



FM868/FM869(文件编号：S&CIC1988) USB Type-C 线缆电子标签芯片(eMarker 3.0)

通用描述

FM868/FM869是USB Type-C电子标签芯片(Emarker)。芯片支持USB Type-C接口和电源传输协议应用的被动式和主动式全功能USB Type-C电缆电子标签IC。

FM868/FM869可直接通过SOP'指令支持USB-PD应用中的结构化VDM身份发现指令,可让拥有DFP接口的主机能确切知道电缆的特性如电流通过能力、性能参数、供货商识别信息等。

FM868/FM869工作2.7V到5.5V电压范围。工作在-40°C到+85°C温度范围,FM868/FM869提供DFN-6L。

封装

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

功能

- 集成双侧RA电阻
- 集成双侧VCONN隔离二极管
- 使用可写入内存存储VDM数据
- 支持经CC引脚写入结构化VDM数据
- 对多个一次性写入内存有写入保护
- 支持雷电3(Thunderbolt 3)高速信号通讯
- $\pm 6\text{KV}$ HBM ESD

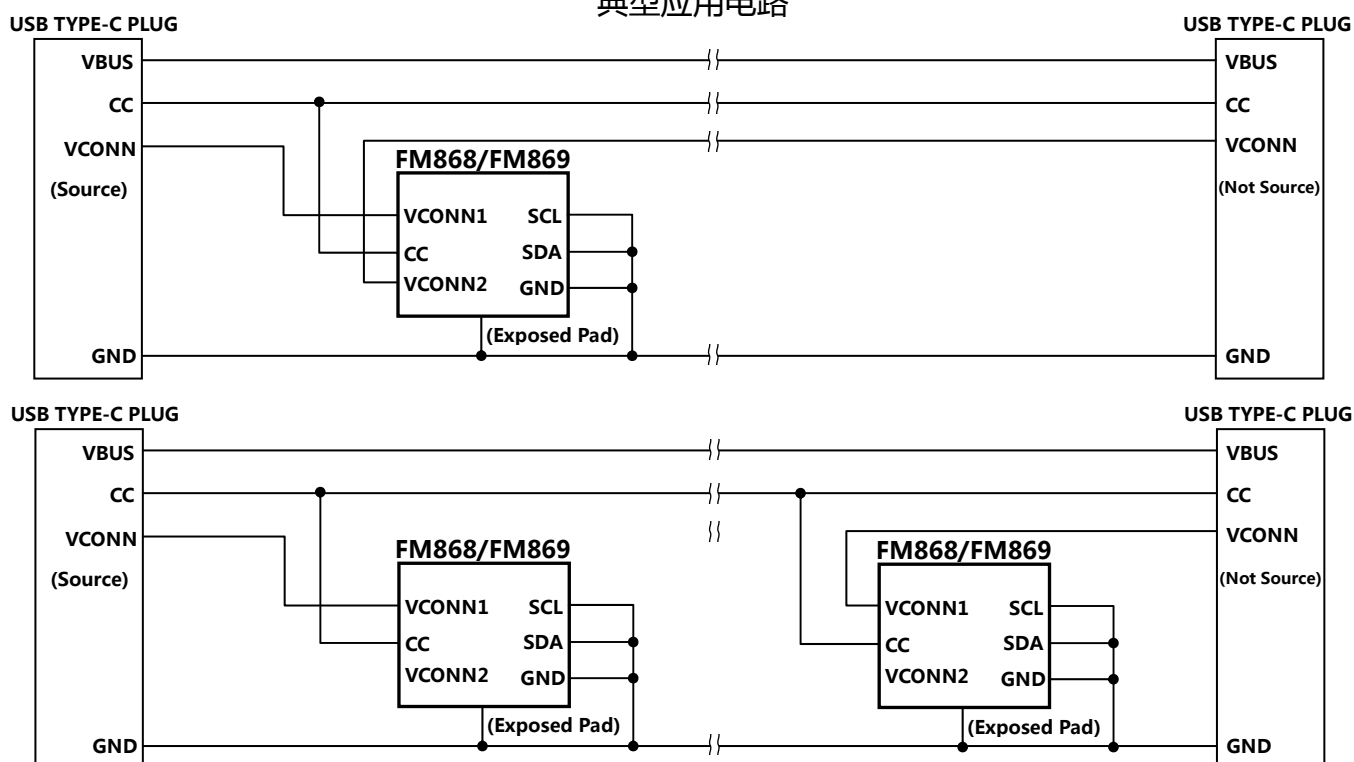
