Withstand Voltage of 36V, Low Battery Leakage Current, 1.3A Single Section Lithium Ion and Lithium Polymer Battery Linear Charging Circuit

General Description

IU5066E is a highly integrated lithium-ion and lithium-polymer linear charger device for space limited portable applications. The device is powered by a USB port or AC adapter. The high input voltage range with input overvoltage protection supports low-cost, non regulated adapters.

Battery charging goes through three stages: trickle, current, and constant voltage. During all charging stages, the internal control loop monitors the IC junction temperature and reduces the charging current when it exceeds the internal temperature threshold. The power level of the charger and the charging current sensing function are fully integrated. The charger has high-precision current and voltage regulation loop function, charging status display, and charging termination function.

The IU5066E is packaged in a slim ESOP8L package to meet customer requirements for product packaging volume as much as possible. Its rated operating temperature range is -40 ℃ to 85 ℃.

Features

- Charging Voltage Accuracy is 1%
- 10% Charging Current Accuracy
- Maximum 1.3A Charging Current, Adjustable External Resistance for Charging Current
- NTC Function
- Automatic Power off Function
- Low Battery Output Leakage Current
- 36V Rated Input Voltage with 6.55V Input Overvoltage Protection (OVP)
- Under Voltage Protection (UVLO)
- Power Overload Protection, PROG Short Circuit Pr Protection, Output Short Circuit Protection
- Chip Temperature Adaptive adjustment
- Chip over Temperature Protection
- Charging Timeout Protection Function

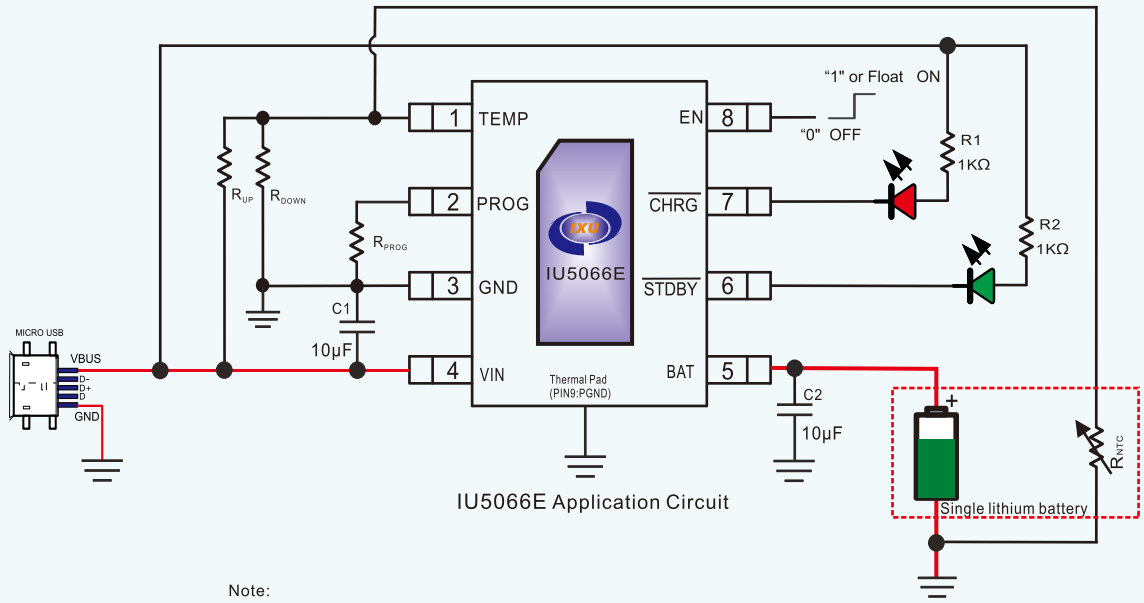
Applications

- Fitness Accessories
- Handheld Devices
- Tools and Equipment
- Home Appliance Products

Package

- ESOP8L

Typical Applications



IU5066E Application Circuit

Note:

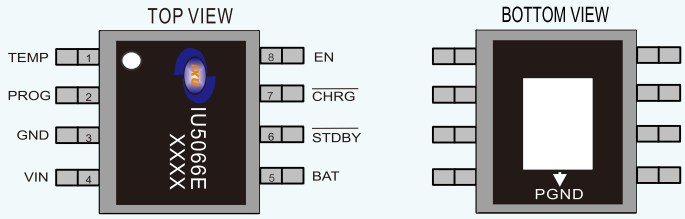
(1) All chip capacitors need to be arranged as close to the chip pins as possible.

