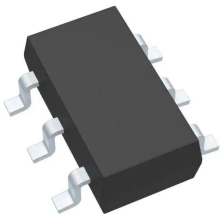
Silicore
芯谷科技

D1524

USB dedicated charging port controller

summary:

The D 1524 is a dedicated USB charging port controller. It can be applied to in-vehicle chargers, AC-DC power adapters with USB ports, and other USB charging devices. The D 1524 features automatic detection; it monitors changes in voltage on D+ and D-, and loads the correct recognizable signals on DP and DM at the right time, enabling fast charging for compatible portable devices connected to it. Supported portable devices include smartphones, 5V chargable tablets, and personal media players.



SOT23-6

D 1524 Supports the following five most commonly used charging protocols:

- Pressure 3 (2.7V and 2.7V are applied to the D+ and D-lines respectively)
- BC1.2 Protocol, USB Battery Charging Technical Specification 1.2, Revision
- China Telecom industry standard YD/T 1591-2009
- A voltage of 1.2V is applied to both D+ and D-

main features:

- According to the USB battery charging technical specification, revision 1.2 (BC1.2) supports USB DCP D+ short to D-.
- In accordance with China Telecom industry standard YD/T 1591-2009, short circuit mode is supported (D+ short circuit to D-)
- Support the USB dedicated charging protocol that applies 2.7V voltage on D+ and 2.7V voltage on D-
- Support USB dedicated charging protocol to apply 1.2V voltage on D+ and D-lines
- The D+ and D-lines are automatically switched to connect the device
- Dual USB port controller
- Working voltage range: 4.5V to 5.5V

Packaging information:

Model	Packaging form	Printing method	Manner of packing
D1524	SOT23-6	D1524 SXXXX	3000 units per tray

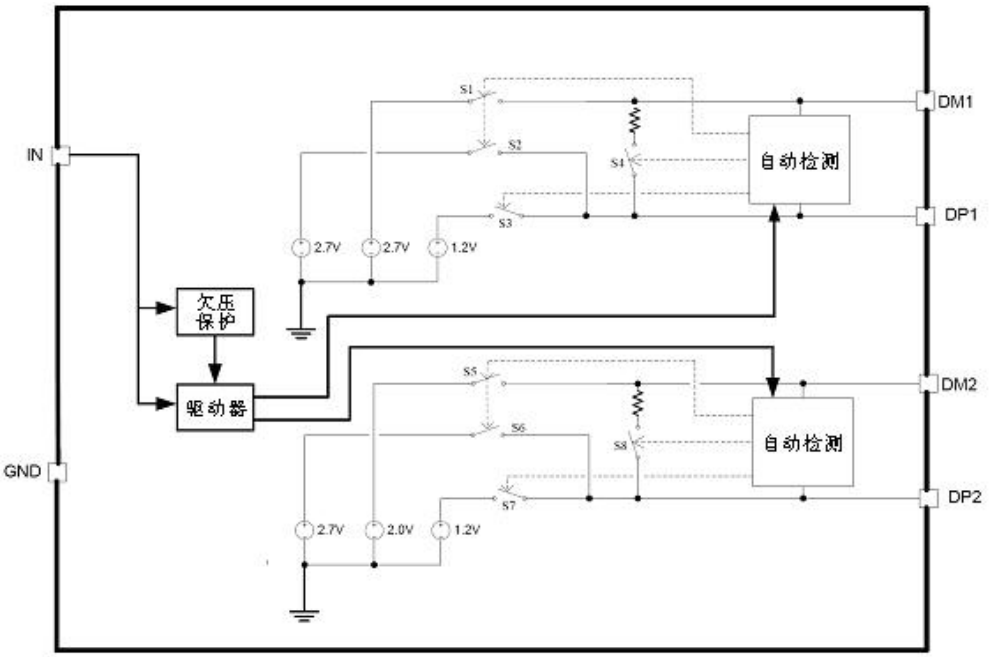
D 1524 is the product name, and SXXXX is the week number.

apply:

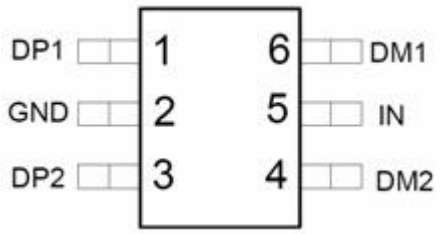
- Car USB charger

- An AC (AC) -DC (DC) adapter with a USB port
- Other USB chargers

functional block diagram:



