6 Cell Li-Ion/Polymer Battery Pack Protection IC

■ Description

The CM1261C-JCA-A is a secondary protection chip for rechargeable batteries, it embeds high precision voltage detection circuit and delay circuit and provides overcharge protection for the battery pack by detecting the voltage of each cell in the battery pack.

■ Features

1) **High accuracy voltage detection for each cell**

• Overcharge detection voltage	3.750 V	Accuracy ±25 mV
• Overcharge release voltage	3.660 V	Accuracy ±50 mV
• Over discharge detection voltage	2.500 V	Accuracy ±50 mV
• Over discharge release voltage	3.600 V	Accuracy ±80 mV

2) **Embedded protection delay time** 1 s

3) **Built-in Open-wire protection function** Y

4) **Output mode Optional:** CMOS output

5) **Output logic Optional:** CO: Active “H”
DO: Active “L”

6) **High breakdown voltage:** Absolute Maximum breakdown voltage 40 V

7) **Ultra-low power dissipation**

• Normal mode 4 μA (Typ.) (Ta = +25°C)

8) **RoHS, PB-Free, HF**

■ Applications

• Vacuum cleaner
• Power Tools
• Sweeping robot
• UPS

■ Packages

• MSOP10

■ Block Diagram

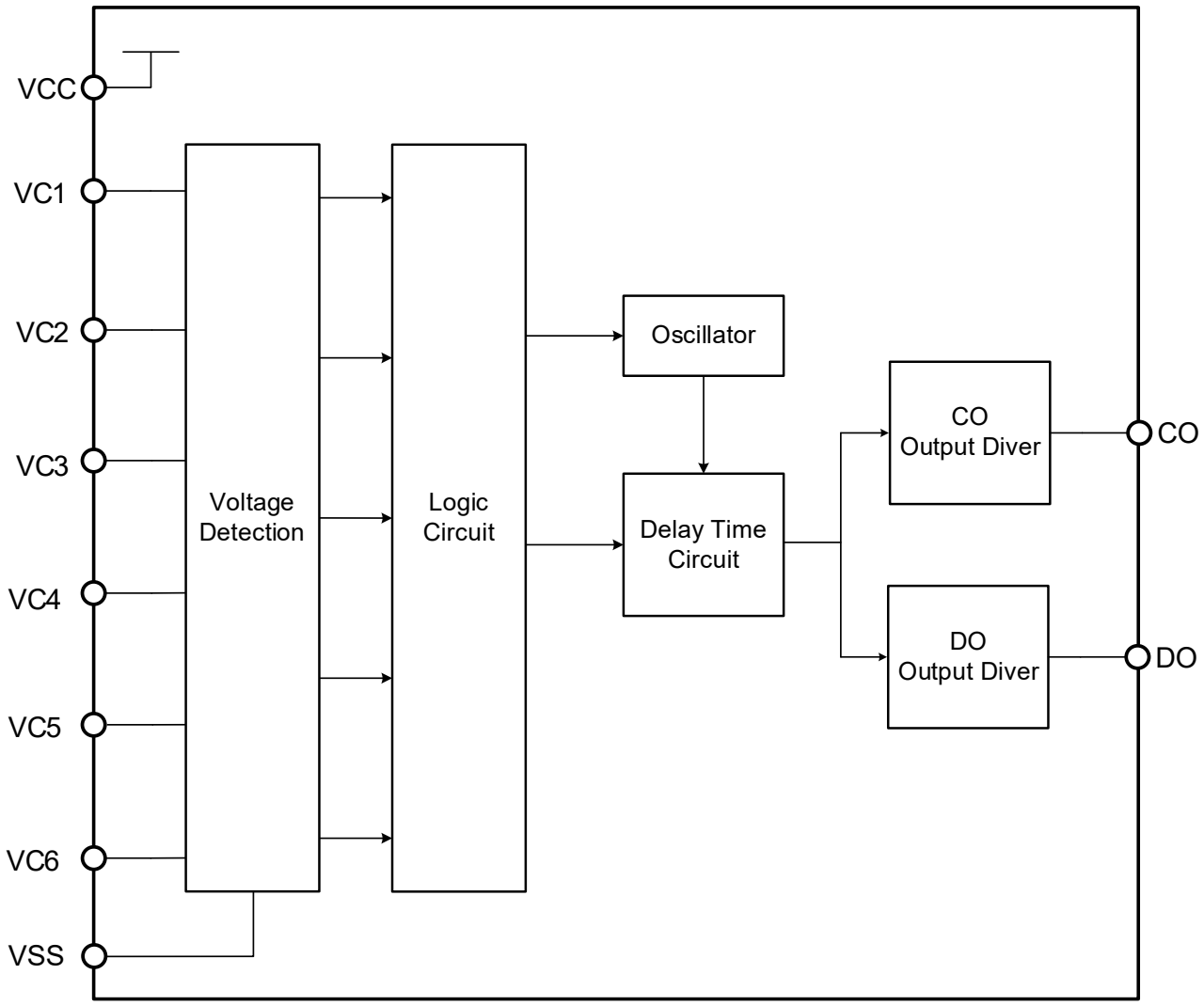


Figure 1

■ Pin Configurations

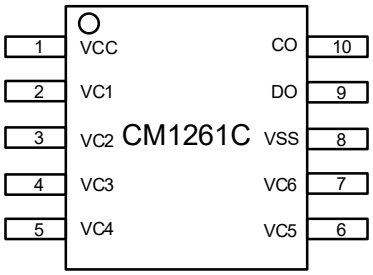
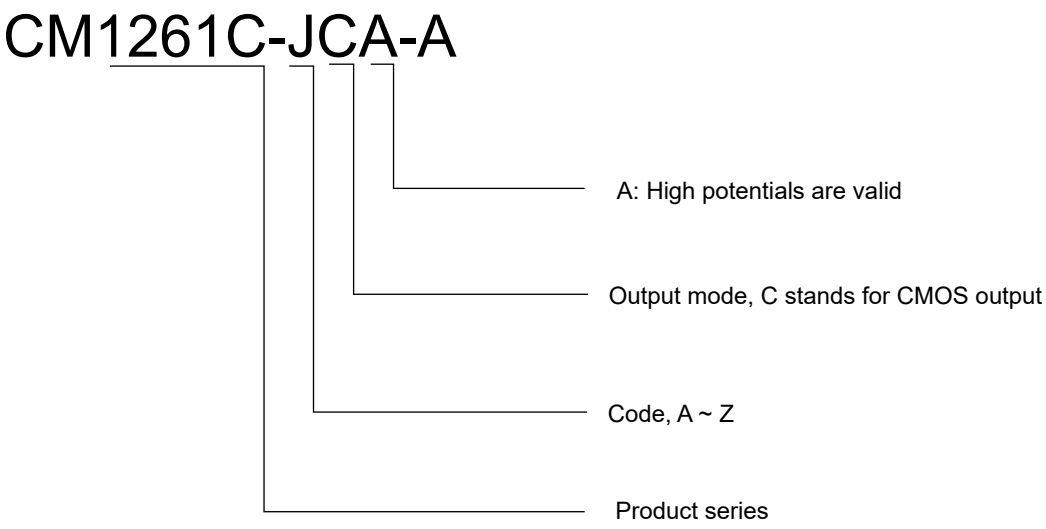


Figure 2 Top View

PIN No.	Symbol	Description
1	VCC	Power supply
2	VC1	Cell1 positive input
3	VC2	Cell1 negative input, Cell2 positive input
4	VC3	Cell2 negative input, Cell3 positive input
5	VC4	Cell3 negative input, Cell4 positive input
6	VC5	Cell4 negative input, Cell5 positive input
7	VC6	Cell5 negative input, Cell6 positive input
8	VSS	Cell6 negative input, GROUND terminal
9	DO	Discharge power mosfet control terminal
10	CO	Charge power mosfet control terminal

