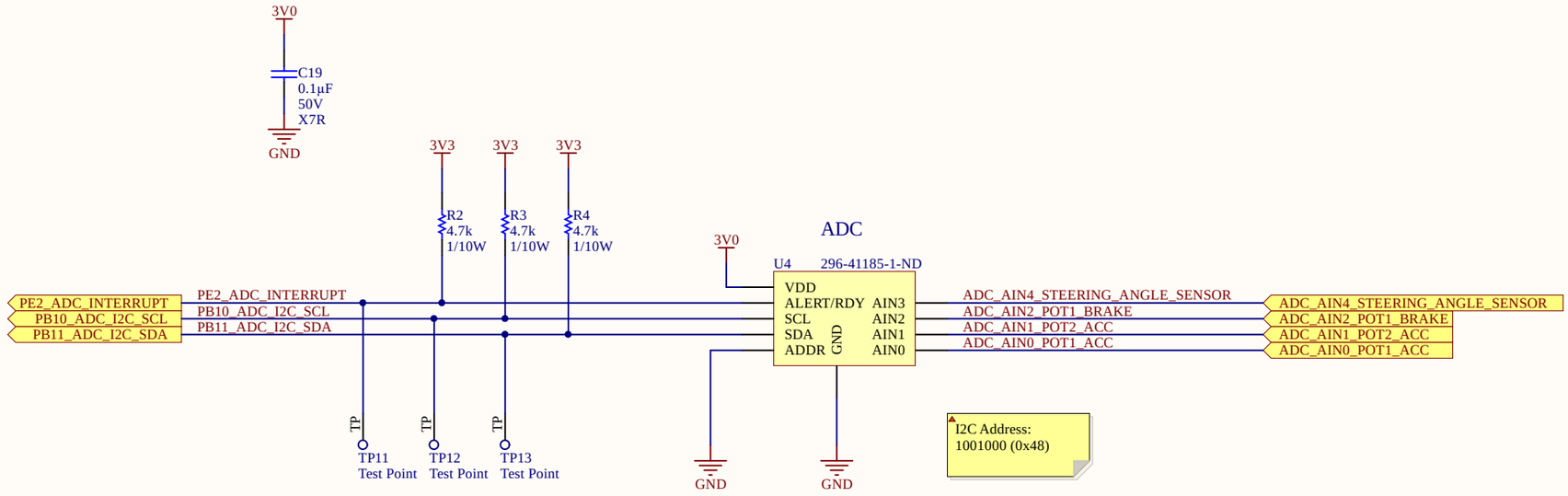
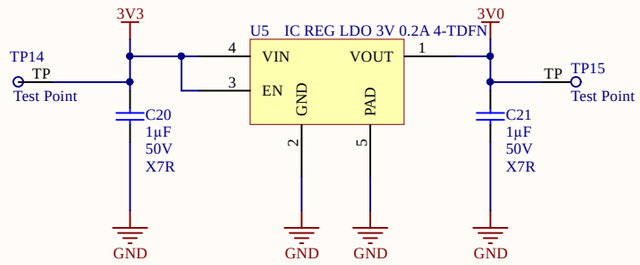
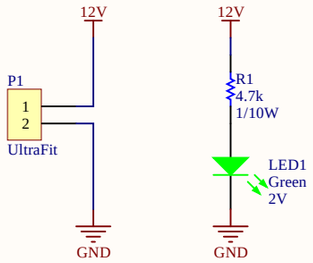



## Power Supply



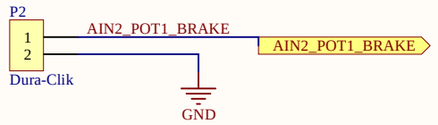

| | | | |
|---|---|---|---|
| PROJECT | MSXII_PedalBoard.PrjPcb | | MIDNIGHT SUN |
| DOCUMENT | Title | | |
| PART NUMBER | | VARIANT [No Variations] | Engineering 5 - 1002<br>University of Waterloo<br>(519) 888-4567 x32978<br>hardware@uwmidsun.com |
| DRAWN BY | Taiping Li | REVISION 2.1 | |
| LAST MODIFIED | 2019-01-18 | SHEET * OF * | |