(2) If the NTC function is not used, the first TEMP pin of the chip must be grounded.。

(3) The 6th and 7th pins of the chip are status indicator pins that output 0 level or high resistance state. If it is determined that the corresponding pin is not needed, it can be floated or grounded.

(4) The solid red line in the figure is the high current path.

PIN Configuration and Functions



PIN	NAME	TYPE	DESCRIPTION
1	TEMP	I	Thermistor input, battery temperature detected by external thermistor
2	PROG	I	Constant current charging current setting port
3	GND	-	Chip analog ground
4	VIN	I	External power input
5	BAT	O	Charge port output, connect lithium batteries
6	$\overline{\text{STDBY}}$	O	Charge Completion Indicator
7	$\overline{\text{CHRG}}$	O	Open Drain Output Charging Status Indicator
8	EN	I	Enable port, ground chip off; High le vel or floating, chip working
Thermal PAD	PGND	-	Power ground, must be connected to ground

Absolute Maximum Ratings [1]

SYMBOL	PARAMETER	VALUE	UNIT
VMAX	VIN, TEMP, $\overline{\text{CHRG}}$, $\overline{\text{STDBY}}$, EN	-0.3~36	V
	BAT	-0.3~20	V
	PROG	-0.3~7	V
T_J	Junction operating temperature range	-40~150	℃
T_{STG}	Storage temperature range	-55~150	℃
T_{SDR}	Lead temperature (Soldering, 10 sec.)	260	℃

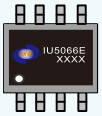
Recommended Operating Conditions

SYMBOL	PARAMETER	VALUE	UNIT
V_{IN}	Input power supply voltage	4.5~6.6	V
T_J	Junction operating temperature range	-40~125	℃
T_A	Ambient temperature range	-40~85	℃

Thermal Information [2]

SYMBOL	PARAMETER	VALUE	UNIT
θ_{JA}	Package thermal resistance - chip to environment thermal resistance	40	℃/W

Ordering Information

Device	Package Type	Device Marking	Package size	Tape Width	Quantity
IU5066E	ESOP8L		13″	12mm	4000 units
			Tube		100 units

ESD Ratings

HBM (Human Body Model) ---------- ±2kV

MM (Machine model) ---------- ±200V

1. The above parameters are only the limit values of device operation. It is not recommended that the working conditions of the device exceed the limit values. Otherwise, the reliability and life of the device will be affected, and even permanent damage will be caused.
2. Where the PCB board is placed in IU5066E, a heat dissipation design is needed. The heat sink at the bottom of IU5066E is connected with the heat sink area of PCB board.

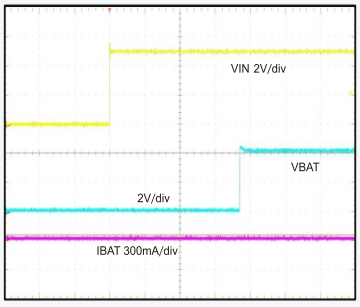
Electrical Characteristics (V_{IN}=5V，unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
VIN	Supply voltage		4. 5	5	6.6	V
VIN_{UVLO}	VIN under voltage lockout threshold	VIN Falling		3.5		V
ΔVIN_{UVLO}	VIN under voltage lockout hysteresis			100		mV
VIN_{OVP}	VIN over voltage protection	VIN Rising		6.55		V
ΔVIN_{OVP}	VIN over voltage protection hysteresis			100		mV
VIN_DPM	Power overload protection threshold			4.35		V
I_Q	Input quiescent current			0.6		mA
I_{SD}	Input shutdown current	EN=0		12		μA
I_{BAT}	Battery leakage current	Unplug charger		0.5		μA
		Charge Complete		10		μA
V_{CV}	Terminal battery voltage		4.16	4.2	4.23	V
V_{RCH}	Recharge voltage	V_{BAT} Falling		4.06		V
V_{TRK}	TC charge mode battery voltage threshold	V_{BAT} Rising		2.55		V
ΔV_{TRK}	TC charge mode battery voltage hysteresis			100		mV
V_{SHORT}	Battery short threshold	V_{BAT} Falling		1.8		V
V_{OVPB}	BAT over voltage threshold	V_{BAT} Rising		4.6		V
I_{CC}	CC charge mode current	R_{PROG}=1KΩ	0.9	1	1.1	A
I_{TC}	TC charge mode current			10%*I_{CC}		A