支持USB Type-C接口、PD协议

- 通过USB PD3.0认证 (TID : 5343, XID : 10004)
- 支持SOP'/SOP"通讯
- 支持主机进行的身份鉴定

供电

- 支持2.7V~5.5V的VCONN1/VCONN2供电

典型应用电路





富满微电子集团股份有限公司

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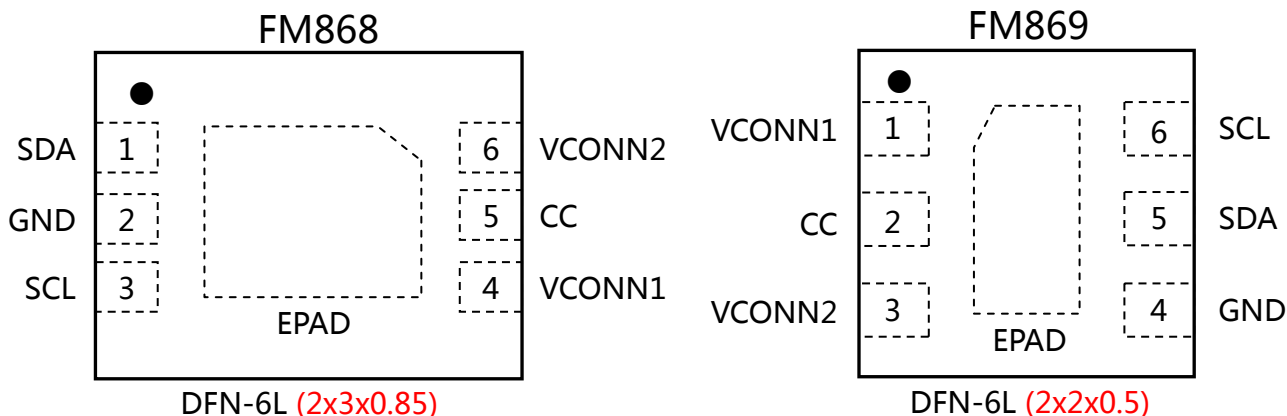
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更改纪录

版本	日期	更新信息
Rev 1.0	2020/6	初版
Rev 1.1	2020/8	更新部分参数设定
Rev 1.3	2021/1	增加 DFN6L (2x3x0.85)封装型式
Rev 1.4	2021/3	增加 DFN6L (2x2x0.5)封装型式
Rev 1.5	2021/3	修改订购指南说明
Rev 1.6	2021/3	修改 DFN6L (2x2x0.5)封装型式
Rev 1.7	2021/7	增加 USB PD3.0 认证 TID 编号



