

TS801/TS802 USB Type-C 線纜電子標籤晶片 (eMarker 3.0)

通用描述

TS801/TS802 是 USB Type-C 電子標籤晶片 (Emarker)。晶片支援 USB Type-C 介面和電源傳輸協定應用的被動式和主動式全功能 USB Type-C 電纜電子標籤 IC。

TS801/TS802 可直接通過 SOP' 指令支援 USB-PD 應用中的結構化 VDM 身份發現指令，可讓擁有 DFP 介面的主機能確切知道電纜的特性如電流通過能力、性能參數、供應商識別資訊等。

TS801/TS802 工作 2.7V 到 5.5V 電壓範圍。工作在 -40°C 到 +85°C 溫度範圍，TS801/TS802 提供 DFN-6L。

支援 USB Type-C 介面、PD 協定

- 通過 USB PD 3.0 認證 (CID 0343, CID 0004)
- 支援 SOP'/SOP" 通訊
- 支援主機進行的身份鑒定

封裝

- TS801 DFN-6L 2mm x 2mm x 0.5mm
- TS802 DFN-6L 2mm x 3mm x 0.85mm

功能

- 集成雙側 RA 電阻
- 集成雙側 VCONN 隔離二極體
- 使用可寫入記憶體存儲 VDM 資料
- 支援經 CC 引腳寫入結構化 VDM 資料
- 對多個一次性寫入記憶體有寫入保護
- 支援雷電 3 (Thunderbolt 3) 高速信號通訊
- ±6KV HBM ESD

供電

- 支持 2.7V~5.5V 的 VCONN1/VCONN2 供電

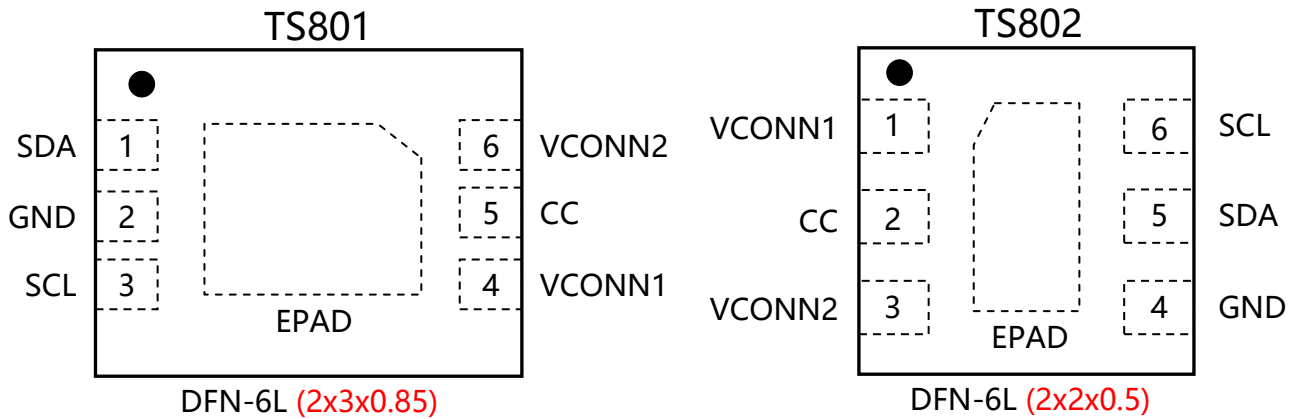
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更改紀錄

版本	日期	更新資訊
Rev 1.0	2020/6	初版
Rev 1.1	2020/8	更新部分參數設定
Rev 1.3	2021/1	增加 DFN6L (2x3x0.85)封裝型式
Rev 1.4	2021/3	增加 DFN6L (2x2x0.5)封裝型式
Rev 1.5	2021/3	修改訂購指南說明
Rev 1.6	2021/3	修改 DFN6L (2x2x0.5)封裝型式
Rev 1.7	2021/7	增加 USB PD3.0 認證 TID 編號