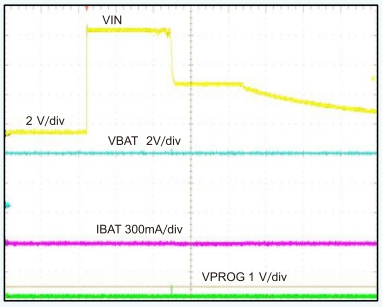
Electrical Characteristics (V_{IN}=5V，unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{BF}	Terminate charge current			10%*I_{CC}		A
K_{PROG}	Constant current charging coefficient	$I_{CC}=K_{PROG}/R_{PROG}$		1000		AΩ
R_{PROG}	Programmable range of constant current charging		770		3300	Ω
V_{cold}	TEMP low temp falling threshold	Percentage of VIN		80		%
V_{hot}	TEMP high temp rising threshold	Percentage of VIN		45		%
TMR_{TC}	Trick charge time limit			3.7		Hour
$TMR_{CC/CV}$	CC/CV charge time limit			21		Hour
T_{REG}	Thermal regulation threshold			120		℃
T_{SD}	Thermal shutdown temperature			150		℃
ΔT	Thermal shutdown temperature hysteresis			30		℃

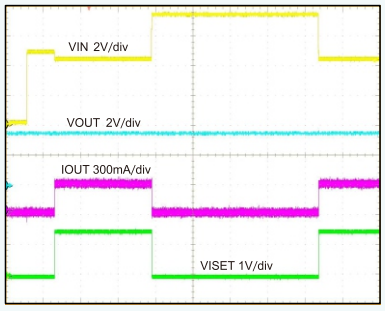
Typical Operating Characteristics (VIN= 5 V, V_{BAT} = 3.6 V, unless otherwise noted)



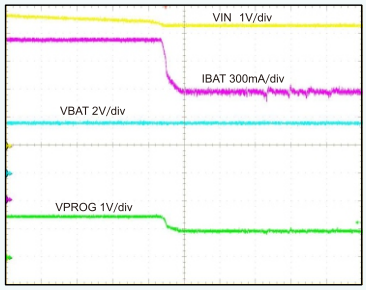
No Battery, No Load
Power Up Timing



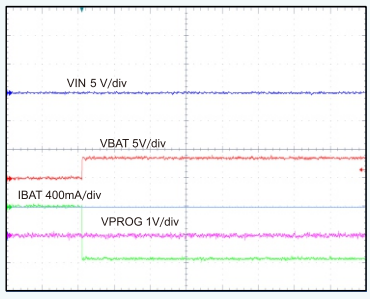
Hot Plug
OVP7-VAdaptor



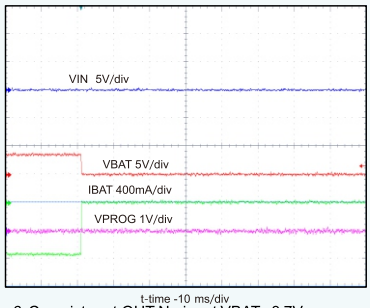
VIN 0V-5V-7V-5V
OVP from Normal Power-Up Operation



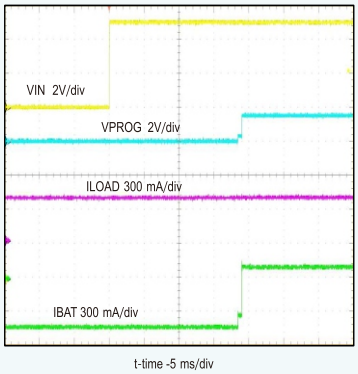
V_{IN} Regulated
DPM-AdaptorCurrentLimits



