Advance Product Information

VSC7927

SDH/SONET 2.5Gb/s
Laser Diode Driver

Features

- Rise Times 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 FET's
- Data Density Monitors
- On-chip Reclocking Register
- On-chip Mux for Clocked or Non-clocked Applications
- On-chip 50 Ohm Input Termination: Clock and Data

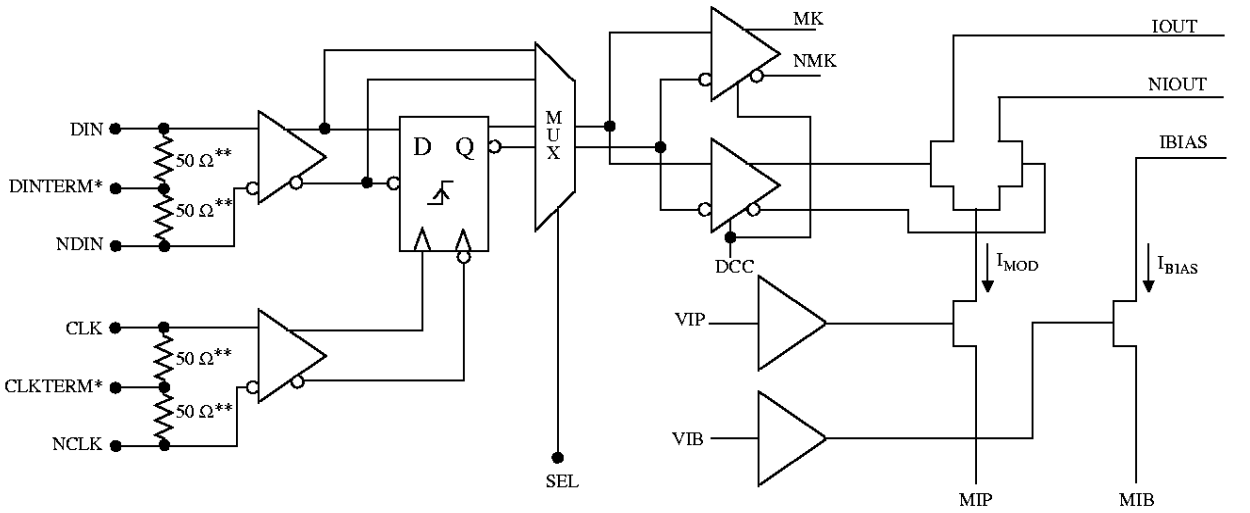
Introduction

The VSC7927 is a single 5V supply, 2.5 Gb/s laser diode driver with direct access to the laser modulation and bias FET's. 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 50 Ohms.

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

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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	3	Negative Voltage Rail
GND	Pwr	Pwr	4	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_{SS}	Clocked Data In
GND	Non-clocked Data In
N/C	Non-clocked Data In

Table 3: Absolute Maximum Ratings

Symbol	*Rating*	*Limit*
V_{SS}	Negative Power Supply Voltage	V_{CC} to -6.0V
T_j	Maximum Junction Temperature	-55C to + 125C
T_{stg}	Storage Temperature	-65C to +150C

Table 4: High Speed Inputs and ECL Outputs

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

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Table 5: 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	
Tc_l	*Operational Temperature	-40		85**	C	Power dissipation = 1.25W
Tj	Junction Temperature			125	C	

**Lower limit of specification is ambient temperature and upper limit is case temperature.*
***See section "Calculation of the Maximum Case Temperature" for detailed maximum temperature calculations.*

Table 6: Power Dissipation

Symbol	Parameter	Min	Typ	Max	Units	Conditions
I_{VSS}	Power Supply Current (VSS)	-	-	150	mA	V_{SS} = -5.5, I_{MOD} = I_{BIAS} = 0 mA
Pd	Total Power Dissipation	-	-	825	mW	V_{SS} = -5.5, I_{MOD} = I_{BIAS} = 0 mA, Rload = 25 Ohms to GND
Pdmax	Maximum Power Dissipation	-	-	1430	mW	V_{SS} = -5.5, I_{MOD} = 60mA, I_{BIAS} = 50 mA, I_{OUT} = 0 Volts

