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SEMICONDUCTOR CORPORATION

Preliminary Data Sheet
VSC7928

SONET/SDH 3.2Gb/s Laser Diode Driver

Features

- Rise Times Less Than 100ps
- High Speed Operation
  (Up to 3.2Gb/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
- Enhanced Pinout

Applications

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

General Description

The VSC7928 is a single 5V supply, 3.2Gb/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.
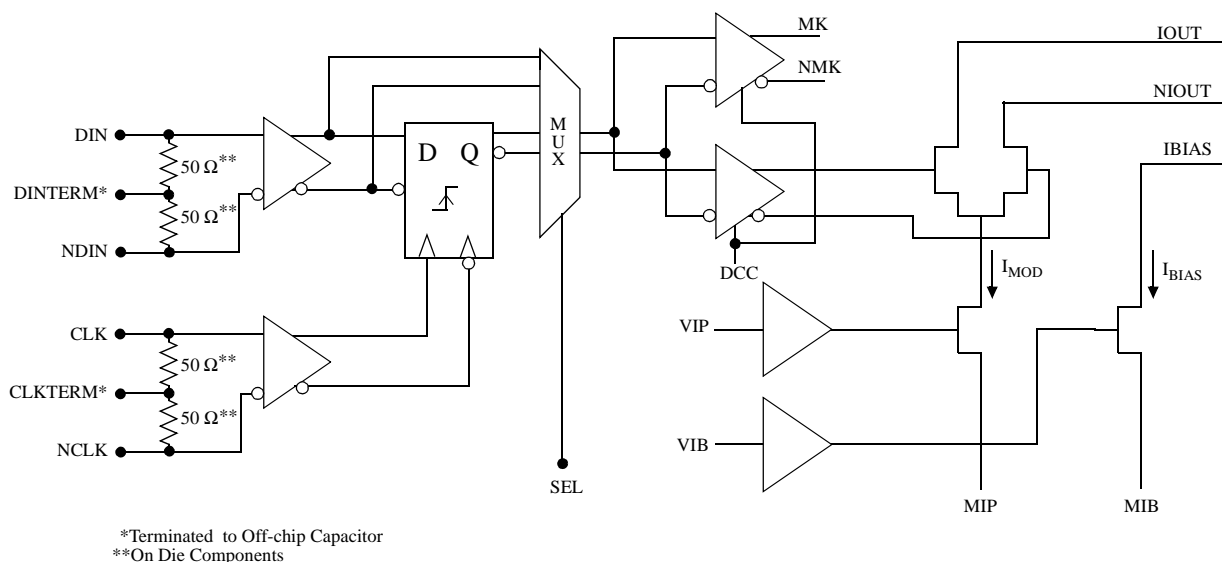
VSC7928 Block Diagram

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

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Page 1

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	5/6[1]	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
GND/NC	Pwr	DC	7[1]	No connection (leave floating or connect to GND)
Total Pins	—	—	24/32*	

NOTE: (1) *Applicable to 32-pin TQFP package only.*

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	-55°C to + 125°C
T_{STG}	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_{Cl}	Operational Temperature[1]	-40	—	85[2]	°C	Power dissipation = 1.3W
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.

G52246-0, Rev 3.0
04/05/01

Preliminary Data Sheet
VSC7928

SONET/SDH 3.2Gb/s Laser Diode Driver

Table 5: High Speed Inputs and ECL Outputs

Symbol	Parameter	Min	Typ	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	50Ω to -2.0V
V_{OL}	ECL Output Low Voltage	—	—	-1600	mV	50Ω to -2.0V
V_{IN}	On-Chip Terminations	35	—	65	Ω	

Table 6: Power Dissipation

Symbol	Parameter	Min	Typ	Max	Units	Conditions
I_{VSS}	Power Supply Current (VSS)	—	80	120	mA	V_{SS} = -5.5V, I_{MOD} = I_{BIAS} = 0mA, MK/NMK open circuit
P_D	Total Power Dissipation	—	—	700	mW	V_{SS} = -5.5V, I_{MOD} = I_{BIAS} = 0mA, R_{LOAD} = 25Ω to GND, MK/NMK terminated 50Ω to -2V

