

# 1cell Li-ion/Li-polymer battery protection IC

## MD1421ExxCPAL Series

### Outline

MD1421ExxCPAL series are protection IC with integrated MOSFET for protection of the rechargeable lithium-ion or lithiumpolymer battery. The overcharge, overdischarge and discharging and charging overcurrent protection of the rechargeable one-cell lithium-ion or lithium-polymer battery can be detected.

### Features

(Unless otherwise specified, Topr=+25°C)

#### (1) Range and accuracy of detection/release voltage

|                                          |                            |                                                     |
|------------------------------------------|----------------------------|-----------------------------------------------------|
| ●Overcharge detection voltage            | 4.10V to 4.45V, 5mV steps  | Accuracy±20mV<br>Accuracy±25mV (Topr=-5°C to +60°C) |
| ●Overcharge release voltage              | 3.90V to 4.30V (Note1)     | Accuracy±50mV                                       |
| ●Overdischarge detection voltage         | 2.00V to 3.00V (Note2)     | Accuracy±100mV                                      |
| ●Overdischarge release voltage           | 2.00V to 3.20V (Note2)     | Accuracy±100mV                                      |
| ●Discharge overcurrent detection voltage | 40mV to 180mV, 5mV steps   | Accuracy±5mV                                        |
| ●Charging overcurrent detect voltage     | -180mV to -50mV, 5mV step  | Accuracy±15mV                                       |
| ●Short detection voltage                 | Selection from 0.56, 0.90V | Accuracy±100mV                                      |
| ●Over voltage charger detection voltage  | VDD-8.0V fixed             | Accuracy±2.0V                                       |
| ●Over voltage charger release voltage    | VDD-7.3V fixed             | Accuracy±1.5V                                       |

#### (2) Range of detection delay time

|                                               |                                            |
|-----------------------------------------------|--------------------------------------------|
| ●Overcharge detection delay time              | Selection from 1.0s, 4.5s, 6.25s           |
| ●Overdischarge detection delay time           | Selection from 100ms, 256ms                |
| ●Discharging overcurrent detection delay time | Selection from 8ms, 12ms, 16ms, 20ms, 34ms |
| ●Charging overcurrent detection delay time    | Selection from 8.5ms, 25ms, 32.5ms         |
| ●Short detection delay time                   | Selection from 0.50ms, 0.75ms, 1.00ms      |

#### (3) 0V battery charge function

Selection from "Permission" or "Prohibition"

#### (4) The overcharge detection delay timer reset time function

(function for the pulse charge) is provided.

fixed

#### (5) Low current consumption

|                |                                                                                                                                                                     |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ●Normal mode   | Typ. 3.0μA, Max. 5.2μA                                                                                                                                              |
| ●Stand-by mode | Max. 0.1μA<br>(For "Charger connection release" the overdischarge release condition.)<br>Max. 0.5μA<br>(For "Voltage release" the overdischarge release condition.) |

#### (6) MOS-FET

|                                       |                         |
|---------------------------------------|-------------------------|
| ●Source to Source on state resistance | Typ. 38.0mΩ (@VCC=3.7V) |
|---------------------------------------|-------------------------|

#### (7) Absolute maximum ratings

|                          |                     |
|--------------------------|---------------------|
| ●VCC pin                 | -0.3V to +12V       |
| ●V- pin                  | VCC-24V to VCC+0.3V |
| ●Drain-source voltage    | Max. 24V            |
| ●Drain current           | Max. 6V             |
| ●Total Power Dissipation | Max. 1.0W           |
| ●Storage temperature     | -40°C to +125°C     |
| ●Operation temperature   | -40°C to + 85°C     |

Note1 : Hysteresis voltage between Overcharge detection and release voltage is selectable from 0.10V/0.15V/0.20V/0.25V.

Note2 : Please inquire to us about details of the setting of Overdischarge detection and release voltage.

