



VIA Labs, Inc.

Preliminary Data Sheet

VL152(C1)

E-Marker for Type-C Cable

Nov. 14th, 2019

Revision 0.83



Revision History

Rev	Date	Note	Initial
0.80	04/10/2019	Preliminary Release	TH
0.81	06/28/2019	Modify typo on block diagram	TH
0.82	07/15/2019	Add WLCSP mechanical specification	TH
0.83	11/14/2019	1. Update revision to C1 2. Update Cable VDO data 3. Update ID Header data	TH

VL152 CONFIDENTIAL

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Product Feature

VL152

E-Marker for USB-C/ TBT3 Passive Cable

■ Thunderbolt 3

- Support Thunderbolt cable VDO

■ PD 3.0/ USB4 Compliant

- Compliant to USB Power Delivery 3.0 and USB4 Specification
- SOP' Endpoint
- Supports Programming over CC Line using Unstructured Vendor Defined Messages

■ Sideband Signal Support

- Supports SMBus for Programming and Debugging

■ Easy Manufacturability

- DFN-8 2x3mm features 0.5mm pin pitch for easy manufacturing
- WLCSP-6 with 0.4mm pin pitches to minimize paddle card size.
- Compatible with standard PCB Process
- Programming Support over CC or SMBus
- Extremely Low BOM Cost: Diodes, Ra are all integrated On-Die
- Compatible with Third-Party Programming Tools

■ DMTP Memory Onboard

- Supports double times writable memory to store Cable VDO, Certification Status VDO, Product VDO, etc.
- Features write-protection support so finished cables cannot be modified
- DMTP memory is the best choice for data-retention and longevity

■ Applications

- USB Type-C Cables such as Full-Featured C-to-C cables
- Passive Thunderbolt cable

■ Misc.

- CC, Vconn1 and Vconn2 pin short to Vbus protection
- Automatic Ra weakening to reduce power consumption
- Optimized for Low Power consumption
- RoHS compliance and HF compliance