Pin layout:



Pin description:

Pin number	Pin name	Type	Functional description
1	DP1	Input/output	Connect to the D+ or D-on the USB port to provide the correct DCP detection signal for the inserted portable device
2	GND	The earth	Connect to the ground
3	DP2	Input/output	Connect to the D+ or D-on the USB port to provide the correct DCP detection signal for the inserted portable device
4	DM2	Input/output	Connect to the D+ or D-on the USB port to provide the correct DCP detection signal for the inserted portable device
5	IN	Source	At the power end, connect a ceramic capacitor greater than 0.1μF between IN and GND, as close to the device as possible
6	DM1	Input/output	Connect to the D+ or D-on the USB port to provide the correct DCP detection signal for the inserted portable device

Maximum value: Unless otherwise stated, the marked voltage values are relative to ground within the recommended junction temperature range

Parameter name	Condition	Minimum	Maximum	Unit
Voltage range	IN	-0.3	7	V
	DP1, DP2 output voltage, DM1, DM2 output voltage	-0.3	5.8	
	DP1, DP2 input voltage, DM1, DM2 input voltage	-0.3	5.8	
Continuous inrush current output	DP1, DP2 input voltage, DM1, DM2 input voltage		35	mA
Continuous source current output	DP1, DP2 output voltage, DM1, DM2 output voltage		35	mA
Working temperature range	TJ	-40	125	℃
Storage temperature range	Tstg	-65	150	℃
ESD voltage (human body mode)		8000		V

* Working beyond the limits listed above may cause permanent damage to the device. The parameters mentioned are only extreme values; we do not recommend using these extreme conditions or any other conditions that exceed the recommended operating range for normal functionality of the device. Prolonged exposure to these extreme values could potentially affect the reliability of the device

Thermal parameter information:

Parameter name	Symbol	DBV	Unit
Resist heat between the ambient temperature and the gentle environment	θ_{JA}	179.9	℃/W
The thermal resistance between the surface (top) temperature of the junction and the package shell	θ_{JCtop}	117.5	
The thermal resistance between the main board temperature and the ambient temperature is reduced	θ_{JB}	41.9	
The characterization parameters are obtained to the top of the encapsulated shell	Ψ_{JT}	17.2	
The characteristic parameters between the junction and the motherboard	Ψ_{JB}	41.5	
The thermal resistance between the back of the warm package and the temperature is measured	θ_{JCbot}	N/A	

Recommended work scope:

Unless otherwise specified, the voltage is referenced to GND and the current flowing into the PIN is positive

Parameter name	Symbol	Minimum	Maximum	Unit

The IN pin is the input voltage	V_{IN}	4.5	5.5	V
DP1 data port input voltage	V_{DP1}	0	5.5	V
DM1 data port input voltage	V_{DM1}	0	5.5	V
DP1 data port continuous source sink current	I_{DP1}		±10	mA
DM1 data port continuous source sink current	I_{DM1}		±10	mA
DP2 data port input voltage	V_{DP2}	0	5.5	V
DM2 data port input voltage	V_{DM2}	0	5.5	V
DP2 data port continuous source sink current	I_{DP2}		±10	mA
DM2 data port continuous source sink current	I_{DM2}		±10	mA
Junction temperature	T_J	-40	125	℃

electrical characteristics:

Unless otherwise specified, the test conditions are-40 °C (TJ= TA) 125 °C, 4.5V VIN 5.5V. The forward current flowing into the PIN pin is positive. The typical test temperature is 25 . All voltages are referenced to GND.

