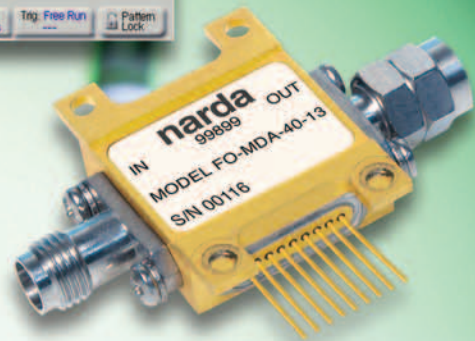
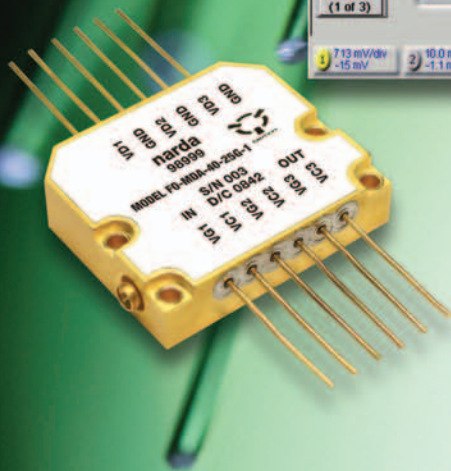
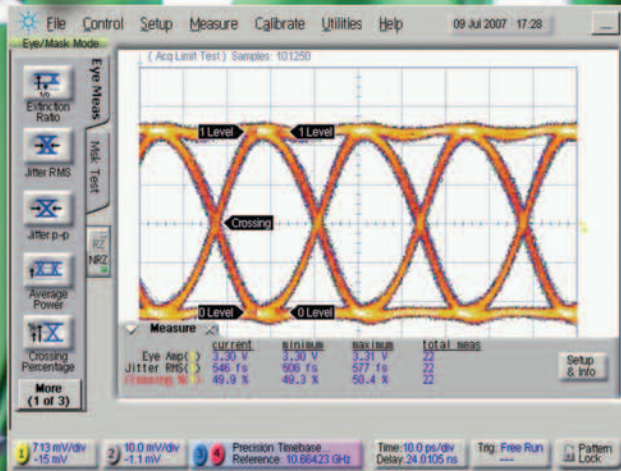


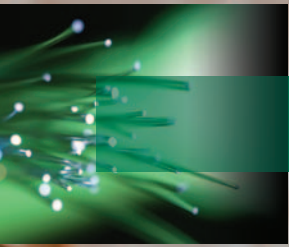
Fiber Optic Modulator Drivers

For 40 Gb/s...and Beyond



narda
microwave-east

an  communications company



Narda...What Do We Offer?



Narda Microwave Headquarters, Hauppauge, New York

When Capital Budgets Are at Risk...Trust Narda.

The Strongest Link to Fiber Optic Modulator Drivers in the Business.

From the beginning in 1953, Narda built both its business model and reputation on manufacturing innovative RF & microwave products which are readily available for commercial and military applications. It prides itself on being a critical and reliable link in the supply chain offering standard components from inventory and special products from dedicated production lines.

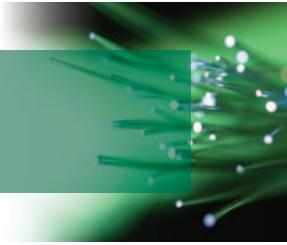
Today, Narda continues to **invest** in R&D, inventory and program support needed for your ongoing

and upcoming Fiber Optic requirements. We have the **foresight** and **strength** to be able to serve you when you need us... today or in the future.

- \$100 million division of L3 Communications, a \$15 billion high technology defense company
- High volume manufacturing
- Recognized, established supplier of EALN driver products

If your business is in Fiber Optics, your partner is Narda.