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引腳定義和功能描述

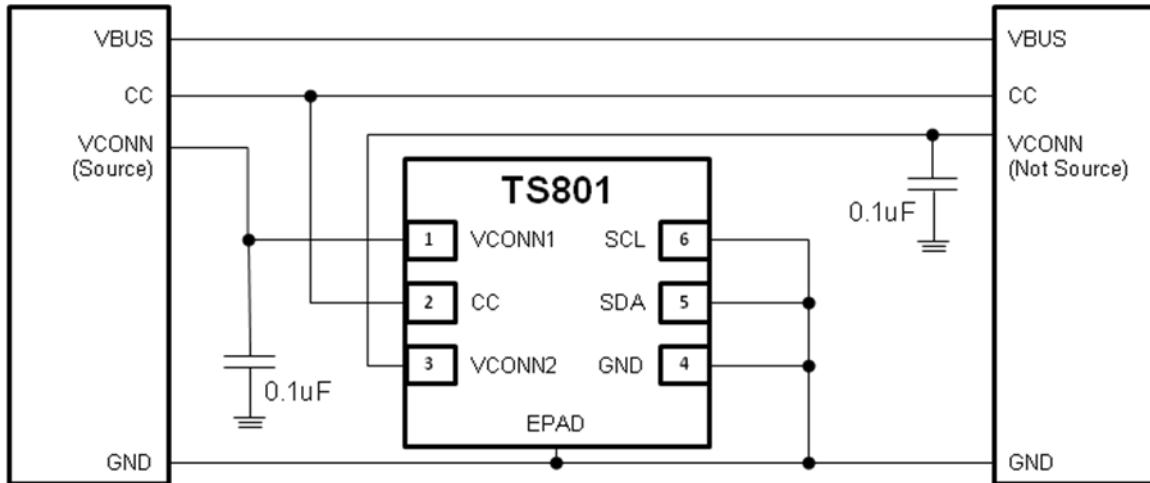


引腳功能描述

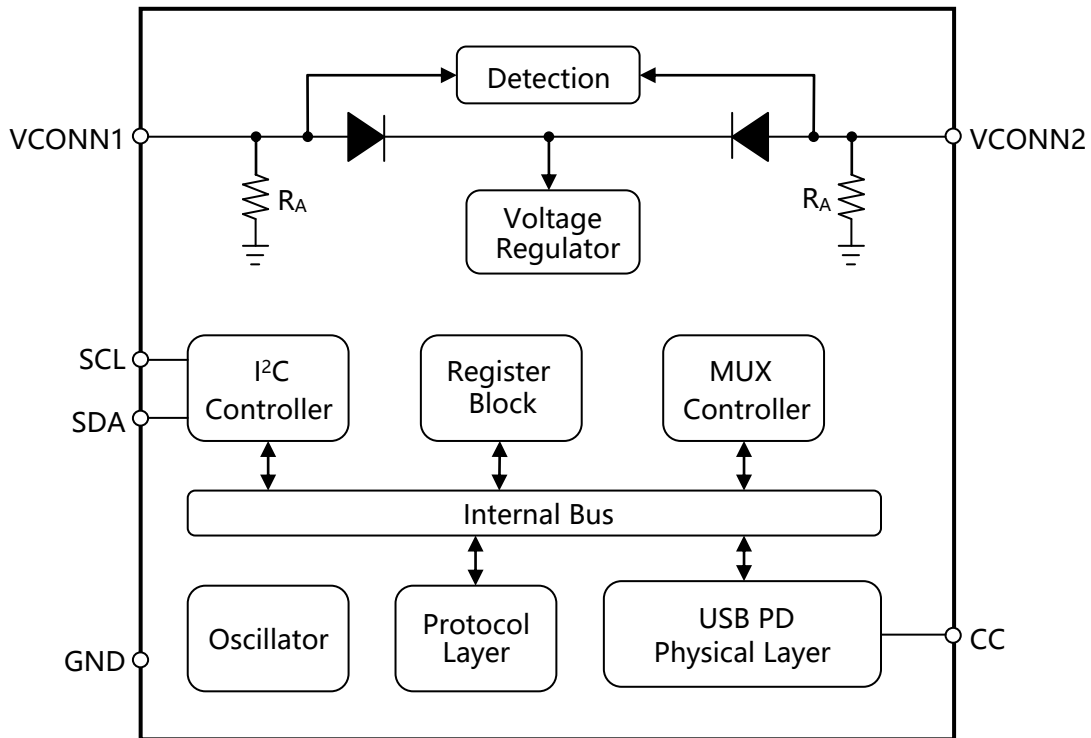
引腳		名稱	功能描述
TS801	TS802		
1	5	SDA	內部調試引腳，建議連接到地
2	4	GND	晶片接地引腳
3	6	SCL	內部調試引腳，建議連接到地
4	1	VCONN1	VCONN 電源供電引腳 1
5	2	CC	Type-C 配置通道引腳
6	3	VCONN2	VCONN 電源供電引腳 2
7	7	EPAD	熱焊盤，需連接到地

