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CM1020 Series

2- series rechargeable lithium battery protection **IC**

The CM1020 series is a protection chip dedicated to 2-series lithium/iron batteries, with built-in high-precision voltage detection circuit and current detection circuit. Support overcharge, over discharge Overcharge, discharge overcurrent, short circuit, charge overcurrent.

ÿ Features

1) High-precision voltage detection function*1

ÿ Overcharge protection voltage	3.500V ~ 4.400V	Accuracy: ÿ25mV
ÿ Overcharge release voltage	3.200V ~ 4.300V	Accuracy: ÿ50mV
ÿ Over discharge protection voltage	2.000V ~ 2.900V	Accuracy: ÿ80mV
ÿ Over discharge release voltage	2.500V ~ 3.000V	Accuracy: ÿ100mV

2) 2-stage discharge overcurrent protection function

ÿ Overcurrent protection voltage	0.050V ~ 0.300V	Accuracy ÿ15mV @ ÿ0.100V
		Accuracy ÿ30mV @ >0.100V
ÿ Short circuit protection voltage	0.5V, 1.0V	Accuracy ÿ0.2V

3) Charging overcurrent protection voltage

ÿ Protection voltage	-0.080V ~ -0.220V	Accuracy: ÿ30mV

4) Charger detection and load detection function

5) 0V battery charging function	You can select "Allow" or "Prohibit"

6) Low current consumption

ÿ At work	5.0 ÿA (Typical) (Ta = +25ÿC)
ÿ Over discharge	3.0 ÿA (Typical) (Ta = +25ÿC)
ÿ When sleeping	0.1 ÿA (Typical) (Ta = +25ÿC)

7) Lead-free, halogen-free

8) Package: SOT23-6

ÿ Application Areas

ÿ 2 series lithium/iron rechargeable battery pack

1 Please refer to the table for specific protection voltage values of different products***2*** ï

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ÿ System function block diagram

