

TOSHIBA CMOS Linear Integrated Circuit Silicon Monolithic

TC75S54F, TC75S54FU, TC75S54FE

Single Operational Amplifier

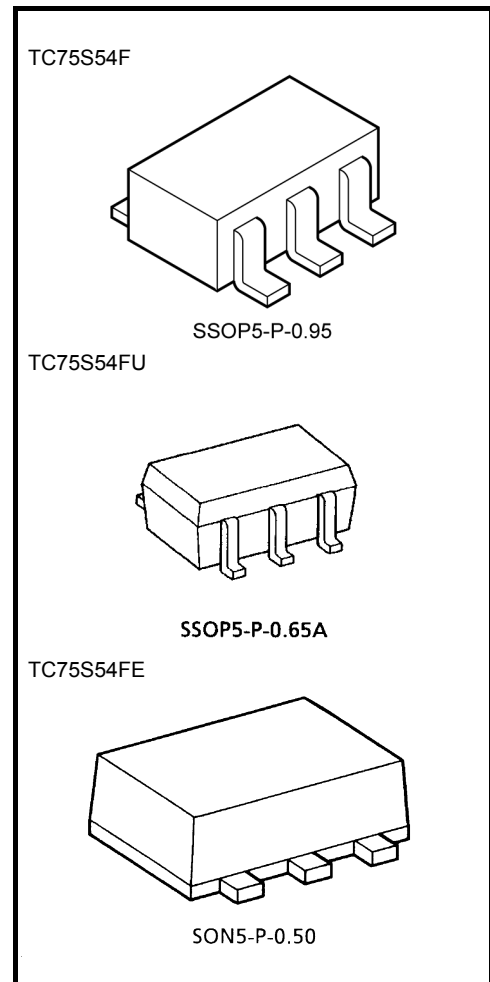
The TC75S54F/TC75S54FU/TC75S54FE is a CMOS single-operation amplifier which incorporates a phase compensation circuit. It is designed for use with a low-voltage, low-current power supply; this differentiates this device from conventional general-purpose bipolar op-amps.

Features

- Low-voltage operation : $V_{DD} = \pm 0.9 \sim 3.5 \text{ V}$ or $1.8 \sim 7 \text{ V}$
- Low-current power supply : $I_{DD} (V_{DD} = 3 \text{ V}) = 100 \mu\text{A}$ (typ.)
- Built-in phase-compensated op-amp, obviating the need for any external device
- Ultra-compact package

Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

Characteristics		Symbol	Rating	Unit
Supply voltage		V_{DD}, V_{SS}	7	V
Differential input voltage		DV_{IN}	± 7	V
Input voltage		V_{IN}	$V_{DD} \sim V_{SS}$	V
Power dissipation	TC75S54F/FU	P_D	200	mW
	TC75S54FE		100	
Operating temperature		T_{opr}	$-40 \sim 85$	$^\circ\text{C}$
Storage temperature		T_{stg}	$-55 \sim 125$	$^\circ\text{C}$



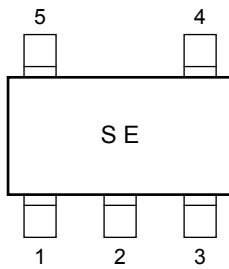
Weight

- SSOP5-P-0.95 : 0.014 g (typ.)
- SSOP5-P-0.65A : 0.006 g (typ.)
- SON5-P-0.50 : 0.003 g (typ.)

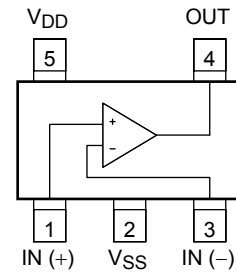
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

Marking (top view)



Pin Connection (top view)



Electrical Characteristics

DC Characteristics ($V_{DD} = 3.0\text{ V}$, $V_{SS} = \text{GND}$, $T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input offset voltage	V_{IO}	1	$R_S = 1\text{ k}\Omega$	—	2	10	mV
Input offset current	I_{IO}	—	—	—	1	—	pA
Input bias current	I_I	—	—	—	1	—	pA
Common mode input voltage	CMV_{IN}	2	—	0.0	—	2.1	V
Voltage gain (open loop)	G_V	—	—	60	70	—	dB
Maximum output voltage	V_{OH}	3	$R_L \geq 100\text{ k}\Omega$	2.9	—	—	V
	V_{OL}	4	$R_L \geq 100\text{ k}\Omega$	—	—	0.1	
Common mode input signal rejection ratio	CMRR	2	$V_{IN} = 0.0\sim 2.1\text{ V}$	60	70	—	dB
Supply voltage rejection ratio	SVRR	1	$V_{DD} = 1.8\sim 7.0\text{ V}$	60	70	—	dB
Supply current	I_{DD}	5	—	—	100	200	μA
Source current	I_{source}	6	—	100	200	—	μA
Sink current	I_{sink}	7	—	200	700	—	μA

