

# Composite Regulator Monolithic IC MM1448

## Outline

This IC was developed as a composite power supply for the RF section of mobile telephones. It is composed of three normal voltage regulator circuits, of which the output of one circuit is divided for two switching circuits.

The regulator output voltage is fixed, and each can be set between 2.0V and 5.0V according to the customer's needs. Output noise voltage noise reduction is made possible by using the noise reduction pin.

Also, switch pins are provided to control each output, making this an ideal IC for use in portable equipment.

## Features

- |                                    |  |
|------------------------------------|--|
| 1. Input/output voltage difference | Vo1 : 0.2V max. Vo2 : 0.2V max. Vo3 : 0.3V max.          |
| 2. Output noise voltage            | Vo1 : 30μVrms typ. Vo2 : 30μVrms typ. Vo3 : 30μVrms typ. |
| 3. Output voltage precision        | Vo1, Vo2, Vo3 : ±3%                                      |
| 4. No-load input current           | Vo1 : 170μA typ. Vo2 : 170μA typ. Vo3 : 170μA typ.       |
| 5. Input voltage                   | 12V max.   |
| 6. Max. output current             | 200mA max.   |
| 7. Output ON/OFF control           | High : ON, Low : OFF                                     |

## Rank Table

| Rank | Regulator Output Voltage |            |            |
|------|--------------------------|------------|------------|
|      | Vo1                      | Vo2        | Vo3        |
| X    | 2.5 ± 0.08               | 2.8 ± 0.08 | 3.0 ± 0.08 |
| B    | 2.8 ± 0.08               | 2.8 ± 0.08 | 3.0 ± 0.08 |
| C    | 2.9 ± 0.08               | 2.9 ± 0.08 | 2.9 ± 0.08 |

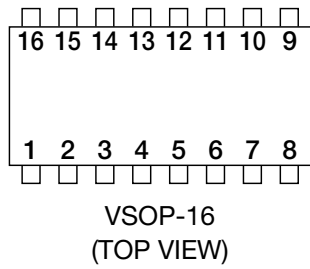
## Package

VSOP-16

## Applications

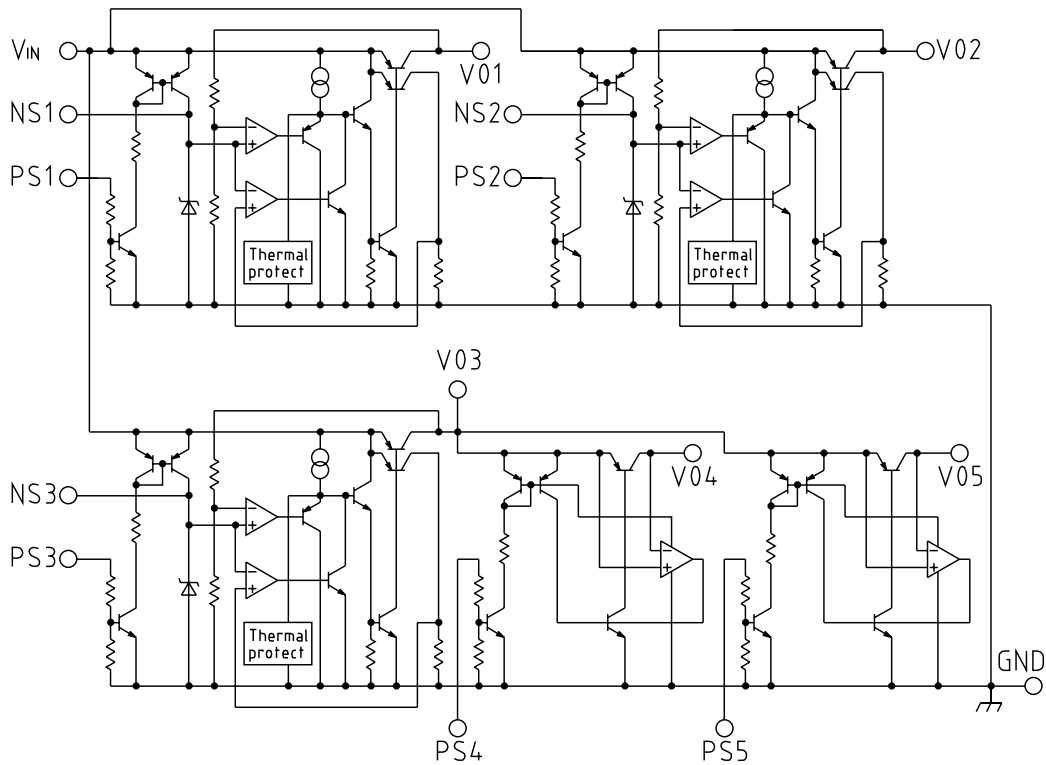
1. Mobile telephones, PHS
2. Video cameras
3. Portable communication equipment
4. Battery-powered portable equipment

