VITESSE
SEMICONDUCTOR CORPORATION

Preliminary Data Sheet

VSC7923

SONET/SDH 2.5Gb/s Laser Diode Driver

Features

- Rise Times Less Than 100ps
- High Speed Operation (Up to 2.4Gb/s NRZ Data)
- Single-Ended or Differential Input Operation
- Single Power Supply
- Direct Access to Modulation and Bias FETs
- Data Density Monitors

Applications

- SONET/SDH at 622Mb/s, 1.244Gb/s, 2.488Gb/s, 3.125Gb/s
- Full-Speed Fibre Channel (1.062Gb/s)

General Description

The VSC7923 is a single 5V supply, 2.4 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 inputs accept ECL levels. Data density outputs are provided to allow the user to adjust the laser bias in high unbalanced data applications.

VSC7923 Block Diagram

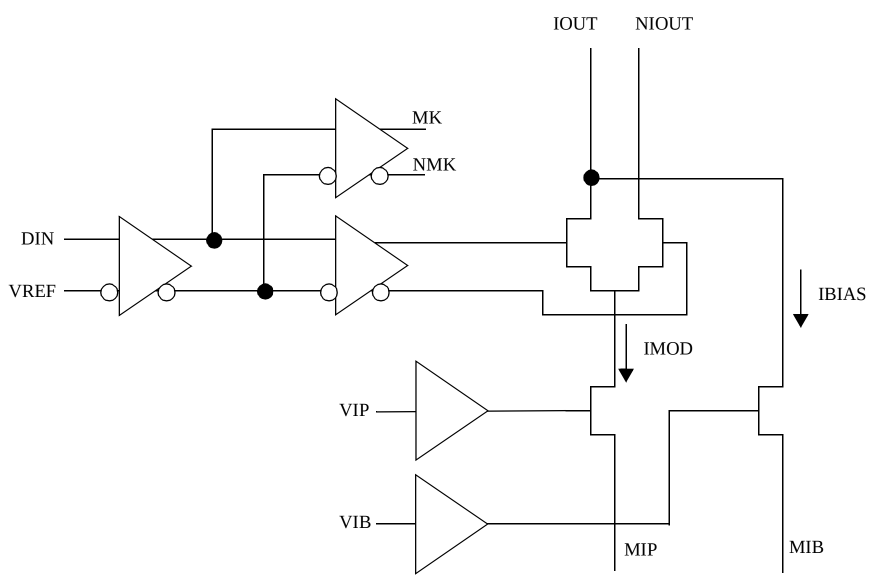


Table 1: Signal Pin Reference

Signal	Type	Level	# Pins	Description
DIN	In	ECL	1	Data Input
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	5	Negative Voltage Rail
GND	Pwr	Pwr	9	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
VREF	In	DC	1	Data Input Reference
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: 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_{Cl}	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 section "Calculation of the Maximum Case Temperature" for detailed maximum temperature calculations.

Table 4: ECL Input and Outputs

Symbol	Parameter	Min	Typ	Max	Units	Conditions
V_{IN}	Input Voltage Swing	300	—	800	mV	Peak-to-peak, V_{REF} = -2.0V
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 5: Power Dissipation

Symbol	Parameter	Min	Typ	Max	Units	Conditions
I_{VSS}	Power Supply Current (VSS)	—	—	220	mA	V_{SS} = -5.5V, I_{MOD} = I_{BIAS} = 0mA
P_D	Total Power Dissipation	—	—	1210	mW	V_{SS} = -5.5V, I_{MOD} = I_{BIAS} = 0mA, R_{LOAD} = 25Ω to GND
P_{DMAX}	Maximum Power Dissipation	—	—	1815	mW	V_{SS} = -5.5V, 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 - 2.2V	—	—	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} < 60mA, I_{BIAS} = 20mA

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
θ_{JCMG}	Thermal Resistance from Junction-to-Case	—	32	—	°C/W	Metal Glass Package

Calculation of the Maximum Case Temperature

The VSC7923 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:

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

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)

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

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

32°C/W * 1.336W = 42.7°C

The maximum case temperature is:

