

EOLP-1360-10

1310nm SFP+ Single-Mode
Multi Rate 600Mbps~6.25Gbps
Duplex SFP+ Transceiver
RoHS 6 Compliant



Features

- ◆ Operating data rate up to 6.25Gbps
- ◆ 1310nm DFB-LD Transmitter
- ◆ Distance up to 10km
- ◆ 2-wire interface for digital diagnostic monitoring
- ◆ Single 3.3V Power supply and TTL Logic Interface
- ◆ Duplex LC Connector Interface
- ◆ Hot Pluggable
- ◆ Operating Case Temperature
 Standard: 0°C~+70°C
 Industrial: -40°C~+85°C
- ◆ Compliant with SFF-8431 and 8472
- ◆ Compliant with FC standard INCITS 352
- ◆ Compliant with IEEE 802.3ae

Applications

- ◆ High speed storage area networks
- ◆ OBSAI interface, such as
 6.144/1.536/3.072/1.536Gbps and
 768Mbps
- ◆ CPRI interface, such as
 6.144/3.072/2.4576/1.228Gbps and
 614Mbps

Ordering information

| Part No. | Data Rate | Laser | Fiber Type | Distance | Temp. | DDMI |
|--------------------|------------------------|---------------|------------|----------|------------|------|
| EOLP-1360-10*note1 | 600Mbps to 6.25Gbps | 1310nm DFB | SMF | 10km | Standard | YES |
| EOLP-1360-10-I | 600Mbps to 6.25Gbps | 1310nm DFB | SMF | 10km | Industrial | YES |

Note1: Standard version.

Regulatory Compliance*

| Product Certificate | Certificate Number | Applicable Standard |
|---------------------|--------------------|----------------------------|
| TUV | R50135086 | EN 60950-1:2006+A11+A1+A12 |
| | | EN 60825-1:2007 |
| | | EN 60825-2:2004+A1+A2 |
| UL | E317337 | UL 60950-1 |
| | | CSA C22.2 No. 60950-1-07 |
| EMC CE | AE 50285865 0001 | EN 55022:2010 |
| | | EN 55024:2010 |
| CB | JPTUV-049251 | IEC 60825-1 |
| | | IEC 60950-1 |
| FCC | WTF14F0514437E | 47 CFR PART 15 OCT., 2013 |
| FDA | 1331340-000 | CDRH 1040.10 |
| ROHS | RHS01G006464 | 2011/65/EU |

*The above certificate number updated to June 2014, because some certificate will be updated every year, such as FCC, FDA and ROHS. For the latest certification information, please check with Eoptolink.

Product Description

This module is designed for single mode fiber and operates at a nominal wavelength of 1310 nm. The transmitter section uses a 1310nm DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825.

The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.

Absolute Maximum Ratings

| Parameter | Symbol | Min. | Max. | Unit |
|---------------------|----------|------|------|------|
| Storage Temperature | T_s | -40 | +85 | °C |
| Supply Voltage | V_{CC} | -0.5 | 3.6 | V |

Recommended Operating Conditions

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|----------------------------|-------------|----------------|---------|------|------|
| Operating Case Temperature | T_c | EOLP-1360-10 | 0 | +70 | °C |
| | | EOLP-1360-10-I | -40 | +85 | |
| Power Supply Voltage | V_{CC} | 3.15 | 3.3 | 3.45 | V |
| Power Supply Current | I_{CC} | | | 300 | mA |
| Surge Current | I_{Surge} | | | +30 | mA |
| Data Rate | | 0.6 | | 6.25 | Gbps |

