CMOS Operational Amplifier (Single)
Monolithic IC MM3002

Outline

This IC is a CMOS (Single) operating amp for which input/output voltage both can be used up to the power supply voltage. Further, low offset voltage, low drift and low consumption current have been achieved. The package is the ultra-small SOT-25.

Features

(1) Input voltage range (V_{DD}=3V)	−0.1V~V_{DD}+0.1V typ.
(2) Output voltage range (V_{DD}=3V)	0.03V~2.97V typ.
(3) Input offset voltage	1mV typ.
(4) Input offset voltage temperature drift	5μV/°C typ.
(5) Input bias current	5pA typ.
(6) Consumption current	120μA typ.
(7) Output current	±5mA typ.
(8) Through rate	0.6V/μS

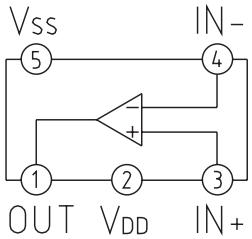
Package

SOT-25

Applications

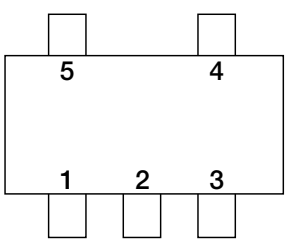
(1) Communication equipment (mobile telephones, cordless telephones, etc.)
(2) Computers and computer peripherals (notebook PCs, mini PCs, PDA, digital cameras, printers, scanners, etc.)
(3) AV equipment (movies, CD players, MD players, etc.)
(4) Other (navigation equipment, measurement equipment, handy terminals, etc.)

Block Diagram



Pin Assignment

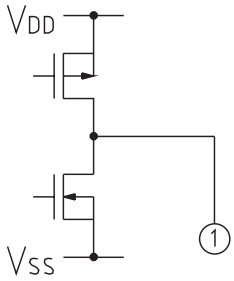
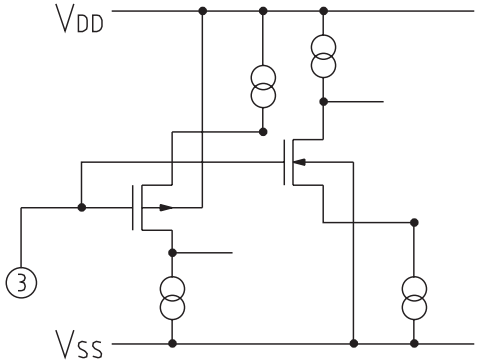
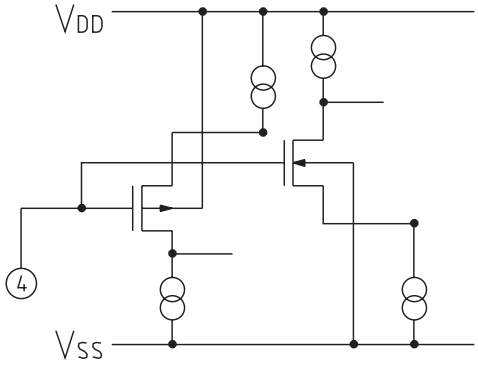
TOP VIEW



SOT-25

1	OUT
2	V_{DD}
3	IN+
4	IN−
5	V_{SS}

Pin Description

Pin No.	Pin name	Functions	Internal Equivaalent Circuit
1	OUT	Output pin	
2	V_{DD}	Power supply input pin	
3	IN+	Non – inverting input pin	
4	IN–	Inverting input pin	
5	V_{SS}	V_{SS} PIN	

Absolute Maximum Ratings (Except where noted otherwise, Ta=25°C)

Item	Symbol	Ratings	Units
Storage temperature	T_{STG}	–40~+125	°C
Operating temperature	T_{OPR}	–30~+85	°C
Power supply voltage	V_{DD} max.	10	V
Input voltage	V_I	–0.3~V_{DD}+0.3	V

