

GB-XK-LR

10 Gigabit XENPAK 10km Transceiver

FEATURES

- XAUI Electrical Interface: 4 Lanes @ 3.125Gbit/s
- 1310nm DFB laser
- Hot Z-Pluggable
- SC-Duplex Optical Receptacle
- MDIO, DOM Support
- Pin Photo-detector
- Compliant to XENPAK MSA
- Compliant to IEEE 802.3ae 10GBASE-LR Application
- Case operating temperature: 0 to 70 °C



REFERENCE

IEEE 802.3ae as 10GBASE-LR, XENPAK MSA Release3.0

GENERAL DESCRIPTION

GB-LINK's 10Gb/s XENPAK transceiver module GB-XK-LR is a hot pluggable in the Z-direction module that is usable in typical router line card applications, Storage, IP network and LAN and compliant to XENPAK MSA. The GB-XK-LR is a fully integrated 10.3Gbit/s optical transceiver module that consists of a 10.3Gbit/s optical transmitter and receiver, XAUI interface, Mux and De-mux with clock and data recovery(CDR).This version of GB-LINK Inc. transceiver line uses an uncooled 1310nm DML Laser Diode to achieve 10km over standard single mode fiber as 10GBASE-LR of the IEEE 802.3ae.

I .Optical Characteristics

Table1. Optical Characteristics

| No. | Parameters | Symbols | Min. | Typ. | Max. | Unit | NOTE |
|-----|--|-------------|------|---------|-------|--------|------|
| 1 | Center Wavelength | λ_C | 1290 | 1310 | 1330 | nm | |
| 2 | Signaling speed | | - | 10.3125 | - | Gbit/s | |
| 3 | Signaling speed variation from nominal | | -100 | - | +100 | ppm | |
| 4 | Average Optical Power | Pf | -5.0 | - | 0.5 | dBm | |
| 5 | Side Mode Suppression Ratio | SMSR | 30 | - | - | dB | |
| 6 | Extinction Ratio | ER | 3.5 | - | - | dB | |
| 7 | Off Transmit Power | Poff | - | - | -30 | dBm | |
| 8 | Receiver Sensitivity | Rsense | - | | -14.4 | dBm | |
| 9 | Receiver Overload | Rro | +0.5 | - | - | dBm | |
| 10 | Optical Centre Wavelength | λ_C | 1270 | | 1610 | nm | |
| 11 | Los D-Assert | ROSd | | | -18 | dBm | |
| 12 | Los Assert | ROSa | -32 | | | | |
| 13 | Los Hysteresis | | 0.5 | - | - | dB | |

II .Electrical Performance

Table2. Power Supply Characteristics

| No. | Parameter | Symbol | Min. | Typ. | Max. | Unit | NOTE |
|-----|--------------------------------------|--------|-------|-------|-------|------|------|
| 1 | Supply Voltage | VCC1 | 3.135 | 3.300 | 3.465 | V | |
| 2 | Supply Voltage | VCC2 | 1.152 | 1.200 | 1.248 | V | |
| 3 | Supply Current | ICC1 | - | - | 1.0 | A | |
| 4 | Supply Current | ICC2 | - | - | 1.7 | A | |
| 5 | Power Consumption | PDS | - | - | 4.0 | W | |
| 6 | Power supply stabilization time | TDF | - | - | 500 | ms | |
| 7 | Initialization Time | TINIT | - | - | 5 | s | |
| 8 | RESET Assert Time | TRESET | 1 | - | - | ms | |
| 9 | Hold Time after rising edge of RESET | THOLD | 500 | - | - | ms | |

Table3. XAUI Driver Characteristics

| No. | Parameter | Symbol | Min. | Typ. | Max. | Unit | NOTE |
|-----|------------------------|--------|------|-------|------|--------|--------------------------|
| 1 | Baud Rate | | - | 3.125 | - | Gbit/s | |
| 2 | Baud Rate Tolerance | | -100 | - | +100 | ppm | |
| 3 | Differential Amplitude | | 800 | - | 1600 | mVPP | AC, near-end value |

