

AW3571X Two-Channel High-Speed Differential 1:2 Switch

Features

- Operating voltage 2.7 to 3.6V
- Compatible with USB3.1, PCIe-Gen3, MIPI DSI/CSI
- Data rates up to 10Gbps
- -3dB bandwidth:
 - Typ. 12GHz AW35710QNR
 - Typ. 12GHz AW35711QNR
- Wide common mode voltage 0 to 2.2V
- Insertion loss:
 - 1.1dB @4GHz AW35710QNR
 - 1.2dB @4GHz AW35711QNR
- Return loss: -20dB @4GHz
- Off isolation: -22dB @4GHz
- QFN 4.5mm X2.5mm X0.5mm-20L package
- QFN 2.0mm X2.0mm X0.55mm-18L package

General Description

The AW3571X is a high-speed differential 1:2 switch. It can support high speed data transmission protocols such as USB 3.1 Gen 1 and Gen 2, PCI-Gen3, MIPI DSI/CSI. The device supports switching on differential channels between Port B or Port C to Port A under the control of pin SEL.

The AW3571X is an analog differential passive switch. The device can operate on any high-speed interface applications in the range of 0 to 2.2V common mode voltage. With employing adaptive tracking, it ensures that the channel holds constant within the entire common mode voltage range.

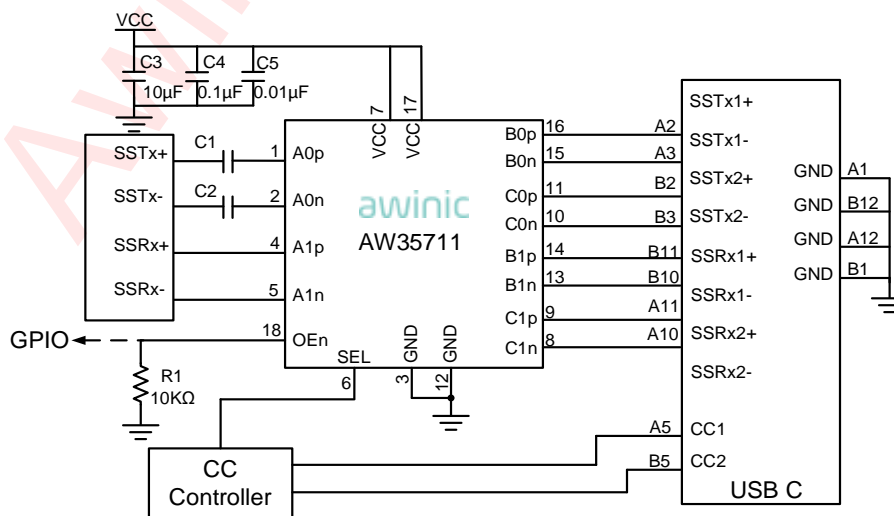
Applications

Desktop and Notebook PCs

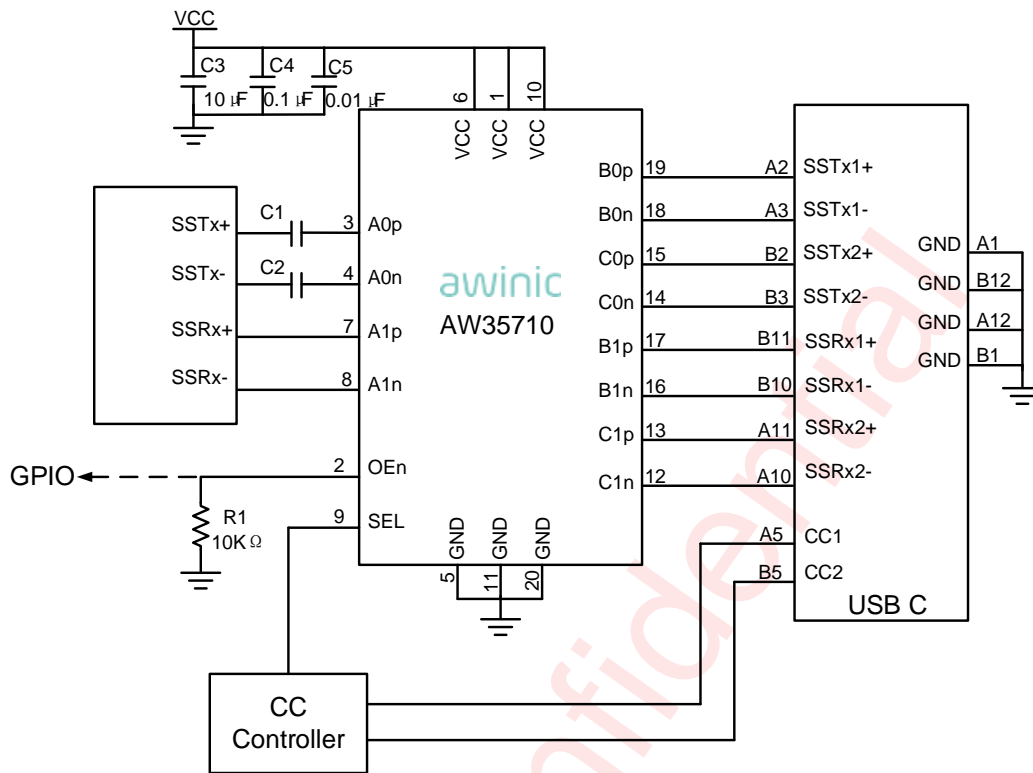
Mobile phones

Type-C Ecosystem

Typical Application Circuit



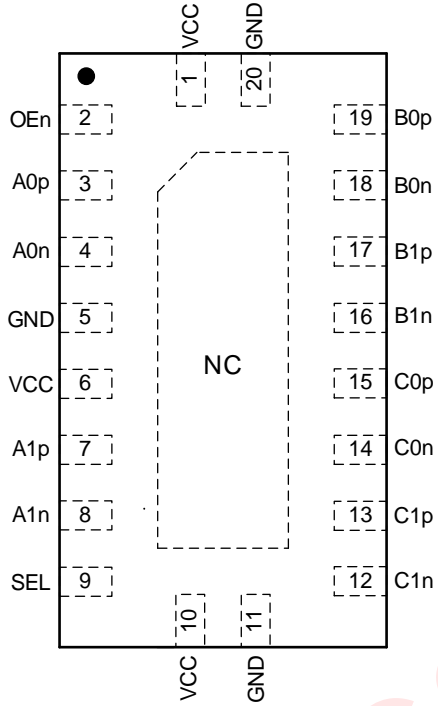
Typical Application Circuit of AW35711



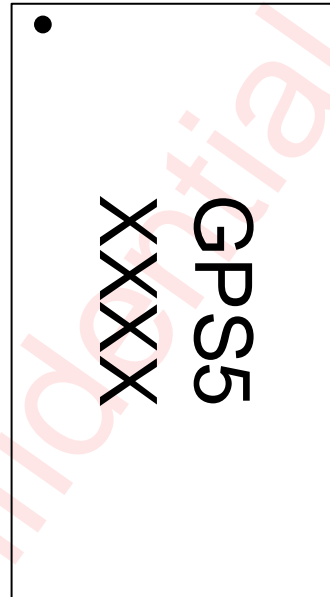
Typical Application Circuit of AW35710

Pin Configuration And Top Mark

**AW35710QNR
(Top View)**

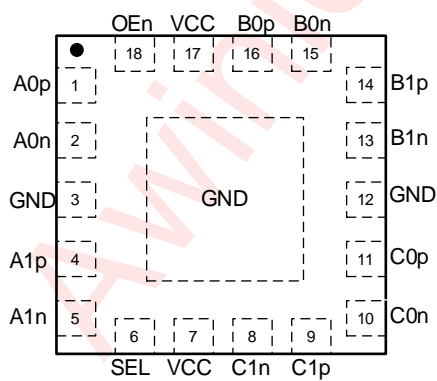


**AW35710QNR Marking
(Top View)**

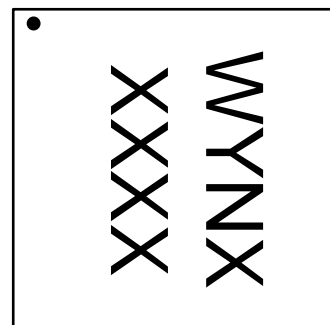


GPS5 – AW35710QNR
XXXX - Production Tracing Code

**AW35711QNR
(Top View)**