Table 7: Laser Driver DC Electrical Specifications

Symbol	Parameter	Min	Typ	Max	Units	Conditions
I_{BIAS}	Programmable Laser Bias Current	2		50	mA	-
I_{MOD}	Programmable Modulation Current	2	-	60	mA	
V_{IB}	Laser Bias Control Voltage			V_{SS} + 2.1	V	I_{BIAS} = 50 mA
V_{IP}	Laser Modulation Control Voltage			V_{SS} + 2.1	V	I_{MOD}= 60 mA
V_{OCM}	Output Voltage Compliance		GND -2.5V		V	V_{SS} = -5.2V

Table 8: Laser Driver AC Electrical Specifications

Symbol	Parameter	Min	Typ	Max	Units	Conditions
t_r t_f	Output Rise and Fall Times			100	ps	25 Ohm load, 20%-80%, 20mA < I_{MOD} < 60mA, I_{BIAS} = 20mA
t_{su}	t Setup Data to Clock		50		ps	
t_h	t Hold		50		ps	

Table 9: Package Thermal Specifications

Symbol	Parameter	Min	Typ	Max	Units	Conditions
θ_{JCC}	Thermal Resistance from Junction to Case		25		°C/W	Ceramic Package
θ_{JCMG}	Thermal Resistance from Junction to Case		32		°C/W	Metal Glass 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_{SS} current plus the operating I_{MOD} and I_{BIAS} 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:

V_{SS} = -5.2V
I_{MOD} = 40mA
I_{BIAS} = 20mA
V_{IBIAS} = -2.0V
V_{IOUT} = -2.0V

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

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

The thermal rise from junction to case is $\theta_{JC} * P_D$. For the metal glass package, θ_{JC} = 32 °C/W. Thus the thermal rise is:

32°C/W * 1.336W = 31.1°C

The maximum case temperature is:

125°C – 31.1°C = 93.9°C

The absolute maximum power dissipation of the device is at:

V_{SS} = -5.5V
I_{MOD} = 60mA
I_{BIAS} = 50mA
V_{IBIAS} = 0V
V_{IOUT} = 0V

$$P_D = (5.5 * 150mA) + (5.5 * 60mA) + (5.5mA * 50mA) \quad P_D = 1.43W$$

This will net a maximum junction to case thermal rise of: 1.43W * 32°C/W = 45.8°C

This situation will allow maximum case temperature of: 125°C – 58°C = 79.2°C

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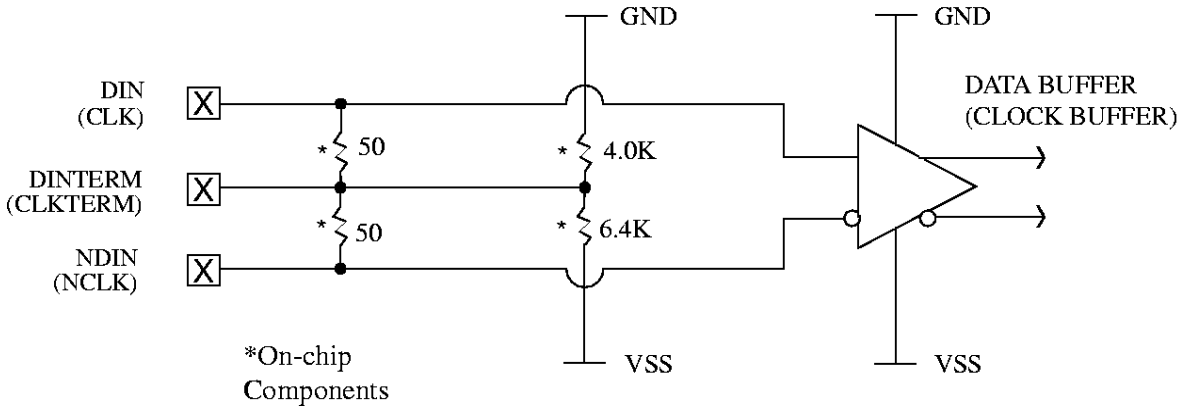
Figure 1: On-chip Data and Clock Input Configuration



