

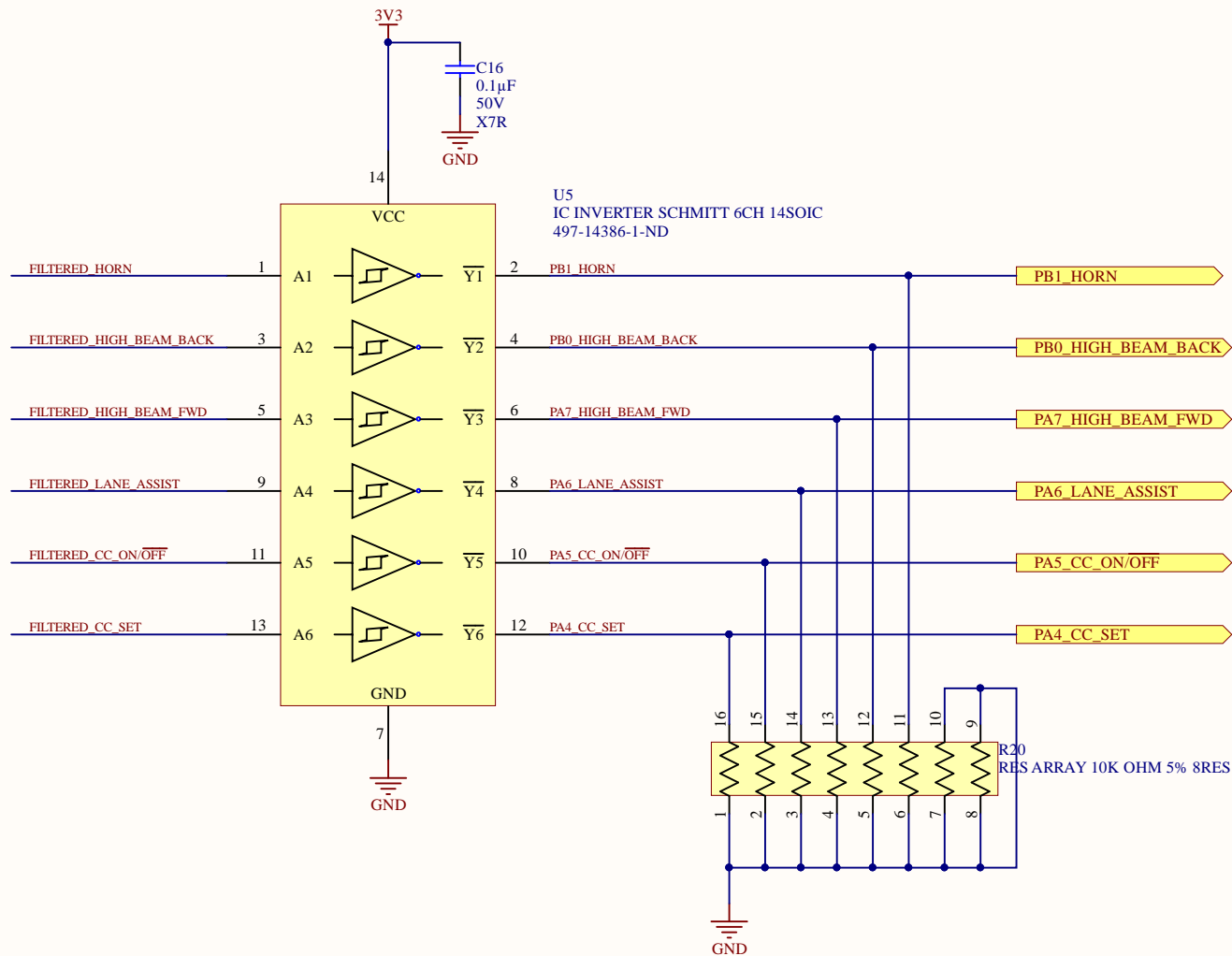
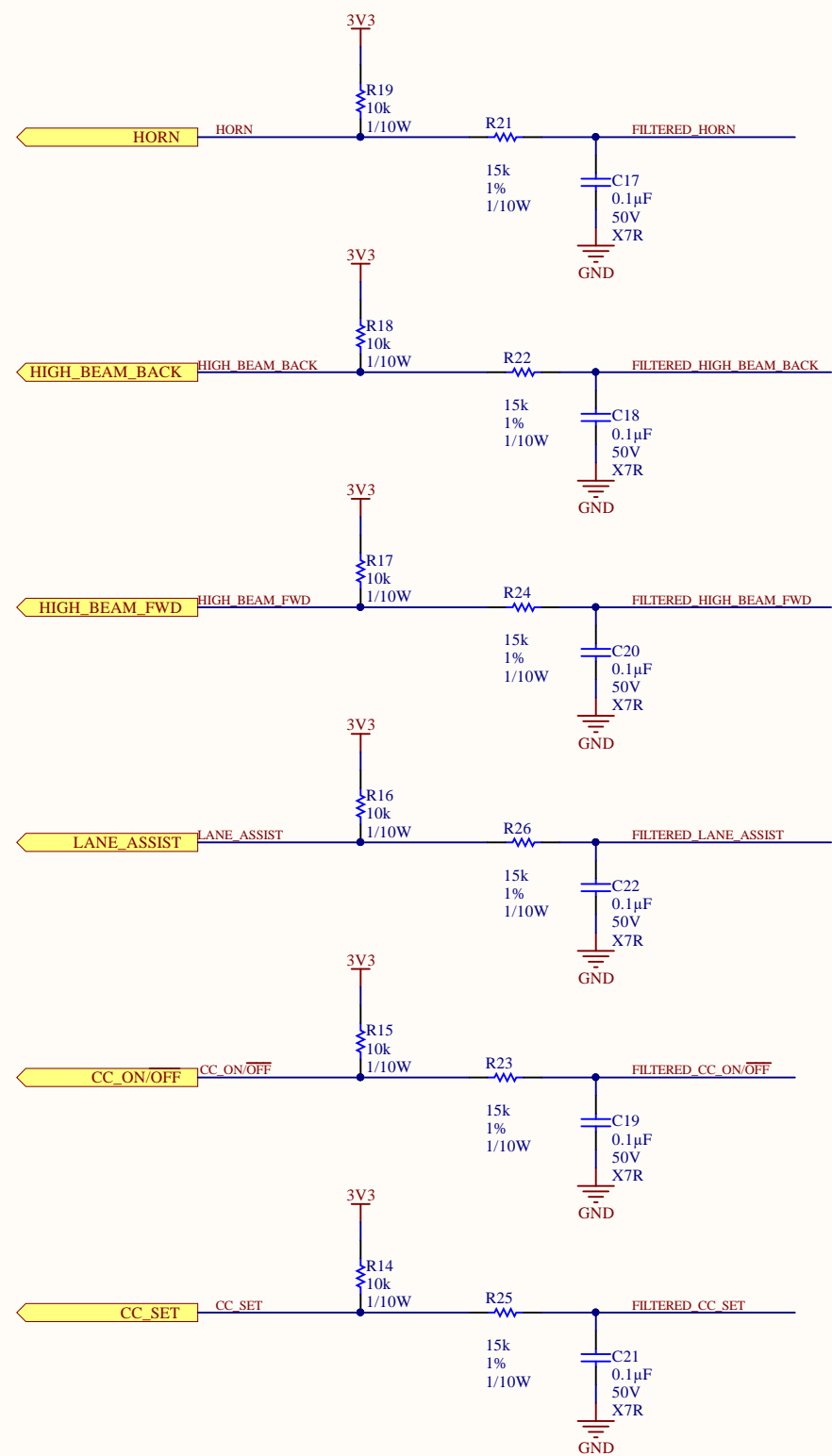
PROJECT	MSXII_SteeringWheelInterfaceBoard.PrjPcb		
DOCUMENT	Steering Wheel Interface - Analog Inputs		
PART NUMBER	MS40012	VARIANT	[No Variations]
DRAWN BY	Jenny Xia	REVISION	3.0
LAST MODIFIED	2019/3/16	SHEET	2 OF 3

