

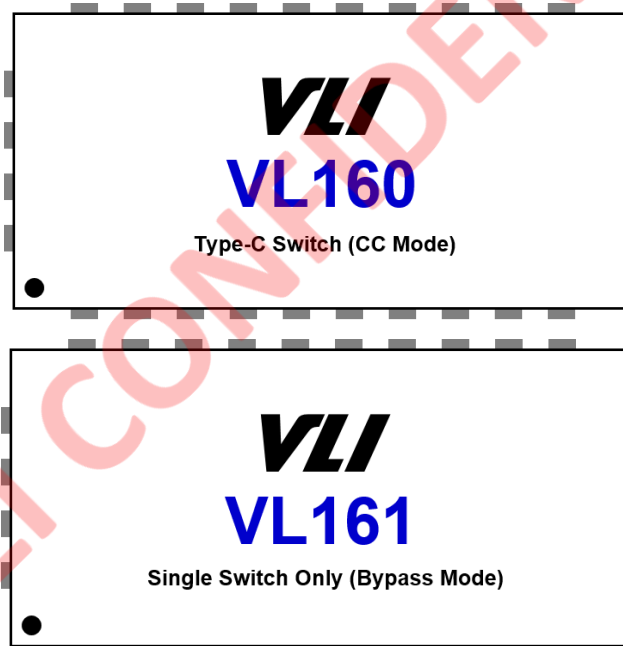
Datasheet

USB 3.1 10G Data Switch with USB Type-C CC Detection Interface

- VL160 Type-C Switch (CC Mode)
- VL161 Single Switch Only (Bypass Mode)

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Revision 0.50



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Revision History

| Revision No. | Draft Date | History | Initial |
|--------------|---------------|---------------------|---------|
| 0.50 | Oct. 08. 2015 | Preliminary Release | TH |

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Product Feature

USB 3.1 10G Data Switch with USB Type-C CC Detection Interface

VL160: Type-C Switch (CC Mode)

VL161: Single Switch Only (Bypass Mode)

- **4:2 10Gbps USB Type-C Data Switch**
- **Support up to 10 Gbps**
- **2 Differential Channel, 2:1 MUX/DeMUX**
- **Compatible with 10 Gbps USB3.1 Gen2**
- **Low power consumption with 0.5mA active and 4uW shutdown**
- **High DC common mode voltage supporting to 2.2V**
- **28 pins QFN 3.5x4.5mm package**
- **ESD > 2KV, CDM > 500V**
- **MUX**
 - Insertion loss: 1.5dB @ 5GHz typ.
 - Return loss: 15dB @ 5GHz typ.
 - Crosstalk Isolation: 30dB @ 5GHz typ.
 - Off Isolation: 15dB @ 5GHz typ.
- **CC Functional**
 - Define Role: Device (UFP, default) or Host (DFP)
 - Plug Orientation: Flipped or Not, and control Switch SEL
 - (UFP) Current Capability Detect: 3.0A, 1.5A, or 0.9A
 - (UFP) Rd
 - (DFP) Rp (or Ip), Vconn SW if Ra
 - (DFP) VBUS_EN to turn on Host VBUS SW
- **Vconn**
 - 5V, max Power is 1W, max current is 250mA
 - Over current protection

