

| TITLE | Page |
|--|-----------|
| Cover Sheet | 1 |
| Block Diagram | 2 |
| CPU-Memory, CPU-PEG/Display | 3,4 |
| CPU-Control/MISC/CFG/Audio | 5 |
| CPU-Power,CPU-GND | 6,7 |
| DDR4 DIMM1&DDR4 DIMM2 & DDR4 POWER | 8,9,10,11 |
| PCH-USB/PCIE/DMI/SATA | 12 |
| PCH-Audio/Display/Clock | 13 |
| PCH-GPIO | 14 |
| PCH-LPC/SPI/SMBUS/MISC | 15 |
| PCH-Power,PCH-GND,PCH-Strap | 16,17,18 |
| PCIE SLOT-CPU(X16) | 19 |
| SIO-NCT5565D-M/FAN CONTROLLOR | 20,21,22 |
| AUDIO - ALC892/887,AUDIO - depop circuit | 23,24 |
| LAN - RTL8111H | 25 |
| DVI/HDMI Connector | 26,27 |
| M2 CONNECTOR/WIFI +BT | 28,29 |
| USB2.0/USB3.0/SATA connector | 30,31,32 |
| CLR_CMOS circuit/BIOS ROM | 33,34 |
| ACPI CONTROLLER | 35 |
| PWM-RT3606BC/VCORE 3PHASE/VGT 2PHASE | 36,37,38 |
| DDR-RT8231/DDR-MP2143-VPP25 | 39,40 |
| PCH power - POWER RT8125E | 41 |
| VCCSA - POWER RT8125E | 42 |
| VCCIO/VCCSTPLL POWER | 43 |
| ATX F_Panel/TPM/MSI_LED | 44 |
| DEBUG LED/EMI CAP/Manial Part | 45,46,47 |
| JLED/Power Map/GPIO MAP | 48,49,50 |
| Power Sequence/Revision History | 51,52 |

MS-7A67

ITX:170*170

Ver: 20

Intel -KabyLake 65W plamform

CPU:

LGA1151
CPU POWER PAK *3 Phase
GT POWER PAK *2 Phase

System Chipset:

SPT-H : H270,B250

Onboard Chip:

HD Audio Codec: ALC887
SIO: NCT5565D
Flash ROM: SPI 128 MB

PWM:

VCORE - RT3606
DDR - RT8231
PCH(1.0V) - RT8125E
VCCSA - RT8125E

Main Memory:

DDR4 * 2 (Dual Channel)

Load Switch:


VCCIO -MP5077 5.5A

ACPI:

5VDAUL:uP7501
5VDIMM:uP7501
3VSB:GS7133+PN MOS
3VDSW:GS7116
VCCSTPLL - NMOS

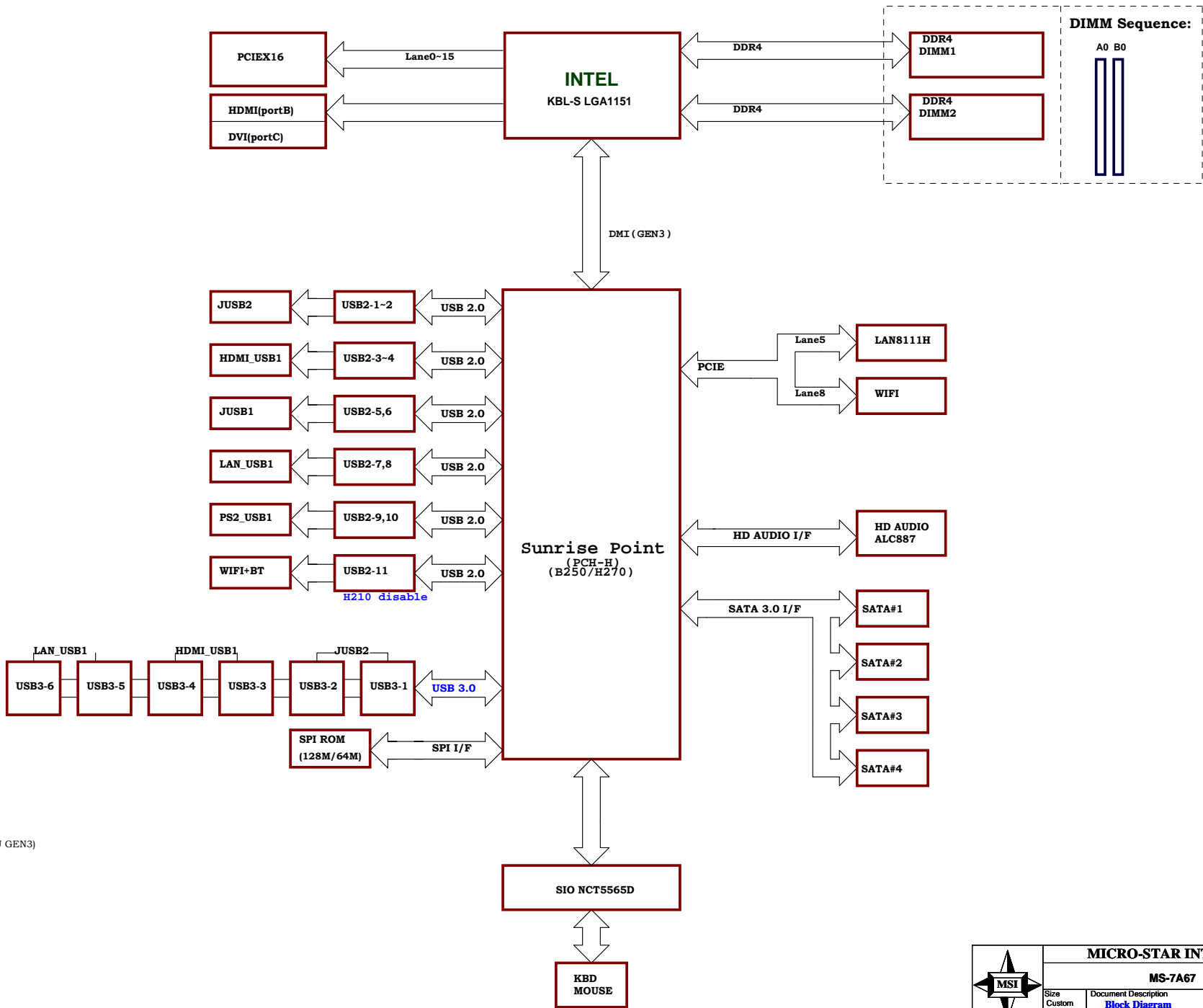
Expansion Slots:

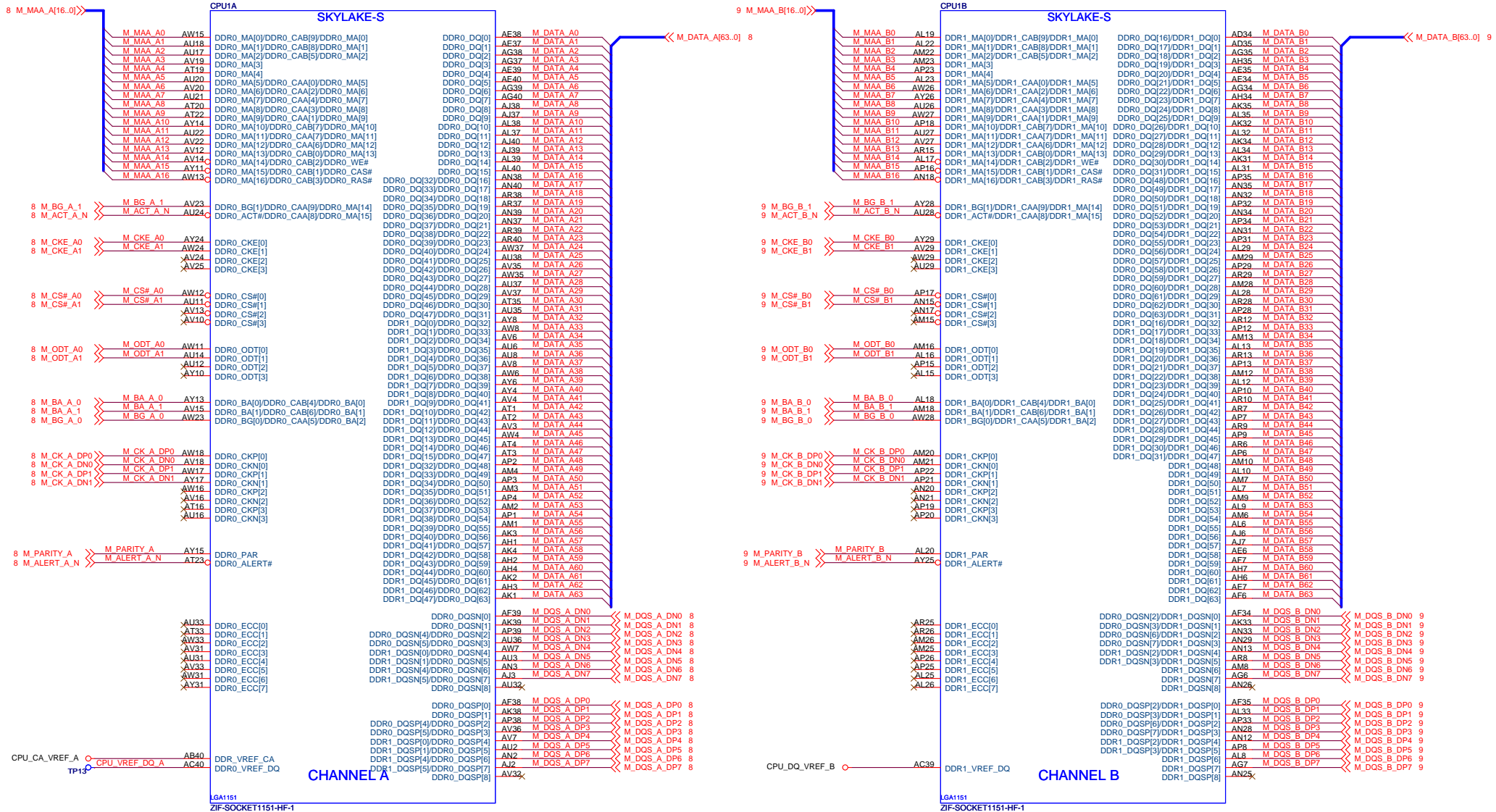
PCI Express (X16) Slot * 1

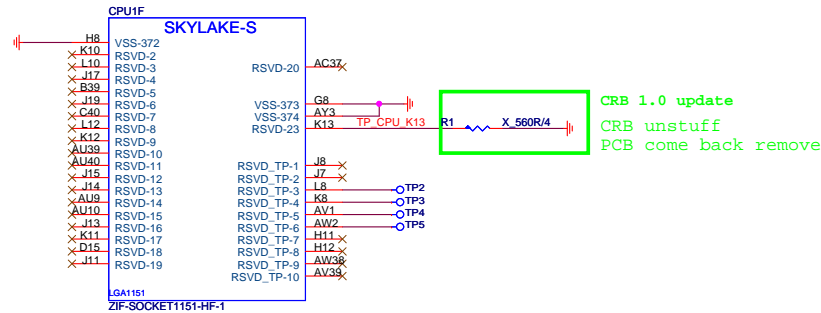
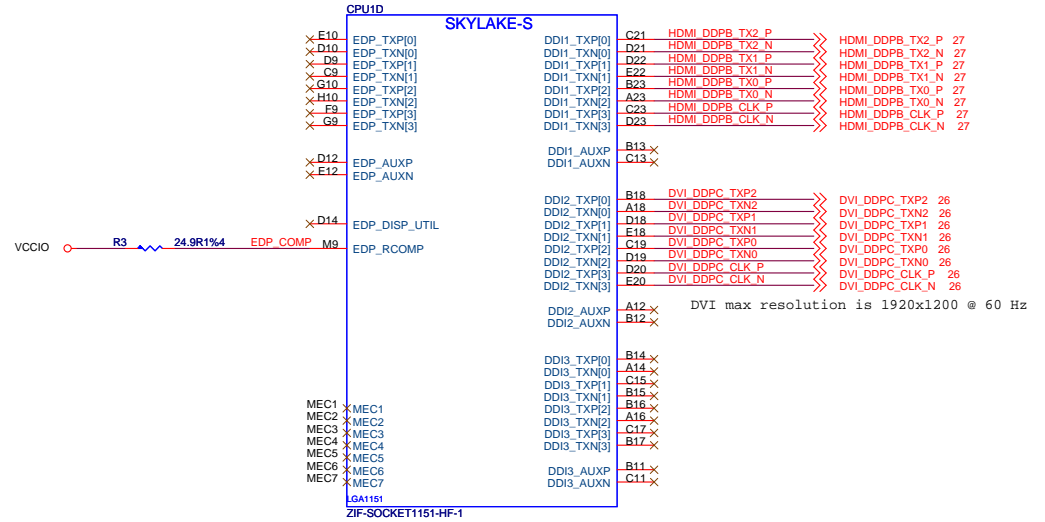
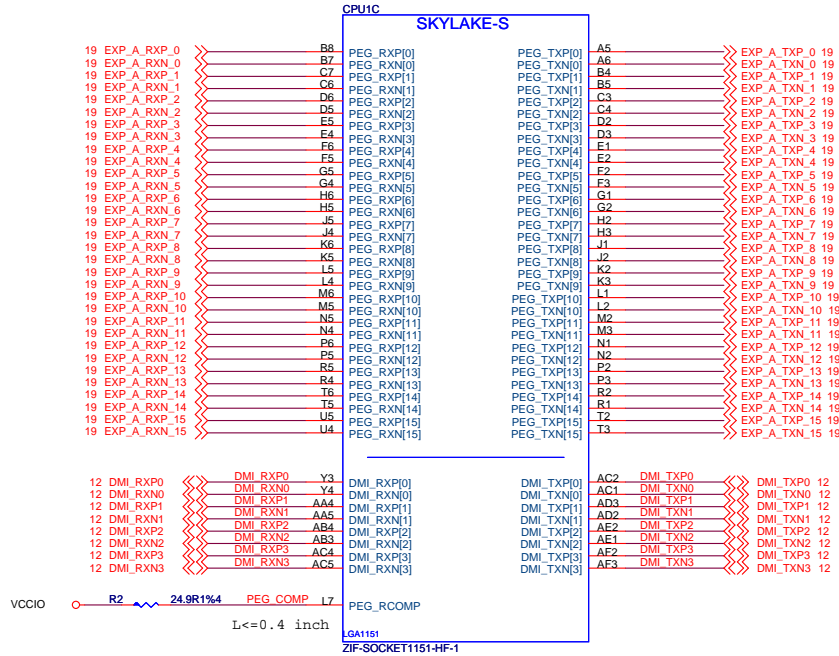


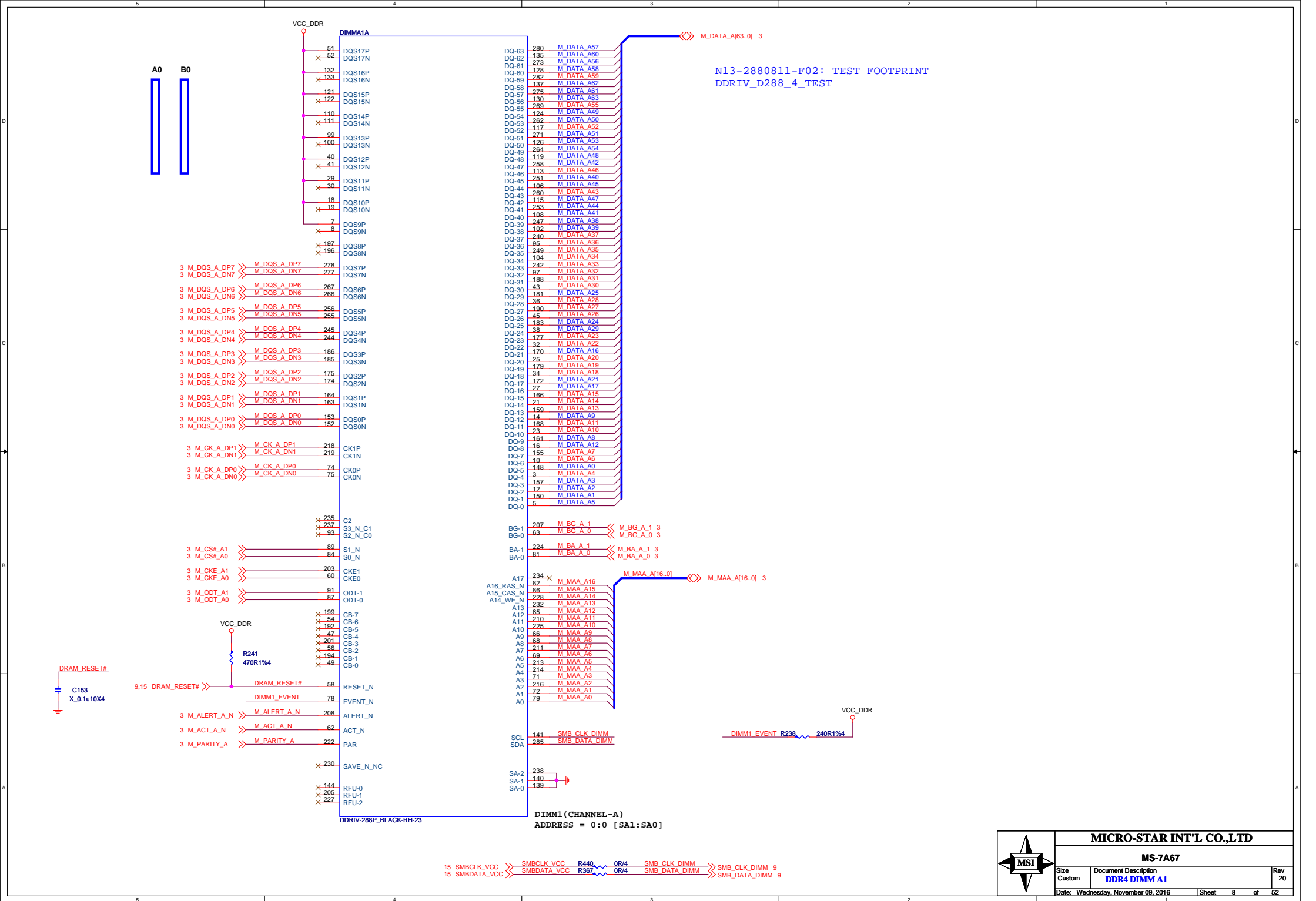
| | | |
|--|-------------------------------------|--------|
| MICRO-STAR INT'L CO.,LTD | | |
| MS-7A67 | | |
| Size Custom | Document Description Cover Sheet | Rev 20 |
| Date: Wednesday, November 09, 2016 Sheet 1 of 52 | | |