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應用線路



系統功能框圖



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應用資訊

DISCOVER IDENTITY 命令

詳細的 Discover Identity 命令參見 USB Power Delivery Specification Revision 3.0, Version 1.1 E-Marker 發送的 Discover Identity 命令應包含一個 ID Header VDO, 一個 Cert Stat VDO, 一個 Product VDO。

Product VDO 的產品類型的定義如下圖所示。

Header No. of Data Objects = 4-7 ¹	VDM Header	ID Header	Cert Stat VDO	Product VDO	0..3 ² Product Type VDO(s)
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Discover Identify 命令的回應

VDO 數據

VDO 定義

ID Header		
Bit(s)	Descriptions	Note
Bit[31]	USB communications capable as USB host : 0b : Otherwise	(固化)
Bit[30]	USB communications capable as a USB device : 0b : Otherwise	(固化)
Bit[29:27]	Product type (cable plug) : 011b : Passive cable	(固化)
Bit[26]	Modal operation supported : 0 : Otherwise	(固化)
Bit[25:23]	Product Type (DFP): 000b – Undefined	(固化)
Bit[22:21]	Connector Type: 11b – USB Type-C Plug	(固化)
Bit[20:16]	0 : Reserved, shall not be used	(固化)
Bit[15:0]	16-bit unsigned integer. USB vendor ID (0x30AC)	(固化)
Cert Stat VDO		
Bit(s)	Descriptions	Note
Bit[31: 0]	32-bit unsigned integer, XID (0x00002714 = 10004)	(固化)

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Product VDO			
Bit(s)	Descriptions		Note
Bit[31:16]	16-bit unsigned integer. USB Product ID (0x3001)		(固化)
Bit[15:0]	16-bit unsigned integer. bcdDevice (0x0000)		(固化)
Passive Cable VDO			
Bit(s)	Descriptions		Note
Bit[31:28]	Cable HW Version	0000b	(固化)
Bit[27:24]	Cable Firmware Version	0000b	(固化)
Bit[23:21]	VDO Version	Version number of the VDO (not this specification version) : Version 1.0 = 000b	(固化)
Bit[20]	Reserved	0 = Reserved, shall not be used	(固化)
Bit[19:18]	USB Type-C plug to USB Type-C/Captive	10b = Type-C	(固化)
Bit[17]	Reserved	0 = Reserved, shall not be used	(固化)
Bit[16:13]	Cable Latency	0000b : Reserved, shall not be used 0001b : < 10ns (~1m) 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)	(可選)
Bit[12:11]	Cable Termination Type	00b = VCONN not required. Cable plugs that only support discover identity commands shall set these bits to 00b.	(固化)
Bit[10:9]	Maximum VBUS Voltage	Maximum Cable VBUS Voltage: 00b – 20V 01b – 30V 10b – 40V 11b – 50V	(可選)

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Bit[8:7]	Reserved	00b = Reserved, shall not be used	(固化)
Bit[6:5]	VBUS Current Handling Capability	01b = 3A 10b = 5A	(可選)
Bit[4]	PD2.0 = VBUS Through Cable PD3.0 = Reserved (0b)	PD2.0 = 1 PD3.0 = 0	(固化)
Bit[3]	Reserved.	Shall be set to 0.	(固化)
Bit[2:0]	USB SuperSpeed Signaling support	000b = USB 2.0 only, no SuperSpeed support 001b = [USB 3.2] Gen1 010b = [USB 3.2] Gen1 and Gen2 See [USB Type-C 1.3] for definitions.	(可選)

規格指標

參數	符號	最小值	典型值	最大值	單位
BMC Signal (測試條件: $V_{CONN} = 3V$ to $5.5V$)					
Bit Rate	$f_{BitRate}$	270	300	330	Kbps
Maximum difference between the bit rate during the part of the packet following the Preamble and the reference bit rate.	$p_{BitRate}$	---	---	0.25	%
Time from the end of last bit of a Frame until the start of the first bit of the next Preamble.	$t_{InterFrameGap}$	25	---	---	μs
Time before the start of the first Bit of the Preamble when the transmitter shall start driving the line.	$t_{StartDrive}$	-1	---	1	μs
BMC Common Normative (測試條件: $V_{CONN} = 3V$ to $5.5V$)					
Time to cease driving the line after the end of the last bit of the Frame.	$t_{EndDriveBMC}$	---	---	23	μs
Fall Time	t_{Fall}	300	---	---	ns
Rise Time	t_{Rise}	300	---	---	ns
Time to cease driving the line after the	$t_{HoldLowBMC}$	1			μs

