

# Ultra-Low Power Consumption Low-Saturation Three-Pin Regulators with On/Off Pin Monolithic ICs MM1065 and 1165

## Outline

These ICs are stabilized power supply devices with ultra-low consumption currents, designed for a greatly reduced reactive current at low input voltages, and with a small input/output difference voltage of 0.2V at an output current of 40mA. The output current is limited to a maximum of 100mA, and in the MMP-4A package, an on/off pin enables the device to be switched on and off.

## Features

- |  |                                    |  |
|--|------------------------------------|--|
| 1. Input/output voltage difference                               | 0.2V typ. ( $I_o=40\text{mA}$ )    |  |
| 2. No-load input current   | 13 $\mu\text{A}$ typ.              |  |
| 3. Maximum reactive current at low input voltages                | 15 $\mu\text{A}$ typ. (no-load)    |  |
| 4. Maximum output current  | 100mA max.                         |  |
| 5. Temperature coefficient of output voltage                     | $\pm 0.01\%/^{\circ}\text{C}$ typ. |  |
| 6. Output voltage ranks  | MM1065, 1165                       | F : 6.0V $\pm 4\%$<br>G : 5.0V $\pm 4\%$<br>H : 4.5V $\pm 4\%$<br>I : 4.0V $\pm 4\%$<br>J : 3.0V $\pm 4\%$<br>Z : 3.3V $\pm 4\%$ |
| 7. With overcurrent protection circuit                           |                                    |  |
| 8. With thermal shutdown circuit                                 |                                    |  |
| 9. With function to turn output on and off (MMP-4A package only) |                                    |  |

On/Off Pin Level	Low	High
MM1065 output	ON	OFF
MM1165 output	OFF	ON

## Package

TO-92A (MM1065□T, MM1165□T)

MMP-4A (MM1065□M, MM1165□M)

\*The output voltage rank appears in the boxes.

## Applications

1. Handheld computers
2. Portable transceivers
3. Cordless phones
4. Other portable equipment which uses batteries

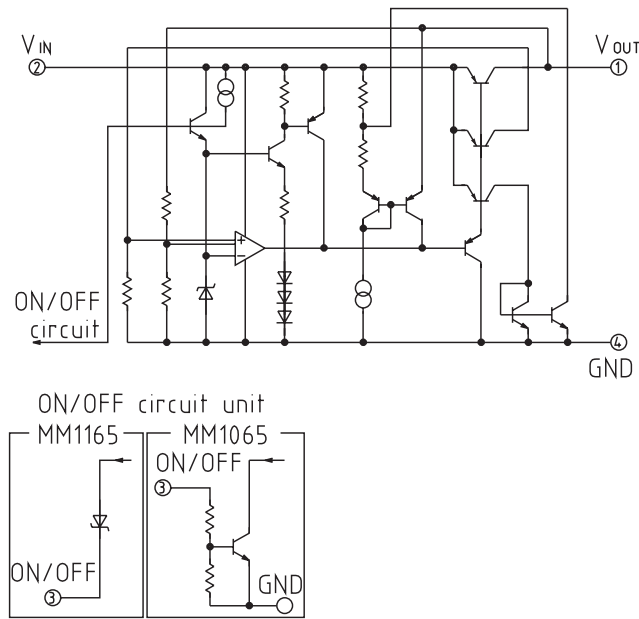
## Absolute Maximum Ratings

Item	Symbol	Ratings	Units
Operating temperature	$T_{OPR}$	-20~+75	°C
Storage temperature	$T_{STG}$	-40~+125	°C
Power supply current	$V_{CC}$ max.	-0.3~10	V
Output current	$I_{OUT}$	100	mA
Maximum Ratings	$P_d$	200 (MMP-4A) 300 (TO-92A)	mW

