Preliminary Data Sheet

VSC7926

SDH/SONET 2.5Gb/s Laser Diode Driver

Features

- Rise Times of Less Than 100ps
- High-Speed Operation (Up to 2.5Gb/s NRZ Data)
- Differential Inputs
- Single Supply
- Direct Access to Modulation and Bias FETs
- Data Density Monitors
- On-Chip Reclocking Register

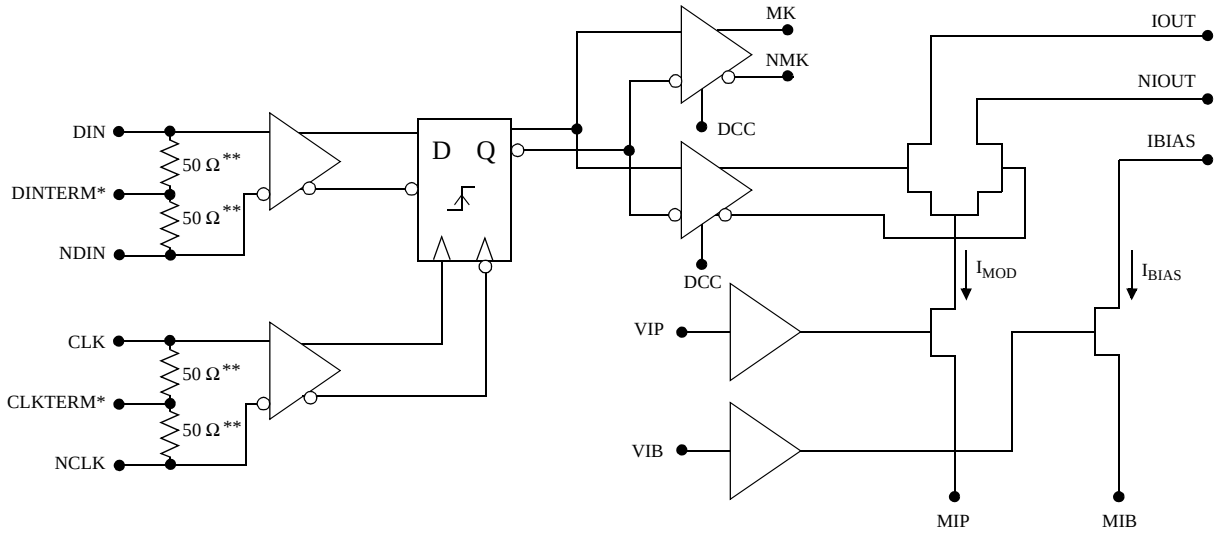
General Description

The VSC7926 is a single 5V supply, 2.5Gb/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)

VSC7926 Block Diagram



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

Table 1: Signal Pin Reference

Signal	*Type*	*Level*	*# Pins*	*Description*
DIN, NDIN	In		2	Data Input and Data Reference
DINTERM	Ref	DC	1	Data Termination
CLKTERM	Ref	DC	1	Clock 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	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		2	Clock Input and Clock Reference
DCC	In	DC	1	Duty Cycle Control, Leave Floating
Total Pins			24	

Table 2: Absolute Maximum Ratings

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

Table 3: High Speed Inputs and ECL Outputs

Symbol	*Parameter*	*Min*	*Max*	*Units*	*Conditions*
V_{IN}	Differential Input Voltage Swing	500	1000	mV	
V_{CM}	Differential Input Common Mode Range	-2.3	-1.3	V	V_{SS} = -5.2V
V_{OH}	ECL Output High Voltage	-1200		mV	50Ω to -2.0V
V_{OL}	ECL Output Low Voltage		-1600	mV	50Ω to -2.0V

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	
Tc_l	Operational Temperature(1)	-40	-	85(2)	°C	Power dissipation = 1.25W
T_J	Junction Temperature	-	-	125	°C	

