1. ALL RESISTANCE VALUES ARE IN OHMS, 0.1 WATT +/- 5%.
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS.
3. ALL CRYSTALS & OSCILLATOR VALUES ARE IN HERTZ.

SCHEM,X646,MLB

X646 MLB

REV	ECN	DESCRIPTION OF REVISION	CK APPD / DATE
			2016-10-06

LAST_MODIFICATION=Thu Oct 6 17:00:29 2016

DRAWING

TITLE=X646_MLB
ABBREV=DRAWING
LAST_MODIFIED=Thu Oct 6 17:00:29 2016

SCHEM,X646,MLB

DRAWING TITLE: SCHEM, MLB, X646

Apple Inc.

DRAWING NUMBER: 051-01506 SIZE: D

REVISION: 5.19.0

BRANCH:

PAGE: 1 OF 121

SHEET: 1 OF 102

BOM Variants

BOM NUMBER	BOM NAME	BOM OPTIONS
985-00160	PCBA,DEV,MLB,X646	DEVELOPMENT,X646_DEVEL
685-00106	PCBA,MLB,COMMON PARTS,X646	X646_COMMON
639-03362	PCBA,MLB,CTO,EL XTA,VRAM_SAMSUNG,8GB,X646	X646,MLB_CMNPTS,CPU:CTO,GPU_SKU:EL_XTA,GPU:EL,FB_8G_SAM_EL,EEEE:HNL6,TRANS:DLT,ENET:TRANS
639-03363	PCBA,MLB,CTO,EL XTA,VRAM_HYNIX,8GB,X646	X646,MLB_CMNPTS,CPU:CTO,GPU_SKU:EL_XTA,GPU:EL,FB_8G_HYN_EL,EEEE:HNL7,TRANS:DLT,ENET:TRANS
639-03364	PCBA,MLB,CTO,EL XTA,VRAM_MICRON,8GB,X646	X646,MLB_CMNPTS,CPU:CTO,GPU_SKU:EL_XTA,GPU:EL,FB_8G_ELP_EL,EEEE:HNL8,TRANS:DLT,ENET:TRANS
639-03365	PCBA,MLB,ULT,EL PROA,VRAM_SAMSUNG,4GB,X646	X646,MLB_CMNPTS,CPU:ULT,GPU_SKU:EL_PROA,GPU:EL,FB_4G7_SAM_EL,EEEE:HNL9,TRANS:DLT,ENET:TRANS
639-03366	PCBA,MLB,ULT,EL PROA,VRAM_HYNIX,4GB,X646	X646,MLB_CMNPTS,CPU:ULT,GPU_SKU:EL_PROA,GPU:EL,FB_4G7_HYN_EL,EEEE:HNLC,TRANS:DLT,ENET:TRANS
639-03367	PCBA,MLB,ULT,EL PROA,VRAM_MICRON,4GB,X646	X646,MLB_CMNPTS,CPU:ULT,GPU_SKU:EL_PROA,GPU:EL,FB_4G7_ELP_EL,EEEE:HNLD,TRANS:DLT,ENET:TRANS
639-03368	PCBA,MLB,BEST,EL LEA,VRAM_SAMSUNG,4GB,X646	X646,MLB_CMNPTS,CPU:BEST,GPU_SKU:EL_LEA,GPU:EL,FB_4G7_SAM_EL,EEEE:HNLF,TRANS:TDK,ENET:TRANS
639-03369	PCBA,MLB,BEST,EL LEA,VRAM_HYNIX,4GB,X646	X646,MLB_CMNPTS,CPU:BEST,GPU_SKU:EL_LEA,GPU:EL,FB_4G7_HYN_EL,EEEE:HNLG,TRANS:TDK,ENET:TRANS
639-03370	PCBA,MLB,BEST,EL LEA,VRAM_MICRON,4GB,X646	X646,MLB_CMNPTS,CPU:BEST,GPU_SKU:EL_LEA,GPU:EL,FB_4G7_ELP_EL,EEEE:HNLH,TRANS:TDK,ENET:TRANS
639-03371	PCBA,MLB,BETTER,BF XPA,VRAM_SAMSUNG,2GB,X646	X646,MLB_CMNPTS,CPU:BTR,GPU_SKU:BF_XPA,GPU:BF,FB_4G7_SAM_BF,EEEE:HNLJ,TRANS:TDK,ENET:TRANS
639-03372	PCBA,MLB,BETTER,BF XPA,VRAM_HYNIX,2GB,X646	X646,MLB_CMNPTS,CPU:BTR,GPU_SKU:BF_XPA,GPU:BF,FB_4G7_HYN_BF,EEEE:HNLK,TRANS:TDK,ENET:TRANS
639-03373	PCBA,MLB,BETTER,BF XPA,VRAM_MICRON,2GB,X646	X646,MLB_CMNPTS,CPU:BTR,GPU_SKU:BF_XPA,GPU:BF,FB_4G7_ELP_BF,EEEE:HNLL,TRANS:TDK,ENET:TRANS
639-02813	PCBA,MLB EL,TEST BOARD,X646	X646,MLB_CMNPTS,GPU:EL,EEEE:HD97,TRANS:DLT,ENET:TRANS
639-02970	PCBA,MLB BF,TEST BOARD,X646	X646,MLB_CMNPTS,GPU:BF,EEEE:HHCG,TRANS:TDK