## Pin Assignment

| Top view<br>PLP-4-1228 | Pin No. | Function                                                                                                                             |
|------------------------|---------|--------------------------------------------------------------------------------------------------------------------------------------|
|                        | 1       | S1 is a source pin of Discharge MOS-FET and a negative power supply, which is connected to the negative terminal of the battery.     |
|                        | 2       | VCC is a positive power supply pin, which is connected to the positive terminal of the battery through Rvcc (330 to 470 ohm).        |
|                        | 3       | V- is an input pin that detects overcurrent. This pin is connected to the source terminal of Charge MOS-FET through Ridt (2.7k ohm). |
|                        | 4       | S2 is a source pin of Charge MOS-FET, which is connected to a negative power supply terminal of chargers.                            |
|                        | D       | D is a common pin of two drains of Charge MOS-FET and Discharge MOS-FET. D must be open electrically.                                |

## Selection Guide

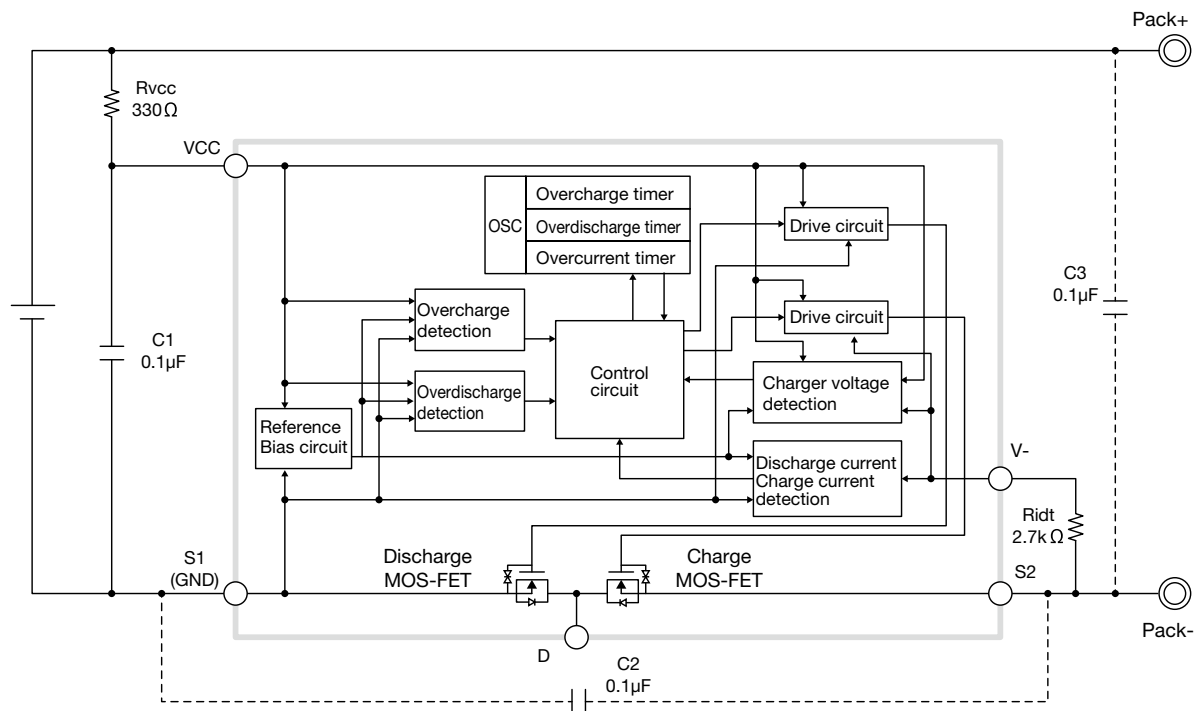
(5000pcs/Reel)