Recommended Operating Conditions

Item	Symbol	Ratings	Units
Operating temperature	T_{OPR}	–30~+85	°C
Power supply voltage	V_{OPR}	+2.7~+9	V
Input voltage	V_I	0~V_{DD}	V

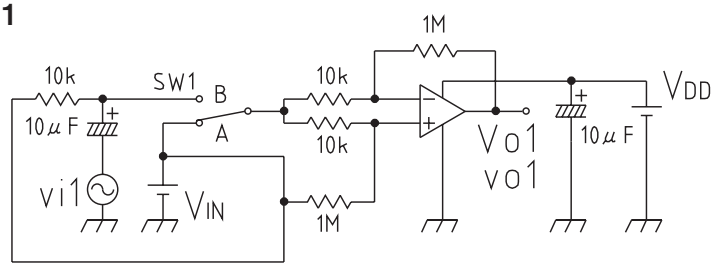
Electrical Characteristics (Except where noted otherwise, Ta=25°C, V_{DD}=3V, V_{IN}=1.5V)

Item	Symbol	Measurement conditions	Measurement curcuit	Min.	Typ.	Max.	Units
Input offset voltage	V_{OS}	Rs ≦ 10kΩ	1		1	3	mV
Input offset voltage temperature Drift	⊿V_{OS}/⊿Ta	Ta=30°C~+85°C	1		5		μV/°C
Input bias current	I_B		2		5		pA
Common - mode signal rejection ratio	CMRR		1	60	70		dB
Power supply voltage rejection ratio	PSRR	V_{DD}=3V~5V	1	70	90		dB
Current consumption	I_{DD}		3	50	120	240	μA
Input voltage L	V_{IL}		4		–0.1	0	V
Input voltage H	V_{IH}		5	V_{DD}	V_{DD}+0.1		V
Voltage gain	A_V	R_L ≧ 100kΩ	6	80	95		dB
Gain band area	GBW	A_V=0dB	6		800		kHz
Output voltage L	V_{OL}		7		0.03	0.05	V
Output voltage H	V_{OH}		8	2.95	2.97		V
Output flow current	I_{SO}		9	2.5	5		mA
Output inflow current	I_{SI}		10	2.5	5		mA
Through rate	SR		11		0.6		V/μS

NOTE1 Put capacitors of number μF between V_{DD}–V_{SS} when using.

Measuring Circuit (Except where noted otherwise, Ta=25°C, V_{DD}=3V, V_{IN}=V_{DD}/2, SW1;A)

Measuring circuit 1

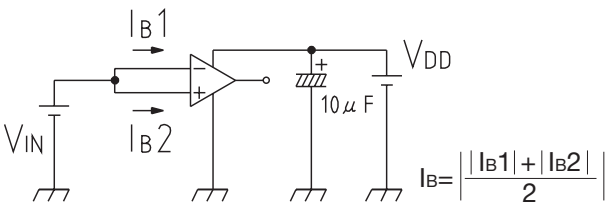


$$V_{OS}=\left|\frac{Vo1-V_{IN}}{100}\right|$$

$$CMRR=20\log\left|\frac{100\times vi1}{vo1}\right|\quad SW1\ ;\ B\quad vi1=1V_{(P-P)}$$

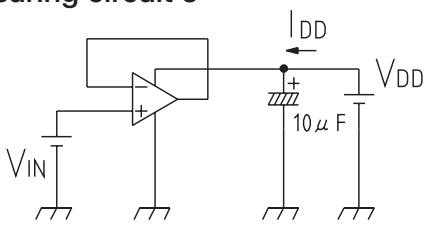
$$PSRR=20\log\left|\frac{(5-3)\times 100}{(vo1-V_{IN}1)-(vo2-V_{IN}2)}\right|\quad V_{IN}2,\ Vo2\ ;\ V_{DD}=5V$$