Table 7: Laser Driver DC Electrical Specifications

Symbol	Parameter	Min	Typ	Max	Units	Conditions
I_{BIAS}	Programmable Laser Bias Current	2	—	100	mA	
I_{MOD}	Programmable Modulation Current	2	—	100	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 - 3V	—	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	25Ω load, 20%-80%, 20mA < I_{MOD} < 60mA, I_{BIAS} = 60mA
t_{SU}	Data to Clock Setup Time	—	50	90	ps	—
t_H	Hold Time	20	50	—	ps	—

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Page 3

Figure 1: On-Chip Data and Clock Input Configuration

DIN
(CLK)

DINTERM
(CLKTERM)

NDIN
(NCLK)

* 50

* 50

GND

* 4.0K

* 6.4K

VSS

GND

DATA BUFFER
(CLOCK BUFFER)

VSS

*On-chip
Components
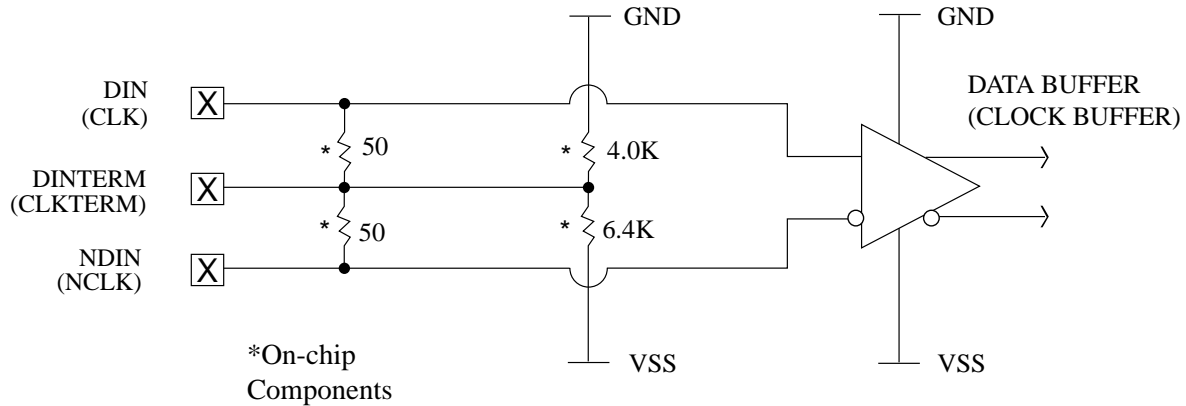
DINTERM to -2.0V for Differential ECL Inputs

Figure 2: Single-Ended Operation

DATA
SOURCE

CLOCK
SOURCE

7928

0.1μf

DIN
DINTERM
NDIN

0.1μf

0.1μf

GND   GND

0.1μf

CLK
CLKTERM
NCLK

0.1μf

0.1μf

GND   GND

G52246-0, Rev 3.0
04/05/01

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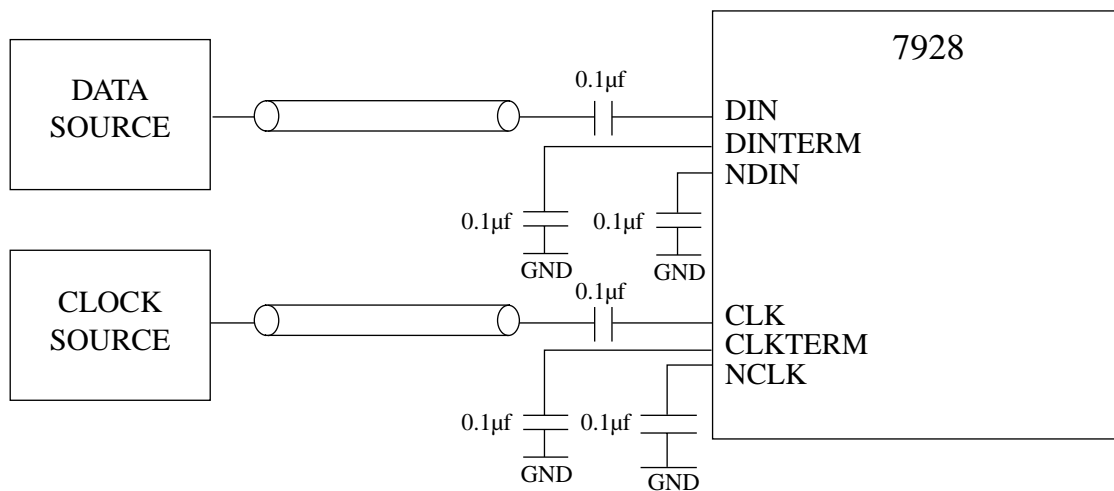
Preliminary Data Sheet
VSC7928
SONET/SDH 3.2Gb/s Laser Diode Driver