BOM Groups

BOM GROUP	BOM OPTIONS
X646_COMMON	COMMON,ALTERNATE,X646_PROGPARTS,XDP,CPU_DRMOS:CURRENT,GPUCLK:OSC,SSD:Y,VR_BULKCAP:CURRENT,1V8_AUDIO_DLY:N
X646_PROGPARTS	SMC:PROG,BOOTROM:PROG,TBTROM:PROG,CIVROM:PROG,CAMROM:PROG
X646_DEVEL	XDP_CONN,T112
FB_8G_SAM_EL	FB_BD_8G:SAM,FB_AC_8G:SAM,VR_VRAM_SAM_1V55
FB_8G_ELP_EL	FB_BD_8G:ELP,FB_AC_8G:ELP,VR_VRAM_ELP_1V50
FB_8G_HYN_EL	FB_BD_8G:HYN,FB_AC_8G:HYN,VR_VRAM_HYN_1V50
FB_4G7_SAM_EL	FB_BD_4G7:SAM,FB_AC_4G7:SAM,VR_VRAM_SAM_1V50
FB_4G7_ELP_EL	FB_BD_4G7:ELP,FB_AC_4G7:ELP,VR_VRAM_ELP_1V55
FB_4G7_HYN_EL	FB_BD_4G7:HYN,FB_AC_4G7:HYN,VR_VRAM_HYN_1V50
FB_4G7_SAM_BF	FB_BD_4G7:SAM,VR_VRAM_SAM_1V50
FB_4G7_ELP_BF	FB_BD_4G7:ELP,VR_VRAM_ELP_1V55
FB_4G7_HYN_BF	FB_BD_4G7:HYN,VR_VRAM_HYN_1V50

CPUs

PART#	QTY	DESCRIPTION	REFERENCE DESIGNATOR(S)	CRITICAL	BOM OPTION
337S00344	1	CPU,KBL,QKHB,B0,QS,4.2,91W,1.15,L1151	CPU	CRITICAL	CPU:CTO
337S00345	1	CPU,KBL,QKH9,B0,QS,3.8,91W,1.15,L1151	CPU	CRITICAL	CPU:ULT
337S00343	1	CPU,KBL,QKHB,B0,QS,3.5,65W,1.15,L1151	CPU	CRITICAL	CPU:BEST
337S00340	1	CPU,KBL,QKHC,B0,QS,3.4,65W,1.1,L1151	CPU	CRITICAL	CPU:BTR

SOCKET& CONNECTOR

PART#	QTY	DESCRIPTION	REFERENCE DESIGNATOR(S)	CRITICAL	BOM OPTION
511S00002	1	CONN,CPU,SOCKET,LGA1151,SKYLAKE,HF	U0500	CRITICAL	
806-07339	1	COVER,SHIELD,USB-C,X635	EMI_SHIELD	CRITICAL	