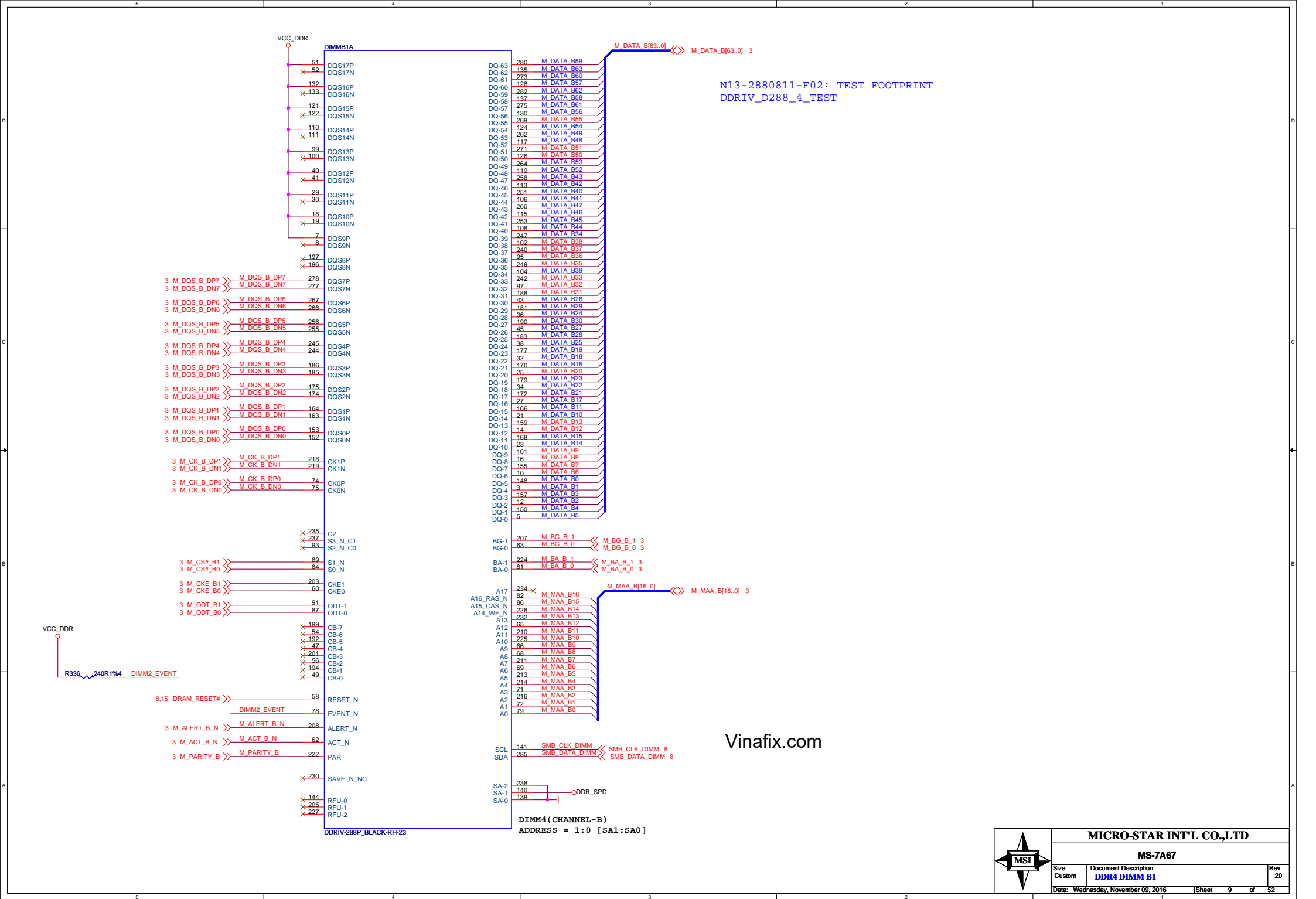
MS-7A67 Block Diagram

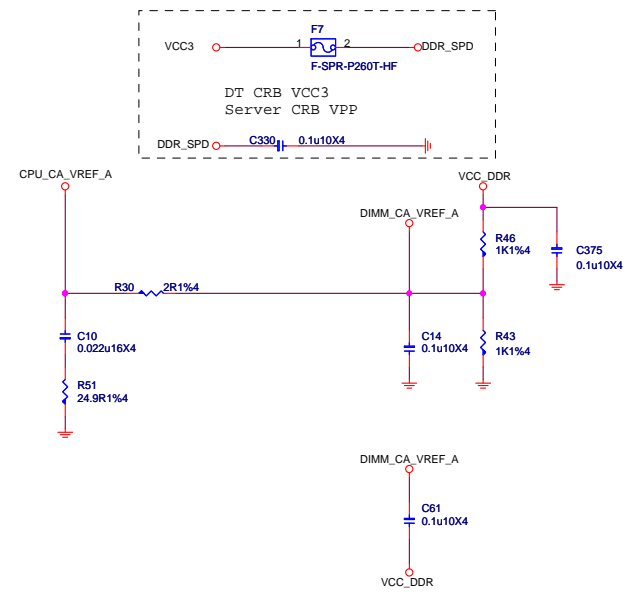
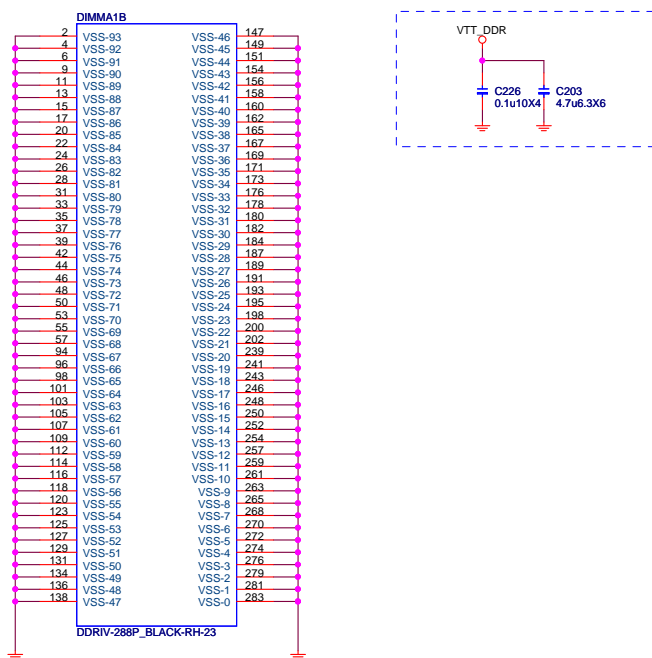
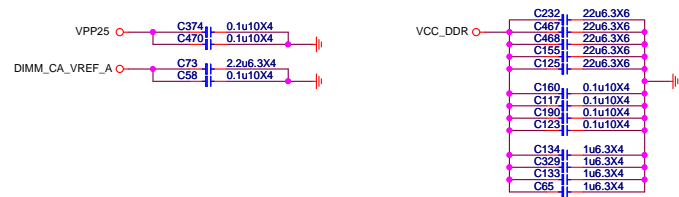
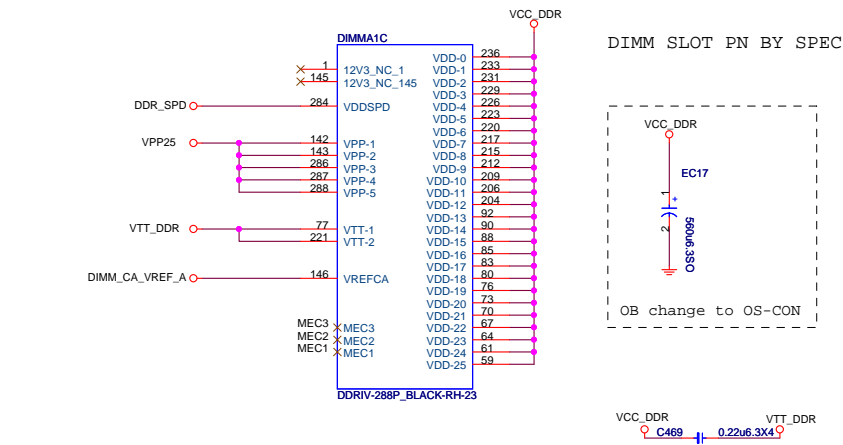


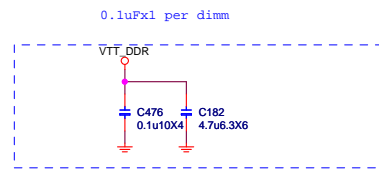
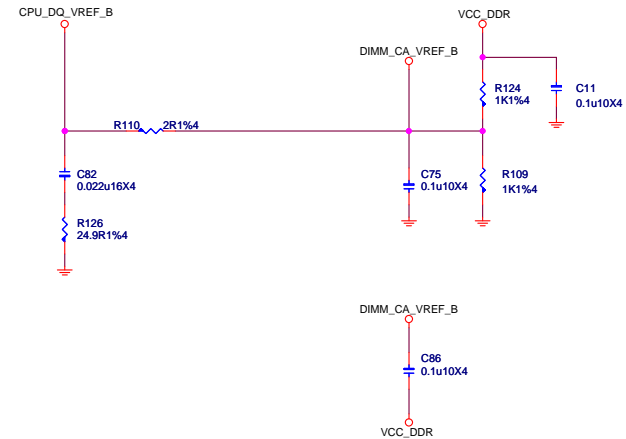
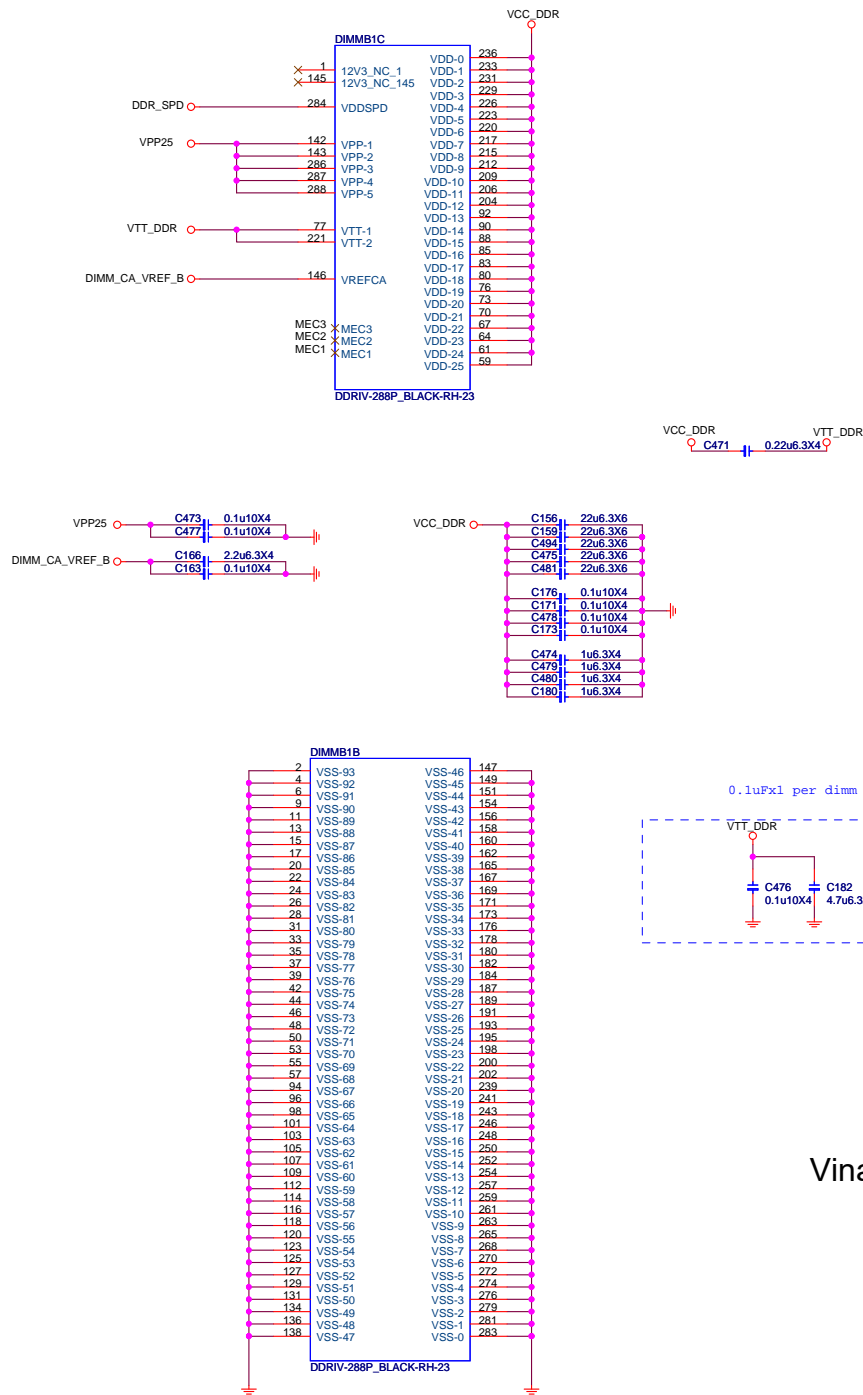




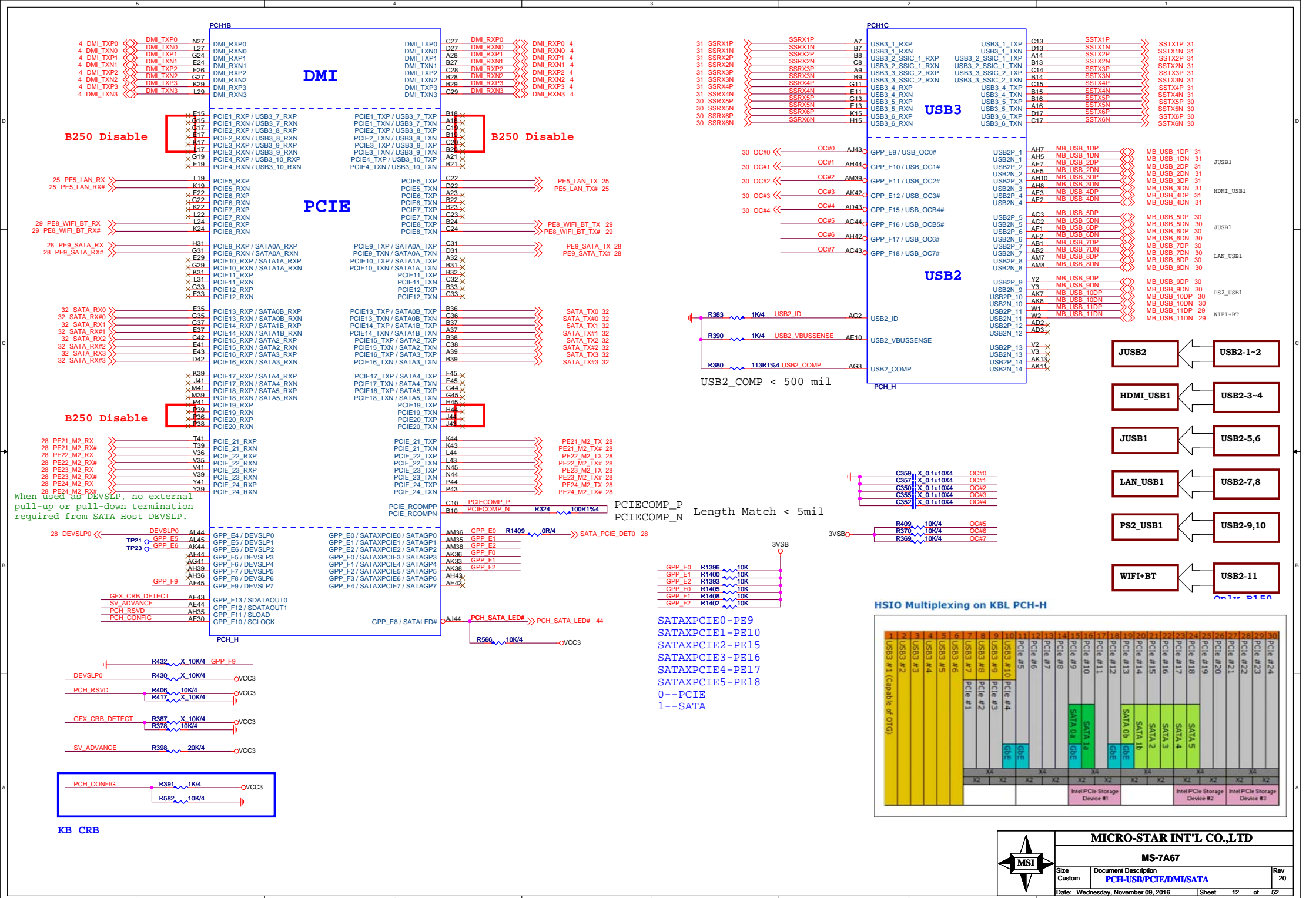


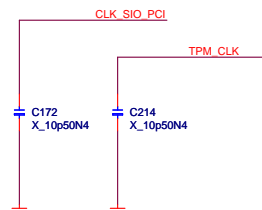
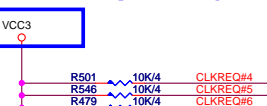
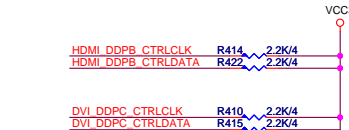




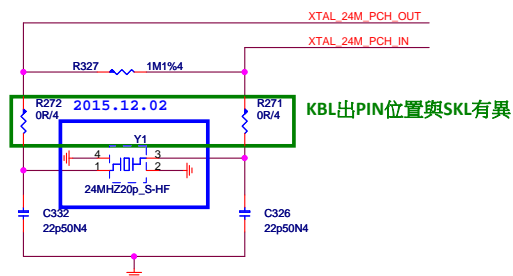


Vinafix.com

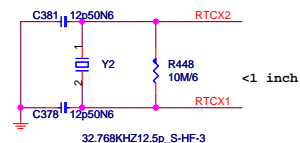




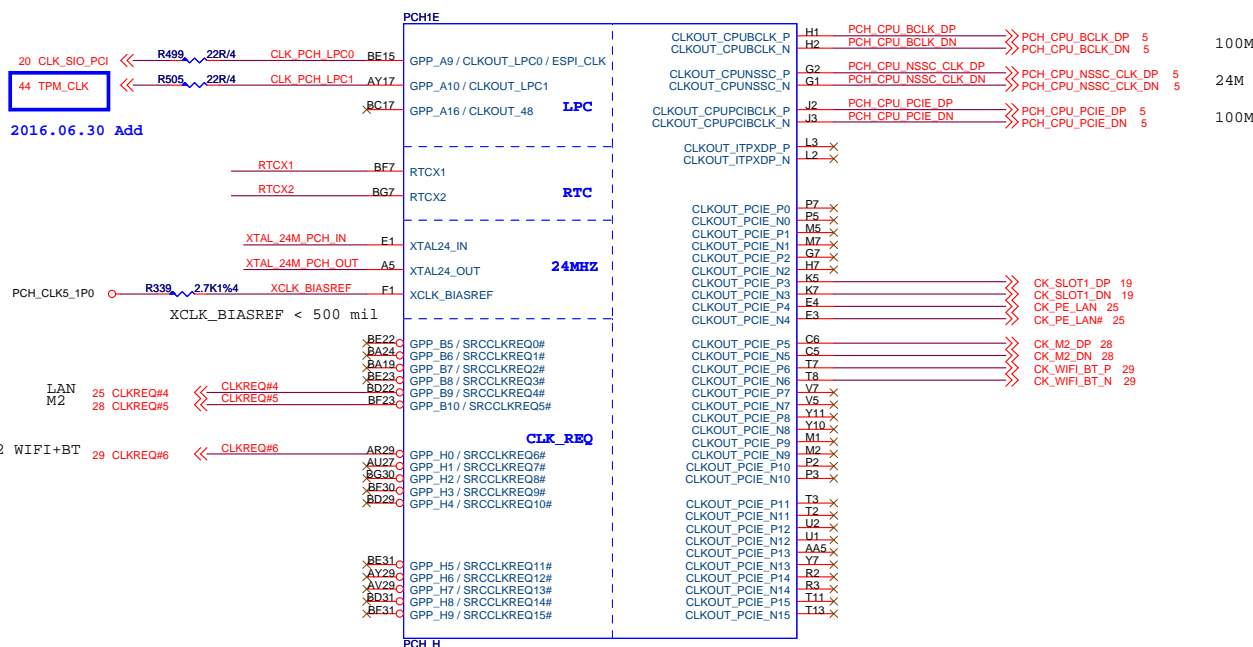
Comntact to SLOT Pin B12
for support L1 PM Substates
ME also can disable this funtion.