DINTERM to -2.0V for Differential ECL Inputs

Figure 2: Single Ended Operation

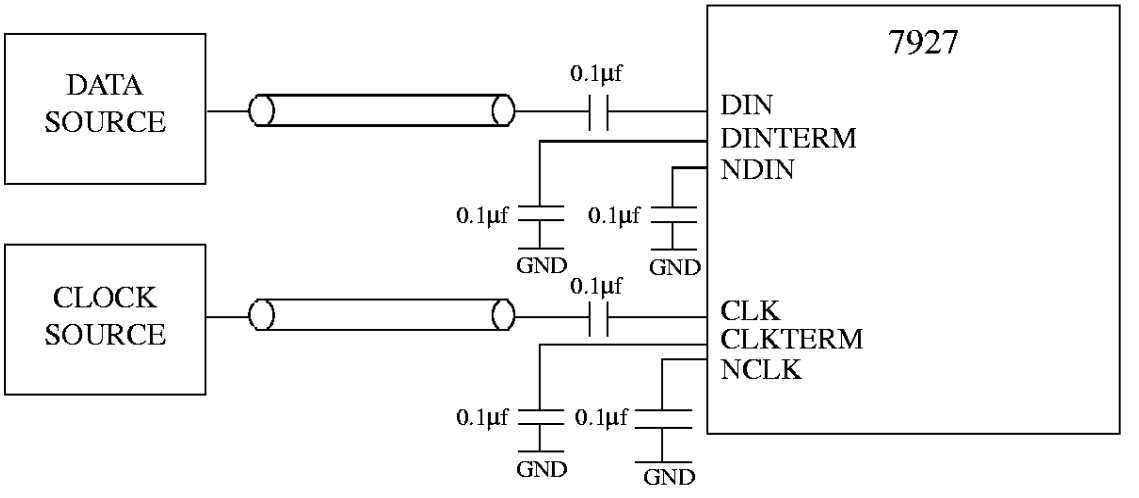


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Figure 3: Single Ended AC Coupled