Performance Specifications – Electrical

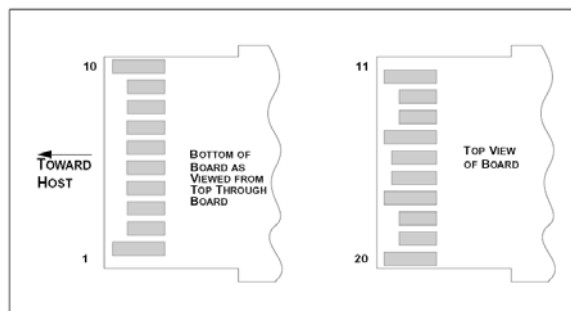
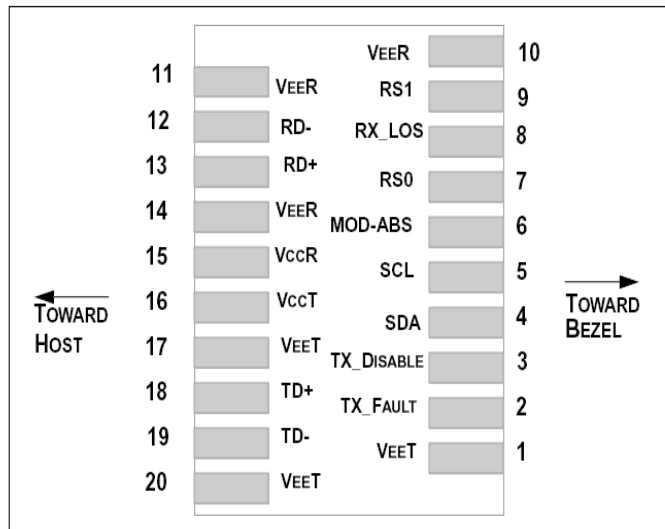
| Parameter | Symbol | Min. | Typ. | Max | Unit | Notes |
|---------------------------------|------------------|------|------|----------------------|------|--|
| Transmitter | | | | | | |
| CML Inputs(Differential) | V _{in} | 150 | | 1200 | mVpp | AC coupled inputs |
| Input Impedance (Differential) | Z _{in} | 85 | 100 | 115 | ohm | R _{in} > 100 kohms @ DC |
| Tx_DISABLE Input Voltage – High | | 2 | | 3.45 | V | |
| Tx_DISABLE Input Voltage – Low | | 0 | | 0.8 | V | |
| Tx_FAULT Output Voltage – High | | 2 | | V _{cc} +0.3 | V | I _o = 400μA; Host V _{cc} |
| Tx_FAULT Output Voltage – Low | | 0 | | 0.5 | V | I _o = -4.0mA |
| Receiver | | | | | | |
| CML Outputs (Differential) | V _{out} | 350 | | 700 | mVpp | AC coupled outputs |
| Output Impedance (Differential) | Z _{out} | 85 | 100 | 115 | ohm | |
| Rx_LOS Output Voltage – High | | 2.0 | | V _{cc} +0.3 | V | I _o = 400μA; Host V _{cc} |
| Rx_LOS Output Voltage – Low | | 0 | | 0.8 | V | I _o = -4.0mA |
| MOD_DEF (2:0) | VoH | 2.5 | | | V | With Serial ID |
| | VoL | 0 | | 0.5 | V | |

Performance Specifications – Optical

| Parameter | Symbol | Min. | Typical | Max. | Unit |
|--|------------------|------|---------|------|------|
| 9μm Core Diameter SMF supported Distance | | | | 10 | km |
| Data Rate | | 0.6 | | 6.25 | Gbps |
| Transmitter | | | | | |
| Centre Wavelength | λ _C | 1290 | 1310 | 1330 | nm |
| Spectral Width (-20dB) | Δλ | | | 1 | nm |
| Side Mode Suppression Ratio | SMSR | 30 | | | dB |
| Average Output Power@10.3Gbps | P _{out} | -8.2 | | +0.5 | dBm |
| Extinction Ratio@10.3Gbps | ER | 4.5 | 6 | | dB |
| Average Power of OFF Transmitter | P _{off} | | | -30 | dBm |
| Input Differential Impedance | Z _{IN} | 90 | 100 | 110 | Ω |
| TX Disable | Disable | | | 2.0 | V |
| | Enable | | | 0 | |