ASICs

PART#	QTY	DESCRIPTION	REFERENCE DESIGNATOR(S)	CRITICAL	BOM OPTION
337S00187	1	IC,PCH-H,SKL,SSKGIZ170,SR2C9,D1,PRQ,BGB37	U1100	CRITICAL	
338S00254	1	IC,TBT,ALPINE RIDGE,SLLSM,PRQ,C1,CSP337	U2800	CRITICAL	
343S0616	1	IC,BCM57766A1,ENET&SD,8X8	U3900	CRITICAL	
353S00961	2	IC,CD3215,ACE,C00,USB PWR SW,BLNK,BGA96	U3100,U3200	CRITICAL	

Programmable Parts

PART#	QTY	DESCRIPTION	REFERENCE DESIGNATOR(S)	CRITICAL	BOM OPTION
341S00734	1	IC,EFI ROM,VTBD,EVT,X646	U5210	CRITICAL	BOOTROM:PROG
335S00006	1	IC,64 MBIT SPI SERIAL FLASH	U5210	CRITICAL	BOOTROM:BLANK
341S00568	1	IC,SMC-B1,EXTERNAL,VTBD,X646	U5000	CRITICAL	SMC:PROG
338S1214	1	IC,SMC12-B1,40MHZ/50DMIPS,MCU,157BGA	U5000	CRITICAL	SMC:BLANK
341S00740	1	IC,AR,V9.3,EVT,X646	U2890	CRITICAL	TBTROM:PROG
335S00133	1	IC,SPI FLASH ROM,8MBIT,50MHZ,USON8	U2890	CRITICAL	TBTROM:BLANK
341S3912	1	IC,ENET ROM,NUMONYX,V1.15,J16/J16G/J17	U3990	CRITICAL	CIVROM:PROG
335S0854	1	1-MBIT,SPI FLASH ROM SOIC, HF	U3990	CRITICAL	CIVROM:BLANK
341S00667	1	IC,CAMERA,FLASH,V72.52,X646	U4202	CRITICAL	CAMROM:PROG
335S0852	1	IC,FLASH,SPI,1MBIT,3V3	U4202	CRITICAL	CAMROM:BLANK
341S00555	1	IC,GPU ROM,ELM,VTBD,X646	U9700	CRITICAL	GPUROM:PROG
335S0724	1	1MBIT SERIAL FLASH 2X3X0.6MM	U9700	CRITICAL	GPUROM:BLANK

Bar Code Labels / EEEE #'s

PART#	QTY	DESCRIPTION	REFERENCE DESIGNATOR(S)	CRITICAL	BOM OPTION
825-7896	1	LABEL,MLB,2D	EEEE_HNL6	CRITICAL	EEEE:HNL6
825-7896	1	LABEL,MLB,2D	EEEE_HNL7	CRITICAL	EEEE:HNL7
825-7896	1	LABEL,MLB,2D	EEEE_HNL8	CRITICAL	EEEE:HNL8
825-7896	1	LABEL,MLB,2D	EEEE_HNL9	CRITICAL	EEEE:HNL9
825-7896	1	LABEL,MLB,2D	EEEE_HNLC	CRITICAL	EEEE:HNLC
825-7896	1	LABEL,MLB,2D	EEEE_HNLD	CRITICAL	EEEE:HNLD
825-7896	1	LABEL,MLB,2D	EEEE_HNLF	CRITICAL	EEEE:HNLF
825-7896	1	LABEL,MLB,2D	EEEE_HNLG	CRITICAL	EEEE:HNLG
825-7896	1	LABEL,MLB,2D	EEEE_HNLH	CRITICAL	EEEE:HNLH
825-7896	1	LABEL,MLB,2D	EEEE_HNLJ	CRITICAL	EEEE:HNLJ
825-7896	1	LABEL,MLB,2D	EEEE_HNLK	CRITICAL	EEEE:HNLK
825-7896	1	LABEL,MLB,2D	EEEE_HNLL	CRITICAL	EEEE:HNLL
825-7896	1	LABEL,MLB,2D	EEEE_HD97	CRITICAL	EEEE:HD97
825-7896	1	LABEL,MLB,2D	EEEE_HHCG	CRITICAL	EEEE:HHCG

