

## 10 Gb/s IR Transponder Module

The Bookham Technology MQ10 IR-2 10 Gb/s WDM Transponder Module, 1550 nm is a very low power, small footprint 300-pin module enabling high port density. It is designed to provide a SONET/SDH or 10 GE compliant interface between the photonic layer and the electrical layer for applications requiring 40 km or more reach.

The transponder allows convenient direct connection to framer ASICs with an SFI-4/XSBI compliant interface. Wavelength Division Multiplexed (WDM) variants are available transmission and reception for applications up to 10.71 Gb/s.

Typical power dissipation of 5.7 W coupled with the small footprint significantly simplifies high speed card design. This results in significant savings in card space and development time, and greatly improved time to market.

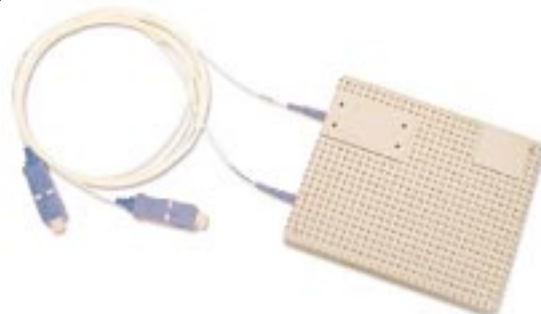
The module provides wavelengths on the 100 GHz ITU grid in the C band. It is also available without an ETALON locker for non-WDM applications that use a single wavelength. A two-wire communication interface (I2C) is available for extended monitoring and alarm information to complement the hardware alarms and monitors.

The MQ10 IR-2 10 Gb/s WDM Transponder Module, 1550 nm, can be used for existing OC192 and OC192c ports as well as emerging IEEE 802.3ae 10 Gigabit Ethernet WAN/LAN ports. The MQ10 is optimized for links spans of up to 40 km (GR-253 IR-2 and IEEE 802.3ae PMD4) using a PIN receiver, with further reach in proprietary networks.

The compact size, low power transponder is connectorized for convenient surface mount assembly. The module comprises a hermetically packaged laser device and electro-absorption modulator with optical isolation and wavelength stabilisation.

This ensures that the optical source remains within optical power and wavelength limits over variations in temperature and over life. A microprocessor coupled with internal circuitry and a

Thermo-Electric Cooler (TEC) controls the operation of the module and ensures the cor



### Features

- WDM 10 Gb/s optical transmitter and receiver with SFI-4/XSBI electrical interface compliant with 300 pin MSA
- C Band operation (100 GHz spacing) with Integrated Etalon Locker
- Very low power dissipation 5.7 W typical (7.5 W maximum)
- Quad-rate selectable between 9.953 Gb/s (OC192, 10 GE WAN), 10.3125 Gb/s (10 GE LAN), 10.664 Gb/s and 10.709 Gb/s (FEC)
- Integrated jitter filter
- Small form factor 1550 nm transponder: 3.35" x 2.76" x 0.53"
- Cooled 1550 nm EA laser for 40 km reach
- Microcontroller with I2C interface for wavelength locking, control and alarms
- Compliant with Telcordia GR-253 IR-2 (40 km) and IEEE 802.3ae 1550 nm serial
- High speed data transmission in SDH/SONET and proposed IEEE 10 Gb/s Ethernet WAN & LAN PHY Standards
- EMI FCC Class B Compliant
- Case operating temperature range +5°C to +70°C
- Also available for fixed wavelength non-WDM applications (without ETALON locker)

The Bookham Technology MQ10 IR-2 10 Gb/s WDM Transponder Module, 1550 nm is a very low power, small footprint 300-pin module enabling high port density. It is designed to provide a SONET/SDH or 10 GE compliant interface between the photonic layer and the electrical layer for applications requiring 40 km or more reach. The transponder allows convenient direct connection to framer ASICs with an SFI-4/XSBI compliant interface. Wavelength Division Multiplexed (WDM) variants are available transmission and reception for applications up to 10.71 Gb/s.

