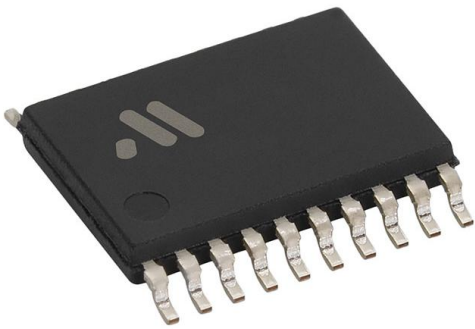


MM3474P04VBE Datasheet

www.digi-electronics.com



<https://www.DiGi-Electronics.com>

| | |
|------------------------------|--|
| DiGi Electronics Part Number | MM3474P04VBE-DG |
| Manufacturer | Mitsumi Electric Company Ltd |
| Manufacturer Product Number | MM3474P04VBE |
| Description | IC, MULTI CELL, BATTERY PROTECTI |
| Detailed Description | Battery Battery Protection IC Lithium Ion/Polymer T SOP-20D |



Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

DiGi is a global authorized distributor of electronic components.

Purchase and inquiry

Manufacturer Product Number:

MM3474P04VBE

Series:

MM3474

Function:

Battery Protection

Number of Cells:

3 ~ 5

Interface:

-

Mounting Type:

Surface Mount

Supplier Device Package:

TSOP-20D

Manufacturer:

Mitsumi Electric Company Ltd

Product Status:

Active

Battery Chemistry:

Lithium Ion/Polymer

Fault Protection:

Over Current, Over Voltage

Operating Temperature:

-40°C ~ 85°C

Package / Case:

20-TSSOP (0.173", 4.40mm Width)

Base Product Number:

MM3474

Environmental & Export classification

RoHS Status:

ROHS3 Compliant

ECCN:

EAR99

Moisture Sensitivity Level (MSL):

2 (1 Year)

HTSUS:

8542.39.0001

3 to 5cells lithium-ion / lithium-polimar secondary battery protection IC

MM3474 Series

Description

MM3474 series is an overcharge, overdischarge and overcurrent protection IC for a lithium-ion / lithium-polymer secondary battery. This supports 3 to 5 serial cells, and the number of cells can be switched over by inputting high / low signal to SEL terminal. MM3474 series can protect Lithium ion battery pack of 6-plus serial cells by connecting in cascade. This also provides the control terminals of output overdischarge detection (SDC) and output overcharge detection (SOC), which allows configuring an application with fewer external parts for 6 or more cells connected in series.

We provide many kinds of optional ICs of MM3474 series, which are customizable for the usage by selecting optional functions.

Low cost and small size configuration can be achieved when MM3474 series is combined with MM3220V series which is 2 cells protection IC and used for the applications of 6 cells or 7 cells, etc.

Cell balance control function can be added when MM3513 series which is cell balance control IC is used.

Features

(Unless otherwise specified, Ta=25 degC)

| •Detection voltage | Range | Accuracy |
|---------------------------------|---------------------------|---------------------------|
| Overcharge detection voltage | 3.6V to 4.5V, 5mV steps | +/-25mV(Ta=0 to +50 degC) |
| Overdischarge detection voltage | 2.0V to 3.0V, 50mV steps | +/-80mV |
| Overcurrent detection voltage | 50mV to 300mV, 5mV steps | +/-15mV |
| Short detection voltage | 0.2V to 1.0mV, 50mV steps | +/-100mV |

•3-, 4-, 5-cell protection switching function

The 3-, 4-, or 5-cell protection can be switched by connecting the SEL1 pin and SEL2 pin to the VDD or VSS2 via a protection resistor. At the time of 4-cell protection, the operation of the overcharge detection circuit and overdischarge detection circuit for the V1 cell is stopped. Therefore, short-circuit the V1 pin and VSS1 pin before use. At the time of 3-cell protection, the operation of overcharge detection circuit and overdischarge detection circuit for V1 and V2 Cell is stopped. Therefore, short-circuit the V2 pin, V1 pin and VSS1 pin before use.

| SEL1 pin | SEL2 pin | MM3474 Setting |
|------------|------------|-------------------|
| High (VDD) | High (VDD) | 5 cell prptection |
| High (VDD) | Low (VSS2) | 4 cell prptection |
| Low (VSS2) | High (VDD) | 3 cell prptection |
| Low (VSS2) | Low (VSS2) | prohibite |

•Communication function when cascade connected

When using a cascade-connected IC with 6 or more cell protection, an overdischarge detection signal can be transmitted by inputting the DCHG output pin signal to the SDC pin via a resistor. If the current input to the SDC pin exceeds the SDC release current, it is recognized as normal state. If it drops below the SDC detection current or if it is open, it is recognized as overdischarge detection state. In the same way, an overdischarge detection signal can be transmitted by inputting the OV output pin signal to the SOC pin via a resistor.

In addition, charge / discharge is more controllable than inputting a signal into SDC terminal, SOC terminal from the outside independently.

