VIA Labs, Inc.

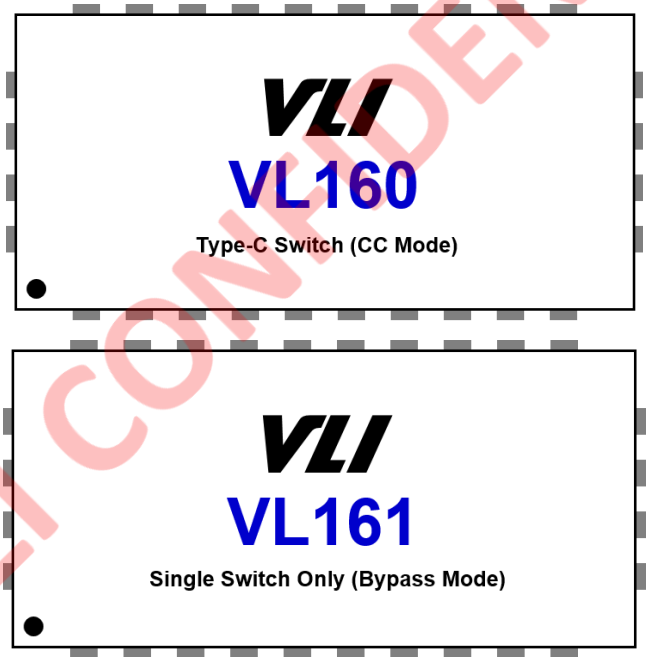
Datasheet

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)

October 08, 2015

Revision 0.50



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Revision History

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

Contents

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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