Table4. 1.2V CMOS Interface Characteristics

| No. | Parameter | Symbol | Min. | Typ. | Max. | Unit | NOTE |
|-----|-------------------------|--------|------|------|------|-------|----------------------------|
| 1 | Input High Voltage | VIH | 0.84 | - | 1.5 | V | |
| 2 | Input Low Voltage | VIL | -0.3 | - | 0.36 | V | |
| 3 | Input Pull-down Current | IIn | 20 | 40 | 120 | μA | Vih=1.2V |
| 4 | Output High Voltage | VOH | 1.0 | - | - | V | Pull-up=10k ohm to 1.2V |
| 5 | Output Low Voltage | VOL | - | - | 0.2 | V | |
| 6 | Pull up Resistance | RLASI | 10 | - | 22 | k ohm | |
| 7 | Capacitance | CLASI | - | - | 10 | pF | |
| 8 | Load Capacitance | CLoad | - | - | 320 | pF | |

Table5. MDIO Bidirectional Interface Characteristics

| No. | Parameter | Symbol | Min. | Typ. | Max. | Unit | NOTE |
|-----|-----------------------|---------|------|------|------|------|------|
| 1 | Input High Voltage | VIHM | 0.84 | - | 1.5 | V | |
| 2 | Input Low Voltage | VILM | -0.3 | - | 0.36 | V | |
| 3 | Output High Voltage | VOHM | 1.0 | - | 1.5 | V | |
| 4 | Output Low Voltage | VOLM | -0.3 | - | 0.2 | V | |
| 5 | Pull up Resistance | RMDIO | 200 | - | | Ohm | 1 |
| 6 | MDC min high/low time | THM,TLM | 160 | - | - | ns | |
| 7 | MDC Frequency | 1/TCK | TBD | - | 2.5 | MHz | |
| 8 | Setup time | TDIS | 10 | - | - | ns | |
| 9 | Hold time | TDIH | 10 | - | - | ns | |



| | | | | | | | |
|----|--|-----|---|---|-----|----|--|
| 10 | MDIO output delay after rising edge of MDC | TPD | 0 | - | 300 | ns | |
| 12 | Input Capacitance | Ci | - | - | 10 | pF | |
| 13 | Bus Loading | CL | - | - | 470 | pF | |

Note:1 The maximum value of RMDIO depends on bus loading(CL) , input capacitance(Ci), and MDC frequency(1/TCK).