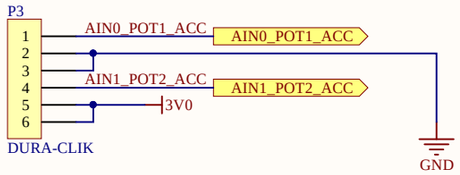




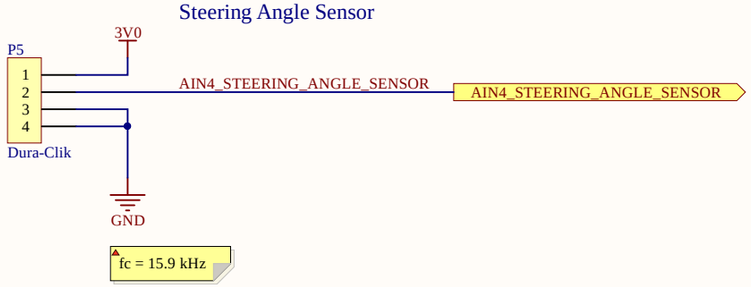
## Brake Pedal Connector



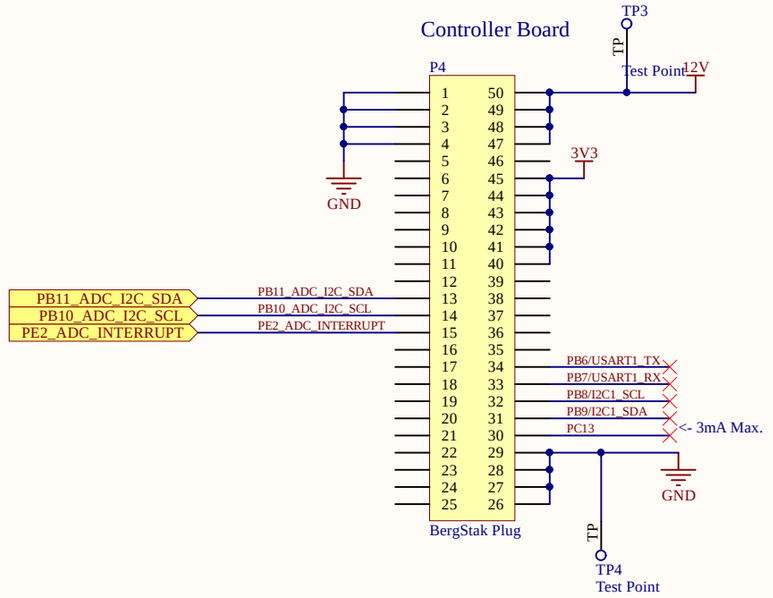

## Accelerator Pedal Connector




## Steering Angle Sensor




## Controller Board



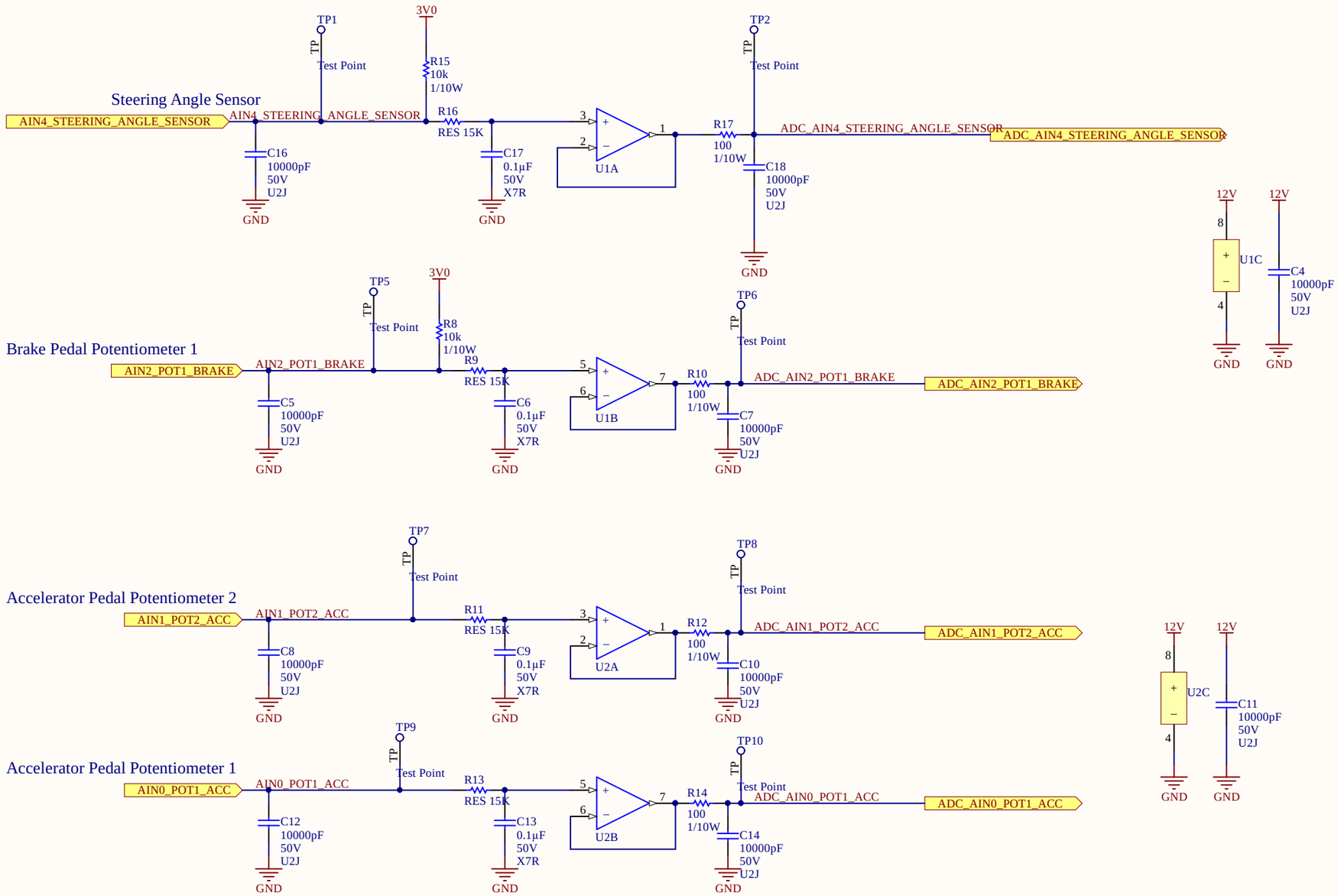

| | | | |
|---|---|---|---|
| PROJECT | MSXII_PedalBoard.PrjPcb | | MIDNIGHT SUN |
| DOCUMENT | Title | | |
| PART NUMBER | | VARIANT | [No Variations] |
| DRAWN BY | Taiping Li | REVISION | 2.1 |
| LAST MODIFIED | 2019-01-18 | SHEET * OF * | |