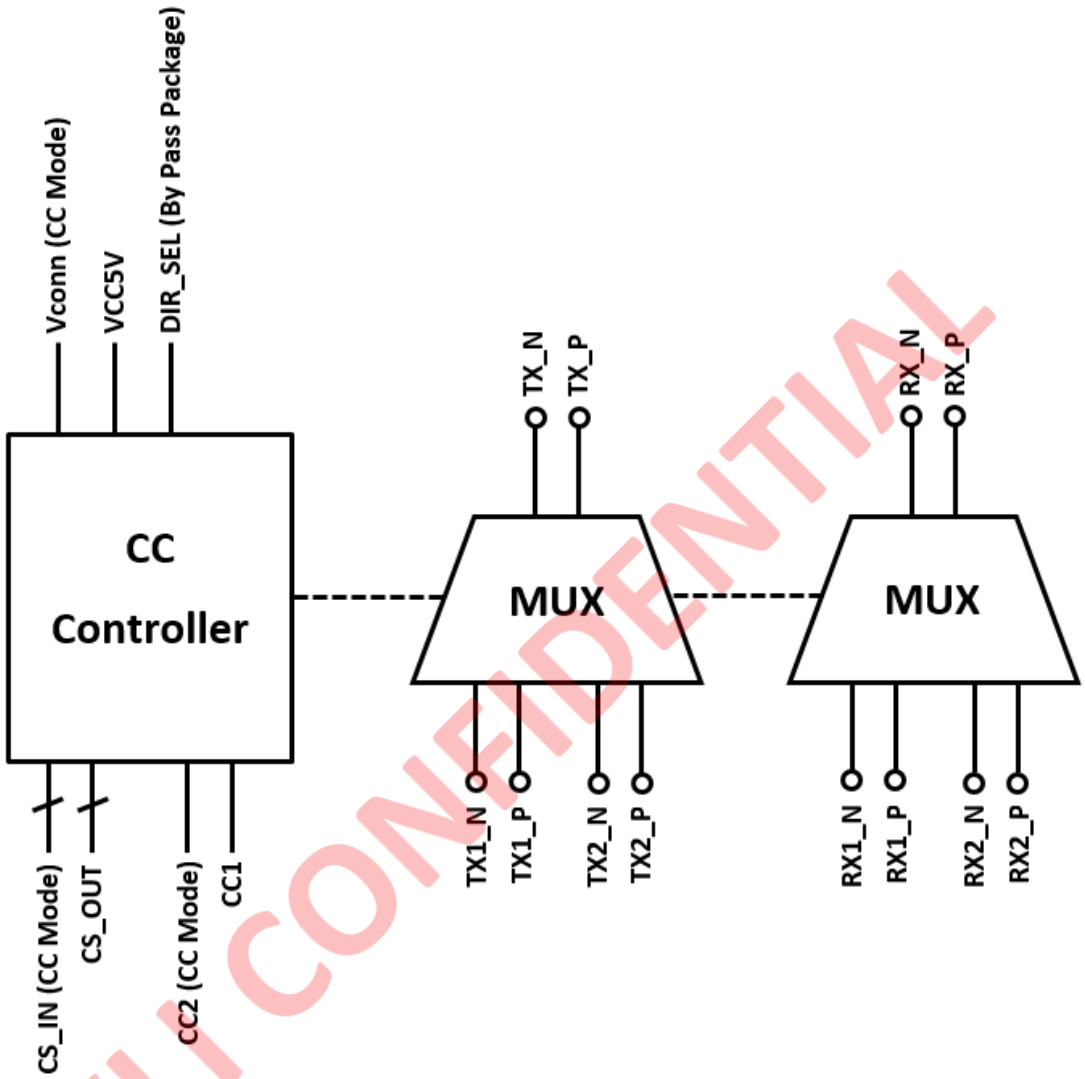


Figure 1 - Block Diagram

Pinout

