

MITSUBISHI (OPTICAL DEVICES)

# MF-2500DS-T12-18x/19x/20x/21x MF-2500DS-R13-18x MF-2500DS-R14-19x/20x/21x

SONET/SDH TRANSMITTER & RECIEVER

## DESCRIPTION

2.5Gb/s ATM LAN and ATM switching systems.

This product is designed to provide high optical performance for SDH STM-16/SONET OC-48. Transmitter uses uncooled laser module with drivered by specific integrated circuit. Receiver uses PD or APD preamp-module and integrated circuits for reshaping, retiming and regenerating optical signal.

## FEATURES

- Full SONET/SDH line up
- Low cost
- Compact, low power
- -5.2V,+5V power supply, DC/DC converter built in for Rx
- Case Temp. Range: Class 1; -5 to +75°C / Class 2; -40 to +85°C
- Clock recovery
- Multi source

## APPLICATION

Short haul and long haul telecommunication systems for SDH STM-16 / SONET OC-48.

## ABSOLUTE MAXIMUM RATINGS

Stress below listed absolute maximum rating may cause permanent damage to the module.

This is a stress only and functional operation of the module at these or any other conditions in excess of those given in the operational sections of this data sheet .

Exposure to Absolute Maximum Rating for extended periods may affect module reliability.

Tc=25°C

Parameters	Symbol	Ratings	Unit
Supply voltage	Vcc	+6.0	V
	Vee	-6.0	V
High output current	-	TBD	mA
Input voltage	-	TBD	V
Storage temperature	Tstg	-40 to +85	°C
Operating case temperature	Tc	class 1:-5 to +75 class 2:-40 to +85	°C
Soldering Temperature	-	+260	°C
Soldering Time	-	10	sec
Relative humidity(non condensation)	-	10 to 80	%
Fiber bend radius	-	32	mm

**MITSUBISHI (OPTICAL DEVICES)**  
**MF-2500DS-T12-18x/19x/20x/21x**  
**MF-2500DS-R13-18x**  
**MF-2500DS-R14-19x/20x/21x**  
**SONET/SDH TRANSMITTER & RECIEVER**

**ELECTRICAL/OPTICAL CHARACTERISTICS** (T<sub>LD</sub>=25°C, unless otherwise noted)

All parameters are specified over the operating case temperature.

Measurement conditions are at 2488.32Mb/s +/-20ppm, NRZ PN2<sup>23</sup>-1 and 50% duty cycle data signal.

V<sub>cc</sub>=+5.0V+/-5%, V<sub>ee</sub>=-5.2V+/-5%, and for Transmitter.

note : V<sub>cc</sub>-V<sub>ee</sub> ; with V<sub>cc</sub> at +5V V<sub>ee</sub> must be at 0V ; with V<sub>ee</sub> at -5.5V V<sub>cc</sub> must be at 0V

note : Internally AC coupled with 50ohm internal termination

**Transmitter**

class1 : -5°C to +75°C class2 : -40°C to +85°C

Parameters	Condition	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	note 1	-	4.75	5.0	5.5	V
Power consumption	total	-	-	0.8	2.0	W
Input sensitivity data and clock voltage	note 2,3	SV	0.6	0.8	1.0	Vpp
Normalized back face voltage	note 5	-	-	500	-	mV
Monitor bias voltage	note 5	-	-	20	-	mV/mA
Logic level	note 4	-	TTL compatible			-

note 1: V<sub>cc</sub>-V<sub>ee</sub> ; with V<sub>cc</sub> at +5V V<sub>ee</sub> must be at 0V ; with V<sub>ee</sub> at -5.5V V<sub>cc</sub> must be at 0V

note 2: Internally AC coupled with 50ohm internal termination

note 3: This sensitivity is achieved by applying at minimum either a 0.6Vpp signal on one input while the other input is tied to ground or by applying two complementary 0.3Vpp signal on both inputs.

note 4: when V<sub>cc</sub> at +5V and V<sub>ee</sub> at 0V

note 5: This voltage is measured taking V<sub>ee</sub> as reference.

