA	V <sub>SS</sub> = -5.5V, I <sub>MOD</sub> = I <sub>BIAS</sub> = 0mA, MK/NMK open circuit
P <sub>D</sub>	Total Power Dissipation	—	—	700	mW	V <sub>SS</sub> = -5.5V, I <sub>MOD</sub> = I <sub>BIAS</sub> = 0mA, R <sub>LOAD</sub> = 25Ω to GND, MK/NMK terminated 50Ω to -2V

**Table 7: Laser Driver DC Electrical Specifications**

Symbol	Parameter	Min	Typ	Max	Units	Conditions
I <sub>BIAS</sub>	Programmable Laser Bias Current	2	—	100	mA	—
I <sub>MOD</sub>	Programmable Modulation Current	2	—	100	mA	—
V <sub>IB</sub>	Laser Bias Control Voltage	—	—	V <sub>SS</sub> + 2.1	V	I <sub>BIAS</sub> = 50mA
V <sub>IP</sub>	Laser Modulation Control Voltage	—	—	V <sub>SS</sub> + 2.1	V	I <sub>MOD</sub> = 60mA
V <sub>OCM</sub>	Output Voltage Compliance	—	GND - 3V	—	V	V <sub>SS</sub> = -5.2V

**Table 8: Laser Driver AC Electrical Specifications**

Symbol	Parameter	Min	Typ	Max	Units	Conditions
t <sub>R</sub> , t <sub>F</sub>	Output Rise and Fall Times	—	—	100	ps	25Ω load, 20%-80%, 20mA < I <sub>MOD</sub> < 60mA, I <sub>BIAS</sub> = 60mA
t <sub>SU</sub>	Data to Clock Setup Time	—	50	90	ps	—
t <sub>H</sub>	Hold Time	20	50	—	ps	—

**Table 9: Package Thermal Specifications**

Symbol	Parameter	Min	Typ	Max	Units	Conditions
θ <sub>JCC</sub>	Thermal Resistance from Junction-to-Case	—	25	—	°C/W	Ceramic Package

## **Calculation of the Maximum Case Temperature**

The VSC7927 is designed to operate with a maximum junction temperature of 125°C. The rise from the case to junction is determined by the power dissipation of the device. The power dissipation is determined by the V<sub>SS</sub> current plus the operating I<sub>MOD</sub> and I<sub>BIAS</sub> currents.

The power of the chip is determined by the following formula:

$$P_D = (-V_{SS} * I_{SS}) + ((V_{IOUT} - V_{SS}) * I_{MOD}) + ((V_{IBIAS} - V_{SS}) * I_{BIAS})$$

For example with:

$$\begin{aligned} V_{SS} &= -5.2V \\ I_{MOD} &= 40mA \\ I_{BIAS} &= 20mA \\ V_{IBIAS} &= -2.0V \\ V_{IOUT} &= -2.0V \end{aligned}$$

$$P_D = (-5.2 * 150mA) + ((5.2 - 2.0) * 40mA) + ((5.2 - 2.0) * 20mA)$$

$$P_D = 780mW + 128mW + 64mW = 972mW$$

The thermal rise from junction-to-case is  $\theta_{JC} * P_D$ . For the ceramic package,  $\theta_{JCP} = 25^\circ C/W$ . Thus the thermal rise is:

$$25^\circ C/W * 972mW = 24.3^\circ C$$

The maximum case temperature is:

$$125^\circ C - 24.3^\circ C = 100.7^\circ C$$

The absolute maximum power dissipation of the device is at:

$$\begin{aligned} V_{SS} &= -5.5V \\ I_{MOD} &= 60mA \\ I_{BIAS} &= 50mA \\ V_{IBIAS} &= 0V \\ V_{IOUT} &= 0V \end{aligned}$$

$$P_D = (5.5 * 150mA) + (5.5 * 60mA) + (5.5mA * 50mA)$$

$$P_D = 1.43W$$

This will net a maximum junction to case thermal rise of:  $1.43W * 25^\circ C/W = 35.8^\circ C$

