

TITLE	Page
Cover Sheet	1
Block Diagram	2
CPU-Memory ,CPU-PEG/Display	3,4
05 CPU-Control/MISC/CFG/Audio	5
CPU-Power/CPU-GND	6,7
DDR 4 DIMM1 & DDR 4 DIMM2	8,9
DDR4-POWER/GND-1 &DDR4-POWER/GND-2	10,11
PCH-USB/PCIE/DMI/SATA	12
PCH-Audio/Display/Clock	13
PCH-GPIO/USBOC#/SATASTRAP	14
PCH-LPC/SPI/SMBUS/MISC	15
PCH-Power,PCH-GND,PCH-Strap	16,17,18
PCIE SLOT-CPU(X16),PCIE SLOT-PCH(X1)	19,20
ASM1142 USB3.1 Host/NA	21,22
BIOS ROM/TPM/Debug LED	23
AUDIO 887, AUDIO de-pop circuit	24,25
LAN - Intel I219V	26
DVI,HDMI,VGA Connector	27,28,29
USB2.0 & USB3.0 & SATA Connector	30,31,32
SIO-NCT6793D,CLR COMS&CUT VBAT	33,34,35
CPU FAN & SYS FAN Controllor	36,37
ATX F_Panel/EMI/ECO/ACPI Controllor UPI	38,39
PWM-RT3606BC/VCORE 3PHASE/VGT 2PHASE	40,41,42
DDR-RT8231 & DDR-MP2147-VPP25	43,44
VCCSA POWR-UP1540Q/VCCIO POWER-NB681	45,46
VCCSTPLL/PCH Core power_RT8125	47,48
NA/Manual parts	49,50
Power Map/Power Sequence/GPIO MAP	51,52,53
Revision History	54

MS-7A65

mATX

Ver: 0A(206x243)

Intel -Kabylake plamform

CPU:

KBL-S LGA1151

CPU POWER PAK *3 Phase

GT POWER PAK *2 Phase

Onboard Chip:

HD Audio Codec:ALC887

LAN-Intel I219V

SIO:NUVOTON 6795

Flash ROM: SPI 128MB

DP to VGA: ITE6515

~~ASM1142 USB3.1 Host~~

Main Memory:

DDR4 *2

Expansion Slots:

PCI Express (X16) Slot * 1

PCI Express (X1) Slot * 2

~~PCI Slot * 1~~

Other:

SATA3.0 x6(PCH)

~~SATA Express x1(PCH)~~

REAL USB2.0 *2

REAL USB3.0 *4

FRONT USB2.0 *4

FRONT USB3.0 *2

M.2 Connector(PCIE X4)

System Chipset:

SPT-H B250

PWM:

VCORE PWM-RT3606

DDR -RT8231

PCH(1.0V) -RT8125E

VCCSA - RT8125E

VCCIO - NB681(Converter)

ACPI:

5VDAUL:uP7501

5VDIMM:uP7501

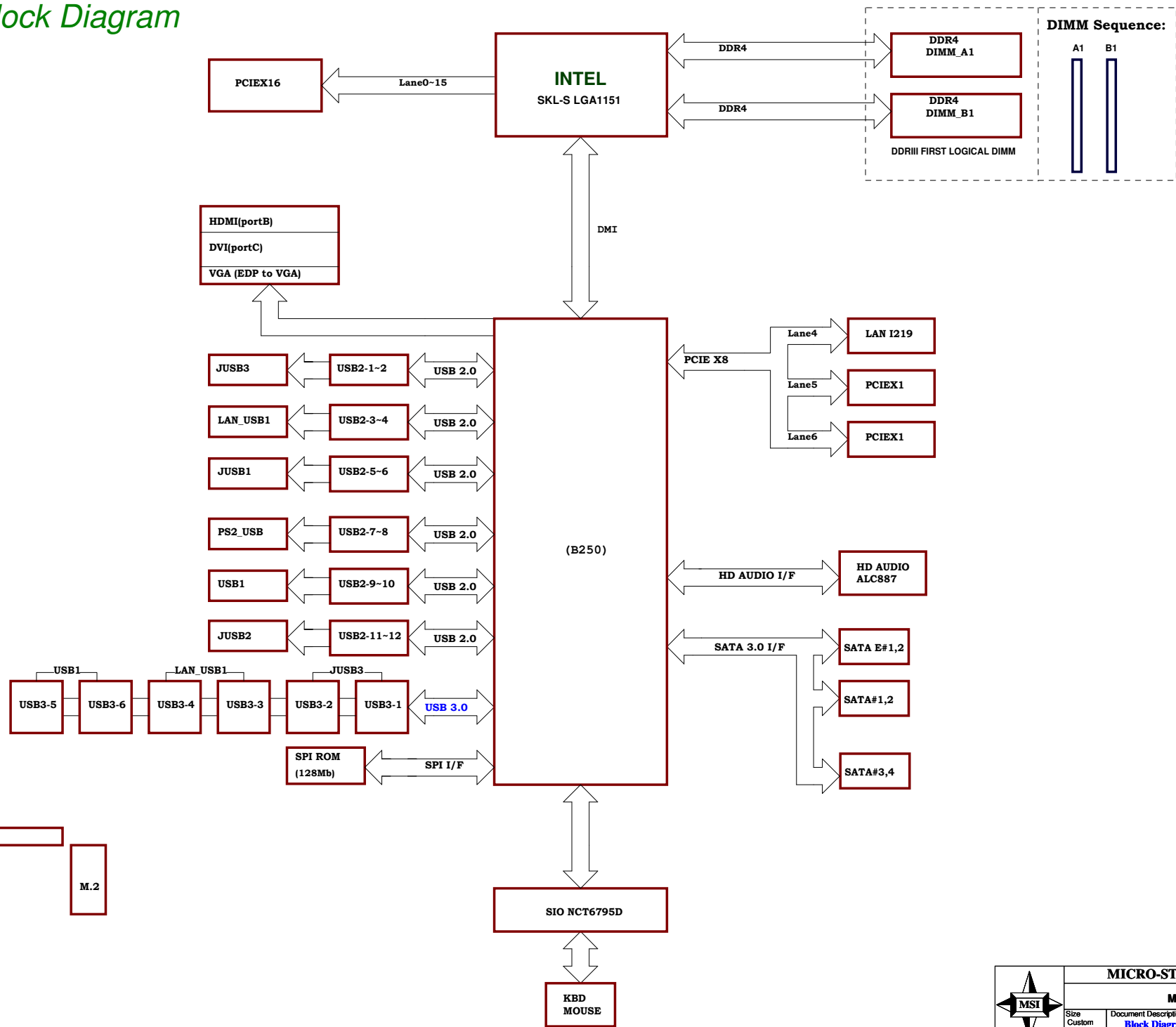
3VSB:GS7166+N MOS

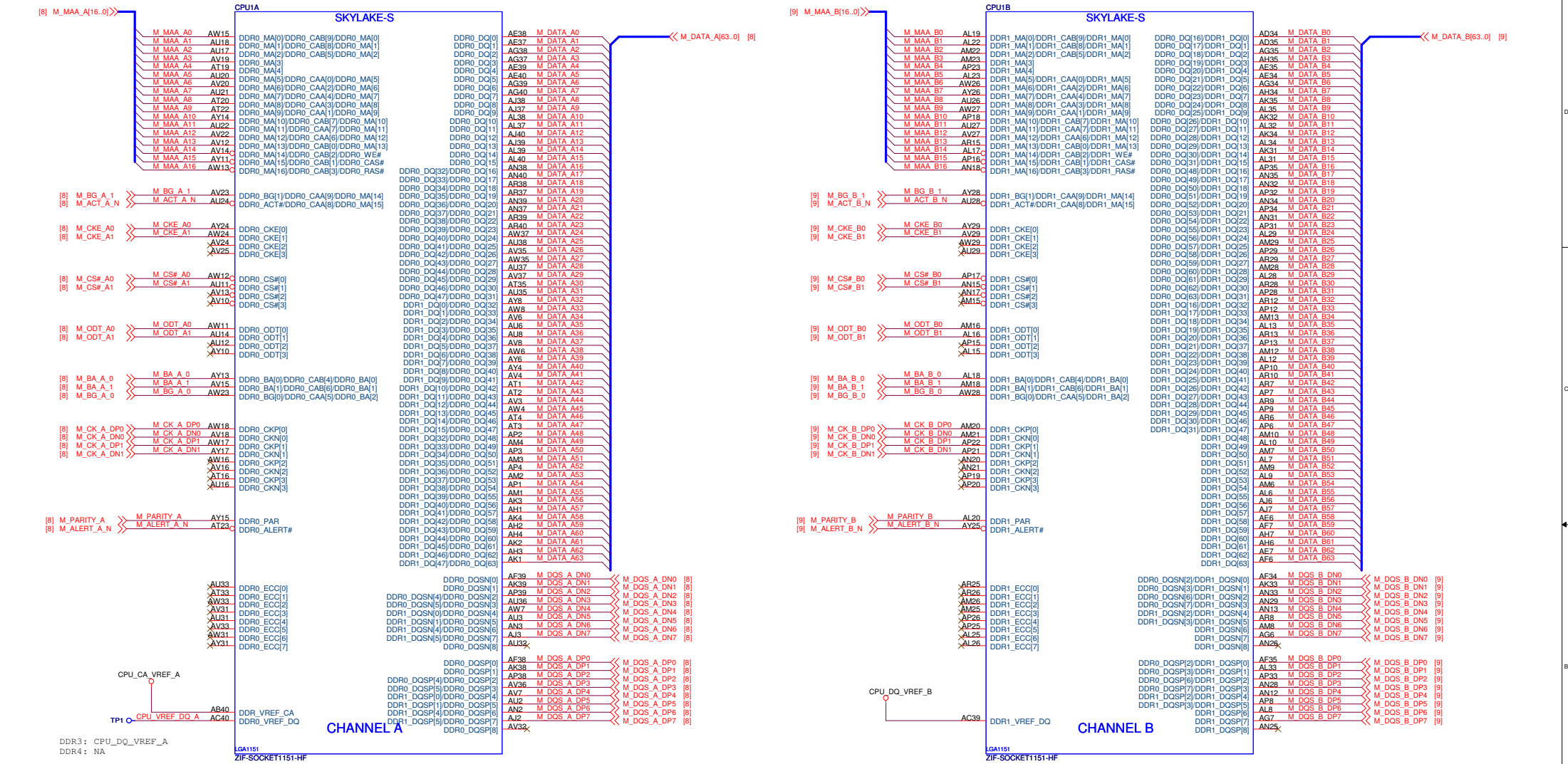
3VDSW:GS7166

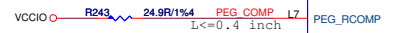
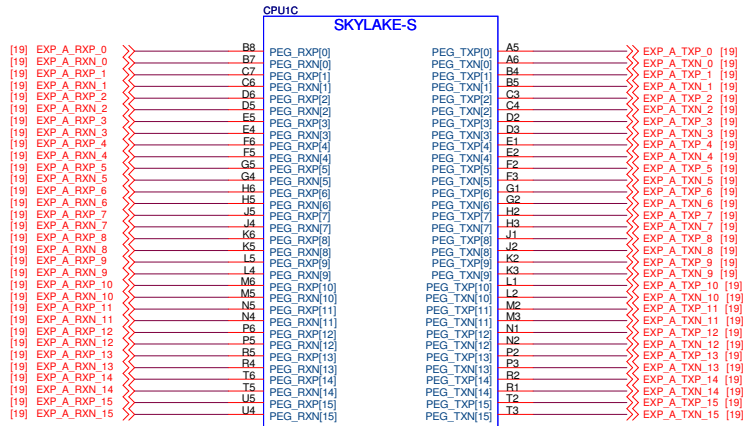
LDO:

VCCSTPLL - GS7166

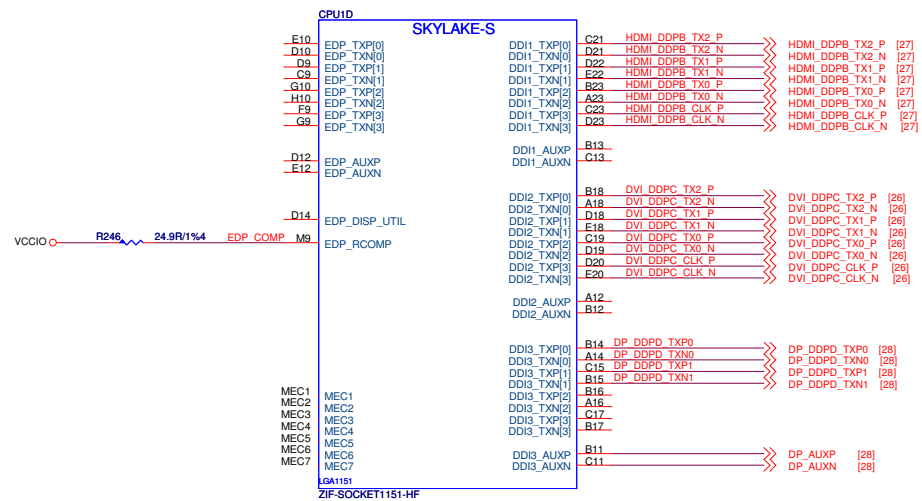
MS-7A65 Block Diagram



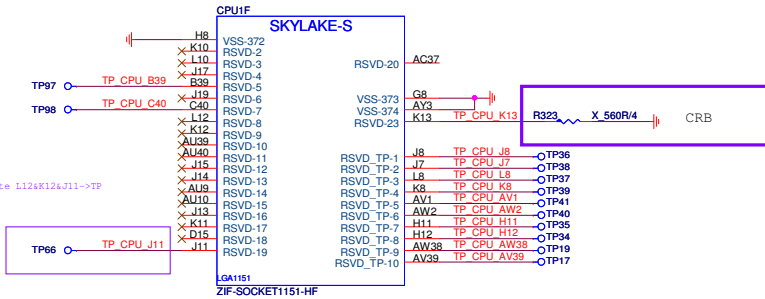


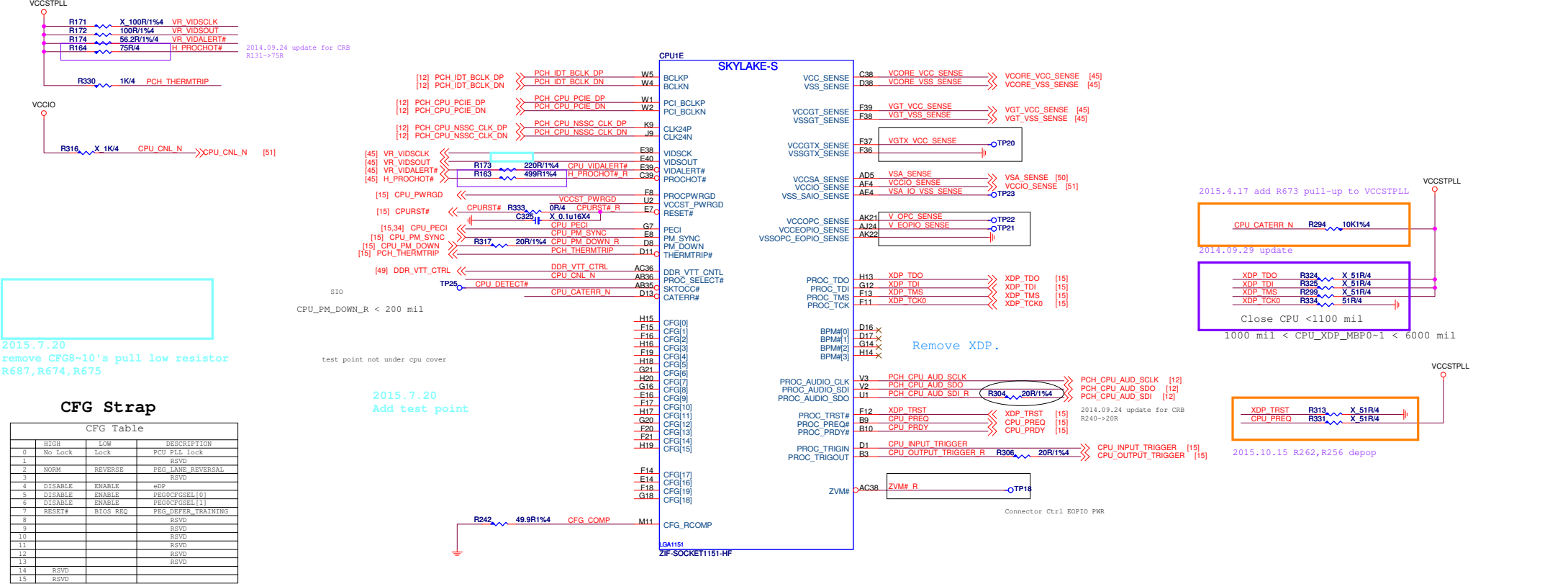


LGA1151 ZIF-SOCKET1151-HF

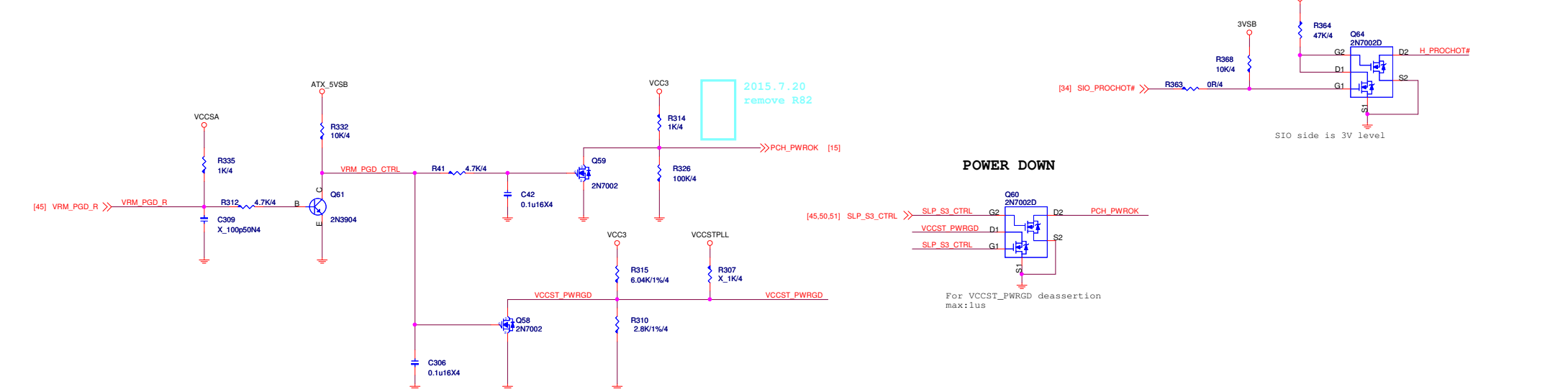


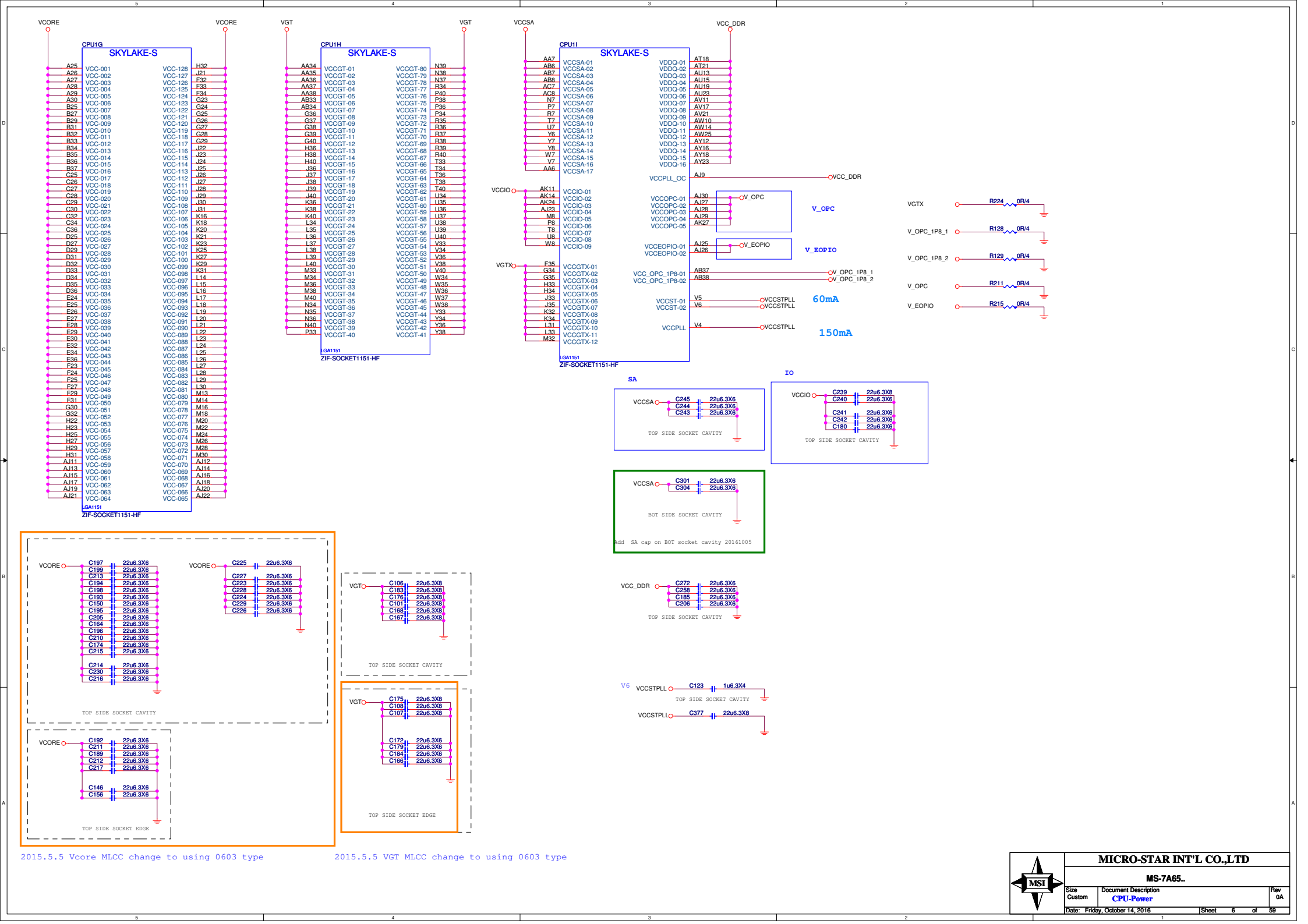
2014.09.24 update L12&K12&J11-->TP CRB update