**AW35711QNR Marking
(Top View)**

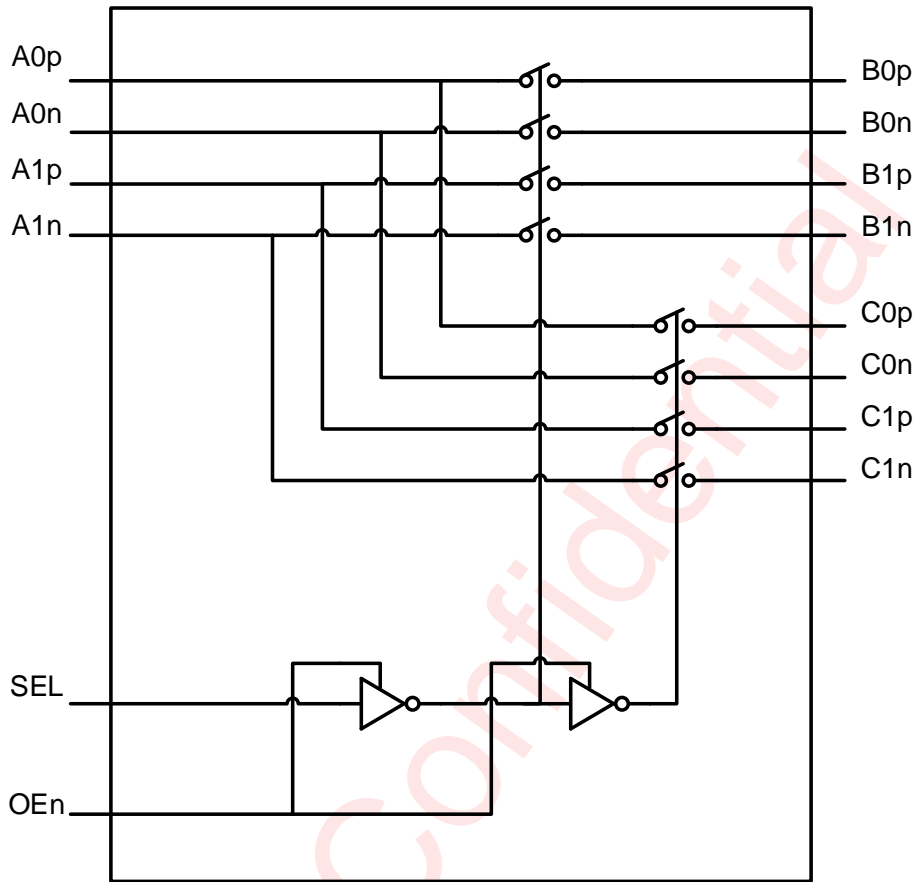


WYNX – AW35711QNR
XXXX - Production Tracing Code

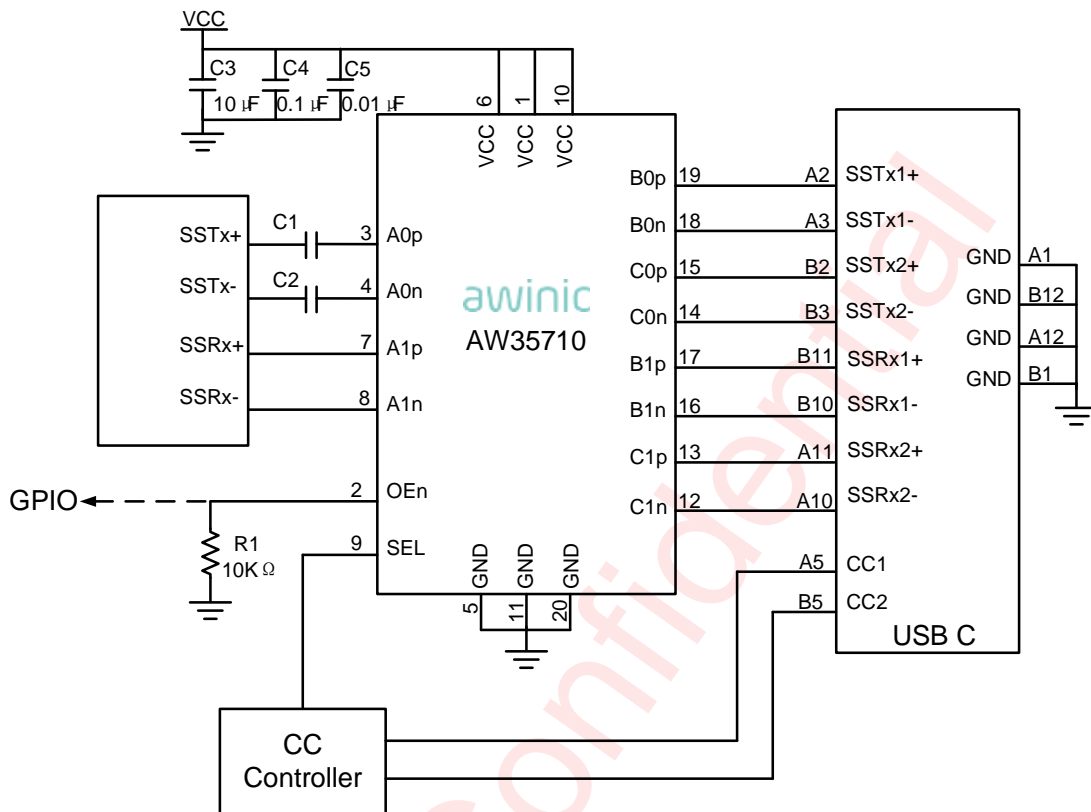
Pin Definition

| Pin No. | | NAME | DESCRIPTION |
|---------|---------|------|--|
| AW35710 | AW35711 | | |
| 1 | 17 | VCC | Power |
| 2 | 18 | OEn | Chip enable L: Normal operation H: Shutdown |
| 3 | 1 | A0p | Port A, channel 0, high-speed positive signal |
| 4 | 2 | A0n | Port A, channel 0, high-speed negative signal |
| 5 | 3 | GND | Ground |
| 6 | | VCC | Power |
| 7 | 4 | A1p | Port A, channel 1, high-speed positive signal |
| 8 | 5 | A1n | Port A, channel 1, high-speed negative signal |
| 9 | 6 | SEL | Port select pin. L: Port A to Port B H: Port A to Port C |
| 10 | 7 | VCC | Power |
| 11 | 12 | GND | Ground |
| 12 | 8 | C1n | Port C, channel 1, high-speed negative signal |
| 13 | 9 | C1p | Port C, channel 1, high-speed positive signal |
| 14 | 10 | C0n | Port C, channel 0, high-speed negative signal |
| 15 | 11 | C0p | Port C, channel 0, high-speed positive signal |
| 16 | 13 | B1n | Port B, channel 1, high-speed negative signal |
| 17 | 14 | B1p | Port B, channel 1, high-speed positive signal |
| 18 | 15 | B0n | Port B, channel 0, high-speed negative signal |
| 19 | 16 | B0p | Port B, channel 0, high-speed positive signal |
| 20 | | GND | Ground |

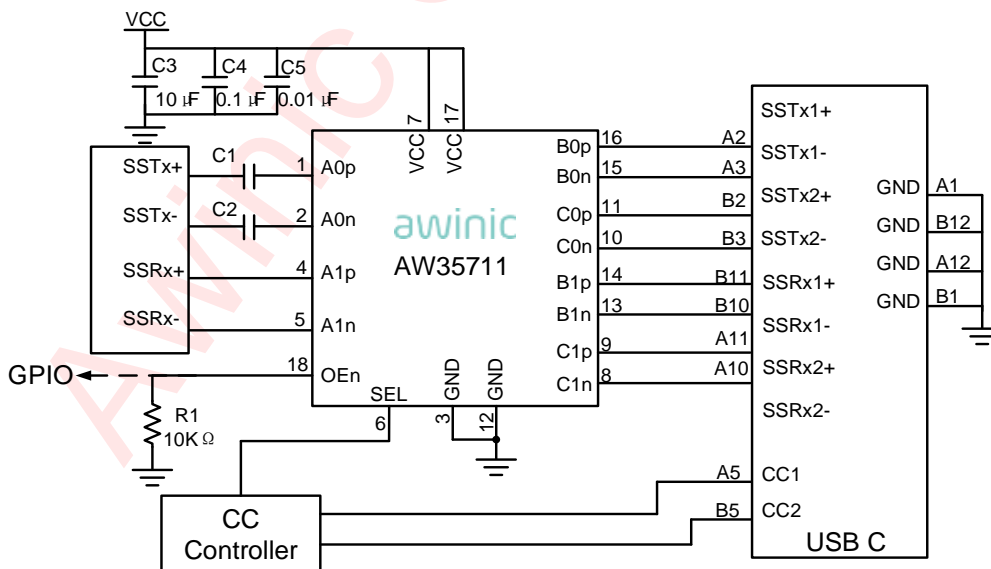
Functional Block Diagram



Typical Application Circuits



AW35710 Application Circuit: Down Facing Port for USB3.1 Type C Connector



AW35711 Application Circuit: Down Facing Port for USB3.1 Type C Connector

Notice for typical application circuits:

1.If AC couple is needed, the capacitance of C1 and C2 is recommended 100nF.

