QSFP addition to SAS

## Supports longer distances and all PMD types

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QSFP Overview

- QSFP was originally developed for 4G FC

- Updated QSFP specification is being formally standardized within the SFF group.
  - Current MSA exists as INF-8438
  - New spec will be SFF-8436
  - Electrical support for higher data rates (up to 12G?) will be added
  - Management I/F support for higher speed variants will be added
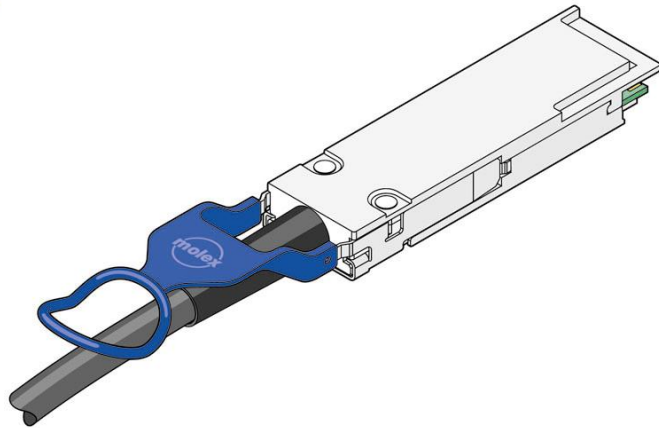
**Copper Cable