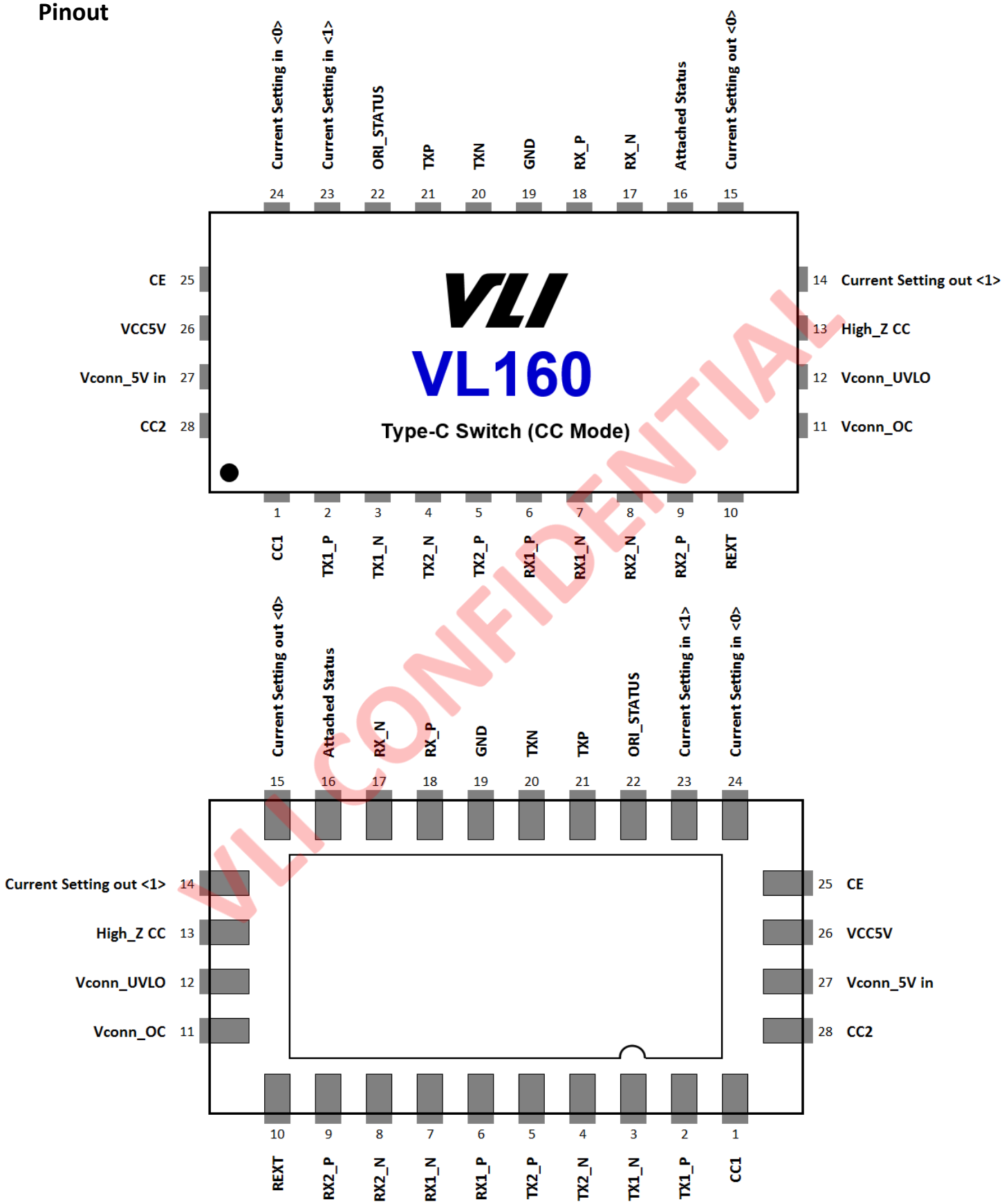


Figure 2 - VL160 Pin Diagram (MQFN-28)

