Features

- QSFP-DD MSA Compliant
- CMIS 4.0 Fully Compliant
- Parallel 8 Optical Lanes
- 100G Lambda MSA 100G-FR Specification compliant
- Electrical Interface Compliant with 800GAUI-8 (8x106.25Gb/s) interface defined in IEEE 802.3ck
- Rate Date operation at 106.25Gbps (PAM4) per channel
- Up to 2km transmission on single-mode fiber (SMF) with FEC
- Maximum Power Consumption 16W
- Operating case temperature: 0~70°C

Applications

- 800G Ethernet
- Infinband Interconnects
- Datacenter Enterprise Networking

Description

This product is a 800Gb/s Quad Small Form-Factor Pluggable-double density (QSFP-DD) optical module designed for 2km optical communication applications. The module converts 8 channels of 100Gb/s (PAM4) electrical input data to 8 channels of parallel optical signals, each capable of 100Gb/s operation for an aggregate data rate of 800Gb/s. Reversely, on the receiver side, the module converts 8 channels of parallel optical signals of 100Gb/s each channel for an aggregate data rate of 800Gb/s into 8 channels of 100Gb/s (PAM4) electrical output data.

An optical fiber cable with an APC/MPO-16 connector can be plugged into the QSFP-DD DR8 module receptacle. Proper alignment is ensured by the guide pins inside the receptacle. The cable usually cannot be twisted for proper channel to channel alignment. Electrical connection is achieved through an QSFP-DD MSA-compliant edge type connector.

The product is designed with form factor, optical/electrical connection and digital diagnostic interface according to the QSFP-DD Multi-Source Agreement (MSA). It has been designed to meet the harshest external operating conditions including temperature, humidity and EMI interference.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Storage Temperature	*Ts*	-40		85	°C	
Operating Case Temperature	T_{op}	0		70	°C	
Power Supply Voltage	V_{cc}	-0.5		3.6	V	
Relative Humidity (non-condensation)	*RH*	0		85	%	
Damage Threshold, each Lane	*THd*	5.5			dBm	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Operating Case Temperature	*Top*	0		70	°C	
Power Supply Voltage	*Vcc*	3.135	3.3	3.465	V	
Data Rate, each Lane			26.5625		GBd	PAM4
Data Rate Accuracy		-100		100	ppm	
Pre-FEC Bit Error Ratio				$2.4x10^{-4}$		
Post-FEC Bit Error Ratio				$1x10^{-12}$		1
Link Distance	*D*	0.2		2000	m	2

Notes:

1. FEC provided by host system.
2. FEC required on host system to support maximum distance.

Diagnostics Monitoring

Parameter	Symbol	Accuracy	Unit	Notes
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	1
Bias Current monitor	DMI_Bias	± 10%	mA	
Laser power monitor absolute error	DMI_TX	± 2	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.

Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Date Rate, each Lane			53.125 ± 100 ppm		Gb/s	
Modulation Format			PAM4			
Transmitter						
Center Wavelength	λc	1304.5	1310	1317.5	nm	
Side-Mode Suppression Ration	*SMSR*	30			dB	
Average Launch Power, each Lane	P_{AVG}	-2.4		4	dBm	1
Outer Optical Modulation Amplitude (OMA_{outer}), each Lane	P_{OMA}	-0.2		4.2	dBm	2
Launch Power in OMA_{outer} minus TDECQ), each Lane For ER ≧ 4.5dB For ER < 4.5dB		-1.6 -1.5			dB	
Transmitter and Dispersion Eye Closure for PAM4 (TDECQ), each Lane	*TDECQ*			3.4	dB	
TDECQ-10*$\log_{10}$ (C_{eq})), each Lane				3.4	dB	3
Extinction Ration	*ER*	3.5			dB	
$RIN_{17.1}$ OMA	*RIN*			-136	dB/Hz	
Optical Return Loss Tolerance	*TOL*			17.1	dB	
Transmitter Reflectance	T_R			-26	dB	
Transmitter Transition Time				17	ps	
Average Launch Power of OFF Transmitter, each Lane	*Poff*			-15	dBm	
Receiver						
Damage Threshold, each Lane	TH_4	5.5			dBm	4
Average Receiver Power, each Lane		-6.4		4.5	dBm	5
Receiver Power (OMA_{outer}), each Lane				4.7	dBm	
Receiver sensitivity (OMA_{outer}), each Lane	*SEN*			Equation (1)	dBm	6