Applications

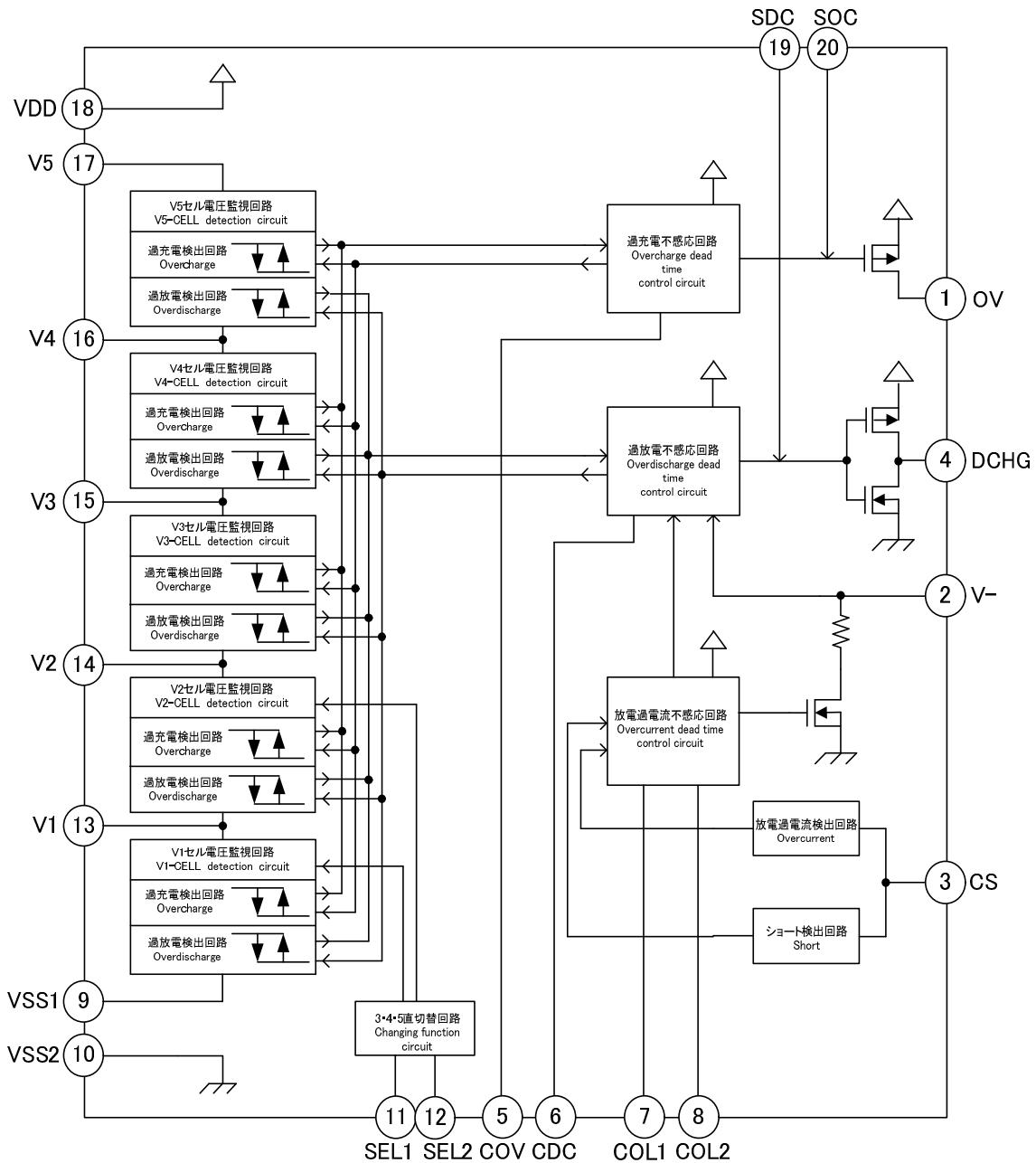
- Lithium-ion rechargeable battery pack
- Lithium polymer rechargeable battery pack

Package type

- TSOP-20C/20D 6.50 × 6.40 × 1.10 [mm]