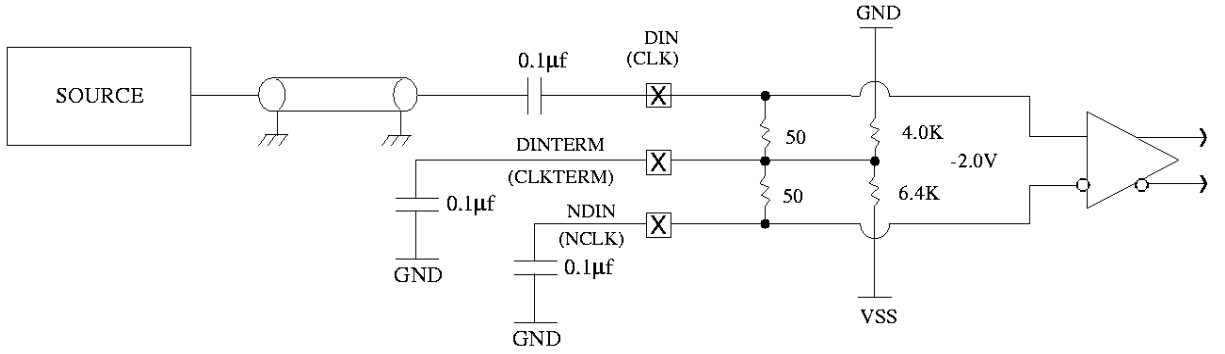

Figure 4: Differential AC Coupled

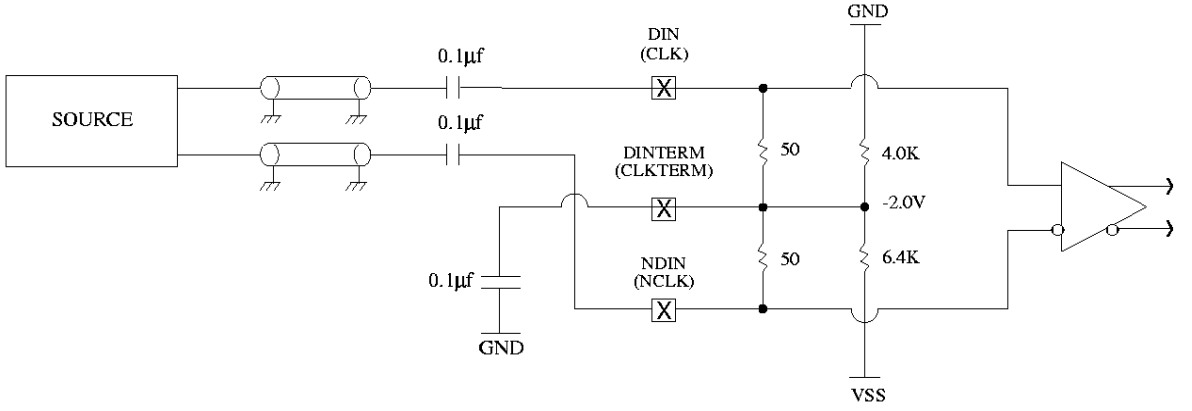

Figure 5: Differential DC Coupled

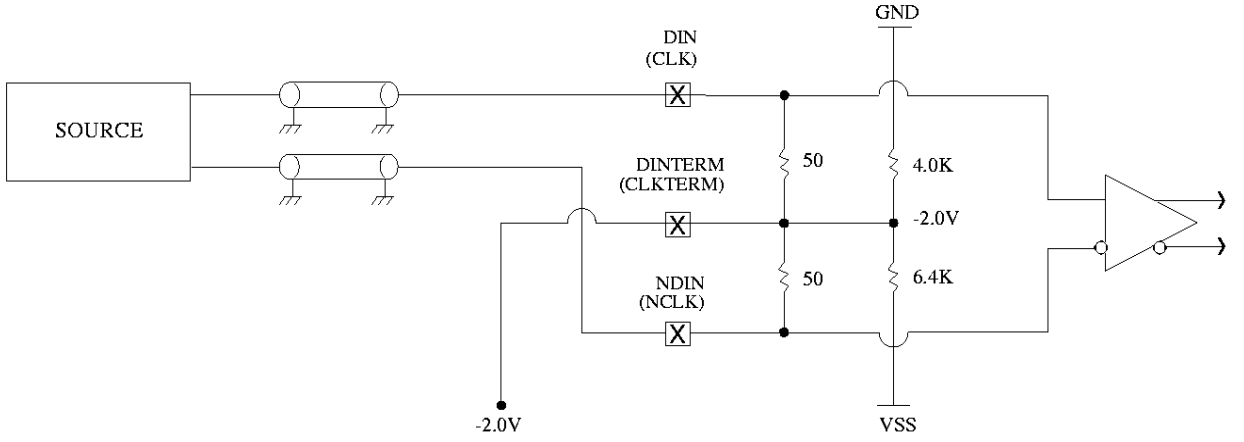

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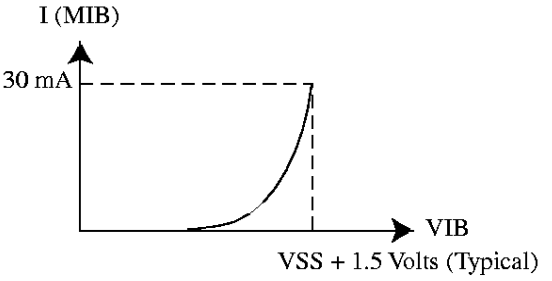
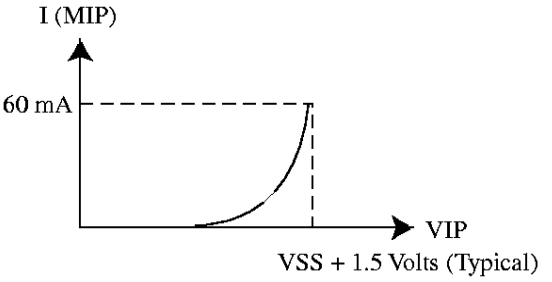
Figure 6: Control Signals VIP and VIB

