

**FU-641SEA-1Mx**

1.55 mm EA MODULATOR INTEGRATED DFB-LD MODULE  
(7 PIN PACKAGE WITH K CONNECTOR, 10GB/s DIGITAL APPLICATION)

**DESCRIPTION**

Module type FU-641SEA-1Mx is a 1.55 $\mu$ m EA modulator integrated DFB-LD module with single-mode optical fiber.

This module is suitable to a light source for use in 10Gb/s digital optical communication systems.

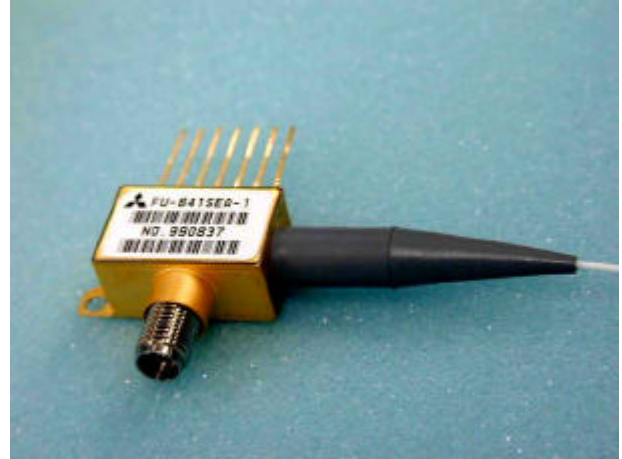
**FEATURES**

- EA(Electro-absorbtion) modulator integrated DFB-LD
- Input impedance is 50 $\Omega$ .
- Emission wavelength is in 1.55 $\mu$ m band
- 7 Pin package with K connector(\*\*)
- Built-in optical isolator
- Built-in thermal electric cooler
- With photodiode for optical output monitor

\*\* :GPO connector is available.

**APPLICATION**

STM-64, OC192 application

**ABSOLUTE MAXIMUM RATINGS**

Item	Symbol	Condition	Rating	Unit	
Laser diode	Optical output power	Pf	CW	10	mW
	Forward current	If	CW	200	mA
	Reverse voltage	Vrl	CW	2	V
Modulator	Reverse voltage	Vrm	-	5	V
	Forward voltage	Vfm	-	1	V
Photodiode	Reverse voltage	Vrd	-	20	V
	Forward current	Ifd	-	2	mA
Thermo-electric cooler(Note1)	Current	Ipe	-	1.5	A
	Voltage	Vpe	-	3	V
Operating case temperature	Tc	-	-20~70	°C	
Storage temperature	Tstg	-	-40~85	°C	

Note) Even if the thermo-electric cooler (TEC) is operated within the rated conditions, uncontrolled current loading or operation without heatsink may easily damage the module by exceeding the storage temperature range. Thermistor resistance should be properly monitored by the feedback circuit during TEC operation to avoid the catastrophic damage.

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

Parameter	Symbol	Test Conditions(Note2)	Limit			Unit
			Min.	Typ.	Max.	
Threshold current	I <sub>th</sub>	CW, V <sub>m</sub> =0V	5	-	30	mA
Operating current	I <sub>op</sub>	CW, V <sub>m</sub> =0V	50	70	100	mA
Operating voltage	V <sub>op</sub>	CW, I <sub>f</sub> =I <sub>op</sub> , V <sub>m</sub> =0V	-	-	1.7	V
Input impedance	Z <sub>in</sub>	I <sub>f</sub> =I <sub>op</sub>	-	50	-	Ω
Light-emission central wavelength	λ <sub>c</sub>	(Note 3,4)	1530	1550	1570	nm
Optical output power from fiber end	P <sub>f</sub>	(Note 3,4)	-2	-	-	dBm
Side mode suppression ratio	S <sub>r</sub>	(Note 3,4)	35	40	-	dB
Power penalty	P <sub>p</sub>	(Note3,4)	See Table 1			dB
Extinction ratio	Ex	(Note 3,4)	10	-	-	dB
Rise/fall time	tr/ta	(Note 3,4)	-	-	45	ps
Cutoff frequency (-1.5dB optical)	f <sub>c</sub>	I <sub>f</sub> =I <sub>op</sub> , V <sub>m</sub> =-1V	11	-	-	GHz
RF return loss	S <sub>11</sub>	I <sub>f</sub> =I <sub>op</sub> , V <sub>m</sub> =-1V, f≤5GHz	10	15	-	dB
		I <sub>f</sub> =I <sub>op</sub> , V <sub>m</sub> =-1V, f≤10GHz	5	7	-	dB
Relative intensity noise	RIN	CW, I <sub>f</sub> =I <sub>op</sub> , V <sub>m</sub> =0V, 10GHz	-	-	-135	dB/Hz
Tracking error	E <sub>r</sub>	I <sub>f</sub> =I <sub>op</sub> , T <sub>c</sub> =-20~70°C, Note 5	-	0.3	0.5	dB
Monitor current	I <sub>mon</sub>	I <sub>f</sub> =I <sub>op</sub> , V <sub>rd</sub> =-5V	0.1	-	1.5	mA
Optical isolation	I <sub>so</sub>	T <sub>c</sub> =-20~70°C	23	-	-	dB
Dark current(PD)	I <sub>d</sub>	V <sub>rd</sub> =-5V	-	-	0.1	μA
Capacitance(PD)	C <sub>t</sub>	V <sub>rd</sub> =-5V	-	10	-	pF
		T <sub>c</sub> =25°C	35	-	-	dB