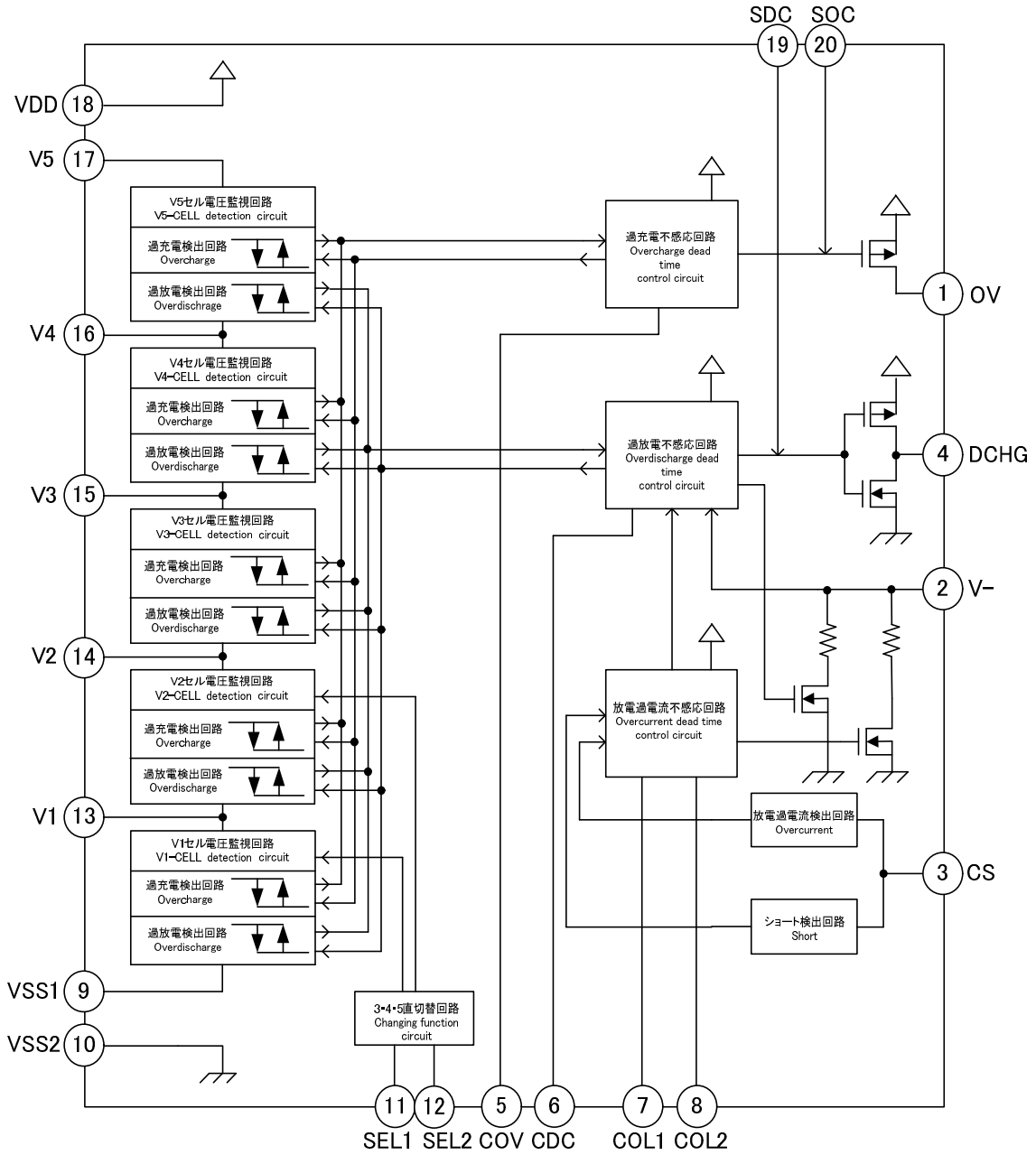
Block diagram

Overdischarge release : 「Voltage release」 type



Block diagram

Overdischarge release : 「Load release + Voltage release」 type



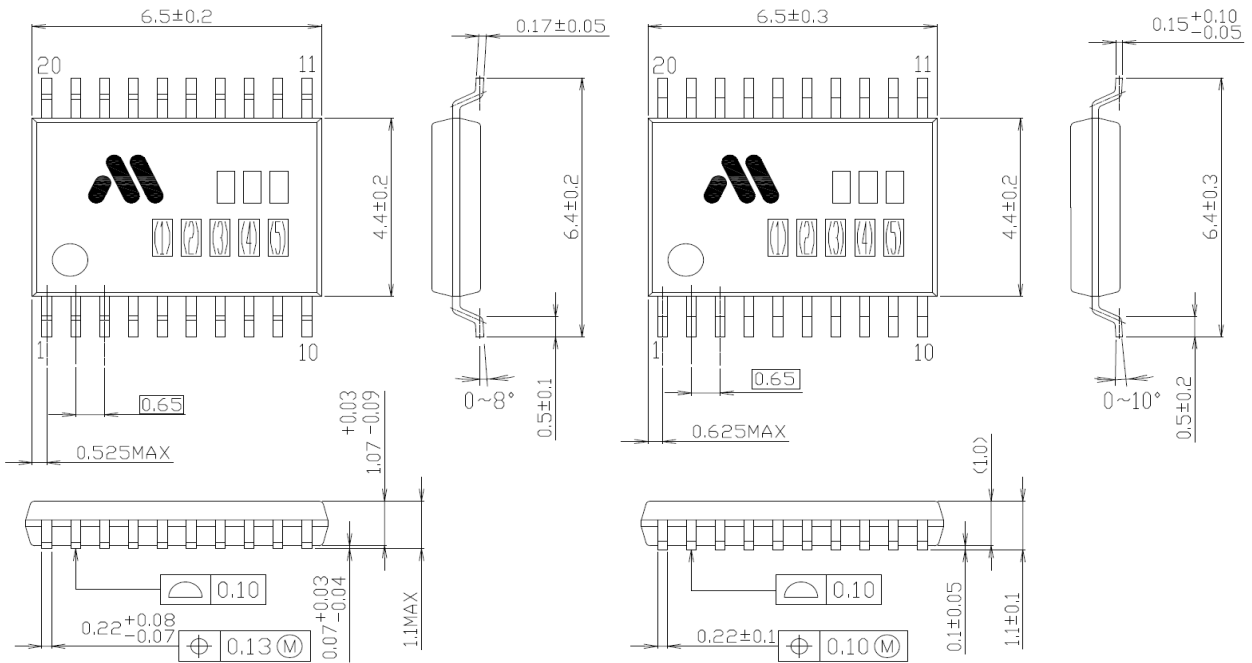
Package and pin configuration

| Pin No. | Pin No. | Function |
|---------|---------|---|
| 1 | OV | Charge control output terminal. Output type is Pch open drain. Active "Hi impedance". |
| 2 | V- | Input terminal connected to charger negative voltage. Detected charger connection and load detection. |
| 3 | CS | Input of overcurrent detection. The voltage of the sense resistance is observed, and the overcurrent is detected. |
| 4 | DCHG | Discharge control output terminal. Output type is CMOS. Active "Low". |
| 5 | COV | This pin is dead time setting of overcharge detection and release. |
| 6 | CDC | This pin is dead time setting of overdischarge detection and release. |
| 7 | COL1 | This pin is dead time setting of overcurrent detection. |
| 8 | COL2 | This pin is dead time setting of overcurrent release. |
| 9 | VSS1 | The input terminal of the negative voltage of V1 cell . |
| 10 | VSS2 | The input terminal of the ground of IC. |
| 11 | SEL1 | This pin is for changing function for 3cell in series or 4cell in series , 5cell in series. SEL1 = H , SEL2 = H → 5Cell protection |
| 12 | SEL2 | SEL1 = H , SEL2 = L → 4Cell protection SEL1 = L , SEL2 = H → 3Cell protection (SEL1=SEL2=L setting is prohibited.) |
| 13 | V1 | The input terminal of the positive voltage of V1 cell, and the negative voltage of V2 cell . |
| 14 | V2 | The input terminal of the positive voltage of V2 cell, and the negative voltage of V3 cell . |
| 15 | V3 | The input terminal of the positive voltage of V3 cell, and the negative voltage of V4 cell . |
| 16 | V4 | The input terminal of the positive voltage of V4 cell, and the negative voltage of V5 cell . |
| 17 | V5 | The input terminal of the positive voltage of V5 cell . |
| 18 | VDD | The input terminal of the power supply of IC. |
| 19 | SDC | The control terminal of output over discharge detection. $I_{SDC} < I_{SDCL} \rightarrow DCHG=Low$ |
| 20 | SOC | The control terminal of output over charge detection. $I_{SOC} < I_{SOCL} \rightarrow OV=Hi impedance$ |

