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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

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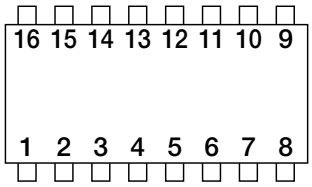
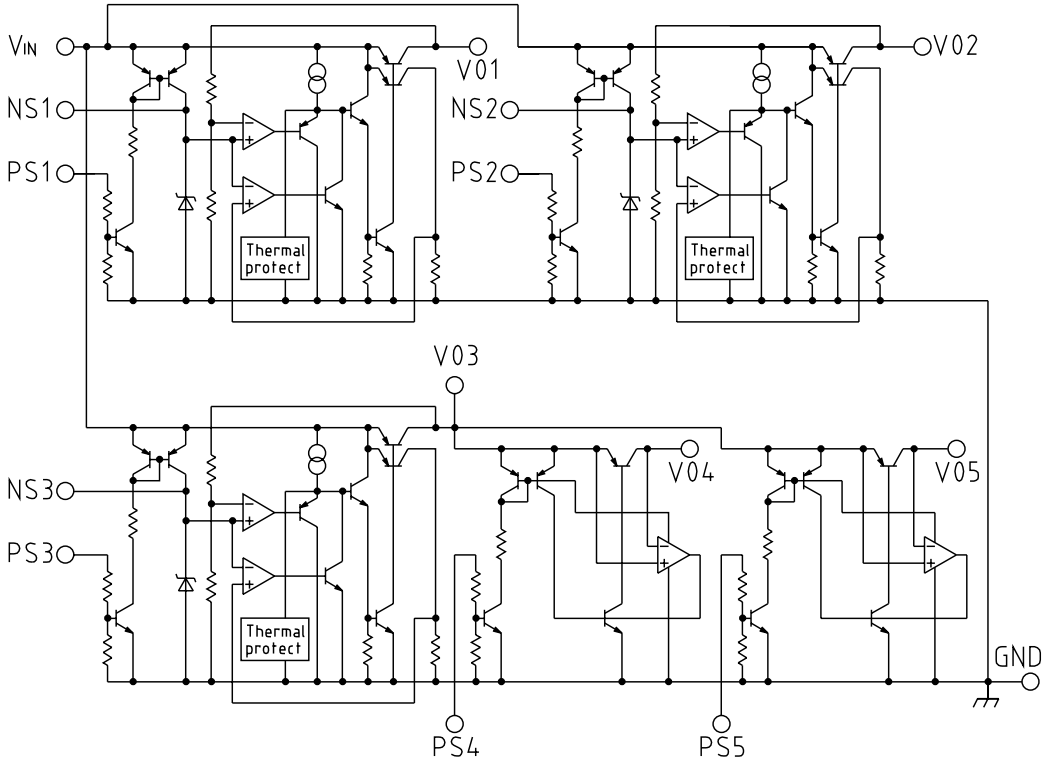
Pin Assignment



VSOP-16
(TOP VIEW)

1	Vo1	9	Vo2
2	NS1	10	GND
3	PS1	11	PS4
4	VIN	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	TSTG	–40~+125	°C
Operating Temperature	TOPR	–20~+75	°C
Power Supply Voltage	VIN	–0.3~+12	V
Output Current (1 circuit)	Io (n)	200	mA
Power Consumption	Pd	400 (IC only)	mW

Recommended Operating Conditions

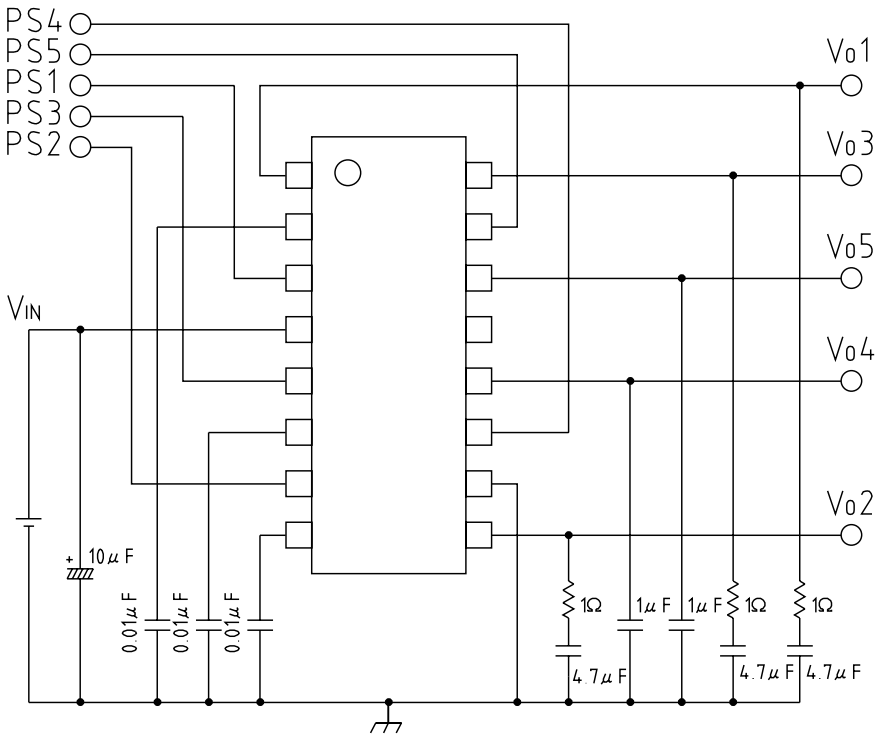
Item	Symbol	Rating	Unit
Operating Temperature	TOP	–20~75	°C
Operating Voltage	VOP	1.8~12	V
Regulator Output Current (1 circuit)	Io (n)	0~100	mA

