



Features

- Compliant to IEEE802.3by 25GBASE-LR
- Up to 25.78Gb/s data links
- 25G 1310nm DFB transmitter
- 25G PIN photo-detector
- 2-wire interface for management specifications compliant with SFF-8472 digital diagnostic monitoring interface for optical transceivers
- Operating case temperature: -40 to 85°C
- All-metal housing for superior EMI performance
- 25G electrical interface (OIF CEI-28G-VSR)
- Maximum power consumption 1.5W
- Advanced firmware allow customer system encryption information to be stored in transceiver
- RoHS compliant

Applications

- High-speed storage area networks
- Computer cluster cross-connect
- Custom high-speed data pipes
- Inter Rack Connection

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Note
Storage Temperature	T_c	-40	85	°C	
Operating Case Temperature	T_c	-40	85	°C	
Supply Voltage	V_{cc}	0	3.6	V	
Relative Humidity	RH	5	85	%	
Damage Threshold	THd	3.5		dBm	

Recommended Operating Conditions

<i>Parameter</i>	<i>Symbol</i>	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>	<i>Units</i>
Case Operating Temperature	<i>T_c</i>	-40		85	°C
Power Supply Voltage	<i>V_{cc}</i>	3.135	3.3	3.465	V
Data Rate, each Lane			25.78125		Gb/s
Data Rate Accuracy		-100		100	ppm
Control Input Voltage High		2		<i>V_{cc}</i>	V
Control Input Voltage Low		0		0.8	V
Link Distance with G.652	<i>D</i>	0.002		10	km

Diagnostics

<i>Parameter</i>	<i>Symbol</i>	<i>Accuracy</i>	<i>Unit</i>	<i>Notes</i>
Temperature monitor absolute error	DMI_Temp	± 3	°C	Over operating Temp
Supply voltage monitor absolute error	DMI_VCC	±0.1	V	Full operating range
RX power monitor absolute error	DMI_RX	± 2 dB	dB	1
Bias Current monitor	DMI_Ibias	± 10%	mA	
Laser power monitor absolute error	DMI_TX	± 2 dB	dB	1

Notes:

1. Due to measurement accuracy of different single mode fibers, there could be an additional +/-1 dB fluctuation, or a +/- 3 dB total accuracy.

Transmitter Electro-optical Characteristics

$V_{CC} = 3.135\text{ V to }3.465\text{ V}$, $T_C = -40\text{ }^\circ\text{C to }85\text{ }^\circ\text{C}$

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Power Consumption				1.5	W	
Supply Current	I_{CC}			450	mA	
Overload Differential Voltage pk-pk	$TP1a$	900			mV	
Common Mode Voltage (V_{cm})	$TP1$	-350		2850	mV	1
Differential Termination Resistance Mismatch	$TP1$			10	%	At 1MHz
Differential Return Loss (SDD11)	$TP1$			See CEI-28G-VSR Equation 13-19	dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC11, SCD11)	$TP1$			See CEI-28G-VSR Equation 13-20	dB	
Stressed Input Test	$TP1a$		See CEI-28G-VSR Section 13.3.11.2.1			
Center Wavelength	λ_t	1295		1325	nm	
Side Mode Suppression Ratio	$SMSR$	30			dB	
Average Optical Power	P_{avg}	-7	---	2	dBm	
OMA	P_{OMA}	-4		2.2	dBm	2
Launch Power in OMA minus Transmitter and Dispersion Penalty (TDP)		-5			dBm	
Transmitter Dispersion Penalty	TDP			2.7	dB	
Extinction Ratio	ER	3.5	---	---	dB	
Relative Intensity Noise	RIN_{20OMA}			-130	dB/Hz	
Optical Return Loss Tolerance	TOL	---	---	20	dB	
Transmitter Reflectance	R_T			-12	dB	
Average Launch Power OFF Transmitter	P_{off}			-30	dBm	
Eye Mask {X1, X2, X3, Y1, Y2, Y3}				{0.31, 0.4, 0.45, 0.34, 0.38, 0.4}		3

Note:

1. V_{cm} is generated by the host. Specification includes effects of ground offset voltage.
2. Even if the TDP < 1 dB, the OMA min must exceed the minimum value specified here.
3. Hit ratio 5×10^{-5} per sample.