Ordering Information

| Part Number | Temperature | Package | Marking | Moisture Sensitivity Level | Environmental Information | Delivery Form |
|-------------|-------------|----------------------------|---------|----------------------------|---------------------------|------------------------------|
| AW35710QNR | -40°C~85°C | QFN 4.5mmX2.5mm- 20L | GPS5 | MSL1 | ROHS+HF | 9000 units/ Tape and Reel |
| AW35711QNR | -40°C~85°C | QFN 2.0mmX2.0mm- 18L | WYNX | MSL1 | ROHS+HF | 4500 units/ Tape and Reel |

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Absolute Maximum Ratings(NOTE1)

| PARAMETERS | | RANGE |
|--|------------------|---------------------------|
| Supply voltage range V_{CC} | | -0.5V to 4V |
| Input voltage range | Differential I/O | -0.5V to 2.7V |
| | Control pins | -0.5V to V_{CC} |
| Junction-to-ambient thermal resistance θ_{JA} (NOTE2) | | 107°C /W |
| Operating free-air temperature range | | -40°C to 85°C |
| Maximum operating junction temperature T_{JMAX} | | 150°C |
| Storage temperature T_{STG} | | -65°C to 150°C |
| Lead temperature (soldering 10 seconds) | | 260°C |
| ESD | | |
| HBM(NOTE3) | | ±2kV |
| CDM(NOTE4) | | ±1.5kV |
| Latch-Up | | |
| Test condition(NOTE5) | | +IT: 200mA -IT: -200mA |

NOTE1: Conditions out of those ranges listed in "absolute maximum ratings" may cause permanent damages to the device. In spite of the limits above, functional operation conditions of the device should within the ranges listed in "recommended operating conditions". Exposure to absolute-maximum-rated conditions for prolonged periods may affect device reliability.

NOTE2: Thermal resistance from junction to ambient is highly dependent on PCB layout.

NOTE3: All pins. Test Condition: ANSI/ESDA/JEDEC JS-001 2017.

NOTE4: All pins. Test Condition: JEDEC EIA/JESD22-C101F .

NOTE5: All pins. Test Condition: JEDEC STANDARD NO.78E NOVEMBER 2016 .

Recommended Operating Conditions

| SYMBOL | PARAMETERS | RANGE |
|------------|---|---------------|
| V_{CC} | Supply voltage | 2.7V to 3.6V |
| V_{IH} | Input high voltage (SEL, OEn pins) | Min 1.2V |
| V_{IL} | Input low voltage (SEL, OEn pins) | Max 0.5V |
| V_{diff} | High-speed signal pins differential voltage | 0V to 1.8V |
| V_{CM} | High speed signal pins common mode voltage | 0V to 2.2V |
| T_A | Operating free-air temperature | -40°C to 85°C |

DC Electrical Characteristics

VCC=2.7 to 3.6V, OEn=0, T_A=-40°C to 85°C (unless otherwise noted)

| PARAMETER | | TEST CONDITION | MIN | TYP | MAX | UNIT |
|----------------------|--|--|-----|-----|-----|------|
| I _{CC} | Device active current | VCC=2.7 to 3.6V, OEn=0 | | 0.2 | 0.6 | mA |
| I _{STDN} | Device shutdown current | VCC=2.7V, OEn=VCC | | 0.6 | 10 | μA |
| | | VCC=3.3V, OEn=VCC | | 2 | 20 | μA |
| | | VCC=3.6V, OEn=VCC | | 5 | 30 | μA |
| C _{ON} | Output ON capacitance | | 0.6 | | | pF |
| C _{OFF} | Output OFF capacitance | | 0.8 | | | pF |
| R _{ON} | Output ON resistance | VCC=2.7 to 3.6V, V _{CM} =0 to 2V I _O =-8mA | | 7.5 | 12 | Ω |
| ΔR _{ON} | On-resistance match between pairs of the same channel | VCC=2.7 to 3.6V, -0.35V ≤ V _{IN} ≤ 2.35V, I _O =-8mA | | 0.1 | 0.5 | Ω |
| R _{FLAT_ON} | On-resistance flatness R _{ON} (MAX)-R _{ON} (MIN) | VCC=2.7 to 3.6V, -0.35V ≤ V _{IN} ≤ 2.35V | | | 1 | Ω |
| I _{IH,CTRL} | Input high current, control pins(SEL, OEn) | | | | 1 | μA |
| I _{IL,CTRL} | Input low current ,control pins(SEL, OEn) | | | | 1 | μA |
| I _{IH,HS} | Input high current, high-speed pins[Ax/Bx/Cx][p/n] | V _{IN} =2V for selected port, A and B with SEL=0, and A and C with SEL=VCC | | | 1 | μA |
| I _{IH,HS} | Input high current, high-speed pins[Ax/Bx/Cx][p/n] | V _{IN} =2V for non-selected C with SEL=0, and B with SEL=VCC ⁽¹⁾ | | 160 | | μA |
| I _{IL,HS} | Input low current, high-speed pins[Ax/Bx/Cx][p/n] | | | | 1 | μA |

(1) There is a 20-kΩ pull-down in non-selected port.

AC Electrical Characteristics

VCC=2.7 to 3.6V, OEn=0, T_A=-40°C to 85°C (unless otherwise noted)

| PARAMETER | | | TEST CONDITION | MIN | TYP | MAX | UNIT |
|-----------------------|--|---------|----------------|------|------|-----|------|
| I _L | Differential insertion loss | AW35710 | f=4GHz | -1.7 | -1.1 | | dB |
| | | | f=5GHz | -1.8 | -1.4 | | |
| | | AW35711 | f=4GHz | -1.7 | -1.2 | | dB |
| | | | f=5GHz | -2.5 | -1.5 | | |
| BW | -3dB bandwidth | AW35710 | | 9 | 12 | | GHz |
| | | AW35711 | | 9 | 12 | | GHz |
| R _L | Differential return loss | | f=4GHz | | -20 | -16 | dB |
| | | | f=5GHz | | -16 | -14 | |
| O _{IRR} | Differential OFF isolation | | f=4GHz | | -22 | -20 | dB |
| | | | f=5GHz | | -20 | -18 | |
| X _{TALK} | Differential crosstalk | | f=4GHz | | -42 | -38 | dB |
| | | | f=5GHz | | -40 | -36 | |
| t _{PD} | Switch propagation delay ⁽¹⁾ ⁽²⁾ | | | 13 | 45 | 70 | ps |
| t _{SEL_ON} | Switching time SEL to Switch ON | | RL=50Ω | | 30 | 250 | ns |
| t _{SEL_OFF} | Switching time SEL to Switch OFF | | RL=50Ω | | 40 | 250 | ns |
| t _{OEn_ON} | Switching time OEn to Switch ON | | RL=50Ω | | 20 | 30 | μs |
| t _{OEn_OFF} | Switching time OEn to Switch OFF | | RL=50Ω | | 1.3 | 2.0 | μs |
| t _{SK_INTRA} | Intra-pair output skew | | | 0.5 | 5.3 | 6 | ps |
| t _{SK_INTER} | Inter-pair output skew | | | 0.5 | 8 | 20 | ps |

(1) The coaxial cable's bandwidth should > 8GHz.

(2) When test t_{PD} characteristic, should keep the input and output coaxial cable's characteristic impedance same.