Package dimensions

Unit:mm

TSOP-20C



Electrical characteristics

Unless otherwise specified, Topr=+25°C

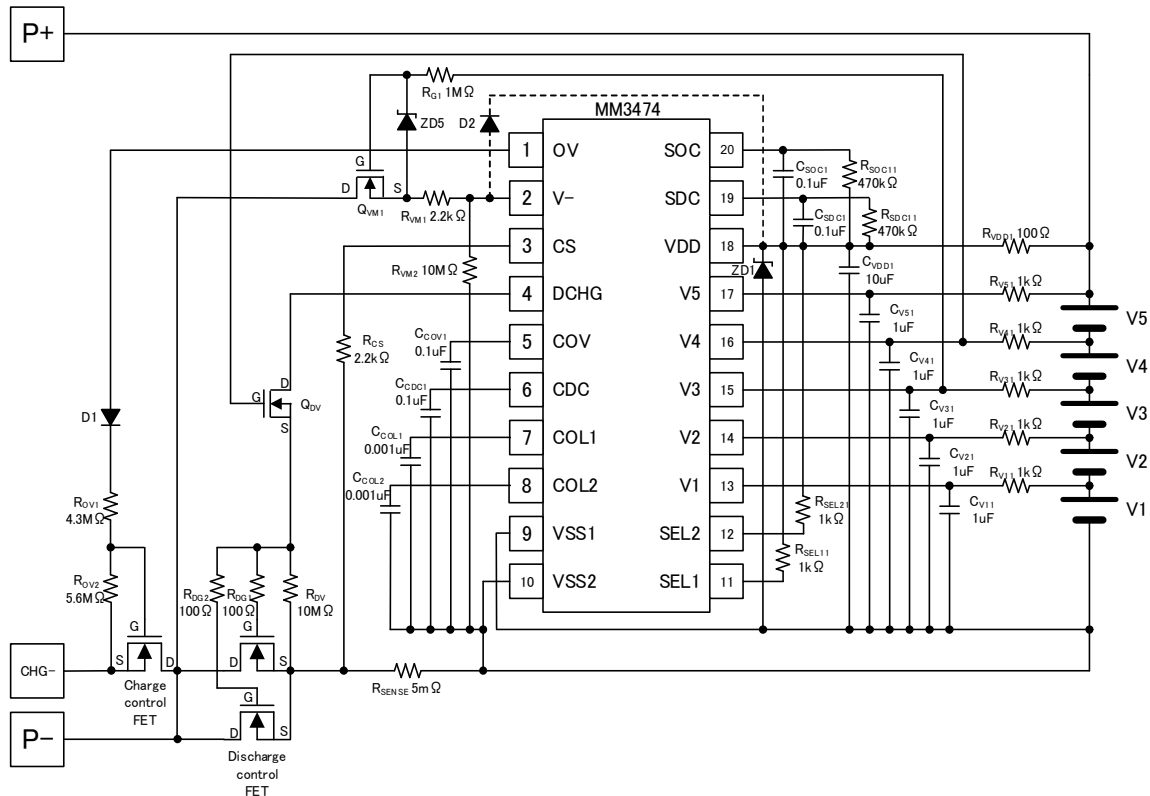
| Parameter | Symbol | Conditions | Min. | Typ. | Max. | unit |
|---|---|---------------------------------------|-----------|-------------|-----------|------|
| ABSOLUTE MAXIMUM RATINGS | | | | | | |
| VDD pin supply voltage | V_{VDDMAX} | | VSS2-0.3 | - | +30 | V |
| V5 pin supply voltage | V_{V5MAX} | | V4-0.3 | - | VDD+0.3 | V |
| Voltage between the input terminals of voltage of battery | $V_{CELLMAX}$ | | -0.3 | - | +10 | V |
| V- pin • OV pin supply voltage | $V_{V-MAX} \cdot V_{OVMAX}$ | | VDD-30 | - | VDD+0.3 | V |
| CS pin • DCHG pin supply voltage | $V_{CSMAX} \cdot V_{DCHGMAX}$ | | VSS2-0.3 | - | VDD+0.3 | V |
| SEL pin supply voltage | V_{SELMAX} | | VSS2-0.3 | - | VDD+0.3 | V |
| SDC/SOCpin supply voltage | V_{SDCMAX} | | VSS2-0.3 | - | VDD+0.3 | V |
| Storage temperature | Tstg | | -55 | - | +125 | degC |
| Power dissipation | Pd | | - | - | 300 | mW |
| RECOMMENDED OPERATING CONDITIONS | | | | | | |
| Operating Temperature | TOPR | | -40.0 | - | +85 | degC |
| Supply Voltage | VOPR | | VSS2+3.5 | - | VSS2+22.5 | V |
| CURRENT CONSUMPTION | | | | | | |
| Consumption current1 (Vdd) | I_{DD1} | $V_{CELL}=4.4V$ | - | 10.0 | 20.0 | uA |
| Consumption current2 (Vdd) | I_{DD2} | $V_{CELL}=3.5V$ | - | 5.0 | 10.0 | uA |
| Consumption current3 (Vdd) | I_{DD3} | $V_{CELL}=1.8V$ | - | 1.5 | 3.0 | uA |
| Consumption current1 (V5) | I_{V5} | $V_{CELL}=4.4V$ | - | 4.0 | 8.0 | uA |
| Consumption current2 (V5) | I_{2V5} | $V_{CELL}=3.5V$ | - | 3.0 | 6.0 | uA |
| Consumption current3 (V5) | I_{3V5} | $V_{CELL}=1.8V$ | - | 1.5 | 3.0 | uA |
| V4 • V3 • V2 • V1 input current | $I_{V4} \cdot I_{V3} \cdot I_{V2} \cdot I_{V1}$ | $V_{CELL}=3.5V$ | - | - | ±300 | nA |
| SEL input current | I_{SEL} | $V_{CELL}=3.5V, SEL=VDD$ | - | 0.5 | 1.0 | uA |
| SDC input current | I_{SDC} | $V_{CELL}=3.5V, R_{SDC}=1M\Omega$ | - | 0.8 | 1.6 | uA |
| SOC input current | I_{SOC} | $V_{CELL}=3.5V, R_{SDC}=1M\Omega$ | - | 0.8 | 1.6 | uA |
| DETECTION/RELEASE VOLTAGE/CURRENT | | | | | | |
| Overcharge detection voltage | V_{CELLU} | $Ta=\pm 0^{\circ}C \sim +50^{\circ}C$ | Typ-0.025 | V_{CELLU} | Typ+0.025 | V |
| Overcharge release voltage | V_{CELLO} | | Typ-0.050 | V_{CELLO} | Typ+0.050 | V |
| Overdischarge detection voltage | V_{CELLS} | | Typ-0.080 | V_{CELLS} | Typ+0.080 | V |
| Overdischarge release voltage | V_{CELLD} | | Typ-0.100 | V_{CELLD} | Typ+0.100 | V |
| Overcurrent detection voltage | V_{OC} | | Typ-0.015 | V_{OC} | Typ+0.015 | V |
| V- pin overcurrent release voltage | V_{VM} | | Typ-0.030 | V_{VM} | Typ+0.030 | V |
| Short detection voltage | V_{SHORT} | | Typ-0.100 | V_{SHORT} | Typ+0.100 | V |
| SDC detection current | I_{SDCL} | $V_{CELL}=3.5V$ | - | - | 0.1 | uA |
| SDC release current | I_{SDCH} | $V_{CELL}=3.5V$ | 0.5 | - | - | uA |
| SOC detection current | I_{SOCL} | $V_{CELL}=3.5V$ | - | - | 0.1 | uA |
| SOC release current | I_{SOCH} | $V_{CELL}=3.5V$ | 0.5 | - | - | uA |
| DETECTION DEAD TIME | | | | | | |
| Overcharge detection dead time | t_{OV1} | $C_{COV}=0.1\mu F$ | 0.50 | 1.00 | 1.50 | sec |
| Overcharge release dead time | t_{OV2} | $C_{COV}=0.1\mu F$ | 0.05 | 0.10 | 0.15 | sec |
| Overdischarge detection dead time | t_{DC1} | $C_{CDC}=0.1\mu F$ | 0.50 | 1.00 | 1.50 | sec |
| Overdischarge release dead time | t_{DC2} | $C_{CDC}=0.1\mu F$ | - | - | 15.0 | msec |
| Overcurrent detection dead time | t_{OC1} | $C_{COL1}=0.001\mu F$ | 5.0 | 10.0 | 15.0 | msec |
| Overcurrent release dead time | t_{OC2} | $C_{COL2}=0.001\mu F$ | 5.0 | 10.0 | 15.0 | msec |
| Short detection dead time | t_{SHORT} | | 100 | 300 | 600 | usec |