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final high to low transition					
Voltage Swing	V_{Swing}	1.05	1.125	1.2	V
Transmitter Output Impedance	Z_{Driver}	33	---	75	Ω
Transmit Low Voltage		-75	---	75	mV
BMC Receiver Normative (測試條件: $V_{CONN} = 3V$ to $5.5V$)					
Cable Termination	R_A	800	---	1200	Ω
Receiver Input Impedance	Z_{BmcRx}	1	---	---	$M\Omega$
Time Window for Detecting Bus Non-idle	$t_{TransitionWindow}$	12	---	20	μs
Number to Count to Detect Bus Non-idle	n_{Count}	3	---	---	
Time constant of a single pole filter to limit broad-band noise ingress	$t_{RxFilter}$	100	---	---	ns

General Parameters					
VCONN1/VCONN2 Voltage	V_{DD}	2.75	5	5.5	V
Operation Current ($V_{CONN} = 5V$)	I_{op}	---	4	---	mA
Standby current ($V_{CONN} = 5V$)	$I_{standby}$	---	1.6	---	mA
Operating Junction Temperature	T_J	-40	---	125	$^{\circ}C$
Operating Ambient Temperature	T_A	-40	---	85	$^{\circ}C$

絕對最大值

參數	等級
VCONN1 / VCONN2	-0.5V to 7V
SDA、SCL、CC to GND	-0.5V to 3.6V
Storage Temperature	-65 $^{\circ}C$ to 150 $^{\circ}C$
Operation Temperature	-40 $^{\circ}C$ to 125 $^{\circ}C$
ESD HBM – CC / VCONN1 / VCONN2	$\pm 8KV$
ESD HBM – SDA / SCL	$\pm 5KV$

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

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封裝熱組係數

封裝	θ_{JA}	θ_{JC}	單位
DFN-6L (2mm x 2mm)	45.5	11.7	°C/W

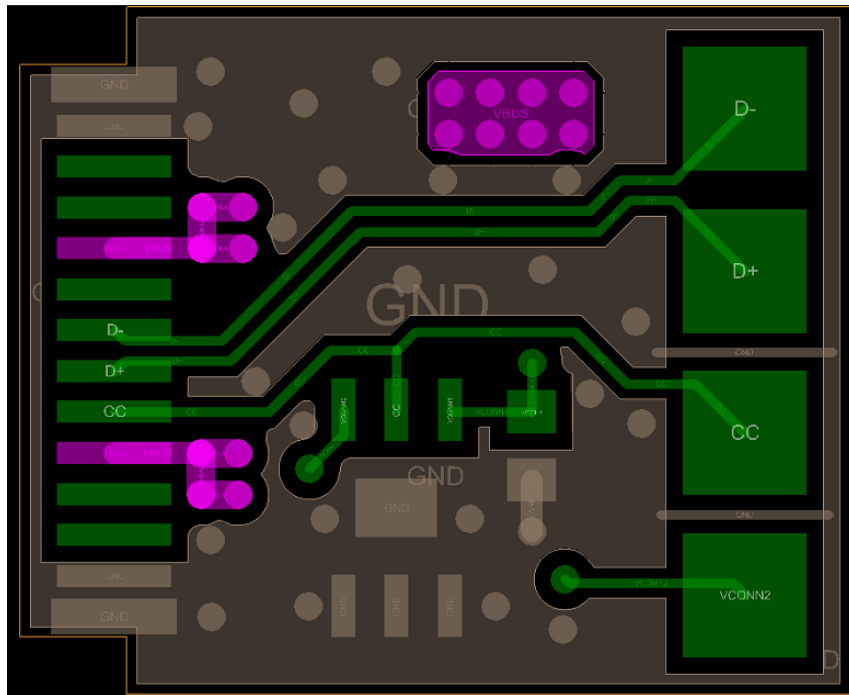
Note: About thermal factors, T_a is the concerned ambient temperature, and