DC Characteristics ($V_{DD} = 1.8\text{ V}$, $V_{SS} = \text{GND}$, $T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input offset voltage	V_{IO}	1	$R_S = 10\text{ k}\Omega$	—	2	10	mV
Input offset current	I_{IO}	—	—	—	1	—	pA
Input bias current	I_I	—	—	—	1	—	pA
Common mode input voltage	CMV_{IN}	2	—	0.2	—	0.9	V
Voltage gain (open loop)	G_V	—	—	60	70	—	dB
Maximum output voltage	V_{OH}	3	$R_L \geq 100\text{ k}\Omega$	1.7	—	—	V
	V_{OL}	4	$R_L \geq 100\text{ k}\Omega$	—	—	0.1	
Supply current	I_{DD}	5	—	—	80	160	μA
Source current	I_{source}	6	—	80	160	—	μA
Sink current	I_{sink}	7	—	200	600	—	μA

AC Characteristics ($V_{DD} = 3.0\text{ V}$, $V_{SS} = \text{GND}$, $T_a = 25^\circ\text{C}$)

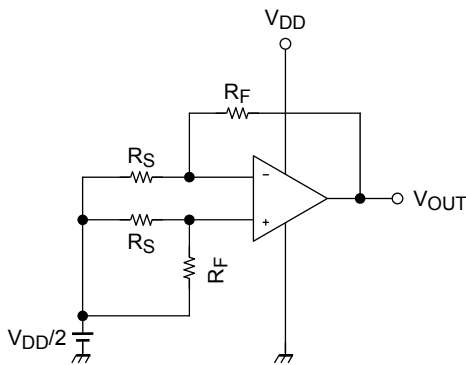
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Slew rate	SR	—	—	—	0.7	—	V/ μs
Unity gain cross frequency	f_T	—	—	—	0.9	—	MHz

AC Characteristics ($V_{DD} = 1.8\text{ V}$, $V_{SS} = \text{GND}$, $T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Slew rate	SR	—	—	—	0.6	—	V/ μs
Unity gain cross frequency	f_T	—	—	—	0.8	—	MHz

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 $V_{DD} = 1.8\text{ V}$, $V_{DD} = V_{DD1}$ and $V_{OUT} = V_{OUT1}$

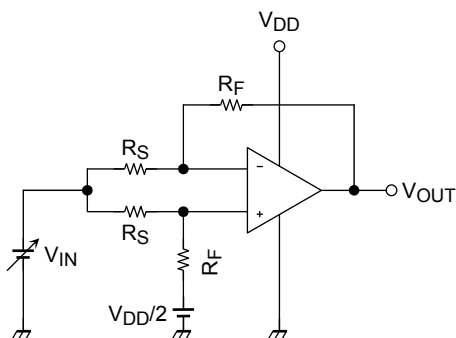
When $V_{DD} = 7.0\text{ V}$, $V_{DD} = V_{DD2}$ and $V_{OUT} = V_{OUT2}$

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

- 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.

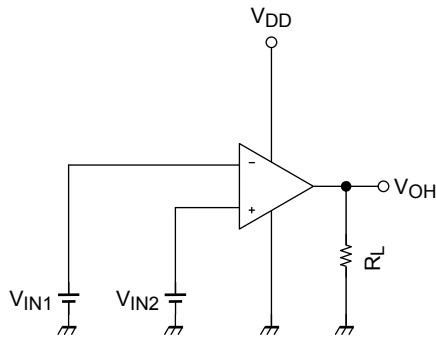
When $V_{IN} = 0.0\text{ V}$, $V_{IN} = V_{IN1}$ and $V_{OUT} = V_{OUT1}$

