

# X299-AORUS Gaming 7 Rev 1.0

Structure Introduction

Power Sequence

Check Points List

JEFF.KO

# Curriculum Content

## ● X299 AORUS GAMING 7 Structure Introduction :

1. X299 AORUS GAMING 7 Specification Introduction
2. X299 AORUS GAMING 7 Power Sequence
3. VCORE,VCCIO,VCCSA Digital Power Circuit
4. DDR\_12V\_A,B,VPP\_25V\_A,B Digital Power Circuit
6. Power good ,Reset Block Diagram Check Keys
5. X299 AORUS GAMING 7 Clock Generator
7. Intel Optane Memory Ready
8. Intel VROC Upgrade Keys Header
9. Main Voltage Signal Clock Classification

## ● X299 AORUS GAMING 7 Full Check Points

1. CPU , PCH ,SIO Voltage Signal Check Points List
2. Power Sequence Voltage Signal Check Points List

# X299 AORUS Gaming 7 (rev. 1.0)



The AORUS X299 enthusiast motherboards are faster and more powerful than any motherboard the world has ever seen. With an aggressively redesigned armor and thermal heatsinks its sure to turn heads and catch eyes. Performance is no stranger to AORUS, with exotic cooling and an ability to be tuned to peak performance AORUS motherboards will exceed expectations.

## X299

**EXCEED EXPECTATIONS**

AORUS GAMING MOTHERBOARDS

# X299 AORUS Gaming 7



RGB FUSION with Digital LED / AMP-UP Audio with ESS SABRE9018 DAC / SMART FAN 5 + FAN STOP / SERVER CLASS Digital Power Design / Triple NVMe PCIe M.2 / Dual Armor / USB with Precise Digital Fuse / Front USB 3.1 Header / Q-Flash Plus

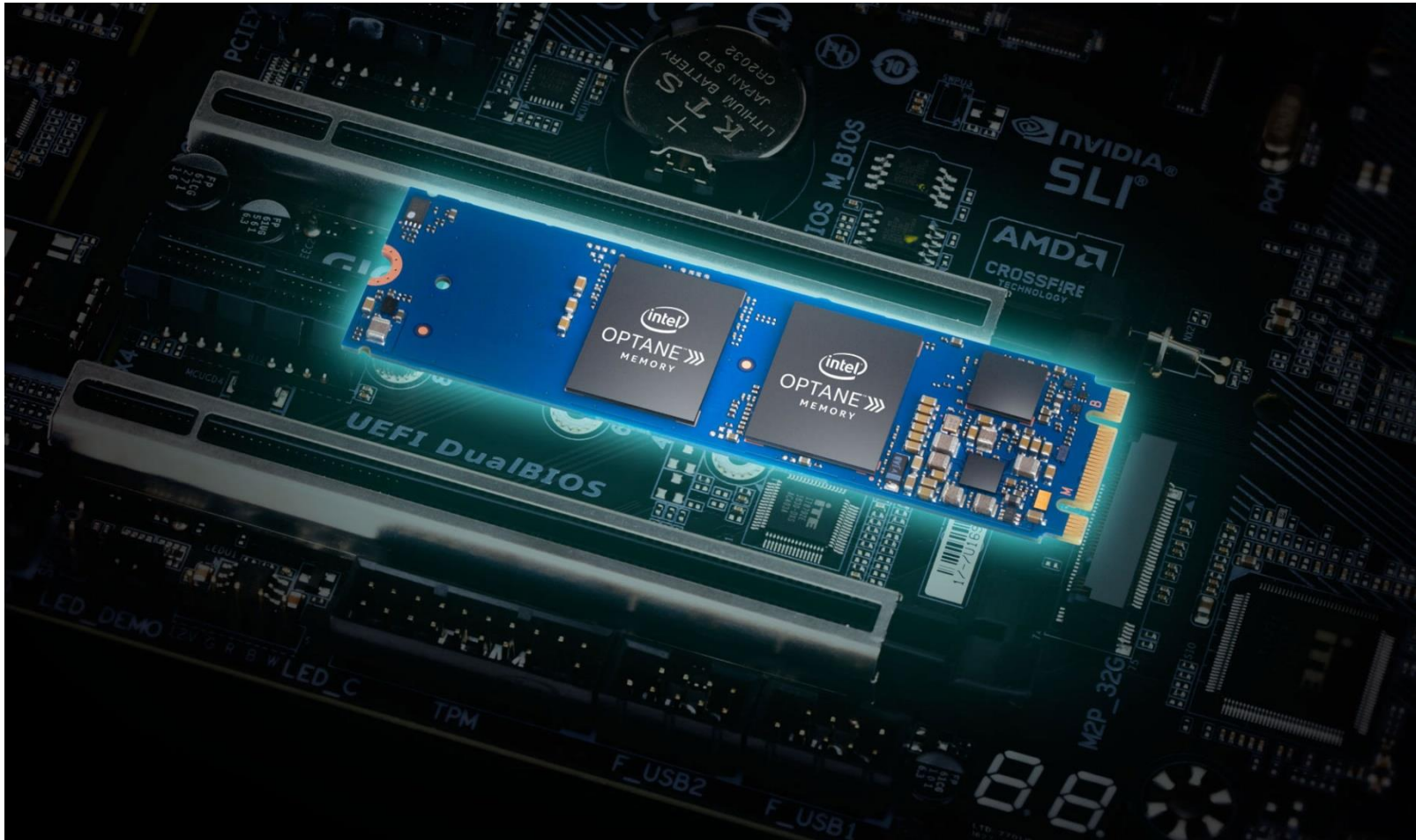
- Chipset
  - Intel X299 chipset
- Processor Support
  - LGA 2066 Intel® Core™ X-Series Processor Family
- Main Memory
  - DDR4, Dual-Channel, 8 DIMMs
- Graphics
  - 2\*PCIe 3.0 x16 + 1\*PCIe 3.0 x8 + 2\*PCIe 3.0 x4
  - 3-way SLI / 3-Way CrossFireX support
- Audio
  - ALC1220 (Front) + ESS9018Q2C (Rear)
- LAN
  - E2500 + Intel Dual GbE LAN
  - Intel® Wireless-AC 8265
- Others
  - 8\*SATA3 / 3\*M.2
  - 2\*USB 3.1 Gen 2 Type C™
  - 4\*USB 3.1 Gen 2 Type-A
  - 8\*USB 3.1 Gen 1
  - 4\*USB 2.0





# PERFORMANCE FUELED BY OPTANE

The AORUS X299 Platform is the first enthusiast platform that supports Intel's latest Optane technology. Optane fuels storage performance by acting as a cache drive giving users a significant boost compared to traditional mechanical drives.



# Triple NVMe PCIe x4 M.2 with Thermal Guard

With a high-end platform that is already so feature-filled triple M.2 support is a rarity. AORUS Gaming Motherboards has focused on delivering this technology to enthusiasts who want to maximize their system's potential. With Triple M.2s available on the X299 AORUS Gaming Series, configuring RAID Arrays have never been simpler.



# Immersive VR Gaming Experience



> VR requires more performance than Full HD graphics for a steady 90FPS or greater.

> Only Gaming PCs can provide the best VR experience.

Recommended configuration for VR Gaming PC\*

- Graphics Card: NVIDIA GTX 1060 / AMD RX 480 or greater, Compatible HDMI 1.4 video output
- CPU: Intel i5 equivalent or greater
- Motherboard: GIGABYTE X299/Z270/H270/B250 motherboards
- Memory: 8GB RAM or greater
- USB Ports: 3x USB 3.0 ports plus 1x USB 2.0 port or greater
- OS: Windows 10 64-bit or newer

# PURE SPEED

## AORUS Extreme USB 3.1 Motherboards

The ASMEDIA 3142 USB 3.1 controller utilizes 2 PCIe Gen3 lanes, offering a total of up to 16 Gb/s, which means you have extra bandwidth to take full control of the 10 Gb/s USB 3.1 ports. With twice the bandwidth compared to its previous generation, and backwards compatibility with USB 2.0 and 3.0, the much improved USB 3.1 protocol is available over the new reversible USB Type-C™ and the traditional USB Type-A connector for better compatibility over a wider range of devices



### ASMEDIA 3142 USB 3.1 Controller

Up to 16 Gb/s\*  
for 2 up to 10 Gb/s USB 3.1 Ports

**PCIe Gen3 x2\***



### ASMEDIA 1142 USB 3.1 Controller

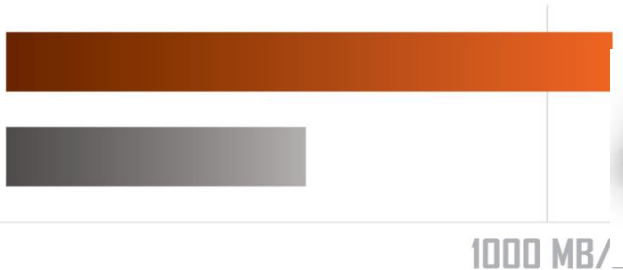
Up to 10 Gb/s\*  
for 2 up to 10 Gb/s USB 3.1 Ports

**PCIe Gen2 x2\***

Max. bandwidth allocated for the controller may vary by model.  
Product features may vary by model.

