VIA Labs, Inc.

Data Sheet

VL160

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

September 20th, 2016

Revision 0.93

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

VL160

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

- **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

Block Diagram

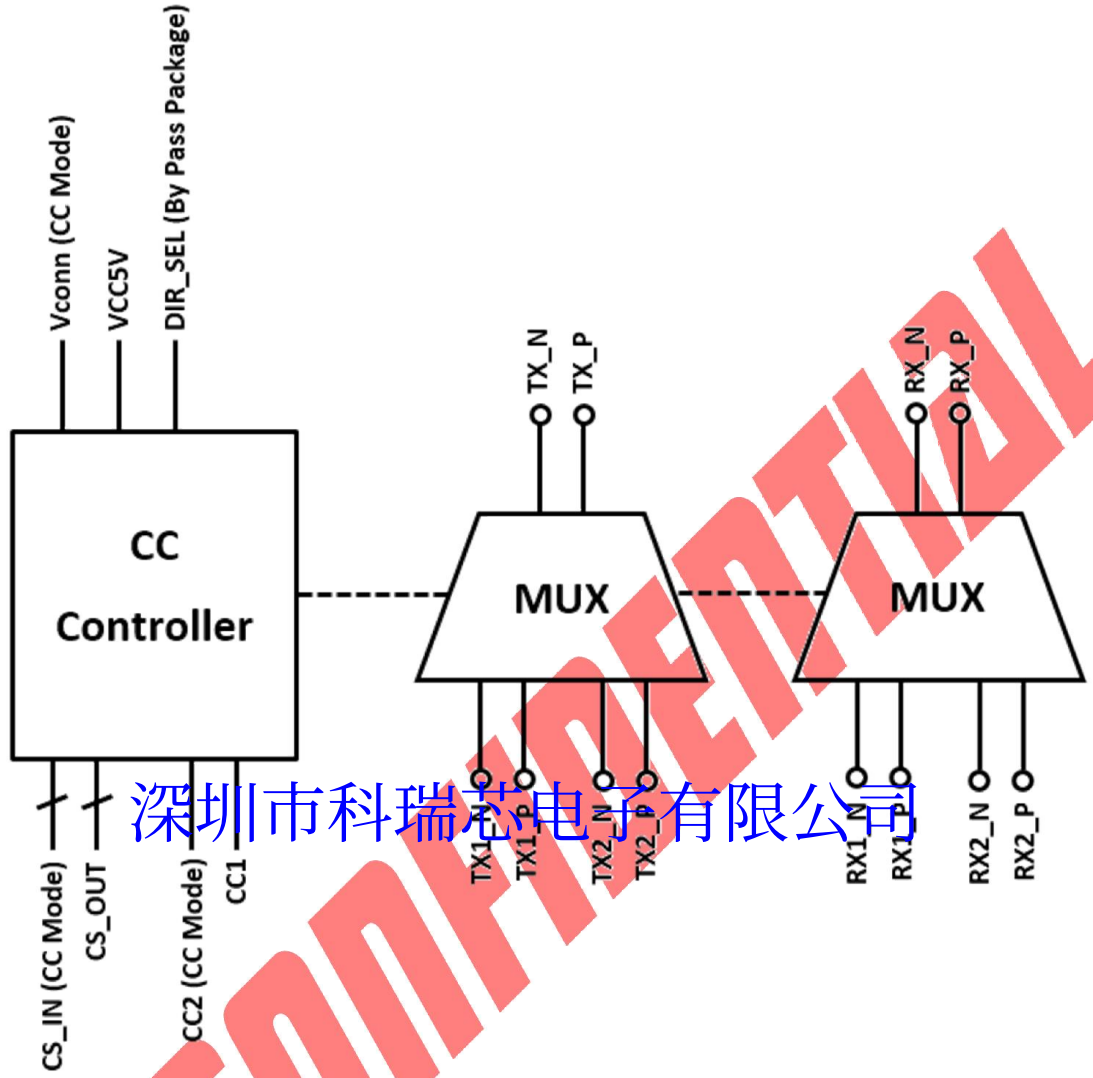


Figure 1 - Block Diagram

Pinout

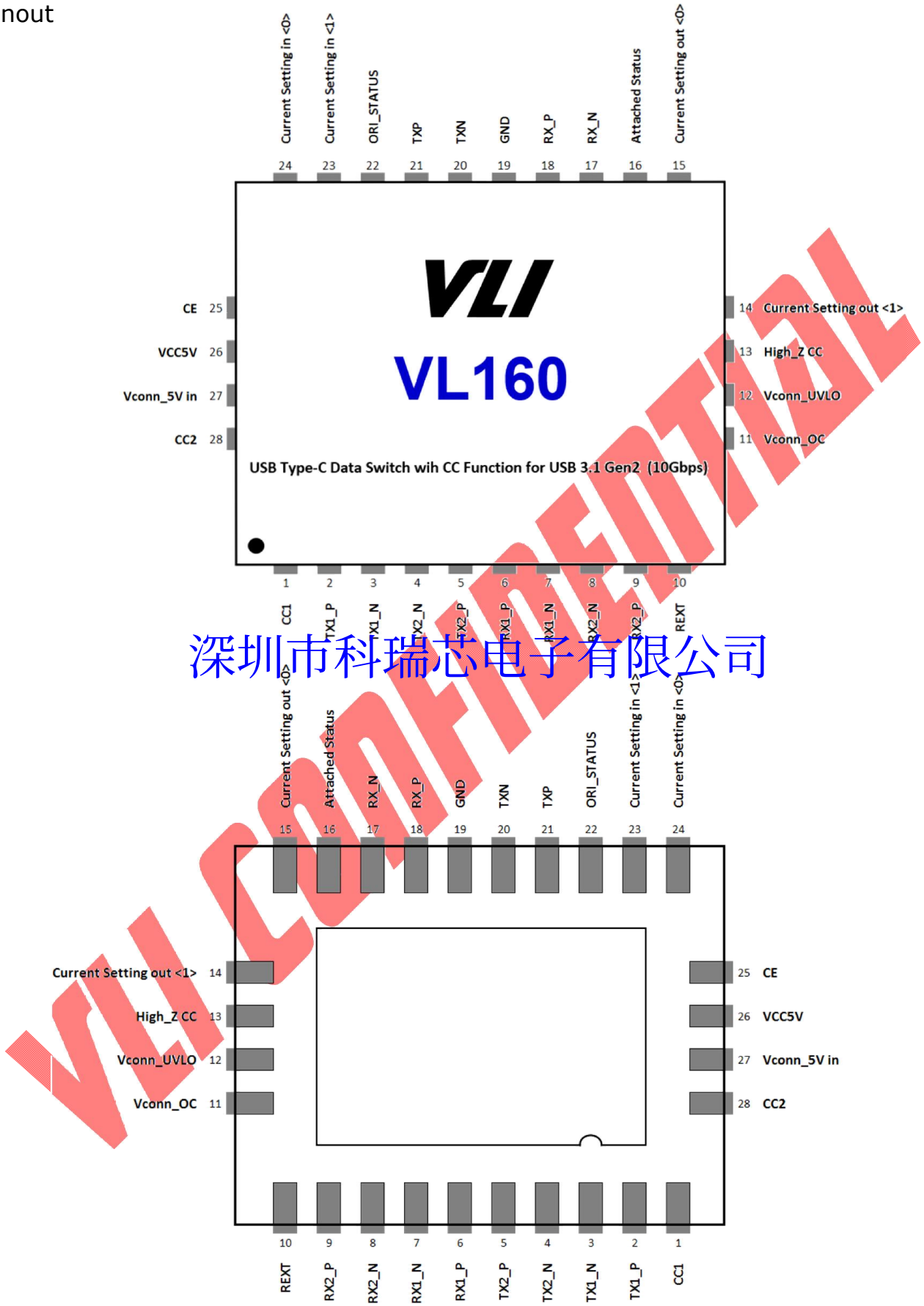


Figure 2 - Pin Diagram (QFN-28)