引脚定义和功能描述

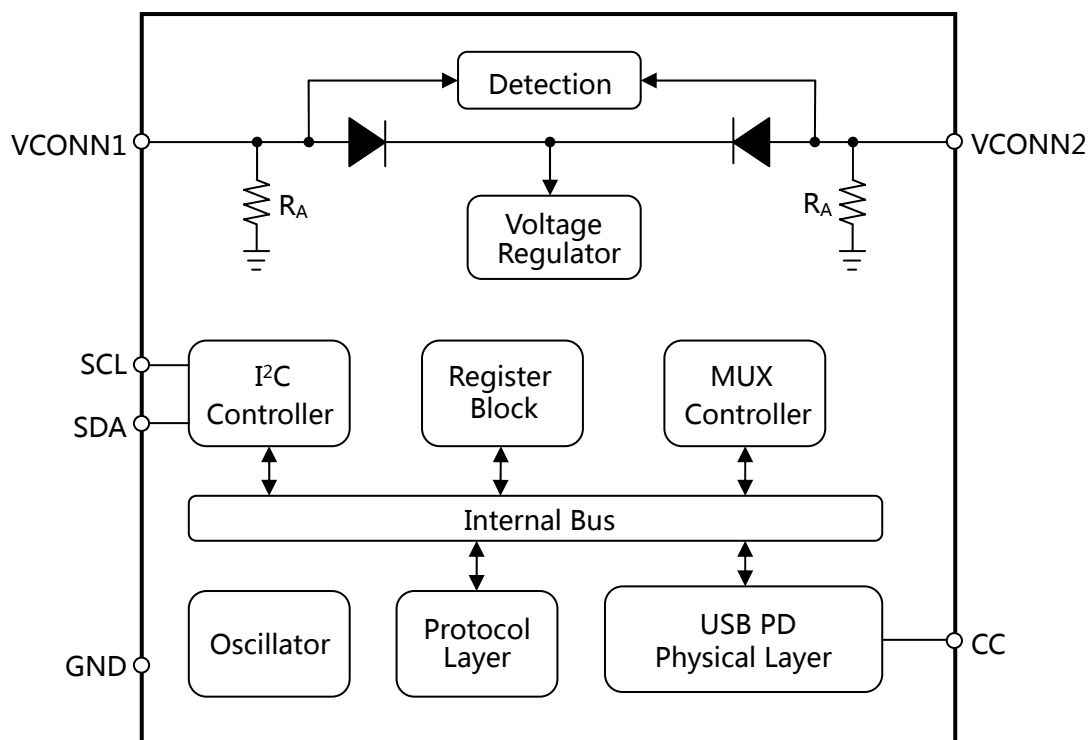


引脚功能描述

引脚		名称	功能描述
FM868	FM869		
1	5	SDA	内部调试引脚，建议连接到地
2	4	GND	芯片接地引脚
3	6	SCL	内部调试引脚，建议连接到地
4	1	VCONN1	VCONN 电源供电引脚 1
5	2	CC	Type-C 配置信道引脚
6	3	VCONN2	VCONN 电源供电引脚 2
7	7	EPAD	热焊盘，需连接到地



系统功能框图



应用信息

DISCOVER IDENTITY 命令

详细的 Discover Identity 命令参见 USB Power Delivery Specification Revision 3.0, Version 1.1 E-Marker 发送的 Discover Identity 命令应包含一个 ID Header VDO, 一个 Cert Stat VDO, 一个 Product VDO。

Product VDO 的产品类型的定义如下图所示。

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

Discover Identify 命令的响应



VDO 数据

VDO 定义

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)
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)	(可选)
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	(可选)
Bit[8:7]	Reserved	00b = Reserved, shall not be used	(固化)
Bit[6:5]	VBUS Current Handling Capability	01b = 3A 10b = 5A	(可选)
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.	(可选)



规格指针

参数	符号	最小值	典型值	最大值	单位
BMC Signal (测试条件: $V_{CONN} = 3V$ 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 (测试条件: $V_{CONN} = 3V$ 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 final high to low transition	$t_{HoldLowBMC}$	1			μs
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 (测试条件: $V_{CONN} = 3V$ 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	°C
Operating Ambient Temperature	T_A	-40	---	85	°C

绝对最大值

参数	等级
VCONN1 / VCONN2	-0.5V to 7V
SDA、SCL、CC to GND	-0.5V to 3.6V
Storage Temperature	-65°C to 150°C
Operation Temperature	-40°C to 125°C
ESD HBM – CC / VCONN1 / VCONN2	± 8KV
ESD HBM – SDA / SCL	± 5KV

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

封装热组系数

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

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

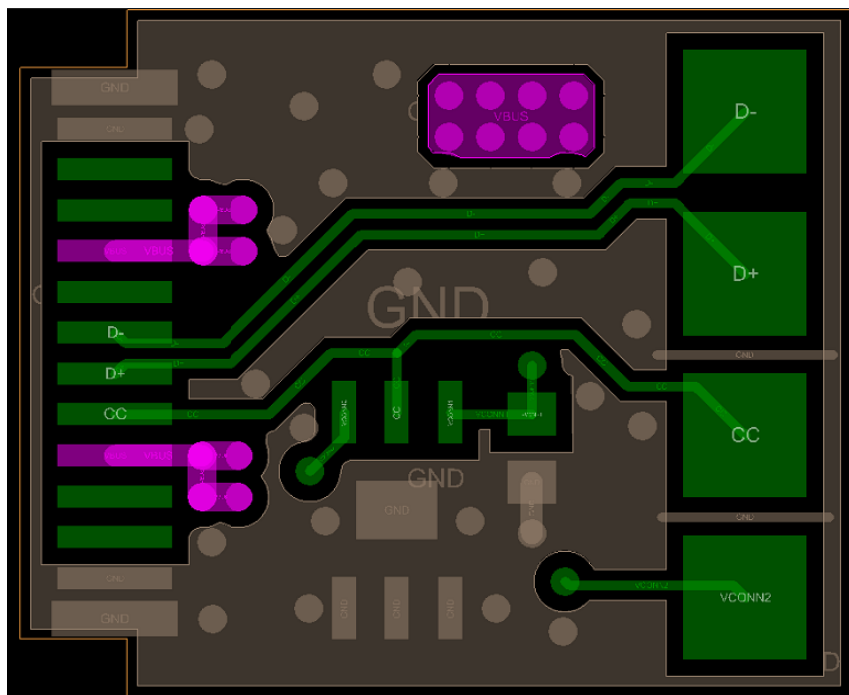
$$\theta_{CA} = \theta_{JA} - \theta_{JC}$$