ASMEDIA 3142

ASMEDIA 1142



Connecting the Future - USB Type-C™

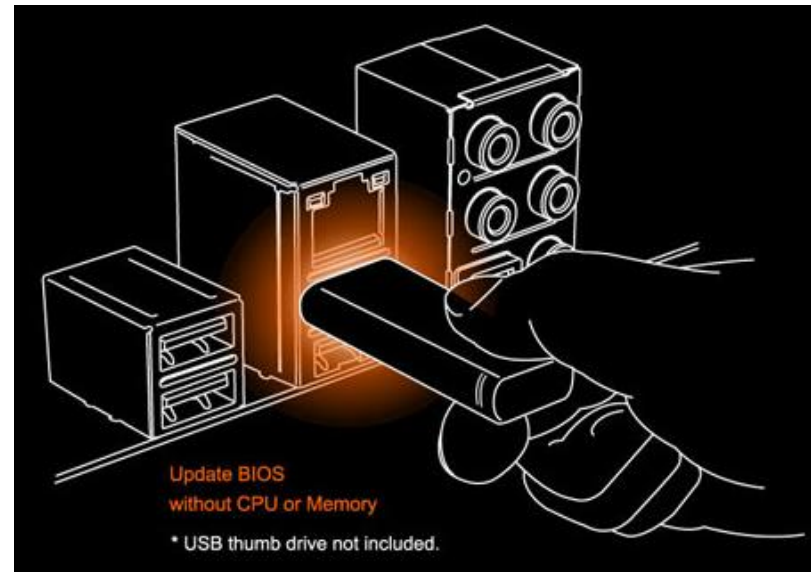
- The World's Next Universal Connector
- Reversible USB Type-C™ with USB 3.1 Gen 2



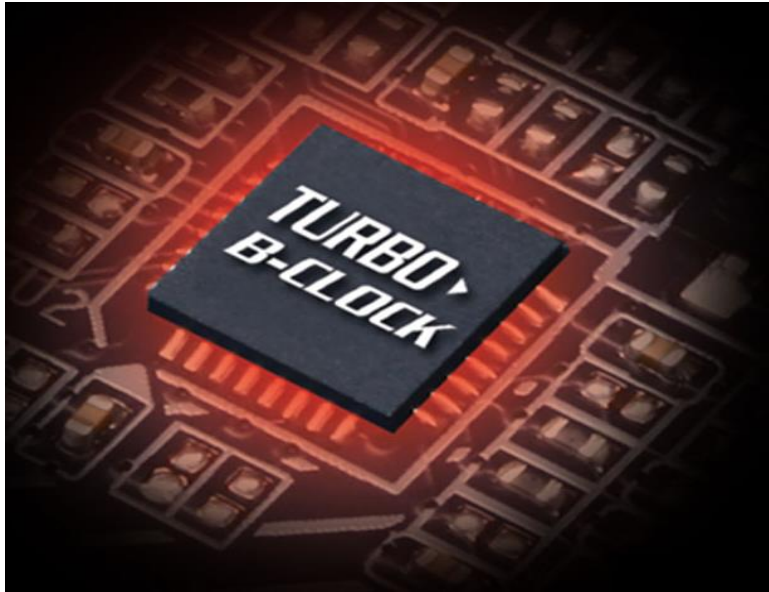
# CPU-Free USB BIOS Updates

AORUS Q-Flash Plus allows users to update to the latest BIOS using a thumb drive without the CPU or Memory needing to be installed.

Updating your BIOS on your AORUS motherboard can be done in a flash – even without memory or CPU onboard. Utilizing the EC Controller, the BIOS on your AORUS Motherboard can now be updated through Q-Flash Plus even if your system is unable to boot. A LED next to the EC controller will notify you once the procedure is complete and you are ready to boot your system normally.



# Turbo B-Clock



## Turbo B-Clock

Built-in Advanced Performance Tuning IC

Turbo B-Clock Tuning IC in the X299 series motherboards enable overclockers to have the ability to change their BCLK frequency to a desired value of their choice. With the new linear range adjustment option of the Tuning IC, ranges from 90MHz to 500MHz are now possible, so that overclockers are not limited to the 5% ranges of traditional straps.

\*Turbo B-Clock overclocking range may vary according to CPU capabilities.

# Intel Core X-Series Processor Families

## 1. Introduction :

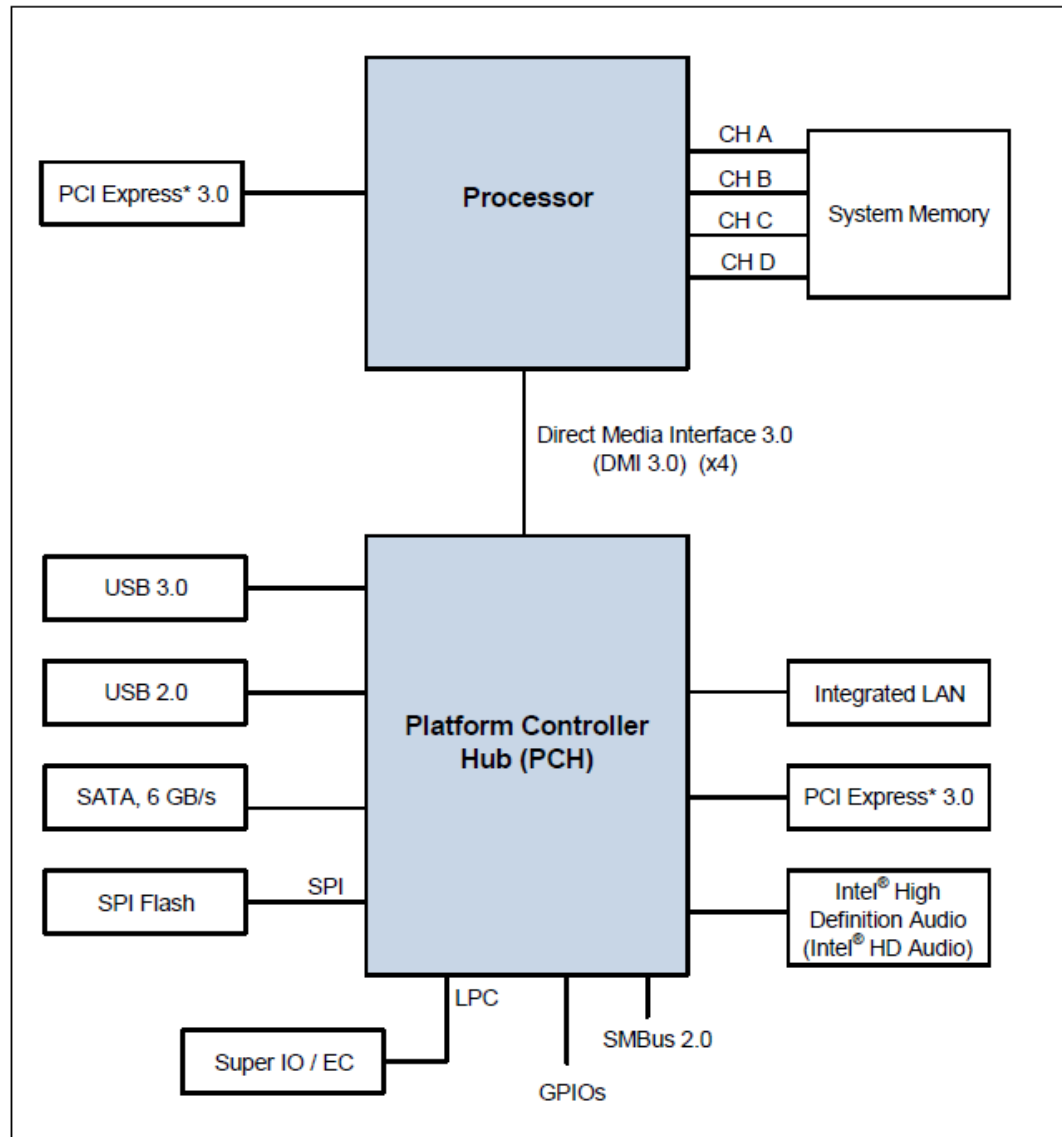
The Intel Core X-Series processor families are the next generation of 64-bit, multi-core processors built on 14-nm process technology. Based on the low power / high performance processor microarchitecture, the processor is designed for a platform consisting of a processor and Platform Controller Hub (PCH). The X-Series processor is used with the Intel® X299 Chipset PCH .