Close to PCH



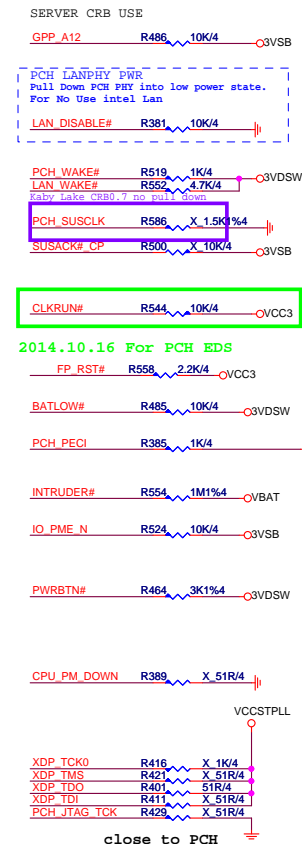
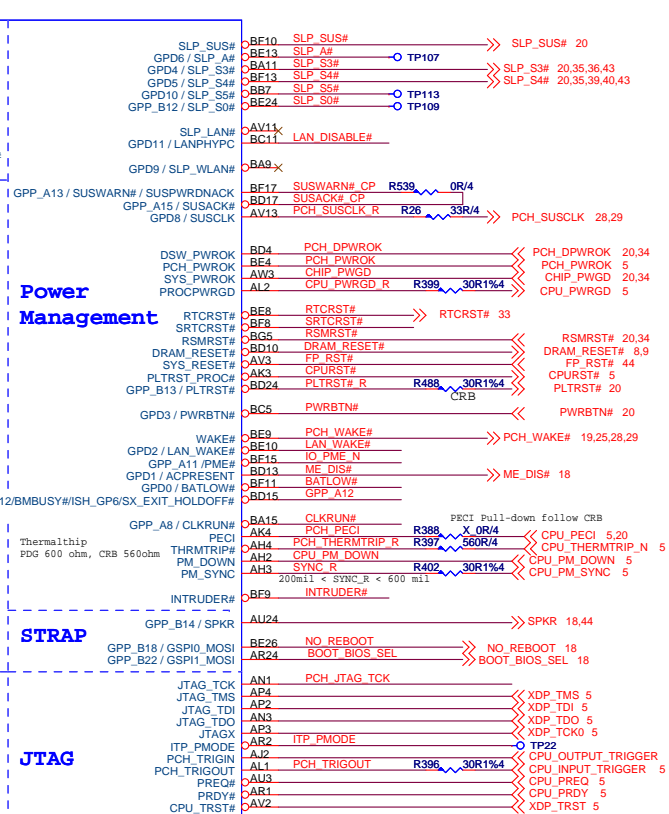
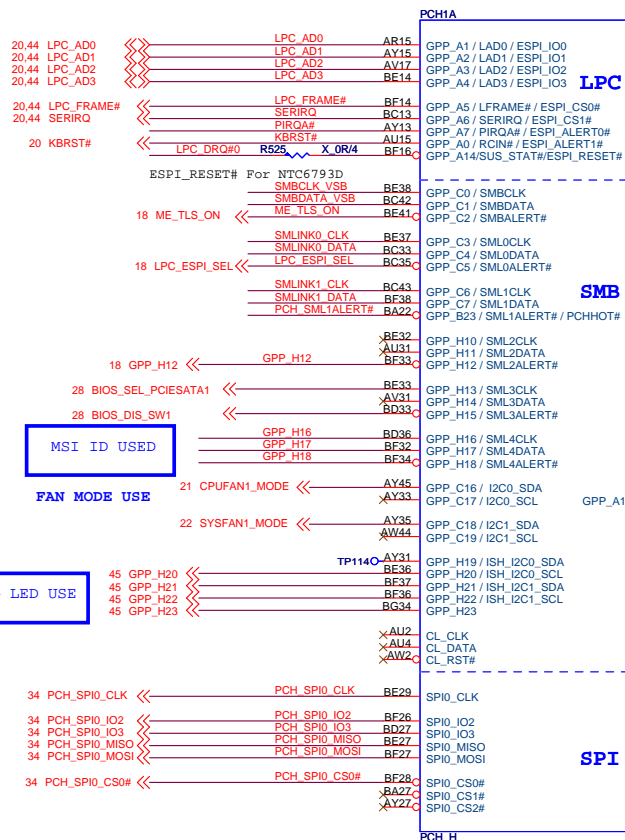
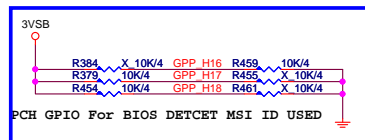
teknisi indonesia



MICRO-STAR INT'L CO.,LTD

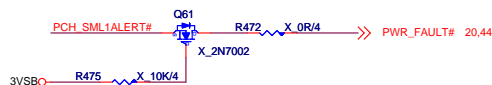
MS-7A67

| | | |
|------------------------------------|--|-----------|
| Size Custom | Document Description PCH-Audio/Display/Clock | Rev 20 |
| Date: Wednesday, November 09, 2016 | Sheet 13 of 52 | |

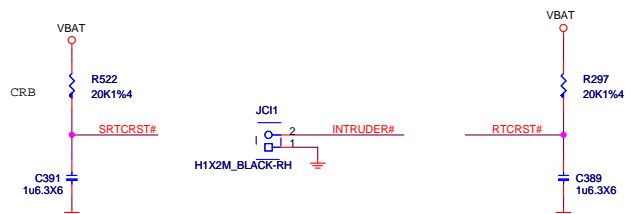


Vinafix.com

PCH Thermal Monitor

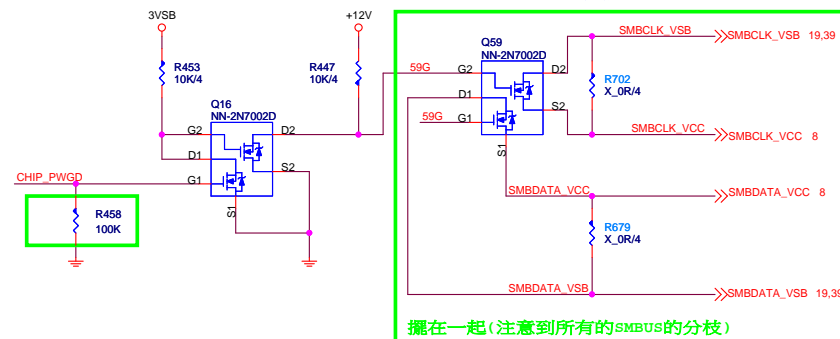


當溫度高於設定之後，此信號會被拉LOW。
PS: 只能在S0下使用，S5 不會有功能



SMBUS隔離線路(PCH接出來是PULL HIGH 3VSB)
需要再S3/S5底下動作的接SMBCLK_VSB/SMBDATA_VSB
不需要的接SMBCLK_VCC/SMBDATA_VCC

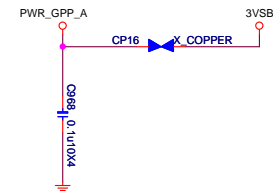
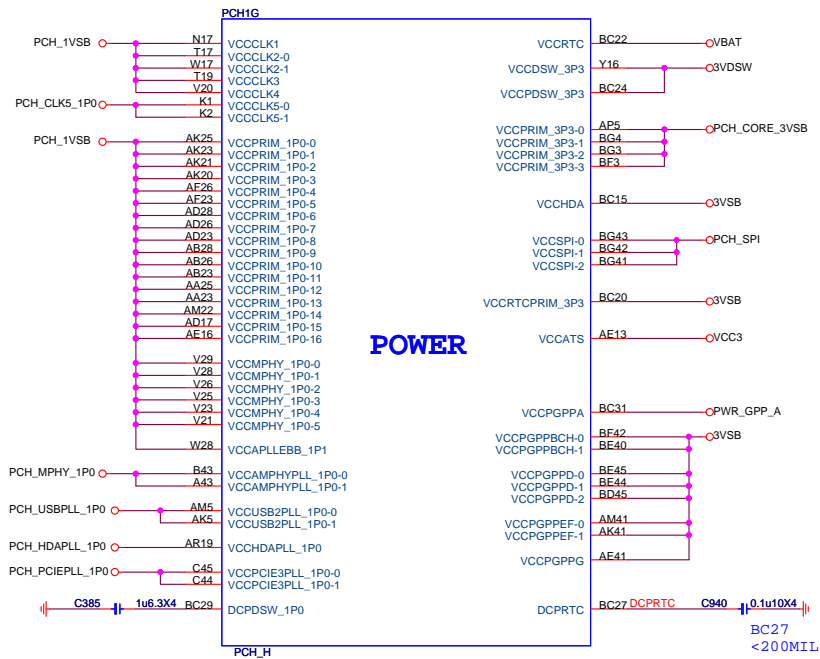
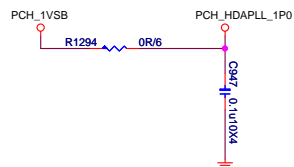
基本上PCIE的SLOT要接
3VSB的CPU的PWM IC/DDR
要接VCC3的其他的請注意
要怎麼接



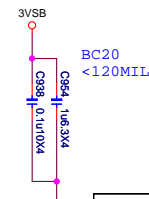
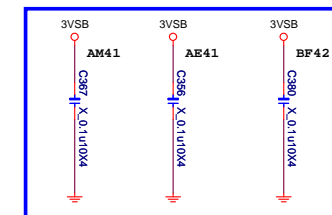
MICRO-STAR INT'L CO.,LTD

MS-7A67

| | | |
|------------------------------------|---|----------------|
| Size Custom | Document Description PCH-LPC/SPI/SMBUS/MISC | Rev 20 |
| Date: Wednesday, November 09, 2016 | | Sheet 15 of 52 |



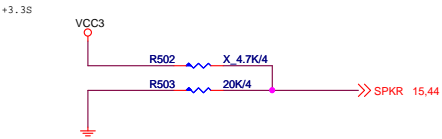
Kabylake?



| | | |
|------------------------------------|--|----------------|
| Size Custom | Document Description PCH-Power | Rev 20 |
| Date: Wednesday, November 09, 2016 | | Sheet 16 of 52 |

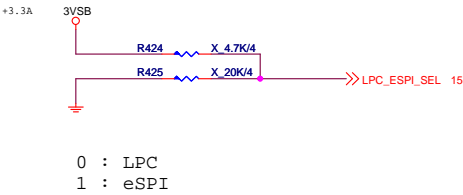
VSS

TOP Swap



Internal pull-down 20K is disabled after PLTRST#

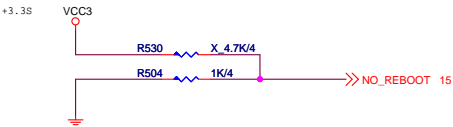
LPC eSPI Mode



0 : LPC
1 : eSPI

Internal pull-down 20K is disabled after RSMRST

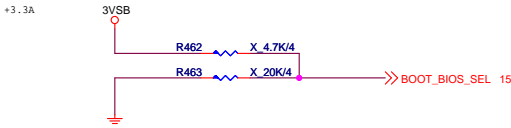
No Reboot



0 : DISABLE (Default)
1 : ENABLE

Internal pull-down 20K is disabled after PLTRST#

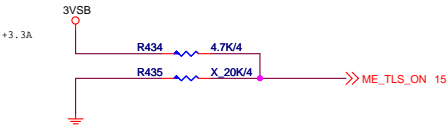
Boot BIOS



0 : SPI
1 : LPC

Internal pull-down 20K is disabled after PLTRST

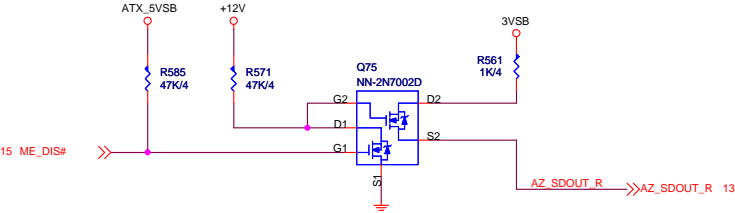
AMT and SBA with confidentiality



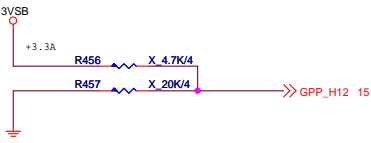
0 : DISABLE
1 : ENABLE (Default)

Internal pull-down 20K is disabled after RSMRST

HDA_SDO



ESPI FLASH SHARING MODE



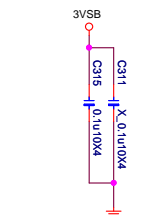
0 : MASTER ATTACHED FLASH SHARING
1 : SLAVE ATTACHED FLASH SHARING

Internal pull-down 20K is disabled after RSMRST



| MICRO-STAR INT'L CO.,LTD | | |
|--------------------------|------------------------------|----------------|
| MS-7A67 | | |
| Size | Document Description | Rev |
| Custom | PCH-Strap | 20 |
| Date: | Wednesday, November 09, 2016 | Sheet 18 of 52 |

2015.12.03



1.0 Remove PCIE SLOT LED



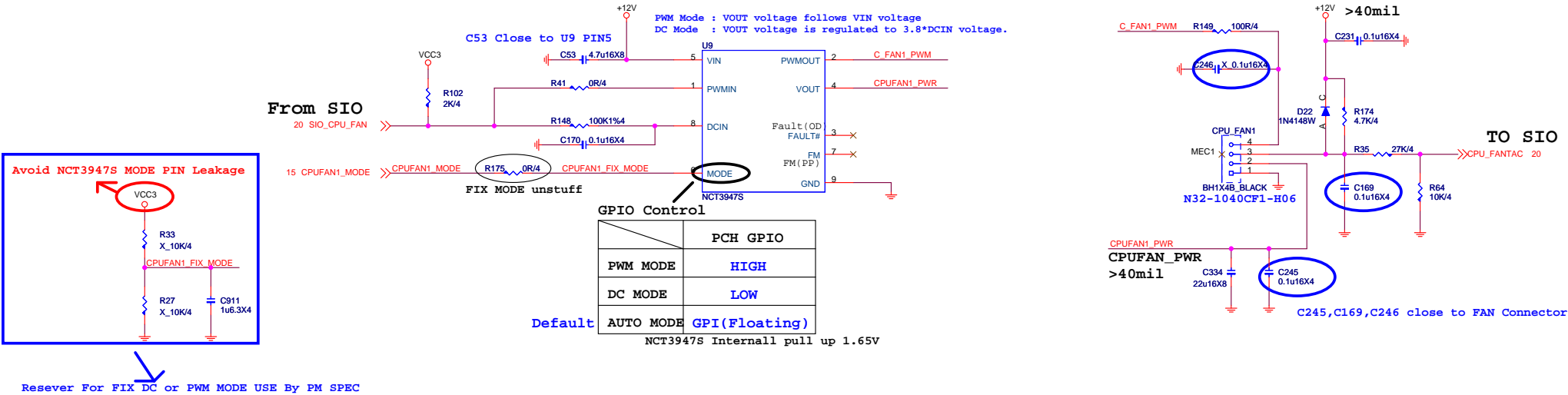
MS-7A67

| | |
|--|-----------|
| | Rev 20 |
|--|-----------|

| | |
|------------------------------------|----------------|
| Date: Wednesday, November 09, 2016 | Sheet 19 of 52 |
|------------------------------------|----------------|

