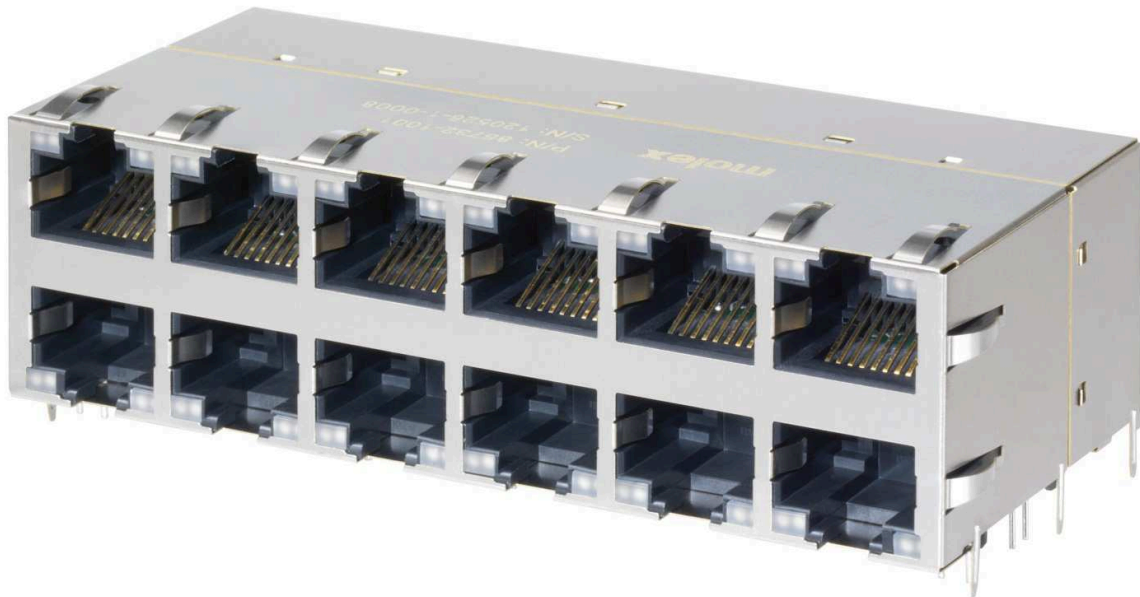# molex

PRODUCT SPECIFICATION

PRODUCT SPECIFICATION
FOR GIGABIT MAGNETIC JACK POEPLUS ENABLED LED CONNECTOR

SCOPE

This specification defines the mechanical and electrical characteristics of the Molex
85732 Series Gigabit Magnetic Jack PoEplus enabled 2x6 LED and for the
85735 Series Gigabit Magnetic Jack PoEplus enabled 2x4 LED.

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PRODUCT SPECIFICATION

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PRODUCT SPECIFICATION

1. PRODUCT DESCRIPTION

1.1. Introduction

The Gigabit Magnetic JackPoEplus enabled is designed for easy implementationby meeting standard footprint and panel cut-outs for industry wide adoption in accordance with PoETecIntegrated Connector Module (ICM).

1.2. Series and Part Numbers

This Product Specification covers the 85732and 85735series of Stacked/Ganged Gigabit connectorswith integrated Power over Ethernet transformers according to IEEE802.3 (PoEplus) for PSE applications.Both series only differ in the number of RJ-45 ports.
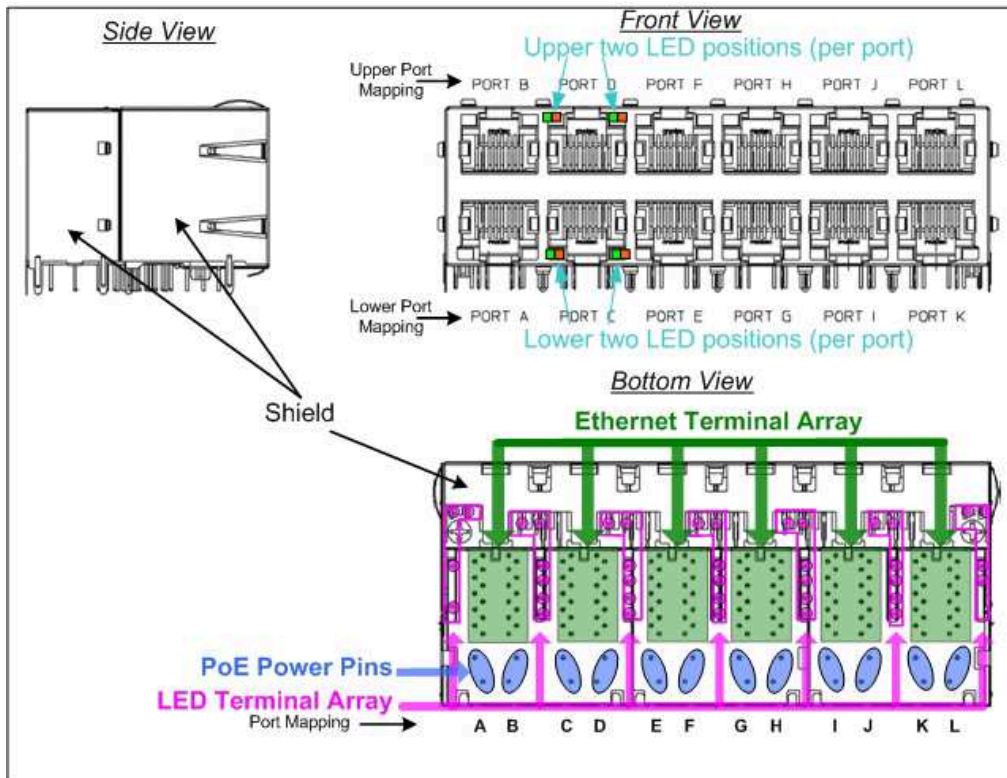For a list of all part number, please refer to the related Sales Drawings (see chapter 1.4).