- The processor supports up to 46 bits of physical address space and 48 bits of virtual address space.
- The processor features up to 44 lanes of PCI Express\* 3.0 links capable of 8.0 GT/s, and 4 lanes of DMI/PCI Express\* 3.0.
- It features an Integrated Memory Controller (IMC) that supports 4 channels of DDR4 memory.

### 1.1 Processor Feature Details

- Up to 10 execution cores
- Each core supports two threads (Intel® Hyper-Threading Technology)
- 32 KB instruction and 32 KB data first-level cache (L1) for each core
- 256 KB shared instruction/data mid-level (L2) cache for each core
- 1.0 MB Mid Level Cache (MLC) per core (non-inclusive with the LLC)

# Intel X299 Platform Block Diagram





# Intel HEDT Processor Families

Intel HEDT Family	Gulftown	Sandy Bridge-E	IVY Bridge-E	Haswell-E	Broadwell-E	Skylake-X	KABY LAKE-X	Coffee Lake-X
Process node	32nm	32nm	22nm	22nm	14nm	14nm	14nm	14nm
Flagship SKU	COREi7-980X	COREi7-3960X	COREi7-4960X	COREi7-5960X	COREi7-6950X	COREi7-7000	COREi7/i5-7000 Series	COREi7-8000 Series
Max Cores/Threads	6/12	6/12	6/12	8/16	10/20	18/36	4/8	6/12
Clock Speeds	3.33/3.60 GHz	3.30/3.90 GHz	3.60/4.00 GHz	3.00/3.50 GHz	3.00/3.50 GHz	TBD/4.50 GHz	4.30/4.50 GHz	TBD
Max Cache	12 MB L3	15 MB L3	15 MB L3	20 MB L3	25 MB L3	24.75 MB L3	8 MB L3	TBD
Max PCI-Express Lanes	32 Gen2	40 Gen2	40 Gen3	40 Gen3	40 Gen3	44 Gen3	16 Gen3	TBD
Chipset Compatibility	X58	X79	X79	X99	X99	X299	X299	TBD
Socket Compatibility	LGA1366	LGA2011	LGA2011	LGA2011-3	LGA2011-3	LGA2066	LGA2066	LGA2066?
Memory Compatibility	DDR3-1066	DDR3-1600	DDR3-1866	DDR4-2133	DDR4-2400	DDR4-2667	DDR4-2667	DDR4-2800?
Max TDP	130W	130W	130W	140W	140W	165W	112W	TBD

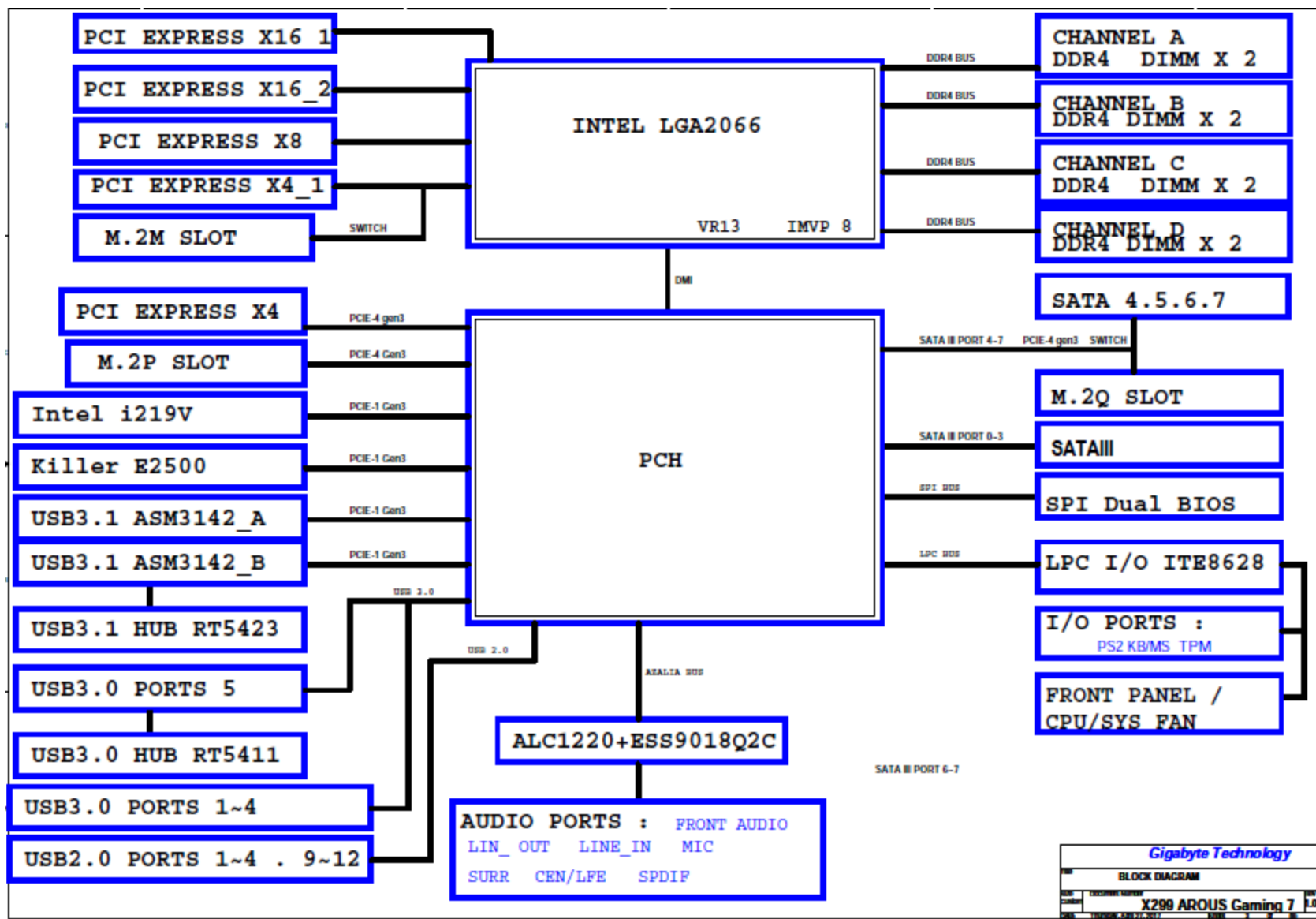
# Intel Core X Series Processor Family Specification