ALTERNATE PARTS TABLE LOCATED ON CSA 115

J135 SCHEMATIC / PCB #'S

PART#	QTY	DESCRIPTION	REFERENCE DESIGNATOR(S)	CRITICAL	BOM OPTION
051-01506	1	SCH,MLB,X646	SCH1	CRITICAL	X646
820-00609	1	PCBF,MLB,X646	PCB1	CRITICAL	X646
685-00106	1	PCBA,MLB COMMON PARTS,X646	CMNPTS	CRITICAL	MLB_CMNPTS

GPU and VRAM

PART#	QTY	DESCRIPTION	REFERENCE DESIGNATOR(S)	CRITICAL	BOM OPTION
337S00277	1	IC,GPU,AMD,ELLESMERE,XTA,QS,A1,LF,BGA1401	U8700	CRITICAL	GPU_SKU:EL_XTA
337S00279	1	IC,GPU,AMD,ELLESMERE,PROA,QS,A1,LF,BGA1401	U8700	CRITICAL	GPU_SKU:EL_PROA
337S00347	1	IC,GPU,AMD,ELLESMERE,LEA,QS,A1,LF,BGA1401	U8700	CRITICAL	GPU_SKU:EL_LEA
337S00346	1	IC,GPU,AMD,BAFFIN,XPA,A1,LF,QS,BGA1401	U8700	CRITICAL	GPU_SKU:BF_XPA
333S00100	4	IC,GDDR5,8GBIT,7GBPS,20NM,BGA170	U9300,U9350,U9500,U9550	CRITICAL	FB_BD_8G:HYN
333S00100	4	IC,GDDR5,8GBIT,7GBPS,20NM,BGA170	U9200,U9250,U9400,U9450	CRITICAL	FB_AC_8G:HYN
333S00075	4	IC,GDDR5,8GBIT,7GBPS,20NM,BGA170	U9300,U9350,U9500,U9550	CRITICAL	FB_BD_8G:ELP
333S00075	4	IC,GDDR5,8GBIT,7GBPS,20NM,BGA170	U9200,U9250,U9400,U9450	CRITICAL	FB_AC_8G:ELP
333S00074	4	IC,GDDR5,8GBIT,7GBPS,20NM,BGA170	U9300,U9350,U9500,U9550	CRITICAL	FB_BD_8G:SAM
333S00074	4	IC,GDDR5,8GBIT,7GBPS,20NM,BGA170	U9200,U9250,U9400,U9450	CRITICAL	FB_AC_8G:SAM
333S00043	4	IC,GDDR5,4GBIT,7GBPS,25NM,BGA170	U9300,U9350,U9500,U9550	CRITICAL	FB_BD_4G7:HYN
333S00043	4	IC,GDDR5,4GBIT,7GBPS,25NM,BGA170	U9200,U9250,U9400,U9450	CRITICAL	FB_AC_4G7:HYN
333S00044	4	IC,GDDR5,4GBIT,7GBPS,25NM,BGA170	U9300,U9350,U9500,U9550	CRITICAL	FB_BD_4G7:ELP
333S00044	4	IC,GDDR5,4GBIT,7GBPS,25NM,BGA170	U9200,U9250,U9400,U9450	CRITICAL	FB_AC_4G7:ELP
333S00078	4	IC,GDDR5,4GBIT,7GBPS,20NM,BGA170	U9300,U9350,U9500,U9550	CRITICAL	FB_BD_4G7:SAM
333S00078	4	IC,GDDR5,4GBIT,7GBPS,20NM,BGA170	U9200,U9250,U9400,U9450	CRITICAL	FB_AC_4G7:SAM

SYNC_MASTER=j135_m1b SYNC_DATE=06/28/2016

PAGE TITLE

BOM Configuration

Apple Inc.