125°C – 42.7°C = 82.3°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)

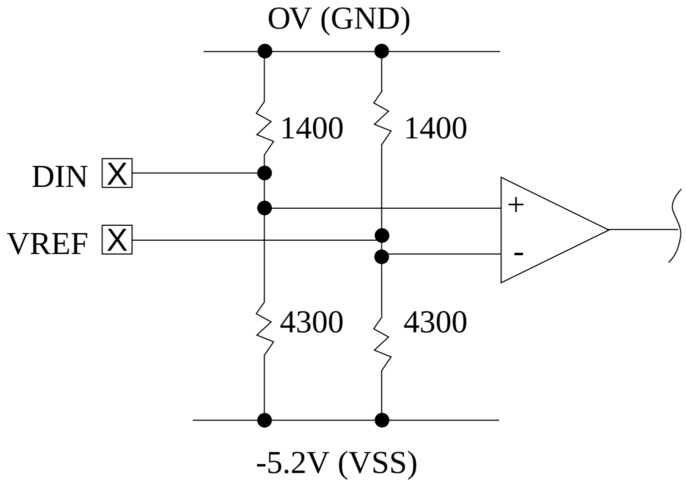
P_D = 1.815W

This will net a maximum junction to case thermal rise of: 1.815W * 32°C/W = 58°C

This situation will allow maximum case temperature of: 125°C – 58°C = 67°C

Input Termination Schemes

Figure 1: Input Structure



- Nominal VREF = -1.3V
- 1400, 4300 Ohm Resistor on die, nominal values