*Schematic Diagram/Functional Diagram*

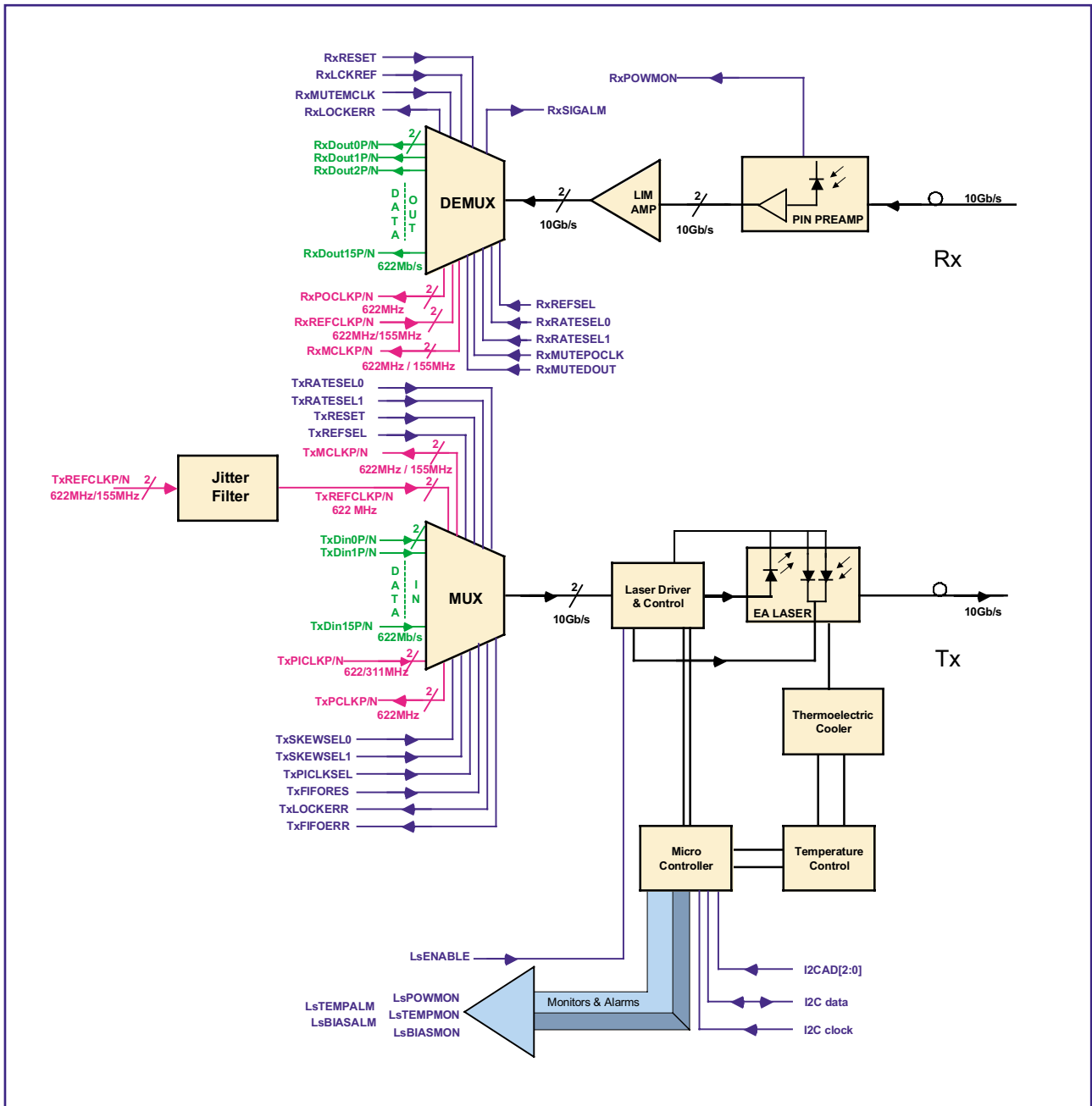


Figure 1: Schematic Diagram/Functional Diagram

Note: Data and clock rates are shown for SONET OC192 only