MIDNIGHT

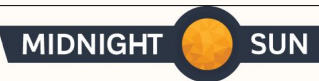
SUN

Engineering 5 - 1002
University of Waterloo
(519) 888-4567 x32978
hardware@uwmidsun.com

f_c = 116.17[Hz]



PROJECT	MSXII_SteeringWheelInterfaceBoard.PrjPcb		
DOCUMENT	Steering Wheel Interface - Digital Inputs		
PART NUMBER	MS40012	VARIANT	[No Variations]
DRAWN BY	Jenny Xia	REVISION	3.0
LAST MODIFIED	2019/3/16	SHEET	3 OF 3



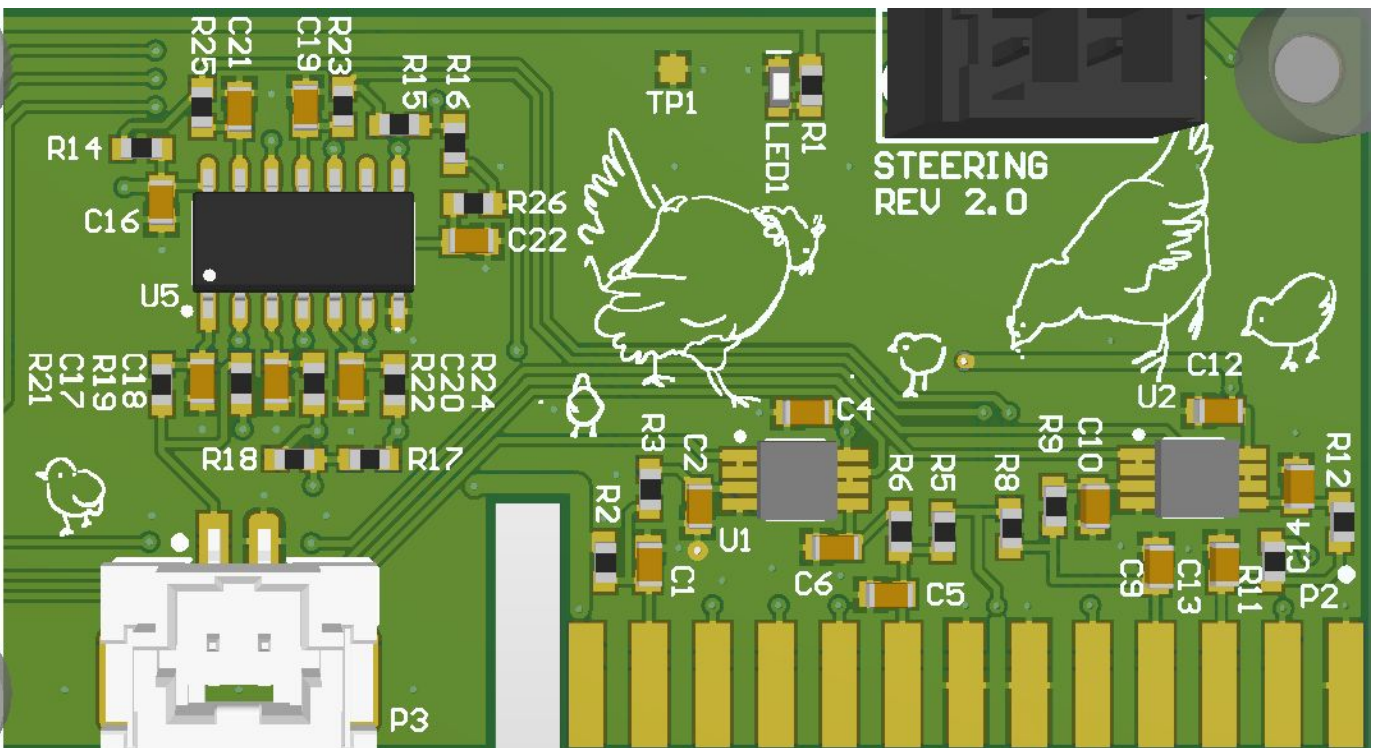
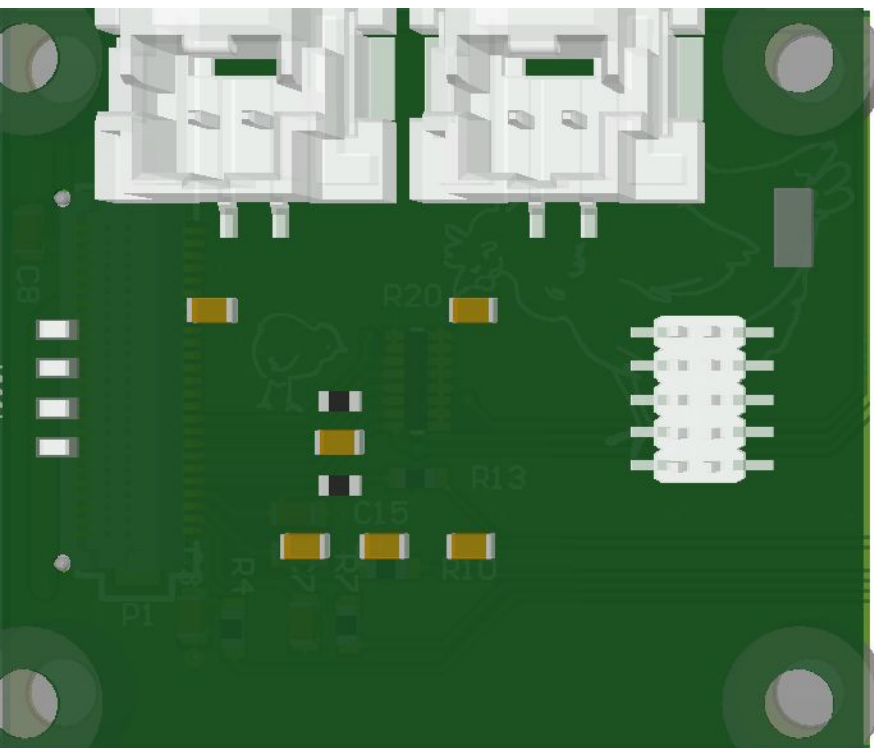
Engineering 5 - 1002
University of Waterloo
(519) 888-4567 x32978
hardware@uwmidsun.com