Figure 3: Single-Ended AC-Coupled
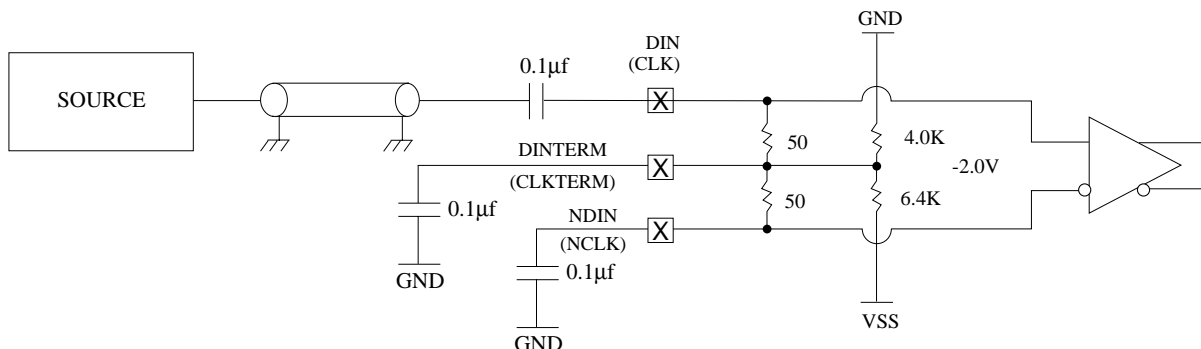
Figure 4: Differential AC-Coupled
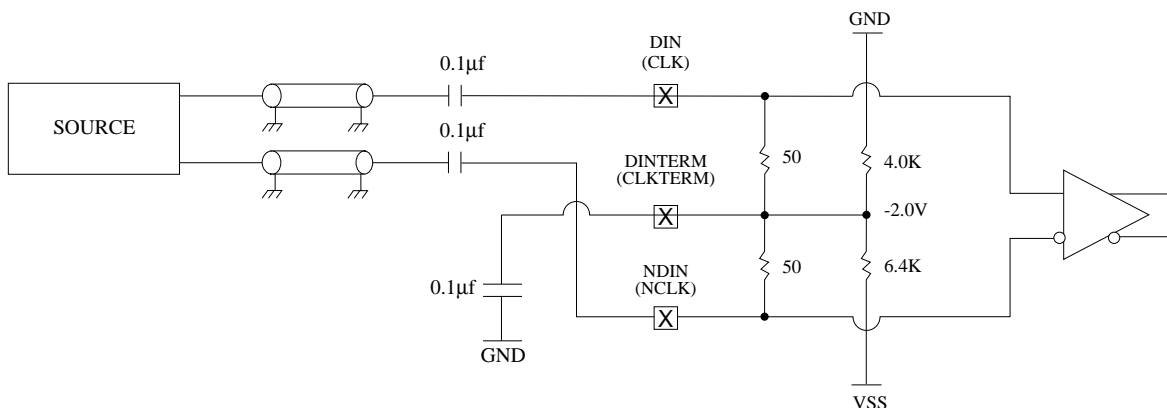
Figure 5: Differential DC-Coupled

