

*Finisar<sup>®</sup>*

*Fiber Optic Solutions  
for High-Speed Networks*

# **QDR Active Optical Cables**

**SC'10 – New Orleans**

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November 16, 2010**

# World's Largest Supplier of Fiber Optic Components

## Company Highlights

**Market leader: Volume and Revenue**

**Founded in 1988 / IPO in 1999**

**Headquarters: Sunnyvale, CA (USA)**

**Global locations with 6000+ employees**

**1300+ issued patents / 1000+ pending**

**High performance, best-in-class broad product line**

**Vertically integrated with low cost manufacturing**

**Experienced management team**

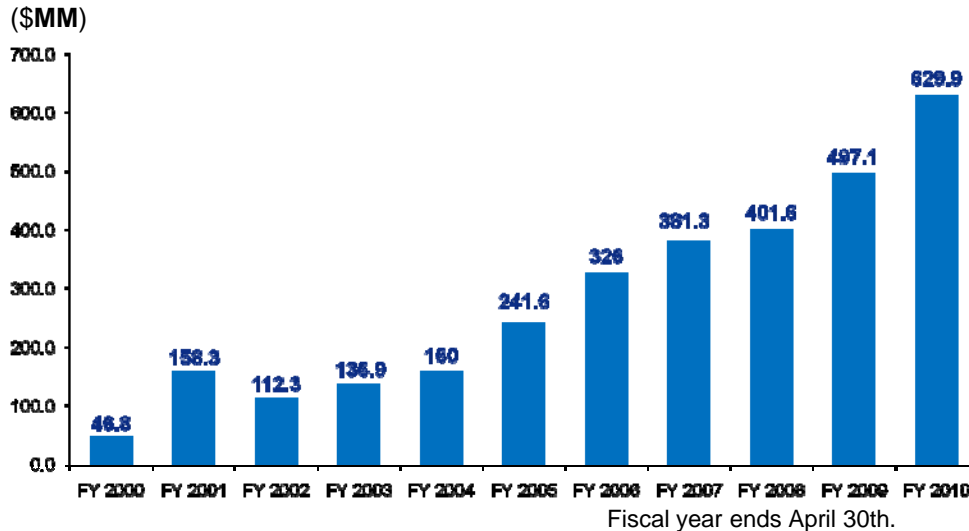
**Financially profitable which allows increased R&D and capacity expansion**



Sunnyvale, CA Headquarters



# Finisar – The Optics Industry Leader

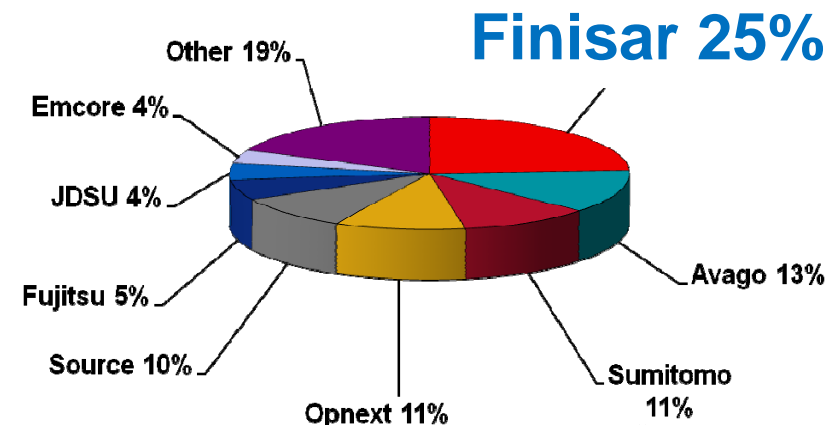


Industry leader by revenue and volume

- #1 share in Storage optics
- #1 share in Ethernet optics
- #1 share in WDM
- #2 share in SONET
- Broadest product portfolio

## CY 2009 Revenue by Vendor

SONET/SDH, Ethernet, Fibre Channel, WDM, Parallel and FTTx



Source: Lightcounting 2010, Ovum-RHK 2010, SEC filings, internal estimates



# Broad Product Portfolio and Customer Base

## PRODUCTS

## CUSTOMERS

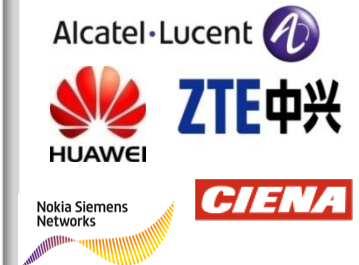
### SAN

### LAN

### SAN

### LAN

### Telecom



### PARALLEL

### METRO/TELECOM

### BROCADE

### H3C



HITACHI  
Inspire the Next

### ROADM

### FTTx and CATV

### SAN and LAN



# High-Volume Low Cost Manufacturing

## Ipoh, Malaysia

Acquired in 2001

20 acres of land

640,000 sq ft facility / 200,000 sq ft clean room

Ipoh manufactured products

- All high-volume transceivers / transponders
- CATV products
- 16M total units per year (CY10)