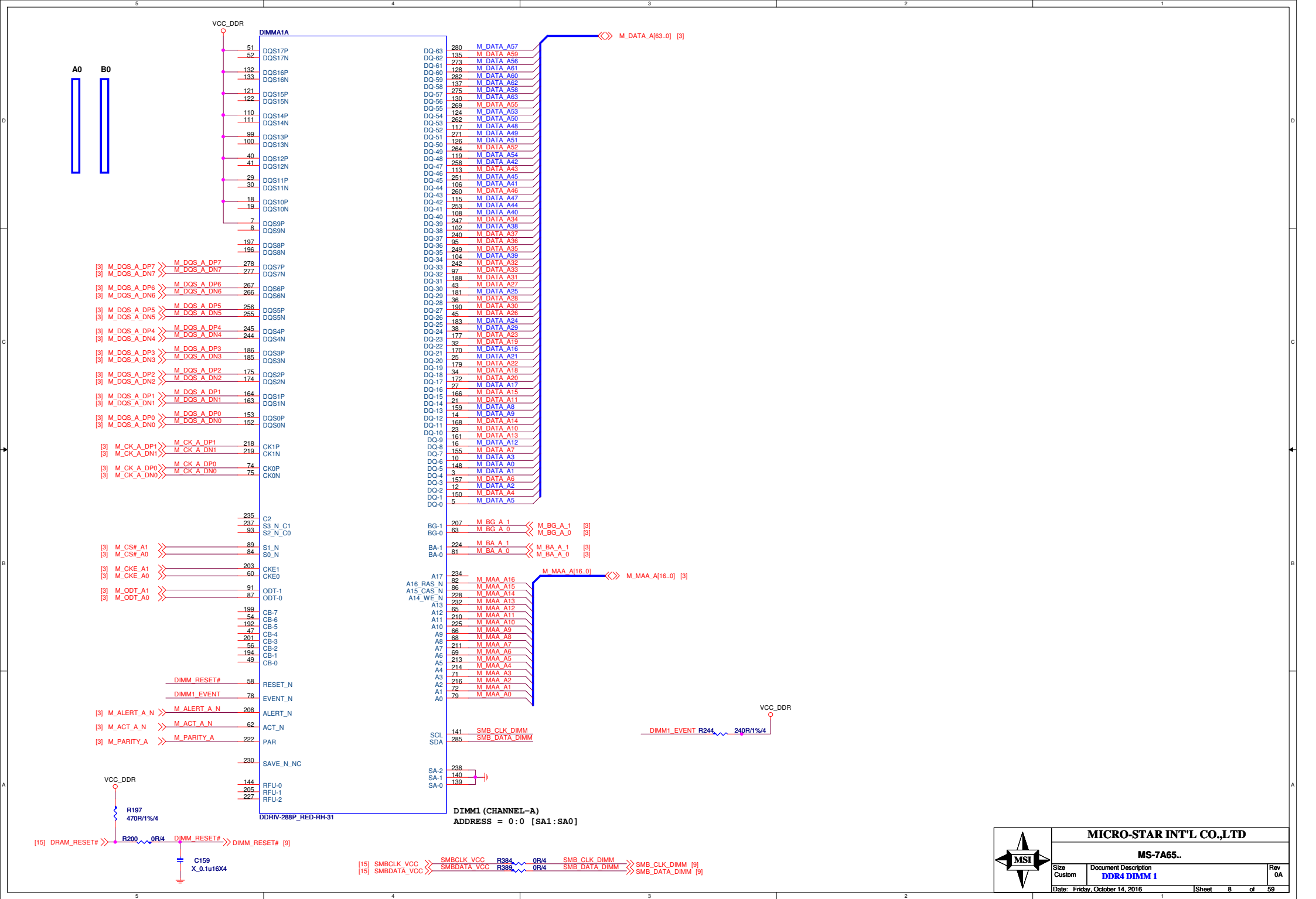


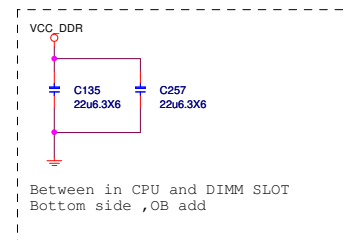
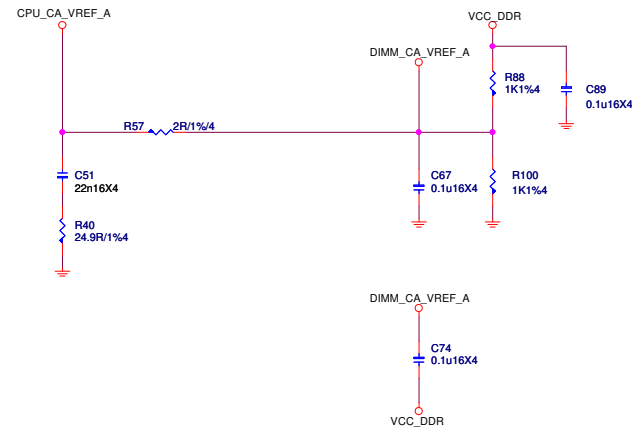
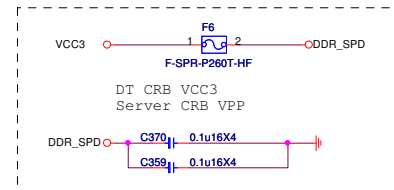
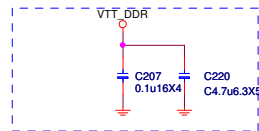
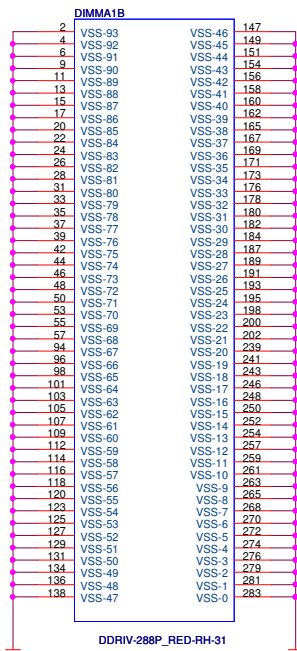
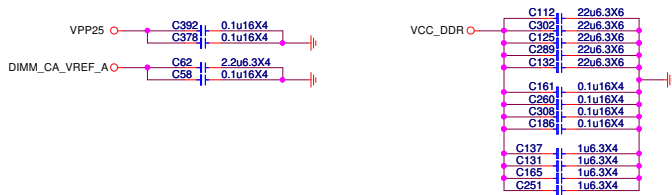
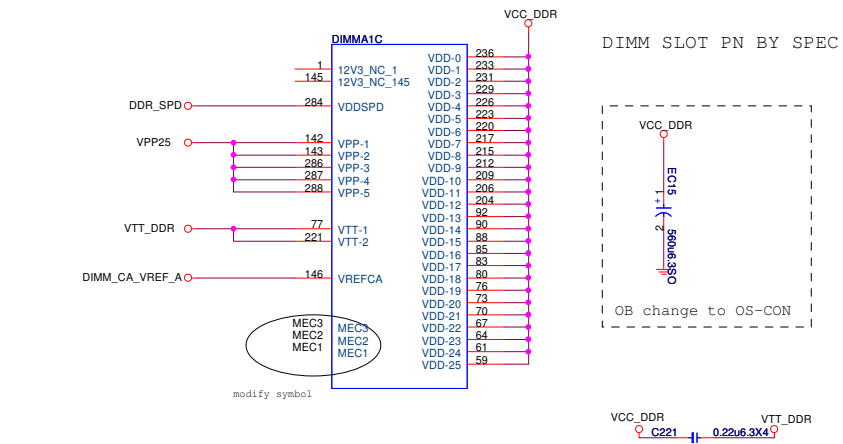


VCCST Power Good





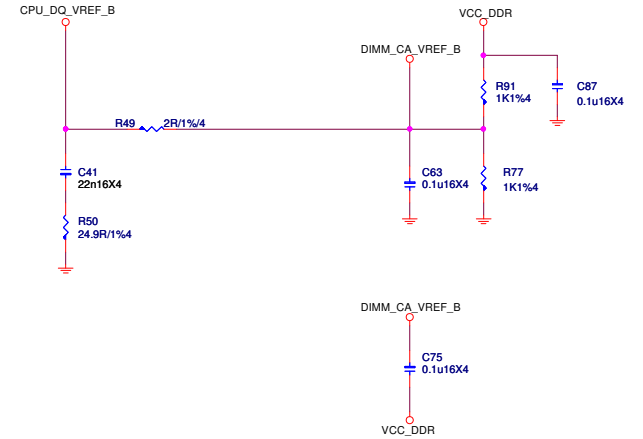
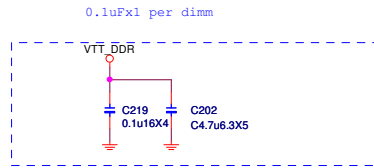
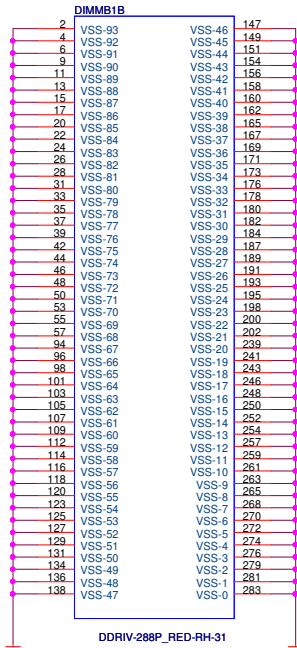
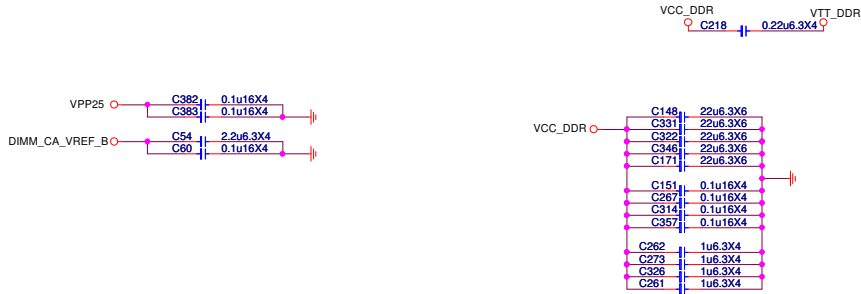
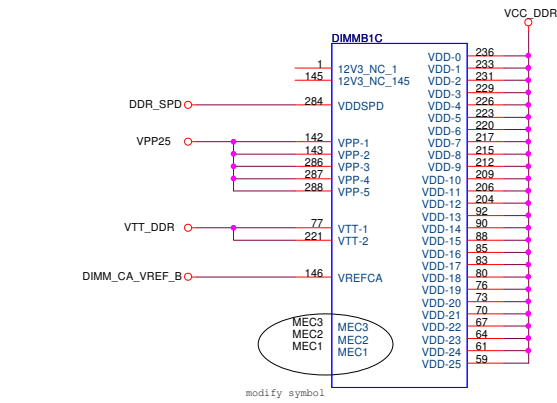


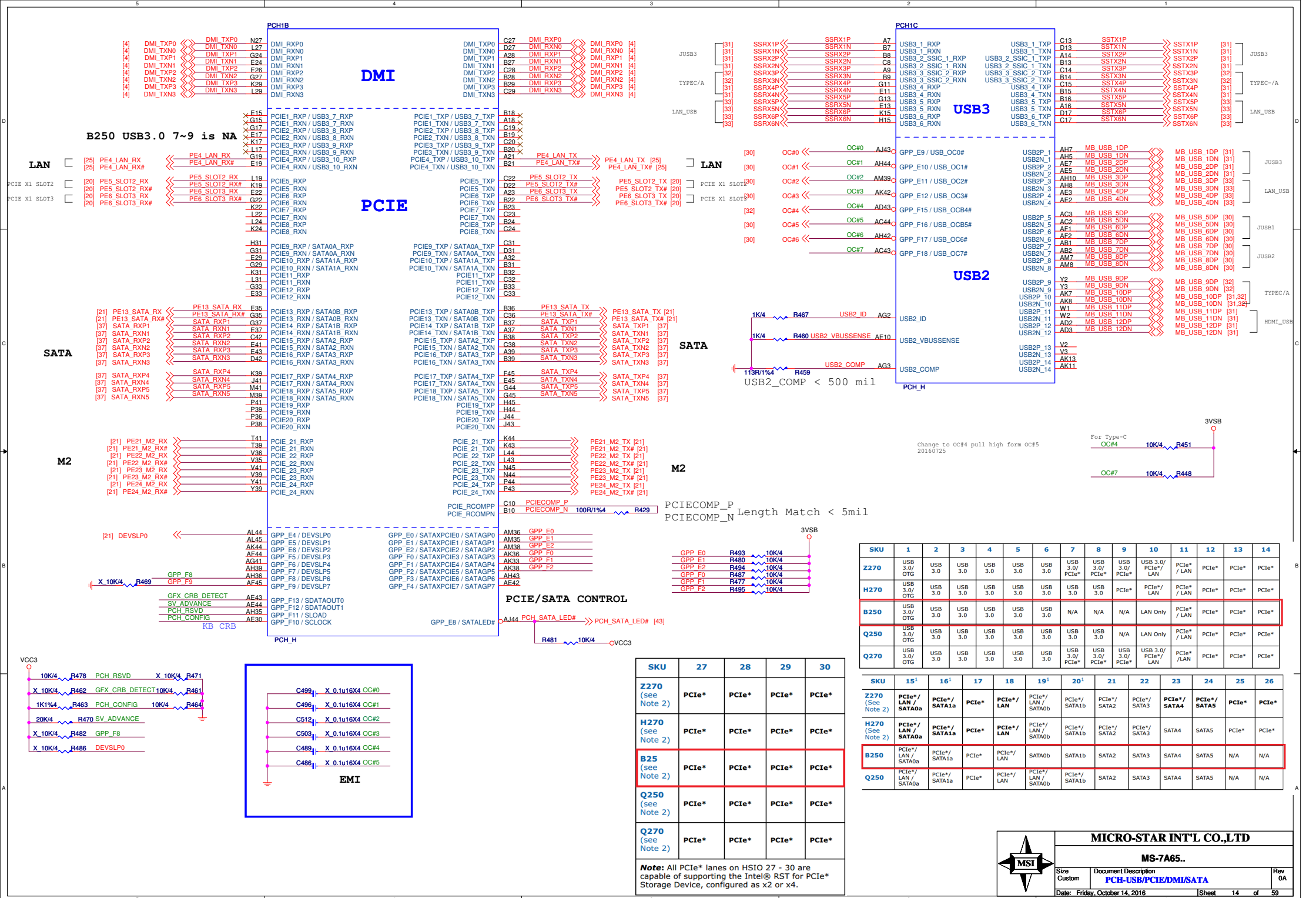


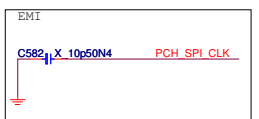
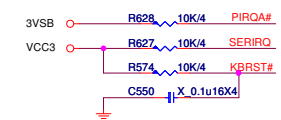
MICRO-STAR INT'L CO.,LTD

MS-7A65..

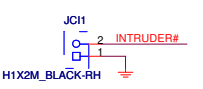
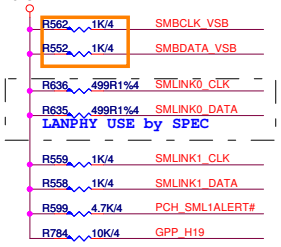
Size	Document Description	Rev
Custom	DDR4-POWER/GND-1	0A
Date: Friday, October 14, 2016	Sheet 10 of 59	



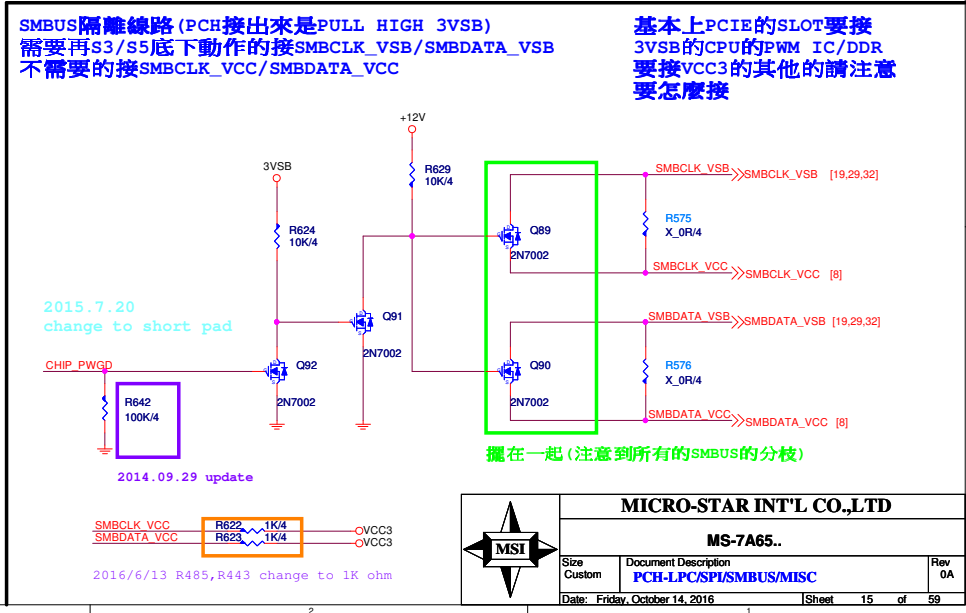
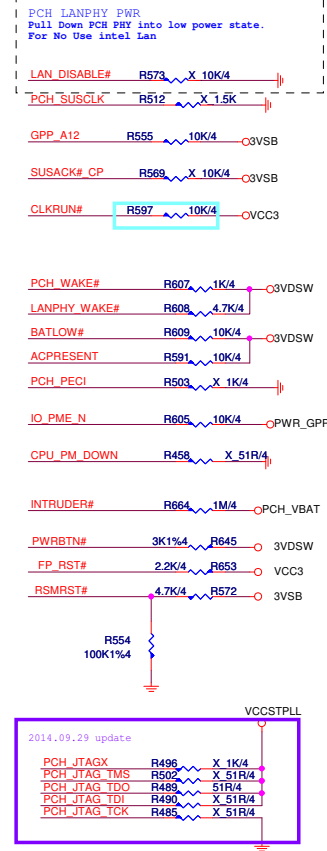
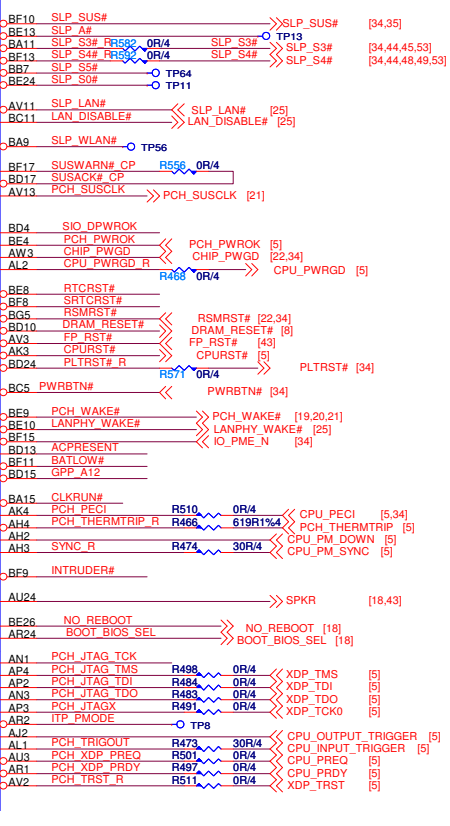
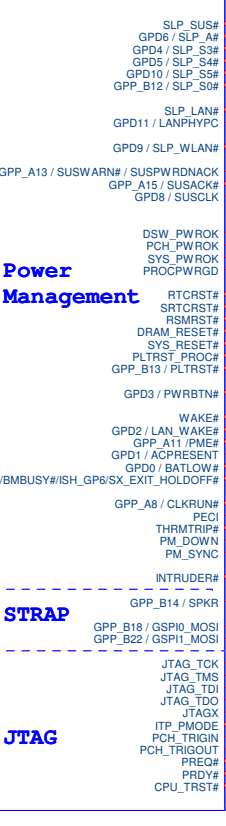
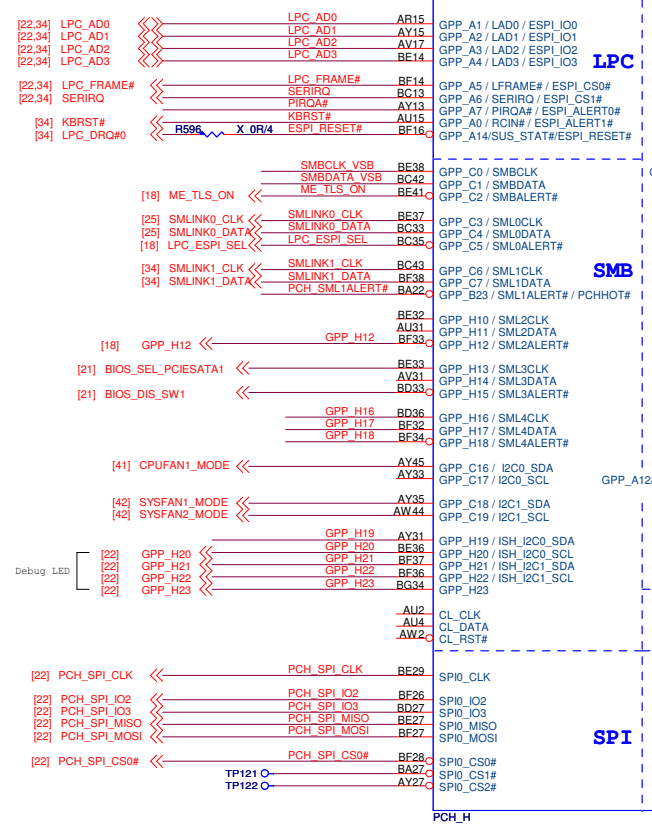
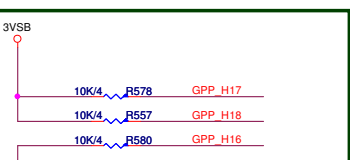




2016/6/13 R478, R484 change to 1K ohm



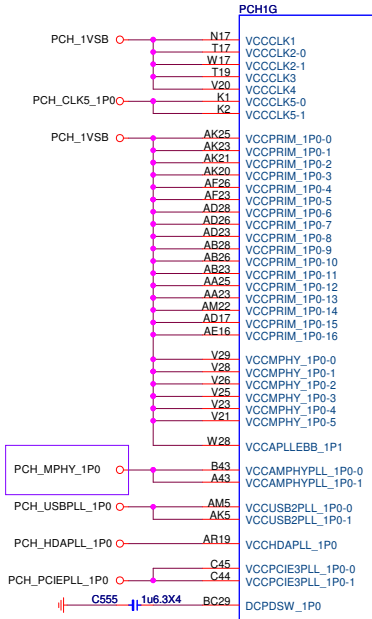
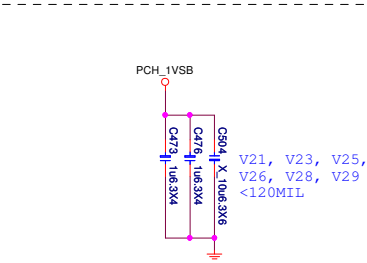
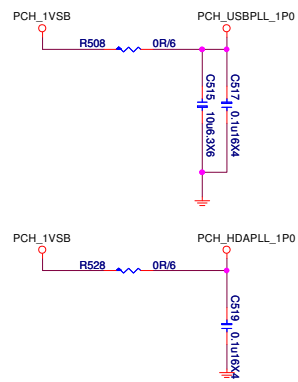
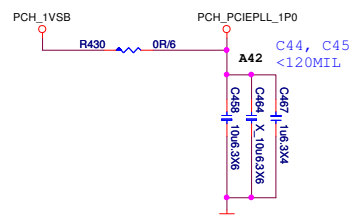
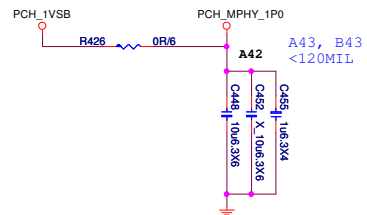
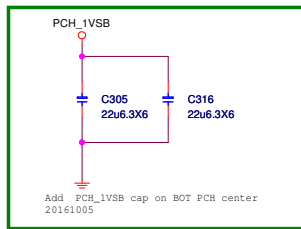
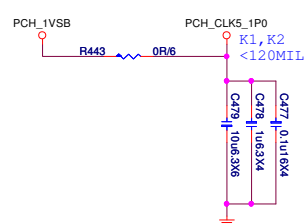
For BIOS DETCET MSI ID USED



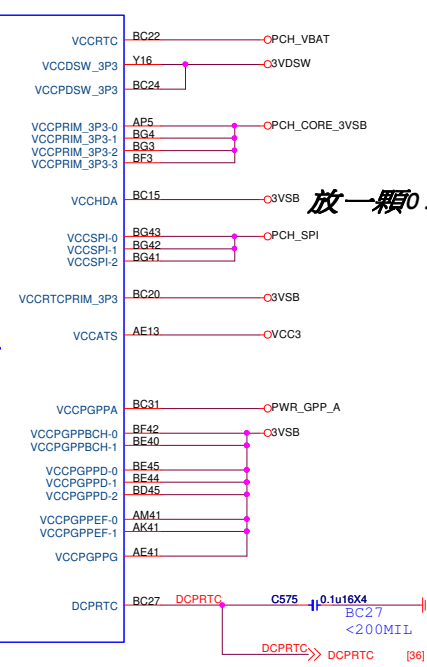
MICRO-STAR INT'L CO.,LTD

MS-7A65..

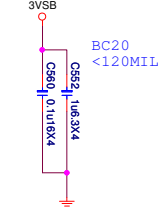
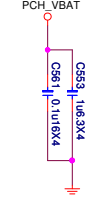
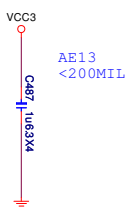
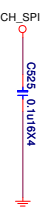
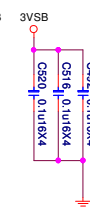
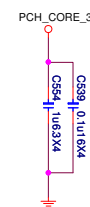
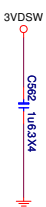
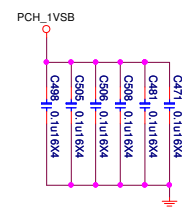
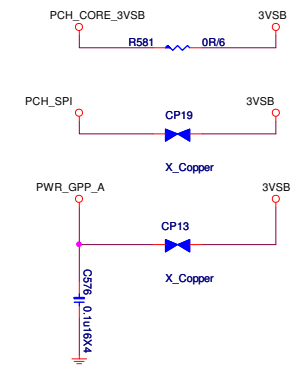
Size	Custom	Document Description	PCH-LPC/SPI/SMBUS/MISC	Rev	0A
Date:	Friday, October 14, 2016	Sheet	15	of	59



POWER



放一顆0.1u到BC15



VSS

PCH_H

PCH_H

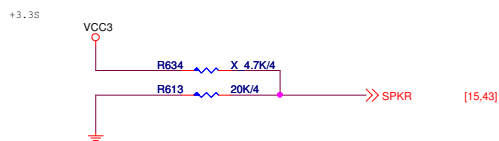


MICRO-STAR INT'L CO.,LTD

MS-7A65..