**Receiver**

class1 : -5°C to +75°C class2 : -40°C to +85°C

Parameters	Condition	Symbol	Min.	Typ.	Max.	Unit
Positive supply voltage		-	4.75	5.0	5.25	V
Negative supply voltage	if equired	-	-5.5	-5.2	-4.94	V
Power consumption	total	-	-	1.3	3	W
Output data and clock voltage single ended		SV	0.3	0.4	1	Vpp
Output data and clock voltage differential		DV	0.6	0.8	2	Vpp
Jitter generation			GR-253/ITU-T G958			UIrms
Jitter tolerance			GR-253/ITU-T G958			UIpp
Jitter transfer peaking		-	GR-253/ITU			dB
Logic output level	note 6	-	TTL compatible			-

note 6: At the moment the jitter bandwidth performance according GR-253/ITU-T G958 is not met at the receiver interface level.

Additional clock filtering is supposed to be done at lower data rates.

Jitter transfer bandwidth will be defined at this level which is a parameter of the whole network element and not of the receiver element.

A further version is under investigation to met simultaneously all the GR-253/ITU-T G958 jitter specifications at the physical interface level.

**MITSUBISHI (OPTICAL DEVICES)**  
**MF-2500DS-T12-18x/19x/20x/21x**  
**MF-2500DS-R13-18x**  
**MF-2500DS-R14-19x/20x/21x**  
**SONET/SDH TRANSMITTER & RECIEVER**

**OPTICAL CHARACTERISTICS**

	cond.	symp.	Min.	Typ.	Max.	Min	Typ.	Max	
ITU-T/SONET	-	-	S-16.1/LR-1			L-16.1/LR-1			-
Optical budget	note7	-	0	-	12	10	-	24	dB
<b>Transmitter</b>									
Center wavelength	-	-	1270	1310	1360	1280	1310	1335	nm
Optical source	-	-	SLM			SLM			-
Optical output power	note8	S <sub>nom</sub>	-4.5	-2	0	-1.5	0	+3	dBm
Shutdown optical power	-	Sidle	-	-50	-40	-	-50	-40	dBm
Spectral width	note9	-	-	0.3	1	-	0.3	1	nm
SMSR	-	-	30	-	-	30	-	-	dB
Extinction ratio	note10	ER	8.2	-	-	8.2	-	-	dB
Dispersion	-	-	100	-	-	250	-	-	ps/nm
maximum return loss	-	-	-	-	24	-	-	24	dB
<b>Receiver</b>									
Receiver sensitivity	note11 note12	R <sub>sen</sub>	-	-20.5	-18.5	-	-29.5	-27.5	dBm
Receiver overload	note13	R <sub>ovr</sub>	0	+1	-	-8	-7	-	dBm
Path penalty	-	-	-	0.2	1	-	0.2	1	dB
Maximum reflectance	-	-	-	-	-27	-	-	-27	dB

	cond.	Symb.	Min.	Typ.	Max.	Min	Typ.	Max	
ITU-T/SONET	-	-	L-16.1/LR-2			V-16.2			-
Optical budget	note7	-	10	-	24	22	-	33	dB
<b>Transmitter</b>									
Center wavelength	-	-	1500	1530	1580	1530	1545	1565	nm
Optical source	-	-	SLM			SLM			-
Optical output power	note8	S <sub>nom</sub>	-1.5	0	+3	-4.5	0	+3	dBm
Shutdown optical power	-	Sidle	-	-50	-40	-	-50	-40	dBm
Spectral width	note9	-	-	0.3	1	-	0.3	0.8	nm
SMSR	-	-	30	-	-	30	-	-	dB
Extinction ratio	note10	ER	8.2	-	-	8.2	-	-	dB
Dispersion	-	-	1600	-	-	2400	-	-	ps/nm
maximum return loss	-	-	-	-	24	-	-	24	dB
<b>Receiver</b>									
Receiver sensitivity	note11 note12	R <sub>sen</sub>	-	-30.5	-28.5	-	-27.5	-25.5	dBm
Receiver overload	note13	R <sub>ovr</sub>	-8	-7	-	-9	-8	-	dBm
Path penalty	-	-	-	1.3	2	-	1.5	2	dB
Maximum reflectance	-	-	-	-	-27	-	-	-27	dB

note7: The V-16.2 version is adapted to standard 10dBm to 13dBm EDFA optical bandwidth.