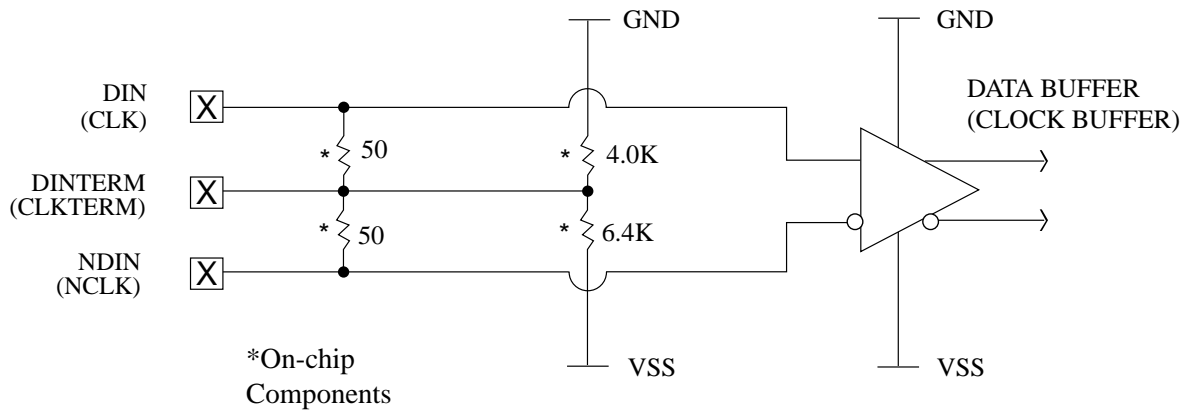
This situation will allow maximum case temperature of:  $35.8^\circ C - 58^\circ C = 89.2^\circ C$

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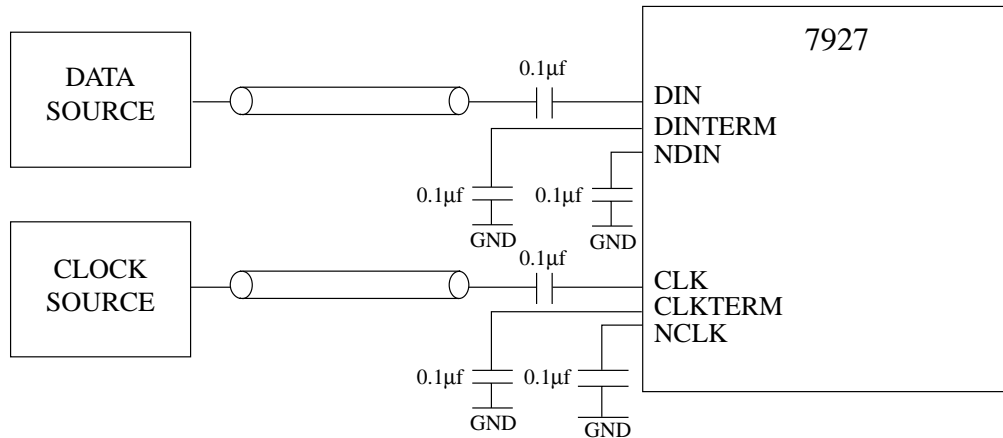
SONET/SDH 2.5Gb/s Laser Diode Driver

