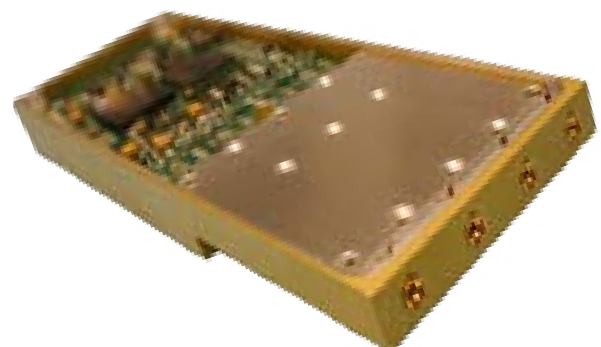


# X-Band QTRM Product Capability

**QTRM** - **Q**uad **T**ransmit **R**eceive **M**odule (4-Channel T/R Module)



- RS485 Half-Duplex, 5.0 Mbps serial data bus for control and monitoring.
- DSP externally programmable via JTAG
- Factory amplitude and phase setting inaccuracies calibrated at the cold-wall operating temperature
- TX output power, HPA temperature, operating current and power supply health monitored and reported on request
- Automatic shut-down if internal temperature reaches a critical limit where damage could occur. Hysteresis applies.
- Positive supplies inhibited (with the exception of the digital control circuits) if negative supply is lost
- Direction cosines used for beam steering
- 4-bit array address code giving up to 16 QTRM sub-array (64- element array)
- TRM's respond to individual address or broadcast messages.
- Module position assignment
- Ability to schedule up to 16 phase & amplitude settings for rapid execution.
- Array CAL allows end-user to add additional TRU phase & amplitude calibration.
- Read-back of set phase & amplitude values for each TRU.
- Selection of internal/external Clock source.
- European Manufacture.



## Electrical Performance

Over T<sub>op</sub> Unless Otherwise stated. Limits & Conditions are indicated values. Indicated values given per channel unless otherwise stated.

Parameter	Min.	Typ.	Max.	Units	Conditions
<b>Parameters: Common</b>					
Centre Frequency		9.5		GHz	
Operating BW		1		GHz	See Note 1
TX/RX Switching Speed			50	ns	Target. From receipt of Gating pulse.
Port-Port Isolation (Antenna)	40			dB	Target 60dB
Input Return Loss	10			dB	
Output Return Loss (Antenna)	10			dB	
Pulse Width	0.2		100	μS	80μS at 30% Duty max.
Duty Cycle	5		30	%	
RF Pulse Rise & Fall time		20		ns	
Data Control Rate		5.0		Mbps	Asynchronous UART RS485 Bus.
Global TX Gating Pulse		Differential			Gate TX PA on 1.0 μS before RF pulse
Beam Steering Pulse		Differential			
No. of Stored Beam Settings			16		Scheduler Mode
Beam Steer Pulse Repetition Rate	15		250	μS	Scheduler Mode – Beam direction change rate.
Power Supplies		+28,+6,-6		V	
Ext. Clock (If used)				MHz	±20ppm LVDS
DC Input CurrentPort)			6	Amps (pk)	+28v supply, TX mode
			1.8	Amps	+6v supply, TX mode
			0.2	Amps	-6v supply
DC Input Consumption (Pk)			170	Watts (pk)	TX mode
<b>Phase Control</b>					
Phase Shift Range	0		355	deg	6-Bits, 64 States, 5.625° Steps.
RMS Error					
9.0 – 10.0GHz	2		4	deg	See Note (2)
Switching Time		500		ns	Target. From receipt of Beam Steer pulse.
<b>Amplitude Control</b>					
Attenuator Range	0		28.5	dB	5-Bits, 32 States, 0.9dB Steps. See Note (3)
RMS Error					
9.0 – 10.0GHz	0.4		0.6	dB	See Note (4)
Switching Time		500		ns	Target. From receipt of Beam Steer pulse.

### Environmental

Operating Ambient: -30 to +70°C. Assumes QTRM is fixed to a cold-wall held at 35 ±10 °C

Storage: -40 to +85°C; MTBF : 100,000 hrs target

### Notes

- (1) Can operate over a wider bandwidth at reduced performance. Limited by circulator bandwidth.
- (2) RMS Phase error given for reference attenuator state.
- (3) Up to 3dB reduction in useable attenuation range due to Calibration.
- (4) RMS Attenuator error given for reference phase state.
- (5) Figure given for Ref Attenuator state, Ref Phase State.
- (6) Noise Figure given for Ref Attenuator state, Ref Phase State.

## Electrical Performance

Over  $T_{op}$  Unless Otherwise stated. Limits & Conditions are indicated values. Indicated values given per channel unless otherwise stated.

