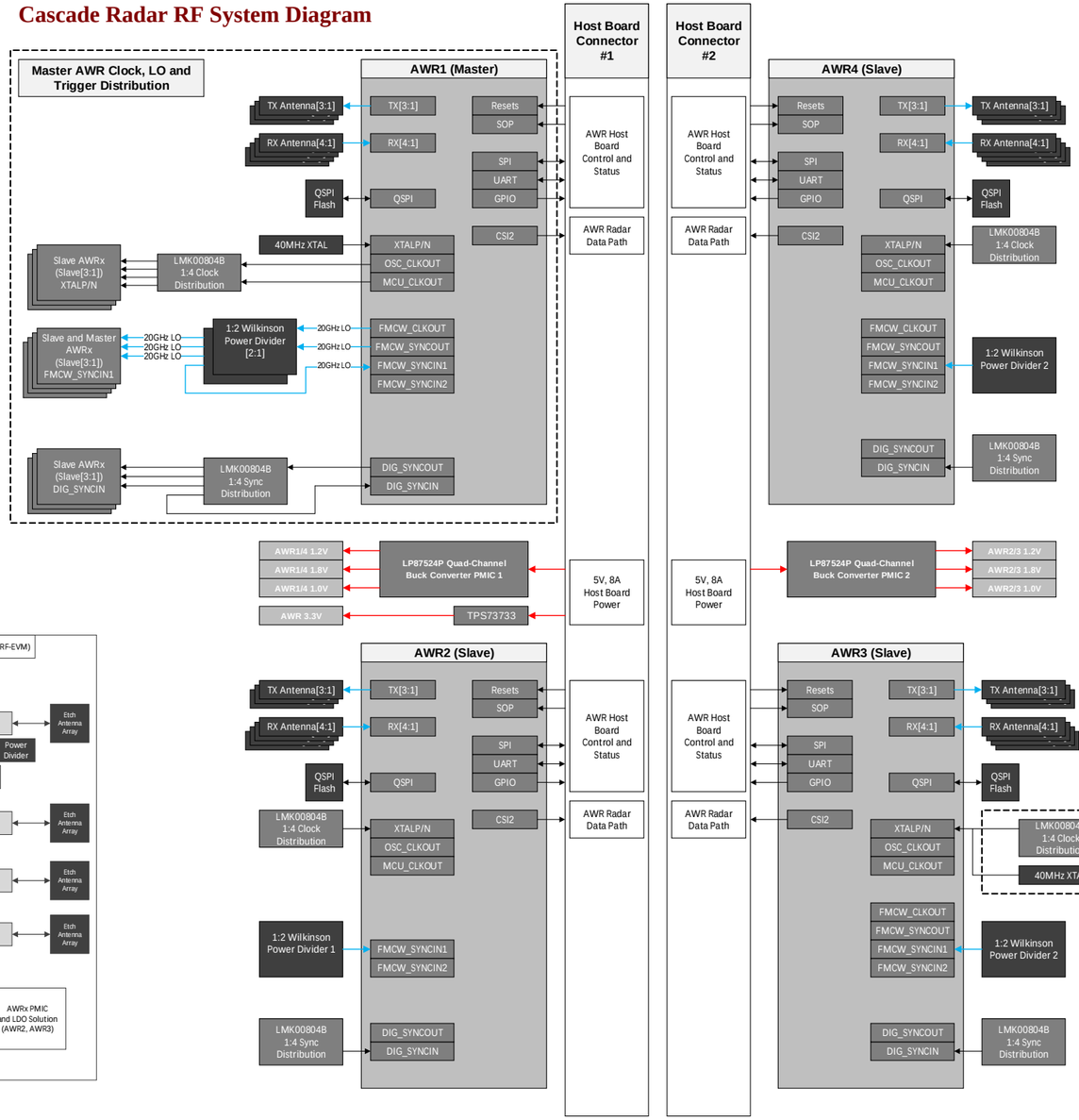
mmWave Cascade Radar RF Board (MMWCAS-RF-EVM)

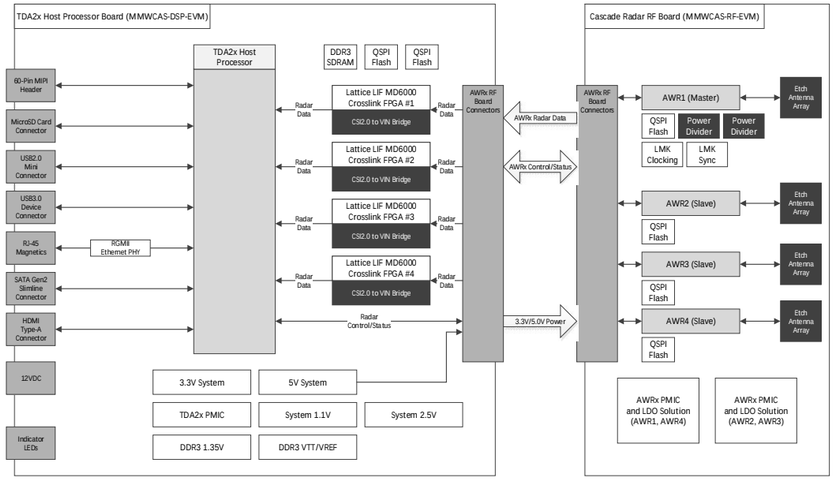
System Description

	Cascade Radar RF Board
4x AWRx 76-81GHz Radar SoC	Integrated VCO, LO distribution, PA, LNA, ADC, 3 TX and 4 RX ARM MCU R4 Controller
AWR RF Peripherals	
12x TX, 16x RX Antennas	12 total transmitters across all 4 AWRx devices 16 total receivers across all 4 AWRx devices
Embedded Antenna	4-element series-fed patch antenna
20 GHz LO Star Distribution	2x Wilkinson Power dividers fed by the Master AWRx device LO output to Slave AWRx devices
AWR Digital Peripherals	
CSI2.0 4-lane	600Mbps/Lane for 2.4Gbps ADC IF data per device
QSPI Flash	16Mbit QSPI flash for AWR firmware updates
Serial Peripherals	SPI, I2C, UART, GPIO
System Temperature	TMP112 I2C Temperature Sensors
Power	
Radar Power Management IC (PMIC) Solution	2x LP87524P Quad-Channel, Integrated FET, Buck Converters and LC filtering solution

Cascade Radar RF System Diagram



Cascade Radar Evaluation Kit Diagram



CASCADE_RF_BOARD
PROC054E_System_Top.SchDoc

EVM_HARDWARE
PROC054E_EVM_Hardware.SchDoc

REVISION_HISTORY
PROC054E_Revision_History.SchDoc

Orderable: MMW_CAS_RF_EVM		Designed for:Public Release	Mod. Date: 8/14/2020
TID #: N/A		Project Title: MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: Coversheet	
SVN Rev: Not in version control		Assembly Variant:001	Sheet:1 of 19
Drawn By:a0271760		File: PROC054E_Coversheet.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

TEXAS INSTRUMENTS
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Cascade Radar RF Board - Top Level Schematic

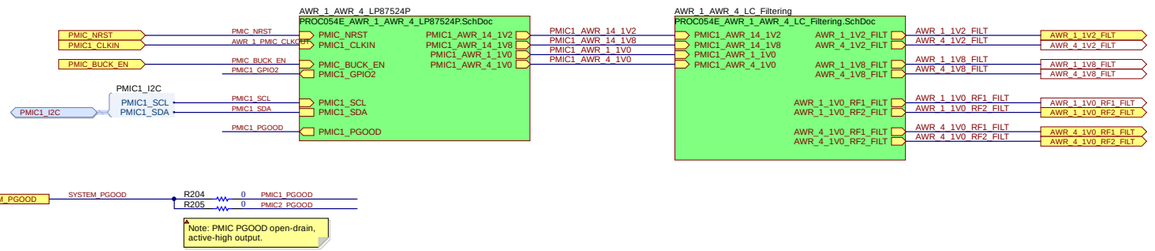
Orderable: MMW_CAS_RF_EVM	Designed for: Public Release	Mod. Date: 8/14/2020	TEXAS INSTRUMENTS
TID #: N/A	Project Title: MMWCAS-RF-EVM		
Number: PROC054 Rev: E	Sheet Title: System Top		
SVN Rev: Not in version control	Assembly Variant: 001	Sheet: 2 of 19	
Drawn By: a0271760	File: PROC054E_System_Top.SchDoc	Size: C	http://www.ti.com
Engineer: a0271760	Contact: http://www.ti.com/mmwave		© Texas Instruments 2020

Cascade RF System Power

References

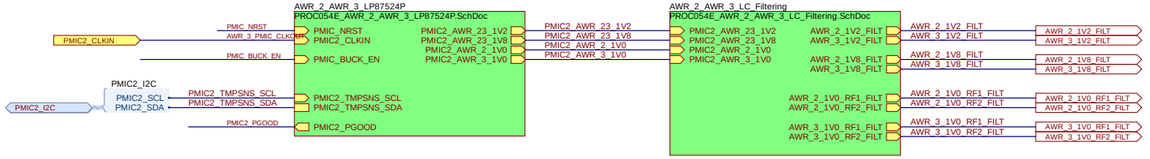
4-A + 2.5-A + Two 1.5-A BLP87524J-Q1 Buck Converters With Integrated Switches
LP87524-Q1 Quad Output, Single-Phase Buck Converter Evaluation Module
XWR1xxx Power Management Optimizations- Low Cost LC Filter Solution

PMIC #1 - Master AWR_1 and Slave AWR_4



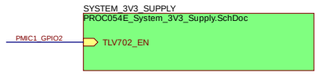
LC Filtering, Ferrite Filtering AWR_1 and AWR_4