Stressed Receiver Sensitivity (OMA_{outer}), each Lane	*SRS*		-2.5	dBm	7
Receiver Reflectance	R_R		-26	dB	
LOS Assert	*LOSA*	-15		dBm	
LOS De-assert	*LOSD*		-9.4	dBm	
LOS Hysteresis	*LOSH*	0.5		dB	
Stressed Conditions for Stress Receiver Sensitivity (Note 8)					
Stressed Eye Closure for PAM4 (SECQ), Lane under Test			3.4	dB	
SECQ-10*$\log_{10}$ (C_{eq}), Lane under Test			3.4	dB	
OMA_{outer} of each Aggressor Lane			4.7	dBm	

Notes:

1. Average launch power, each lane (min) is informative and not the principal indicator of signal strength. A transmitter with launch power below this value cannot be compliant, however, a value above this does not ensure compliance.
2. Even if the TDECQ < 1.4dB for an extinction ration of ≧ 4.5dB or TDECQ < 1.3dB for an extinction ration of < 4.5dB, the OMA_{outer} (min) must exceed the minimum value specified here.
3. C_{eq} is a coefficient defined in IEEE Std 802.3-2018 clause 121.8.5.3, which accounts for the reference equalizer noise enhancement.
4. Average receiver power, each lane (min) is informative and not the principal indicator of signal strength. A received power below this value cannot be compliant, however, a value above this does not ensure compliance. however, a value above this does not ensure compliance.
5. 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.
6. Receive sensitivity (OMA_{outer}) is informative and is defined for a transmitter with a value of SECQ up to 3.4dB. Receiver sensitivity should meet Equation (1), which is illustrated in Figure 4.

$$RS = \max(-4.5, SECQ-5.9)\ dBm \quad (1)$$

Where:

RS is the receiver sensitivity, and

SECQ is the SECQ of the transmitter used to measure the receiver sensitivity.

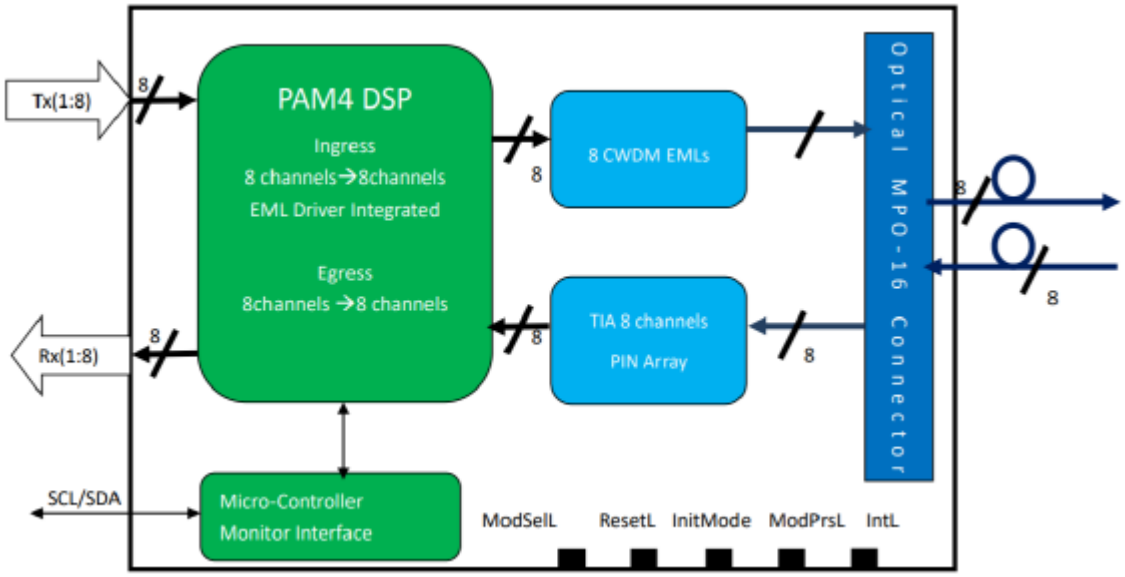
7. Measured with conformance test signal at TP3 for the BER equal to 2.4×10^{-4}
8. These test conditions are for measuring stressed receiver sensitivity. They are not characteristics of the receiver.