**Figure 1: On-chip Data and Clock Input Configuration**

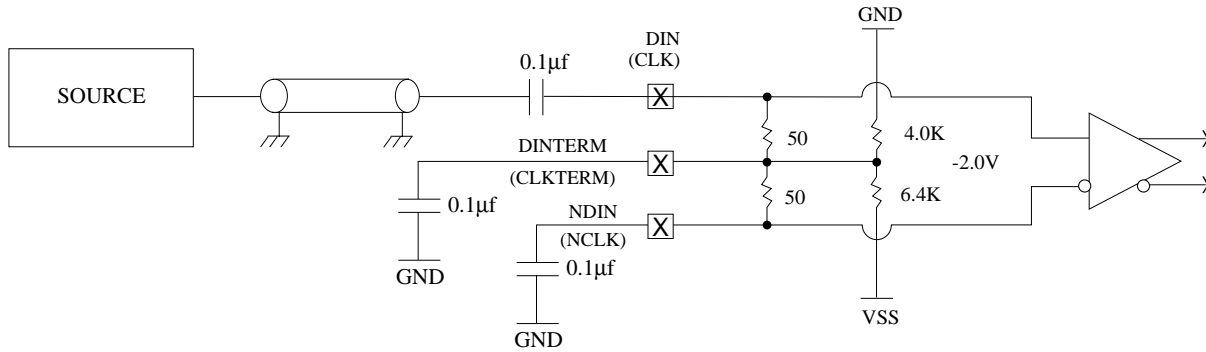


DINTERM to -2.0V for Differential ECL Inputs

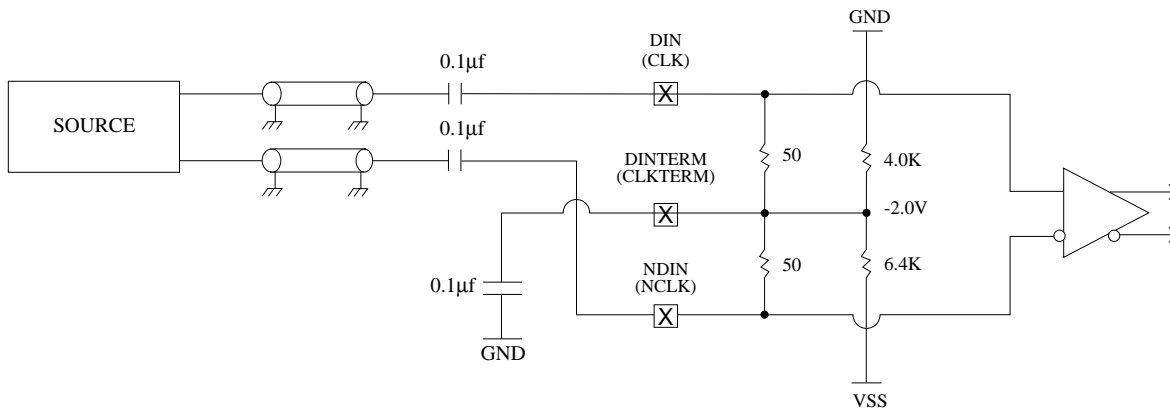
**Figure 2: Single-Ended Operation**