Block Diagram

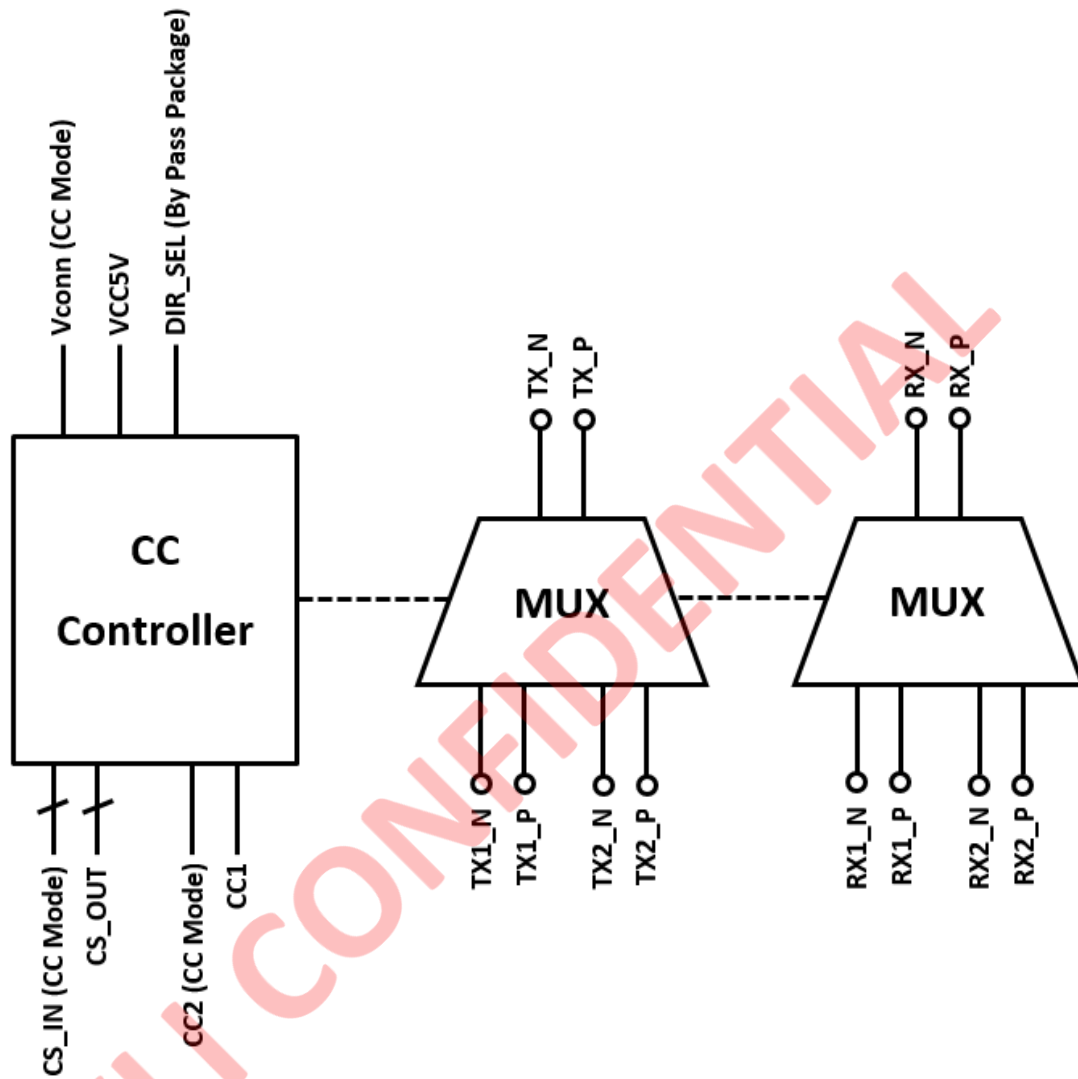


Figure 1 - Block Diagram