## Electrical Characteristics

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units	
Output voltage	$V_o$	$V_{IN}=V_o+1V$ $I_o=40mA$	F	5.76	6.00	6.24	V
			G	4.80	5.00	5.20	
			H	4.32	4.50	4.68	
			I	3.84	4.00	4.16	
			J	2.88	3.00	3.12	
			Z	3.17	3.30	3.43	
No-load input current	$I_{ccq1}$	$V_{IN}=V_o+1V, I_o=0mA$		13	20	μA	
Minimum I/O voltage difference	$V_d$ min.	$V_{IN}=V_o$ min., $I_o=40mA$		0.2	0.3	V	
Input fluctuation rate	$\Delta V_2$	$V_{IN}=(V_o+1V)\sim 10V, I_o=40mA$		±0.01	±0.1	%/V	
Load fluctuation rate	$\Delta V_1$	$V_{IN}=V_o+1V, I_o=0\sim 100mA$		±0.01	±0.03	%/mA	
Output voltage temperature coefficient	$\Delta V_o/T$	$T_j=-20\sim +75^\circ C$		±100		ppm/°C	
Ripple rejection rate	RR	$V_{RIPPLE}=1V, V_{IN}=V_o+2V$ $f=120Hz, I_o=40mA$	50	60		dB	

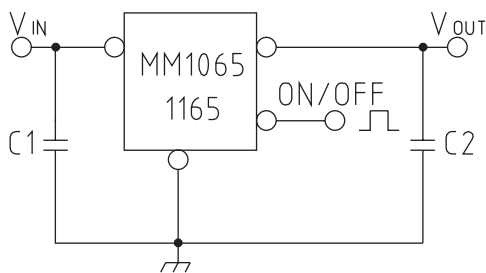
## Equivalent Circuit Diagram



## Electrical Characteristics (MMP-4P)

Item	Symbol	Measurement conditions		Min.	Typ.	Max.	Units
Input current while off	I <sub>ccq2</sub>	MM1065	V <sub>IN</sub> =6V V(ON/OFF)=High		2.5	7	μA
		MM1165	V <sub>IN</sub> =6V V(ON/OFF)=Low		3	6	μA
On/off pin current while off	I <sub>OFF</sub>	MM1065	V(ON/OFF)=2.4V		4	7	μA
		MM1165	V(ON/OFF)=0.4V		0.2	0.1	μA
On/off pin level							
On/off pin high level	High			2.4		V <sub>IN</sub> +0.3	V
On/off pin low level	Low			-0.3		0.4	V

## Basic Circuit Connection Diagram

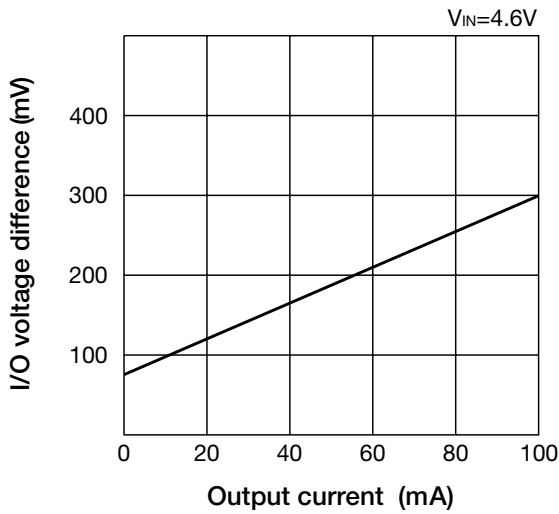


[ C1 ≥ 1μF (ceramic)  
C2 ≥ 1μF (ceramic)

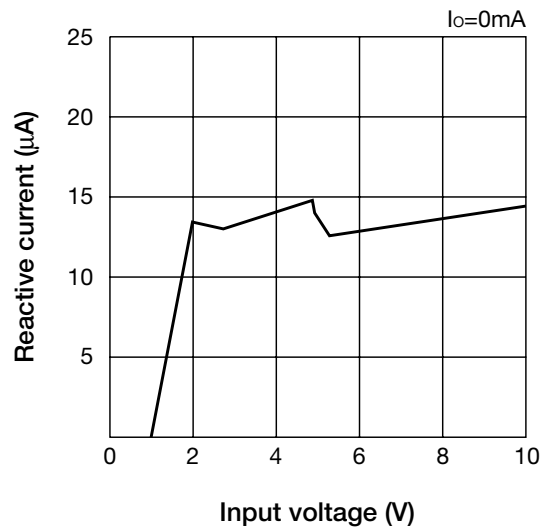
On/Off Pin Level	Low	High
MM1065 output	ON	OFF
MM1165 output	OFF	ON