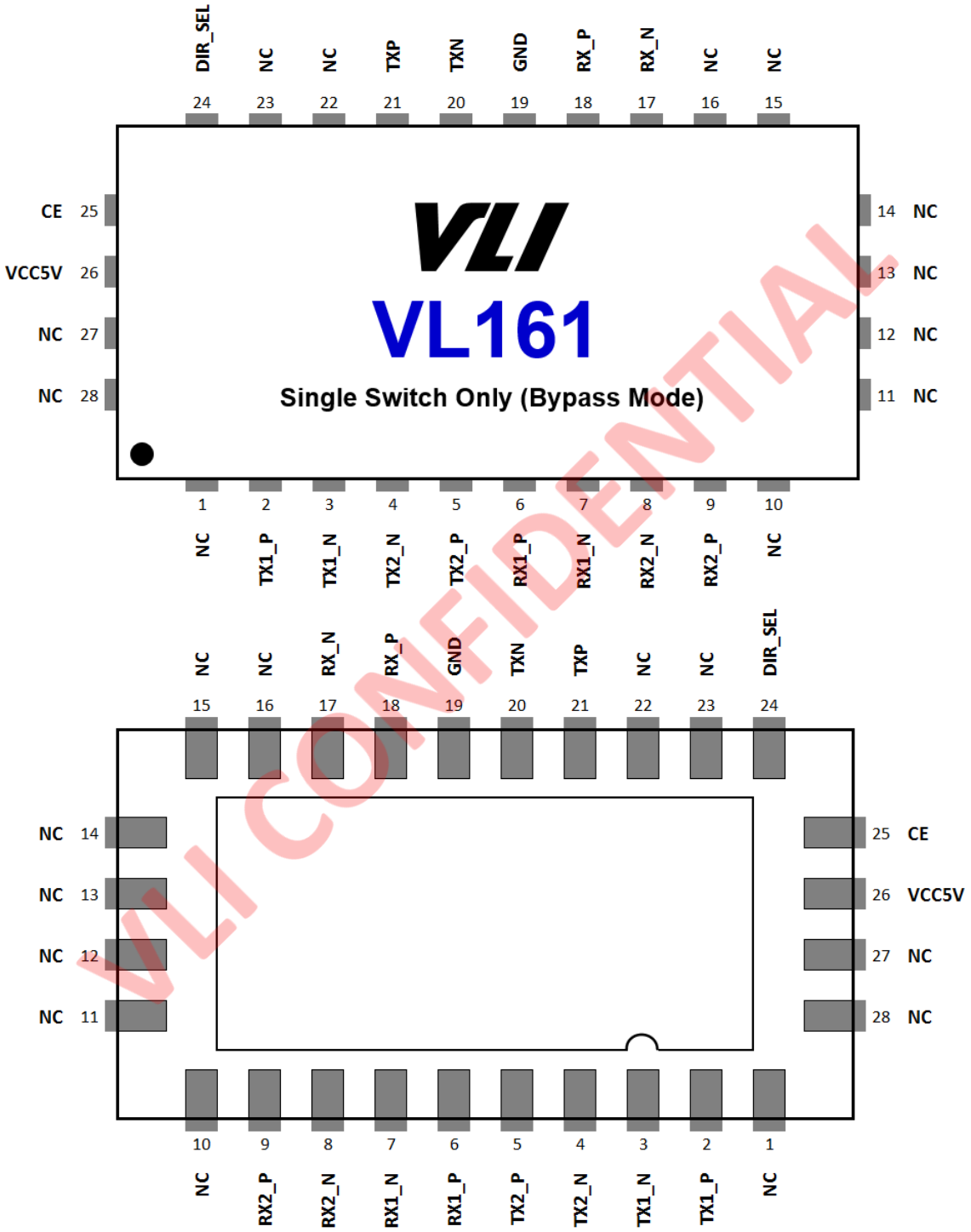


Figure 3 - VL161 Pin Diagram (MQFN-28)