| | | | | | | |
|-------------------------------|--------|-----------|------|-----|--------------|----------|
| TX Fault | Fault | | 2.0 | | $V_{CC}+0.3$ | V |
| | Normal | | 0 | | 0.8 | |
| TX Disable Assert Time | | t_{off} | | | 10 | us |
| Receiver | | | | | | |
| Centre Wavelength | | λ | 1260 | | 1360 | nm |
| Sensitivity @ 6.25Gbps | | P_{min} | | | -14.4 | dBm |
| Sensitivity @ 4.95Gbps | | | | | -17 | |
| Sensitivity @ 2.5Gbps | | | | | -20 | |
| Sensitivity @ 1.25Gbps | | | | | -22 | |
| Receiver Overload | | P_{max} | 0.5 | | | dBm |
| Optical Return Loss | | ORL | | | -12 | dB |
| LOS De-Assert | | LOS_D | | | -16 | dBm |
| LOS Assert | | LOS_A | -28 | | | dBm |
| LOS Hysteresis | | LOS_H | 0.5 | | | dB |
| Output Differential Impedance | | Z_{OUT} | 90 | 100 | 110 | Ω |
| LOS | High | | 2.0 | | $V_{CC}+0.3$ | V |
| | Low | | 0 | | 0.8 | |

SFP+ Transceiver Electrical Pad Layout



Pin Function Definitions

| Pin Num. | Name | FUNCTION | Plug Seq. | Notes |
|----------|------------|------------------------------|-----------|--|
| 1 | VeeT | Transmitter Ground | 1 | Note 5 |
| 2 | TX Fault | Transmitter Fault Indication | 3 | Note 1 |
| 3 | TX Disable | Transmitter Disable | 3 | Note 2, Module disables on high or open |
| 4 | SDA | Module Definition 2 | 3 | Data line for Serial ID. |
| 5 | SCL | Module Definition 1 | 3 | Clock line for Serial ID. |
| 6 | MOD-ABS | Module Definition 0 | 3 | Note 3 |
| 7 | RS0 | RX Rate Select (LVTTTL). | 3 | This pin has an internal 30k pull down to ground. A signal on this pin will not affect module performance. |
| 8 | LOS | Loss of Signal | 3 | Note 4 |
| 9 | RS1 | TX Rate Select (LVTTTL). | 1 | This pin has an internal 30k pull down to ground. A signal on this pin will not affect module performance. |
| 10 | VeeR | Receiver Ground | 1 | Note 5 |
| 11 | VeeR | Receiver Ground | 1 | Note 5 |
| 12 | RD- | Inv. Received Data Out | 3 | Note 6 |
| 13 | RD+ | Received Data Out | 3 | Note 7 |
| 14 | VeeR | Receiver Ground | 1 | Note 5 |
| 15 | VccR | Receiver Power | 2 | 3.3V ± 5%, Note 7 |
| 16 | VccT | Transmitter Power | 2 | 3.3V ± 5%, Note 7 |
| 17 | VeeT | Transmitter Ground | 1 | Note 5 |
| 18 | TD+ | Transmit Data In | 3 | Note 8 |
| 19 | TD- | Inv. Transmit Data In | 3 | Note 8 |
| 20 | VeeT | Transmitter Ground | 1 | Note 5 |

Notes:

1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor on the host board. Pull up voltage between 2.0V and VccT/R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8V.

2) TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7K – 10 KΩ resistor. Its states are:

Low (0 – 0.8V): Transmitter on

(>0.8, < 2.0V): Undefined

High (2.0 – 3.465V): Transmitter Disabled

Open: Transmitter Disabled

3) Module Absent, connected to VeeT or VeeR in the module.

4) LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K – 10KΩ resistor. Pull up voltage between 2.0V and $V_{ccT/R} + 0.3V$. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to $< 0.8V$.

5) VeeR and VeeT may be internally connected within the SFP+ module.

6) RD-/+ : These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board.