Pin List

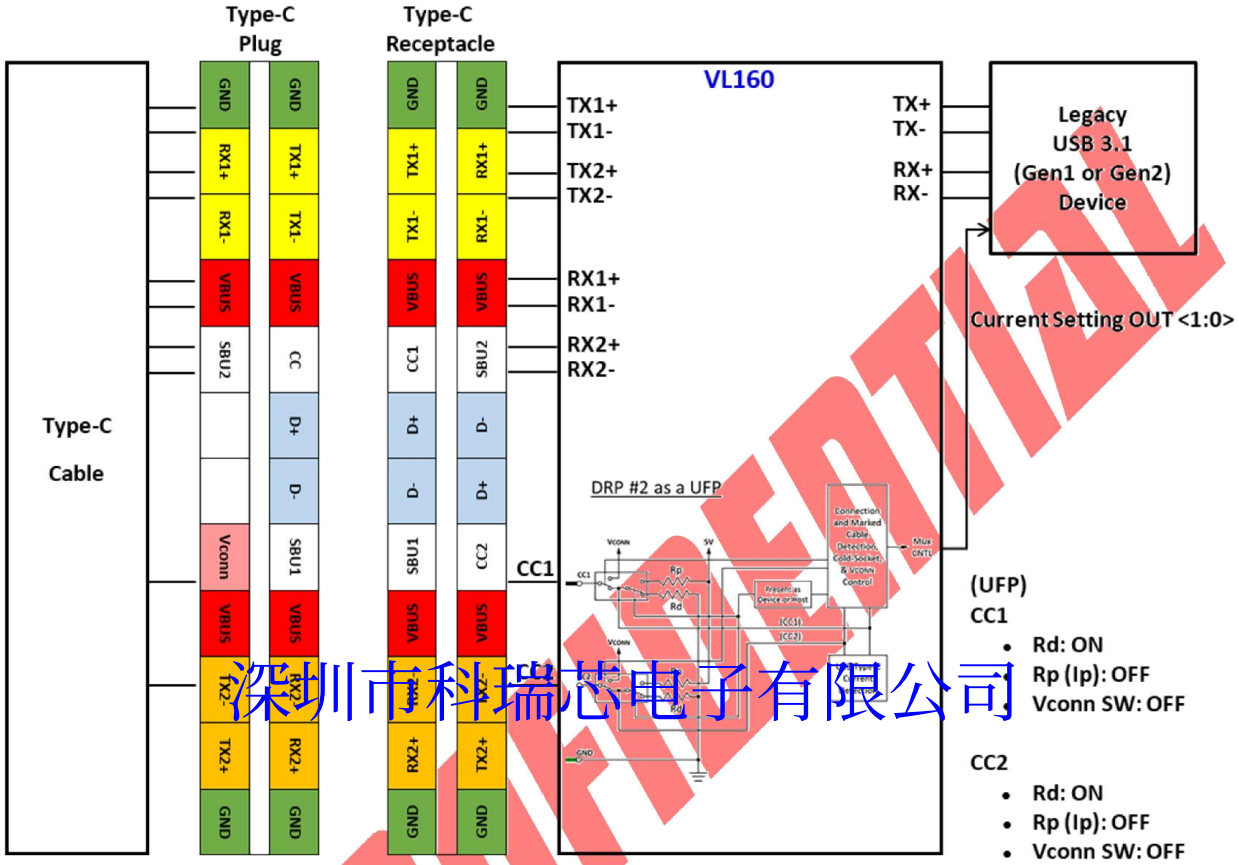
Pin	Pin Name	Pin	Pin Name
1	CC1	15	Current Setting out <0>
2	TX1_P	16	Attached_Status
3	TX1_N	17	RX_N
4	TX2_N	18	RX_P
5	TX2_P	19	GND
6	RX1_P	20	TXN
7	RX1_N	21	TXP
8	RX2_N	22	ORI_STATUS
9	RX2_P	23	Current Setting in <1>
10	REXT	24	Current Setting in <0>
11	Vconn_OC	25	CE
12	Vconn_UVLO	26	VCC5V
13	High_Z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