Pinout

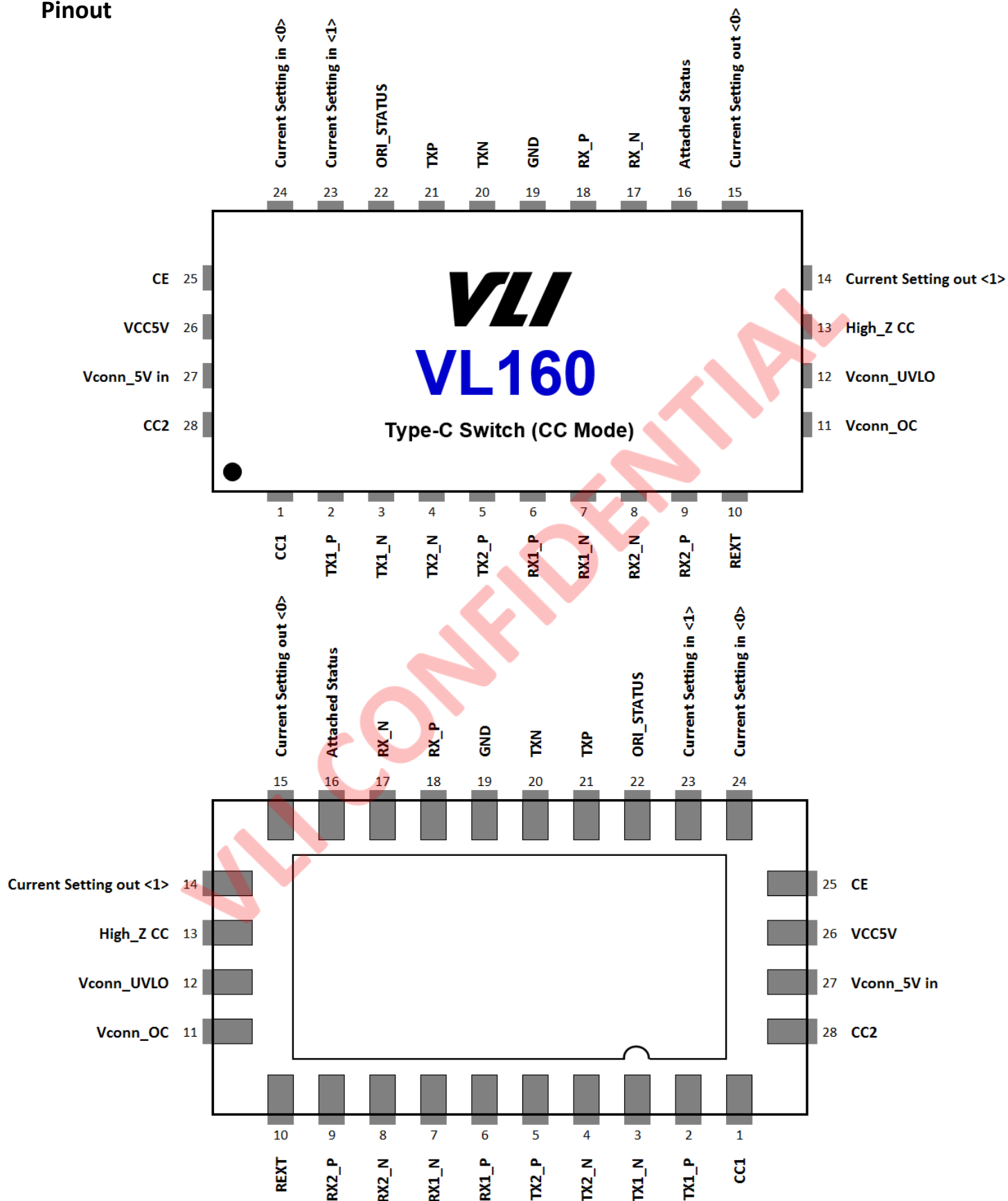


Figure 2 - VL160 Pin Diagram (MQFN-28)

