

TOSHIBA CMOS Linear Integrated Circuit Silicon Monolithic

TC75S102F

Single Operational Amplifier

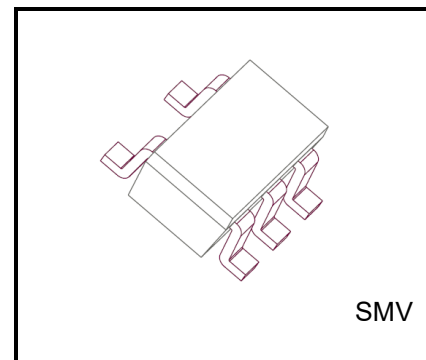
Ultra-Low supply current

Features

- Input and Output Full Range
- Ultra-Low supply current 0.27 μ A (Typ.) @V_{DD}=1.5V
- Low Input offset voltage 1.3mV (Max) @V_{DD}=1.5V
- Wide Operating Voltage Range 1.5V to 5.5V

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	V _{DD} - V _{SS}	6	V
Differential input voltage	DV _{IN}	±6	V
Input voltage	V _{IN}	V _{DD} to V _{SS}	V
Output voltage	V _{OUT}	V _{SS} - 0.3V to V _{DD} + 0.3V $\leq$ V _{SS} + 6V	V
Output current	I _{OUT}	±25	mA
Power dissipation	P _D	200	mW
Operating temperature	T _{opr}	-40 to 105	°C
Storage temperature	T _{stg}	-55 to 150	°C



Weight:
SMV (SOT-25)(SC-74A) : 14 mg (typ.)

Note1: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Operating Ratings (Ta = -40 to 105°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	V _{DD} - V _{SS}	1.5 to 5.5	V

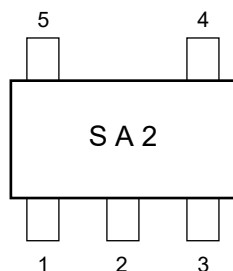
Note2: A higher load capacitance will increase the risk of voltage oscillation. Allow sufficient capacitance value when designing your circuit and using this product to prevent voltage oscillation.

Note3: This device is sensitive to electrostatic discharge.

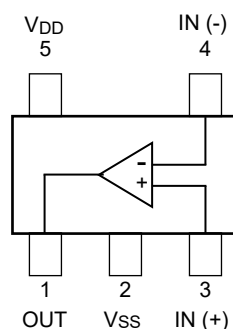
Please ensure equipment, operator and tools are adequately earthed when handling.

Start of commercial production
2020-06

Marking (top view)



Pin Assignment (top view)



Electrical Characteristics

DC Characteristics ($V_{DD} = 1.5V$, $V_{SS} = GND$, $T_a = 25^\circ C$, $V_{IN} = V_{DD}/2$, unless otherwise noted.)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input offset voltage	V_{IO}	1	$R_S = 1\text{ k}\Omega$, $R_F = 100\text{ k}\Omega$	-1.3	-0.1	1.3	mV
Input offset voltage drift	$V_{IO\text{drift}}$	1	$R_S = 1\text{ k}\Omega$, $R_F = 100\text{ k}\Omega$	-	2.8	-	$\mu V/^\circ C$
Input offset current	I_{IO}	-	-	-	1	-	pA
Input bias current	I_I	-	-	-	1	-	pA
Common mode input voltage	CMV_{IN}	2	$R_S = 1\text{ k}\Omega$, $R_F = 100\text{ k}\Omega$	0	-	V_{DD}	V
Voltage gain (open loop)	G_V	-	-	64	139	-	dB
Maximum output voltage	V_{OH}	3	$R_L \geq 100\text{ k}\Omega$	1.4	-	-	V
	V_{OL}	4	$R_L \geq 100\text{ k}\Omega$	-	-	0.1	
Common mode input signal rejection ratio	$CMRR$	2	$V_{IN} = 0$ to $1.5V$	53	80	-	dB
Supply voltage rejection ratio	$SVRR$	1	$V_{DD} = 1.5$ to $5.0V$	61	80	-	dB
Supply current	I_{DD}	5	$T_a = -40$ to $105^\circ C$	-	0.27	0.60	μA
			$T_a = 25^\circ C$	-	0.27	0.46	μA
Source current	I_{source}	6	-	0.34	0.6	-	mA
Sink current	I_{sink}	7	-	0.28	0.4	-	mA