Block Diagram

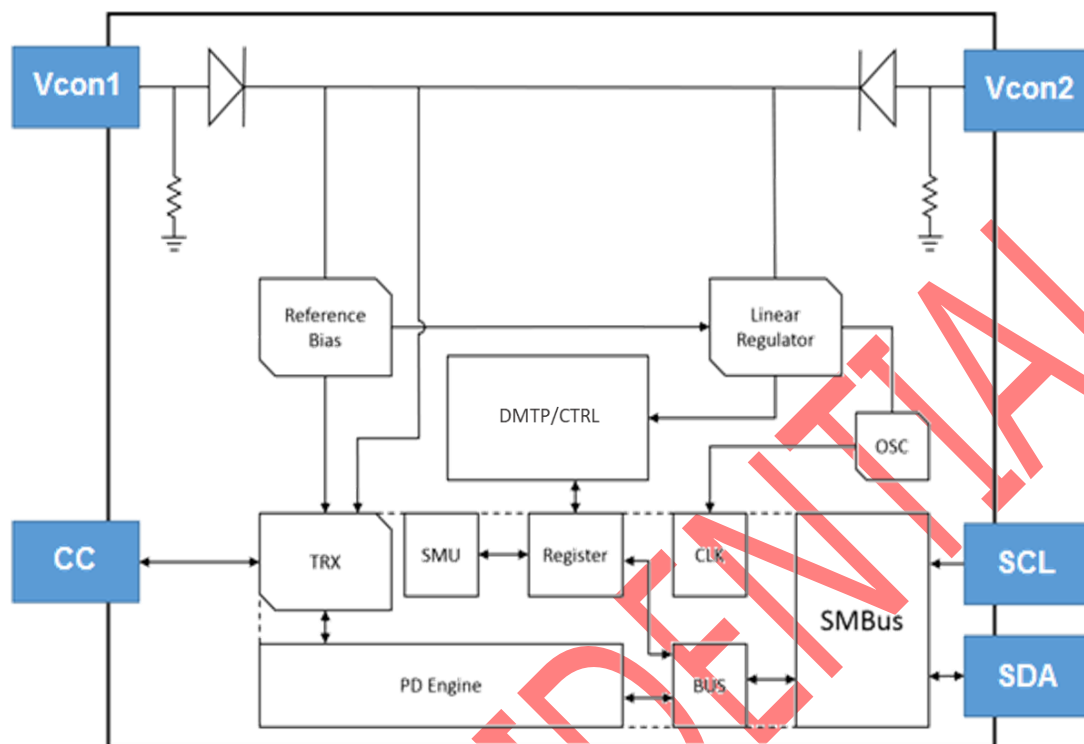
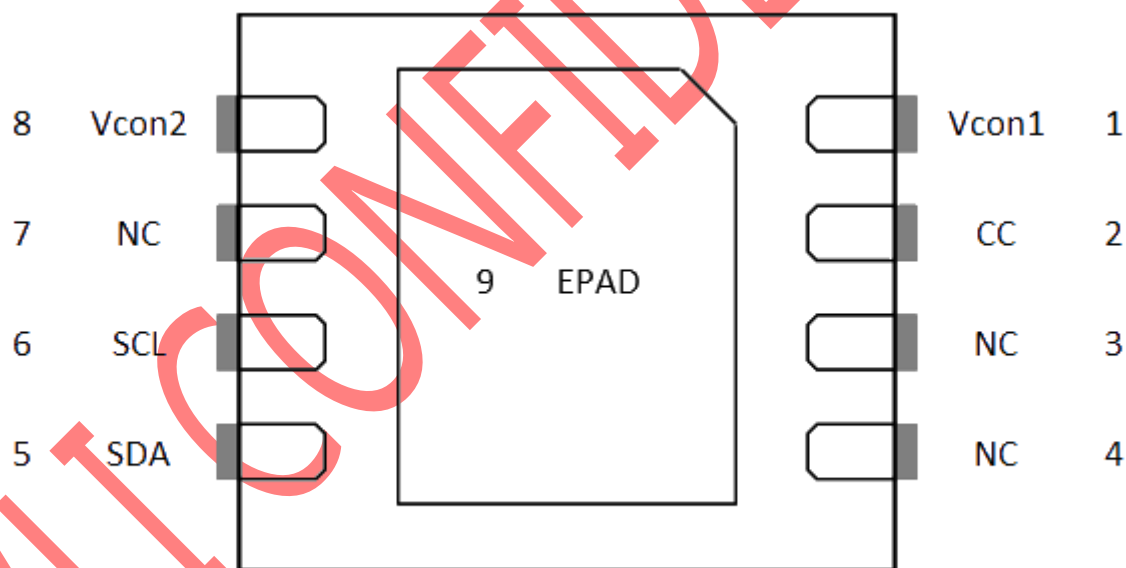


Figure 1 - Block Diagram

Pinout

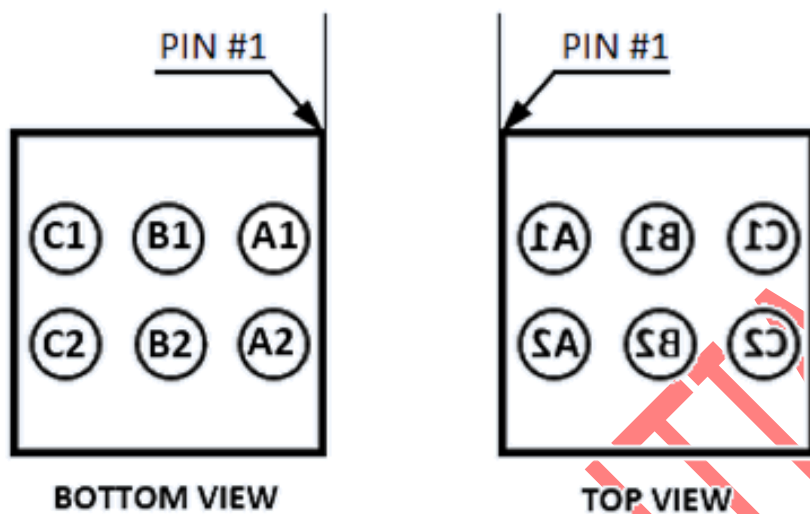


-TOP VIEW-



-BOTTOM VIEW-

Figure 2 - Pin Diagram (DFN-8)



A1:	SDA	A2:	GND
B1:	SCL	B2:	CC
C1:	Vcon2	C2:	Vcon1

Figure 3 - Pin Diagram (WLCSP-6)