### Pin Assignment



|   |                 |    |     |
|---|-----------------|----|-----|
| 1 | Vo1             | 9  | Vo2 |
| 2 | NS1             | 10 | GND |
| 3 | PS1             | 11 | PS4 |
| 4 | V <sub>IN</sub> | 12 | Vo4 |
| 5 | PS3             | 13 | NC  |
| 6 | NS3             | 14 | Vo5 |
| 7 | PS2             | 15 | PS5 |
| 8 | NS2             | 16 | Vo3 |

### Equivalent Circuit Diagram



### Absolute Maximum Ratings

| Item                       | Symbol             | Rating        | Unit |
|----------------------------|--------------------|---------------|------|
| Storage Temperature        | T <sub>STG</sub>   | -40~+125      | °C   |
| Operating Temperature      | T <sub>OPR</sub>   | -20~+75       | °C   |
| Power Supply Voltage       | V <sub>IN</sub>    | -0.3~+12      | V    |
| Output Current (1 circuit) | I <sub>O (m)</sub> | 200           | mA   |
| Power Consumption          | P <sub>d</sub>     | 400 (IC only) | mW   |

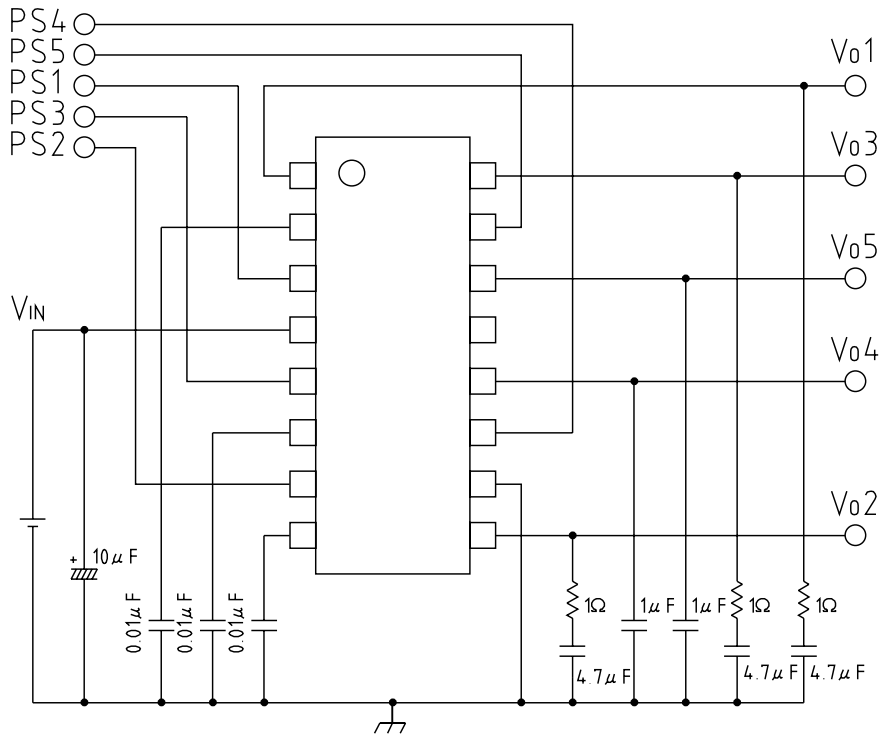
### Recommended Operating Conditions

| Item                                 | Symbol             | Rating | Unit |
|--------------------------------------|--------------------|--------|------|
| Operating Temperature                | T <sub>OP</sub>    | -20~75 | °C   |
| Operating Voltage                    | V <sub>OP</sub>    | 1.8~12 | V    |
| Regulator Output Current (1 circuit) | I <sub>O (m)</sub> | 0~100  | mA   |