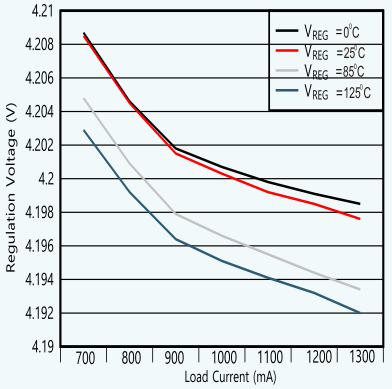
6-Ω resistor at OUT,No input,VBAT=3.7V
BatteryPlugIn



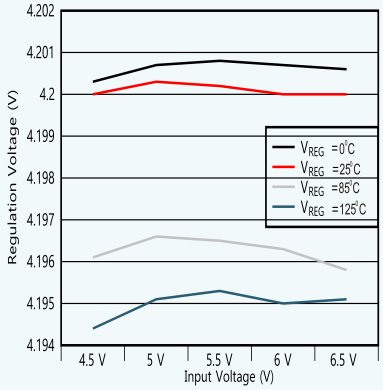
6-Ω resistor at OUT,No input,VBAT=3.7V
Battery Removal



400-mA Load,500-mA ICHG
Power Up



Load Regulation Over Temperature



Line Regulation Over Temperature

IU5066E Application Points

1. Charge Process

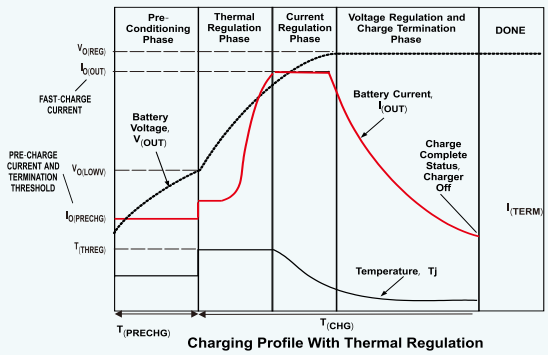
The IU5066E adopts a complete TC/CC/CV charging process. When the voltage of a single lithium battery is less than the trickle point, the system charges at 10%* I_{CC} charging current; When the voltage of a single lithium battery is greater than the trickle point, the system charges with I_{CC} charging current; When the battery voltage approaches the set float charging voltage, the system enters constant voltage charging, and the charging current continues to decrease. When the charging current is less than 10%*I_{CC}, the system will stop charging; When the battery is fully charged and the battery voltage drops to the set recharge voltage due to self discharge or load consumption, the system will restore the charging state. This chip is suitable for USB (100mA current limit) or DC power supply.

2. Power Supply Overload Protection (IN-DPM)

When the power terminal voltage is overloaded and reaches the protection point of IU5066E overload, IU5066E has a special built-in loop which can automatically adjust the size of the charging current to prevent the input DC power from entering the overdrive state, thereby preventing the adapter from collapse due to any improper settings.

3. Protection Function

IU5066E has the following characteristics of safe charging: input overvoltage (OVP), input undervoltage (UVLO), output short circuit/overvoltage, chip thermostatic self-adjusting charging protection, chip overtemperature protection, PROG short circuit protection. In addition, the system has outdated charging protection. If there is a problem with the lithium battery, the charging time will be too long. When the TC stage charging time is longer than 3.7 hours or the CC/CV charging time is longer than 21 hours, the obsolete charging protection function will start, forcing the charging process to terminate, and the charging time will be re-timed when the system is powered on again or when the battery status changes.IU5066E has an automatic power-off function when the input power is not supplied or the input power voltage is reduced to a lower value than the output battery voltage, which prevents the battery from charging back current to the chip and the power terminal, greatly extending the battery life.



Charging Profile With Thermal Regulation

4. Charging Indication Function

The 6th and 7th pins of the chip are the status indicator pins, which output 0 level or high resistance state. If the LED lamp is not connected, but directly connected to the main control, there must be a pull-up resistance to convert the high resistance state to an exact high level.