Electronical Characteristics

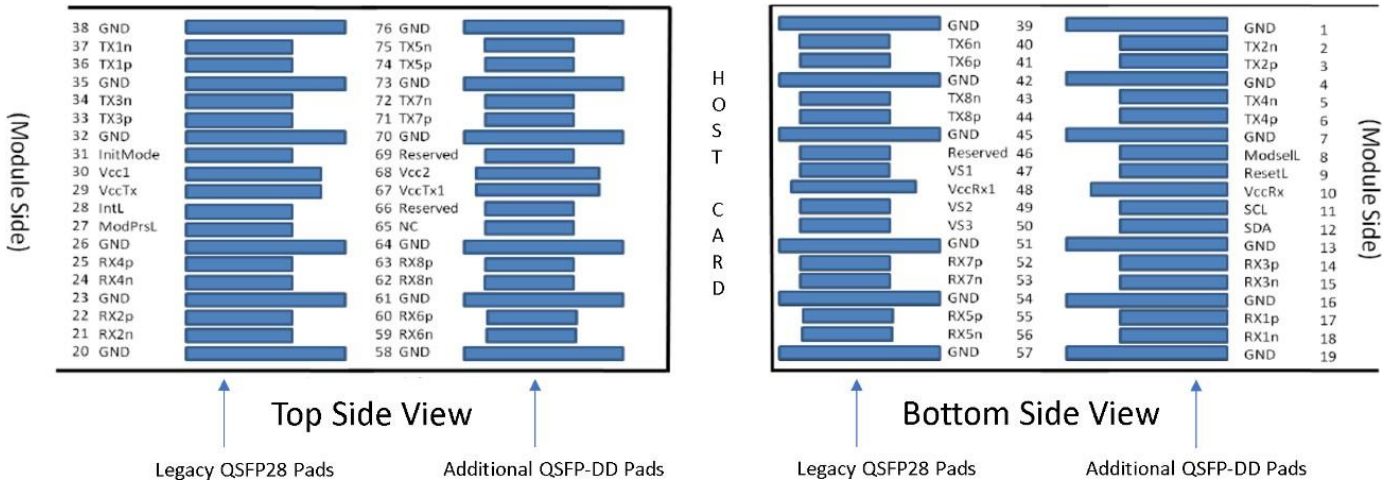
Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Power Consumption				16	W	
Supply Current	*Icc*			4.84	A	
Signaling Rate, each Lane	*TP1*		53.125 ± 100 ppm		Gb/s	
Transmitter (each Lane)						
DC Common-Mode Input Voltage	*TP1*	-0.3		2,8	V	
Single-Ended Input Voltage	*TP1*	-0.4		3.3	V	
AC Common-Mode RMS Input Voltage	*TP1*			17.5	mV	
Differential Peak-to-Peak Input Voltage	*TP1*			870	mV	
Differential Input Eye Height	*TP1*	15			mV	
Differential Input Vertical Eye Closure	*TP1*			9	dB	
Common to Different Mode Input Return Loss	*TP1*		IEEE 802.3ck Equation 120G-1			
Eye Symmetry Mask Width (ESMW)	*TP1*		TBD		UI	
Effective Input Return Loss	*TP1*		TBD			
Differential Input Termination Mismatch	*TP1*			10	%	
Input Transition Time (20% to 80%)	*TP1*		TBD		ps	
Receiver (each Lane)						
Differential Peak-to-Peak Output Voltage	*TP4*			900	mV	
AC Common Mode Output Voltage, RMS	*TP4*			17.5	mV	
Differential Termination Mismatch	*TP4*			10	%	
Differential Near-End Output Eye Height	*TP4*		IEEE 802.3ck 120E.4.2		mV	
Near-End Output ESMW	*TP4*		IEEE 802.3ck 120E.4.2		UI	
Far-End Output ESMV	*TP4*		IEEE 802.3ck 120E.4.2		UI	
Differential Far-End Output Eye Height	*TP4*		IEEE802.3ck 120E.3.3.2.1		mV	
Far-End Output Pre-Cursor ISI Ratio	*TP4*		IEEE802.3ck 120E.3.3.1.2			
Common-Mode to Differential Mode	*TP4*		IEEE802.3ck Equation 120G-1		dB	

