IW-RS108-07 HYBRID BACKPLANE USER MANUAL

P/N : 2RAKVI008200

Model : IW-RS104-07/ IW-RS108-07 4BAY HYBRID Backplane-H MODULE

Version : V1.0

Revision History

Version	Changes	Date
V1.0	Official Release	2021/05/25

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Overview

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

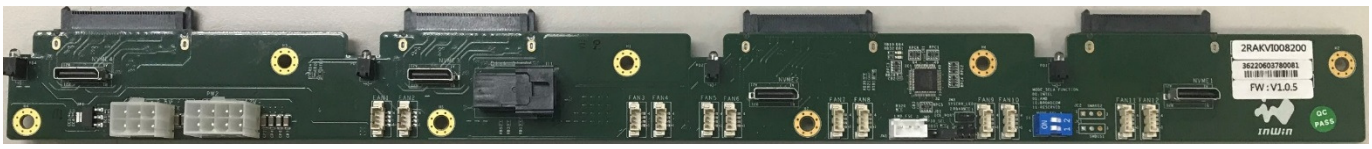
The passive backplanes support state-of-the-art SAS3 12Gbps HDD/SSD and also backward compatible with SAS 6Gbps, SATA 6Gps and SATA 3Gps HDD/SSD. The backplane supports NVMe SSD through OcuLink x4 connectors.

Basically, one single SFF-8643 miniSAS connector can support up to 4 disk bays. 2 of them are so called Hybrid that further support NVMe SSD via Oculink x4 connectors.

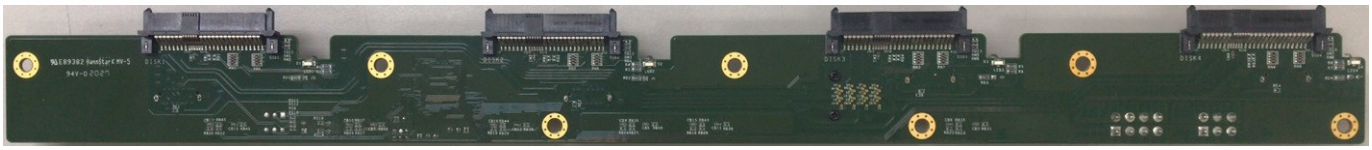
There are four Fan connectors on backplane to support enclosure cooling system. It is implemented with smart fan control feature to support wide variety of fan modules by auto-calibrating the installed fan modules at system boot.