※1 Dead time can be set by external capacitor.

Electrical characteristics

Unless otherwise specified, Topr=+25°C

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | unit |
|-----------------------------|-----------------|------------------------|---------|------|------|------|
| OUTPUT PIN / SEL PIN | | | | | | |
| DCHG source current | $I_{SO}D_{CHG}$ | $V_{DCHG}=VDD-0.5V$ | - | - | -20 | uA |
| DCHG sink current | $I_{SI}D_{CHG}$ | $V_{DCHG}=0.5V$ | 20 | - | - | uA |
| DCHG output voltage H | $V_{TH}D_{CH}$ | $I_{SO}=-20uA$ | VDD-0.5 | - | - | V |
| DCHG output voltage L | $V_{TH}D_{CL}$ | $I_{SI}=20uA$ | - | - | 0.5 | V |
| OV source current | $I_{SO}O_V$ | $V_{OV}=VDD-0.5V$ | - | - | -20 | uA |
| Ov leak current | $I_{LEAK}O_V$ | $V_{OV}=VSS2$ | - | - | 0.1 | uA |
| SEL input voltage L | $V_{SEL}L$ | | - | - | 0.5 | V |
| SEL input voltage H | $V_{SEL}H$ | | VDD-0.5 | - | - | V |
| V- pin pulldown resistance | V_{PD} | $V_{CELL}=3.5v, V=-1V$ | 15 | 30 | 60 | kΩ |

Typical application circuit


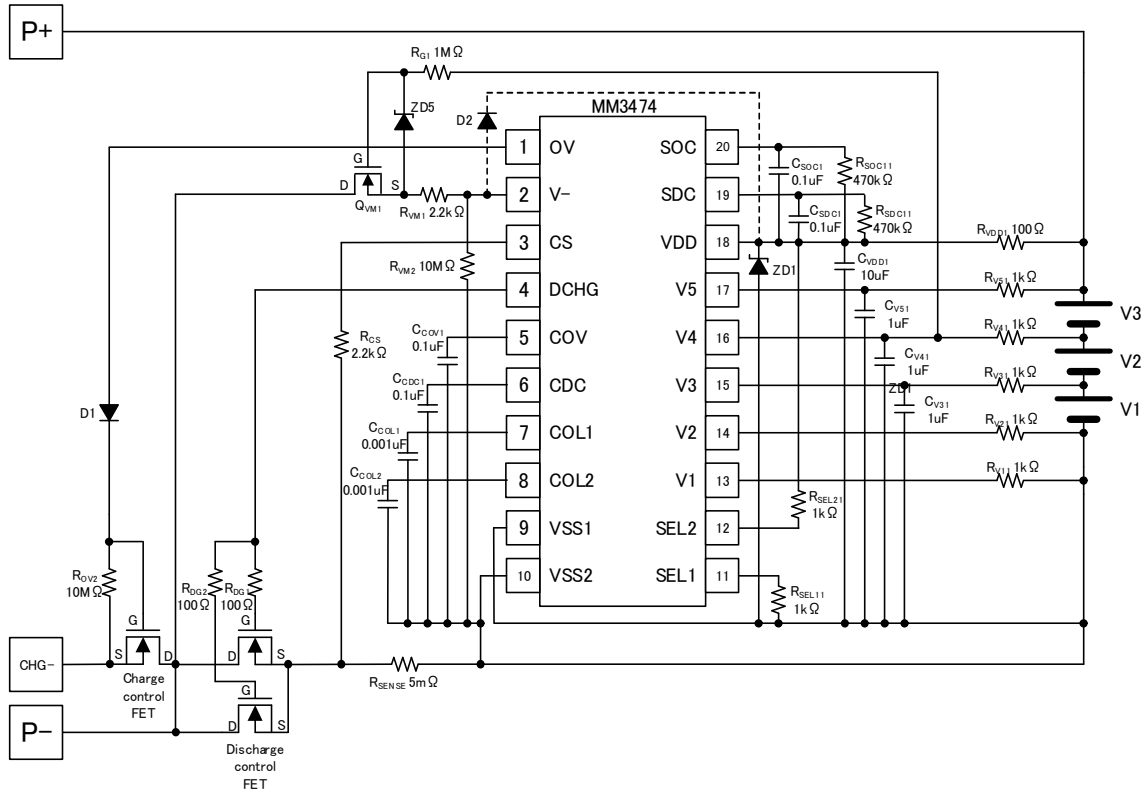
| Parts name | Roles of parts |
|--|--|
| $R_{VDD1} \cdot R_{V51} \cdot R_{V41} \cdot R_{V31} \cdot R_{V21} \cdot R_{V11}$ | CR low-pass filter to stabilize a supply ripple of VDD pin · V5pin · V4pin · V3pin · V2pin · V1pin. |
| $C_{VDD1} \cdot C_{V51} \cdot C_{V41} \cdot C_{V31} \cdot C_{V21} \cdot C_{V12}$ | |
| $R_{SEL11} \cdot R_{SEL21}$ | Resistor to protect terminal. |
| $R_{SDC11} \cdot R_{SOC11}$ | Current limitation resistor. (The voltage signal is converted into the current signal by this resistor at the cascading connection.) |
| C_{COV1} | Capacitor to sets overcharge detection/release dead time. |
| C_{CDC1} | Capacitor to sets overdischarge detection/release dead time. |
| C_{COL1} | Capacitor to sets overcurrent detection dead time. |
| C_{COL2} | Capacitor to sets overcurrent release dead time. |
| R_{SENSE} | Sense resistance to observe discharging current. |
| R_{CS} | Resistor to protect terminal. |
| R_{VM1} | Resistor to protect terminal. |
| $R_{DG1} \cdot R_{DG2}$ | Resistor for preventing the gate destruction due to parasitic oscillation. |
| $Q_{DV} \cdot R_{DV}$ | The voltage between gate and source of FET must not exceed the absolute maximum rating. Therefore, The output voltage is clamped by FET or divided with a resistor. |
| $R_{OV1} \cdot R_{OV2}$ | |
| $Q_{VM1} \cdot R_{VM2}$ | FET to prevent voltage input to V-pin from rising more than voltage of VDD pin. |
| $ZD5 \cdot R_{G1}$ | Zener diode and resistor to prevent VGS of Q_{VM1} from exceeding maximum rating. |
| D1 | Diode to turn off FET quickly by discharging charge of parasitic capacitance of FET. |
| D2 | When a V-pin becomes more than it in VDD pin voltage, it is Schottky barrier diode to bypass the electric current so that an electric current does not flow through the IC inside. |
| ZD1 | Zener diode to prevent destruction of IC by surge voltage. |
| Charge control FET | Nch MOS FET to control charging current. |
| Discharge control FET | Nch MOS FET to control discharging current. |

