



25G SFP28 DWDM Tunable Transceiver

Hot Pluggable, Duplex LC, 50GHz DWDM MZM, SMF 10KM, DDM

Part Number: FSPP-N7-DTU-10DQ



Overview

FSPP-N7-DTU-10DQ is a Small Form Factor Pluggable SFP28 transceiver compliant with SFF-8402 SFP28 MSA standard. The high performance DWDM C-band tunable cooled InP MZM-based transmitter and high Sensitivity APD receiver with built-in CDR provide superior performance for 25GBASE-LR, CPRI Option #10 and DWDM Networks applications up to SMF 10km optical links.

Applications

- 25GBASE-LR Ethernet @25.78G
- CPRI Option #10 @24.33G
- eCPRI 5G Mobile Networks
- DWDM Networks

Features

- Compatible with IEEE802.3cc 25GBASE-LR
- Compliant with CPRI option10
- Compliant with SFF-8402 SFP28 MSA
- Data Rate up to 25.78Gbps
- Built-in CDR on both Transmitter and Receiver
- Hot Pluggable
- 50GHz ITU Grid channel spacing with integrated wavelength locker and auto-tuning technology
- Monolithically integrated full C-band DWDM tunable transmitter
- APD receiver
- Duplex LC connector
- 2-wire interface for management and diagnostic monitor compliant with SFF-8472
- Single +3.3V power supply
- Link distance 10km over SM fiber
- Maximum power consumption 3W
- RoHS Compliant

Laser Safety

- This is a Class 1 Laser Product complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.
- Caution: Use of control or adjustments or performance of procedure other than those specified herein may result in hazardous radiation exposure.



Absolute Maximum Ratings

Parameters	Symbol	Min.	Max.	Unit
Storage Temperature	T _{ST}	-40	+85	°C
Storage Relative Humidity	RH	0	85	%
Supply Voltage	V _{CC}	-0.5	+3.6	V

Recommended Operating Conditions

Parameters	Symbol	Min.	Typ.	Max.	Unit
Case Operating Temp. (FSPP-N7-DTU-10DQ)	T _{OP}	0	-	+70	°C
Case Operating Temp. (FSPP-N7-DTU-10DQi)	T _{OP}	-40	-	+85	°C
Supply Voltage	V _{CC}	+3.13	+3.3	+3.47	V
Supply Current (FSPP-N7-DTU-10DQ)	I _{CC}			600	mA
Supply Current (FSPP-N7-DTU-10DQi)	I _{CC}			900	mA
Power Consumption (FSPP-N7-DTU-10DQ)	P			2	W
Power Consumption (FSPP-N7-DTU-10DQi)	P			3	W

Transmitter Electro-optical Characteristics

V_{CC} = 3.13V to 3.47V, T_{OP} = 0 °C to 70 °C(FSPP-N7-DTU-10DQ); T_{OP} = -40 °C to 85 °C(FSPP-N7-DTU-10DQi)

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Data Rate	DR	10.3125	25.78		Gb/s	
Optical Launch Power	P _o	0		+4	dBm	1
Wavelength Range	λ _c	1528.77		1566.31	nm	
Optical Center Wavelength		λ _c -0.05	λ _c	λ _c +0.05	nm	
Frequency Range	f _c	196.10		191.40	GHz	
Frequency Stability (BOL)		f _c -6.5		f _c +6.5	GHz	2
Frequency Stability (EOL)		f _c -12.5		f _c +12.5	GHz	2
Center Wavelength Spacing			50		GHz	3
Spectral Width (-20dB)	Δλ			0.4	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Optical Extinction Ratio	ER	6			dB	
Transmitter Dispersion Penalty	TDP			3	dB	4
Optical Eye Mask		IEEE 802.3cc				
Relative Intensity Noise	RIN			-128	dB/Hz	



Optical Return Loss Tolerance	ORLT			20	dB	
Differential Data Input Swing	V _{IN}	150		900	mV	
Tx Disable Input Voltage-Low (Tx ON)	TDISV _L	GND		0.8	V	
Tx Disable Input Voltage-High (Tx OFF)	TDISV _H	2.0		V _{cc} +0.3	V	
Tx Fault Output Voltage-Low (Tx Normal)	TFLTV _L	GND		0.8	V	
Tx Fault Output Voltage-High (Tx Fault)	TFLTV _H	2.0		V _{cc}	V	

Note1: The optical power is launched into a 9/125μm single mode fiber.

Note2: The *f_c* test condition is reflect power to transmitter lower than -27dBm.

Note3: Corresponds to approximately 0.4nm.

Note4: After 10km G.652D 9/125μm single mode fiber.