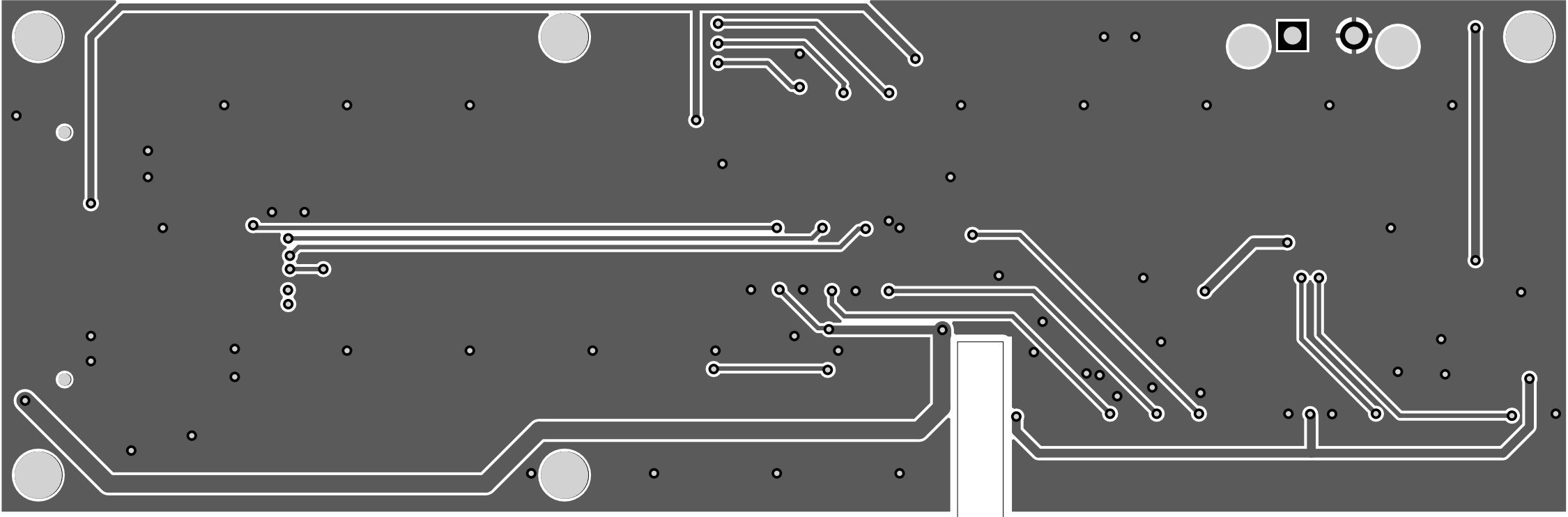
Bill of Materials

Project:	SXII_SteeringWheelInterfaceBoard.PrjPcb
Revision:	3
Project Lead:	Jenny Xia
Generated On:	2019/3/16 下午 9:21
Production Quantity:	1
Currency:	CAD
Total Parts Count:	55



LibRef	Designator	Manufacturer 1	Manufacturer Part Number 1	Supplier 1	Supplier Part Number 1	Supplier Unit Price 1	Quantity	Supplier Subtotal 1
CAP CER 10nF 50V 5% X7R 0603	C1, C3, C5, C7, C9, C11, C13, C15	KEMET	C0603C103J5JACTU	Digi-Key	399-13384-1-ND	0.48011	8	\$ 3.84
CAP CER 0.1uF 50V 10% X7R 0603	C6, C10, C12, C14, C16, C17, C18, C19, C20, C22	Kyocera AVX	06035C-104KAT2A	Digi-Key	478-5052-1-ND	0.15337	13	\$ 1.99
CAP CER 4.7uF 25V 10% X5R 0603	C8	Murata	GRM188R61E475KE11D	Digi-Key	490-7203-1-ND	0.49345	1	\$ 0.49
LED GREEN CLEAR 2V 0603	LED1	Wurth Electronics	150060VS75000	Digi-Key	732-4980-1-ND	0.18671	1	\$ 0.19
CONN 50POS Bergstak Plug 0.02"	P1	Amphenol FCI	10132797-055100LF	Digi-Key	609-5226-1-ND	1.87	1	\$ 1.87
CONN 2POS DURA-CLIK 0.079" VERT	P3	Molex	560020-0220	Digi-Key	WM10862CT-ND	1.04	1	\$ 1.04