| Product name    | Package    | Optional function          |                                                                  | Detection / Release voltage  |                            |                                 |                               |                                                       |                                                    |                        | Detection delay time            |                                    |                                              |                                           |                            | Optional function                   |                                  |         |
|-----------------|------------|----------------------------|------------------------------------------------------------------|------------------------------|----------------------------|---------------------------------|-------------------------------|-------------------------------------------------------|----------------------------------------------------|------------------------|---------------------------------|------------------------------------|----------------------------------------------|-------------------------------------------|----------------------------|-------------------------------------|----------------------------------|---------|
|                 |            | 0V battery charge function | Discharge overcurrent detection voltage becomes dependent on VDD | Overcharge detection voltage | Overcharge release voltage | Overdischarge detection voltage | Overdischarge release voltage | Discharging overcurrent detection voltage (@VCC=3.5V) | Charging overcurrent detection voltage (@VCC=3.5V) | Shortdetection voltage | Overcharge detection delay time | Overdischarge detection delay time | Discharging overcurrent detection delay time | Charging overcurrent detection delay time | Short detection delay time | Discharge current limit (@VCC=3.5V) | Charge current limit (@VCC=3.5V) |         |
|                 |            |                            |                                                                  |                              |                            |                                 |                               |                                                       |                                                    |                        |                                 |                                    |                                              |                                           |                            |                                     |                                  |         |
|                 |            |                            |                                                                  | (Note3)                      | (Note4)                    | V1                              | V2                            | V4                                                    | V3                                                 | V5                     | V9                              | V6                                 | Tsp3                                         | Tsp1                                      | Tsp2                       | Tsp5                                | Tsp4                             | Idischg |
|                 |            |                            |                                                                  | V                            | V                          | V                               | V                             | V                                                     | V                                                  | s                      | ms                              | ms                                 | ms                                           | μs                                        | A                          | A                                   |                                  |         |
| MD1421E28CPAL-R | PLP-4-1228 | ○                          | ×                                                                | 4.375                        | 4.175                      | 3.000                           | 3.000                         | 0.040                                                 | -0.050                                             | 0.900                  | 1.0                             | 100.0                              | 12.0                                         | 8.5                                       | 500                        | 1.05                                | 1.30                             |         |
| MD1421E34CPAL-R | PLP-4-1228 | ○                          | ×                                                                | 4.375                        | 4.175                      | 3.000                           | 3.200                         | 0.040                                                 | -0.050                                             | 0.900                  | 1.0                             | 100.0                              | 12.0                                         | 8.5                                       | 500                        | 1.05                                | 1.30                             |         |
| MD1421E35CPAL-R | PLP-4-1228 | ×                          | (0.65V)                                                          | ○                            | 4.425                      | 4.225                           | 2.700                         | 2.700                                                 | 0.070                                              | -0.070                 | 0.560                           | 1.0                                | 100.0                                        | 20.0                                      | 8.5                        | 750                                 | 1.80                             | 1.80    |
| MD1421E36CPAL-R | PLP-4-1228 | ○                          | ○                                                                | 4.425                        | 4.225                      | 2.800                           | 2.800                         | 0.085                                                 | -0.095                                             | 0.900                  | 1.0                             | 100.0                              | 20.0                                         | 8.5                                       | 750                        | 2.20                                | 2.45                             |         |
| MD1421E39CPAL-R | PLP-4-1228 | ×                          | (0.90V)                                                          | ×                            | 4.280                      | -                               | 2.700                         | 2.700                                                 | 0.080                                              | -0.080                 | 0.900                           | 1.0                                | 100.0                                        | 20.0                                      | 8.5                        | 750                                 | 2.05                             | 2.05    |

Note3 0V battery charge function ○ : Permission × : Prohibition  
 Note4 Optional functions ○ : Provided × : Not provided

Please inquire to us, if you request a rank other than the above.

## Application Circuit



- The resistors that are inserted into each pin are to protect the IC. They help to remove ESD and latch-up damages.
- The capacitors help to reduce the effects of transient variations in voltage and electromagnetic waves, and to improve ESD tolerance of the IC.  
Please use either C2 or C3, or both of them by request of your application.
- These values in the above figure are for example. Please choose appropriate values.