Typical Characteristics

Test Information

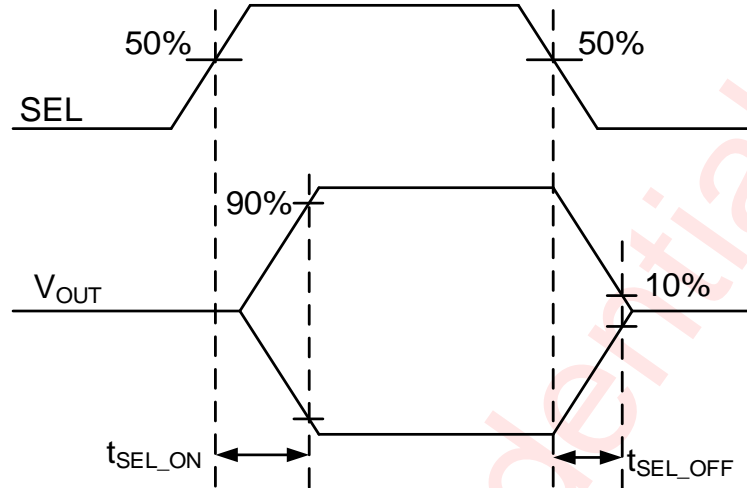


Figure1 Switch on and off

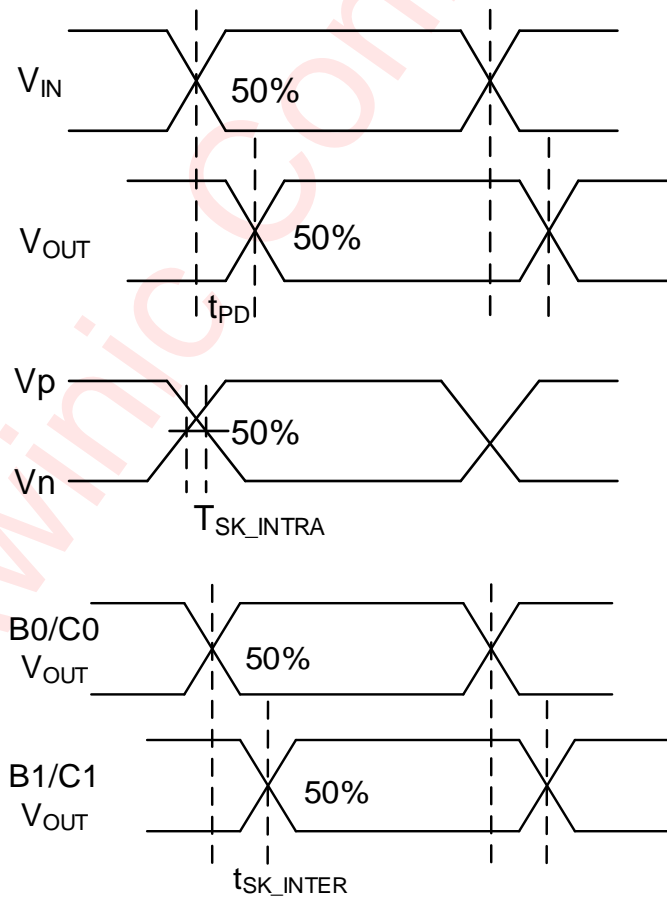
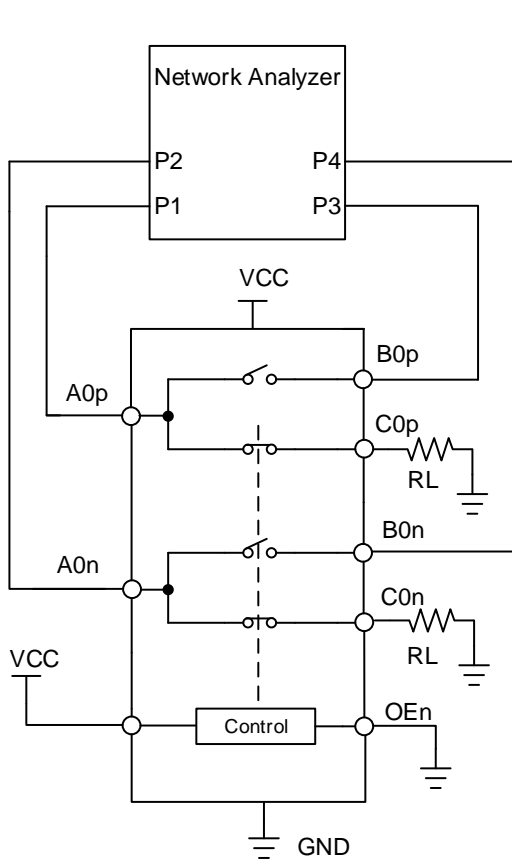
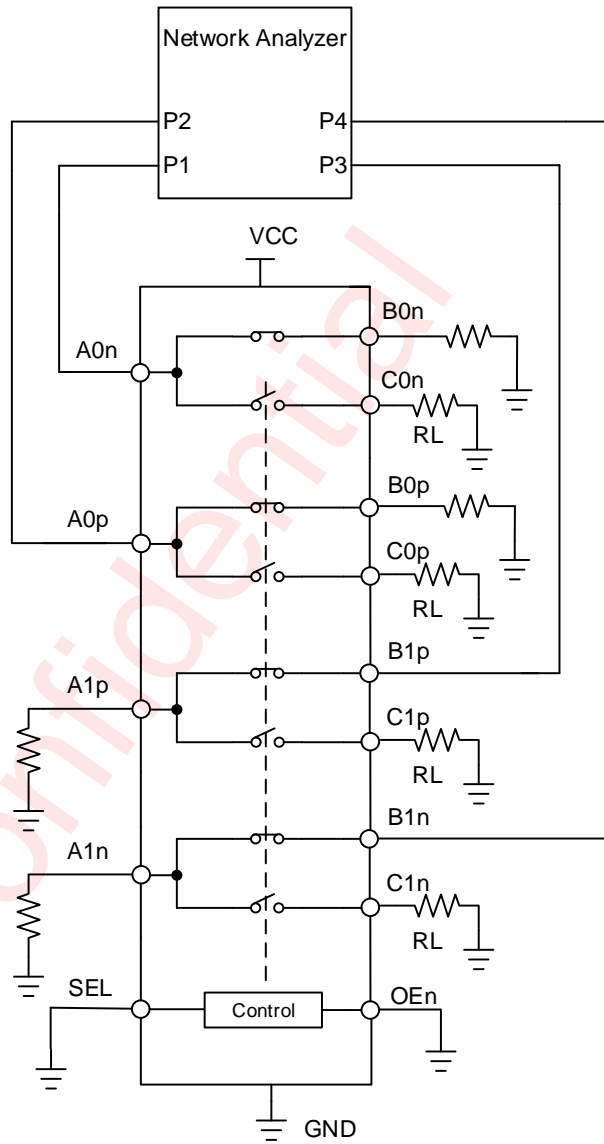


Figure2 Timing Diagrams



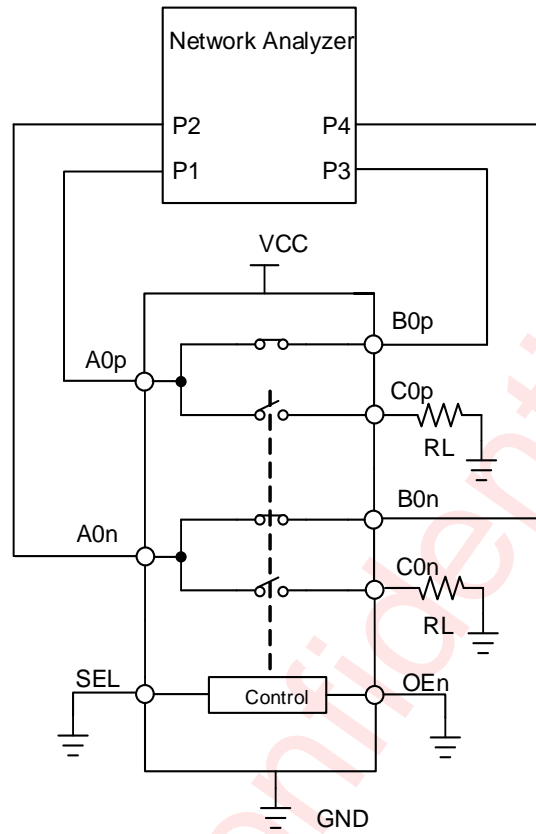
RL=50Ω
All unused ports are connected to GND through a 50Ω pull-down resistors

