



VIA Labs, Inc.

Data Sheet

**VL160**

**USB Type-C Data Switch with CC Function  
for USB 3.1 Gen2 (10Gbps)**

September 20<sup>th</sup>, 2016

Revision 0.93

**VLI**

**VL160**

深圳市科瑞芯电子有限公司

USB Type-C Data Switch with CC Function for USB 3.1 Gen2 (10Gbps)



## Revision History

Rev	Draft Date	History	Initial
0.50	10/18/2015	Preliminary Release	TH
0.51	10/16/2015	Add DC Parameter	TH
0.60	02/02/2016	Add Tape and Reel Information	TH
0.9	02/17/2016	Update Electrical Specification	TH
0.91	04/11/2016	Update ordering information	TH
0.92	05/24/2016	Update Package Mechanical Specification	TH
0.93	09/20/2016	Add Lead(Pb)-Free and RoHS compliant	TH

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## Product Feature

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### VL160

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USB Type-C Data Switch with CC Function for USB 3.1 Gen2 (10 Gbps)

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- **4:2 10Gbps USB Type-C Data Switch**

- **Support up to 10Gbps**

- **2 Differential Channel, 2:1 MUX/DeMUX**

- **Compatible with 10Gbps 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 3.5 x 4.5mm package**

- **ESD > 4KV, CDM > 500V**

- **Lead(Pb)-Free and RoHS compliant**

- **MUX**

- Insertion loss: 1.5dB @ 5GHz typ.
- Return loss: 15dB @ 5GHz typ.
- Crosstalk Isolation: 30dB @ 5GHz typ.
- Off Isolation: 15dB @ 5GHz typ.

- **CC Functional**

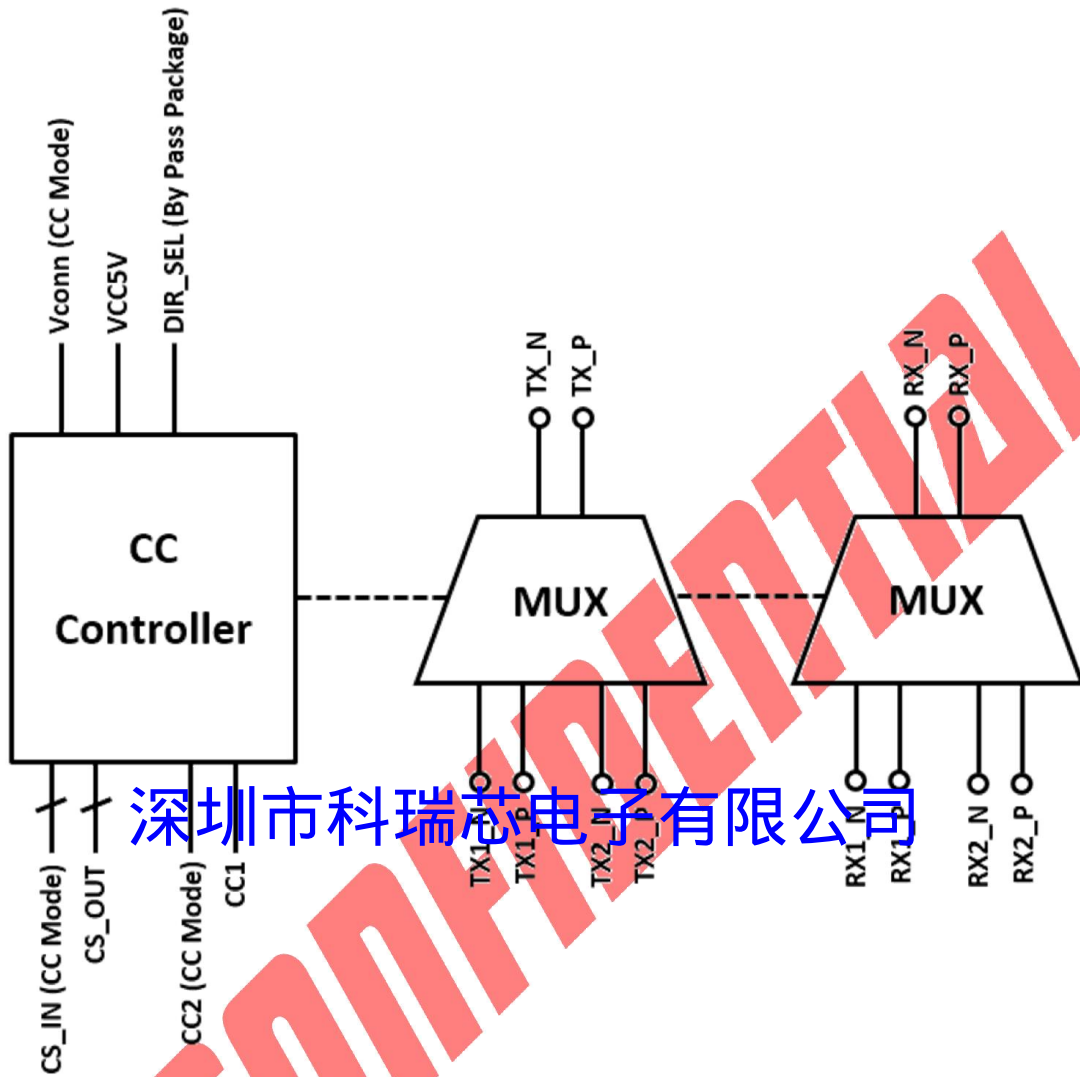
- Define Role: Device (UFP, default) or Host (DFP)
- Plug Orientation: Flipped or Not, and control Switch SEL
- (UFP) Current Capability Detect: 3.0A, 1.5A, or 0.9A
- (UFP) Rd
- (DFP) Rp (or Ip), Vconn SW if Ra
- (DFP) VBUS\_EN to turn on Host VBUS SW