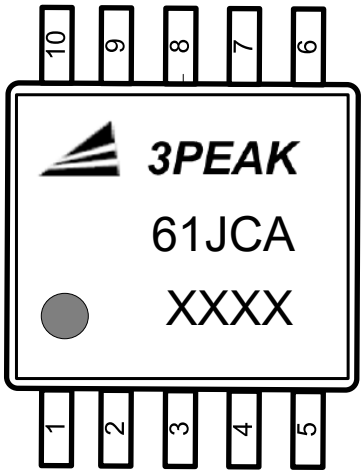
Table 1

■ Naming rule



■ Marking

MSOP10



The first line：Logo
The second line：
61: Product series code
JCA: Code
The third line: Lot numbe

Figure 3

■ Products Catalogue

MSOP10 Package

Part No.	Overcharge protection voltage [V_{OC}]	Overcharge release voltage [V_{OCR}]	Over-discharge protection voltage [V_{OD}]	Over- discharge release voltage [V_{ODR}]	Over-charge/discharge protection delay time [T_{OC}/T_{OD}]
CM1261C-JCA-A	3.750 V	3.660 V	2.500 V	2.600 V	1 s

Table 2

Part No.	CO/DO Output mode	CO Output logic	DO Output logic	Open-wire detection
CM1261C-JCA-A	CMOS	Active “H”	Active “L”	Y

Table 3

Remark: For more product info, please contact iCM marketing department.

■ Absolute Maximum Ratings

(Unless otherwise specified: Ta = +25°C)

Item	Symbol	Description	Ratings	Unit
Power supply voltage	VCC	VCC	VSS-0.3 ~ VSS+40	V
Single cell input voltage	V_{CELL}	VC1-VC2, VC2-VC3, VC3-VC4, VC4-VC5, VC5-VC6, VC6-VSS	-0.3 ~ +12	V
CO output voltage	V_{CO}	CO	VSS-0.3 ~ VCC+0.3	V
DO output voltage	V_{DO}	DO	VSS-0.3 ~ VCC+0.3	V
Operating temperature	T_{OPR}	-	–40 ~ +105	°C
Storage temperature	T_{STG}	-	–55 ~ +125	°C

Table 4

Caution: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded in any conditions.

■ Electrical Characteristics

(Unless otherwise specified : Ta = +25°C)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Operating consumption		I_{VCC}	V1=V2=V3=V4=V5=V6=3.5V	-	4	6	μA
Overcharge	Protection threshold	V_{OC}	V1=V2=V3=V4=V5=3.5V, VC6=3.5 → 4.4V	3.725	3.750	3.775	V
	Release threshold	V_{OCR}	V_{OC}-V_{OCR}＜0.250V V1=V2=V3=V4=V5=3.5V, VC6=4.4 → 3.5V	3.610	3.660	3.710	V
	Protection delay time	T_{OC}	V1=V2=V3=V4=V5=3.5V, VC6=3.5 → 4.4V	0.5	1.0	1.5	s
	Reset delay time	T_{TR}	-	1.0	2.5	4.0	ms
Over-discharge	Protection threshold	V_{OC}	V1=V2=V3=V4=V5=3.5V, VC6=3.5 → 2.0V	2.450	2.500	2.550	V
	Release threshold	V_{ODR}	V1=V2=V3=V4=V5=3.5V, VC6=2.0 → 3.5V	2.520	2.600	2.680	V
	Protection delay time	T_{OD}	-	0.5	1.0	1.5	s
CO/DO high Output level		V_{COH}	-	8	10	12	V
		V_{DOH}	-	8	10	12	V
CO/DO low Output level		V_{COL}	-	-	VSS	-	V
		V_{DOL}	-	-	VSS	-	V
Output current (CMOS)	CO absorption current	I_{COL}	-	0.4	-	-	mA
	CO output current	I_{COH}	-	0.4	0.6	-	uA
	DO absorption current	I_{DOL}	-	0.4	-	-	mA
	DO output current	I_{DOH}	-	0.4	0.6	-	uA