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Page 5
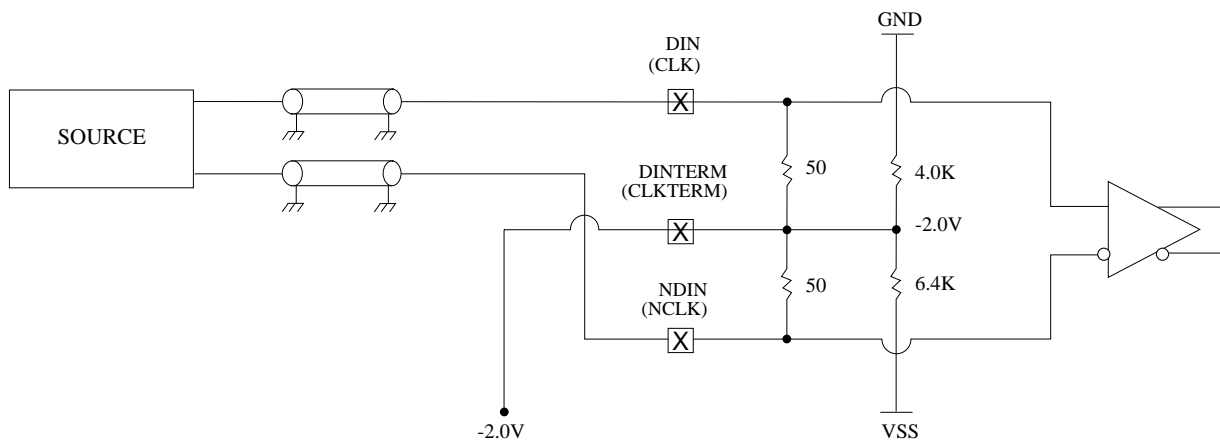
Figure 6: Control Signals VIP and VIB
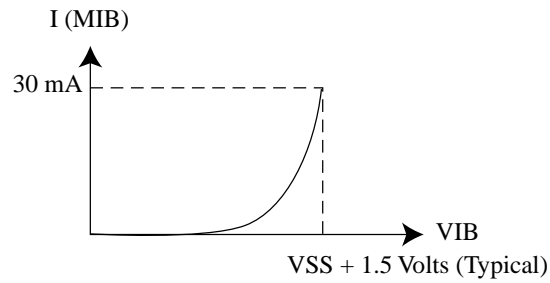
Typical Bias Current v.s. Bias Voltage
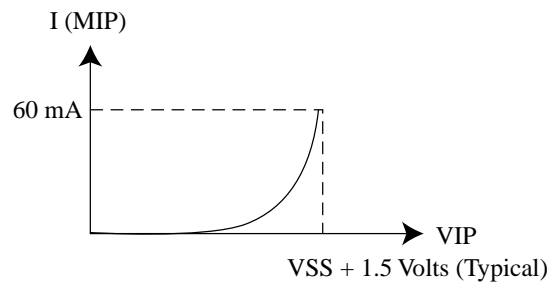
Typical Modulation Current v.s. Modulation Voltage

Figure 7: Simplified Output Structure
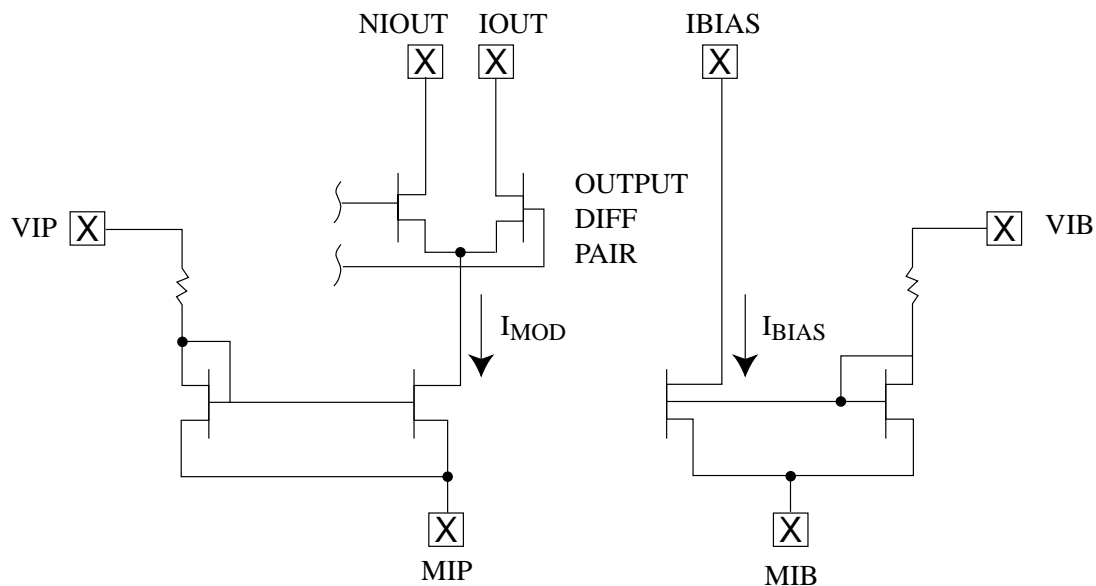
Preliminary Data Sheet
VSC7928