AC Characteristics ($V_{DD} = 0.75\text{ V}$, $V_{SS} = -0.75\text{ V}$, $T_a = 25^\circ C$)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Unity Gain Cross Frequency	f_T	-	-	-	0.5	-	kHz
Phase margin	Φ_m	-	-	-	53	-	degrees
Slew Rate	SR	-	-	-	0.37	-	V/ms

DC Characteristics ($V_{DD} = 5.0V$, $V_{SS} = GND$, $T_a = 25^\circ C$, $V_{IN} = V_{DD}/2$, unless otherwise noted.)

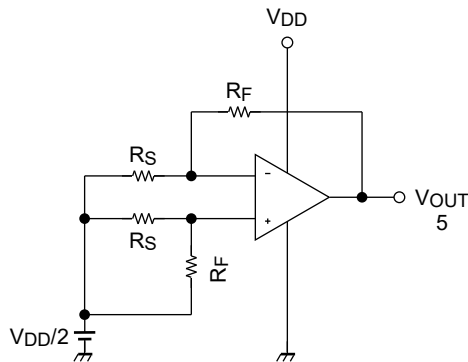
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input offset voltage	V_{IO}	1	$R_S = 1\text{ k}\Omega$, $R_F = 100\text{ k}\Omega$	-1.7	-0.1	1.7	mV
Input offset voltage drift	$V_{IO\text{drift}}$	1	$R_S = 1\text{ k}\Omega$, $R_F = 100\text{ k}\Omega$	-	2.4	-	$\mu V/^\circ C$
Input offset current	I_{IO}	-	-	-	1	-	pA
Input bias current	I_I	-	-	-	1	-	pA
Common mode input voltage	CMV_{IN}	2	$R_S = 1\text{ k}\Omega$, $R_F = 100\text{ k}\Omega$	0	-	V_{DD}	V
Voltage gain (open loop)	G_V	-	-	80	100	-	dB
Maximum output voltage	V_{OH}	3	$R_L \geq 100\text{ k}\Omega$	4.9	-	-	V
	V_{OL}	4	$R_L \geq 100\text{ k}\Omega$	-	-	0.1	
Common mode input signal rejection ratio	$CMRR$	2	$V_{IN} = 0\text{ to }5.0V$	59	80	-	dB
Supply current	I_{DD}	5	$T_a = -40\text{ to }105^\circ C$	-	0.35	0.7	μA
			$T_a = 25^\circ C$	-	0.35	0.54	μA
Source current	I_{source}	6	-	7.8	11	-	mA
Sink current	I_{sink}	7	-	8.2	10	-	mA

AC Characteristics ($V_{DD} = 2.5\text{ V}$, $V_{SS} = -2.5\text{ V}$, $T_a = 25^\circ C$)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Unity Gain Cross Frequency	f_T	-	-	-	0.63	-	kHz
Phase margin	Φ_m	-	-	-	63	-	degrees
Slew Rate	SR	-	-	-	0.45	-	V/ms

Test Circuit

1. SVRR, V_{IO}



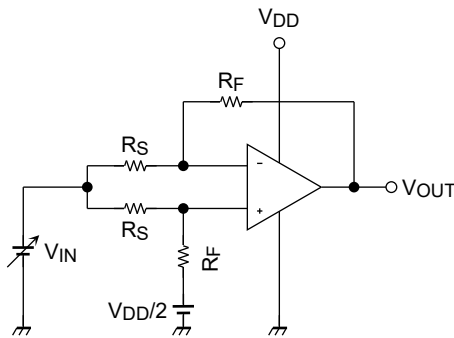
- SVRR
- For each of the two V_{DD} values, measure the V_{OUT} value, as indicated below, and calculate the value of SVRR using the equation shown.
When $V_{DD} = 1.5\text{ V}$, $V_{DD} = V_{DD1}$ and $V_{OUT} = V_{OUT1}$
When $V_{DD} = 5.0\text{ V}$, $V_{DD} = V_{DD2}$ and $V_{OUT} = V_{OUT2}$

$$SVRR = 20 \log \left[\left| \frac{V_{DD1} - V_{DD2}}{\left\{ V_{OUT1} - \left(\frac{V_{DD1}}{2} \right) \right\} - \left\{ V_{OUT2} - \left(\frac{V_{DD2}}{2} \right) \right\}} \right| \times \frac{R_F + R_S}{R_S} \right]$$