Table 5

(Unless otherwise specified : Ta = +25°C)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Operating consumption		I_{VCC}	V1=V2=V3=V4=V5=V6=3.5V	-	4	8	μA
Overcharge	Protection threshold	V_{OC}	V1=V2=V3=V4=V5=3.5V, VC6=3.5 → 4.4V	3.680	3.750	3.790	V
	Release threshold	V_{OCR}	V_{OC}-V_{OCR}＜0.250V V1=V2=V3=V4=V5=3.5V, VC6=4.4 → 3.5V	3.590	3.660	3.720	V
	Protection delay time	T_{OC}	V1=V2=V3=V4=V5=3.5V, VC6=3.5 → 4.4V	0.4	1.0	1.6	s
	Reset delay time	T_{TR}	-	1.0	2.5	4.0	ms
Over-discharge	Protection threshold	V_{OC}	V1=V2=V3=V4=V5=3.5V, VC6=3.5 → 2.0V	2.430	2.500	2.560	V
	Release threshold	V_{ODR}	V1=V2=V3=V4=V5=3.5V, VC6=2.0 → 3.5V	2.500	2.600	2.700	V
	Protection delay time	T_{OD}	-	0.4	1.0	1.6	s
CO/DO high Output level		V_{COH}	-	7	10	13	V
		V_{DOH}	-	7	10	13	V
CO/DO low Output level		V_{COL}	-	-	VSS	-	V
		V_{DOL}	-	-	VSS	-	V
Output current (CMOS)	CO absorption current	I_{COL}	-	0.3	-	-	mA
	CO output current	I_{COH}	-	0.3	0.6	-	mA
	DO absorption current	I_{DOL}	-	0.3	-	-	mA
	DO output current	I_{DOH}	-	0.3	0.6	-	mA

Table 6

■ Function Description

1. Normal Working

When the voltage of all battery is below the overcharge protection release voltage (V_{OCR}), the output of the CO terminal is "L" (active "H") or "H" (active "L"), this state is called the normal state.

2. Overcharge

During charging, If the voltage of any battery exceeds the overcharge protection voltage (V_{OC}) and this state remains above the T_{OC}. The output voltage of CO will reverse. This state is called the overcharged state. By connecting the MOSFET at the CO terminal, charge control and secondary protection are available. When the battery voltage after overcharge protection is all lower than the V_{OCR} and this state lasts for more than 2.0 ms (typ), the normal state is returned.

3. Overcharging reset time

During charging, any battery voltage, waiting for overcharge protection delay in the process, If there is a pulse lower than the overcharge release protection voltage and the pulse width is less than the overcharge reset delay time (T_{TR}), T_{OC} will not be re-timed; If there is a pulse lower than the overcharge release protection voltage and the pulse width is greater than the overcharge reset delay time (T_{TR}), T_{OC} will time again.

4. Over-discharge

During discharging, If the voltage of any battery drops below the overdischarge protection voltage (V_{OD}) and this state remains above the T_{OD}. The output voltage of DO will reverse. This state is called the overdischarged state. By connecting the MOSFET at the DO terminal, discharge control and secondary protection are available. When the battery voltage after overdischarge protection is all higher than the V_{ODR} and this state lasts for more than 2.0 ms (typ), the normal state is returned.

5. Open-wire Detection

Under normal states, any one or more of the chip pins VC1, VC2, VC3, VC4, VC5 and VC6 are disconnected from the cell. The chip is detected and judged to be in a disconnection statel and force the CO and DO output levels to be reversed at the same time. This state is called the disconnection protection state.