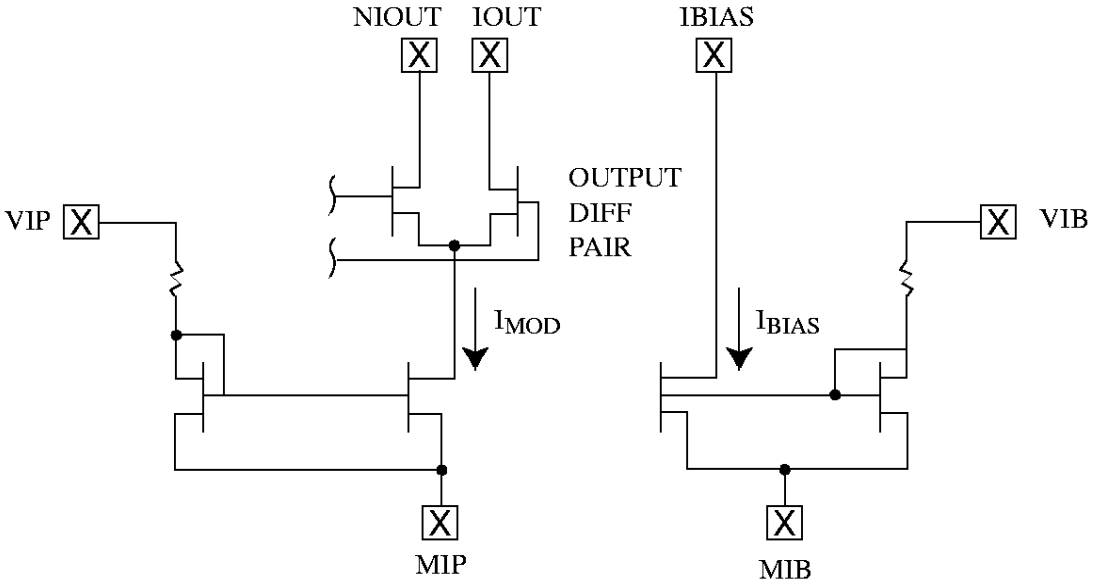


Typical Bias Current v.s. Bias Voltage



Typical Modulation Current v.s. Modulation Voltage

Figure 7: Simplified Output Structure



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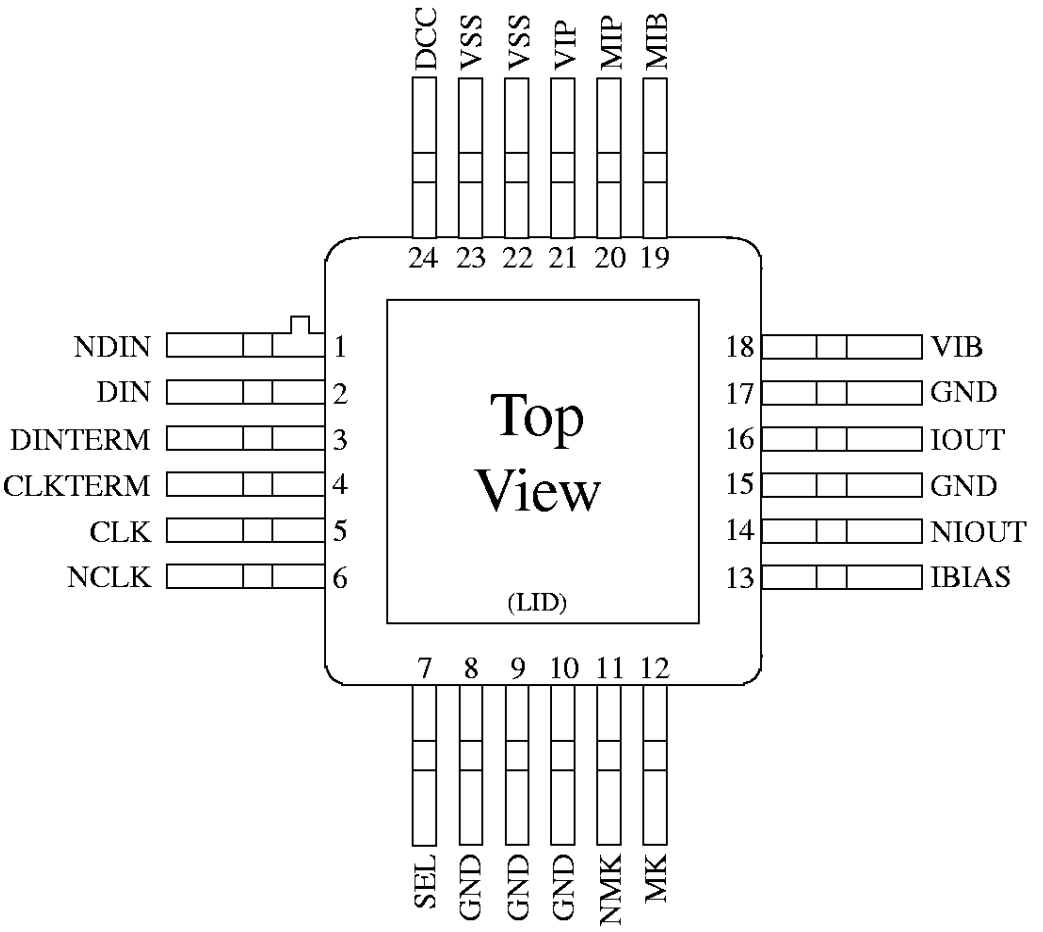
Pin Diagram for 24 Pin Metal-Glass Package