PMIC #2 - Master AWR_2 and Slave AWR_3

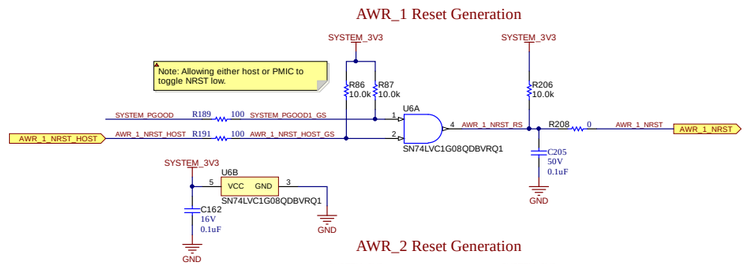


LC Filtering, Ferrite Filtering AWR_2 and AWR_3

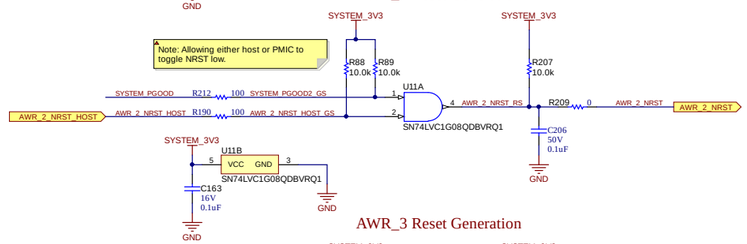
3.3V System LDO



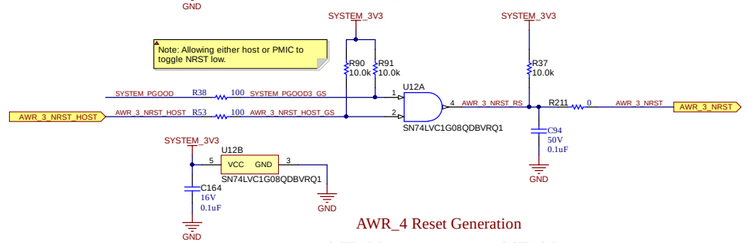
AWR_1 Reset Generation



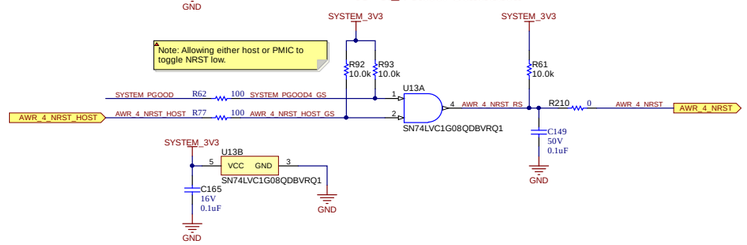
AWR_2 Reset Generation



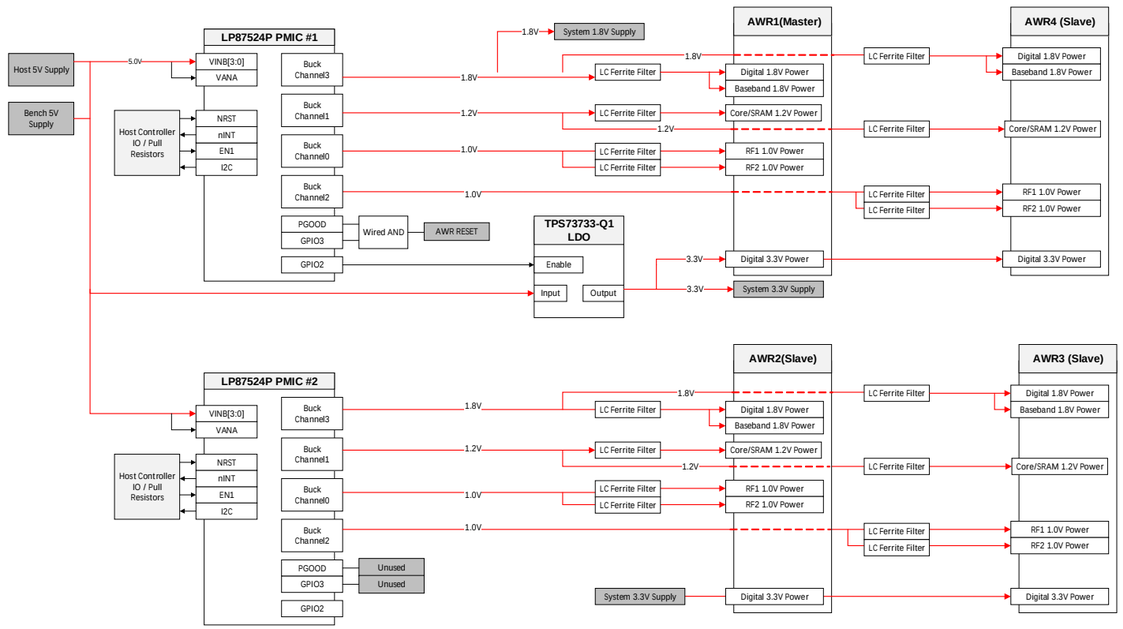
AWR_3 Reset Generation



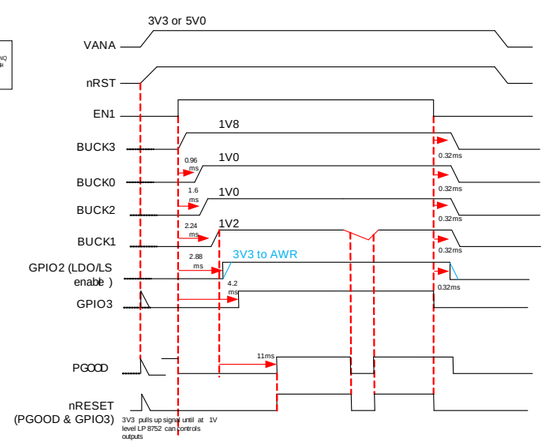
AWR_4 Reset Generation



System Power Diagram



System Power Sequence Diagram



Orderable: MMW_CAS_RF_EVM		Designed for:Public Release	Mod. Date: 8/14/2020
TID #: N/A		Project Title: MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: System Power	
Cust Rev: Not in version control		Assembly VAWRiant:	Sheet:3 of 19
Drawn By:a0271760		File: PROC054E_System_Power.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

Texas Instruments
http://www.ti.com

LP87524P Quad-Channel Synchronous Buck PMIC - Master AWR_1 and Slave AWR_4

References

4-A + 2.5-A + Two 1.5-A BLP875241-Q1 Buck Converters With Integrated Switches
LP87524-Q1 Quad Output, Single-Phase Buck Converter Evaluation Module
XWR1xxx Power Management Optimizations- Low Cost LC Filter Solution

LP8752x input filtering, bulk and decoupling capacitance

SYSTEM_5V0 — L9 BLM21PG300SH1D — PMIC1_VIN_B0
C39 6.8nF 100V; DNP C40 6.3V; DNP C41 6.3V 100uF; C42 16V 0.1µF; C43 10V 10µF; GND

SYSTEM_5V0 — L10 BLM21PG300SH1D — PMIC1_VIN_B1
C44 6.8nF 100V; DNP C45 6.3V 100uF; DNP C46 6.3V 100uF; C47 16V 0.1µF; C48 10V 10µF; GND

SYSTEM_5V0 — L11 BLM21PG300SH1D — PMIC1_VIN_B2
C51 6.8nF 100V; DNP C52 6.3V; DNP C53 6.3V 100uF; C54 16V 0.1µF; C55 10V 10µF; GND

SYSTEM_5V0 — L12 BLM21PG300SH1D — PMIC1_VIN_B3
C56 6.8nF 100V; DNP C57 6.3V 100uF; DNP C58 6.3V 100uF; C59 16V 0.1µF; C60 10V 10µF; GND

LP8752x Output snubber RC filter

PMIC1_SW_B0 — C37 50V 390pF — R39 3.9 — GND
PMIC1_SW_B1 — C38 50V 390pF — R40 3.9 — GND
PMIC1_SW_B2 — C49 50V 390pF — R41 3.9 — GND
PMIC1_SW_B3 — C50 50V 390pF — R42 3.9 — GND

PMIC_NRST ↔ PMIC1_NRST — TP4
PMIC1_CLKIN ↔ AWR_1_PMIC_CLKOUT — TP5
PMIC_BUCK_EN ↔ PMIC1_GPIO2 — TP6 TP7
PMIC1_SCL ↔ PMIC1_SCL — TP9
PMIC1_SDA ↔ PMIC1_SDA — TP10
PMIC1_PGOOD — PMIC1_PGOOD — R96 0 PMIC1_PGOOD_RS — TP11; R73 0 PMIC1_GPIO3
PMIC1_AWR_1_1V0 ↔ PMIC1_AWR_1_1V0
PMIC1_AWR_14_1V2 ↔ PMIC1_AWR_14_1V2
PMIC1_AWR_4_1V0 ↔ PMIC1_AWR_4_1V0
PMIC1_AWR_14_1V8 ↔ PMIC1_AWR_14_1V8

SYSTEM_5V0 — R44 0 — PMIC1_VANA
LP87524 VANA input capacitance
C63 16V 0.1µF — GND

ClassName: SYSTEM_5V_INPUT
ClassName: PMIC_OUTPUT
U3

PMIC1_VIN_B0	9	VIN_B0	SW_B0 10 — PMIC1_SW_B0
PMIC1_VIN_B1	13	VIN_B1	FB_B0 8 — PMIC1_FB_B0
PMIC1_VIN_B2	26	VIN_B2	SW_B1 12 — PMIC1_SW_B1
PMIC1_VIN_B3	22	VIN_B3	FB_B1 14 — PMIC1_FB_B1
TP14 — PMIC1_VANA	18	VANA	SW_B2 25 — PMIC1_SW_B2
			FB_B2 1 — PMIC1_FB_B2
			SW_B3 23 — PMIC1_SW_B3
			FB_B3 21 — PMIC1_FB_B3
			PGND_B01 11
			PGND_B23 24
			AGND 17
			AGND 4
			AGND 27

ClassName: PMIC_CONTROL

PMIC_NRST	20	RST
AWR_1_PMIC_CLKOUT	3	CLKIN
PMIC1_INTN	19	INT
PMIC1_PGOOD_RS	16	PGOOD
PMIC_BUCK_EN	7	EN1
PMIC1_GPIO2	15	EN2
PMIC1_GPIO3	2	EN3
PMIC1_SCL	5	SCL
PMIC1_SDA	6	SDA

LP87524PRNFTQ1

SYSTEM_3V3
LP87524 I2C Open-drain only 3.6V max compatible
R46 4.7k; R47 4.7k

LP87524 Buck-Converter Channels
SW0 - AWRx 1.0V RF
SW1 - AWRx/y 1.2V Core Digital
SW2 - AWRy 1.0V RF
SW3 - AWRx/y 1.8V Analog/Digital

LP87524 default pull resistors

RSTN - Pulled to 3.3V after SYSTEM_5V power on. Can be driven low by host.

CLKIN - Digital input, default pull-down. Can be driven by AWR

INTN - Open-drain, active-low interrupt output for host. De-asserted by pull-up to 3.3V after SYSTEM_3V3 power on.

PGOOD/GPIO3 - Open-drain, active-high output. Shorted together in wired AND. Pulled to PMIC_3V3 after all LP87524 rails active and additional delay.

BUCK_EN1 - Digital input, pull-ed up to 5.0V after power on to stAWRt LP87524 stAWRtup sequence. Can be driven low by host to stAWRt shutdown sequence.

GPIO2 - Digital ouput, default pull-down. Used by LP87524 to driv SYSTEM_3V3 LDO enable.

