SK-SERIES BACKPLANE

USER'S MANUAL

P/N : 2RAKVI005301

Model：SK35-07 5BAY HYBRID OCULINK*2 BP MODULE

Draft Version : V1.0

Revision History

Version	Changes	Date
V1.0	Official Release	2021/07/23

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Overview

IN WIN backplanes (without Expander) are high performance and cost effective solution for supporting Intel Purley platform by adding NVMe support.

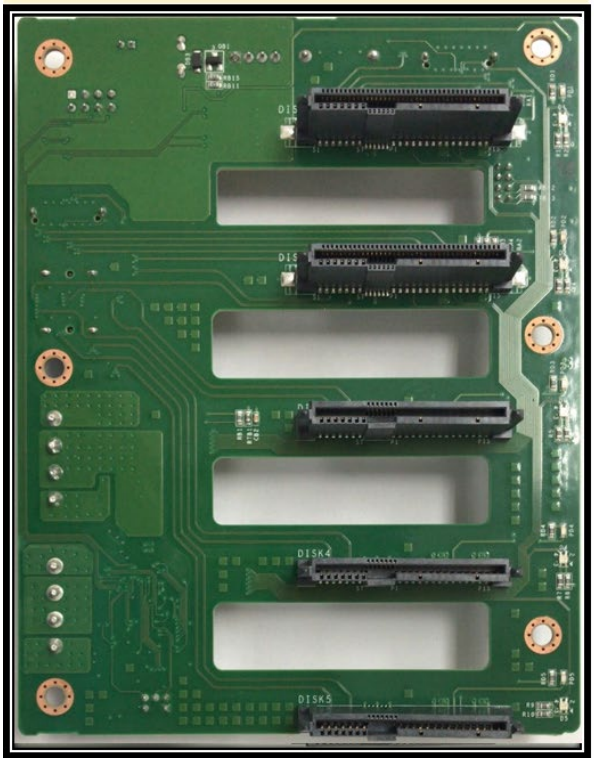
The passive backplanes support state-of-the-art SAS3 12Gbps HDD/SSD and also backward compatible with SAS 6Gbps, SATA 6Gps and SATA 3Gps HDD/SSD. The backplane supports NVMe SSD through OcuLink x4 connectors.

Basically, A 7-pin SATA connector and Oculink x4 share a U.2 connector(Disk#1) to support either 6Gps SATA drive or x4 NVMe SSD. One single SFF-8643 miniSAS connector can support up to 4 disk bays, says Disk#2 to Disk#5. 1 of them(Disk#2) is so called Hybrid that further supports NVMe SSD via Oculink x4 connector.

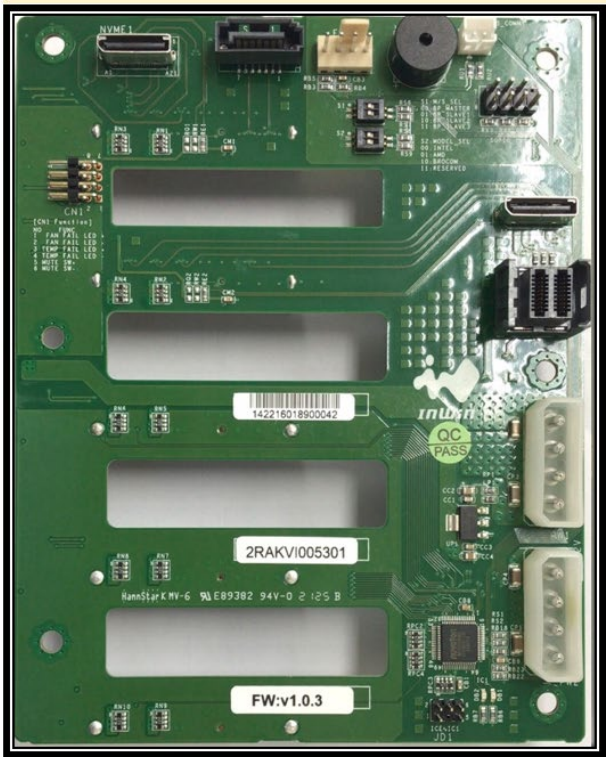
There is a Fan connector on backplane to support enclosure cooling system. It is implemented with smart fan control feature to support wide variety of fan modules by auto-calibrating the installed fan modules at system boot.