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

# RC Low Pass Filter

fc = 116.17[Hz]

fc = 159154.94[Hz]



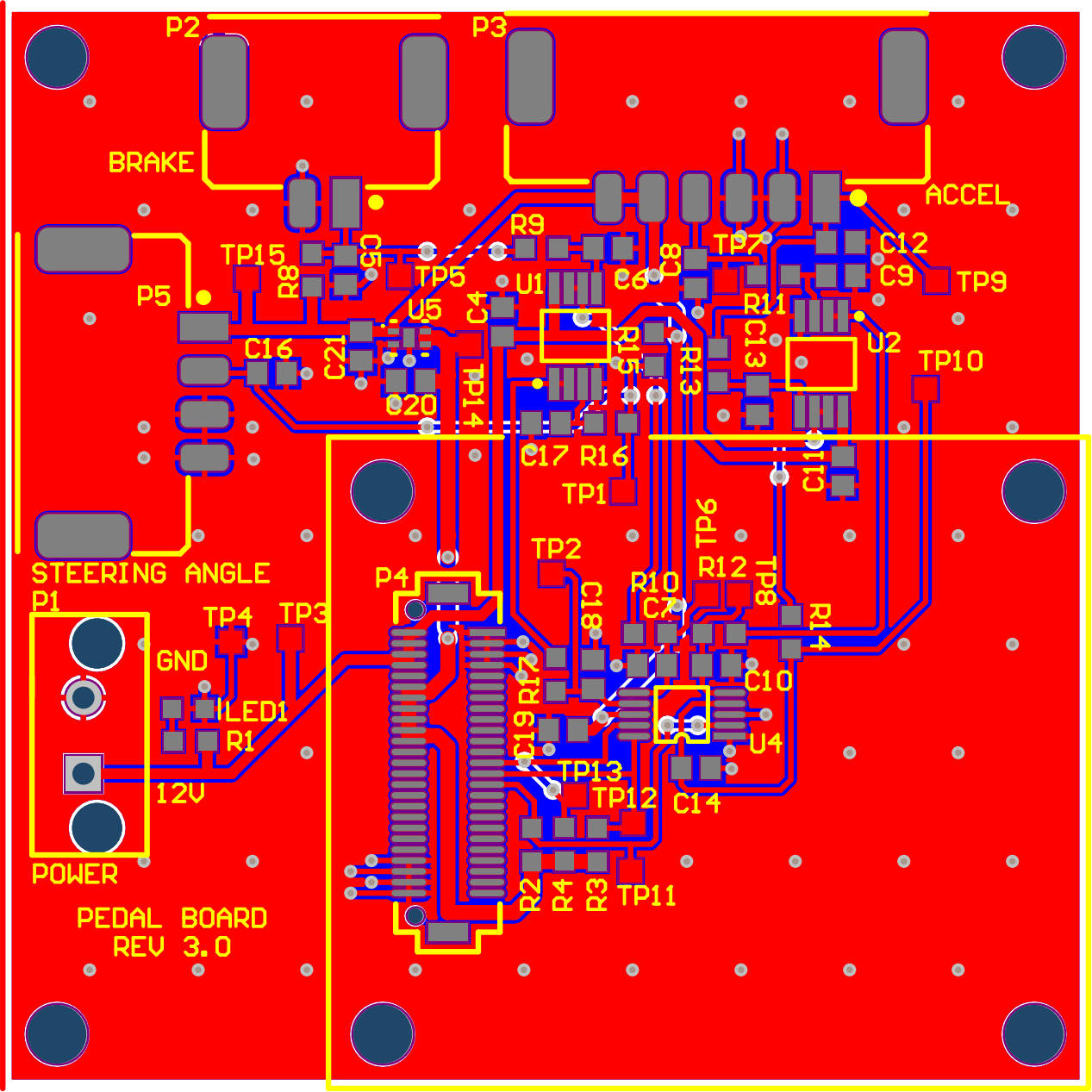

| | | | |
|---|---|---|---|
| PROJECT | MSXII_PedalBoard.PrjPcb | | MIDNIGHT SUN |
| DOCUMENT | Title | | |
| PART NUMBER | | VARIANT | [No Variations] |
| DRAWN BY | Taiping Li | REVISION | 2.1 |
| LAST MODIFIED | 2019-01-18 | SHEET * OF * | |