Figure3 Isolation



RL=50Ω
All unused ports are connected to GND through a 50Ω pull-down resistors

Figure4 Crosstalk

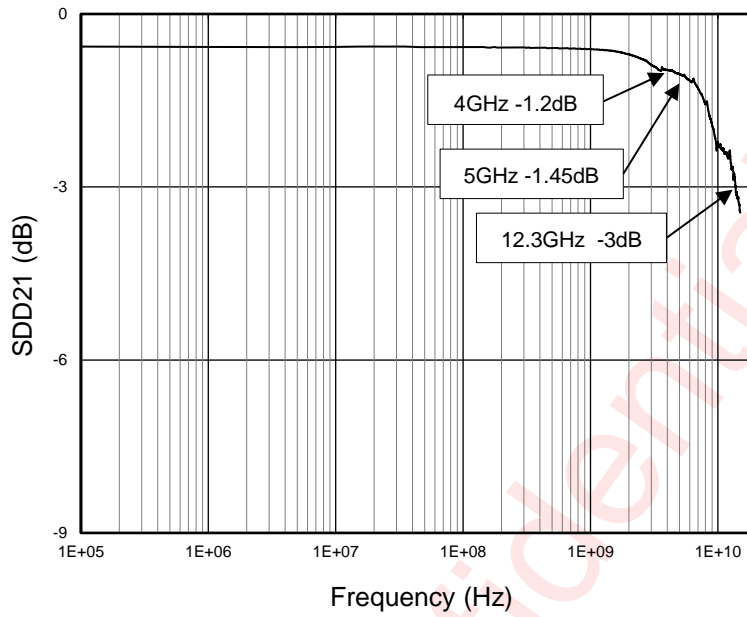


$RL=50\Omega$

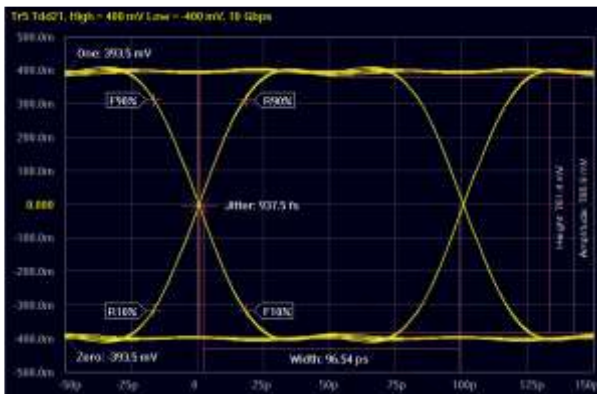
All unused ports are connected to GND through a 50Ω pull-down resistors

Figure5 -3dB Bandwidth, Differential return loss, Differential insertion loss

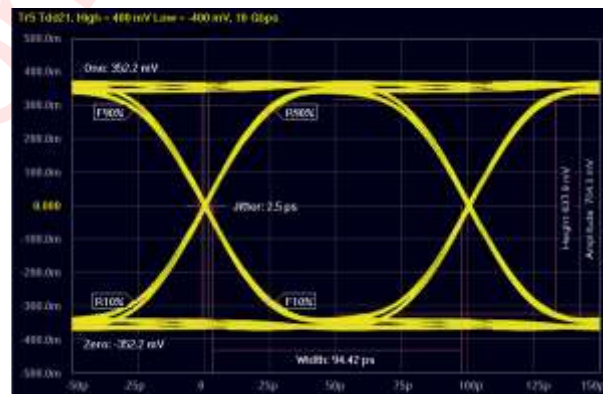
Typical Curve TA=25°C



-3dB Bandwidth Diagram



Before AW35710QNR



After AW35710QNR

10Gbps Output Eye Diagram

Detailed Functional Description

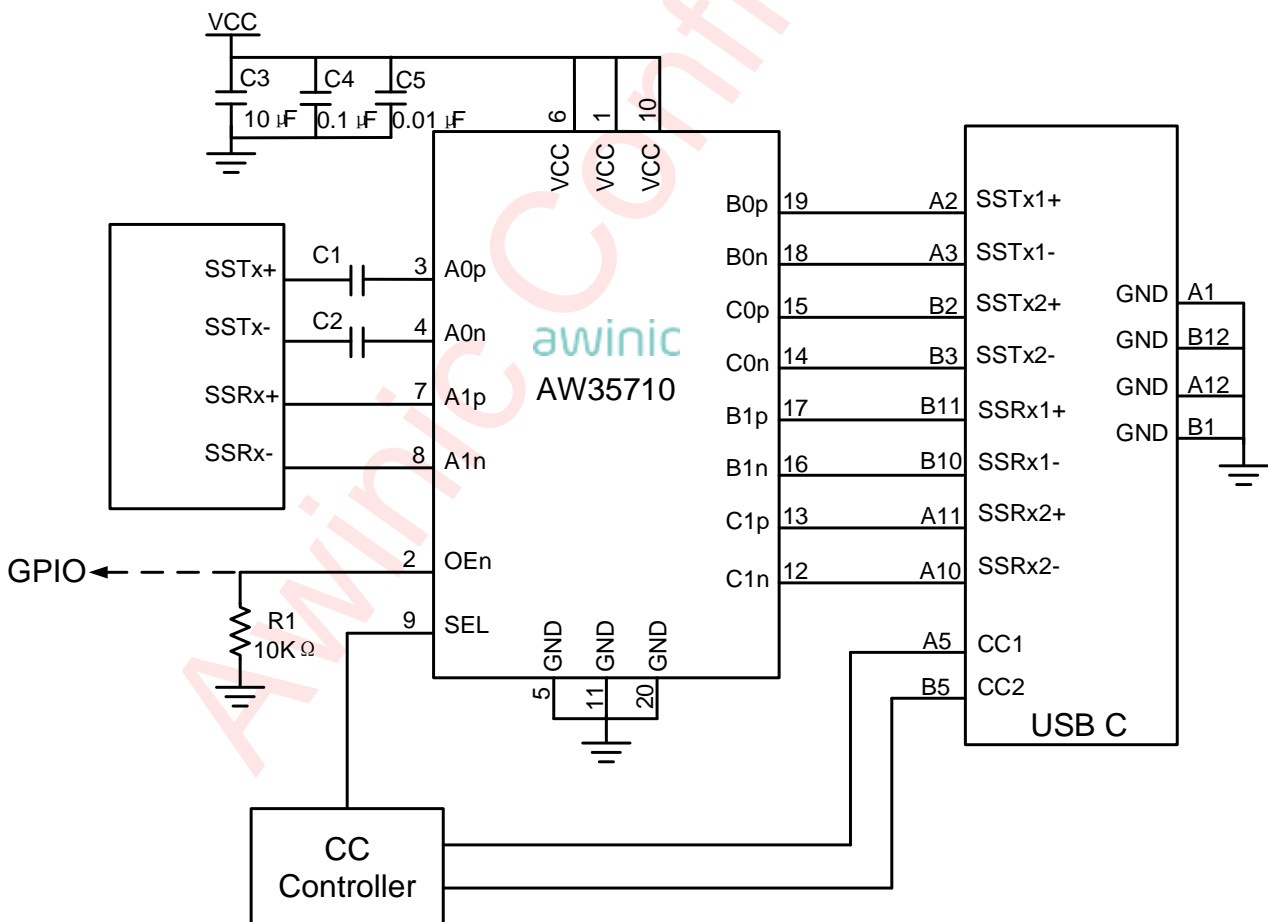
The AW3571X is a class of analog differential passive switch. The device can operate on any high-speed interface applications in the range of 0 to 2.2V common mode voltage. With employing adaptive tracking ,it ensures that the channel holds constant within the entire common mode voltage range.

The device has excellent dynamic characteristics, which allows high-speed switching with minimum attenuation with little extra jitter to the signal eye diagram.

Application Information

The AW3571X is a high-speed bidirectional passive switch, which can be configured in either mux or demux switch to meet the requirement of any high-speed interface application. The AW3571X supports signals with common mode voltage from 0V to 2.2V and differential amplitude up to 1800mVpp. The device adopts adaptive tracking to ensure that the channel remains unchanged in the whole common mode voltage range.

Many interfaces require AC coupling between the transmitter and receiver. The 0402 capacitor is best, and the value should match for the signal pairs. Place them along the TX pairs on the system board. The best way to place AC coupling capacitors is to keep them symmetric on the top layer of the board.