$$\theta_{CA} = \theta_{JA} - \theta_{JC}$$

$$T_J = \theta_{JA} * P_D + T_a \quad T_C = \theta_{CA} * P_D + T_a$$

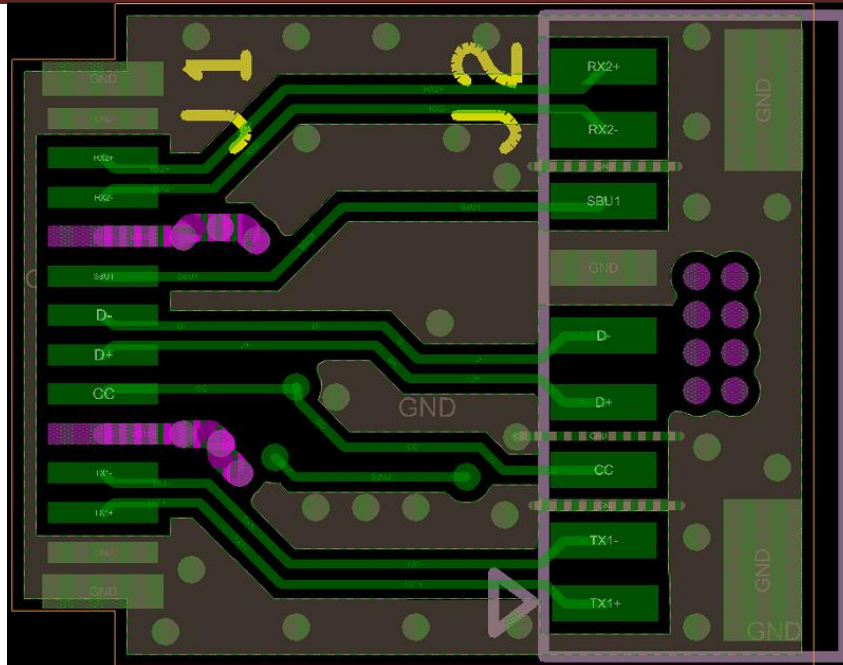
應用資訊

(a) 6 pins charge board



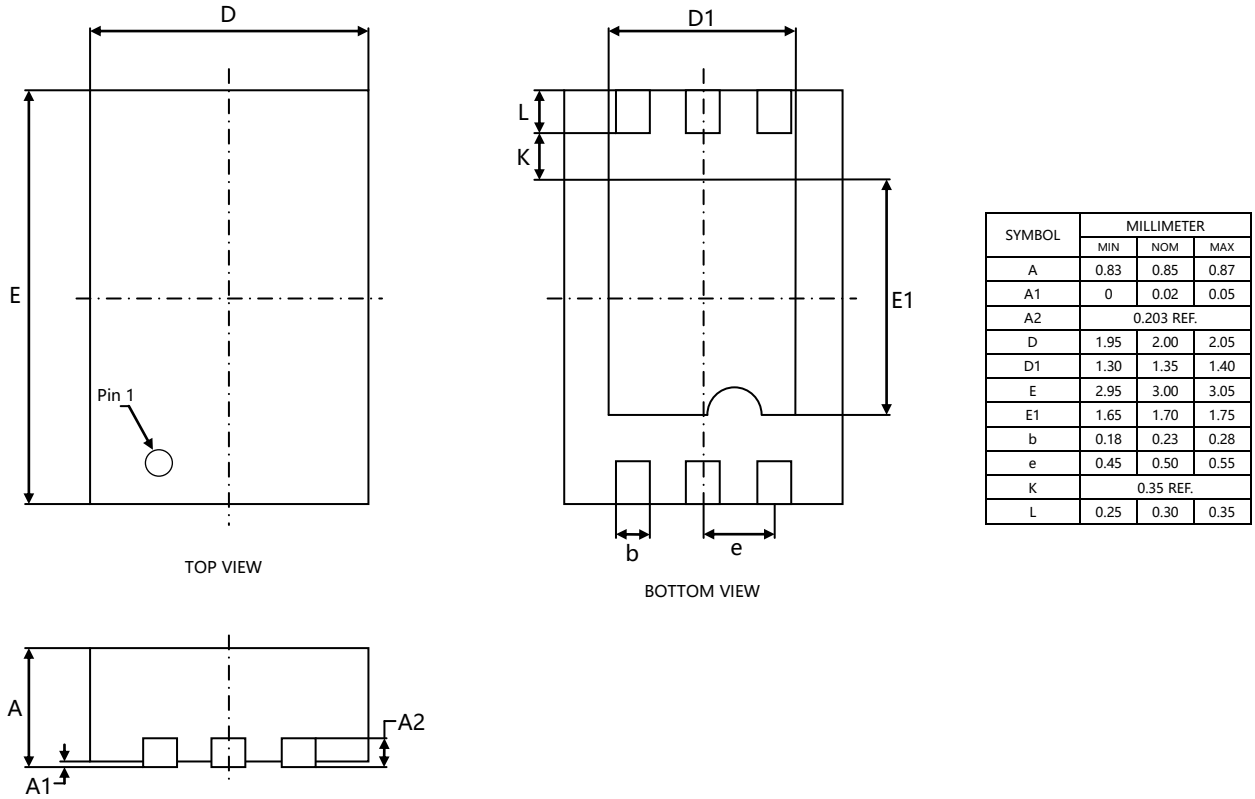
(b) 24 pins full-function board

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封裝 DFN-6L (TS801)



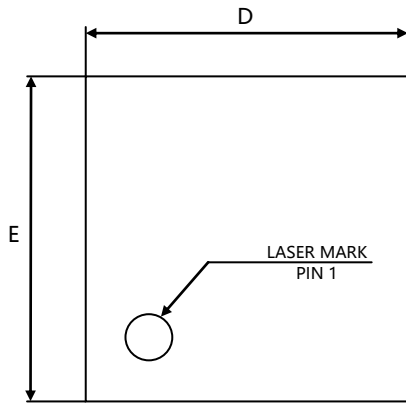
DFN-6L 封裝, 2 mm × 3 mm

訂購指南

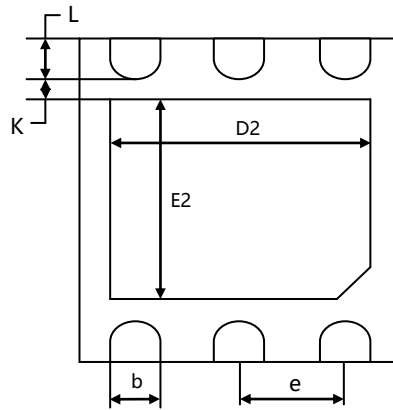
訂貨型號	描述	環境溫度範圍	包裝形式
TS801A	USB2.0, 1M~2M cable, 5A, VBUS=20V, DFN-6L 封裝	-40°C to +85°C	Tape & Reel, 4000
TS801B	USB3.2 Gen 1, 1M~2M cable, 5A, VBUS=20V, DFN-6L 封裝	-40°C to +85°C	Tape & Reel, 4000
TS801C	USB3.2 Gen 2, 1M~2M cable, 5A, VBUS=20V, DFN-6L 封裝	-40°C to +85°C	Tape & Reel, 4000