Physical Outlook

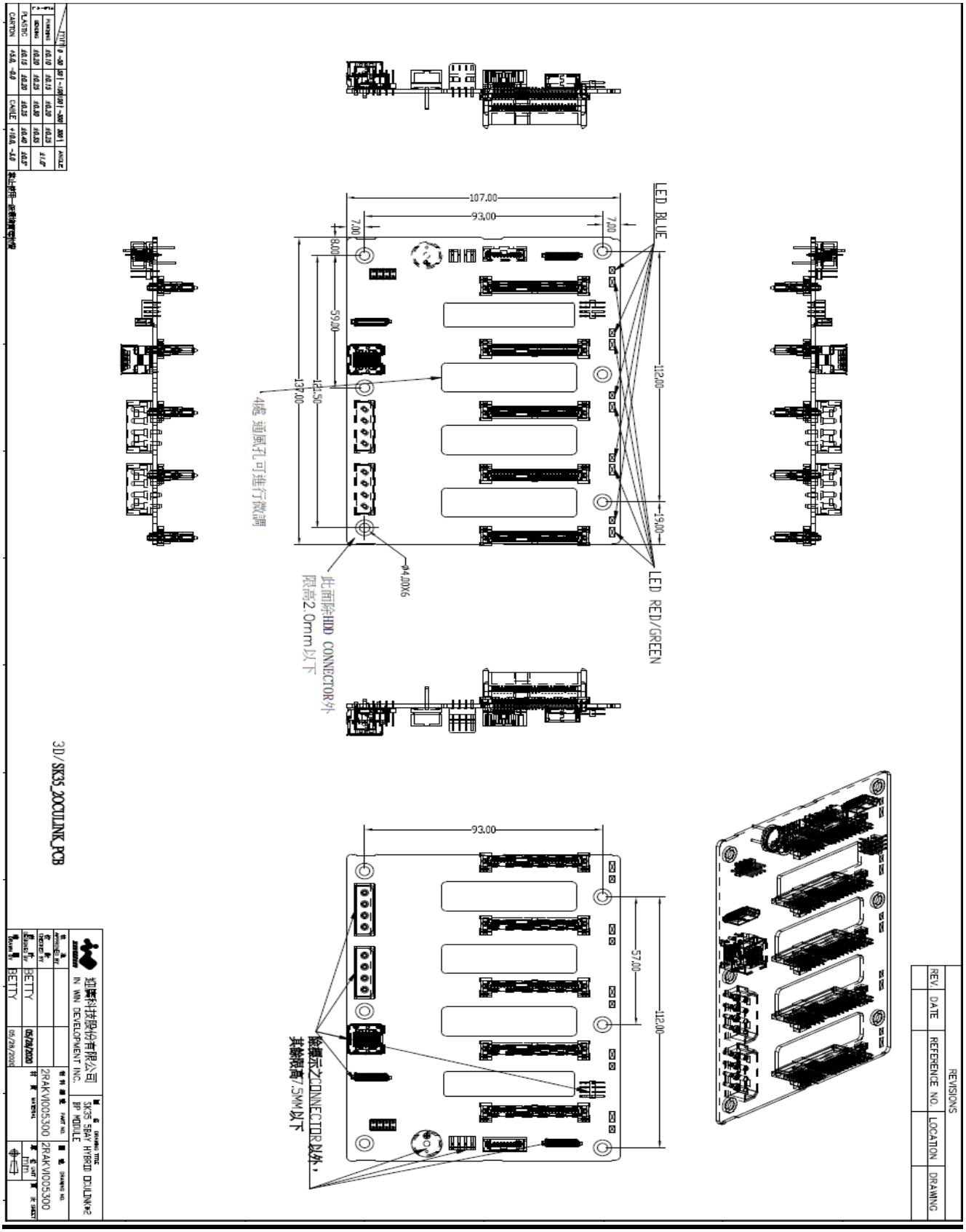
2RAKVI005301-SK35-TOP VIEW



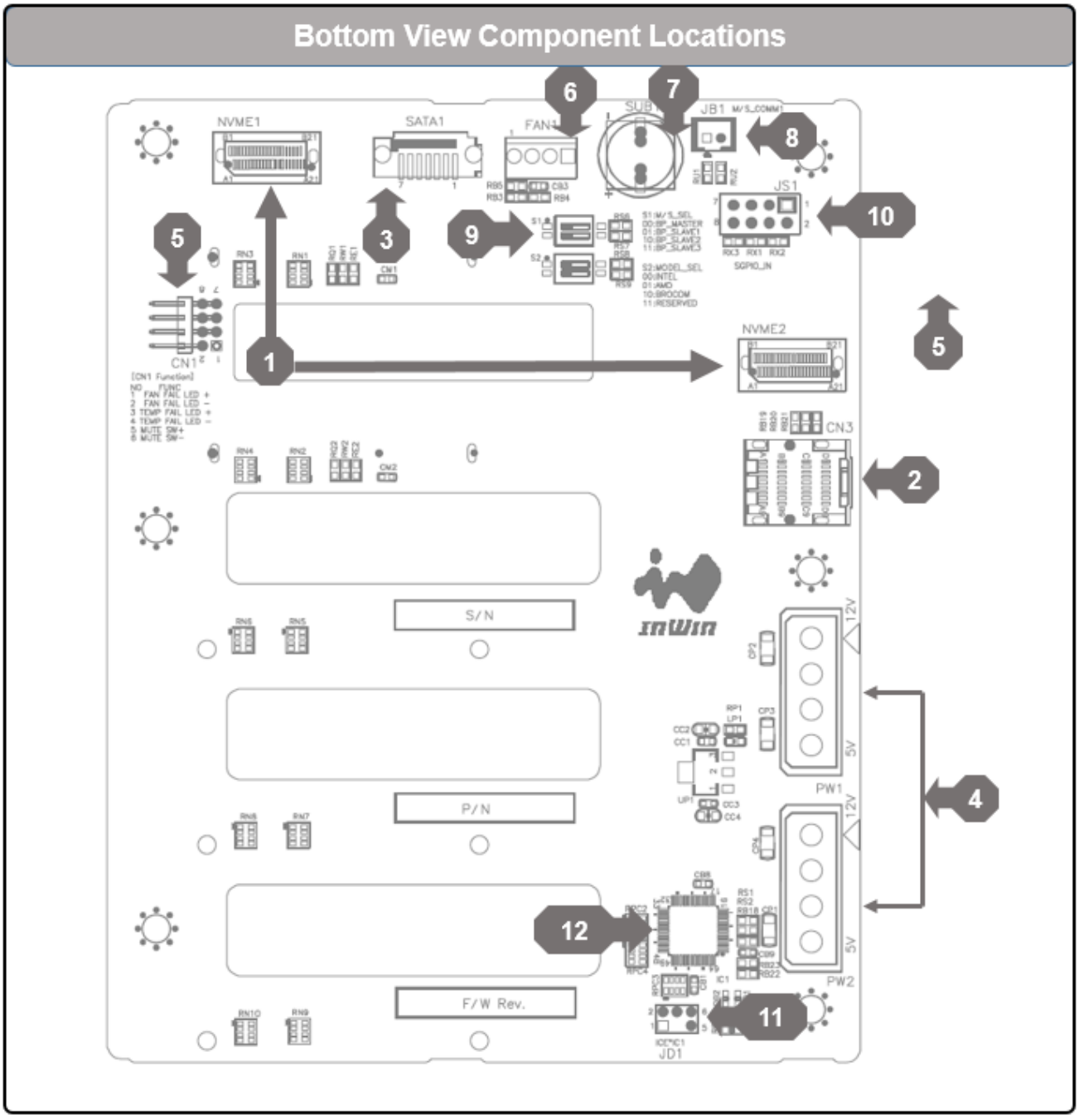
2RAKVI005301-SK35-BOTTOM VIEW



Mechanical

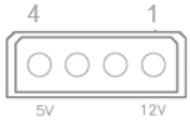

107.00
93.00
7.00
8.00
59.00
125.50
137.00
112.00
19.00
LED BLUE
LED RED/GREEN
4處 通風孔 可進行微調
此面除HDD CONNECTOR外
限高2.0mm以下
93.00
57.00
112.00
除標示之CONNECTOR以外，
其餘限高7.5MM以下
3D/SK35_2OCULINK_PCB
REVISIONS
REV.
DATE
REFERENCE NO.
LOCATION
DRAWING
IN WIN DEVELOPMENT INC.
SK35 SERAY HYBRID OCULINK*2
BP MODULE
2RAKVI005300
2RAKVI005300
BETTY
BETTY

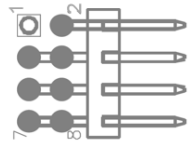
Connector Locations and LED Indicators

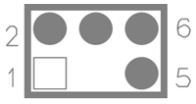


No	Description	No	Description
1	Host facing interface : NVME1/MVME2	7	Alarm Buzzer : SUB1
2	Host facing interface (SAS3) : CN3	8	M/S Communication Connector : JB1
3	Host facing interface (SATA) : SATA1	9	M/S BP Selection Switch : S1
4	Main Power Connector ： PW1/PW2	10	SGPIO Header : JS1
5	LED & Mute_SW Header : CN1	11	Firmware Programming Header ： JD1
6	FAN Connector : FAN1	12	M058 Micro-controller : IC1

Bottom Connector and Pin Definitions

PW1/PW2	Power 4-Pin Connector	
	PIN #	Definition
	1	+12V
	2 & 3	Ground
	4	+5V

CN1	LED & Mute SW 8Pin-Key#8 Connector			
	PIN #	Definition	PIN No#	Definition
	2	FAN Fail LED -	1	FAN Fail LED +
	4	TEMP_Fail LED -	3	TEMP_Fail LED +
	6	Mute_SW -	5	Mute_SW +
	8	#Key	7	NC

JD1	Firmware Programming Connector			
	PIN #	Definition	PIN No#	Definition
	2	ICE_CLK	1	VCC
	4	ICE_DATA	3	#Key
	6	ICE_RST	5	Ground