Note: ***Package bottom plate is connected to GND within the package. Package lid is electrically unconnected.***

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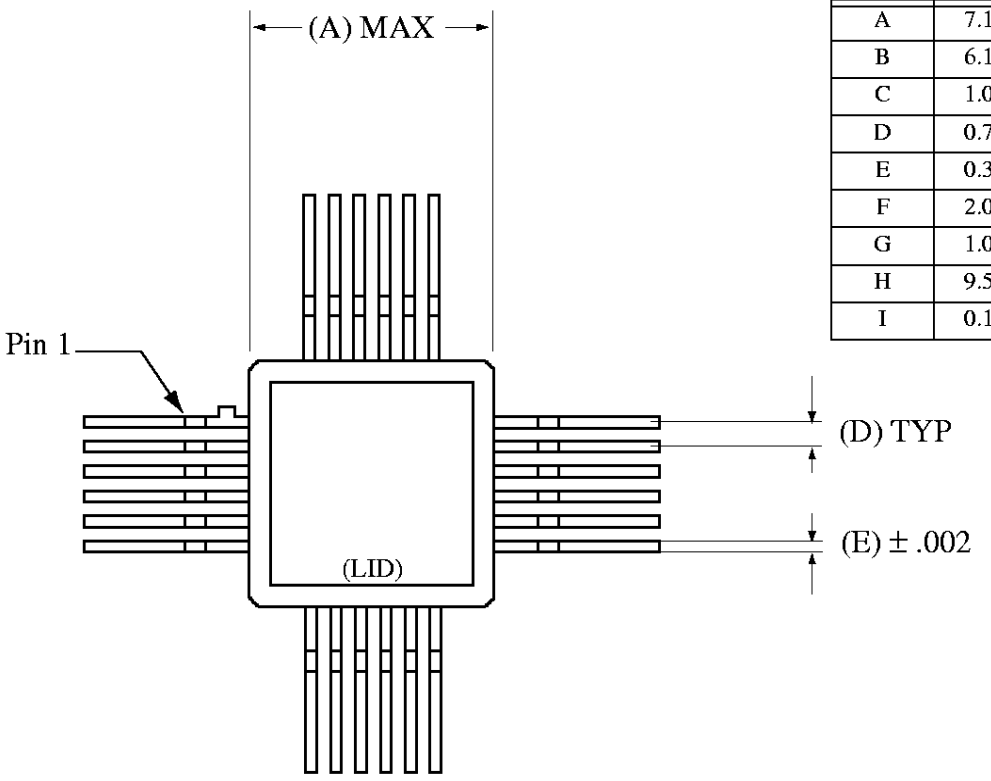
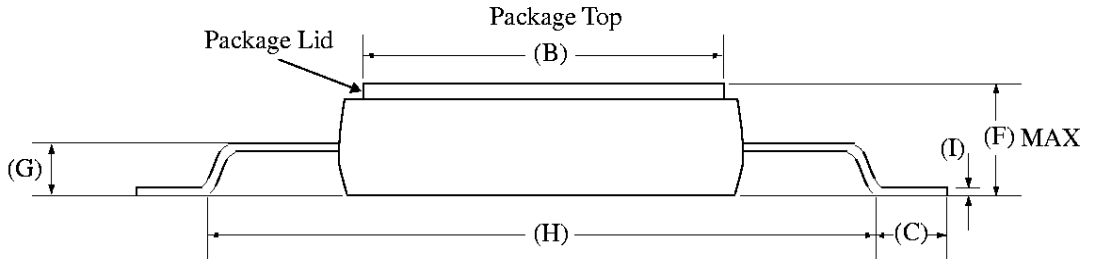
Package Information - 24 Pin Metal-Glass Package