Receiver Electro-optical Characteristics

V_{cc} = 3.13V to 3.47V, T_{op} = 0 °C to 70 °C(FSPP-N7-DTU-10DQ); T_{op} = -40 °C to 85 °C(FSPP-N7-DTU-10DQi)

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Data Rate	DR	10.3125	25.78		Gb/s	
Receiver Sensitivity	SEN			-18	dBm	1
Maximum Receive Power	PRX_MAX	-4			dBm	1
Optical Center Wavelength	λ _c	1270		1620	nm	
Optical Return Loss	ORL			-26	dB	
LOS De-Assert	LOS _D			-20	dBm	
LOS Assert	LOS _A	-35			dBm	
LOS Hysteresis	LOS _{HY}	0.5			dB	
Differential Data Output Swing	V _{OUT}	300		850	mV	
Receiver LOS Signal Output Voltage-Low	LOSV _L	GND		0.8	V	
Receiver LOS Signal Output Voltage-High	LOSV _H	2.0		V _{cc}	V	

Note1: Measured with a PRBS 2³¹-1 test pattern @25.78Gbps BER<5x10⁻⁵.

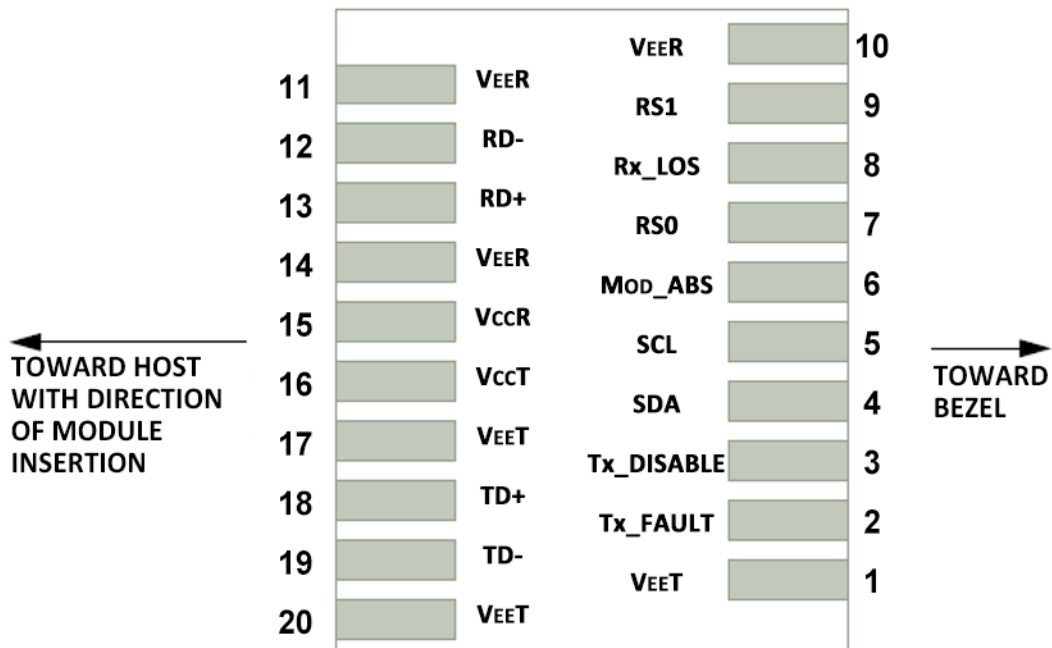


Self-Tuning

The bits listed in below Table are intended to support auto-tuning operation in conjunction with transceiver module firmware.

Device Address	Page	Byte	Bit	Name	Unit
A2h	02h	128	3	Self-Tuning supported	0 = supported 1 = not supported
		151	1	Enable Self-Tuning	1 = enable (default). A2h page 02h bytes 144-147 are ready only when the bit is set to 1. 0 = disable self-tuning
		168	7	Self-Tuning current status	1 = tuning 0 = locked
		172	7	Self-Tuning latched status	1 = tuning 0 = locked