Pin List

DFN-8

Pin	Pin Name	Pin	Pin Name
1	Vcon1	5	SDA
2	CC	6	SCL
3	NC	7	NC
4	NC	8	Vcon2
		9	EPAD

WLCSP-6

Pin	Pin Name	Pin	Pin Name
A1	SDA	A2	GND
B1	SCL	B2	CC
C1	Vcon2	C2	Vcon1

Pin Descriptions

Signal Type Definition

Name	Type	Signal Description
Input	I	A Logic Input Only Signal
Output	O	A Logic Output Only Signal
Input/ Output	I/O	A Logic Bi-Directional Signal
Power	PWR	A Power Pin
Ground	GND	A Ground Pin

Type-C Interface

Pin Name	Pin #DFN-8	Pin #WLCSP-6	I/O	Signal Description
Vcon1	1	C2	PWR	VCONN Power (Near Side)
CC	2	B2	I/O	CC communication line
Vcon2	8	C1	PWR	VCONN Power (Far Side)

Sideband & Miscellaneous

Pin Name	Pin#DFN-8	Pin #WLCSP-6	I/O	Signal Description
SCL	6	B1	I	SMBus Clock (Open Drain)
SDA	5	A1	I/O	SMBus Data (Open Drain)
NC	3,4,7	-	-	Not Connected (Float)

Ground

Pin Name	Pin #DFN-8	Pin #WLCSP-6	I/O	Signal Description
EPAD	9	A2	GND	Exposed Pad; System Ground

Electrical Specification

Absolute Maximum Rating

Symbol	Parameter	Min	Max	Unit	Note
T _{STG}	Storage Temperature	-55	125	°C	-
V _{CON1/2}	VCONN pin	-0.5	22	V	Short to Vbus Protection
CC	CC pin	-0.5	22	V	Short to Vbus Protection
V _{ESD}	Electrostatic Discharge	-8000	8000	V	Human Body Model
θ _{jc}	Thermal resistance between junction and case	TBD	-	°C/W	4L PCB definitions follow JESD51-7 for WLCSP

Note 1: Stress above conditions may cause permanent damage to the device.
Functional operation of this device should be restricted to the conditions described.

Note 2: 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
T _A	Ambient Temperature	-25		85	°C	-
T _j	Junction Temperature	-40		125	°C	-
V _{CON1/2}	VCONN	2.7		5.5	V	-
P _D	Power Consumption – operation	-	40		mW	-
P _D	Power Consumption - Suspend	-	0.9		mA	-

Electrical Characteristics

VDD=5V, TA=25°C (unless otherwise noted)

Common Normative Signaling Requirements						
Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
fBitRate	Bit rate	-	270	300	330	kbps
pBitRate	Maximum difference between the bit-rate during the part of the packet following the Preamble and the reference bit-rate.	-			0.25	%
tInterFrameGap	Time from the end of last bit of a Frame until the start of the first bit of the next Preamble.	-	25			us
tStartDrive	Time before the start of the first bit of the Preamble when the transmitter shall start driving the line.	-	-1		1	us

Default VDM Register Map

This table shows the default VDM DMTP section address mapping to Discover Identity Command ACK response message, which VL152 sends when receiving a Discover Identity command, if VL152 has not been programmed. Once VL152 DMTP is programmed, the default values will be discarded and VL152 will respond to Discover Identity command with the programmed values.

Address	bits	Description
Cable VDO		
0x8010	[7:4]	HW Version Number assigned by vendor, 0000b...1111b. 0000b [Default]
	[3:0]	Firmware Version Number, assigned by vendor, 0000b...1111b 0000b [Default]
0x8011	[7:5]	Version number of VDO, Version 1.0=000b, Values 001b...111b are Reserved Shall Not be used 000b [Default]
	[4]	Reserved 0 [Default]
	[3:2]	Type-C Plug to Type-C/Captive 00b = Reserved, Shall Not be used 01b = Reserved, Shall Not be used 10b = USB Type-C [Default] 11b = Captive
	[1]	Reserved 0 [Default]
	[0]	Cable Latency 0000b – Reserved, shall not be used 0001b – <10ns (~1m) [Default] 0010b – 10ns to 20ns (~2m) 0011b – 20ns to 30ns (~3m) 0100b – 30ns to 40ns (~4m) 0101b – 40ns to 50ns (~5m) 0110b – 50ns to 60ns (~6m) 0111b – 60ns to 70ns (~7m) 1000b – 1000ns (~100m) 1001b – 2000ns (~200m) 1010b – 3000ns (~300m) 1011b1111b Reserved, shall not be used Includes latency of electronics in Active Cable
0x8012	[7:5]	
	[4:3]	Cable Termination Type 00b = VCONN not required [Default] 01b = VCONN required 10b...11b Reserved, Shall Not be used
	[2:1]	Maximum cable VBus Voltage 00b = 20V [Default] 01b = 30V 10b = 40V 11b = 50V
	[0]	Reserved 0 [Default]