Measuring circuit 2

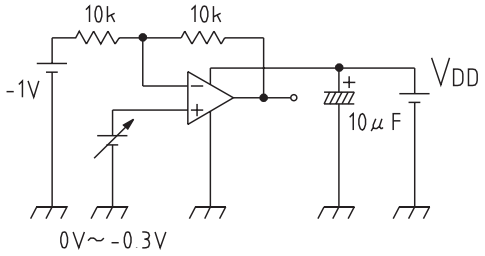


$$I_B = \left| \frac{|I_{B1}| + |I_{B2}|}{2} \right|$$

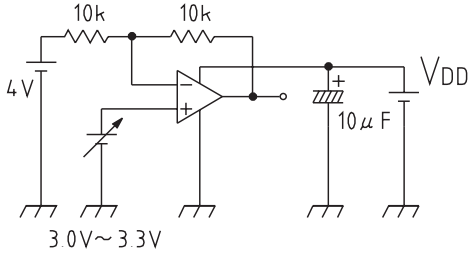
Measuring circuit 3



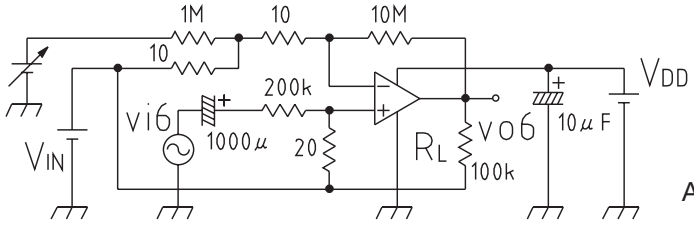
Measuring circuit 4



Measuring circuit 5

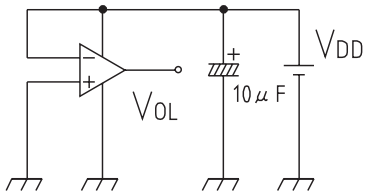


Measuring circuit 6

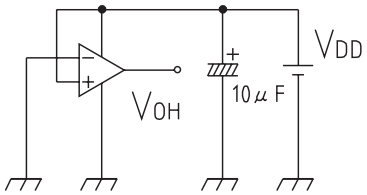


$$Av = 20\log \left| \frac{vo6 \times 10^4}{vi6} \right| \quad vo6 = 1V_{P-P}$$

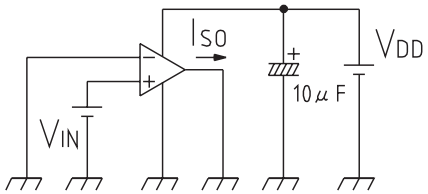
Measuring circuit 7



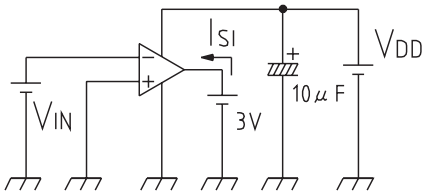
Measuring circuit 8