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

Table 5: Power Dissipation

Symbol	*Parameter*	*Min*	*Typ*	*Max*	*Units*	*Conditions*
I_{VSS}	Power Supply Current (VSS)	-	-	220	mA	V_{SS} = -5.5, I_{MOD} = I_{BIAS} = 0mA
P_D	Total Power Dissipation	-	-	1210	mW	V_{SS} = -5.5, I_{MOD} = I_{BIAS} = 0mA, R_{LOAD} = 25Ω to GND
P_{DMAX}	Maximum Power Dissipation	-	-	1815	mW	V_{SS} = -5.5, I_{MOD} = 60mA, I_{BIAS} = 50mA, I_{OUT} = 0V

Table 6: 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} = 50mA
V_{IP}	Laser Modulation Control Voltage	-	-	V_{SS} + 2.1	V	I_{MOD}= 60mA
V_{OCM}	Output Voltage Compliance	GND -2.5V	-	-	V	V_{SS} = -5.2V

Table 7: Laser Driver AC Electrical Specifications

Symbol	*Parameter*	*Min*	*Typ*	*Max*	*Units*	*Conditions*
t_R t_F	Output Rise and Fall Times	-	-	100	ps	25Ω load, 20%-80%, 15mA < I_{MOD} < 60 mA, I_{BIAS} = 40mA
t_{SU}	Setup Data to Clock Setup Time	-	50	-	ps	
t_H	Hold Time	-	50	-	ps	

Table 8: Package Thermal Specifications

Symbol	*Parameter*	*Min*	*Typ*	*Max*	*Units*	*Conditions*
θ_{JCC}	Thermal Resistance from Junction-to-Case	-	25	-	°C/W	Ceramic Package

Calculation of the Maximum Case Temperature

The VSC7926 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 * 220mA) + ((5.2 - 2.0) * 40mA) + ((5.2_- 2.0) * 20mA)

P_D = 1144mW + 128mW + 64mW = 1.336W

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

25°C/W * 1.336W = 33.4°C

The maximum case temperature is:

125°C – 33.4°C = 91.6°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

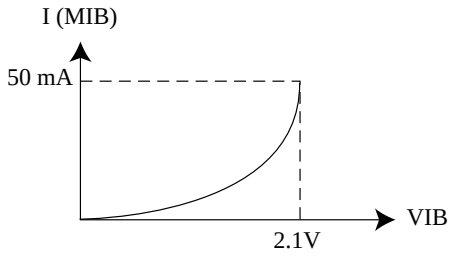
P_D = (5.5 * 220mA) + (5.5 * 60mA) + (5.5mA * 50mA)

P_D = 1.815W

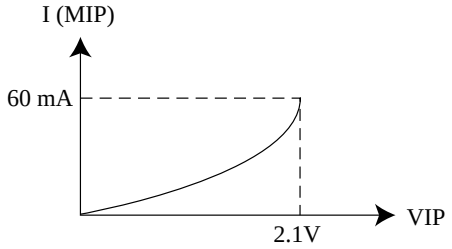
This will net a maximum junction to case thermal rise of: 1.815W * 25°C/W = 45.4°C