Output Return Loss				
Effective Output Return Loss	*TP4*		TBD	dB
Output Transition Time (20% to 80%)	*TP4*		TBD	ps
DC Common-Mode Output Voltage	*TP4*	-350	2850	mV

Transceiver Block Diagram



Pin Assignment and Description



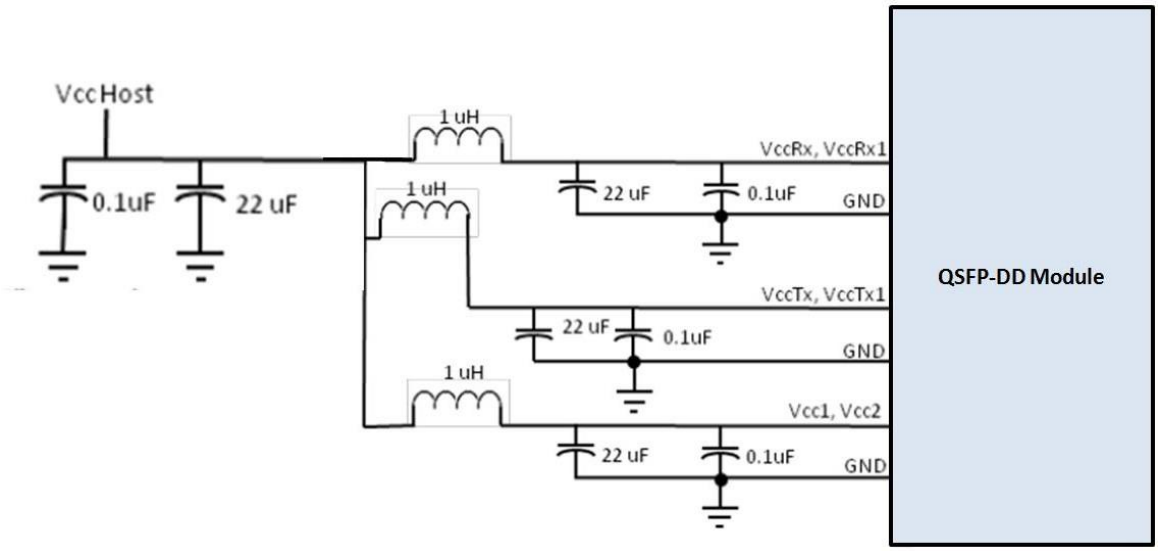
Pin Descriptions

PIN	Logic	Symbol	Name / Description	Note
1		GND	Ground	1
2	CML-I	Tx2n	Transmitter inverted data input	3
3	CML-I	Tx2p	Transmitter non-inverted data input	3
4		GND	Ground	1
5	CML-I	Tx4n	Transmitter inverted data input	3
6	CML-I	Tx4p	Transmitter non-inverted data input	3
7		GND	Ground	1
8	LVTTL-I	ModSelL	Module Select	3
9	LVTTL-I	ResetL	Module Reset	3
10		VccRx	+3.3v Receiver Power Supply	2
11	LVCMOS-I/O	SCL	2-wire Serial interface clock	3
12	LVCMOS-I/O	SDA	2-wire Serial interface data	3
13		GND	Ground	1
14	CML-O	RX3p	Receiver non-inverted Data Output	3
15	CML-O	RX3n	Receiver inverted Data Output	3
16		GND	Ground	1
17	CML-O	Rx1p	Receiver non-inverted Data Output	3
18	CML-O	Rx1n	Receiver inverted Data Output	3
19		GND	Ground	1
20		GND	Ground	1
21	CML-O	Rx2n	Receiver Inverted Data Output	3
22	CML-O	Rx2p	Receiver Non-Inverted Data Output	3
23		GND	Ground	1
24	CML-O	Rx4n	Receiver Inverted Data Output	3
25	CML-O	Rx4p	Receiver Non-Inverted Data Output	3
26		GND	Ground	1
27	LVTTL-O	ModPrsL	Module Present	3
28	LVTTL-O	IntL	Interrupt	3
29		VccTx	+3.3v Power supply transmitter	2
30		Vcc1	+3.3v Power supply	2