Figure 2: Single Ended AC Coupled

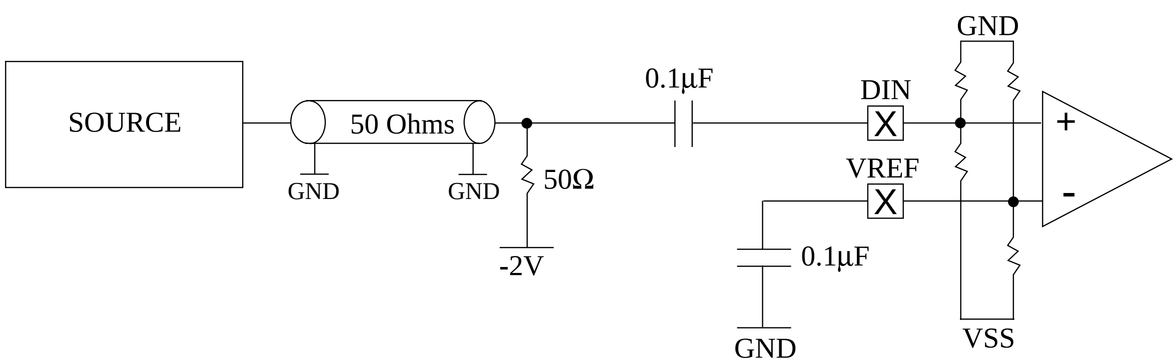


Figure 3: Differential AC Coupled

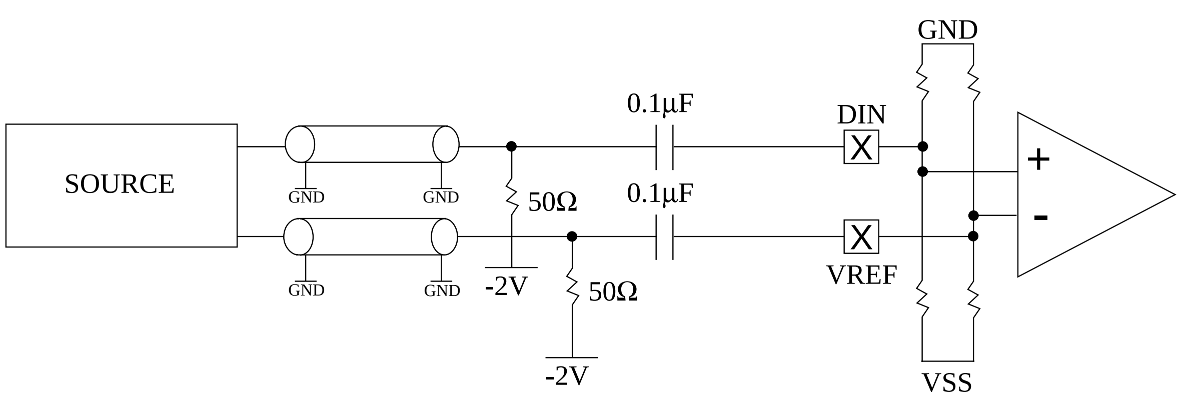


Figure 4: Differential DC Coupled

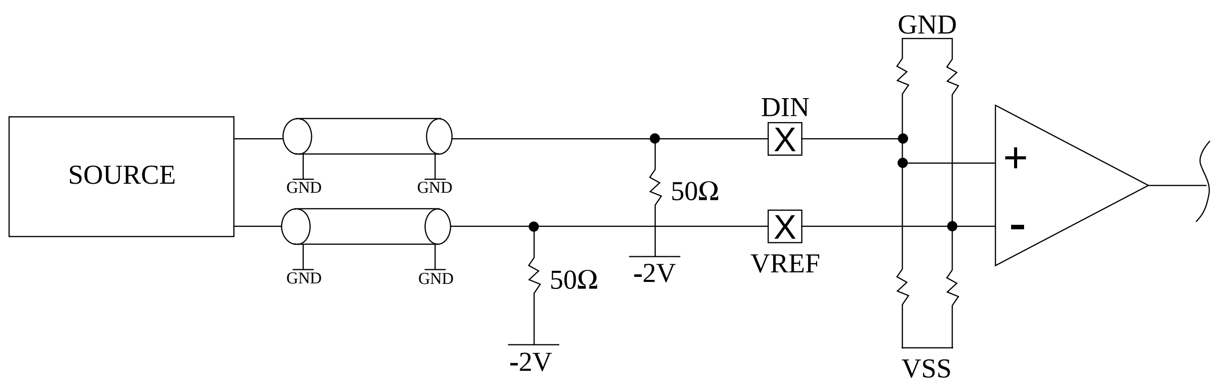


Figure 5: Single Ended AC Coupled with Offset Adjust

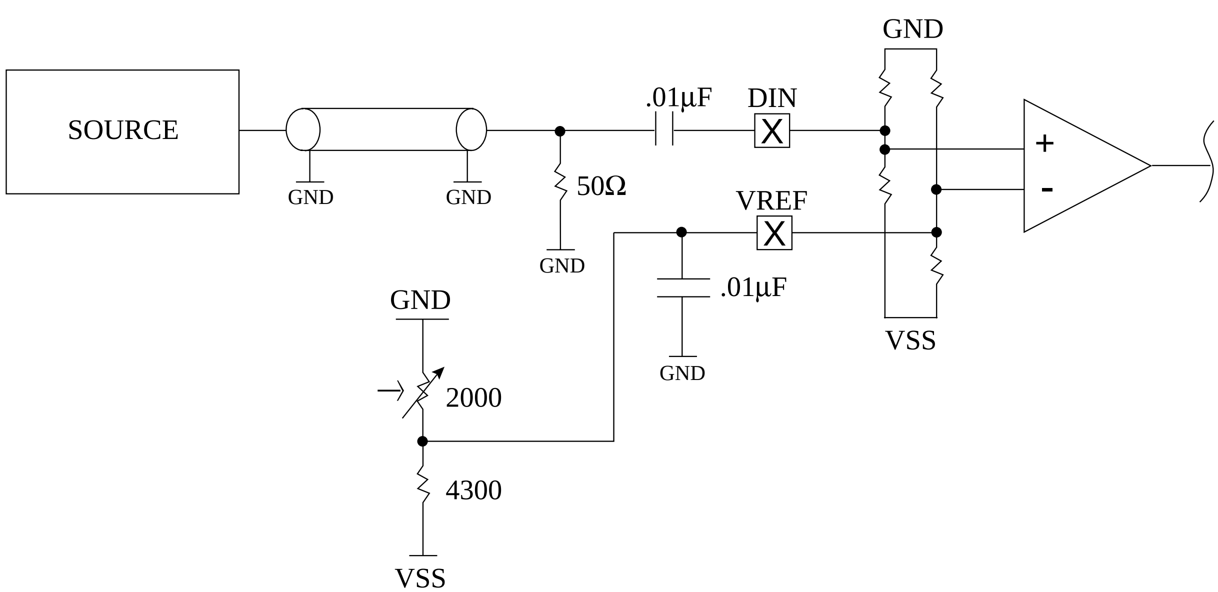
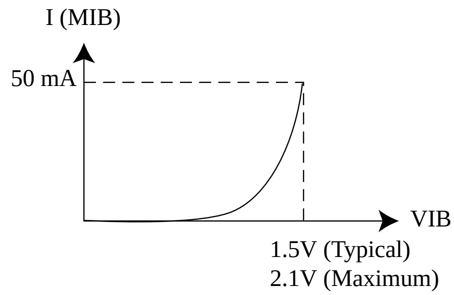
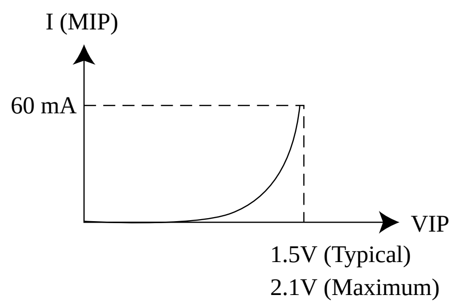