PMIC1_3V3
R94 10.0k; R54 10.0k; R49 10.0k; R56 10.0k; R50 10.0k; R51 10.0k
PMIC_NRST
AWR_1_PMIC_CLKOUT
PMIC1_INTN
PMIC1_PGOOD_RS
PMIC_BUCK_EN
PMIC1_GPIO2
PMIC1_GPIO3
R55 10.0k; R57 10.0k; R58 10.0k — GND

SYSTEM_5V0 — R34 1.02k — PMIC1_3V3 — R36 1.96k — GND

ClassName: AWR1_POWER_RF
L13 470nH — PMIC1_SW_B0 — PMIC1_AWR_1_1V0 — R43 0 — PMIC1_FB_B0
AWR1 1.0V RF1/RF2 - 3A Max
C61 10V 22uF; C62 10V 22uF — GND

ClassName: AWR14_POWER_1V2
L14 470nH — PMIC1_SW_B1 — PMIC1_AWR_14_1V2 — R45 0 — PMIC1_FB_B1
AWR1/4 1.2V Core/SRAM - 1.5A Max
C64 10V 22uF; C65 10V 22uF — GND

ClassName: AWR4_POWER_RF
L15 470nH — PMIC1_SW_B2 — PMIC1_AWR_4_1V0 — R48 0 — PMIC1_FB_B2
AWR4 1.0V RF1/RF2 - 3A Max
C66 10V 22uF; C67 10V 22uF — GND

ClassName: AWR14_POWER_1V8
L16 470nH — PMIC1_SW_B3 — PMIC1_AWR_14_1V8 — R52 0 — PMIC1_FB_B3
AWR1/4 1.8V Baseband and Digital I/O - 2.5A Max
C68 10V 22uF; C69 10V 22uF — GND

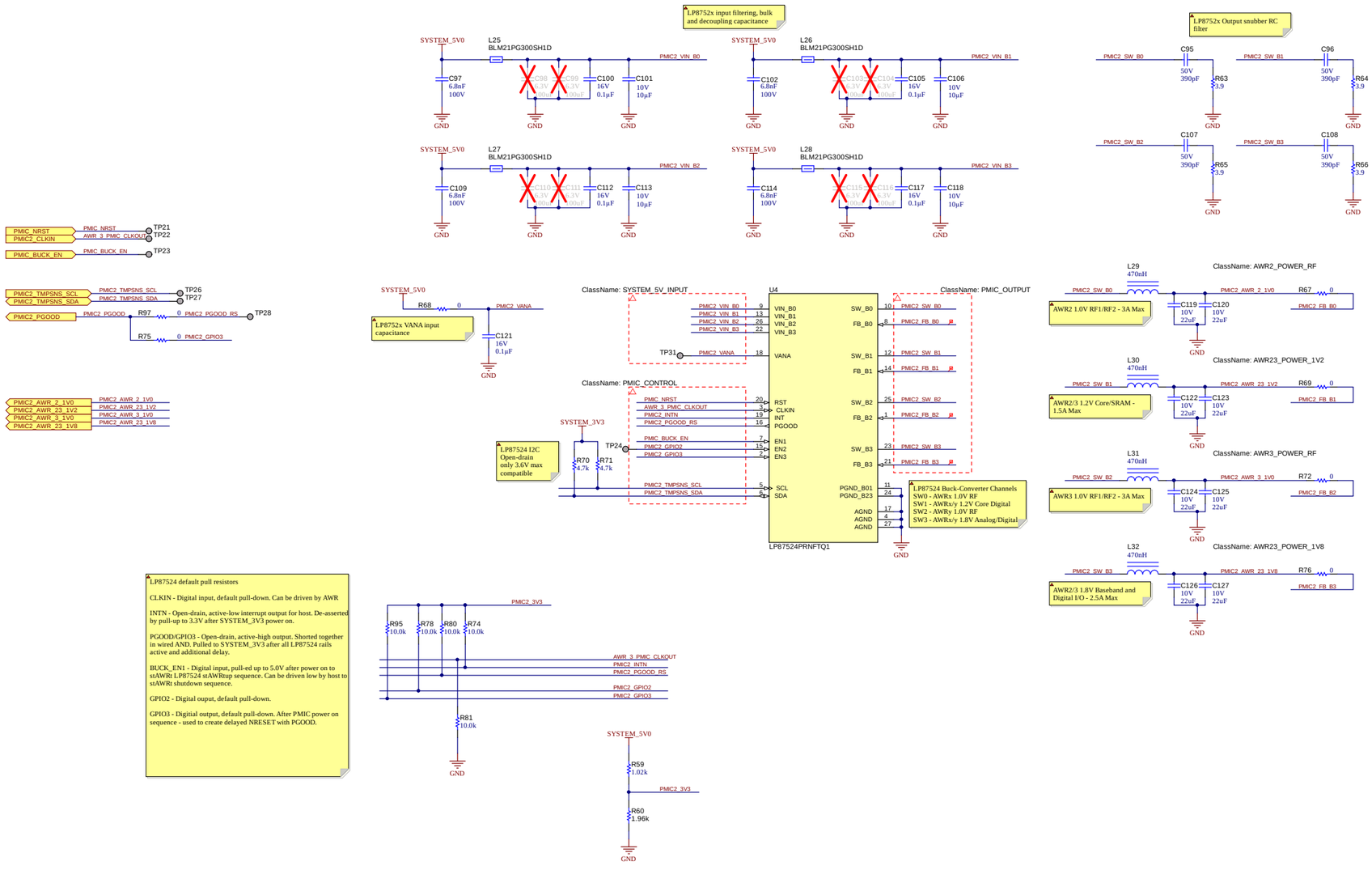
Orderable: MMW_CAS_RF_EVM		Designed for: Public Release	Mod. Date: 8/14/2020
TID #: N/A		Project Title: MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: AWR_1_AWR_4_LP87524P	
SVN Rev: Not in version control		Assembly VAWRiant:	Sheet: 4 of 19
Drawn By: a0271760		File: PROC054E_AWR_1_AWR_4_LP87524P.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

TEXAS INSTRUMENTS
http://www.ti.com

LP87524P Quad-Channel Synchronous Buck PMIC - Slave AWR_2 and Slave AWR_3

References

4-A + 2.5-A + Two 1.5-A BLP875241-Q1 Buck Converters With Integrated Switches
LP87524-Q1 Quad Output, Single-Phase Buck Converter Evaluation Module
XWR1xxx Power Management Optimizations- Low Cost LC Filter Solution



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SVN Rev: Not in version control		Assembly VAWRiant:	Sheet: 5 of 19
Drawn By: a0271760		File: PROC054E_AWR_2_AWR_3_LP87524P.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

AWR Power Filtering and Decoupling - Master AWR_1 and Slave AWR_4

References

4-A + 2.5-A + Two 1.5-A BLP87524J-Q1 Buck Converters With Integrated Switches
LP87524-Q1 Quad Output, Single-Phase Buck Converter Evaluation Module
XWR1xxx Power Management Optimizations- Low Cost LC Filter Solution

PMIC1_AWR_14_1V2 → PMIC1_AWR_14_1V2
PMIC1_AWR_14_1V8 → PMIC1_AWR_14_1V8
PMIC1_AWR_1_1V0 → PMIC1_AWR_1_1V0
PMIC1_AWR_4_1V0 → PMIC1_AWR_4_1V0

AWR_1_1V2_FILT → AWR_1_1V2_FILT
AWR_4_1V2_FILT → AWR_4_1V2_FILT
AWR_1_1V8_FILT → AWR_1_1V8_FILT
AWR_4_1V8_FILT → AWR_4_1V8_FILT
AWR_1_1V0_RF1_FILT → AWR_1_1V0_RF1_FILT
AWR_1_1V0_RF2_FILT → AWR_1_1V0_RF2_FILT
AWR_4_1V0_RF1_FILT → AWR_4_1V0_RF1_FILT
AWR_4_1V0_RF2_FILT → AWR_4_1V0_RF2_FILT

LP87524P PMIC switcher LC ripple filtering and decoupling for AWR1 and AWR4

PMIC1_AWR_14_1V2 → L1 NLCV32T-R10M-EFRD 100nH → AWR_1_1V2_FILT
ClassName: AWR_1_POWER_1V2
1.2V Digital Core/SRAM AWR1/AWR4
C10 10V 10uF; C11 10V 22uF; C12 10V 10uF; C13 16V 1µF → GND

PMIC1_AWR_14_1V2 → L3 NLCV32T-R10M-EFRD 100nH → AWR_4_1V2_FILT
ClassName: AWR_4_POWER_1V2
1.2V Digital Core/SRAM AWR1/AWR4
C161 10V 10uF; C21 10V 22uF; C29 10V 10uF; C78 16V 1µF → GND

PMIC1_AWR_14_1V8 → L2 NLCV32T-R10M-EFRD 100nH → AWR_1_1V8_FILT
ClassName: AWR_1_POWER_1V8
1.8V Digitial I/O and Analog Baseband AWR1/AWR4
C14 10V 10uF; C15 10V 22uF; C16 10V 10uF; C17 16V 1µF → GND

PMIC1_AWR_14_1V8 → L6 NLCV32T-R10M-EFRD 100nH → AWR_4_1V8_FILT
ClassName: AWR_4_POWER_1V8
1.8V Digitial I/O and Analog Baseband AWR1/AWR4
C86 10V 10uF; C150 10V 22uF; C151 10V 10uF; C152 16V 1µF → GND

PMIC1_AWR_1_1V0 → L4 NLCV32T-R10M-EFRD 100nH → AWR_1_1V0_RF1_FILT
ClassName: AWR_1_POWER_1V0_RF
1.0V Analog RF AWR1
C25 10V 10uF; C22 10V 22uF; C23 10V 10uF; C26 16V 1µF → GND

L5 NLCV32T-R10M-EFRD 100nH → AWR_1_1V0_RF2_FILT
ClassName: AWR_1_POWER_1V0_RF
C27 10V 10uF; C24 10V 22uF; C32 10V 10uF; C28 16V 1µF → GND

PMIC1_AWR_4_1V0 → L7 NLCV32T-R10M-EFRD 100nH → AWR_4_1V0_RF1_FILT
ClassName: AWR_4_POWER_RF
1.0V Analog RF AWR4
C33 10V 10uF; C30 10V 22uF; C31 10V 10uF; C34 16V 1µF → GND

L8 NLCV32T-R10M-EFRD 100nH → AWR_4_1V0_RF2_FILT
ClassName: AWR_4_POWER_RF
C35 10V 10uF; C81 10V 22uF; C89 10V 10uF; C36 16V 1µF → GND

ClassName: SYSTEM_1V8
PMIC1_AWR_14_1V8 → R35 0 → SYSTEM_1V8
C18 10V 22uF; C19 10V 10uF; C20 16V 1µF → GND
AWR_1 1.8V supply also generates SYSTEM_1V8
- LMK00804B clock distribution
- LMK00804B sync distribution

Orderable: MMW_CAS_RF_EVM	Designed for:Public Release	Mod. Date: 8/14/2020
TID #: N/A	Project Title: MMWCAS-RF-EVM	
Number: PROC054 Rev: E	Sheet Title: AWR_1_AWR_4_LC_Filtering	
Sys Rev: Not in version control	Assembly VAWRiant:	Sheet:6 of 19
Drawn By:a0271760	File: PROC054E_AWR_1_AWR_4_LC_Filtering.SchDoc	Size: C
Engineer: a0271760	Contact: http://www.ti.com/mmwave	

Texas Instruments http://www.ti.com

AWR1243 Power Filtering and Decoupling - Master AWR_2 and Slave AWR_3

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LP87524-Q1 Quad Output, Single-Phase Buck Converter Evaluation Module
XWR1xxx Power Management Optimizations- Low Cost LC Filter Solution

PMIC2_AWR_23_1V2 → PMIC2_AWR_23_1V2
PMIC2_AWR_23_1V8 → PMIC2_AWR_23_1V8
PMIC2_AWR_2_1V0 → PMIC2_AWR_2_1V0
PMIC2_AWR_3_1V0 → PMIC2_AWR_3_1V0

