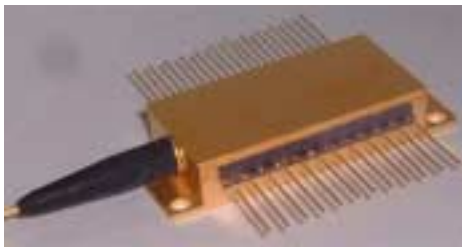


Technical Specification
for
2.5Gbps Tunable Transmitter Module

SDT9951-T

Data Rate:	OC-3	**OC-48**	Other **FEC Rate 2.666Gb/s**
Application:	**DWDM**	SupervisoryChannel	Other _____
Wavelength:	Fixed	**4 Channel-Selectable**	Other _____
Output Power:	+1dBm	**+7dBm**	Other _____
Dispersion:	**1600ps/nm**	3200ps/nm	Other _____
Supply Voltage:	Single 5.0 V	Single 3.3 V	Other **+5.0V and +3.3V**
Function:	Transceiver	**Transmitter**	Other _____
Package:	**Original**	MSA	Other _____

SUMITOMO ELECTRIC

Sumitomo Electric reserves the right to make changes in the specification without prior notice.

#Safety Precaution Symbols This specification uses various picture symbols to prevent possible injury to operator or other persons or damage to properties for appropriate use of the product. The symbols and definitions are as shown below. Be sure to be familiar with these symbols before reading this specification.

⚠ Warning	Wrong operation without following this instruction may lead to human death or serious injury.
⚠ Caution	Wrong operation without following this instruction may lead to human injury or property damage.

Example of picture symbols
- ❗ indicates prohibition of actions. Action details are explained thereafter.
- ⃠ indicates compulsory actions or instructions. Action details are explained thereafter.

1. General

The features of SDT9951-T are listed below:

* Data rates up to 2.7Gbit/s.
* SONET and ITU-T compliant at OC-48 and STM-16
* Wavelength range, 1528.77nm to 1563.05nm.
* Four 100GHz ITU-T channels remotely Wavelength tunable.
* 1GHz step precise wavelength control.
* Digital controlled and analogue monitoring on I²C® Interface.
* Clocked or Non-clocked operation with single-ended or differential inputs.
* Tiny Size 18mm(W) x 35mm(D) x 8.5mm(H).
* 24 pin Butterfly package at included Transmitter function.
* Transmitter requires +5V and +3.3V.
* Optical Connector Interface FC / SC / MU / LC.

I²C® is a trademark of Philips Semiconductors Corporation.