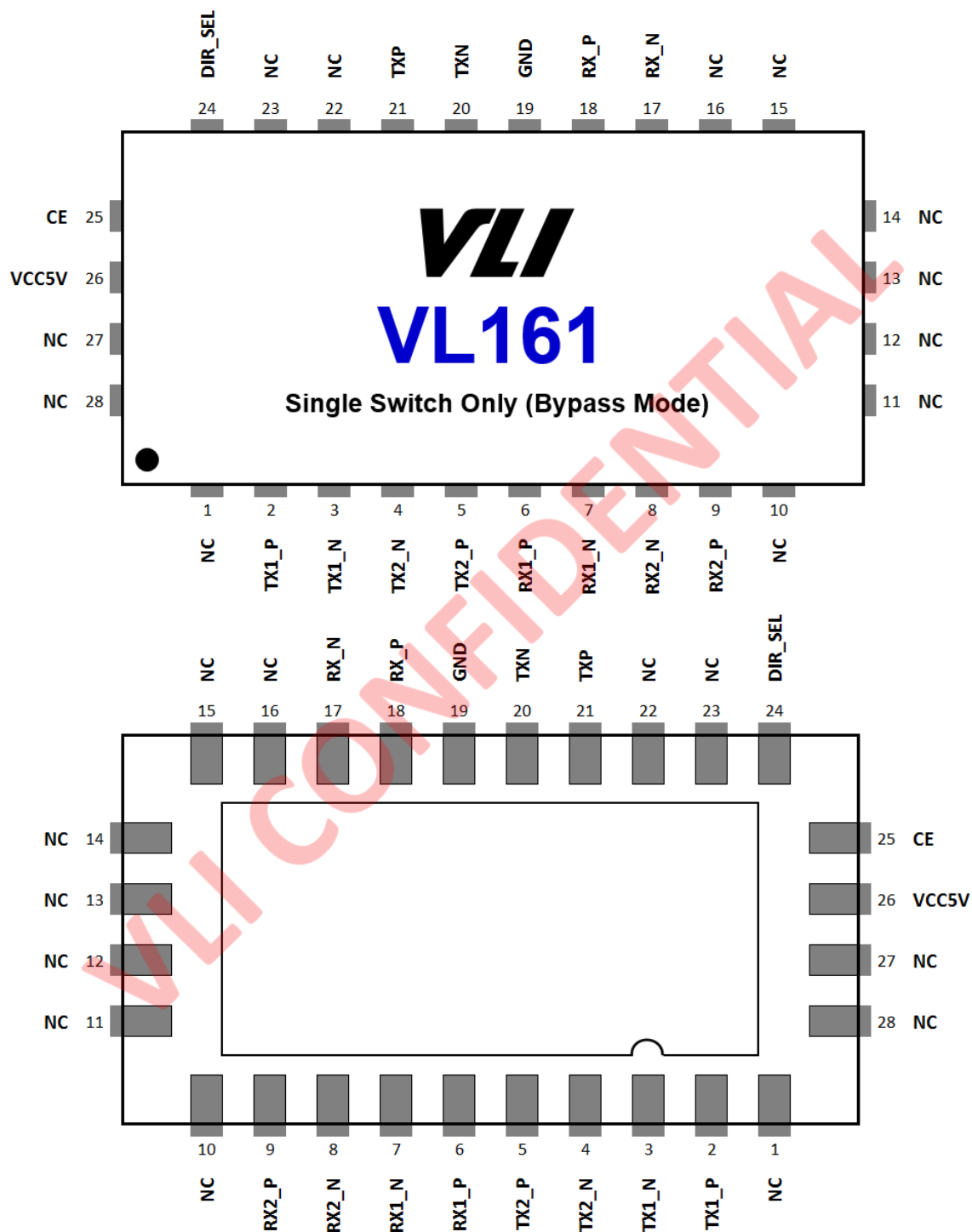


Figure 3 - VL161 Pin Diagram (MQFN-28)

Pin List

VL160

| Pin | Pin Name |
|-----|-------------------------|
| 1 | CC1 |
| 2 | TX1_P |
| 3 | TX1_N |
| 4 | TX2_N |
| 5 | TX2_P |
| 6 | RX1_P |
| 7 | RX1_N |
| 8 | RX2_N |
| 9 | RX2_P |
| 10 | REXT |
| 11 | Vconn_OC |
| 12 | Vconn_UVLO |
| 13 | High_Z CC |
| 14 | Current Setting out <1> |

| Pin | Pin Name |
|-----|-------------------------|
| 15 | Current Setting out <0> |
| 16 | Attached_Status |
| 17 | RX_N |
| 18 | RX_P |
| 19 | GND |
| 20 | TXN |
| 21 | TXP |
| 22 | ORI_STATUS |
| 23 | Current Setting in <1> |
| 24 | Current Setting in <0> |
| 25 | CE |
| 26 | VCC5V |
| 27 | Vconn_5V in |
| 28 | CC2 |

VL161

| Pin | Pin Name |
|-----|----------|
| 1 | NC |
| 2 | TX1_P |
| 3 | TX1_N |
| 4 | TX2_N |
| 5 | TX2_P |
| 6 | RX1_P |
| 7 | RX1_N |
| 8 | RX2_N |
| 9 | RX2_P |
| 10 | NC |
| 11 | NC |
| 12 | NC |
| 13 | NC |
| 14 | NC |

| Pin | Pin Name |
|-----|----------|
| 15 | NC |
| 16 | NC |
| 17 | RX_N |
| 18 | RX_P |
| 19 | GND |
| 20 | TXN |
| 21 | TXP |
| 22 | NC |
| 23 | NC |
| 24 | DIR_SEL |
| 25 | CE |
| 26 | VCC5V |
| 27 | NC |
| 28 | NC |