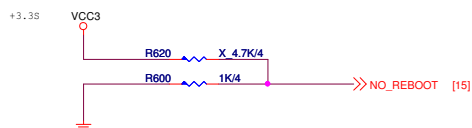
Size	Document Description	Rev
Custom	PCH-GND	0A
Date: Friday, October 14, 2016		Sheet 17 of 59

TOP Swap



Internal pull-down is disabled after PLTRST#

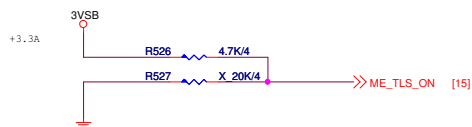
No Reboot



0 : DISABLE (Default)
1 : ENABLE

Internal pull-down is disabled after PLTRST#

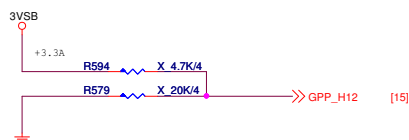
AMT and SBA with confidentiality



0 : DISABLE
1 : ENABLE (Default)

Internal pull-down is disabled after RSMRST

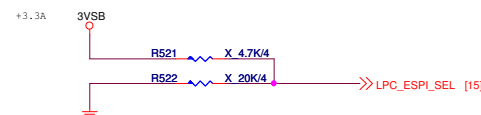
ESPI FLASH SHARING MODE



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

Internal pull-down is disabled after RSMRST

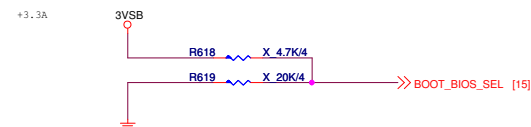
LPC eSPI Mode



0 : LPC
1 : eSPI

Internal pull-down is disabled after RSMRST

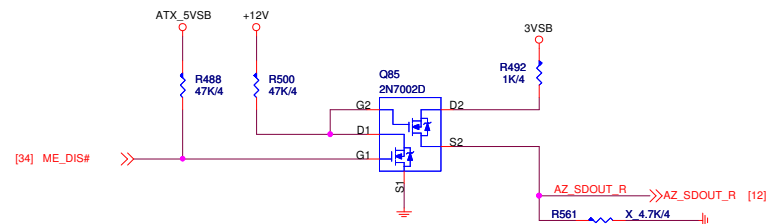
Boot BIOS



0 : SPI
1 : LPC

Internal pull-down is disabled after PLTRST

HDA_SDO



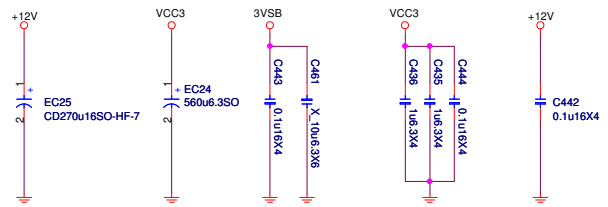
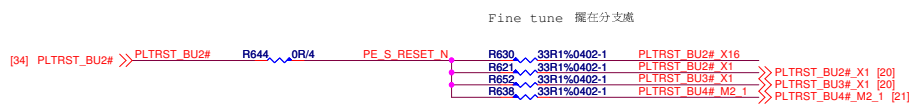
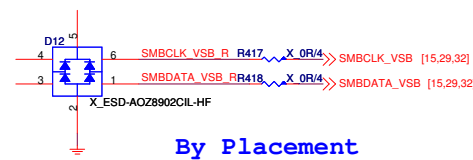
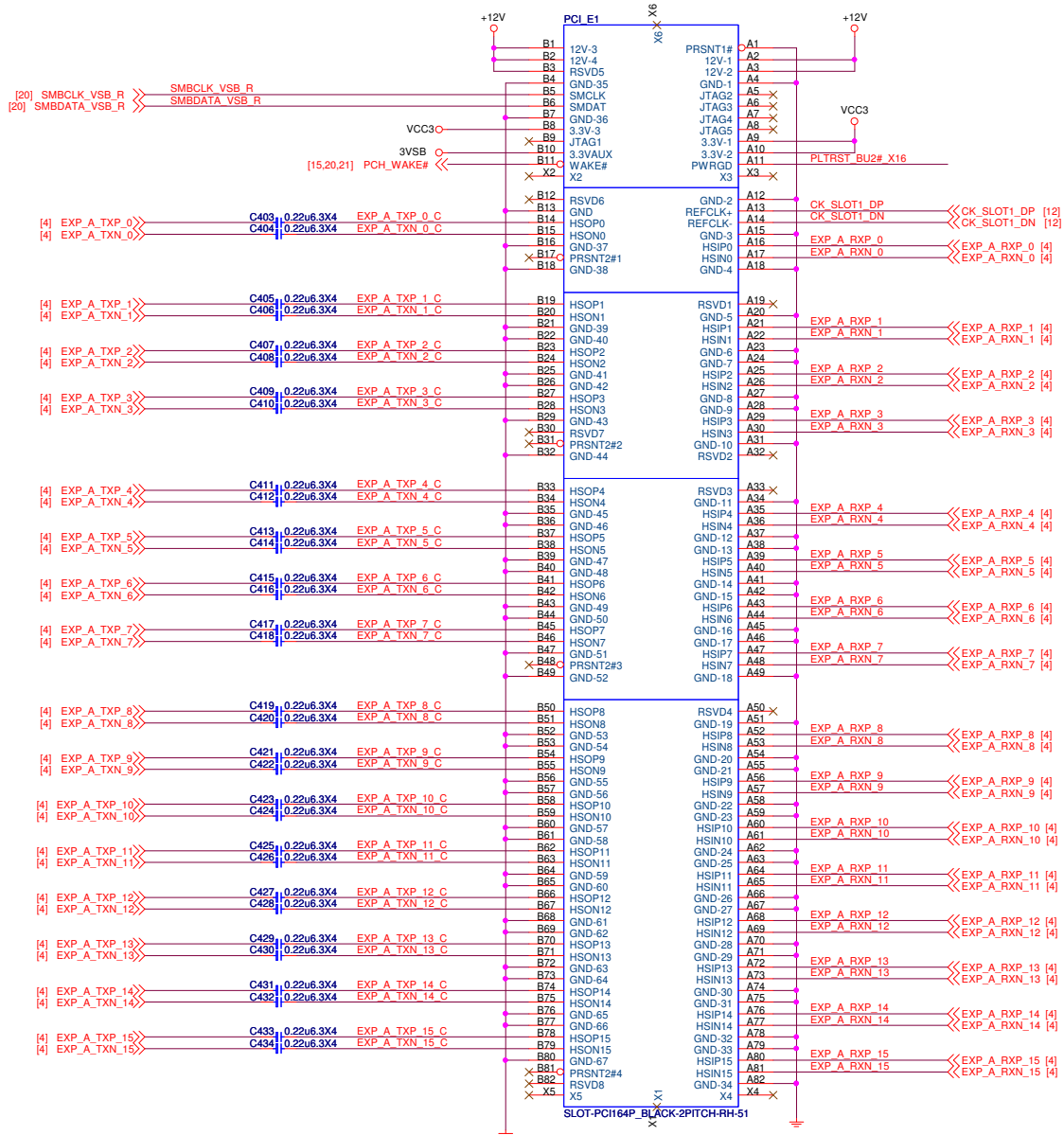
MICRO-STAR INT'L CO.,LTD

MS-7A65..

Size Custom	Document Description PCH-Strap	Rev 0A
Date: Friday, October 14, 2016	Sheet 18 of 59	

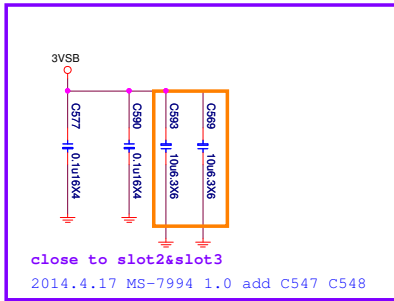
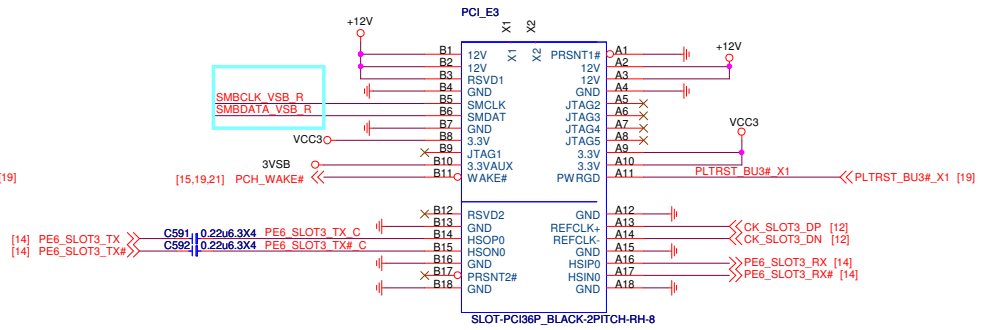
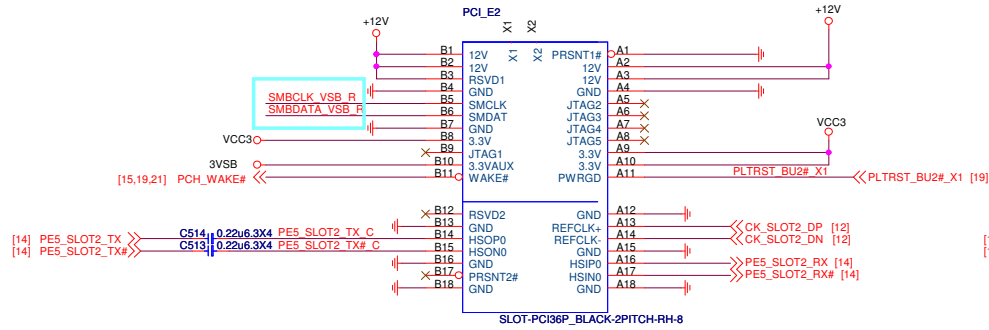
SMBUS ESD

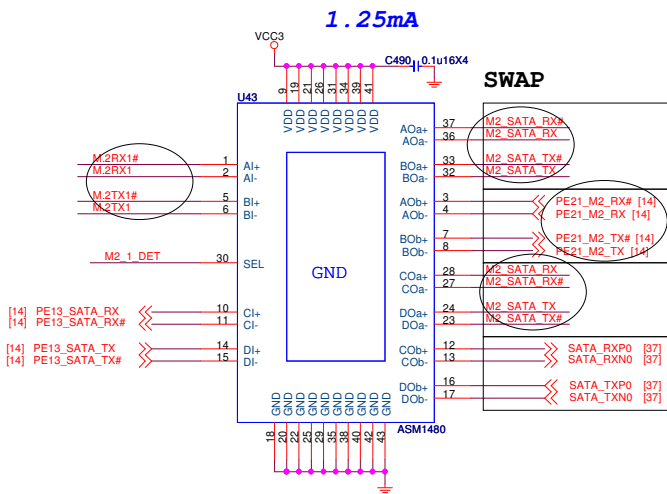
SMBCLK_VSB_R R416 4.7K/4 3VSB
SMBDATA_VSB_R R418 4.7K/4 3VSB



2015.7.20
change net name to SMBCLK_VSB,SMBDATA_VSB

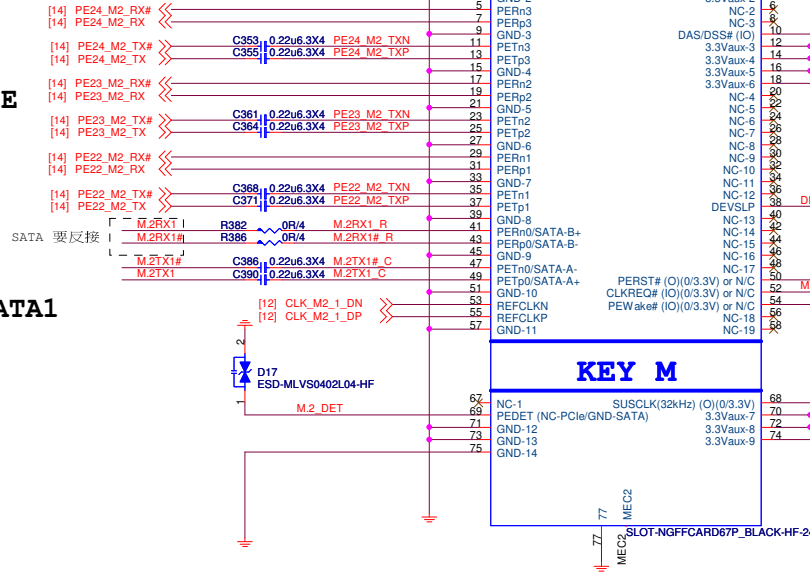
[19] SMBCLK_VSB_R >> SMBCLK_VSB_R
[19] SMBDATA_VSB_R >> SMBDATA_VSB_R





PCIE

SATA1



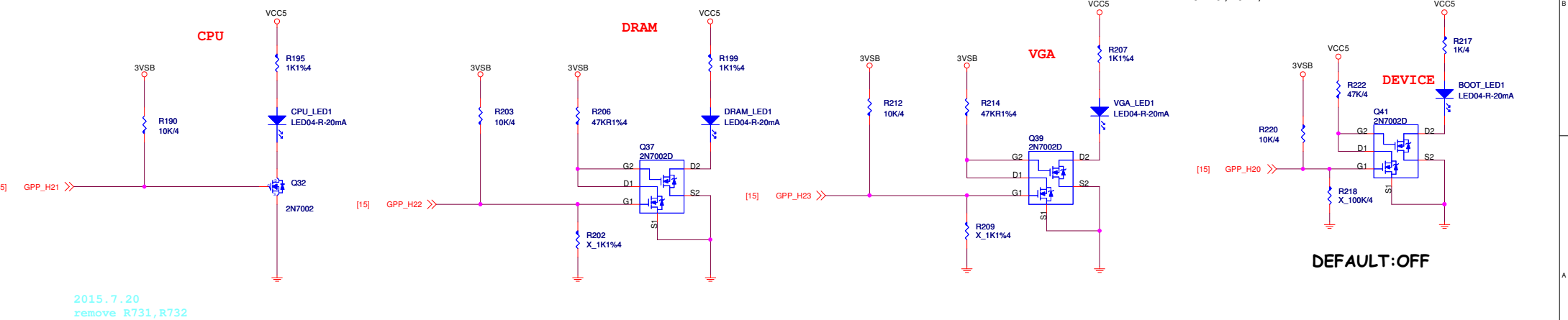
BIOS ROM

[15] PCH_SPI_MOSI << PCH_SPI_MOSI
[15] PCH_SPI_MISO << PCH_SPI_MISO
[15] PCH_SPI_CLK << PCH_SPI_CLK
[15] PCH_SPI_CS0# << PCH_SPI_CS0#
[15] PCH_SPI_IO2 << PCH_SPI_IO2
[15] PCH_SPI_IO3 << PCH_SPI_IO3

ATX_5VSB << R688 10K/4 SPI_SW_SEL
[15,34] RSMRST# << D19
S-RB751V-40_SOD323-RH
[15,34] CHIP_PWGD << D20
S-RB751V-40_SOD323-RH
[34,35,44,52] SIO_SLPSUS << D21
S-RB751V-40_SOD323-RH
2015.4.21 Add D22
Add IO2 pull-up (depop)
Add MISO/MOSI pull-up (depop)

Debug LED

MS-7994 Add. Debug LED circuit



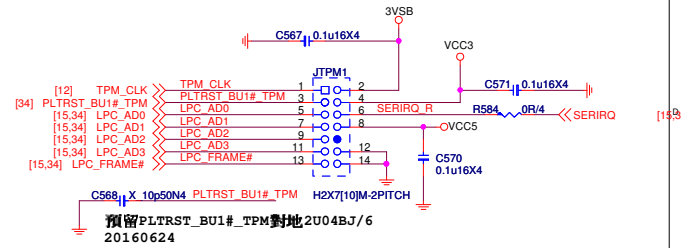
2015.7.20
remove R731,R732

SPI CS# < 25pF
DOG-0402510-SIO

For TL624-1.1 : Stuff R235
Old : Don't stuff R235

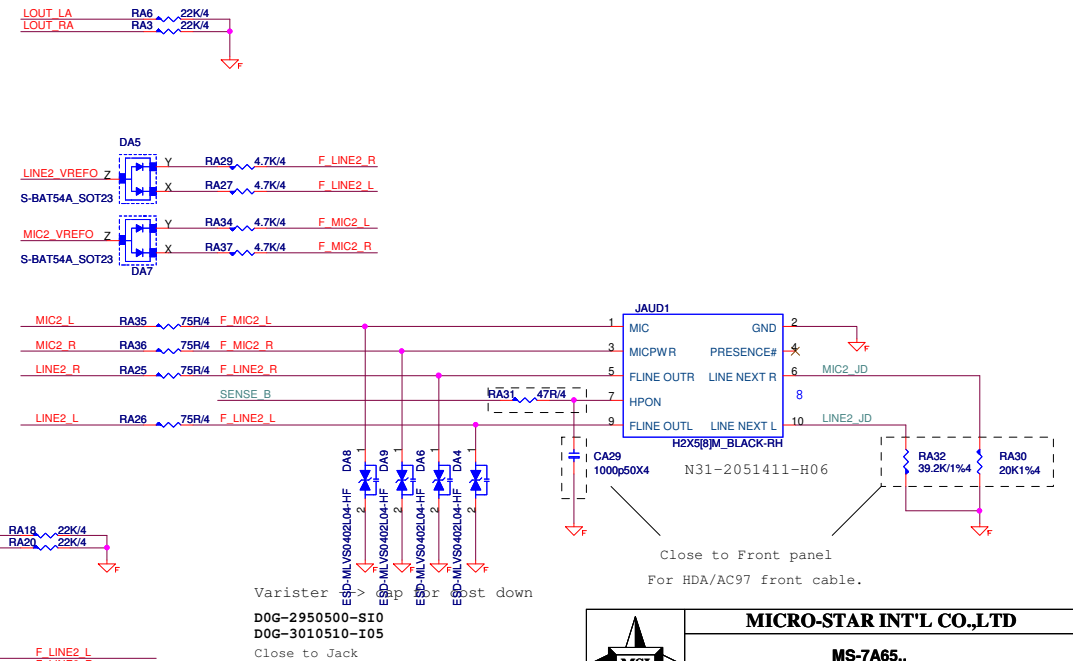
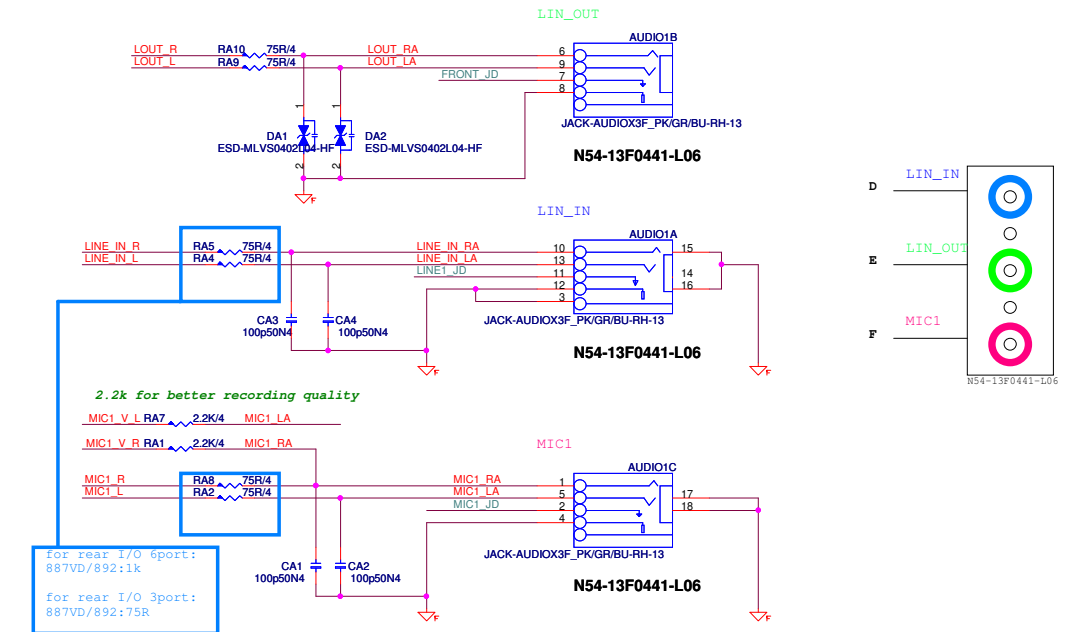
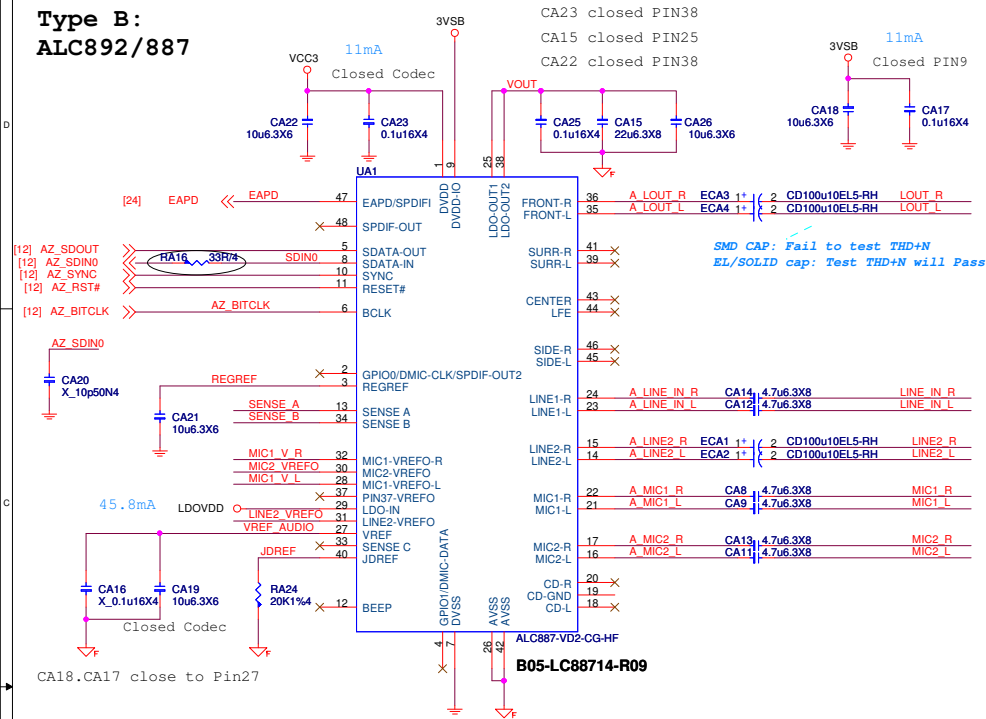
For TL624-1.1 : Stuff D5
Old : Only RSVD (Because 12V level)

TPM



Add EZdebug LED for BOOT device
2016/01/11

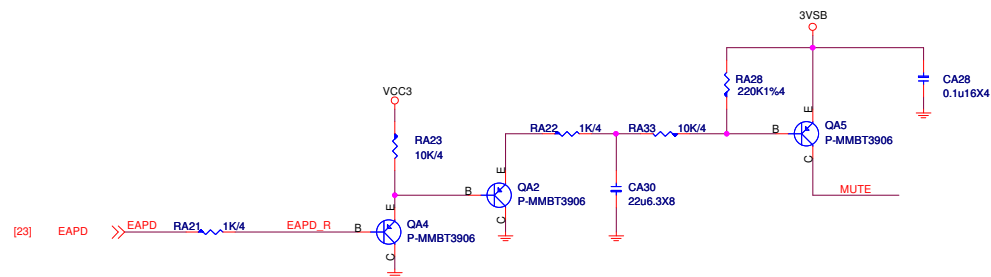
Type B:
ALC892/887



MICRO-STAR INT'L CO.,LTD			
MS-7A65..			
Size Custom	Document Description AUDIO 887		Rev 0A
Date: Friday, October 14, 2016		Sheet 23	of 59

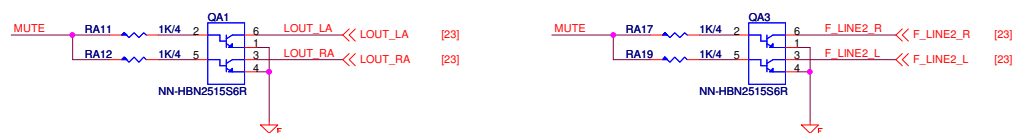
Rear Line OUT De-POP circuit

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

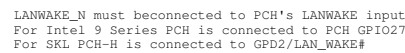
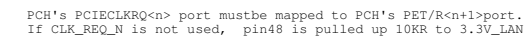


Digital

Analog



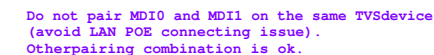
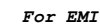
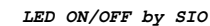
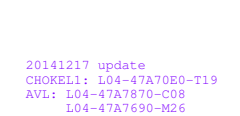
Reserve RL9,RL13 for Schematic Checklists



Remove pull-up R if R existence on motherboard
(or PCH has internal pull-up R).