CONN 2POS ULTRA-FIT 0.138"	P4	Molex	1722861302	Digi-Key	WM11673-ND	1.95	1	\$ 1.95
RES 4.7K OHM 1% 1/10W 0603	R1	Yageo Phycomp	RC0603FR-074K7L	Digi-Key	311-4.70KHRCT-ND	0.13336	1	\$ 0.13
RES SMD 1K OHM 0.1% 1/10W 0603	R2, R5, R8, R11	Panasonic	ERA3AEB102V	Digi-Key	P1.0KDBCT-ND	0.46678	4	\$ 1.87
RES SMD 15K OHM 1% 1/10W 0603	R3, R6, R9, R12, R21, R22, R23, R24, R25, R26	Yageo	RC0603FR-0715KL	Digi-Key	311-15.0KHRCT-ND	0.03201	10	\$ 0.32
RES 100 OHM 1% 1/10W 0603	R4, R7, R10, R13	Yageo	RC0603FR-07100RL	Digi-Key	311-100HRCT-ND	0.13336	4	\$ 0.53
RES 10K OHM 1% 1/10W 0603	R14, R15, R16, R17, R18, R19	Yageo Phycomp	RC0603FR-0710KL	Digi-Key	311-10.0KHRCT-ND	0.13336	6	\$ 0.80
RES ARRAY 10K OHM 5% 8RES EXB-2HV103JV	R20	Panasonic	EXB2HV103JV	Digi-Key	Y1103CT-ND	0.38676	1	\$ 0.39
IC OP AMP DUAL GP RR 10MHZ 8-VSSOP	U1, U2	Texas Instruments	OPA2197IDGKR	Digi-Key	296-47349-1-ND	3.21	2	\$ 6.43
IC INVERTER SCHMITT 6CH 14TSSOP	U5	STMicroelectronics	M74HC14YRM13TR	Digi-Key	497-14386-1-ND	0.64015	1	\$ 0.64
							Total:	\$ 22.48