Pin Descriptions

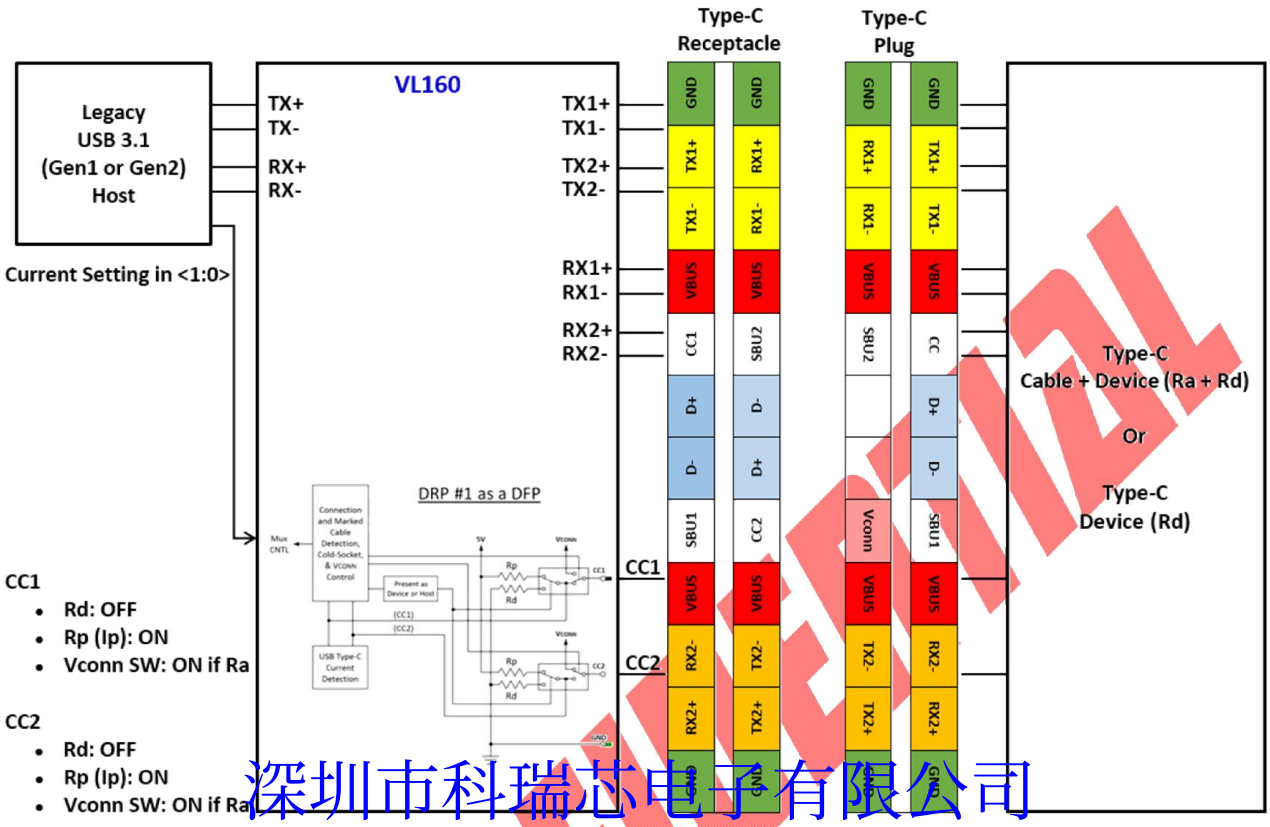
Pin Name	Pin #	I/O	Description
CC1	1	AI/O	0~5V analog input
TX1_P	2	High Speed I/O	USB differential pair
TX1_N	3		
TX2_N	4	High Speed I/O	USB differential pair
TX2_P	5		
RX1_P	6	High Speed I/O	USB differential pair
RX1_N	7		
RX2_N	8	High Speed I/O	USB differential pair
RX2_P	9		
REXT	10		External resister 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	(3.3V logic) Rp/Rd setting input 00: Ip = 80uA 01: Ip = 180uA 10: Ip = 330uA 11: Rd = 5.1kΩ 00: Rp = 36kΩ 01: Rp = 12kΩ 10: Rp = 4.7kΩ 11: Rd = 5.1kΩ
Current Setting in <0>	24	AI	
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