## Characteristics

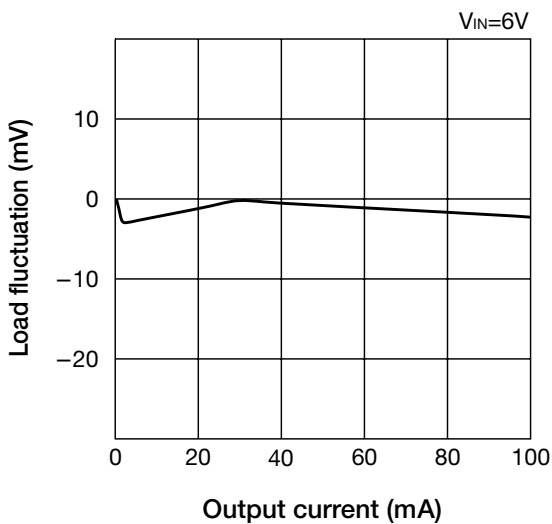
I/O voltage difference



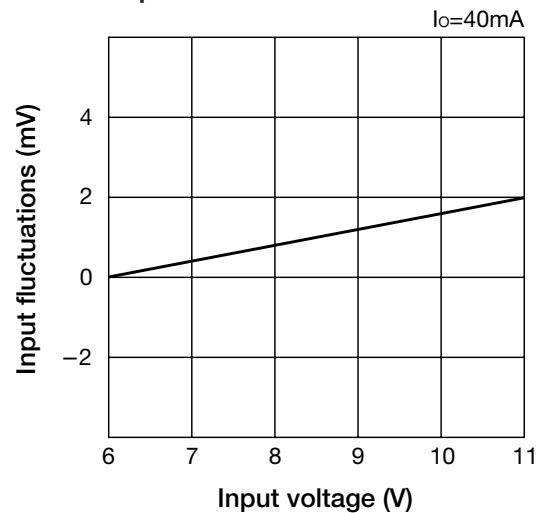
No-load input current



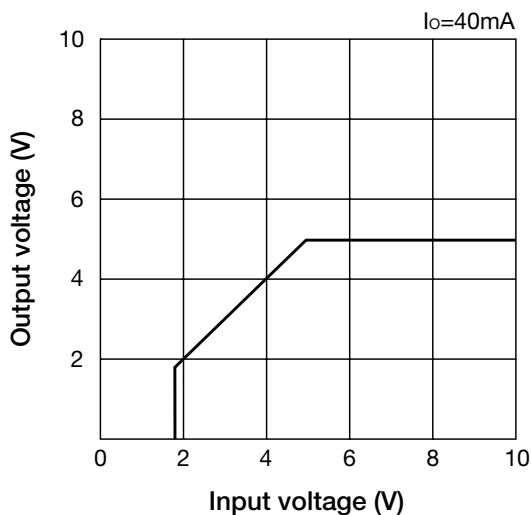
Load fluctuation rate



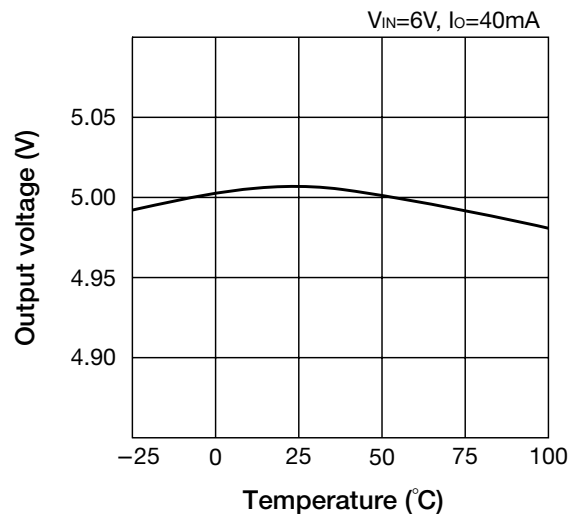
Input fluctuation rate



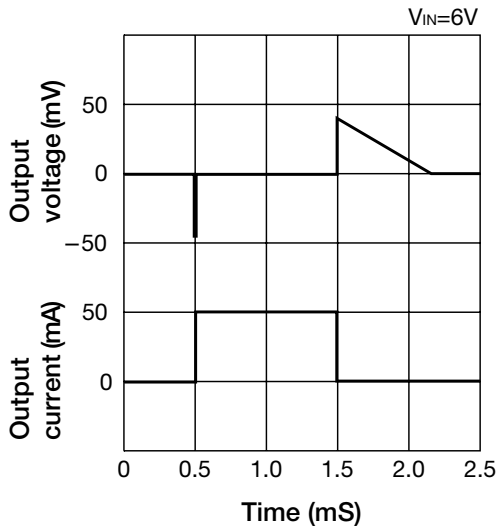
Output voltage characteristic