- **Vconn**

- 5V, max Power is 1W, max current is 250mA
- Over current protection

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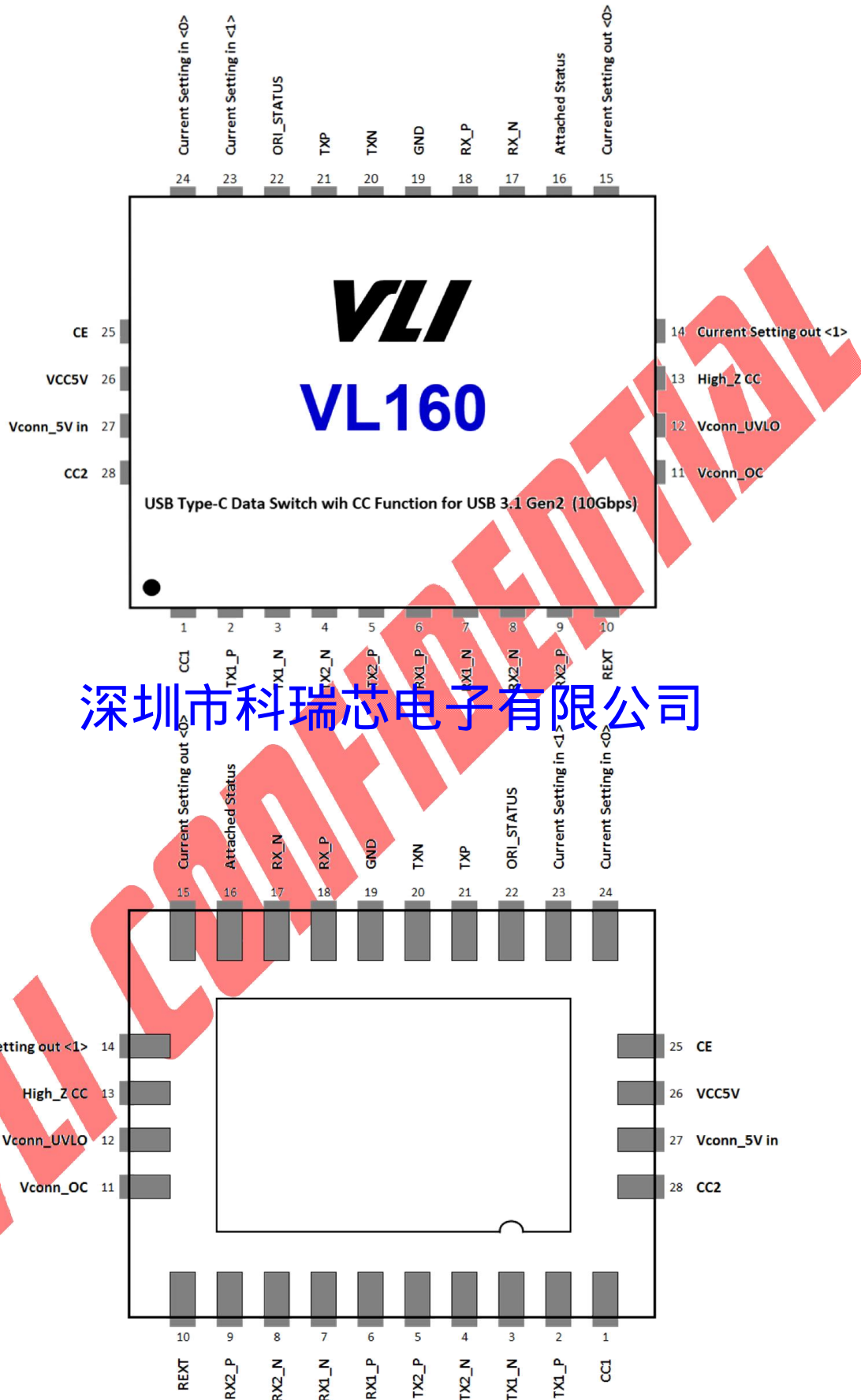
### Block Diagram