■ Operation Timing Chart

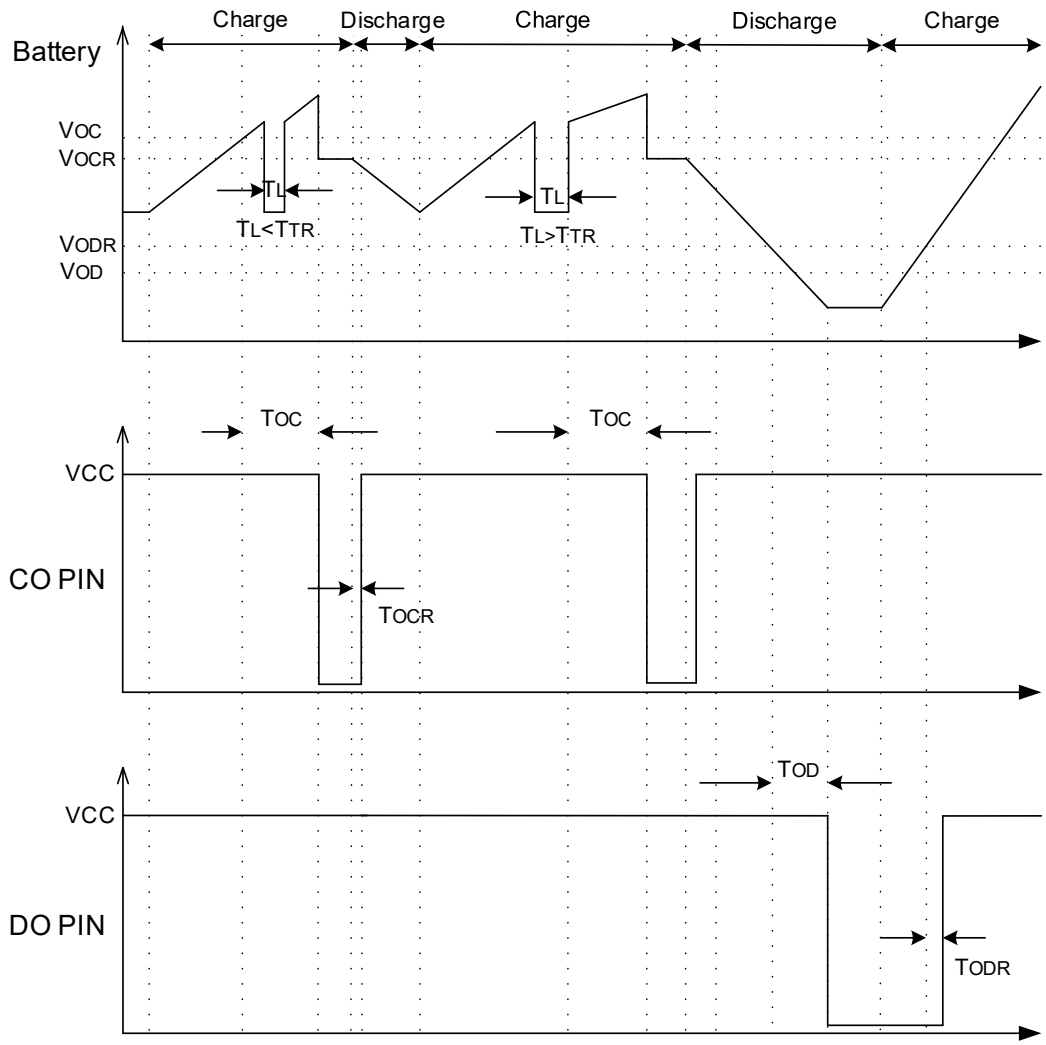


Figure 4

■ Application Circuits

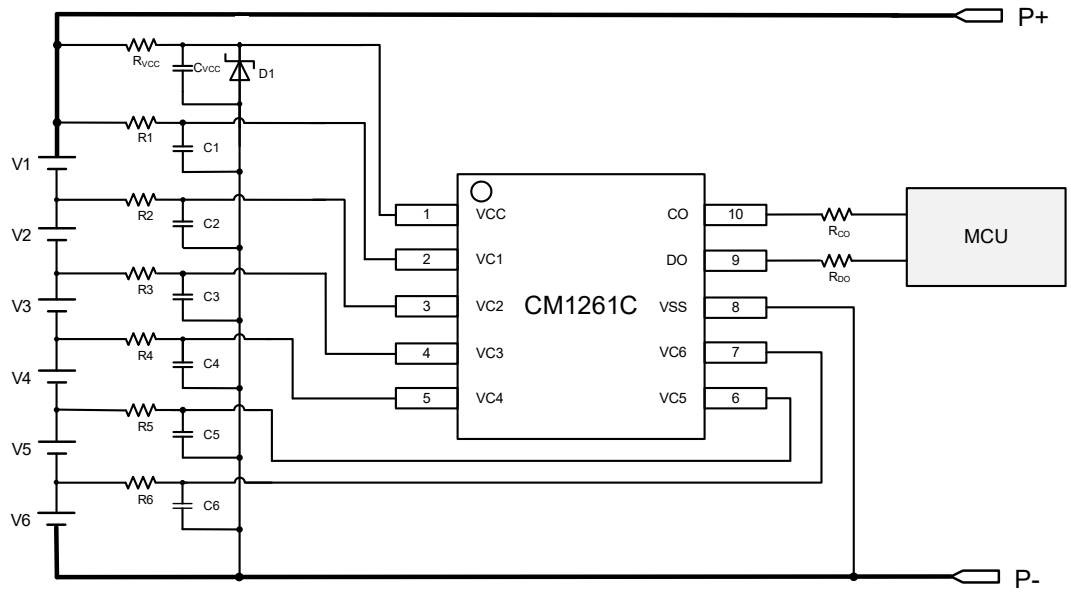


Figure 5

■ BOM List

Component Symbol	Type	Range	Unit
R_{VCC}	1	0.5 ~ 2	KΩ
R1、R2、R3、R4、R5、R6	1	0.5 ~ 2	KΩ
R_{CO}、R_{DO}	5.1	4.7 ~ 10	KΩ
C_{VCC}	1	1 ~ 10	μF
C1、C2、C3、C4、C5、C6	0.1	0.1 ~ 1.0	μF

Table 7

Caution :

1. **The above constants may be changed without notice.**
2. **The above circuit and parameters do not guarantee the normal operation under all application conditions. Please set