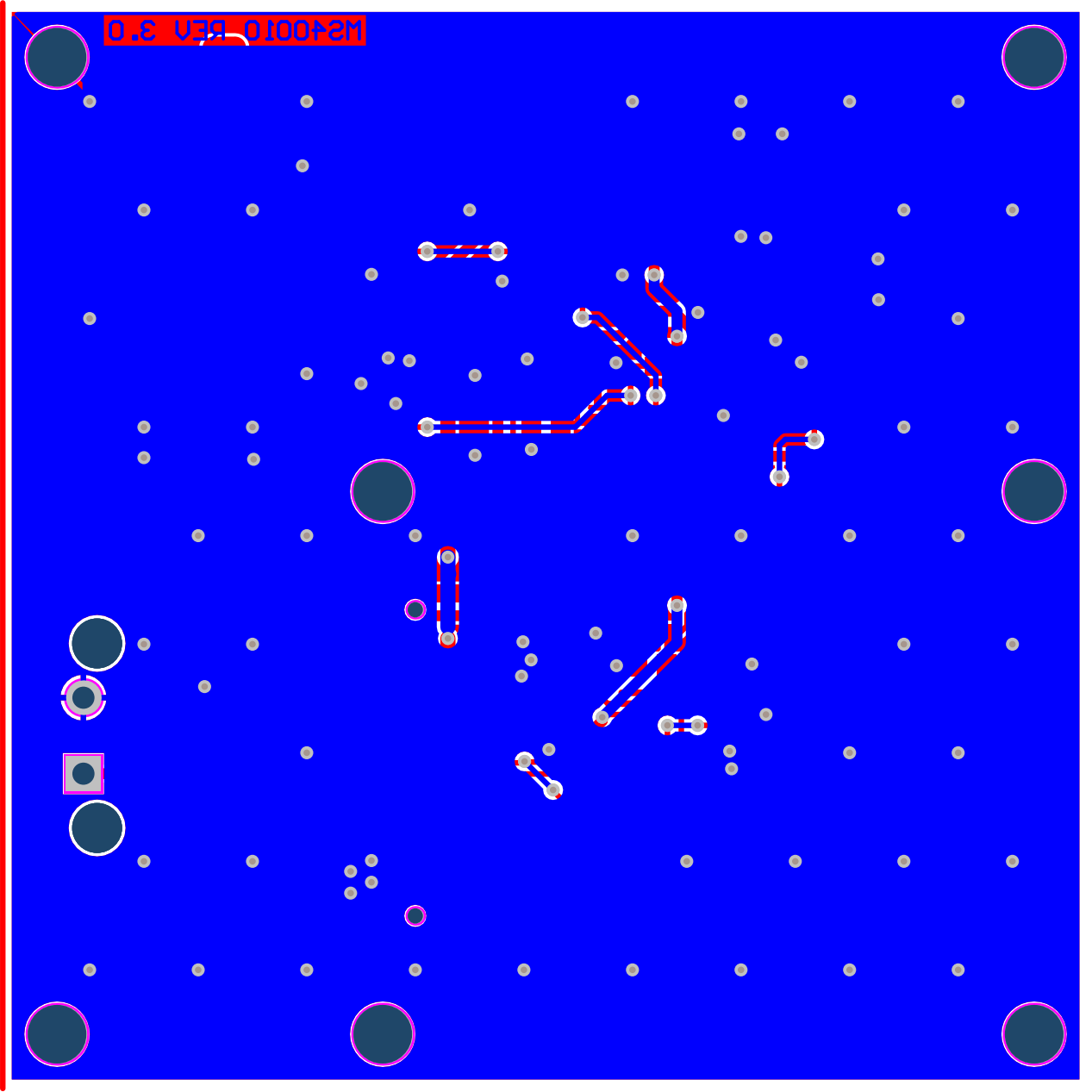

Engineering 5 - 1002
University of Waterloo
(519) 888-4567 x32978
hardware@uwmidsun.com