Narda's New Family of Modulator Drivers for 40 and 100 Gb/s Fiber Optic Systems



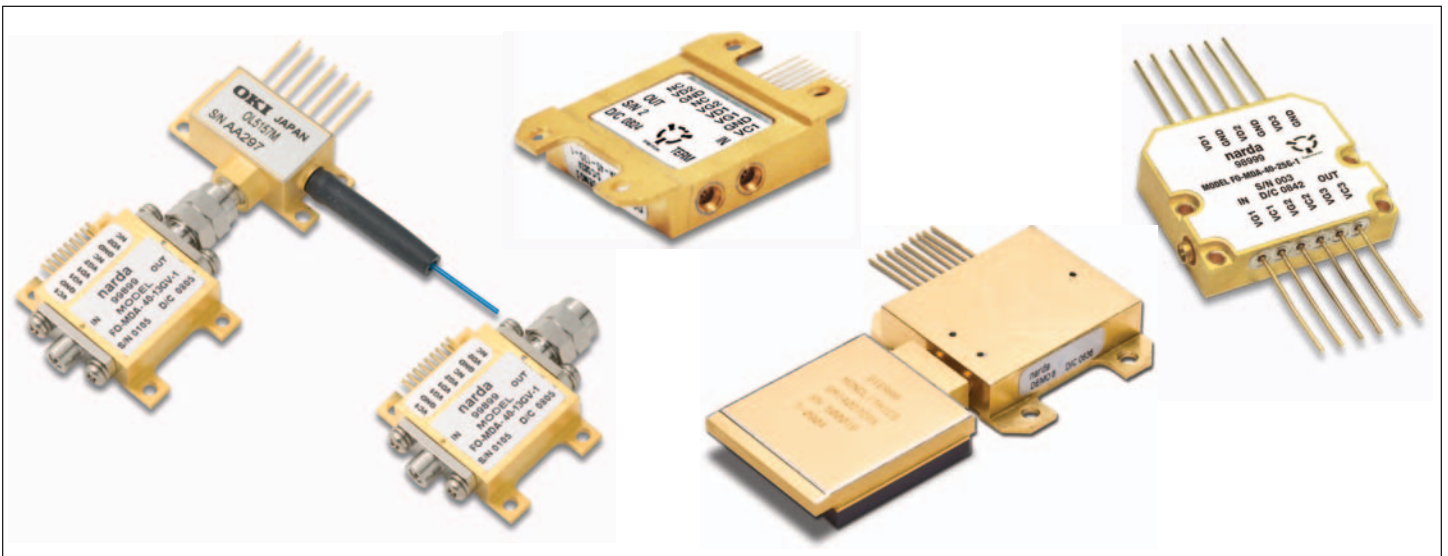
Narda's new driver products utilize proprietary GaAs MMIC technology which provide the broader bandwidth and the higher performance needed for the emerging new modulation formats including DSPK and DQPSK. These new products are cost-effective, allowing the realization of the financial targets required by industry.

Optimized for 300 PIN MSA Transponders

- SFF VSR Applications
- DPSK and ODB Long Reach Applications
- DQPSK Requirements at 40 and 100 Gb/s
- Next Generation Designs using SMT Technology

Current Production Packages

Designed for Easy Connection to Adjacent Parts



Next Generation Products

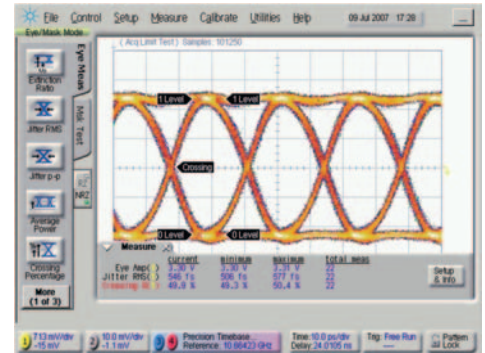
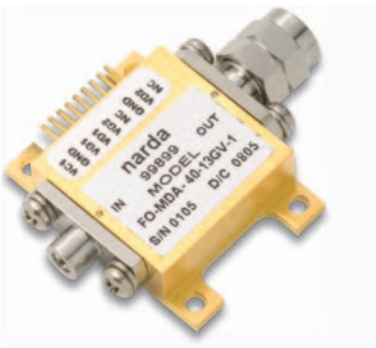
PTFE Microwave Laminates* for Low Cost and SMT Applications