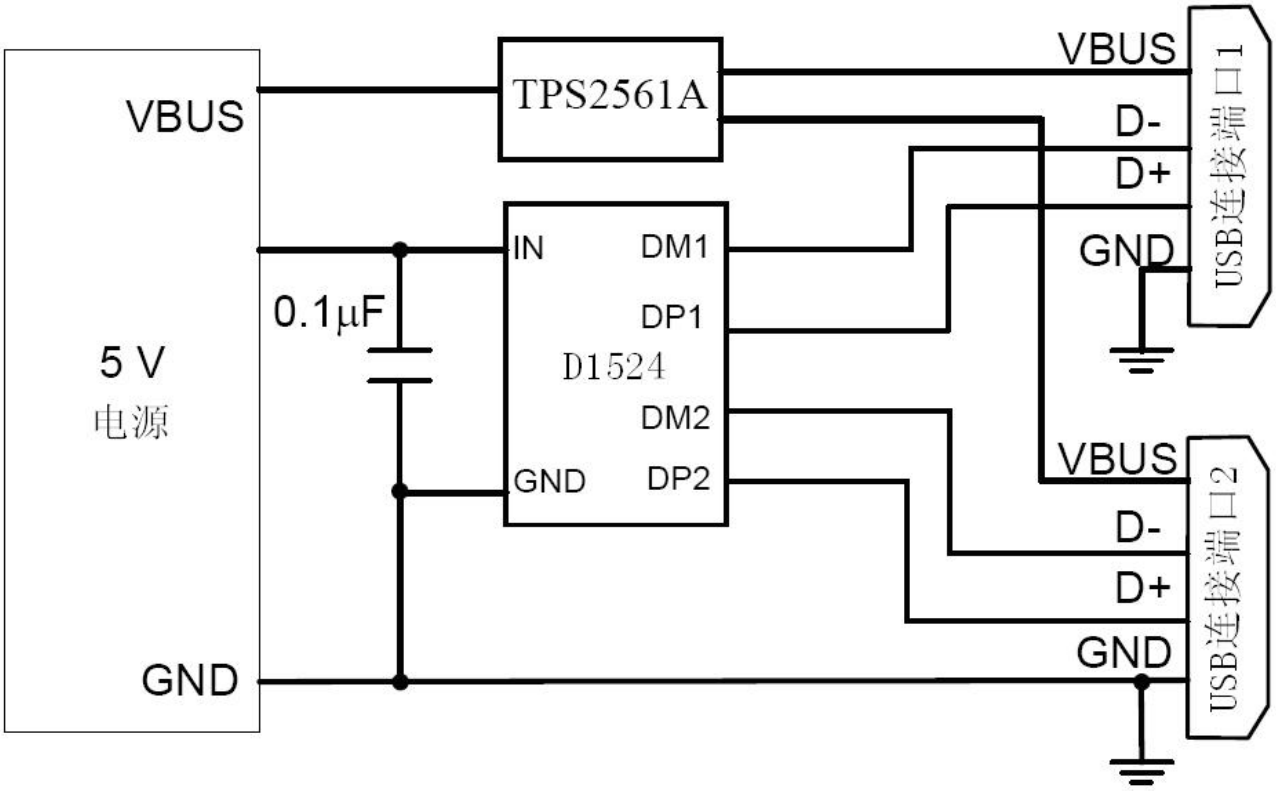
Parameter name	Symbol	Test condition	Minimum	Typical case	Maximum	Unit
Under-voltage lockout						
The IN pin starts at the threshold voltage	VUVLO		3.89	4.15	4.38	V
Under voltage hysteresis				100		mV
Source current						
The IN foot power current	I	4.5 V ≤ V_{IN} ≤ 5.5 V		155	231	μA
BC 1.2 DCP mode (short circuit mode)						
DP1 and DM1 short circuit resistance	RDPM_SHORT1	V_{DP1}= 0.8V, I_{DM1}= 1 mA		157	200	Ω
DP1/DM1 to ground resistance	RDCHG_SHORT1	V_{DP1}= 0.8V	350	656	1150	kΩ
DP1 jumps back to the threshold voltage of the split voltage mode	VDPL_TH_DETACH1		310	330	350	mV
Under-voltage hysteresis *	VDPL_TH_DETACH_H			50		mV
DP2 and DM2 short circuit resistance	RDPM_SHORT2	V_{DP2}= 0.8V, I_{DM2}= 1 mA		157	200	Ω
DP2/DM2 to ground	RDCHG_					