Receiver Electro-optical Characteristics

V_{cc} = 3.135 V to 3.465 V, T_c = -40 °C to 85 °C

<i>Parameter</i>	<i>Symbol</i>	<i>Min.</i>	<i>Typ.</i>	<i>Max.</i>	<i>Units</i>	<i>Note</i>
Differential Voltage, pk-pk	<i>TP4</i>			900	mV	
Common Mode Voltage (V _{cm})	<i>TP4</i>	-350		2850	mV	1
Common Mode Noise, RMS	<i>TP4</i>			17.5	mV	
Differential Termination Resistance Mismatch	<i>TP4</i>			10	%	At 1MHz
Differential Return Loss (SDD22)	<i>TP4</i>			See CEI-28G-VSR Equation 13-19	dB	
Common Mode to Differential conversion and Differential to Common Mode conversion (SDC22, SCD22)	<i>TP4</i>			See CEI-28G-VSR Equation 13-21	dB	
Common Mode Return Loss (SCC22)	<i>TP4</i>			-2	dB	2
Transition Time, 20 to 80%	<i>TP4</i>	9.5			ps	
Vertical Eye Closure (VEC)	<i>TP4</i>			5.5	dB	
Eye Width at 10 ⁻¹⁵ probability (EW15)	<i>TP4</i>	0.57			UI	
Eye Height at 10 ⁻¹⁵ probability (EH15)	<i>TP4</i>	228			mV	
Center Wavelength	<i>λ_r</i>	1260		1350	nm	
Damage Threshold	<i>TH_d</i>	3.5			dBm	3
Average Receive Power		-13.3		2	dBm	
Receive Power (OMA)				2.2	dBm	
Receiver Sensitivity (OMA)	<i>SEN</i>			-11.3	dBm	for BER = 5x10 ⁻⁵
Stressed Receiver Sensitivity (OMA)				-8.8	dBm	4
Receiver Reflectance	<i>R_R</i>			-26	dB	
LOS Assert	<i>LOSA</i>	-30			dBm	
LOS Deassert	<i>LOSD</i>			-14	dBm	
LOS Hysteresis	<i>LOSH</i>	0.5			dB	
Receiver Electrical 3 dB upper Cutoff Frequency	<i>F_c</i>			31	G/Hz	

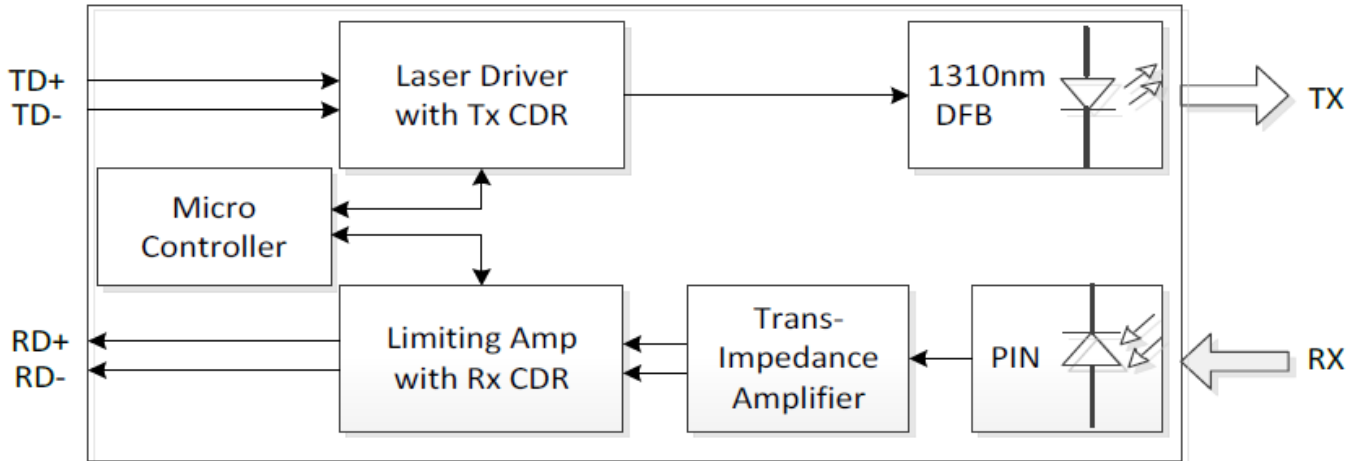
Conditions of Stressed Receiver Sensitivity Test (Note 5)