CPU Name	Intel Core i9 7980XE	Intel Core i9 7960X	Intel Core i9 7940X	Intel Core i9 7920X	Intel Core i9 7900X	Intel Core i7 7820X	Intel Core i7 7800X	Intel Core i7 7740X	Intel Core i7 7640X
CPU Process	14nm+	14nm+	14nm+	14nm+	14nm+	14nm+	14nm+	14nm+	14nm+
Architecture	SKL-X	SKL-X	SKL-X	SKL-X	SKL-X	SKL-X	SKL-X	KBL-X	KBL-X
Cores/ Threads	18/36	16/32	14/28	12/24	10/20	8/16	6/12	4/8	4/4
Base Clock	TBA	TBA	TBA	TBA	3.3 GHz	3.6 GHz	3.5 GHz	4.3 GHz	4.0 GHz
Boost Clock / Turbo Boost 2.0	TBA	TBA	TBA	TBA	4.3 GHz	4.0 GHz	4.0 GHz	4.5GHz	4.2GHz
Boost Clock / Turbo Boost 3.0	4.5 GHz	4.5 GHz	4.5 GHz	4.5 GHz	4.5 GHz	4.5 GHz	N/A	N/A	N/A
L3 Cache	TBA	TBA	TBA	TBA	13.75MB	11MB	8.25MB	6MB	6MB
L2 Cache	18MB	16MB	14MB	12MB	10MB	8MB	6MB	4MB	4MB
Memory Support	Quad DDR4	Quad DDR4	Quad DDR4	Quad DDR4	Quad DDR4	Quad DDR4	Quad DDR4	Dual DDR4	Dual DDR4
PCIe Lanes	44	44	44	44	44	28	28	16	16
Socket Type	LGA2066	LGA2066	LGA2066	LGA2066	LGA2066	LGA2066	LGA2066	LGA2066	LGA2066

# Intel Kaby Lake-X Lineup

CPU Name	Intel Core i5-7600K	Intel Core i5-7640X	Intel Core i7-7700K	Intel Core i7-7740K
CPU Process	14nm+	14nm+	14nm+	14nm+
Cores/Threads	4/4	4/4	4/8	4/8
Base Clock	3.8GHz	4.0GHz	4.3GHz	4.2GHz
Boost Clock	4.2GHz	4.2GHz	4.5GHz	4.5GHz
L3 Cache	6MB	6MB	8MB	8MB
Memory Support	DDR4 Dual Channel	DDR4 Dual Channel	DDR4 Dual Channel	DDR4 Dual Channel
Socket Type	LGA1151	LGA2066	LGA1151	LGA2066
TDP	91W	112W	91W	112W