Pin Descriptions

VL160

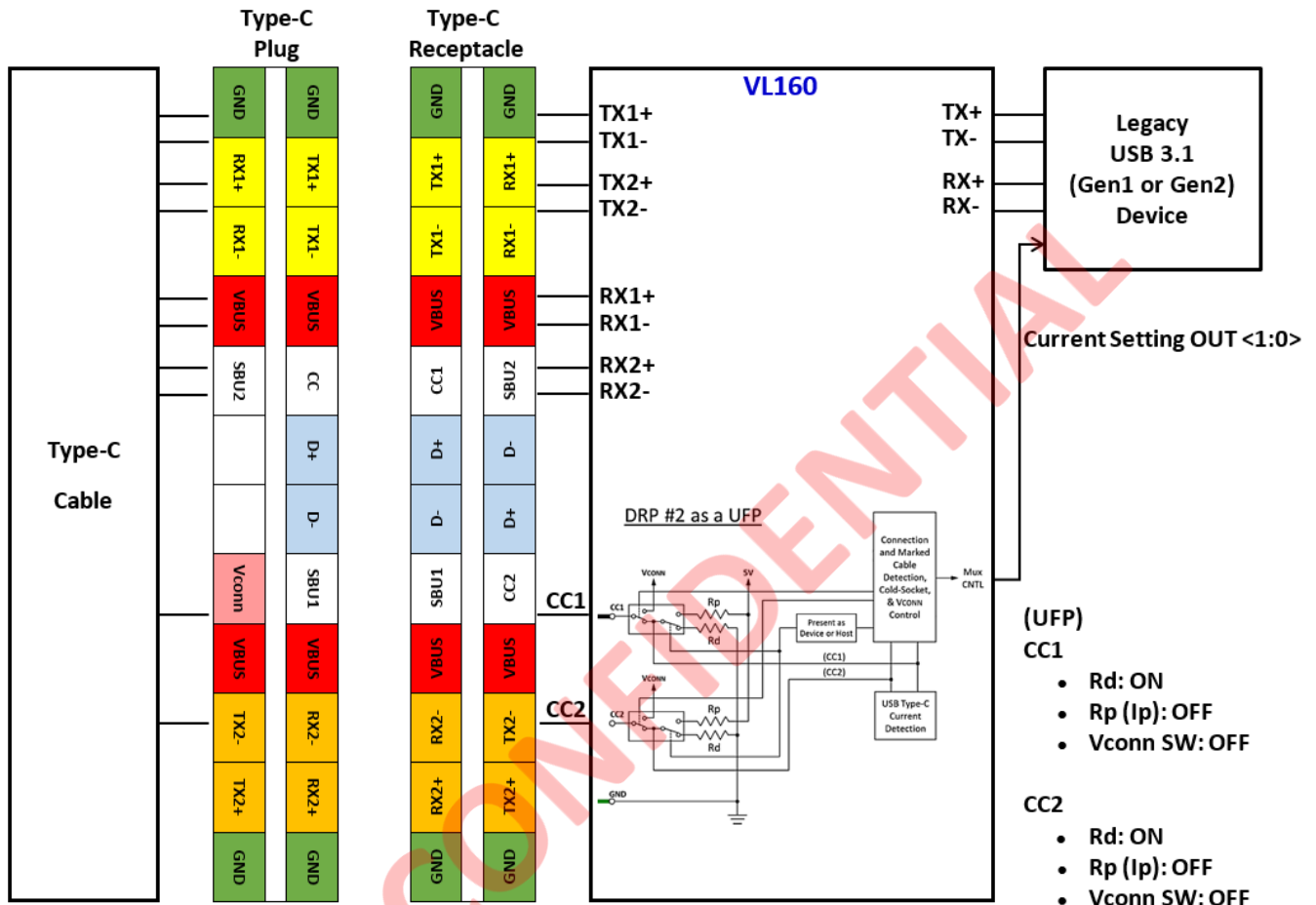
| Pin Name | Pin # | I/O | Description |
|-------------------------|-------|----------------|--|
| AI/O | 1 | AI/O | 0~5V analog input |
| TX1_P | 2 | High Speed I/O | USB differential pair |
| TX1_N | 3 | | |
| TX2_N | 4 | High Speed I/O | USB differential pair |
| TX2_P | 5 | | |
| RX1_P | 6 | High Speed I/O | USB differential pair |
| RX1_N | 7 | | |
| RX2_N | 8 | High Speed I/O | USB differential pair |
| RX2_P | 9 | | |
| REXT | 10 | | External resister 20.5k 1% connect to GND |
| Vconn_OC | 11 | DO | Vconn Over current, 3.3V = Over current |
| Vconn_UVLO | 12 | DO | Vconn Under voltage, 3.3V = under voltage |
| High_Z CC | 13 | DI | Turn off Rp/Rd on CC1/CC2, 0V = Normal mode, 5V = Hi-Z mode |
| Current Setting out <1> | 14 | DO | (3.3V logic) 11: CC Support 3A 10: CC Support 1.5A 01: UNDEFINED |
| Current Setting out <0> | 15 | DO | 00: CC Support Legacy Reasoning: Easily identify 3A vs 1.5A or Legacy / 1.5A or Legacy using just 1 pin. If they need to differentiate between 1.5A and 3A, then use 2 pins |
| Attached_Status | 16 | DO | Indication for port attached, 3.3V = attached |
| RX_N | 17 | High Speed I/O | USB differential pair |
| RX_P | 18 | | |
| GND | 19 | GND | Ground |
| TXN | 20 | High Speed I/O | USB differential pair |
| TXP | 21 | | |
| ORI_STATUS | 22 | DO | Orientation status 0 = TX1/RX1, 3.3V = TX2/RX2 |
| Current Setting in <1> | 23 | AI | Rp/Rd setting input (3.3V logic) 00: Ip = 80uA 01: Ip = 180uA 10: Ip = 330uA 11: Rd = 5.1Kohm |
| Current Setting in <0> | 24 | AI | 00: Rp = 36Kohm 01: Rp = 12Kohm 10: Rp = 4.7Kohm 11: Rd = 5.1Kohm |
| CE | 25 | DI | Chip Enable (5V = Enable) |
| VCC5V | 26 | PWR | VCC5V for controller |
| VCONN_5V in | 27 | PWR | 5V input for Vconn |
| CC2 | 28 | AI/O | 0~5V analog input |