Examples of application circuit

Examples of 3 cells application circuit

Circuit condition

- Number of cells : 3 cells
- Charge and discharge route : Separated
- Overdischarge release method : Voltage release
- Optional functions : Nothing

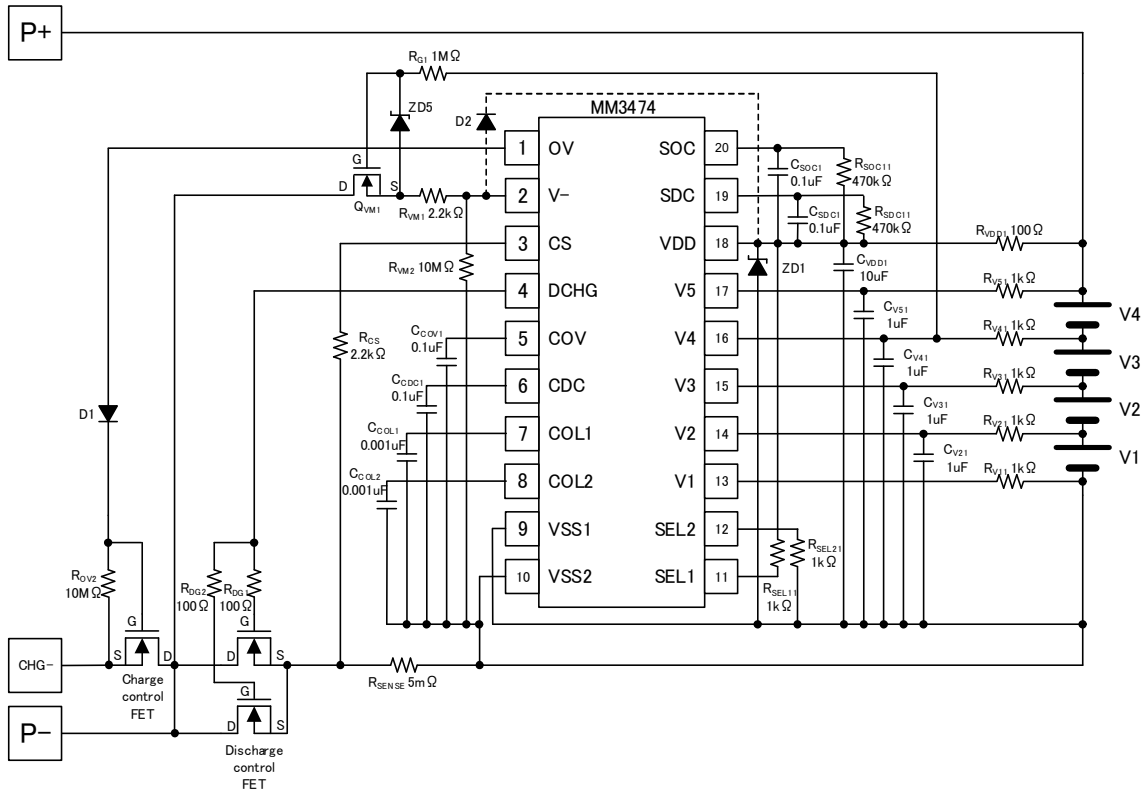


Examples of application circuit

Examples of 4 cells application circuit

Circuit condition

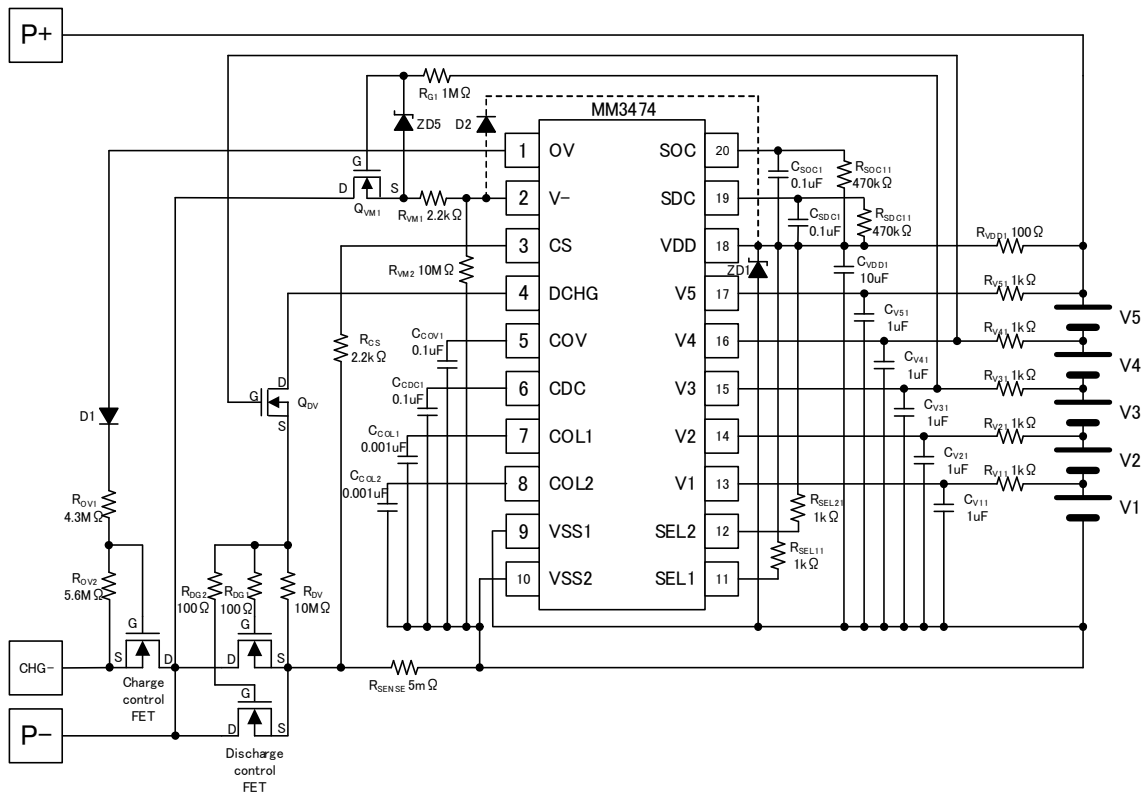
- Number of cells : 4 cells
- Charge and discharge route : Separated
- Overdischarge release method : Voltage release
- Optional functions : Nothing