Electrical Rules Check Report

Class	Document	Message
Warning	Steering Wheel Interface Analog Inputs.SchDoc	Net NetC2_1 has no driving source (Pin C2-1,Pin R3-1,Pin U1-3)
Warning	Steering Wheel Interface Analog Inputs.SchDoc	Net NetC6_1 has no driving source (Pin C6-1,Pin R6-1,Pin U1-5)
Warning	Steering Wheel Interface Analog Inputs.SchDoc	Net NetC10_1 has no driving source (Pin C10-1,Pin R9-1,Pin U2-3)
Warning	Steering Wheel Interface Analog Inputs.SchDoc	Net NetC14_1 has no driving source (Pin C14-1,Pin R12-1,Pin U2-5)
Warning	Steering Wheel Interface Digital Inputs.SchDoc	Off grid Net Label CC_ON/O\F\F\ at 2514.02mil,2900mil

Design Rules Verification Report

Filename : C:\Users\jieni\Documents\Github\hardware\MSXII_SteeringWheelInterfaceBoard\

Warnings 0
Rule Violations 58

Warnings	
Total	0

Rule Violations	
Clearance Constraint (Gap=0.152mm) (All),(All)	0
Short-Circuit Constraint (Allowed=No) (All),(All)	0
Un-Routed Net Constraint ((All))	1
Modified Polygon (Allow modified: No), (Allow shelved: No)	0
Width Constraint (Min=0.152mm) (Max=2.54mm) (Preferred=0.254mm) (All)	0
Power Plane Connect Rule(Relief Connect)(Expansion=0.508mm) (Conductor Width=0.254mm) (Air Gap=0.254mm)	0
Minimum Annular Ring (Minimum=0.06mm) (All)	0
Hole Size Constraint (Min=0.3mm) (Max=6.3mm) (All)	0
Hole To Hole Clearance (Gap=0.254mm) (All),(All)	0
Minimum Solder Mask Sliver (Gap=0mm) (All),(All)	0
Silk To Solder Mask (Clearance=0.178mm) (IsPad),(All)	17
Silk to Silk (Clearance=0.254mm) (All),(All)	9
Net Antennae (Tolerance=0mm) (All)	1
Board Clearance Constraint (Gap=0mm) (All)	30
Height Constraint (Min=0mm) (Max=25.4mm) (Preferred=12.7mm) (All)	0
Total	58

Un-Routed Net Constraint ((All))	
Un-Routed Net Constraint: Net FILTERED_LANE_ASSIST Between Track (49.713mm,22.3mm)(49.75mm,22.263mm) on Top Layer And Pad	