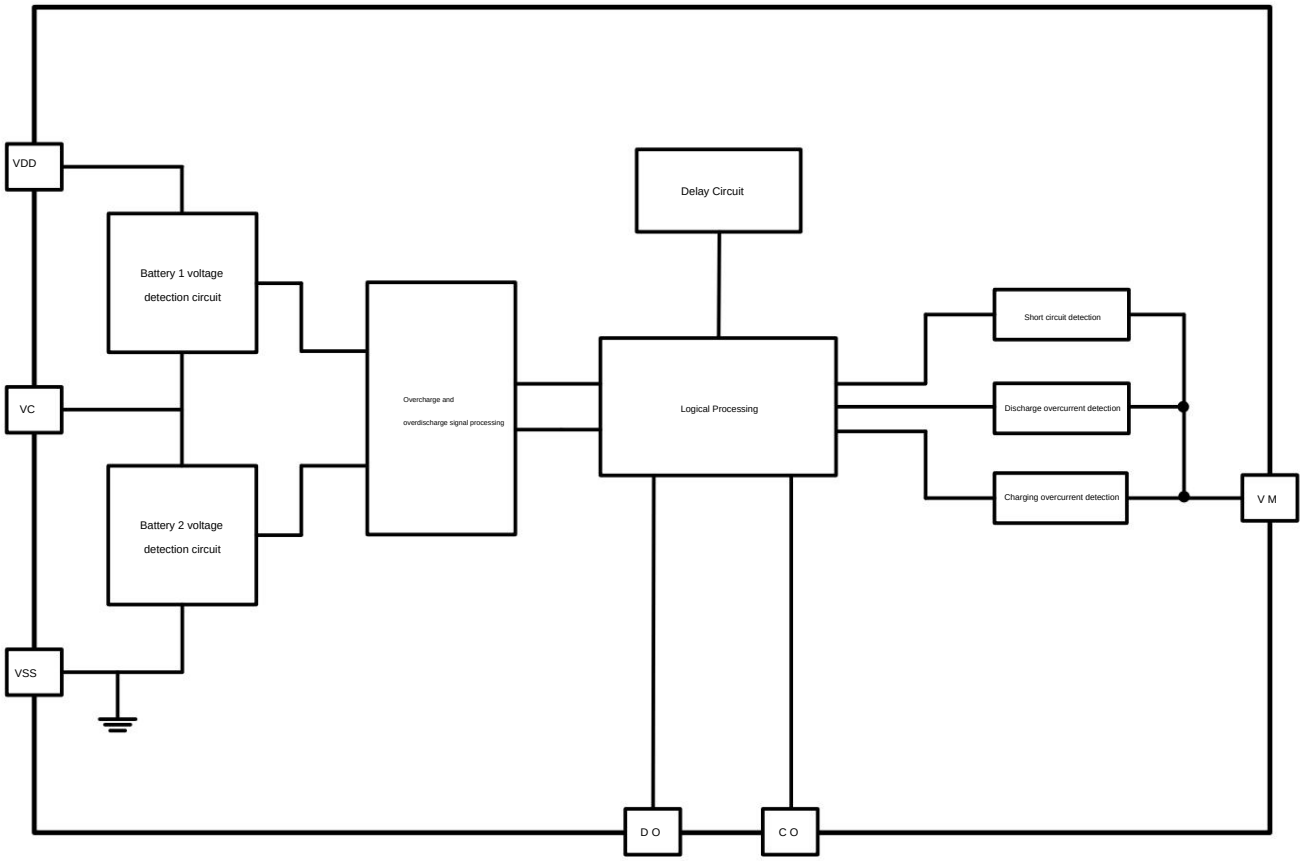

Figure **1**

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ÿ Pinout

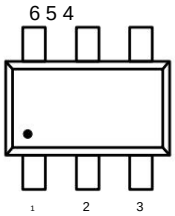

Figure **2**

Pin Number	symbol	describe
1	DO	Discharge control MOSFET gate connection terminal
2	CO	MOSFET gate connection terminal for charging control
3	VM	Overcurrent detection terminal, charger detection terminal
4	VC	Negative voltage of battery 1, positive voltage of battery 2 connection terminals
5	VDD	Positive power input terminal, battery 1 positive voltage connection terminal
6	VSS	Ground terminal, negative power input terminal, battery 2 negative voltage connection terminal

Table **1**

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ÿ Naming convention

CM1020-X

Parameter information

Set in A~Z order

ÿ Product List

1. Test voltmeter

Product Name	Overcharge Protection voltage VOC	Overcharge Release voltage VOCR	Over discharge Protection voltage VOD	Over discharge Release voltage V.O.D.R.	Discharge overcurrent THING	Short Circuit VSHORT	Charging overcurrent VCHA	Delay Interval Code	Function Code
CM1020-B	4.350 V	4.150 V	2.300 V	3.100 V	0.200 V	1.000 V	-0.210 V			A	1
CM1020-C	4.280 V	4.080 V	2.900 V	3.100 V	0.200 V	1.000 V	-0.210 V			A	1
CM1020-D	4.280 V	4.080 V	2.350 V	2.850 V	0.200 V	1.000 V	-0.210 V			A	1
CM1020-E	4.250 V	4.150 V	2.800 V	3.050 V	0.100 V	0.500 V	-0.100 V			B	2
CM1020-F	4.225 V	4.125 V	2.800 V	3.050 V	0.100 V	0.500 V	-0.100 V			B	2
CM1020-J	3.650 V	3.480 V	2.000 V	2.350 V	0.200 V	1.000 V	-0.200 V			A	1
CM1020-N	4.280 V	4.080 V	2.800 V	2.950 V	0.200 V	1.000 V	-0.210 V			A	2
CM1020-H	4.225 V	4.025 V	2.400 V	2.900 V	0.100 V	0.500 V	-0.100 V			A	3
CM1020-K	4.250 V	4.050 V	2.400 V	2.900 V	0.200 V	0.500 V	-0.200 V			A	4
CM1020-L	4.425 V	4.225 V	2.500 V	3.050 V	0.200 V	0.500 V	-0.150 V			A	5
CM1020-M	4.280 V	4.080 V	2.500 V	3.050 V	0.200 V	0.500 V	-0.170 V			A	5
CM1020-P	4.225 V	4.125 V	2.500 V	3.000 V	0.200 V	0.500 V	-0.170 V			A	5

Table **2**

2. Delay time code

Delay time code	Overcharge protection delay TOC	Over discharge protection delay TOD	Discharge overcurrent delay TEC	Charge overcurrent delay TCHA	Short circuit delay TSHORT
A	1000 ms	128 ms	10 ms	8 ms	250 ÿs
B	1000 ms	1000 ms	1000 ms	8 ms	250 ÿs

Table **3**

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3. Function code

Function Code	Overcharge self-recovery function*2	Sleep function	0V battery charging function
1	none	have	allow
2	have	none	allow
3	none	have	prohibit
4	none	none	allow
5	have	have	allow

Table **4**

2 See the overcharge status in "Function Description" for details.***2.1*** and ***2.2*** 。

Note: If you need products other than the above specifications, please contact our sales department.