ISO 9001 and 14001 Certified



## Shanghai, China

Began Operations in 2001

State of the Art facility expansion in 2008

- Increased from 50,000 to 150,000 sq ft

Shanghai manufactured products

- Parallel optics transceivers and active cables
- WSS ROADM line cards
- High-end TOSAs / ROSAs
- Passive optical components

ISO 9001 Certified



*Finisar is one of a few optics companies to own assembly / manufacturing facilities*

# What is the Ideal High-Speed Interconnect Solution?

## ◆ Wish list

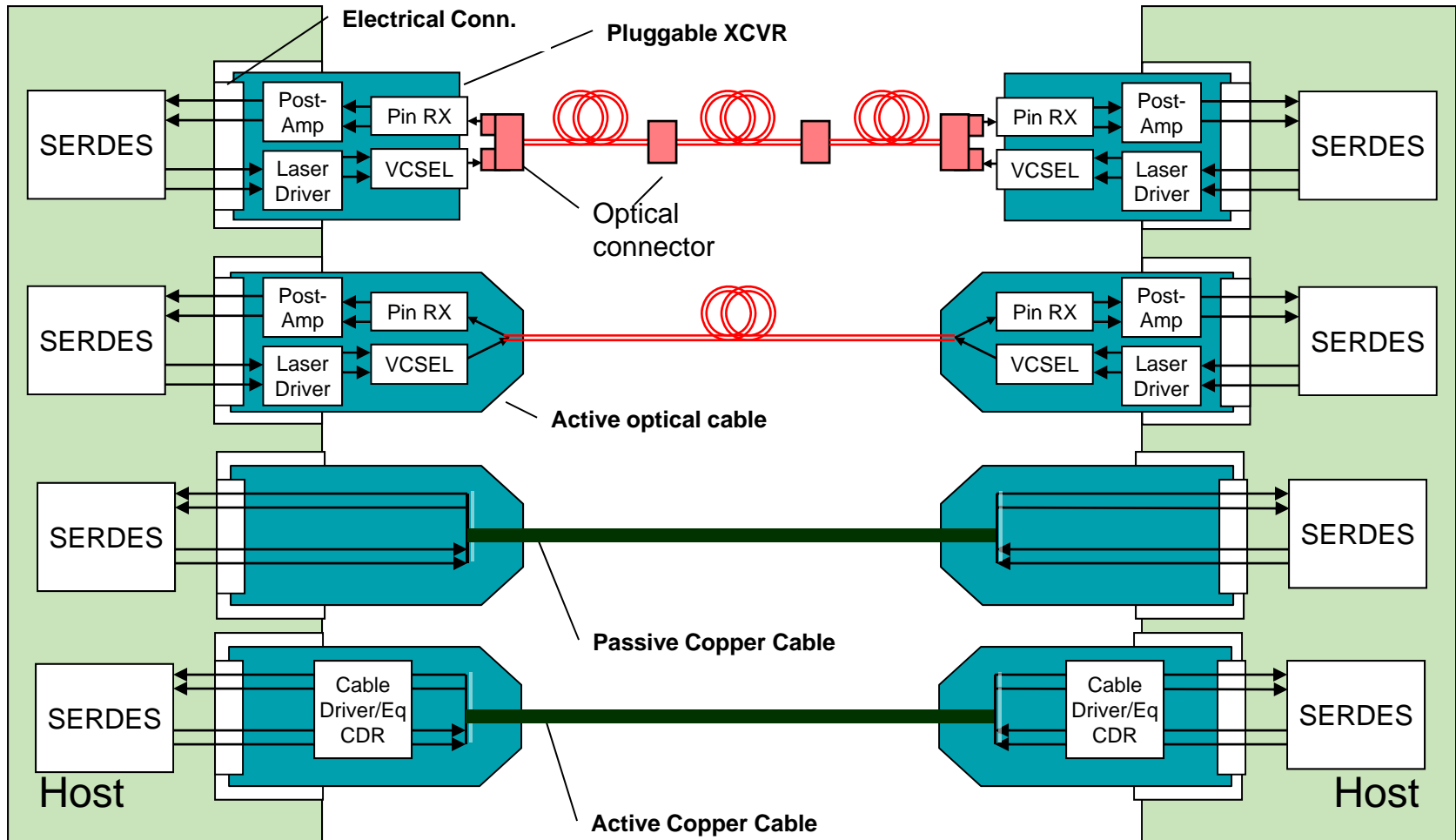
- Optimized for short distances (MMF)
- Low cost
- Low power consumption
- Small cable bend radius
- Low cable weight
- High density
- Low link latency