2. Block Diagram

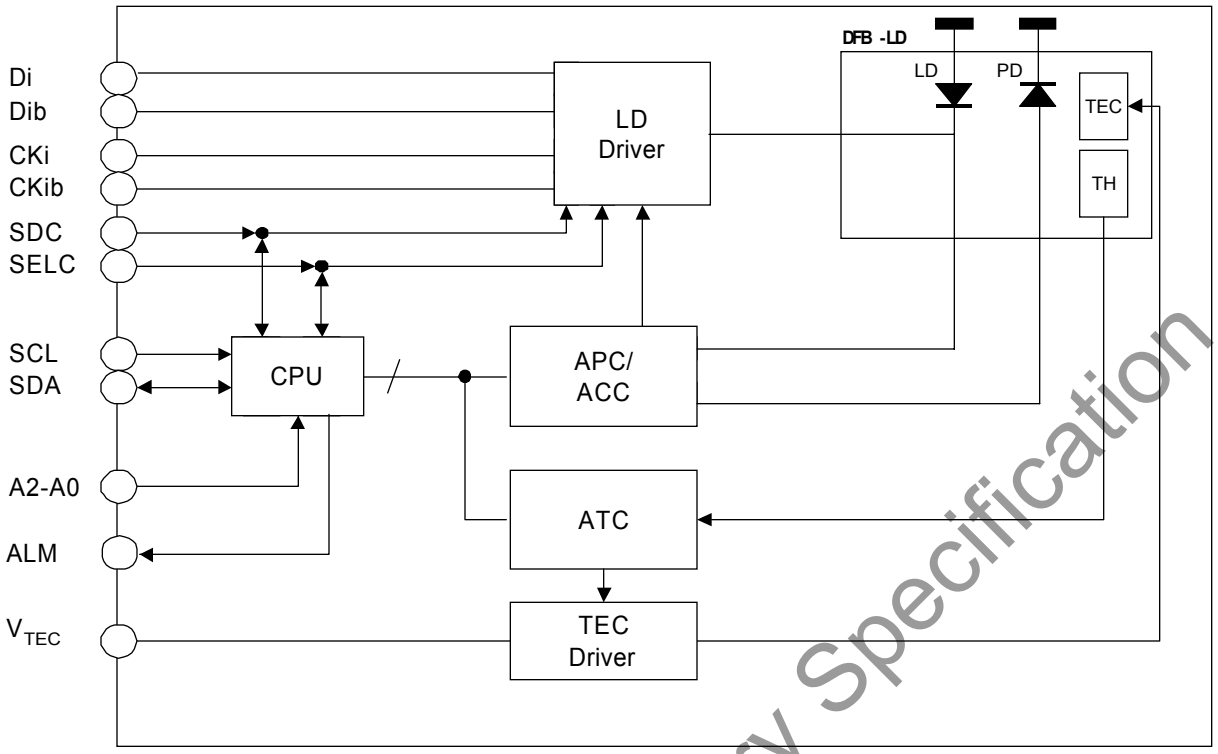


Figure 1 Block Diagram

3. Package Dimension

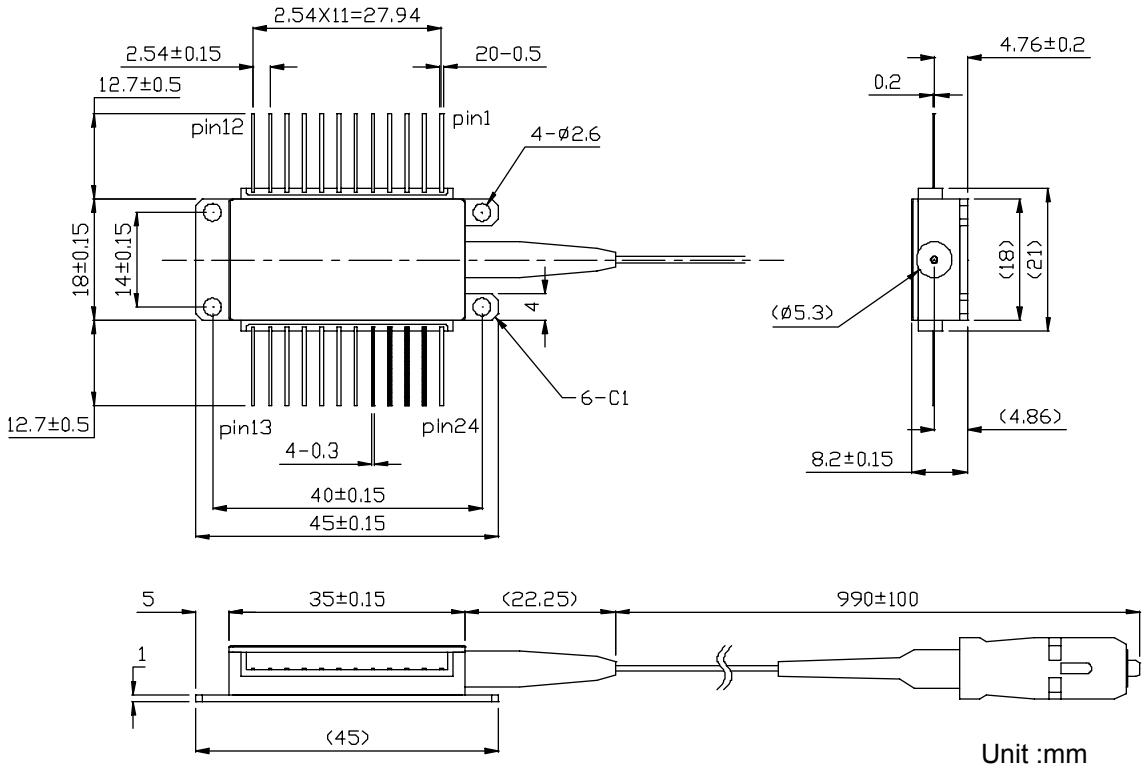


Figure 2 Package Dimension

⚠Caution
⃠ Do not disassemble this product. Otherwise, failure, electrical shock, overheating or fire may occur. Handle the lead pins carefully. Use assisting tools or prospective aids as required. A lead pin may injure skin or human body