TYPE K : 4 PIN CPU FAN USE NCT3947S USE PCH GPIO CONTROL FAN MODE

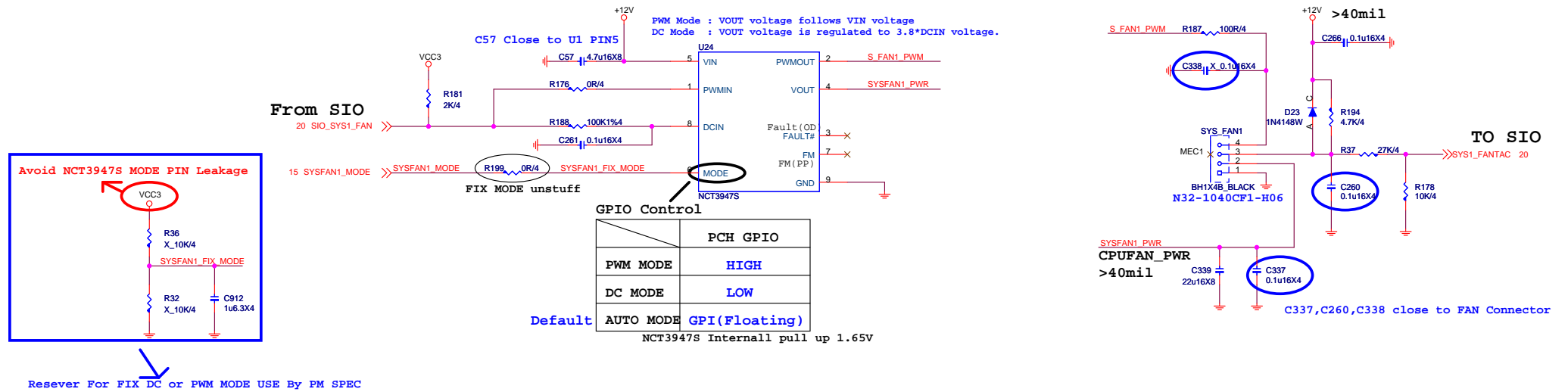
2.GPIO可以由BIOS切换 PWM/DC MODE



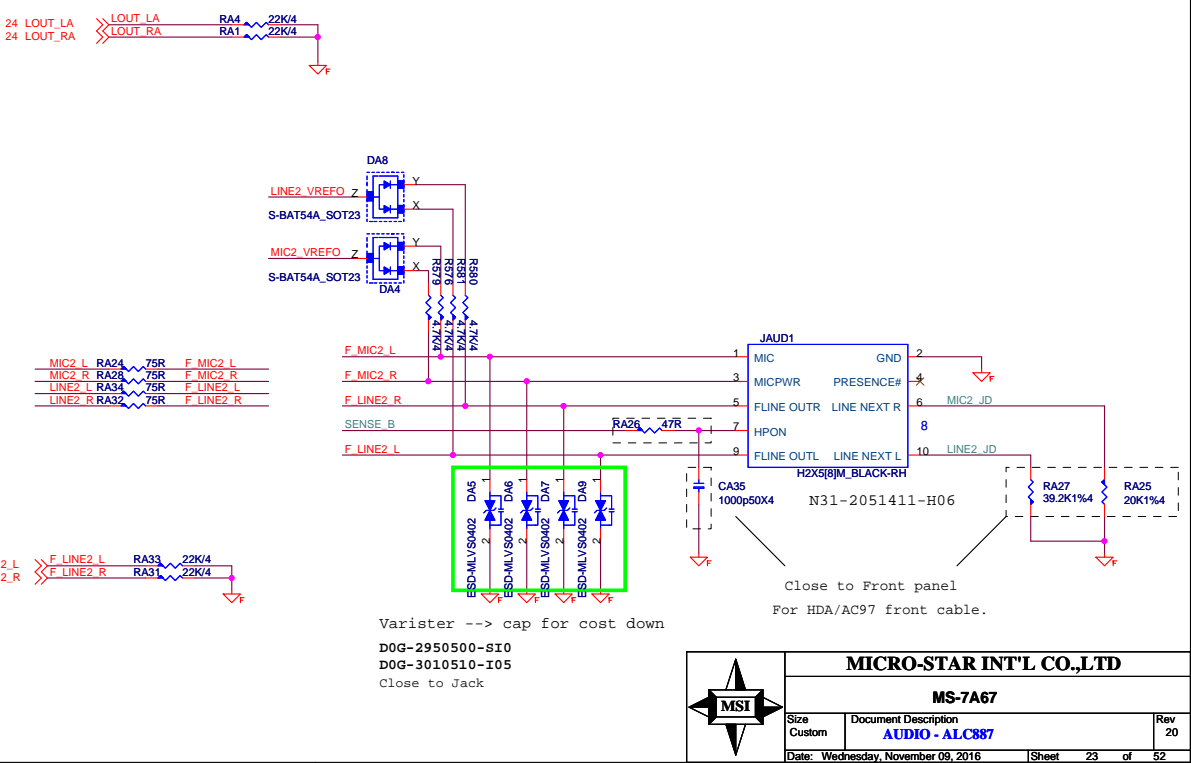
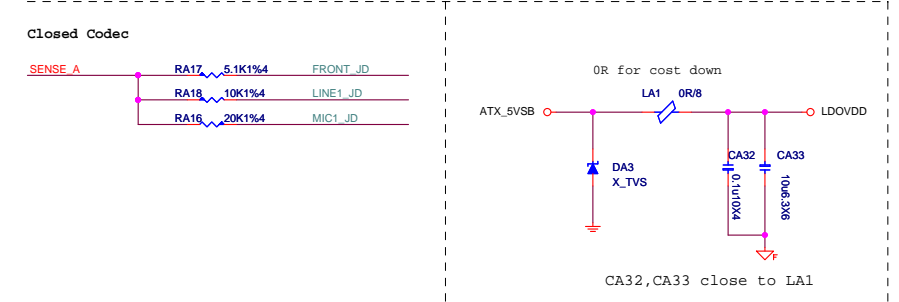
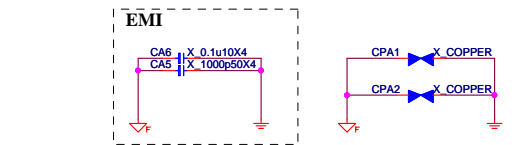
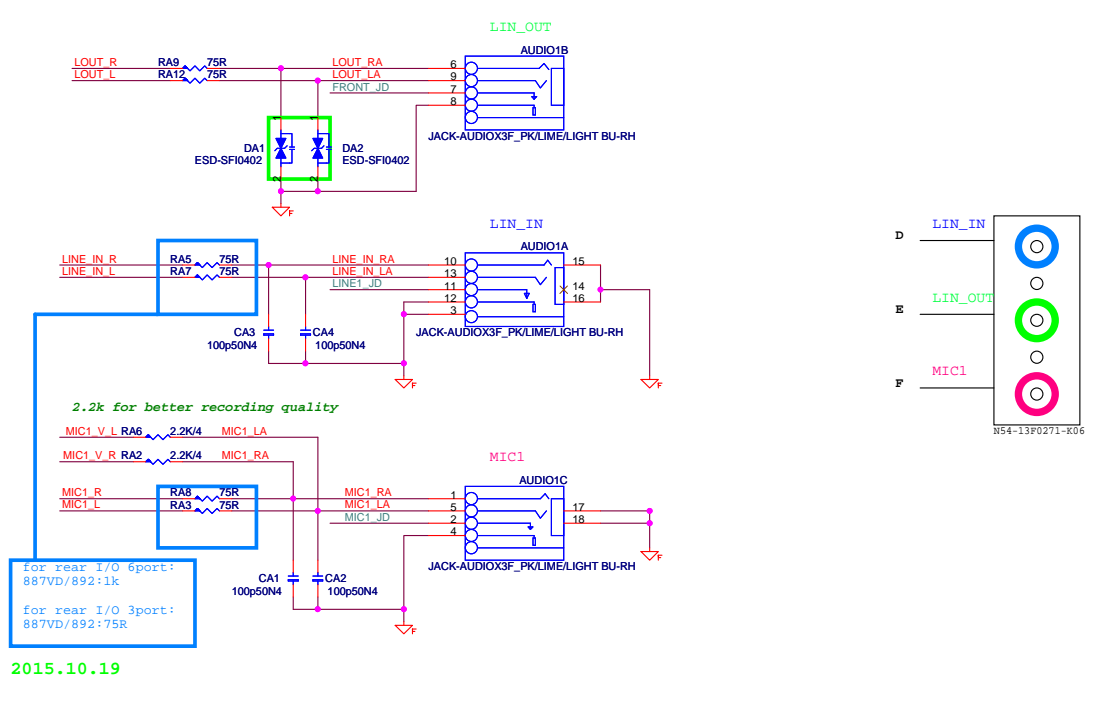
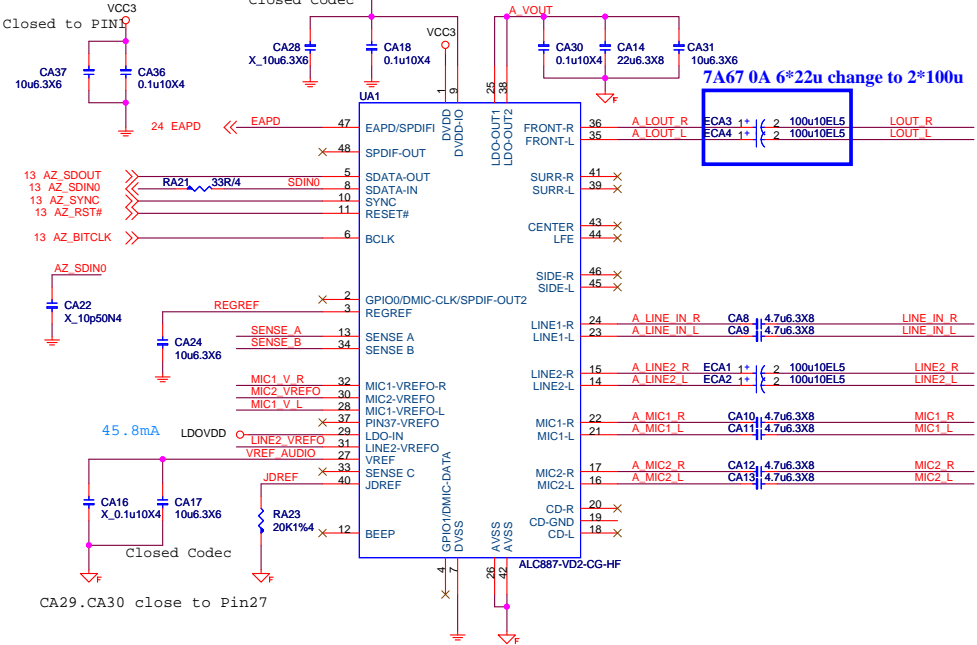
Vinafix.com

TYPE K : 4 PIN CPU FAN USE NCT3947S USE PCH GPIO CONTROL FAN MODE

2.GPIO可以由BIOS切換 PWM/DC MODE

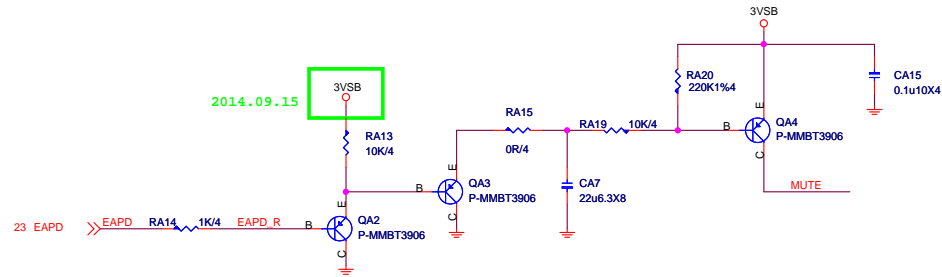


Type B:
ALC892/887



Rear Line OUT De-POP circuit

De-pop circuit for Rear Line out & Front Headphone out)

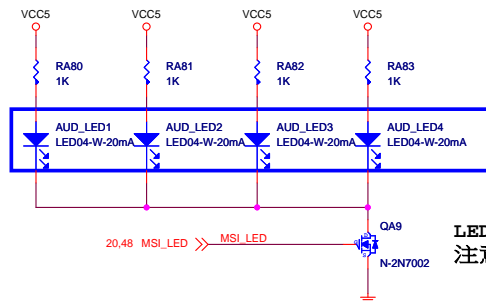


Digital

Analog



Audio LED



LED的數量需參考各案子的layout placement
注意LED導通電流總和是否會超過MOS的最大電流

紅 : D0C-040S600-E07
colay 白 : M:D0C-040T300-H91/S:D0C-040S300-E07

History:

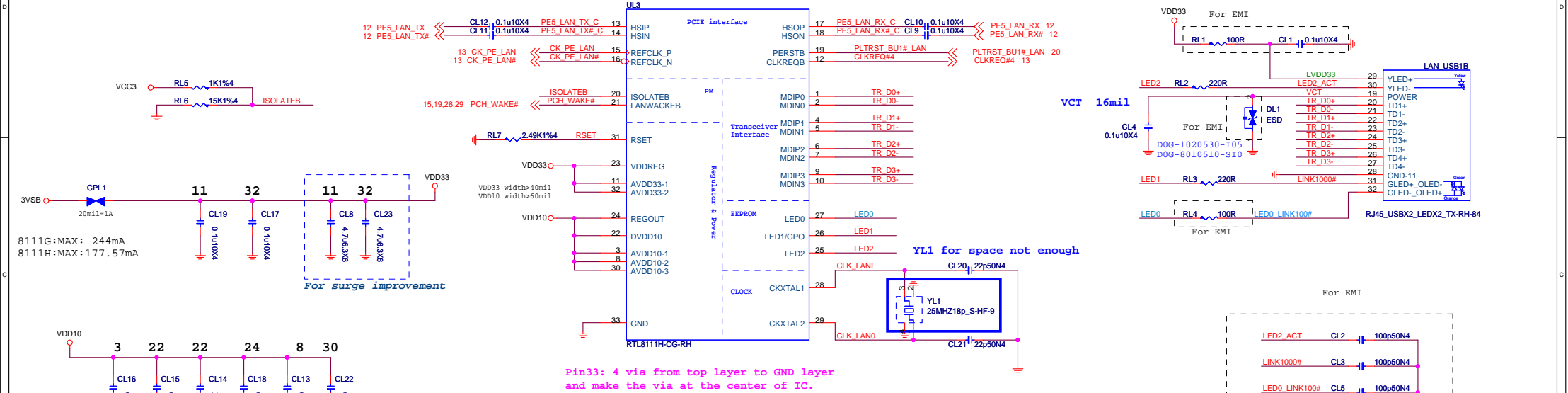
2014/02/13: stuff de-pop circuit of Line out & HP out.

Vinafix.com

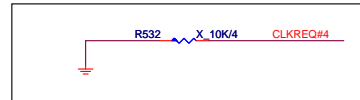
RTL8111G/RTL8111H Giga LAN

8111H:B06-08111CC-R09
8111G:B06-081116C-R09

LAN Connector



For module unstuff



8111G POWER Consumption

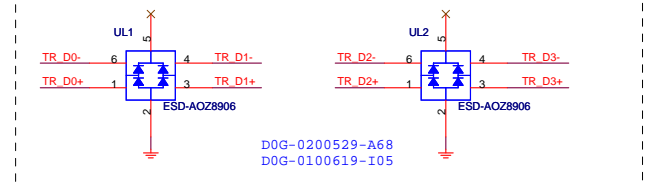
| | 3.3V @ mA | mW |
|-----------------|-------------|-------------|
| 10 M Idle/TxRx | 17.15/116.7 | 56.6/385.1 |
| 100 M Idle/TxRx | 71.45/129.5 | 235.8/427.4 |
| Giga Idle/TxRx | 179.1/243.9 | 591/804.9 |
| ALDPS | 6.41 | 21.15 |

8111H POWER Consumption

| | 3.3V @ mA | mW |
|-----------------|--------------|---------------|
| 10 M Idle/TxRx | 9.9/84.69 | 32.67/279.48 |
| 100 M Idle/TxRx | 48.11/92.44 | 158.76/305.05 |
| Giga Idle/TxRx | 124.5/177.57 | 410.85/585.98 |
| ALDPS | 5.50 | 18.15 |

ESD Protect

UL1&UL2 close to connector



D0G-0200529-A68
D0G-0100619-I05



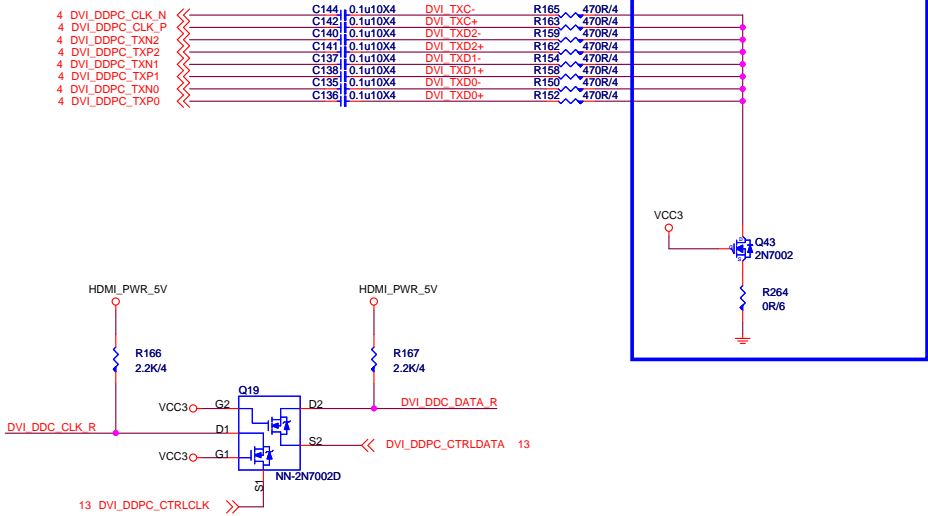
MICRO-STAR INT'L CO.,LTD

MS-7A67

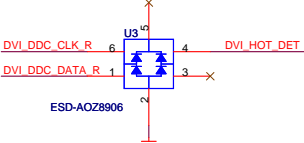
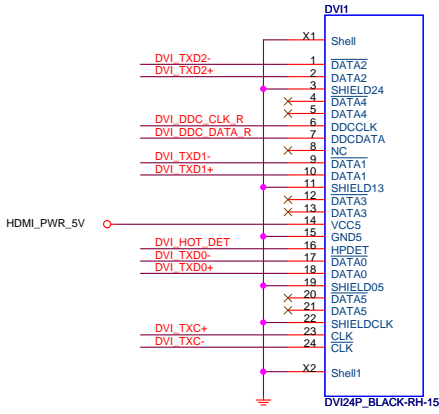
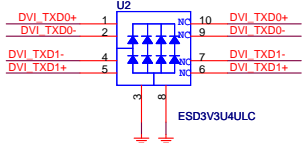
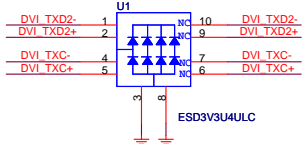
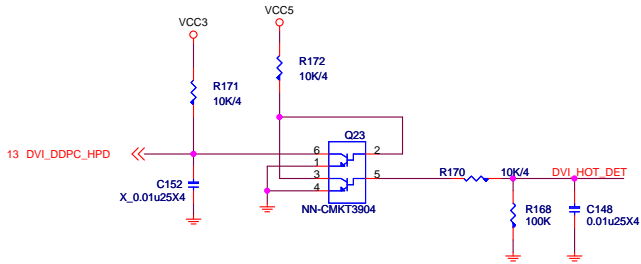
| Size | Document Description | Rev |
|------------------------------------|----------------------|-----|
| Custom | LAN - RTL8111H | 20 |
| Date: Wednesday, November 09, 2016 | Sheet 25 of 52 | |

DVI max resolution is 1920x1200 @ 60 Hz

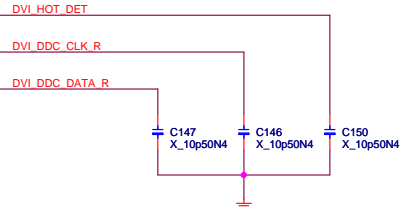
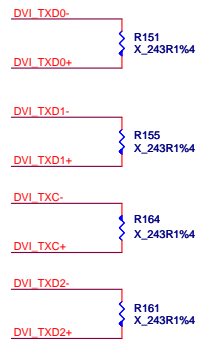
7A67 0A change



HPD



For EMI

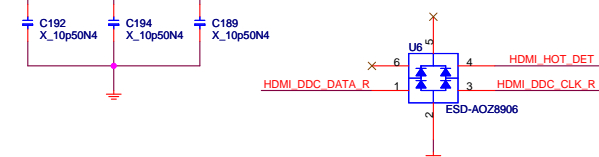
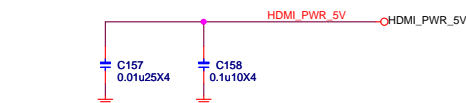
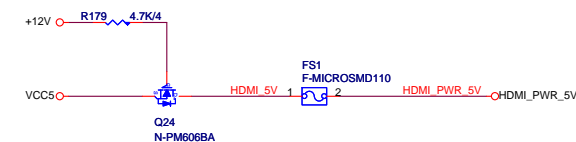
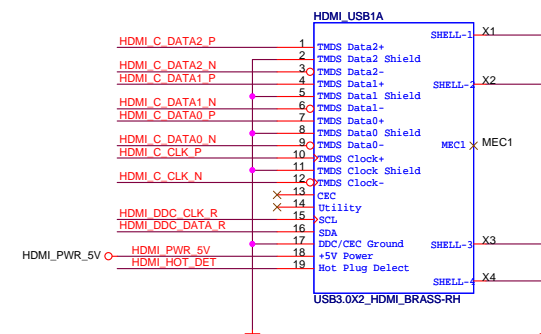
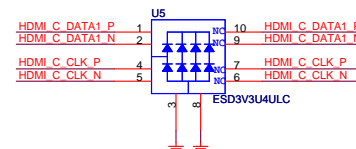
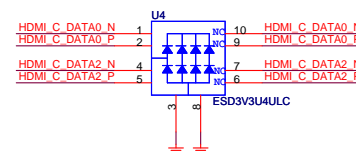
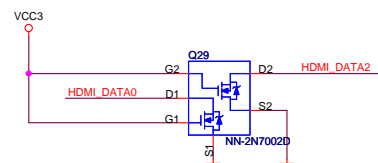
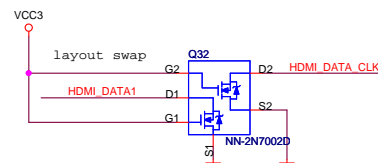
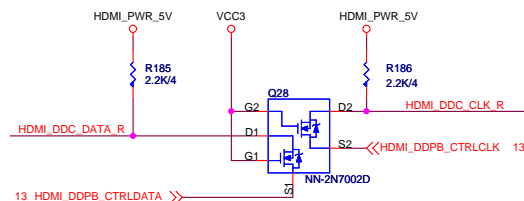
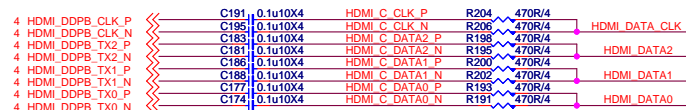


MICRO-STAR INT'L CO.,LTD

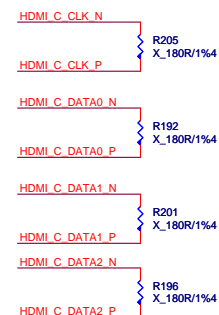
MS-7A67

| | | |
|------------------------------------|----------------------|-----|
| Size | Document Description | Rev |
| Custom | DVI Connector | 20 |
| Date: Wednesday, November 09, 2016 | Sheet 26 of 52 | |

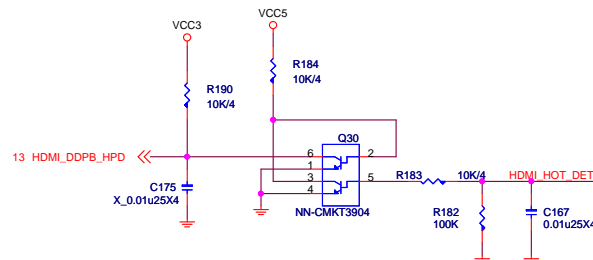
The HDMI* interface supports HDMI with 3D, 4Kx2K@24Hz, Deep Color, and x.v.Color.