* A Narda proprietary process - patent pending

Drivers for VSR Transponders

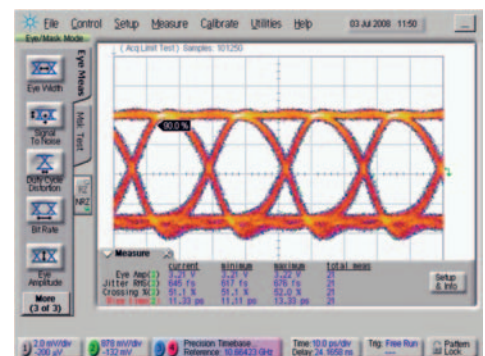
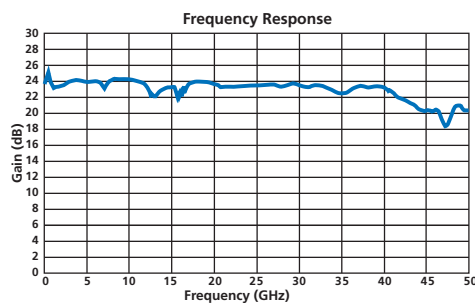
FO-MDA-40-13D-1 Series



Electrical Eye Diagram

PARAMETER	SYMBOL	UNIT	MINIMUM	TYP	MAXIMUM
Data Rate	DR	Gbps	39		43
Small Signal 3dB Low Freq BW	F3 dB Low	kHz			85
Input Voltage	V _{ipp}	V _{pp}		.45	
Output Signal Amplitude (Max)	V _{oppMx}	V _{pp}	3.1	3.4	
Output Signal Amplitude (Min)	V _{oppMn}	V _{pp}		2.2	2.5
Small Signal Gain @ 20 GHz	G	dB		21	
Output Return Loss	ORL	dB		10	
RMS Additive Jitter	J _{rms}	ps		0.55	.9
Additive Rise Time (20%-80%)	T _r	ps		10	
Additive Fall Time (20%-80%)	T _f	ps		10	
Zero Crossing Point Control	X _p	%	40		70
Small Signal 3 db high freq bw (see note 2)	F3 db High	GHz	22.5		

FO-MDA-40-15D-1

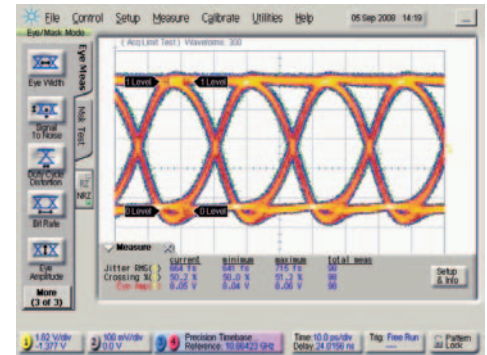
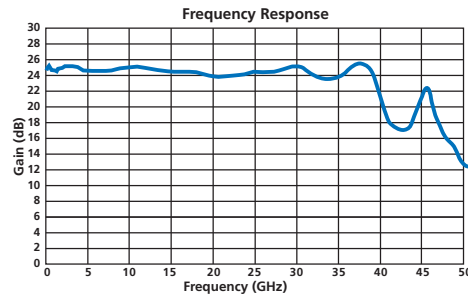


Electrical Eye Diagram

PARAMETER	SYMBOL	UNIT	MINIMUM	TYP	MAXIMUM
Data Rate	DR	Gbps	39		43
Small Signal 3dB Low Freq BW	F3 dB Low	kHz			85
Input Voltage	V _{ipp}	V _{pp}		0.45	
Output Signal Amplitude (Max)	V _{oppMx}	V _{pp}	3.1	3.4	
Output Signal Amplitude (Min)	V _{oppMn}	V _{pp}		2.5	2.6
Small Signal Gain @ 20 GHz	G	dB		23	
Input Return Loss	IRL	dB		12	
Output Return Loss	ORL	dB		12	
RMS Additive Jitter	J _{rms}	ps		0.55	0.9
Additive Rise Time (20%-80%)	T _r	ps		10	
Additive Fall Time (20%-80%)	T _f	ps		10	
Zero Crossing Point Control	X _p	%	40		70
Small Signal 3 db high freq bw (see note 2)	F3 db High	GHz	30	35	