Electrical Characteristics

Typical model : MM1448B (Except where noted otherwise, Ta=25°C, V_{IN}=4V, C_{IN}=10μF, $C_{VO(n)}$=4.7μF+1Ω, $C_{ns(n)}$=0.01μF)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Standby current	Iins	V_{PS1}=V_{PS2}=V_{PS3}=0V		0	3	μA
Operating currents 1~3 (for 1 circuit; all 3 circuits the same)	I_{IN}1~3	No-load (unload)		170	350	μA
		V_{PS1}=3V, V_{PS2}=V_{PS3}=V_{PS4}~V_{PS5}=0V				
		V_{PS2}=3V, V_{PS1}=V_{PS3}=V_{PS4}~V_{PS5}=0V				
		V_{PS3}=3V, V_{PS1}=V_{PS2}=V_{PS4}~V_{PS5}=0V				
Vo1						
Output voltage	Vo1	Io1=30mA	2.72	2.80	2.88	V
Minimum input/ output voltage difference	Vdmin1	V_{IN}=2.6V, Io1=30mA			0.20	V
Load fluctuation	⊿VLo1	Io1=0~100mA			60	mV
Input fluctuation	⊿VLi1	V_{IN}=4.0~8.0V, Io1=30mA			20	mV
Output voltage temperature coefficient	⊿Vo1/⊿T	Tj=–20~75°C, Io1=30mA		±100		ppm/°C
Ripple rejection rate	RR1	f=120Hz, V_{RIPPLE}=1V_{P-P}, Io1=30mA	50	60		dB
Output noise voltage	Vn1	f=10Hz~10kHz, Io1=30mA, Cns1=0.01μF		30	60	μVrms
Output rise time	TdH1	Io1=30mA, V_{PS1}=0→4V		0.04	0.8	ms
Vo2						
Output voltage	Vo2	Io2=30mA	2.72	2.80	2.88	V
Minimum input/ output voltage difference	Vdmin2	V_{IN}=2.6V, Io2=30mA			0.20	V
Load fluctuation	⊿VLo2	Io2=0~100mA			60	mV
Input fluctuation	⊿VLi2	V_{IN}=4.0~8.0V, Io2=30mA			20	mV
Output voltage temperature coefficient	⊿Vo2/⊿T	Tj=–20~75°C, Io2=30mA		±100		ppm/°C
Ripple rejection rate	RR2	f=120Hz, V_{RIPPLE}=1V_{P-P}, Io2=30mA	50	60		dB
Output noise voltage	Vn2	f=10Hz~10kHz, Io2=30mA, Cns2=0.01μF		30	60	μVrms
Output rise time	TdH2	Io2=30mA, V_{PS2}=0→4V		0.04	0.8	ms
Vo3						
Output voltage	Vo3	Io3=30mA	2.92	3.00	3.08	V
Minimum input/ output voltage difference	Vdmin3	V_{IN}=2.8V, Io3=30mA			0.20	V
Load fluctuation	⊿VLo3	Io3=0~100mA			60	mV
Input fluctuation	⊿VLi3	V_{IN}=4.0~8.0V, Io3=30mA			20	mV
Output voltage temperature coefficient	⊿Vo3/⊿T	Tj=–20~75°C, Io3=30mA		±100		ppm/°C
Ripple rejection rate	RR3	f=120Hz, V_{RIPPLE}=1V_{P-P}, Io3=30mA	50	60		dB
Output noise voltage	Vn3	f=10Hz~10kHz, Io3=30mA, Cns3=0.01μF		30	60	μVrms
Output rise time	TdH3	Io3=30mA, V_{PS3}=0→4V		0.04	0.8	ms
Vo4						
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, C_{VO4}=1μF, V_{PS4}=0→4V		0.02	0.1	ms
Reactive current	Iq4	Io4=20mA, Vo3=3V		0.5	0.8	mA
Vo5						
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, C_{OUT5}=1μF, V_{PS5}=0→4V		0.02	0.1	ms
Reactive current	Iq5	Io5=40mA, Vo3=3V		2	2.8	mA
PS output control pin						
Psn pin OFF voltage	V_{OFF}				0.4	V
Psn pin ON voltage	V_{ON}		1.6			V
Psn pin inflow current	I_{PSn}	V_{PSn}=1.6V			10	μA