# BLOCK DIAGRAM



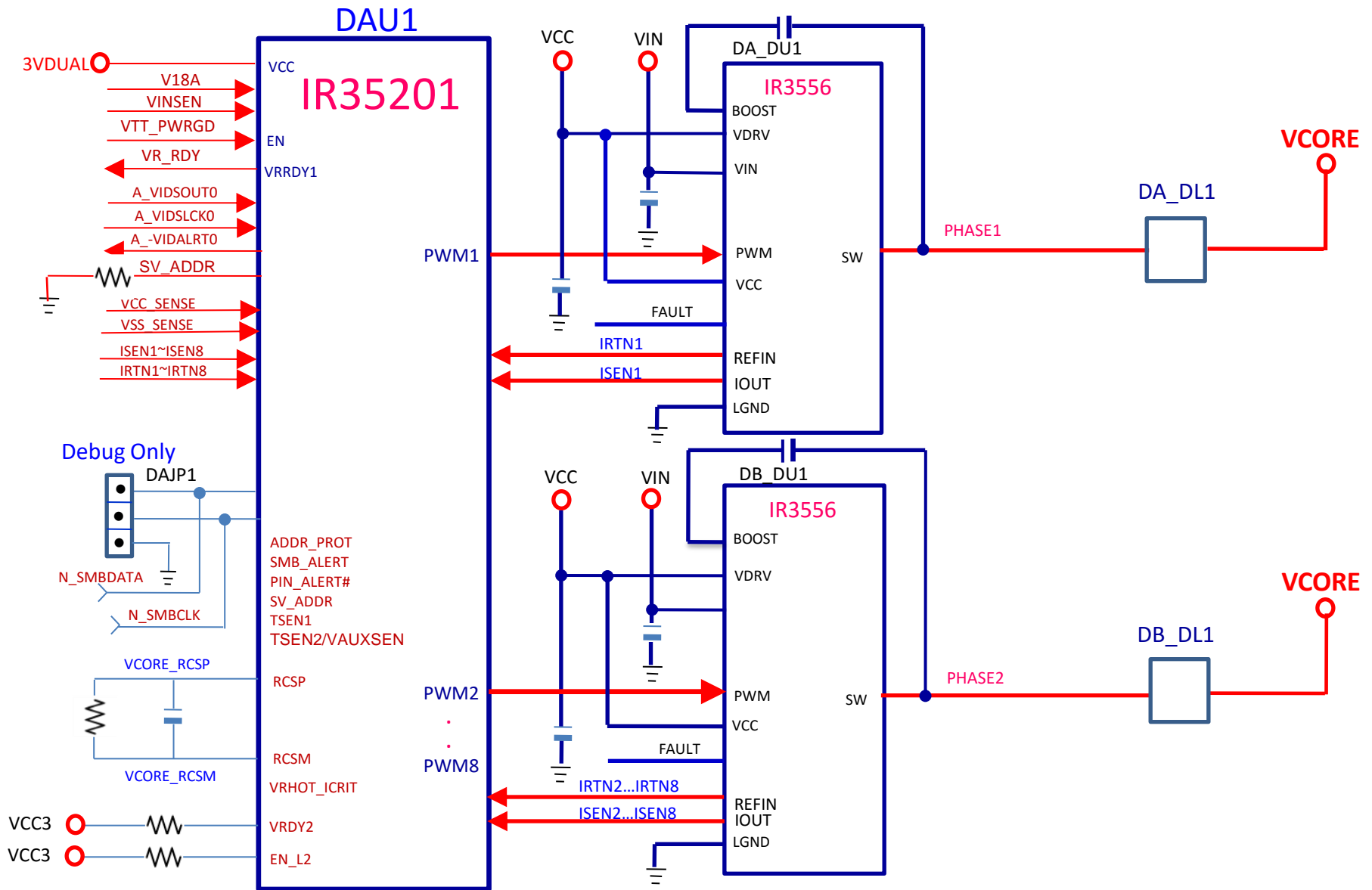




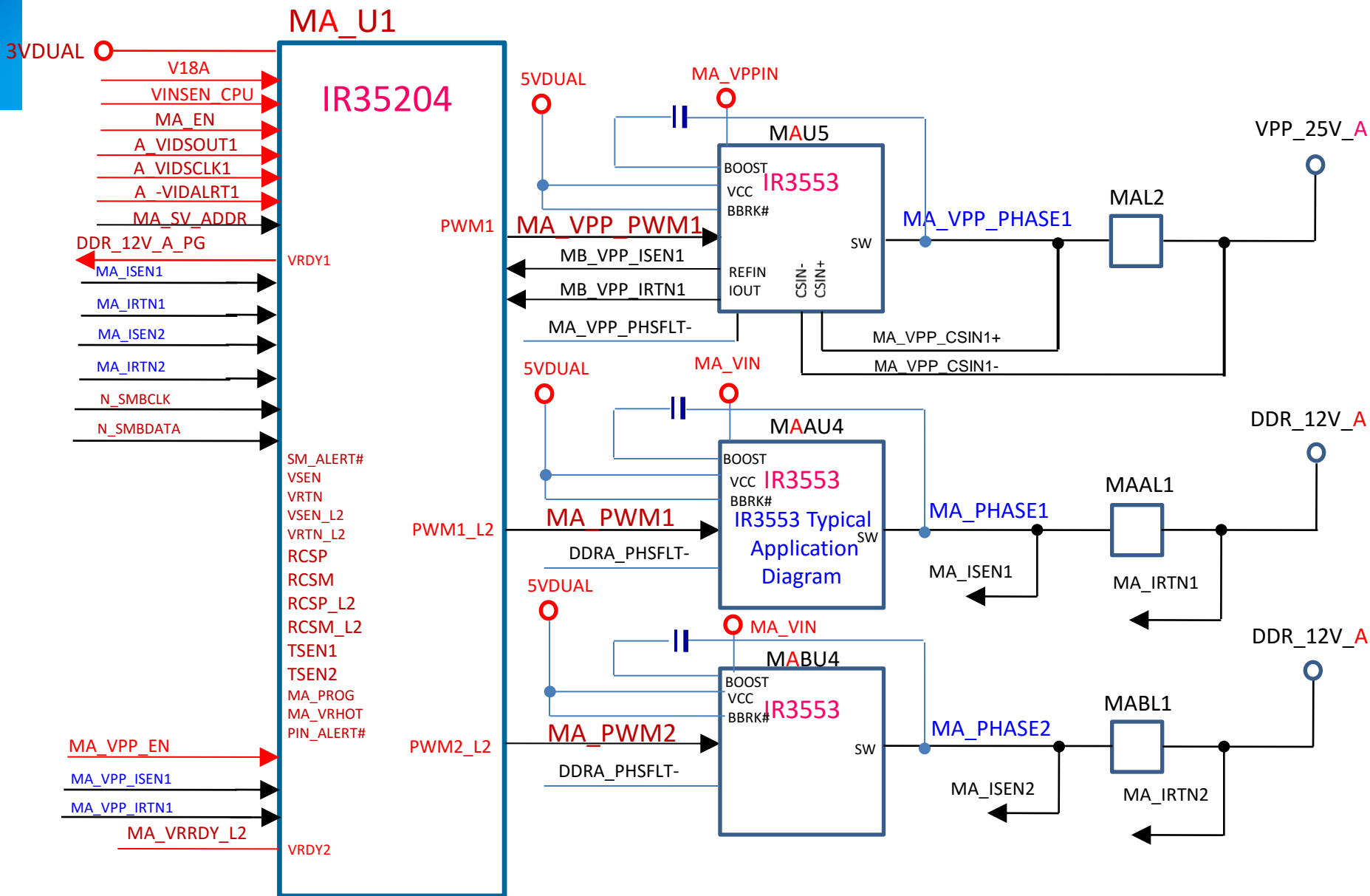
# X299 AORUS Gaming 7 All Voltages List

Power Rail	Voltage	CPU	PCH	DDR4	Parts	Description
DDR_12V_A	1.2V	V		V	IR35204	Power source for DDR4 Memory and the CPU
DDR_12V_B	1.2V	V		V	IR35204	Power source for DDR4 Memory and the CPU
DDRVTT_A	0.6V			V	RT9173	Power source for DDR4 Memory
DDRVTT_B	0.6V			V	RT9173	Power source for DDR4 Memory
VPP_25V_A	2.5V			V	IR35204	VPP VR power source for DDR4 Memory
VPP_25V_B	2.5V			V	IR35204	VPP VR power source for DDR4 Memory
VCORE	1.8V	V			IR35201	Processor core power supply
VCCIO	1V	V			IR35204	0.95 V - 1.0 V power supply for the processor IO.
VCCSA	0.85V	V			IR35204	1.05 V - 0.55 V supply for IIO
VCCST	1V	V			RT9018	NC_SKLW[2]
VCCSFR_SOC	1.1V	V			RT9018	NC_SKLW[2]
VCCSFR	1V	V			RT9018	NC_SKLW[2]
VCC1_0_PCH	1V		V		RT8120	Primary Well 1.0 V:
VCC3_PCH	3.3V		V		NR8P4R	Primary Well 3.3 V
3VDUAL_PCH	3.3V		V		L1117	3.3 V supply for Deep Sx wells.
3VDUAL	3.3V		V		L1085	3.3 V supply for suspend well I/O buffers.
RTCVD	3.3V		V		Battery	Battery Voltage 3 .3 V