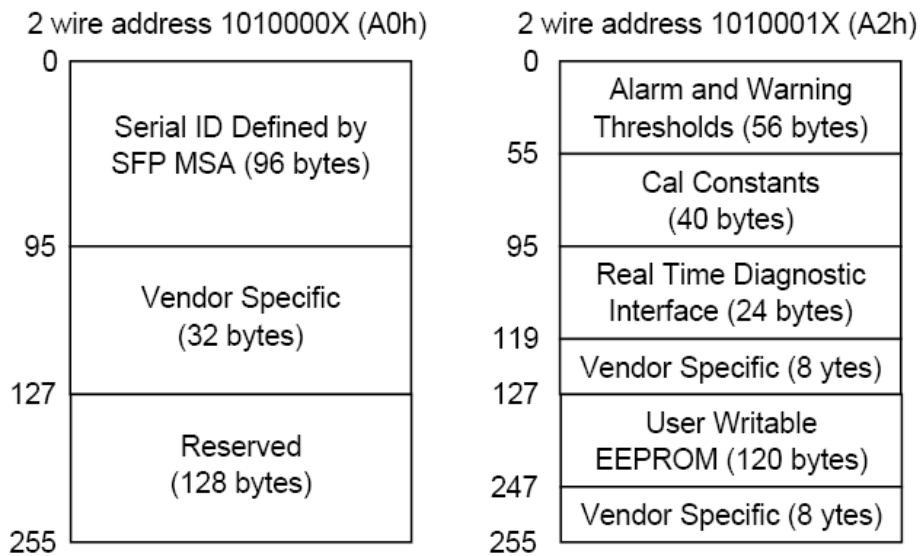
7) VccR and VccT are the receiver and transmitter power supplies. They are defined as $3.3V \pm 5\%$ at the SFP+ connector pin. Maximum supply current is 300mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 ohm should be used in order to maintain the required voltage at the SFP+ input pin with 3.3V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP+ transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP+ transceiver module.

8) TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

EEPROM

The serial interface uses the 2-wire serial CMOS EEPROM protocol defined for the ATMEL AT24C02/04 family of components. When the serial protocol is activated, the host generates the serial clock signal (SCL). The positive edge clocks data into those segments of the EEPROM that are not writing protected within the SFP+ transceiver. The negative edge clocks data from the SFP+ transceiver. The serial data signal (SDA) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. If the module is defined as external calibrated, the diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at wire serial bus address A2h. The digital diagnostic memory map specific data field define as following .For detail EEPROM information, please refer to the related document of SFF 8472 Rev 10.2.



EEPROM Serial ID Memory Contents

Accessing Serial ID Memory uses the 2 wire address 1010000X (A0H). Memory Contents of Serial ID are shown in Table 1.