Figure 6: Control Signals VIP and VIB



Typical Bias Current v.s. Bias Voltage



Typical Modulation Current v.s. Modulation Voltage

Figure 7: Simplified Output Structure

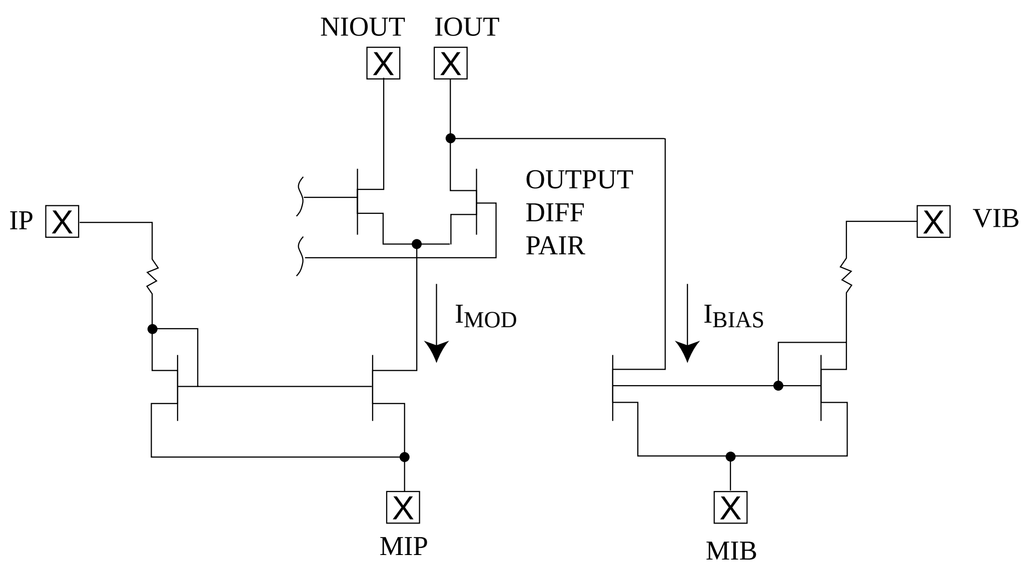
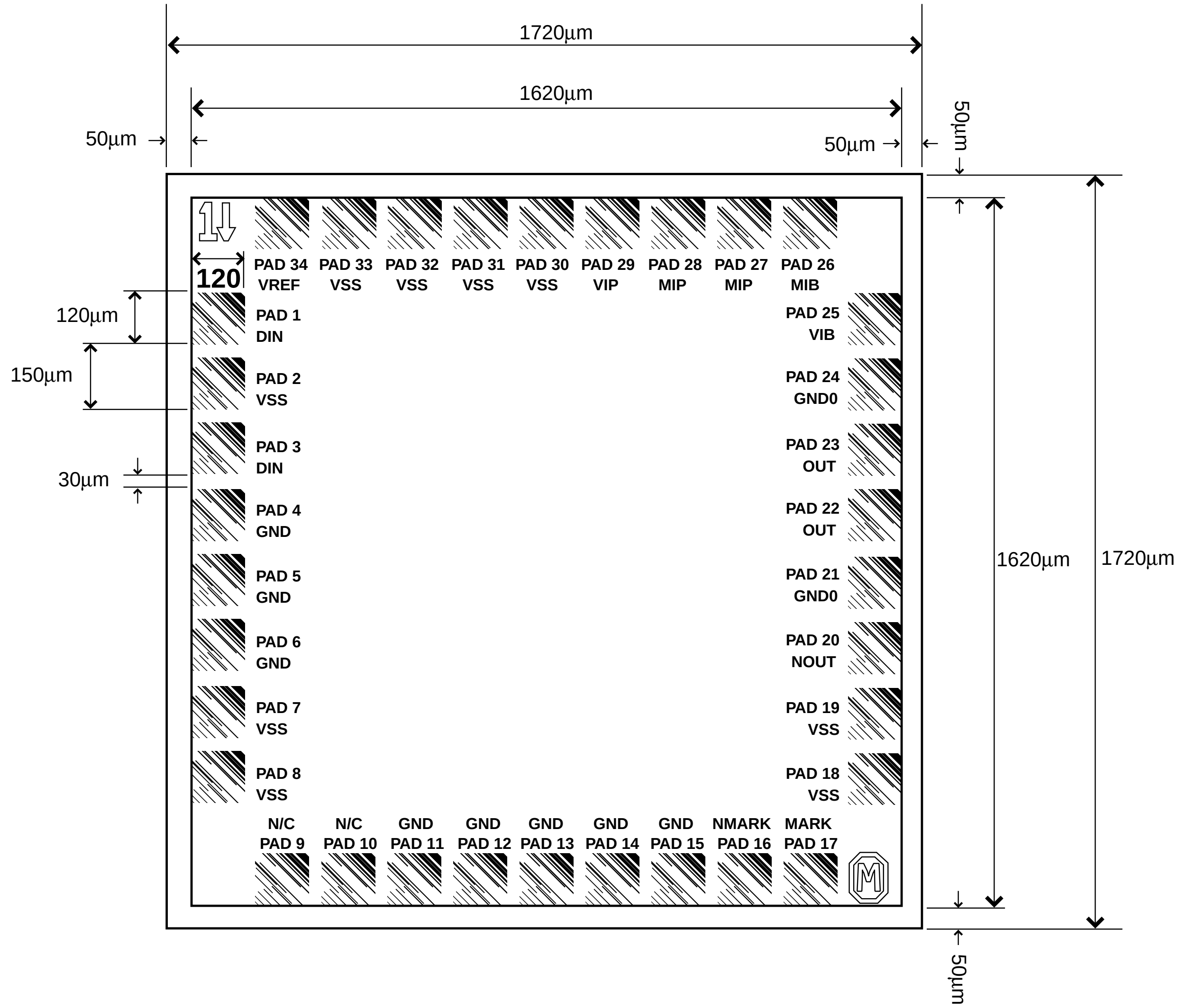


Figure 8: Pad Assignments for VSC7923 Die



NOTES:
1) Die size = 1620µm x 1620µm
2) Actual die size = 1720µm x 1720µm (after die are cut up)
3) Pad size = 120µm x 120µm
4) Pad pitch = 150µm
5) Space betwen pads = 30µm

