

## Advance Product Information

### VSC7991

SONET/SDH 10.7Gb/s  
Electroabsorption Modulator/Laser Diode Driver

### Features

- Maximum Rise/Fall Times of 38ps
- High-Speed Operation (Up to 10.7Gb/s NRZ Data)
- Differential Inputs
- Single-Supply
- CML-Compatible Data Inputs
- On-Chip  $50\Omega$  Input Terminations
- $50\Omega$  Output Impedance

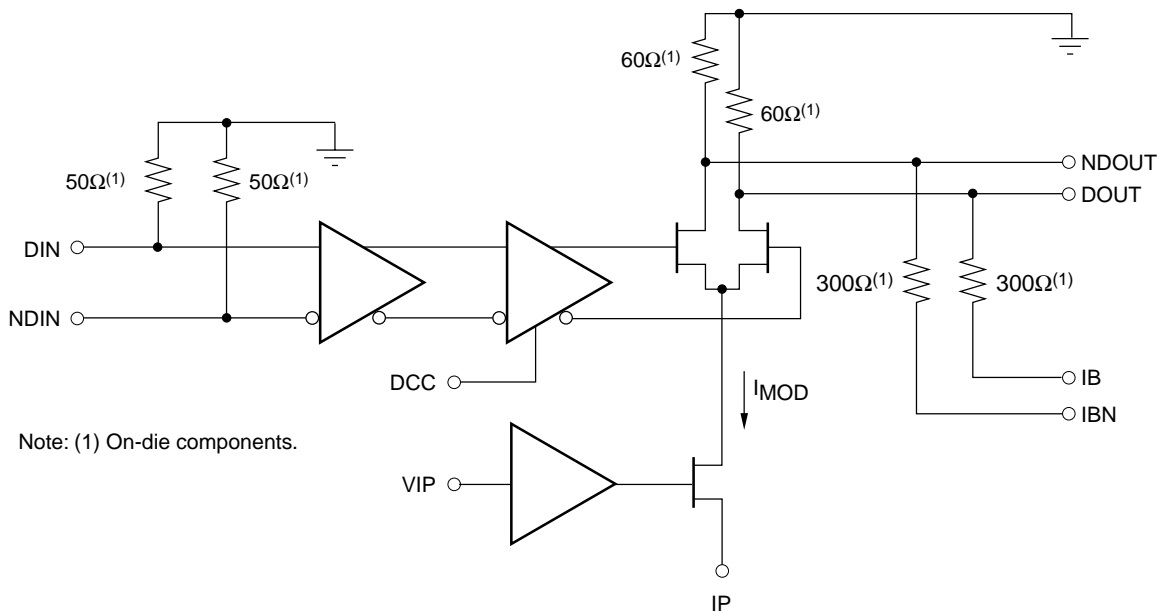
### General Description

The VSC7991 is a single 7V supply, 10.7Gb/s Electroabsorption Modulator (EAM)/laser diode driver with direct access to the laser modulation FETs. Laser offset and modulation currents are set by external components allowing precision monitoring and setting of the voltage levels. Data inputs are differentially terminated to  $50\Omega$ .

### Applications

- SONET/SDH @ 2.488Gb/s, 9.952Gb/s, 10.7Gb/s

### VSC7991 Block Diagram



## AC Characteristics (Over recommended operating conditions)

Table 1: High Speed Inputs /Outputs

Symbol	Parameter	Min	Typ	Max	Units	Conditions
IRL	Input Return Loss, 50Ω System	—	-15	—	dB	50MHz to 10GHz
ORL	Output Return Loss, 50Ω System	—	-12	—	dB	50MHz to 10GHz

Table 2: Laser Driver AC Electrical Specifications

Symbol	Parameter	Min	Typ	Max	Units	Conditions
$t_R$ $t_F$	Output Rise and Fall Times	—	—	38	ps	50Ω load, 20% to 80%, $V_{MOD} = 3V$
Jitter	Output Jitter	—	—	15	ps/p-p	50Ω Load, $V_{MOD} = 3V$
	Overshoot/Undershoot	-10	—	+10	%	
	Duty-Cycle	-25	—	+25	%	DCC in the range of $V_{SS} - 0.5V$ to $V_{SS} + 2V$