AW35710 Application Circuit: Down Facing Port for USB3.1 Type C Connector

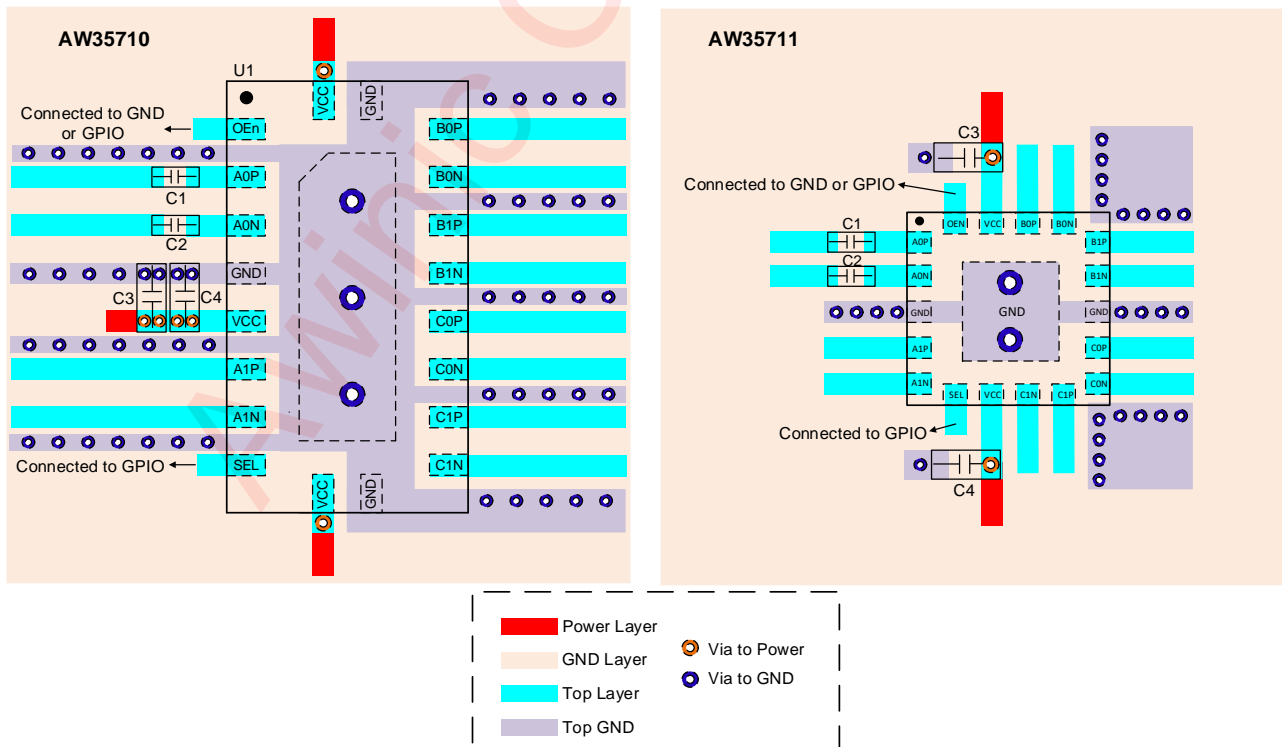
PCB Layout Information

Layout Guidelines

To obtain the optimal performance of AW3571X, PCB layout should be considered carefully. Here are some guidelines:

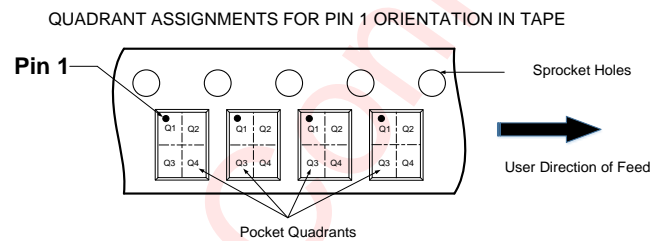
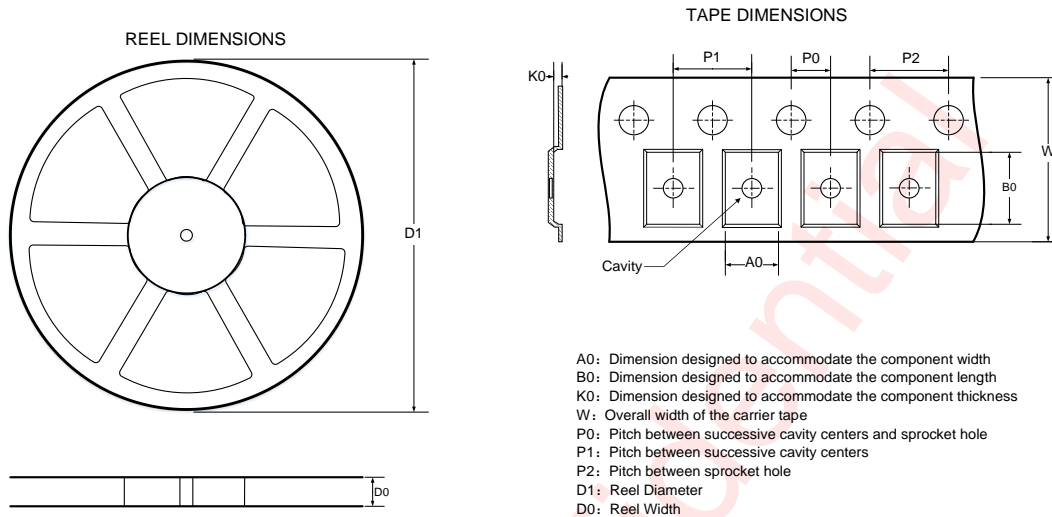
1. Place supply bypass capacitors as close to VCC and GND pin as possible and avoid placing the bypass capacitors near the high-speed traces.
2. The characteristic impedance of the traces must match that of the receiver and transmitter to maintain signal integrity.
3. Route the high-speed signals using a minimum amount of vias and corners which reduces signal reflections and impedance changes. When it becomes necessary to make the traces turn 90°, use an arc instead of making a single 90° turn.
4. Do not route high-speed traces under or near crystals, oscillators, clock signal generators, switching regulators, mounting holes, magnetic devices or ICs that use or duplicate clock signals.
5. Avoid stubs on the high-speed signal lines because they cause signal reflections.
6. Route all high-speed signal traces over continuous GND planes, with no interruptions.
7. High speed differential traces ensures equal width, line length and line spacing.

Layout Example



Tape And Reel Information

QFN 4.5mmX2.5mm-20L

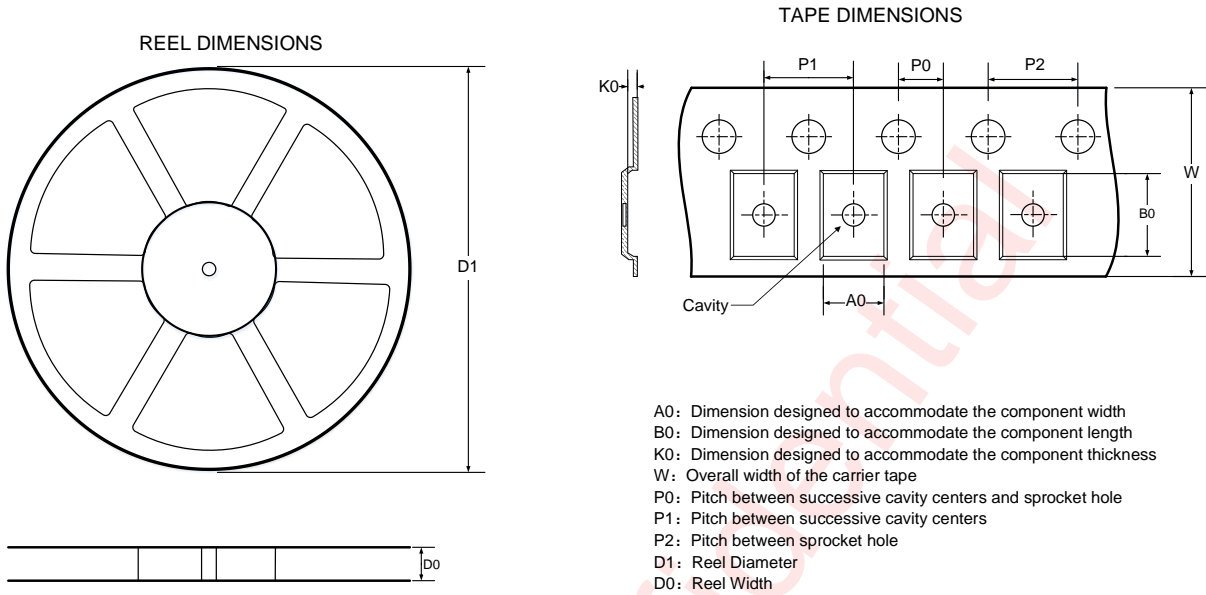


DIMENSIONS AND PIN1 ORIENTATION

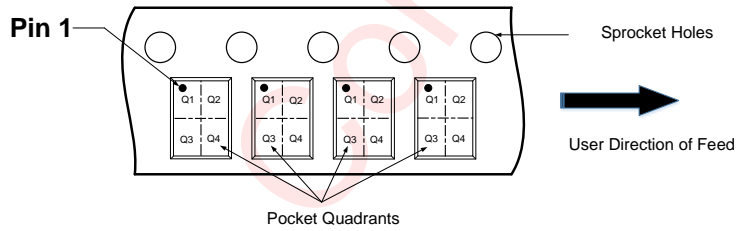
| D1 (mm) | D0 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|------------|------------|------------|------------|------------|------------|------------|------------|-----------|---------------|
| 330 | 12.4 | 2.75 | 4.75 | 0.75 | 2 | 4 | 4 | 12 | Q1 |