Parameter	Min.	Typ.	Max.	Units	Conditions
<b>Parameters: Transmit</b>					
TX Psat		8.5		Watts (pk)	8.5 Watts output per antenna at Fo
TX Gain		>40		dB	8.5 to 10.5GHz
TX Power Variation		$\pm 0.5$		dB	Per 100MHz in operating bandwidth
TX Power Variation		$\pm 1.0$			9.0 to 10.0GHz
Power Variation Between Outputs		$\pm 1.0$		dB	
TX Input Power Level		+5		dBm	For Ps at Out.
Spurious		-60		dBc	
TX Phase Variation across pulse		4.0		deg	Across 80 $\mu$ S Pulse at 30% Duty
TX Amplitude Variation across pulse		0.5		dB	Across 80 $\mu$ S Pulse at 30% Duty
Harmonics		-20		dBc	
TX Insertion Phase Balance		$\pm 15$		deg	Between any two channels.Target $\pm 10$
TX Insertion Phase Balance		$\pm 2.0$		dB	Between any two channels.Target $\pm 1.0$
<b>Parameters: Receive</b>					
RX P1dB		12		dBm	
RX Gain		35		dB	See Note (5)
RX Input IP3		-15		dBm	
RX Gain Variation		$\pm 0.25$		dB	Per 100MHz in operating bandwidth
RX Gain Variation		$\pm 1.5$		dB	9.0 to 10.0GHz
RX Noise Figure			3.5	dB	See Note (6). Target <3dB
Receiver Protection			10	Watts (pk)	Protection from reflected TX Power
RX Insertion Phase Balance		$\pm 15$		deg	Between any two channels.Target $\pm 10$
RX Gain Balance		$\pm 2.0$		dB	Between any two channels.Target $\pm 1.0$
Recovery Time		100		ns	
Spurious Free Dynamic Range		88		dB	5MHz Bandwidth

### Mechanical

Size: 150(L) x 59.5(W) x 14.5mm(D) excluding connectors

Mass: < 200gm, target <150gm

RF Connectors: Male GPO hermetic shroud (Corning Gilbert)

DC Connectors: 177-704H37SS (Glenair Hermetic Micro-D)

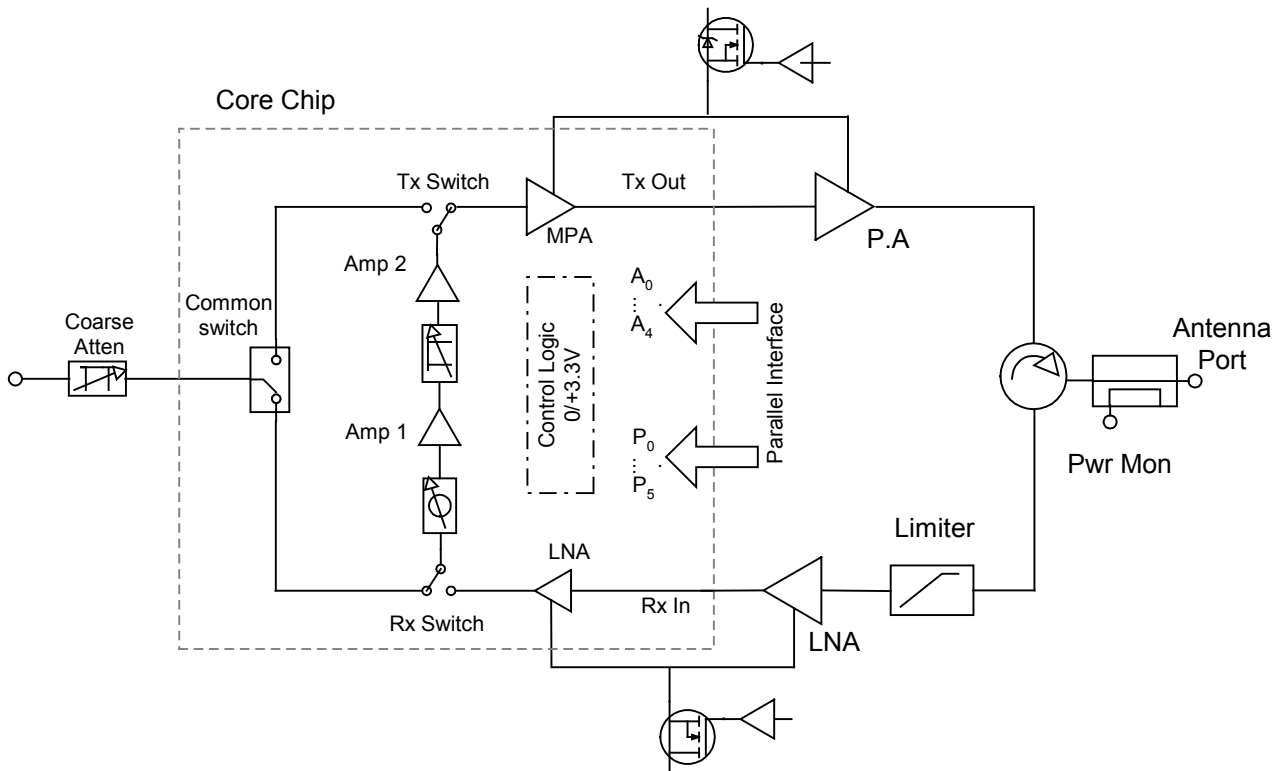
Cooling Method: Heatsink mounted, forced air cooled for demonstration purposes.