Pin Assignment



Host PCB SFP28 Pad Assignment Top View



Pin Description

Pin	Name	Function / Description
1	VEET	Transmitter Ground
2	Tx_FAULT	Transmitter Fault Indication (1)
3	Tx_DISABLE	Transmitter Disable – Turns off transmitter laser output (2)
4	SDA	2-wire Serial Interface Data Line (SDA: Serial Data Signal) (3)
5	SCL	2-wire Serial Interface Clock (SCL: Serial Clock Signal) (3)
6	MOD_ABS	Module Absent, connected to VEET or VEER in the module (3)
7	RS0	Rate Select 0, optional (5)
8	Rx_LOS	Receiver Loss of Signal Indication (4)
9	RS1	Rate Select 1, optional (5)
10	VEER	Receiver Ground
11	VEER	Receiver Ground
12	RD-	Receiver Inverted Data output, AC coupled
13	RD+	Receiver Non-Inverted Data output, AC coupled
14	VEER	Receiver Ground
15	VccR	Receiver 3.3V Power Supply
16	VccT	Transmitter 3.3V Power Supply
17	VEET	Transmitter Ground
18	TD+	Transmitter Non-Inverted Data Input, AC coupled
19	TD-	Transmitter Inverted Data Input, AC coupled
20	VEET	Transmitter Ground

Note1: Tx Fault is open collector/drain output which should be pulled up externally with a 4.7K~10KΩ resistor on the host board to supply <VccT+0.3V or VccR+0.3V. When high, this output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to <0.8V.

Note2: Tx Disable input is used to shut down the laser output per the state table below. It is pulled up within the module with a 4.7K~10KΩ resistor. 1) Low(0~0.8V): Transmitter on; 2) Between(0.8V and 2V): Undefined; 3) High (2.0~ VccT): Transmitter Disabled; 4) Open: Transmitter Disabled.

Note3: These are the module definition pins. They should be pulled up with a 4.7K~10KΩ resistor on the host board to supply less than VccT+0.3V or VccR+0.3V. MOD_ABS is grounded by the module to indicate that the module is present.

Note4: Rx_LOS (Loss of signal) is an open collector/drain output which should be pulled up externally with a 4.7K~10KΩ resistor on the host board to supply <VccT+0.3V or VccR+0.3V. When high, this output indicates the received optical power is below the worst case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to <0.8V.

Note5: Tied to ground through a 30K ohm resistor. Rate select can be set through the 2-wire bus in accordance with SFF-8472 v12.1c. Rx Rate Select is set at Bit 3, Byte 110, Address A2h. Tx Rate Select is set at Bit 3, Byte 118, Address A2h. Writing a “1” selects maximum bandwidth operation.



Digital Diagnostic Functions

As defined by the SFP MSA (SFF-8472) Ficer's SFP28 transceivers provide digital diagnostic functions via a 2-wire serial interface, which allows real-time access to the following operating parameters:

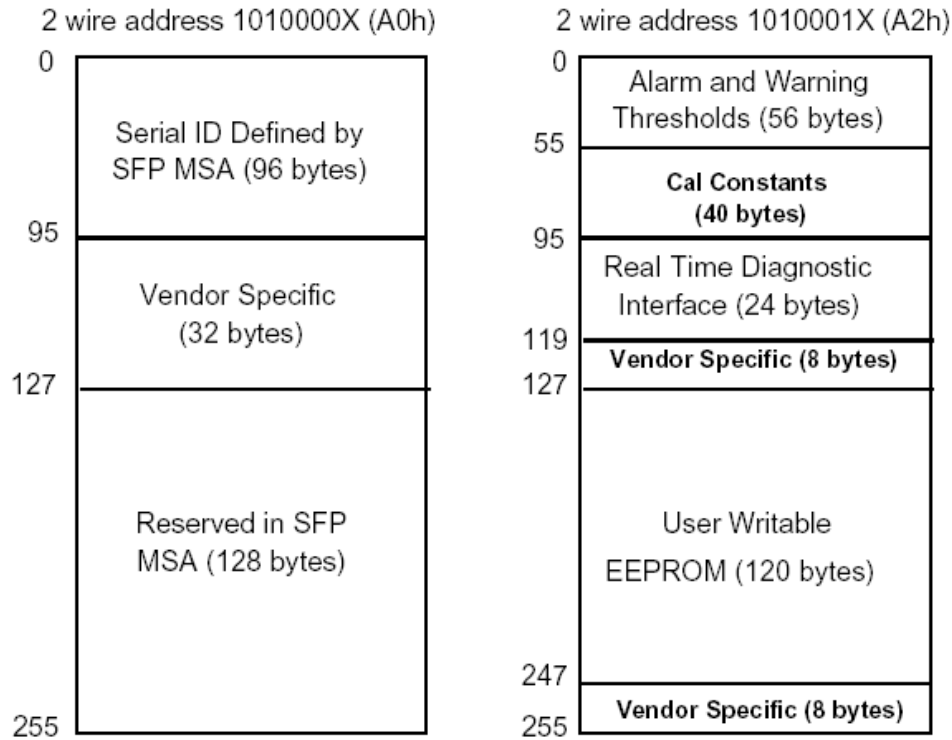
- Transceiver temperature
- Laser bias current
- Transmitted optical power
- Received optical power
- Transceiver supply voltage

It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Controller (DDC) inside the transceiver, which is accessed through the 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL pin) is generated by the host. The positive edge clocks data into the SFP28 transceiver into those segments of its memory map that are not write-protected. The negative edge clocks data from the SFP28 transceiver. The serial data signal (SDA pin) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially. For more detailed information including memory map definitions, please see the SFP MSA (SFF-8472) Specification.