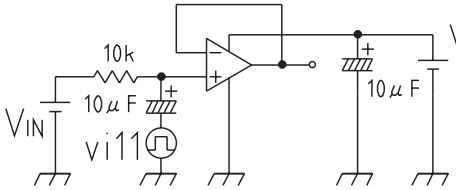
Measuring circuit 9



Measuring circuit 10



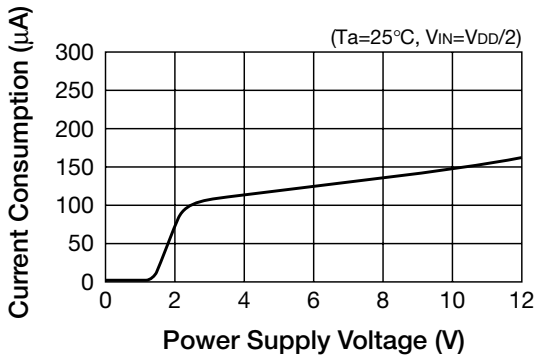
Measuring circuit 11



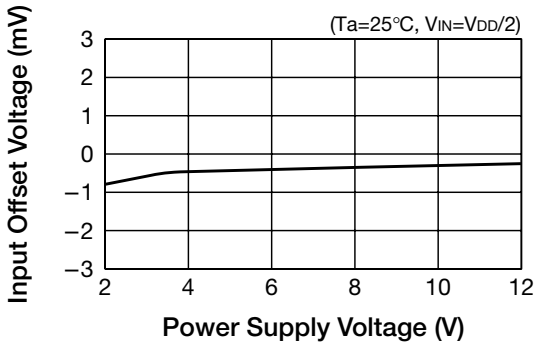
$vi11 = 1V_{P-P}$

Characteristics

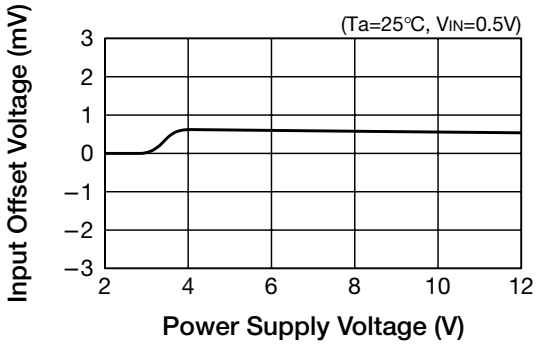
Current consumption vs power supply voltage



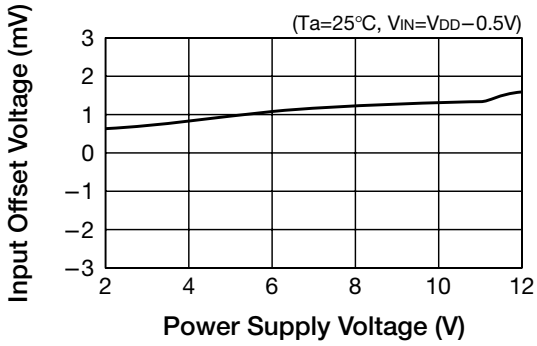
Input offset voltage vs power supply voltage



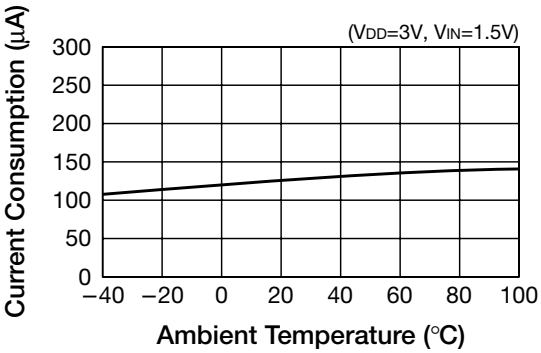
Input offset voltage vs power supply voltage



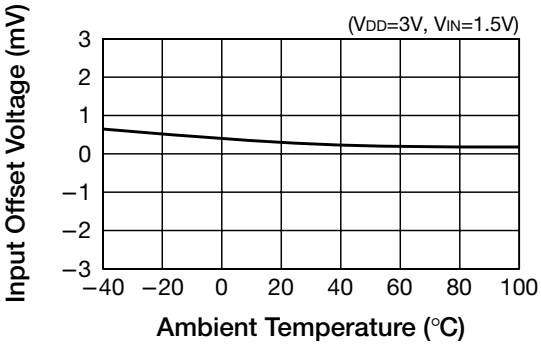
Input offset voltage vs power supply voltage