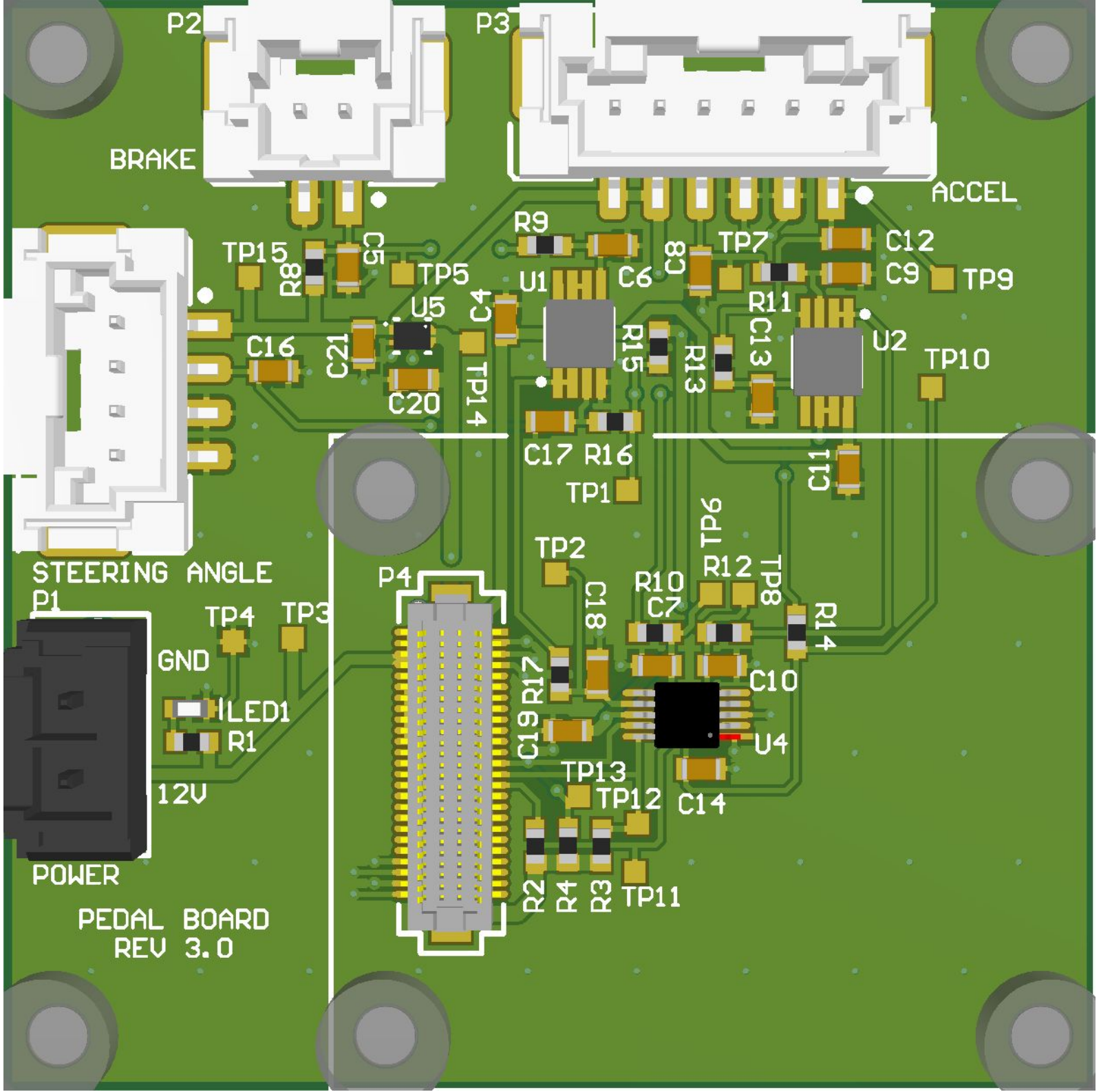
# Bill of Materials

| | |
|---|---|
| Project: | MSXII_PedalBoard.PrjPcb |
| Revision: | 2.1 |
| Project Lead: | Taiping Li |
| Generated On: | 2019-01-18 7:46:40 PM |
| Production Quantity: | 1 |
| Currency | CAD |
| Total Parts Count: | 41 |