## DC Characteristics (Over recommended operating conditions)

Table 3: Power Dissipation

Symbol	Parameter	Min	Typ	Max	Units	Conditions
$I_{VSS}$	Power Supply Current ( $V_{SS}$ )	—	300	330	mA	$V_{SS} = -6.8$ , $R_L = 50\Omega$ to GND, $I_{MOD} = 120mA$ , $V_{BIAS} = 0V$
$P_D$	Total Power Dissipation	—	2040	2244	mW	$V_{SS} = -6.8$ , $R_L = 50\Omega$ to GND, $I_{MOD} = 120mA$ , $V_{BIAS} = 0V$

Table 4: Laser Driver DC Electrical Specifications

Symbol	Parameter	Min	Typ	Max	Units	Conditions
$V_{BIAS}$	Programmable Output Offset Voltage	-0.8	—	0	V	
$V_{MOD}$	Modulation Voltage Amplitude	1.5	—	3	V	
$V_{OCM}$	Output Voltage Compliance	—	4	—	V	
$I_B$ , $I_{BN}$	Laser Bias Control Voltage	-10	—	0	V	
$V_{IP}$	Laser Modulation Control Voltage	$V_{SS}$	—	$V_{SS} + 0.7$	V	
$V_{IH}$	Input High Voltage	-150	—	0	mV	
$V_{IL}$	Input Low Voltage	-1.00	—	-0.60	V	
$V_{SW}^{(1)}$	Input Voltage Swing	450	—	1000	mVp-p	
DCC	Duty-Cycle Control	$V_{SS} - 0.5V$	—	$V_{SS} + 2V$		

NOTE: DIN and NDIN inputs need to be driven differentially. If single-ended drive is desired, it is necessary to add a DC bias to the unused pin.

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**Absolute Maximum Ratings<sup>(1)</sup>**

Negative Power Supply Voltage ( $V_{SS}$ ).....	$V_{CC}$ to $-8.0V$
All Pins .....	$V_{SS}$ to $+ .5V$
Supply Voltage ( $V_{SS}$ ) .....	8V
Supply Current ( $I_{SS}$ ).....	500mA
Input Voltage ( $V_{IN}$ ).....	$-2.0V$
Output Voltage ( $V_{OUT}$ ).....	$-4.0V$
Modulation Control Voltage ( $V_{IP}$ ).....	$V_{SS} - 0.5V$
Output Offset Control Voltage ( $I_B, I_{BN}$ ) .....	11V
Output Offset Control Current ( $I_{IB}$ ) .....	50mA
Maximum Junction Temperature Range .....	$-55^{\circ}C$ to $+125^{\circ}C$
Storage Temperature Range: .....	$-55^{\circ}C$ to $+125^{\circ}C$

*Note:*

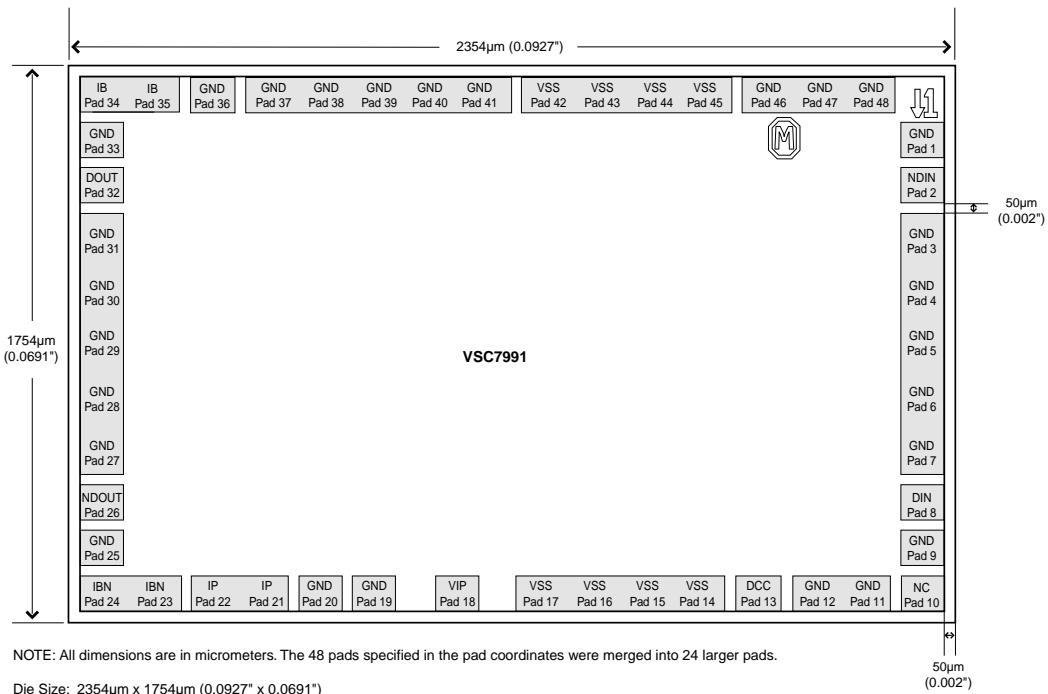
(1) *CAUTION: Stresses listed under "Absolute Maximum Ratings" may be applied to devices one at a time without causing permanent damage. Functionality at or above the values listed is not implied. Exposure to these values for extended periods may affect device reliability.*