note8: Measured at the connector interface. Provision of 0.5dB is taken for S point measurement.

note9: The maximum full width of the central wavelength peak, measured 20dB down from maximum amplitude under modulation condition PRBS 2<sup>23</sup>-1.

note10: Measured at the connector interface under modulation condition PRBS 2<sup>23</sup>-1.

note11: Measured at BER 10<sup>-10</sup>.

note12: Provision of 0.5dB is taken for R point measurement if SMF fiber is used.

Note13: The device must not be damaged when this optical power is applied to the optical input.

The device is not meant to operate at such an optical input power.

All min and max. parameters are specified End-of-Life within the overall relevant operating temperature range.

The typical values are referenced to +25deg.C ,nominal power supply, beginning of life.

MITSUBISHI (OPTICAL DEVICES)

**MF-2500DS-T12-18x/19x/20x/21x**  
**MF-2500DS-R13-18x**  
**MF-2500DS-R14-19x/20x/21x**  
SONET/SDH TRANSMITTER & RECIEVER

---

**ORDERING INFORMATION**

**Transmitter**

Part number	ITU-code	Optical connector type
MF-2500DS-T12-180	S-16.1	FC
MF-2500DS-T12-181	S-16.1	SC
MF-2500DS-T12-190	L-16.1	FC
MF-2500DS-T12-191	L-16.1	SC
MF-2500DS-T12-200	L-16.2	FC
MF-2500DS-T12-201	L-16.2	SC
MF-2500DS-T12-210	V-16.2	FC
MF-2500DS-T12-211	V-16.2	SC

**Receiver**

Part number	ITU-code	Optical connector type
MF-2500DS-R13-180	S-16.1	FC
MF-2500DS-R13-181	S-16.1	SC
MF-2500DS-R14-190	L-16.1	FC
MF-2500DS-R14-191	L-16.1	SC
MF-2500DS-R14-200	L-16.2	FC
MF-2500DS-R14-201	L-16.2	SC
MF-2500DS-R14-210	V-16.2	FC
MF-2500DS-R14-211	V-16.2	SC

**MITSUBISHI (OPTICAL DEVICES)**  
**MF-2500DS-T12-18x/19x/20x/21x**  
**MF-2500DS-R13-18x**  
**MF-2500DS-R14-19x/20x/21x**  
**SONET/SDH TRANSMITTER & RECIEVER**

**PIN ALLOCATION**

**Transmitter pin allocation**

No.	Symbol	Description	No.	Symbol	Description
1	VEE	Negative power supply ****	24	VCC	Positive power supply ****
2	BACK(+)	Monitoring for back fact current	23	GND	Ground
3	BIAS(+)	Monitoring for LD current	22	Cki-	False clock input
4	SDC	Shut Down Command ***	21	GND	Ground
5	SELC	Clock mode select **	20	Cki+	True clock input *
6	GND	Ground	19	GND	Ground
7	NUC	No user connection	18	Di-	False data input
8	LDA	Laser Degrade Alarm *****	17	GND	Ground
9	NUC	No user connection	16	Di+	True data input
10	NUC	No user connection	15	GND	Ground
11	GND	Ground	14	NUC	No user connection
12	VEE	Negative power supply ****	13	VCC	Positive power supply ****

\*: The falling edge of Cki clock input signal is at the Di data eye pattern crossing point.

\*\* : When open (or low) the module is in the operating mode. When high the module operates in non clocked mode.

\*\*\*: When high the module in the shut down mode (no optical output power).  
When open (or low) the module is in the operating mode.

\*\*\*\*: Vcc-Vee; with Vcc at +5V Vee must be at 0V; with Vee at -5.5V Vcc must be at 0V

\*\*\*\*\*: When provided a digital alarm indicates that the laser is degraded.

The active level is a low level.