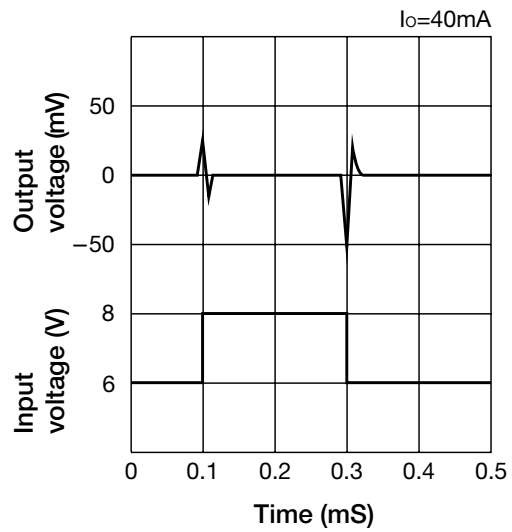
Output voltage temperature characteristic



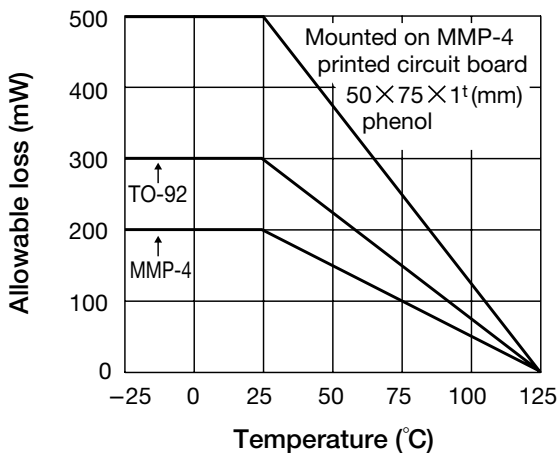
■ Load transient response



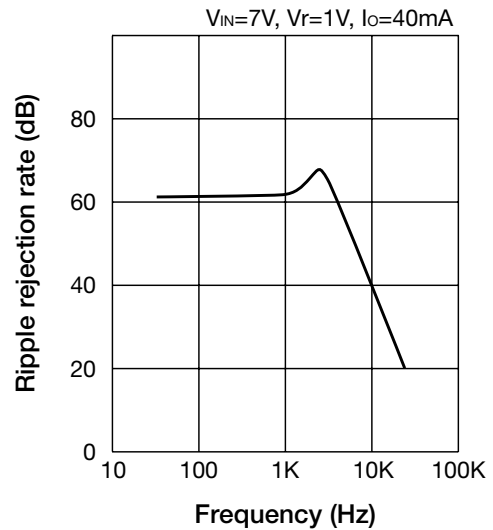
■ Transient response to input fluctuation



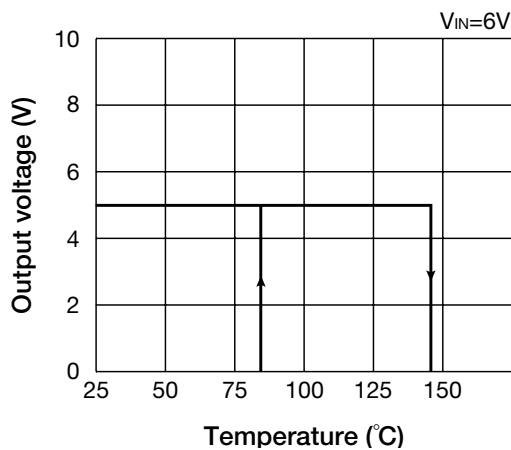
■ Allowable loss



■ Ripple rejection rate



■ Thermal shutdown



■ Output current characteristic