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ÿ Absolute Maximum Ratings

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

project	symbol	Absolute Maximum Ratings	unit
VDD and VC, VC and VSS Input voltage between	VDD-VC, VC-VSS	-0.3 ~ +8.0	V
CO output terminal voltage	VCO	VDD-28 ~ VDD+0.3	V
DO output terminal voltage	VDO	VSS-0.3 ~ VDD+0.3	V
VM input terminal voltage	EIA	VDD-28 ~ VDD+0.3	V
Operating temperature range	TOPR	ÿ40 ~ +85	°C
Storage temperature range	TSTG	ÿ40 ~ +125	°C

Table **5**

Note: Applying voltage exceeding the absolute maximum rating may cause irreversible damage to the chip.

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ÿElectrical characteristics

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

project	symbol	Test conditions	Minimum Typical Value		Maximum value uni	
[Power consumption]	Models with sleep function					
Normal operating current	IDD	V1=V2=3.5V,VVM=0V	·	5.0	9.0	ÿA
Sleep current	IPDN	V1=V2=1.5V,VVM=3V	·	0.1	0.3	ÿA
[Power consumption]	Models with over discharge self-recovery function					
Normal operating current	IDD	V1=V2=3.5V,VVM=0V	·	5.0	9.0	ÿA
Over discharge current	IOPED	V1=V2=1.5V,VVM=3V	·	3.0	6.0	ÿA
[Detection voltage]						
Overcharge protection voltage	VOC		VOC -0.025	VOC	VOC +0.025	V
Overcharge release voltage	VOCR		VOCR -0.050	VOCR	VOCR +0.050	V
Over discharge protection voltage	VOD		VOD -0.080	VOD	VOD +0.080	V
Over discharge release voltage	V.O.D.R.		VODR -0.100	V.O.D.R.	VODR +0.100	V
Discharge overcurrent protection voltage	THING	VECÿ0.100V	VEC -0.015	THING	VEC +0.015	V
		VECÿ0.100V	VEC -0.030	THING	VEC +0.030	V
Short circuit protection voltage	VSHORT		VSHORT -0.2	VSHORT	VSHORT +0.2	V
Charge overcurrent protection voltage VCHA			VCHA -0.030	VCHA	VCHA +0.030	V
[Delay time]						
Overcharge protection delay	TOC		TOC*60%	TOC	TOC*140%	ms
Over discharge protection delay	TOD		TOD*60%	TOD	TOD*140%	ms
Discharge overcurrent protection delay TEC			TEC*60%	TEC	TEC*140%	ms
Charging overcurrent protection delay TCHA			TCHA*60%	TCHA	TCHA*140%	ms
Short circuit protection delay	TSHORT		TSHORT*60%	TSHORT	TSHORT*140%	ÿs
[Control terminal output voltage]						
DO terminal outputs high voltage VDH			VDD -0.1 VDD -0.02		·	V
DO terminal outputs low voltage VDL			·	0.2	0.5	V
CO terminal outputs high voltage VCH			VDD -0.1 VDD -0.02		·	V
CO terminal outputs low voltage VCL			·	0.2	0.5	V
[Function to charge **0V** battery]						
Charger starting voltage (allowable 0V battery charging function)	V0CH	Allows charging of 0V batteries able	1.2	·	·	V
Battery voltage (0V is prohibited Battery charging function)	V0IN	Disable charging of 0V battery able	·	·	0.5	V

Table **6**

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ÿ Functional description

1. Normal working status

The IC continuously detects the voltage of battery 1 connected between VDD and VC, the voltage of battery 2 connected between VC and VSS, and the voltage of battery 2 connected between VM and VSS.
When the voltage of battery 1 and battery 2 is above the over-discharge protection voltage (VOD) and below the over-charge protection voltage (VOC), and the VM pin voltage is above the charge over-current protection voltage (VCHA) and below the discharge over-current protection voltage (VEC), both the CO and DO pins of the IC output a high level , turning on the charge control MOSFET and the discharge control MOSFET at the same time. This state is called the "normal working state". In this state, normal charging and discharging are possible.

electricity.