## ◆ The solution

- Finisar active optical cable assemblies



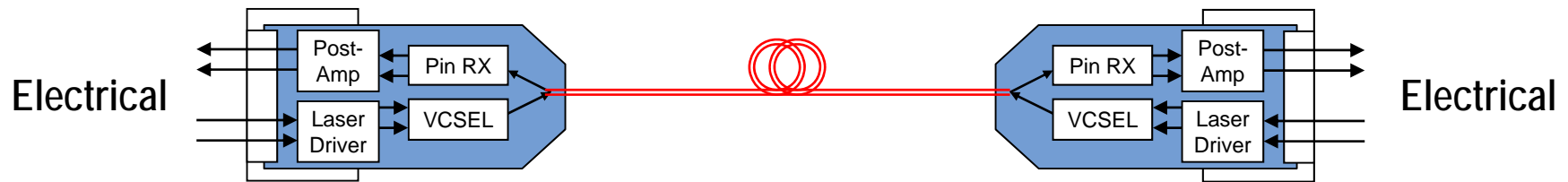
# Best of Both Worlds: Copper and Optics



***Comparison of Cable Types and Optical Transceivers***



# Advantages of Active Optical Cables (AOC)



## Compared to Copper Cables

- ◆ Longer reach
- ◆ Lower weight and tighter bend radius enable simpler cable management
- ◆ Thinner cable allows better airflow for cooling
- ◆ Lower power consumption
- ◆ No need for power-hungry conditioning ICs on the host board

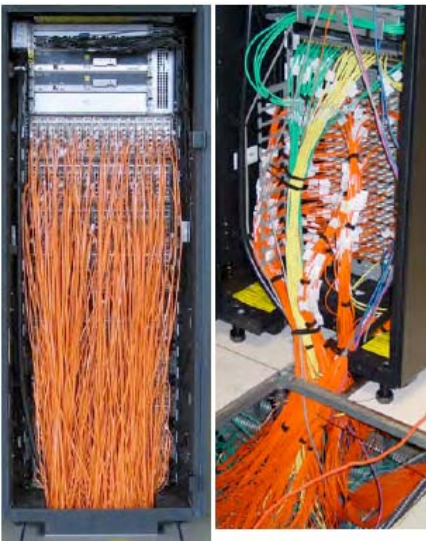
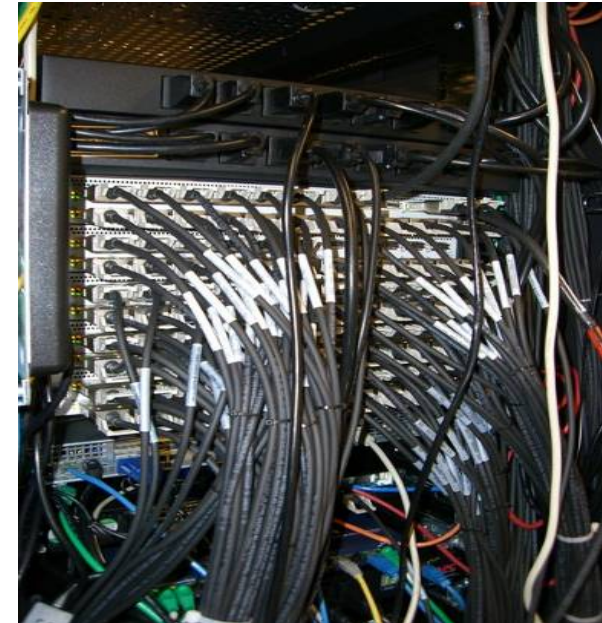
## Compared to Optical Transceivers

- ◆ Datacenter/Consumer friendly: No cleanliness issues in optical connector
- ◆ Cost-optimized: Not constrained by optical interface specifications driven by longer reach applications
- ◆ Disadvantage: Cannot be routed through optical patch panels