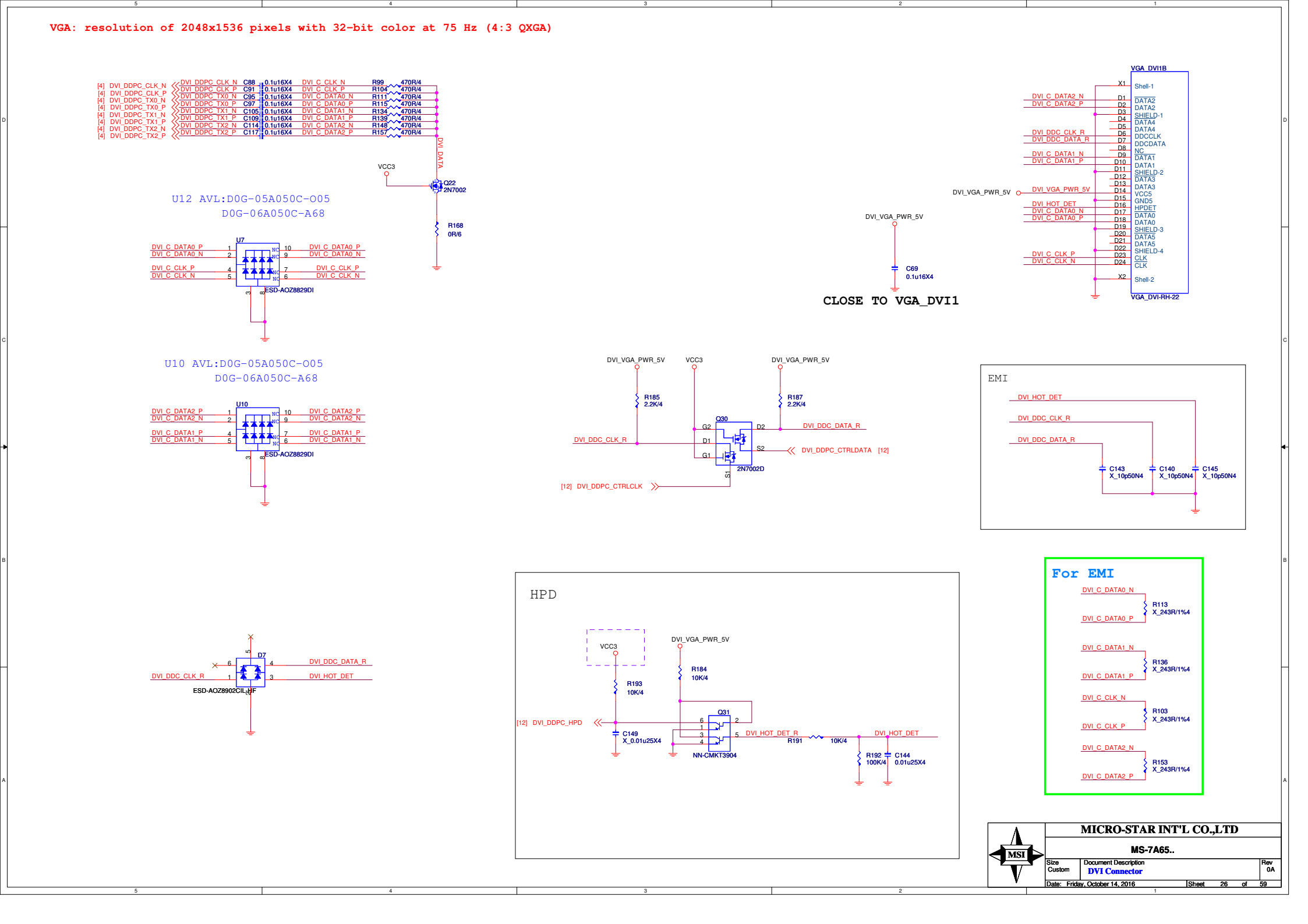
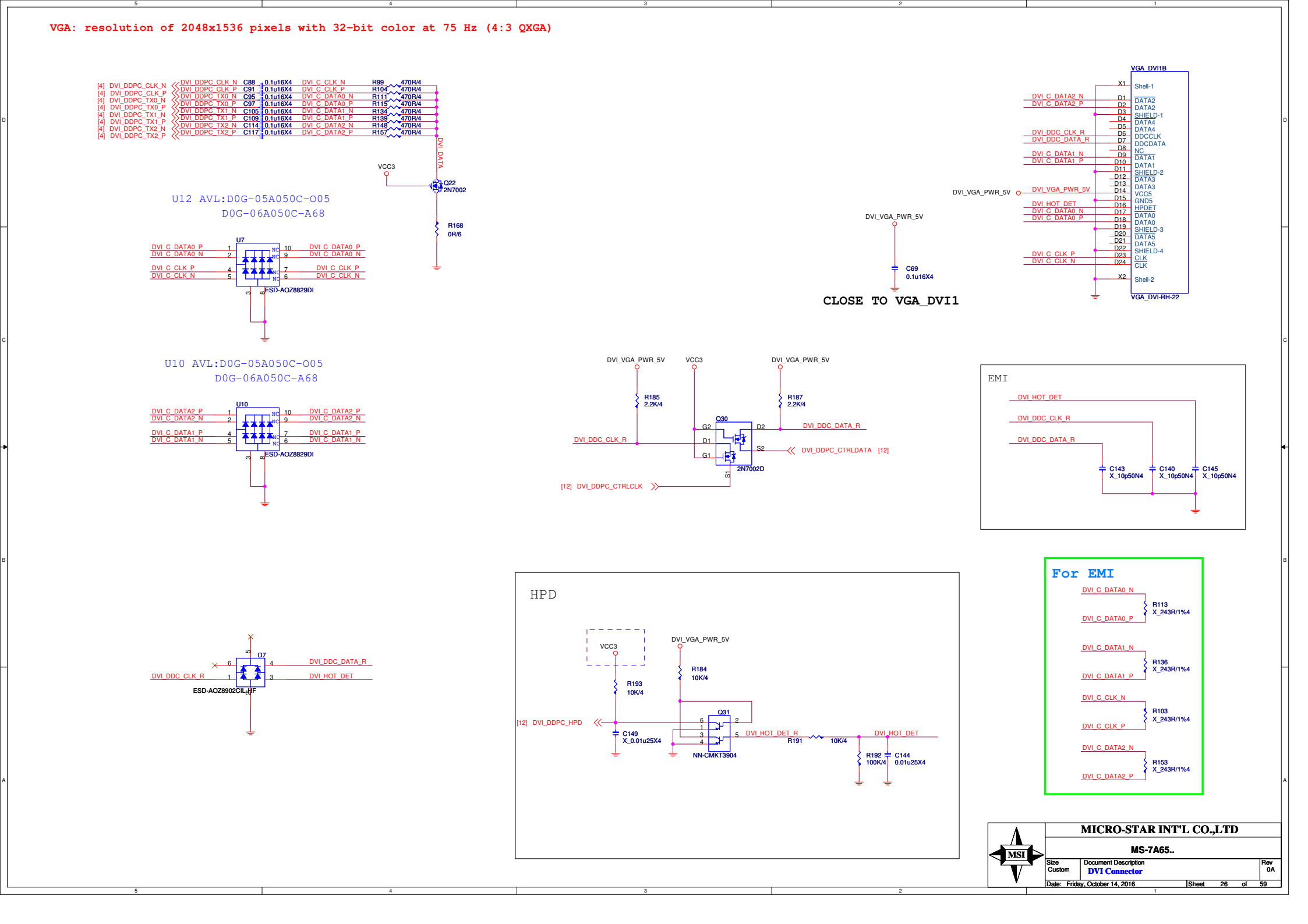
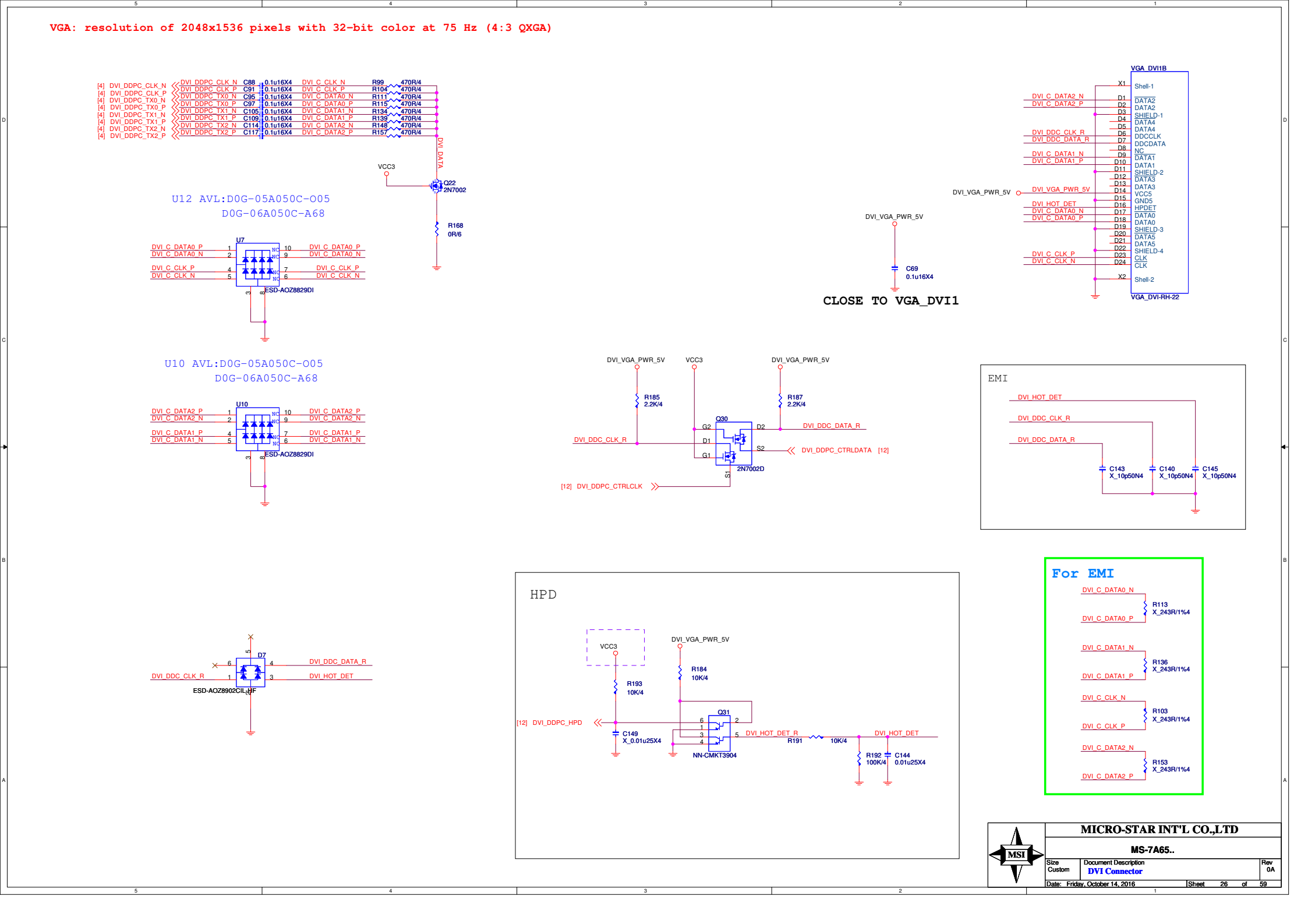
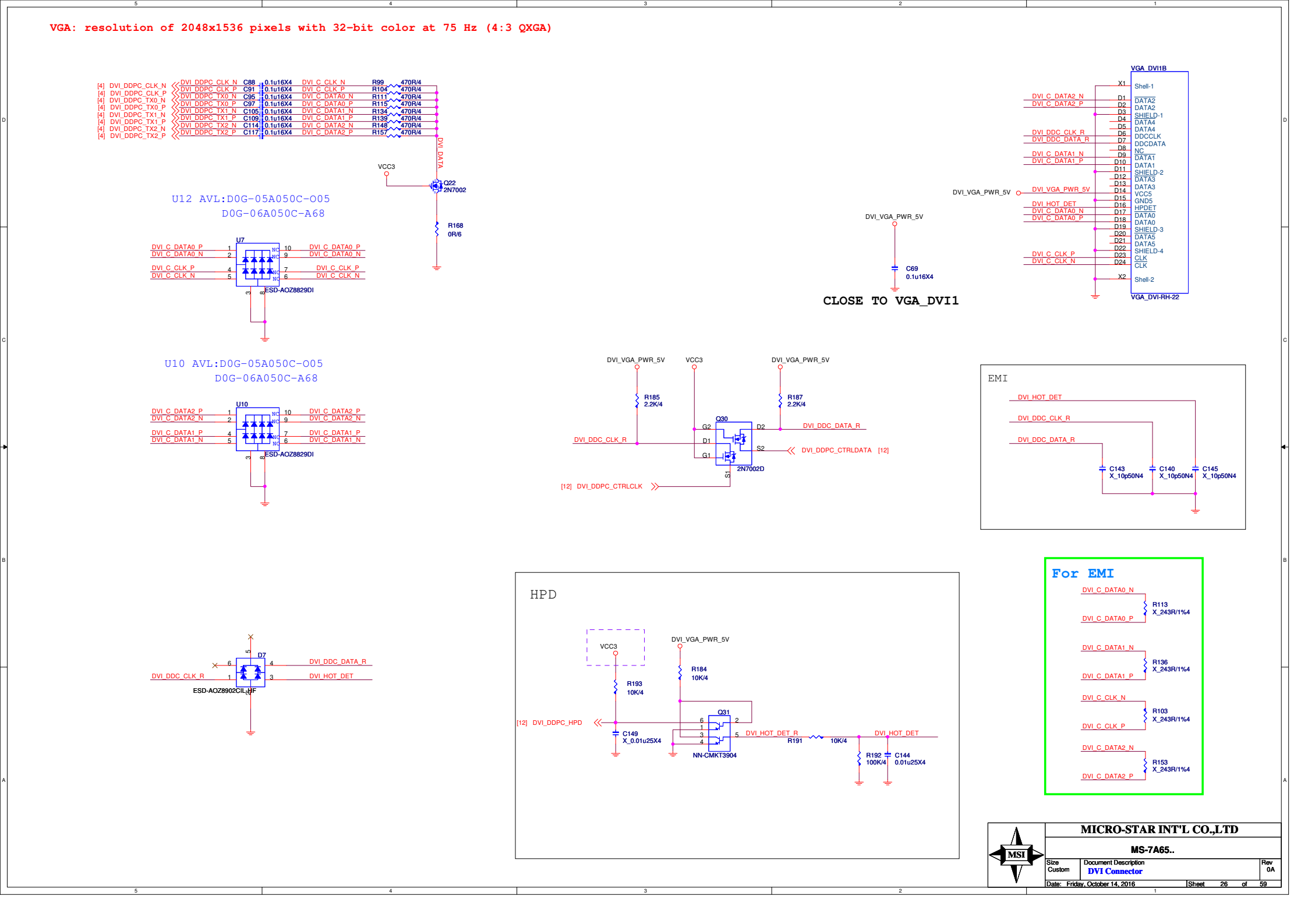
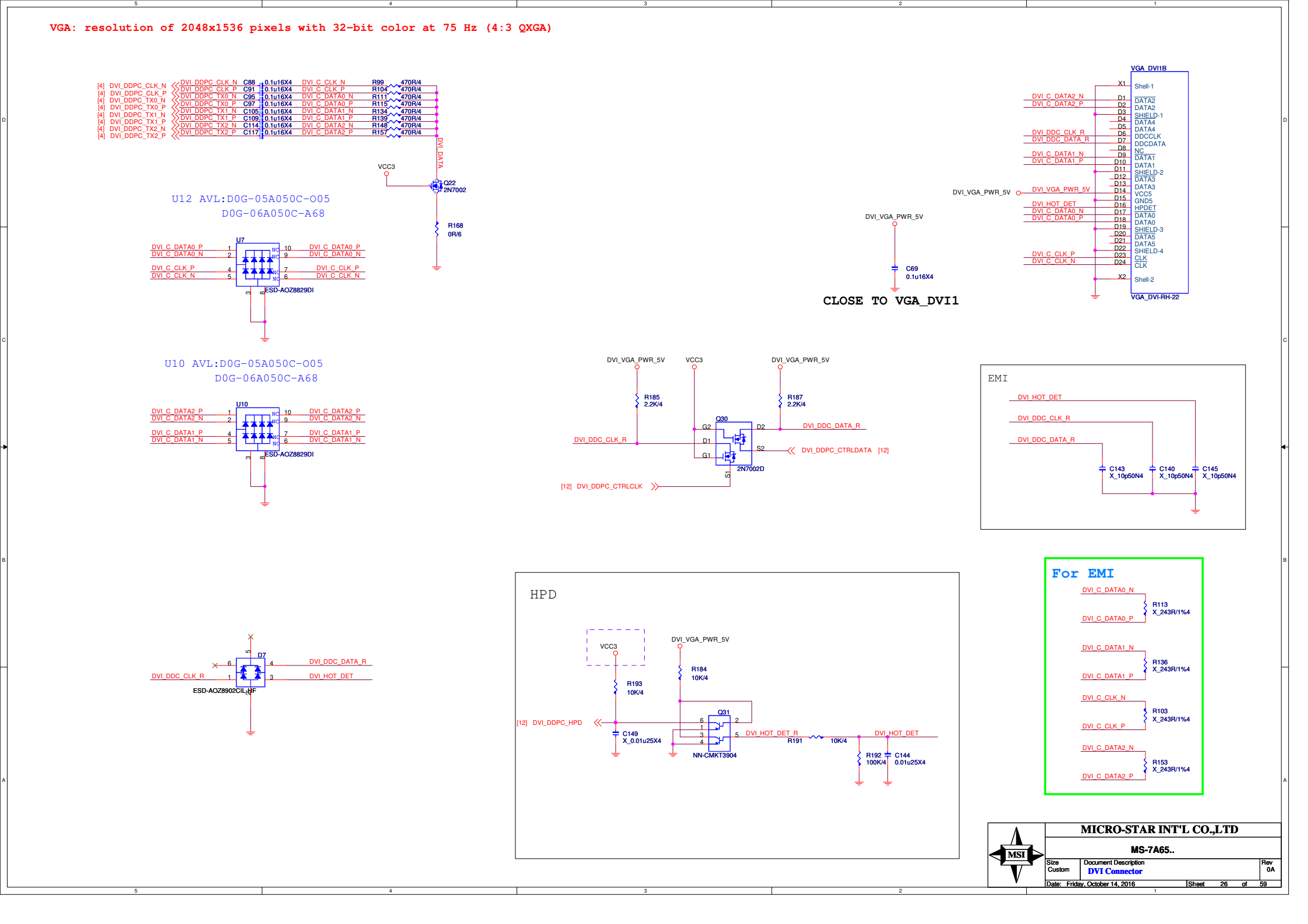
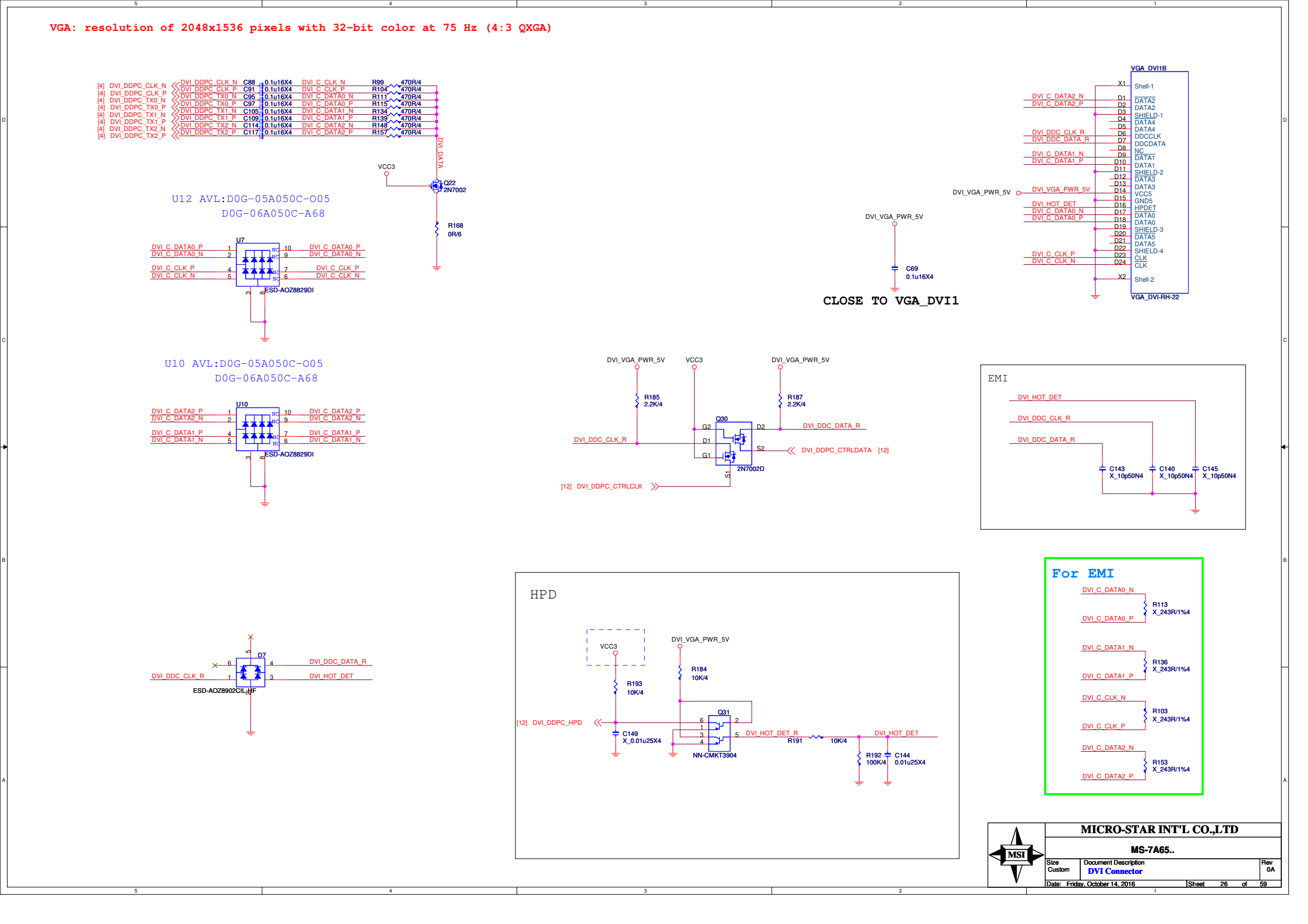
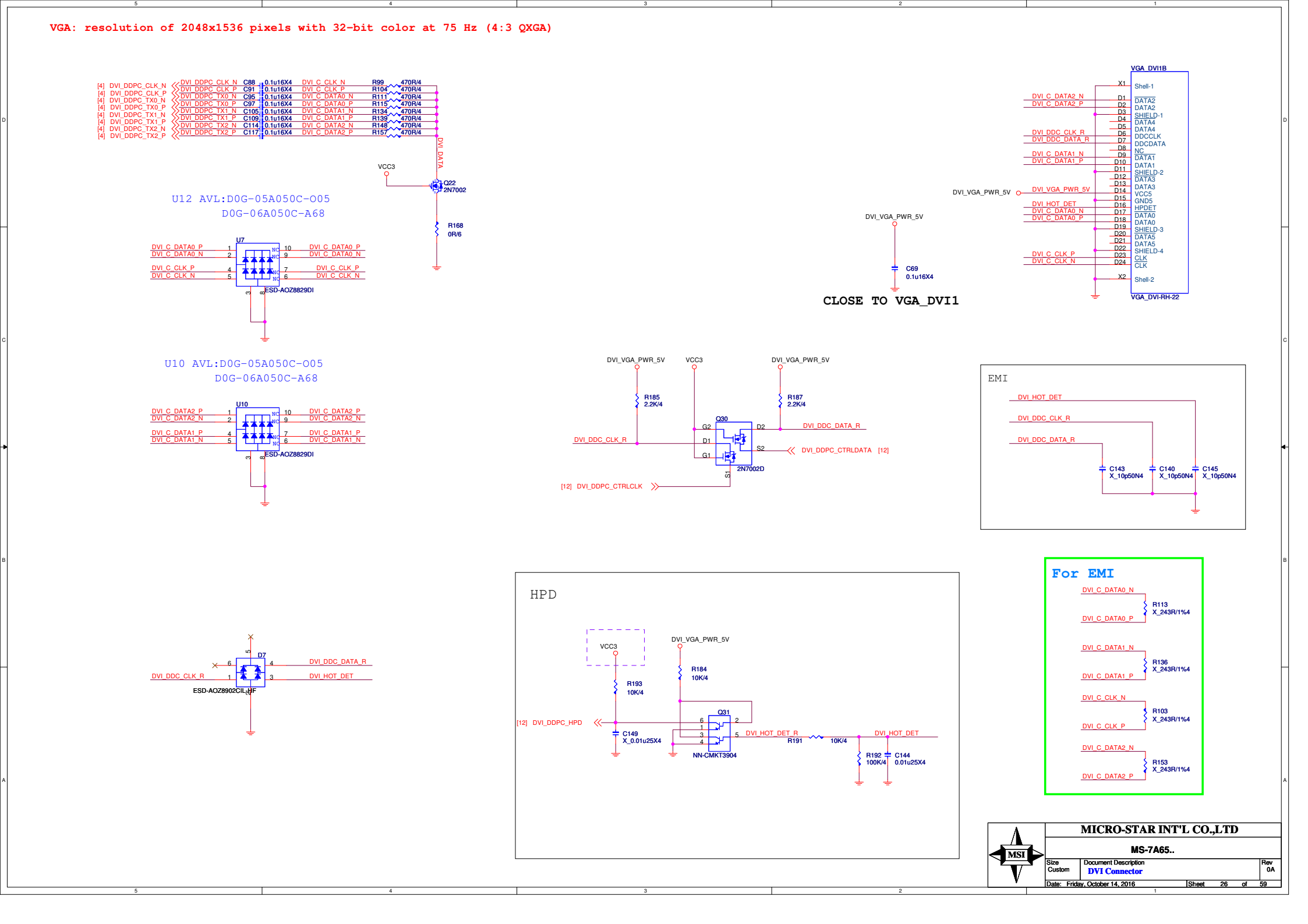
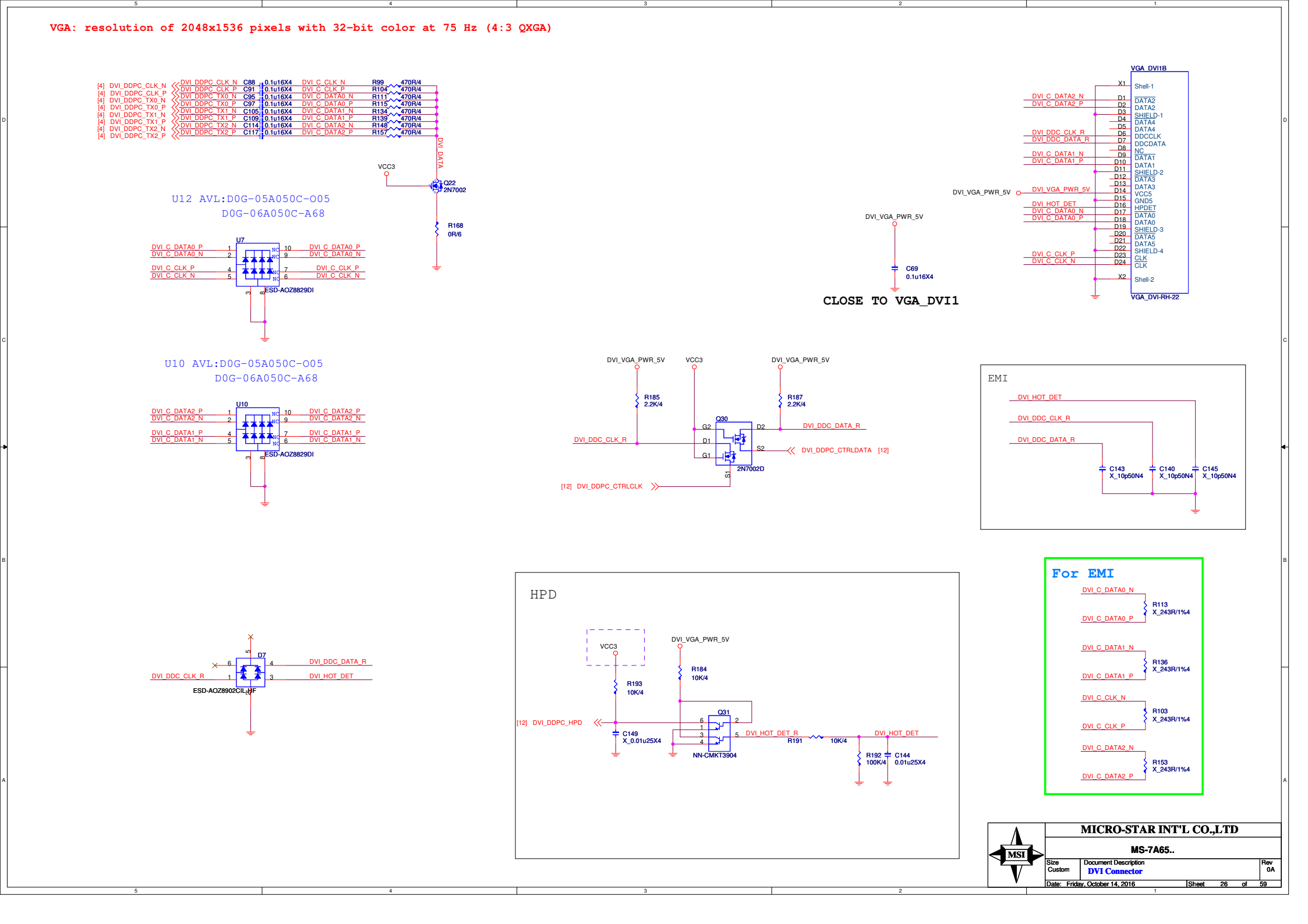
The 10Kohm pull-up resistor (RL18) of CLK_REQ_N is connected to 3.3V Suspend/Core/etc. power well, depending on the power well of PCH's input PCIECLKRQ<n> buffer.