For EMI

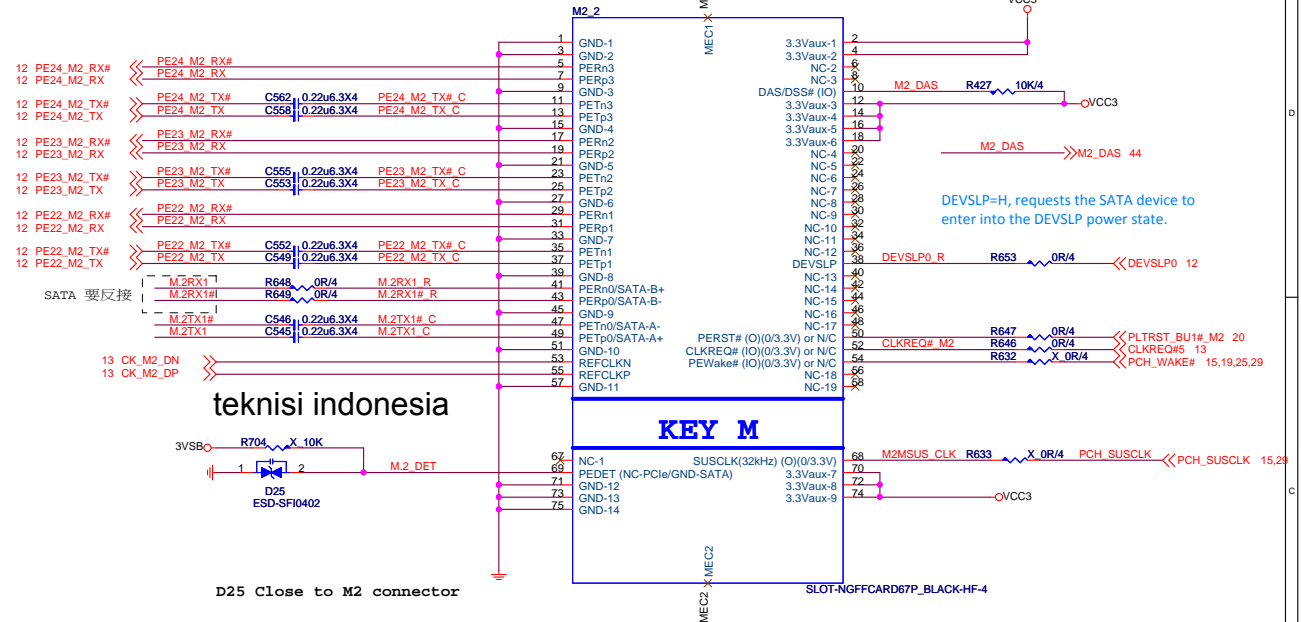
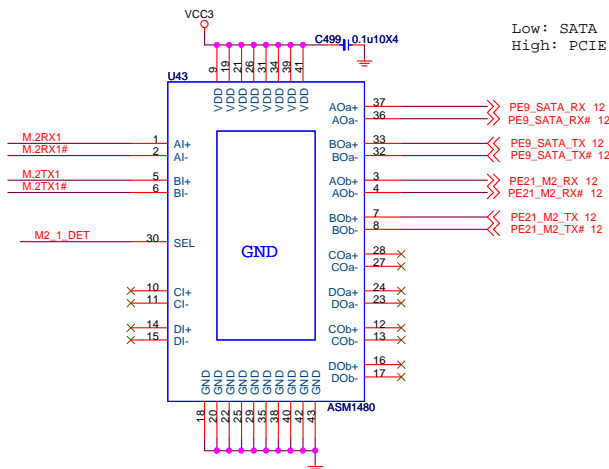


HPD



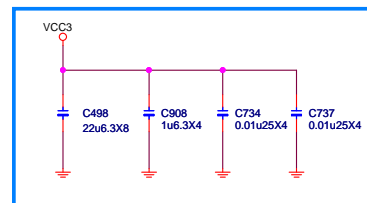
Vinafix.com

| | | | |
|---|--------------------------|-------------------------------------|--------|
|  | MICRO-STAR INT'L CO.,LTD | | |
| | MS-7A67 | | |
| | Size Custom | Document Description HDMI Connector | Rev 20 |
| Date: Wednesday, November 09, 2016 | | Sheet 27 | of 52 |

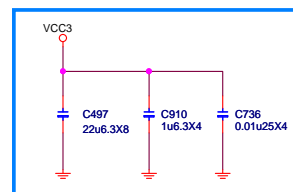


M.2 VCC3>=2.5A

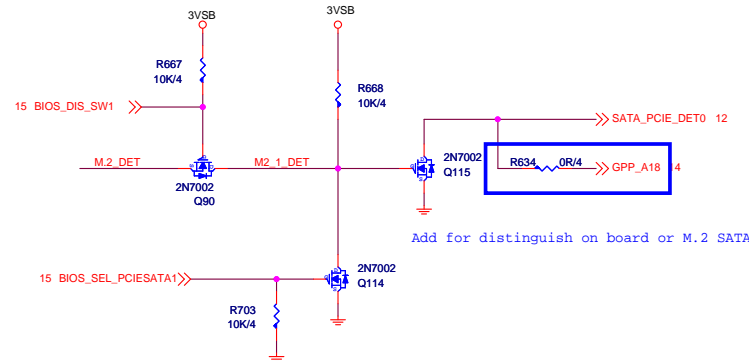
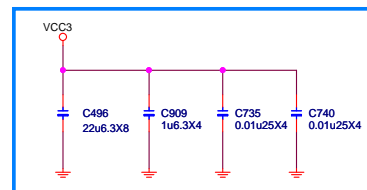
Near Pin2,Pin4



Near Pin12,Pin14,Pin16,Pin18

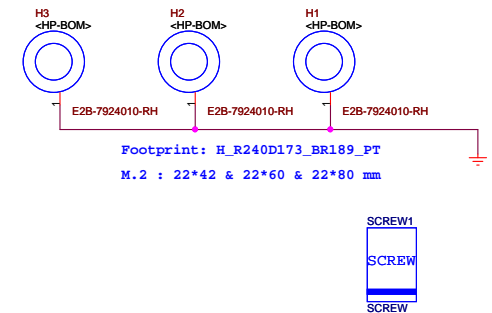


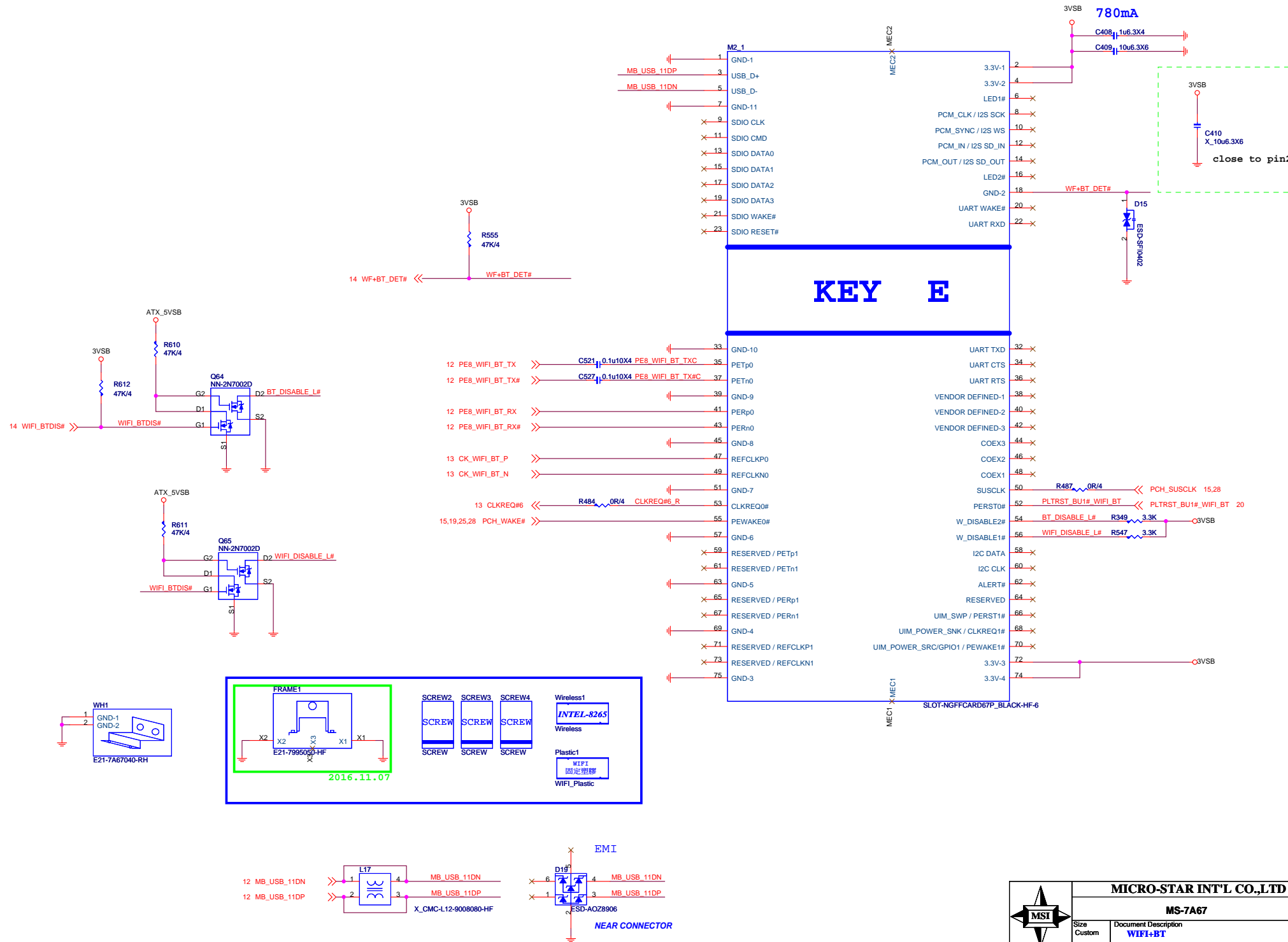
Near Pin70,Pin72,Pin74



BIOS_MODE

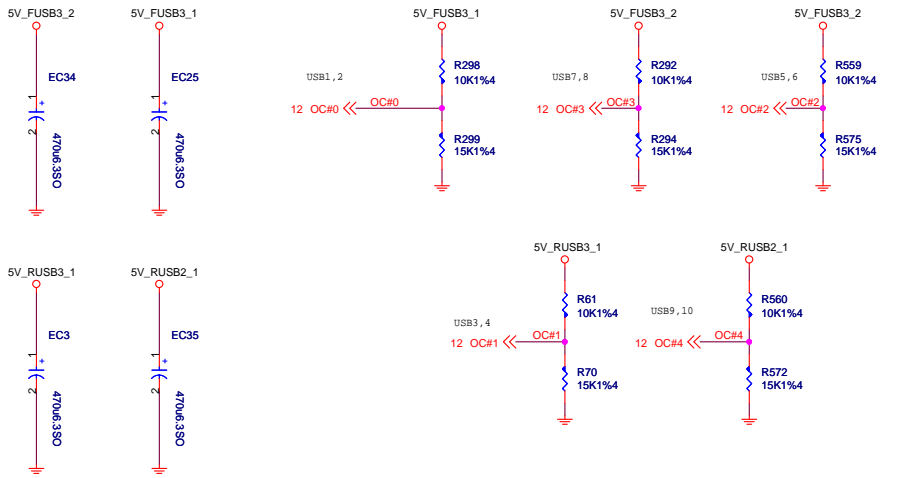
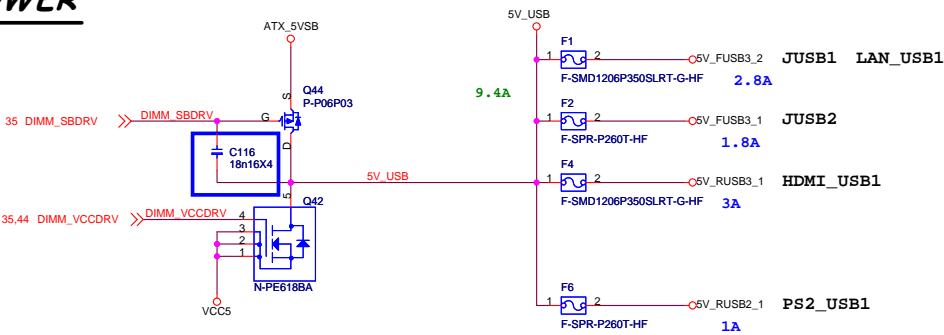
| BIOS_DIS_SW1 | BIOS_SEL_PCIESATA1 | Mode |
|--------------|--------------------|---------|
| 0 | 1 | M2-SATA |
| 0 | 0 | M2-PCIE |
| GPI | GPI | AUTO |



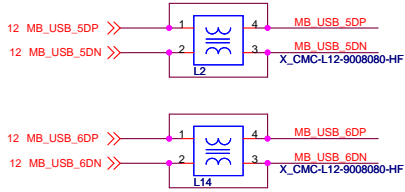


USB POWER

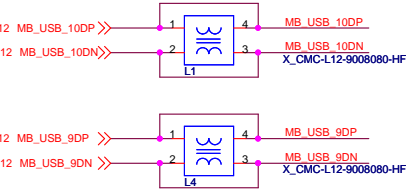
1.0 change to P&N MOS



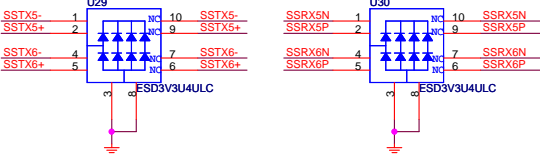
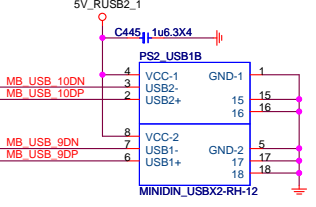
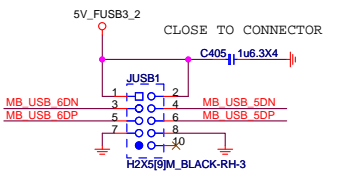
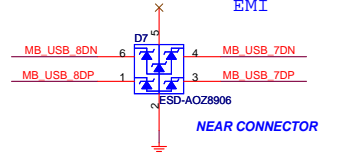
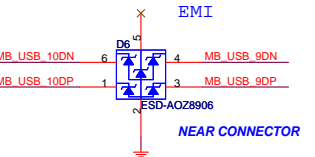
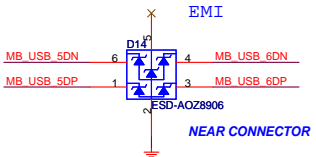
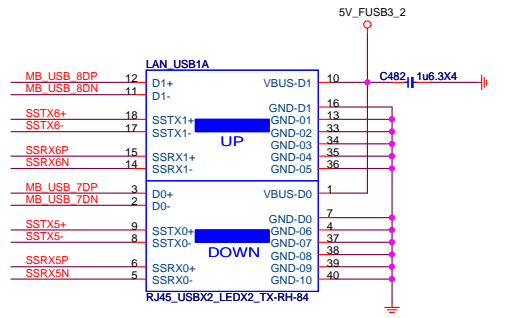
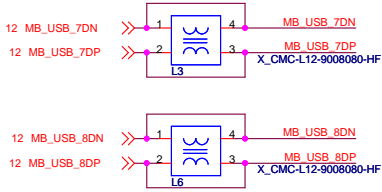
FRONT USB PORT 5,6



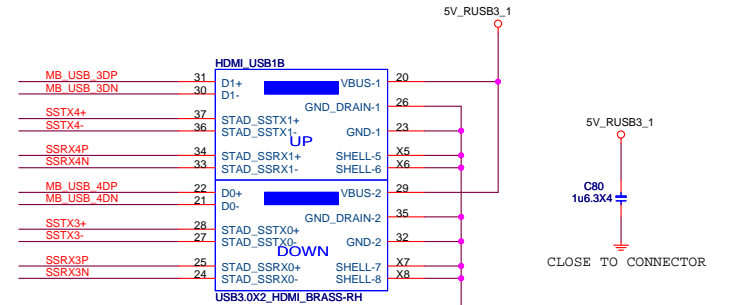
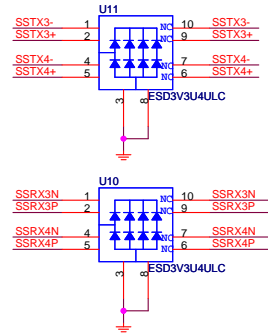
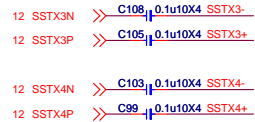
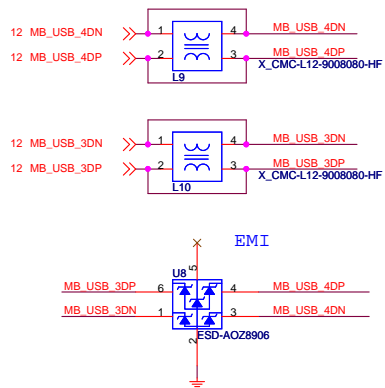
FRONT USB PORT 9,10