Address	bits	Description
0x8013	[7]	Reserved 0 [Default]
	[6:5]	VBUS Current Handling Capability 00b = Reserved, shall not be used 01b = 3A [Default] 10b = 5A 11b = Reserved, shall not be used.
	[4:3]	Reserved 00 [Default]
	[2:0]	USB SuperSpeed Signaling Support 000b = USB 2.0 only 001b = USB 3.2 Gen1 010b = USB 3.2 Gen2 and USB4 Gen2 [Default] 011b = USB4 Gen3 100b..111b = Reserved, shall not be used
Product VDO		
0x8014	[7:0]	USB Product ID, 16-bit unsigned integer, assigned by the cable vendor 00000000b, 00000000b [Default]
0x8015	[7:0]	
0x8016	[7:0]	Device version, bcdDevice , 16-bit unsigned integer, assigned by the cable vendor 00000000b, 00000000b [Default]
0x8017	[7:0]	
Cert Stat VDO		
0x8020	[7:0]	32-bit unsigned integer, USB-IF assigned XID for this cable 00000000b x4 [Default]
0x8021	[7:0]	
0x8022	[7:0]	
0x8023	[7:0]	
ID Header		
0x8024	[7]	Data Capable as USB Host ● Shall be set to one if the product is capable of enumerating USB Devices. ● Shall be set to zero otherwise. 0b [Default]
	[6]	Data Capable as a USB Device ● Shall be set to one if the product is capable of enumerating as a USB Device. ● Shall be set to zero otherwise 0b [Default]
	[5:3]	Product Type (cable plug) 000b – Undefined 001b...010b–Reserved, shall not be used. 011b–Passive Cable [Default] 100b–Active Cable 101b...111b–Reserved, shall not be used.
	[2]	Modal Operation Supported ● Shall be set to one if the product supports Modal Operation. ● Shall be set to zero otherwise 1b [Default]
	[1:0]	Reserved
0x8025	[7]	Reserved 00b, 0b [Default]
	[6:5]	Connector Type: 00b – Reserved, for compatibility with legacy systems. (USB3.2 Gen1 and Gen2) [Default] 01b – Reserved, Shall Not be used. 10b – USB Type-C Receptacle 11b – USB Type-C Plug (USB4 Gen3)
	[4:0]	Reserved 00000b [Default]
0x8026	[7:0]	USB Vendor ID, 16-bit unsigned integer 00100001b(21), 00001001b(09) [Default]
0x8027	[7:0]	

Address	bits	Description
Thunderbolt Mode VDO		
0x8054	[7:0]	Reserved 00000000b [Default]
0x8055	[7]	Active Cable Plug Link Training 0b – Active with bi-directional LSRX communication or when passive [Default] 1b – Active with uni-directional LSRX communication
	[6]	Re-timer 0b – Not Re-timer [Default] 1b – Re-timer
	[5]	Cable Type 0b – Non-Optical [Default] 1b – Optical
	[4:3]	TBT_Rounded_Support 00b – 3rd generation Non-Rounded TBT [Default] 01b – 3rd & 4th Gen Rounded and Non-Rounded TBT 10b...11b – Reserved
	[2:0]	Cable_Speed 000b – Reserved 001b – USB 3.1 Gen1 cable (10Gbps TBT support) 010b – 10Gbps (USB3.2 Gen1 and Gen2 passive cables) 011b – 10Gbps and 20Gbps (TBT 3rd Gen Active Cables and 20Gbps passive cables) [Default] 100b...111b – Reserved
0x8056	[7:0]	Thunderbolt Alternate Mode 0x0001 (Thunderbolt Mode) 00000000b(00), 00000001b(01) [Default]