**Electrical Characteristics** Typical model : MM1448B (Except where noted otherwise, Ta=25°C, VIN=4V, CIN=10μF, Cvo(n)=4.7μF+1Ω, Cns(n)=0.01μF)

| Item  | Symbol           | Measurement conditions                                     | Min. | Typ. | Max. | Unit              |
|---|------------------|--|------|------|------|-------------------|
| Standby current   | Iins             | VPS1=VPS2=VPS3=0V  |      | 0    | 3    | μA                |
| Operating currents 1~3<br>(for 1 circuit; all<br>3 circuits the same) | IN1~3            | No-load (unload)   |      | 170  | 350  | μA                |
|   |                  | VPS1=3V, VPS2=VPS3=VPS4~VPS5=0V                            |      |      |      |                   |
|   |                  | VPS2=3V, VPS1=VPS3=VPS4~VPS5=0V                            |      |      |      |                   |
|   |                  | VPS3=3V, VPS1=VPS2=VPS4~VPS5=0V                            |      |      |      |                   |
| <b>Vo1</b>  |                  |  |      |      |      |                   |
| Output voltage  | Vo1              | Io1=30mA   | 2.72 | 2.80 | 2.88 | V                 |
| Minimum input/<br>output voltage difference                           | Vdmin1           | VIN=2.6V, Io1=30mA   |      |      | 0.20 | V                 |
| Load fluctuation  | ΔVLo1            | Io1=0~100mA  |      |      | 60   | mV                |
| Input fluctuation   | ΔVLi1            | VIN=4.0~8.0V, Io1=30mA                                     |      |      | 20   | mV                |
| Output voltage<br>temperature coefficient                             | ΔVo1/ΔT          | Tj=-20~75°C, Io1=30mA                                      |      | ±100 |      | ppm/°C            |
| Ripple rejection rate   | RR1              | f=120Hz, V <sub>ripple</sub> =1V <sub>P-P</sub> , Io1=30mA | 50   | 60   |      | dB                |
| Output noise voltage  | Vn1              | f=10Hz~10kHz, Io1=30mA, Cns1=0.01μF                        |      | 30   | 60   | μV <sub>rms</sub> |
| Output rise time  | TdH1             | Io1=30mA, VPS1=0 → 4V                                      |      | 0.04 | 0.8  | ms                |
| <b>Vo2</b>  |                  |  |      |      |      |                   |
| Output voltage  | Vo2              | Io2=30mA   | 2.72 | 2.80 | 2.88 | V                 |
| Minimum input/<br>output voltage difference                           | Vdmin2           | VIN=2.6V, Io2=30mA   |      |      | 0.20 | V                 |
| Load fluctuation  | ΔVLo2            | Io2=0~100mA  |      |      | 60   | mV                |
| Input fluctuation   | ΔVLi2            | VIN=4.0~8.0V, Io2=30mA                                     |      |      | 20   | mV                |
| Output voltage<br>temperature coefficient                             | ΔVo2/ΔT          | Tj=-20~75°C, Io2=30mA                                      |      | ±100 |      | ppm/°C            |
| Ripple rejection rate   | RR2              | f=120Hz, V <sub>ripple</sub> =1V <sub>P-P</sub> , Io2=30mA | 50   | 60   |      | dB                |