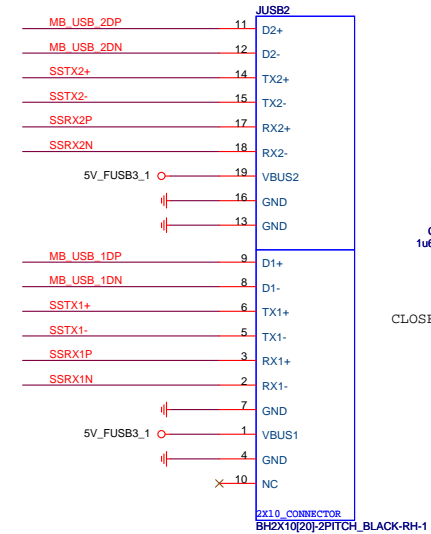
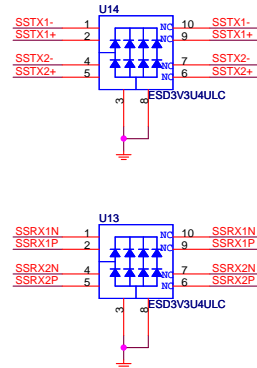
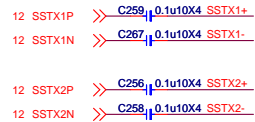
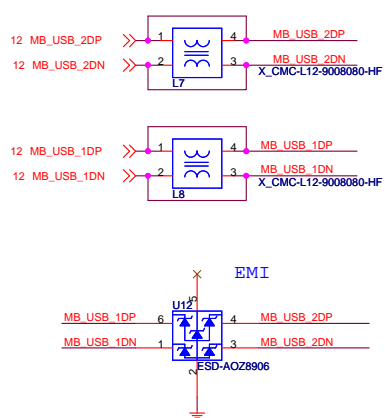
FRONT USB PORT 7,8 + USB3 PORT 5,6



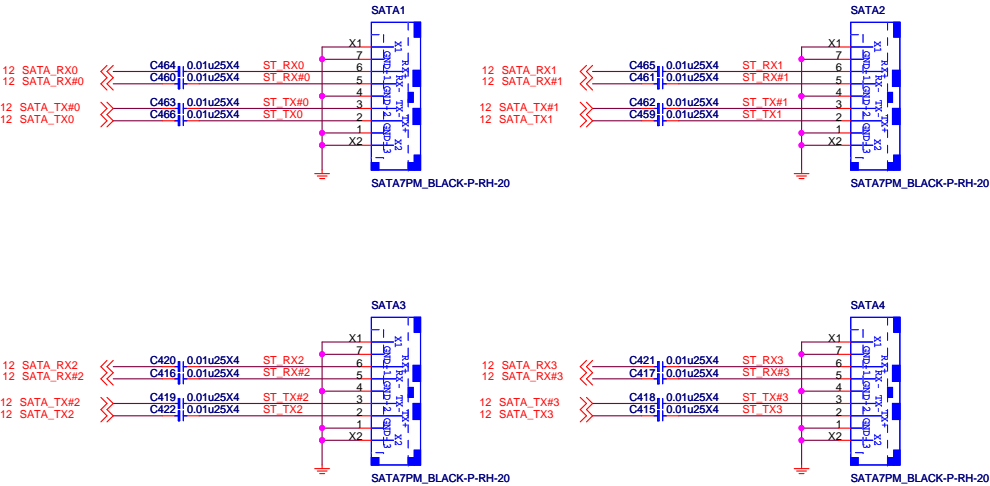
Vinafix.com



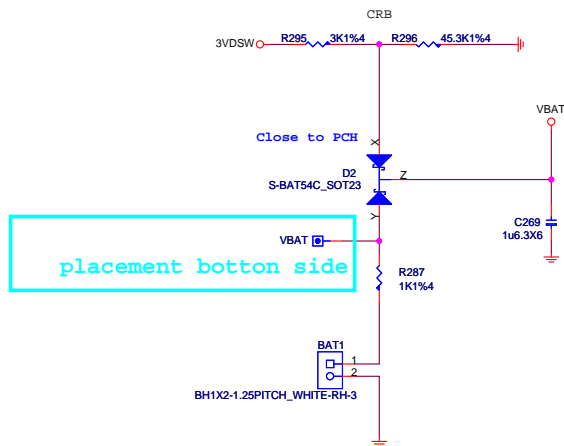
2016.10.18 7A67 1.0 remove VR function



SATA GEN3



Vinafix.com



| Function 1 | | |
|------------|--------|---------|
| IN | | OUT |
| INPUT1 | INPUT2 | OUTPUT1 |
| 0 | 1 | 1 |
| 1 | 0 | 0 |
| 1 | 1 | 0 |
| 0 | 0 | 0 |

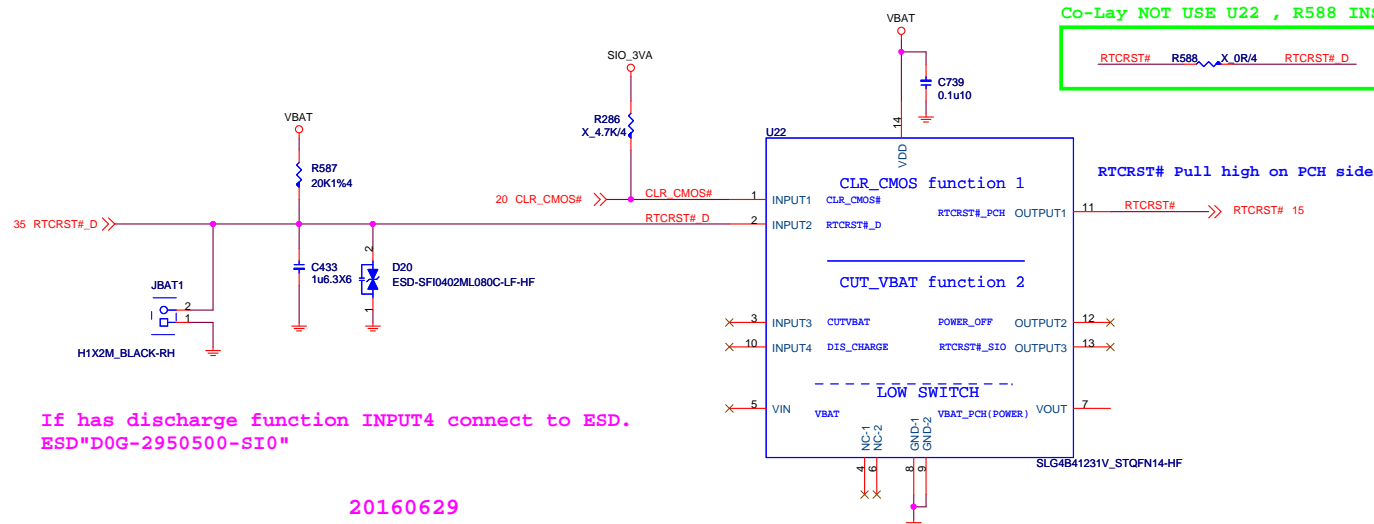
Default

BIOS MODE

If INSTALL R588 Please Check RTCRST# Double Pull High

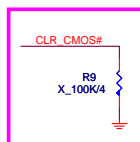
Co-Lay NOT USE U22 , R588 INSTALL

RTCRST# R588 X 0R/4 RTCRST#_D



If has discharge function INPUT4 connect to ESD.
ESD"D0G-2950500-SIO"

20160629

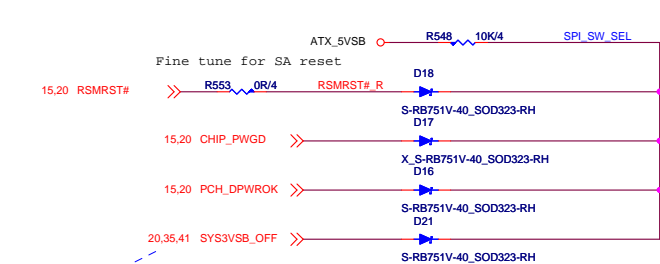


MICRO-STAR INT'L CO.,LTD

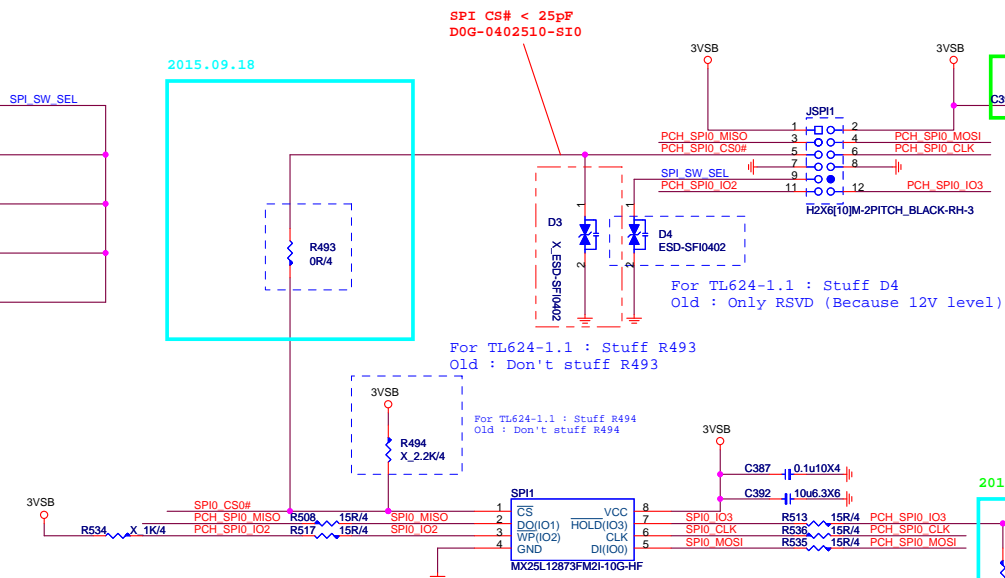
MS-7A67

| | | |
|------------------------------------|--|-----------|
| Size Custom | Document Description CLR_CMOS circuit | Rev 20 |
| Date: Wednesday, November 09, 2016 | Sheet 33 of 52 | |

15 PCH_SPI0_MOSI << PCH_SPI0_MOSI
 15 PCH_SPI0_MISO << PCH_SPI0_MISO
 15 PCH_SPI0_CLK << PCH_SPI0_CLK
 15 PCH_SPI0_CS0# << PCH_SPI0_CS0#
 15 PCH_SPI0_IO2 << PCH_SPI0_IO2
 15 PCH_SPI0_IO3 << PCH_SPI0_IO3



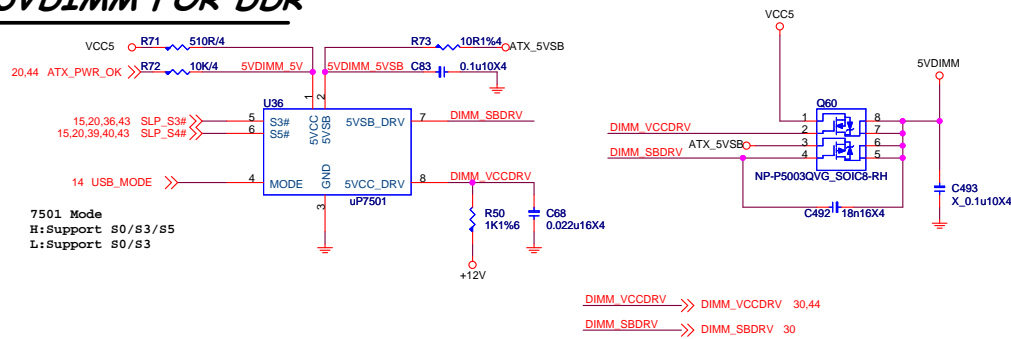
For TL624-1.1 (SKYLAKE)
 In skylake,PCH core is powered by VSB which need sink RSMRST# to low by SPI_SW_SEL.



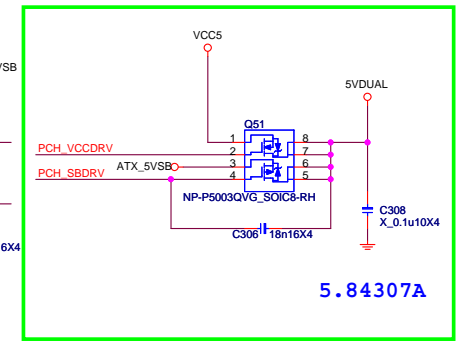
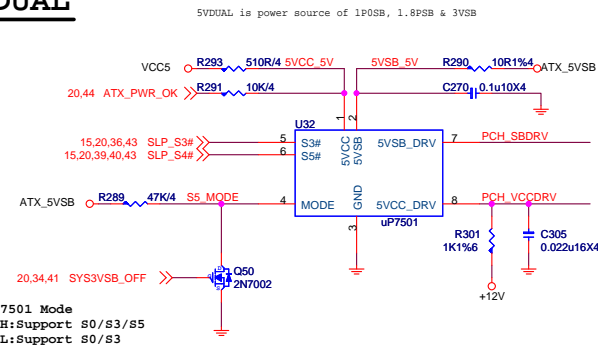
- * if you not support Standby power in S5 Status, component Q14.G Pull-high to +12V & Q14 MOS select 2N7002
- * if you support Standby power in S5 Status(Ex; PCH is B75 Chipset) , component Q14.G Pull-high to ATX_5VSB , Q14 must select "Vth" under 1V (Component Suggestion as below)

D03-0341409-A68 / D03-0230019-A30

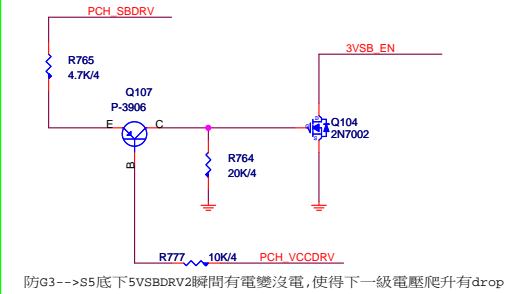
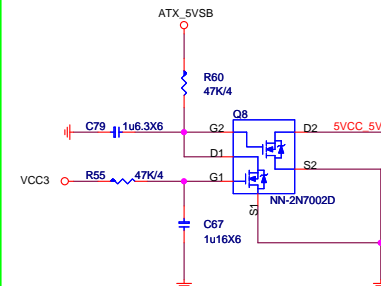
5VDIMM FOR DDR



5VDUAL



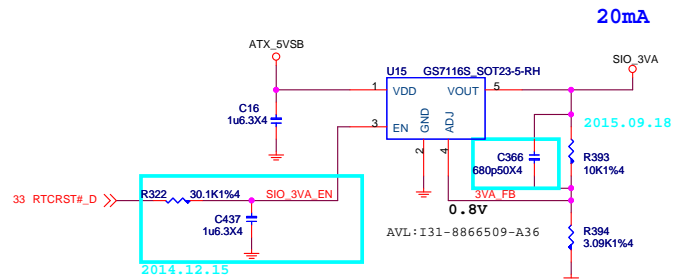
For power 700W solution (only for uP7501+uP7506 for 3VSB solution)
The power supply VCC3 delay 12ms after VCC5 assert.
The chip U7501 PCH_VCCDRV work when the VCC5 ready
(When VCC5 up to 4.2V and the 5VDRV1 delay 6ms assert), but
VCC3 not ready and let the 3VSB sequence fail.



防G3-->S5底下5VSBDRV2瞬間有電變沒電,使得下一級電壓爬升有drop

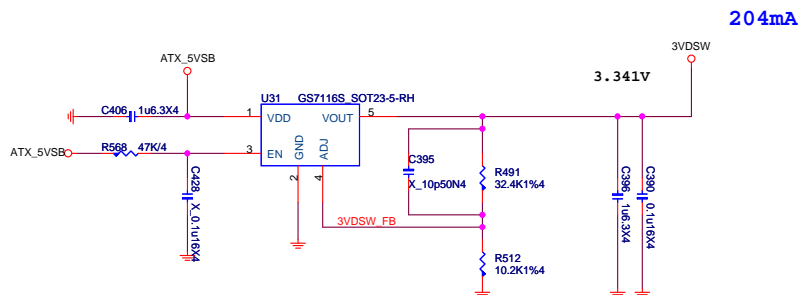
teknisi indonesia

SIO_3VA

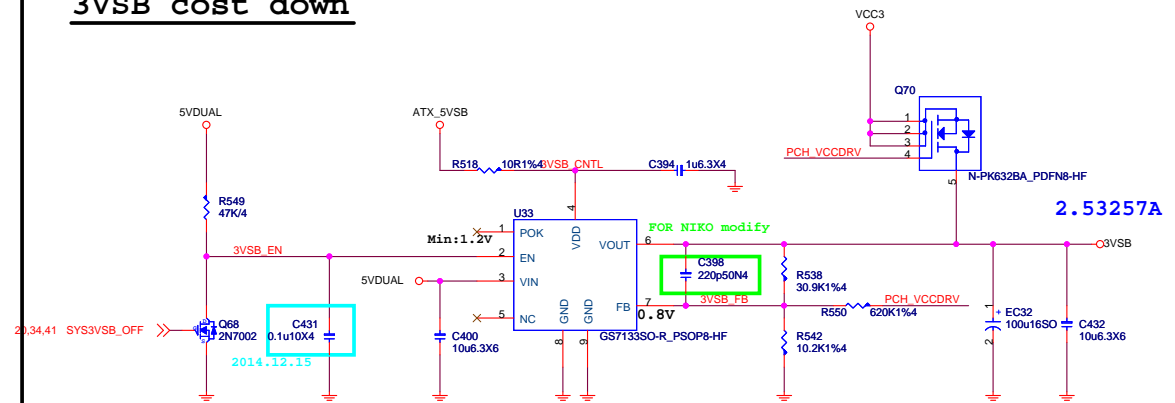


3VDSW

2016.07.25 Modify to GS7116



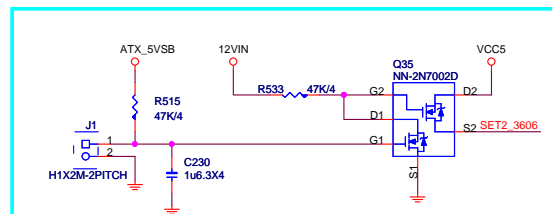
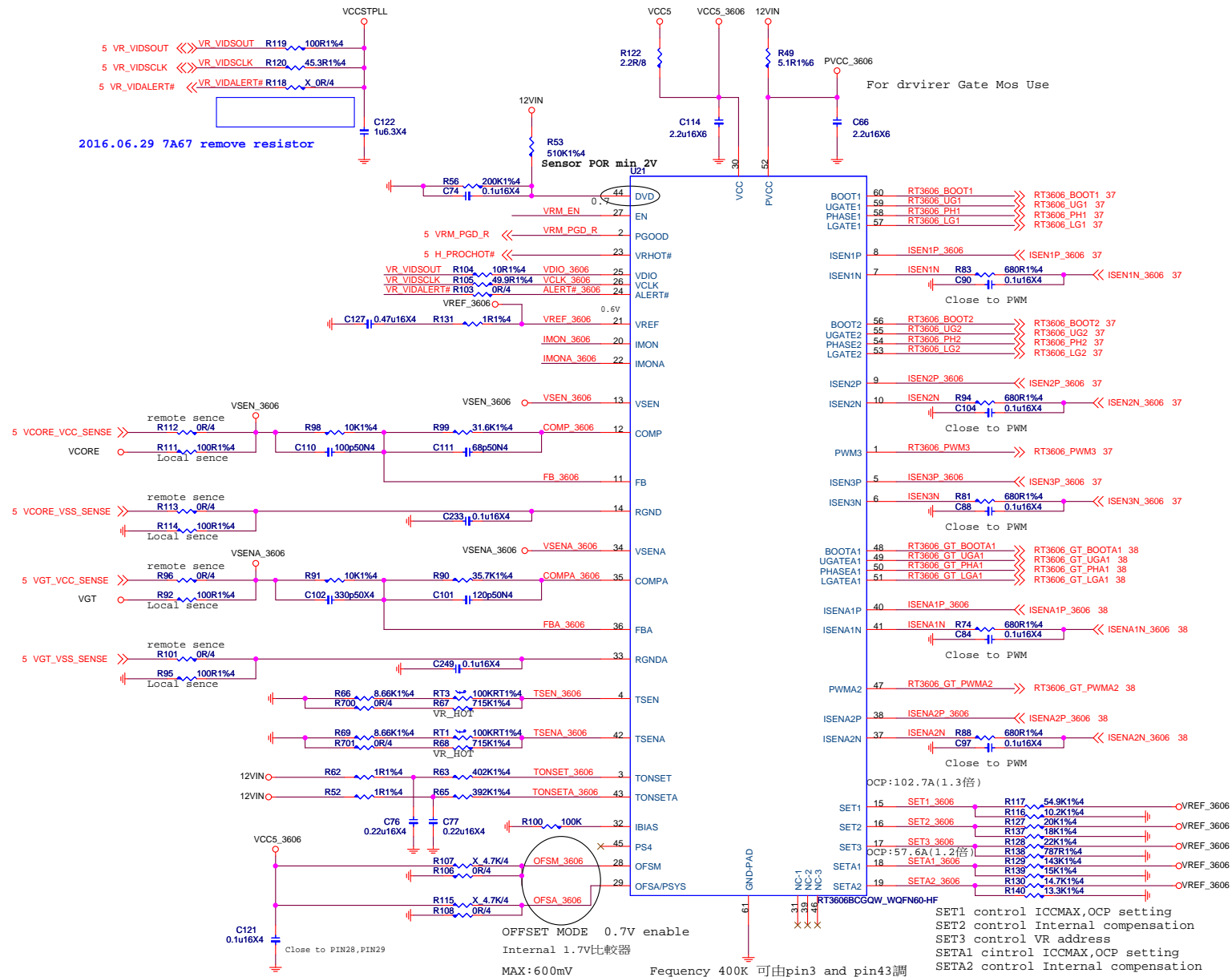
3VSB cost down