Physical Outlook

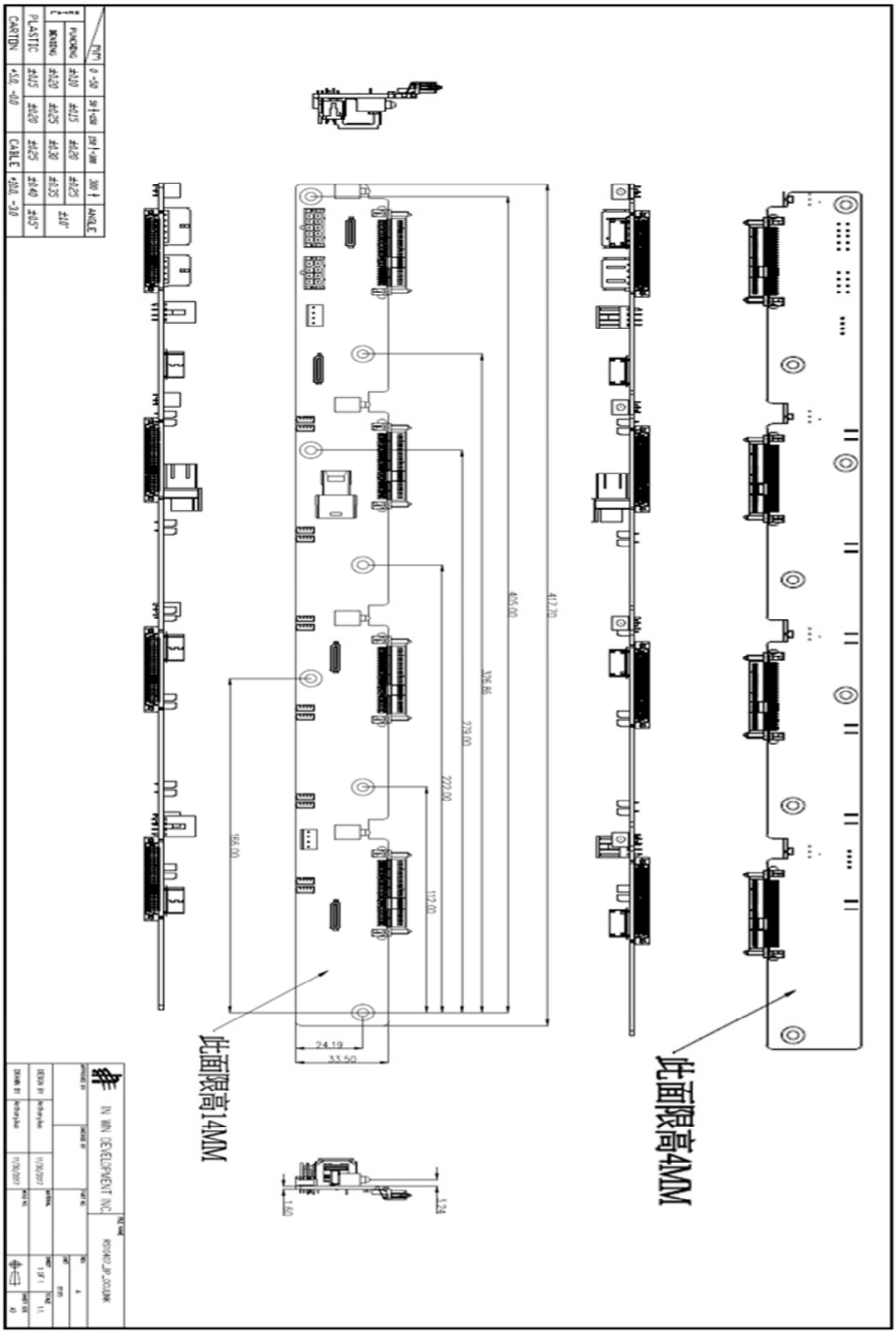
TOP VIEW



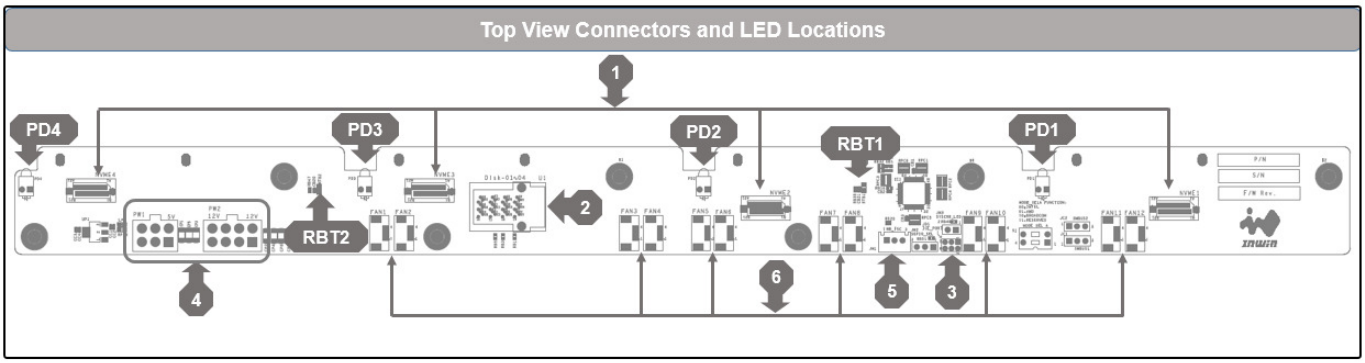
BOTTOM VIEW

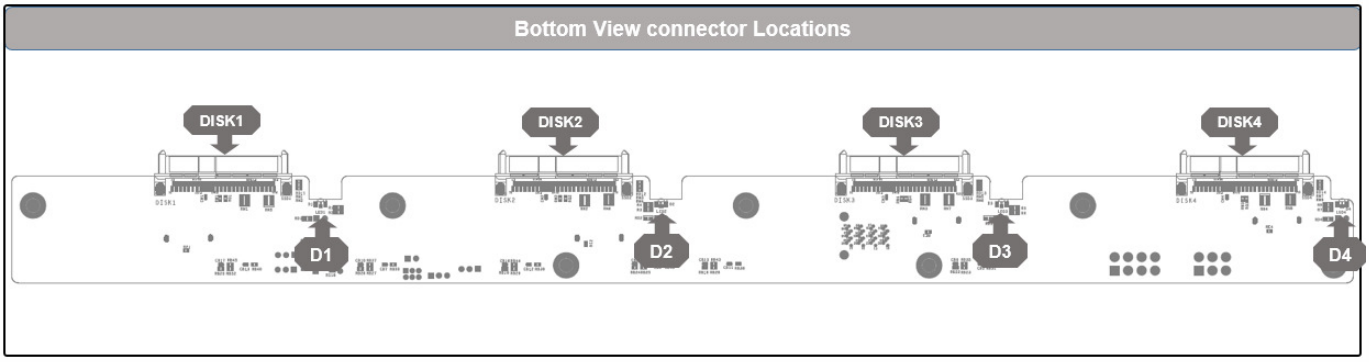


Mechanical


此面限高14MM
此面限高4MM
IN WIN DEVELOPMENT INC.
417.20
326.86
278.00
222.00
165.00
117.00
24.19
33.50
1.60
1.24

Connector Locations and LED Indicators