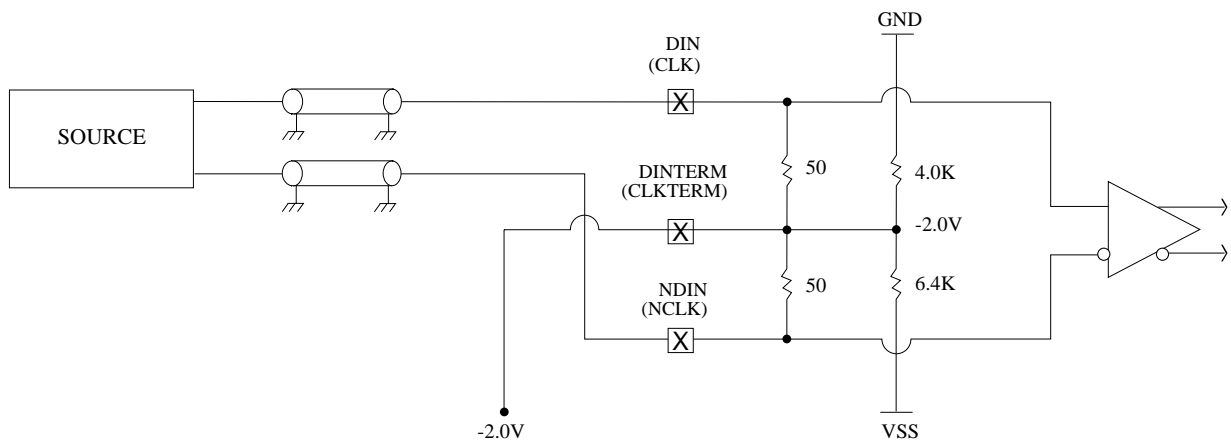
**Figure 3: Single-Ended AC-Coupled**



**Figure 4: Differential AC-Coupled**



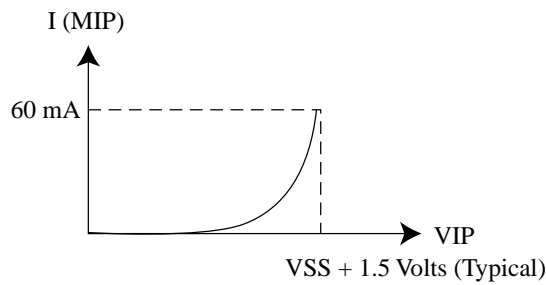
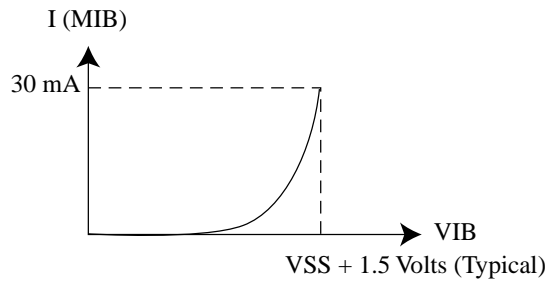