4. Pin Assignment

Pin No	Symbol	Function	Pin No	Symbol	Function
1	NUC	No User Connection	24	VCC3	Power Supply
2	NUC	No User Connection	23	CKib	False Clock Input
3	ALM*1	Module Alarm output (include TDA)	22	CKi	True Clock Input
4	SDC*2	Shut Down Command	21	Dib	False Data Input
5	SELC*3	Clock Mode Select	20	Di	True Data Input
6	GND	Ground	19	GND	Ground
7	GTEC	TEC Ground	18	VTEC	TEC Supply voltage
8	SCL	I²C® Bus Clock Input	17	RST*4	Reset
9	SDA	I²C® Bus Data In/Output	16	A2*5	I²C® Hardware Address
10	VCC1	Power Supply	15	A1*5	I²C® Hardware Address
11	GND	Ground	14	A0*5	I²C® Hardware Address
12	VCC2	Power Supply	13	GND	Ground

*1, *2, *3, *4 refer to Logic Status Descriptions.

Clocked Operation Mode

Data Input				Optical Output
Di	DiB	CKi	CKib	
H	L	↗	↘	H
L	H	↗	↘	L
ϕ	ϕ	L	H	Q0

H:High Level, L:Low Level, ϕ:H or L
Q0:Previous optical output status before data input condition defined

Non-Clocked Operation Mode

Data Input		Optical Output
Di	DiB	
H	L	H
L	H	L

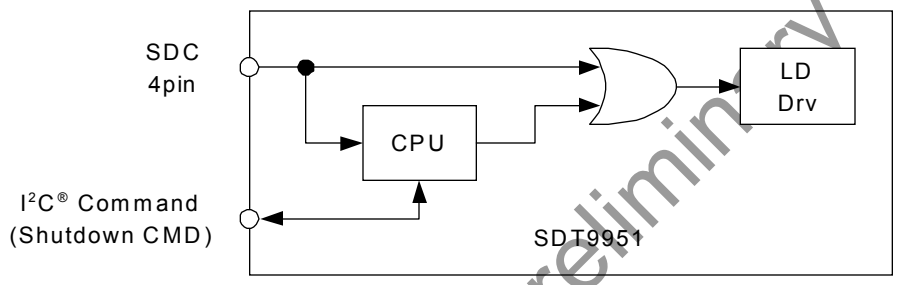
H:High Level, L:Low Level

*1, *2, *3, *4 : Logic Status Descriptions
*2 : Refer to Figure 3
*3 : Refer to Figure 4
*4 : Refer to Figure 5

*1	ALM	H	normal
		L	alarm
*2	SDC	H	shut down mode
		L	operating mode (default)
*3	SELC	H	non-clocked mode
		L	clocked mode (default)
*4	RST	H	normal
		L	active