support WOL from Deep Sx:
Power source from 3VA (DSW power)
& make sure MAX current is enough to support i218/i219.

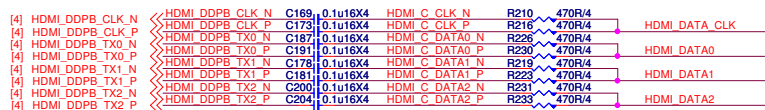


MS-7A65..

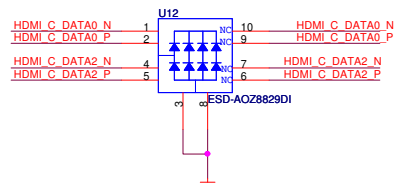
Size Custom	Document Description LAN - Intel I219V	Rev 0A
Date: Friday, October 14, 2016		Sheet 25 of 59

[illegible][illegible][illegible][illegible]

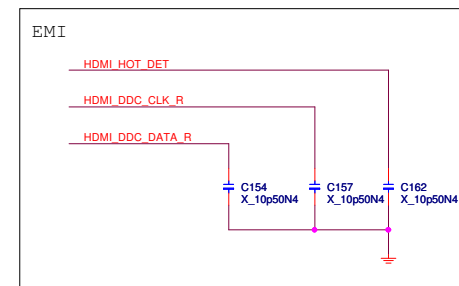
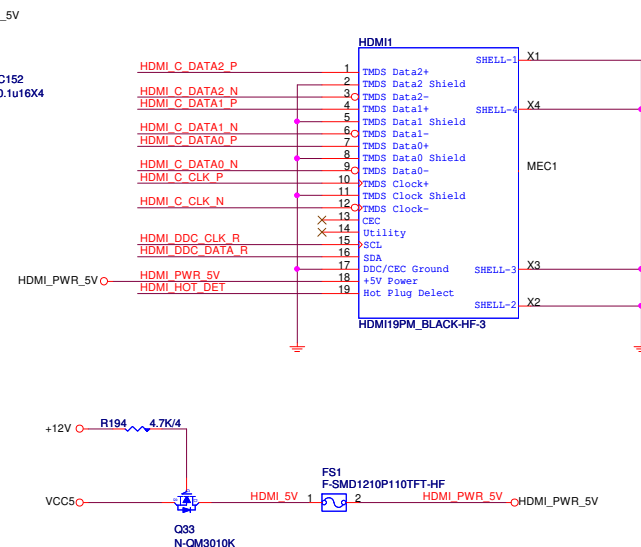
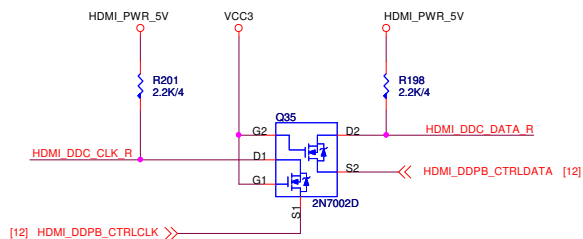
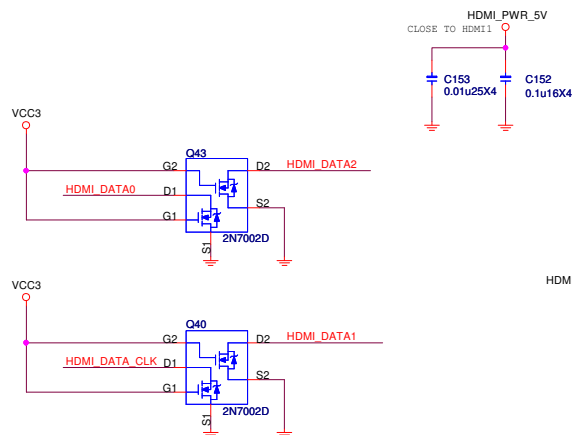
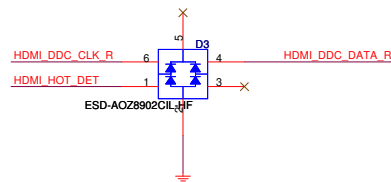
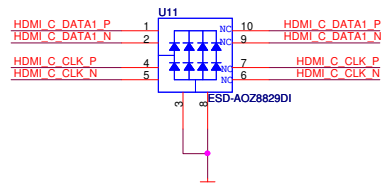
VGA: resolution of 2048x1536 pixels with 32-bit color at 75 Hz (4:3 QXGA)



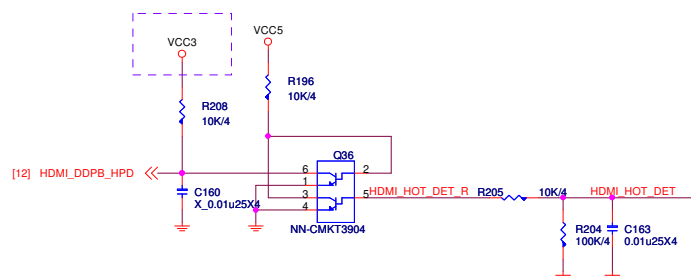
U26 AVL:D0G-05A050C-O05
D0G-06A050C-A68



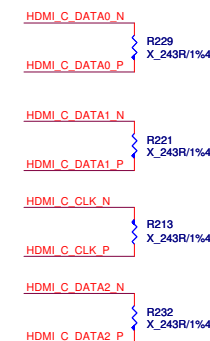
U27 AVL:D0G-05A050C-O05
D0G-06A050C-A68



HPD



For EMI



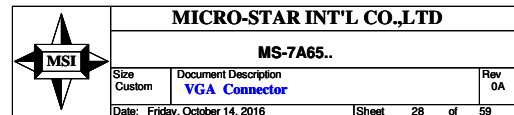
MICRO-STAR INT'L CO.,LTD

MS-7A65..

Size	Document Description	Rev
Custom	HDMI Connector	12
Date: Friday, October 14, 2016	Sheet 27 of 59	

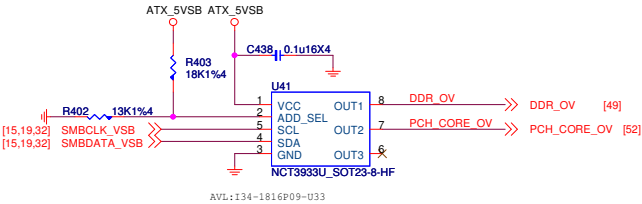
If connect to eDP port,must confirm whether it support hot plug detection HPD and re-auxtraining

IT6516BFN CX

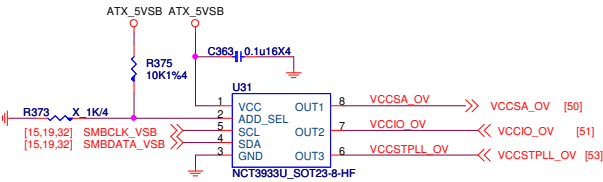


UPI VOLTAGE CONSOLE

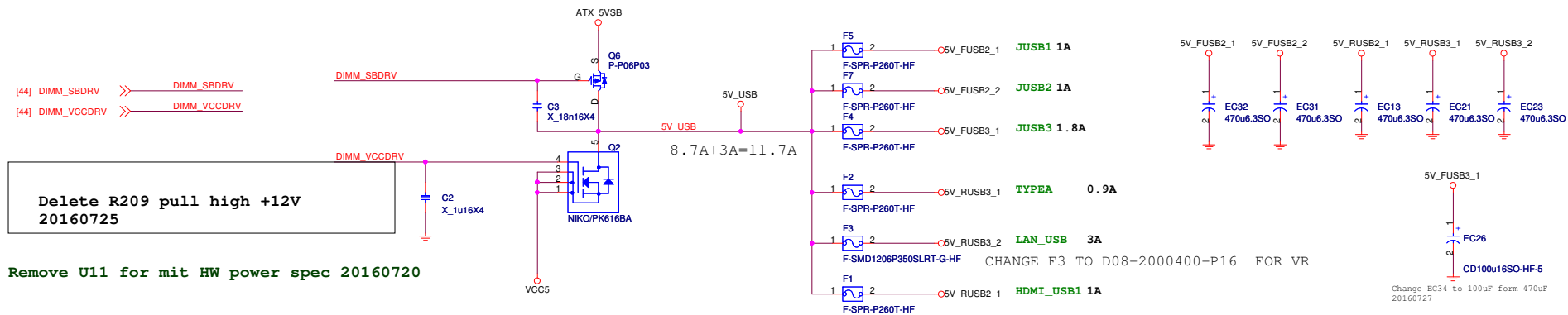
0x26:RH=18K,RL=13K



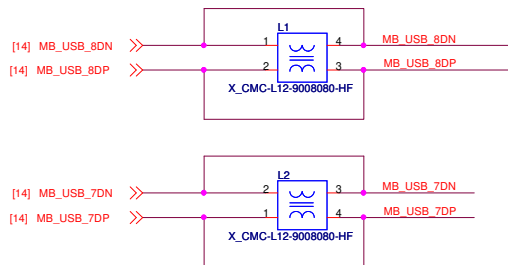
0x20:RH=10K,RL=OPEN



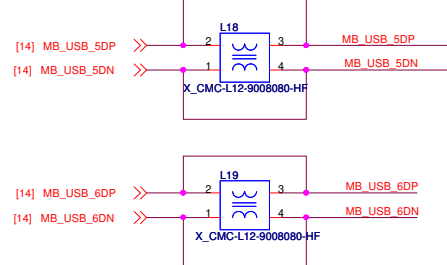
ADDRESS	0x2A	0X28	0x26	0x24	0x22	0x20
RH (KOhm)	OPEN	3.9	3	2.2	1.3	10
RL (KOhm)	10	1.3	2.3	3	3.9	OPEN
BUS_SEL	0%	25%	40%	60%	75%	100%



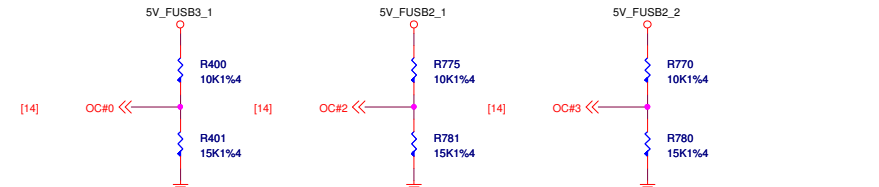
FRONT USB PORT 7,8(OC3#)



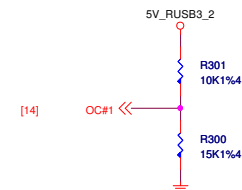
FRONT USB PORT 5,6(OC2#)



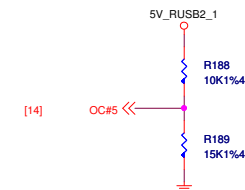
FRONT JUSB3 PORT 1,2 FRONT JUSB1 PORT 5,6 FRONT JUSB2 PORT 7,8



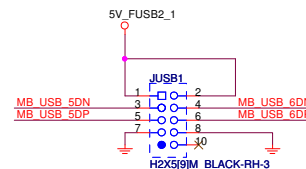
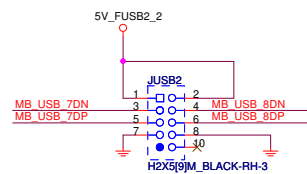
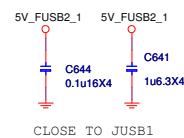
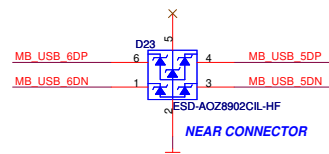
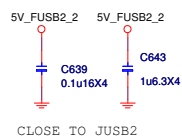
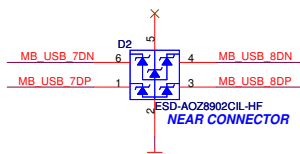
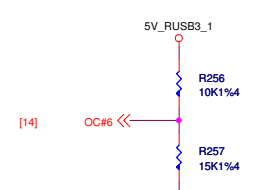
REAL LAN_USB PORT 3,4



REAL HDMI_USB1 PORT 11,12



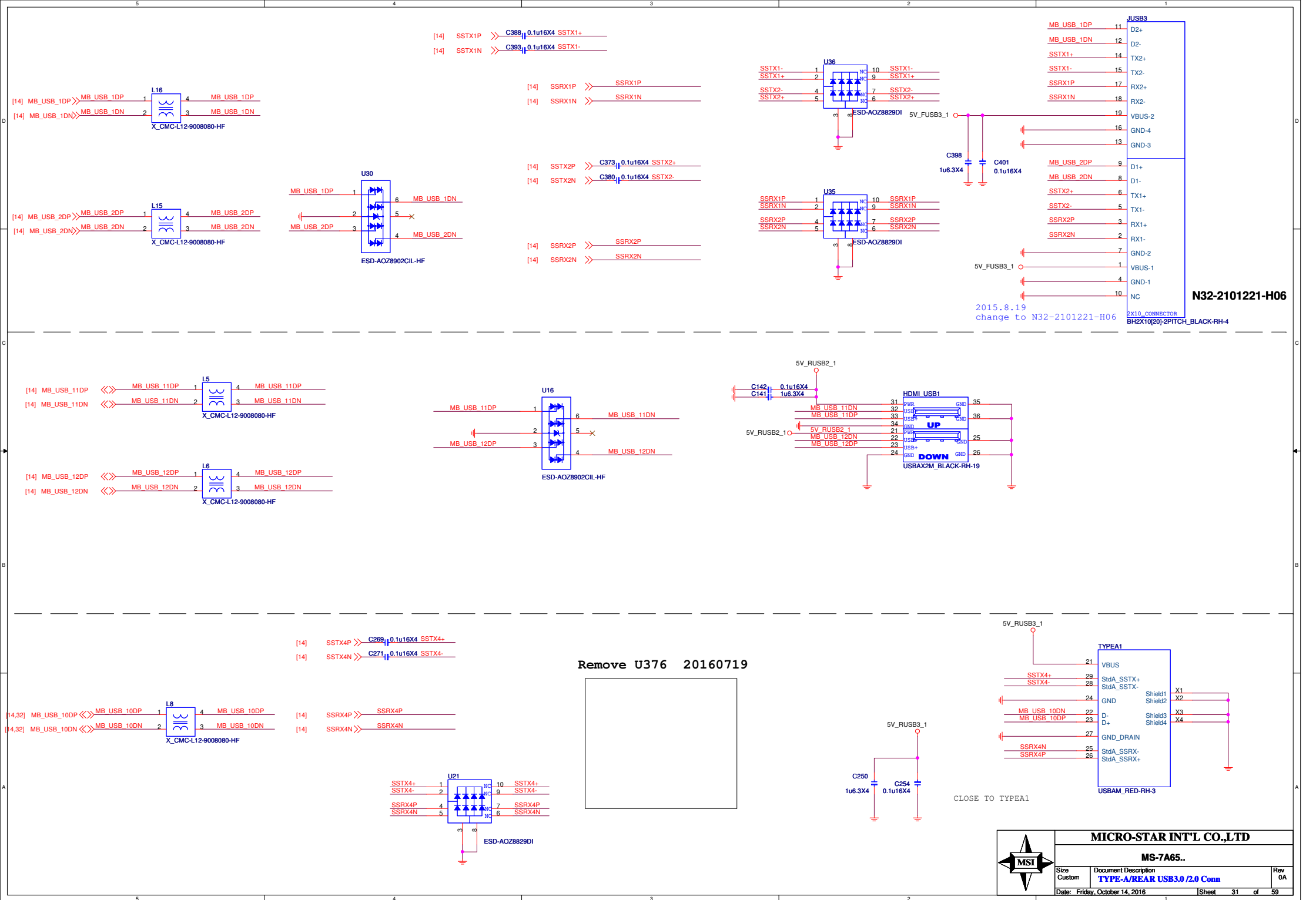
REAL TYPEA1 PORT 10



MICRO-STAR INT'L CO.,LTD

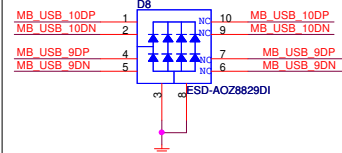
MS-7A65..

Size	Document Description	Rev
Custom	Rear I/O & USB2.0 Connector	0A
Date: Friday, October 14, 2016	Sheet 30 of 59	

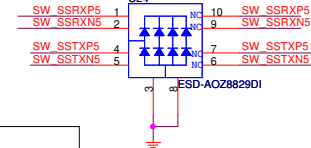
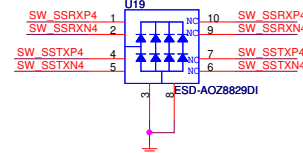


Rear USB3 CONN

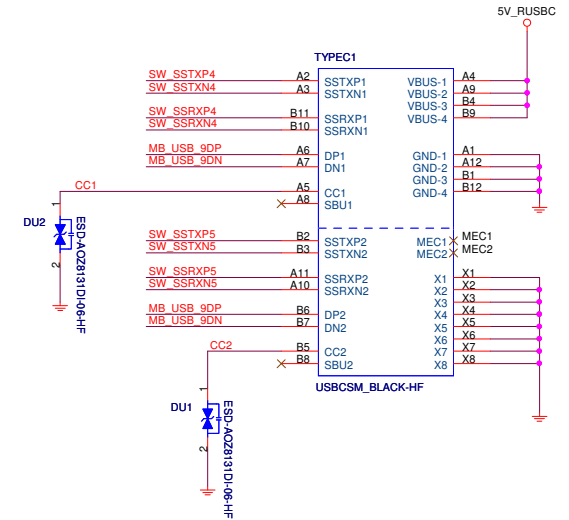
[14] MB_USB_9DP <<>
[14] MB_USB_9DN <<>



ESD整合到D38 2016/07/19
[14,31] MB_USB_10DP <<> MB_USB_10DP
[14,31] MB_USB_10DN <<> MB_USB_10DN

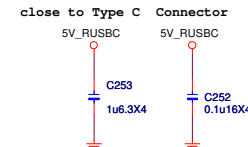
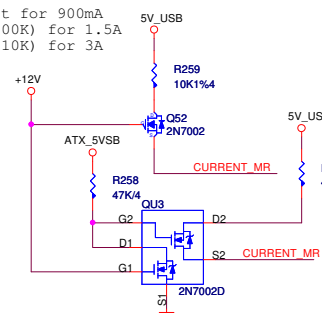


ECU1 CLOSE TO TYPEC1

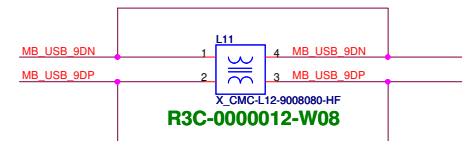
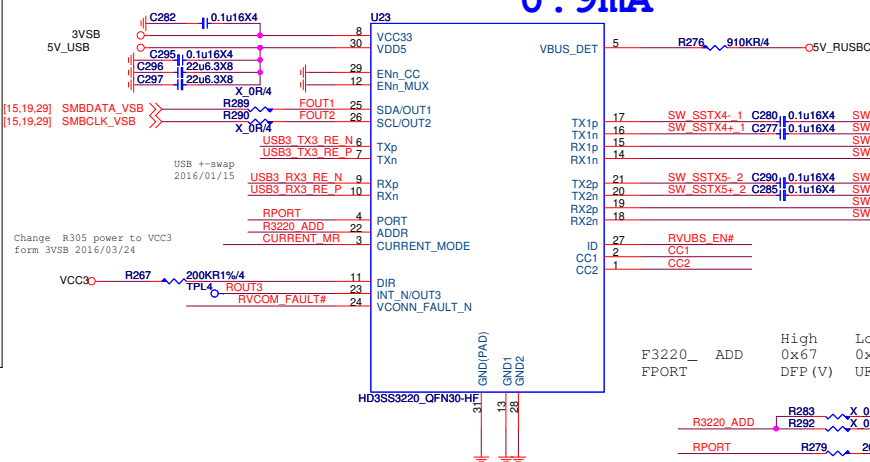