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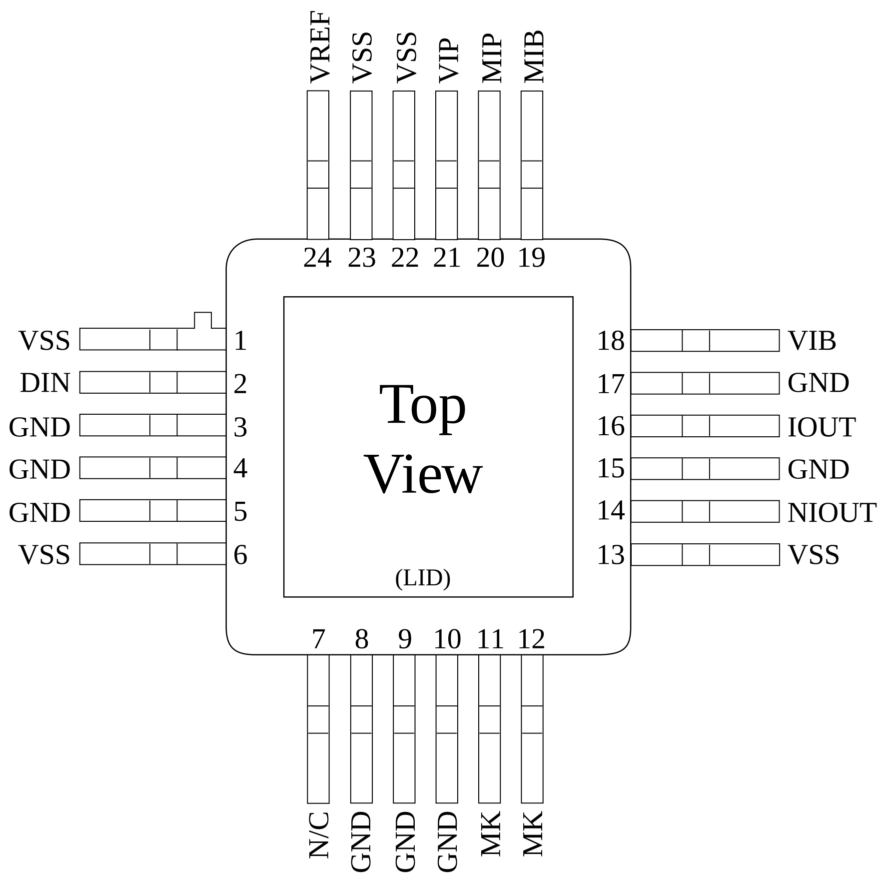
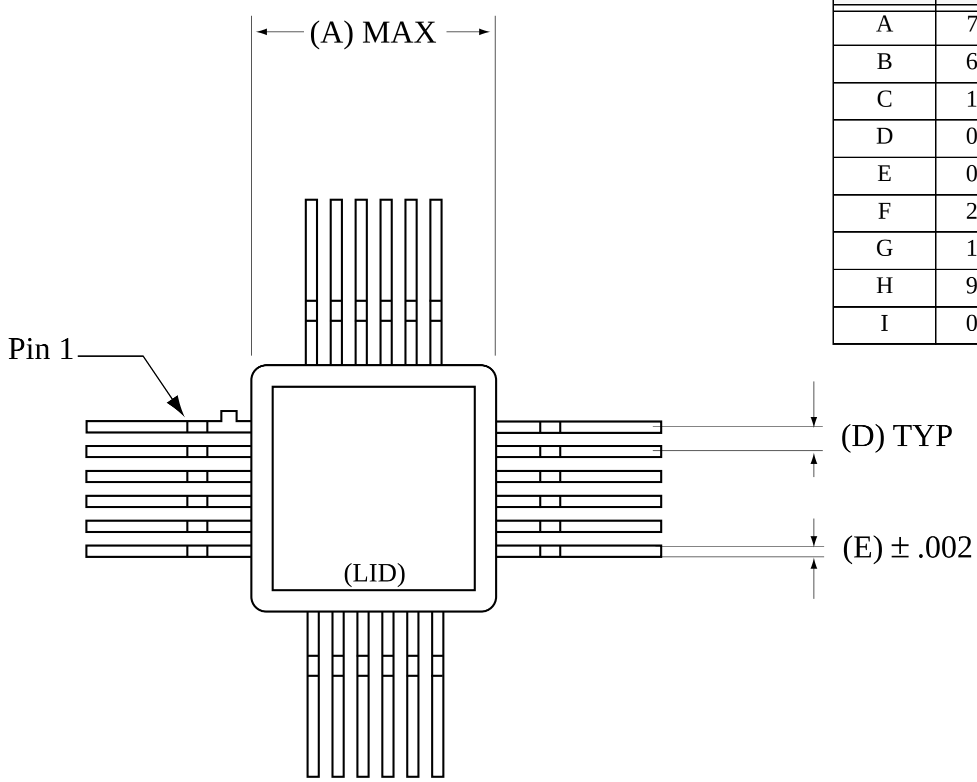
Pin Diagram for 24 Pin Metal-Glass Package