the parameters of the actual application circuit according to the actual application.**
3. **R1 to R6 must be set to the same values, and C1 to C6 and C_{VCC} should be adjusted according to the actual application.**

■ Package

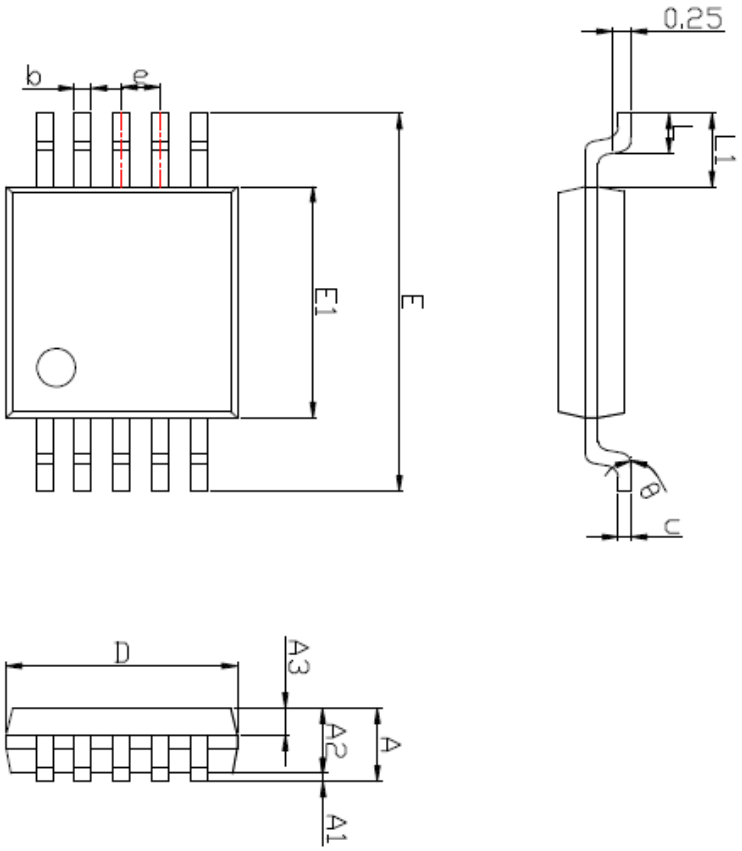


Figure 6

NOTE:ALL DIMENSIONS IN MM

SYMBOL	MIN	NOM	MAX
A	-	-	1.10
A1	0.05	0.10	0.15
A2	0.80	0.85	0.90
A3	0.30	0.35	0.40
b	0.17	0.20	0.23
c	0.13	0.15	0.17
D	2.80	3.00	3.20
E	4.70	4.90	5.10
E1	2.80	3.00	3.20
e	0.50 BSC		
L	0.40	0.55	0.70
L1	0.90	0.95	1.00
θ	0°	-	8°