| Output noise voltage  | Vn2              | f=10Hz~10kHz, Io2=30mA, Cns2=0.01μF                        |      | 30   | 60   | μV <sub>rms</sub> |
| Output rise time  | TdH2             | Io2=30mA, VPS2=0 → 4V                                      |      | 0.04 | 0.8  | ms                |
| <b>Vo3</b>  |                  |  |      |      |      |                   |
| Output voltage  | Vo3              | Io3=30mA   | 2.92 | 3.00 | 3.08 | V                 |
| Minimum input/<br>output voltage difference                           | Vdmin3           | VIN=2.8V, Io3=30mA   |      |      | 0.20 | V                 |
| Load fluctuation  | ΔVLo3            | Io3=0~100mA  |      |      | 60   | mV                |
| Input fluctuation   | ΔVLi3            | VIN=4.0~8.0V, Io3=30mA                                     |      |      | 20   | mV                |
| Output voltage<br>temperature coefficient                             | ΔVo3/ΔT          | Tj=-20~75°C, Io3=30mA                                      |      | ±100 |      | ppm/°C            |
| Ripple rejection rate   | RR3              | f=120Hz, V <sub>ripple</sub> =1V <sub>P-P</sub> , Io3=30mA | 50   | 60   |      | dB                |
| Output noise voltage  | Vn3              | f=10Hz~10kHz, Io3=30mA, Cns3=0.01μF                        |      | 30   | 60   | μV <sub>rms</sub> |
| Output rise time  | TdH3             | Io3=30mA, VPS3=0 → 4V                                      |      | 0.04 | 0.8  | ms                |
| <b>Vo4</b>  |                  |  |      |      |      |                   |
| Output voltage  | Vo4              | Io3=Io4=20mA, Io5=40mA                                     | 2.82 |      | Vo3  | V                 |
| Output current  | Io4              | Vo4=2.72V, Io3=Io5=0mA                                     | 50   |      |      | mA                |
| Output rise time  | TdH4             | Io4=20mA, Cvo4=1μF, VPS4=0 → 4V                            |      | 0.02 | 0.1  | ms                |
| Reactive current  | Iq4              | Io4=20mA, Vo3=3V   |      | 0.5  | 0.8  | mA                |
| <b>Vo5</b>  |                  |  |      |      |      |                   |
| Output voltage  | Vo5              | Io3=Io4=20mA, Io5=40mA                                     | 2.82 |      | Vo3  | V                 |
| Output current capacity   | Io5              | Vo5=2.72V, Io3=Io4=0mA                                     | 80   |      |      | mA                |
| Output rise time  | TdH5             | Io5=40mA, Cout5=1μF, VPS5=0 → 4V                           |      | 0.02 | 0.1  | ms                |
| Reactive current  | Iq5              | Io5=40mA, Vo3=3V   |      | 2    | 2.8  | mA                |
| <b>PS output control pin</b>  |                  |  |      |      |      |                   |
| Psn pin OFF voltage   | V <sub>OFF</sub> |  |      |      | 0.4  | V                 |
| Psn pin ON voltage  | V <sub>ON</sub>  |  | 1.6  |      |      | V                 |
| Psn pin inflow current  | I <sub>PSN</sub> | V <sub>PSN</sub> =1.6V                                     |      |      | 10   | μA                |