resistance	SHORT2	V_{DP2}= 0.8V	350	656	1150	kΩ
DP2 jumps back to the threshold voltage of the divided pressure mode	VDPL_TH_DETACH2		310	330	350	mV
Under-voltage hys-teresis*	VDPL_TH_DETACH_H			50		mV
Pressure mode						
DP1 output voltage	VDP1_2.7V	VIN =5V	2.56	2.7	2.87	V
DM1 output voltage	VDM1_2V	VIN =5V	2.56	2.7	2.87	V
DP1 output impedance	RDP1_PAD1	IDP1=-5μA	23.9	30	36.1	kΩ
DM1 output impedance	RDM1_PAD1	IDM1=-5μA	23.9	30	36.1	kΩ
DP2 output voltage	VDP2_2.7V	VIN =5V	2.56	2.7	2.87	V
DM2 output voltage	VDM2_2V	VIN =5V	2.56	2.7	2.87	V
DP2 output impedance	RDP2_PAD1	IDP2=-5μA	23.9	30	36.1	kΩ
DM2 output impedance	RDM2_PAD1	IDM2=-5μA	23.9	30	36.1	kΩ
1.2V/1.2V pattern						
DP1 output voltage	VDP1_2.7V	VIN =5V	1.11	1.2	1.29	V
DM1 output voltage	VDM1_2V	VIN =5V	1.11	1.2	1.29	V
DP1 output impedance	RDP1_PAD1	IDP1=-5μA	79.9	102	130.1	kΩ
DM1 output impedance	RDM1_PAD1	IDM1=-5μA	79.9	102	130.1	kΩ
DP2 output voltage	VDP2_2.7V	VIN =5V	1.11	1.2	1.29	V

DM2 output voltage	VDM 2_2V	VIN =5V	1.11	1.2	1.29	V
DP2 output impedance	RDP2_ PAD1	IDP2=- 5μA	79.9	102	130.1	kΩ
DM2 output impedance	RDM2_ PAD1	IDM2=- 5μA	79.9	102	130.1	kΩ

* Design guaranteed, non-test parameters.

Typical application diagram:



application message:

summary:

The following overview references a variety of industry standards, and we recommend that you refer to the latest version to ensure timeliness and accuracy.

A rechargeable portable device requires an external power source to charge the battery. Since there is a usable 5V power supply, choosing a USB port for charging is more convenient. To ensure that both the master and slave devices meet the power management requirements, a universal standard must be adopted. Traditionally, the USB master port using USB2. 0 technology specifications must provide at least 500mA of current to the slave device. As multiple USB portable devices can connect to the same USB port via a hub with bus power, all slave devices must coordinate to ensure that the total current obtained from the master device does not exceed 500mA. Generally, each USB charging device will subsequently request additional current ranging from 100mA to 500mA. Based on the actual available current, the host can either allow or deny the slave device's request.

In addition, due to the success of USB technology, micro-USB ports have become the preferred charging cable for power adapters. This allows a portable device to connect to a power adapter or USB port with just one charging cable.

This has led to a widespread challenge. With the popularization of USB charging, the 500 mA charging current specified in USB2. 0 or the 900mA charging current specified in USB3. 0 can no longer meet the charging requirements of most devices such as smartphones, tablets, and personal video players (PMPs), which have higher charging currents. Power adapters and

Far exceeding 500mA or 900 mA. Here, several new standards will be introduced where master and slave devices identify each other through a handshake protocol, allowing the slave device to draw more than 500 mA (as defined by the USB2. 0 specification) or 900mA (as defined by the USB3. 0 specification) from the master device using a single micro-USB charging cable.

D 1524 Supports the following four commonly used protocols:

- BC1.2 protocol, USB battery charging technical specification 1.2 revision
- China Telecom industry standard YD/T 1591-2009
- Pressure mode
- A voltage of 1.2V was applied to both D+ and D-

The YD/T 1591-2009 protocol is a branch of the BC1.2 protocol, and most devices that use USB charging support this protocol. The voltage divider mode and 1.2V mode are chosen by certain but also popular device manufacturers. The BC1.2 protocol has three different port types, as follows:

- Standard Downstream Port (SDP)
- Charging Downstream Port (CDP)
- Special charging port (DCP)

The BC1.2 protocol defines a charging port, which is a USB port facing the lower end and can provide power for portable charging devices. The table below lists the different port operating modes included in the BC1.2 protocol.