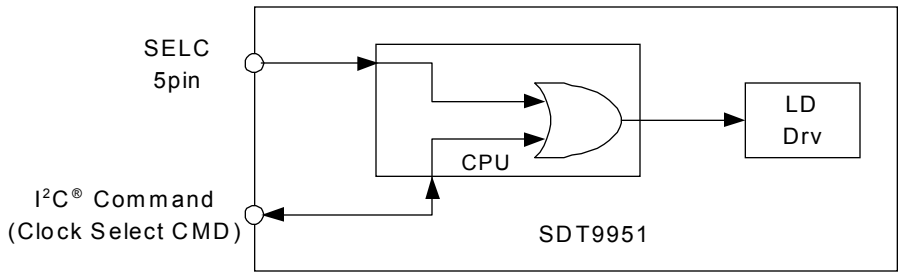
*5 : I²C® Address

H	Open or Pull up
L	GND



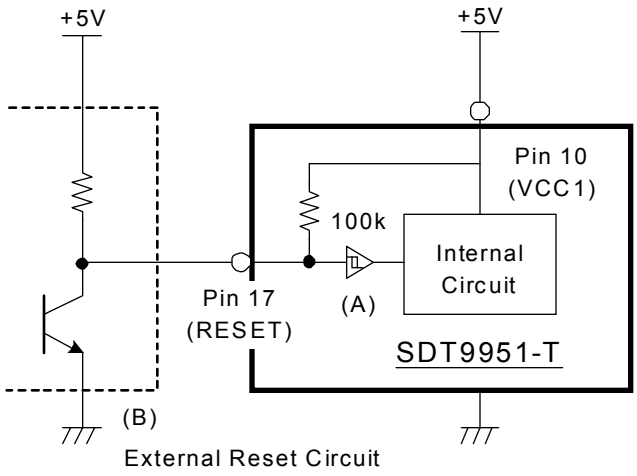
When SDC is high or I²C® Command for shut down is received, Tx output will deactive.

Figure 3. Shutdown Function



When SELC is high or I²C® Command for clock select is received. Tx will operate with Non-clocked mode.

Figure 4 Clock Select Function



(A) Input Stage Interface of SDT9951-T

Input Stage	:Schmitt Trigger
Input Low Level	:0.0 - 1.0V
Input High Level	:4.0 - 5.0V
Pullup register	:100k ohm

(B) Requirement of External Reset Circuit

Output Stage	:Open Collector or Open Drain
Leak Pass	:R value > 5uA
Ditecting Supply Voltage	:2.5 - 4.5V

Figure 5 Interface for Reset Function

5. Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device.

Parameters	Condition	Symbol	Min.	Max.	Unit
Storage Case Temperature	No Condensation allowed	Ts	-40	85	°C
Operating Case Temperature	RH 85% (Non-condensation)	Tc	0	70	°C
Supply Voltage		VCC	-0.3	6	V
TEC Supply Voltage		VTEC	-0.3	3.5	V
Input Voltage (Data, Clock)			0	VCC +0.5	V
Input Voltage (SDC, SELC)			-0.3	VCC +0.3	V
Input Voltage Swing	Di-Dib, CKi-CKib		-1	1	V
SDC, SELC Input Current			-0.5	25	mA
ALM Output DC Current			-0.5	25	mA
Lead Soldering Temperature	10 sec Max			260	°C

⚠ Warning

Use the product with the rated voltage described in the specification. If the voltage exceeds the maximum rating, overheating or fire may occur.

⚠ Caution

Do not store the product in the area where temperature exceeds the maximum rating, where there is too much moisture or dampness, where there is acid gas or corrosive gas, or other extreme conditions. Otherwise, failure, overheating or fire may occur.

6. Electrical Interface

(Unless otherwise specified, Vcc = 4.75 to 5.25 V Vtec = 3.1 to 3.5 V @2488.32Mbps, PRBS2^23-1, 50% duty and all operating temperature shall apply.)

Parameters	Condition	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage		VCC	4.75	5	5.25	V
Supply Current		ICC	-	200	450	mA
TEC Supply Voltage		VTEC	3.1	3.3	3.5	V
TEC Supply Current		ITEC			2.2	A
Power Dissipation		Pdis			10.0*	W
Single-ended input sensitivity data & clock voltage	AC coupled	Vse	500	800	1000	mVpp
Differential input sensitivity data & clock voltage	AC coupled for earch input	Vdi	250	400	500	mVpp
Bit rate					2.7	Gb/s
Clock Duty cycle			40		60	%
Data input impedance		Zin		50		Ω
Electrical input data return loss(50Ω)	0.1GHz < f < 1.2GHz	Rld1	8			dB
	1.2GHz < f < 2.0GHz	Rld2	8			dB
Electrical input clock return loss(50Ω)	0.1GHz < f < 2.7GHz	Rlc	8			dB
Set-up / Hold time				T.B.D		ps
SDC, SELC logic high level input voltage		VIH	2.0		VCC	V
SDC, SELC logic low level input voltage		VIL	0		0.7	V
ALM logic high level output voltage	Pulled up to VCC	VOH	VCC-0.7			V
ALM logic low level output voltage	Pulled up to VCC	VOL	0		0.6	V
ALM response time					T.B.D	ms
SDC activation time		tact			T.B.D	us
SDC deactivation time		tdeact			T.B.D	ms
SCL, SDA logic high level input voltage			0.9*VCC		VCC	V
SCL, SDA logic low level input voltage			0		0.3*VCC	V
SDA Output high voltage			VCC-0.7	-	-	V
SDA Output low voltage			-	-	0.6	V