III. Electrical Pad Layout

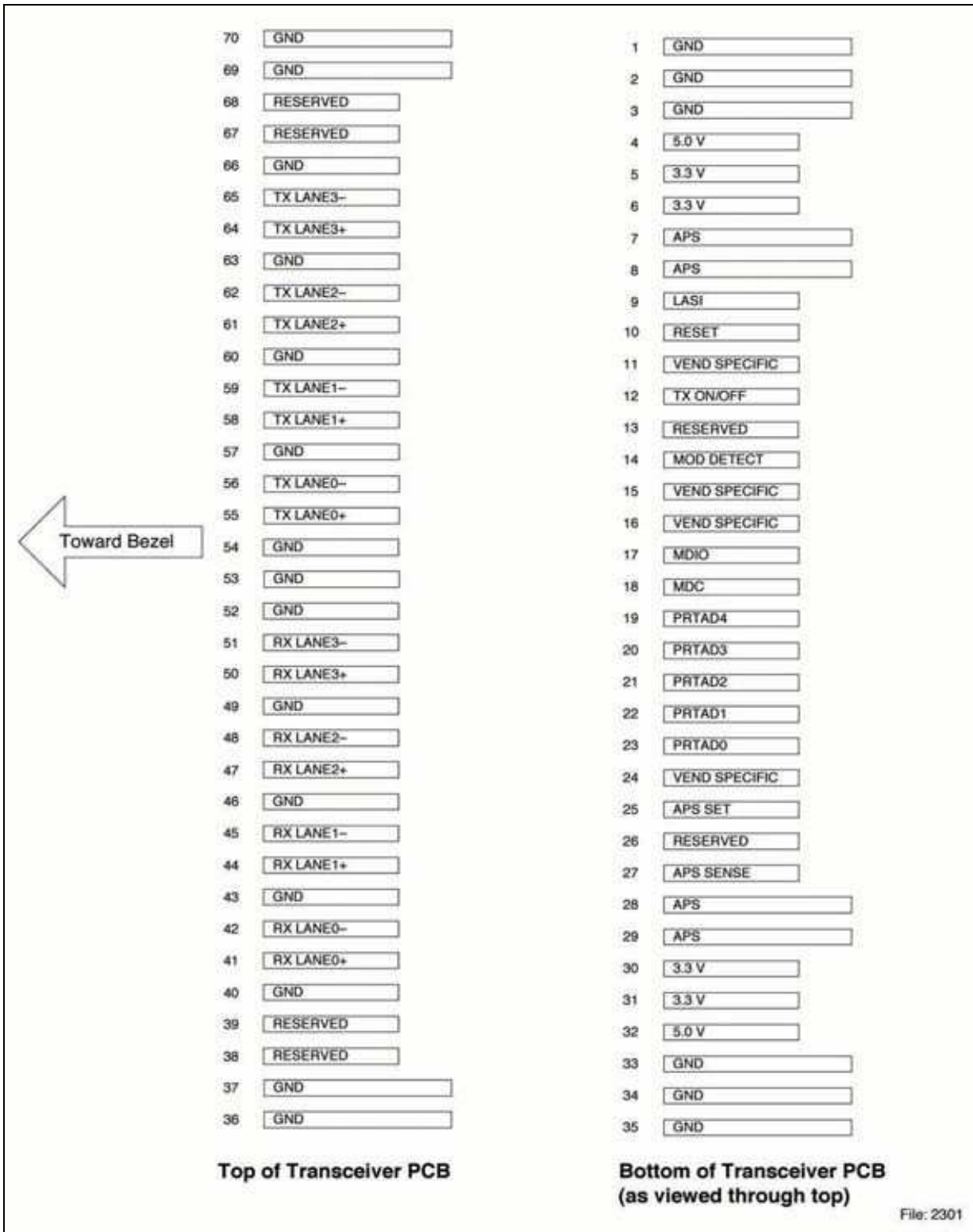


Fig 1-XENPAK Transponder Electrical Pad Layout

Table6. XENPAK Pin Configuration

| Pin # | Symbol | I/O | Logic | Description |
|-------|---------------|-----|------------|--|
| 1 | GND | I | Supply | Electrical ground |
| 2 | GND | I | Supply | Electrical ground |
| 3 | GND | I | Supply | Electrical ground |
| 4 | RESERVED | - | - | Reserved |
| 5 | 3.3 V | I | Supply | Power |
| 6 | 3.3 V | I | Supply | Power |
| 7 | APS | I | Supply | Adaptive Power Supply |
| 8 | APS | I | Supply | Adaptive Power Supply |
| 9 | LASI | O | Open Drain | Link Alarm Status Interrupt. 10-22k ohm pull up on host. |
| 10 | RESET | I | 1.2V CMOS | TX OFF when MDIO RESET |
| 11 | VEND SPECIFIC | - | - | Vendor Specific Pin. Leave unconnected. |
| 12 | TX ON/OFF | I | 1.2V CMOS | Transmitter ON/OFF |
| 13 | RESERVED | - | - | Reserved |
| 14 | MOD DETECT | O | - | Pulled low inside module through 1k ohm. |
| 15 | VEND SPECIFIC | - | - | Vendor Specific Pin. Leave unconnected. |
| 16 | VEND SPECIFIC | - | - | Vendor Specific Pin. Leave unconnected. |
| 17 | MDIO | I/O | Open Drain | Management Data IO |
| 18 | MDC | I | 1.2V CMOS | Management Data Clock |
| 19 | PRTAD4 | I | 1.2V CMOS | Port Address bit 4 (Low=0) |
| 20 | PRTAD3 | I | 1.2V CMOS | Port Address bit 3 (Low=0) |
| 21 | PRTAD2 | I | 1.2V CMOS | Port Address bit 2 (Low=0) |
| 22 | PRTAD1 | I | 1.2V CMOS | Port Address bit 1 (Low=0) |
| 23 | PRTAD0 | I | 1.2V CMOS | Port Address bit 0 (Low=0) |
| 24 | VEND SPECIFIC | - | - | Vendor Specific Pin. Leave unconnected. |
| 25 | APS SET | O | - | Feedback output for APS |
| 26 | RESERVED | - | - | Reserved for Avalanche Photodiode use. |
| 27 | APS SENSE | O | Analog | APS Sense Connection |
| 28 | APS | I | Supply | Adaptive Power Supply |
| 29 | APS | I | Supply | Adaptive Power Supply |
| 30 | 3.3 V | I | Supply | Power |