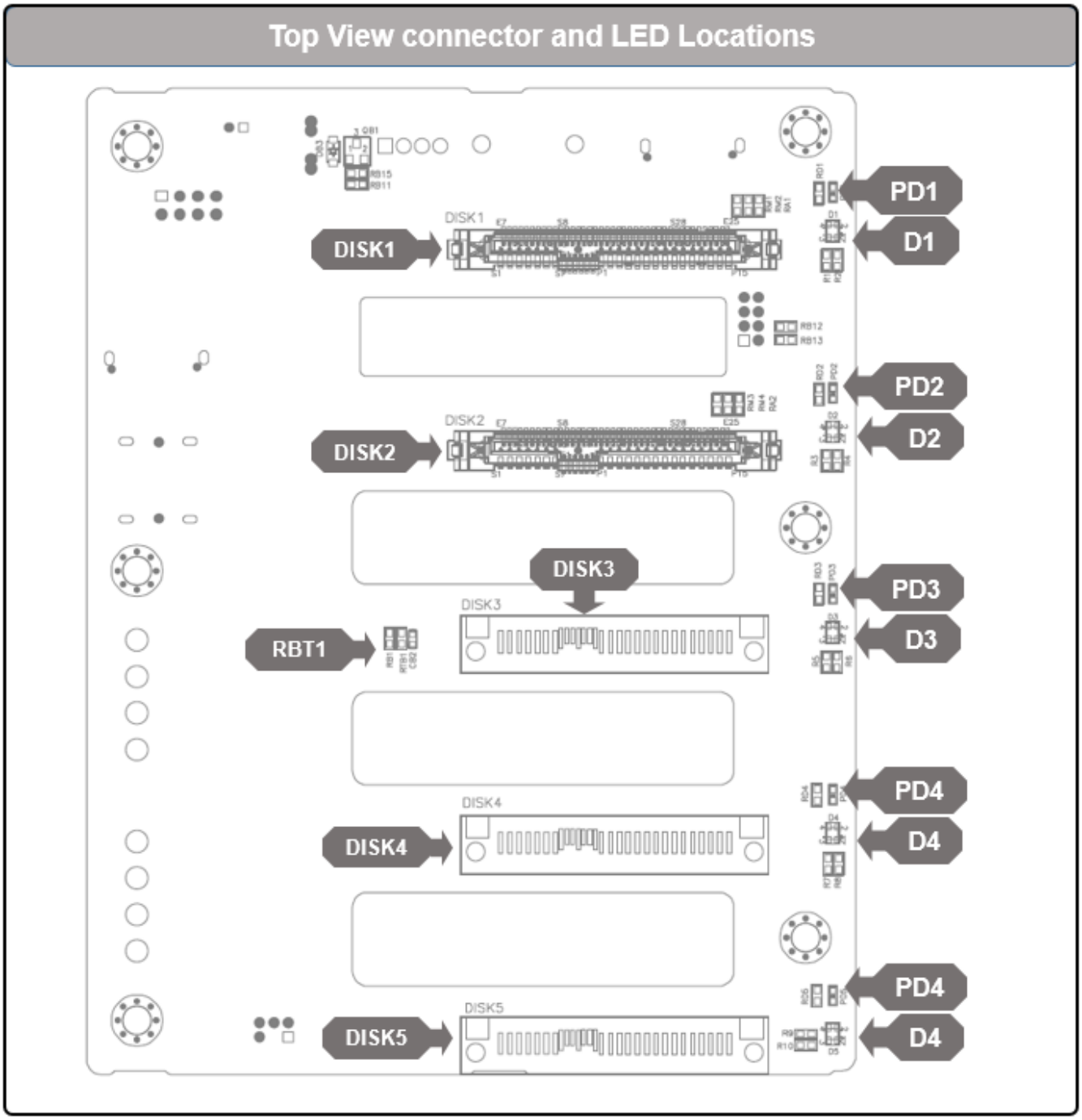
FAN1	FAN 4-Pin Connector	
	PIN #	Definition
	1	Ground
	2	+12V
	4	Tachometer
	5	PWM Output

JB1	SYNC 2-Pin Connector	
	PIN #	Definition
	1	LINK_CLK
	2	LINK_DAT

JS1	SGPIO 8Pin-Key#1 Connector			
	PIN #	Definition	PIN No#	Definition
	2	NC	1	#Key
	4	SData_Out	3	Ground
	6	Ground	5	SLoad
	8	NC	7	SClock

S1 M/S Selection	Function Description	S1 M/S Selection	Function Description
	00 : BP_MASTER		10 : BP_slave2
	01 : BP_slave1		11 : BP_slave3

Top Connectors and LED Indicators



Location	SAS/U.2 Drive Number
DISK1/ DISK2	SATA/SAS Disk or NVMe SSD #1/#2
DISK3/ DISK4/DISK5	SATA/SAS Disk #3/#4/#5

Location	Hard Drive Power/Activity/Failure/Locate LEDs
PD1/PD2/PD3/PD4/PD5	DISK1~DISK5 Power LED
D1/D2/D3/D4/D5	DISK1~DISK5 Activity/Failure/Locate LED