Current Mode

L - Default for 900mA
M - Mid (500K) for 1.5A
H - High (10K) for 3A



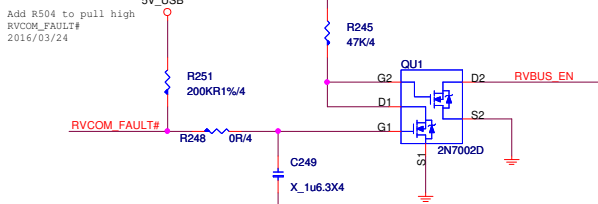
0.9mA



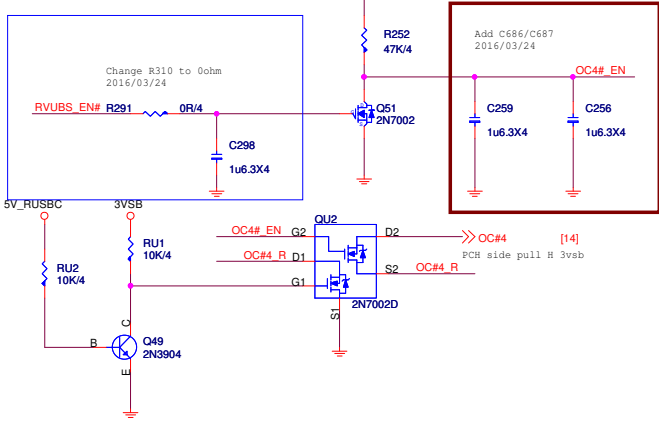
F3220_ ADD High Low NC
FPORT ADD 0x67 0x47 GPIO mode (V)
DFP (V) UFP DRP



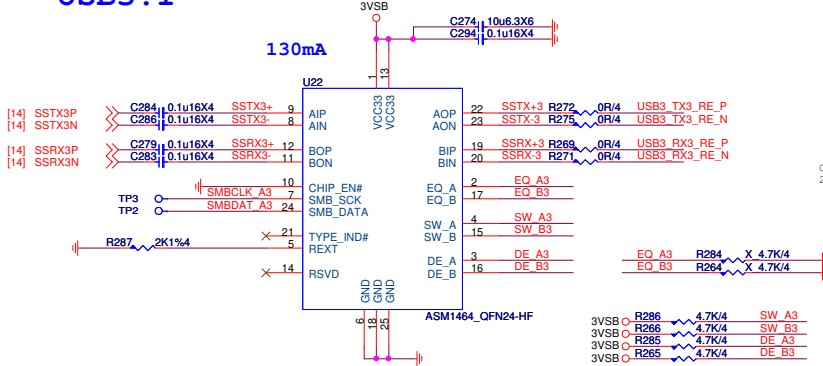
VCONN OC#



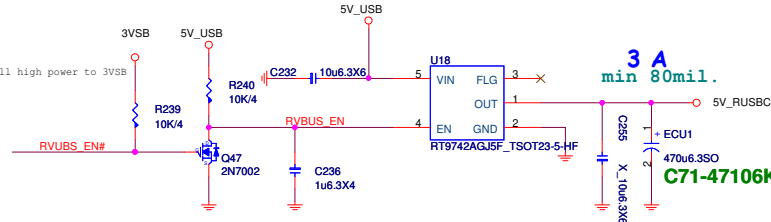
VBUS OC#



USB3.1



Change R273 Pull high power to 3VSB 2016/03/24

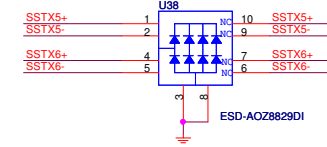
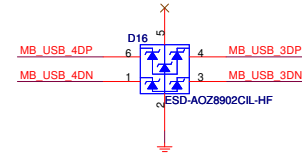
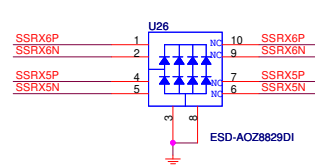
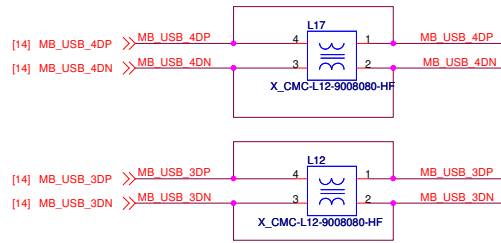


3 A min 80mil.

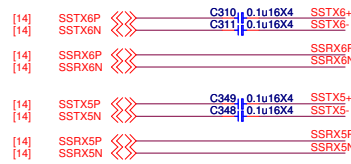
C71-47106K1-A05



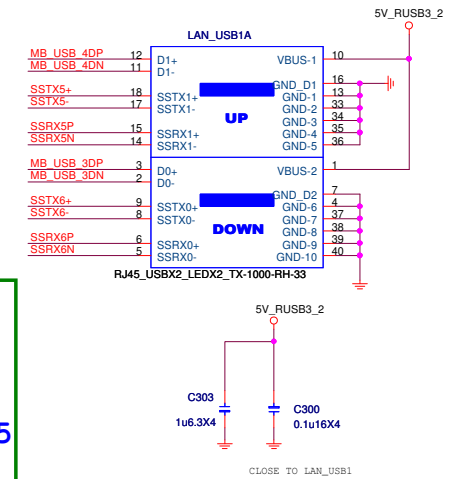
MICRO-STAR INT'L CO.,LTD			
MS-7A65..			
Size	Document Description	Rev	
Custom	TYPE-C/HD3SS3220/REPEAT	0A	
Date:	Friday, October 14, 2016	Sheet	32 of 59



USB20 REPEAT--->Delete 20161005



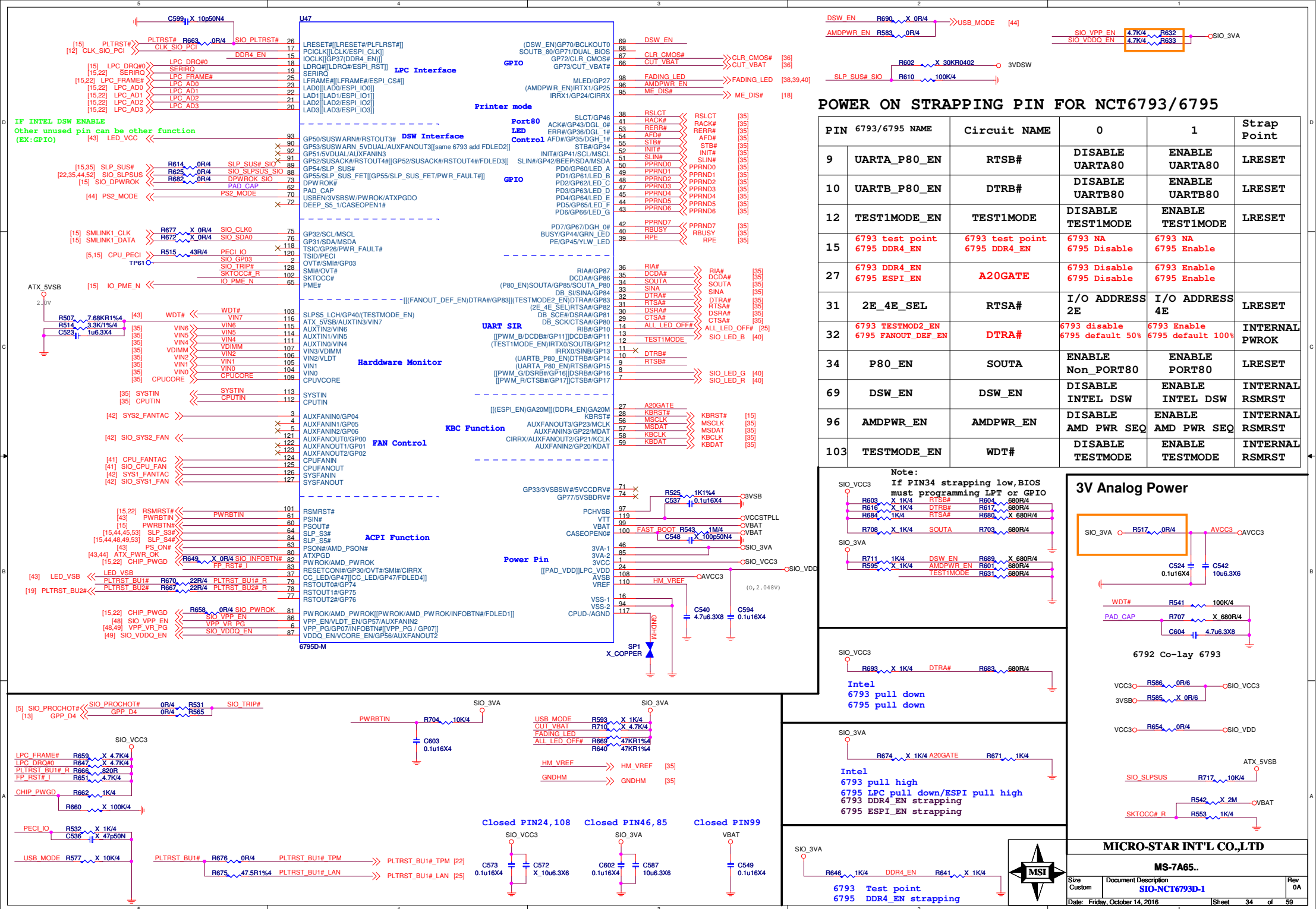
USB3.1 GEN1 REPEAT--->Delete 20161005



MICRO-STAR INT'L CO.,LTD

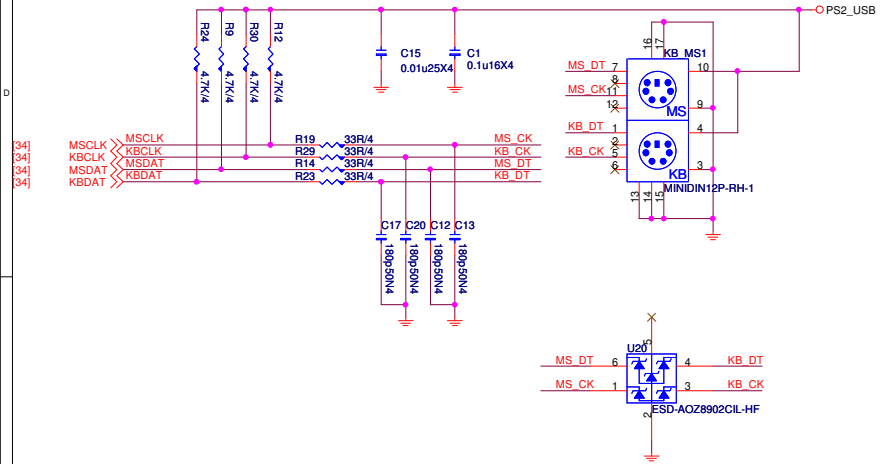
MS-7A65..

Size	Document Description	Rev
Custom	USB REPEAT FOR VR	0A
Date: Friday, October 14, 2016	Sheet 33 of 59	

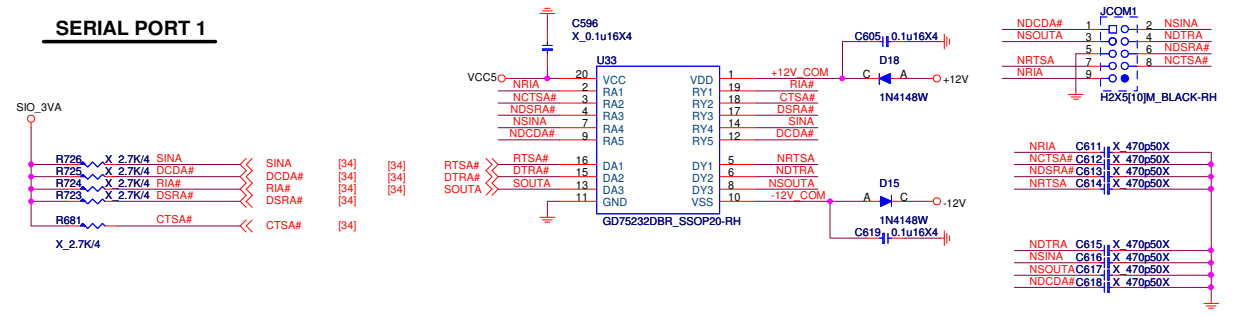


PS2 KEYBOARD & MOUSE CONNECTOR

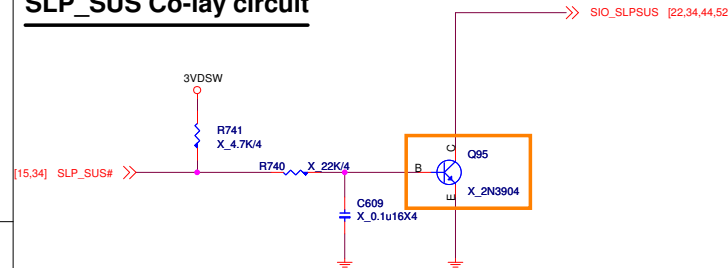
2015.8.13change to N56-12F0211-F02



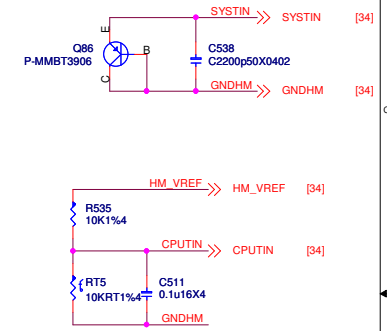
SERIAL PORT 1



SLP_SUS Co-lay circuit

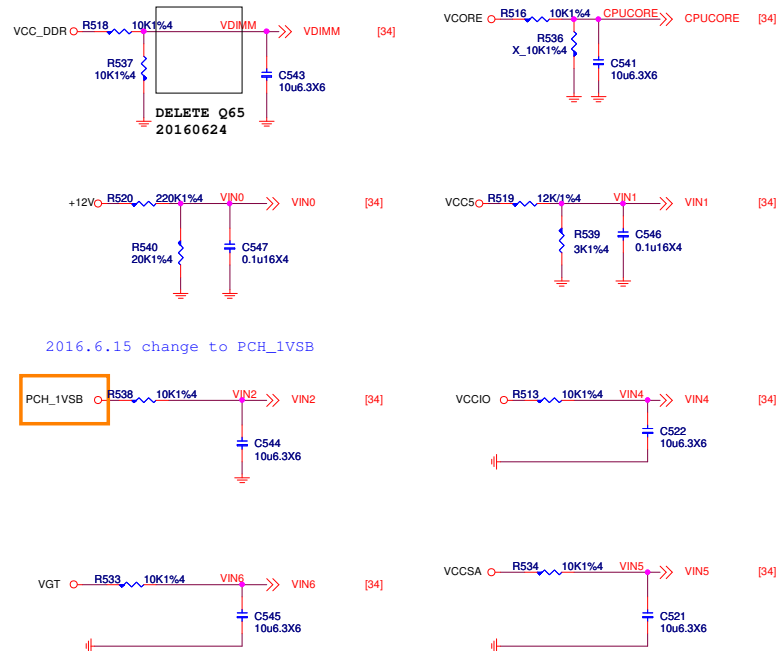


Thermal Monitor

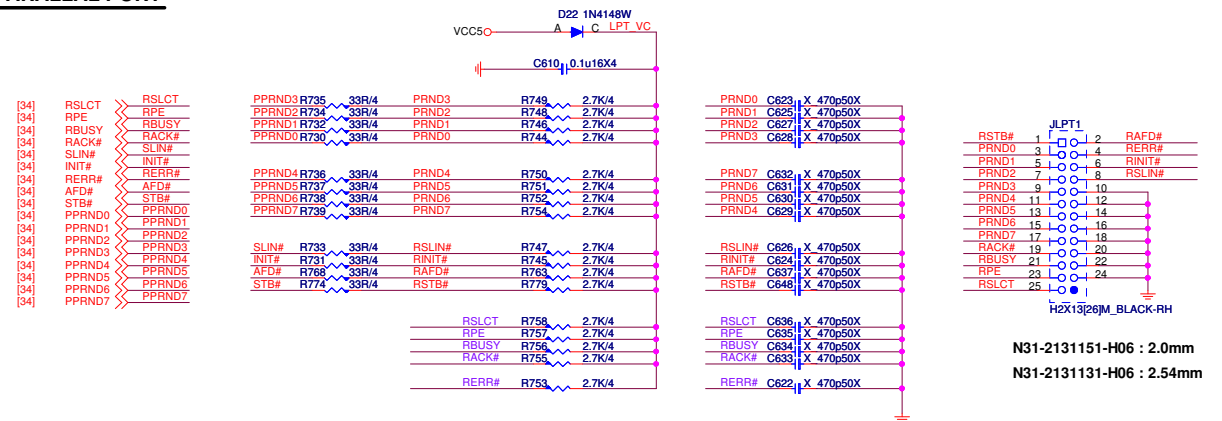


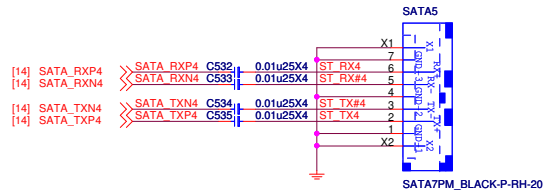
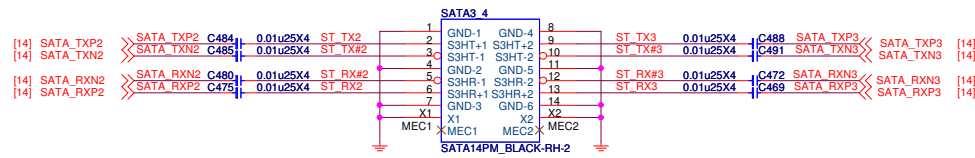
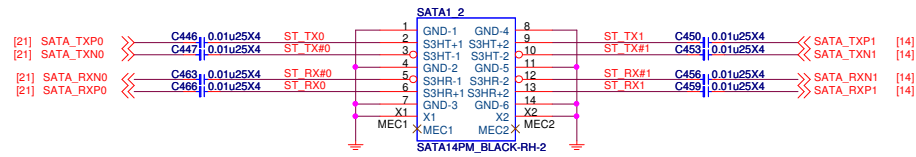
HW Monitor - Voltage

SIO HM Voltage voer 2V will not detect

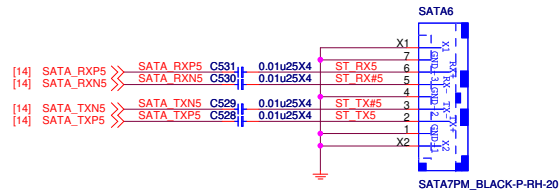


PARALLAL PORT





N5N-07M2441-H06



N5N-07M2441-H06



MICRO-STAR INT'L CO.,LTD

MS-7A65..

Size	Document Description	Rev
Custom	SATA Connector	0A
Date: Friday, October 14, 2016	Sheet 37 of 59	

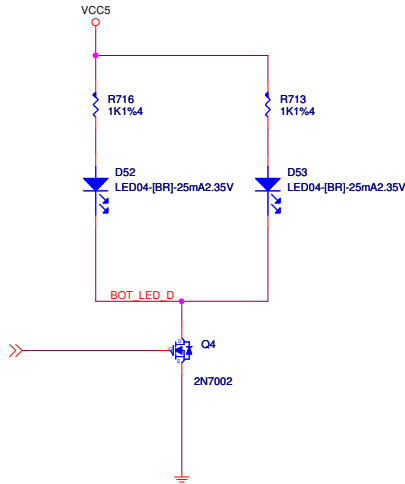
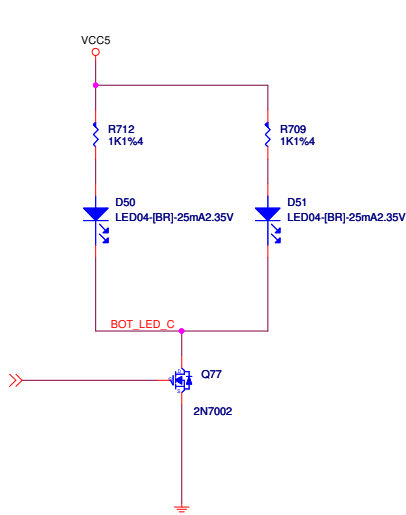
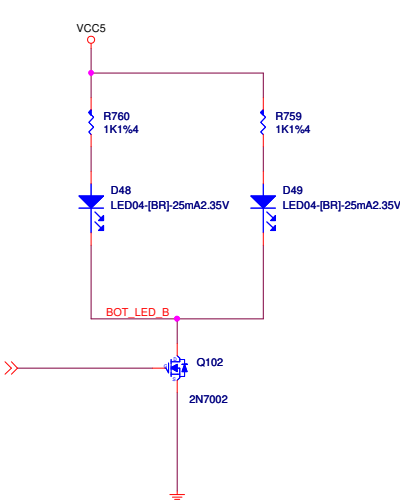
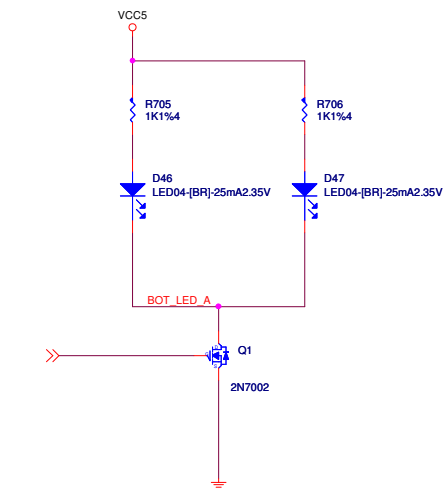
BOT LED

[34,39,40] FADING_LED

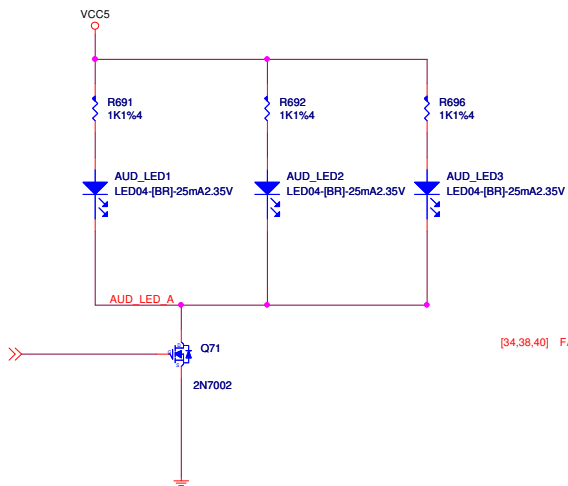
[34,39,40] FADING_LED

[34,39,40] FADING_LED

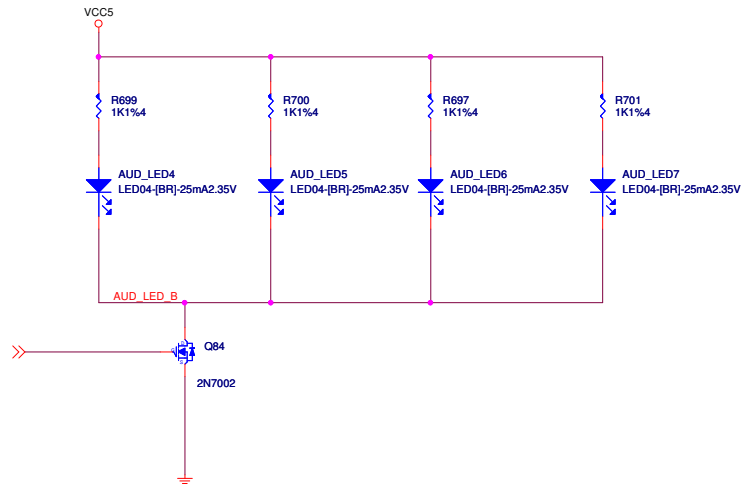
[34,39,40] FADING_LED



[34,38,40] FADING_LED



[34,38,40] FADING_LED



MICRO-STAR INT'L CO.,LTD

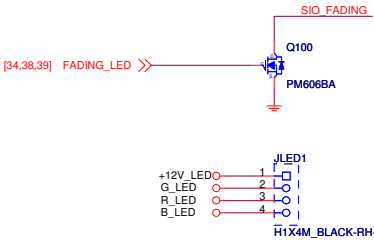
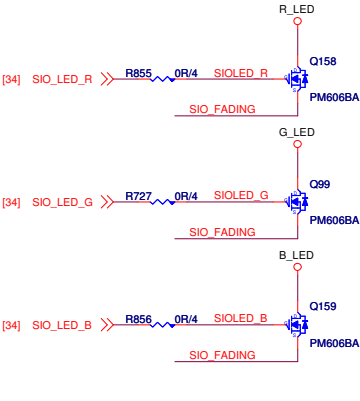
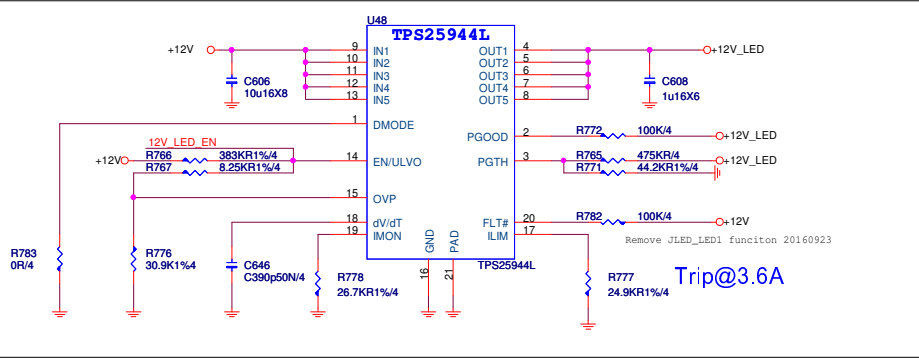
MS-7A65..