AWR_2_1V2_FILT → AWR_2_1V2_FILT
AWR_3_1V2_FILT → AWR_3_1V2_FILT
AWR_2_1V8_FILT → AWR_2_1V8_FILT
AWR_3_1V8_FILT → AWR_3_1V8_FILT
AWR_2_1V0_RF1_FILT → AWR_2_1V0_RF1_FILT
AWR_2_1V0_RF2_FILT → AWR_2_1V0_RF2_FILT
AWR_3_1V0_RF1_FILT → AWR_3_1V0_RF1_FILT
AWR_3_1V0_RF2_FILT → AWR_3_1V0_RF2_FILT

LP87524P PMIC switcher LC ripple filtering and decoupling for AWR2

PMIC2_AWR_23_1V2 → L17 NLCV32T-R10M-EFRD 100nH → AWR_2_1V2_FILT
ClassName: AWR_2_POWER_1V2
1.2V Digital Core/SRAM AWR2
C70 10V 10uF
C71 10V 22uF
C72 10V 10uF
C73 16V 1µF
GND

LP87524P PMIC switcher LC ripple filtering and decoupling for AWR3

PMIC2_AWR_23_1V2 → L19 NLCV32T-R10M-EFRD 100nH → AWR_3_1V2_FILT
ClassName: AWR_3_POWER_1V2
1.2V Digital Core/SRAM AWR3
C153 10V 10uF
C154 10V 22uF
C155 10V 10uF
C156 16V 1µF
GND

PMIC2_AWR_23_1V8 → L18 NLCV32T-R10M-EFRD 100nH → AWR_2_1V8_FILT
ClassName: AWR_3_POWER_1V8
1.8V Digitial I/O and Analog Baseband AWR2
C74 10V 10uF
C75 10V 22uF
C76 10V 10uF
C77 16V 1µF
GND

PMIC2_AWR_23_1V8 → L22 NLCV32T-R10M-EFRD 100nH → AWR_3_1V8_FILT
ClassName: AWR_3_POWER_1V8
1.8V Digitial I/O and Analog Baseband AWR3
C157 10V 10uF
C158 10V 22uF
C159 10V 10uF
C160 16V 1µF
GND

PMIC2_AWR_2_1V0 → L20 NLCV32T-R10M-EFRD 100nH → AWR_2_1V0_RF1_FILT
ClassName: AWR_2_POWER_1V0_RF
1.0V Analog RF AWR2
C82 10V 10uF
C79 10V 22uF
C80 10V 10uF
C83 16V 1µF
GND

L21 NLCV32T-R10M-EFRD 100nH → AWR_2_1V0_RF2_FILT
ClassName: AWR_2_POWER_1V0_RF
C84 10V 10uF
C166 10V 22uF
C201 10V 10uF
C85 16V 1µF
GND

PMIC2_AWR_3_1V0 → L23 NLCV32T-R10M-EFRD 100nH → AWR_3_1V0_RF1_FILT
ClassName: AWR_3_POWER_RF
1.0V Analog RF AWR3
C90 10V 10uF
C87 10V 22uF
C88 10V 10uF
C91 16V 1µF
GND

L24 NLCV32T-R10M-EFRD 100nH → AWR_3_1V0_RF2_FILT
ClassName: AWR_3_POWER_RF
C92 10V 10uF
C204 10V 22uF
C207 10V 10uF
C93 16V 1µF
GND

Orderable: MMW_CAS_RF_EVM	Designed for:Public Release — Mod. Date: 8/14/2020
TID #: N/A	Project Title: MMWCAS-RF-EVM
Number: PROC054 Rev: E	Sheet Title: AWR_2_AWR_3_LC_Filtering
Cust Rev: Not in version control	Assembly VAWRiant: — Sheet: 7 of 19
Drawn By:a0271760	File: PROC054E_AWR_2_AWR_3_LC_Filtering.SchDoc — Size: C
Engineer: a0271760	Contact: http://www.ti.com/mmwave

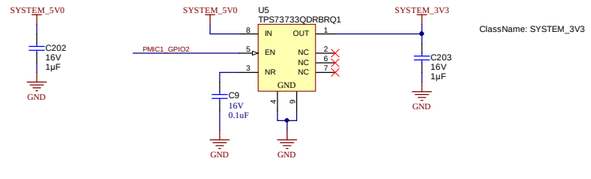
Texas Instruments — http://www.ti.com

System 3.3V Supply

References

TLV70028EVM-463 Evaluation Module
TPS22965 Evaluation Module

TPS73733-Q1 5.0V to 3.3V LDO - System 3.3V Power



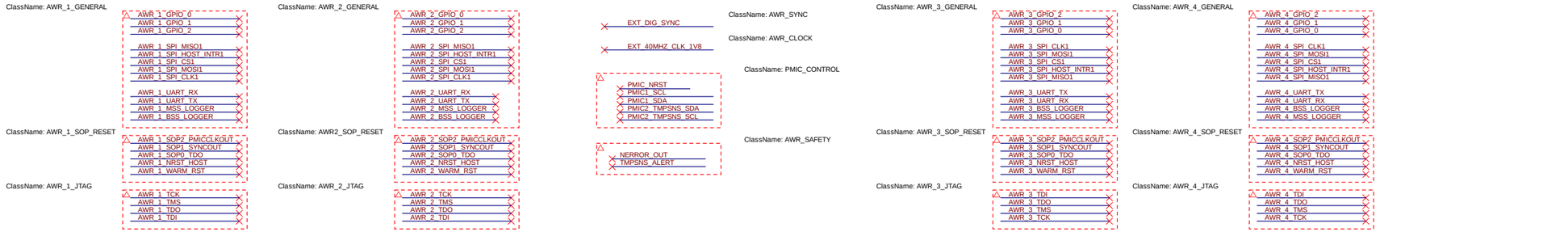
ClassName: SYSTEM_3V3

TLV702_EN — PMIC1_GPIO2

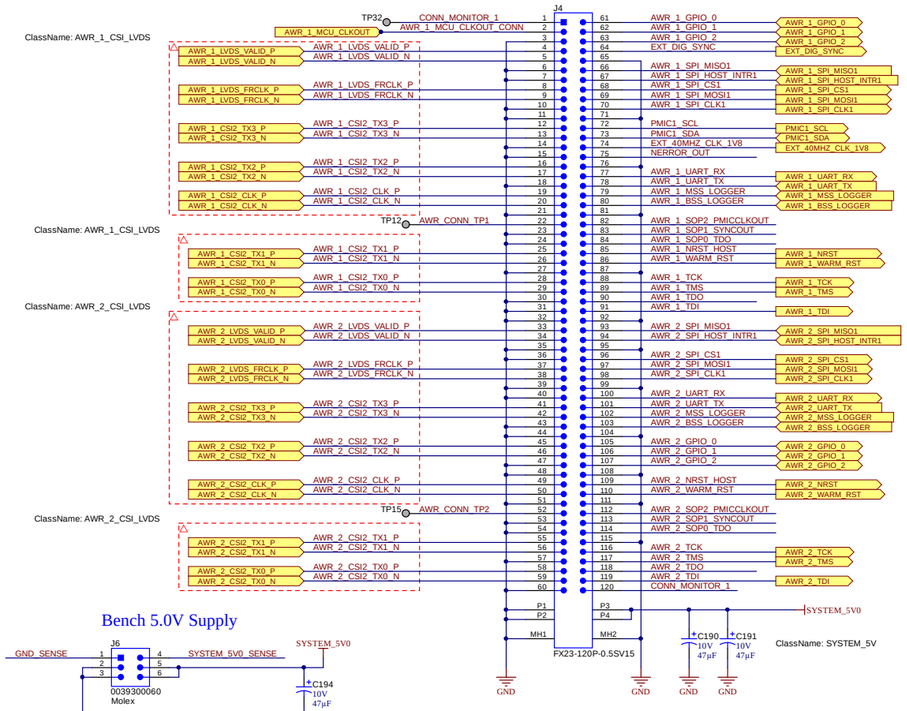
Orderable: MMW_CAS_RF_EVM		Designed for:Public Release	Mod. Date: 8/14/2020
TID #: N/A		Project Title: MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: System_3V3_Supply	
Variant:	Rev: Not in version control	Assembly VAWRiant:	Sheet:8 of 19
Drawn By:a0271760		File: PROC054E_System_3V3_Supply.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

TEXAS INSTRUMENTS
http://www.ti.com

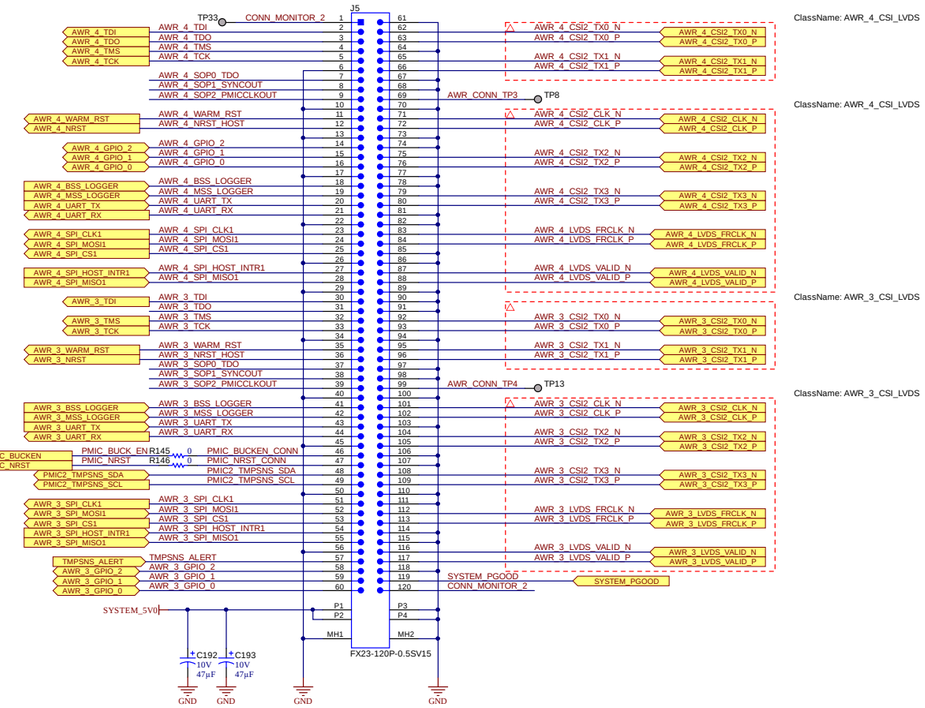
Host to RF Board Connectors



Host Board Connector 1

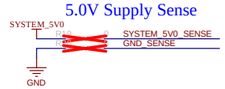


Host Board Connector 2

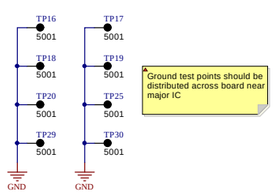


Bench 5.0V Supply

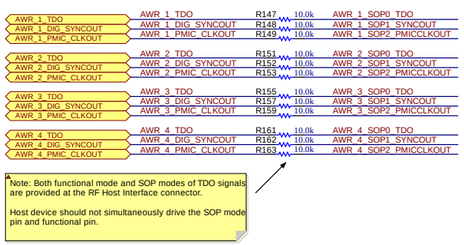
5.0V Supply Sense



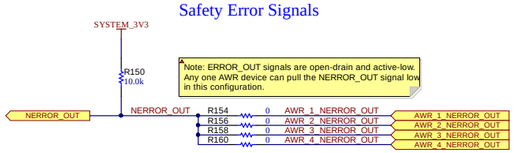
GROUND TEST POINTS



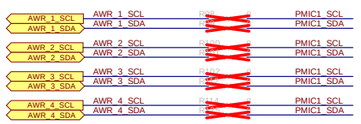
SOP Mode / Functional Mode Signals



Safety Error Signals



AWR and PMIC I2C Signals



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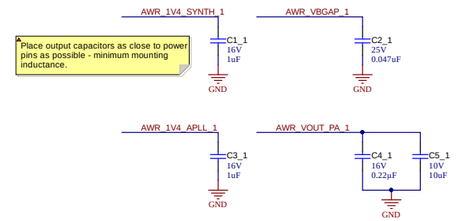
TID #: N/A		Project Title: MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: HOST_CONNECTOR	
Cust Rev: Not in version control		Assembly VAWRiant:	Sheet: 9 of 19
Drawn By: a0271760		File: PROC054E_Host_Connector.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