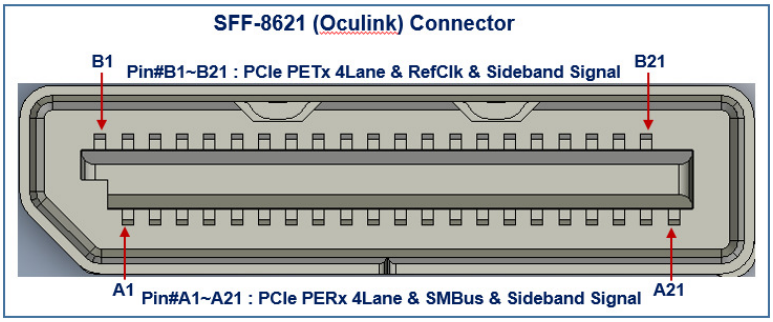
No	Description	No	Description
1	Host facing interface : NVME1~NVME4	4	Main Power Connector ： PW1/PW2
2	Host facing interface (SAS3) : CN1	5	M/B Fan Speed Control : JM1
3	Firmware Programming Header ： JD1	6	FAN Connector : FAN1~FAN12

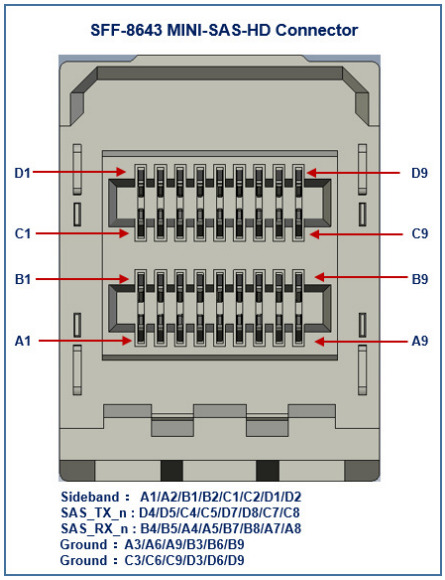
Connector/ LED Indicators.