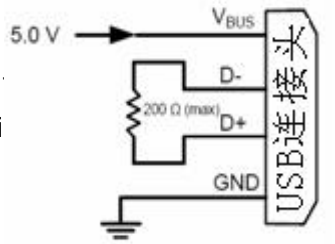
Port type	Supports USB2.0 communi-cation	Maximum current available on the mobile device (A)
SDP(USB2.0)	Yes	0.5
SDP(USB3.0)	Yes	0.9
CDP	Yes	1.5
DCP	No	1.5

The BC1.2 technical specification defines an agreement that allows portable devices to identify the type of port they are connected to, so it can draw its maximum allowable current. The handshake protocol consists of two steps. The first step is preliminary detection: the portable device outputs a nominal voltage of 0.6V on D+, then reads the input voltage on D-. If the detected voltage is less than 0.3V nominal, the portable device will recognize it as being connected to an SDP port. If the detected voltage is greater than 0.3V nominal but less than 0.8V nominal, the portable device will recognize it as being connected to a CDP port. The second step is secondary detection: the portable device needs to determine whether it is connected to a CDP port or a DCP port. The portable device outputs a nominal voltage of 0.6V on D-, then reads the input voltage on D+. If the detected voltage is less than 0.3V nominal, the portable device will recognize it as being connected to a CDP port. If the detected voltage is greater than 0.3V nominal but less than 0.8V nominal, the portable device will recognize it as being connected to a DCP port.

Special charging port (DCP)

The dedicated charging port (DCP) is a downstream port on the charging device, which outputs power through a USB charging head. However, it cannot be further divided to connect multiple devices for fast charging with the maximum current available. Devices like power adapters and car chargers are examples of DCP devices. Different types of DCPs are identified by the electrical characteristics of the USB data port. Below are the common DCP line structures used in handshake detection for various portable devices.

D+ to D-short circuit

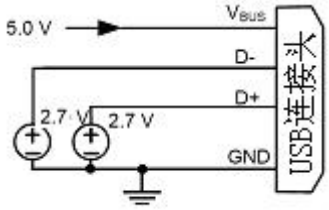


USB BC1.2 Protocol and China Telecom Industry Standard YD/T 1591 nd
The maximum impedance between the D-is 200 Ω. As shown in the fi

DCP short circuit mode

Pressure mode 3 (2.7V and 2.7V voltage are applied to the D+ and

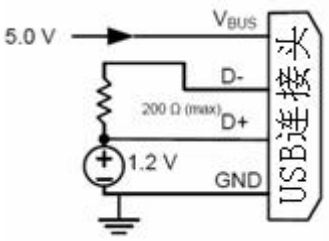
There is a charging scheme for the voltage divider DCP called voltage divider 3, as shown in the figure below. The voltage divider 3 charging scheme is used on a 12W adapter, which applies 2.7V to D+ and 2.7V to D-.



Pressure 3 DCP

A voltage of 1.2V is applied to both D+ and D-

As shown in the figure below, some tablet USB chargers require 1.2V voltage to be applied on the short-circuited data line, and the maximum short-circuit resistance of D+ and D- connection is 200 Ω.



The DCP applied 1.2V voltage on both D+ and D-

The D 1524 is a dedicated USB charging port controller. It can be applied to in-car chargers, AC-DC power adapters with USB ports, and other USB charging devices. The D 1524 features automatic detection; it monitors changes in the voltage on D+ and D-, and loads the correct recognizable signals on DP and DM at the right time, enabling fast charging for compatible portable devices connected to it. Supported portable devices include smartphones, 5V chargable tablets, and personal media players.

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DCP sense

D 1524 It integrates the feature of automatic detection, enabling it to support voltage divider mode, short-circuit mode, and 1.2V/1.2V mode simultaneously. If it is connected to a device that requires voltage divider mode, 2.7V will be applied to the DP pin, and 2V will be applied to the DM pin. If it is connected to a BC1.2

The D 1524 will automatically switch to short-circuit mode when the device is compatible with the protocol. If it connects to a device that supports the 1.2V/1.2V charging scheme, 1.2V will be applied simultaneously to both the DP and DM pins. The following figure illustrates the DCP automatic detection feature for the DP1 and DM1 pins, with DP2 and DM2 having the same configuration.