# IR35201 Dual Output Digital Multi-Phase Controller

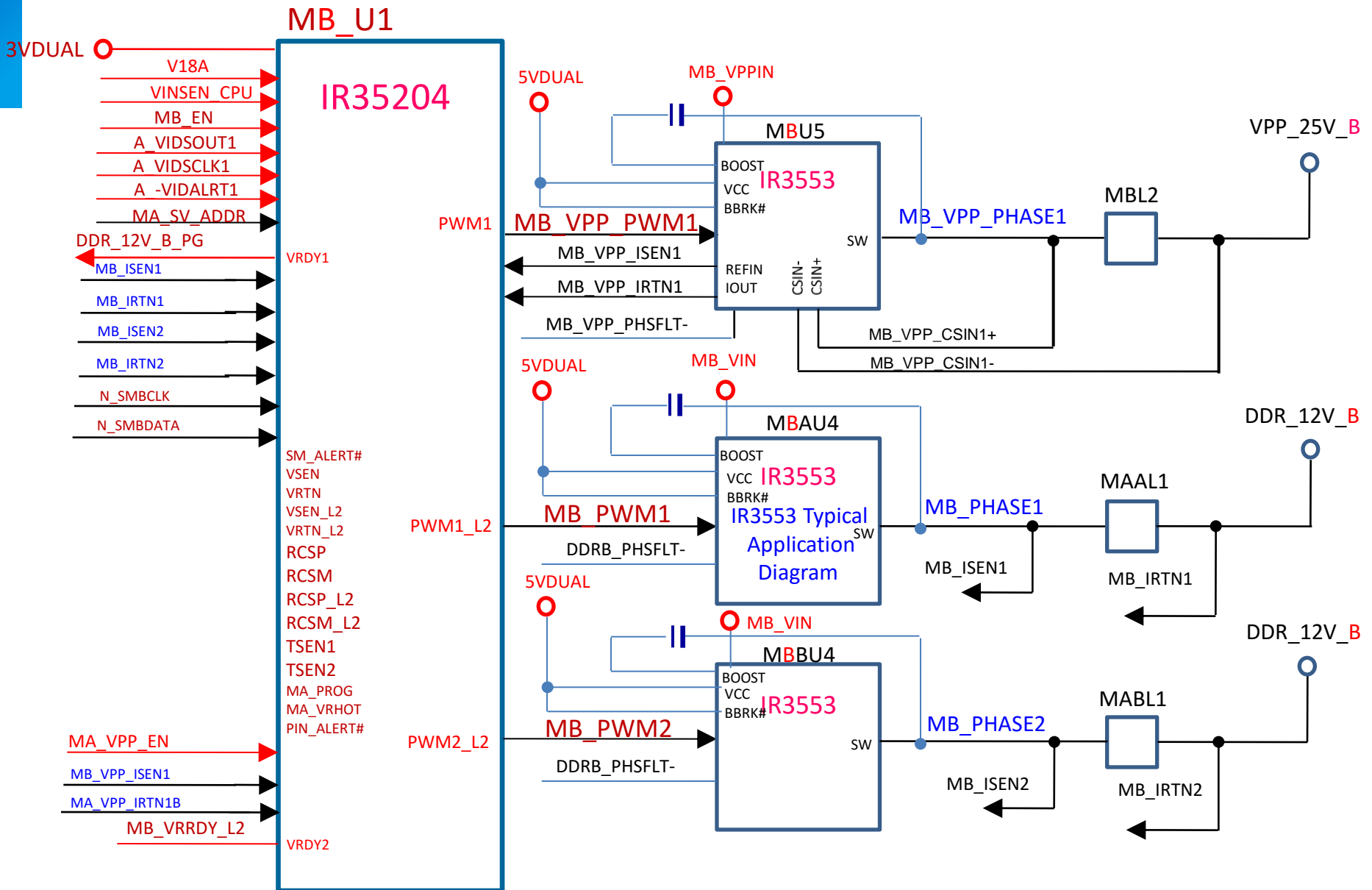


# DDR\_12V\_A ,VPP\_25V\_A Digital Power Circuit





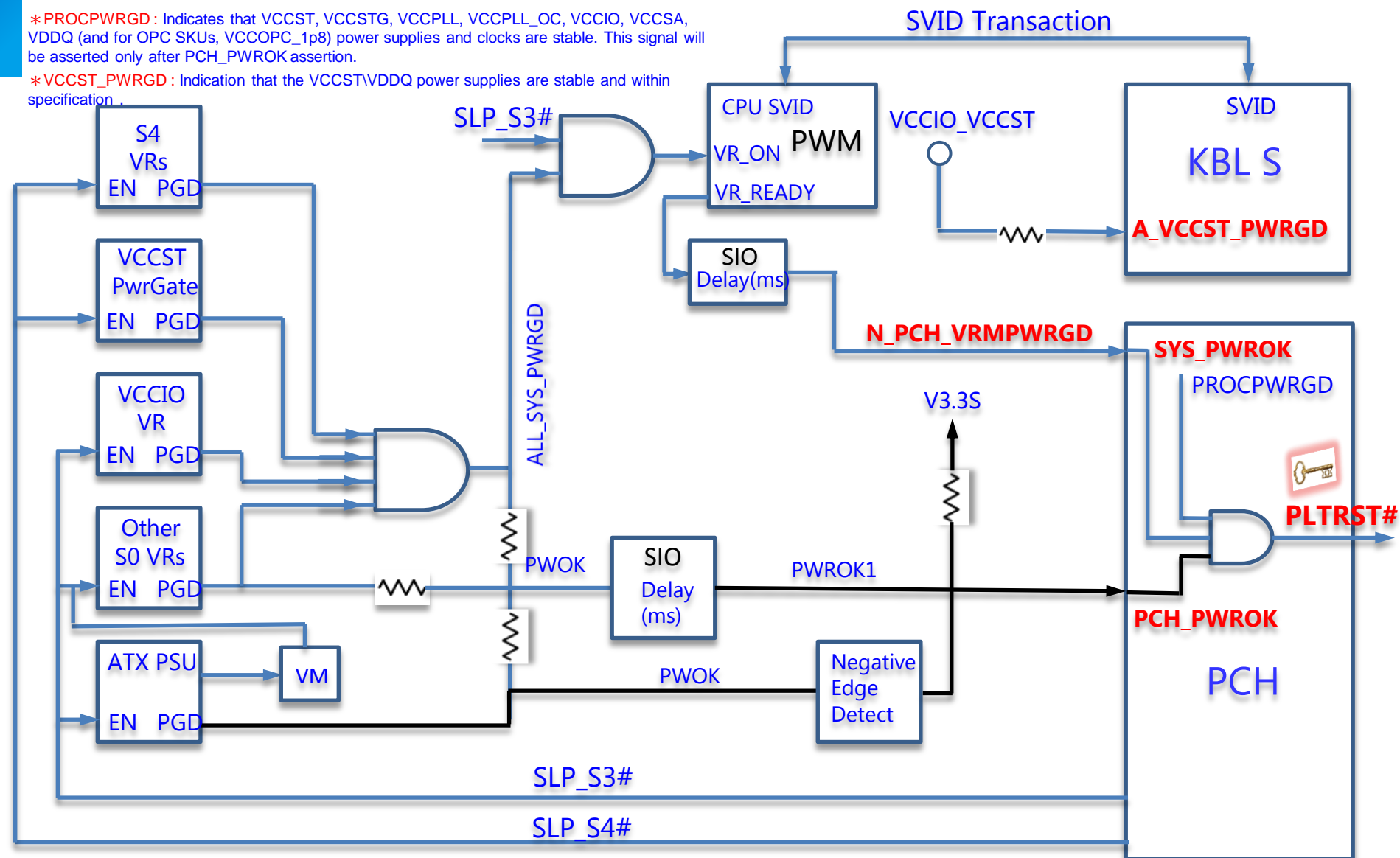
# DDR\_12V\_B ,VPP\_25V\_B Digital Power Circuit



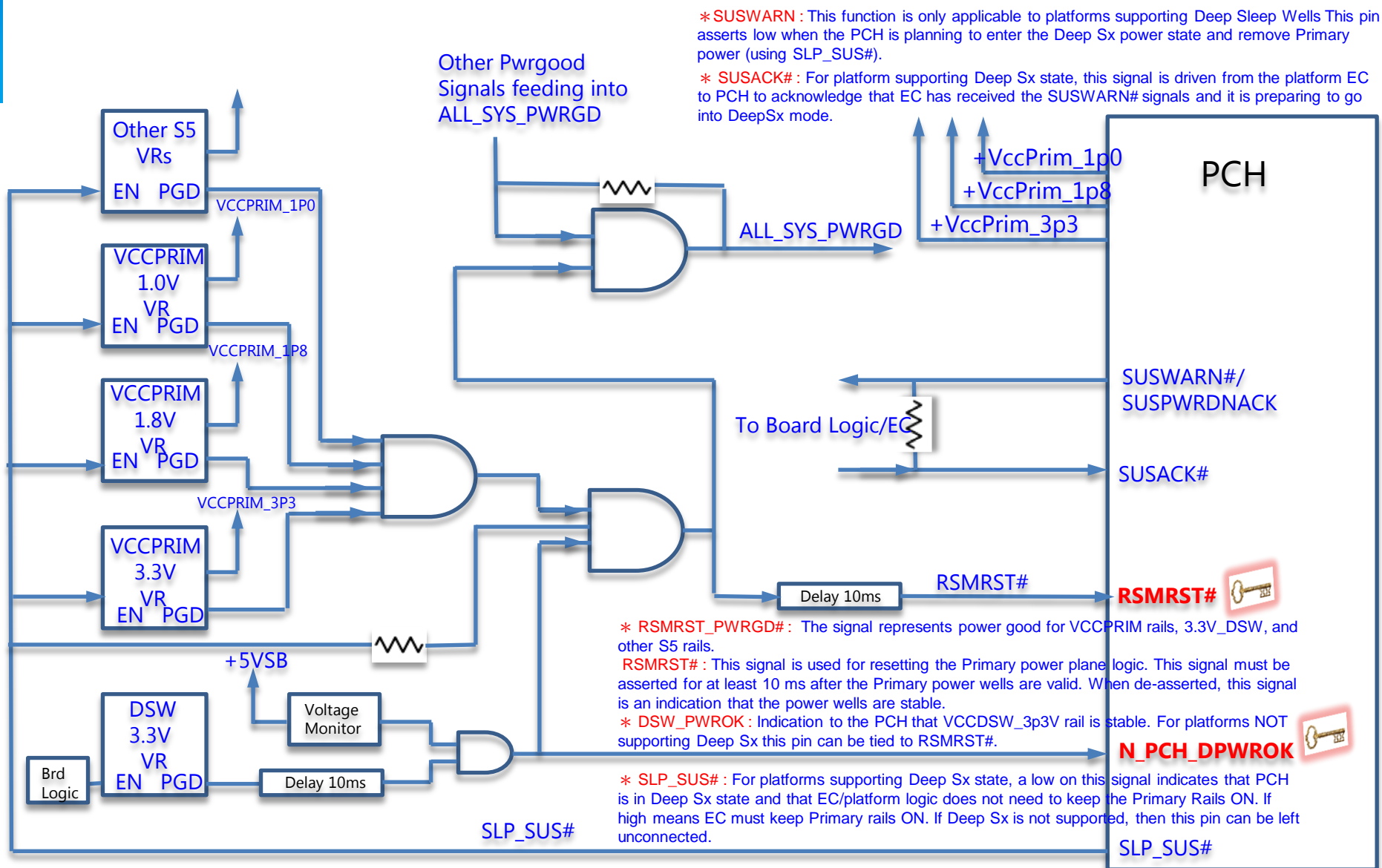
# Flow Diagram for SYS\_PWROK / PCH\_PWROK Generation(Check Keys)

\***PROC\_PWRGD**: Indicates that VCCST, VCCSTG, VCCPLL, VCCPLL\_OC, VCCIO, VCCSA, VDDQ (and for OPC SKUs, VCCOPC\_1p8) power supplies and clocks are stable. This signal will be asserted only after PCH\_PWROK assertion.

\***VCCST\_PWRGD**: Indication that the VCCST/VDDQ power supplies are stable and within specification.