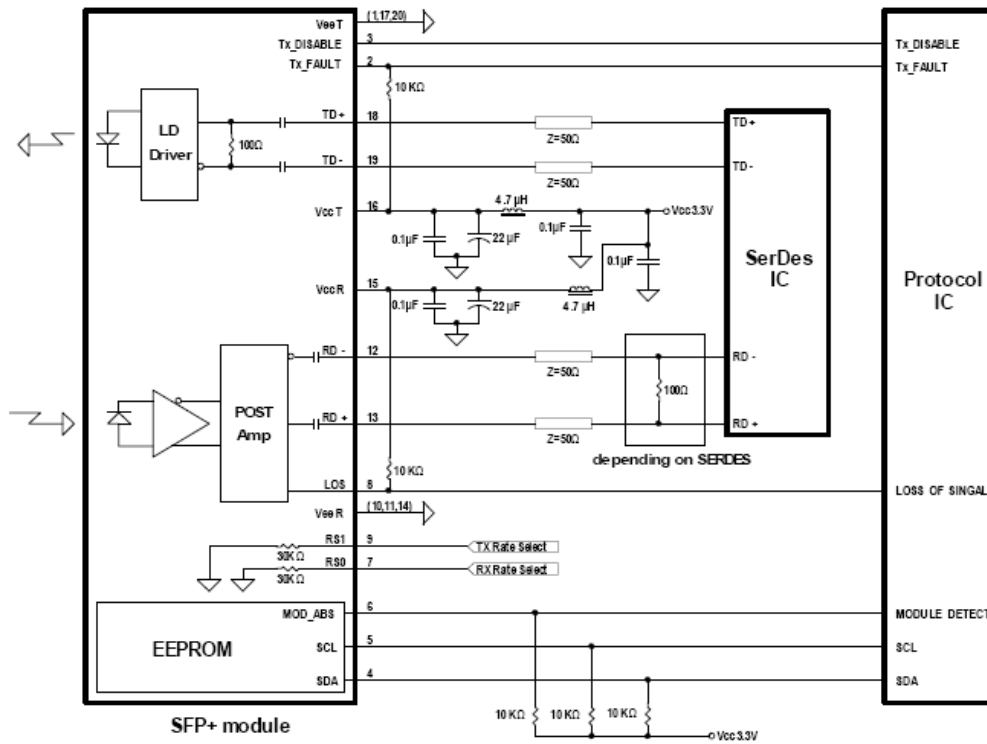
Table 1 Serial ID Memory Contents

| Addr. | Size (Bytes) | Name of Field | Hex | Description |
|-----------------------|--------------|-------------------|--|---|
| BASE ID FIELDS | | | | |
| 0 | 1 | Identifier | 03 | SFP |
| 1 | 1 | Ext. Identifier | 04 | SFP function is defined by serial ID only |
| 2 | 1 | Connector | 07 | LC Connector |
| 3-10 | 8 | Transceiver | 00 00 00 00 00 00 00 00 | Undefined |
| 11 | 1 | Encoding | 01 | NRZ |
| 12 | 1 | BR, Nominal | 3F | 6250Mbps |
| 13 | 1 | Reserved | 00 | |
| 14 | 1 | Length (9µm)km | 0A | Transceiver transmit distance |
| 15 | 1 | Length(9µm)100m | 64 | |
| 16 | 1 | Length (50µm) 10m | 00 | |
| 17 | 1 | Length(62.5µm)10m | 00 | |
| 18 | 1 | Length (Copper) | 00 | Not compliant |
| 19 | 1 | Reserved | 00 | |
| 20-35 | 16 | Vendor name | 45 4F 50 54 4F 4C 49 4E 4B 20 20 20 20 20 20 20 20 | EOPTOLINK |
| 36 | 1 | Reserved | 00 | |