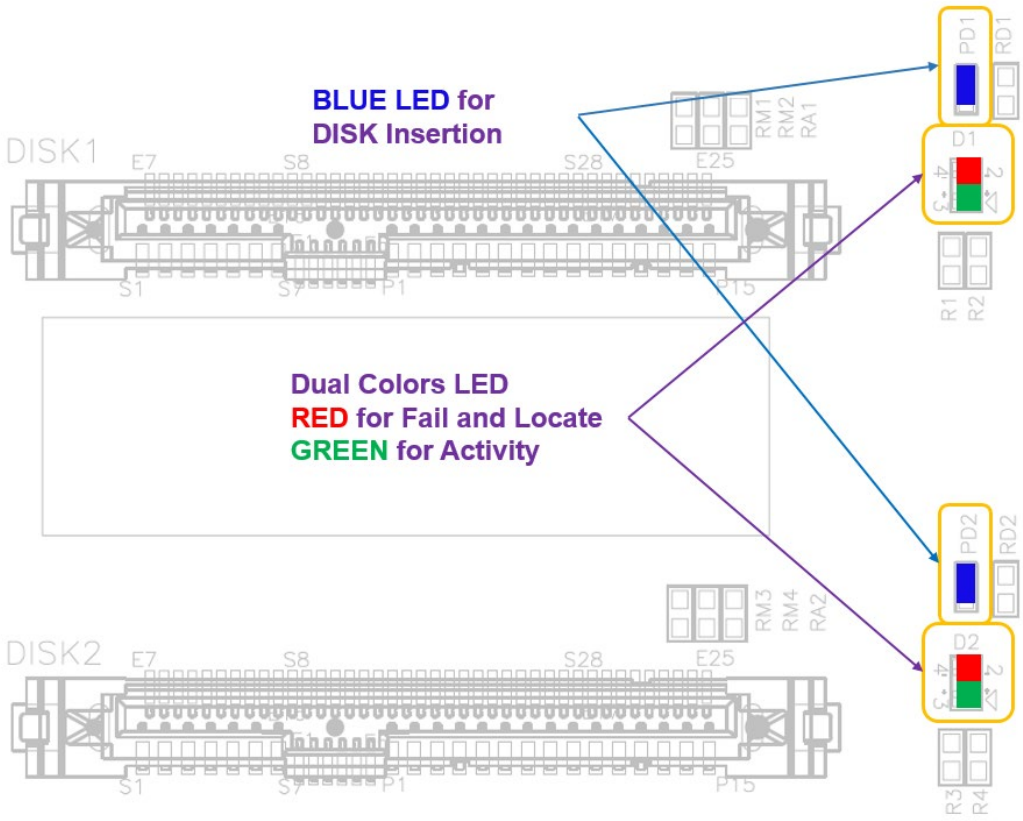
Hardware Specification

HOST Facing Interface ： SATA/OCulink
DEVICE Facing Interface ： SATA/SAS/NVMe
Indicator ：

- Indicator ：
  - Power LED PD1~PD5: Steady Blue –(When HDD is resent)
  - Dual color(Green/Red) LED D1~D5 for Hard Disk Drive Status (Activity/Failure/Locate)
    - Activity LED: Blinking Green (When HDD is Access)
    - Locate LED : Blinking Red (When HDD Fail or Locate)
    - Fail LED : Steady Red (When HDD Fail or Locate)
- Environment Control :
  - PWM FAN Connector (FAN1) for Cooling system.
  - Temperature Sensor (RTB1) Monitor HDD bay inside temperature.
  - M/S Link Connector (JB1) for Synchronous signal connection between two backplane.
  - Buzzer (SUB1) for Over-temperature and FAN fail alerting.
- Connector
  - SATA-7PIN Connector *1 (SATA1)
  - SFF-8621 OCULINK 42PIN Connector *2 (NVME1~NVME2)
  - SFF-8643 MiniSAS HD Connector *1 (CN3)
  - SFF-8639 U.2 68PIN Connector *1 (DISK1) for SATA Disk or NVMe SSD.
  - SFF-8639 U.2 68PIN Connector *1 (DISK2) for SATA/SAS3 Disk or NVMe SSD.
  - SFF-8680 SAS29PIN Connector*3 (DISK3~DISK5) for SATA/SAS3 Disk.
  - P5.08mm Disk Drive Power Connector*2 (PW1~PW2)
- JS1 connector for SGPIO Cable connection from Mother Board to Backplane.
- CN1 connector for LED/Mute SW cable connection from Front Panel to Backplane.
- JD1 MCU Programming Header for Programming MCU Firmware
- S2 DIP Switch for Backplane Master/Slave Selection.

LED Behavior

Disk Bay LED



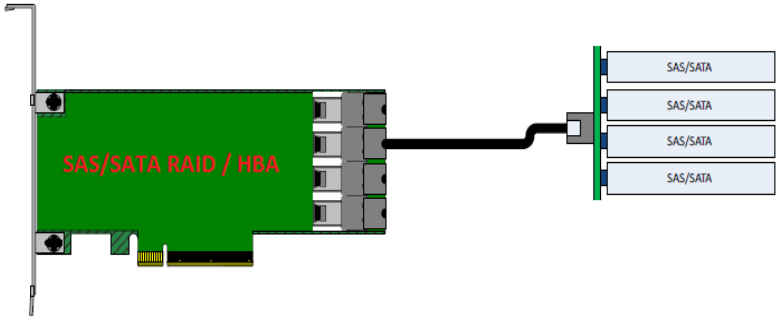
Blue LED:
Disk Insertion Indicator –
Turned on whenever disk drive is properly installed.

Green LED:
Activity indicator –
Stay off when idle and blinking (~8 Hz) whenever disk drive is being accessed.

RED LED:
Fail and Locate indicator –
Turned steady on when disk failure occurs. Blinking (1 Hz) when locating Disk, RAID rebuild and RAID consistent check.

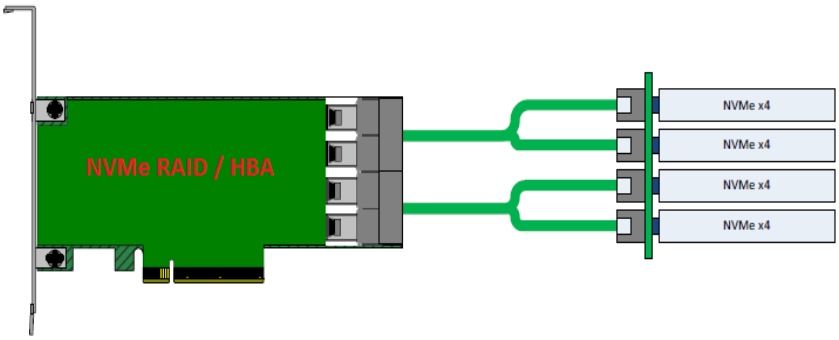
There are 2 parts of LED Management on the backplane. One is for SAS and another is for NVMe. Please note that the disk slots can only accommodate SAS/SATA or NVMe disk at a time since they share the same disk connector.

For SAS application, The LEDs behave by following SGPIO signal coming through sideband bus inside the SFF-8643 cables. Please refer to Section 2 for SGPIO settings. When SGPIO Jumper setting is enabled the LEDs behave according to the SGPIO signals. When SGPIO is disabled, the RED LEDs (for Locate and Fail) do not behave while the GREEN LEDs (for Activity) behave according to the signal from P11 (READY LED) of the disk connectors.