*Figure 1   View of Gigabit Magnetic Jack PoEplus enabled2x6 port version
See Sales Drawing for detailed dimensions*

1.3. Features

- Fully shielded RJ-45 connector with multiple ports
- Integrated Ethernet magnetics with Bob Smith termination with isolation capacitor
- Compatible with a variety of Gigabit Ethernet transceiver ICs (PHY's)
- Compliant with IEEE 802.3ab standard.(1000 Base-T)
- Ethernet Transformers according to IEEE802.3 (PoEplus) for PSE applications.
- Connector intended to be mated with plugs according IEC 60603-7
- Dielectric isolation of 2250VDC
- Two or four LED's per port where applicable, (two single colour or bi-colourper position)
- Operating temperature: 0°C to70°C, external ambient temperature

1.4. Related Documentation

MOLEX Sales Drawings and Packaging Specifications:

See the appropriate Sales Drawings for information on dimensions, materials, plating and marking, LED options..

Series	Description	Sales Drawing	Packaging Specification
85732	Versions with 12 RJ-45 ports and different LED options	SD-85732-001	PK-85732-001
85735	Versions with8 RJ-45 ports and different LED options	SD-85735-001	PK-85735-001

Application Specification for Molex ICMs

AS-85719-001: This specification covers the requirements for the application and handling of the Molex Integrated Connector Module family.

PoETec V2: Power over Ethernet Technology Consortium

This consortium specifies dimensions and characteristics for stacked ganged RJ45 magnetic jacks including integrated and Enabled Power over Ethernet functionality.

For further information please contact Molex (poe@molex.com)

Normative references:

IEEE 802.3
IEC 60603-7, 60603-7-5, 62471, 60512-1-1, 60512-11-7, 60512-15-6, 60950-1
EIA 364-13, 364-17A, 364-23B, 364-31B, 364-52

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2. Terminal Details

The following sections detail the functional, mechanical and electrical characteristics of the terminals on the Gigabit Magnetic Jack PoEplus enabled

2.1. ETHERNET TERMINALS

2.1.1. Ethernet Terminal Pinout

The pin-out for the Ethernet Terminals on the module is shown below (12-port version).