| LibRef | Designator | Manufacturer 1 | Manufacturer Part Number 1 | Supplier 1 | Supplier Part Number 1 | Supplier Unit Price 1 | Supplier Order Qty 1 | Supplier Subtotal 1 |
|---|---|---|---|---|---|---|---|---|
| CAP CER 10nF 50V 5% X7R 0603 | C4 | KEMET | C0603C103J5JACTU | Digi-Key | 399-13384-1-ND | 0.49 | 1 | $ 0.49 |
| CAP CER 10nF 50V 5% X7R 0603 | C5 | KEMET | C0603C103J5JACTU | Digi-Key | 399-13384-1-ND | 0.49 | 1 | $ 0.49 |
| CAP CER 0.1UF 50V 10% X7R 0603 | C6 | Kyocera AVX | 06035C-104KAT2A | Digi-Key | 478-5052-1-ND | 0.23 | 1 | $ 0.23 |
| CAP CER 10nF 50V 5% X7R 0603 | C7 | KEMET | C0603C103J5JACTU | Digi-Key | 399-13384-1-ND | 0.49 | 1 | $ 0.49 |
| CAP CER 10nF 50V 5% X7R 0603 | C8 | KEMET | C0603C103J5JACTU | Digi-Key | 399-13384-1-ND | 0.49 | 1 | $ 0.49 |
| CAP CER 0.1UF 50V 10% X7R 0603 | C9 | Kyocera AVX | 06035C-104KAT2A | Digi-Key | 478-5052-1-ND | 0.23 | 1 | $ 0.23 |
| CAP CER 10nF 50V 5% X7R 0603 | C10 | KEMET | C0603C103J5JACTU | Digi-Key | 399-13384-1-ND | 0.49 | 1 | $ 0.49 |
| CAP CER 10nF 50V 5% X7R 0603 | C11 | KEMET | C0603C103J5JACTU | Digi-Key | 399-13384-1-ND | 0.49 | 1 | $ 0.49 |
| CAP CER 10nF 50V 5% X7R 0603 | C12 | KEMET | C0603C103J5JACTU | Digi-Key | 399-13384-1-ND | 0.49 | 1 | $ 0.49 |
| CAP CER 0.1UF 50V 10% X7R 0603 | C13 | Kyocera AVX | 06035C-104KAT2A | Digi-Key | 478-5052-1-ND | 0.23 | 1 | $ 0.23 |
| CAP CER 10nF 50V 5% X7R 0603 | C14 | KEMET | C0603C103J5JACTU | Digi-Key | 399-13384-1-ND | 0.49 | 1 | $ 0.49 |
| CAP CER 10nF 50V 5% X7R 0603 | C16 | KEMET | C0603C103J5JACTU | Digi-Key | 399-13384-1-ND | 0.49 | 1 | $ 0.49 |
| CAP CER 0.1UF 50V 10% X7R 0603 | C17 | Kyocera AVX | 06035C-104KAT2A | Digi-Key | 478-5052-1-ND | 0.23 | 1 | $ 0.23 |
| CAP CER 10nF 50V 5% X7R 0603 | C18 | KEMET | C0603C103J5JACTU | Digi-Key | 399-13384-1-ND | 0.49 | 1 | $ 0.49 |
| CAP CER 0.1UF 50V 10% X7R 0603 | C19 | Kyocera AVX | 06035C-104KAT2A | Digi-Key | 478-5052-1-ND | 0.23 | 1 | $ 0.23 |
| CAP CER 1UF 50V 10% X7R 0603 | C20 | Taiyo Yuden | UMK107AB7105KA-T | Digi-Key | 587-3247-1-ND | 0.38 | 1 | $ 0.38 |
| CAP CER 1UF 50V 10% X7R 0603 | C21 | Taiyo Yuden | UMK107AB7105KA-T | Digi-Key | 587-3247-1-ND | 0.38 | 1 | $ 0.38 |
| LED GREEN CLEAR 2V 0603 | LED1 | Wurth Electronics | 150060VS75000 | Digi-Key | 732-4980-1-ND | 0.19 | 1 | $ 0.19 |
| CONN 2POS ULTRA-FIT 0.138" | P1 | Molex | 1722861302 | Digi-Key | WM11673-ND | 1.94 | 1 | $ 1.94 |
| CONN 2POS DURA-CLIK 0.079" VERT | P2 | Molex | 560020-0220 | Digi-Key | WM10862CT-ND | 1.03 | 1 | $ 1.03 |
| CONN 6POS DURA-CLIK 0.079" | P3 | Molex | 560020-0620 | Digi-Key | WM10866CT-ND | 1.52 | 1 | $ 1.52 |
| CONN 50POS Bergstak Plug 0.02" | P4 | Amphenol FCI | 10132797-055100LF | Digi-Key | 609-5226-1-ND | | | |
| CONN 4POS DURA-CLIK 0.079" | P5 | Molex | 560020-0420 | Digi-Key | WM10864CT-ND | 2.2 | 1 | $ 2.20 |
| RES 4.7K OHM 1% 1/10W 0603 | R1 | Yageo | RC0603FR-074K7L | Digi-Key | 311-4.70KHRCT-ND | 0.13 | 1 | $ 0.13 |
| RES 4.7K OHM 1% 1/10W 0603 | R2 | Yageo | RC0603FR-074K7L | Digi-Key | 311-4.70KHRCT-ND | 0.13 | 1 | $ 0.13 |
| RES 4.7K OHM 1% 1/10W 0603 | R3 | Yageo | RC0603FR-074K7L | Digi-Key | 311-4.70KHRCT-ND | 0.13 | 1 | $ 0.13 |
| RES 4.7K OHM 1% 1/10W 0603 | R4 | Yageo | RC0603FR-074K7L | Digi-Key | 311-4.70KHRCT-ND | 0.13 | 1 | $ 0.13 |
| RES 10K OHM 1% 1/10W 0603 | R8 | Yageo Phycomp | RC0603FR-0710KL | Digi-Key | 311-10.0KHRCT-ND | 0.13 | 1 | $ 0.13 |
| RES SMD 15K OHM 1% 1/10W 0603 | R9 | | | | | | | |
| RES 100 OHM 1% 1/10W 0603 | R10 | Yageo | RC0603FR-07100RL | Digi-Key | 311-100HRCT-ND | 0.13 | 1 | $ 0.13 |
| RES SMD 15K OHM 1% 1/10W 0603 | R11 | | | | | | | |
| RES 100 OHM 1% 1/10W 0603 | R12 | Yageo | RC0603FR-07100RL | Digi-Key | 311-100HRCT-ND | 0.13 | 1 | $ 0.13 |
| RES SMD 15K OHM 1% 1/10W 0603 | R13 | | | | | | | |
| RES 100 OHM 1% 1/10W 0603 | R14 | Yageo | RC0603FR-07100RL | Digi-Key | 311-100HRCT-ND | 0.13 | 1 | $ 0.13 |
| RES 10K OHM 1% 1/10W 0603 | R15 | Yageo Phycomp | RC0603FR-0710KL | Digi-Key | 311-10.0KHRCT-ND | 0.13 | 1 | $ 0.13 |
| RES SMD 15K OHM 1% 1/10W 0603 | R16 | | | | | | | |
| RES 100 OHM 1% 1/10W 0603 | R17 | Yageo | RC0603FR-07100RL | Digi-Key | 311-100HRCT-ND | 0.13 | 1 | $ 0.13 |
| IC OP AMP DUAL GP RR 10MHZ 8-VSSOP | U1 | Texas Instruments | OPA2197IDGKR | Digi-Key | 296-47349-1-ND | 3.2 | 1 | $ 3.20 |
| IC OP AMP DUAL GP RR 10MHZ 8-VSSOP | U2 | Texas Instruments | OPA2197IDGKR | Digi-Key | 296-47349-1-ND | 3.2 | 1 | $ 3.20 |
| IC ADC 12-BIT VSSOP-10 | U4 | Texas Instruments | ADS1015IDGSR | Digi-Key | 296-41185-1-ND | 3.66 | 1 | $ 3.66 |
| IC REG LDO 3V 0.2A 4-TDFN | U5 | Microchip | MIC94310-PYMT-TR | Digi-Key | 576-4761-1-ND | 0.38 | 1 | $ 0.38 |
| | | | | | | | Total: | $ 25.43 |