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封裝 DFN-6L (TS802)

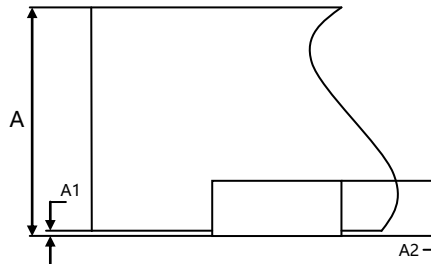
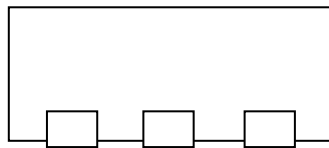


TOP VIEW



BOTTOM VIEW

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.45	0.50	0.55
A1	0	0.02	0.05
A2	0.127 REF.		
b	0.25	0.3	0.35
D	1.95	2.00	2.05
D2	1.58	1.6	1.62
E	1.95	2.00	2.05
E2	1.28	1.3	1.32
e	0.65 REF.		
K	0.35 REF.		
L	0.2	0.25	0.3



DFN-6L 封裝, 2 mm × 2 mm

訂購指南

訂貨型號	描述	環境溫度範圍	包裝形式
TS802A	USB2.0, 1M~2M cable, 5A, VBUS=20V, DFN-6L 封裝	-40°C to +85°C	Tape & Reel, 4000
TS802B	USB3.2 Gen 1, 1M~2M cable, 5A, VBUS=20V, DFN-6L 封裝	-40°C to +85°C	Tape & Reel, 4000
TS802C	USB3.2 Gen 2, 1M~2M cable, 5A, VBUS=20V, DFN-6L 封裝	-40°C to +85°C	Tape & Reel, 4000