# Flow Diagram for RSMRST\_PWRGD# Generation(Check Keys)



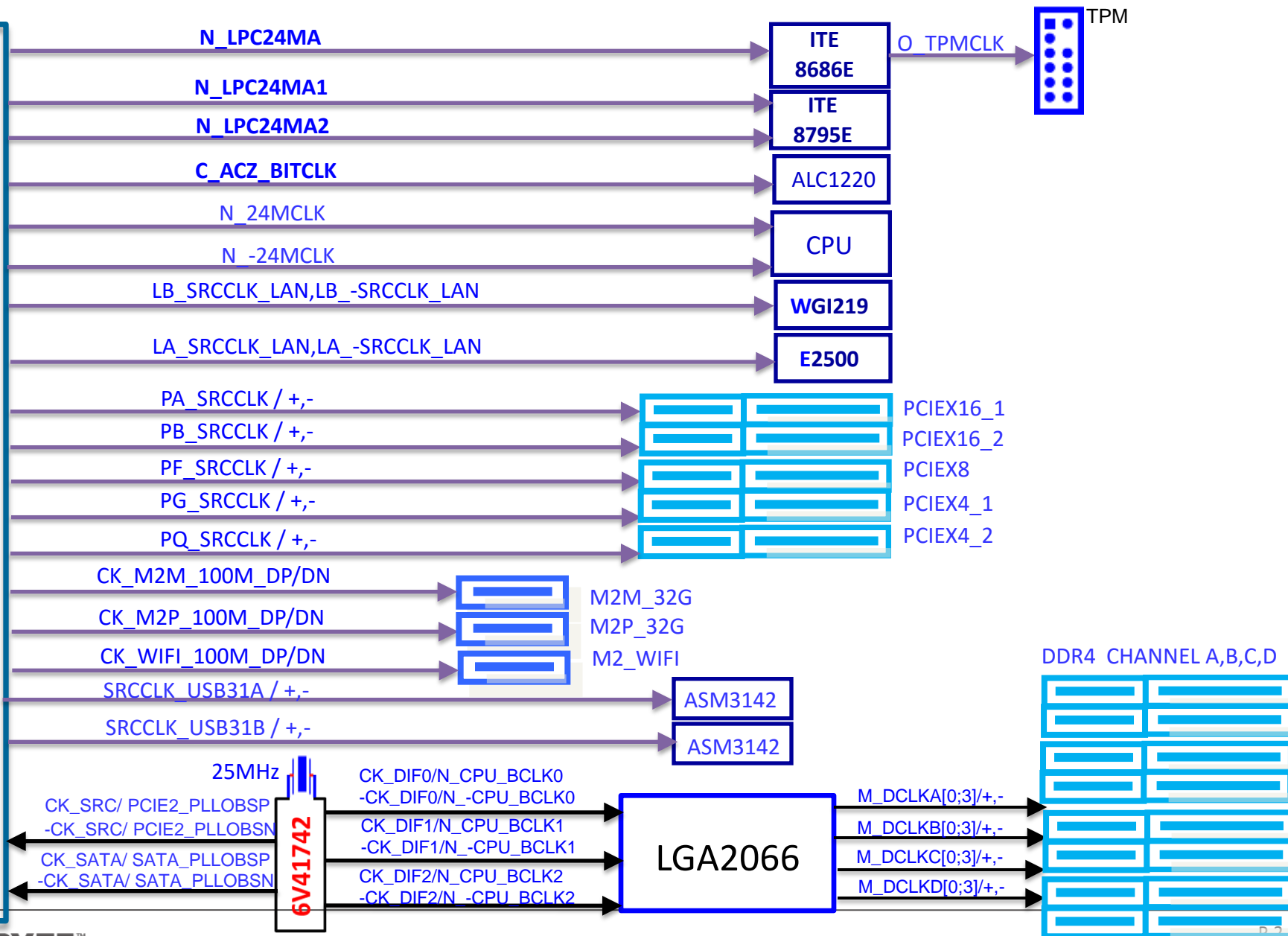
# Power States

Rail	S0/M0	S0ix / M-off	S3 / M3	S3 / M3-off	S4-S5 / M3	S4-S5 / M3-off	Deep S3	Deep S4 / S5	G3
RTC Well	ON	ON	ON	ON	ON	ON	ON	ON	ON
5VSB	ON		ON	ON	ON	ON	ON	ON	ON
3VDUAL_PCH	ON	ON	ON	ON	ON	ON	ON	ON	No Power
5VDUAL	ON	ON	ON	ON	ON	ON	OFF	OFF	No Power
VCC3_PCH	ON	ON	ON	ON	ON	ON	OFF	OFF	No Power
VCC1_0_PCH	ON	ON	ON	ON	ON	ON	OFF	OFF	No Power
VCCSFR	ON	ON	ON	ON	ON	ON	OFF	OFF	No Power
VCCSFR_OC	ON	ON	ON	ON	ON	ON	OFF	OFF	No Power
VCCST	ON	ON	ON	ON	ON	ON	OFF	OFF	No Power
DDR_12V_A,B	ON	ON	ON	ON	OFF	OFF	ON	OFF	No Power
VCCIO_VCCST	ON	ON	ON	ON	OFF	OFF	OFF	OFF	No Power
VCORE	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	No Power
VCCIO	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	No Power
VCCSA	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	No Power
P12V , P5V, P3V3	ON		OFF	OFF	OFF	OFF	OFF	OFF	No Power

24MHz

# X299 AORUS Gaming 7 Clock Generator

Clock Generator Integrated X299



GIGABYTE™

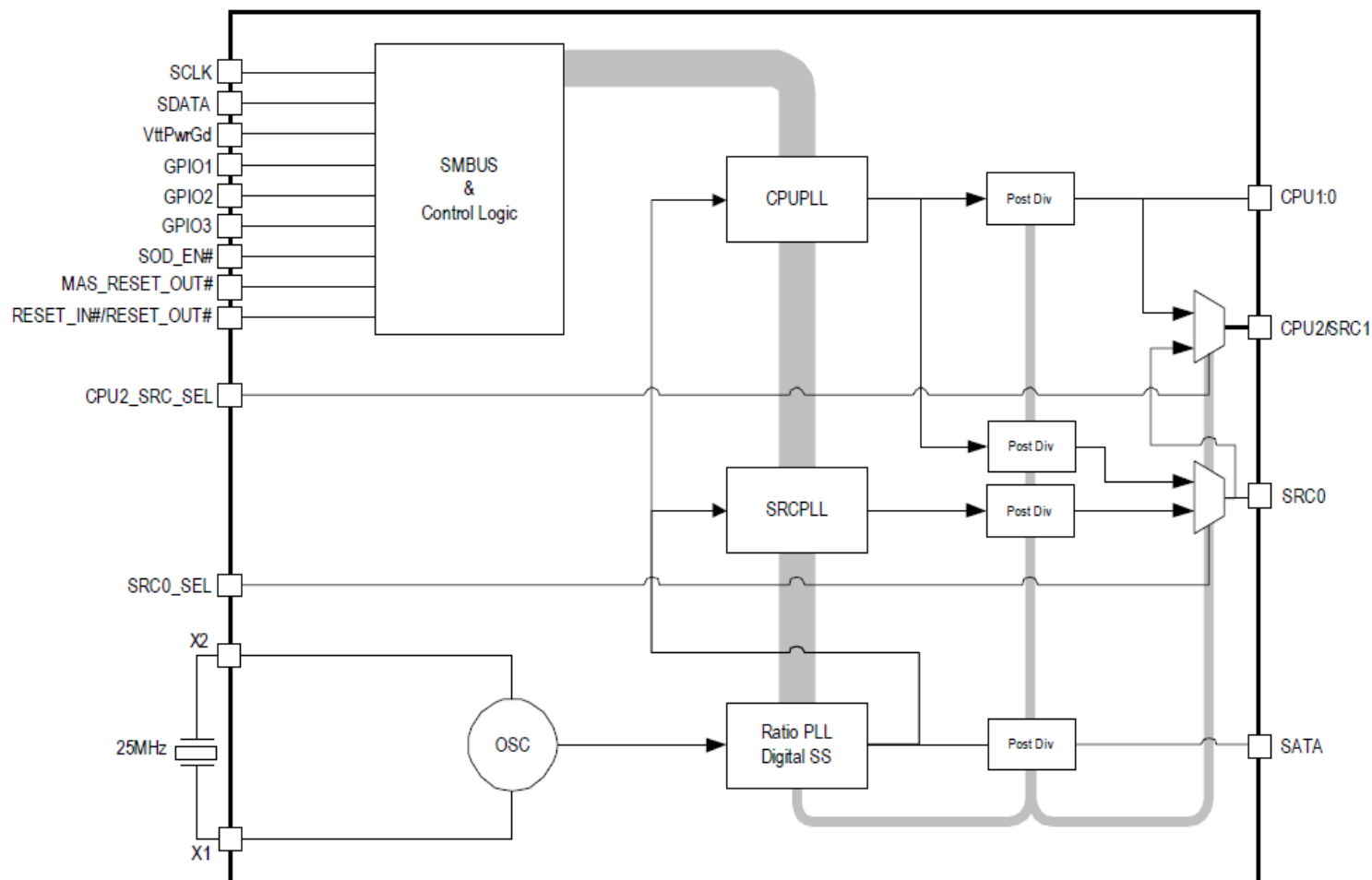
Dept. #41B 研發服務部  
Overclock Solution for Intel High-End Desktop

By:

# 6V41742 Overclock Solution for Intel High-End Desktop

## 1. Description :

The 6V41742 is a main clock synthesizer for Intel High-End desktop platforms based on the Skylake and Kabylake series of CPUs. It provides extensive ver/underclocking support.