**Recommended Operating Conditions**

Positive Voltage Rail (GND).....	0V
Negative Voltage Rail ( $V_{SS}$ ).....	$-6.5V$ to $-7.2V$
Operational Case Temperature ( $T_{C1}$ ) .....	$0^{\circ}C$ to $75^{\circ}C$

Bare Die Descriptions

Figure 1: Pad Assignments



NOTE: All dimensions are in micrometers. The 48 pads specified in the pad coordinates were merged into 24 larger pads.

Die Size: 2354µm x 1754µm (0.0927" x 0.0691")  
 Die Thickness: 381µm (0.015")  
 Pad Pitch: 150µm (0.0059")  
 Pad Size: 116µm x 116µm (0.0046" x 0.0046")  
 Pad Passivation Opening: 100µm x 100µm (0.0039" x 0.0039")  
 Scribe Size: 50µm (0.002")

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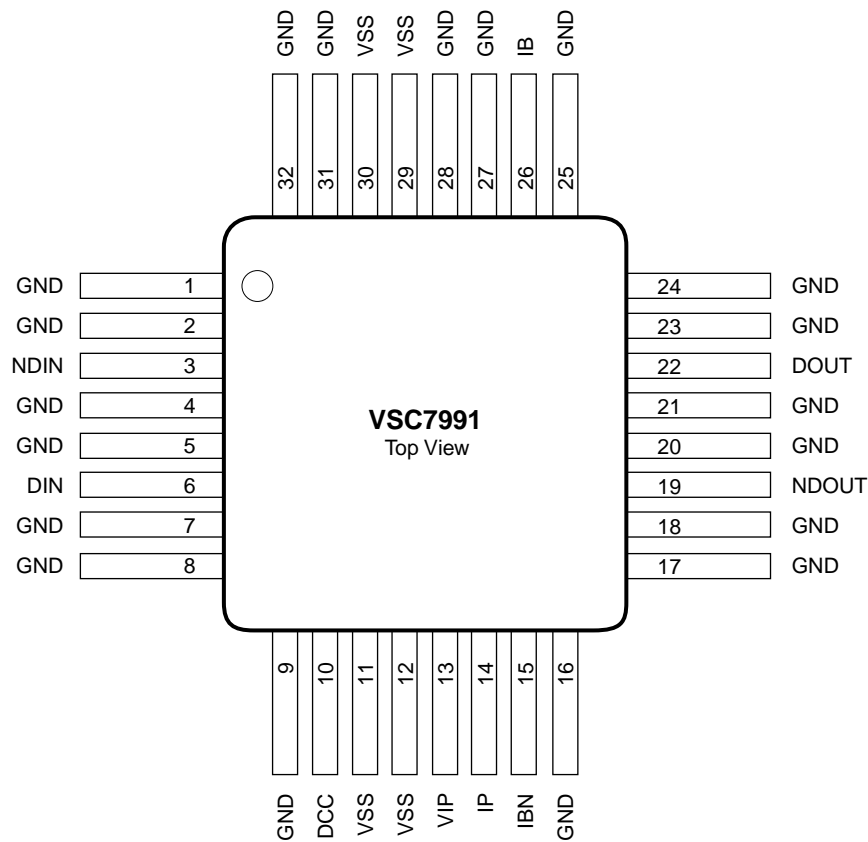
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**Table 5: Pad Coordinates**