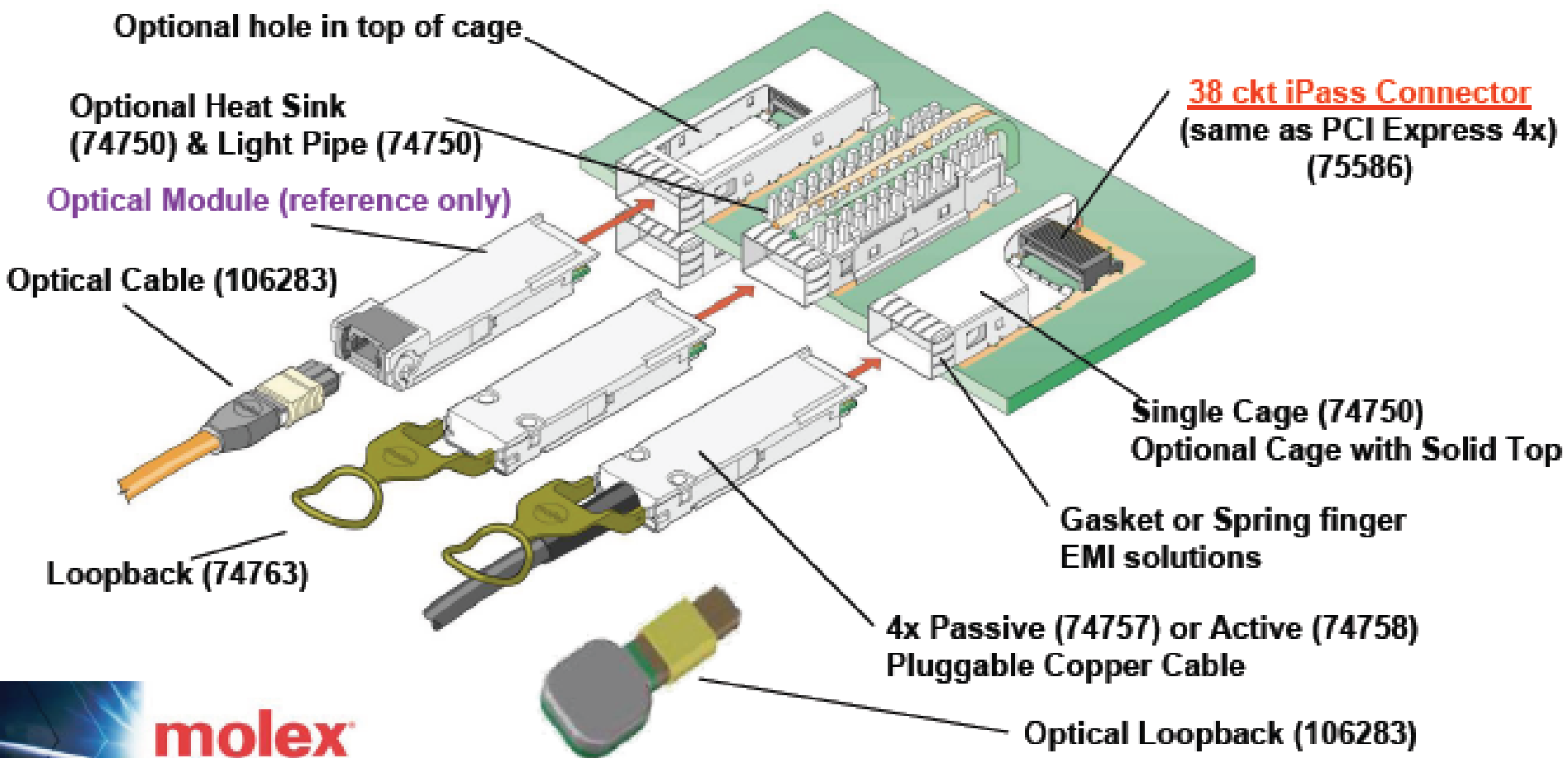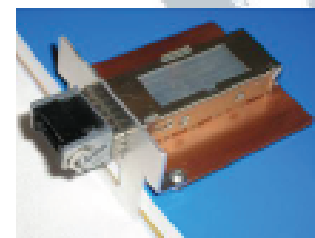Passive & Active**
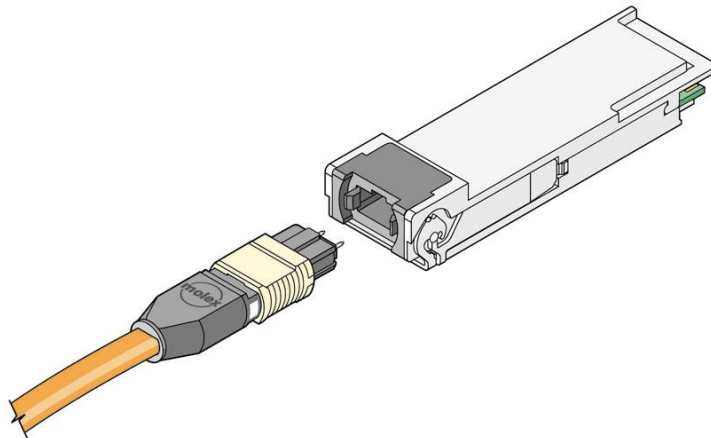
Pluggable Optical Module
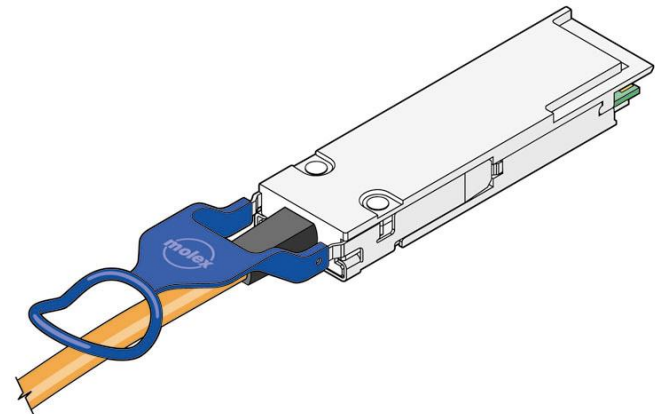
Active Optical Cable
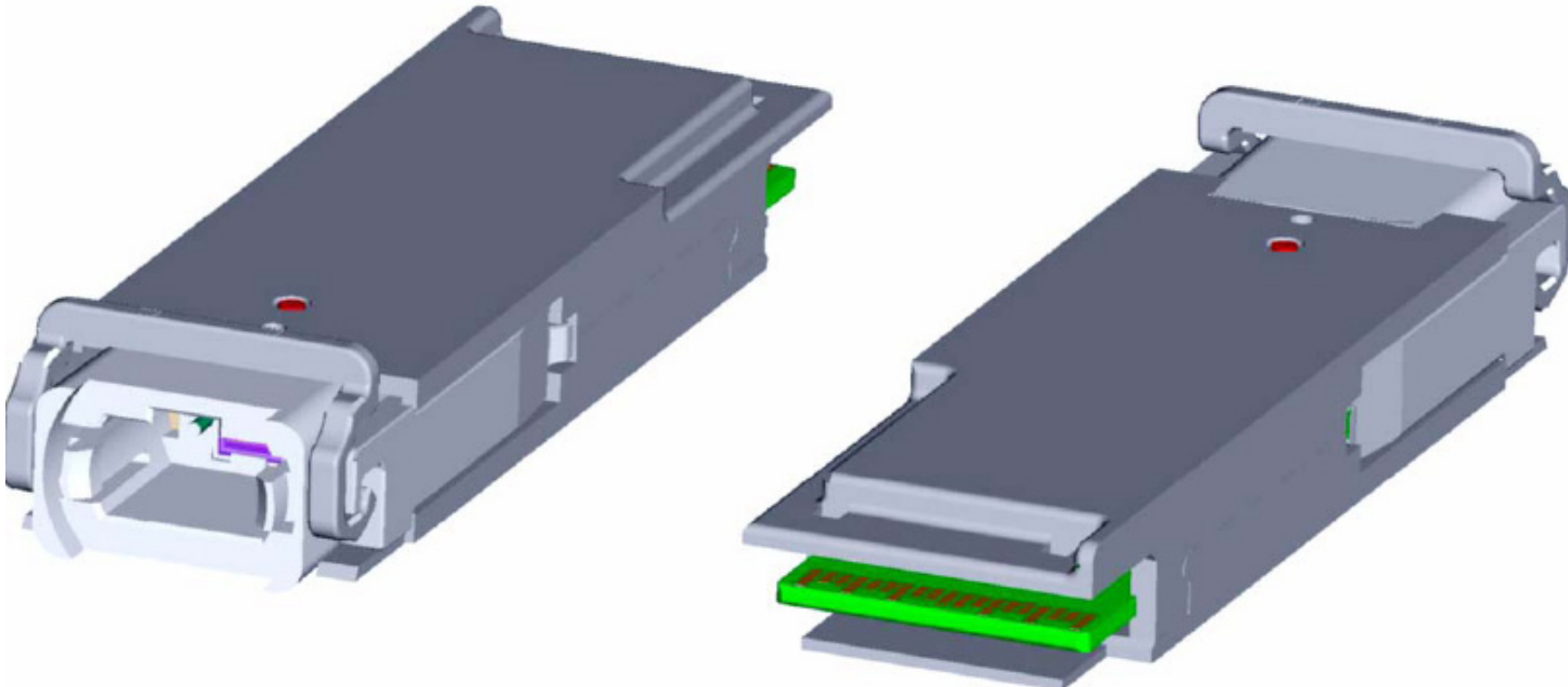
QSFP – Quad Small Form-factor Pluggable