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

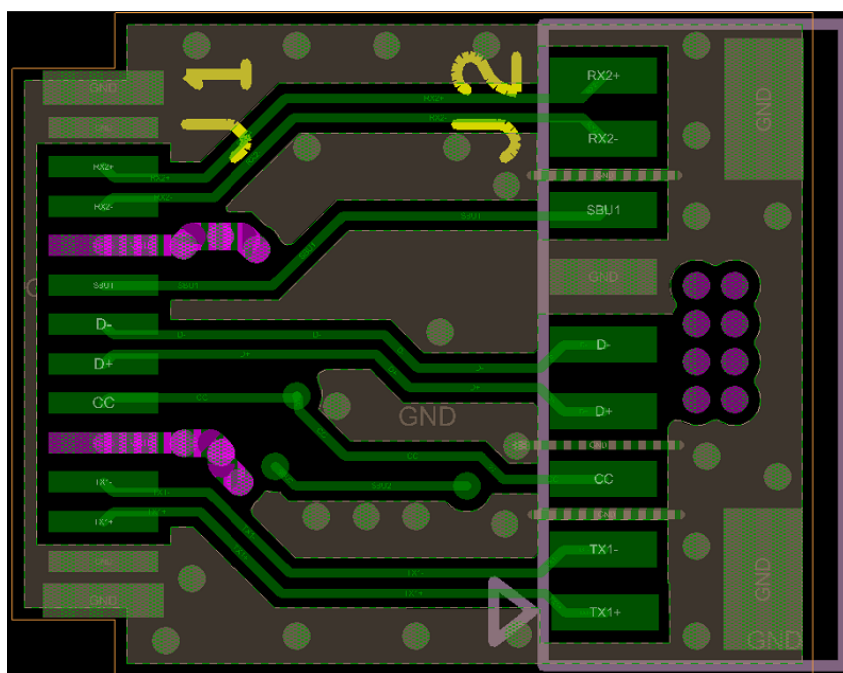


应用信息

(a) 6 pins charge board



(b) 24 pins full-function board





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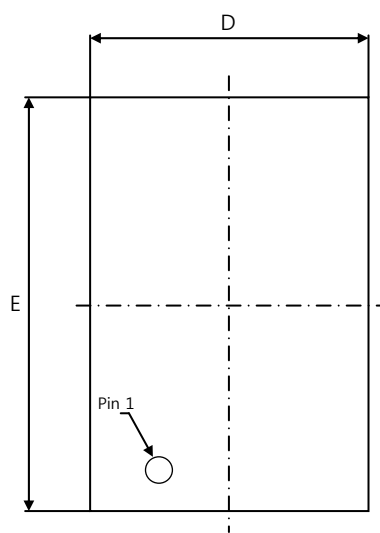
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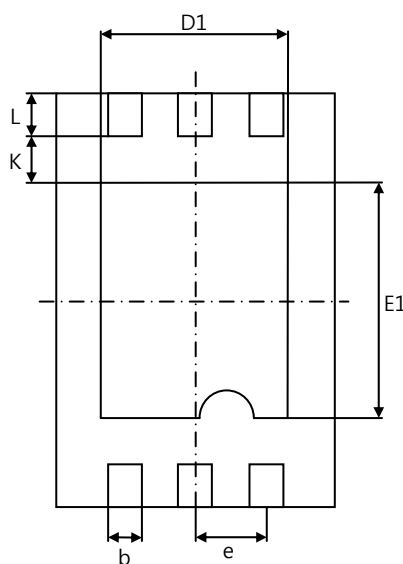
DFN-6L (2x3x0.85)封装顶层丝印