Silk To Solder Mask (Clearance=0.178mm) (IsPad),(All)	
Silk To Solder Mask Clearance Constraint: (Collision < 0.178mm) Between Pad C11-1(11.325mm,8.1mm) on Top Layer And Text "C7" (11.75mm,7.95mm)	
Silk To Solder Mask Clearance Constraint: (Collision < 0.178mm) Between Pad C11-2(12.675mm,8.1mm) on Top Layer And Text "C7" (11.75mm,7.95mm)	
Silk To Solder Mask Clearance Constraint: (0.175mm < 0.178mm) Between Pad C13-1(84mm,7mm) on Top Layer And Text "R11" (84.75mm,7.5mm) on	
Silk To Solder Mask Clearance Constraint: (0.092mm < 0.178mm) Between Pad C3-1(7.8mm,6.275mm) on Top Layer And Text "C3" (7.266mm,8.225mm)	
Silk To Solder Mask Clearance Constraint: (0.092mm < 0.178mm) Between Pad C7-1(12.25mm,6mm) on Top Layer And Text "C7" (11.75mm,7.95mm) on	
Silk To Solder Mask Clearance Constraint: (0.005mm < 0.178mm) Between Pad C9-1(81.38mm,6.915mm) on Top Layer And Text "C9" (80mm,7.75mm) on	
Silk To Solder Mask Clearance Constraint: (0.122mm < 0.178mm) Between Pad C9-2(81.38mm,8.265mm) on Top Layer And Text "C9" (80mm,7.75mm) on	
Silk To Solder Mask Clearance Constraint: (0.163mm < 0.178mm) Between Pad P3-3(40mm,3mm) on Top Layer And Track	
Silk To Solder Mask Clearance Constraint: (Collision < 0.178mm) Between Pad R10-1(14.825mm,7.5mm) on Top Layer And Text "C11"	
Silk To Solder Mask Clearance Constraint: (0.025mm < 0.178mm) Between Pad R10-1(14.825mm,7.5mm) on Top Layer And Text "R7" (13.5mm,7.95mm)	
Silk To Solder Mask Clearance Constraint: (Collision < 0.178mm) Between Pad R10-2(16.375mm,7.5mm) on Top Layer And Text "C11"	
Silk To Solder Mask Clearance Constraint: (0.16mm < 0.178mm) Between Pad R11-1(86mm,8.55mm) on Top Layer And Text "C14" (87.46mm,7.4mm) on	
Silk To Solder Mask Clearance Constraint: (Collision < 0.178mm) Between Pad R11-2(86mm,7mm) on Top Layer And Text "R11" (84.75mm,7.5mm) on	
Silk To Solder Mask Clearance Constraint: (0.105mm < 0.178mm) Between Pad R23-2(48.763mm,26.762mm) on Top Layer And Text "R23"	
Silk To Solder Mask Clearance Constraint: (0.138mm < 0.178mm) Between Pad R25-2(43.125mm,26.73mm) on Top Layer And Text "R25"	
Silk To Solder Mask Clearance Constraint: (0.117mm < 0.178mm) Between Pad R4-1(9.4mm,5.875mm) on Top Layer And Text "R4" (9.366mm,7.825mm)	
Silk To Solder Mask Clearance Constraint: (0.117mm < 0.178mm) Between Pad R7-1(14mm,6mm) on Top Layer And Text "R7" (13.5mm,7.95mm) on Top	

Silk to Silk (Clearance=0.254mm) (All),(All)