AWR Radar SoC - Interfaces

References

http://www.ti.com/product/AWR2243

AWR LDO and Bandgap Output Capacitors



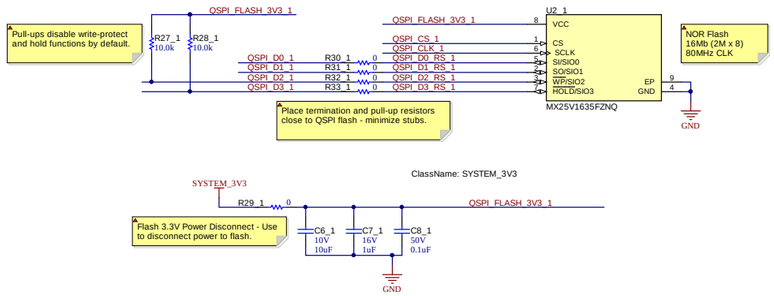
AWR Interfaces

SOP[2:0] Pins

NOTE: SOP (start on power) Pins
SOP[2]/PMIC_CLK_OUT
SOP[1]/SYNC_OUT
SOP[0]TDO

SOP[2:0] = 0b011 -> SOP_MODE2 "Development"
SOP[2:0] = 0b001 -> SOP_MODE4 "Functional"
SOP[2:0] = 0b101 -> SOP_MODE5 "QSPI Flashing"

NOR QSPI FLASH (For Development Purposes)



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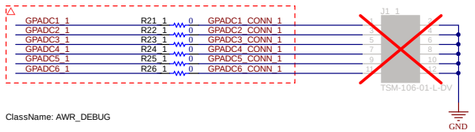

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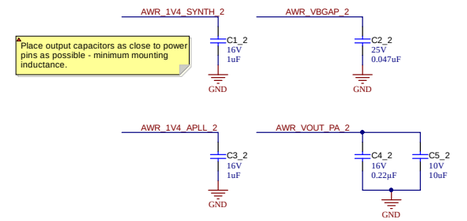
TID #: N/A		Project Title: MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: AWR_1	
Cust Rev: Not in version contrl		Assembly VAWRiant:	Sheet:10of 19
Drawn By:a0271760		File: PROC054E_AWR_Interfaces.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	http://www.ti.com

AWR Radar SoC - Interfaces

References

http://www.ti.com/product/AWR2243

AWR LDO and Bandgap Output Capacitors



AWR Interfaces

SOP[2:0] Pins

NOTE: SOP (start on power) Pins
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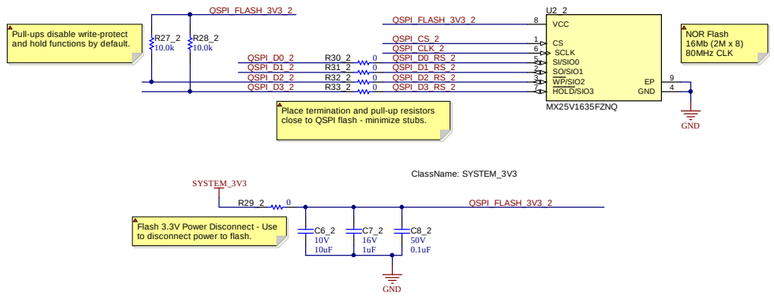
NOR QSPI FLASH (For Development Purposes)



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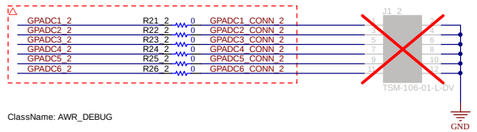

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TID #: N/A		Project Title: MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: AWR_1	
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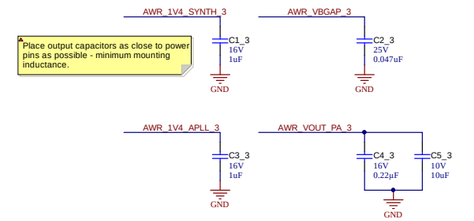
Drawn By:a0271760		File: PROC054E_AWR_Interfaces.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	http://www.ti.com

AWR Radar SoC - Interfaces

References

http://www.ti.com/product/AWR2243

AWR LDO and Bandgap Output Capacitors



AWR Interfaces

SOP[2:0] Pins

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SOP[1]/SYNC_OUT
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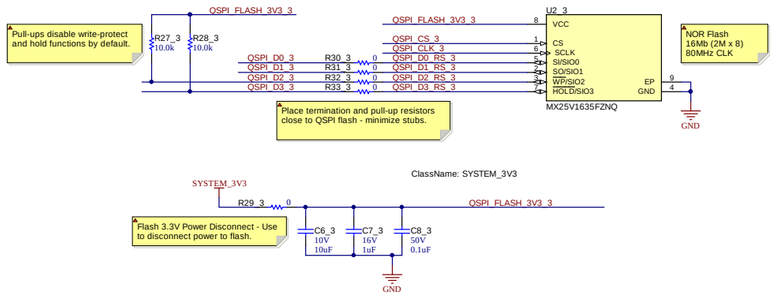
SOP[2:0] = 0b001 -> SOP_MODE4 "Functional"
SOP[2:0] = 0b101 -> SOP_MODE5 "QSPI Flashing"

NOR QSPI FLASH (For Development Purposes)



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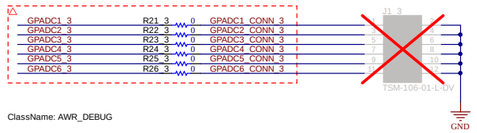

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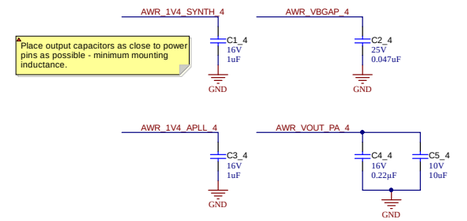
Drawn By:a0271760		File: PROC054E_AWR_Interfaces.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	http://www.ti.com

AWR Radar SoC - Interfaces

References

http://www.ti.com/product/AWR2243

AWR LDO and Bandgap Output Capacitors



AWR Interfaces

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SOP[1]/SYNC_OUT
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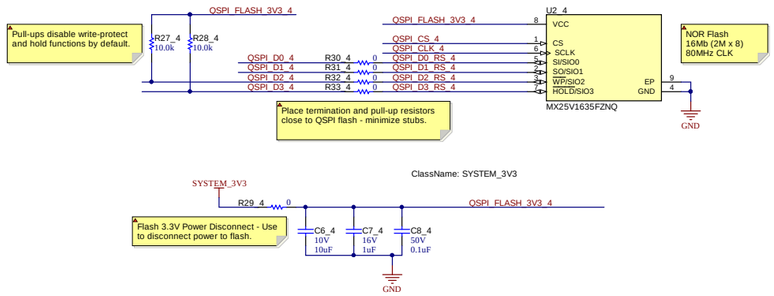
SOP[2:0] = 0b101 -> SOP_MODE5 "QSPI Flashing"

NOR QSPI FLASH (For Development Purposes)



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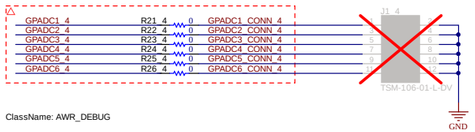

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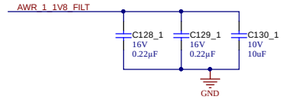
Drawn By:a0271760		File: PROC054E_AWR_Interfaces.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	http://www.ti.com

References
http://www.ti.com/product/AWR2243

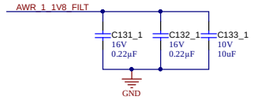
AWR Radar SoC - Power and Decoupling

AWR Power - BGA Decoupling

VIN_18BB SUPPLY



VIN_18VCO, VIN_18CLK SUPPLY



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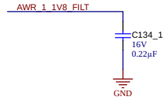

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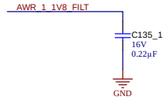

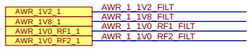

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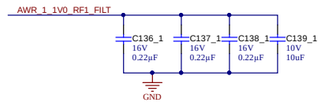

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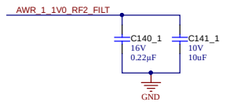

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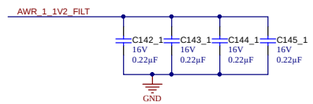

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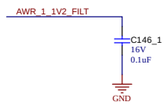

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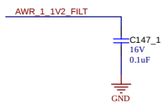

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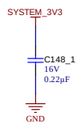
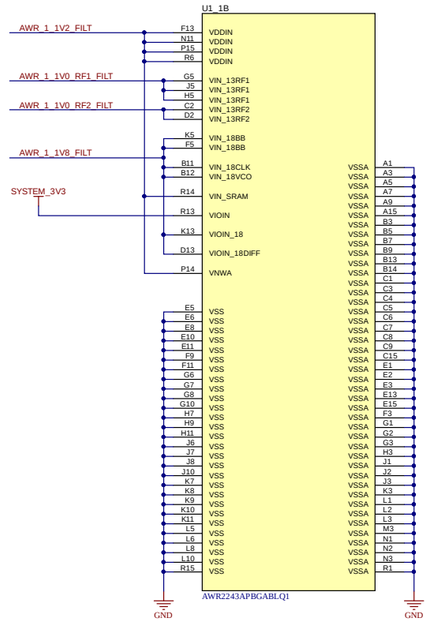


AWR Power



Orderable: MMW_CAS_RF_EVM		Designed for:Public Release	Mod. Date: 8/14/2020
TID #: N/A		Project Title:MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: DECOUPLING_CAPS_1	
Variant:	Rev: Not in version control	Assembly VAWRiant:	Sheet: 11 of 19
Drawn By:a0271760		File: PROC054E_AWR_Power_Decoupling.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

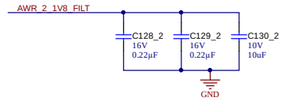
TEXAS INSTRUMENTS
http://www.ti.com

References
http://www.ti.com/product/AWR2243

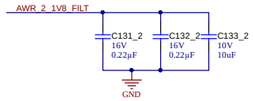
AWR Radar SoC - Power and Decoupling

AWR Power - BGA Decoupling

VIN_18BB SUPPLY



VIN_18VCO, VIN_18CLK SUPPLY



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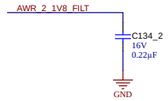