- During the charging process, $\overline{\text{CHRG}}$ foot lights are on and $\overline{\text{STDBY}}$ lights are off ;
- When charging is completed, $\overline{\text{CHRG}}$ footlights go out and $\overline{\text{STDBY}}$ lights go on ;
- When there are input overvoltage, input undervoltage, battery short circuit, chip overtemperature, TEMP port detects abnormal battery temperature, charging timeout, the two LED indicators will blink alternately at 1.5Hz frequency.

5. Charge Current Setting

Constant current charging current I_{CC} is set by adding a pair of ground resistance R_{PROG} at the PROG end:

$$I_{CC}=1000/R_{PROG}\ (A)$$

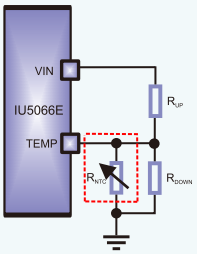
The constant current current can be set in a range of 300mA~1.3A. R_{PROG} ranges from 0.77 to 3.3KΩ. The default trickle charging is 10% of the constant current charging current and the cutoff charging current is 10% of the constant current charging current.

6. Chip Temperature Regulation Function

IU5066E has a built-in temperature adaptive adjustment loop. When the chip is in the charging process, if the temperature rises to 120℃, the temperature control loop starts to function, the charging current starts to decrease gradually, the chip temperature then decreases, and the final chip temperature will stabilize at the set value to protect the chip.

7. NTC Resistor Setting

Battery charging supports NTC protection, and TEMP pin detects the temperature of the battery. When TEMP detects that the battery temperature is within the set temperature window, it charges normally. When TEMP detects that the battery temperature is below the set low temperature protection point or above the set high temperature protection point, it stops charging and alarms.If NTC function is not used, TEMP pin must be grounded.The figure below shows the high and low temperature reference points set internally by piezoresistors, with the low temperature reference point being VIN*80% and the high temperature reference point being VIN*45%. Set the normal operating temperature range of NTC by selecting an appropriate external resistance.



$$\frac{R_{DOWN}//R_{NTC\_Cold}}{R_{UP}+R_{DOWN}//R_{NTC\_Cold}}=80\%$$

$$\frac{R_{DOWN}//R_{NTC\_Hot}}{R_{UP}+R_{DOWN}//R_{NTC\_Hot}}=45\%$$

R_{NTC_Cold} in Top Format is the resistance value corresponding to the NTC resistance at the set low temperature point, while R_{NTC_Hot} is the resistance value corresponding to the NTC resistance at the set high temperature point. Because R_{DOWN} and R_{UP} resistors can independently set low and high temperature windows, IU5066E can meet most NTC resistance models, which brings great convenience for application. The relationship between resistance R_{DOWN} and R_{UP} and NTC resistance can be defined as follows:

$$R_{UP}=\frac{35*R_{NTC\_Hot}*R_{NTC\_Cold}}{36*(R_{NTC\_Cold}-R_{NTC\_Hot})}$$

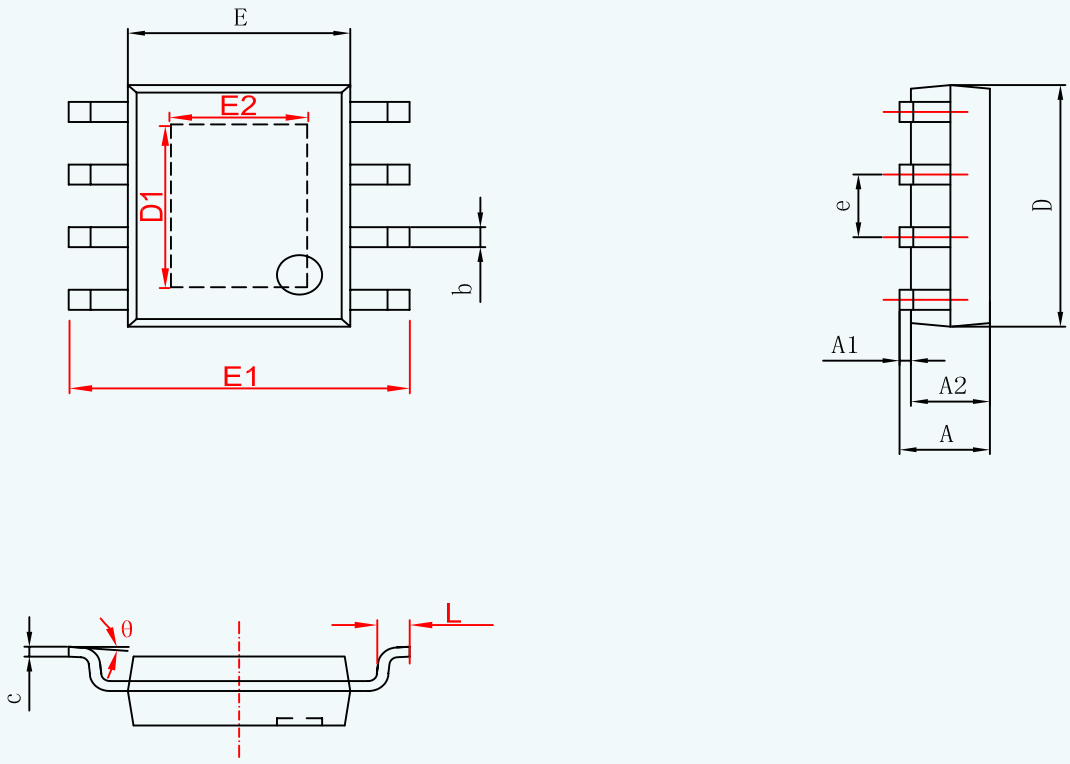
$$R_{DOWN}=\frac{35*R_{NTC\_Hot}*R_{NTC\_Cold}}{9*R_{NTC\_Cold}-44*R_{NTC\_Hot}}$$

8. Enable Input Function

The EN end of the enabling pin of IU5066E enables the chip to be switched on and charged when it is high or floating. EN terminal grounded to turn off the chip for charging.

Package Information

IU5066E ESOP8L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.150	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	9°

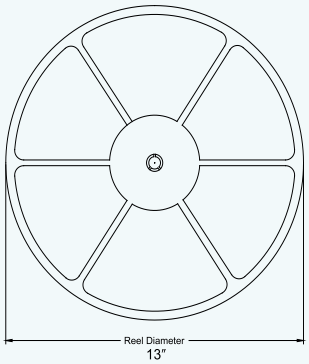
Notes:

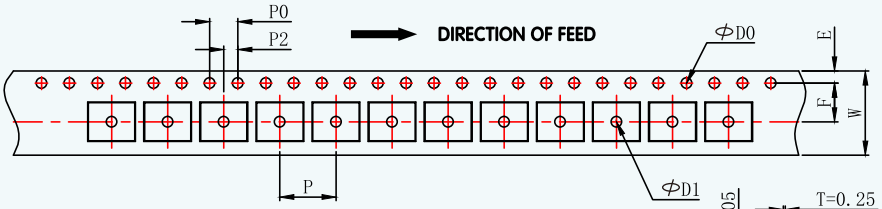
(1) All dimensions are in millimeters.

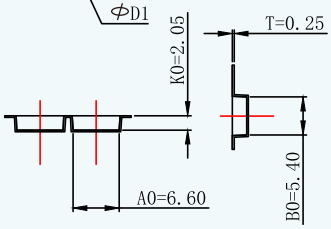
(2) Refer to JEDEC MO-187 standard

TAPE AND REEL INFORMATION

REEL DIMENSIONS







W	12.00±0.30	P0	4.00±0.10
S	---	A0	6.60±0.10
P	8.00±0.10	A1	
E	1.75±0.10	B0	5.40±0.10
F	5.50±0.10	B1	
P2	2.00±0.10	K0	2.05±0.10
D0	1.50+0.10/-0.00	K1	
D1	1.50+0.10/-0.00	t	0.25±0.05

MOS电路操作注意事项:

静电在很多地方都会产生, 采取下面的预防措施, 可以有效防止MOS电路由于受静电放电影响而引起的损坏:

- 操作人员要通过防静电腕带接地。
- 设备外壳必须接地。
- 装配过程中使用的工具必须接地。
- 必须采用导体包装或抗静电材料包装或运输。

声明:

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