Drivers for Long Reach DPSK Transponders

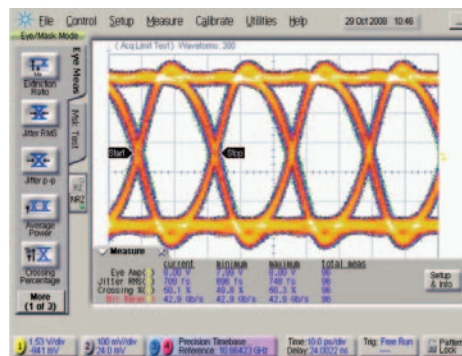
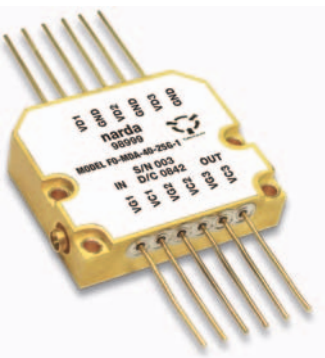
FO-MDA-40-20D-1



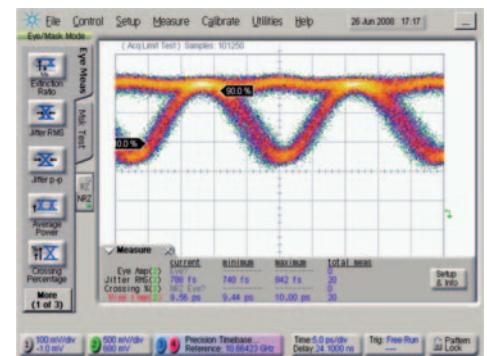
Electrical Eye Diagram

PARAMETER	SYMBOL	UNIT	MINIMUM	TYP	MAXIMUM
Data Rate	DR	Gbps	39		43
Small Signal 3dB Low Freq BW	F3dBLow	kHz			85
Input Voltage	Vipp	Vpp		0.45	
Output Signal Amplitude (Max)	VoppMx	Vpp	7.0	7.5	
Output Signal Amplitude (Min)	VoppMn	Vpp		3.5	4.0
Small Signal Gain @ 20 GHz	G	dB		23	
Input Return Loss	IRL	dB		12	
Output Return Loss	ORL	dB		12	
RMS Additive Jitter	Jrms	ps		0.55	0.9
Additive Rise Time (20%-80%)	Tr	ps		10	
Additive Fall Time (20%-80%)	Tf	ps		10	
Zero Crossing Point Control	Xp	%	40		70
Small Signal 3 db high freq bw (see note 2)	F3 db High	GHz	30	35	