Vertical Eye Closure Penalty, each Lane	1.9	dB
Stressed Eye J2 Jitter	0.27	UI
Stressed Eye J4 Jitter	0.39	UI
SRS Eye Mask Definition {X ₁ , X ₂ , X ₃ , Y ₁ , Y ₂ , Y ₃ }	{0.24, 0.5, 0.5, 0.24, 0.24, 0.4}	
Hit ratio 5x10 ⁻⁵ per sample		

Note:

1. Vcm is generated by the host. Specification includes effects of ground offset voltage.
2. From 250MHz to 30GHz.
3. The receiver shall be able to tolerate, without damage, continuous exposure to a modulated optical input signal having this power level on one lane. The receiver does not have to operate correctly at this input power.
4. Measured with conformance test signal at receiver input for BER = 5x10⁻⁵.
5. Vertical eye closure penalty, stressed eye J2 jitter, stressed eye J4 jitter, and SRS eye mask definition are test conditions for measuring stressed receiver sensitivity. They are not the required characteristics of the receiver.

Block Diagram of Transceiver



This 1310 nm DFB 25Gb/s SFP28 LR transceiver is designed to transmit and receive optical data over single mode optical fiber for link length up to 10km.

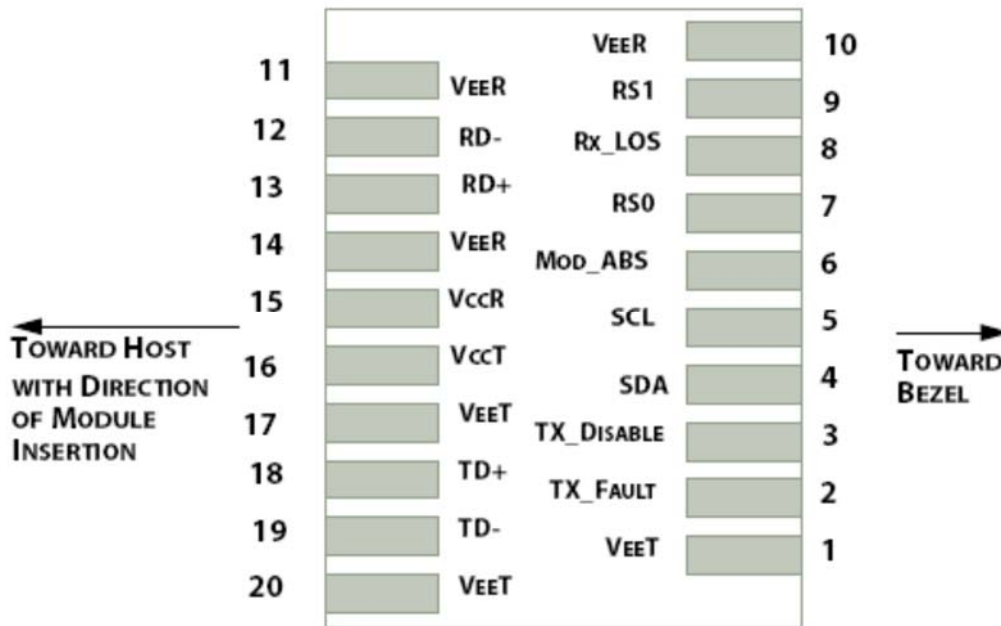
The module optical connection is duplex LC and shall be compatible with SFP+ 28Gbps and backward compatible with legacy 10G SFP+ pluggable. The SFP28 LR module is a dual directional device with a transmitter and receiver plus a control management interface (2-wire interface) in the same physical package. 2-wire interface is used for serial ID, digital diagnostics and module control function.