When $V_{IN} = 2.1\text{ V}$, $V_{IN} = V_{IN2}$ and $V_{OUT} = V_{OUT2}$

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

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

3. V_{OH}

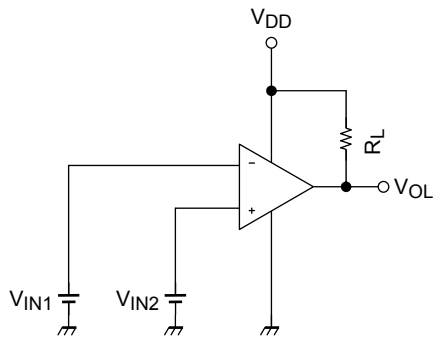


- V_{OH}

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

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

4. V_{OL}

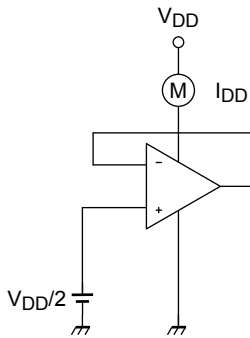


- V_{OL}

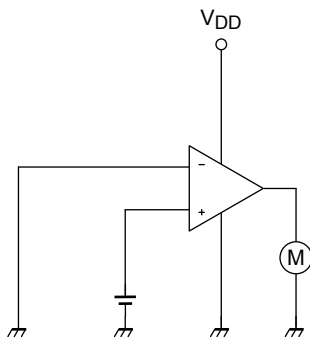
$$V_{IN1} = \frac{V_{DD}}{2} + 0.05 \text{ V}$$

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

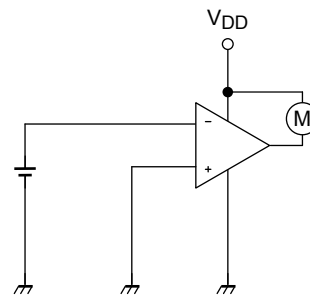
5. I_{DD}

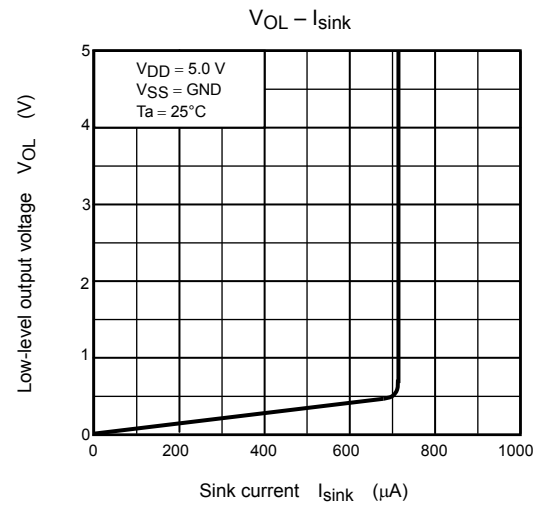
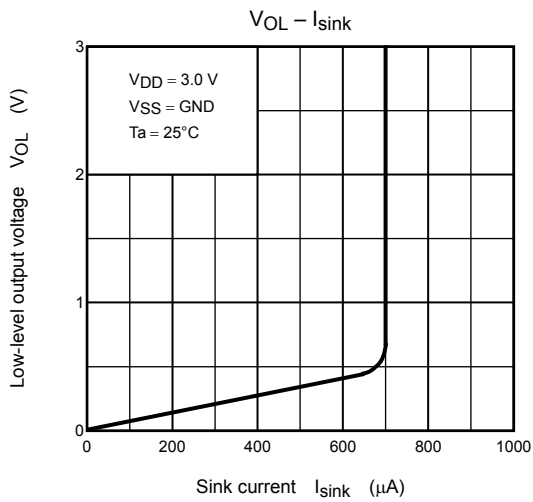
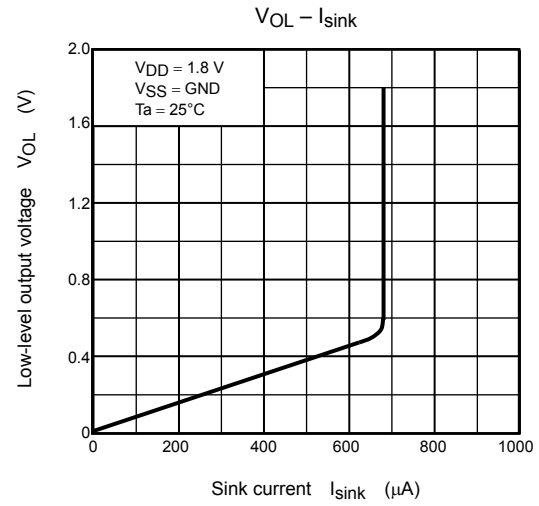
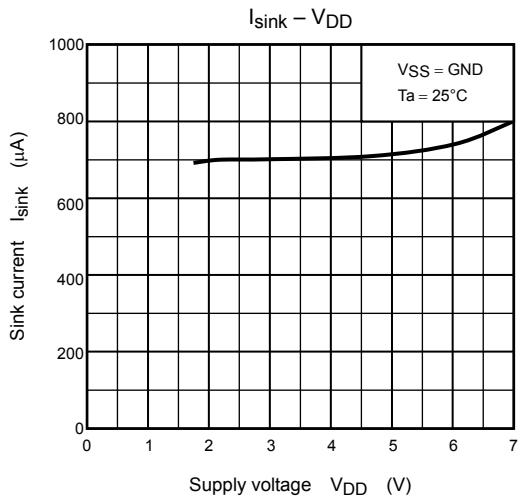
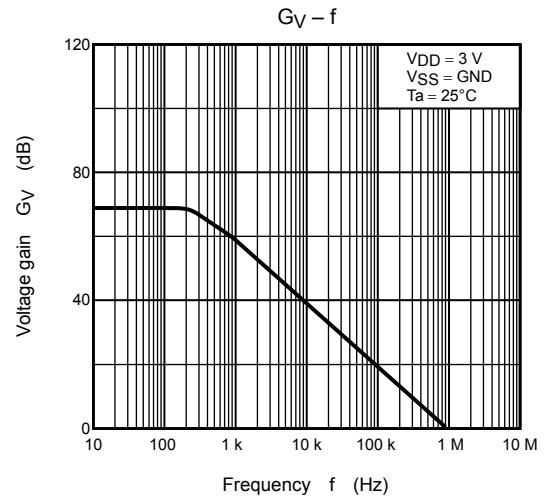
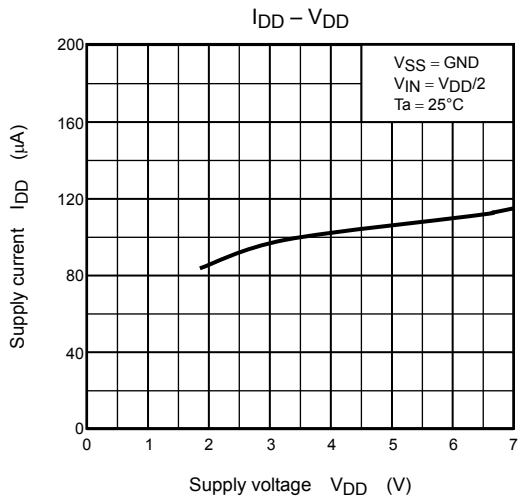