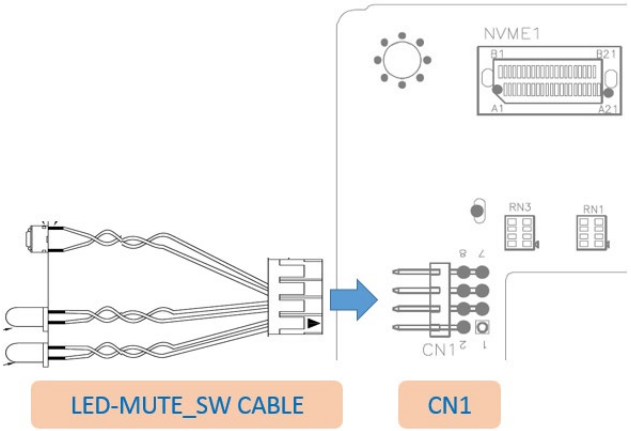
For NVMe application, The LEDs behave according to the VPP over I2C signals from NVMe host controllers through sideband bus of Oculink or SlimSAS cables. Whenever the NVMe host controller support VPP over I2C, the RED LEDs behave Locate, Fail and Rebuild signals following VPP signals on the I2C bus. The Green LEDs (for Activity) behave according to the signal from P11 (Activity) of the disk connectors.

Examples of NVMe connections to Broadcom RAID/HBA controller. Each pair of VPP over I2C signal supports 2 pieces of NVMe disks LED management. The I2C bus is leaded to odd-number NVMe connector (Oculink or SlimSAS) to manage its corresponding and the following NVMe disks. For example, NVMe1 and NVMe2 LED management signal is form NVMe1 connector's sideband I2C bus, NVMe3 and NVMe4 LED management signal is from NVMe3 connector's sideband I2C bus and …etc.



System Alarm LED

There are two FAIL LED design on the Backplane to indicate Fan Fail and Over-Temperature. Lead 2.0mm 8-pin header CN1 to front panel for indicating system fault.



Fan Fail:
When any fan module RPM is lower than 75% of the expected speed the Fan Fail is triggered and the Fail LED blinks in 0.5Hz rate. Goes off when the issue is resolved or disappeared.

Overheat:
When the system temperature at the backplane area is going beyond 45℃ the Temp Fail triggered and Fail LED blinks in 2Hz rate. Goes off when temperature is going under 45℃.

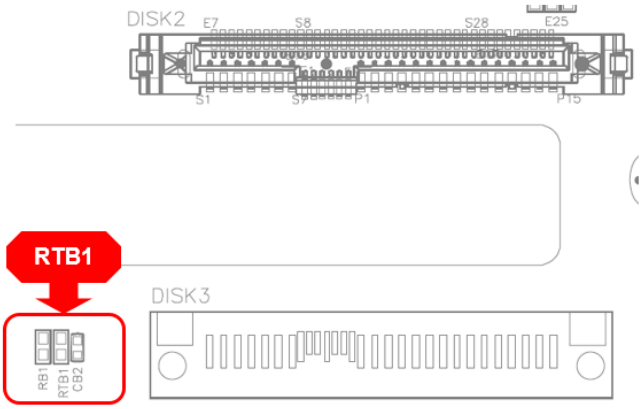
Overheat & Fan Fail:
Fail LED stays steady on when both events triggered at the same time.

Note:

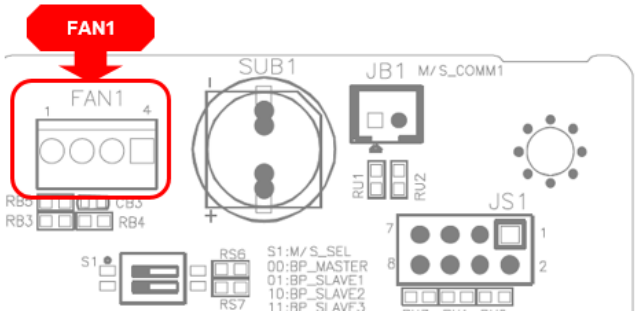
- When the system alarm is triggered, the Buzzer beeps along with it and stops beeping when alarm is disappeared.
- 1 short beep(B—B—B) stands for Fan Fails
- 2 short beeps(BB—BB—BB) stand for Over-Temperature
- Press Mute Button to disable buzzer beeping and will be retriggered when either failure occurs again.

Smart Fan Control

IN WIN's Backplane is implemented Smart Fan Control feature by automatically detecting the existences of the Fan Modules and intelligently control the Fan RPM per the system temperature being detected by a thermal sensor (RTB1) on the backplane.



Thanks to Smart Fan Control feature the Fan connector (FAN1) on backplane support wide variety of PWM driven Fan modules being used in the enclosure.



How it works?

1. Fan module auto-calibration triggered in every system boot. The thermal profile would then be recorded and used until next reboot.
2. Backplane starts fan calibration and calculates the corresponding PWM duty cycle for each level. There are totally 8 speed levels to be sensed and used until next system boot.
3. The 8 levels of fan speed are mapped to the temperature readings detected by thermistor spreading from 25 to 45 °C in 3.75 degree C step.
4. In normal operation, when the system temperature changes to next level, the fan module would change speed accordingly. And, the Fan failure alarm would be triggered when the RPM of the Fan module is dropped lower than 75% of its expected speed.
5. The fan module calibration and thermal profile are as below.
6. When an external PWM source joins, the output PWM duty is determined by comparing the internal calculated PWM and external PWM and then select whichever is higher as the output PWM to the fan modules.