**Figure 5: Differential DC-Coupled**



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**Figure 6: Control Signals VIP and VIB**



**Figure 7: Simplified Output Structure**

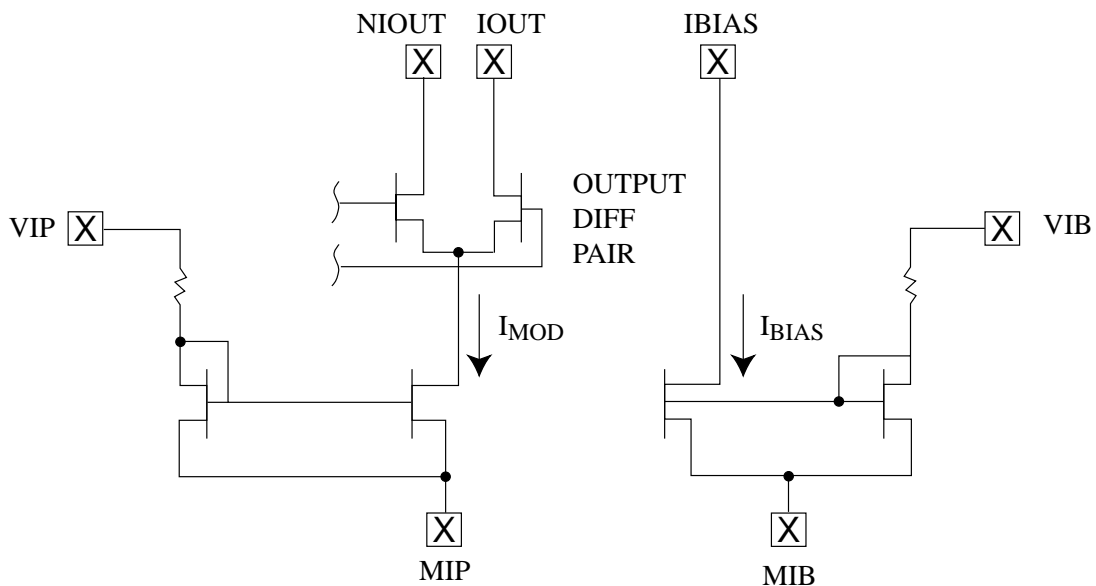
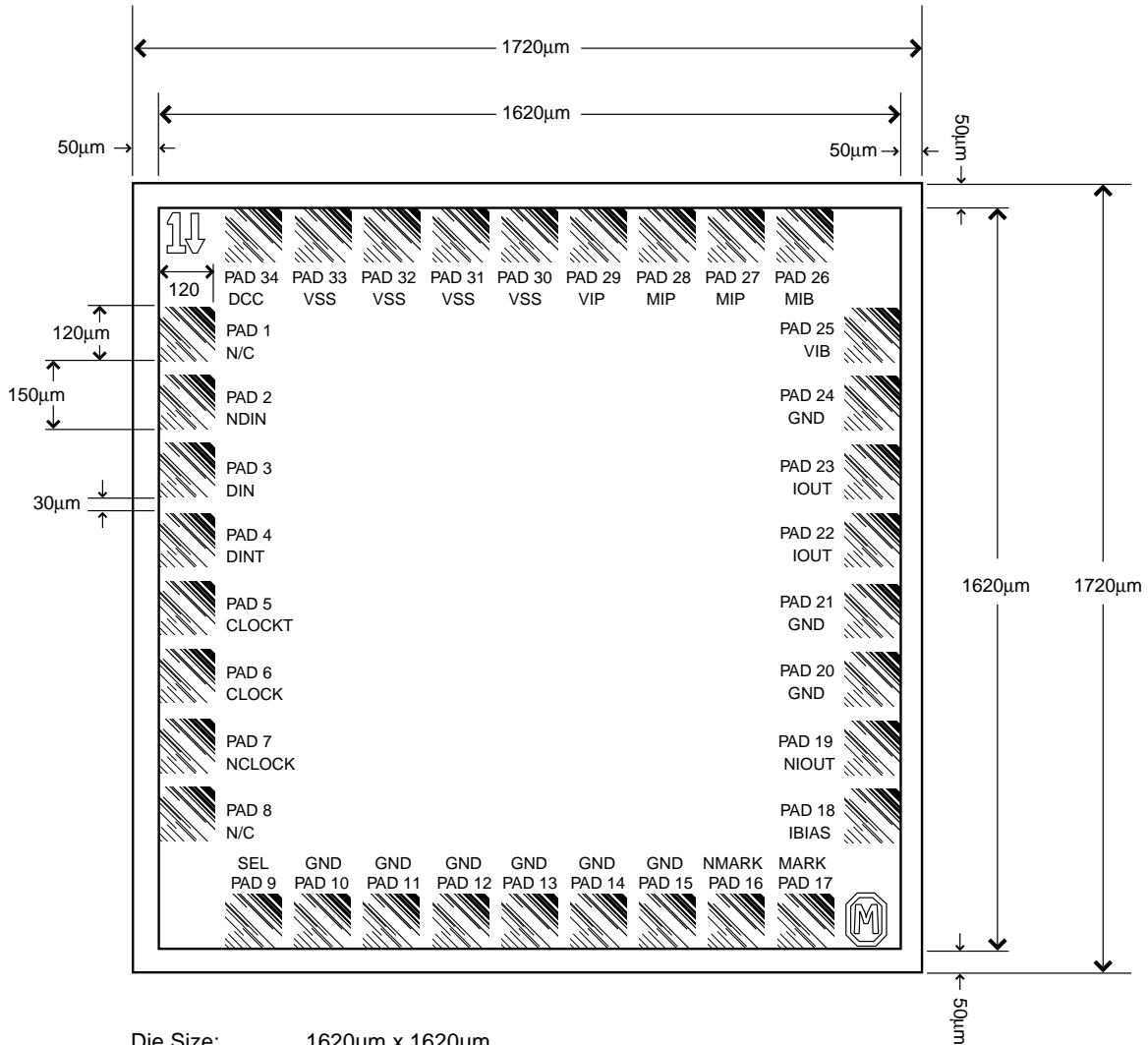