SONET/SDH 3.2Gb/s Laser Diode Driver

Figure 8: Pad Assignments for VSC7928 Die
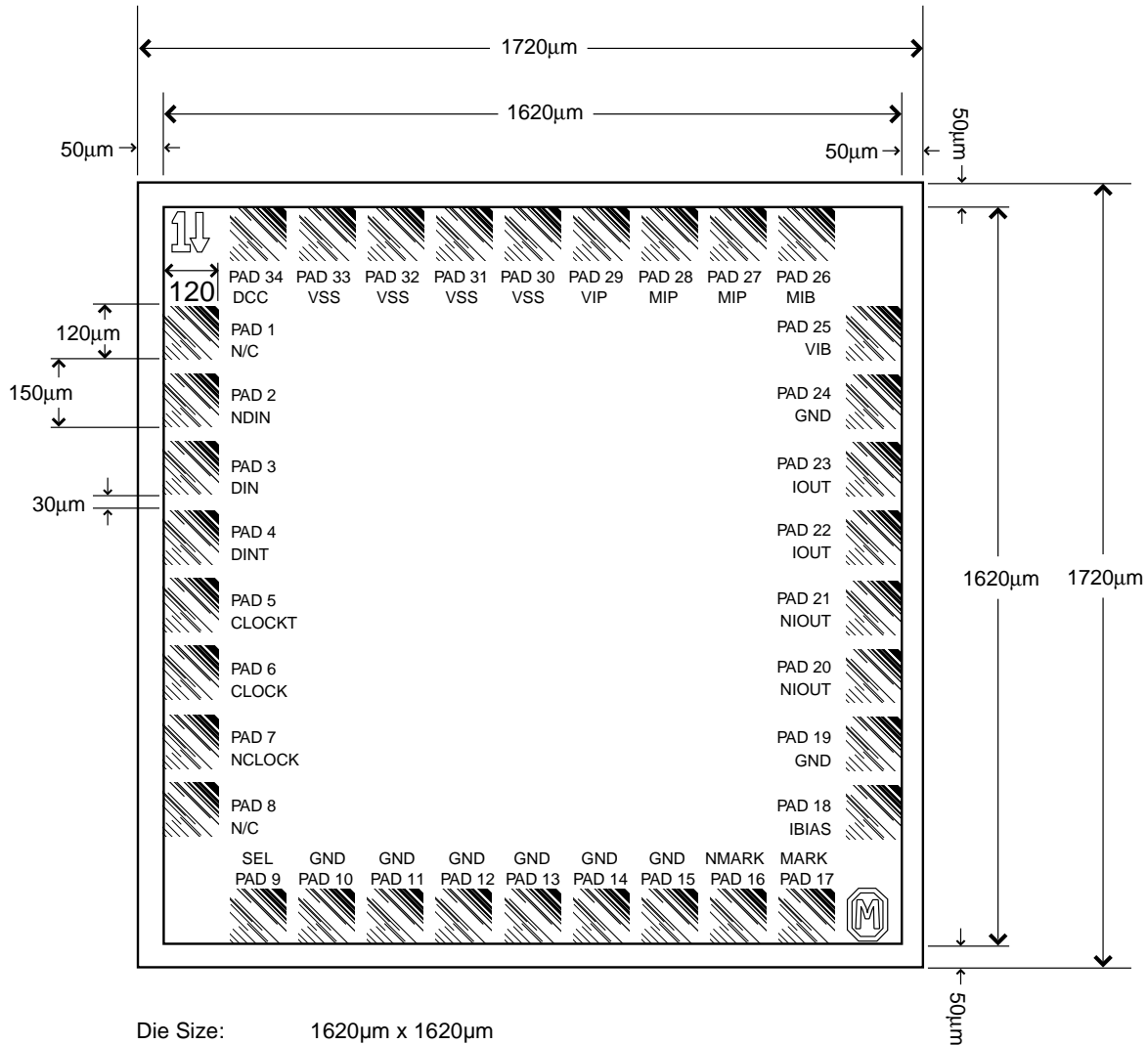
Die Size: 1620μm x 1620μm
Actual Die Size: 1720μmx1720μm (after the die are cut up)
Pad Size: 120μm x 120μm
Pad Pitch: 150μm
Space
Between Pads: 30μm