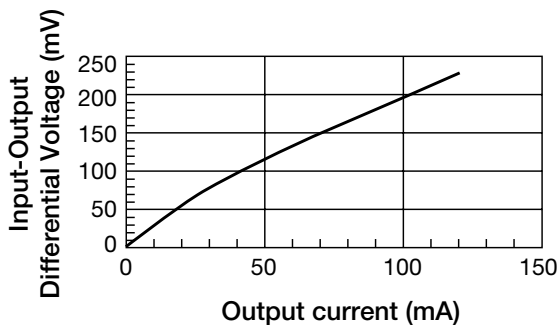
Measurement Circuit



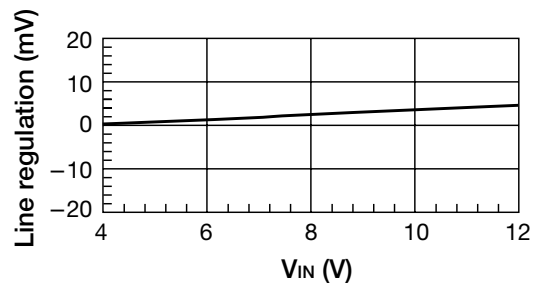
- Note 1: Output capacitance definitely is required to perform regulator and switch phase compensation. Also, please note that oscillation may occur depending on the ESR value.
- Note 2: Vo pin output noise voltage is reduced using NS pin capacitance value. Even if there is no need to take output noise voltage into consideration, connection of a capacitor is recommended for stable operation and improvement of AC characteristics.
- Note 3: The cause of oscillation is due to set wiring and capacitance changes in capacitor caused by temperatures changes, so please take extra care in placing the wires.

Characteristics

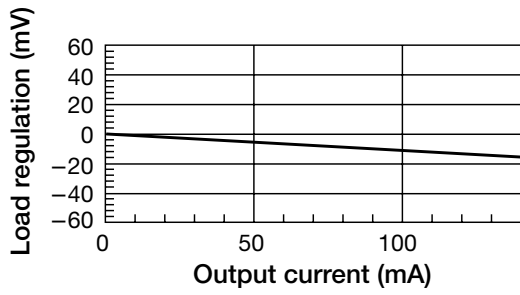
Input-Output Differential Voltage



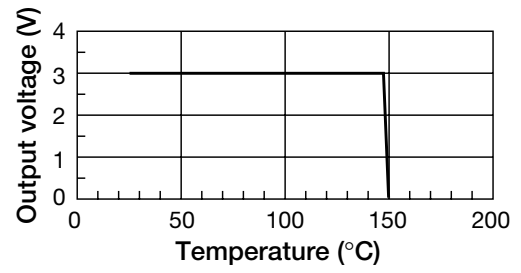
Line Regulation



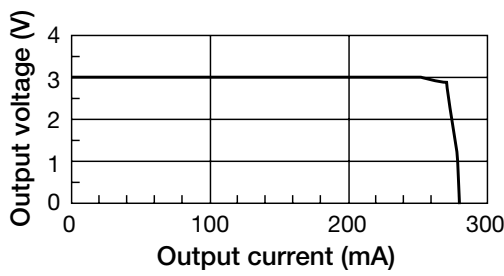
■ Load Regulation



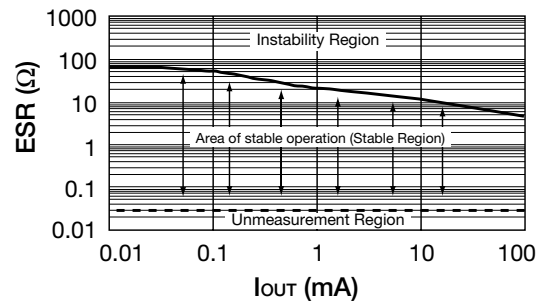
■ Thermal Shutdown



■ Output Current

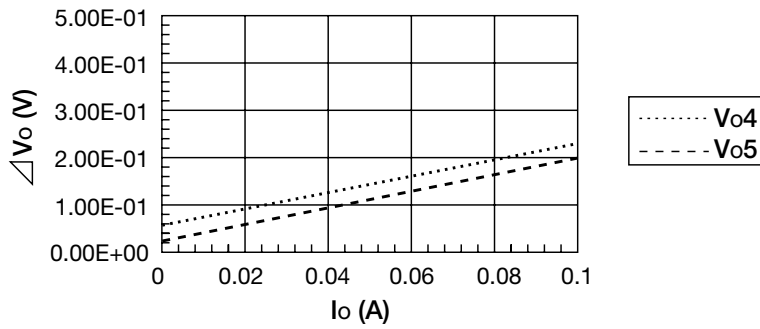


■ ESR Stable Region



Note: Reference data

■ Io4 (5) – ΔVo34 (35)(Vo3=3V)



■ Io4 (5) – Iq4 (5)(Vo3=3V)