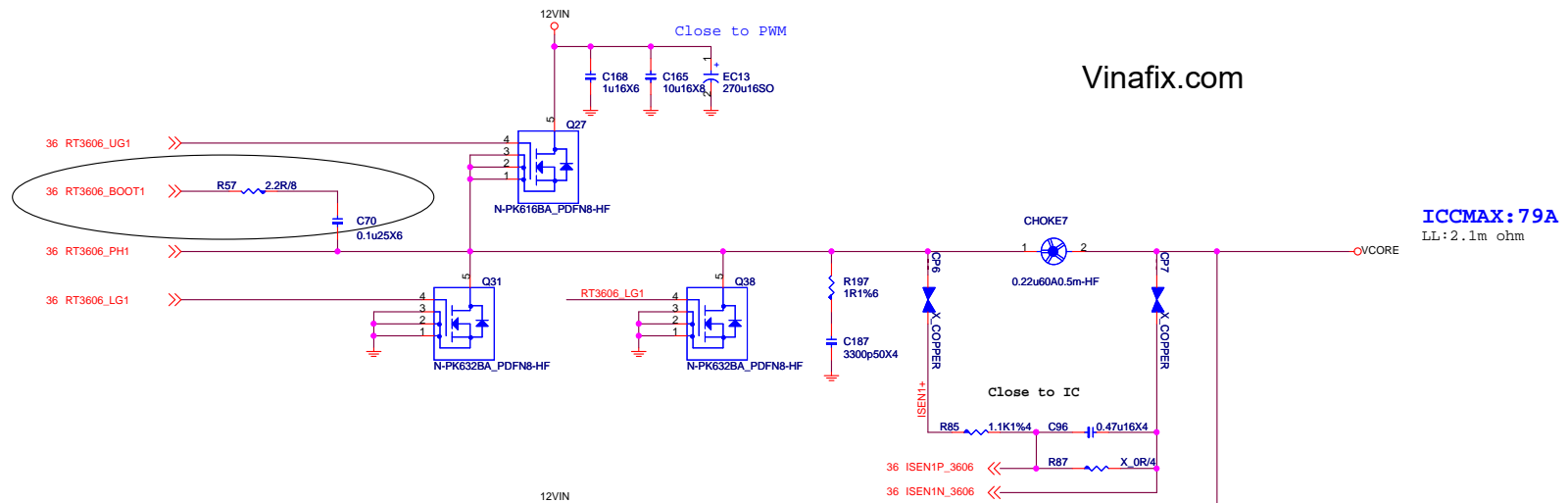


MICRO-STAR INT'L CO.,LTD

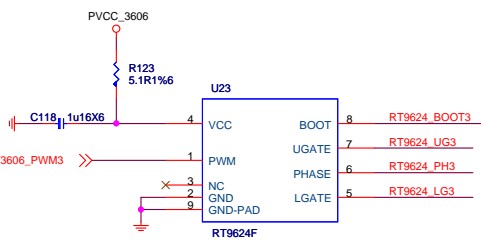
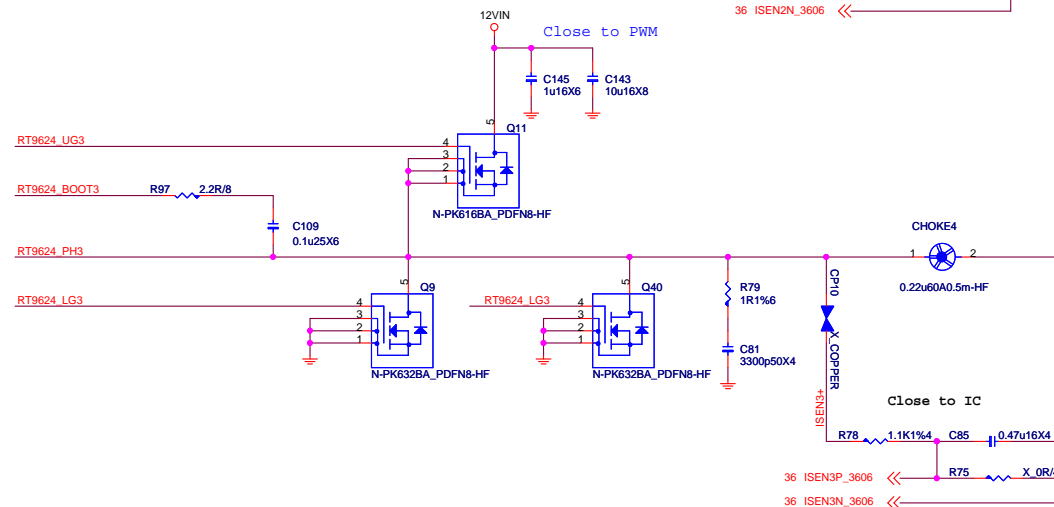
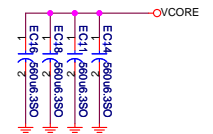
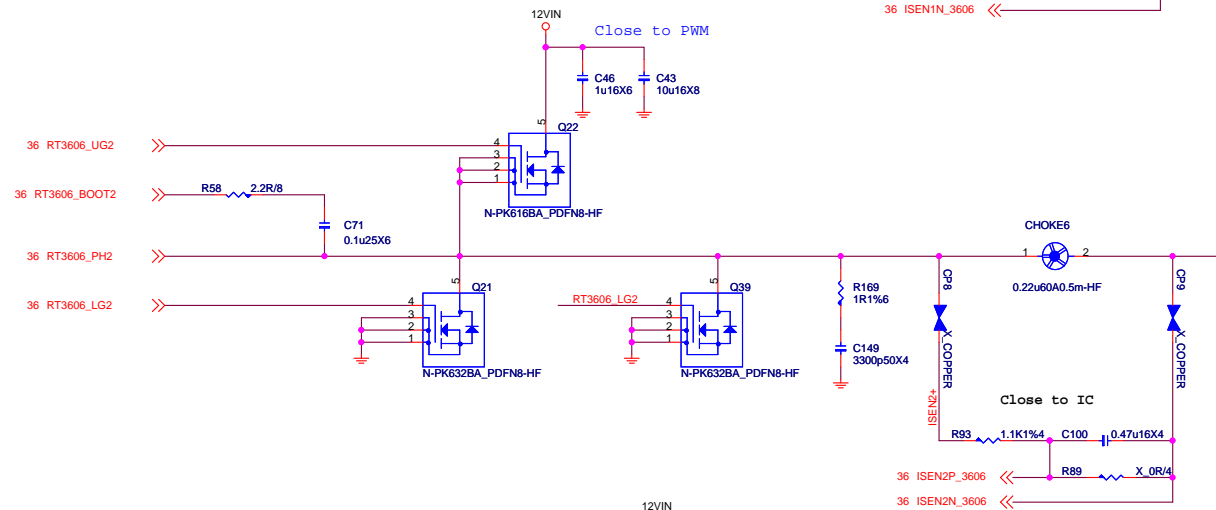
MS-7A67

| Size | Document Description | Rev |
|------------------------------------|----------------------|-----|
| Custom | ACPI CONTROLLER | 20 |
| Date: Wednesday, November 09, 2016 | Sheet 35 of 52 | |





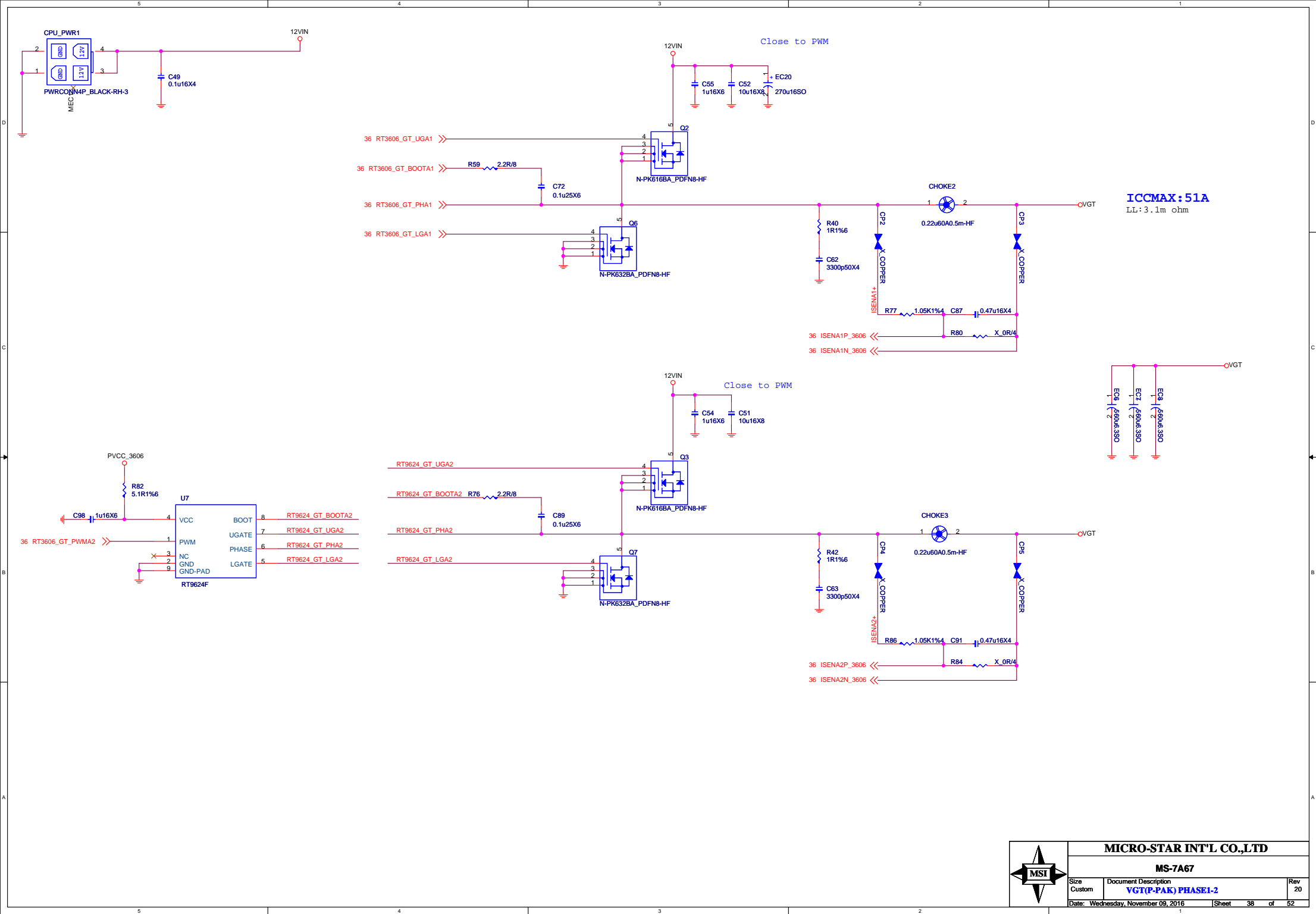
ICCMAX: 79A
LL: 2.1m ohm



MICRO-STAR INT'L CO.,LTD

MS-7A67

| | | |
|------------------------------------|--|----------------|
| Size Custom | Document Description VCORE(P-PAK) PHASE1-3 | Rev 20 |
| Date: Wednesday, November 09, 2016 | | Sheet 37 of 52 |



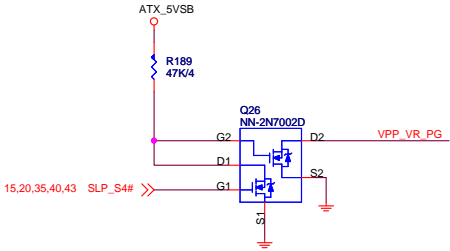
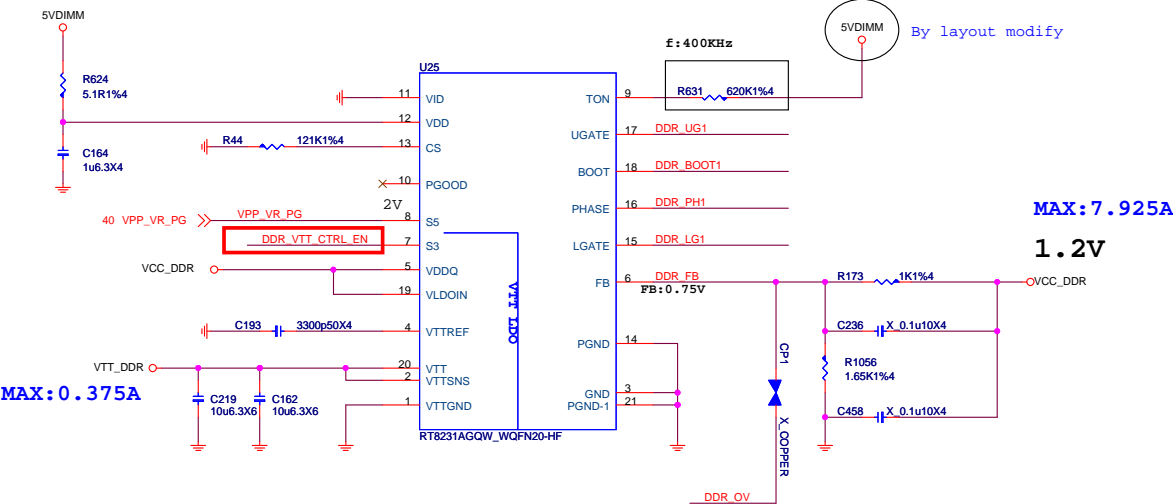
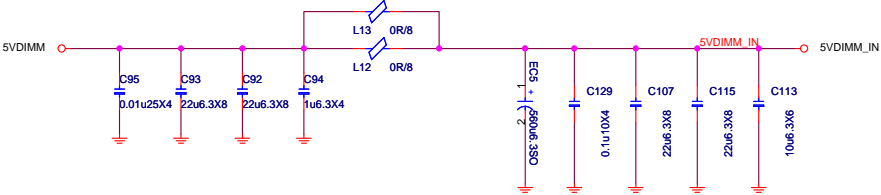
| MICRO-STAR INT'L CO.,LTD | | | |
|------------------------------------|----------------------|-------|----------|
| MS-7A67 | | | |
| Size | Document Description | Rev | |
| Custom | VGT(P-PAK) PHASE1-2 | 20 | |
| Date: Wednesday, November 09, 2016 | | Sheet | 38 of 52 |

DDR4_1.2V 2.8A+ 4.75A+0.375A=7.925

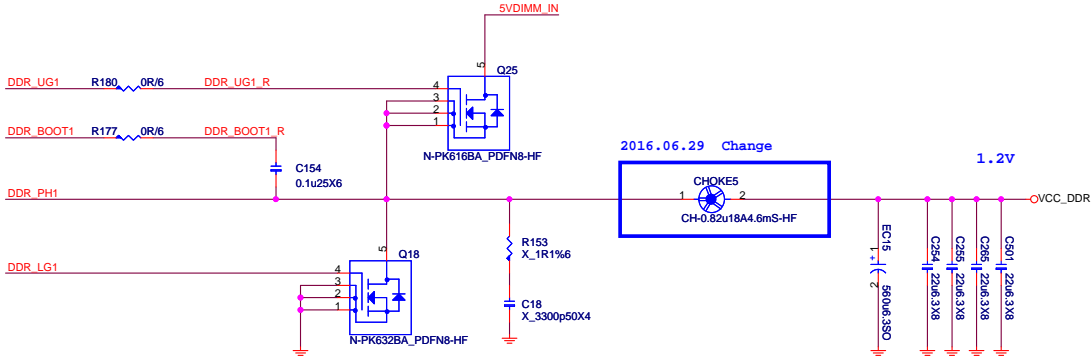
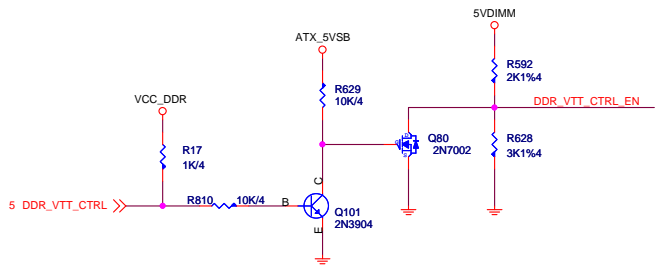
2.8A FOR CPU
9.5A FOR 4DIMM DDR4
4.75A FOR 2DIMM DDR4
0.375A FOR VTT_DDR

OCP =7.925A*1.5=11.8875A
Rlimit(R44)
Current Limit =121K*5uA/10/5mohm
--> 121Kohm(12.1A)

$$I_{rms} = I_{out} * \sqrt{((V_{out}/V_{in}) * (1 - (V_{out}/V_{in})))}$$
$$= 9.357 * 0.44$$
$$= 4.154A$$

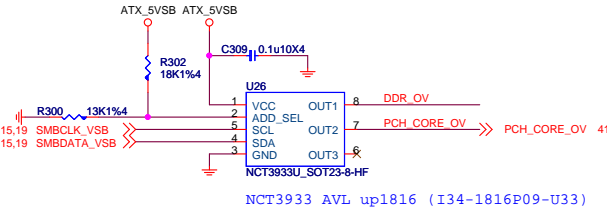


Vinafix.com



UPI VOLTAGE CONSOLE

0x26 : RH=18K, RL=13K



| | | | |
|--------------------------|------------------------------|-------|----------|
| MICRO-STAR INT'L CO.,LTD | | | |
| MS-7A67 | | | |
| Size | Document Description | Rev | |
| Custom | DDR-RT8231 | 20 | |
| Date: | Wednesday, November 09, 2016 | Sheet | 39 of 52 |