ETHERNET TERMINALS EACH PORT	
Pin #	Terminal
10	GND
9	VCC
8	TD3+
7	TD3-
6	TD2+
5	TD2-
4	TD1+
3	TD1-
2	TD0+
1	TD0-
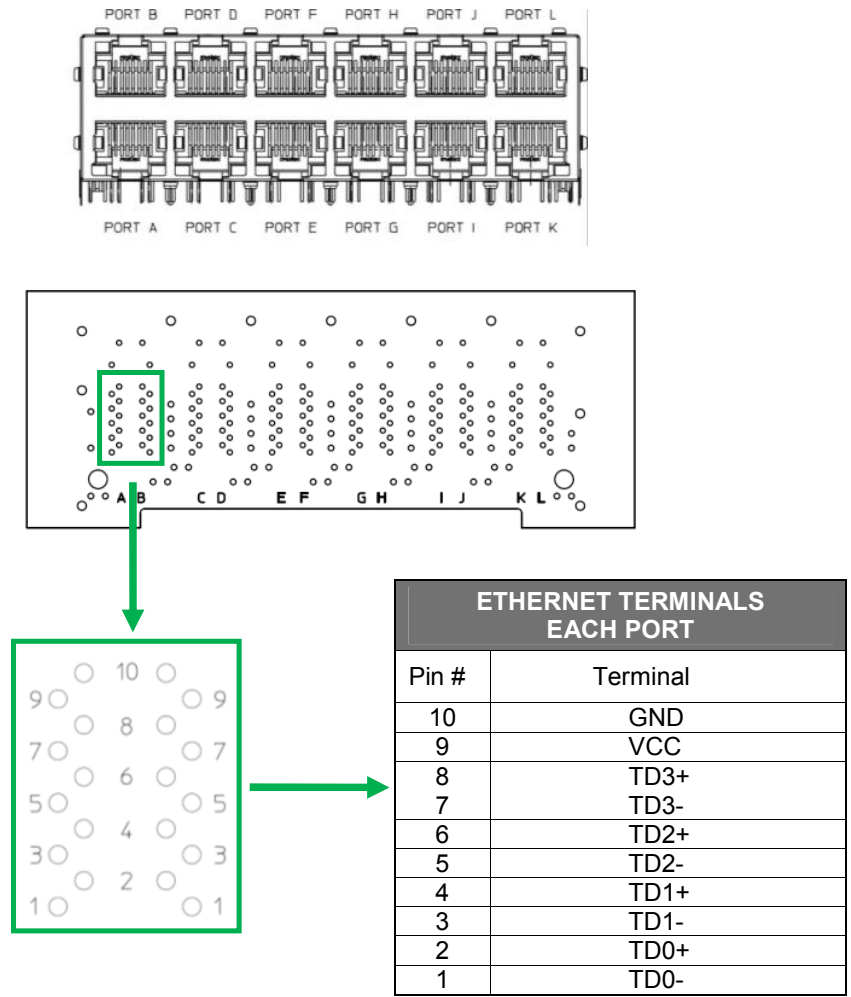
Figure 2   Ethernet terminals and mapping of port to terminal (85735 series only port A to H)
Suggested PCB Board layout component side view
See Sales Drawings for detailed dimensions

2.1.2. Magnetic Wiring Schematic Diagram

The following is the magnetic wiring schematic diagram for the Ethernet Magnetics on the Gigabit Magnetic JackPoEplus enabled
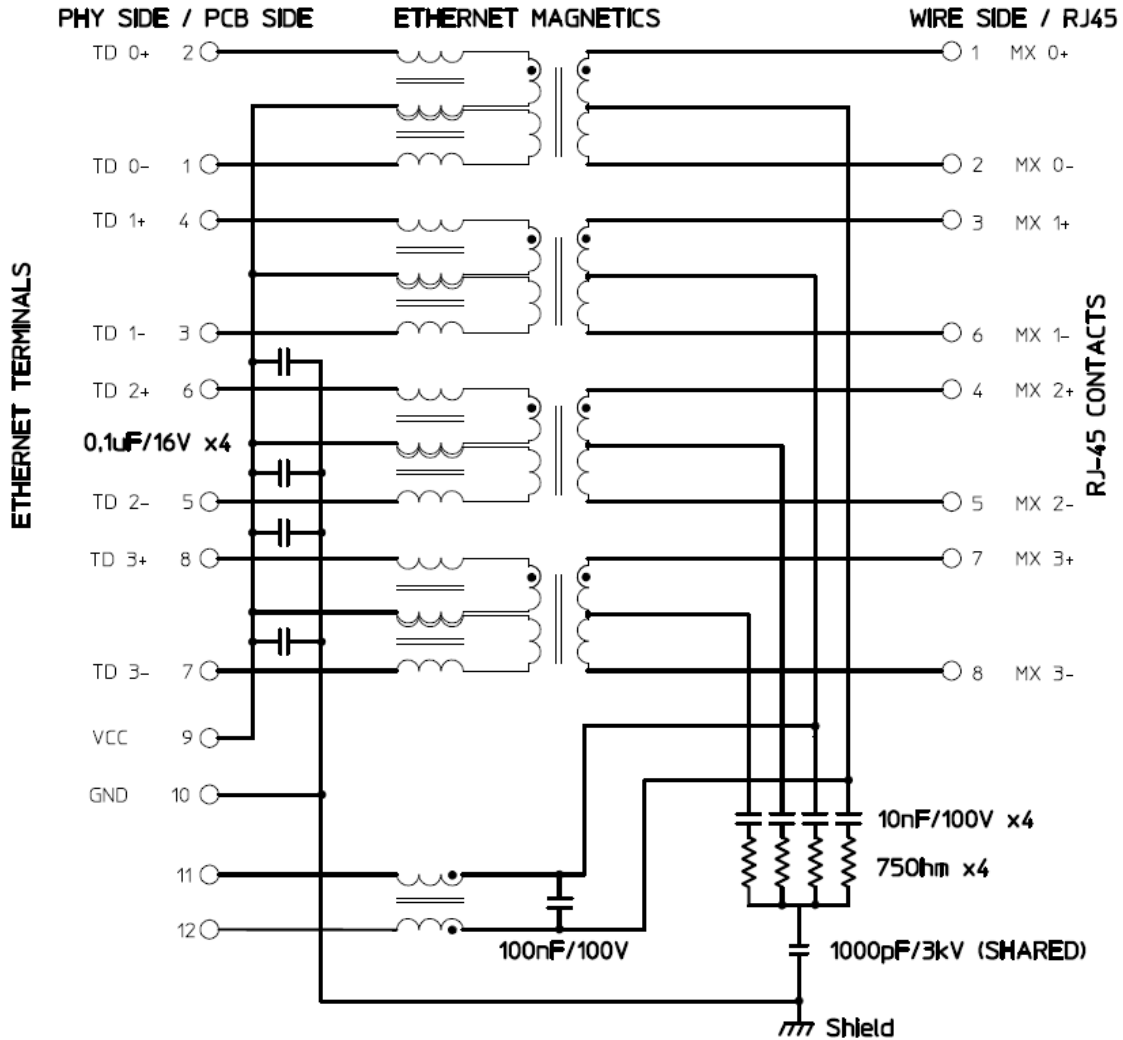
Figure 3   Ethernet magnetic wiring schematic diagram (one port shown)