The QSFP MSA was released 12/4/2006

- The MSA defines an (8) Differential Pair / 4x
  Pluggable Copper & Optical Module
- 4 lanes @ up to 10 Gbps each per connector
- Uses only 30% more PCB space over SFP to get 10x data density

Optional hole in top of cage

Optional Heat Sink
(74750) & Light Pipe (74750)

Optical Module (reference only)

Optical Cable (106283)

Loopback (74763)

38 ckt iPass Connector
(same as PCI Express 4x)
(75586)

Single Cage (74750)
Optional Cage with Solid Top

Gasket or Spring finger
EMI solutions

4x Passive (74757) or Active (74758)
Pluggable Copper Cable
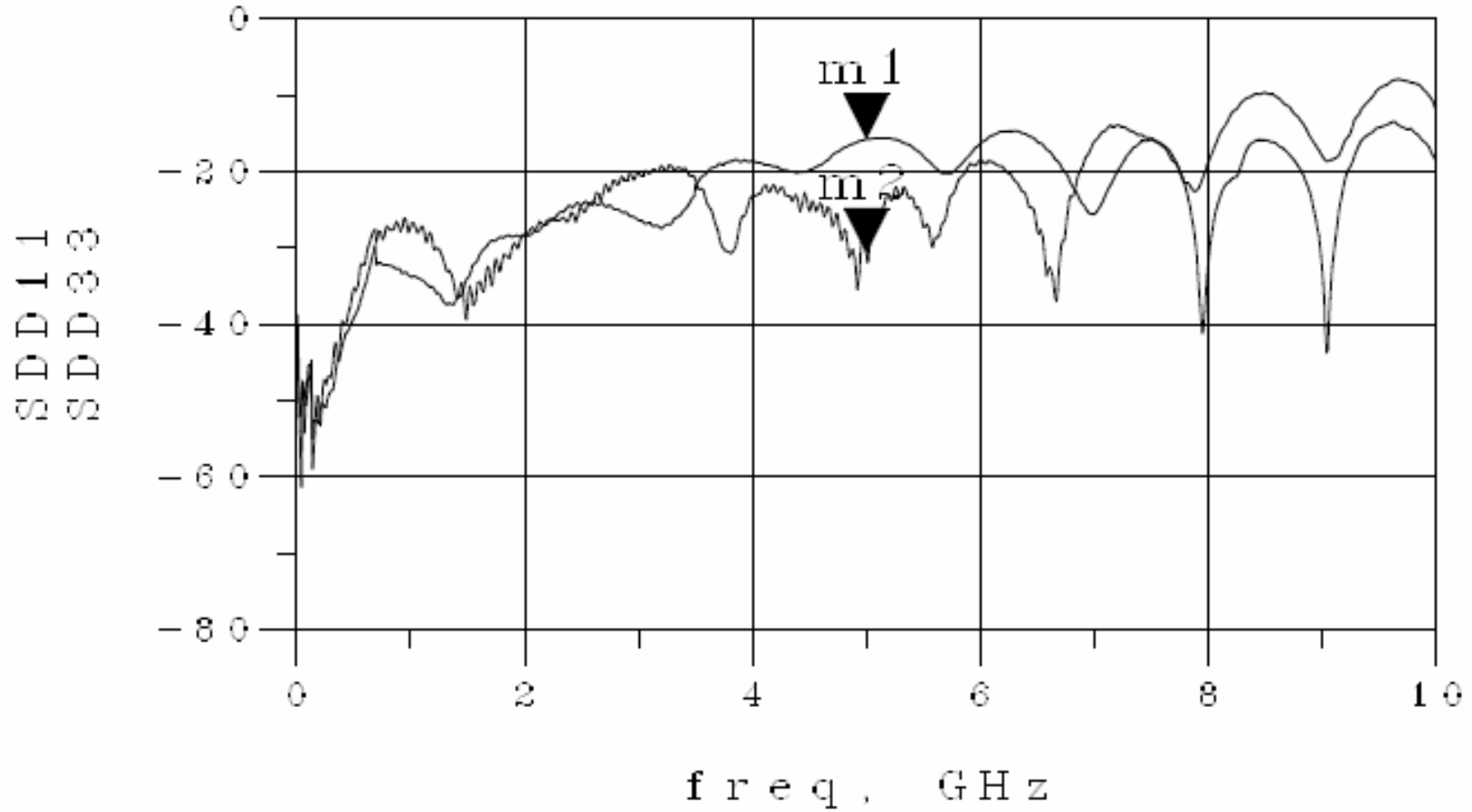
Optical Loopback (106283)

molex

QSFP module

Electrical I/F support

- Support 'new' Electrical I/F: 8G to 10G
  - SFF-8431 (8G-11.1G)
  - XFI (10.3-11.1G)
  - FC-PI-4 (8.5G)
  - 40G Ethernet? (4x10.3G?)
  - IB QDR (10G)
  - 10GBASE-KR (10.3G)
  - SAS 2.0 (6G)
  - SAS 3.0 (12G?)
  - PCI Exp 3 (8G)