Fan Speed Measurement

R_{diff} = Maximum RPM – Minimum RPM

PWM Duty: 10
PWM Duty: 20
PWM Duty: 30
PWM Duty: 40
PWM Duty: 50
PWM Duty: 60
PWM Duty: 70
PWM Duty: 80
PWM Duty: 100

Minimum RPM
RPM1
RPM2
RPM3
RPM4
RPM5
RPM6
RPM7
Maximum RPM

Fan Speed Table

Minimum RPM + R_{diff} x20%
Minimum RPM + R_{diff} x30%
Minimum RPM + R_{diff} x40%
Minimum RPM + R_{diff} x50%
Minimum RPM + R_{diff} x60%
Minimum RPM + R_{diff} x70%
Minimum RPM + R_{diff} x80%
Maximum RPM

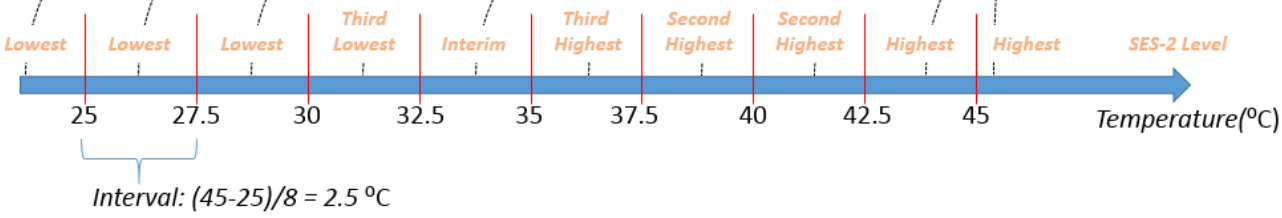
PWM Level Table

PWM Duty0
PWM Duty1
PWM Duty2
PWM Duty3
PWM Duty4
PWM Duty5
PWM Duty6
PWM 100

Cooling Control Policy – 45 Celsius

Fan Speed Table

Minimum RPM + R_{diff} x20%
Minimum RPM + R_{diff} x30%
Minimum RPM + R_{diff} x40%
Minimum RPM + R_{diff} x50%
Minimum RPM + R_{diff} x60%
Minimum RPM + R_{diff} x70%
Minimum RPM + R_{diff} x80%
Maximum RPM



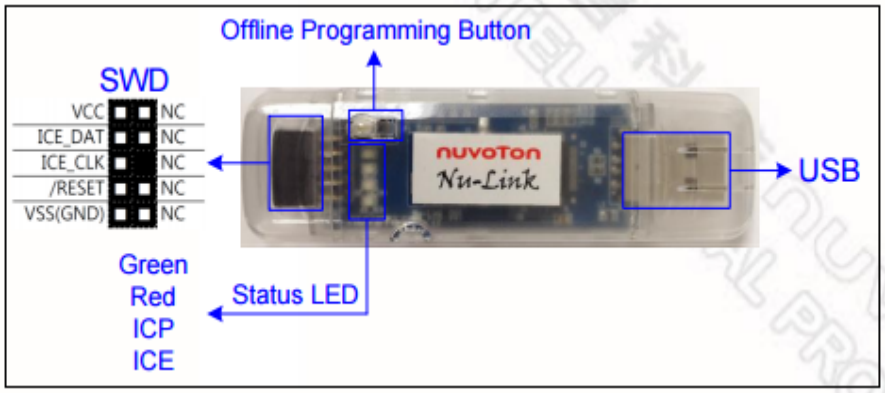
Interval: (45-25)/8 = 2.5 °C

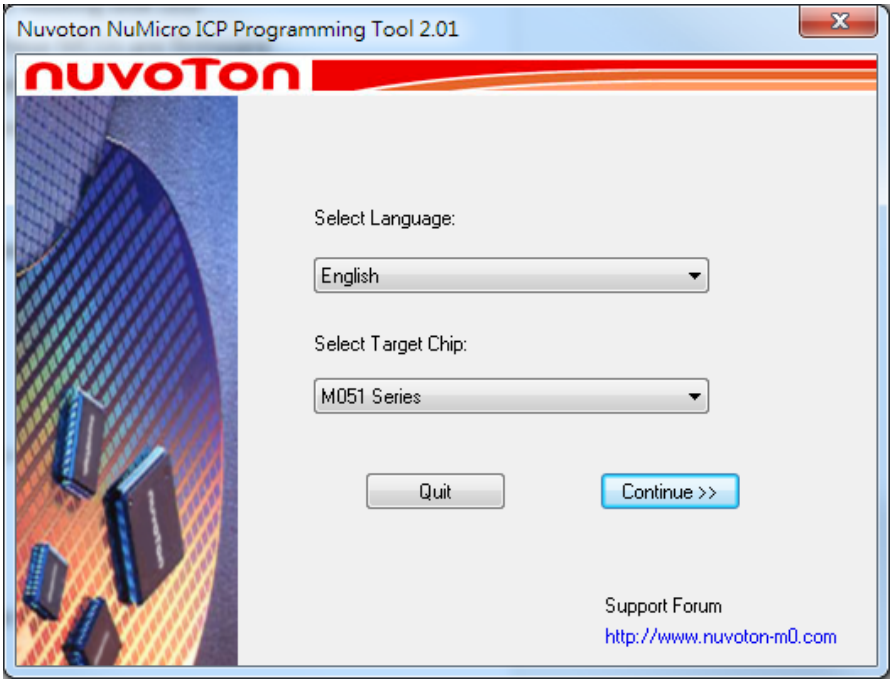
Firmware Upgrade

The passive backplanes are planted Nuvoton M058 series MCUs for hosting disk LED indication, Fan speed control and system fail alarm. These MCUs are preprogrammed in manufacturing. In most cases, the MCUs are not required to reprogram unless there is issue needed to fix.