* Including Transient State.

7. Optical Interface

(Unless otherwise specified, Vcc = 4.75 to 5.25 V @2488.32Mbps, PRBS2^23-1, Clocked mode, 50% duty and all operating temperature shall apply.)

Parameters	Condition	Symbol	Min.	Typ.	Max.	Unit
ITU-Tx/SONET			L16.2/LR-2			
Optical output power		Pnom	5	7	9	dBm
SD optical output power	SDC=ON	Pd			-40	dBm
Center wavelength range		λ	1528.773		1563.047	nm
Spectrical width	at-20dB	Δλ		0.2	0.5	nm
Side mode suppression ratio		SMSR	30			dB
BOL wavelength deviation	BOL,over temperature	ΔλT	-50		50	pm
EOL wavelength deviation	EOL	Δλa	-100		100	pm
Return loss at S		RL	24			dB
Extinction ratio		ER	8.2			dB
Chromatic dispersion		D	1600			ps/n

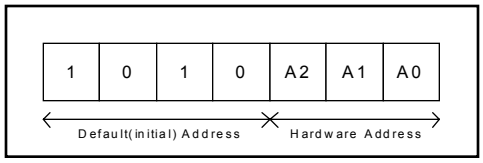
⚠ Warning
⃠ Do not look at the laser beam projection area (e.g. end of optical connector) with naked eyes or through optical equipment while the power is supplied to this product. Otherwise, your eyes may be injured.

8. I²C® Interface

Data Transfer Rate ; Only 100KHz (Standard Mode)

Parameters	Symbol	Min.	Typ.	Max.	Unit
Start condition Setup time	Tsu:sta	4700		ns	Only relevant repeated START condition
Start condition Hold time	Thd:sta	4000		ns	After this period the first clock pulse is generated
Stop condition Setup time	Tsu:sto	4700		ns	
Stop condition Hold time	Thd:sto	4000		ns	
Clock high time	Thigh	4000		ns	
Clock low time	Tlow	4700		ns	
SDA and SCL rise time	Tr		1000	ns	
SDA and SCL fall time	Tf		300	ns	
Data input setup time	Tsu:dat	250		ns	
Data input hold time	Thd:dat	0		ns	
Output valid from clock	Taa		3500	ns	
Bus free time	Tbuf	4700		ns	Time the bus must be free before a new transmission can start

9. I²C® Address



Hardware Addresses : The A2,A1 and A0 pins are device address inputs that are hard wired

10. I²C® Command

I²C® Command	Function
SET_CMD	Set command register value (shutdown, clock)
SET_FREQ	Set selected frequency register
RD_CMD	Read command register value (shutdown, clock)
RD_FREQ	Read selected frequency register
MES_VBIAS	Read laser diode bias voltage in μV
MES_VBACK	Read laser diode back face monitor voltage in μV
MES_ITEC	Read thermo electric cooler current in μA
MES_ATCMON	Read automatic temperature voltage in μV
MES_TEMPMON	Read module inner temperature voltage in μV
RD_ALARM	Read alarm status
RD_MOD_TYP	Read module type code
RD_USER	Read one customer parameter from user memory area(64 byte wide)
WR_USER	Write one customer parameter from user memory area(64 byte wide)