DRAWING NUMBER 051-01506 SIZE D

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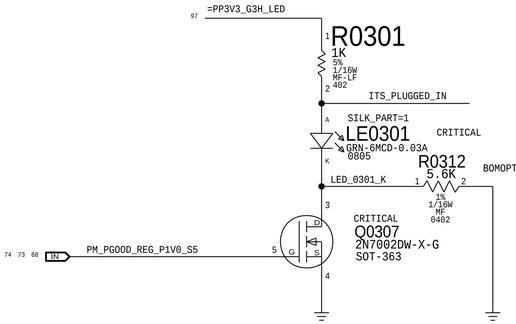
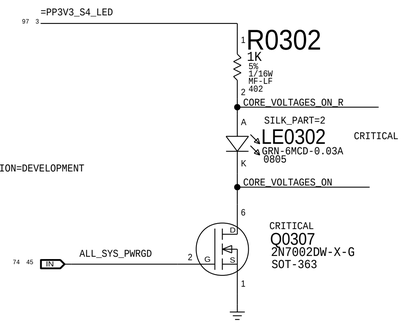
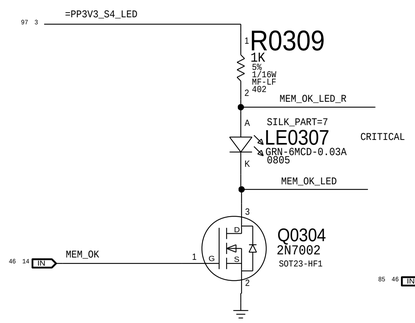
S5 Pwr LED



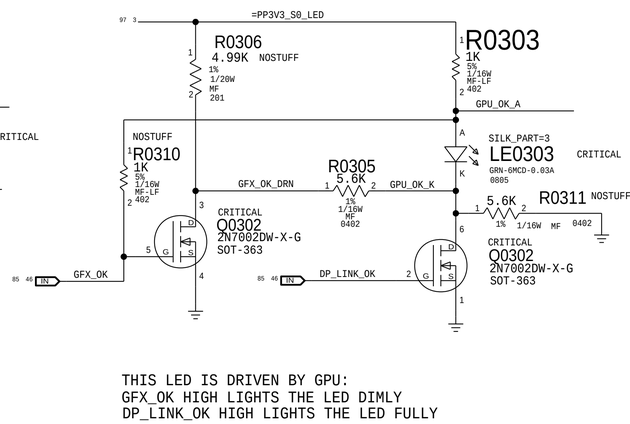
ALL_SYS_PWRGD LED



MEM_OK LED

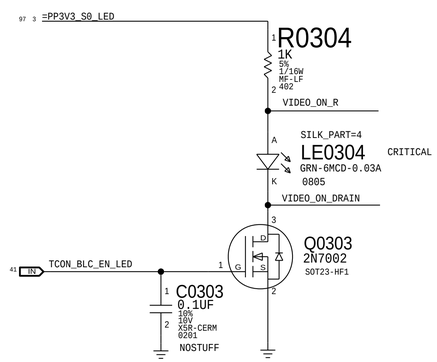


GPU OK LED

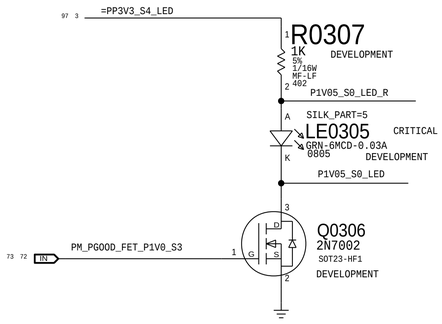


THIS LED IS DRIVEN BY GPU:
GFX_OK HIGH LIGHTS THE LED DIMLY
DP_LINK_OK HIGH LIGHTS THE LED FULLY

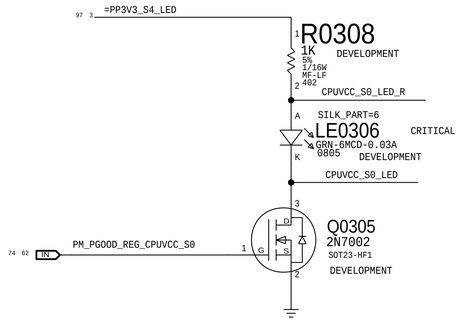
TCON OK LED



P1V0_S3_PWRGD LED



CPUVCC_S0_PWRGD LED



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SYNC_MASTER=ANDREW SYNC_DATE=02/18/2016

PAGE TITLE: DEBUG: LEDs

Apple Inc.