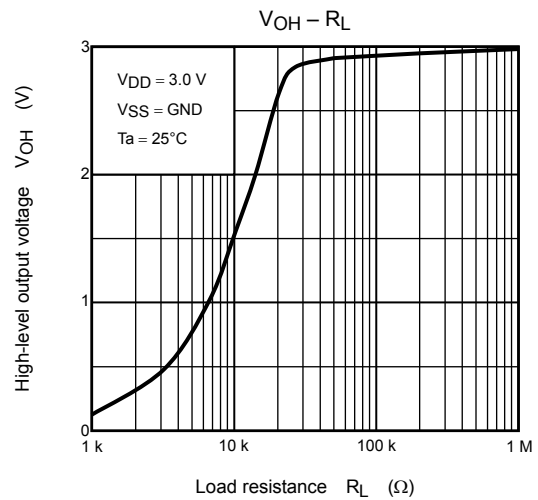
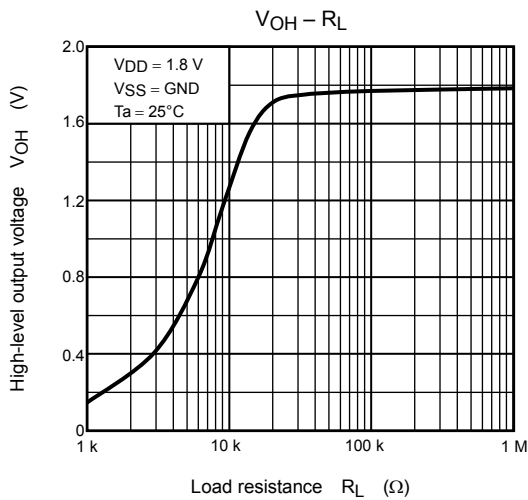
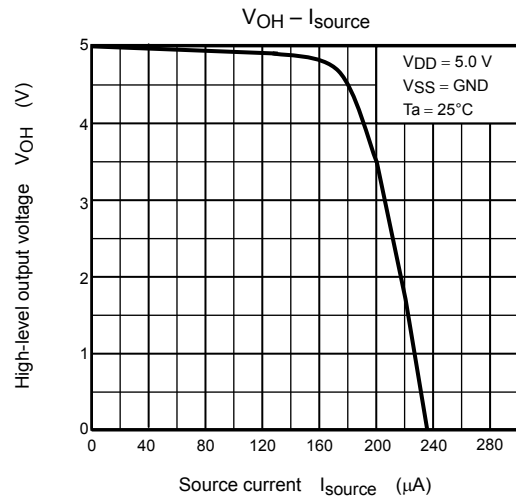
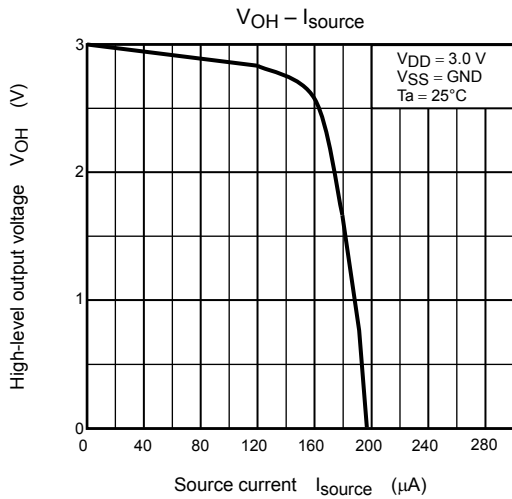
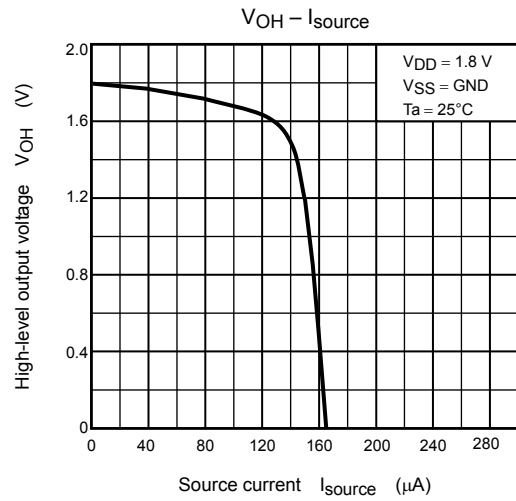
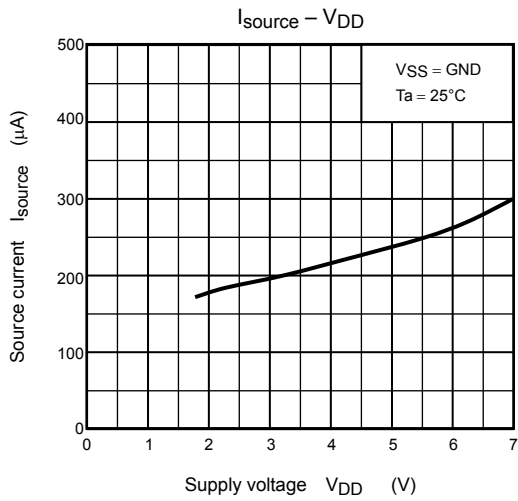
6. I_{source}