Mechanical Outline

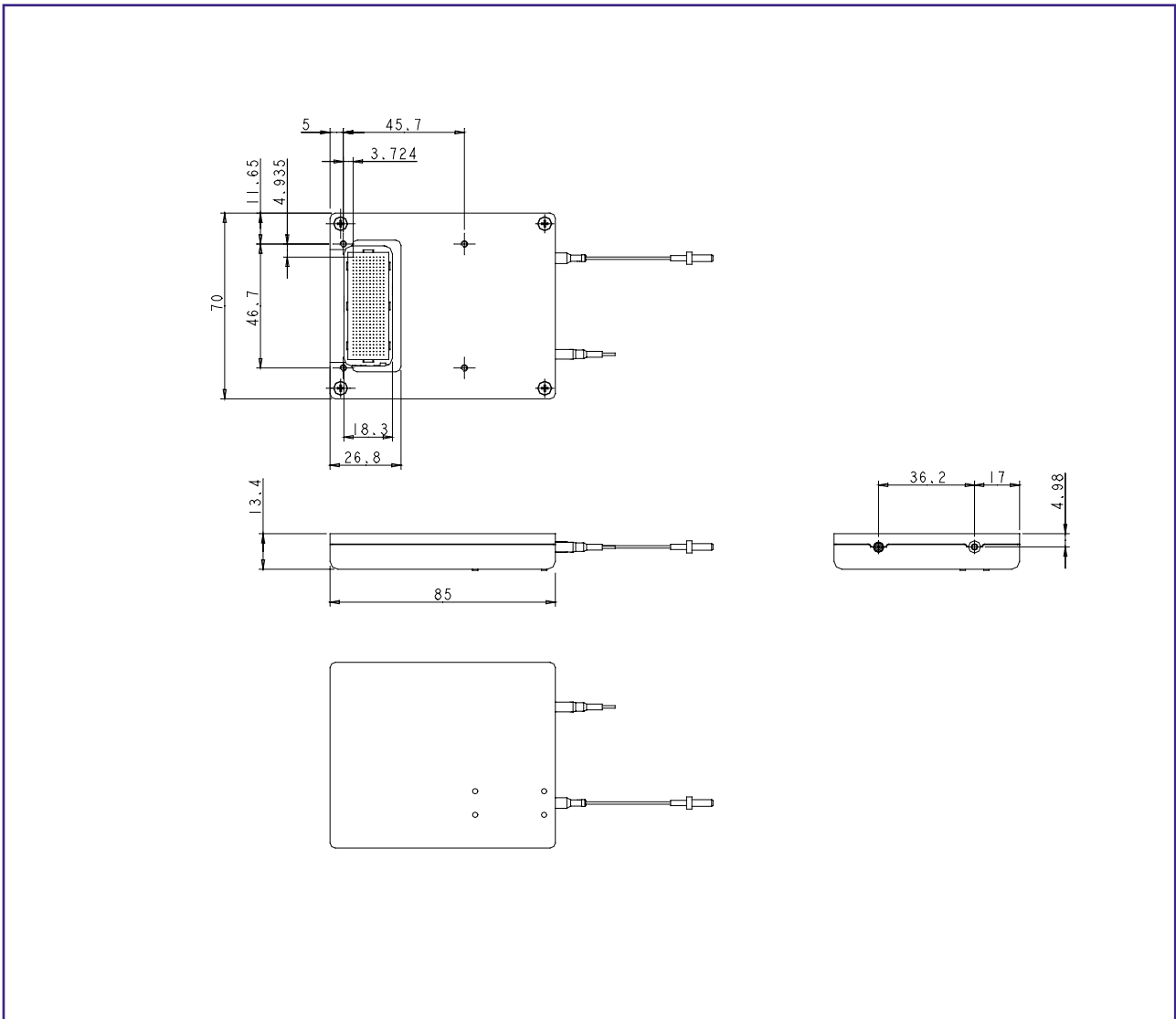


Figure 2: Mechanical Outline

Note: All dimensions in mm unless otherwise stated, general tolerance = +/- 0.25 mm