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Page 7

Package Information - 32 Pin Plastic TQFP Package

HEATSINK INTRUSION .0127 MAX.

EXPOSED HEATSINK 4.32 ±.12 DIA.

Dimension	mm	Tolerance
A	1.60	MAX
A1	.10	±.05
A2	1.40	±.05
D	9.00	±.20
D1	7.00	±.10
E	9.00	±.20
E1	7.00	±.10
L	.60	+.15/-.10
e	.80	BASIC
b	.35	±.05
θ	0° - 7°	
ddd	.20	MAX
ccc	.10	MAX

12° TYP.

12° TYP.

0.20 RAD. TYP.

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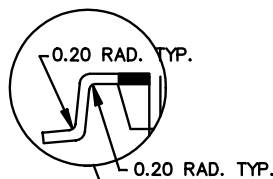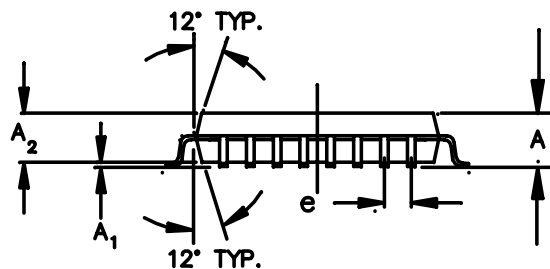
Note: *Package lid and bottom heat spreader are electrically connected to GND within the package.*