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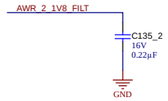

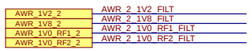

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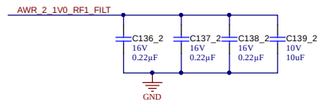

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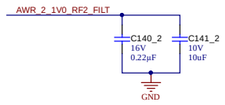

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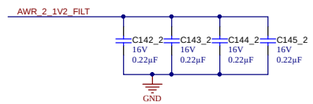
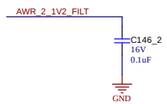
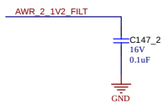


VIN_SRAM SUPPLY



VNWA SUPPLY



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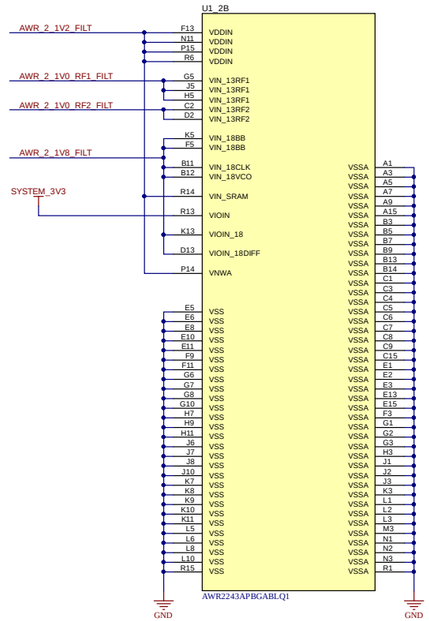

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Drawn By: a0271760		File: PROC054E_AWR_Power_Decoupling.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

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References
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AWR Radar SoC - Power and Decoupling

AWR Power - BGA Decoupling

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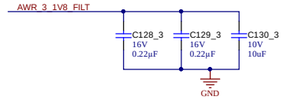

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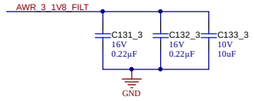

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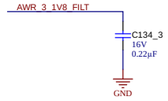

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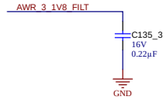

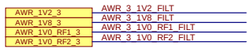

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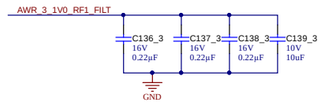

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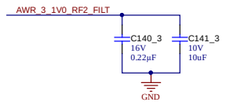

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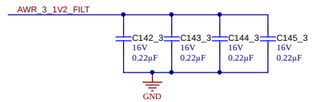

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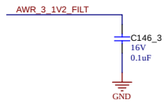

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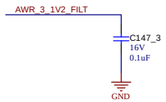

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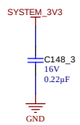
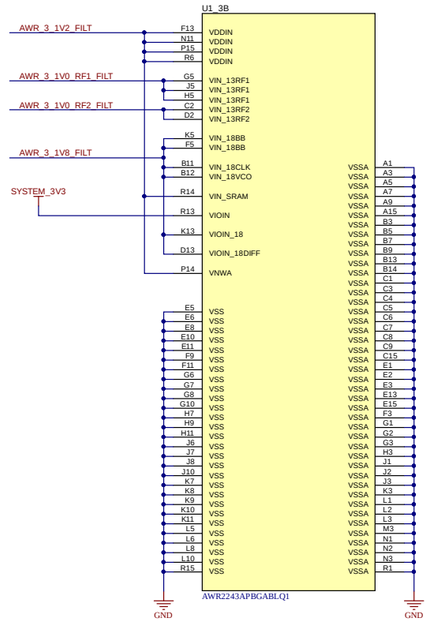


AWR Power



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Number: PROC054	Rev: E	Sheet Title: DECOUPLING_CAPS_1	
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Engineer: a0271760		Contact: http://www.ti.com/mmwave	

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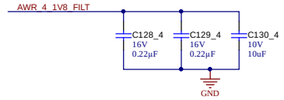
VIN_18BB SUPPLY



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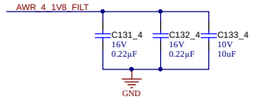

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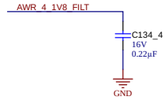

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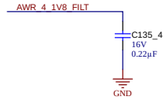

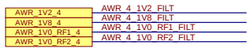

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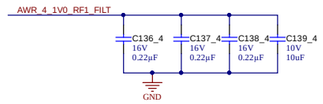

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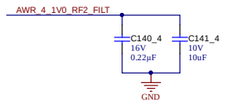

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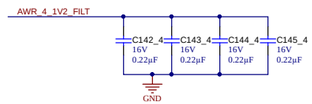

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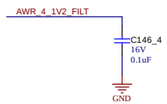

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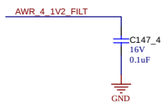
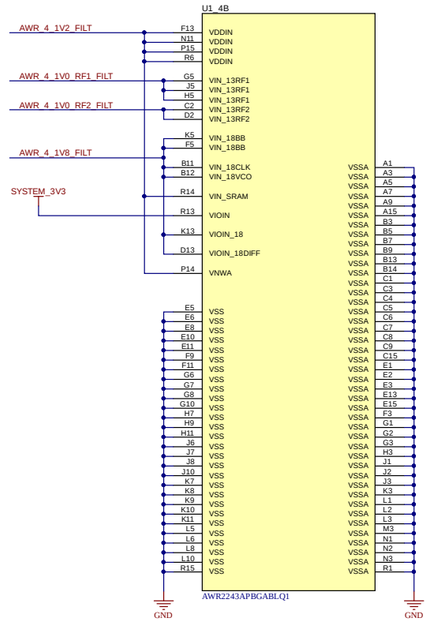


VIOIN SUPPLY

AWR Power



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Number: PROC054	Rev: E	Sheet Title: DECOUPLING_CAPS_1	
VariantRev: Not in version control		Assembly VAWRiant:	Sheet: 11 of 19
Drawn By:a0271760		File: PROC054E_AWR_Power_Decoupling.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

TEXAS INSTRUMENTS
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References
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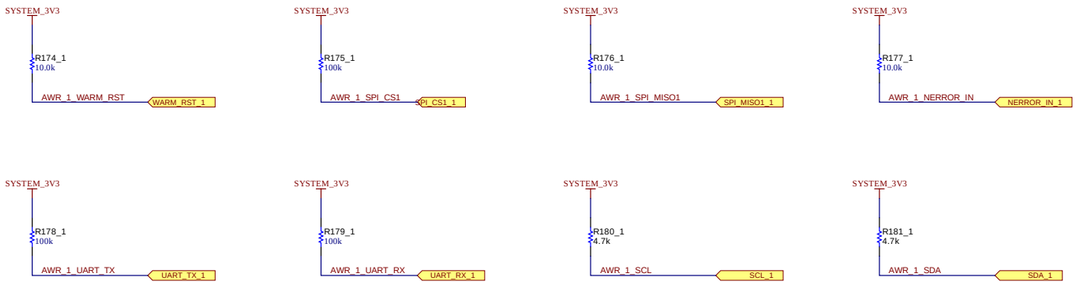
AWR Radar SoC - Pull-Up and Pull-Down Resistors

PULL-UP OPTIONS



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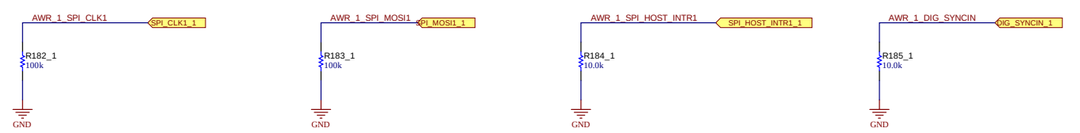

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Engineer: a0271760		Contact: http://www.ti.com/mmwave	

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References
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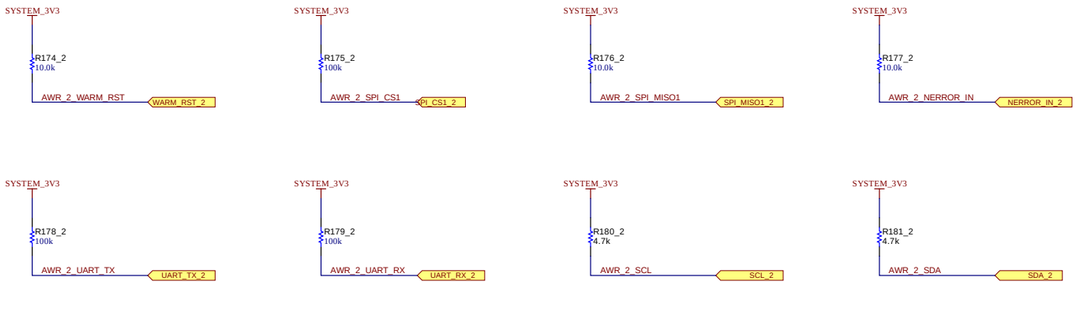

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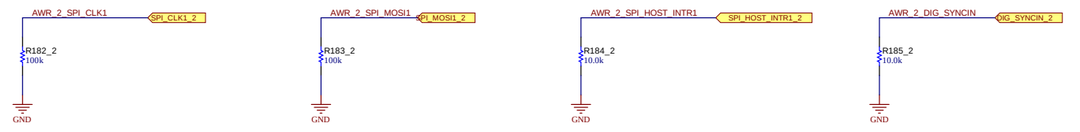

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AWR Radar SoC - Pull-Up and Pull-Down Resistors

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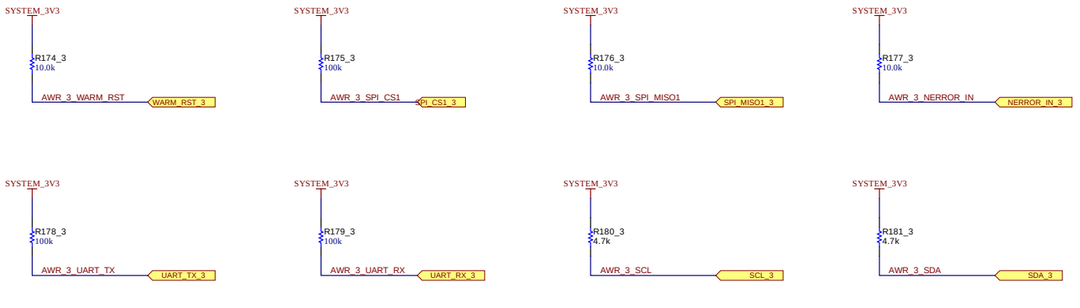

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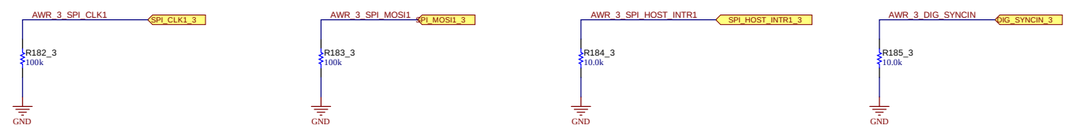