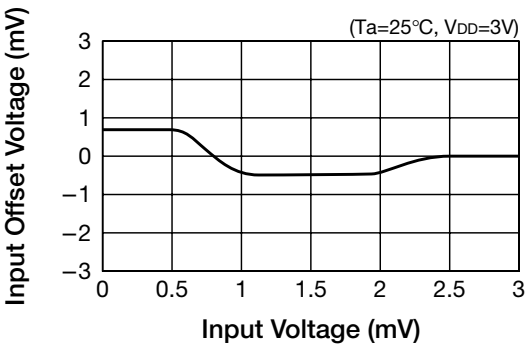
Current consumption vs ambient temperature



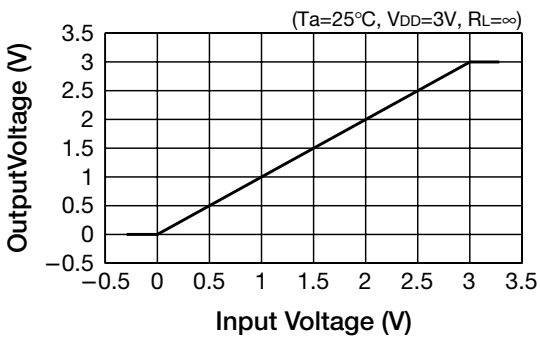
Input offset voltage vs ambient temperature



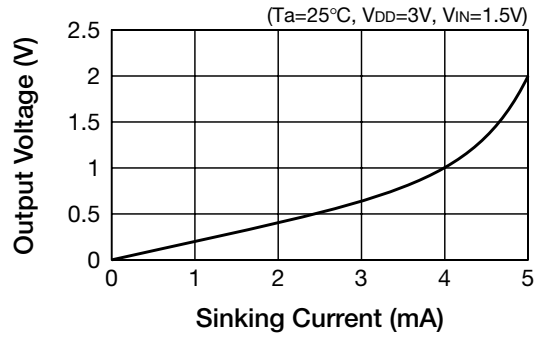
Input offset voltage vs input voltage



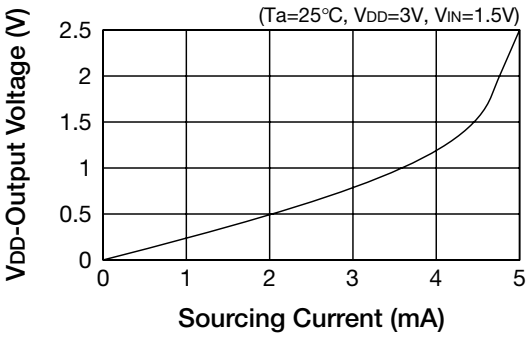
Output voltage vs input voltage



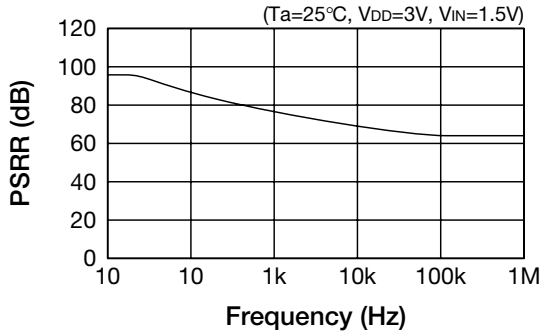
Output voltage vs sinking current



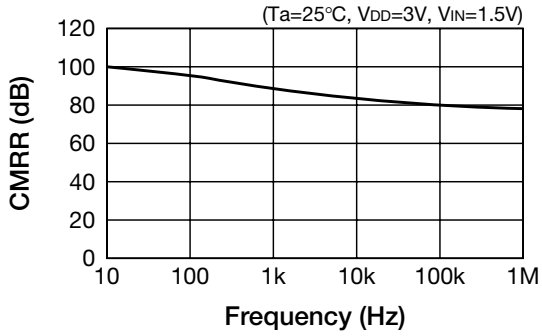
Output voltage vs sourcing current



PSRR vs frequency



CMRR vs frequency



Voltage gain vs frequency