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Figure 1 - Block Diagram

Pinout



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Figure 2 - Pin Diagram (QFN-28)

## Pin List

Pin	Pin Name	Pin	Pin Name
1	CC1	15	Current Setting out <0>
2	TX1_P	16	Attached_Status
3	TX1_N	17	RX_N
4	TX2_N	18	RX_P
5	TX2_P	19	GND
6	RX1_P	20	TXN
7	RX1_N	21	TXP
8	RX2_N	22	ORI_STATUS
9	RX2_P	23	Current Setting in <1>
10	REXT	24	Current Setting in <0>
11	Vconn_OC	25	CE
12	Vconn_UVLO	26	VCC5V
13	High_Z CC	27	Vconn_5V in
14	Current Setting out <1>	28	CC2

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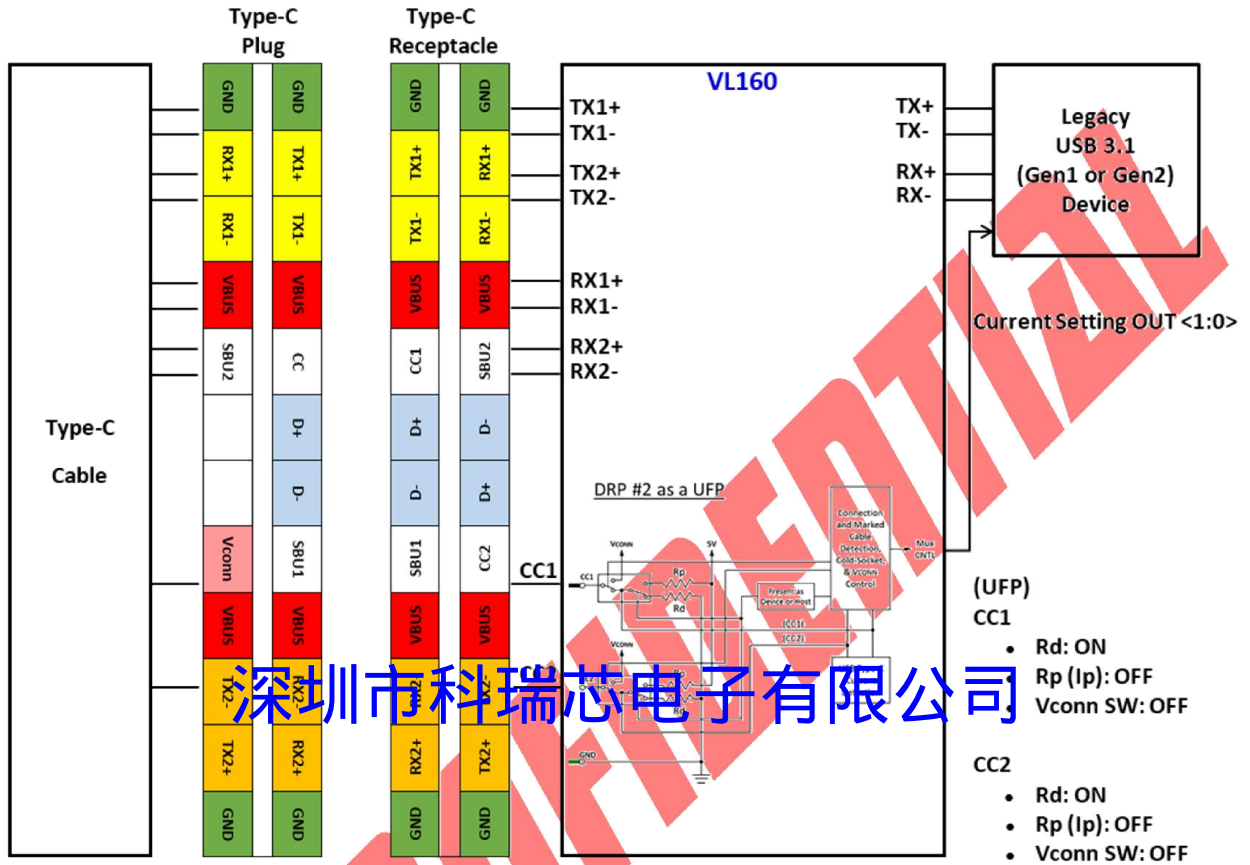
## Pin Descriptions