General Reflow Profile Guidelines

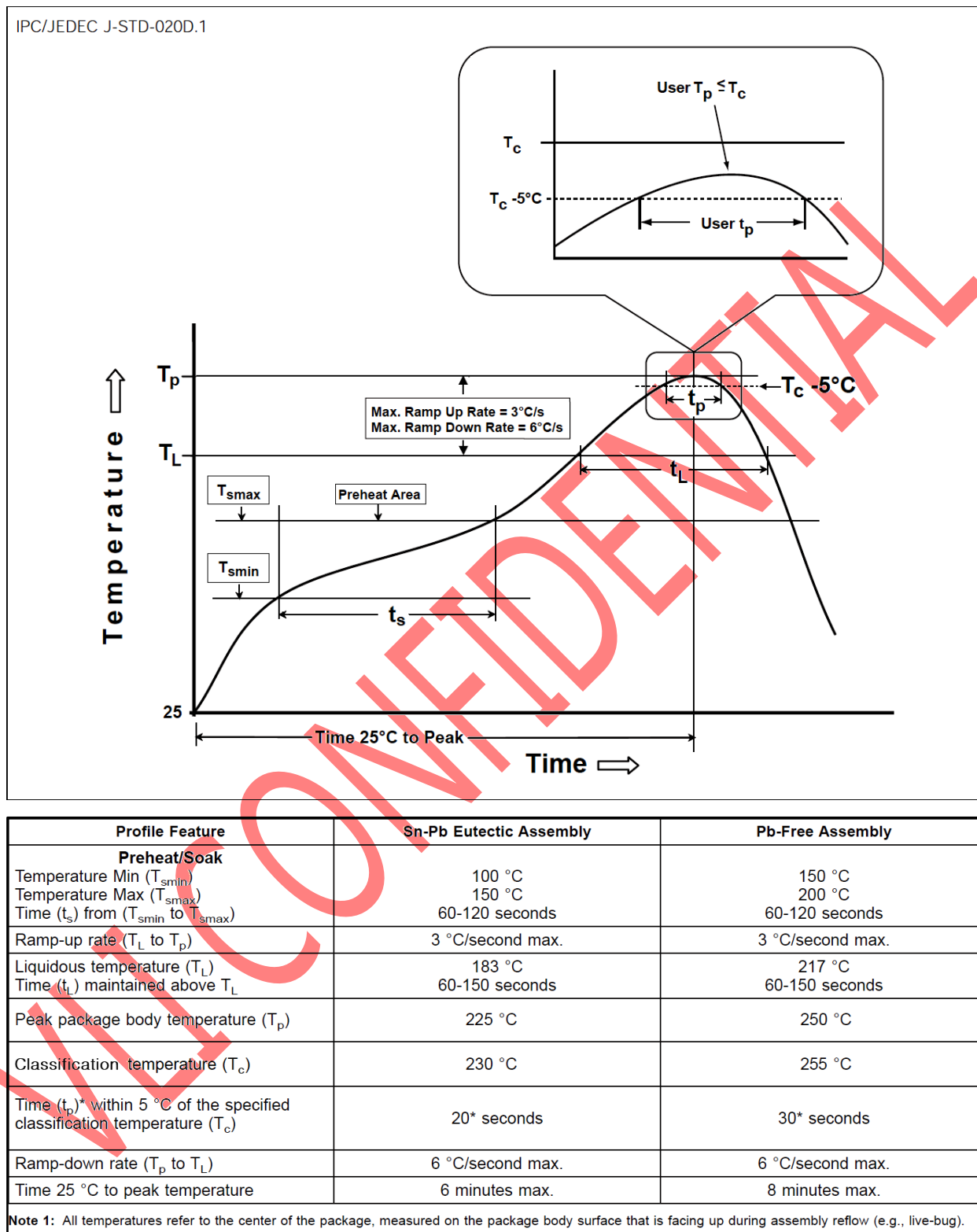


Figure 4 - Reflow