11. Recommended User SDT9951 Interface

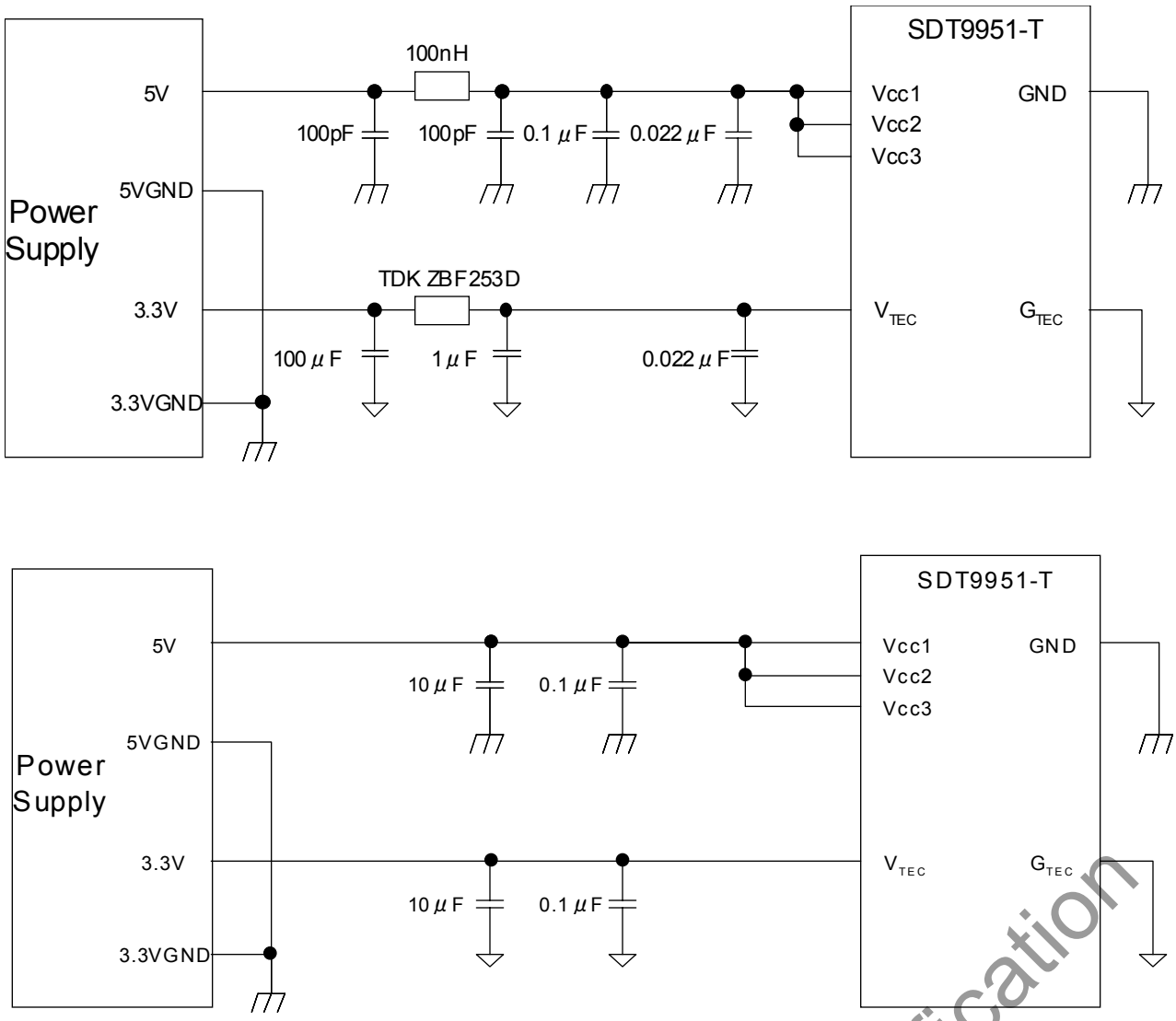


Figure 6 Recommended Power Supply Filtering

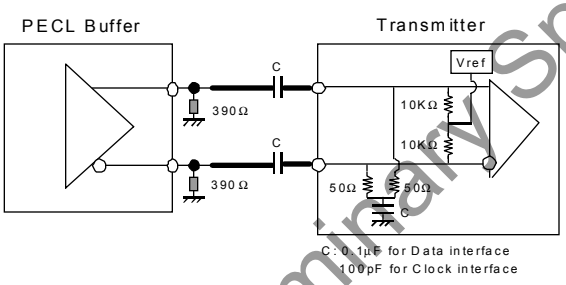
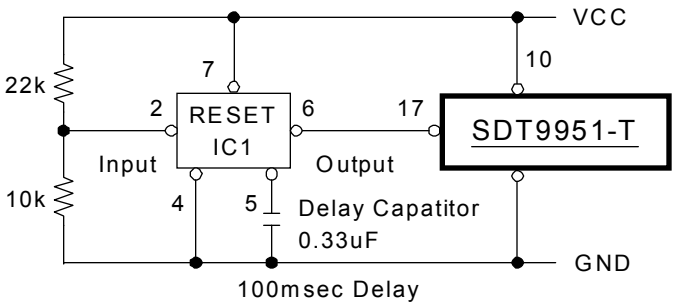


Figure 7 Data and Clock Interface with PECL Device