## Absolute Maximum Ratings

Parameter	Description	Min	Max	Unit
$\vartheta_{stg}$	Storage Temperature	-40	85	°C
$R_H$	Humidity/Temperature Test Condition <sup>1</sup>	5	95	% / °C
Supply Voltage Range	$V_{CC1}$	-0.5	3.6	V
	$V_{CC2}$	-0.5	6	V
	$V_{CC3}$	-0.2	2	V
	$V_{EE1}$	-6	0.5	V
$V_{IECL}$	ECL Input Levels	$V_{EE}-0.25$	0	V
$V_{ILVTTL}$	LVTTTL Input Voltage	-0.5	$V_{CC1}+0.5$	V
$V_{OLVTTL}$	LVTTTL Output Voltage	-0.5	$V_{CC1}+0.5$	V
$V_{LVDSIO}$	LVDS I/O Voltage (any I/O wrt Ground)	0	3.3	V
$I_{ILVTTL}$	LVTTTL Input Current per pin	-450	1000	μA
$I_{OLVTTL}$	LVTTTL Output Current per pin		15	mA
ESD	ESD Resistance (All pins to $V_{EE}$ ) <sup>2</sup>	Class 2 Precautions <sup>3</sup>	500	V

1 Non Condensing

2 Human Body Model

3 In accordance with Bellcore TR-NWT-000870, ESD Class 2 Handling

## Optical Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
Transmitter					
$\lambda_c$	Wavelength (C band)	1527.22		1565.50	nm
$\lambda_c$	Wavelength (non-WDM version)		1550		nm
$\Delta \lambda$	Spectral Width (-20 dBm)			TBD	nm
SMSR	Side Mode Suppression Ratio	36			dB
$P_o$	Optical Output Power <sup>1</sup>	-1		2	dBm
ER	Extinction Ratio	8.2			dB
Receiver					
$\lambda_{NOM}$	Nominal Wavelength	1525		1566	nm
$P_{OL}$	Optical Overload	-1			dBm
$P_{IN}$	Sensitivity <sup>2</sup> (BER not worse than $10^{-12}$ )		-17.5	-14	dBm
$R_{LFX}$	Optical Return Loss			-27	dB

1 Mean Launch Power

2 Guaranteed sensitivity with worst case conditions

## AC Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
Reference Clock Frequency	REFCLK <sub>WAN</sub>		155.52/ 622.08		MHz
	REFCLK <sub>LAN</sub>		161.133/ 644.53		MHz
	REFCLK <sub>FEC1</sub>		166.63/ 666.51		MHz
	REFCLK <sub>FEC2</sub>		167.33/ 669.32		MHz
Reference Clock Tolerance <sup>1</sup>		-20		20	ppm
Reference Clock Duty Cycle	DUTY <sub>REFCLK</sub>	40		60	%
Reference Clock Output Jitter <sup>2,3</sup>	JITTER <sub>REFCLK</sub>			0.5 <sup>4</sup>	mUI <sub>RMS</sub>
Reference Clock Rise/Fall Time (20-80%)	T <sub>RISE/FALL</sub>			350	ps
Reference Clock Single Ended Input Voltage Swing	V <sub>ISWING</sub>	200		900	mV
Transmit Clock Output Jitter Generation (PLL locked) <sup>5</sup>	JITTER <sub>GENO/P</sub>			0.07	UI <sub>p-p</sub>

### Transmitter

Duty Cycle for Tx Output Reference Clock (TxPCLK)	Td <sub>TxPCLK</sub>	40		60	%
Duty Cycle for Tx Data Input Clock (TxPICLK)	Td <sub>TxPICLK</sub>	40		60	%
Rise & Fall Time for Tx Data Input Clock (TxPICLK) (20-80%)	T <sub>riseTx</sub> , T <sub>fallTx</sub>	100		300	ps
Setup time for Clock wrt Data In	t <sub>suTx</sub>	300			ps
Hold time for Clock wrt Data In	t <sub>hTx</sub>	50			ps

### Receiver

Received Clock RxPOCLK Duty Cycle	Td <sub>RxPOCLK</sub>	45		55	%
Rise & Fall Time for RxPOCLK (20-80%)	T <sub>riseRx</sub> , T <sub>fallRx</sub>	100		250	ps
Setup time for Rx Clock wrt Data Out	t <sub>suRx</sub>	570			ps
Hold time for Rx Clock wrt Data Out	t <sub>hRx</sub>	570			ps

1. +/-20 ppm is recommended for SONET operation, however, Tx PLL will lock to +/-400 ppm signal
2. Jitter BW = 50 kHz to 80 MHz
3. 155 Reference clock output jitter requirement is identical to 622, with 0.5/4 = 0.125 mUI<sub>RMS</sub> maximum jitter
4. Which translates to 0.8 ps RMS
5. Jitter generation with 622 Reference clock with 0.5 mUI<sub>RMS</sub> maximum jitter