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

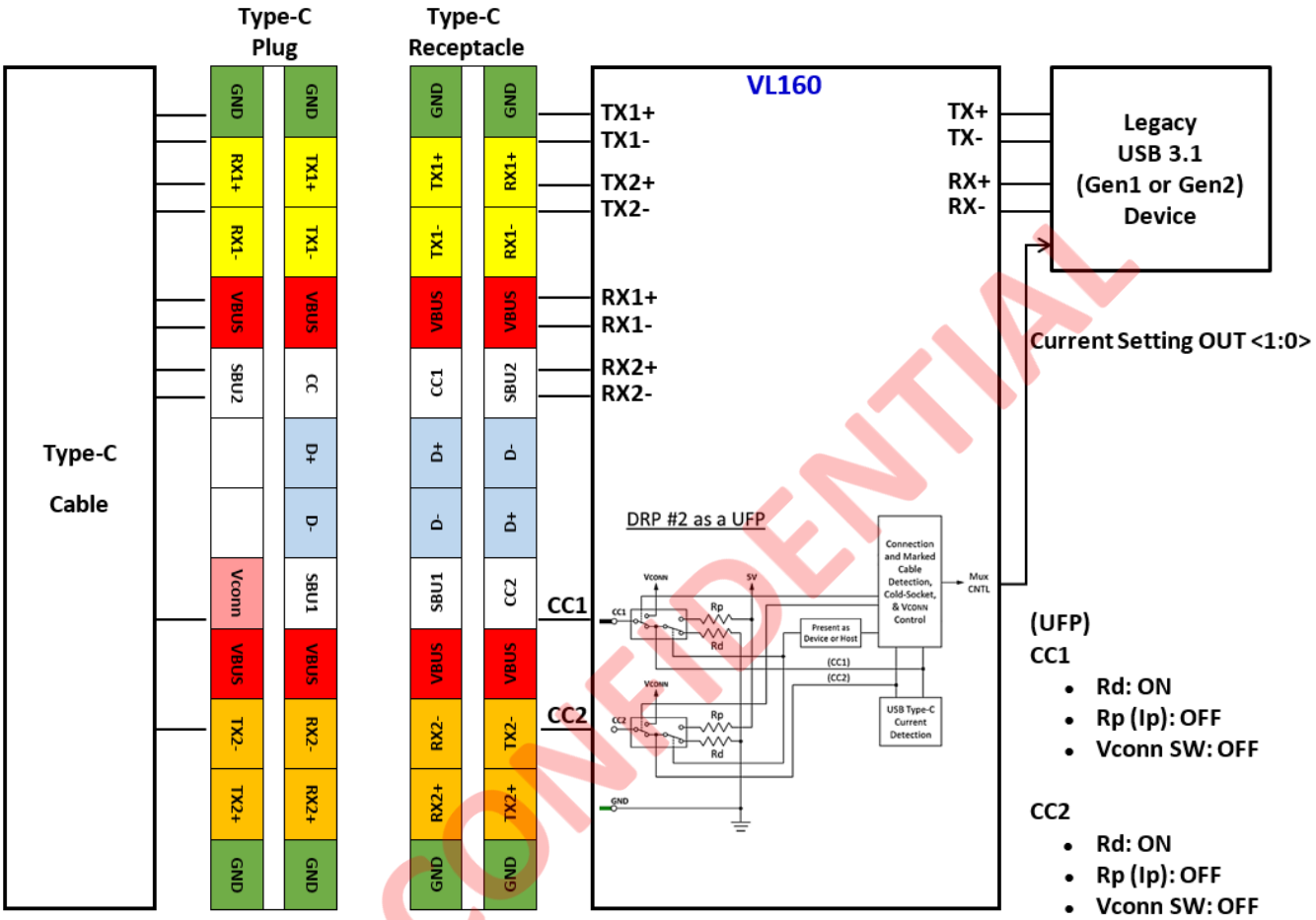
Pin Name	Pin #	I/O	Description
AI/O	1	AI/O	0~5V analog input
TX1_P	2	High Speed I/O	USB differential pair
TX1_N	3		
TX2_N	4	High Speed I/O	USB differential pair
TX2_P	5		
RX1_P	6	High Speed I/O	USB differential pair
RX1_N	7		
RX2_N	8	High Speed I/O	USB differential pair
RX2_P	9		
REXT	10		External resister 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 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
Current Setting out <0>	15	DO	
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