VL161

| Pin Name | Pin # | I/O | Description |
|----------|-------|----------------|--|
| NC | 1 | | No connection |
| TX1_P | 2 | High Speed I/O | USB differential pair |
| TX1_N | 3 | | |
| TX2_N | 4 | High Speed I/O | USB differential pair |
| TX2_P | 5 | | |
| RX1_P | 6 | High Speed I/O | USB differential pair |
| RX1_N | 7 | | |
| RX2_N | 8 | High Speed I/O | USB differential pair |
| RX2_P | 9 | | |
| NC | 10 | | No connection |
| NC | 11 | | No connection |
| NC | 12 | | No connection |
| NC | 13 | | No connection |
| NC | 14 | | No connection |
| NC | 15 | | No connection |
| NC | 16 | | No connection |
| RX_N | 17 | High Speed I/O | USB differential pair |
| RX_P | 18 | | |
| GND | 19 | GND | Ground |
| TXN | 20 | High Speed I/O | USB differential pair |
| TXP | 21 | | |
| NC | 22 | | No connection |
| NC | 23 | | No connection |
| DIR_SEL | 24 | AI | BYPASS mode (3.3V logic) (1)DIR_SEL='L', <TX1, RX1> output (2)DIR_SEL='H', <STX2, RX2> output |
| CE | 25 | | No connection |
| VCC5V | 26 | PWR | VCC5V for controller |
| NC | 27 | | 5V input for Vconn |
| NC | 28 | | 0~5V analog input |

Application Diagram

VL160 (CC Mode) for Cable + Device



Legacy USB 3.1 (Gen1 or Gen2) Host

Current Setting in <1:0>

VL160

Type-C Receptacle

Type-C Plug

Type-C Cable + Device (Ra + Rd) Or Type-C Device (Rd)

DRP #1 as a DFP

CC1

- Rd: OFF
- Rp (Ip): ON
- Vconn SW: ON if Ra

CC2

- Rd: OFF
- Rp (Ip): ON
- Vconn SW: ON if Ra

Electrical Specification

Absolute Maximum Rating

| Symbol | Parameter | Min | Max | Unit | Note |
|------------------|--|-----|-----|------|------------------|
| T _{STG} | Storage Temperature | -55 | 125 | °C | - |
| V _{ESD} | Electrostatic Discharge | TBD | TBD | V | Human Body Model |
| θ _{jc} | Thermal resistance between junction and case | TBD | | °C/W | |
| P _D | Max Power Dissipation | - | TBD | W | |

Note: Stress above conditions may cause permanent damage to the device.
Functional operation of this device should be restricted to the conditions described.

Note: About thermal factors, T_a is the concerned ambient temperature, and

$$\theta_{ca} = \theta_{ja} - \theta_{jc}$$

$$T_j = \theta_{ja} * P_D + T_a$$

$$T_c = \theta_{ca} * P_D + T_a$$

Operating Conditions

| Symbol | Parameter | Min | Typ. | Max | Unit | Note |
|----------------|----------------------|-----|------|-----|------|------|
| VDD | Supply voltage | 3.0 | 3.3 | 3.6 | V | |
| T _A | Ambient Temperature | -45 | | 85 | °C | |
| T _j | Junction Temperature | 0 | | 125 | °C | - |

Static characteristics:

VDD = 3.3V ± 10 %; Tamb = -40°C to +85°C; unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ. | Max | Unit |
|--------|---------------------------|-------------------|-----|------|-----|------|
| IDD | Supply current | Operation mode | | | | mA |
| | | Shutdown mode | | | | mA |
| VIH | High-level input voltage | | | | | V |
| VIL | Low-level input voltage | | | | | V |
| VI | Input voltage | Differential pins | | | | V |
| VIC | Common mode input voltage | | | | | |

Reflow Profile

Follow: IPC/JEDEC J-STD-020 D.1

Condition

Average ramp-up rate (217°C to peak): 1~2°C /sec max.