This situation will allow maximum case temperature of: 125°C – 45.4°C = 79.6°C

Figure 1: Control Signals VIP and VIB



Typical Bias Current v.s. Bias Voltage



Typical Modulation Current v.s. Modulation Voltage

Figure 2: Simplified Output Structure

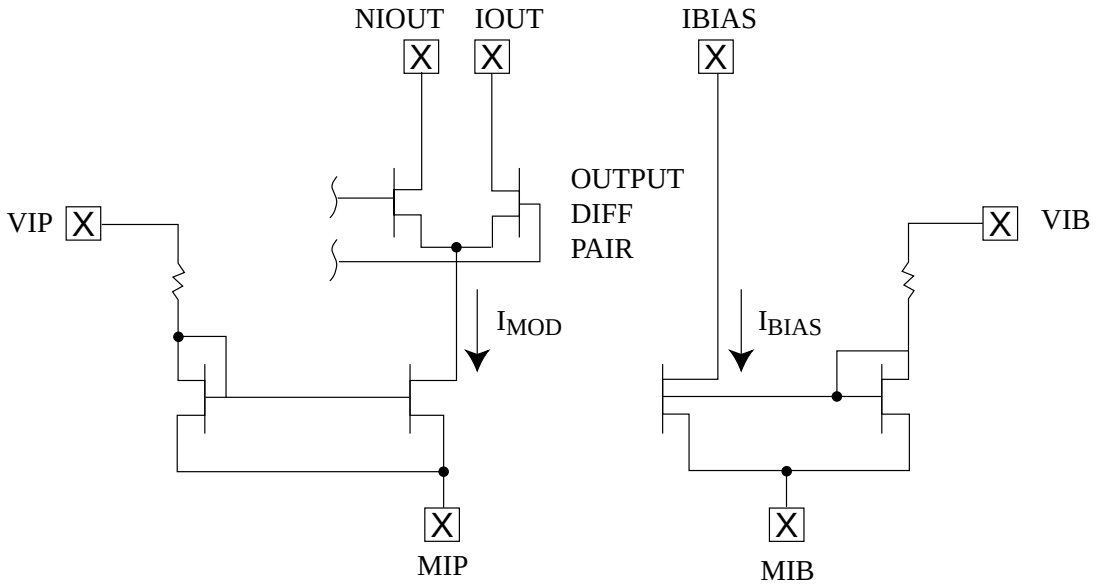
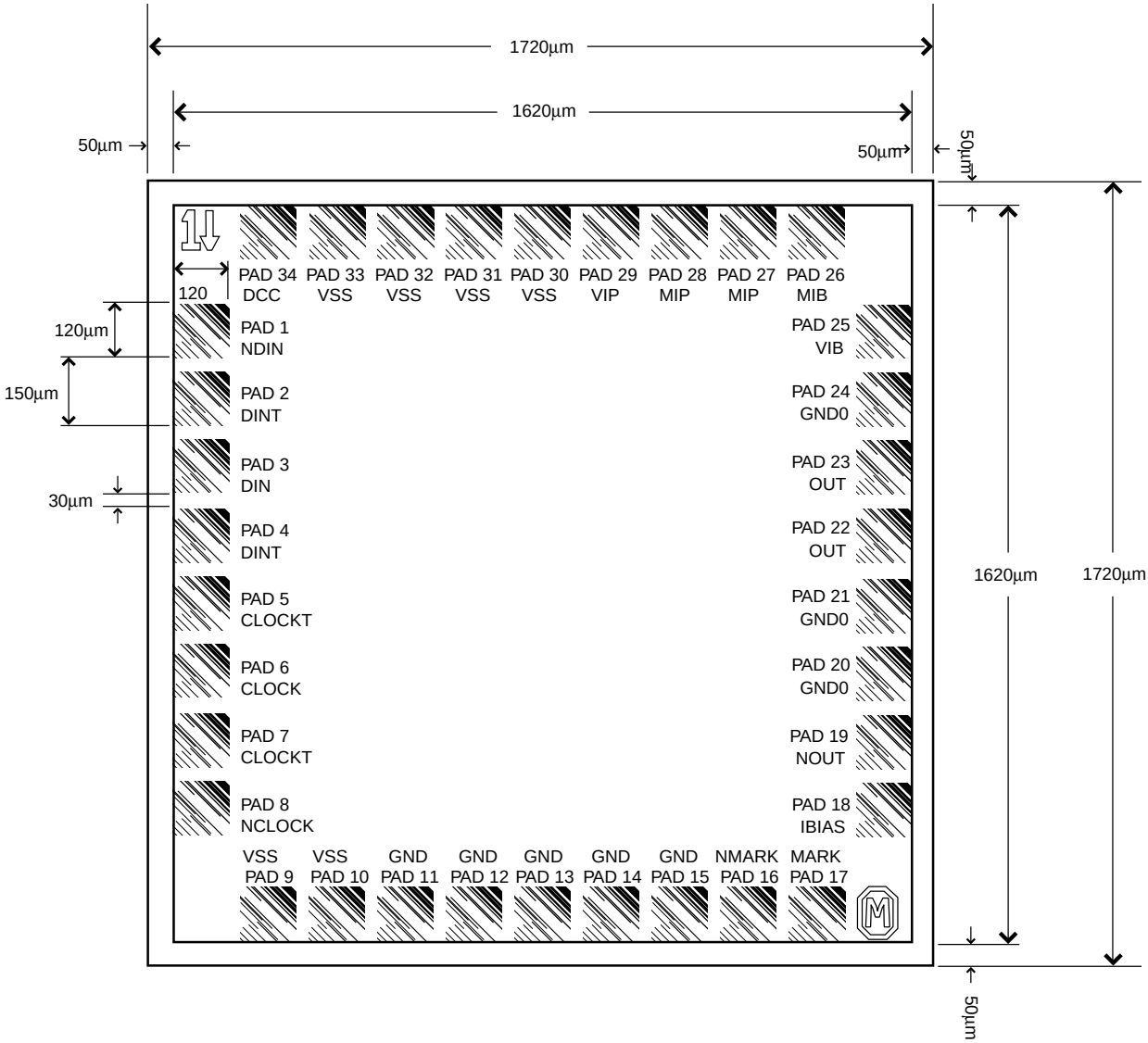
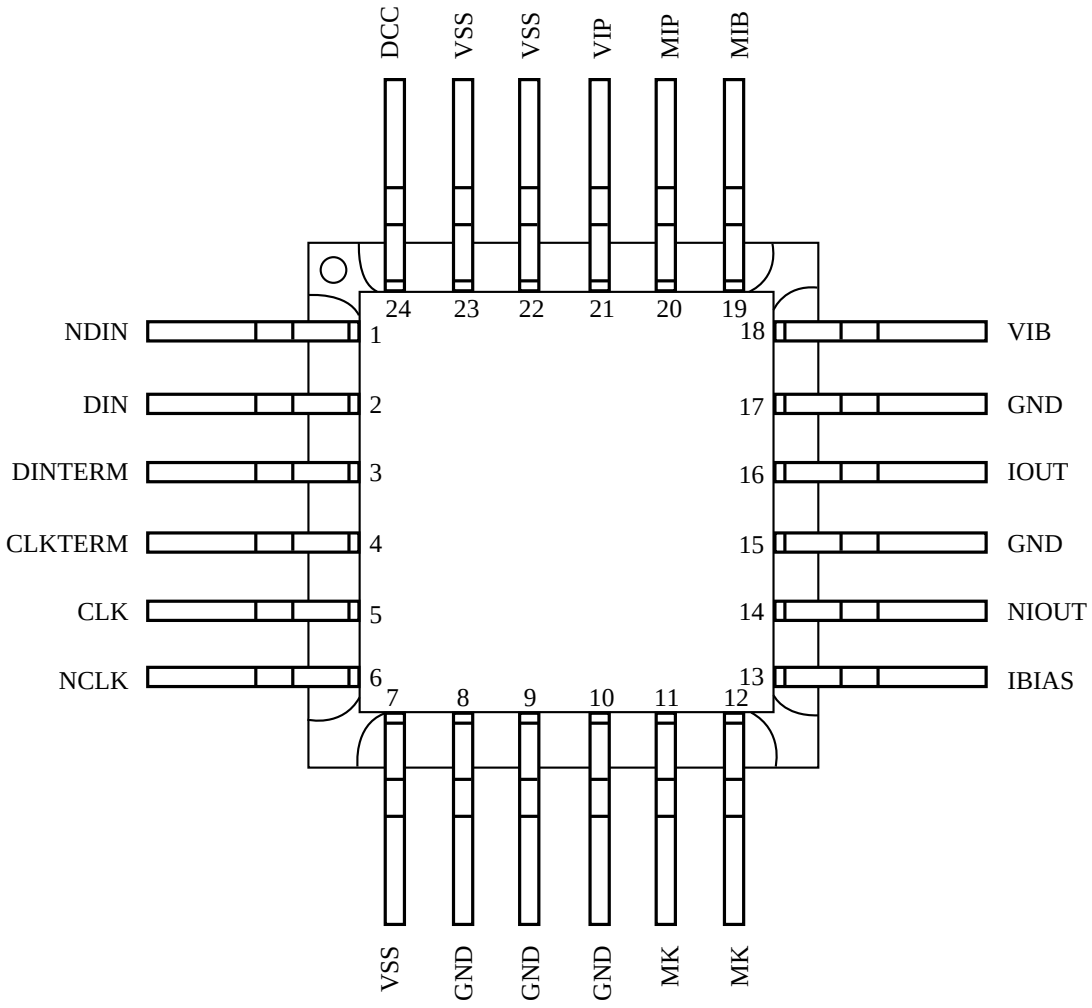