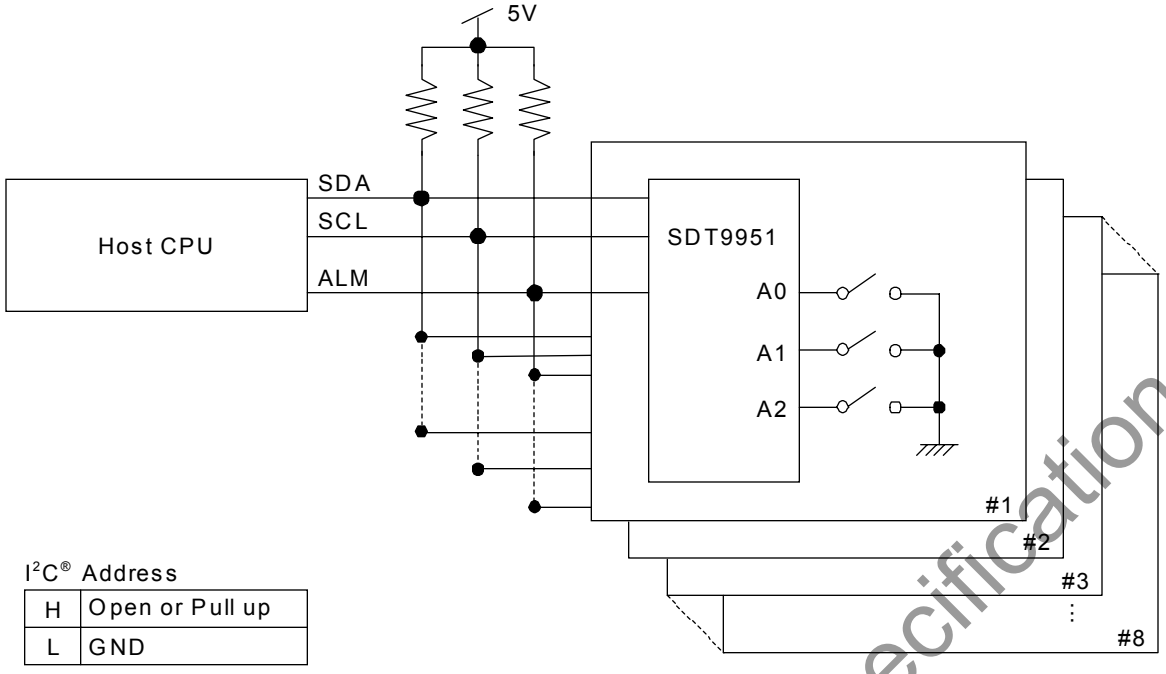


IC1: Mitsubishi M51957BFP

http://www.mitsubishichips.com/data/datasheets/assps/assppdf/ds/m51957e.pdf

Figure 8 External Reset Circuit

12. Recommended User I²C® Interface



I²C® Address

H	Open or Pull up
L	GND

* ALM, SDA and SCL must be pulled up.