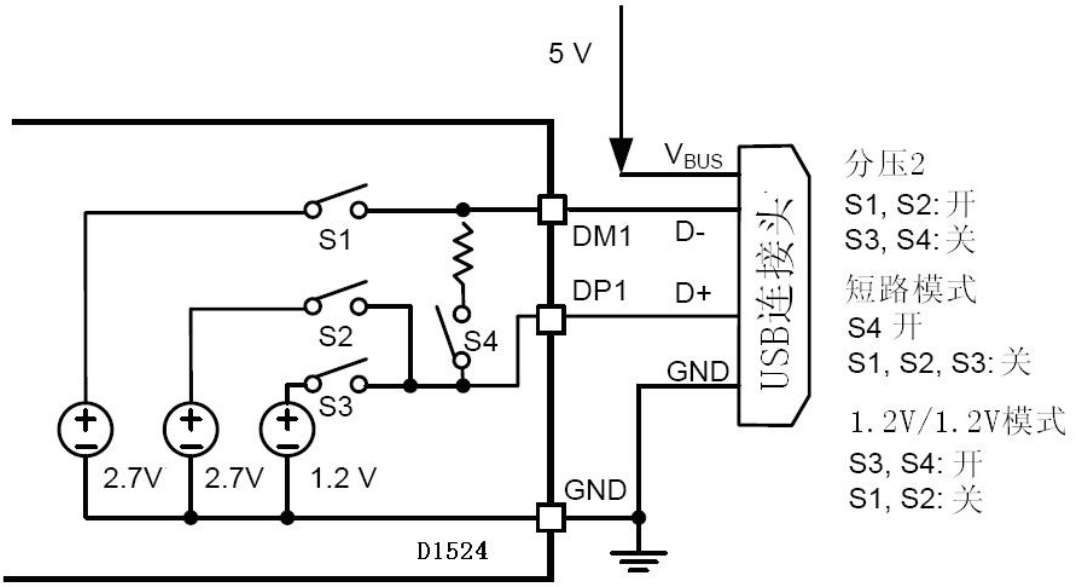


Chart of DCP automatic detection function

Under-voltage lockout (UVLO)

Under-voltage Lockout (UVLO) circuit will turn off the output voltages of DP1, DM1, DP 2, and DM2 until the input voltage reaches the under-voltage lockout threshold. Due to the sudden drop in input voltage caused by large current surges, D1524 is equipped with an under-voltage hysteresis to prevent unexpected oscillations from affecting the output voltage.

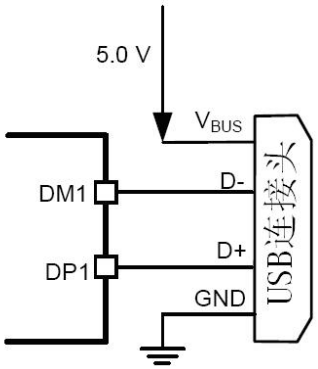
D 1524 It will only provide the correct recognizable signal on the data line of the USB charging port, and will not output any power to the VBUS end.

Selection of 12W USB charger in pressure mode

D 1524 A connection method is provided between the DP pin and DM pin, as well as between the D+ data line and D-data line of the USB connector, corresponding to a 12W USB charger. For a 12W USB charger, connect the DP1 pin to the D+ data line and the DM1 pin to the D-data line, as shown in the figure below. The table below lists the charging solutions provided for a 12W USB charger. Similarly, the DP2 and DM2 pins of the D 1524 also offer these two connection methods.

Table: Charging scheme for 12W USB charger

USB charging type	Contains the charging scheme		
12-W	Divider 1	1.2V on both D+ and D- Lines	BC1.2DCP