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2.1.3. Pin Functions

The following table contains the pin function descriptions for the Ethernet terminals on the Gigabit Magnetic Jack PoEplus enabled (one port).

Pin #	Ethernet signal	I/O	Description
1	TD0-	I/O	Gigabit Ethernet data (negative polarity).
2	TD0+	I/O	Gigabit Ethernet data (positive polarity).
3	TD1-	I/O	Gigabit Ethernet data (negative polarity).
4	TD1+	I/O	Gigabit Ethernet data (positive polarity).
5	TD2-	I/O	Gigabit Ethernet data (negative polarity).
6	TD2+	I/O	Gigabit Ethernet data (positive polarity).
7	TD3-	I/O	Gigabit Ethernet data (negative polarity).
8	TD3+	I/O	Gigabit Ethernet data (positive polarity).
9	VCC	n/a	V_{cc} supply of the Ethernet PHY.
10	GND	n/a	Ground of the Ethernet PHY.

2.1.4. Electrical Characteristics at 25°C

The following tables contain the electrical characteristics and transmission performance for the Ethernet terminals on the Gigabit Magnetic Jack PoEplus enabled.

Parameter	Test Condition	Min	Typ	Max	Units
HiPot isolation (see note)	**PHY side** (Ethernet terminals (1-10), LED terminals (13-16), shield) **to cable side** (RJ-45-contacts, PoE Terminals 11 and 12) **for 1min.** **Requirement: No breakdown**	2250			V DC
		(1500)			V AC
Isolation Resistance after 10 HiPot Pulses*	10/700µs 1500V (IEC 60950-1)	>40			MOhm
OCL	With 8mA BIAS at 100kHz, 100mV – Non PoE pairs With 18mA BIAS at 100kHz, 100mV – PoE plus pairs	350			µH

Note: The module includes several capacitors that are charged during the performance of a HiPot test. Using an AC HiPot test will show a high reactive current (due to capacitance), which could mask an abnormally high insulation leakage. This high reactive current might also overload the HiPot test equipment. Therefore a DC test setup is strongly recommended.
Properly discharge the device under test after the test has been performed.
* Compliance verification can be completed by analysis versus actual measurements.