- V_{IO}
Measure the value of V_{OUT} and calculate the value of V_{IO} using the following equation.

$$V_{IO} = \left(V_{OUT} - \frac{V_{DD}}{2} \right) \times \frac{R_S}{R_F + R_S}$$

2. CMRR, CMV_{IN}

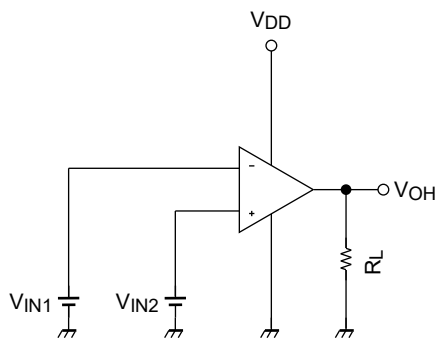


- CMRR
Measure the V_{OUT} value, as indicated below, and calculate the value of the CMRR using the equation shown.
When $V_{IN} = 0\text{ V}$, $V_{IN} = V_{IN1}$ and $V_{OUT} = V_{OUT1}$
When $V_{IN} = 5.0\text{ V}$, $V_{IN} = V_{IN2}$ and $V_{OUT} = V_{OUT2}$

$$CMRR = 20 \log \left(\left| \frac{V_{IN1} - V_{IN2}}{V_{OUT1} - V_{OUT2}} \right| \times \frac{R_F + R_S}{R_S} \right)$$

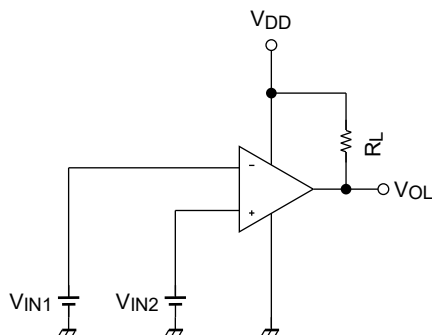
- CMV_{IN}
Input range within which the CMRR specification guarantees V_{OUT} value (as varied by the V_{IN} value).

3. V_{OH}



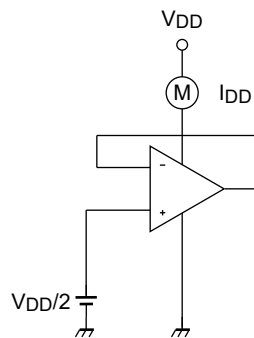
- V_{OH}
 $V_{IN1} = \frac{V_{DD}}{2} - 0.05\text{ V}$
 $V_{IN2} = \frac{V_{DD}}{2} + 0.05\text{ V}$

4. V_{OL}

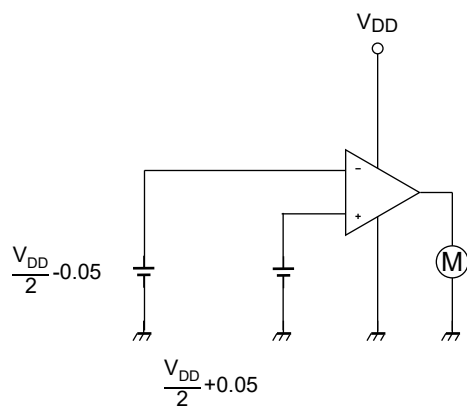


- V_{OL}
 $V_{IN1} = \frac{V_{DD}}{2} + 0.05\text{ V}$
 $V_{IN2} = \frac{V_{DD}}{2} - 0.05\text{ V}$