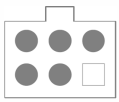
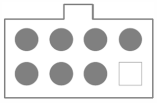
Location	SAS/U.2 Drive Number
DISK1/ DISK2	SATA/SAS Disk or NVMe SSD #1/#2
DISK3/ DISK4	SATA/SAS Disk or NVMe SSD #3/#4

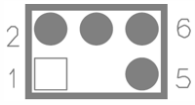
Location	Hard Drive Power/Activity/Failure/Locate LEDs
PD1/PD2/PD3/PD4	DISK1~DISK4 Power LED
D1/D2/D3/D4	DISK1~DISK4 Activity/Failure/Locate LED

Connector Pin Definitions.

NVME1~NVME4


CN1


PW1	Power 2*3-Pin Connector	
	PIN #	Definition
	1~3	+5V
	4~6	Ground
PW2	Power 2*4-Pin Connector	
	PIN #	Definition
	1~4	+12V
	5~8	Ground

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~FAN12	FAN 4-Pin Connector	
	PIN #	Definition
	1	PWM Output
	2	Tachometer
	3	+12V
	4	Ground

JM1	M/B FSC 3-Pin Connector	
	PIN #	Definition
	1	MB_PWM
	2	BP_TACH
	3	Groubd

Hardware Specification

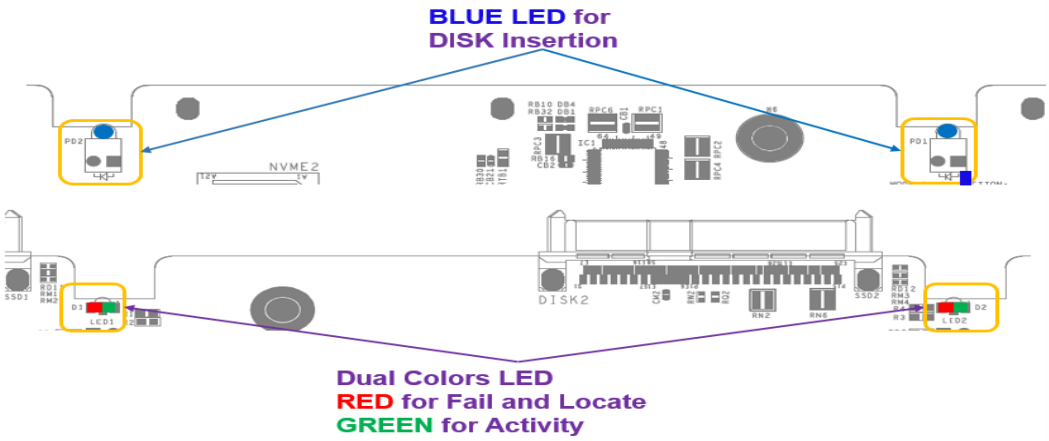
HOST Interface ： MiniSAS HD/OCulink

Hard Disk (SSD) Interface ： SATA/SAS3/NVMe

- Indicator ：
  - Power LED (PD1~PD4) : Blue –(When HDD is resent)
  - Dual color(Green/Red) LED D1~D4 for Hard Disk Drive Status (Activity/Fail/Locate)
  - Activity LED: Green (When HDD is Access)
  - Fail/Locate LED : Red (When HDD Fail or Locate)
- Environment Control :
  - PWM FAN Connector(FAN1~FAN12) for Cooling system.
  - Temperature Sensor (RTB1/RBT2) Monitor HDD bay inside temperature.
  - DB4 (RED LED) for Over-temperature and FAN fail indicator.
- DIP-Switch
  - S1 : NVME Control Function Model Selection.
- Header and Connector