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2.1.5. **Transmission Performance at 25°C**

Insertion Loss [dB max.][2]

Frequency [MHz]	LIMITS
1.0-9.9	$-(0.4+0.1*\log(F))$
10.0-49.9	$-(0.5+0.3*\log(F/10))$
50.0-79.9	$-(1+1.4*\log(F/80))$
80.0-99.9	$-(1.3+3*\log(F/100))$
100.0-199.9	$-(4+9*\log(F/200))$
Values below provided for information only	
1	-0.4
10	-0.5
50	-0.7
80	-1.0
100	-1.3
200	-4

Return Loss [dB min.][3]

Frequency [MHz]	LIMITS
1.0-9.9	-27
10.0-49.9	$-(27-17*\log(F/10))$
50.0-79.9	$-(27-17*\log(F/10))$
80.0-99.9	$-(27-17*\log(F/10))$
100.0-199.9	$-(1-30*\log(F/200))$
Values below provided for information only	
1	-27
10	-27
50	-15
80	-12
100	-10
200	-1

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NEXT [dB min.][4]	
Frequency [MHz]	**LIMITS**
1.0-9.9	-(66-21*log(F))
10.0-49.9	-(45-16*log(F/10))
50.0-79.9	-(25-30*log(F/100))
80.0-99.9	-(25-30*log(F/100))
100.0-199.9	-(20-16.5*log(F/200))
Values below provided for information only	
1	-66
10	-45
50	-34
80	-27.9
100	-25
200	-20

CM-DM [dB min.][1]	
Frequency [MHz]	**LIMITS**
1.0-9.9	-(48-12*log(F))
10.0-59.9	-(36-7.8*log(F/10))
60.0-79.9	-(18-54*log(F/100))
80.0-99.9	-(18-54*log(F/100))
100.0-199.9	-(8.7-15.5*log(F/400))
200.0-399.9	-(8.7-15.5*log(F/400))
400.0-1000.0	-(4.5-10.5*log(F/1000))
Values below provided for information only	
1	-48
10	-36
50	-30.5
80	-23.2
100	-18
200	-13.5
400	-9
1000	-4.5

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DM-CM [dB min.]^2	
Frequency [MHz]	**LIMITS**
1.0-9.9	-(54.5-14.5*log(F))
10.0-49.9	-25
50.0-79.9	-25
80.0-99.9	-25
100.0-199.9	-(9-23*log(F/500))
200.0-499.9	-(9-23*log(F/500))
500.0-1000.0	-(6-10*log(F/1000))
Values below provided for information only	
1	-54.5
10	-25
50	-25
80	-25
100	-25
200	-18.2
400	-11.2
1000	-6

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CMR [dB min.]^2	
Frequency [MHz]	LIMITS
1.0-9.9	-(57-23*log(F))
10.0-19.9	-(57-23*log(F))
20.0-79.9	-27
80.0-99.9	-(27-14.5*log(F/80))
100.0-199.9	-(27-14.5*log(F/80))
200.0-399.9	-(21.5-39*log(F/200))
400.0-1000.0	-10
Values below provided for information only	
1	-57
10	-34
50	-27
80	-27
100	-25.5
200	-21.5
400	-10
1000	-10

1 = Measurements made from Cable side to PHY side
2 = Measurements made from PHY side to Cable side
4 = Measurements made from Cable side to Cable side
5 = Measurements made from PHY side to PHY side

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2.2. PoE POWER SUPPLY TERMINALS

2.2.1. PoE Power Supply Pinout and Assignment

The pin-out for the Power Supply Terminals is shown below (12-port version).

ETHERNET TERMINALS EACH PORT			
Pin #	Assigned RJ-45 Contacts	MDI-X	MDI
11	3-6	Vc+	Vc-
12	1-2	Vc-	Vc+
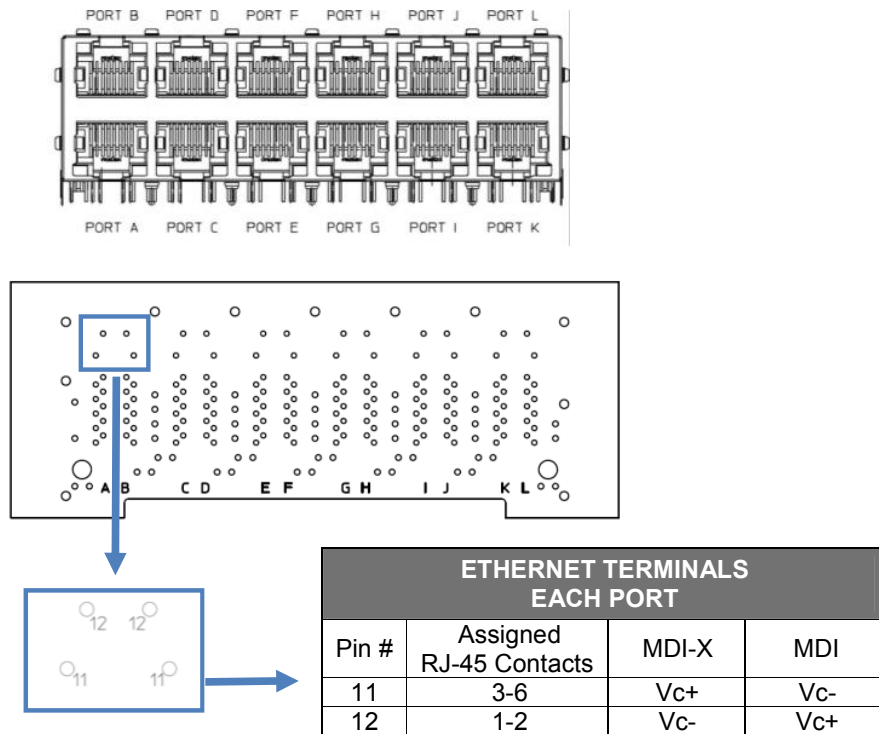
Figure 4   Power Supply Terminals (85735 series only port A to H)
See Sales Drawings for detailed dimensions