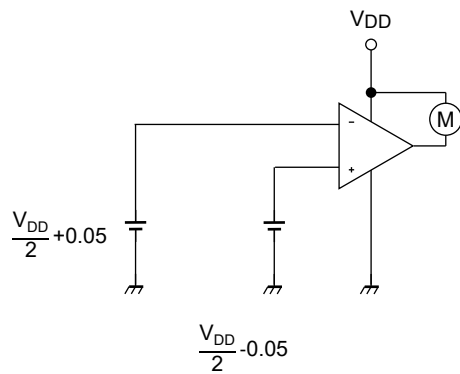
5. I_{DD}



6. I_{source}



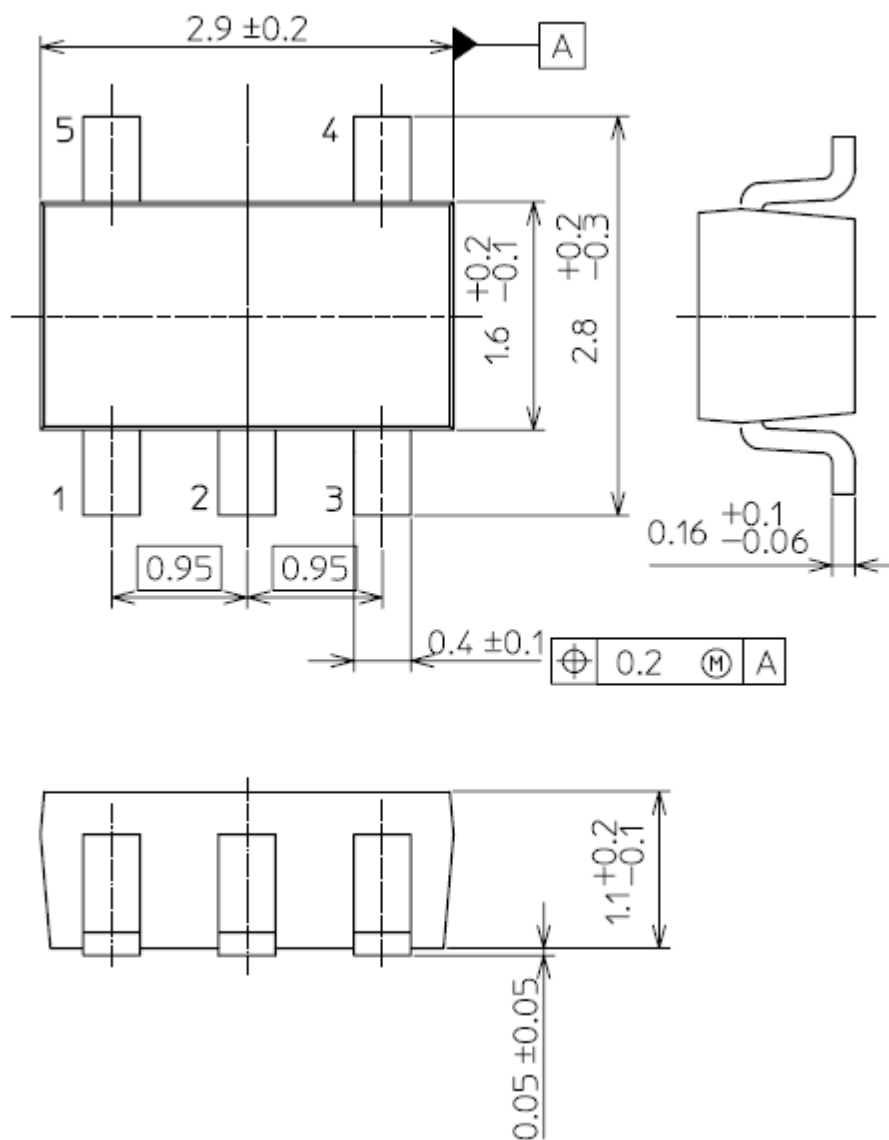
7. I_{sink}



Package Dimensions

SMV (SOT-25)(SC-74A)

Unit: mm



Weight : 14 mg (typ.)

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