Figure 3: Pad Assignments for VSC7926 Die



Die Size: 1620µm x 1620µm
Actual Die Size: 1720µmx1720µm (after the die are cut up)
Pad Size: 120µm x 120µm
Pad Pitch: 150µm
Space Between Pads: 30µm

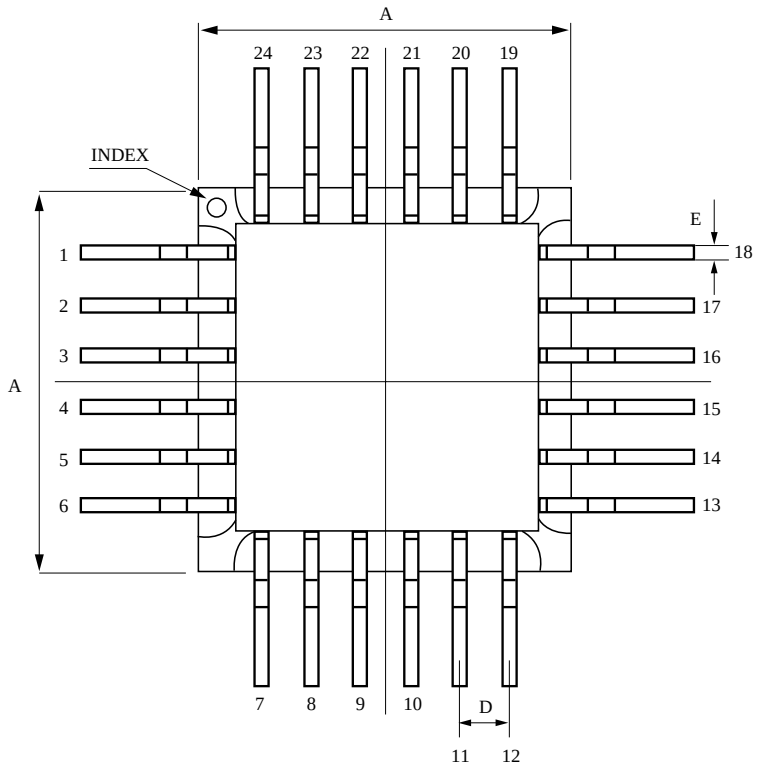
Pin Diagram for 24-Pin Ceramic Package



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

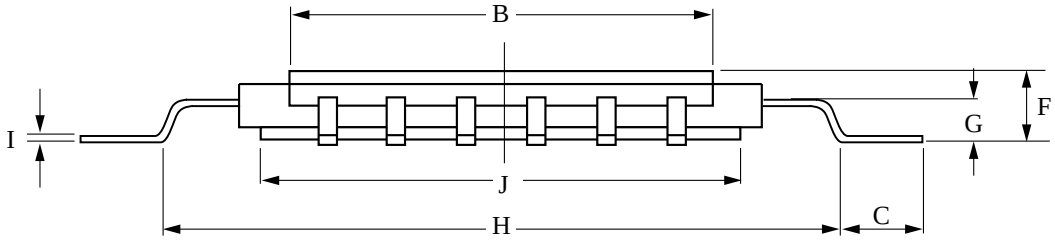
Package Information - 24-Pin Ceramic Package (Formed Leads)