- Support legacy I/F: 1G to 5G
  - IB –SDR and DDR (2.5G and 5G)
  - Ethernet/SFP – (1G)
  - FC-PI-2 – (1,2,4.25G)

QSFP return loss measurements support 12G

Media support:

- Passive copper cable
- Active copper cable
- Active optical cable
- Parallel fiber
  - SM
  - MM

SFF-8376 Coordinators

- Scott Kipp (Brocade) Co-chair

- Jay Neer (Molex) Co-chair

- Tom Palkert (Luxtera) Editor

Why add QSFP to SAS?

- Supports
  - longer lengths of interconnects
  - Multiple user selectable PMDs with a single connector:
    - Passive copper cables
    - Active copper cables
    - Active optical cables
    - Connectorized optical/copper cables

- Multiple vendor support
  - 3 passive copper cables
  - 3 active copper cables
  - 3 active optical cables
  - 2 connectorized optical cable

Who specifies QSFP today?

- IB (DDR (5G) and QDR (10G) applications)

- 802.3ba: Not directly specified but presented to show technical feasibility of 40G rate. Also used for link simulations.

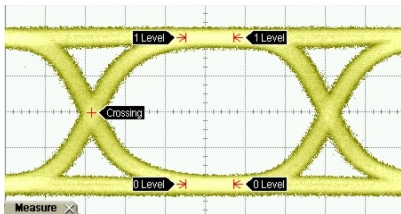- Fibre Channel: Origin of MSA and supporting use at 8G

- Others?

Blazar – 4x10Gbps Optical Active Cable

**QSFP Pluggable
Active Cable Assembly**

Sampling to Customers Q4 2007

Silicon Functional
SFP+ Output
10Gbps Eye

- ▶ **Available as an optical active cable at multiple lengths up to 300 meters**

- ▶ **Four lane, full duplex XCVR, multi-rate**
  - 10 Gbps per line rate supported
  - Total cable bandwidth up to 42 Gbps

- ▶ **Target market**
  - Infiniband, Ethernet, Fibre Channel

- ▶ **Potential other applications**
  - PCI-Express extender
  - SAS extender

- ▶ **QSFP MSA form factor compatible**

- ▶ **SFP+ standards compliant electrical interface**

- ▶ **Single-Mode Ribbon Fiber Cable**
  - Up to 300 meter reach
  - Permanently attached to transceivers

- ▶ **Power consumption**
  - 2W typical per end (at 4x10Gbps)

- ▶ **Hot pluggable**

Estimated distances supported

	Direct attach copper	Active copper	Active optical	MM optical	SM Optical LC-I	SM optical LC-L
FC-PI-4 delta	7m	20m	.1-2km	50-100m	1.4km.	10km
FC-PI-4 Beta	5m	20m	.1-2km	NA	NA	NA
8431	7m	20m	.1-2km			10km
XFI	1m	20m	.1-2km			
IB QDR	3m	20m	.1-2km			
IB DDR	10m	20m	.1-2km			
IB SDR	17m	20m	.1-2km			
6G SAS	10m	20m	.1-2km	>50	1.4km	10km
10-12G SAS	10m	20m	.1-2km	50m	1.4km	10km

What needs to be done?

- Add QSFP connector and card cage to SAS specification
  - SAS 3.0 is too far out to meet the industry requirements for optical links in the next 1-3 yrs.
  - Will there be a SAS 2.x?
  - No changes to SAS electrical/jitter specs.
  - Add optical specs as needed.
    - This should be considered for next SAS spec.