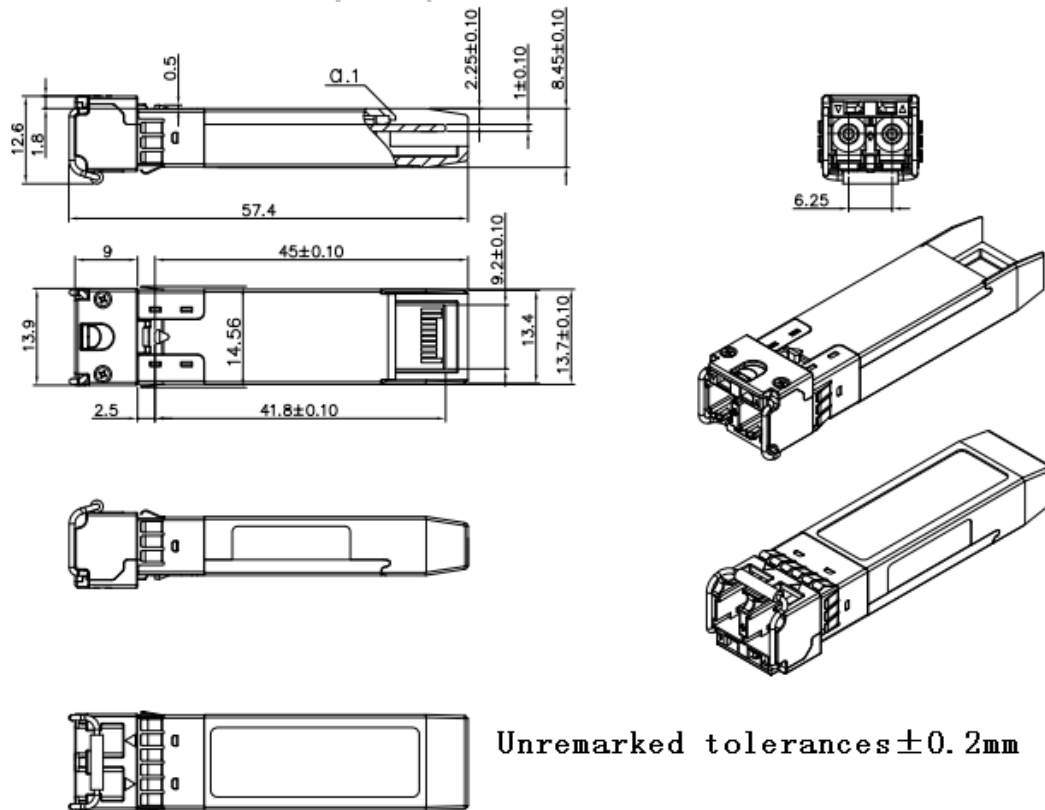
| | | | | |
|----------------------------------|-----|----------------------------|--|--|
| 37-39 | 3 | Vendor OUI | XX XX XX ^(Note2) | |
| 40-55 | 16 | Vendor PN | 45 4F 4C 50 2D 31 33 36 30 2D 31 30 20 20 20 20 | EOLP-1360-10 |
| 56-59 | 4 | Vendor rev | 31 2E 30 20 | 1.0 |
| 60-61 | 2 | Wavelength | 05 1E | 1310nm |
| 62 | 1 | Reserved | 00 | |
| 63 | 1 | CC_BASE | Check Sum (Variable) | Check code for Base ID Fields |
| EXTENDED ID FIELDS | | | | |
| 64-65 | 2 | Options | 00 1A | TX_DISABLE, TX_FAULT and Loss of Signal implemented. |
| 66 | 1 | BR,max | 00 | |
| 67 | 1 | BR,min | 00 | |
| 68-83 | 16 | Vendor SN | XX XX XX XX XX XX XX XX 20 20 20 20 20 20 20 20 ^(Note2) | Serial Number of transceiver (ASCII). For example "B000822". |
| 84-91 | 8 | Date code | XX XX XX XX XX XX XX XX ^(Note2) | Manufactory date code. For example "080405". |
| 92 | 1 | Diagnostic Monitoring Type | XX ^(Note2) | Digital diagnostic monitoring implemented |
| 93 | 1 | Enhanced Options | XX ^(Note2) | Optional flags |
| 94 | 1 | SFF_8472 Compliance | XX ^(Note2) | 01 for diagnostics (Rev9.3 SFF-8472). |
| 95 | 1 | CC_EXT | Check Sum (Variable) | Check sum for Extended ID Field. |
| VENDOR SPECIFIC ID FIELDS | | | | |
| 96-127 | 32 | Vendor Specific | Read only | Depends on customer information |
| 128-255 | 128 | Reserved | Read only | |

Note2: The "XX" byte should be filled in according to practical case. For more information, please refer to the related document of SFP Multi-Source Agreement (MSA).

Recommend Circuit Schematic



Mechanical Specifications



Eye Safety

This single-mode transceiver is a Class 1 laser product. It complies with IEC-60825 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug.

Obtaining Document

You can visit our website: <http://www.eoptolink.com>

Or contact Eoptolink Technology Inc., Ltd. Listed at the end of the documentation to get the latest document.

Revision History

| Revision | Initiated | Reviewed | Approved | DCN | Release Date |
|----------|-------------|---------------|----------|--|------------------|
| V1.a | Cathy | | | Released. | 2009-12-15 |
| V1.b | Kelly.Cao | | | Add extended PN, update Po and Sen. | 2011-6-10 |
| V2.0 | Alex/Townie | Kelly | | Update spelling mistake | Aug 10, 2011 |
| V2.a | Kelly | | | Update industrial product. | Sep 15, 2011 |
| V2.b | Kelly | | | Update photo. | Oct 27, 2011 |
| V2.c | Angela | Kelly | | Update regulatory compliance and ER. | October 17, 2013 |
| V2.d | Eason/Abby | Kelly/Fing | | Update Pout and LOSA&LOSD | Jan 6, 2014 |
| V2.e | Angela | Kelly/JP/Vina | | Update the regulatory compliance and the tolerances of 2D drawing. | July 3, 2015 |

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