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AWR Radar SoC - Pull-Up and Pull-Down Resistors

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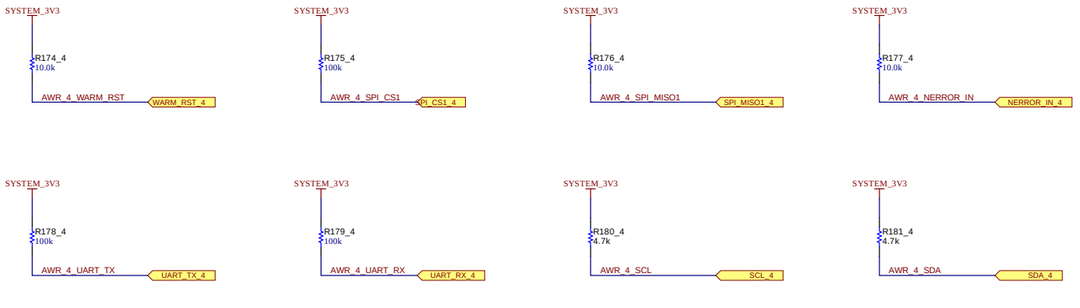

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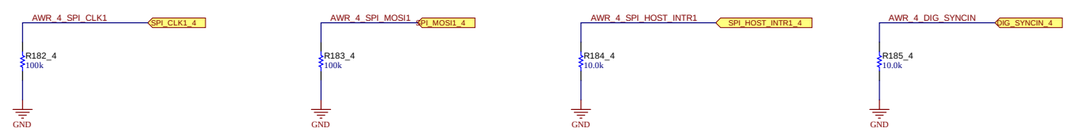

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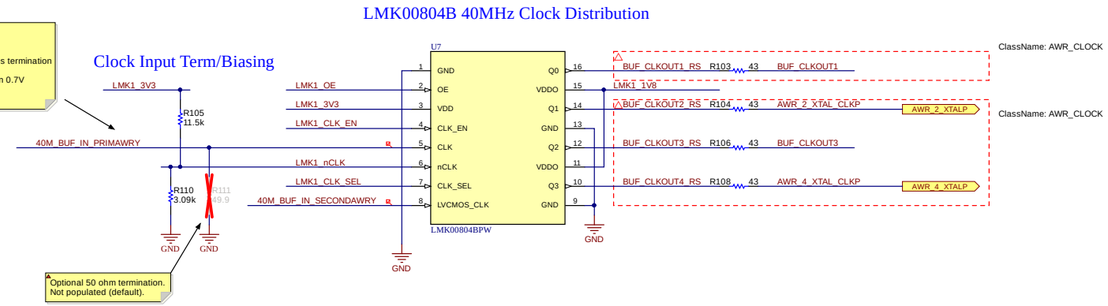
40 MHz Clock Generation and Distribution

References

LMK00804BEVM User's Guide

LMK00804B 40MHz Clock Distribution



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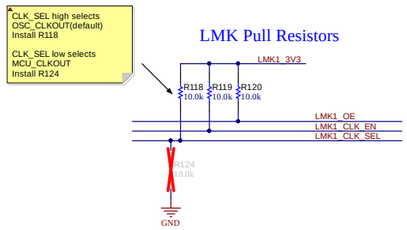

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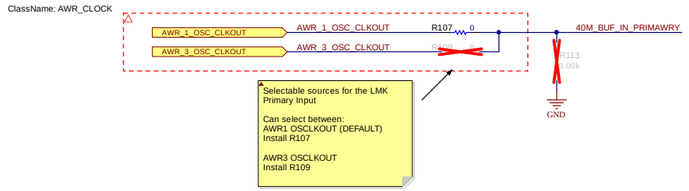

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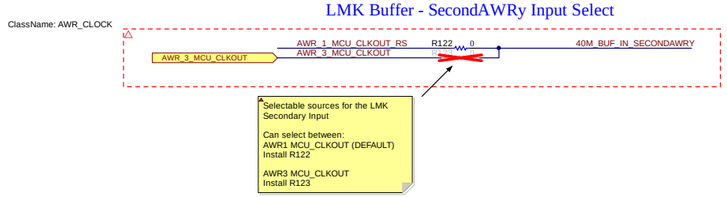

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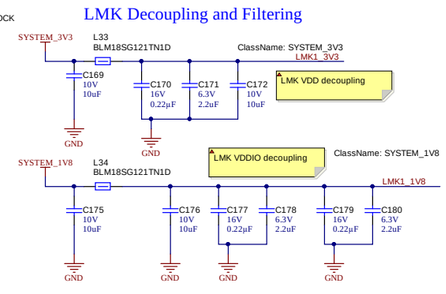

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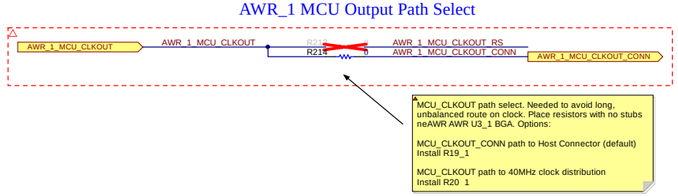

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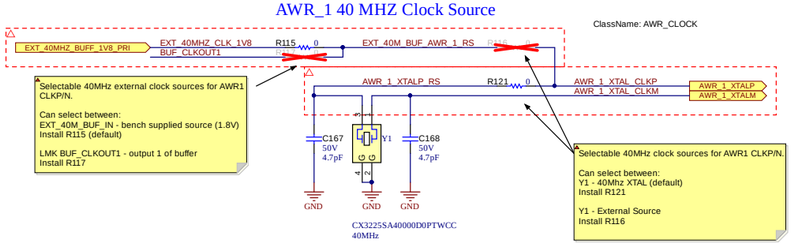

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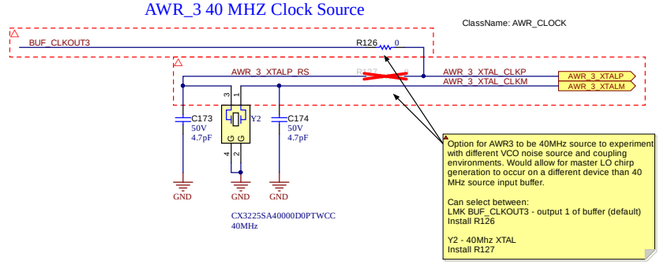

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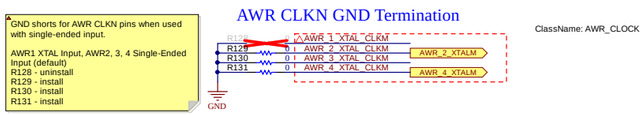

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Engineer: a0271760		Contact: http://www.ti.com/mmwave	

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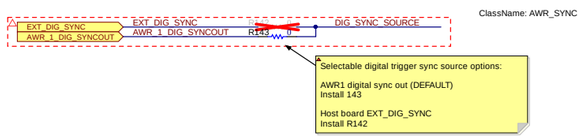
Digital Sync Trigger and 20GHz LO Distribution

References

LMK00804BEVM User's Guide

Digital Sync Source Select



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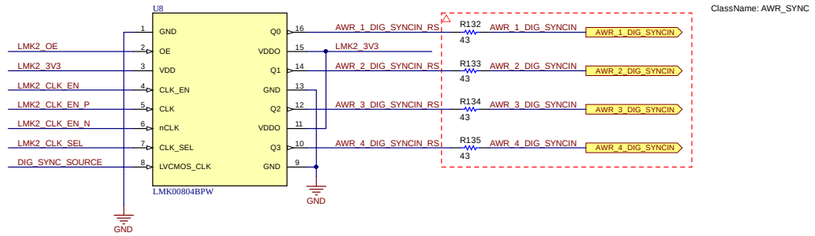

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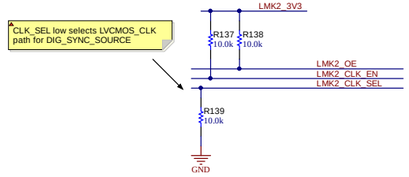
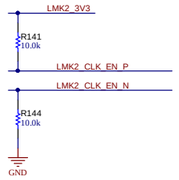
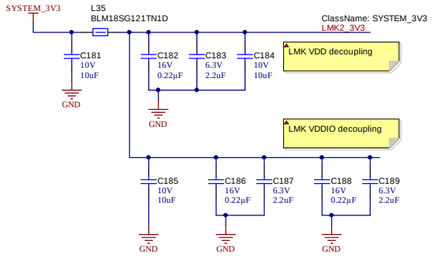


LMK Unused Input

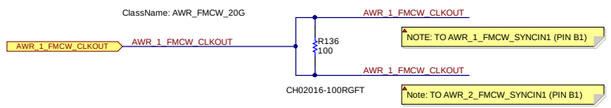


LMK Decoupling and Filtering

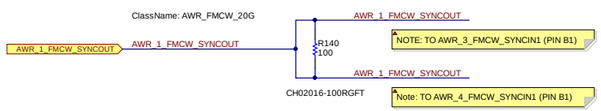


FMCW 20GHz LO SYNC

Wilkenson Power Divider #1



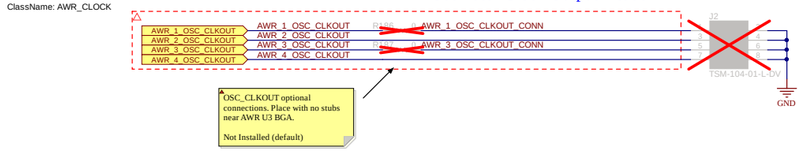
Wilkenson Power Divider #2



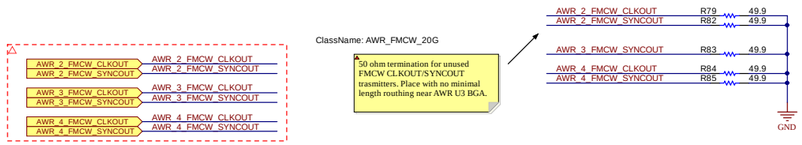
Orderable: MMW_CAS_RF_EVM		Designed for:Public Release	Mod. Date: 8/14/2020
TID #: N/A		Project Title: MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: FMCW_SYNC	
Variant:	Not in version control	Assembly VAWRiant:	Sheet:14of 19
Drawn By:a0271760		File: PROC054E_FMCW_Sync.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	http://www.ti.com

Test Headers, Connectors and Terminations

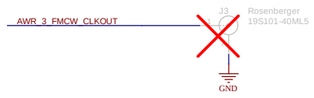
Oscillator Clock Output Header



Unused 20GHz LO Output Termination



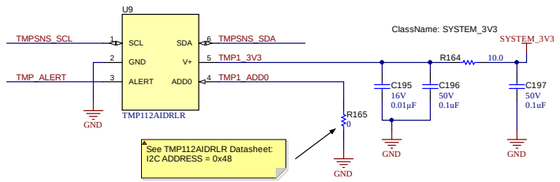
20GHz LO Test Output



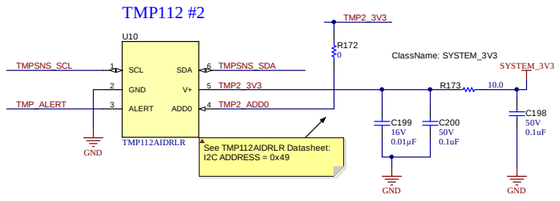
Orderable: MMW_CAS_RF_EVM		Designed for: Public Release	Mod. Date: 8/14/2020
TID #: N/A		Project Title: MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: SMA_SMP_CONNECTORS	
Variant:	Not in version control	Assembly VAWRiant:	Sheet 15 of 19
Drawn By: a0271760		File: PROC054E_SMA_SMP_Connectors.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