Pin Name	Pin #	I/O	Description
CC1	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 resistor 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
Current Setting out <0>	15	DO	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	(3.3V logic) Rp/Rd setting input 00: Ip = 80uA 01: Ip = 180uA 10: Ip = 330uA 11: Rd = 5.1kΩ
Current Setting in <0>	24	AI	00: Rp = 36kΩ 01: Rp = 12kΩ 10: Rp = 4.7kΩ 11: Rd = 5.1kΩ
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



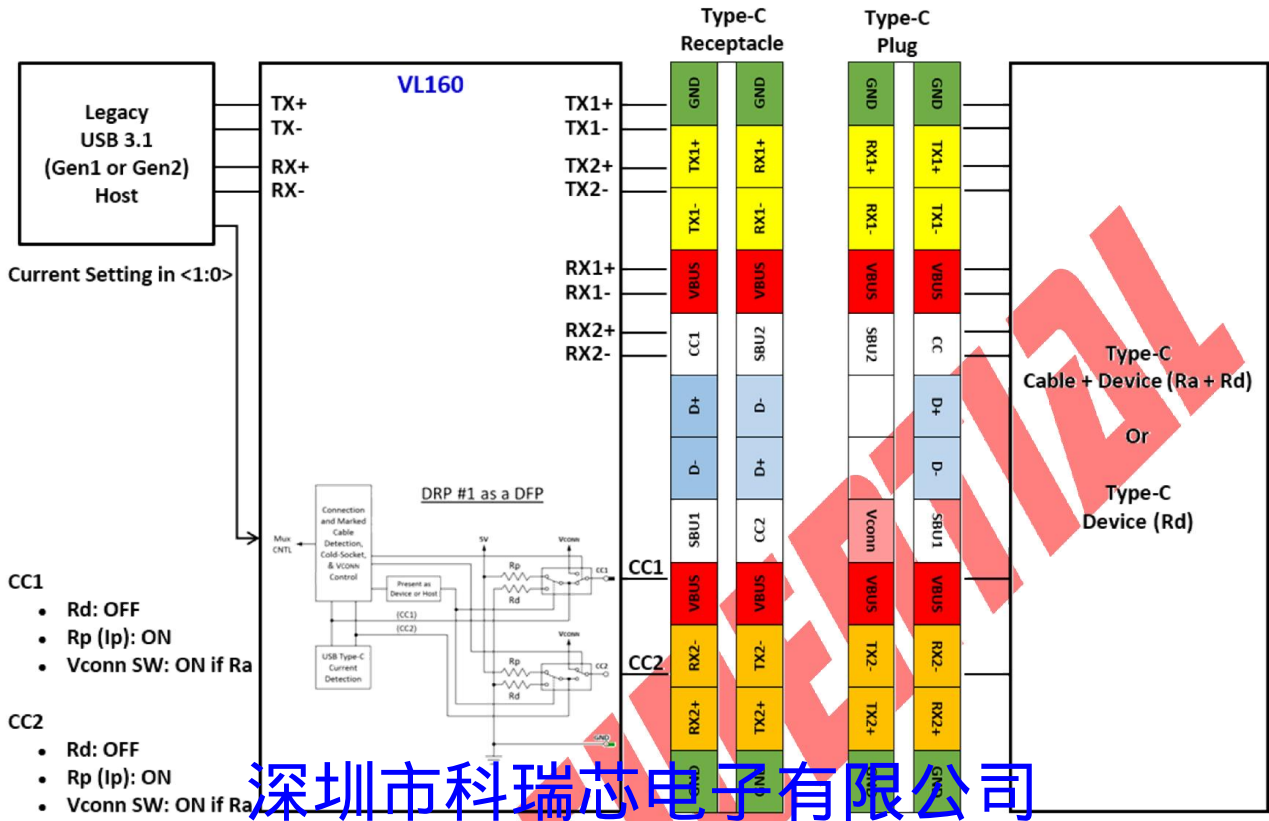
### Application Diagram

Application for Cable + Device



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Application for Host + Cable or Host only



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## Electrical Specification

### Absolute Maximum Rating

Symbol	Parameter	Min	Max	Unit	Note
T <sub>STG</sub>	Storage Temperature	-55	125	°C	-
V <sub>ESD</sub>	Electrostatic Discharge	4KV		V	Human Body Model
θ <sub>jc</sub>	Thermal resistance between junction and case	4L PCB	36.7	°C/W	
		2L PCB	28.1		
P <sub>D</sub>	Max Power Dissipation	-	8m	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<sub>a</sub> 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	4.5	5.0	5.5	V	
T <sub>A</sub>	Ambient Temperature	-45		85	°C	
T <sub>j</sub>	Junction Temperature	0		125	°C	-

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Static characteristics:

VDD = 5.0V ± 10%; Temp = -40°C to +85°C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ.	Max	Unit
IDD	Supply current	Operation mode			500	uA
		Shutdown mode			1.5	uA
VIH	High-level input voltage		2.7			V
VIL	Low-level input voltage				0.4	V
Vcom	Input Common mode voltage		0		2.2	V

## 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)  $\geq 30$  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