  - JM1 connector for Fan speed control connected between Motherboard and backplane.
  - JM2 Header for SGPIO function Enable/Disable selection.
  - JM3 Header for external Over-temperature and FAN fail indicator.
  - JD1 Header for Programming MCU Firmware.
  - P4.2mm Disk Drive Power Connector*2 (PW1[5V]/PW2[12V]).
- Hi-Speed Connector
  - SFF-8643 MiniSAS HD Connector *1 (CN1)
  - SFF-8621 OCULINK 42PIN Connector *4 (NVME1~NVME4)
  - SFF-8639 U.2 68PIN Connector *4 (DISK1~DISK4) for SATA/SAS3 Disk or NVMe SSD.

LED Behavior

Disk Bay LED



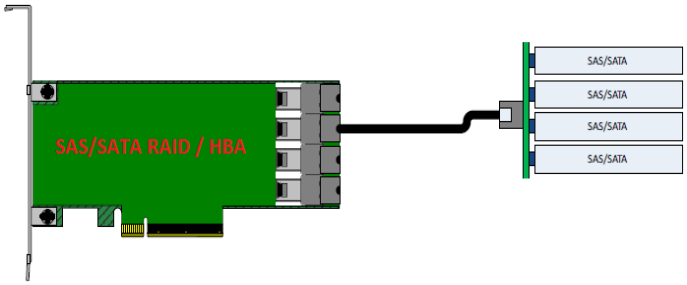
Blue LED:
Disk Insertion Indicator –
Turned on whenever disk drive is properly installed.

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.

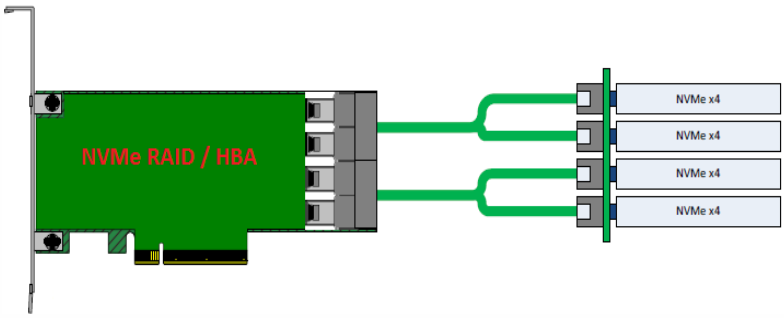
There are 2 parts of LED Management on the backplane. One is for SAS and another is for NVMe. Please note that the disk slots can only accommodate SAS/SATA or NVMe disk at a time since they share the same disk connector.

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.



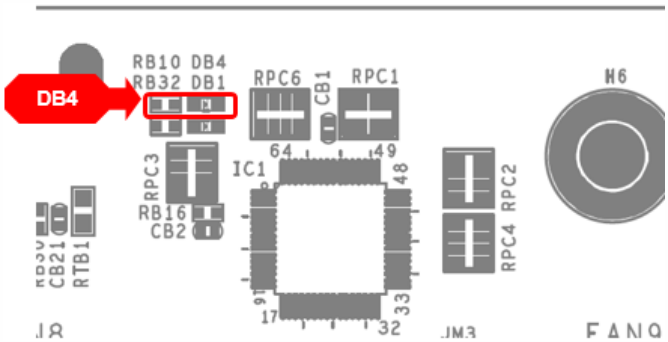
For NVMe application, The LEDs behave according to the VPP over I2C signals from NVMe host controllers through sideband bus of Oculink or SlimSAS cables. Whenever the NVMe host controller support VPP over I2C, the RED LEDs behave Locate, Fail and Rebuild signals following VPP signals on the I2C bus. 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 is a FAIL LED (DB4) design on the Backplane to indicate Fan Fail and Over-Temperature for indicating system fault.