All dimensions are nominal

QFN 2.0mmX2.0mm-18L



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



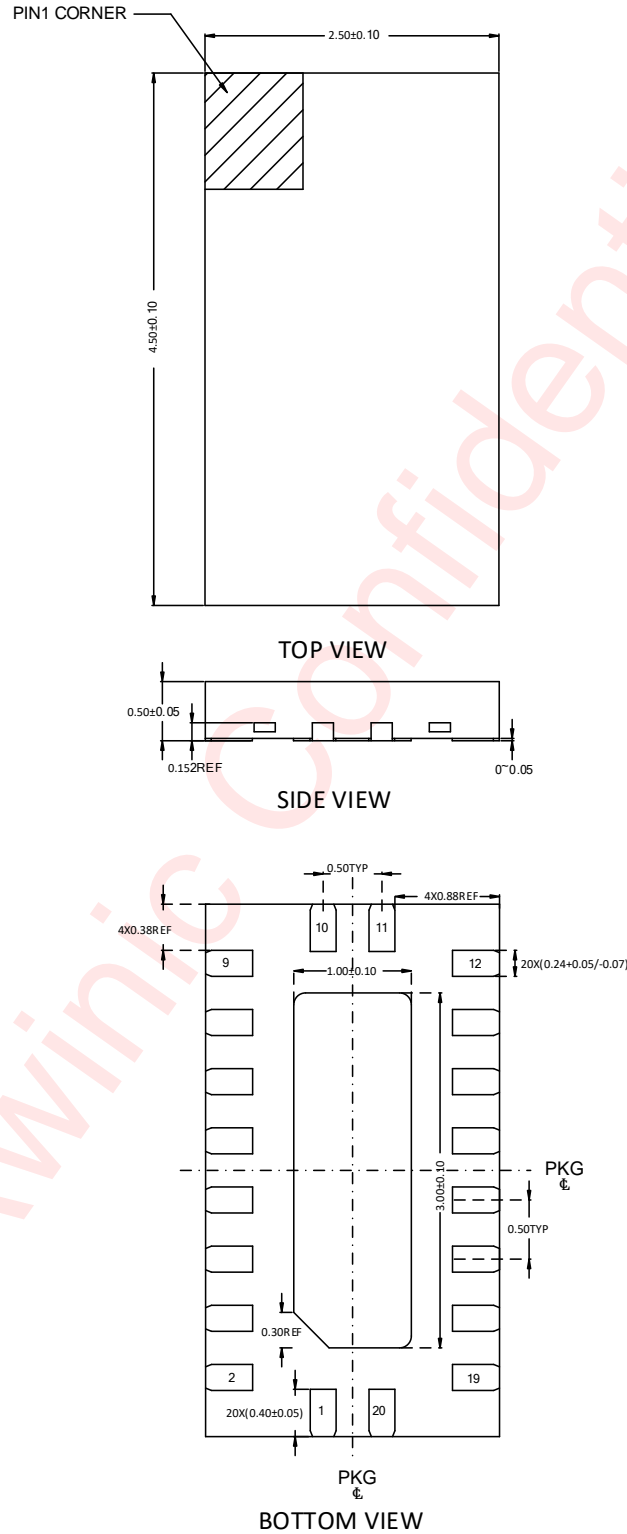
DIMENSIONS AND PIN1 ORIENTATION

| D1 (mm) | D0 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|---------|---------|---------|---------|---------|---------|---------|---------|--------|---------------|
| 178 | 8.4 | 2.25 | 2.25 | 0.75 | 2 | 4 | 4 | 8 | Q1 |