Measurement Circuit



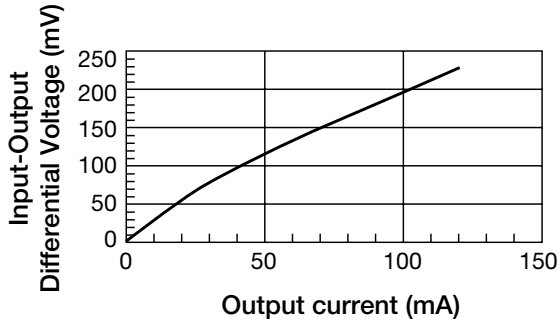
Note 1: Output capacitance definitely is required to perform regulator and switch phase compensation. Also, please note that oscillation may occur depending on the ESR value.

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.

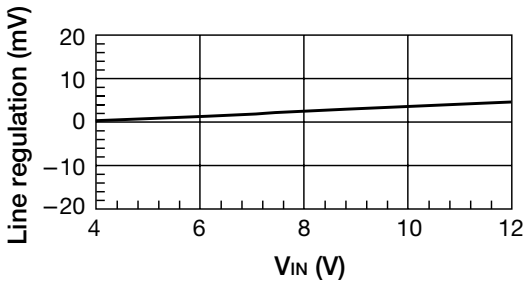
Note 3: The cause of oscillation is due to set wiring and capacitance changes in capacitor caused by temperatures changes, so please take extra care in placing the wires.

Characteristics

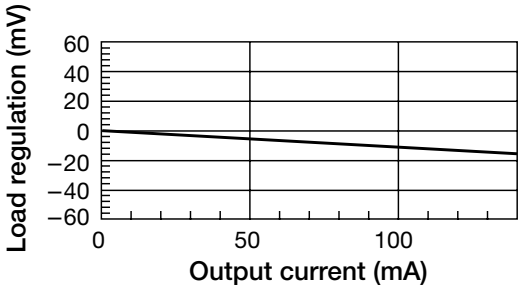
Input-Output Differential Voltage



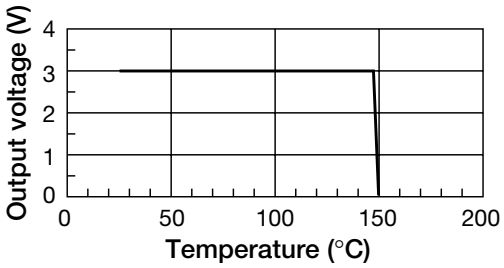
Line Regulation



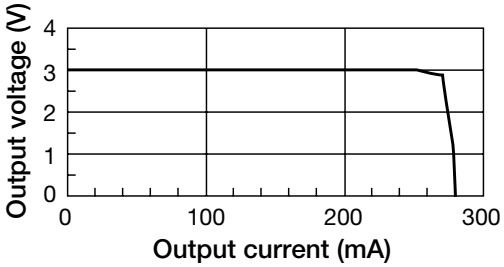
Load Regulation



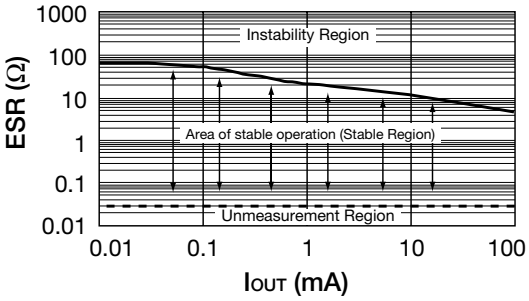
Thermal Shutdown



Output Current

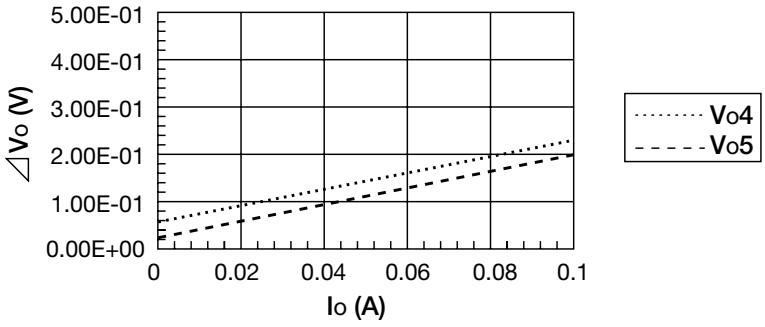


ESR Stable Region



Note: Reference data

Io4 (5) −⊿Vo34 (35)(Vo3=3V)



Io4 (5) −Iq4 (5)(Vo3=3V)