Note: When you connect the battery for the first time, it may not be able to discharge. Short-circuit the VM terminal and the VSS terminal, or connect a charger to restore the normal working state.
state.

2. Overcharge state

2.1 Models without overcharge self-recovery function

For batteries in normal working state, during the charging process, if the voltage of battery 1 connected between VDD and VC terminals or the voltage of battery 2 connected between VC and VSS terminals exceeds the overcharge protection voltage (VOC), and this state lasts longer than the overcharge protection delay time (TOC), the output voltage of the CO terminal of the IC changes from high level to low level, turning off the MOSFET used for charging control and stopping charging. This state is called "overcharge state".

The overcharge state can be released in the following two cases: the CO pin output voltage changes from low level to high level, turning on the charge control MOSFET.

(1) Disconnect the charger and the voltage of both battery 1 and battery 2 drops below the overcharge release voltage (VOCR) due to self-discharge. The overcharge state is released.
Restore to normal working condition.

(2) Disconnect the charger and connect the load. When the voltage of battery 1 and battery 2 drops below the overcharge protection voltage (VOC), the overcharge state is released and the battery is restored.
Restore to normal working state, this function is called load detection function. Note: If the
charger is connected after overcharge protection occurs, even if the battery voltage drops below the overcharge release voltage (VOCR), it cannot be released.
Overcharge state. When the charger is disconnected and the VM pin voltage rises above the charge overcurrent protection voltage (VCHA), the overcharge state is released.

2.2 Models with overcharge self-recovery function

For batteries in normal working state, during the charging process, if the voltage of battery 1 connected between VDD and VC terminals or the voltage of battery 2 connected between VC and VSS terminals exceeds the overcharge protection voltage (VOC), and this state lasts longer than the overcharge protection delay time (TOC), the output voltage of the CO terminal of the IC changes from high level to low level, turning off the MOSFET used for charging control and stopping charging. This state is called "overcharge state".

The overcharge state can be released in the following two cases: the CO pin output voltage changes from low level to high level, turning on the charge control MOSFET.

(1) When the voltage of both battery 1 and battery 2 drops below the overcharge release voltage (VOCR) due to self-discharge, the overcharge state is released and normal operation is restored.
Working status.

(2) Remove the charger and connect the load. When the voltage of battery 1 and battery 2 drops below the overcharge protection voltage (VOC), the overcharge state is released and the battery is restored.
This function is called load detection function.

3. Over discharge state

In normal working state, during the discharge process, the voltage of battery 1 connected between VDD and VC terminals or the voltage of battery 2 connected between VC and VSS terminals is
When the voltage drops below the over-discharge protection voltage (VOD) and this state lasts longer than the over-discharge protection delay time (TOD), the DO pin of the IC outputs
The output voltage changes from high level to low level, turning off the MOSFET used for discharge control and stopping discharge. This state is called "over-discharge state".

3.1 Models with sleep function

When the discharge control MOSFET is turned off, VM is pulled up to VDD by the internal resistor of the IC, and the power consumption of the IC is reduced to the current consumption during sleep (IPDN).
It is called "sleep state".

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The over-discharge state can be released in the following two cases. The DO pin output voltage changes from low level to high level, turning on the discharge control MOSFET.

(1) Connect the charger. If the VM terminal voltage is lower than the charge overcurrent protection voltage (VCHA), when the voltages of battery 1 and battery 2 are both higher than the overdischarge protection voltage When (VOD), the over-discharge state is released and the charger returns to normal working state. This function is called charger detection function.

(2) Connect a charger. If the VM terminal voltage is higher than the charge overcurrent protection voltage (VCHA), when the voltages of both battery 1 and battery 2 are higher than the overdischarge release voltage (VODR), the over-discharge state is released and the device returns to normal working state.

3.2 Models without sleep function

When the IC enters the over-discharge state, there are three ways to release it:

(1) Connect the charger. If the VM terminal voltage is lower than the charge overcurrent protection voltage (VCHA), when the voltages of battery 1 and battery 2 are both higher than the overdischarge protection voltage When (VOD), the over-discharge state is released and the charger returns to normal working state. This function is called charger detection function.