System Temperature Sensors

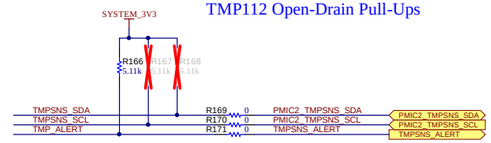
TMP112 #1



TMP112 #2



TMP112 Open-Drain Pull-Ups



Orderable: MMW_CAS_RF_EVM		Designed for:Public Release	Mod. Date: 8/14/2020
TID #: N/A		Project Title: MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: ON_BRD_TEMP_SENSOR	
Custom Rev: Not in version control		Assembly VAWRiant:	Sheet: 16 of 19
Drawn By: a0271760		File: PROC054E_Temp_Sensor.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

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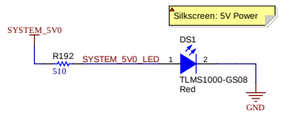
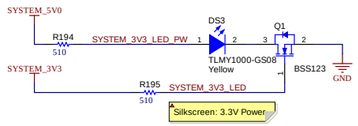
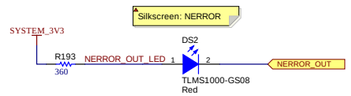
System Indicator LED

POWER LEDS

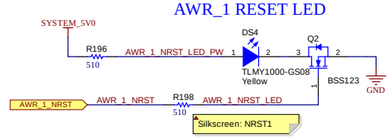




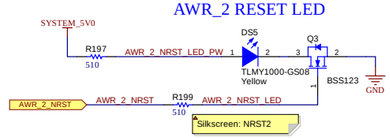
ERROR LEDS



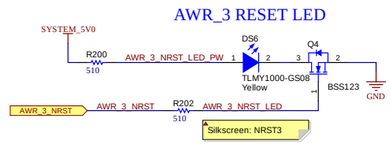
AWR_1 RESET LED



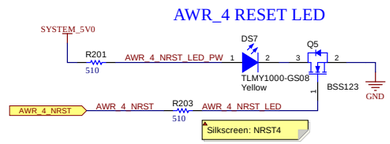
AWR_2 RESET LED



AWR_3 RESET LED



AWR_4 RESET LED



Orderable: MMW_CAS_RF_EVM	Designed for: Public Release	Mod. Date: 8/14/2020
TID #: N/A	Project Title: MMWCAS-RF-EVM	
Number: PROC054 Rev: E	Sheet Title: SYSTEM_LED	
Variant: Not in version control	Assembly VAWRiant:	Sheet: 17 of 19
Drawn By: a0271760	File: PROC054E_System_LED.SchDoc	Size: C
Engineer: a0271760	Contact: http://www.ti.com/mmwave	

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Hardware, Mounting Holes and Logos

FID1 FID2 FID3 FID4 FID5 FID6

PCB Number: PROC054
PCB Rev: E

PCB LOGO
Texas Instruments

CE MAWRk

PCB LOGO
FCC disclaimer

PCB LOGO
WEEE logo

PCB LOGO
ESD Susceptible

CAUTION HOT SURFACE

ZZ1
Assembly Note
These assemblies AWRe ESD sensitive, ESD precautions shall be observed.

ZZ2
Assembly Note
These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.

ZZ3
Assembly Note
These assemblies must comply with workmanship standAWRds IPC-A-610 Class 2, unless otherwise specified.

ZZ4
Assembly Note
R136/R140 require special attention due to no solder-mask RF construction. For any questions, please contact TI design team.

Orderable: MMW_CAS_RF_EVM		Designed for:Public Release	Mod. Date: 8/14/2020
TID #: N/A		Project Title: MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: HAWRdwAWRe	
Cust Rev: Not in version control		Assembly VAWRiant:	Sheet:18 of 19
Drawn By:a0271760		File: PROC054E_EVM_Hardware.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

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Cascade Radar RF Board - Revision History

Revision History			
Rev	**Date**	**Released By**	**Notes**
1	2018/07/09	Randy Rosales <rosales.r@ti.com>	Initial release for layout cleanup and internal review.
2	2018/07/17	Randy Rosales <rosales.r@ti.com>	Updating based on 2018/07/09 comments. Combined PMIC_BUCK_EN and PMIC_NRST Combined PMIC1_PGOOD and PMIC2_PGOOD into single SYSTEM_PGOOD Updating NRST generation scheme from LP87524P PMIC Created sepAWRate AWR_X reset generation paths Combined GPIO2 and PGOOD into PGOOD net Removing leftover resistor selection options from the previous LDO and PMIC power paths. Removing first level LC filtering options from the previous LDO and PMIC power paths. Removed: L3, L6, L19, L22 Removed: C21, C29, C78, C86 Removed: C21, C29, C78, C86 This also removed a few power net segments which will now be fed directly from PMIC output Combined AWR_1_1V8_FILT and AWR_4_1V8_FILT into AWR_14_1V8_FILT Combined AWR_2_1V8_FILT and AWR_3_1V8_FILT into AWR_23_1V8_FILT Changing XWR LC filter to use TDK NLCV32T-R10M-EFRD identified by power team analysis PMIC1_AWR_14_1V8 now directly feeds into SYSTEM_1V8 supply - there was no reason to run this through XWR 1.8V LC filter. Added SYSTEM_5V0 to 3.3V resistor divider for LP87524 PMIC pull-up resistors Updated U2 to the Macronix MX25V1635FZNQ - aligning with other XWR EVM kits Removed R125 - Optional resistor remaining from previously removed option for alternative XTAL input Changed NERROR_OUT LED bias to SYSTEM_3V3 Updated coversheet block diagram Updated power distribution block diagram
2	2018/07/17	Randy Rosales <rosales.r@ti.com>	Added variant information for do not populate stuffing options.
3	2018/07/18	Randy Rosales <rosales.r@ti.com>	Removed 50 ohm terminations to ground at the J2 OSCCLK_OUT test header Removed test headers on PMIC output rails Added zero-ohm resistor between PMIC GPIO3 and PGOOD Replaced all note, class and netname instances of AWR with XWR for industrial/automotive alignment of schematics Replaced all series termination on LMK00804B output with 43 ohm resistors per LMK00804B datasheet Replaced XWR reset generation circuit with discrete AND gate Required for achieving clean reset of XWR devices across all device mAWRgins Netname error on XWR SPI interface - MISO netname change R112 and EXT_40MHZ_CLK_1V8 removed - this was an alternative clock path that is no longer supported Eliminated RF1/2 channel naming error in PROC054_System_Power.SchDoc and PROC054_System_Top.SchDoc
4	2018/07/21	Randy Rosales <rosales.r@ti.com>	Changed R54 to pull-up resistor. LP87524P GPIO2 and GPIO3 both configured as open-drain output.
5	2018/07/21	Randy Rosales <rosales.r@ti.com>	Added 10kohm pull-up to LP87524P GPIO3 - required after change separating out GPIO3 and PGOOD nets Aligned PMIC1 and PMIC2 RF1 and RF2 LC filter components with 1.2V and 1.8V filter Previous RF1 and RF2 LC values were still not merged from removal of LDO option separation of RF1 and RF2 supplies
6	2018/07/28	Randy Rosales <rosales.r@ti.com>	Changing all layout critical resistors and capacitors to small-outline version in Altium Vault library Required to allow Tessolve to implement original decoupling and series resistor layout near the AWR BGA Will allow for more compact routing throughout the design as well Changed R136, R140 FMCW LO power divider resistor to RF resistor CH02016-100RJFT Changed U3 and U4 PMIC to reference proper P-version in Altium vault. Adding zero-ohm resistors to AWR_1/2/3/4 I2C interfaces, optionally shorting those interfaces to the PMIC1_I2C Changed NERROR_OUT LED to sourced from shorted NERROR_OUT Originally being fed AWR_1_ERROR_OUT
7	2018/08/08	Randy Rosales <rosales.r@ti.com>	Added R188 which shorts AWR_VOUT_PA to AWR_1V0_RF2 supply nets. Recommended for supporting increased current into the RF2 supplies in 1.0V mode supporting simultaneous 3 TX operation
8	2018/08/09	Randy Rosales <rosales.r@ti.com>	Added burn danger logo Added ESD danger logo Consolidated FMCW 20G LO, digital sync and clock net classes. Created the following net classes: AWR_FMCW_20G AWR_CLOCK AWR_SYNC Removed extraneous MCU_CLKOUT_CONN path from XWR2, XWR3 and XWR4 Consolidated XWR1 MCU_CLKOUT path output options on PROC054_40MHZ_CLK1 schematic sheet Renamed schematic PROC054_40MHZ_FMCW_SYNC to PROC054_FMCW_SYNC Aligned antennas with AWR prefix naming convention Added all nets on 40MHZ_CLOCK_1 schematic sheet to netclass XWR_CLOCK
9	2018/08/10	Randy Rosales <rosales.r@ti.com>	Added additional nets to the AWR_SYNC net class Added additional nets to the AWR_FMCW_20G net class Replaced J3 with correct Rosenberger 19S101 part from TI Altium Vault.
10	2018/08/16	Randy Rosales <rosales.r@ti.com>	Added additional R19 and R20 0-ohm resistors to create optional feedback path for bench supply connector P3
11	2020/01/16	Randy Rosales <rosales.r@ti.com>	Revision D updates Changing primary IC (U1_1, U1_2, U1_3 and U1_4) to AWR2243P Cleaning up net names, ports, net classes, and notes to reference AWR vs. AWR12 specificially
12	2020/08/13	Randy Rosales <rosales.r@ti.com>	Revision E updates Changing primary IC (U1_1, U1_2, U1_3 and U1_4) to AWR2243P ES1.1, AWR2243APBGABLQ1 Changing AWR VBGAP capacitor (C1_1, C1_2, C1_3 and C1_4) to 47nF capacitor GRM155R71E473KA88D Changing PMIC digital input voltage divider resistors (R34, R59) to from 1.0ohhm to 1.0kohm resistors This matches initial design intent Simplified BOM by removing duplicate 0402 0-ohm resistors models on optional signal paths Cleaned up top layer soldermask near edges of RF regions Cleaning up various note spelling errors

Orderable: MMW_CAS_RF_EVM		Designed for:Public Release	Mod. Date: 8/14/2020
TID #: N/A		Project Title: MMWCAS-RF-EVM	
Number: PROC054	Rev: E	Sheet Title: Revision History	
Cust Rev: Not in version control		Assembly VAWRiant:	Sheet:19 of 19
Drawn By:a0271760		File: PROC054E_Revision_History.SchDoc	Size: C
Engineer: a0271760		Contact: http://www.ti.com/mmwave	

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