Pad Number	Signal Name	Coordinates ( $\mu\text{m}$ )		Pad Number	Signal Name	Coordinates ( $\mu\text{m}$ )	
		X	Y			X	Y
1	GND	2296	1546	25	GND	58	208
2	NDIN	2296	1396	26	NDOUT	58	358
3	GND	2296	1246	27	GND	58	508
4	GND	2296	1061.5	28	GND	58	692.5
5	GND	2296	877	29	GND	58	877
6	GND	2296	692.5	30	GND	58	1061.5
7	GND	2296	508	31	GND	58	1246
8	DIN	2296	358	32	DOUT	58	1396
9	GND	2296	208	33	GND	58	1546
10	NC	2296	58	34	IB	58	1696
11	GND	2146	58	35	IB	208	1696
12	GND	1996	58	36	GND	358	1696
13	VDCC	1846	58	37	GND	508	1696
14	VSS	1696	58	38	GND	658	1696
15	VSS	1546	58	39	GND	808	1696
16	VSS	1396	58	40	GND	958	1696
17	VSS	1246	58	41	GND	1108	1696
18	VIP	1027	58	42	VSS	1258	1696
19	GND	808	58	43	VSS	1408	1696
20	GND	658	58	44	VSS	1558	1696
21	IP	508	58	45	VSS	1708	1696
22	IP	358	58	46	GND	1858	1696
23	IBN	208	58	47	GND	2008	1696
24	IBN	58	58	48	GND	2158	1696

### Package Pin Descriptions

Figure 2: Pin Identification



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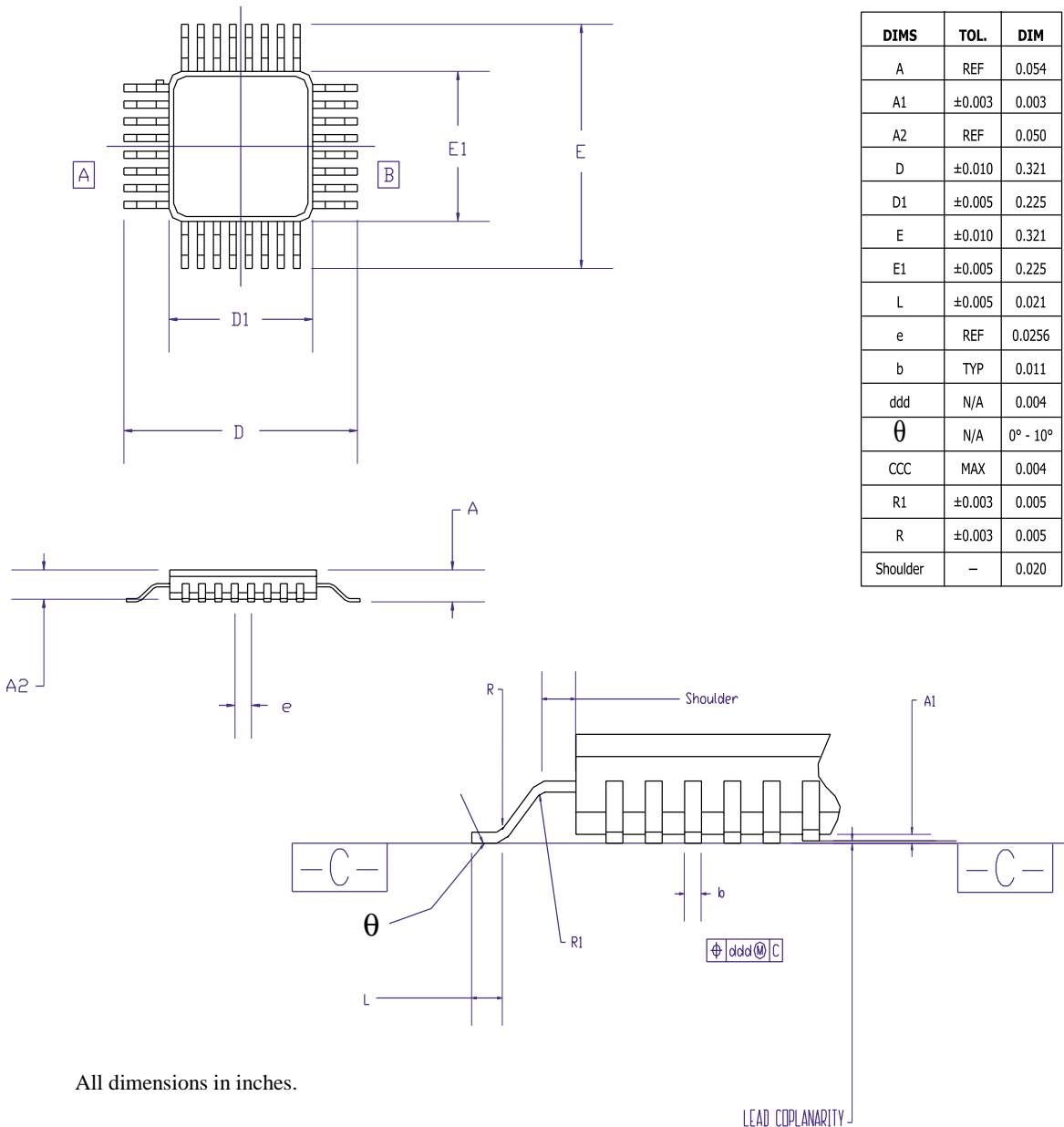
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**Table 6: Pin Identifications**