As shown in the magnetic wiring diagram, the supply pins are connected to the centre tabs of the Ethernet magnetics in order to supply a PoE voltage according IEEE802.3at (PoEplus) to the corresponding RJ-45 contacts.
Each Pin 11 is assigned to the RJ-45 contacts 3 and 6 of the related port while pin 12 is assigned to the RJ-45 contacts 1 and 2. Depending of the polarity of the supplied PoE voltage, both options of Alternative A according IEEE802.3at could be realized (see table above).

Voltages and currents applied to these terminals shall not exceed the specifications of IEEE802.3at-33.2.7 (as applicable).

2.3. RJ-45 CONTACTS AND PORT DETAILS

2.3.1. RJ-45 Contact (Cable Interface) Arrangement

CKT 8 7 6 5 4 3 2 ①

CKT ① 2 3 4 5 6 7 8
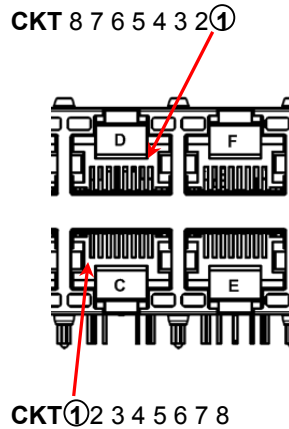
Figure 5   RJ-45 contacts (front view detail)

2.3.2. Contact Functions

Contact #	Ethernet signal	I/O	Description
			Ethernet Function
1	MX 0+	I/O	Gigabit Ethernet data (+) / PoE power Pin12
2	MX 0-	I/O	Gigabit Ethernet data (-) / PoE power Pin12
3	MX 1+	I/O	Gigabit Ethernet data (+) / PoE power Pin11
4	MX 2+	I/O	Gigabit Ethernet data (+)
5	MX 2-	I/O	Gigabit Ethernet data (-)
6	MX 1-	I/O	Gigabit Ethernet data (-) / PoE power Pin11
7	MX 3+	I/O	Gigabit Ethernet data (+)
8	MX 3-	I/O	Gigabit Ethernet data (-)

2.3.3. Transmission Performance, Wiring Schematic Diagram

For transmission performance, wiring schematic diagram, HiPot characteristics see information shown in sections2.1.2Magnetic Wiring Schematic Diagram, 2.1.4Electrical Characteristics at 25°C and 2.1.5Transmission Performance at 25°C.

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2.4.   LED TERMINAL DETAIL

The following section details the functional, mechanical and electrical characteristics of the LED terminals on the Gigabit Magnetic Jack PoEplus enabled.

2.4.1. LED Terminal Pinout

The Gigabit Magnetic Jack PoEplus enabled has on-board LEDs that can be controlled directly. Each port has two LED positions with up to two different colors (single or bicolour) per position. The bicolour LEDs are bipolar. Color change is achieved by reversing voltage using an external switch or relay.

The LED Terminal Pinout is shown on sheet 4 of the related Sales Drawing (see 1.4 Related Documentation).

Available colours are shown on sheet 3 of the related Sales Drawing (see 1.4 Related Documentation).

Note that the LEDs need external current limitation and voltage adjustment according the LED-characteristics.

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	PS-85732-001	**P.Tunn**	**S. Steinke**	**C. Burger**

2.4.2. Electrical Characteristics

The following table contains the electrical characteristics for the LED and LED terminals on the Gigabit Magnetic Jack PoEplus enabled.

All LEDs are low power LEDs according IEC 62471 /exempt group.