# Successfully Deployed in HPC Clusters Today

- ◆ Passive copper cables used for very short links and lowest cost
- ◆ Active optical cables used for links with
  - Longer distance (> 7 meters)
  - Architectures with challenging cable routing
  - Cooling/Power concerns
    - Copper signal-conditioning ICs add power/heat
    - Thick copper cables block airflow



← Active Optical Cables

Copper Cables →



# Active Optical Cables Portfolio



- ◆ 10Gb/s Serial Active Optical Cables
  - High-density form factor, XFP/SFP+ adapters
  - 10G Ethernet
  - 10G Fibre Channel



- ◆ 4x10Gb/s Parallel Active Optical Cables
  - QSFP+ form factor
  - InfiniBand 4xQDR
  - 40G Ethernet
  - SAS



- ◆ 12x10Gb/s Parallel Active Optical Cables
  - CXP form factor
  - InfiniBand 12xQDR
  - 100G Ethernet

# 10Gb/s Serial Active Optical Cable

- ◆ Finisar's first AOC product, introduced in 2007
- ◆ 10G serial cable targeting 10GbE LAN on motherboard (LOM)
- ◆ Supports distances up to 30 meters
- ◆ Enables 48-port 1U switch designs
- ◆ Low Power: ~0.5W per port compared to >>5W for 10GBASE-T
- ◆ Adaptable to XFP, SFP+ and QSFP+ ports



Laserwire Jack



SFP+ Adapter



XFP Adapter



QSFP+ Adapter



# 10Gb/s Copper Cables

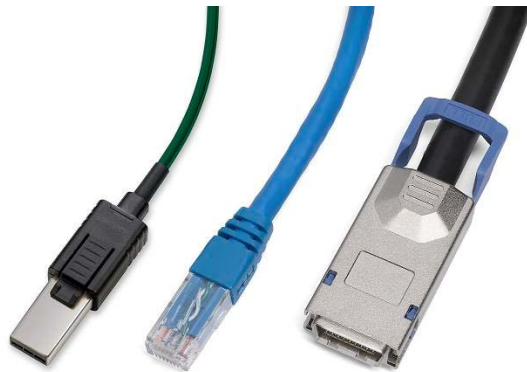


**10GBASE-CX4 Copper Cables**



**10GBASE-T Copper Cables**

10GbE copper cable solutions are heavier, bulkier and require significantly higher power than active optical cables



Connector size comparison  
between Laserwire™ AOC,  
RJ-45 and CX4



Laserwire™ AOC

10G-T

10G-CX4



# 40Gb/s Active Optical Cable

- ◆ Finisar's second AOC product, introduced in 2008
- ◆ 4 lanes x 10 Gbit/s (full duplex)
- ◆ Based on QSFP+ MSA form factor (SFF-8436)
- ◆ Applications
  - 4xQDR InfiniBand; 40G Ethernet; SAS
- ◆ Power dissipation ~1W
- ◆ Supports links of up to 300 meters
- ◆ Utilizes Finisar's internal VCSEL and PIN arrays
- ◆ QSFP+ optical module version also available
  - MTP/MPO12 parallel optical connector
  - Requires the use of 1x12 parallel optics cable assemblies
  - Utilized when routing through patch panels is required



quadwire™



# 150Gb/s Active Optical Cables

- ◆ Finisar's third AOC product, introduced in 2009
- ◆ 12 lanes x 12.5 Gbit/s (full duplex)
- ◆ Based on CXP form factor (IBTA Spec)
- ◆ Applications
  - 12xQDR InfiniBand; 100G Ethernet
  - Proprietary interconnections
- ◆ Power dissipation ~3W
- ◆ Supports links of up to 300 meters
- ◆ Utilizes Finisar's internal VCSEL and PIN arrays
- ◆ CXP optical module version also available
  - MTP/MPO24 parallel optical connector
  - Requires the use of 2x12 parallel optics cable assemblies
  - Utilized when routing through patch panels is required