Digital Diagnostic Memory Map

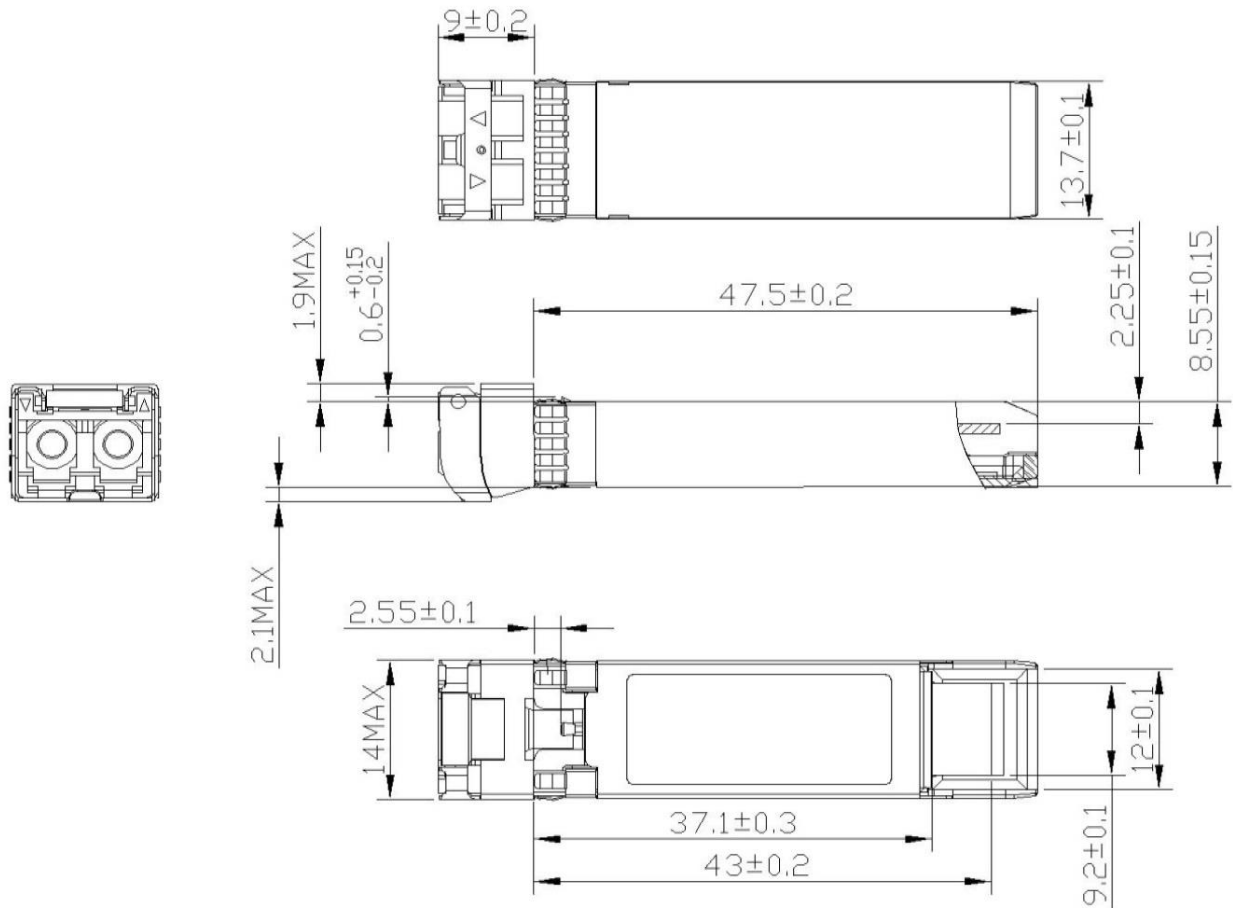


Digital Diagnostic Monitoring Characteristics

Parameter	Accuracy	Unit	Note
Temperature	±3	°C	Internal Calibration
Supply Voltage	±0.1	V	Internal Calibration
Tx Bias Current	±5	mA	Internal Calibration
Tx Output Power	±3	dB	Internal Calibration
Rx Received Optical Power	±3	dB	Internal Calibration



Mechanical Dimensions



(All Dimensions are ±0.20mm Unless Otherwise Specified, Unit: mm)

Ordering Information

Part No.	Tx	Rx	Link	DDM	Temp.
FSPN7-DTU-10DQ	50GHz ITU Grid C-Band DWDM	1270nm	SMF 10km	Yes	0~70°C
FSPN7-DTU-10DQi		~ 1620nm			-40~85°C

Note: Distances are indicative only. To calculate a more precise link budget based on specific conditions in your application, please refer to the optical characteristics.