(2) Connect a charger. If the VM terminal voltage is higher than the charge overcurrent protection voltage (VCHA), when the voltages of both battery 1 and battery 2 are higher than the overdischarge release voltage (VODR), the over-discharge state is released and the device returns to normal working state.

(3) When the charger is not connected, when the voltage of battery 1 and battery 2 are both higher than the over-discharge release voltage (VODR), the over-discharge state is released and returns to normal. Working state, that is, "no sleep function".

4. Discharge overcurrent state

When the battery is in normal working condition, the IC continuously detects the discharge current through the VM pin voltage. If the VM pin voltage exceeds the discharge overcurrent protection voltage (VEC), If this state lasts longer than the discharge overcurrent protection delay time (TEC), the DO terminal output voltage changes from high level to low level, turning off the discharge control function. MOSFET stops discharging, and this state is called "discharge overcurrent state".

If the VM terminal voltage exceeds the load short-circuit protection voltage (VSHORT) and this state lasts longer than the load short-circuit protection delay time (TSHORT), The DO terminal output voltage also changes from high level to low level, turning off the MOSFET used for discharge control and stopping discharge. This state is called "load short-circuit state".

After entering the discharge overcurrent protection state, when the VM voltage is lower than the overcurrent 1 voltage, the discharge overcurrent state is released and returns to the normal state.

5. Charging overcurrent state

In a normal working state of the battery, during the charging process, if the VM terminal voltage is lower than the charge overcurrent protection voltage (VCHA), and this state lasts for a certain period of time, When the over-current protection delay time (TCHA) is exceeded, the CO terminal output voltage changes from high level to low level, turning off the MOSFET used for charging control and stopping charging. This state is called "charging overcurrent state".

After entering the charge overcurrent protection state, if the charger is disconnected and the VM pin voltage is higher than the charge overcurrent detection voltage (VCHA), the charge overcurrent state is released. Restore to normal working condition.

6. 0V battery charging function (allowed)

This function is used to recharge a battery that has self-discharged to 0V. When the charger voltage is connected between the positive terminal (P+) and the negative terminal (P-) of the battery, the high At the "charger start voltage (V0CH) for charging a 0V battery", the gate of the charge control MOSFET is fixed to the potential of the VDD terminal. The voltage difference between the gate and source of the MOSFET is higher than its conduction voltage (Vth), and the charge control MOSFET is turned on, and charging begins. The MOSFET is still off and the charging current flows through its internal parasitic diode. When the battery voltage is higher than the over-discharge protection voltage (VOD), the IC enters normal operation. Working status.

Note: Please ask the battery supplier to confirm whether the purchased battery has the "0V Battery charging function", or prohibit to "0V Battery charging function".

7. 0V battery charging function (disabled)

When an internally shorted battery (0V battery) is connected, the 0V battery charge inhibit function prevents it from being recharged. When the battery voltage is higher than the "0V battery charging prohibited battery voltage (V0IN)", the gate of the charging control MOSFET is fixed to the P- voltage, and charging is prohibited. When the voltage (V0IN) is turned on, charging can be performed.

Note: Please ask the battery supplier to confirm whether the purchased battery has the "0V Battery charging prohibition function", or "0V Battery charging function".

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ÿ Typical application schematic diagram