Parameter	Test Condition	Min	Max	Units
Intensity Orange LED	Measured at connector front with If=10mA / 25°C	5	10	mcd
Intensity Yellow LED	Measured at connector front with If=10mA / 25°C	5	10	mcd
Intensity Green LED	Measured at connector front with If=10mA / 25°C	5	10	mcd
Wavelength Orange LED	Dominant @ 20mA	605.5	621.5	nm
Wavelength Yellow LED	Dominant @ 20mA	580	595	nm
Wavelength Green LED	Dominant @ 20mA	567.5	575.5	nm
Forward Voltage Orange LED	@ 20mA	1.7	2.3	V
Forward Voltage Yellow LED	@ 20mA	2	2.5	V
Forward Voltage Green LED	@ 20mA	1.75	2.35	V
Forward Current Orange LED		5	25	mA
Forward Current Yellow LED		5	25	mA
Forward Current Green LED		5	25	mA

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APPENDICES

Appendix A: Mechanical and Environmental requirements

PARAMETER	TEST CONDITION					SPECIFICATION REFERENCE	REQUIREMENT
Vibration: Operating Random Vibration	Frequency[Hz]	5-350	350-350	500			No damage **<20**milliohms increase from initial: Discontinuity: Not greater than **5 microseconds**
	Amplitude[g rms]	0.30	0.30	0.30			
	Duration[minutes]	10.00	10.00	10.00			
	Slope[dB/Octave]	0.00	-6	--			
	Power Spectral Density[g^2/Hz]	0.0001	--	0.00005			
Vibration: Non-Operating Sinusoidal Vibration	Swept Sine: 5 to 500Hz resonant search 1 octave/minute sweep rate, 5-minute resonant dwell at 4 resonances per axis - 0.5 g (0-peak)						

PARAMETER	TEST CONDITION						SPECIFICATION REFERENCE	REQUIREMENT
Vibration: Non-Operational Survival, Sinusoidal 10mins/axis	Frequency (Hz)	5-100	100-137	137-350	350-500	500		
	Amplitude (g rms)	2.41	2.41	2.41	2.41	2.41		
	Duration (minutes)	10.00	10.00	10.00	10.00	10.00		
	Slope (dB/Octave)	0.00	-6.00	0.00	-6.00	-		
	Power Spectral Density (g^2/Hz)	0.015	-	0.0080	-	0.0039		
Shock Operational – End-Use Handling	One drop on each of six faces shock machine test with half-sine waveform, duration 3ms, minimum velocity change **424** cm/s ±5%							
Shock Non-Operational	One drop of each of six faces, shock machine test with trapezoidal waveform, velocity change of **742** cm/s ±10%, minimum acceleration **30g**							

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(MECHANICAL AND ENVIRONMENTAL REQUIREMENTS CONTINUED)

PARAMETER	TEST CONDITION	SPECIFICATION REFERENCE	REQUIREMENT
Contact Resistance (Low Level)	Mate connectors: apply a maximum voltage of **20** mV and a current of **100** mA over jack contacts	EIA 364-23B	**20** milliohms MAXIMUM [initial] – Bulk resistance removed
Connector Insertion and Removal Force	Mate and unmate connector (male to female) at a rate of **25 ± 6** mm (**1 ± ¼** inch) per minute.	EIA 364-13	MAX. insertion force MAX. removal force **20 N (4.5 lbf)**
Locking Force (Plug Retention)	Insert plug and apply a **50**N (11 lbf) axial static load **60** s +/- 5 s to mated assembly	N/A	Assy to remain engaged and electrical continuity maintained.
Mating Cycles (Durability)	Mate connectors up to **750** cycles at a maximum rate of **10** cycles per minute prior to Environmental Tests.	N/A	Contact Resistance: **<20 milliohm increase from initial**
Effectiveness of Connector Coupling	Rate of load application 44,5 N/s max.	*IEC60512-15-6-Test 15f*	**50 N** for **60 s ± 5s.**

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Appendix B: ENVIRONMENTAL REQUIREMENTS