Preheat: 150~200°C, 60~120 seconds

Temperature maintained above 217°C: 60~150 seconds

Time (tp)* within 5 °C of the specified classification temperature ($T_c = (260^\circ\text{C})$), (the time above 255°C) ≥ 30 sec.

Peak temperature: 260+5/-0°C

Ramp-down rate: 3°C /sec. max.

Time 25°C to peak temperature: 8 minutes max.

Cycle interval: 5 minus

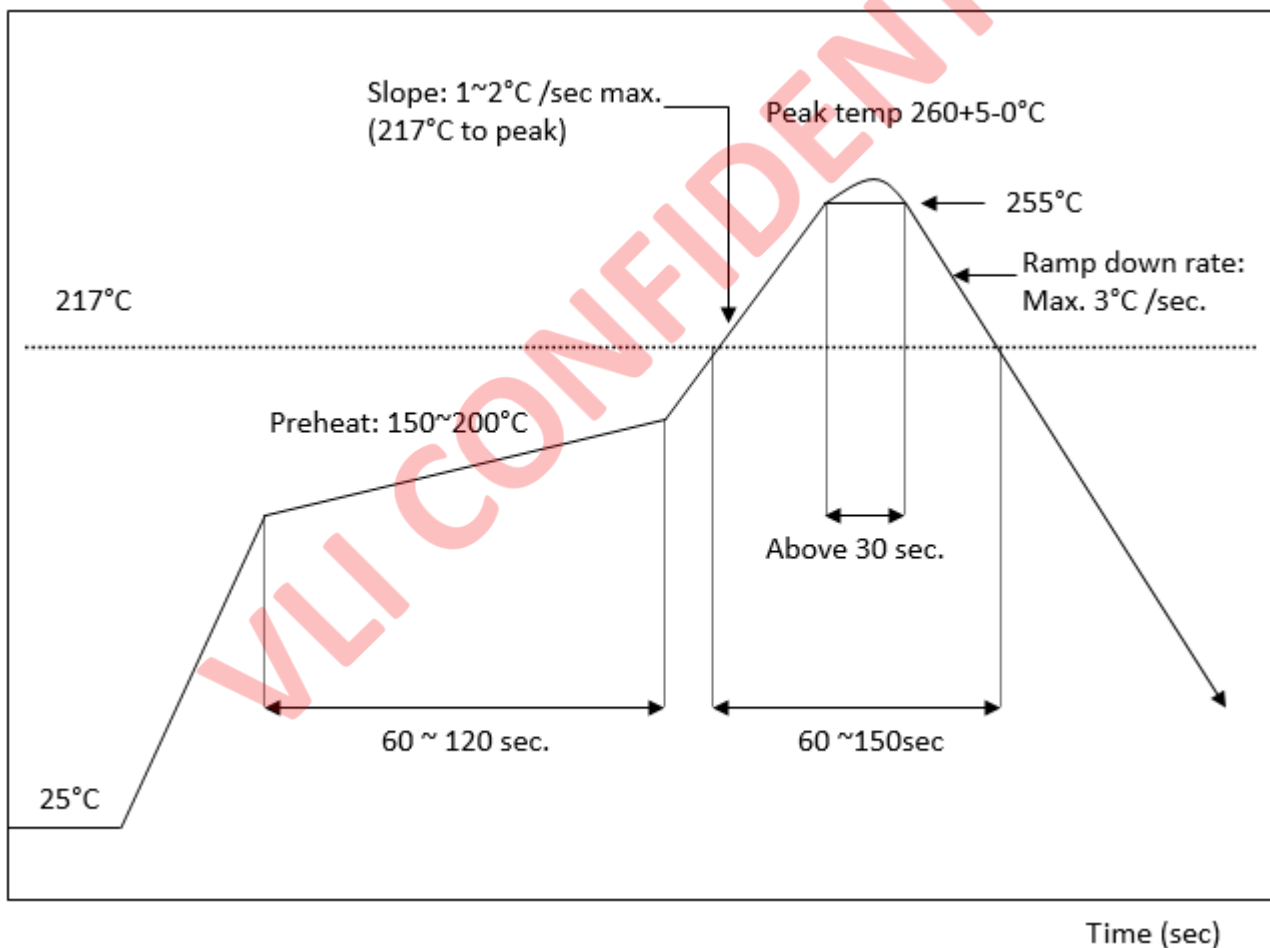


Figure 4 - Reflow