P2
P3
BRAKE
ACCEL
TP15
P5
R8
C5
R9
TP5
U1
C6
C8
TP7
C12
C9
TP9
U5
C4
R11
C13
U2
TP10
C16
C21
C20
TP14
R15
R13
C17
R16
TP1
C11
TP6
TP2
P4
R12
TP8
R14
C18
R10
C7
C10
R17
C19
U4
TP13
TP12
C14
R2
R4
R3
TP11
STEERING ANGLE
P1
TP4
TP3
GND
LED1
R1
12V
POWER
PEDAL BOARD
REV 3.0


MS-100J0 REV 3.0


P2
P3
BRAKE
ACCEL
R9
TP15
R8
C5
TP5
U1
C6
C8
TP7
C12
C9
TP9
U5
C4
R11
C13
U2
C16
C21
R15
R13
TP10
C20
TP14
C17
R16
C11
TP1
TP6
TP2
R12
TP8
P4
C18
R10
C7
R14
STEERING ANGLE
P1
TP4
TP3
GND
C10
R17
LED1
R1
C19
U4
TP13
TP12
C14
12V
R2
R4
R3
TP11
POWER
PEDAL BOARD
REV 3.0

## Electrical Rules Check Report

| Class | Document | Message |
|---|---|---|
| Warning | PedalBoardAnalogInputs.SchDoc | Net NetC6_1 has no driving source (Pin C6-1,Pin R9-1,Pin U1-5) |
| Warning | PedalBoardAnalogInputs.SchDoc | Net NetC9_1 has no driving source (Pin C9-1,Pin R11-1,Pin U2-3) |
| Warning | PedalBoardAnalogInputs.SchDoc | Net NetC13_1 has no driving source (Pin C13-1,Pin R13-1,Pin U2-5) |
| Warning | PedalBoardAnalogInputs.SchDoc | Net NetC17_1 has no driving source (Pin C17-1,Pin R16-1,Pin U1-3) |

# Design Rules Verification Report

Filename : C:\Users\Taiping\Documents\MidnightSun\hardware\MSXII_PedalBoard\Pedal Bc

Warnings 0
Rule Violations 46

| 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) ) | 0 |
| 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=0.05mm) (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=0.1mm) (All),(All) | 4 |
| Silk To Solder Mask (Clearance=0.178mm) (IsPad),(All) | 26 |
| Silk to Silk (Clearance=0.254mm) (All),(All) | 10 |
| Net Antennae (Tolerance=0mm) (All) | 0 |
| Board Clearance Constraint (Gap=0mm) (All) | 6 |
| Height Constraint (Min=0mm) (Max=25.4mm) (Prefered=12.7mm) (All) | 0 |
| Total | 46 |

| Minimum Solder Mask Sliver (Gap=0.1mm) (All),(All) |
|---|
| Minimum Solder Mask Sliver Constraint: (0.012mm < 0.1mm) Between Pad U5-1(18.01mm,34.871mm) on Top Layer And Pad U5-5(18.725mm,34.571mm) |
| Minimum Solder Mask Sliver Constraint: (0.012mm < 0.1mm) Between Pad U5-2(18.01mm,34.271mm) on Top Layer And Pad U5-5(18.725mm,34.571mm) |
| Minimum Solder Mask Sliver Constraint: (0.022mm < 0.1mm) Between Pad U5-3(19.45mm,34.271mm) on Top Layer And Pad U5-5(18.725mm,34.571mm) |
| Minimum Solder Mask Sliver Constraint: (0.022mm < 0.1mm) Between Pad U5-4(19.45mm,34.871mm) on Top Layer And Pad U5-5(18.725mm,34.571mm) |