All dimensions are nominal

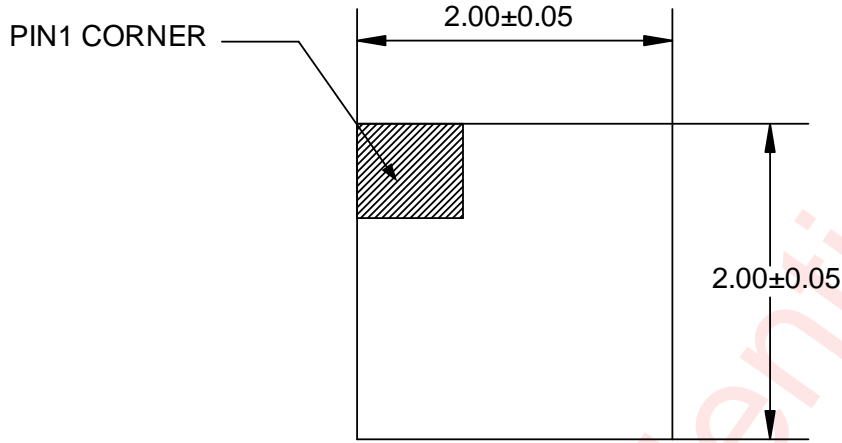
Package Description

QFN 4.5mmX2.5mm-20L

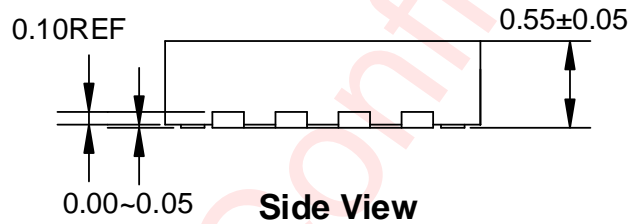


Unit: mm

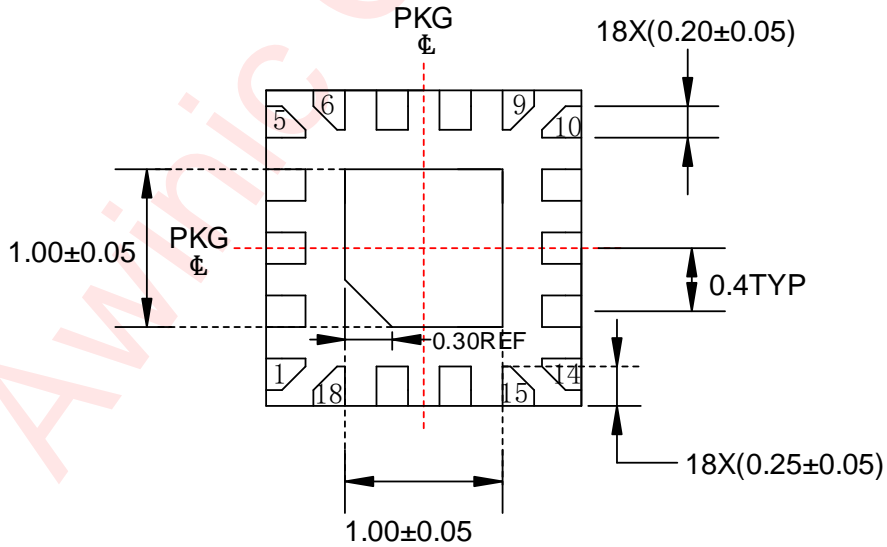
QFN 2.0mmX2.0mm-18L



Top View



Side View

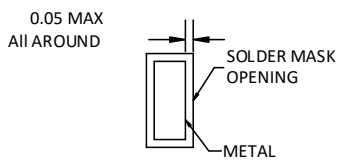
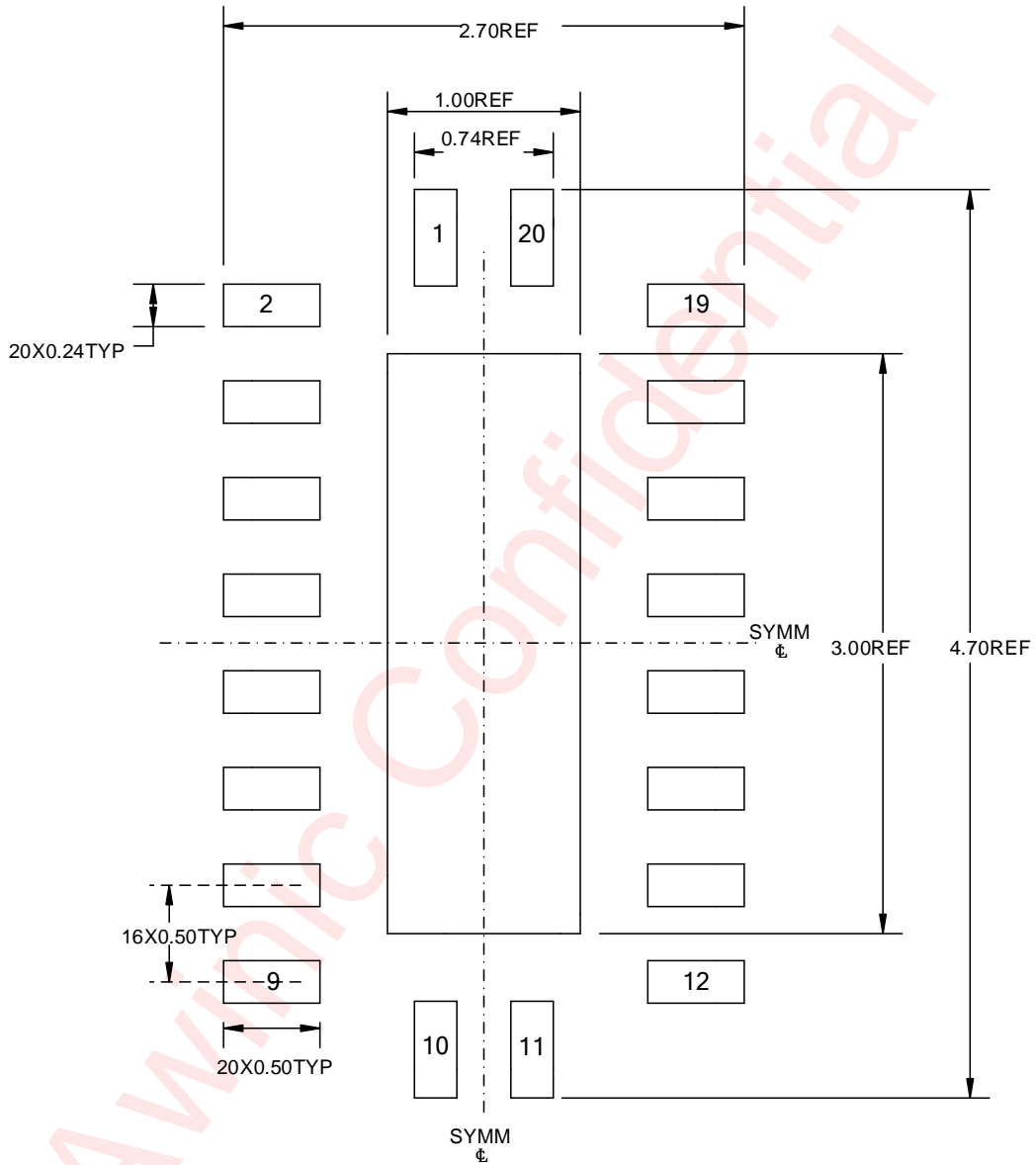


Bottom View

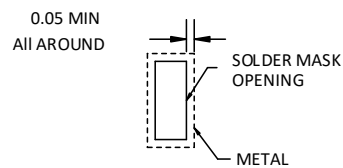
Unit: mm

Land Pattern Data

QFN 4.5mmX2.5mm-20L



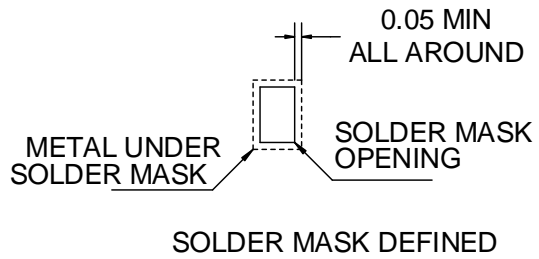
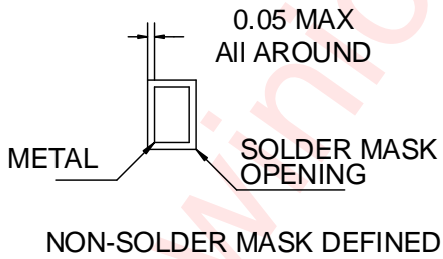
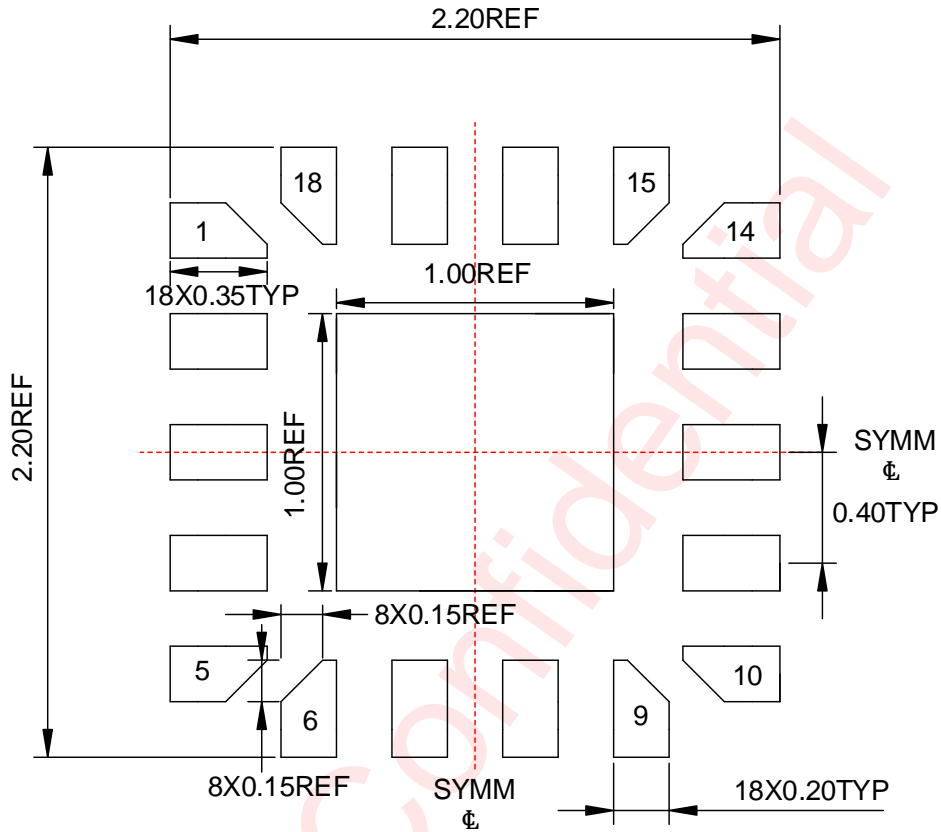
NON SOLDER MASK DEFINED



SOLDER MASK DEFINED

Unit: mm

QFN 2.0mmX2.0mm-18L



Unit: mm

Revision History

| Version | Date | Change Record |
|---------|----------------|--|
| V1.0 | July 2020 | Officially released |
| V1.1 | November 2020 | Add t_{PD} , t_{SK_INTRA} , t_{SK_INTER} min characteristics |
| V1.2 | January 2021 | Add ΔR_{ON} TYP characteristic |
| V1.3 | April 2021 | Update the DC and AC Electrical Characteristics |
| V1.4 | September 2021 | Add AW35711QNR |
| V1.5 | November 2021 | Add 2.7V and 3.6V characteristics |
| V1.6 | November 2021 | Add t_{PD} characteristic's test condition |
| V1.7 | June 2022 | Update Pin Configuration and Absolute Maximum Ratings |
| V1.8 | Jan 2026 | Update -3dB bandwidth and Differential insertion loss |

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