1



○



1

D03-3669S00-F01 : 14.4A

D03-3669S00-F01 : 5.2m ohm



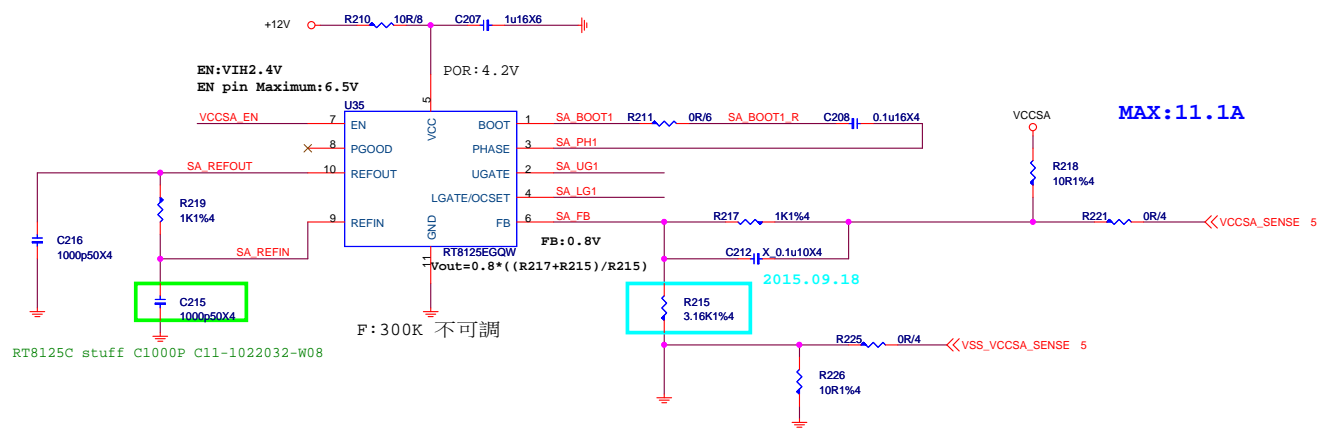
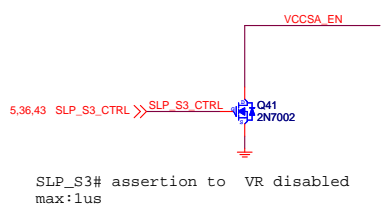
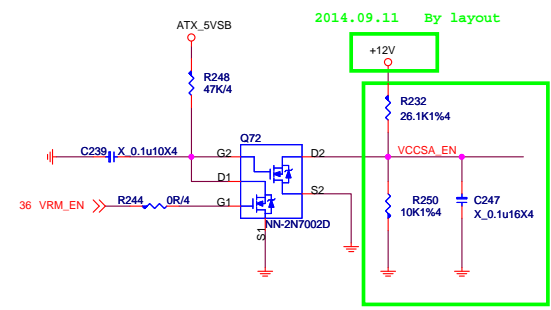
SA Power:1.05V,11.1A

2016.07.25
Remove UP1540 colay schematic

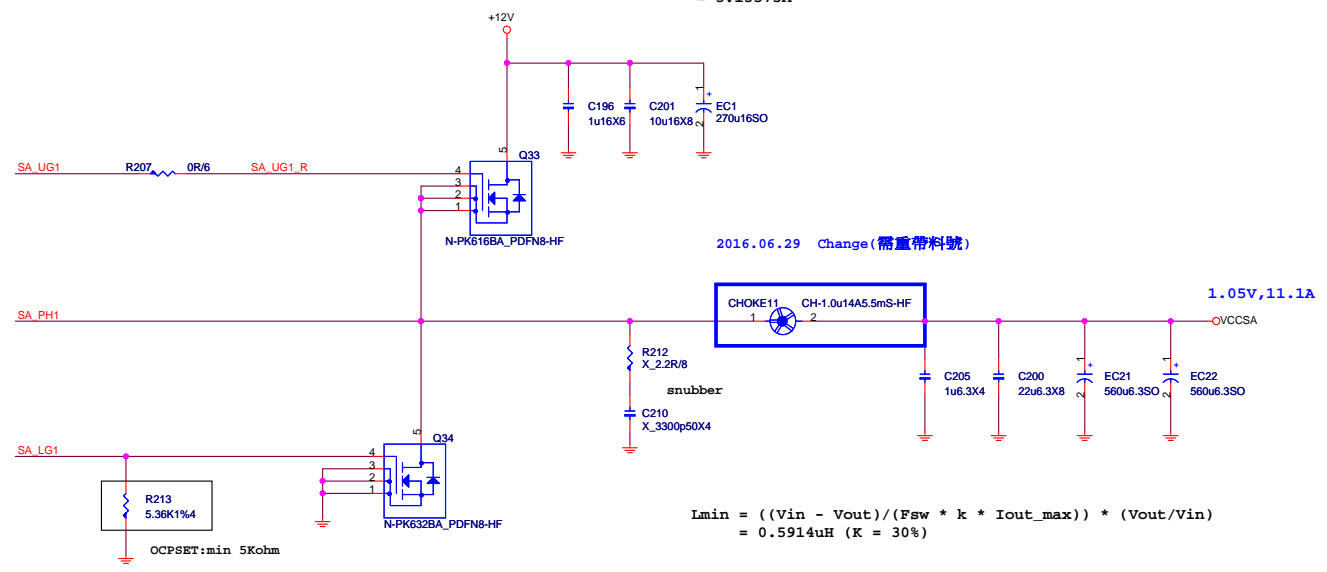
$OCP = 11.1A * 1.4 = 15.54A$
 $R_{cs}(R15) = OCP * R_{dson}(Low\ side) / 10uA$
 $= 15.54 * (3.4)mohm / 10uA$
 $= 5.2836Kohm$

Rdcs:5.2836K, OCP:
D03-4C05N03-005 : 15.76A
D03-632BA0C-N03 : 16.24A
use UBIQ MOS need Check

| |
|---------------------------|
| Rdson(Low) 10V |
| D03-4C05N03-005 : 3.4mohm |
| D03-632BA0C-N03 : 3.3mohm |
| D03-3056M00-U47 : 4.2mohm |



$I_{rms} = I_{out} * \sqrt{((V_{out}/V_{in}) * (1 - (V_{out}/V_{in})))}$
 $= 11.1 * 0.2825$
 $= 3.13575A$



$L_{min} = ((V_{in} - V_{out}) / (F_{sw} * k * I_{out_max})) * (V_{out}/V_{in})$
 $= 0.5914uH (K = 30\%)$

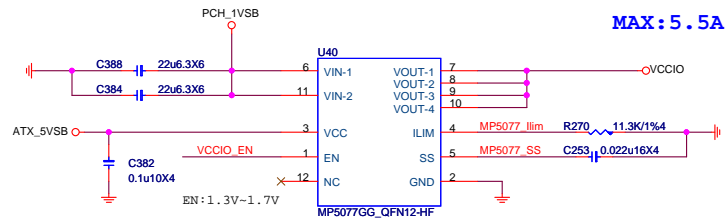
2016.07.05 change to MP5077

OV: 1~1.2V

VCCIO

0.95V; 5.5A

Source 1.00V



MAX: 5.5A

$$I_{limit} = (1/R_{limit}) * S, S = 80000, \text{when } V_{IN} = 1V \\ = (1/11.3) * 80000 = 7.079A$$

$$T_{ss} = (1/3) * ((V_{out} * C_{ss}) / I_{ss}), I_{ss} = 9uA \\ T_{ss} = (1/3) * ((1 * 22n) / 9uA) = 0.814ms$$

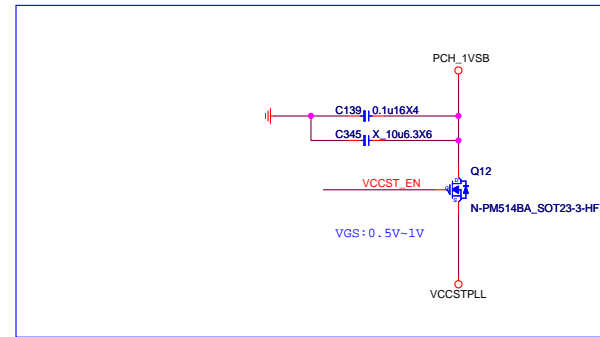
Vinafix.com

2016.07.25 change from GS7133 to MOS

VCCSTPLL

1.0V; VCCST:60mA,VCCPLL:150mA=60+150=210mA

For Cost down VCCST&VCCPLL merge

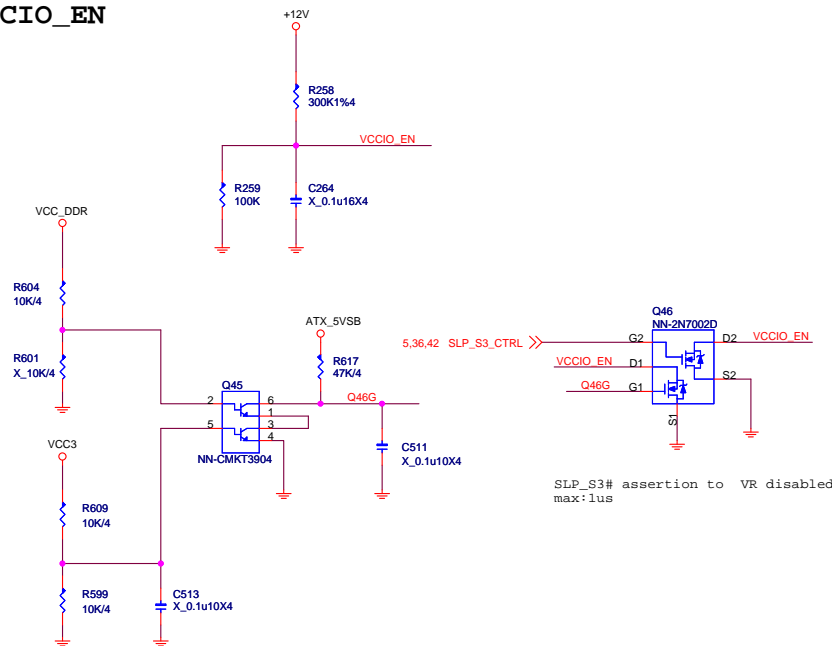


MAX: 210mA

Main:D03-514BA09-N03
AVL:D03-0341409-A68,D03-P500209-N03 ?

VCCIO ramped and stable before
beginning of VCCOPC/VCCOPIO ramp
VCCST/PLL stable 1ms before PROCPPWRGD

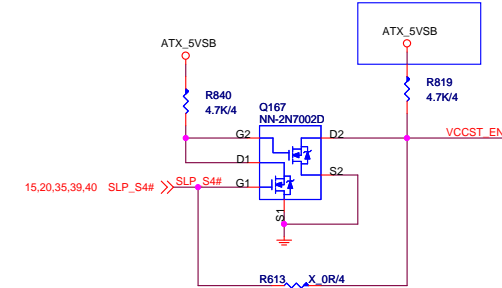
VCCIO_EN



SLP_S3# assertion to VR disabled
max:lus

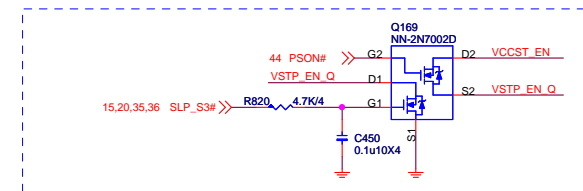
VCCSTPLL_EN

7A67 change



FIX G3 -> S5 mode VCCSTPLL leakage

2015.12.02



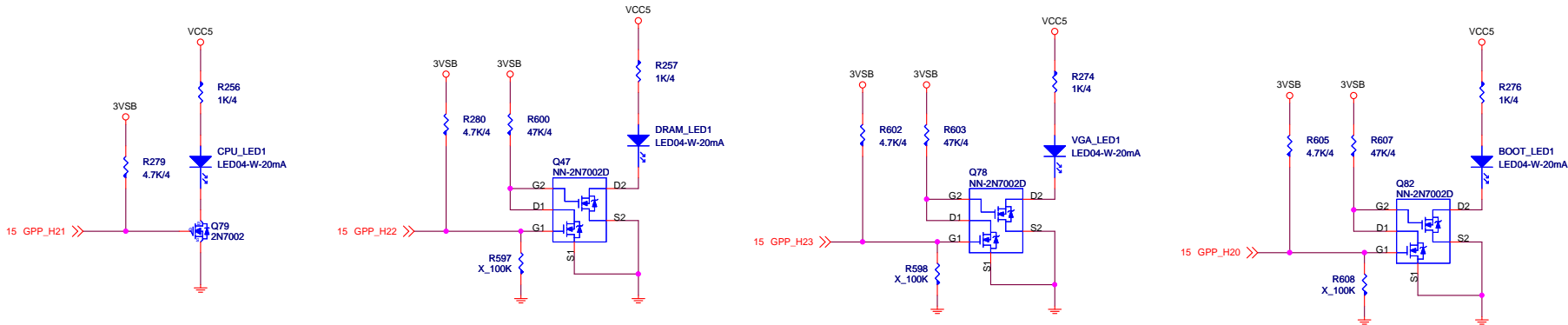
MICRO-STAR INT'L CO.,LTD

MS-7A67

| Size | Document Description | Rev |
|--------|------------------------------|----------------|
| Custom | VCCIO/VCCSTPLL POWER | 20 |
| Date: | Wednesday, November 09, 2016 | Sheet 43 of 52 |

DEBUG LED

白：D0C-040T200-H91
AVL：D0C-040S200-E07




開機斷電狀態下，4個LED先維持default全暗，開機通電後：

1. 首先進行CPU checkCPU LED 亮，check PASS後則CPU LED減掉。
2. 接著依序進行Memory /memory LED亮check PASS後則memory LED減掉。
3. VGA的check/VGA LED亮，check PASS後則VGA LED減掉。
4. 因此最後正常順利開機後，三個LED燈都是減掉的。
(系統重啟或其他原因造成系統重開機，則LED仍按上述行為動作)

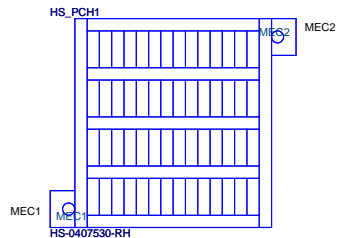
| LED \ | PCH_GP20 | PCH_GP21 | PCH_GP22 | PCH_GP23 |
|-------|---------------------|--------------------------|--------------------------|--------------------------|
| 亮 | NATIVE PULL HIGH | GPO PULL HIGH | GPO PULL HIGH | NATIVE PULL HIGH |
| 滅 | NATIVE LOW | GPO LOW (default LOW) | GPO LOW (default LOW) | GPO LOW (default LOW) |

1.0 Remove DIMM SLOT LED

EMI CAP



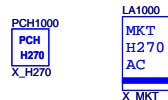
| | | |
|------------------------------------|---------------------------------|----------------|
| MICRO-STAR INT'L CO.,LTD | | |
| MS-7A67 | | |
| Size Custom | Document Description EMI CAP | Rev 20 |
| Date: Wednesday, November 09, 2016 | | Sheet 46 of 52 |



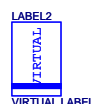
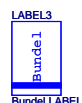
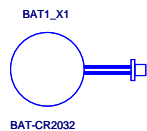
B250 NO AC OPT.



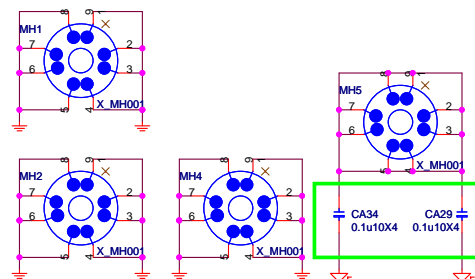
H270 AC OPT.



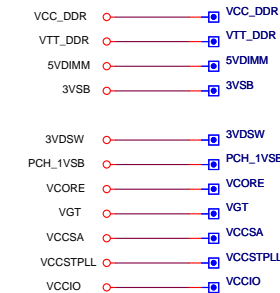
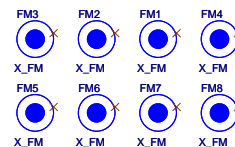
B250 OPT.



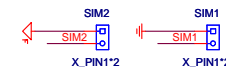
Mounting Holes




Optical Fiducial Marks-120



Simulation



2016/8/242016/9/1PK0-07A670A-G37, 精成-深圳, 23, 寶安恩斯邁廠 (MSIS) 6, Coffee
2016/8/242016/9/1PK0-07A670A-E48, 競華, 23, 寶安恩斯邁廠 (MSIS) 6, Coffee

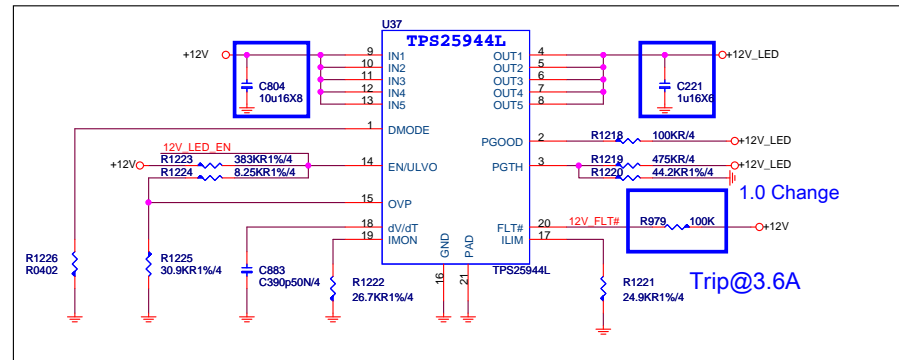


| MICRO-STAR INT'L CO.,LTD | | |
|------------------------------------|---|----------------|
| MS-7A67 | | |
| Size Custom | Document Description Manual Parts | Rev 20 |
| Date: Wednesday, November 09, 2016 | | Sheet 47 of 52 |

2016.08.16 remove BOT LED

LED STRIPLINE

2016.07.06 Use TPS25944L

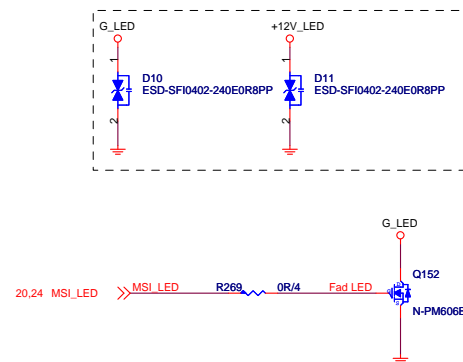


外接LED 燈條 (RGB)

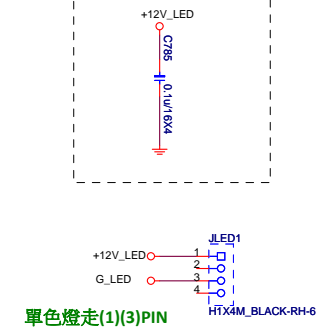
---- PCB 文字面 (JLED1)

---- 手冊註明 RGB 接頭支援標準 5050 RGB LED 燈條 (12V/G/R/B)，燈條總輸出電流限制為3安培 (12 伏特)，長度限制為2公尺 (待7A20驗證)

2016.07.06 only reserve now



2016.08.02 Add +12V_LED 0.1uF



MICRO-STAR INT'L CO.,LTD

MS-7A67

| | | |
|------------------------------------|-------------------------------------|----------------|
| Size Custom | Document Description JLED | Rev 20 |
| Date: Wednesday, November 09, 2016 | | Sheet 48 of 52 |