Package Mechanical Specifications

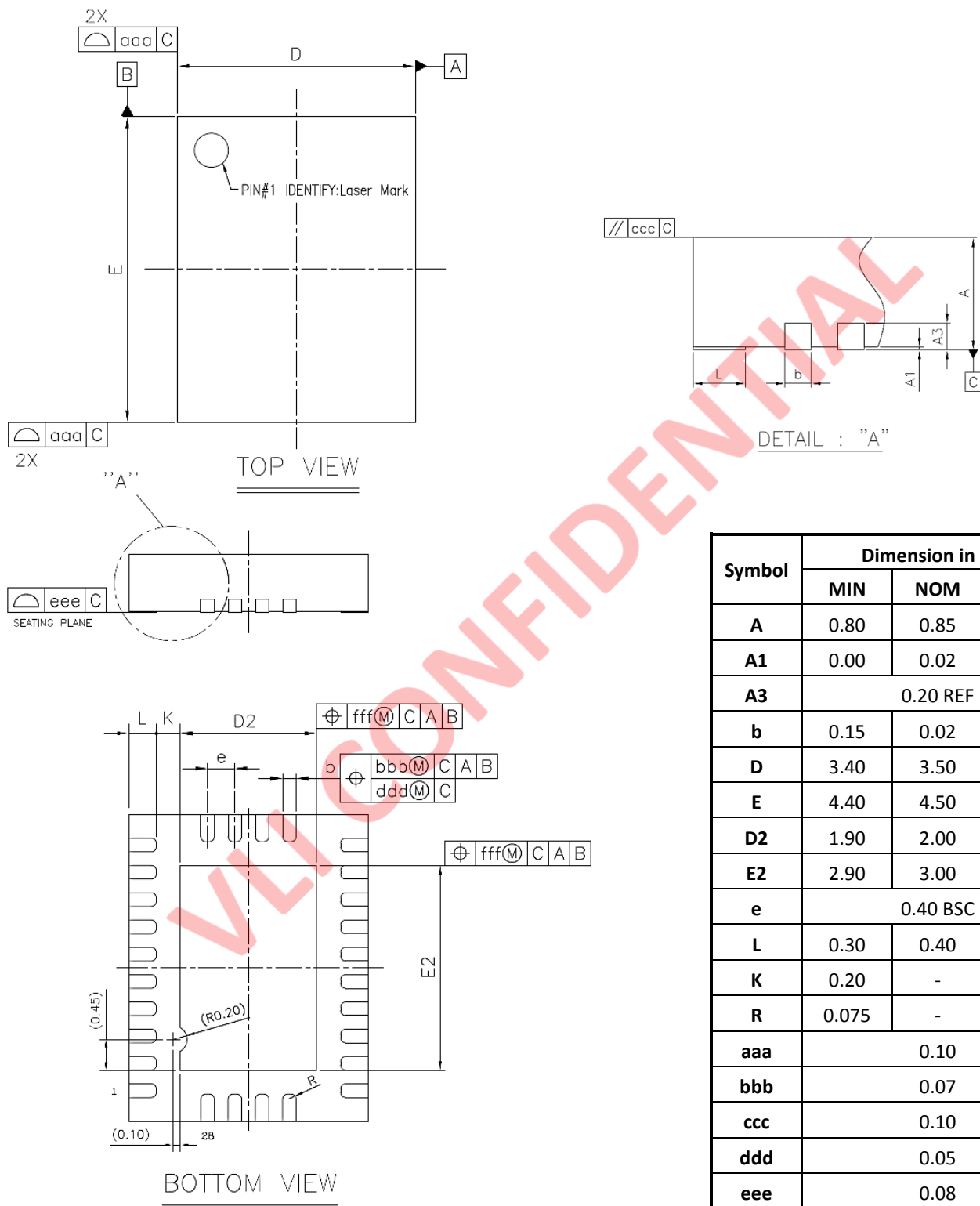


Figure 5 - Mechanical Specification

Ordering Information

| Part Number | Description | Package Type |
|-------------|----------------------------------|---------------------|
| VL160 | Type-C Switch (CC Mode) | MQFN-28 (3.5x4.5mm) |
| VL161 | Single Switch Only (Bypass mode) | MQFN-28 (3.5x4.5mm) |

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