| | | | | |
|----|------------|---|--------|----------------------------|
| 31 | 3.3 V | I | Supply | Power |
| 32 | RESERVED | - | - | Reserved |
| 33 | GND | I | Supply | Electrical Ground |
| 34 | GND | I | Supply | Electrical Ground |
| 35 | GND | I | Supply | Electrical Ground |
| 36 | GND | I | Supply | Electrical Ground |
| 37 | GND | I | Supply | Electrical Ground |
| 38 | RESERVED | - | - | Reserved |
| 39 | RESERVED | - | - | Reserved |
| 40 | GND | I | Supply | Electrical Ground |
| 41 | RX LANE 0+ | O | AC | Module XAUI Output Lane 0+ |
| 42 | RX LANE 0- | O | AC | Module XAUI Output Lane 0- |
| 43 | GND | I | Supply | Electrical Ground |
| 44 | RX LANE 1+ | O | AC | Module XAUI Output Lane 1+ |
| 45 | RX LANE 1- | O | AC | Module XAUI Output Lane 1- |
| 46 | GND | I | Supply | Electrical Ground |
| 47 | RX LANE 2+ | O | AC | Module XAUI Output Lane 2+ |
| 48 | RX LANE 2- | O | AC | Module XAUI Output Lane 2- |
| 49 | GND | I | Supply | Electrical Ground |
| 50 | RX LANE 3+ | O | AC | Module XAUI Output Lane 3+ |
| 51 | RX LANE 3- | O | AC | Module XAUI Output Lane 3- |
| 52 | GND | I | Supply | Electrical Ground |
| 53 | GND | I | Supply | Electrical Ground |
| 54 | GND | I | Supply | Electrical Ground |
| 55 | TX LANE 0+ | I | AC | Module XAUI Input Lane 0+ |
| 56 | TX LANE 0- | I | AC | Module XAUI Input Lane 0- |
| 57 | GND | I | Supply | Electrical Ground |
| 58 | TX LANE 1+ | I | AC | Module XAUI Input Lane 1+ |
| 59 | TX LANE 1- | I | AC | Module XAUI Input Lane 1- |
| 60 | GND | I | Supply | Electrical Ground |
| 61 | TX LANE 2+ | I | AC | Module XAUI Input Lane 2+ |
| 62 | TX LANE 2- | I | AC | Module XAUI Input Lane 2- |

| | | | | |
|----|------------|---|--------|---------------------------|
| 63 | GND | I | Supply | Electrical Ground |
| 64 | TX LANE 3+ | I | AC | Module XAUI Input Lane 3+ |
| 65 | TX LANE 3- | I | AC | Module XAUI Input Lane 3- |
| 66 | GND | I | Supply | Electrical Ground |
| 67 | RESERVED | - | - | Reserved |
| 68 | RESERVED | - | - | Reserved |
| 69 | GND | I | Supply | Electrical Ground |
| 70 | GND | I | Supply | Electrical Ground |

Note: Case is connected to electrical ground in the module.