| Silk To Solder Mask (Clearance=0.178mm) (IsPad),(All) |
|---|
| Silk To Solder Mask Clearance Constraint: (0.175mm < 0.178mm) Between Pad C10-2(33.564mm,19.475mm) on Top Layer And Text "C10" |
| Silk To Solder Mask Clearance Constraint: (0.175mm < 0.178mm) Between Pad C16-1(11.7mm,32.95mm) on Top Layer And Text "C16" |
| Silk To Solder Mask Clearance Constraint: (0.175mm < 0.178mm) Between Pad C16-2(13.05mm,32.95mm) on Top Layer And Text "C16" |
| Silk To Solder Mask Clearance Constraint: (0.096mm < 0.178mm) Between Pad C20-1(19.45mm,32.571mm) on Top Layer And Text "C20" |
| Silk To Solder Mask Clearance Constraint: (0.096mm < 0.178mm) Between Pad C20-2(18.1mm,32.571mm) on Top Layer And Text "C20" |
| Silk To Solder Mask Clearance Constraint: (0.175mm < 0.178mm) Between Pad C4-2(23mm,36mm) on Top Layer And Text "C4" (22.25mm,35.325mm) on |
| Silk To Solder Mask Clearance Constraint: (0.175mm < 0.178mm) Between Pad C5-1(15.8mm,38.357mm) on Top Layer And Text "C5" |
| Silk To Solder Mask Clearance Constraint: (0.175mm < 0.178mm) Between Pad C8-1(31.9mm,38.207mm) on Top Layer And Text "C8" (31.15mm,37.5mm) |
| Silk To Solder Mask Clearance Constraint: (0.135mm < 0.178mm) Between Pad P2-3(19.4mm,46.35mm) on Top Layer And Track |
| Silk To Solder Mask Clearance Constraint: (0.155mm < 0.178mm) Between Pad P5-7(3.714mm,25.457mm) on Top Layer And Track |
| Silk To Solder Mask Clearance Constraint: (0.17mm < 0.178mm) Between Pad P5-7(3.714mm,38.657mm) on Top Layer And Track |
| Silk To Solder Mask Clearance Constraint: (0.131mm < 0.178mm) Between Pad TP11-TP(28.915mm,10.005mm) on Top Layer And Text "TP11" |
| Silk To Solder Mask Clearance Constraint: (0.145mm < 0.178mm) Between Pad TP13-TP(26.342mm,13.5mm) on Top Layer And Text "TP13" |
| Silk To Solder Mask Clearance Constraint: (0.138mm < 0.178mm) Between Pad TP15-TP(11.25mm,37.298mm) on Top Layer And Text "TP15" |
| Silk To Solder Mask Clearance Constraint: (0.165mm < 0.178mm) Between Pad TP4-TP(10.525mm,20.575mm) on Top Layer And Text "TP4" |
| Silk To Solder Mask Clearance Constraint: (0.175mm < 0.178mm) Between Pad U4-1(33.476mm,16.225mm) on Top Layer And Track |
| Silk To Solder Mask Clearance Constraint: (0.176mm < 0.178mm) Between Pad U4-10(29.076mm,16.225mm) on Top Layer And Track |
| Silk To Solder Mask Clearance Constraint: (0.176mm < 0.178mm) Between Pad U4-2(33.476mm,16.725mm) on Top Layer And Track |
| Silk To Solder Mask Clearance Constraint: (0.176mm < 0.178mm) Between Pad U4-3(33.476mm,17.225mm) on Top Layer And Track |
| Silk To Solder Mask Clearance Constraint: (0.176mm < 0.178mm) Between Pad U4-4(33.476mm,17.725mm) on Top Layer And Track |
| Silk To Solder Mask Clearance Constraint: (0.157mm < 0.178mm) Between Pad U4-5(33.476mm,18.225mm) on Top Layer And Text "C10" |
| Silk To Solder Mask Clearance Constraint: (0.176mm < 0.178mm) Between Pad U4-5(33.476mm,18.225mm) on Top Layer And Track |
| Silk To Solder Mask Clearance Constraint: (0.176mm < 0.178mm) Between Pad U4-6(29.076mm,18.225mm) on Top Layer And Track |
| Silk To Solder Mask Clearance Constraint: (0.176mm < 0.178mm) Between Pad U4-7(29.076mm,17.725mm) on Top Layer And Track |
| Silk To Solder Mask Clearance Constraint: (0.176mm < 0.178mm) Between Pad U4-8(29.076mm,17.225mm) on Top Layer And Track |
| Silk To Solder Mask Clearance Constraint: (0.176mm < 0.178mm) Between Pad U4-9(29.076mm,16.725mm) on Top Layer And Track |

| Silk to Silk (Clearance=0.254mm) (All),(All) |
|---|
| Silk To Silk Clearance Constraint: (0.225mm < 0.254mm) Between Text "C7" (29.6mm,21.75mm) on Top Overlay And Text "R10" (29.039mm,22.925mm) |
| Silk To Silk Clearance Constraint: (0.231mm < 0.254mm) Between Text "LED1" (10.359mm,16.98mm) on Top Overlay And Track |
| Silk To Silk Clearance Constraint: (0.049mm < 0.254mm) Between Text "P1" (1.464mm,22.05mm) on Top Overlay And Track |
| Silk To Silk Clearance Constraint: (0.018mm < 0.254mm) Between Text "P1" (1.464mm,22.05mm) on Top Overlay And Track |
| Silk To Silk Clearance Constraint: (0.131mm < 0.254mm) Between Text "P3" (21.75mm,48.5mm) on Top Overlay And Track |
| Silk To Silk Clearance Constraint: (0.131mm < 0.254mm) Between Text "P4" (17.275mm,23.133mm) on Top Overlay And Track |
| Silk To Silk Clearance Constraint: (0.254mm < 0.254mm) Between Text "POWER" (1.464mm,9.5mm) on Top Overlay And Track |
| Silk To Silk Clearance Constraint: (0.068mm < 0.254mm) Between Text "R8" (13.55mm,36.5mm) on Top Overlay And Text "TP15" (10.094mm,38.012mm) |
| Silk To Silk Clearance Constraint: (Collision < 0.254mm) Between Text "TP3" (12.8mm,21.5mm) on Top Overlay And Track (15mm,0mm)(15mm,30mm) on |
| Silk To Silk Clearance Constraint: (0.046mm < 0.254mm) Between Text "U5" (18.775mm,35.5mm) on Top Overlay And Track |

| Board Clearance Constraint (Gap=0mm) (All) |
|---|
| Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (0mm,0mm)(0mm,50mm) on Top Layer |
| Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (15mm,0mm)(15mm,30mm) on Top Overlay |
| Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (15mm,0mm)(50mm,0mm) on Top Overlay |
| Board Outline Clearance(Outline Edge): (0.353mm < 0.406mm) Between Board Edge And Track (23.2mm,49.52mm)(42.55mm,49.52mm) on Top Overlay |
| Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (29.854mm,30mm)(50mm,30mm) on Top Overlay |
| Board Outline Clearance(Outline Edge): (Collision < 0.406mm) Between Board Edge And Track (50mm,0mm)(50mm,30mm) on Top Overlay |