Top View



Key	mm	In
A	7.11	0.280
B	6.10	0.240
C	1.02	0.040
D	0.76	0.030
E	0.30	0.012
F	2.08	0.082
G	1.02	0.040
H	9.52	0.375
I	0.13	0.005

Side View



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

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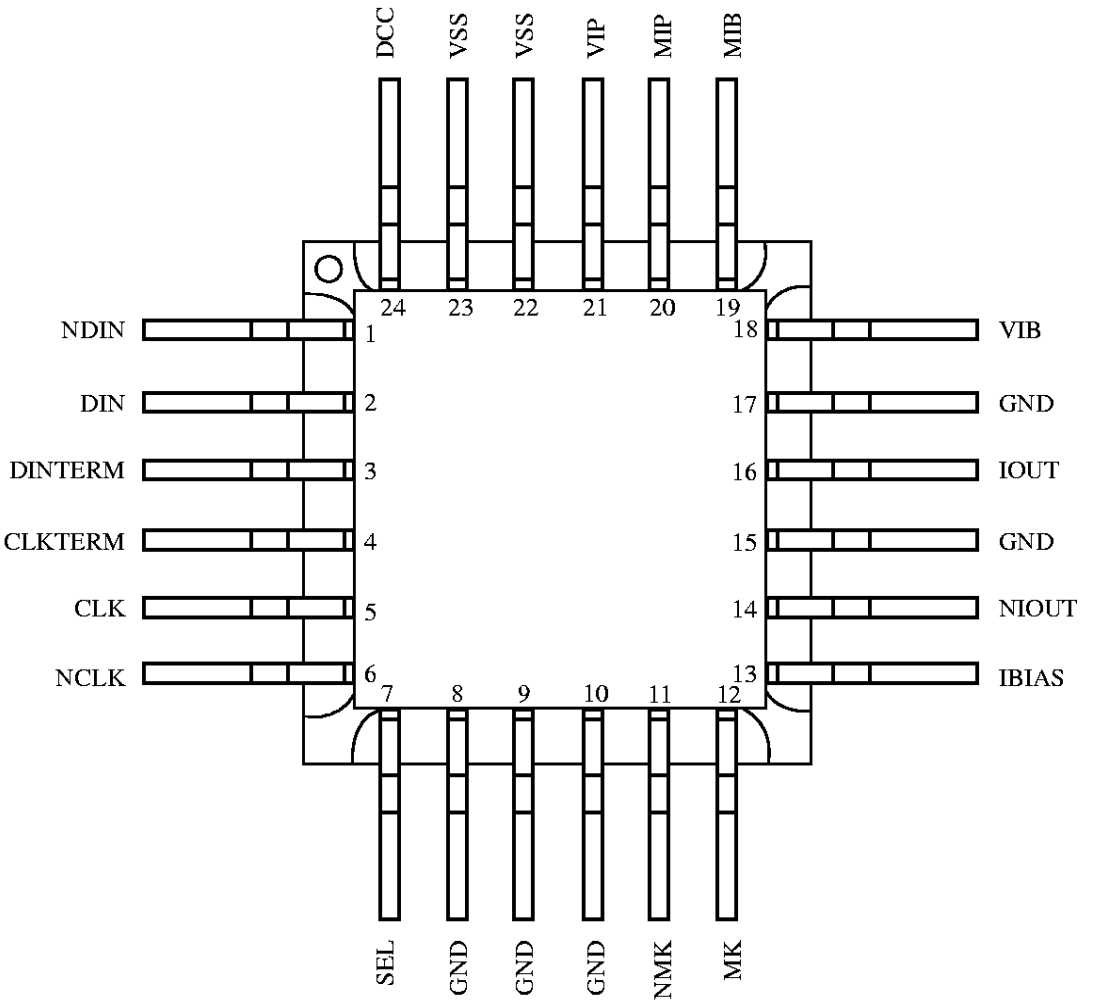
Pin Diagram for 24 Pin Ceramic Package