:::C.wire™

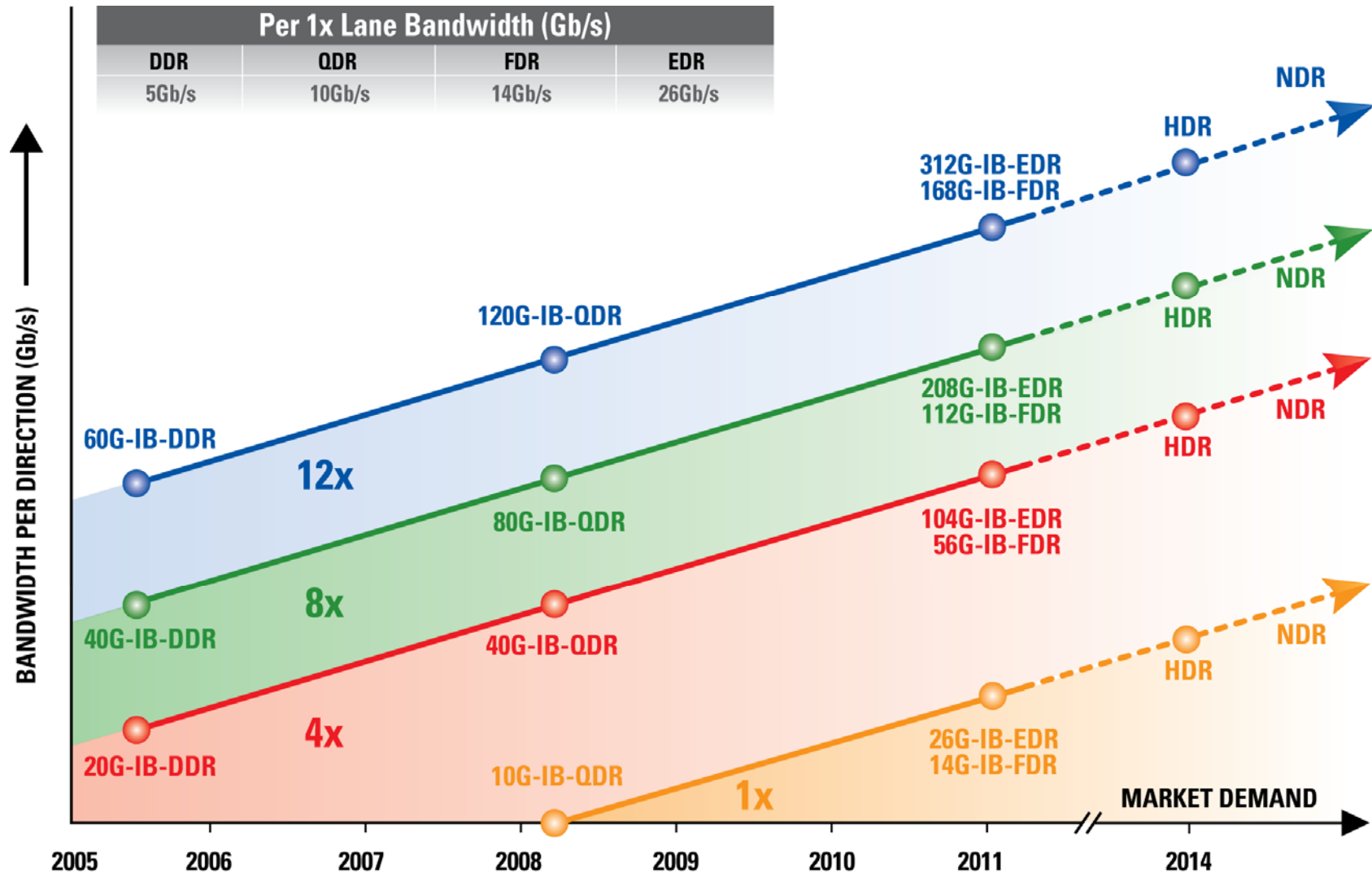


# CXP to 3xQSFP Breakout Active Optical Cable



- ◆ Application: Switch to Node interconnects based on CXP form factor on switch side and QSFP form factor on node
  - Connects three QSFP-based systems to one CXP switch port
- ◆ Initially demonstrated at SC '09

# InfiniBand Roadmap Drives AOC Development





# FDR Technology Demonstration at SC'10

**quadwire™ FDR**

## 4 x 14 Gbit/s Active Optical Cable

- ◆ Supports InfiniBand FDR and 16xFC
- ◆ QSFP+ MSA form factor
- ◆ Power dissipation ~1W
- ◆ Supports links of up to 300 meters
- ◆ Utilizes Finisar VCSEL and PIN arrays
- ◆ See our live demonstration at Finisar Booth #4738



# The Finisar Advantage

## World's Largest Supplier of Fiber Optic Components and Subsystems



*Market Share Leader*

*Global Reach*

*Diverse Customer Base*

*Broad product portfolio*

*Technology pioneer*

*Vertically integrated*

*Internal manufacturing*

*Diversifying into new markets*

*Profitable*