FO-MDA-40-25G-1



Electrical Eye Diagram

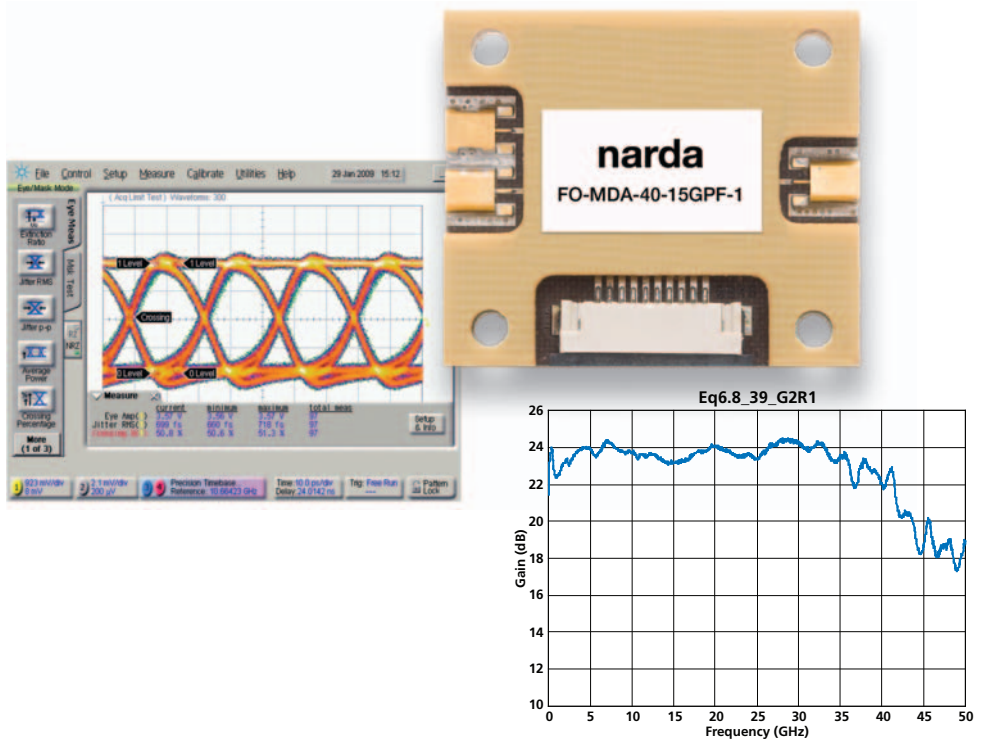


Optical Eye Diagram

PARAMETER	SYMBOL	UNIT	MINIMUM	TYP	MAXIMUM
Data Rate	DR	Gbps	39		43.2
Small Signal 3dB Low Freq BW	F3 dB Low	kHz			85
Input Voltage	Vipp	Vpp		0.45	
Output Signal Amplitude (Max)	VoppMx	Vpp	7.0	8.0	
Output Signal Amplitude (Min)	VoppMn	Vpp		4.0	4.5
Small Signal Gain @ 20 GHz	G	dB		29	
Input Return Loss	IRL	dB		12	
Output Return Loss	ORL	dB		12	
RMS Additive Jitter	Jrms	ps		0.55	0.9
Additive Rise Time (20%-80%)	Tr	ps		10	
Additive Fall Time (20%-80%)	Tf	ps		10	
Zero Crossing Point Control	Xp	%	40		70
Small Signal 3 db High Freq BW (see note 2)	F3 db High	GHz	30	40	

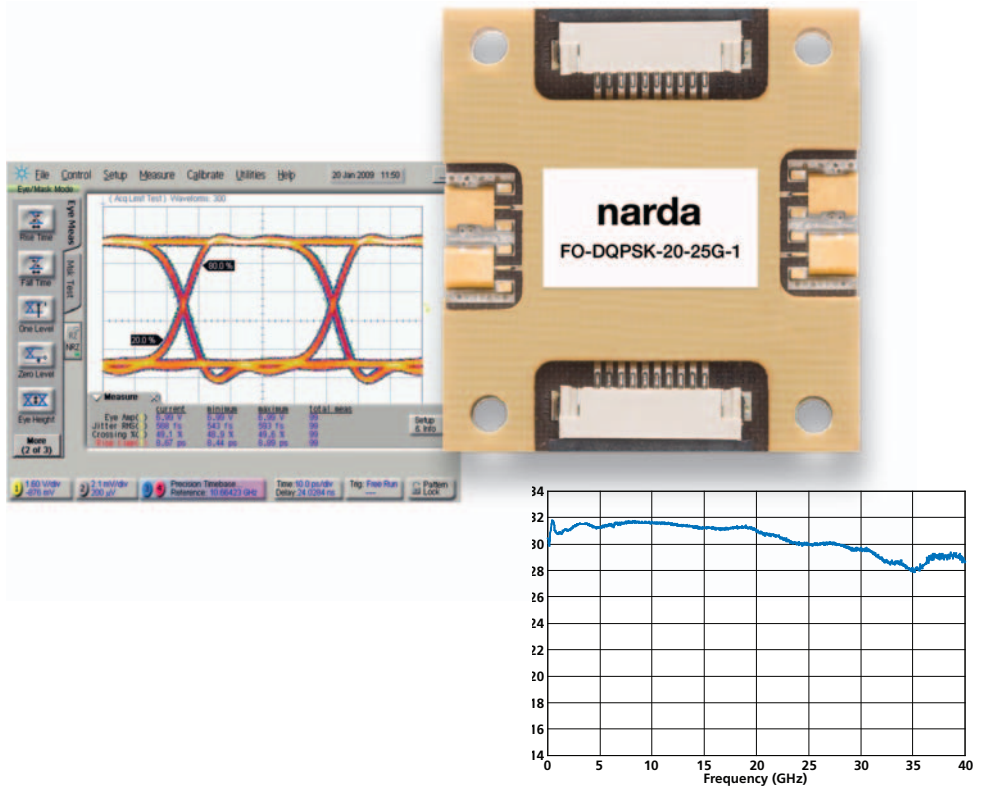
VSR Transponder Driver

- Manufactured with conventional microwave laminates
- Greatly reduced parts count and assembly time
- Integral GPPO connector or coplanar
- Compatible with SMT assemblies
- Engineering evaluation units now available