This pin must be teitdo Vcc through a 100k ohm resistor when the digital alarm is not proved

**Receiver pin allocation**

No.	Symbol	Description	No.	Symbol	Description
1	HV / NIC	High Voltage *	24	NUC	No user connection
2	NUC	No user connection	23	OILV / NIC	Optical Input Light Voltage ##
3	LPA	Loss of Power Alarm ***	22	VCC	Positive power supply
4	GND	Ground **	21	NUC	No user connection
5	Cko-	False clock output	20	GND	Ground **
6	Cko+	True clock output	19	GND	Ground **
7	GND	Ground **	18	VEE	Negative power supply
8	VCC	Positive power supply	17	GND	Ground **
9	GND	Ground	16	GND	Ground **
10	Do+	True data output	15	GND	Ground **
11	Do-	False data output	14	GND	Ground **
12	GND	Ground **	13	DTV / NIC	Decision Threshold Voltage #

\*: This pin is Not Internally Connected(NIC) in case of the high voltage generator is inside the module.

\*\* : Package is at same potential as GND .

\*\*\*: LPA output is a logic level that indicates the presence or absence of a sufficient optical input level.  
A logical high level indicates an input optical level too low.

#: This pen is not internally connected if the amplitude decision threshold is not made adjustable.

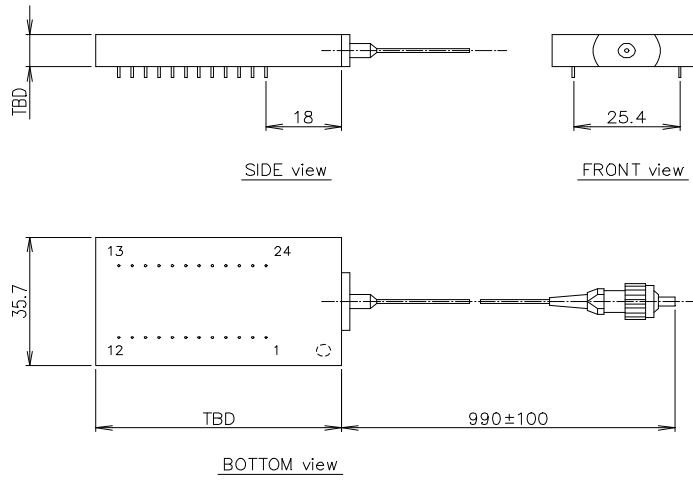
##: This pen is not internally connected if the Optical Input Light Voltage functionality is not provided.

**MITSUBISHI (OPTICAL DEVICES)**  
**MF-2500DS-T12-18x/19x/20x/21x**  
**MF-2500DS-R13-18x**  
**MF-2500DS-R14-19x/20x/21x**  
**SONET/SDH TRANSMITTER & RECIEVER**