Size Custom	Document Description MCU_AUDIO_LED	Rev 0A
Date: Friday, October 14, 2016		
Sheet 39 of 59		

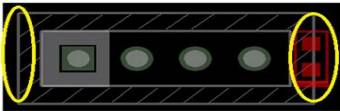
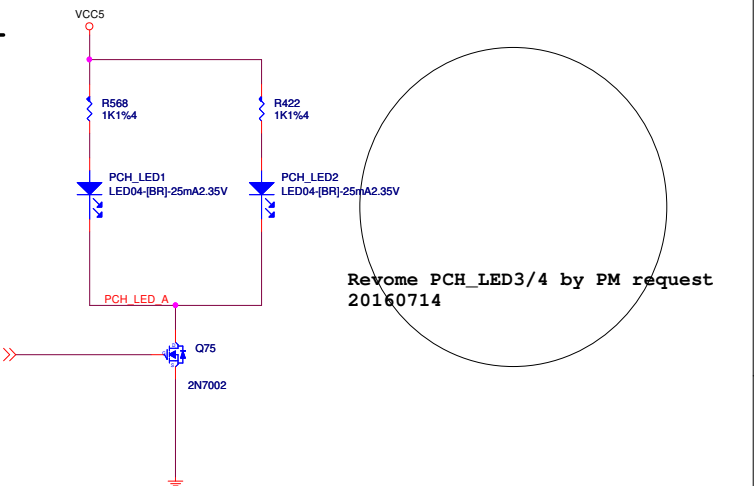
LED Control by SIO

2016.07.07 Use TPS25944L

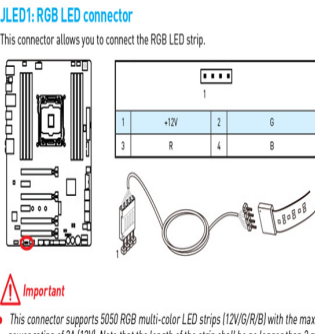
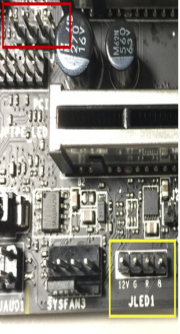
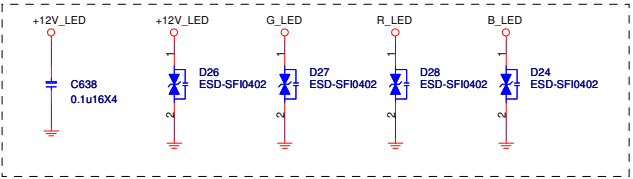
Swap C606/C608 20161005



PCH LED



JLED1電源警示燈請延在旁側



Important

- This connector supports 5050 RGB multi-color LED strips (12V/G/R/B) with the maximum power rating of 3A (12V). Note that the length of the strip shall be no longer than 2 meters, or the LED brightness would become weak.
- Always turn off the power supply and unplug the power cord from the power outlet before installing or removing the RGB LED strip.
- Please use the LED Effect of GAMING APP to adjust, calibrate and control the LED light, refer to the Software section for details.

GPIO LED	GPP_C8	GPP_C9
	GPO PO HIGH	GPO PO HIGH
亮		
減	GPI (default LOW)	GPI (default LOW)

Remove PCIE_SLOT_LED by PM request
20161011

XMP LED

Remove XMP by PM request
20160720

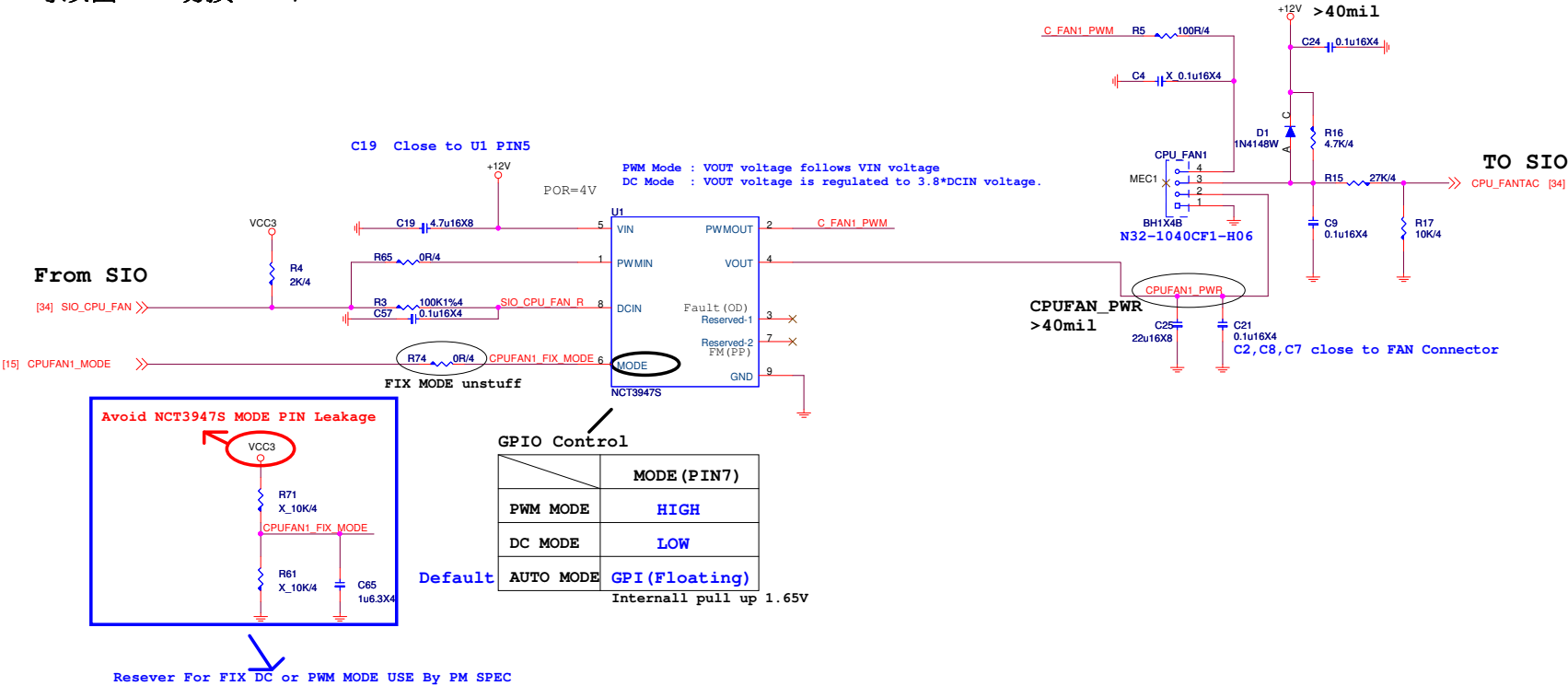
Remove DIMM_LED by PM request
20161011

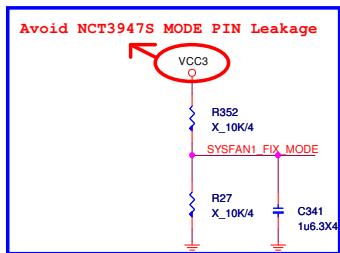


MICRO-STAR INT'L CO.,LTD		
MS-7A65..		
Size Custom	Document Description OTHERLEDS	Rev 0A
Date: Friday, October 14, 2016	Sheet 40 of 59	

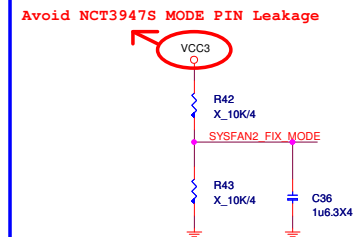
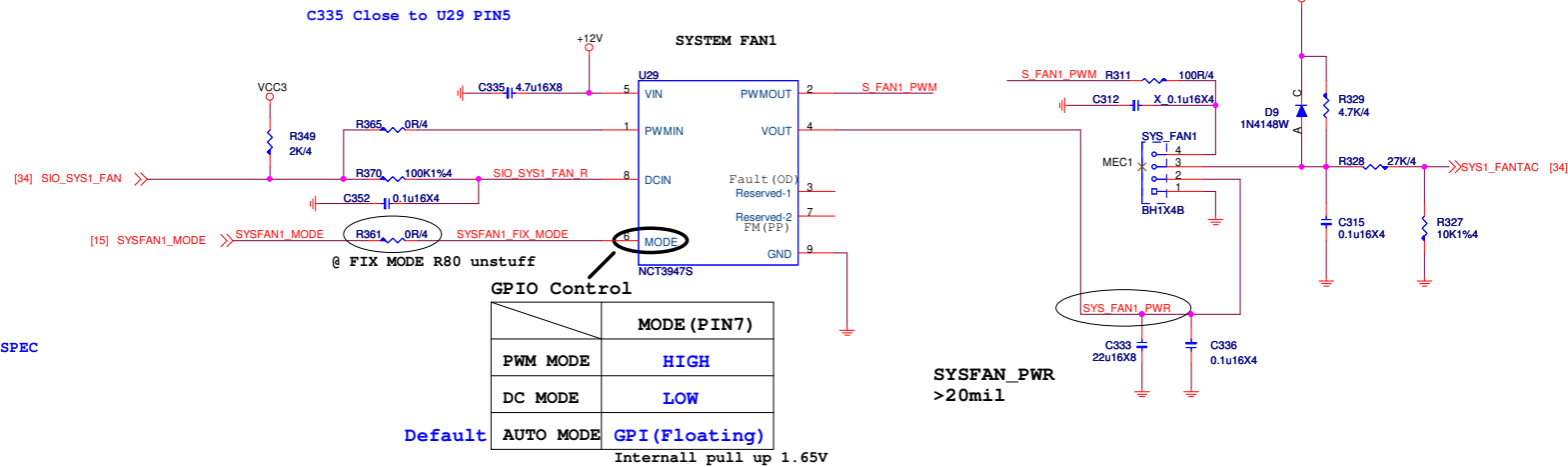
TYPE K : 4 PIN CPU FAN USE NCT3947S USE PCH GPIO CONTROL FAN MODE

2.GPIO可以由BIOS切换 PWM/DC MODE

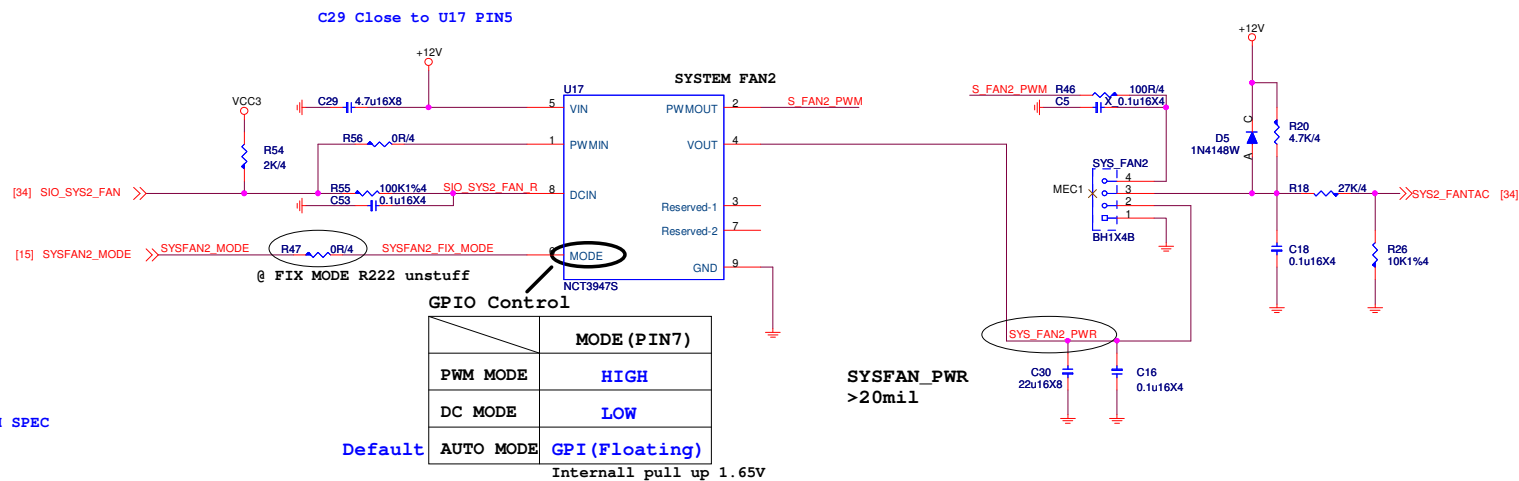




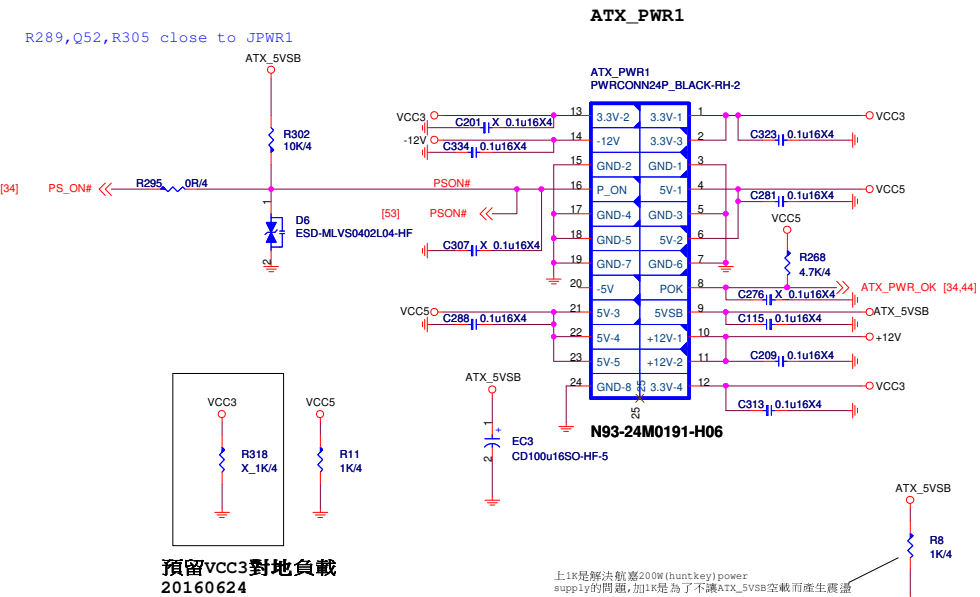
Resever For FIX DC or PWM MODE USE By PM SPEC



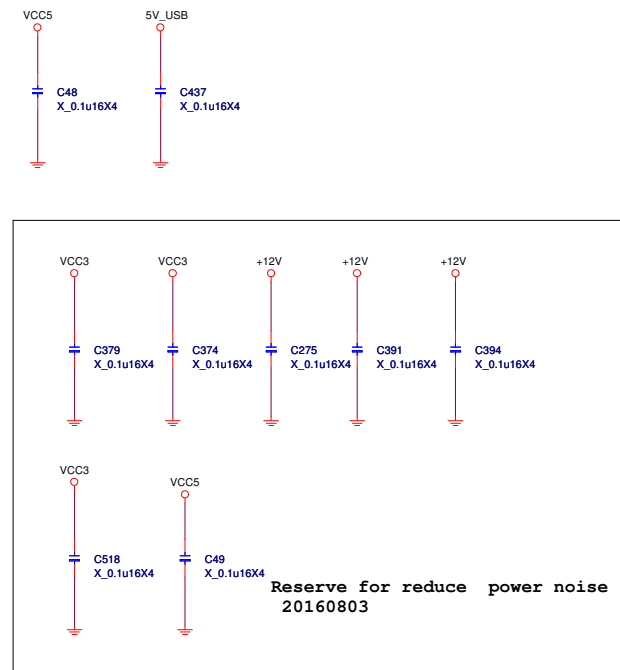
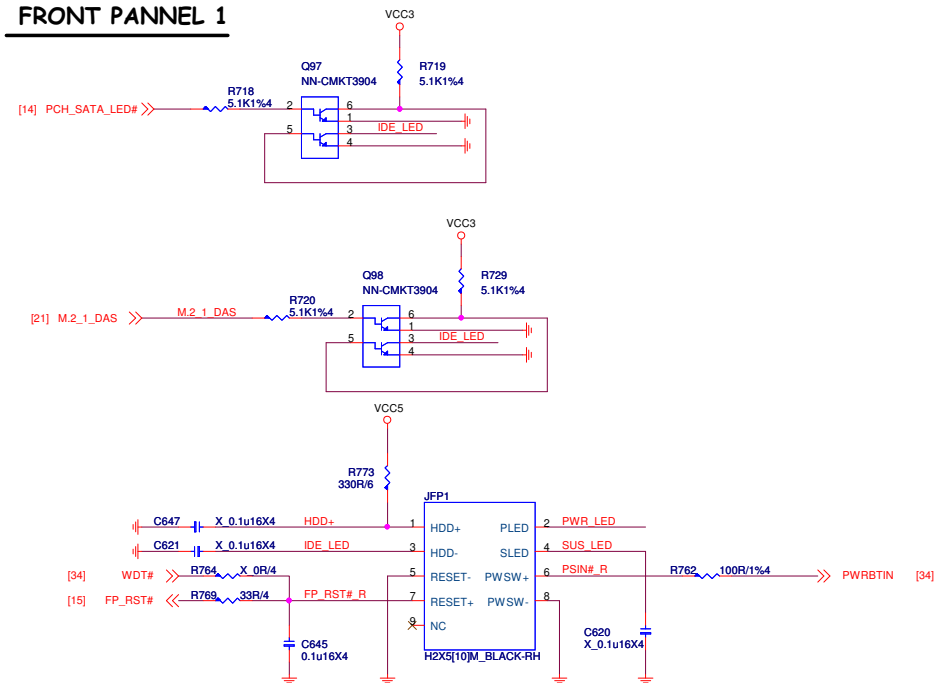
Resever For FIX DC or PWM MODE USE By PM SPEC



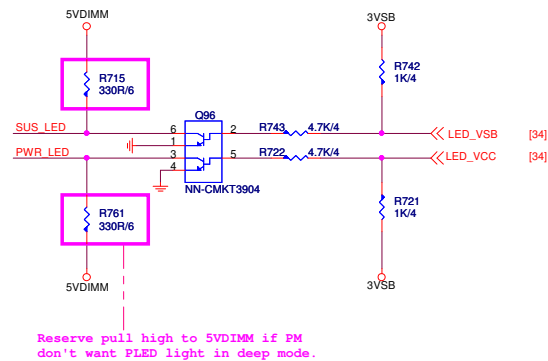
ATX POWER CONNECTOR



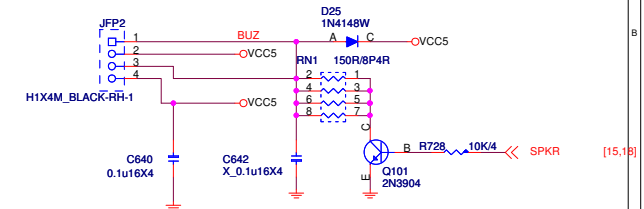
FRONT PANNEL 1



LED



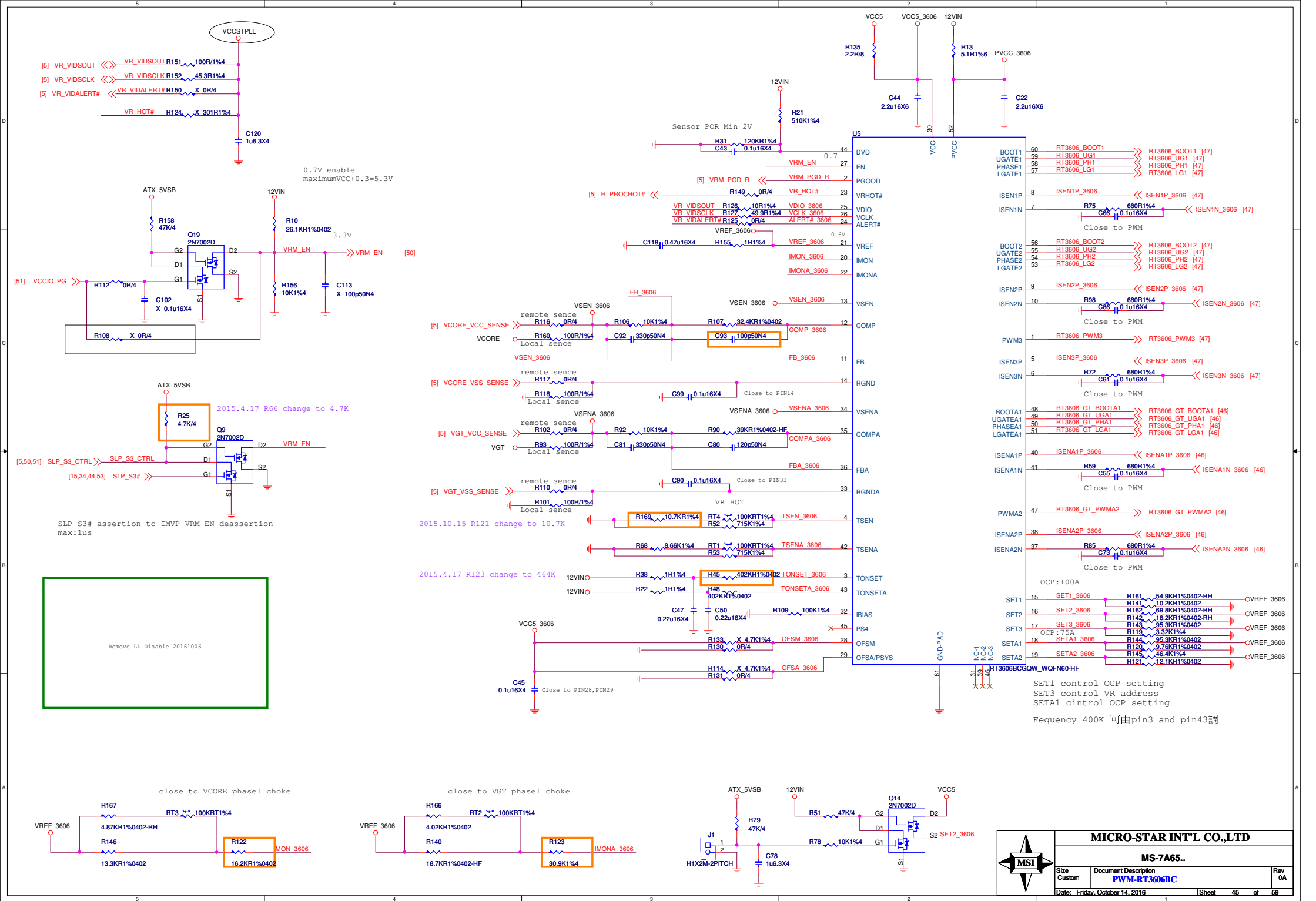
FRONT PANNEL 2

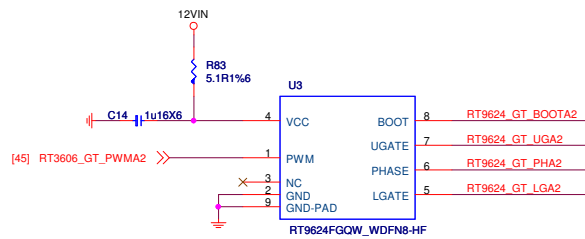
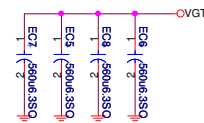
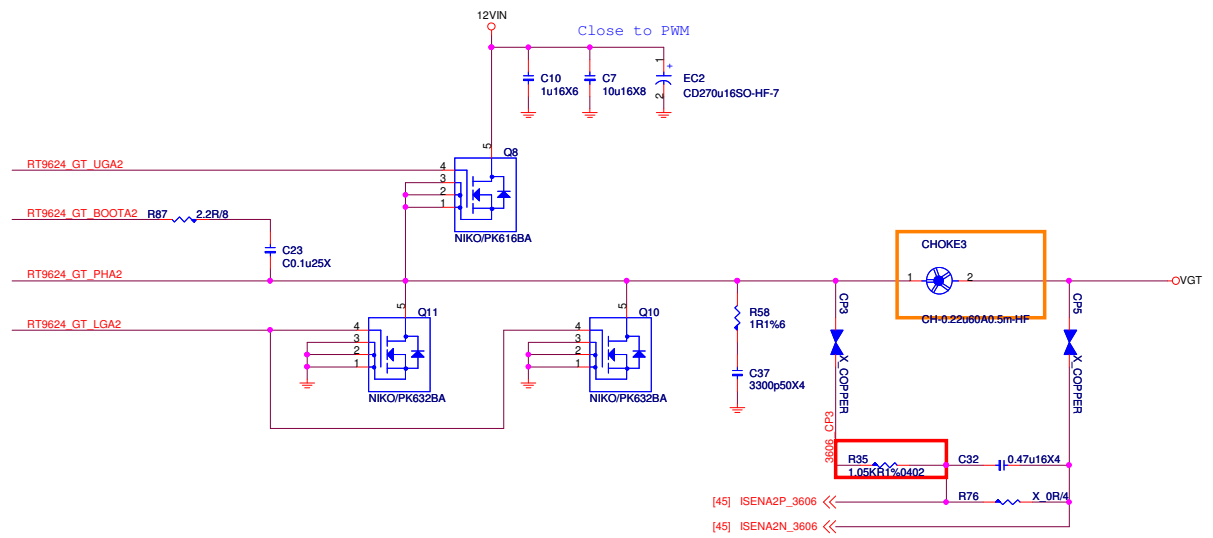
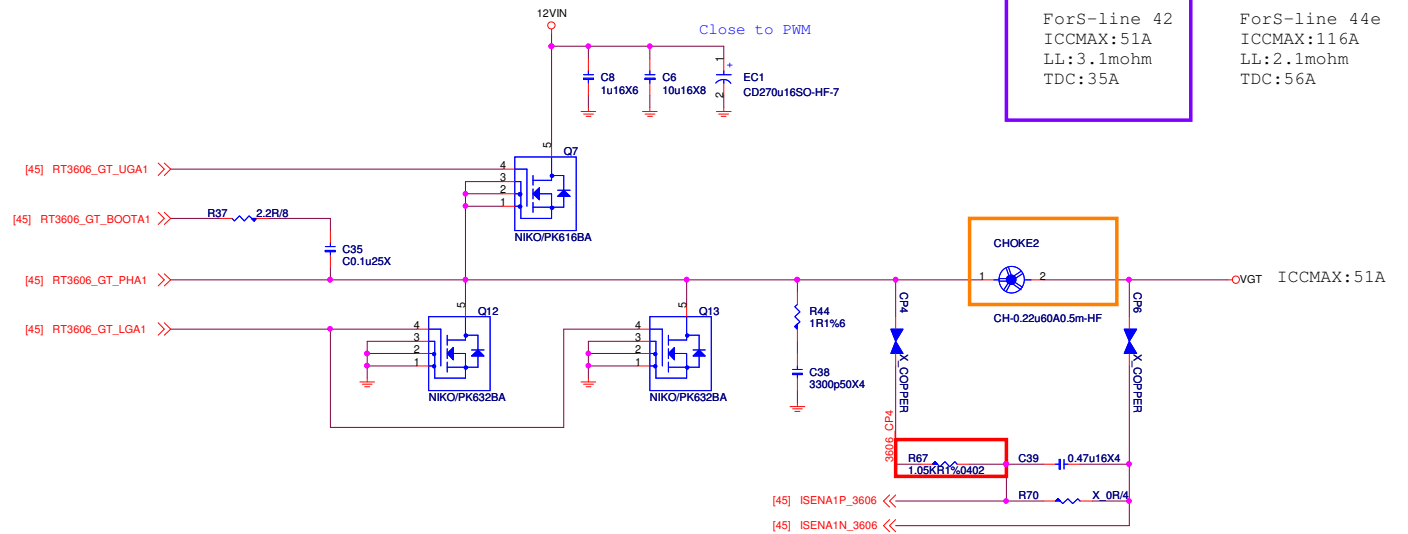