Table 8

■ Carrier Tape information

MSOP10

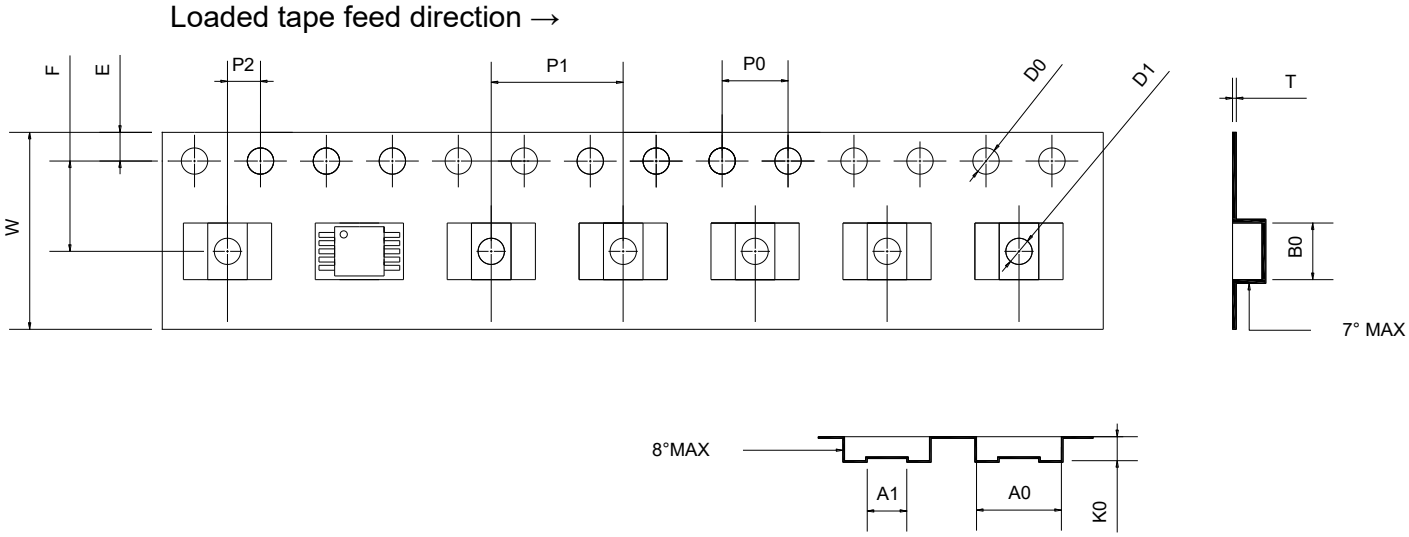


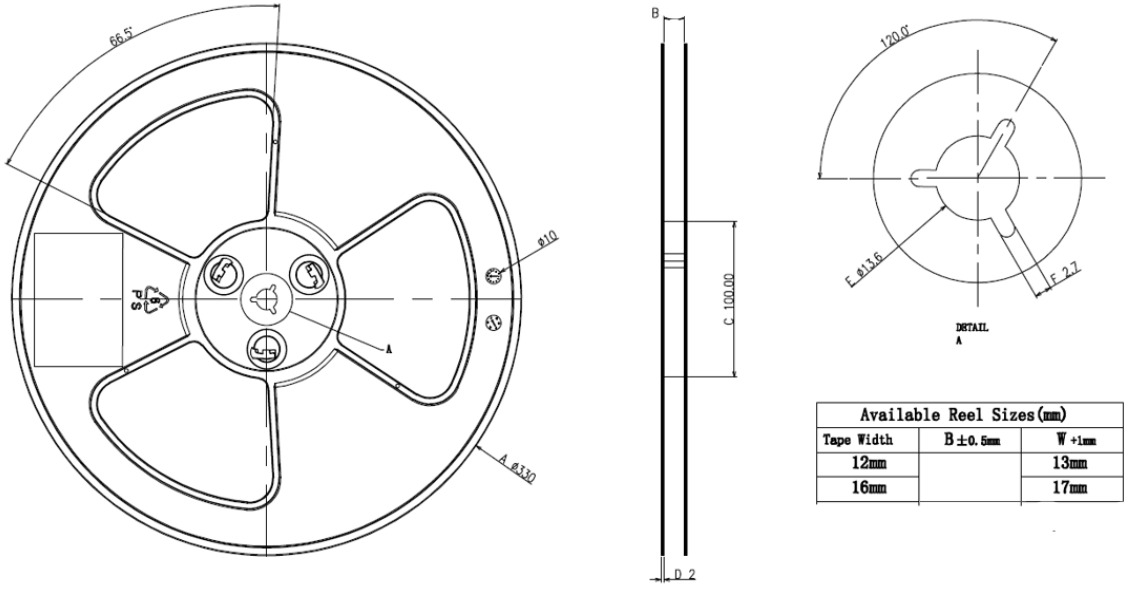
Figure 7

Type	W*P1	Unit
MSOP10	12.0*8.0	mm
Item	**Specification**	**Tol（+/-）**
W	12.00	+0.30/-0.10
F	5.50	±0.05
E	1.75	±0.10
P2	2.00	±0.10
P1	8.00	±0.10
P0	4.00	±0.10
P0*10	40.00	±0.20
D0	1.50	+0.10/-0
D1	1.50	+0.25/-0
T	0.20	±0.05
B0	3.40	±0.10
A1	2.60	±0.10
A0	5.33	±0.10
K0	1.53	±0.10

Table 9

■ Reel information

MSOP10



Available Reel Sizes (mm)		
Tape Width	B ±0.5mm	W +1mm
12mm		13mm
16mm		17mm

Figure 8

■ Package information

Reel	PCS/Reel	Reel /Inner Box	Inner Box/Carton
13”×12mm	4000	2	8

Precautions for use

1. The content in this manual may be changed without notice as the product improves. For more detailed content, please contact our company's marketing department.
2. The circuit examples, usage methods, etc. in this specification are for reference only, and are not designed to guarantee mass production. The company does not assume any responsibility for problems caused by third-party ownership.
3. When this specification is used alone, our company guarantees that its performance, typical applications and functions meet the conditions in the specification. When using the customer's products or equipment, we do not guarantee the above conditions, we recommend that customers do adequate evaluation and testing.
4. Please pay attention to the use of the product within the conditions stated in the specification. Please pay special attention to the use conditions of input voltage, output voltage, and load current so that the power dissipation in the IC does not exceed the power dissipation of the package. The company will not be liable for any losses caused by customers using the product beyond the rated value specified in the specification, even if it is used instantaneously.