DRAWING NUMBER: 051-01506 SIZE: D

REVISION: 5.19.0

BRANCH:

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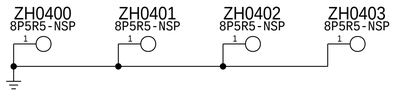
SHEET: 3 OF 102

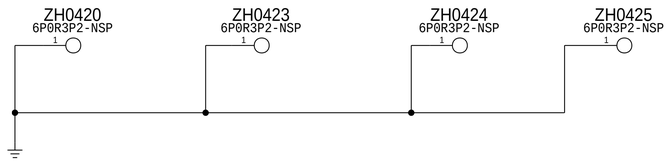
CPU Heatsink

4MM PLATED HOLES (998-4158)



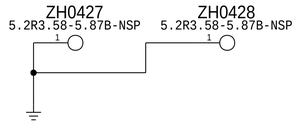
GPU HEATSINK MOUNTING FEATURES

(998-5013. PLATED HOLE, 3.2MM DIA, 6MM PAD TOP/BOT)



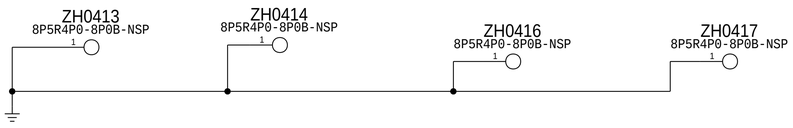
GPU HEATPIPE MOUNTING FEATURES

998-06191 (PLATED HOLES, 3.58MM INNER DIAMETER)

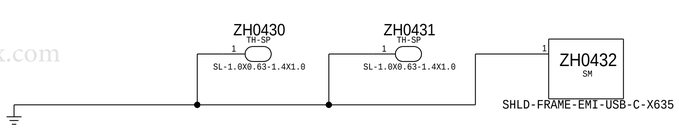


Rear Cover

998-5014 (PLATED HOLES, 4MM DRILL, 8.5MM TOP, 8MM BOT)

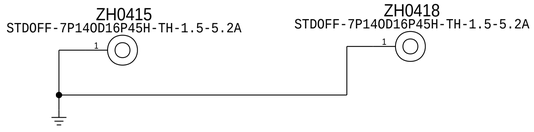


USB-C Alignment Holes and EMI Can



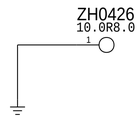
Rear Cover

860-5674 (PCB STANDOFF)



HEATPIPE MTG HOLES

998-5527 (PLATED HOLES, 8MM DIA, 10MM PAD)

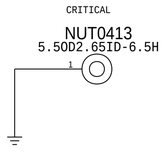


WIRELESS CARD MTG HOLES

998-06186 (PLATED HOLES, 3.3mm INNER DIAMETER, 5mm Top pad)

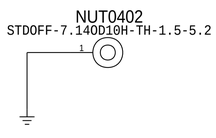
SSD STANDOFF

APN: 860-00314



LOL Boss

860-5675 (PLATED HOLE, 8.41mm pad Top, 8mm pad Bot)



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SYNC_MASTER=SYDYA SYNC_DATE=07/15/2019

PAGE TITLE
MECHANICAL: Holes/PD parts

Apple Inc.