## Environmental Conditions

Parameter	Min	Typ	Max	Unit
Ambient Temperature	5	45	55	°C
Case Operating Temperature	5		70	°C
Airflow(based on typical ambient temp)	200			LFPM

## Pin Assignment

	K	J	H	G	F	E	D	C	B	A
1	5.0V RX	NO CONNECT	GND	RxDout12P	1.8V RX	RxDout8P	GND	RxDout4P	GND	RxDout0P
2	5.0V RX	NO CONNECT	GND	RxDout12N	1.8V RX	RxDout8N	GND	RxDout4N	GND	RxDout0N
3	RxRATESELO	RxRATESEL1	NO CONNECT	GND	RxPOWMON	GND	I2CAD0	GND	NO CONNECT	GND
4	3.3V RX	NO CONNECT	GND	RxDout13P	3.3V RX	RxDout9P	GND	RxDout5P	GND	RxDout1P
5	3.3V RX	NO CONNECT	GND	RxDout13N	3.3V RX	RxDout9N	GND	RxDout5N	GND	RxDout1N
6	RxRESET	NO CONNECT	NO CONNECT	GND	NO CONNECT	GND	I2CAD1	GND	RxMUTEDOUT	GND
7	3.3V RX	NO CONNECT	GND	RxDout14P	3.3V RX	RxDout10P	GND	RxDout6P	GND	RxDout2P
8	3.3V RX	NO CONNECT	GND	RxDout14N	3.3V RX	RxDout10N	GND	RxDout6N	GND	RxDout2N
9	RxMUTEPOCLK	NO CONNECT	NO CONNECT	GND	NO CONNECT	GND	I2CAD2	GND	RxLCKREF	GND
10	-5.2V RX	NO CONNECT	GND	RxDout15P	-5.2V RX	RxDout11P	GND	RxDout7P	GND	RxDout3P
11	-5.2V RX	NO CONNECT	GND	RxDout15N	-5.2V RX	RxDout11N	GND	RxDout7N	GND	RxDout3N
12	RxMUTEMCLK	NO CONNECT	NO CONNECT	GND	RxSIGALM	GND	NO CONNECT	GND	NO CONNECT	GND
13	-5.2V RX	NO CONNECT	GND	NO CONNECT	-5.2V RX	RxPOCLKP	GND	RxMCLKP	GND	RxREFCLKP
14	-5.2V RX	NO CONNECT	GND	NO CONNECT	-5.2V RX	RxPOCLKN	GND	RxMCLKN	GND	RxREFCLKN
15	I2CCLOCK	NO CONNECT	NO CONNECT	GND	RxREFSEL	GND	NO CONNECT	GND	RxLOCKERR	GND
16	5.0V TX	NO CONNECT	GND	TxDin12P	1.8V TX	TxDin8P	GND	TxDin4P	GND	TxDin0P
17	5.0V TX	NO CONNECT	GND	TxDin12N	1.8V TX	TxDin8N	GND	TxDin4N	GND	TxDin0N
18	I2CDATA	NO CONNECT	NO CONNECT	GND	LsBIASMON	GND	LsPOWMON	GND	TxSKEWSELO	GND
19	3.3V TX	NO CONNECT	GND	TxDin13P	3.3V TX	TxDin9P	GND	TxDin5P	GND	TxDin1P
20	3.3V TX	NO CONNECT	GND	TxDin13N	3.3V TX	TxDin9N	GND	TxDin5N	GND	TxDin1N
21	TxRATESELO	TxRATESEL1	NO CONNECT	GND	LsENABLE	GND	LsTEMPMON	GND	TxSKEWSEL1	GND
22	3.3V TX	NO CONNECT	GND	TxDin14P	3.3V TX	TxDin10P	GND	TxDin6P	GND	TxDin2P
23	3.3V TX	NO CONNECT	GND	TxDin14N	3.3V TX	TxDin10N	GND	TxDin6N	GND	TxDin2N
24	TxRESET	NO CONNECT	NO CONNECT	GND	LsBIASALM	GND	NO CONNECT	GND	NO CONNECT	GND
25	-5.2V TX	NO CONNECT	GND	TxDin15P	-5.2V TX	TxDin11P	GND	TxDin7P	GND	TxDin3P
26	-5.2V TX	NO CONNECT	GND	TxDin15N	-5.2V TX	TxDin11N	GND	TxDin7N	GND	TxDin3N
27	TxFIFO RES	NO CONNECT	NO CONNECT	GND	LsTEMPALM	GND	NO CONNECT	GND	TxPICKSEL	GND
28	-5.2V TX	NO CONNECT	GND	TxPICKLP	-5.2V TX	TxPCLKP	GND	TxMCLKP	GND	TxREFCLKP
29	-5.2V TX	NO CONNECT	GND	TxPICKLN	-5.2V TX	TxPCLKN	GND	TxMCLKN	GND	TxREFCLKN
30	TxFIFO ERR	NO CONNECT	NO CONNECT	GND	TxREFSEL	GND	NO CONNECT	GND	TxLOCKERR	GND