Pin #	Name	Type	Level	Description
1	GND	Pwr	Pwr	Positive Voltage Rail
2	GND	Pwr	Pwr	Positive Voltage Rail
3	NDIN	In	CML	Complementary Data In
4	GND	Pwr	Pwr	Positive Voltage Rail
5	GND	Pwr	Pwr	Positive Voltage Rail
6	DIN	In	CML	Data In
7	GND	Pwr	Pwr	Positive Voltage Rail
8	GND	Pwr	Pwr	Positive Voltage Rail
9	GND	Pwr	Pwr	Positive Voltage Rail
10	DCC	In	DC	Duty-Cycle Control Voltage
11	VSS	Pwr	Pwr	Negative Voltage Rail
12	VSS	Pwr	Pwr	Negative Voltage Rail
13	VIP	In	DC	Modulation Control Voltage
14	IP	In	DC	Modulation Current Monitor
15	IBN	In	DC	Data Offset Control Current (complementary)
16	GND	Pwr	Pwr	Positive Voltage Rail
17	GND	Pwr	Pwr	Positive Voltage Rail
18	GND	Pwr	Pwr	Positive Voltage Rail
19	NDOUT	Out		Laser Modulation Current Output (complementary)
20	GND	Pwr	Pwr	Positive Voltage Rail
21	GND	Pwr	Pwr	Positive Voltage Rail
22	DOUT	Out		Laser Modulation Current Output
23	GND	Pwr	Pwr	Positive Voltage Rail
24	GND	Pwr	Pwr	Positive Voltage Rail
25	GND	Pwr	Pwr	Positive Voltage Rail
26	IB	In	DC	Data Offset Control Current
27	GND	Pwr	Pwr	Positive Voltage Rail
28	GND	Pwr	Pwr	Positive Voltage Rail
29	VSS	Pwr	Pwr	Negative Voltage Rail
30	VSS	Pwr	Pwr	Negative Voltage Rail
31	GND	Pwr	Pwr	Positive Voltage Rail
32	GND	Pwr	Pwr	Positive Voltage Rail

*NOTE: A voltage HIGH on the data input (pin 6) corresponds to a voltage HIGH on the data output (pin 22).*

## Package Information





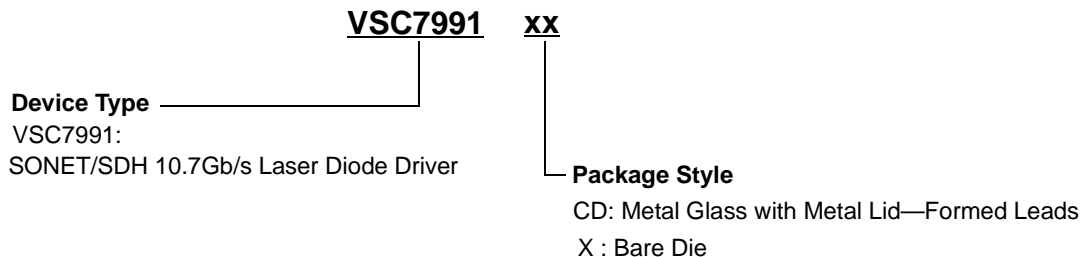
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### Ordering Information

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



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