The module operates by a single +3.3V power supply. LVCMOS/LVTTL global control signals, such as Module Present, Reset, Interrupt and Low Power Mode, are available with the modules. The SFP28 LR module electrical interface is compliant to OFI CEI-VSR-28G-VSR. It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference. The module offers very high functionality and feature integration, accessible via a two-wire serial interface.

The transmitter converts 25Gbit/s serial PECL or CML electrical data into serial optical data compliant with the 25GBASE-LR standard. An open collector compatible Transmit Disable (Tx_Dis) is provided. Logic "1" or no connection on this pin will disable the laser from transmitting. Logic "0" on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (Tx_Fault) is provided. TX_Fault is module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX_Fault output contact is an open drain/collector and shall be pulled up to the Vcc_Host in the host with a resistor in the range 4.7-10 kΩ. TX_Disable is a module input contact. When TX_Disable is asserted high or left open, the SFP28 module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor.

The receiver converts 25Gbit/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx_LOS contact is an open drain/collector output and shall be pulled up to Vcc_Host in the host with a resistor in the range 4.7-10 k Ω , or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx_LOS signal is intended as a preliminary indication to the system in which the SFP28 is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

Pin Assignment



Module Interface to Host



Module Contact Assignment

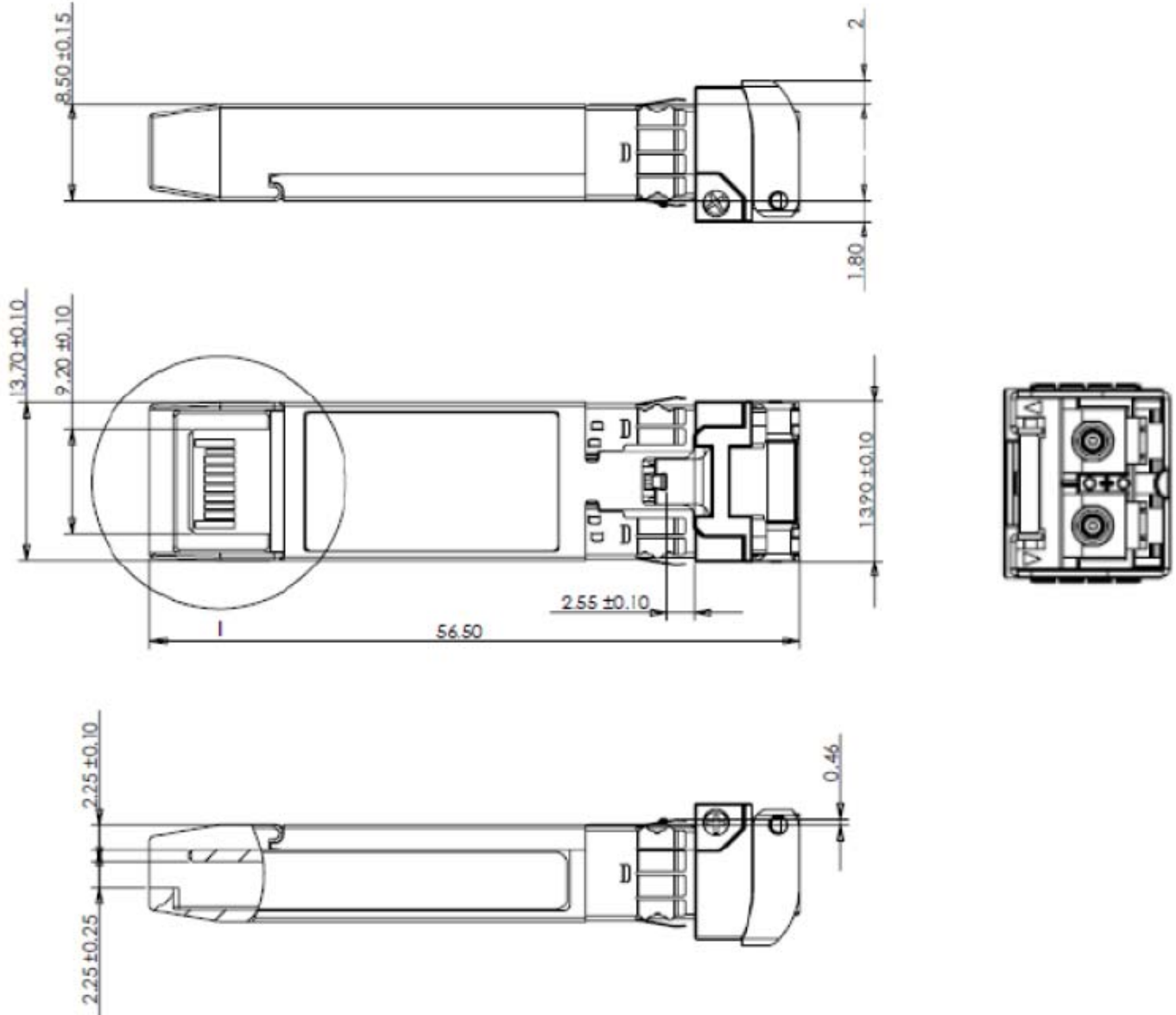
Pin Descriptions

PIN	Logic	Symbol	Name / Description	Note
1		VeeT	Module Transmitter Ground	1
2	LVTTL-O	TX_Fault	Module Transmitter Fault	
3	LVTTL-I	TX_Dis	Transmitter Disable; Turns off transmitter laser output	
4	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	2
5	LVTTL-I	SCL	2-Wire Serial Interface Clock	2
6		MOD_DEF0	Module Definition, Grounded in the module	
7	LVTTL-I	RS0	Receiver Rate Select	
8	LVTTL-O	RX_LOS	Receiver Loss of Signal Indication Active LOW	
9	LVTTL-I	RS1	Transmitter Rate Select (not used)	
10		VeeR	Module Receiver Ground	1
11		VeeR	Module Receiver Ground	1
12	CML-O	RD-	Receiver Inverted Data Output	
13	CML-O	RD+	Receiver Data Output	
14		VeeR	Module Receiver Ground	1
15		VccR	Module Receiver 3.3 V Supply	
16		VccT	Module Receiver 3.3 V Supply	
17		VeeT	Module Transmitter Ground	1
18	CML-I	TD+	Transmitter Non-Inverted Data Input	
19	CML-I	TD-	Transmitter Inverted Data Input	
20		VeeT	Module Transmitter Ground	1

Note:

1. Module ground pins GND are isolated from the module case.2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.
2. Shall be pulled up the voltage between 3.15V and 3.47V with 4.7K – 10Kohms on the host board.