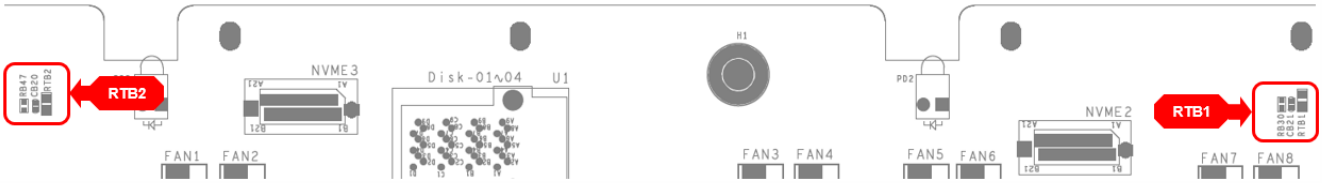
Fan Fail:
When any fan module RPM is lower than 75% of the expected speed the Fan Fail is triggered and the Fail LED blinks in 0.5Hz rate. Goes off when the issue is resolved or disappeared.

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 ℃.

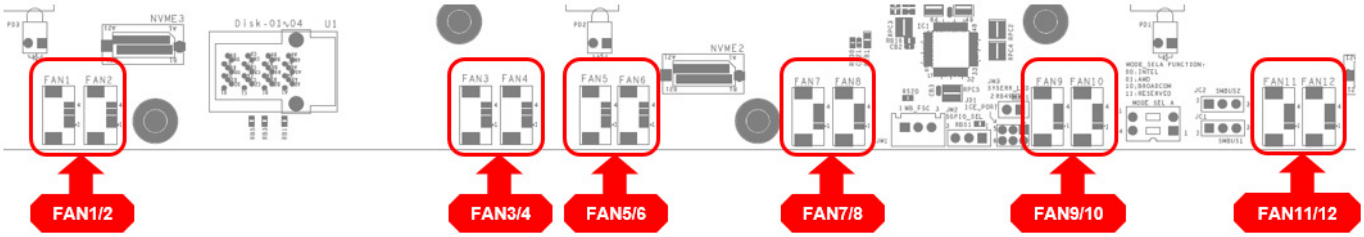
Overheat & Fan Fail:
Fail LED stays steady on when both events triggered at the same time.

Smart Fan Control

InWin'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 two thermal sensors (RTB1/RTB2) on the backplane.



Thanks to Smart Fan Control feature the Fan connectors (FAN1/FAN2/FAN3/FAN4) 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 ℃ 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