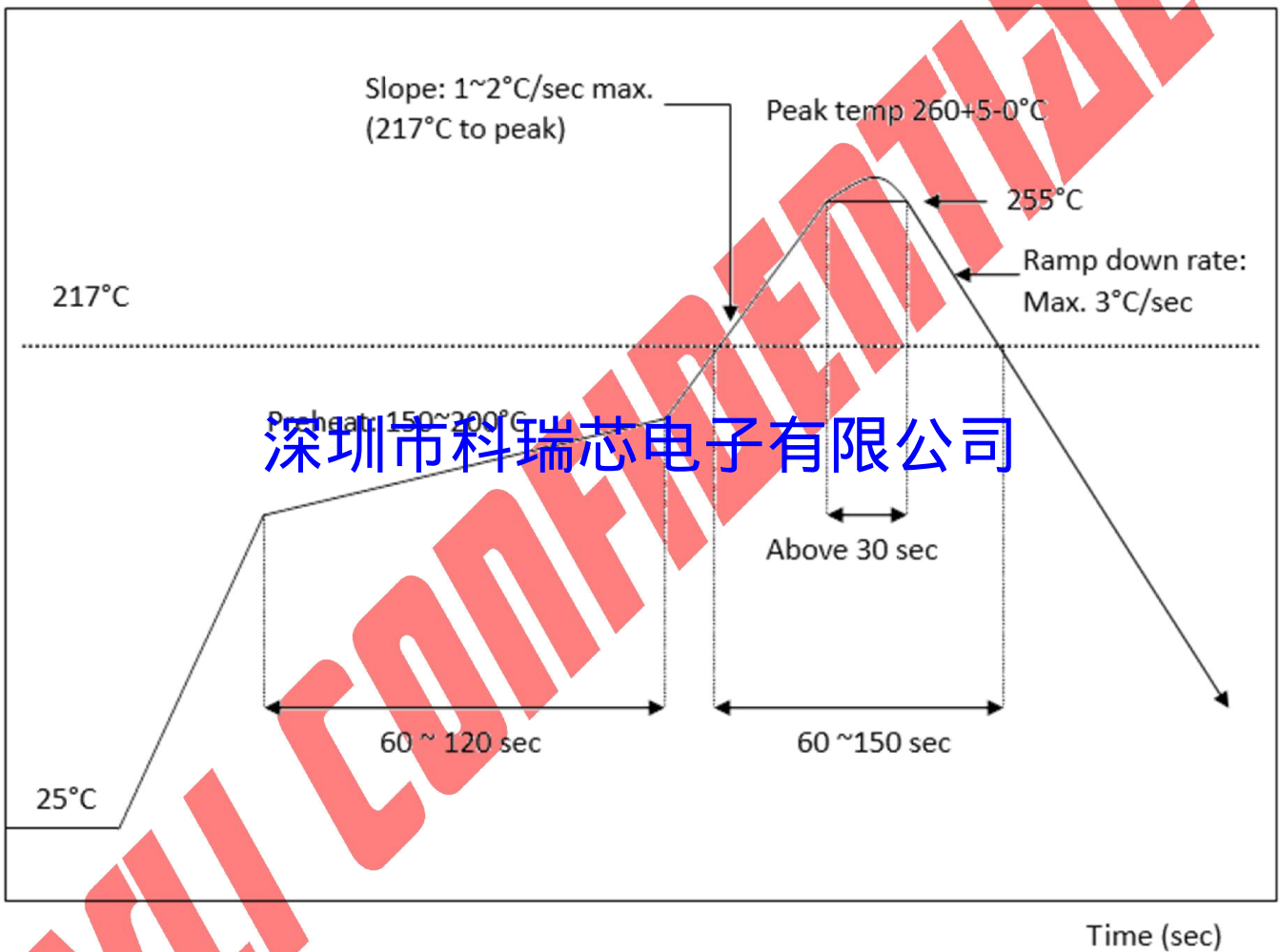