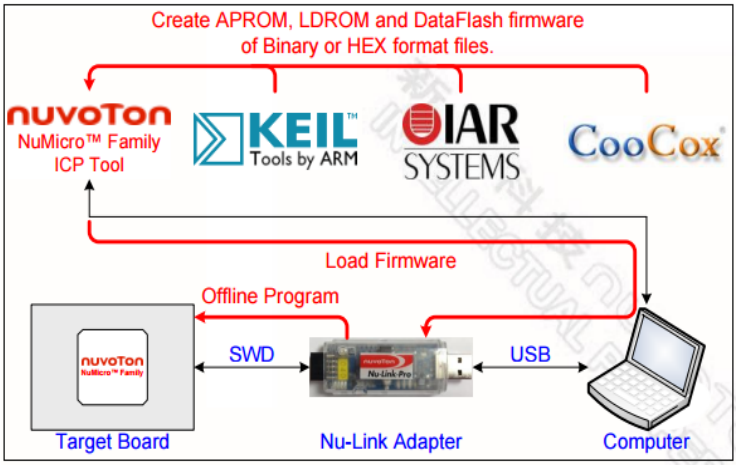
How to upgrade firmware?

1. Require Nuvoton ARM Cortex-M0 programming tool. Nu-Me or Nu-Link and install Nuvoton ICP Programming tool software.

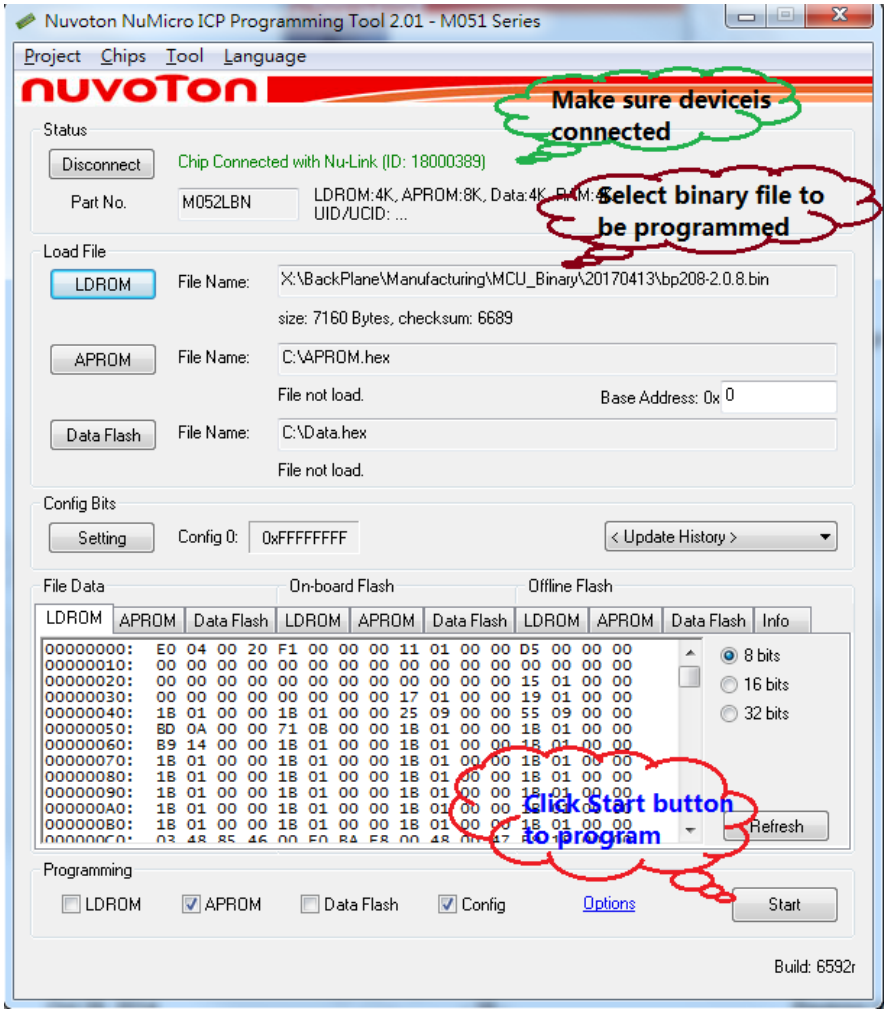




2. Connect Nu-Link USB end to a host and the SWD end to Backplane ICE connector for each MCU.



3. Make sure device is connected and select the binary file being programmed and then click on Start button to program firmware.



4. Please refer to http://www.nuvoton.com/resource-files/NuLink_Adapter_User_Manual_EN_V1.01.pdf for more details.