Examples of application circuit
Examples of 5 cells application circuit

Circuit condition

- Number of cells : 5 cells
- Charge and discharge route : Separated
- Overdischarge release method : Voltage release
- Optional functions : Nothing

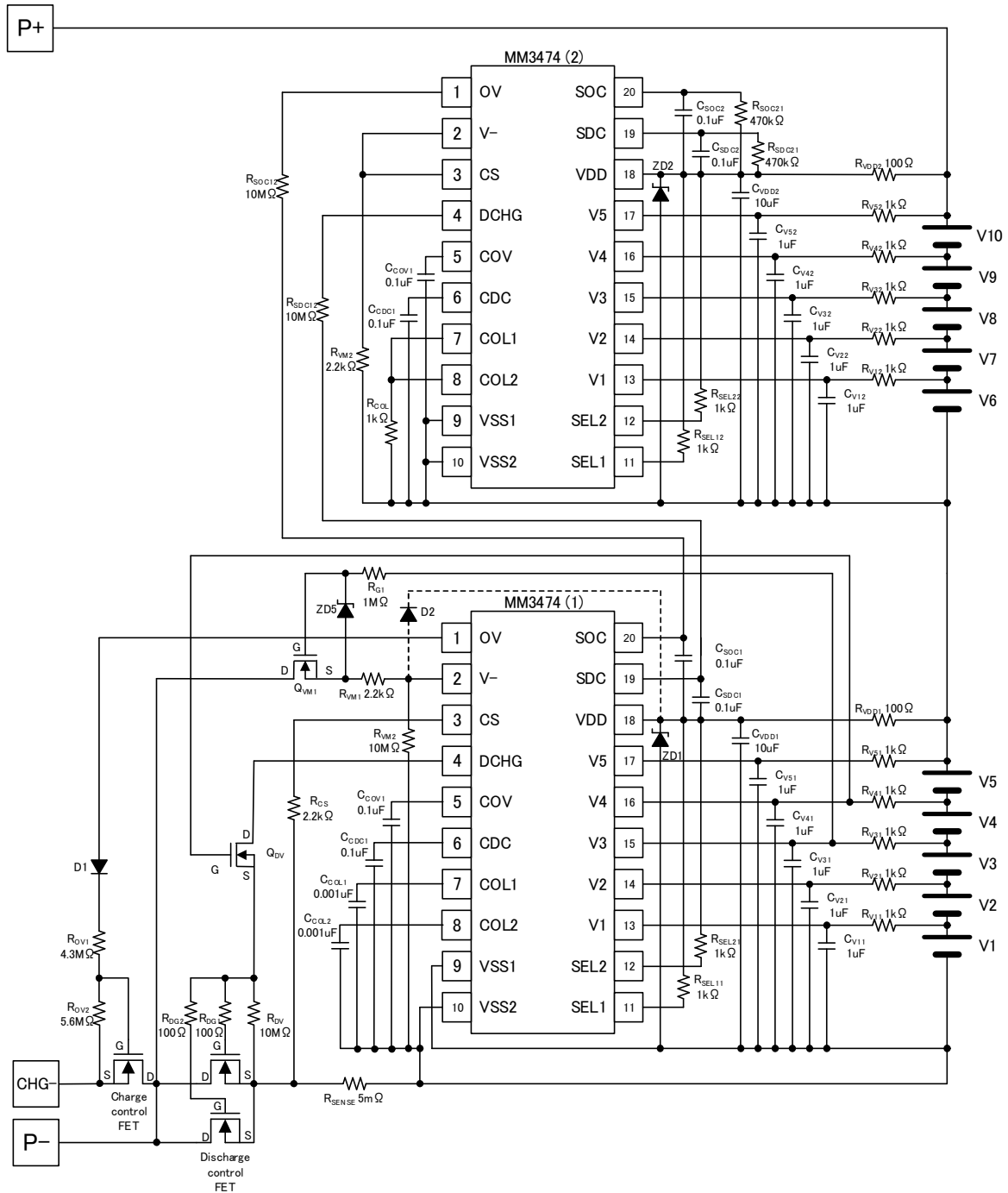


Examples of application circuit

Examples of 10 cells application circuit

Circuit condition

- Number of cells : 10 cells (5cells + 5cells)
- Charge and discharge route : Separated
- Overdischarge release method : Voltage release
- Optional functions : Nothing