## Module Characteristics

Parameter	Description	Unit
Housing	Aluminum	
Length Housing	85 (3.35)	mm (inch)
Length Housing Including Fibre Bend Radius	132 (5.2)	mm (inch)
Width Housing	70 (2.76)	mm (inch)
Height Housing	13.5 mm (0.53)	mm (inch)
Pigtail Length	116 +/- 30 (46 +/- 1.2)	cm (inch)
Electrical Connector	Meg-Array 300 Position Receptacle (10 x 30 BGA connector) Connector on user-board is BERG 300-pin plug part #84500-102	
Optical Connector	SC Optical Connector (FC, LC, DSC available on request)	

## Ordering Information

TYPE	$\lambda$ (WDM Only)	Jitter Filter and Ref. Clock	Power (&)	Reach (#)	Optical Connector
MQ10EW	****	A = Filter, 155 MHz ref, SONET B = Filter, 161 MHz ref, 10GE C = Filter, 167 MHz ref, FEC 10.7 D = Filter, 622 MHz ref, SONET E = Filter, 644 MHz ref, 10GE F = Filter, 669 MHz ref, FEC 10.7 N = No filter, 155/622 MHz ref, quad rate	B = 2 mW	A = 10 km B = 40 km	C\$\$
Appears in all except non-WDM	5898 (1558.98)		B - 2 mW standard	B - 40 km with standard fibre length	C28 - SC C33 - FC C57 - LC C59 - MU

### Example 1:

A 10 Gb/s 300-pin IR WDM transponder with a wavelength of 1554.13 nm, jitter filter for a 644 MHz reference clock running at the 10GE rate (10.3125 Gb/s), and a SC connector would be - MQ10EW5413EBB-C28.

### Example 2:

A 10 Gb/s 300-pin IR WDM transponder with a wavelength of 1532.68 nm, jitter filter for a 155 MHz reference clock running at the SONET rate (9.95328 Gb/s), and a SC connector would be - MQ10EW5413ABB-C28.

### Example 3:

A 10 Gb/s 300-pin IR non-WDM transponder with no jitter filter and FC connectors would be - MQ10NBB-C33.

For the initial samples of the MQ10 IR-2 transponder module, several jitter filter and reference clock options are available. The 11th character of the order code (N in the list below) determines the choice. Select from the following options:

N - No jitter filter and quad rate operation (9.9 GHz, 10.3 GHz, 10.6 GHz, 10.7 GHz). Reference clock input can be either 155 or 622 MHz.

A - Jitter filter at OC-192 (9.9 GHz) bit rate, 155 MHz reference clock.

B - Jitter filter at 10G Ethernet (10.3 GHz) bit rate, 161 MHz reference clock.

C - Jitter filter at FEC (10.7 GHz) bit rate, 167 MHz reference clock.

D - Jitter filter at OC-192 (9.9 GHz) bit rate, 622 MHz reference clock.

E - Jitter filter at 10G Ethernet (10.3 GHz) bit rate, 644 MHz reference clock.

F - Jitter filter at FEC (10.7 GHz) bit rate, 669 MHz reference clock.