31	LVTTL-I	InitMode	Initialization mode; In legacy QSFP applications, the InitMode pad is called LPMOD	3
32		GND	Ground	1
33	CML-I	Tx3p	Transmitter Non-Inverted Data Input	3

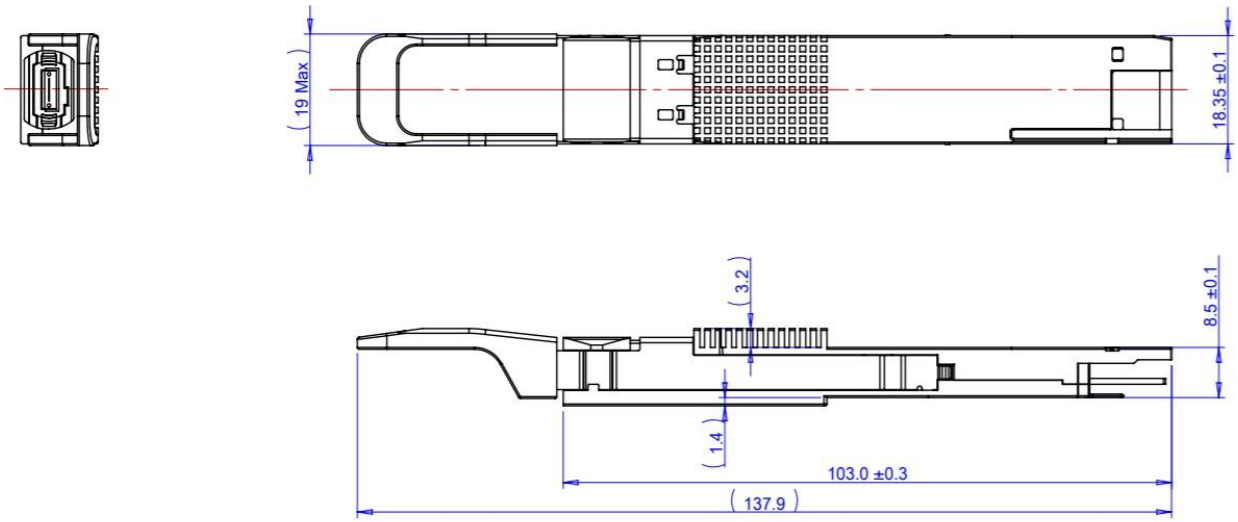
34	CML-I	Tx3n	Transmitter Inverted Data Input	3
35		GND	Ground	1
36	CML-I	Tx1p	Transmitter Non-Inverted Data Input	3
37	CML-I	Tx1n	Transmitter Inverted Data Input	3
38		GND	Ground	1
39		GND	Ground	1
40	CML-I	Tx6n	Transmitter Inverted Data Input	3
41	CML-I	Tx6p	Transmitter Non-Inverted Data Input	3
42		GND	Ground	1
43	CML-I	Tx8n	Transmitter Inverted Data Input	3
44	CML-I	Tx8p	Transmitter Non-Inverted Data Input	3
45		GND	Ground	1
46		Reserved	For future use	3
47		VS1	Module Vendor Specific 1	3
48		VccRx1	3.3V Power Supply	2
49		VS2	Module Vendor Specific 2	3
50		VS3	Module Vendor Specific 3	3
51		GND	Ground	1
52	CML-O	Rx7p-	Receiver Non-Inverted Data Output	3
53	CML-O	Rx7n	Receiver Inverted Data Output	3
54		GND	Ground	1
55	CML-O	Rx5p-	Receiver Non-Inverted Data Output	3
56	CML-O	Rx5n	Receiver Inverted Data Output	3
57		GND	Ground	1
58		GND	Ground	1
59	CML-O	Rx6n-	Receiver Inverted Data Output	3
60	CML-O	Rx6p	Receiver Non-Inverted Data Output	3
61		GND	Ground	1
62	CML-O	Rx8n	Receiver Inverted Data Output	3
63	CML-O	Rx8p	Receiver Non-Inverted Data Output	3
64		GND	Ground	1
65		NC	No connect	3
66		Reserved	For future use	3
67		VccTx1	3.3V Power Supply	2
68		Vcc2	3.3V Power Supply	2
69		Reserved	For Future Use	3