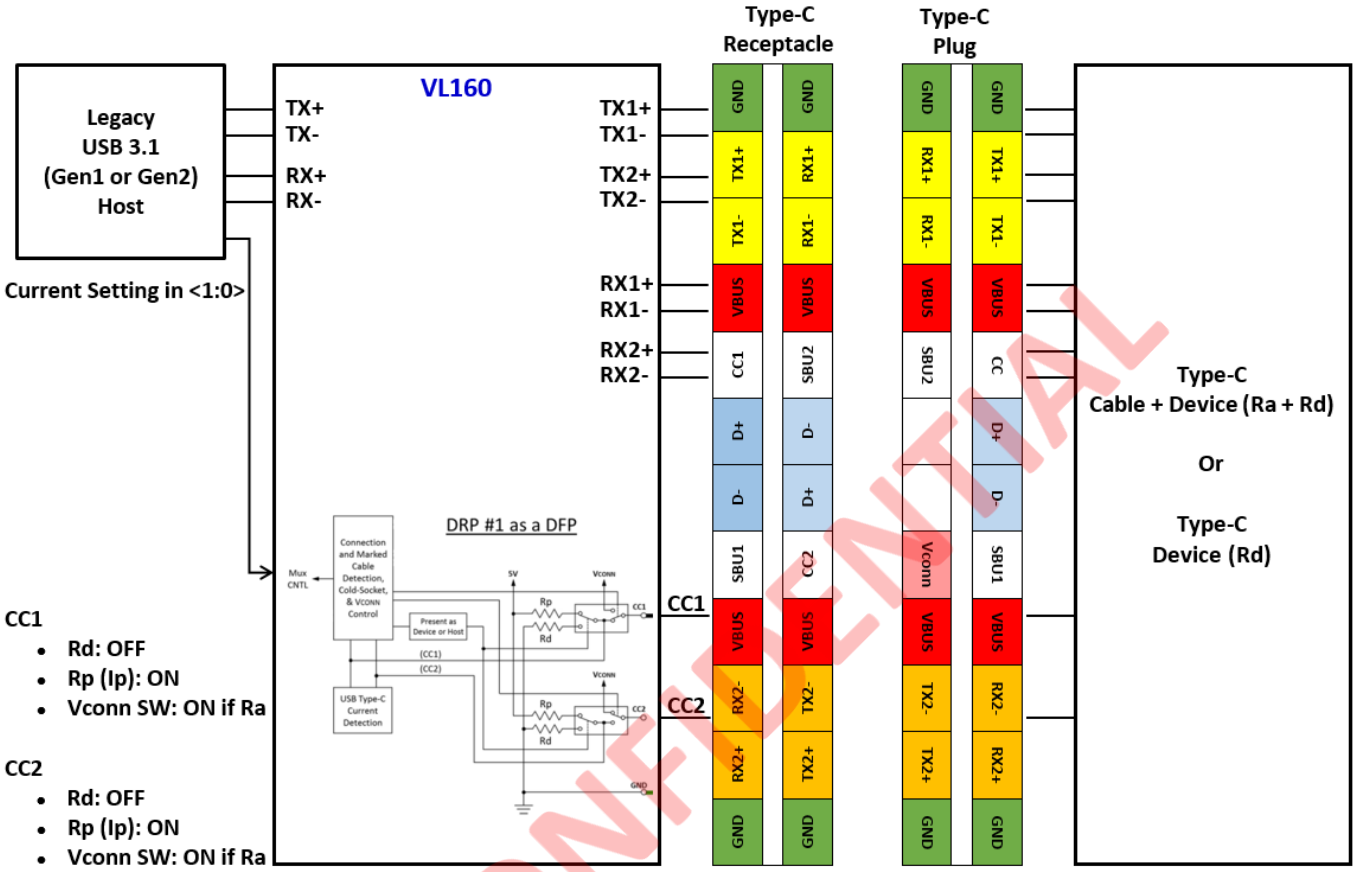
Pin Name	Pin #	I/O	Description
NC	1		No connection
TX1_P	2	High Speed I/O	USB differential pair
TX1_N	3		
TX2_N	4	High Speed I/O	USB differential pair
TX2_P	5		
RX1_P	6	High Speed I/O	USB differential pair
RX1_N	7		
RX2_N	8	High Speed I/O	USB differential pair
RX2_P	9		
NC	10		No connection
NC	11		No 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



VL160 (CC Mode) for Host + Cable or Host only



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: 150~200C, 60~120 seconds

Temperature maintained above 217°C: 60~150 seconds

Time (tp)* within 5 °C of the specified classification temperature (Tc = (260°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