# X299 AORUS Gaming 7 Voltage

CPU	PCH (X299)	SIO (IT8686E)	DDR4
VCORE VCCIO VCCIO1~5 VCCSA VCCST VCCSFR VCCSFR_OC SK_VCORE SK_VRING DDR_12V_A DDR_12V_B VPP_25V_A VPP_25V_B A_VREFDQ_C0~C3	N_RTCVDD 3VDUAL 3VDUAL_PCH VCC3 VCC3_PCH VCC1_0_PCH VCCDSW_1P0 VCC10_VCCAPLL VCC10_VCCF24_1P0 VCC10_VCCAMPHYPLL	IT_AVCC IT_VCCH 28_3VSB N_VBAT 2_5LEVEL 5VAUX_SW SIO_18V VCCIO	DDR_12V_A DDR_12V_B VDDSPDA VPP_25V_A VPP_25V_B DDRVTT_A DDRVTT_B M_VREF_DDRA M_VREF_DDRB M_VREF_DDRC M_VREF_DDRD

# X299 AORUS Gaming 7 Clock

CPU	PCH (X299)	SIO (IT8686E)	DDR4
N_CPU_BCLK0~2 N_CPU_BCLK0~2 M_DCLKA0~A3 M_-DCLKA0~A3 M_DCLKB0~B3 M_-DCLKB0~B3 M_DCLKC0~C3 M_-DCLKC0~C3 M_DCLKD0~D3 M_-DCLKD0~D3 M_CKEA0~A3 M_CKEB0~B3 M_CKEC0~C3 M_CKED0~D3 N_24MCLK N_-24MCLK OCCLK[0;2]	32.768K 24M N_CPU_BK0~2 N_-CPU_BK0~2 N_24MCLK N_-24MCLK N_LPC24MA N_LPC24MA1~2	N_LPC24MA O_TPMCLK	M_DCLKA0~A3 M_-DCLKA0~A3 M_DCLKB0~B3 M_-DCLKB0~B3 M_DCLKC0~C3 M_-DCLKC0~C3 M_DCLKD0~D3 M_-DCLKD0~D3 M_CKEA0~A3 M_CKEB0~B3 M_CKEC0~C3 M_CKED0~D3

# X299 AORUS Gaming 7 PWOK

CPU	PCH (X299)	SIO (IT8686E)	DDR4
N_CPUPWROK A_VCCST_PWRGD A_DRAM_PWROK0 A_DRAM_PWROK1	N_CPUPWROK N_PCH_DPWROK SYS_PWROK PCH_PWROK	PWOK O_PWROK1 N_PCH_DPWROK N_PCH_VRMPWRGD A_DRAM_PWROK1	

# X299 AORUS Gaming 7 Reset

CPU	PCH (X299)	SIO (IT8686E)	DDR4
N_-CPURST A_-M_RSTC01 A_-M_RSTC23	N_-CPURST N_-RTCRST N_-SRTCST O_-RSMRST N_-SYS_RST N_-PFMRST N_-KBRST -DDR_RST	O_-RSMRST N_-PFMRST O_-PFMRST2 O_-PCIE_RST -PCIRSTIN N_-KBRST	A_-M_RSTC01 A_-M_RSTC23_T

# X299 AORUS Gaming 7 Signals

CPU	PCH (X299)	SIO (IT8686E)	DDR4
A_-VIDALRT0~1 A_VIDSLCK0~1 A_VIDSOUT0~1 VCC_SENSE VSS_SENSE VCCSA_SENSE VCCSA_VSS_SENSE VCCIO_SENSE VCCIO_VSS_SENSE VSENSE_PMAX A_-THRMTRIP A_-PROCHOT A_PECI A_PROC_ID[0;1] SOCKET[0;1] BIST_ENABLE A_-BMCINIT A_FRMAGENT A_DMIMODE KBLX_CFG[0;13] N_PCH_CPU_TO N_PCH_CPU_TI A_DMI_[0;3]TXP/N A_DMI_[0;3]RXP/N	N_-SLP_S3 N_-S4_S5 O_PWRBTSW N_LAD0~3 N_SMBDATA N_SMBCLK N_SERIRQ N_-LFRAME N_-LPCPME N_-PCIE_WAKE N_ICH_SPI_MOSI N_ICH_SPI_MISO N_ICH_SPI_CS N_ICH_SPI_CLK N_SPI_DQ2 N_SPI_DQ3 A_PROC_ID[0;1] N_PCH_CPU_TO N_PCH_CPU_TI N_-DEVSLP[0,2] N_DDR_V_SEL N_-DEPSLP N_-THRMTRIP A_PECI_R A_DMI_[0;3]TXP/N A_DMI_[0;3]RXP/N	N_-SLP_S3 N_-S4_S5 -PWRBTSW O_PWRBTSW N_LAD0~3 N_A20GATE N_-LDRQ0 N_SERIRQ N_-LFRAME N_-LPCPME VIN0~VIN6 VREF CEB_N BIOS_SEL JP2,3,4,5 -SPI_HOLD_M,B -ICH_SPI_CS A_PECI A_-PROCHOT N_-THRMTRIP CPU_TEMP VCCSA_EN VPP25_EN_IO VCC1_0_EN VCCIO_EN MA_EN_IO	

# 6V41742 Overclock Solution for Intel High-End Desktop

## 2. Power Group :

Pin Number		Description
VDD	GND	
3	39	Power for CPU PLL analog and CPU0 output.
4, 6	5	Crystal oscillator, REF outputs, SMBus.
14	11	Power for SATA clock output.
23, 24	27	Power for CPU2 and SRC clock outputs.

## 3. Power Management :

VTPWRGD(PD#)	SMBus Register OE	CPU/SRC/SATA
0	0	Low/Low
0	1	Low/Low
1	Enable	Running
X	Disable	Low/Low



## 4. Pin Descriptions:

Number	Name	Type	Description
1	CPUT0	Output	Differential LPHCSL clock CPUCLK0_T.
2	CPUC0	Output	Differential LPHCSL clock CPUCLK0_C.
3	VDDCPU_01	Power	Power supply pin for CPU0 and CPU1.
4	VDDSEED	Power	Power supply pin for internal seed clock.
5	GNDX	Power	Ground.
6	VDDX	Power	Power supply for crystal oscillator.
7	X2	Output	Crystal oscillator output, 25MHz.
8	X1	Input	Crystal oscillator input, 25MHz.
9	NC	—	No connect.
10	NC	—	No connect.
11	GND SATA	Power	Ground.
12	SATA_T	Output	Differential LPHCSL clock SATA_T.
13	SATA_C	Output	Differential LPHCSL clock SATA_C.
14	VDD SATA	Power	Power supply for SATA clock.
15	NC	—	No connect.
16	NC	—	No connect.
17	MAS_RESET_OUT#	Output	Real-time timer (long) master reset output signal for frequency gear ratio change or watchdog timer timeout. This signal is active low. This is open drain output in which a pull-high to $V_{DD}$ is required on board.

18	SCK	Input	SMBUS clock pin.
19	SDA	I/O	SMBUS data pin.
20	RESET_IN#/RESET_OUT#	I/O	Real-time active low input. When active, SMBus is reset to power up default / Real time system (short) reset signal for frequency change or watchdog timer timeout. This signal is active low. This is open drain I/O in which a pull-high to $V_{DD}$ is required on board.
21	SRC0T	Output	Differential LPHCSL clock SRCT.
22	SRC0C	Output	Differential LPHCSL clock SRCC.
23	VDDSRC	Power	Power supply pin of SRC.
24	VDDCPU2	Power	Power supply pin of CPU2.
25	CPU2_Z85T/SRC1T	Output	Differential LPHCSL CPU2_Z85T clock or SRCT clock.
26	CPU2_Z85C/SRC1C	Output	Differential LPHCSL CPU2_Z85C clock or SRCC clock.
27	GNDCPU2	Power	Ground.
28	ADFC	Input	Analog dynamic frequency control input pins.
29	GPIO1	I/O	General purpose IO pin 1.
30	GPIO2	I/O	General purpose IO pin 2.

# Q & A