Note 2 : V<sub>m</sub> is EAM bias voltage at CW condition, V<sub>pp</sub> and V<sub>off</sub> are EAM amplitude and EAM high level offset voltage respectively at modulation condition.

Note 3 : 9.95328Gbps, NRZ, PRBS2<sup>23</sup>-1, I<sub>f</sub>=I<sub>op</sub>, V<sub>pp</sub>=2.5V, V<sub>off</sub>=0V to -1V

Note 4 : Optical return loss of the connectors should be greater than 40dB in order to get specified performance.

Note 5 : E<sub>r</sub>=10×log[P<sub>f</sub>(T<sub>c</sub>)/P<sub>f</sub>(25°C)]

Table 1

Type number	Dispersion	Limit			Unit	Comment
		Min.	Typ.	Max.		
FU-641SEA-1M1	130ps/nm	-	-	1	dB	IR-3 application
FU-641SEA-1M2	800ps/nm	-	-	2	dB	IR-2 application
FU-641SEA-1M3	36ps/nm	-	-	1	dB	SR-1 application
FU-641SEA-1M4	400ps/nm	-	-	1.5	dB	SR-2 application

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## THERMAL CHARACTERISTICS (T<sub>ld</sub>=25°C, T<sub>c</sub>=-20~70°C)

Parameter	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Thermistor resistance	R <sub>th</sub>	T <sub>ld</sub> =25°C	9.5	10	10.5	kΩ
B constant of R <sub>th</sub>	B	-	-	3950	-	K
Cooling capacity	ΔT	I <sub>f</sub> =I <sub>op</sub> , T <sub>c</sub> =70°C	45	-	-	°C
Cooler current	I <sub>pe</sub>	I <sub>f</sub> =I <sub>op</sub> , T <sub>c</sub> =70°C, T <sub>ld</sub> =25°C	-	0.6	1.2	A
Cooler voltage	V <sub>pe</sub>	I <sub>f</sub> =I <sub>op</sub> , T <sub>c</sub> =70°C, T <sub>ld</sub> =25°C	-	1.2	2.5	V

## FIBER PIGTAIL SPECIFICATIONS

Parameter	Limits	Unit
Type	SM	-
Mode field diameter	9.5+/-1	μm
Cladding diameter	125+/-2	μm
Secondary coating outer diameter	0.9+/-0.1	mm

## DOCUMENTATION

- Fiber output power vs. Laser forward current at T<sub>ld</sub>=25°C and T<sub>c</sub>=-20,25,70°C
- BER curves at 9.95328Gb/s modulation
- Threshold current (I<sub>th</sub>)
- Laser forward current (I<sub>op</sub>)
- Laser forward voltage (V<sub>op</sub>) at I<sub>f</sub>=I<sub>op</sub>, T<sub>ld</sub>=25°C
- Monitor current (I<sub>mon</sub>) at I<sub>f</sub>=I<sub>op</sub>, T<sub>ld</sub>=25°C
- Extinction ratio at I<sub>f</sub>=I<sub>op</sub>, T<sub>ld</sub>=25°C
- Offset voltage
- Thermistor resistance (R<sub>th</sub>) at I<sub>f</sub>=I<sub>op</sub>, T<sub>ld</sub>=25°C
- Cooler current (I<sub>pe</sub>) at I<sub>f</sub>=I<sub>op</sub>, T<sub>ld</sub>=25°C
- Cooler voltage (V<sub>pe</sub>) at I<sub>f</sub>=I<sub>op</sub>, T<sub>ld</sub>=25°C

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## OUTLINE DIAGRAM

(Unit : mm)

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NOTES 1. TOLERANCES UNLESS NOTED ±0.5  
2. THE TIGHTENING TORQUE OF THE CONNECTOR ON CABLE CONNECTED TO THE SMA CONNECTOR SHOULD BE 8-11.4 [Kgf-cm]

Pin	FUNCTION
1	THERMISTOR
2	THERMISTOR
3	LD DC BIAS (ANODE)
4	PD ANODE
5	PD CATHODE
6	COOLER ANODE