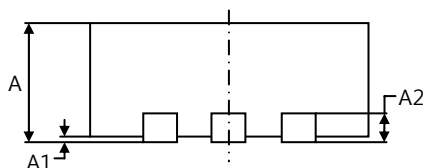
封装 DFN-6L



TOP VIEW



BOTTOM VIEW



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.83	0.85	0.87
A1	0	0.02	0.05
A2	0.203 REF.		
D	1.95	2.00	2.05
D1	1.30	1.35	1.40
E	2.95	3.00	3.05
E1	1.65	1.70	1.75
b	0.18	0.23	0.28
e	0.45	0.50	0.55
K	0.35 REF.		
L	0.25	0.30	0.35

DFN-6L 封装, 2 mm × 3 mm

订购指南

订货型号	描述	环境温度范围	包装形式
FM868A	USB2.0, 1M~2M cable, 5A, VBUS=20V, DFN-6L 封装	-40°C to +85°C	Tape & Reel, 4000
FM868B	USB3.2 Gen 1, 1M~2M cable, 5A, VBUS=20V, DFN-6L 封装	-40°C to +85°C	Tape & Reel, 4000
FM868C	USB3.2 Gen 2, 1M~2M cable, 5A, VBUS=20V, DFN-6L 封装	-40°C to +85°C	Tape & Reel, 4000



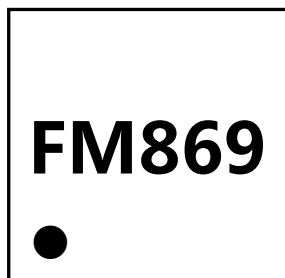
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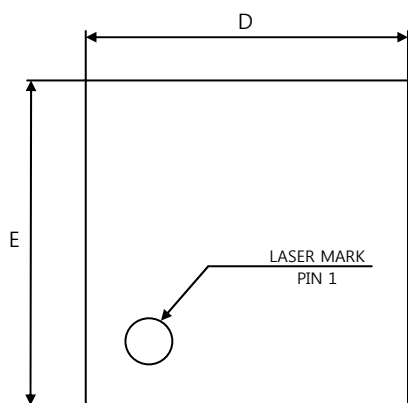
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封装和丝印

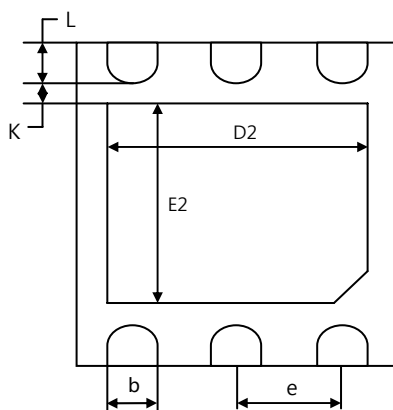
DFN-6L (2x2x0.5)封装顶层丝印



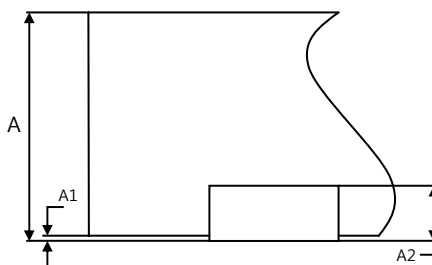
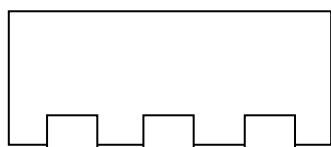
封装 DFN-6L



TOP VIEW



BOTTOM VIEW



DFN-6L 封装, 2 mm × 2 mm

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

订购指南

订货型号	描述	环境温度范围	包装形式
FM869A	USB2.0, 1M~2M cable, 5A, VBUS=20V, DFN-6L 封装	-40°C to +85°C	Tape & Reel, 4000
FM869B	USB3.2 Gen 1, 1M~2M cable, 5A, VBUS=20V, DFN-6L 封装	-40°C to +85°C	Tape & Reel, 4000
FM869C	USB3.2 Gen 2, 1M~2M cable, 5A, VBUS=20V, DFN-6L 封装	-40°C to +85°C	Tape & Reel, 4000