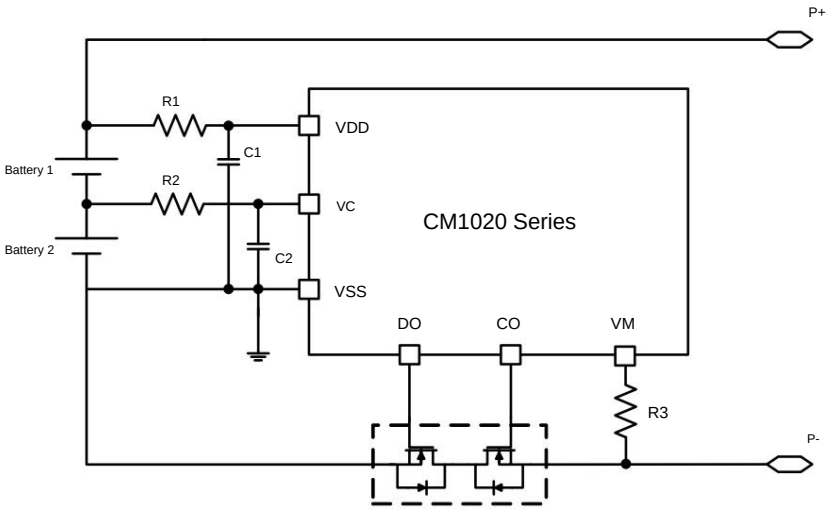

Figure **3**

Device identification	Typical Value	Parameter range	unit
R1	330	100 ~ 510	Oh
C1	0.1	0.01 ~ 1.0	ÿF
R2	330	100 ~ 510	Oh
C2	0.1	0.01 ~ 1.0	ÿF
R3	2000	1000 ~ 4000	Oh

Table **7**

1) If the connection resistance of R1 or R2 is too large, it will affect the detection voltage accuracy. When the charger is reversely connected, the current flows from the charger to the IC. If R1 or R2 is too large, it may cause

The voltage between the VDD and VSS pins exceeds the absolute maximum rating.

2) If R3 is too large, when the voltage connected to the charger is too high, the charging current may not be turned off.

Current, do not choose a resistance that is too small.

3) C1 and C2 have the function of stabilizing the voltage. Capacitors below 0.01ÿF cannot be connected.

Notice:

1.The above parameters are subject to change without prior notice.

2. The schematic diagram and parameters of the above IC are not used as a basis for guaranteeing the operation of the circuit. Please set the parameters after sufficient actual measurements on the actual application circuit.

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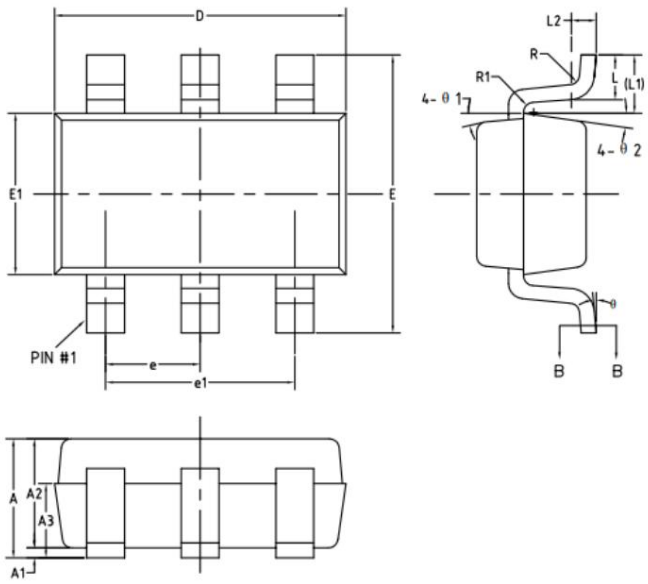
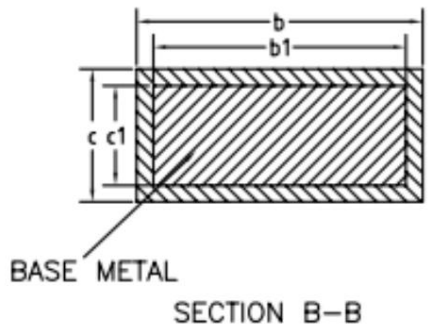
ÿ Packaging information





SYMBOL MIN		NAME	MAX
A	·	·	1.45
A1	0	·	0.15
A2	0.90	1.15	1.30
A3	0.60	0.65	0.70
b	0.39	·	0.49
b1	0.35	0.40	0.45
c	0.08	·	0.22
c1	0.08	0.13	0.20
D	2.80	2.90	3.00
AND	2.60	2.80	3.00
E1	1.50	1.60	1.70
and	0.85	0.95	1.05
e1	1.80	1.90	2.00
L	0.35	0.45	0.60
L1	0.35	0.60	0.85
L2	0.25BSC		
R	0.10	·	·
R1	0.10	·	0.25
i	0°	·	8°
i1	7°	9°	11°
i2	8°	10°	12°

NOTES:

ALL DIMENSIONS REFER TO JEDEC STANDARD MO-178 C

DO NOT INCLUDE MOLD FLASH OR FROTRUSIONS.

ALL DIMENSIONS ARE IN MILLIMETERS.ANGLES ARE IN DEGREES.