Silk To Silk Clearance Constraint: (0.235mm < 0.254mm) Between Arc (42.513mm,17.775mm) on Top Overlay And Text "U5" (40.75mm,18mm) on Top
Silk To Silk Clearance Constraint: (0.15mm < 0.254mm) Between Region (2 hole(s)) Top Overlay And Text "U2" (80.75mm,14mm) on Top Overlay Silk Text
Silk To Silk Clearance Constraint: (Collision < 0.254mm) Between Text "C11" (14.325mm,7.685mm) on Top Overlay And Text "R7" (13.5mm,7.95mm) on
Silk To Silk Clearance Constraint: (0.25mm < 0.254mm) Between Text "C18" (40mm,16mm) on Top Overlay And Text "R19" (38.8mm,15.934mm) on Top
Silk To Silk Clearance Constraint: (0.227mm < 0.254mm) Between Text "C20" (52.75mm,16mm) on Top Overlay And Text "R22" (51.573mm,16mm) on Top
Silk To Silk Clearance Constraint: (0.164mm < 0.254mm) Between Text "C3" (7.266mm,8.225mm) on Top Overlay And Track
Silk To Silk Clearance Constraint: (Collision < 0.254mm) Between Text "C3" (7.266mm,8.225mm) on Top Overlay And Track
Silk To Silk Clearance Constraint: (Collision < 0.254mm) Between Text "C3" (7.266mm,8.225mm) on Top Overlay And Track
Silk To Silk Clearance Constraint: (0.048mm < 0.254mm) Between Text "P1" (5mm,5.25mm) on Top Overlay And Track (4.1mm,6.3mm)(6.9mm,6.3mm) on

Net Antennae (Tolerance=0mm) (All)

Net Antennae: Track (49.75mm,21.058mm)(49.75mm,22.263mm) on Top Layer

Board Clearance Constraint (Gap=0mm) (All)

Board Outline Clearance(Cutout Edge): (0.32mm < 0.406mm) Between Board Cutout (Multi-Layer)Region (0 hole(s)) Multi-Layer And Pad
Board Outline Clearance(Cutout Edge): (0.375mm < 0.406mm) Between Board Cutout (Multi-Layer)Region (0 hole(s)) Multi-Layer And Track
Board Outline Clearance(Cutout Edge): (0.375mm < 0.406mm) Between Board Cutout (Multi-Layer)Region (0 hole(s)) Multi-Layer And Track
Board Outline Clearance(Cutout Edge): (0.375mm < 0.406mm) Between Board Cutout (Multi-Layer)Region (0 hole(s)) Multi-Layer And Track
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-1(89mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-10(66.14mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-11(63.6mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-12(61.06mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-13(58.52mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-2(86.46mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-3(83.92mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-4(81.38mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-5(78.84mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-6(76.3mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-7(73.76mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-8(71.22mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.3mm < 0.406mm) Between Board Edge And Pad P2-9(68.68mm,2.8mm) on Top Layer
Board Outline Clearance(Outline Edge): (0.35mm < 0.406mm) Between Board Edge And Text "C19" (47mm,29.5mm) on Top Overlay
Board Outline Clearance(Outline Edge): (0.35mm < 0.406mm) Between Board Edge And Text "C21" (44.25mm,29.5mm) on Top Overlay
Board Outline Clearance(Outline Edge): (0.35mm < 0.406mm) Between Board Edge And Text "R23" (48.25mm,29.5mm) on Top Overlay
Board Outline Clearance(Outline Edge): (0.35mm < 0.406mm) Between Board Edge And Text "R25" (42.773mm,29.5mm) on Top Overlay
Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (0mm,0mm)(0mm,30mm) on Top Overlay
Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (0mm,0mm)(35mm,0mm) on Top Overlay
Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (0mm,30mm)(35mm,30mm) on Top Overlay
Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (35mm,0mm)(35mm,30mm) on Top Overlay
Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (39.325mm,-0.02mm)(49.875mm,-0.02mm) on Top Overlay
Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (70.255mm,24.64mm)(70.255mm,29.94mm) on Top
Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (70.255mm,29.94mm)(78.5mm,29.94mm) on Top Overlay
Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (77.5mm,29.94mm)(81.33mm,29.94mm) on Top Overlay
Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (81.33mm,24.64mm)(81.33mm,29.94mm) on Top Overlay