PARAMETER		TEST CONDITION	SPECIFICATION REFERENCE	REQUIREMENT
Solderability		**260 ±5 °C, 3-5s**, non active flux, leadfree Solder: Sn Ag 0.55 Cu 0.66	EIA 364-52	Wetting > **90%**
Solder Heat Resistance		Dip connector terminal tails in solder: Solder Duration: **10 ± 0.5** seconds; Solder Temperature: **260 ± 5°**C	EIA 364-52	Visual: No damage to insulator material
Electrical Load and Aging		**500** hours at **70° ± 2°**C / 350mA (at each pair)	EIA 364-17A	Contact Resistance: **<20** milliohms INCREASE FROM INITIAL HiPot: No breakdown at **2250 VDC** (Cable-side to PHY-side) Signal-transmission: No failure Visual: No damage
Dry Heat Climatic cycle	Climatic Cycle	Mate connectors: Temperature: **75°**C / Duration: **16** hours	EIA 364-17A	
Damp Heat (Cyclic)	Climatic Cycle	Mate connectors; expose for **2** cycles at **90 - 95%** relative humidity with atransition time of **24** hours one cycle. **+25°C/+55°C** Note: Remove surface moisture and air dry for **1** hour prior to measurements.	EIA 364-31B	
Cold Resistance	Climatic Cycle	Mate connectors: Duration: **2** hours; Temperature: **-40 ± 3**°C		
Corrosion, Industrial Atmosphere: Flowing Mixed Gas (FMG)		Halfmate and unmate connectors: **0.5 ppm SO$_2$** and **0.1 ppm H$_2$S** Temperature: **(25±2)°C** Relative humidity **(75±3)%** Duration: **10 days**	IEC 60512-11-7 Test 11g	
Rapid Change of Temperature		Mate connectors; expose to 25 cycles of: Temperature °C Duration (Minutes) **-40** **30** **+70** **30** Recovery time: 2 hours		
Damp Heat Steady State (Humidity)		Humidity: **93**% Temperature: **40°**C Duration: **21**days		

REVISION: **A**	ECR/ECN INFORMATION: EC No: **IPG2013-0106** DATE: **24 / 07 / 2012**	TITLE: **PRODUCT SPECIFICATION GIGABIT MAGNETIC JACK PoEplus enabled LED 2x6, 2x4**	SHEET No. **18** of **21**
DOCUMENT NUMBER: **PS-85732-001**	CREATED / REVISED BY: **P.Tunn**	CHECKED BY: **S. Steinke**	APPROVED BY: **C. Burger**

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PRODUCT SPECIFICATION

Appendix C: TEST REQUIREMENT ADDITIONAL TO POETEC

PARAMETER	TEST CONDITION	SPECIFICATION REFERENCE	REQUIREMENT
Visual Inspection	Test 1a	IEC 60512-1-1	No defects that would impair normal operation
Gauging Continuity	All signal contact and screen specimens Annex A	IEC 60603-7-5	Contact disturbance 10µs Maximum

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Appendix D: TEST SEQUENCE

ITEM	DESCRIPTION	GROUP P	GROUP AP	GROUP BP	GROUP CP	GROUP DP	GROUP EP	GROUP FP
1	Visual Inspection	1	6,11	8	3	4		5
2	Contact Resistance	2	4,8	4,6	2	2,		2,4
3	HiPot	3	5,15	7		3		
4	Insertion and Removal Force		1,9					
5	Effectiveness of Connector Coupling		2,10					
6	Locking Force			1				
7	Durability (half rated cycles)			2,5				
8	Vibration				1			
9	Gauging Continuity					5		
10	Solderability		12					
11	Solder Heat Resistance		13					
12	Rapid Change of Temperature		3					
13	Climatic Cycle		7					3
14	Flowing Mixed Gas Corrosion			3				
15	Electrical Load and Aging					1		
16	Damp Heat Steady State (Humidity)							1
17	Insertion Loss						1	
18	Return Loss						2	
19	NEXT						3	
20	CMR						4	
21	OCL						5	
	Sample Quantity		8	8	8	8	8	8

Notes:
Group P to be completed on all samples before testing begins excluding Group EP
Where contact resistance measurements are not possible, Insertion Loss should be completed instead

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Appendix E: ROHS COMPLIANCE / SAFETY APPROVAL

All versions of the Gigabit Magnetic Jack PoEplus enabled are RoHS compliant and lead free.

UL Certification to UL/IEC 60950 pending: File E177474.

Appendix F: HANDLING AND STORAGE

F.1   Washing Process

Water inside the module could cause faults and/or failures and would reduce HiPot insulation. Therefore it is imperative that no water can enter the module during a washing process.

F.2   Storage

- The modules have to be stored under the conditions shown on the table below:

Parameter	Min	Max	Units
Storage temperature	5	50	°C
Storage humidity	20	70	% RH

- Avoid areas with corrosive agents (gases) or dust.
- Do not store the modules in direct sunlight or humid environment.
- Avoid freezing and condensation.
- It is recommended to use the modules within 6 months after delivery.
- Solderability guaranteed for 6 months after delivery.
- Do not open the original package until immediately before use.

For further information please contact Molex (poe@molex.com)

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