Figure 8: Pad Assignments for VSC7927 Die



Die Size: 1620µm x 1620µm  
 Actual Die Size: 1720µm x 1720µm (after the die are cut up)  
 Pad Size: 120µm x 120µm  
 Pad Pitch: 150µm  
 Space Between Pads: 30µm

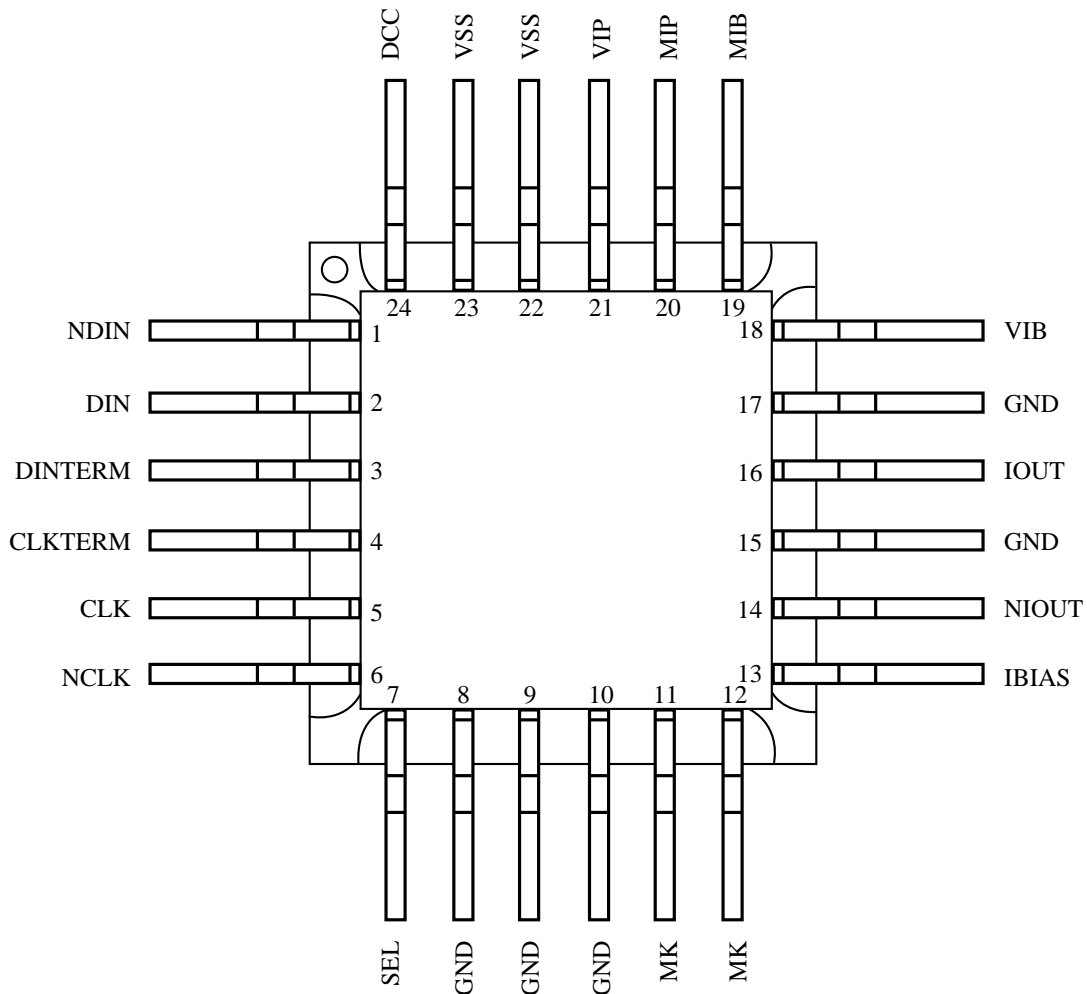


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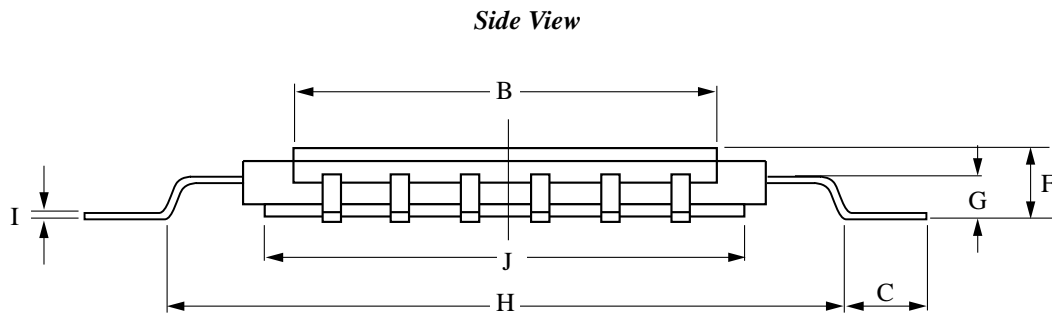
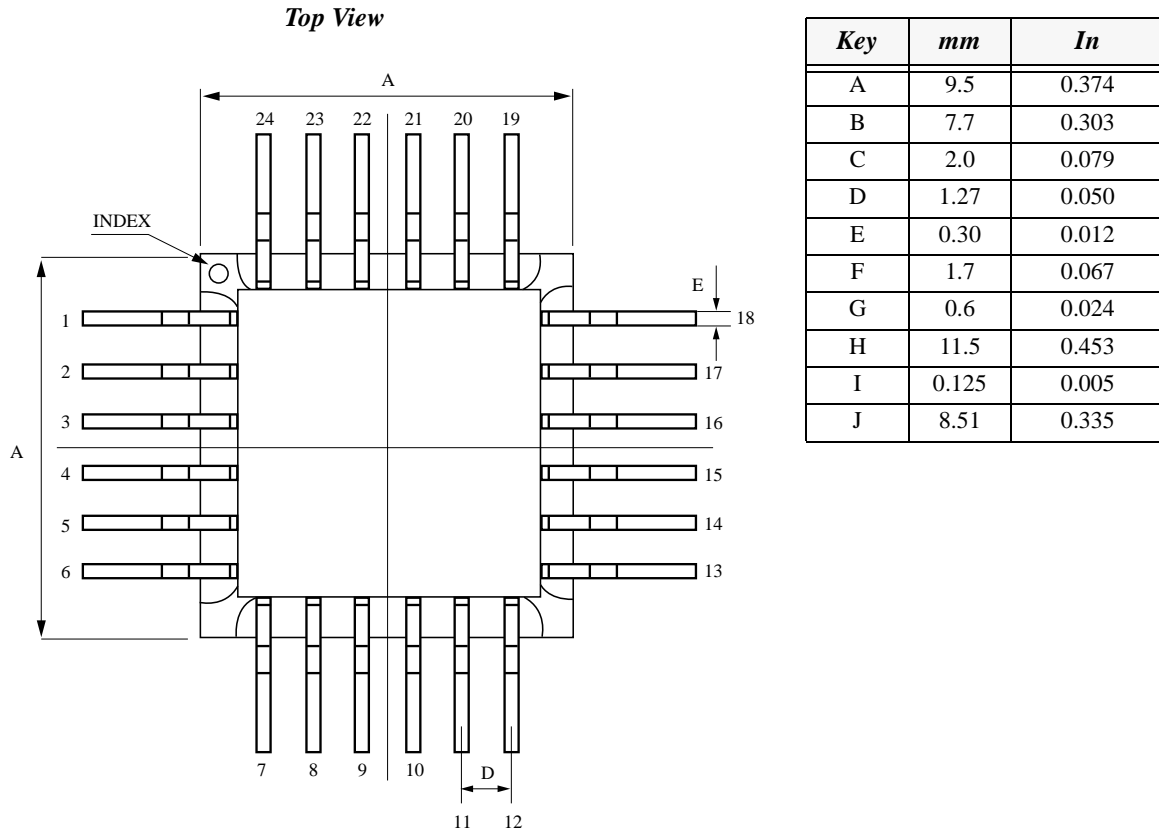
SONET/SDH 2.5Gb/s Laser Diode Driver