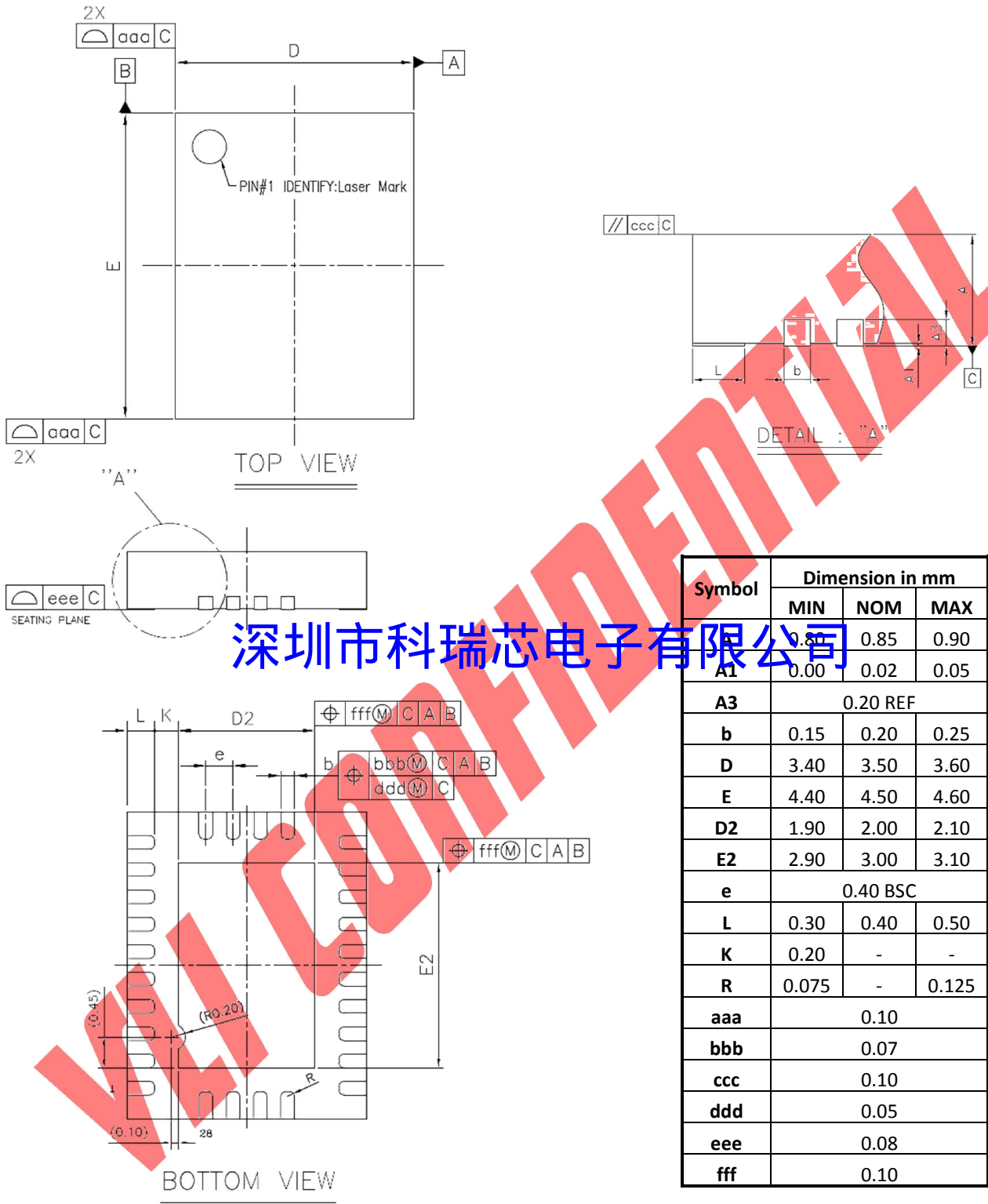