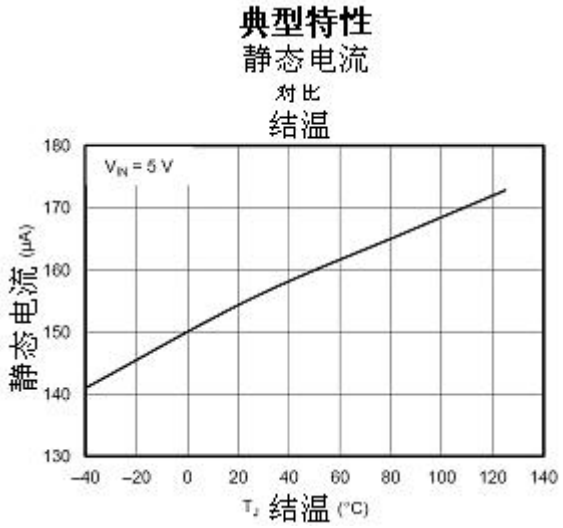


12W USB charging application diagram

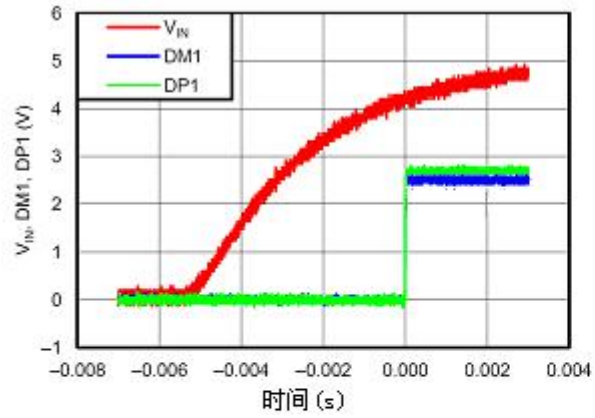
Cabling guide

D 1524 Place it near the USB output connector, and place a 0.1μF bypass capacitor near the IN pin.

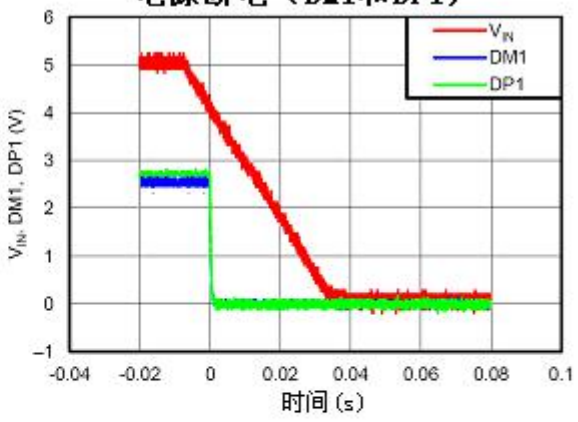
characteristic curve:



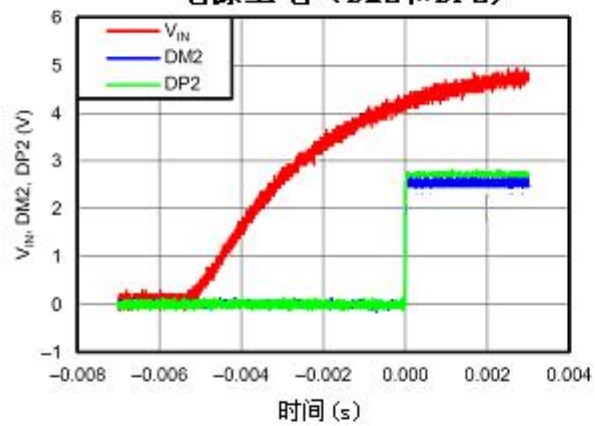
电源上电（DM1和DP1）



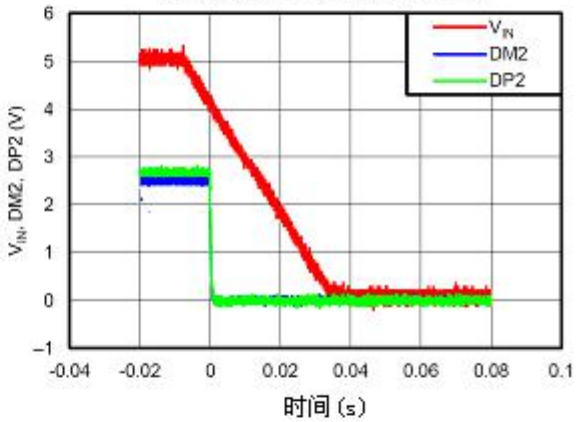
电源断电（DM1和DP1）



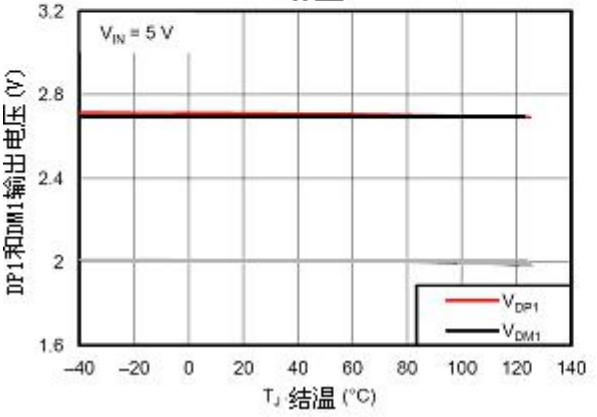
电源上电（DM2和DP2）



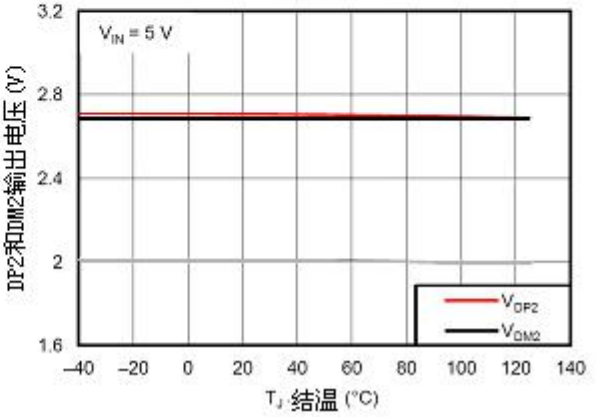
电源断电（DM2和DP2）



DP1和DM1输出电压
对比
结温

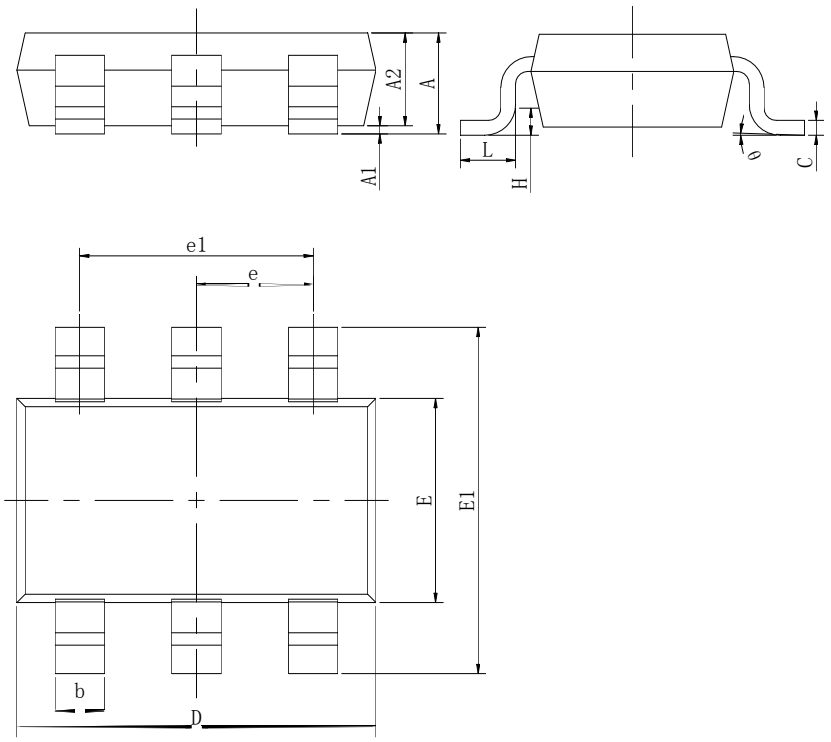


DP2和DM2输出电压
对比
结温



Encapsulation shape diagram:

SOT23-6 Unit: mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
A	0.700	0.900	0.028	0.035
A1	0.000	0.100	0.000	0.004
A2	0.700	0.800	0.028	0.031
b	0.350	0.500	0.014	0.020
c	0.080	0.200	0.003	0.008
D	2.820	3.020	0.111	0.119
E	1.600	1.700	0.063	0.067
E1	2.650	2.950	0.104	0.116
e	0.95（BSC）		0.037(BSC)	
e1	1.90（BSC）		0.075(BSC)	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

statement:

- Xinggu Technology reserves the right to change the product specification without further notice! Before placing an order, customers should confirm whether the obtained information is the latest version and verify the integrity of relevant information.
- Any semiconductor product has the possibility of failure or malfunction under certain conditions. The buyer is responsible for complying with safety standards and taking corresponding safety measures when using Xinggu Technology products for system design and complete machine manufacturing, so as to avoid the occurrence of personal injury or property loss caused by potential failure risks!
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