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

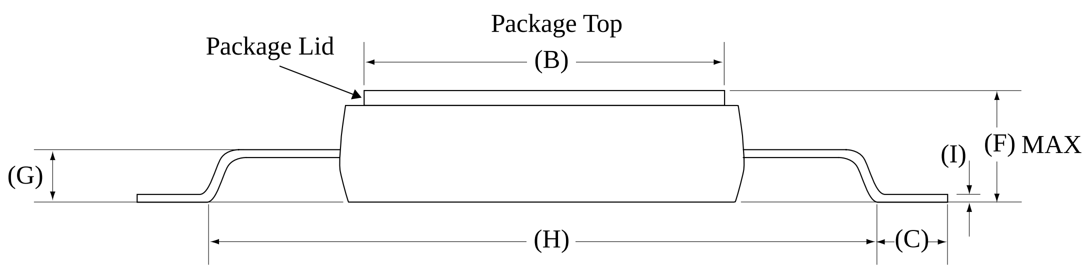
Package Information - 24 Pin Metal-Glass Package

Top View



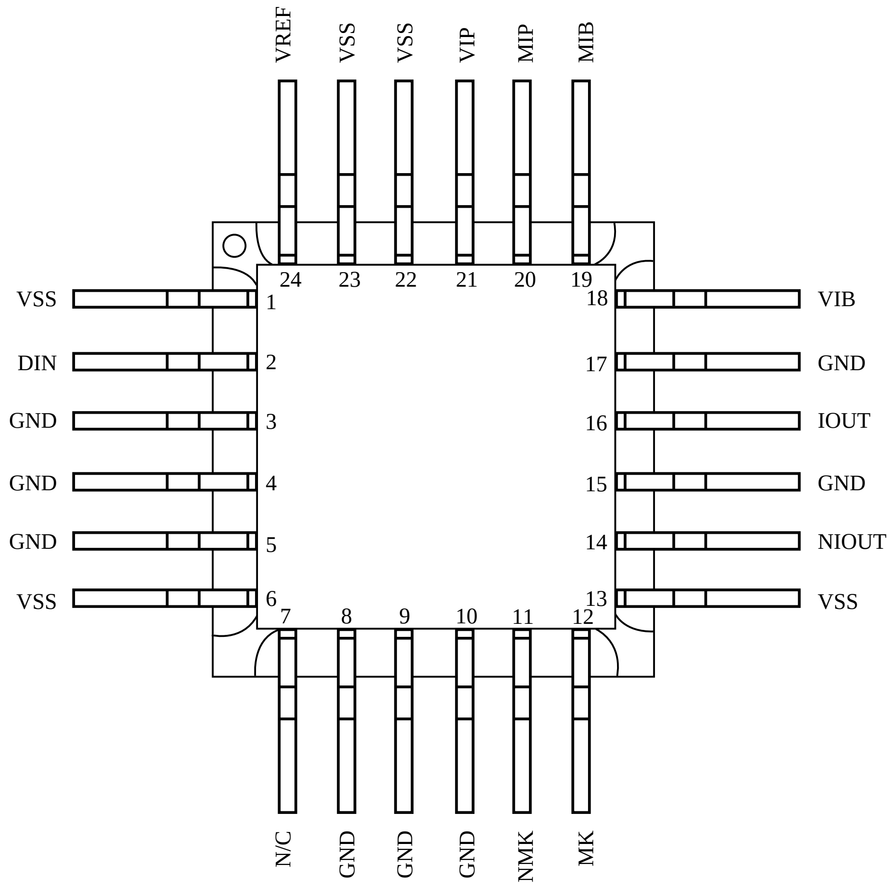
Key	*mm*	*In*
A	7.11	0.280
B	6.10	0.240
C	1.02	0.040
D	0.76	0.030
E	0.30	0.012
F	2.08	0.082
G	1.02	0.040
H	9.52	0.375
I	0.13	0.005