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

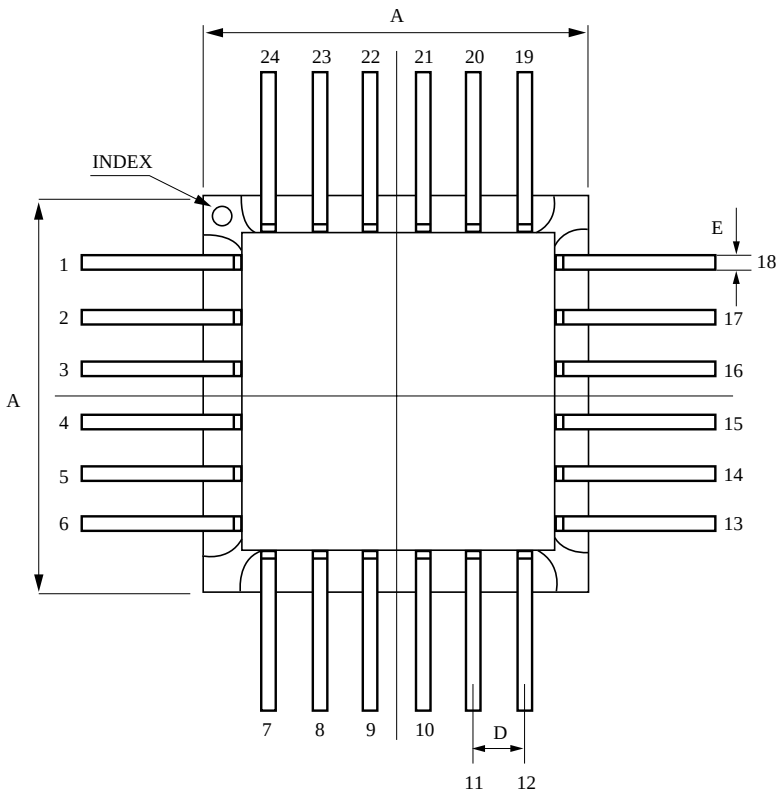
Side View



NOTES: Drawing not to scale.
Package #: 101-300-7, Issue #:1
Lid #: 101-303-1, Issue #:1

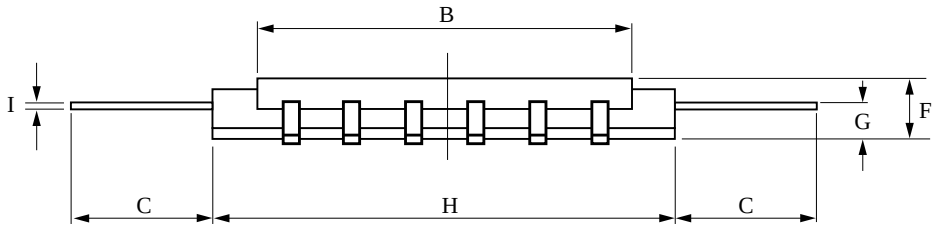
Package Information - 24-Pin Ceramic Package (Straight Leads)

Top View



Key	*mm*	*In*
A	9.5	0.374
B	7.7	0.303
C	5.8	.230
D	1.27	0.050
E	0.30	0.012
F	1.7	0.067
G	0.6	0.024
H	9.53	0.375
I	0.125	0.005
J	8.51	0.335

Side View



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

Ordering Information

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

VSC7926 XX

Device Type
VSC7926: 2.5Gb/s Laser Diode Driver

Package Style
KF: (Ceramic - Straight Leads)
KFL: (Ceramic- Formed Leads)
W: Dice Waffle Pack

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