13. Fiber Pigtail Specification

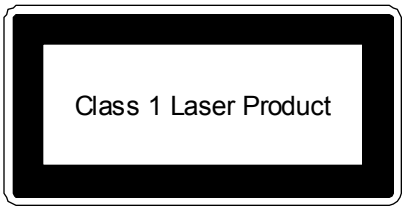
Parameter	Min.	Typ.	Max.	Unit
Core Diameter		9.5		μm
Cladding Diameter		125		μm
Outer Diameter		0.9		mm
Fiber Length	890	990	1090	mm
Optical Cord Tensile Break Max.Force			9.8	N
Bend Radius	30			mm

⚠ Caution

⃠ Do not give undue force or impact to the optical fiber pigtail. A broken optical fiber may injure skin or human body, or a strong laser beam may cause eye injury. Operate the equipment carefully. Use assisting tools or prospective aids as required.

14. Laser Safety

This product uses a semiconductor laser system and is a laser class 1 product acc. FDA, complies with 21CFR1040. 10 and 1040.11. Also this product is a laser class 1 product acc. IEC 60825.



⚠Caution
⃠ If this product is used under conditions not recommended in the specification or this product is used with unauthorized revision, classfication for laser product safety standard is invalid. Classify the product again at your responsibility and take appropriate actions.

15. Ordering Information

Operating Case Temperature	Tc = 0~70°C			
Connector Type	FC - PC	SC	MU-J	LC
Ordering Number	SDT9951 - TD - XXXX	SDT9951 - TC - XXXX	SDT9951 - TM - XXXX	SDT9951 - TL - XXXX

XXXX : Refer to Table 1

Wavelength(nm)	Frequency(THz)	Channel No.	Order No.
1528.773	196.10	F610	
○ 1529.553	196.00	F600	
1530.334	195.90	F590	
1531.116	195.80	F580	F580
1531.898	195.70	F570	
○ 1532.681	195.60	F560	
1533.465	195.50	F550	
1534.250	195.40	F540	F540
1535.036	195.30	F530	
○ 1535.822	195.20	F520	
1536.609	195.10	F510	
1537.397	195.00	F500	F500
1538.186	194.90	F490	
○ 1538.976	194.80	F480	
1539.766	194.70	F470	
1540.557	194.60	F460	F460
1541.349	194.50	F450	
○ 1542.142	194.40	F440	
1542.936	194.30	F430	
1543.730	194.20	F420	F420
1544.526	194.10	F410	
○ 1545.322	194.00	F400	
1546.119	193.90	F390	
1546.917	193.80	F380	F380

Wavelength(nm)	Frequency(THz)	Channel No.	Order No.
1547.715	193.70	F370	
○ 1548.515	193.60	F360	
1549.315	193.50	F350	
1550.116	193.40	F340	F340
1550.918	193.30	F330	
○ 1551.721	193.20	F320	
1552.524	193.10	F310	
1553.329	193.00	F300	F300
1554.134	192.90	F290	
○ 1554.940	192.80	F280	
1555.747	192.70	F270	
1556.555	192.60	F260	F260
1557.363	192.50	F250	
○ 1558.173	192.40	F240	
1558.983	192.30	F230	
1559.794	192.20	F220	F220
1560.606	192.10	F210	
○ 1561.419	192.00	F200	
1562.233	191.90	F190	
1563.047	191.80	F180	F180

○ : default

Table 1

16. Other Precaution

Under such a strong vibration environment as in automobile, the performance and reliability are not guaranteed.

The governmental approval is required to export this product to other countries. To dispose of these components, the appropriate procedure should be taken to prevent illegal exportation.

This module must be handled, used and disposed of according to your company's safe working practice.

⚠ Warning
Be sure to carry out correct soldering for connection to peripheral circuits in order to prevent contact failure or short-circuit. Otherwise, a strong laser beam may cause eye injury, overheating or fire. Do not put this product or components of this product into your mouth. This product contaions material harmful to health.

⚠ Caution
Be sure to turn the power off when you touch this product connected to the printed circuit boards. Otherwise, electric shock may occur. Dispose this product or equipment including this product properly as an industrial waste according to the regulations.

17. For More Information

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