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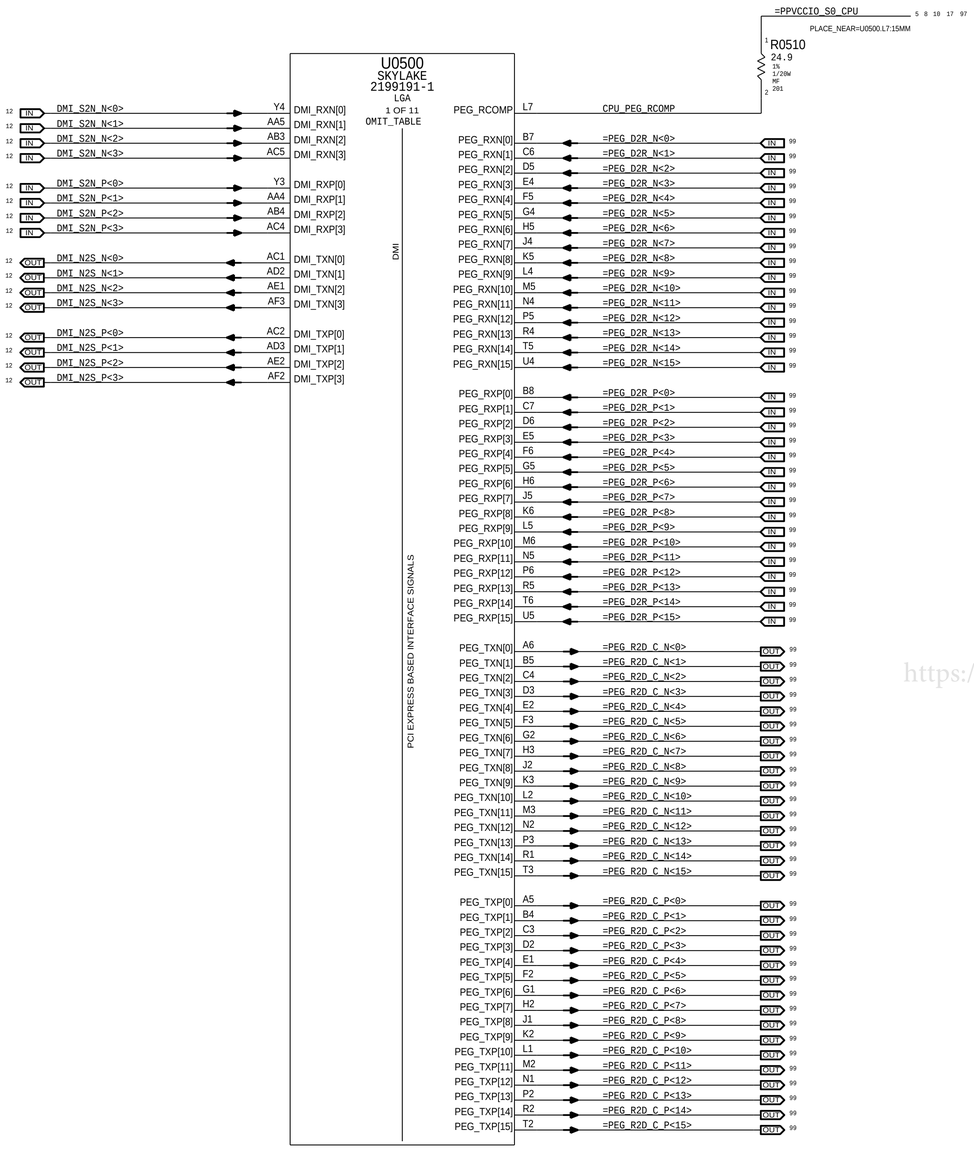

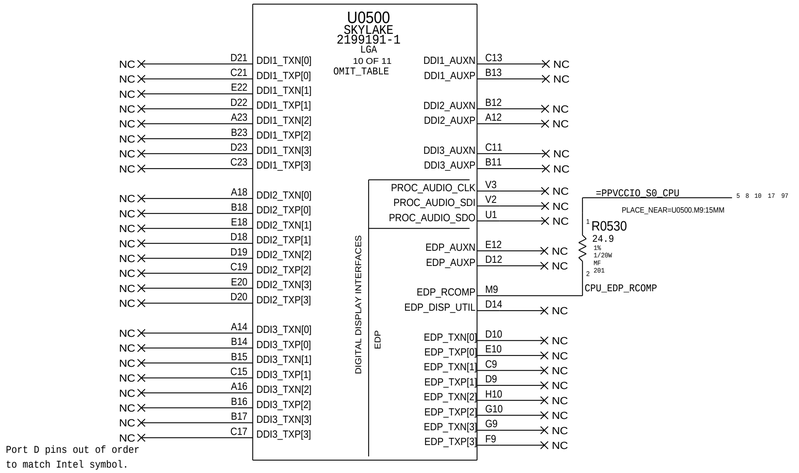

Port D pins out of order
to match Intel symbol.

BOM_COST_GROUP=CPU & CHIPSET

SYNC_MASTER=DRESSLER SYNC_DATE=02/03/2016

PAGE TITLE
CPU & CHIPSET: CPU DMI/PEG/FDI/RSVD

Apple Inc.

DRAWING NUMBER 051-01506
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