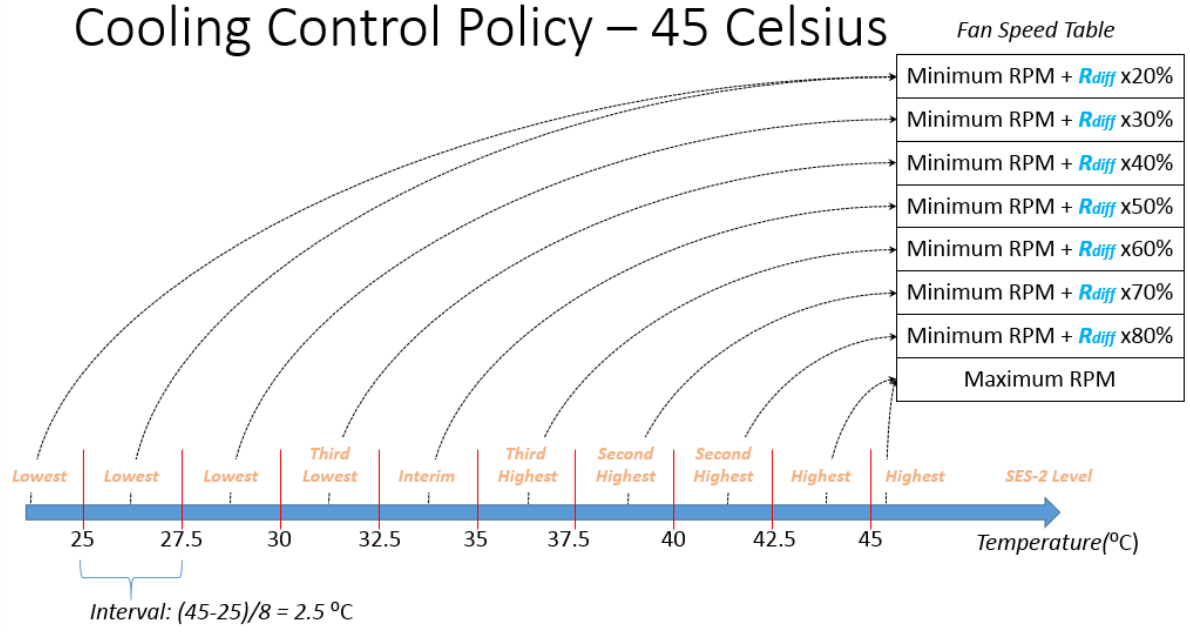
Fan Speed Table

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

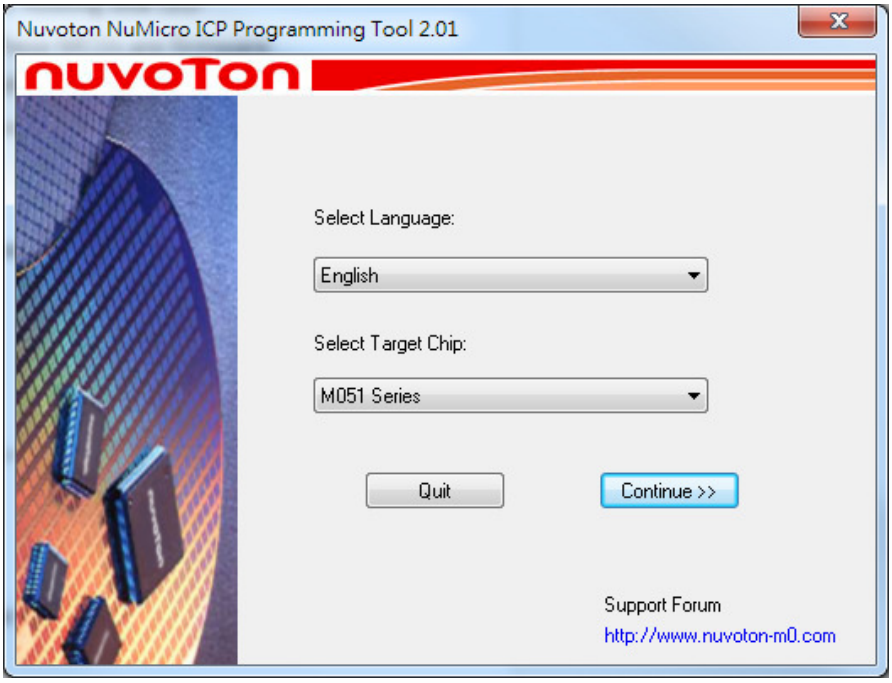


Firmware Upgrade

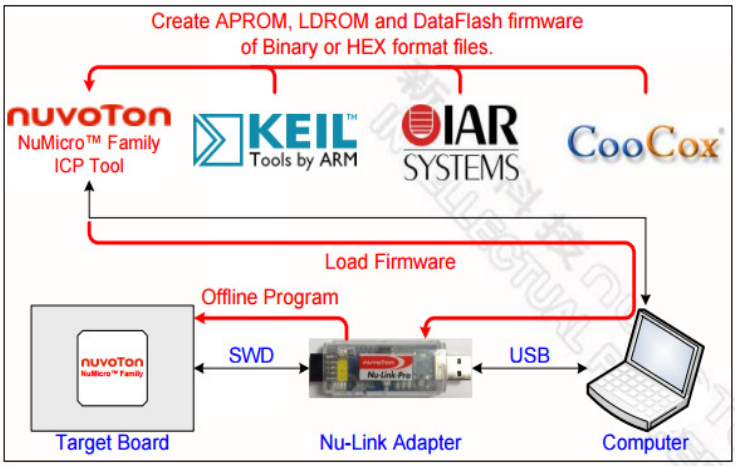
The passive backplanes are planted Nuvoton M058 series MCUs for hosting disk LED indication, Fan speed control and system fail alarm. These MCUs are