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

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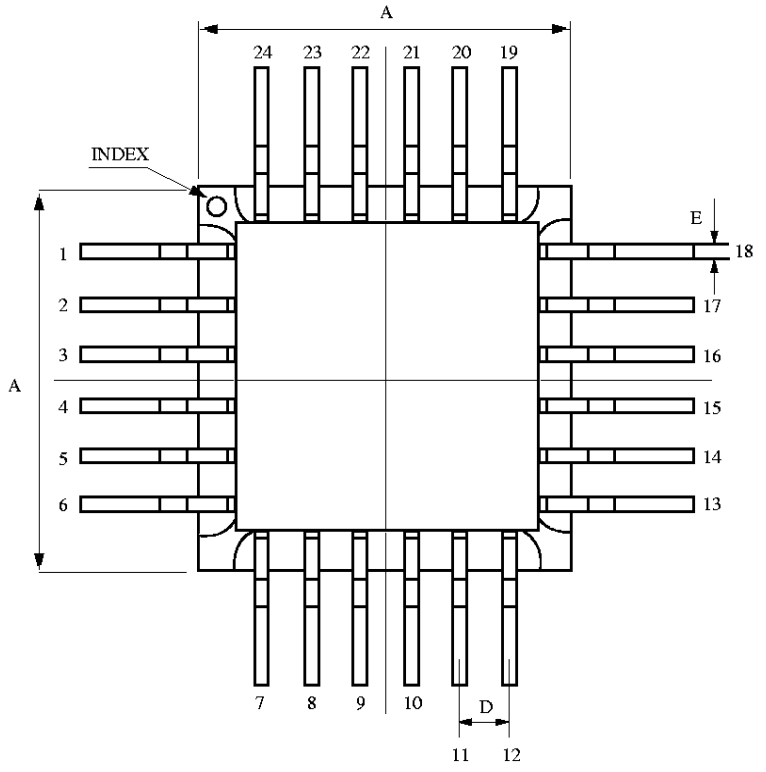
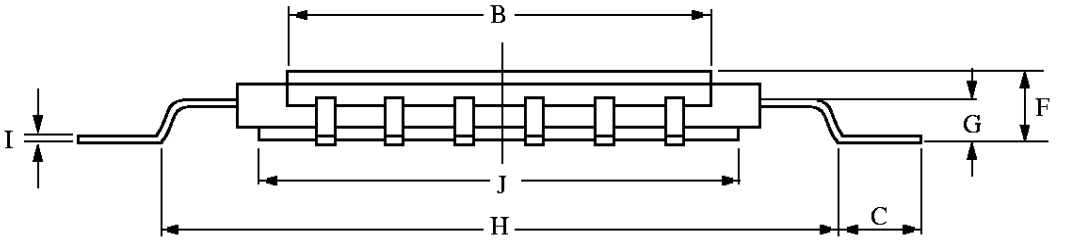
Package Information - 24 Pin Ceramic Package

Top View



Key	mm	In
A	9.5	0.374
B	7.7	0.303
C	2.0	0.079
D	1.27	0.050
E	0.30	0.012
F	1.7	0.067
G	0.6	0.024
H	11.5	0.453
I	0.125	0.005
J	8.51	0.335

Side View



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

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Ordering Information

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

VSC7927 **XXX-T** Tape and Reel Devices

Device Type
VSC7927: 2.5Gb/s Laser Diode Driver

Package Style
CA: (Metal Glass - Straight Leads)
KF: (Ceramic - Straight Leads)
CAL: (Metal Glass - Formed Leads)
KFL: (Ceramic- Formed Leads)
KFRL: (Ceramic - Reversed Formed Leads}*

*Reversed Formed Leads: Package leads have the same profile and dimensions, but heat spreader is away from board

Notice

This document contains information about a new product during its fabrication or early sampling phase of development. The information in this document is based on design targets, simulation results or early prototype test results. Characteristic data and other specifications are subject to change without notice. Therefore the reader is cautioned to confirm that this datasheet is current prior to design or order placement.

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