Application for Host + Cable or Host only



Electrical Specification

Absolute Maximum Rating

Symbol	Parameter		Min	Max	Unit	Note
T_{STG}	Storage Temperature		-55	125	°C	-
V_{ESD}	Electrostatic Discharge		4KV		V	Human Body Model
θ_{jc}	Thermal resistance between junction and case	4L PCB	36.7		°C/W	
		2L PCB	28.1			
P_D	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_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	4.5	5.0	5.5	V	
T_A	Ambient Temperature	-45		85	°C	
T_j	Junction Temperature	0		125	°C	-

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 (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

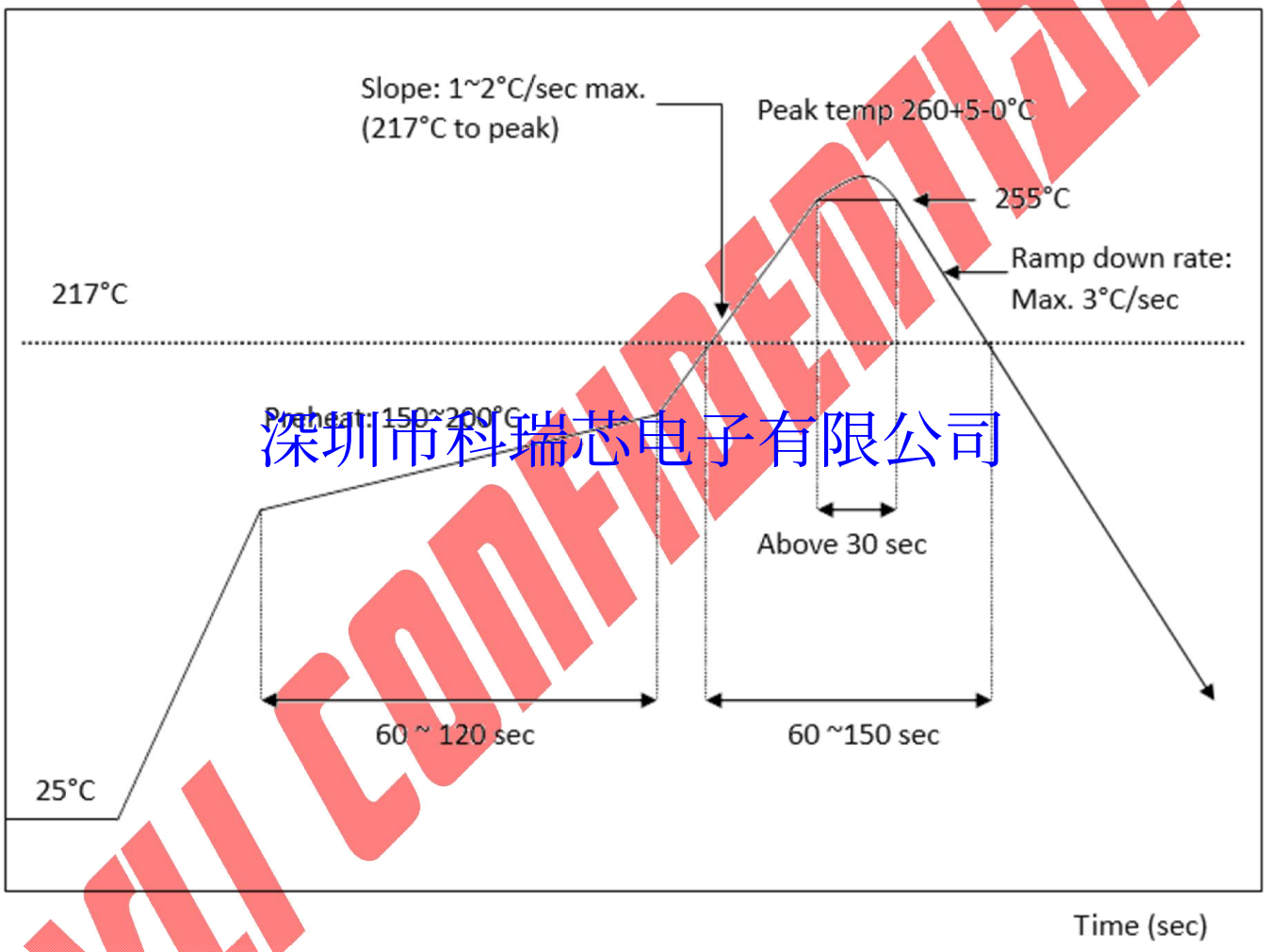
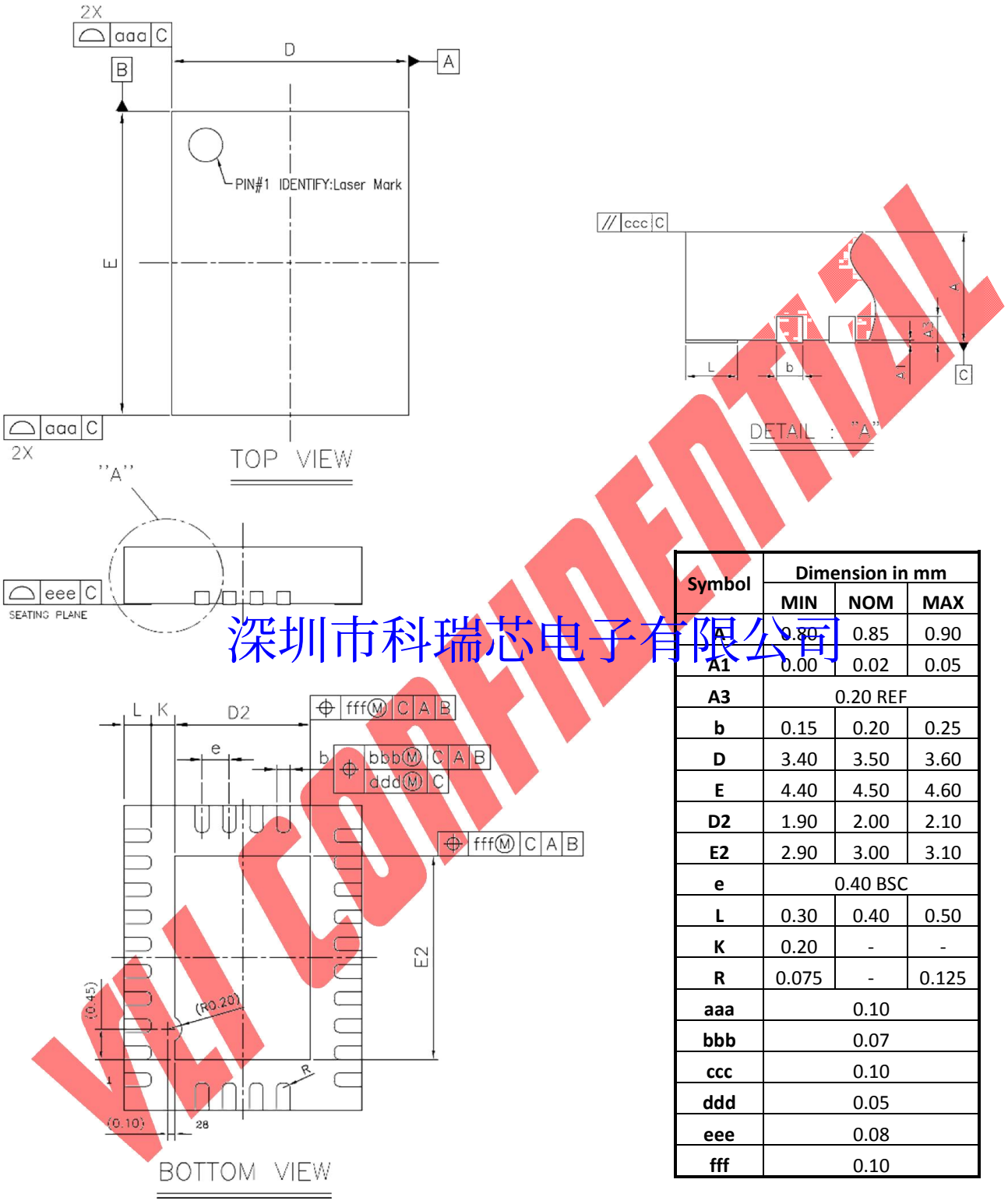