Figure 3 - Reflow

### Package Mechanical Specifications



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Figure 4 - Mechanical Specification

### Package Top Side Marking

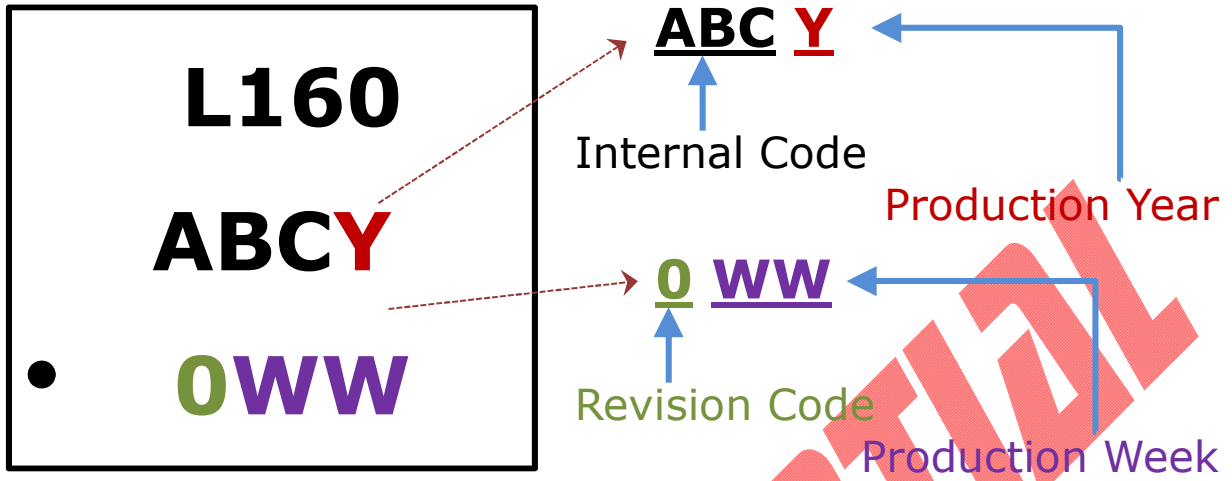


Figure 5 - Package Top Side Marking

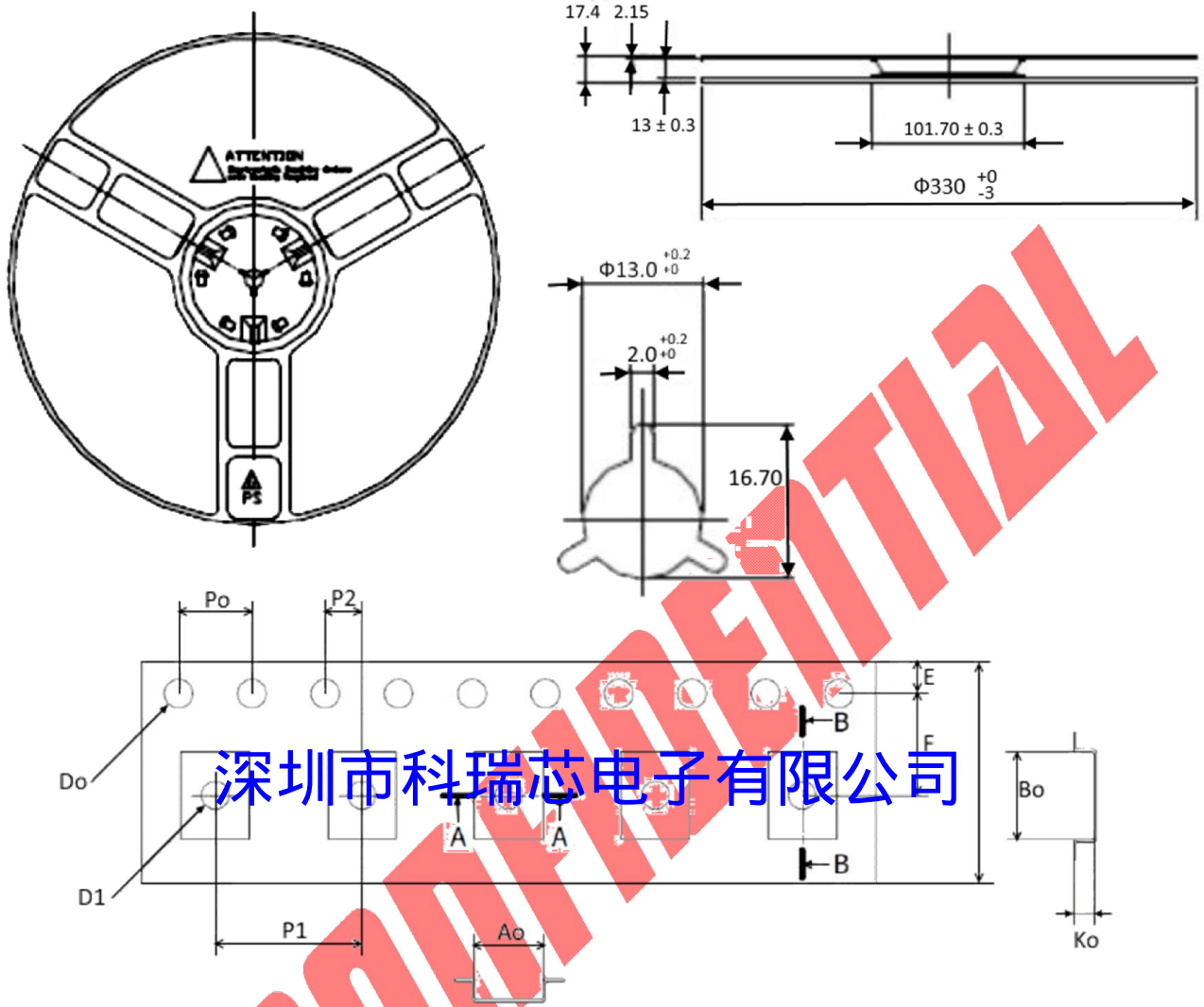
### Ordering Information

Part Number	Description	Package Type
VL160 (B0)	VL160 Tape and Reel (3K)	QFN-28 (3.5x4.5mm)

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Tape and Reel Information



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Unit: mm

Symbol	Spec	Tolerance
Ao	3.75	$\pm 0.10$
Bo	4.75	$\pm 0.10$
Ko	1.10	$\pm 0.10$

Unit: mm

Symbol	Spec	Tolerance
Po	4.00	$\pm 0.10$
P1	8.00	$\pm 0.10$
P2	2.00	$\pm 0.05$
Do	1.55	$\pm 0.05$
D1	1.50	(Min.)
E	1.75	$\pm 0.10$
F	5.50	$\pm 0.05$
10Po	40.00	$\pm 0.20$
W	12.00	$\pm 0.20$
T	0.25	$\pm 0.05$

Figure 6 - Tape & Reel Information



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