Package Mechanical Specifications

DFN-8

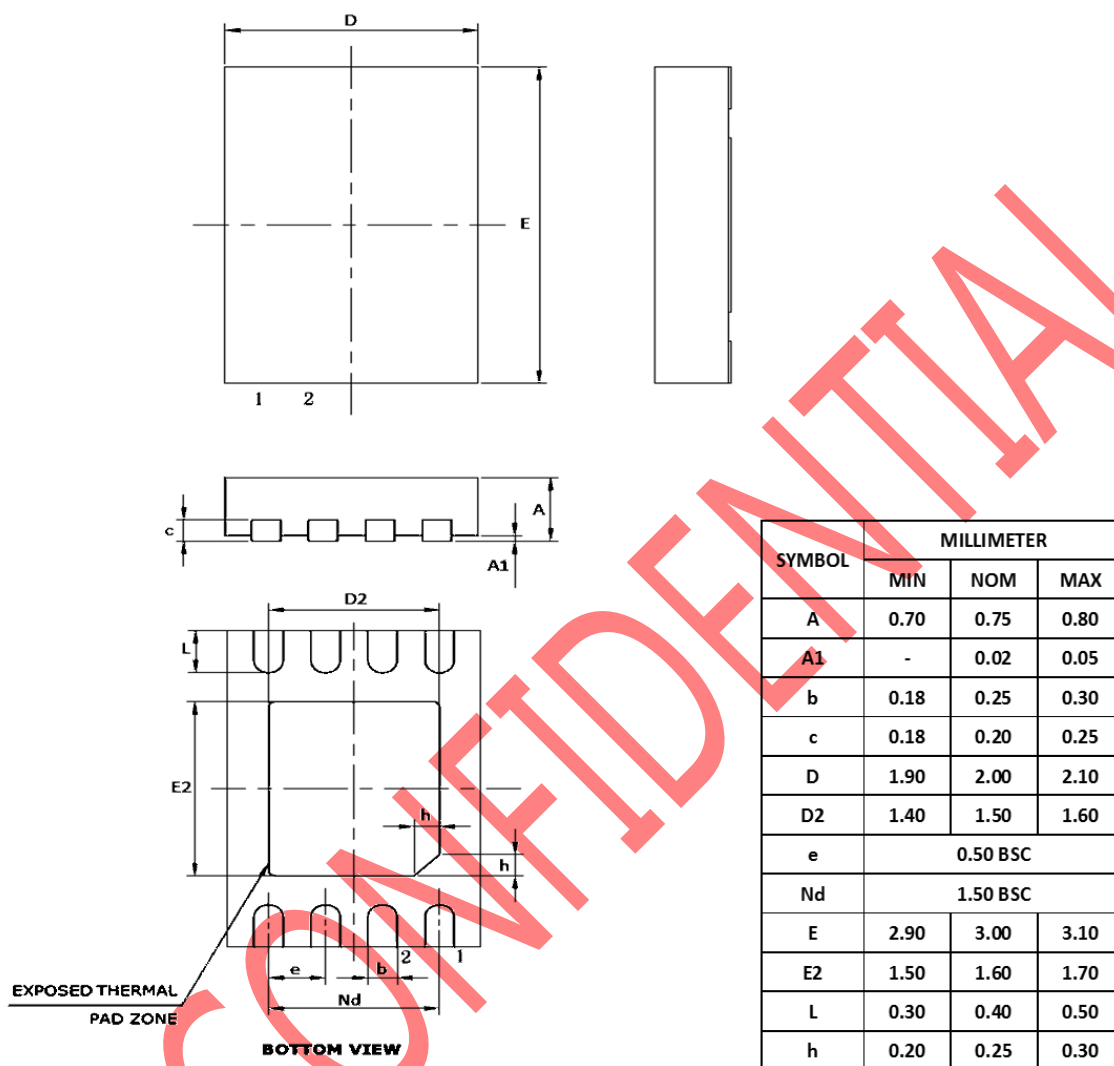


Figure 5 - Mechanical Specification (DFN-8)