Side View



NOTES: Drawing not to scale.
Package #: 101-291-8 Issue #:1
Lid #: 101-292-3 Issue #:1

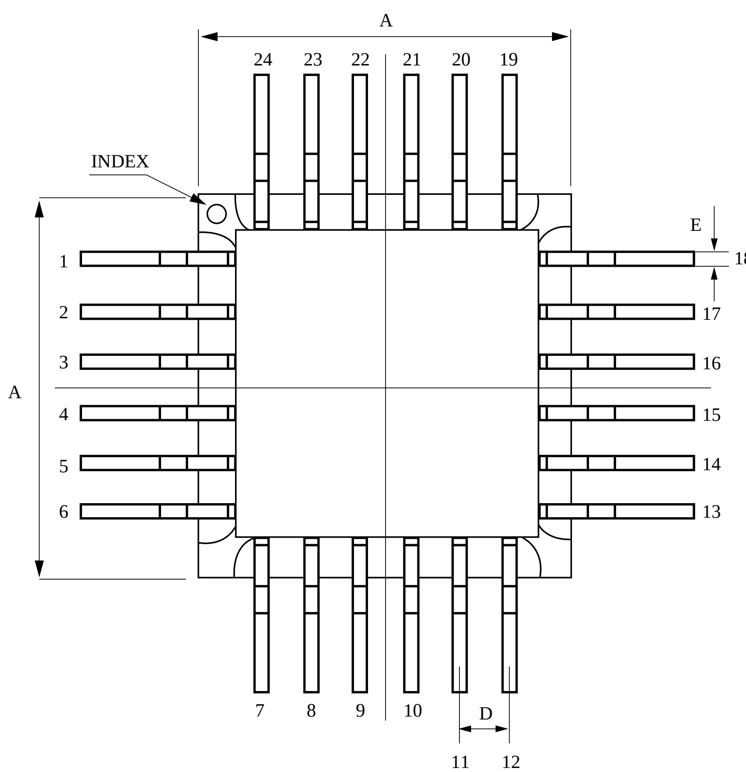
Pin Diagram for 24 Pin Ceramic Package



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

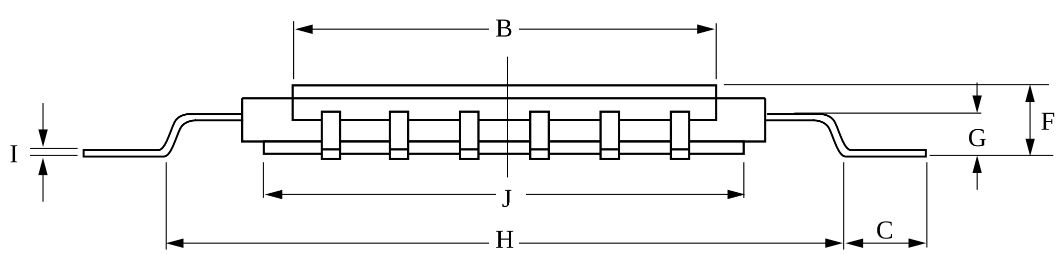
Package Information - 24 Pin Ceramic Package

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 #: 101-312-0 Issue #:1
L id #: 101-303-1 Issue #:1

Ordering Information

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

VSC7923 XX

Device Type
2.5Gb/s Laser Diode Driver

Package Style (24 pin)

CA: Metal Glass Package—Straight Leads
KF: Ceramic Package—Straight Leads
KFL: Ceramic Package—Formed Leads
X: Bare Die