6°±4°

STANDOFF A1

.25

A

0.17 MAX.

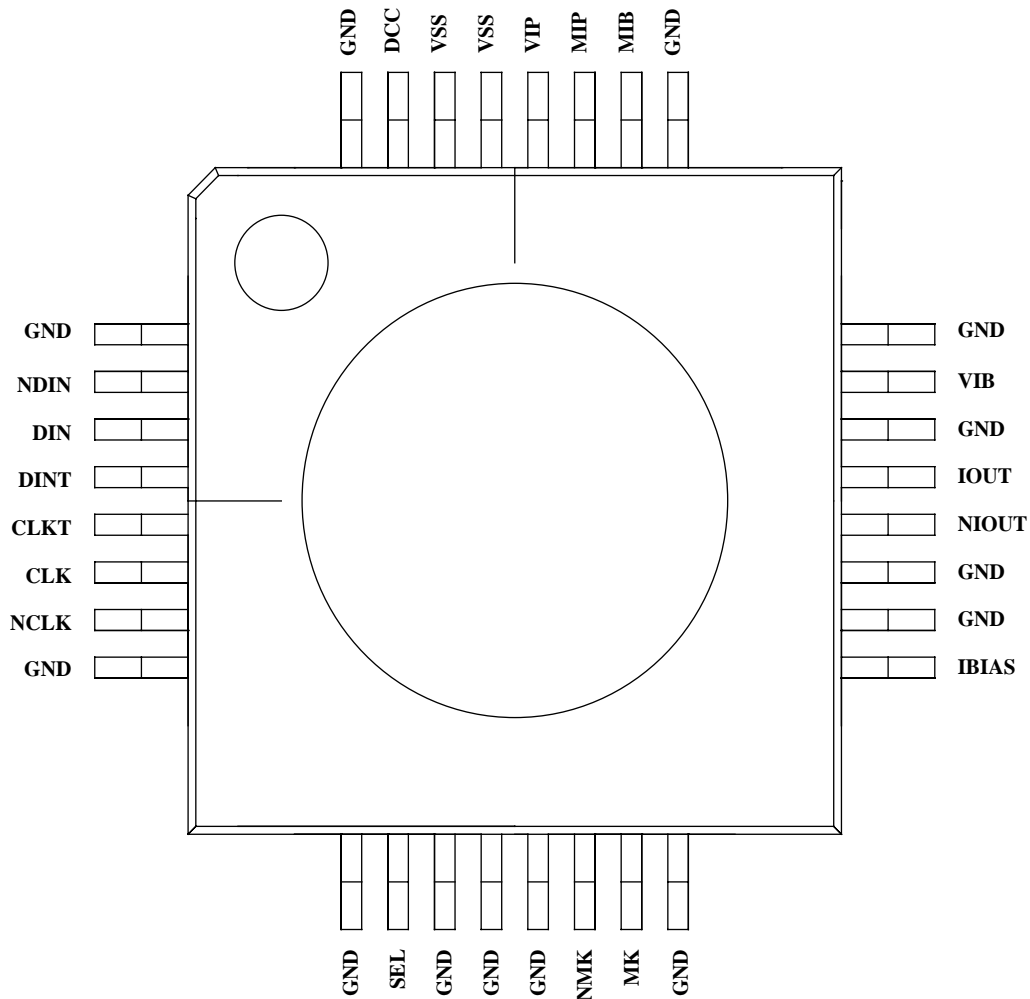SEATING PLANE

-C-

LEAD COPLANARITY

b

L

θ
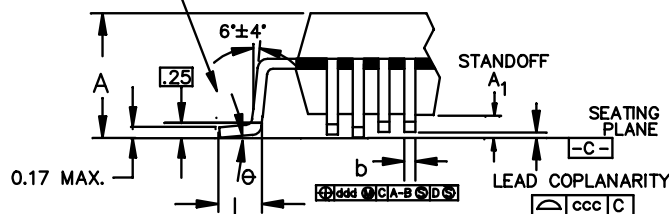
NOTES: 1) ALL DIMENSIONS IN MM.
2) DIMENSIONS SHOWN ARE NOMINAL WITH TOL. AS INDICATED
3) L/F: EFTEC 64T COPPER, OR EQUIVALENT, 0.127 MM (.005") THICK.
4) FOOT LENGTH "L" IS MEASURED AT GAGE PLANE, AT 0.25 ABOVE THE SEATING PLANE.

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04/05/01

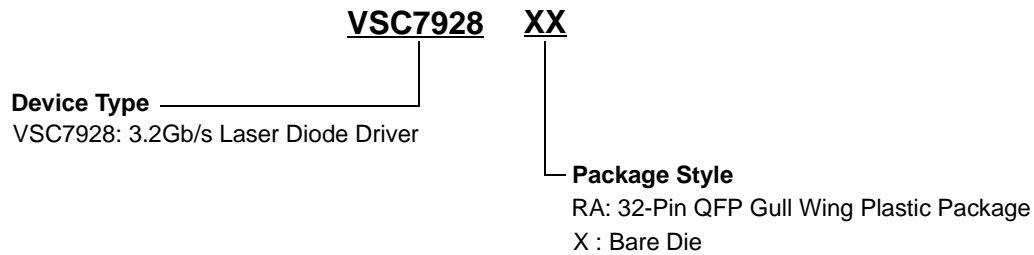## 32-Pin Plastic Package Pin Designation

Top pins (left to right): GND, DCC, VSS, VSS, VIP, MIP, MIB, GND

Left pins (top to bottom): GND, NDIN, DIN, DINT, CLKT, CLK, NCLK, GND

Right pins (top to bottom): GND, VIB, GND, IOUT, NIOUT, GND, GND, IBIAS

Bottom pins (left to right): GND, SEL, GND, GND, GND, NMK, MK, GND

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Page 9

Ordering Information

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

VSC7928   **XX**

Device Type
VSC7928: 3.2Gb/s Laser Diode Driver

Package Style
RA: 32-Pin QFP Gull Wing Plastic Package
X : Bare Die

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