5. When using this product, please confirm the laws and regulations of the country, region and purpose of use, and test the ability and safety performance of the product.
6. The products in this specification, without written permission, cannot be used in high-reliability circuits of equipment or devices that may cause damage to the human body, life and property, such as: medical equipment, disaster prevention equipment, vehicle equipment, and vehicle Equipment, aviation equipment, space equipment, nuclear energy equipment, etc., shall not be used as their parts.
7. The company does not assume any responsibility for damages caused by using the products described in this specification for purposes other than those specified by the company.
8. The company has been committed to improving the quality and reliability of products, but all semiconductor products have a certain probability of failure.
9. In order to prevent personal accidents, fire accidents, social damages, etc. caused by the probabilistic failure of this product, customers are requested to fully evaluate the entire system and be responsible for redundant design, measures to prevent fire spread, and safety design to prevent mishandling, you can avoid accidents.
10. This product will not affect human health under normal conditions of use, but because it contains chemical substances and heavy metals, please do not put it in your mouth. In addition, the cracked surface of the package and chip may be sharp, so please protect it when touching it with bare hands to avoid injury.
11. When disposing of this product, please abide by the laws and regulations of the country and region of use and dispose of it reasonably.
12. The content in this specification is strictly prohibited from being reproduced or copied for other purposes without the permission of our company.