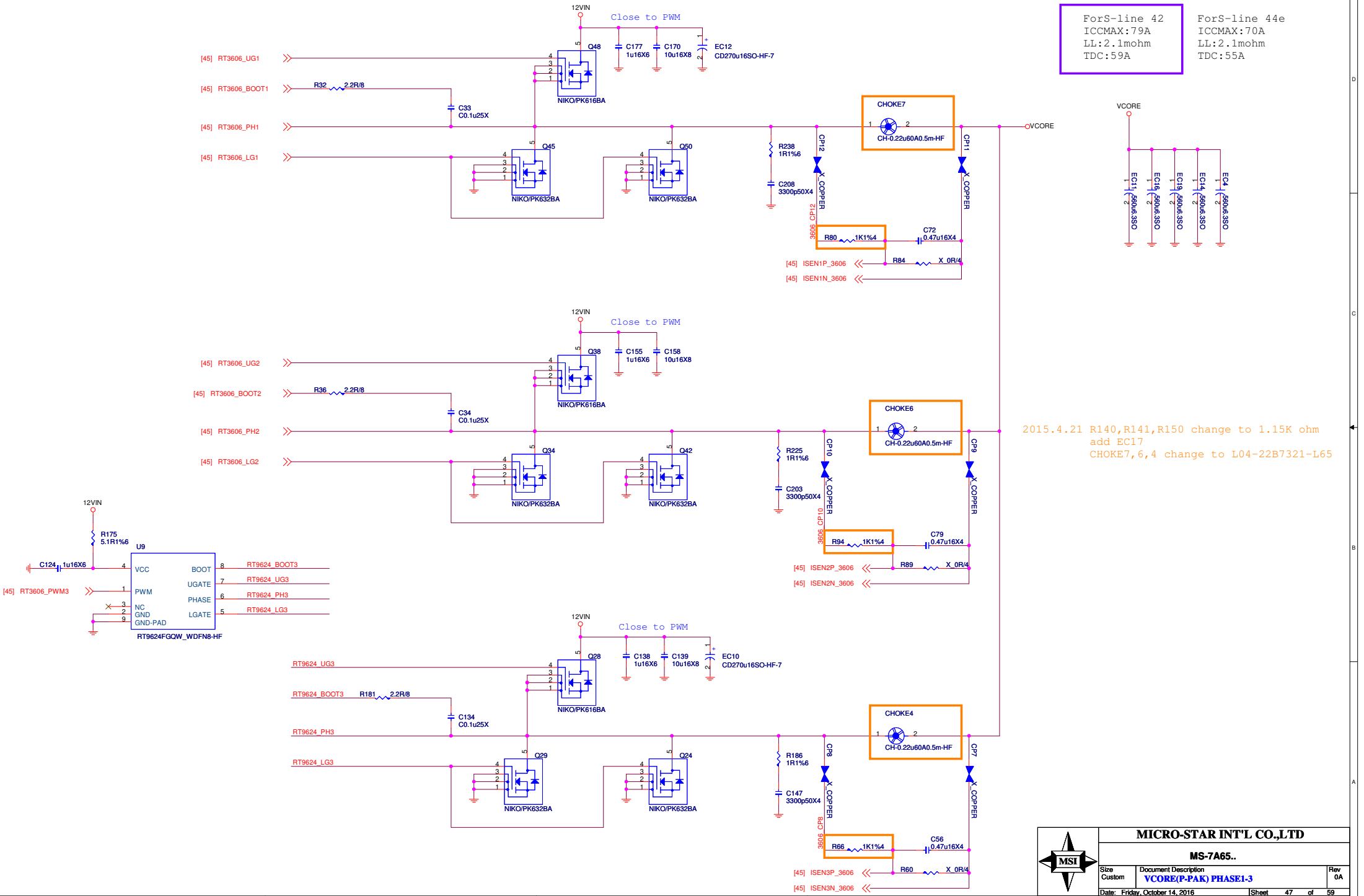
MICRO-STAR INT'L CO.,LTD

MS-7A65..

Size Custom	Document Description ATX F_Panel/EMI	Rev 0A
Date: Friday, October 14, 2016	Sheet 43 of 59	







ForS-line 42
ICCMAX:79A
LL:2.1mohm
TDC:59A

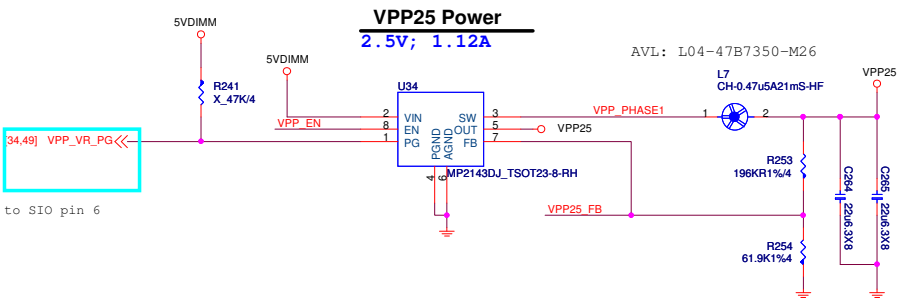
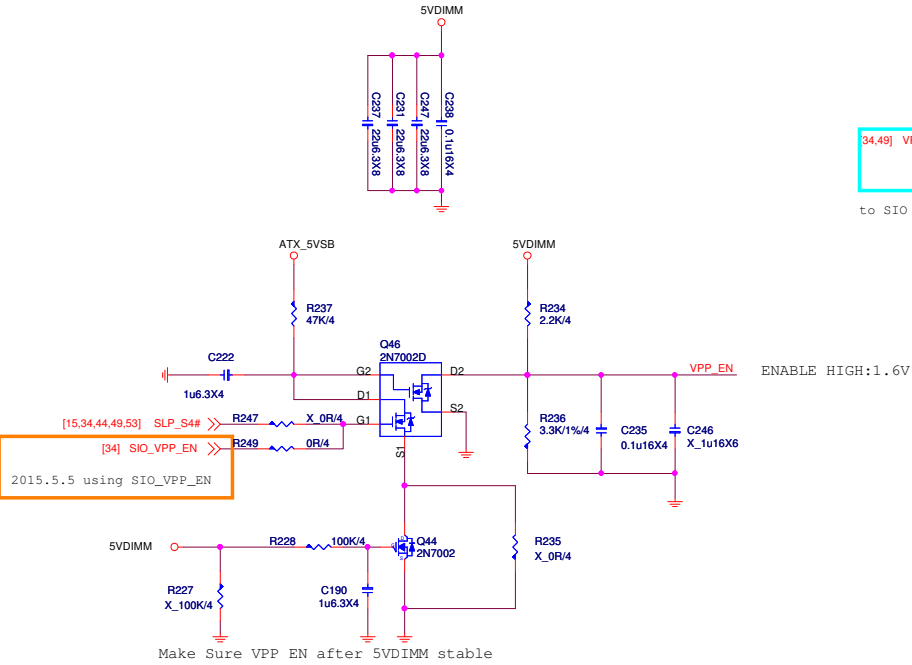
ForS-line 44e
ICCMAX:70A
LL:2.1mohm
TDC:55A

2015.4.21 R140,R141,R150 change to 1.15K ohm
add EC17
CHOKE7,6,4 change to L04-22B7321-L65



MICRO-STAR INT'L CO.,LTD		
MS-7A65..		
Size Custom	Document Description VCORE(P-PAK) PHASE1-3	Rev 0A
Date: Friday, October 14, 2016		
Sheet 47 of 59		

2DIMM :1.12A FOR DDR VPP2.5V



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

2.8A FOR CPU

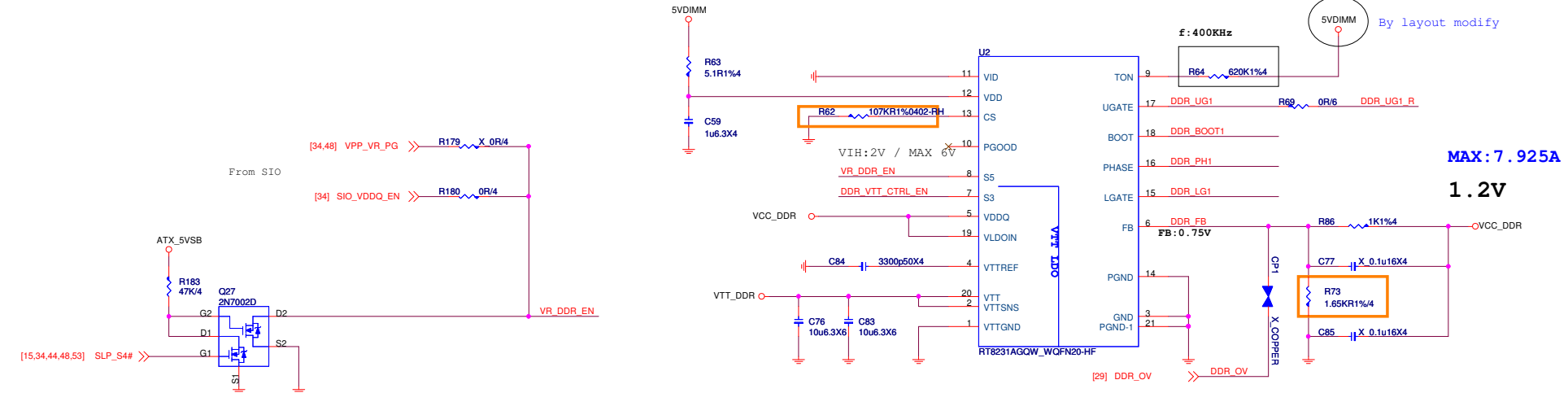
4.8A FOR 2DIMM DDR4

0.375A FOR VTT_DDR

$$OCP = 7.925A * 1.5 = 11.8875A$$

$$Current\ limit = 95.3K(R1054) * 5uA / 10 / 4mohm = 11.91A$$

VID	Reference Voltage (V)
H	0.675
L	0.75



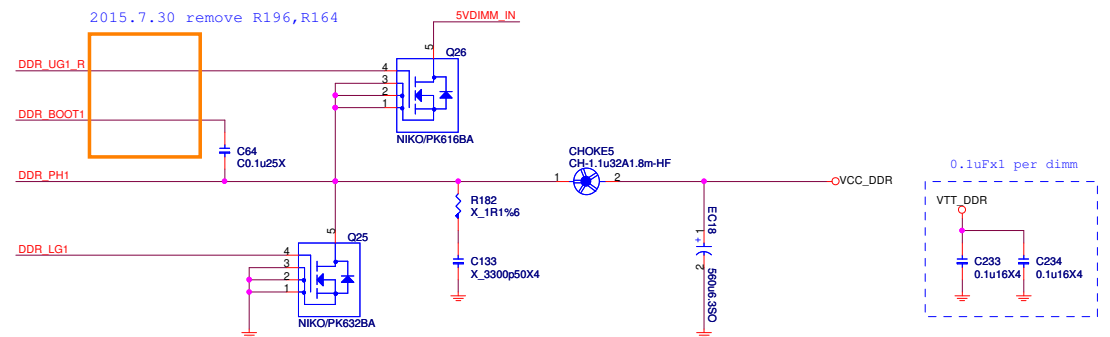
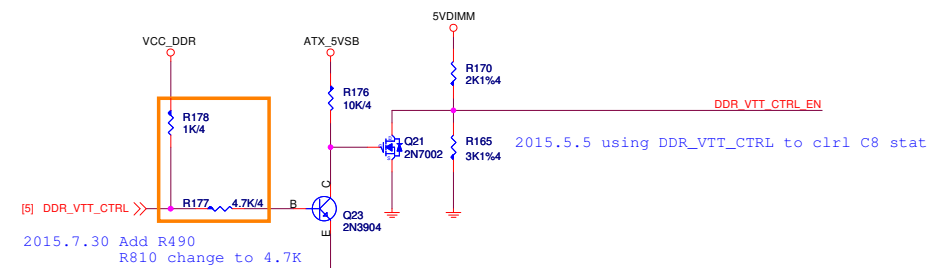
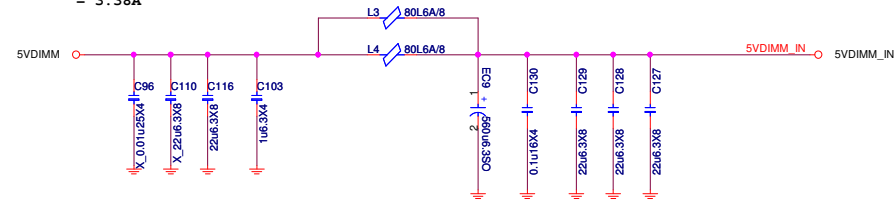
SLP_S4# de-assertion to VDDQ ramp down start

VPP ramp down after VDDQ ramp down

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

$$= 7.925 * 0.427$$

$$= 3.38A$$



VCCIO

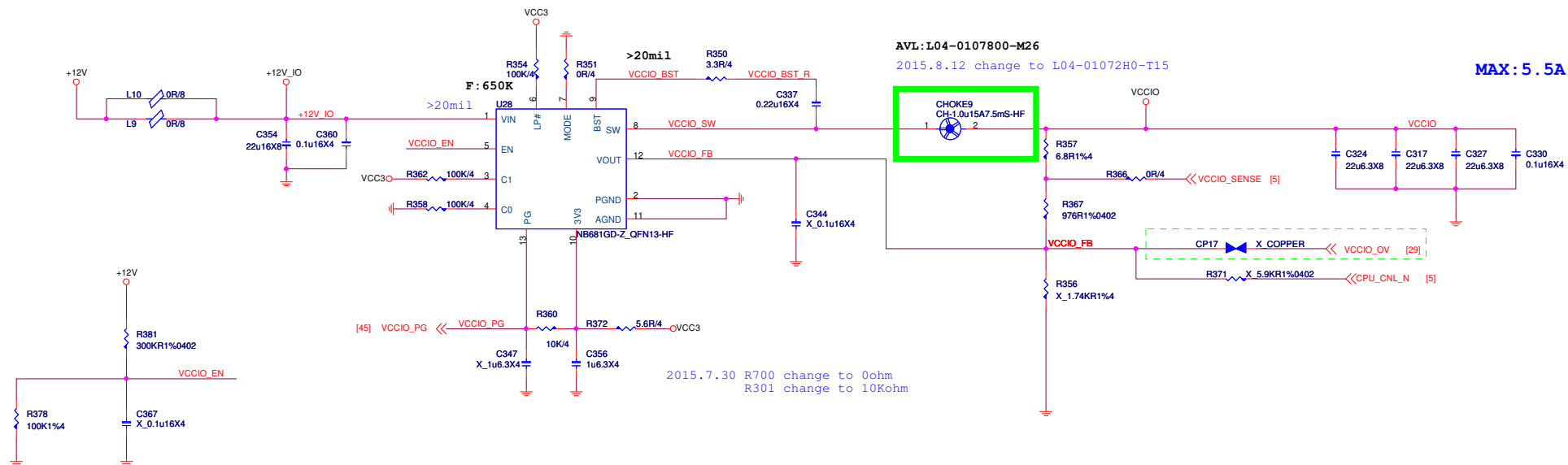
0.95V; 5.5A

support OV=>NB685
not support OV=> NB681

IMAX 10A
ILIMIT=10A~12A
IOC=ILIMIT+40%*IMAX/2=12A~14A.

0.7776uH<L<1.1664uH

I9C-6816DOC-M03

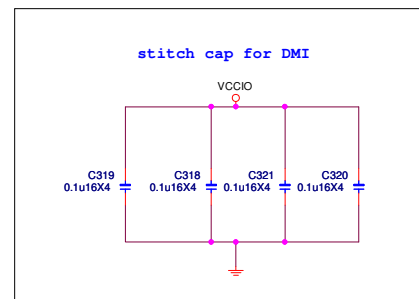
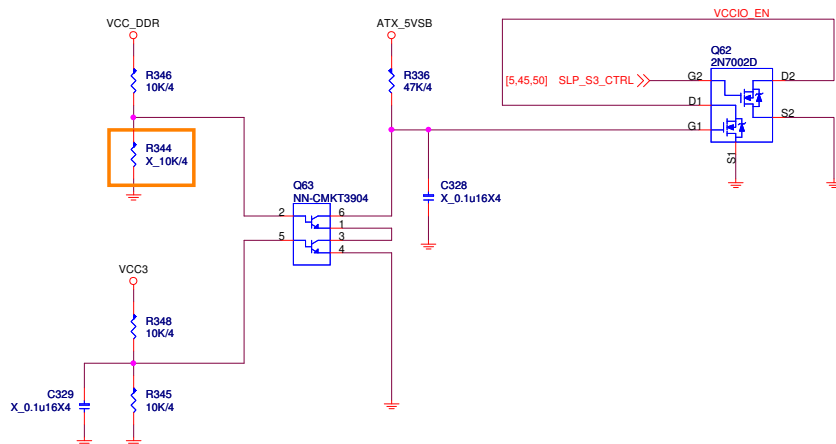


SLP_S3# assertion to VCCIO VR disabled <1uS.

SLP_S3# assertion to VCC, VCCGT, VCCIO and VCCSA rails completely off. <500ms

	LP#	C1	C0	VOUT (V)
VCCIO	0	X	X	0
	1	0	0	0.85
	1	0	1	0.875
	1	1	0	0.95
	1	1	1	0.975

Q106.2/Q106.5 SWAP POWER 20160712



1.0V; 10.391A

$$\begin{aligned} R_{ocset} &= 1.5 * I_{max} * R_{dson}(low) / I_{ocset} \\ &= 1.5 * 10.391 * 4.6m\Omega / 10\mu A \\ &= 7.17K \end{aligned}$$

Rocs:5.9K,OCP:
D03-632BA0C-N03 : 15.54A
use UBIQ MOS need Check

Rdson (low) 4.5V

D03-4C05N03-O05	:	5 mohm
D03-632BA0C-N03	:	4.6mohm
D03-3056M00-U47	:	6.2mohm

```
2015.01.22
for up1540:R323->2.2R
for RT8125:R323->10R
```

2015.8.11
U14 change to RT8125E I32-8125E0C-R11

```
Irms = Iout * SQRT((Vout/Vin) * (1 - (Vout/Vin)))
      = 10.664 * 0.4
      = 4.2656A < 5000mA
```

MAX:10.391A

$$L_{min} = ((V_{in} - V_{out}) / (F_{sw} * k * I_{out_max})) * (V_{out} / V_{in})$$

$$= 0.8335 \mu H \quad (K = 30\%)$$
$$\begin{aligned} V_{out} &= V_{ref} * (1 + R_{107}/R_{112}) \\ &= 0.8 * (1 + 1K/3.92K) \\ &= 0.8 * 1.2551 \\ &= 1.004V \end{aligned}$$

to sink/source over voltage IC.
pin10 sink/source current capability can't over 1mA
So max voltage can't over 1.8V.

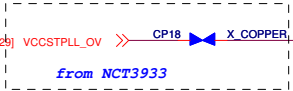
from NCT3933

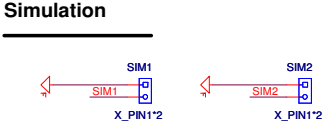
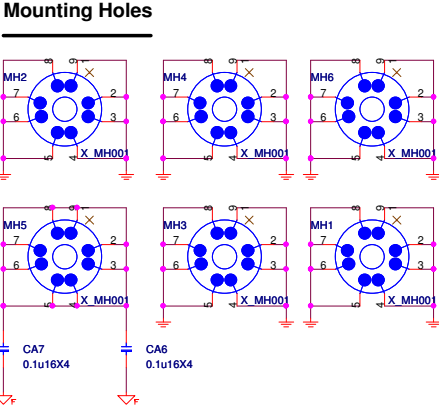
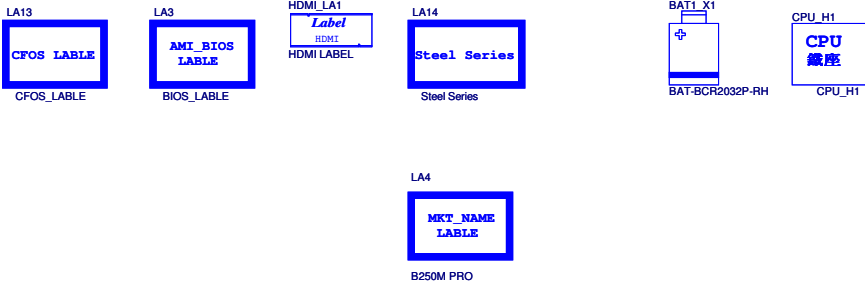
PLACE UNDER THE PCH

```
0728: add
```

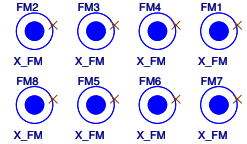
*for Gaming3/5, Classic, ECO
and H110*

1.0V; 0.25A

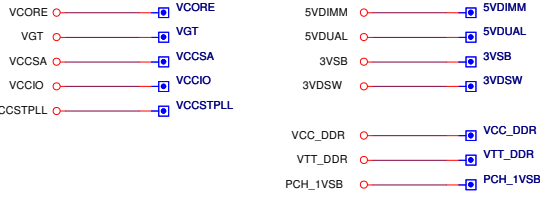




Optical Fiducial Marks-120



Test point

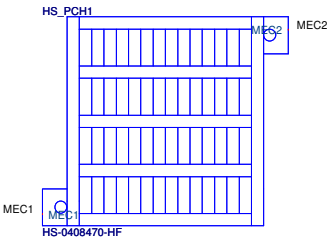


2015.9.30 LA7 change to N58-22F1871-F02
2015.10.23 B150-A and H110-A change to N11-1641521-L06



PD0-07A650A-G37, 精成-深圳, 23, 寶安恩斯邁廠 (MSIS)
PD0-07A650A-E48, 競華, 23, 寶安恩斯邁廠 (MSIS)

HEATSINK



MS-7994-11 主BOM為B150

OPT	Configure	BOM	Function
	B150-COMBO	601-7983-A10	MS-7983 0A, B150, LGA1151, 2DDR3, 2DDR4, 1PCI-Ex16, 2PCI-Ex1, 4SATA3, 6USB3, HD Audio, Gb LAN, DSUB, DVI, HDMI