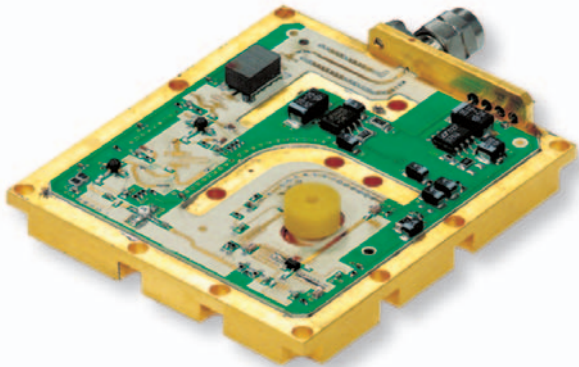


DQPSK Drivers for 40 and 100 Gb/s Applications

- New 40 Gb/s DPSK Drivers perform well at 20 to 28 Gb/s
- Single and multiple channel configurations available in conventional packages
- Dual channel module plug into MUX and modulator.
- Contact factory for availability of PTFE version

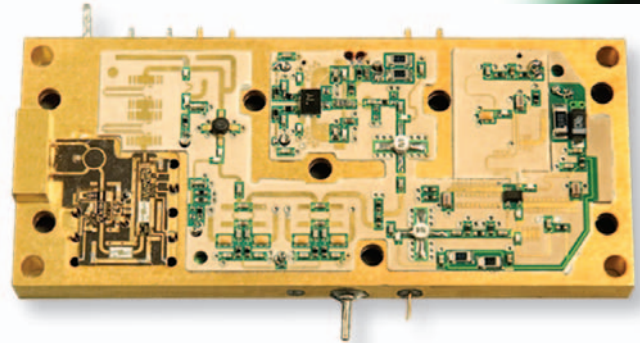


* A Narda proprietary process - patent pending



Clock Oscillators

Narda manufactures voltage tuned DRO and phase-locked oscillators for OC-192 and OC-768 applications. The unit shown is an example of a phase-locked VT-DRO. This package is typical for the free-running and phase-locked oscillators.



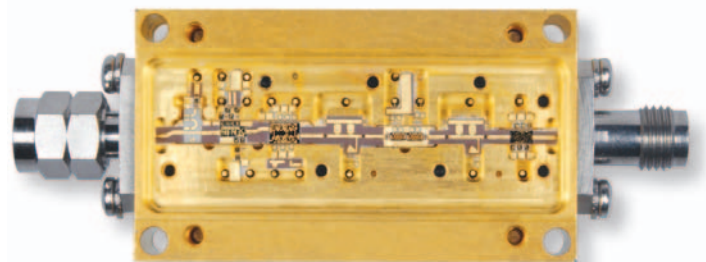
Phase-Locked Oscillators

The OC-768 PLL source is an example of Narda's custom capability. This oscillator produces an OC-768 output which is locked to OC-12 reference. The unit has a dual output with relative phase adjustment and was designed to be a modulator driver for a pulse carver modulator.



LN Modulator Driver

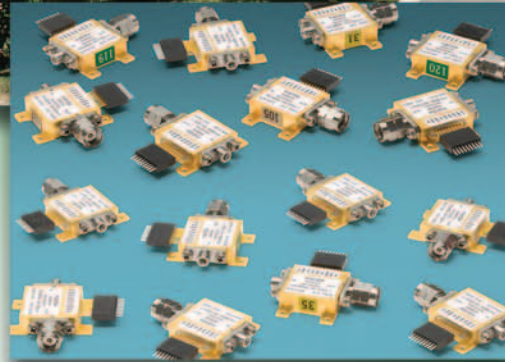
Narda offers an LN Modulator Driver Amplifier for OC-768 applications. The unit accommodates data rates up to 44 Gb/s and provides a 6 volt peak-to-peak output voltage. Features of the modulator driver include: electronic crossing % control, dither control capability and temperature compensated output level.



Carver Clock Driver

Narda manufactures a series of Carver Clock Drivers for OC-192 and OC-768 applications. The Model FO-CD-43-01 pictured above provides 3.6 to 8.0 Vp-p output for driving OC-768 Carver Modulators and covers the band from 39.9 to 43.1 GHz. The Model FO-CD-21.4-01 provides similar capability in the 19.9 to 21.6 GHz band. These units have electronic gain control and are offered with V or GPPO connectors.

Narda's Wholly Owned Low-Cost Manufacturing Facility



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