WLCSP-6

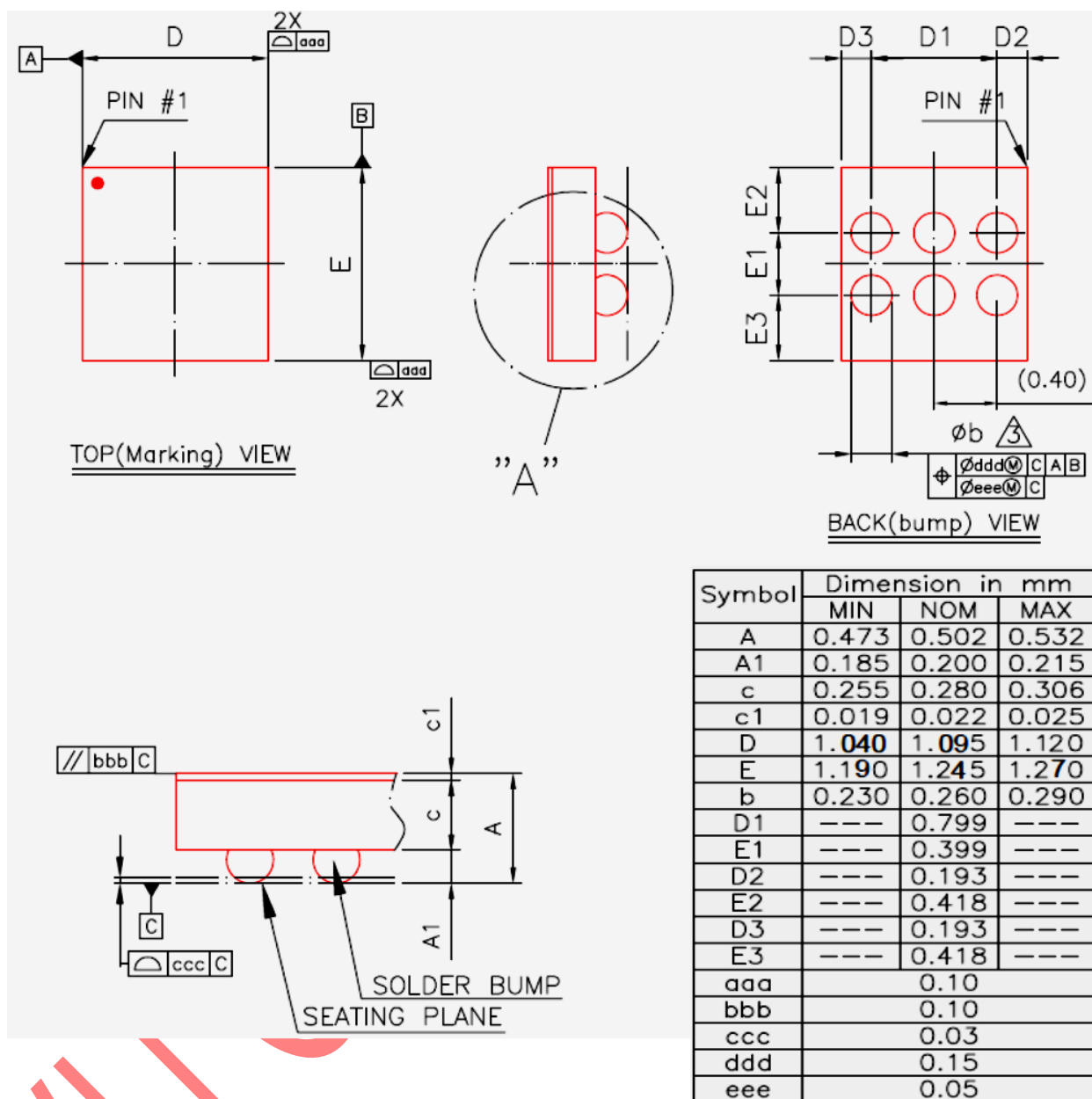
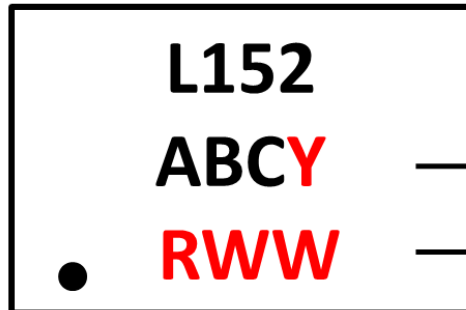


Figure 6 - Mechanical Specification (WLCSP-6)

Package Top Side Marking

DFN-8



ABC Y → Y: Production Year

↓
ABC: Internal code

R WW → WW: Production Week

↓
R: Revision Code

WLCSP-6



R Y → Y: Production Year

↓
R: Revision code

AB W → W: Production Week

↓
AB: Internal Code

Figure 7 - Package Top Side Marking

Ordering Information

Please contact VIA Labs sales representative or distributor in your region for ordering part number details.

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