preprogrammed in manufacturing. In most cases, the MCUs are not required to reprogram unless there is issue needed to fix.

How to upgrade firmware?

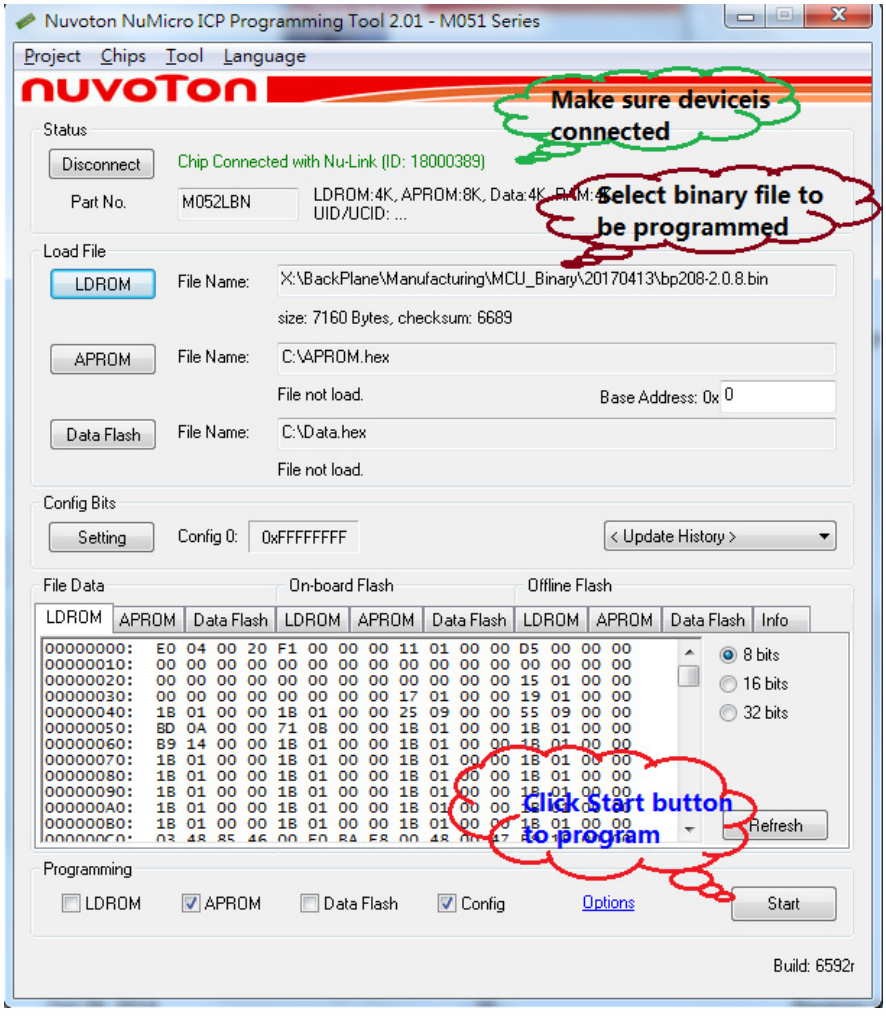
1. Require Nuvoton ARM Cortex-M0 programming tool. Nu-Me or Nu-Link and install Nuvoton ICP Programming tool software.



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.