70		GND	Ground	1
71	CML-I	Tx7p	Transmitter Non-Inverted Data Input	3
72	CML-I	Tx7n	Transmitter Inverted Data Input	3
73		GND	Ground	1
74	CML-I	Tx5p	Transmitter Non-Inverted Data Input	3
75	CML-I	Tx5n	Transmitter Inverted Data Input	3
76		GND	Ground	1

Recommended Power Supply Filter



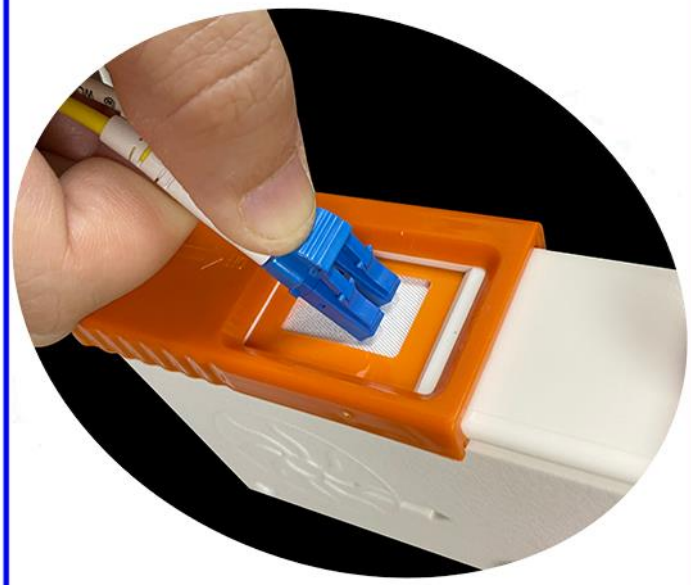
Dimensions



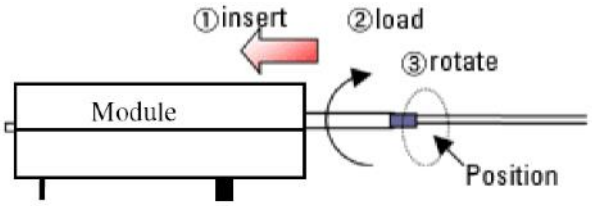
Optical Receptacle Cleaning Recommendations :

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

Model Number	Part Number	Voltage	Temperature
800G QSFP-DD DR8+	OPDM-S02-13-CBS	3.3V	0°C to 70 °C

Modification History

Revision	Date	Description
A1	Dec. 2020	Initial Release

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