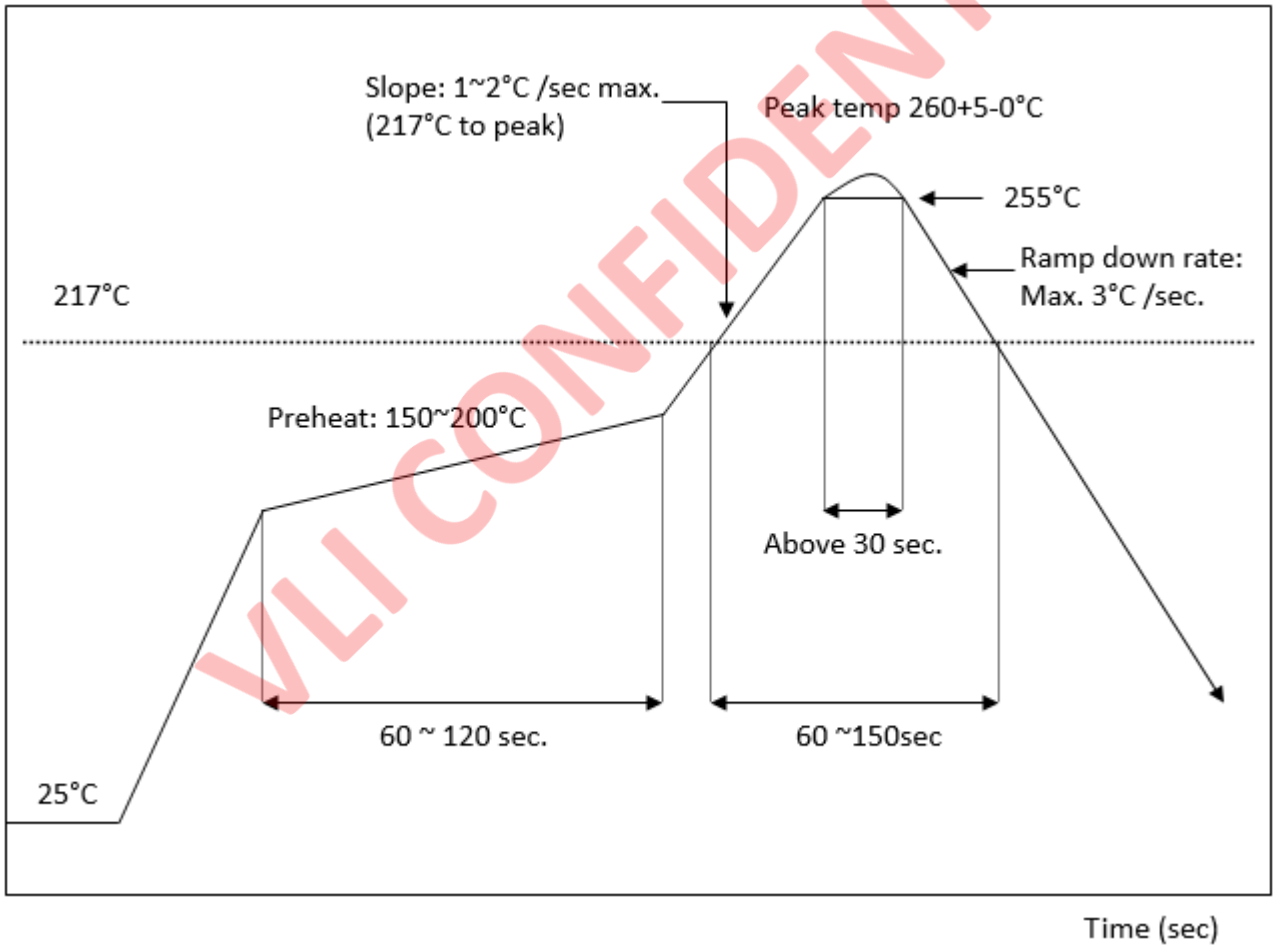
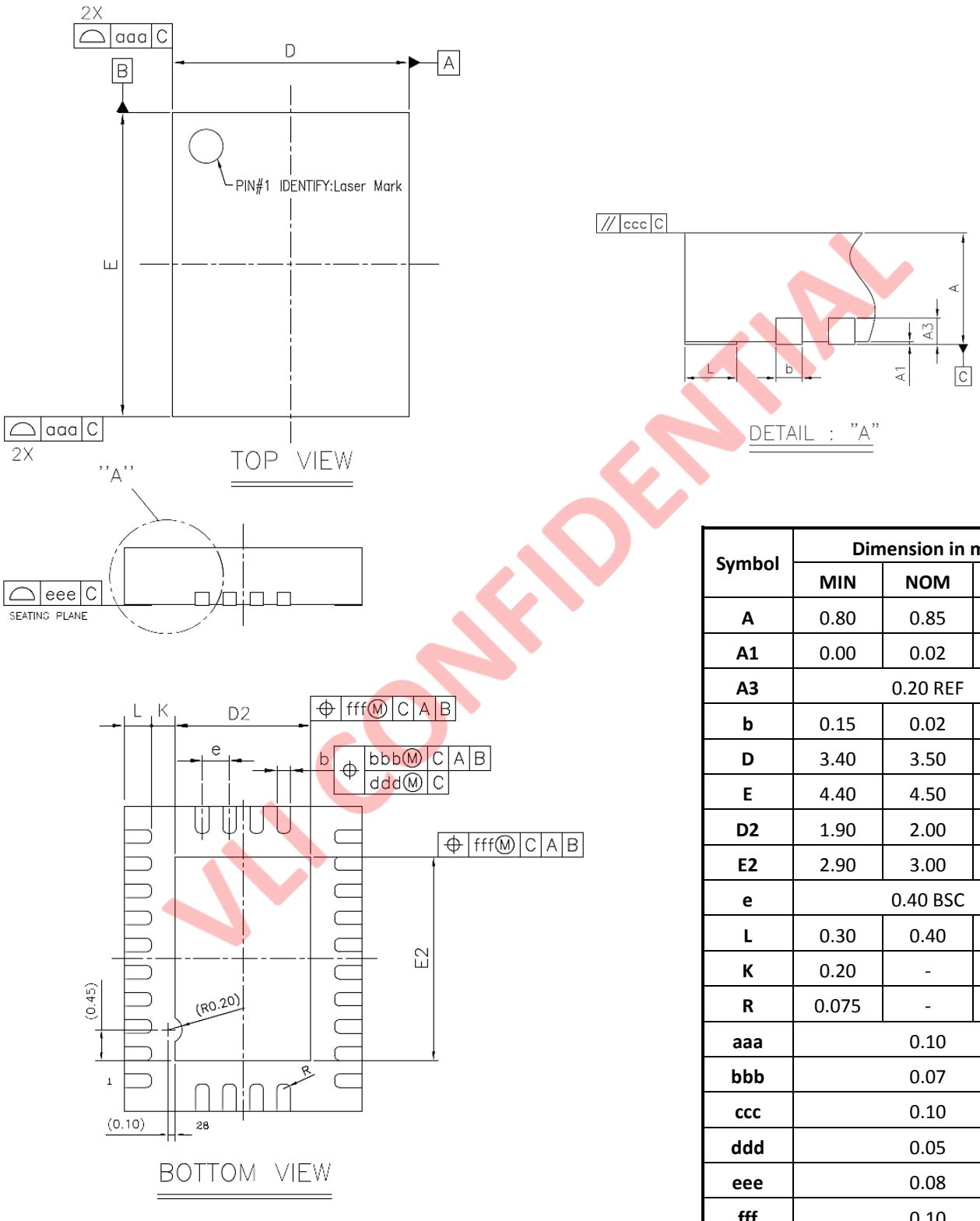


Figure 4 - Reflow

Package Mechanical Specifications



Symbol	Dimension in mm		
	MIN	NOM	MAX
A	0.80	0.85	0.90
A1	0.00	0.02	0.05
A3	0.20 REF		
b	0.15	0.02	0.25
D	3.40	3.50	3.60
E	4.40	4.50	4.60
D2	1.90	2.00	2.10
E2	2.90	3.00	3.10
e	0.40 BSC		
L	0.30	0.40	0.50
K	0.20	-	-
R	0.075	-	0.125
aaa	0.10		
bbb	0.07		
ccc	0.10		
ddd	0.05		
eee	0.08		
fff	0.10		

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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