Dimensions



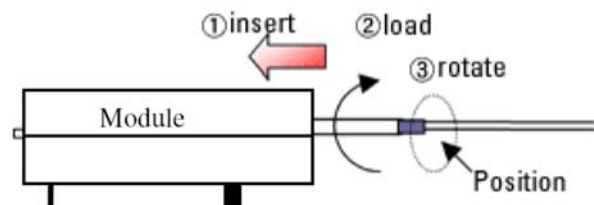
Optical Receptacle Cleaning Recommendations :

All fiber stubs inside the receptacle portions were cleaned before shipment. In the event of contamination of the optical ports, the recommended cleaning process is the use of forced nitrogen. If contamination is thought to have remained, the optical ports can be cleaned using a NTT international Cletop® stick type and HFE7100 cleaning fluid. Before the mating of patch-cord, the fiber end should be cleaned up by using Cletop® cleaning cassette.

Cleaning of patch-cord



Cleaning of fiber stub



1. Insert
Ensure that stick is held straight when inserting into sleeve.
2. Load
Apply sufficient pressure (approx 600-700g) to ensure ferrule a little depressed in sleeve.
3. Rotate
Rotate stick clockwise 4-5 times, while ensuring direct contact with ferrule end-face is maintained.

*Notice: Number of possible wipes:
Maintenance (repair) ~1 use / piece
Equipment construction: 4 uses / piece (max.)*

Note: The pictures were extracted from NTT-ME website. And the Cletop® is a trademark registered by NTT-ME

Ordering Information

OP	6	C	-	S	-	10	-	13	-	C	M
	↑	↑		↑		↑		↑		↑	↑
Product Code: 5=GBIC; 6=SFP-LC; 7=XFP; 8=XENPAK; 9=X2; A=SFP+ (SFP28); C=QSFP+ (QSFP28); F=CFP; P=SFP-SC; Q=SFP-MTRJ	Data Rate: A=155Mb/s; B=622Mb/s; C=1.25Gb/s; D=2.125Gb/s; E=2.5Gb/s; F=4.25Gb/s; G=3.1Gb/s; J=2.97G; P=6.144G; Q=7.37G; H=8.5Gb/s; K=10Gb/s; T=1/10Gb/s; L=11.09Gb/s; R=20Gb/s; X=25Gb/s; S=40Gb/s; W=100Gb/s (4x25G or 10x10G); M=100Base-X SGMII; N=100/1000Base-X SGMII;	Type: S=Single-mode; M=Multi-mode; W=BWDM; C=CWDM; D=DWDM; T=Copper-T (RJ-45) E=GEPON ONU; F=GEPON OLT; G=GPON ONU; H=GPON OLT X=MMF/SMF	Reach: Normal: X1=Under 150m; X3=300m; X5=550m; O2=2km, 10=10km; 70=70km; A0=100km; C0=120km CWDM: 20=20dB; 24=24dB; 28=28dB	Wavelength: Normal: 85=850nm; 13=1310nm; 15=1550nm; 00=Copper T (RJ-45) CWDM: 27=1270nm; 47=1470nm; 61=1610nm BWDM: B3=Tx1310/Rx1550; B5=Tx1550/Rx1310; B4=Tx1310/Rx1490; B9=Tx1490/Rx1310; 51=Tx1510/Rx1570; 57=Tx1570/Rx1510; 27=Tx1270/Rx1330; 33=Tx1330/Rx1270; B2=Tx1270/Rx1577; B7=Tx1577/Rx1270 T2=2TX1310nm; T3=TX1310nm; T5=TX1550nm DWDM: 17=Channel 17 34= Channel 34 00=Channel 17-61 Tunable	Operating Temperature: C=Commercial Purpose (0~70°C); I= Industrial Purpose (Extended Range)	Additional Feature: M=Digital Optical Monitoring (DOM) (RX_LOS for Copper TX); F=with Fiber Stub; I=with Isolator; S=Customized Style					

Model Number	Part Number	Reach	Input/Output	Signal Detect	Voltage	Temperature
SFP28-LR-I	OPAX-S10-13-IB	10km	AC/AC	TTL	3.3V	-40°C to 85 °C

Note: All information contained in this document is subject to change without notice.