(Unit designed to mount against a liquid cooled cold-wall, meeting height constraints for stacked QTRM's in X and Y to form a 2D array)

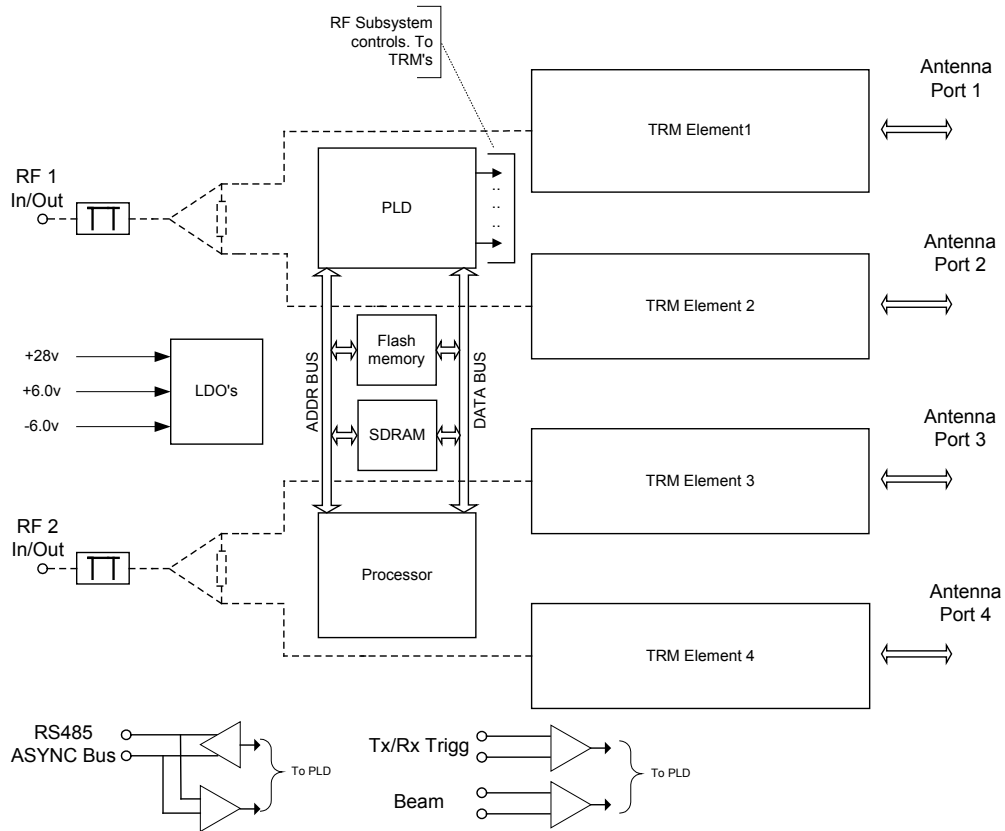
### Notes

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- (3) Up to 3dB reduction in useable attenuation range due to Calibration.
- (4) RMS Attenuator error given for reference phase state.
- (5) Figure given for Ref Attenuator state, Ref Phase State.
- (6) Noise Figure given for Ref Attenuator state, Ref Phase State.

# Functional Block Diagram



TRM Element Block diagram



QTRM Block diagram

## Typical Performance

### DC Pin-Out Connection's (MWDM2L-37 Series)

Pin No.	Description	Pin No.	Description	Pin No.	Description	Pin No.	Description
1 <sub>(7)</sub>	Ext_CLK +ve	11	ADDR_4	21	+6V	31	Beam +ve
2 <sub>(7)</sub>	Ext_CLK -ve	12 <sub>(8)</sub>	WD_DIS_DSP	22	GND	32	TxPreTrigg +ve
3	ADDR_5	13 <sub>(8)</sub>	EM_VDD	23	GND	33	Beam -ve
4	Spare	14 <sub>(8)</sub>	TDO_DSP	24	GND	34	+28V
5	Spare	15 <sub>(8)</sub>	TMS_DSP	25	GND	35	+28V
6	GND	16 <sub>(8)</sub>	TRSTn_DSP	26	GND	36	+28V
7	ADDR_0	17 <sub>(8)</sub>	EMUn_DSP	27	GND	37	+28V
8	ADDR_1	18 <sub>(8)</sub>	TDI_DSP	28	RS485 -ve		
9	ADDR_2	19 <sub>(8)</sub>	TCK_DSP	29	RS485 +ve		
10	ADDR_3	20	-6V	30	Tx PreTrigg -ve		

#### Notes

(7) External Clock (if used) 100MHz LVDS  $\pm 20$ ppm

(8) For Factory use only, do not connect leave open circuit.

Whilst every effort is made to ensure the accuracy of the information contained in this brochure, no responsibility can be accepted for any errors and/or omissions.

Descriptions and specifications of products are subject to change without notice.