Lineup

| Product name (MM3474) | Detection / Release voltage | | | | | | Detection / Release voltage | | | | | | function |
|-----------------------|------------------------------|----------------------------|---------------------------------|-------------------------------|-------------------------------|-------------------------|--------------------------------|------------------------------|-----------------------------------|---------------------------------|---------------------------------|-------------------------------|-----------------------|
| | Overcharge detection voltage | Overcharge release voltage | Overdischarge detection voltage | Overdischarge release voltage | Overcurrent detection voltage | Short detection voltage | Overcharge detection dead time | Overcharge release dead time | Overdischarge detection dead time | Overdischarge release dead time | Overcurrent detection dead time | Overcurrent release dead time | Overdischarge release |
| | V _{CELLU} | V _{CELLO} | V _{CELLS} | V _{CELLD} | V _{OC} | V _{SHORT} | t _{OV1} | t _{OV2} | t _{DC1} | t _{DC2} | t _{OC1} | t _{OC2} | |
| V | V | V | V | mV | V | sec | msec | sec | msec | msec | msec | | |
| C01VBE | 4.250 | 4.150 | 2.800 | 3.000 | 250 | 1.00 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| C02VBE | 4.250 | 4.150 | 2.400 | 2.600 | 250 | 1.00 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| C03VBE | 4.250 | 4.150 | 2.800 | 3.000 | 250 | 0.80 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| C04VBE | 4.250 | 4.150 | 2.800 | 3.000 | 150 | 0.25 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Latch |
| C05VBE | 4.250 | 4.150 | 2.800 | 3.000 | 150 | 0.25 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| D01VBE | 3.850 | 3.650 | 2.300 | 2.500 | 150 | 1.00 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| D03VBE | 3.800 | 3.600 | 2.000 | 2.500 | 150 | 0.60 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| E01VBE | 4.250 | 4.150 | 2.800 | 3.000 | 150 | 1.00 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| E02VBE | 4.200 | 4.100 | 2.800 | 3.000 | 150 | 1.00 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| E03VBE | 4.175 | 4.100 | 2.800 | 3.000 | 150 | 0.50 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| E04VBE | 4.250 | 4.150 | 2.800 | 3.000 | 100 | 0.50 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| E05VBE | 4.250 | 4.150 | 2.800 | 3.000 | 50 | 0.40 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| F01VBE | 4.250 | 4.150 | 2.500 | 3.000 | 150 | 1.00 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| F02VBE | 4.200 | 4.100 | 2.500 | 3.000 | 100 | 1.00 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| F03VBE | 4.250 | 4.150 | 2.500 | 3.000 | 100 | 0.30 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Latch |
| F04VBE | 4.250 | 4.210 | 2.500 | 3.000 | 100 | 0.80 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| F05VBE | 4.250 | 4.150 | 2.500 | 3.000 | 100 | 0.25 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| F06VBE | 4.225 | 4.150 | 2.000 | 3.000 | 50 | 0.20 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| F08VBE | 4.400 | 4.300 | 2.500 | 3.000 | 120 | 0.25 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| F11VBE | 4.400 | 4.300 | 2.500 | 3.000 | 150 | 0.50 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| F12VBE | 4.250 | 4.150 | 2.500 | 3.000 | 200 | 0.50 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| G01VBE | 4.200 | 4.100 | 2.750 | 3.000 | 100 | 1.00 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| G02VBE | 4.250 | 4.150 | 2.750 | 3.000 | 100 | 1.00 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| G03VBE | 4.200 | 4.100 | 2.750 | 3.000 | 100 | 0.40 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| G05VBE | 4.250 | 4.150 | 2.750 | 3.000 | 100 | 0.40 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| G06VBE | 4.225 | 4.100 | 2.750 | 3.000 | 100 | 0.80 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| G07VBE | 4.250 | 4.150 | 2.750 | 3.000 | 100 | 0.20 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| J01VBE | 4.250 | 4.100 | 2.800 | 3.000 | 50 | 1.00 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| K02VBE | 4.250 | 4.100 | 3.000 | 3.225 | 100 | 0.40 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| K03VBE | 4.250 | 4.190 | 3.000 | 3.200 | 80 | 0.70 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Latch |
| K04VBE | 4.175 | 4.100 | 3.000 | 3.200 | 100 | 0.50 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| L02VBE | 3.750 | 3.550 | 2.200 | 2.700 | 100 | 0.40 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| L03VBE | 3.650 | 3.500 | 2.000 | 2.700 | 200 | 0.25 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| L04VBE | 3.750 | 3.550 | 2.200 | 2.700 | 100 | 0.40 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Latch |
| M01VBE | 4.350 | 4.150 | 2.300 | 3.000 | 150 | 0.50 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| N01VBE | 3.900 | 3.600 | 2.000 | 3.000 | 100 | 0.20 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Latch |
| P03VBE | 4.230 | 4.220 | 2.800 | 3.400 | 100 | 0.80 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| P04VBE | 4.200 | 4.170 | 2.750 | 2.800 | 100 | 1.00 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| P05VBE | 4.200 | 4.140 | 2.750 | 2.810 | 100 | 0.50 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Latch |
| P06VBE | 4.230 | 4.220 | 2.800 | 3.000 | 100 | 0.80 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| R03VBE ※2 | 4.225 | 4.100 | 2.750 | 3.000 | 100 | 0.80 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |
| S01VBE | 3.600 | 3.500 | 2.800 | 3.000 | 100 | 0.40 | 1.0 | 0.1 | 1.0 | Max.15 | 10.0 | 10.0 | Non Latch |

※1 Non Latch : voltage release

Latch : voltage release + load remove

※2 OV charge disable

NOTES**【Safety Precautions】**

- Though Mitsumi Electric Co., Ltd. (hereinafter referred to as "Mitsumi") works continually to improve our product's quality and reliability, semiconductor products may generally malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of this product could cause loss of human life, bodily injury, or damage to property, including data loss or corruption. Before customers use this product, create designs including this product, or incorporate this product into their own applications, customers must also refer to and comply with (a) the latest versions or all of our relevant information, including without limitation, product specifications, data sheets and application notes for this product and (b) the user's manual, handling instructions or all relevant information for any products which is to be used, or combined with this products. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. Mitsumi assumes no liability for customers' product design or applications.
- This product is intended for applying to computers, OA units, communication units, instrumentation units, machine tools, industrial robots, AV units, household electrical appliances, and other general electronic units.

【Precautions for Product Liability Act】

- No responsibility is assumed by us for any consequence resulting from any wrong or improper use or operation, etc. of this product.

【ATTENTION】

- This product is designed and manufactured with the intention of normal use in general electronics. No special circumstance as described below is considered for the use of it when it is designed. With this reason, any use and storage under the circumstances below may affect the performance of this product. Prior confirmation of performance and reliability is requested to customers.
 - Environment with strong static electricity or electromagnetic wave
 - Environment with high temperature or high humidity where dew condensation may occur
- This product is not designed to withstand radioactivity, and must avoid using in a radioactive environment.
- This specification is written in Japanese and English. The English text is faithfully translated into the Japanese. However, if any question arises, Japanese text shall prevail.

OUR CERTIFICATE

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