IV. Package Outline

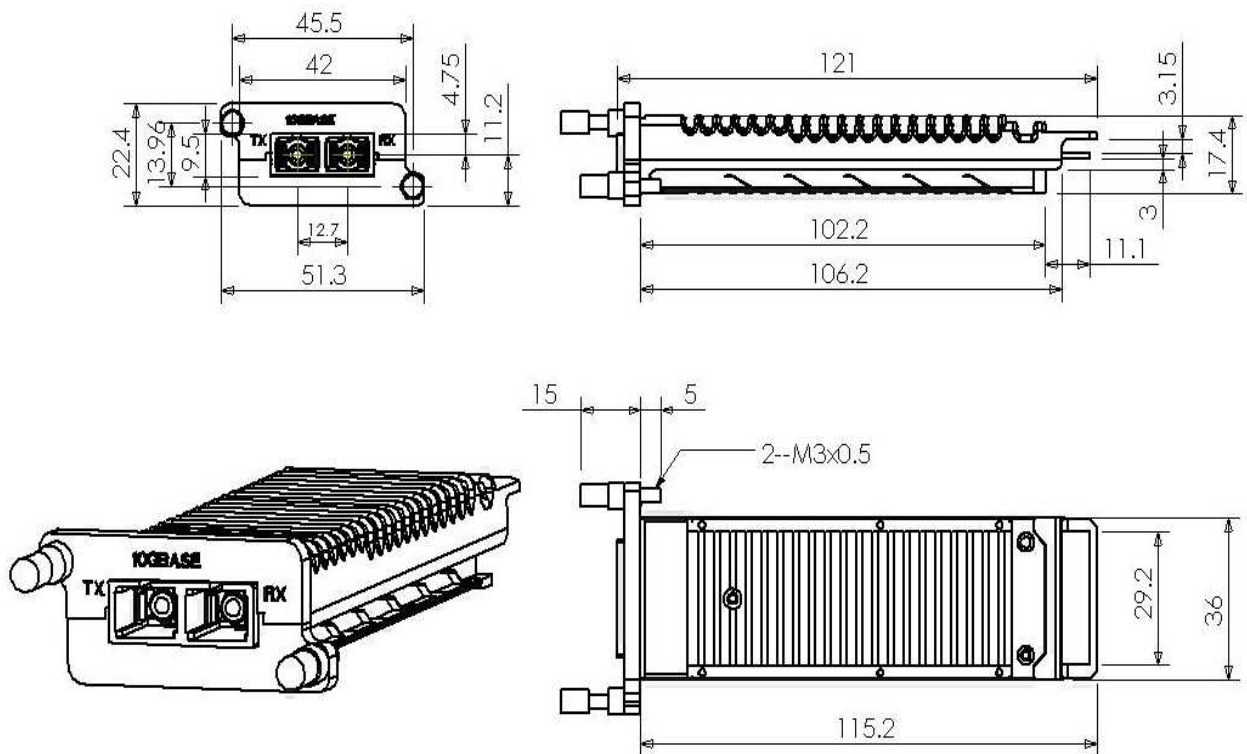


Figure 1 Mechanical dimensions

V. Register Definition



| Device Address (Dec) Register Address (Hex) | PMA/PMD 1 | PCS 3 | PHY XS 4 |
|---|-----------------------------|--|---------------------------|
| 0x0000 | PMA/PMD Control1 | PCS Control1 | PHY XS Control1 |
| 0x0001 | PMA/PMD Status1 | PCS Status1 | PHY XS Status1 |
| 0x0002 | PMA/PMD Device Identifier0 | PCS Device Identifier0 | PHY XS Device Identifier0 |
| 0x0003 | PMA/PMD Device Identifier1 | PCS Device Identifier1 | PHY XS Device Identifier1 |
| 0x0004 | PMA/PMD Speed Ability | PCS Speed Ability | PHY XS Speed Ability |
| 0x0005 | PMA/PMD Device in Package1 | PCS Device in Package1 | PHY XS Device in Package1 |
| 0x0006 | PMA/PMD Device in Package2 | PCS Device in Package2 | PHY XS Device in Package2 |
| 0x0007 | 10G PMA/PMD Control2 | PCS Control2 | Reserved |
| 0x0008 | 10G PMA/PMD Status2 | PCS Status2 | PHY XS Status2 |
| 0x0009 | 10G PMD Transmit Disable | Reserved | Reserved |
| 0x000A | 10G PMD Receive Signal O.K. | Reserved | Reserved |
| 0x000E | Package Identifier0 | Reserved | Reserved |
| 0x000F | Package Identifier1 | Reserved | Reserved |
| 0x0018 | Reserved | Reserved | 10G PHY XGXS Lane Status |
| 0x0019 | Reserved | Reserved | 10G PHY XGXS Test Control |
| 0x0020 | Reserved | 10GBASE-R PCS Status1 | Reserved |
| 0x0021 | Reserved | 10GBASE-R PCS Status2 | Reserved |
| 0x0022 | Reserved | 10GBASE-R PCS Test pattern Seed A0 | Reserved |
| 0x0023 | Reserved | 10GBASE-R PCS Test pattern Seed A1 | Reserved |
| 0x0024 | Reserved | 10GBASE-R PCS Test pattern Seed A2 | Reserved |
| 0x0025 | Reserved | 10GBASE-R PCS Test pattern Seed A3 | Reserved |
| 0x0026 | Reserved | 10GBASE-R PCS Test pattern Seed B0 | Reserved |
| 0x0027 | Reserved | 10GBASE-R PCS Test pattern Seed B1 | Reserved |
| 0x0028 | Reserved | 10GBASE-R PCS Test pattern Seed B2 | Reserved |
| 0x0029 | Reserved | 10GBASE-R PCS Test pattern Seed B3 | Reserved |
| 0x002A | Reserved | 10GBASE-R PCS Test pattern Control | Reserved |