Figure 3 - Reflow

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	0.20	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 4 - Mechanical Specification

Package Top Side Marking

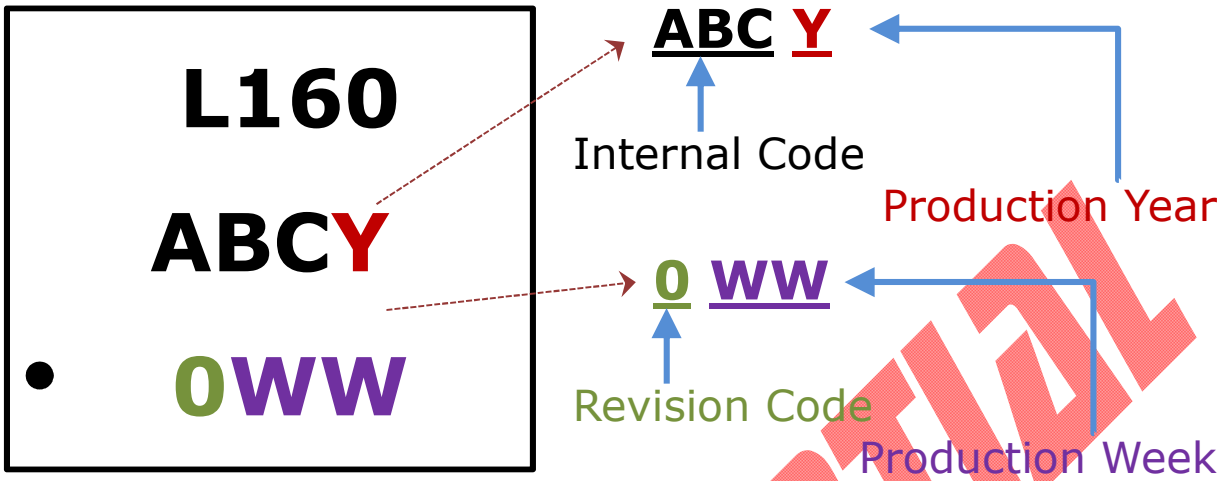
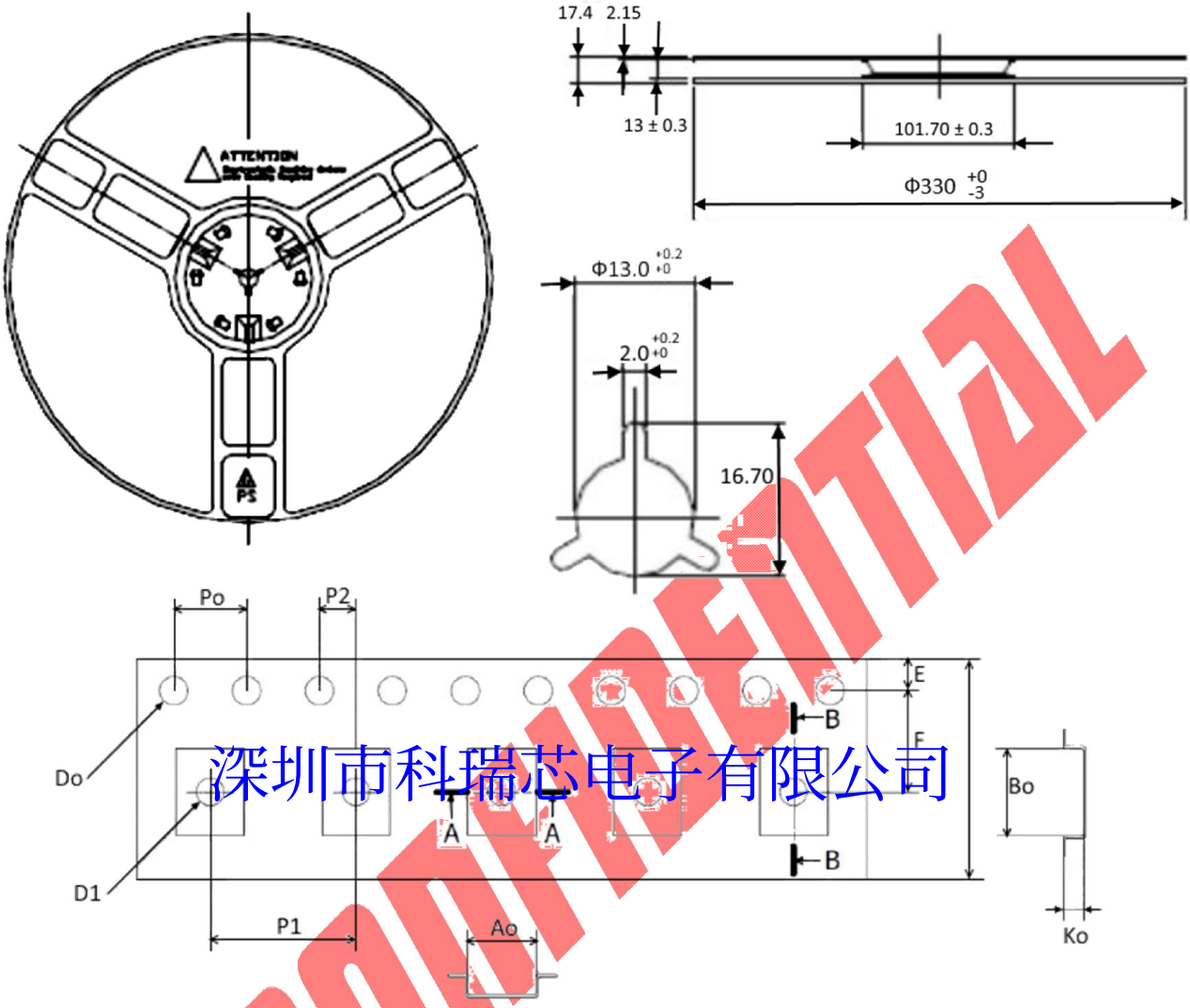


Figure 5 - Package Top Side Marking

Ordering Information

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

Tape and Reel Information



Unit: mm

Symbol	Spec	Tolerance
Ao	3.75	± 0.10
Bo	4.75	± 0.10
Ko	1.10	± 0.10

Unit: mm

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

Figure 6 - Tape & Reel Information

深圳市科瑞芯电子有限公司

VIA Labs, Inc.
www.via-labs.com
7F, 529-1, Zhongzheng Rd.,
Xindian District, New Taipei City 23148 Taiwan
Tel: (886-2) 2218-1838
Fax: (886-2) 2218-2553
Email: sales@via-labs.com.tw