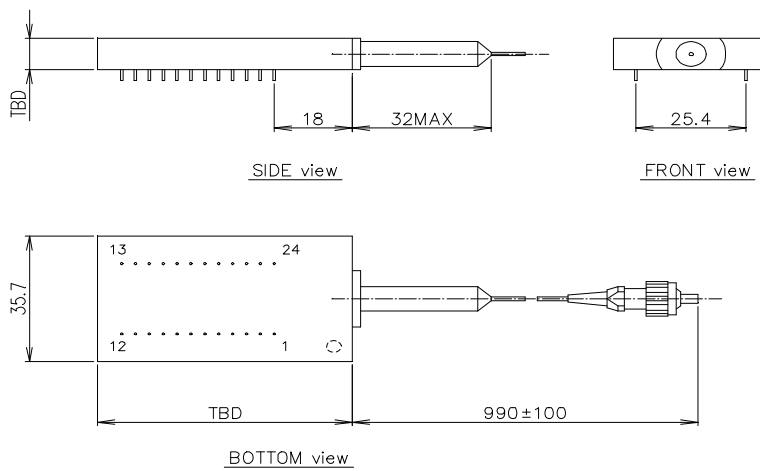
**GENERAL OUTLINE DRAWING**

NOTE: TOLERANCES UNLESS NOTED +/-0.5  
DIMENSIONS ARE IN MILLIMETERS

**Transmitter**

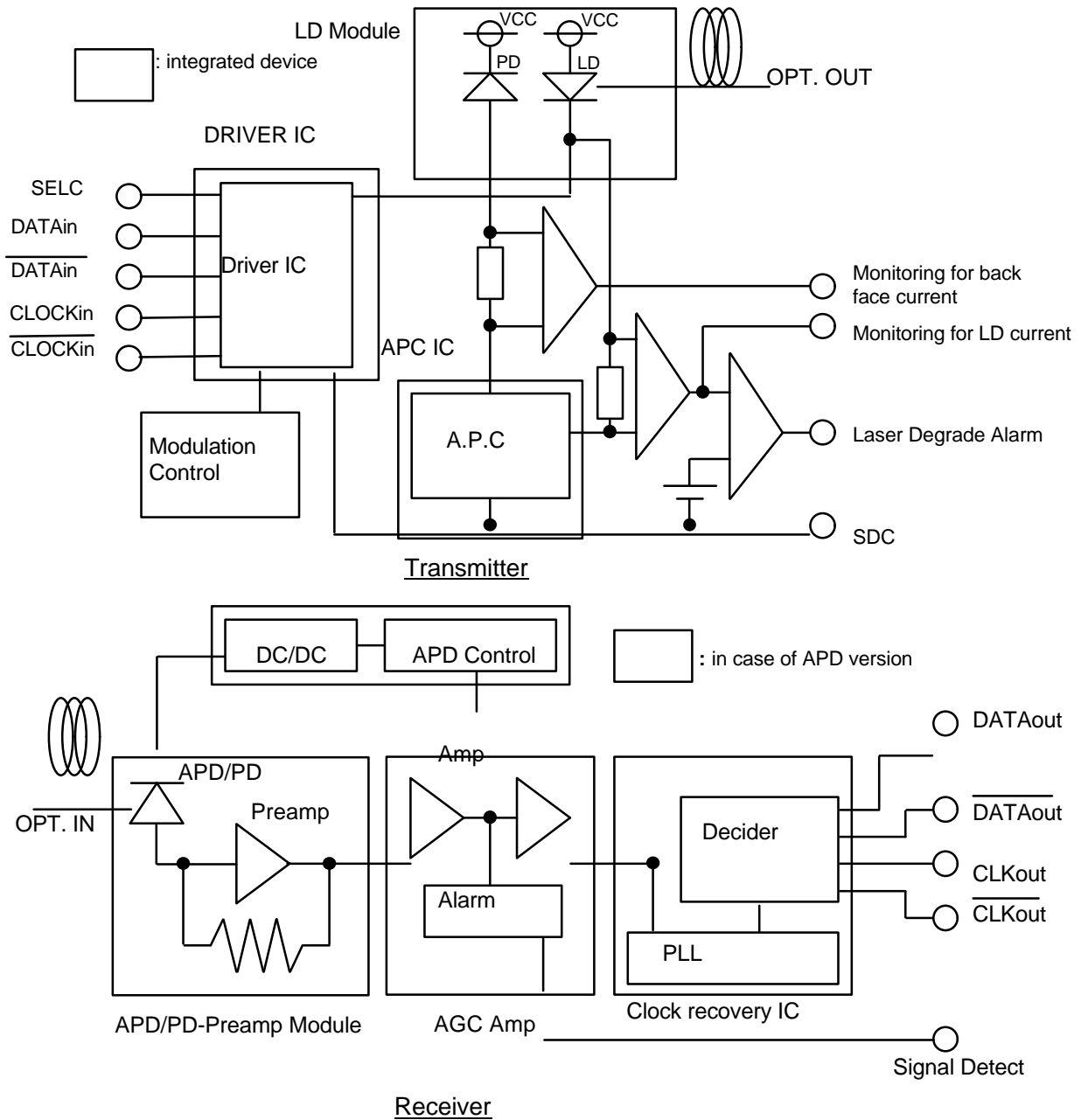


**Receiver**



MITSUBISHI (OPTICAL DEVICES)  
**MF-2500DS-T12-18x/19x/20x/21x**  
**MF-2500DS-R13-18x**  
**MF-2500DS-R14-19x/20x/21x**  
SONET/SDH TRANSMITTER & RECIEVER