#### Pin Diagram for 24-Pin Ceramic Package



**Note:** Package lid and bottom heat spreader are electrically connected to GND within the package.

**Package Information - 24 Pin Ceramic Package (Formed Leads)**



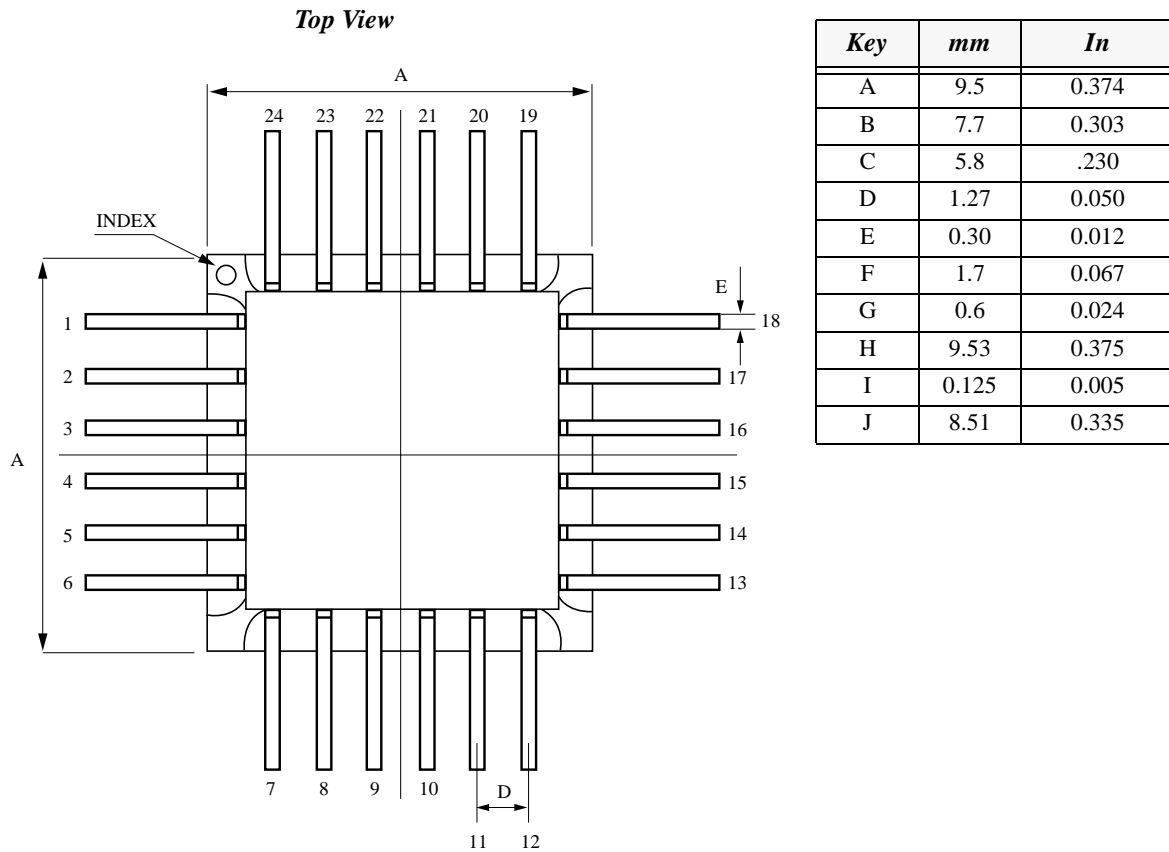
NOTES: Drawing not to scale.  
Package #: 101-000-0 Issue #:1

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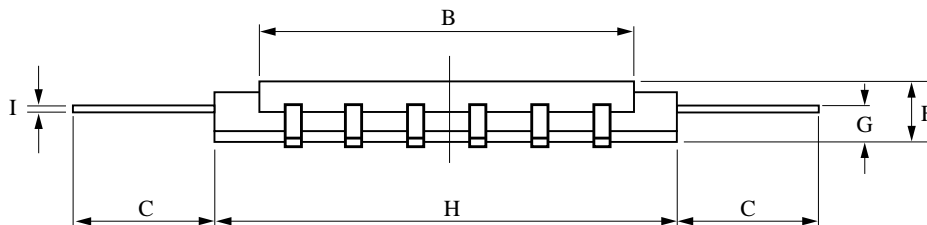
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#### Package Information - 24 Pin Ceramic Package (Straight Leads)



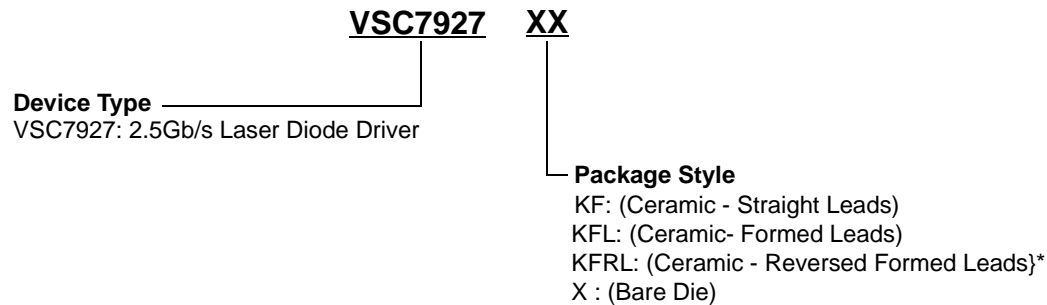
**Side View**



NOTES: Drawing not to scale.

### Ordering Information

The order number for this product is formed by a combination of the device number, and package style.



\*Optional Reversed Formed Leads: Package leads have the same profile and dimensions, but heat spreader is away from board. Please contact the factory for additional information.

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