| 0x002B | Reserved | 10GBASE-R PCS Test pattern Error counter | Reserved |



| | | |
|--------------------|---|----------|
| 0x8000 | NVR Control/Status (XENPAK Register) | Reserved |
| 0x8007 - 0x807D | NVR (XENPAK Register) | Reserved |
| 0x807E- 0x80AD | Customer AREA | Reserved |
| 0x80AE - 0x8106 | GB-LINK Specific Area(XENPAK Register) | Reserved |
| 0x9000 | RX_ALARM Control (XENPAK Register) | Reserved |
| 0x9001 | TX_ALARM Control (XENPAK Register) | Reserved |
| 0x9002 | LASI Control (XENPAK Register) | Reserved |
| 0x9003 | RX_ALARM Status (XENPAK Register) | Reserved |
| 0x9004 | TX_ALARM Status (XENPAK Register) | Reserved |
| 0x9005 | LASI Status (XENPAK Register) | Reserved |
| 0x9006 | TX_FLAG Control Bits | Reserved |
| 0x9007 | RX_FLAG Control Bits | Reserved |
| 0xA000 - 0xA027 | Alarm and Warning Thresholds | Reserved |
| 0xA060 - 0xA069 | Digital Optical Monitoring Interface | Reserved |
| 0xA06F | DOM Capability - Extended | Reserved |
| 0xA070 | TX_ALARM_FLAG Bits | Reserved |
| 0xA071 | RX_ALARM_FLAG Bits | Reserved |
| 0xA074 | TX_WARNING_FLAG Bits | Reserved |
| 0xA075 | RX_WARNING_FLAG Bits | Reserved |
| 0xA100 | Optional Digital Optical Monitoring (DOM) Control/Status | Reserved |

VI. Regulatory Compliance

| Feature | Reference | Performance |
|------------------------------------|---|---------------------------|
| Electrostatic discharge (ESD) | IEC/EN 61000-4-2 | Compatible with standards |
| Electromagnetic Interference (EMI) | FCC Part 15 Class B EN 55022 Class B (CISPR 22A) | Compatible with standards |
| Laser Eye Safety | FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, 2 | Class 1 laser product |
| ROHS | 2002/95/EC | Compatible with standards |
| EMC | EN61000-3 | Compatible with standards |

Appendix A. Document Revision

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| Version No. | Date | Description |
|-------------|------------|----------------------------------|
| 1.0 | 2010-09-01 | Preliminary datasheet |
| 2.0 | 2011-09-10 | Update format and company's logo |