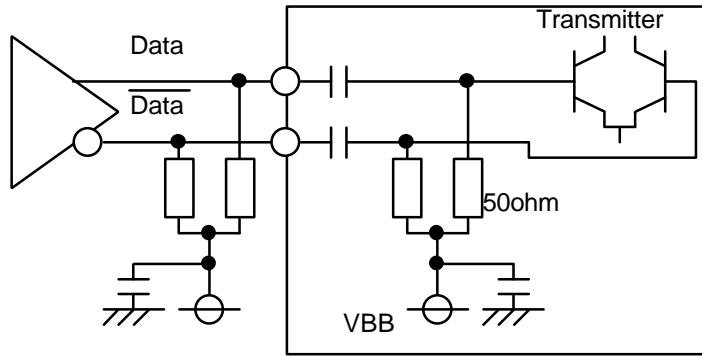
**BLOCK DIAGRAM**



**MITSUBISHI (OPTICAL DEVICES)**  
**MF-2500DS-T12-18x/19x/20x/21x**  
**MF-2500DS-R13-18x**  
**MF-2500DS-R14-19x/20x/21x**  
**SONET/SDH TRANSMITTER & RECIEVER**

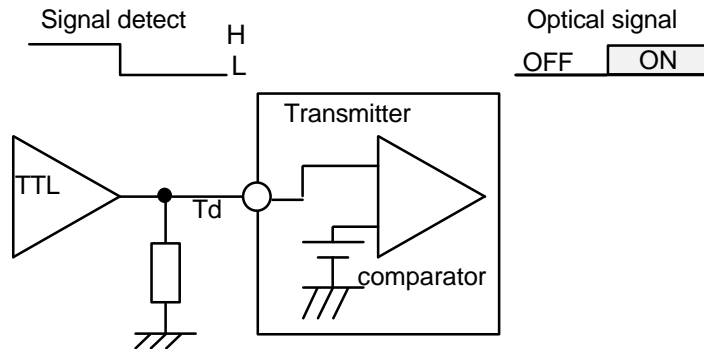
**NOTE**

**NOTE1: Input interface**



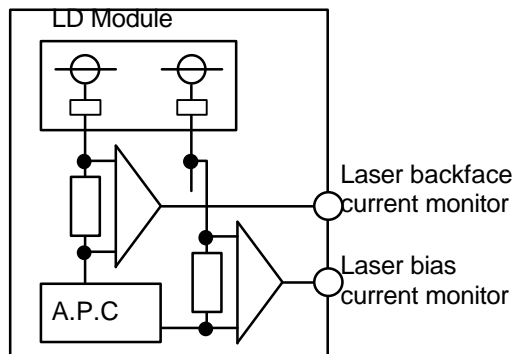
AC Coupled Interface

**NOTE2: Shut Down Command interface**



The transmitter is normally enabled and only requires an external voltage to disable.

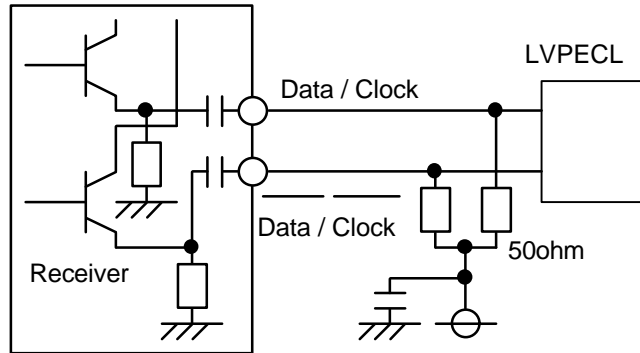
**NOTE3: Laser bias / Laser backface monitor interface**





**MITSUBISHI (OPTICAL DEVICES)**  
**MF-2500DS-T12-18x/19x/20x/21x**  
**MF-2500DS-R13-18x**  
**MF-2500DS-R14-19x/20x/21x**  
**SONET/SDH TRANSMITTER & RECIEVER**

**NOTE4: Output interface**



**NOTE5: Data and Clock relationship**

TBD

**NOTE6: Signal detect interface**