Module	Wavelength	Module	Wavelength
MQ10EW2722NBB-C\$\$	1527.22	MQ10NBB-C\$\$	Fixed Wavelength
MQ10EW2799NBB-C\$\$	1527.99	MQ10EW4692NBB-C\$\$	1546.92
MQ10EW2877NBB-C\$\$	1528.77	MQ10EW4772NBB-C\$\$	1547.72
MQ10EW2955NBB-C\$\$	1529.55	MQ10EW4851NBB-C\$\$	1548.51
MQ10EW3033NBB-C\$\$	1530.33	MQ10EW4932NBB-C\$\$	1549.32
MQ10EW3112NBB-C\$\$	1531.12	MQ10EW5012NBB-C\$\$	1550.12
MQ10EW3190NBB-C\$\$	1531.90	MQ10EW5092NBB-C\$\$	1550.92
MQ10EW3268NBB-C\$\$	1532.68	MQ10EW5172NBB-C\$\$	1551.72
MQ10EW3347NBB-C\$\$	1533.47	MQ10EW5252NBB-C\$\$	1552.52
MQ10EW3425NBB-C\$\$	1534.25	MQ10EW5333NBB-C\$\$	1553.33
MQ10EW3504NBB-C\$\$	1535.04	MQ10EW5413NBB-C\$\$	1554.13
MQ10EW3582NBB-C\$\$	1535.82	MQ10EW5494NBB-C\$\$	1554.94
MQ10EW3661NBB-C\$\$	1536.61	MQ10EW5575NBB-C\$\$	1555.75
MQ10EW3740NBB-C\$\$	1537.40	MQ10EW5655NBB-C\$\$	1556.55
MQ10EW3819NBB-C\$\$	1538.19	MQ10EW5736NBB-C\$\$	1557.36
MQ10EW3898NBB-C\$\$	1538.98	MQ10EW5817NBB-C\$\$	1558.17
MQ10EW3977NBB-C\$\$	1539.77	MQ10EW5898NBB-C\$\$	1558.98
MQ10EW4056NBB-C\$\$	1540.56	MQ10EW5979NBB-C\$\$	1559.79
MQ10EW4135NBB-C\$\$	1541.35	MQ10EW6061NBB-C\$\$	1560.61
MQ10EW4214NBB-C\$\$	1542.14	MQ10EW6142NBB-C\$\$	1561.42
MQ10EW4294NBB-C\$\$	1542.94	MQ10EW6223NBB-C\$\$	1562.23
MQ10EW4373NBB-C\$\$	1543.73	MQ10EW6305NBB-C\$\$	1563.05
MQ10EW4453NBB-C\$\$	1544.53	MQ10EW6387NBB-C\$\$	1563.87
MQ10EW4532NBB-C\$\$	1545.32	MQ10EW6468NBB-C\$\$	1564.68
MQ10EW4612NBB-C\$\$	1546.12	MQ10EW6550NBB-C\$\$	1565.50

### North America

Bookham Technology Inc.  
49 Buford Highway  
Suwanee  
GA 30024  
USA

- Tel: +1 678 482 4021
- Fax: +1 678 482 4022

### Europe

Bookham Technology plc  
Brixham Road  
Paignton  
Devon  
TQ4 7BE  
UK

- Tel: +44 (0) 1803 66 2875
- Fax: +44 (0) 1803 66 2801

### Asia

Bookham Technology plc  
21/F Cityplaza One  
1111 King's Road  
Quarry Bay  
Hong Kong

- Tel: +852 (2100) 2249
- Fax: +852 (2100) 2585

[Sales@bookham.com](mailto:Sales@bookham.com)

### Important Notice

Bookham Technology has a policy of continuous improvement, as a result certain parameters detailed on this flyer may be subject to change without notice. If you are interested in a particular product please request the available from any Bookham Technology sales representative.

**INVISIBLE LASER RADIATION DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS CLASS 1 LASER PRODUCT**
  
 REFERENCE IEC 60825-1: Edition 1.2

**DANGER**
  
 INVISIBLE LASER RADIATION AVOID DIRECT EXPOSURE TO BEAM
   
 OUTPUT POWER 2 mW WAVELENGTH >1527 nm
   
 CLASS 1 for non-viewed sources

This product is classified as Class 1 for non-viewed sources against 21CFR 1040.10.

**CAUTION**
  
 STATIC SENSITIVE DEVICE OBSERVE PRECAUTIONS