Appendix A: 50GHz ITU Grid DWDM Central Wavelength Table

Channel	Wavelength (nm)	Frequency (THZ)	Channel	Wavelength (nm)	Frequency (THZ)
1 (C14)	1566.31	191.40	49 (C38)	1546.92	193.80
2 (H14)	1565.90	191.45	50 (H38)	1546.52	193.85
3 (C15)	1565.50	191.50	51 (C39)	1546.12	193.90
4 (H15)	1565.09	191.55	52 (H39)	1545.72	193.95
5 (C16)	1564.68	191.60	53 (C40)	1545.32	194.00
6 (H16)	1564.27	191.65	54 (H40)	1544.92	194.05
7 (C17)	1563.86	191.70	55 (C41)	1544.53	194.10
8 (H17)	1563.45	191.75	56 (H41)	1544.13	194.15
9 (C18)	1563.05	191.80	57 (C42)	1543.73	194.20
10 (H18)	1562.64	191.85	58 (H42)	1543.33	194.25
11 (C19)	1562.23	191.90	59 (C43)	1542.94	194.30
12 (H19)	1561.83	191.95	60 (H43)	1542.54	194.35
13 (C20)	1561.42	192.00	61 (C44)	1542.14	194.40
14 (H20)	1561.01	192.05	62 (H44)	1541.75	194.45
15 (C21)	1560.61	192.10	63 (C45)	1541.35	194.50
16 (H21)	1560.20	192.15	64 (H45)	1540.95	194.55
17 (C22)	1559.79	192.20	65 (C46)	1540.56	194.60
18 (H22)	1559.39	192.25	66 (H46)	1540.16	194.65
19 (C23)	1558.98	192.30	67 (C47)	1539.77	194.70
20 (H23)	1558.58	192.35	68 (H47)	1539.37	194.75
21 (C24)	1558.17	192.40	69 (C48)	1538.98	194.80
22 (H24)	1557.77	192.45	70 (H48)	1538.58	194.85
23 (C25)	1557.36	192.50	71 (C49)	1538.19	194.90
24 (H25)	1556.96	192.55	72 (H49)	1537.79	194.95
25 (C26)	1556.55	192.60	73 (C50)	1537.40	195.00
26 (H26)	1556.15	192.65	74 (H50)	1537.00	195.05
27 (C27)	1555.75	192.70	75 (C51)	1536.61	195.10
28 (H27)	1555.34	192.75	76 (H51)	1536.22	195.15
29 (C28)	1554.94	192.80	77 (C52)	1535.82	195.20
30 (H28)	1554.54	192.85	78 (H52)	1535.43	195.25
31 (C29)	1554.13	192.90	79 (C53)	1535.04	195.30
32 (H29)	1553.73	192.95	80 (H53)	1534.64	195.35
33 (C30)	1553.33	193.00	81 (C54)	1534.25	195.40
34 (H30)	1552.93	193.05	82 (H54)	1533.86	195.45
35 (C31)	1552.52	193.10	83 (C55)	1533.47	195.50
36 (H31)	1552.12	193.15	84 (H55)	1533.07	195.55
37 (C32)	1551.72	193.20	85 (C56)	1532.68	195.60
38 (H32)	1551.32	193.25	86 (H56)	1532.29	195.65
39 (C33)	1550.92	193.30	87 (C57)	1531.90	195.70
40 (H33)	1550.52	193.35	88 (H57)	1531.51	195.75
41 (C34)	1550.12	193.40	89 (C58)	1531.12	195.80
42 (H34)	1549.72	193.45	90 (H58)	1530.72	195.85
43 (C35)	1549.32	193.50	91 (C59)	1530.33	195.90
44 (H35)	1548.91	193.55	92 (H59)	1529.94	195.95
45 (C36)	1548.51	193.60	93 (C60)	1529.55	196.00
46 (H36)	1548.11	193.65	94 (H60)	1529.16	196.05
47 (C37)	1547.72	193.70	95 (C61)	1528.77	196.10
48 (H37)	1547.32	193.75			