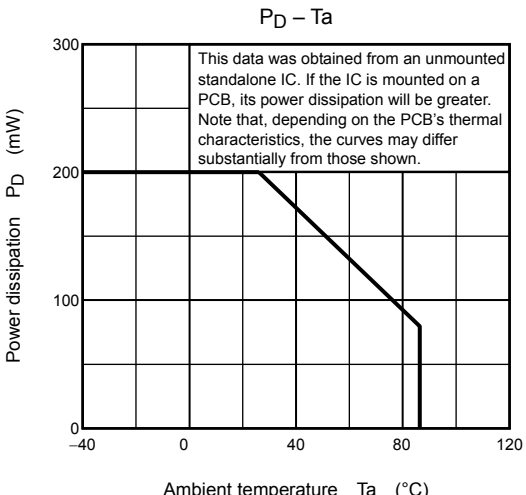
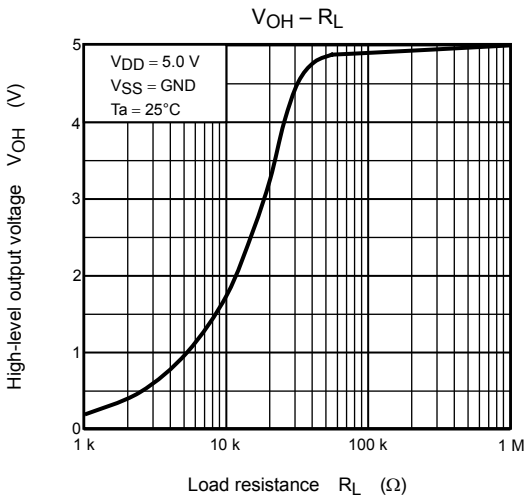


7. I_{sink}





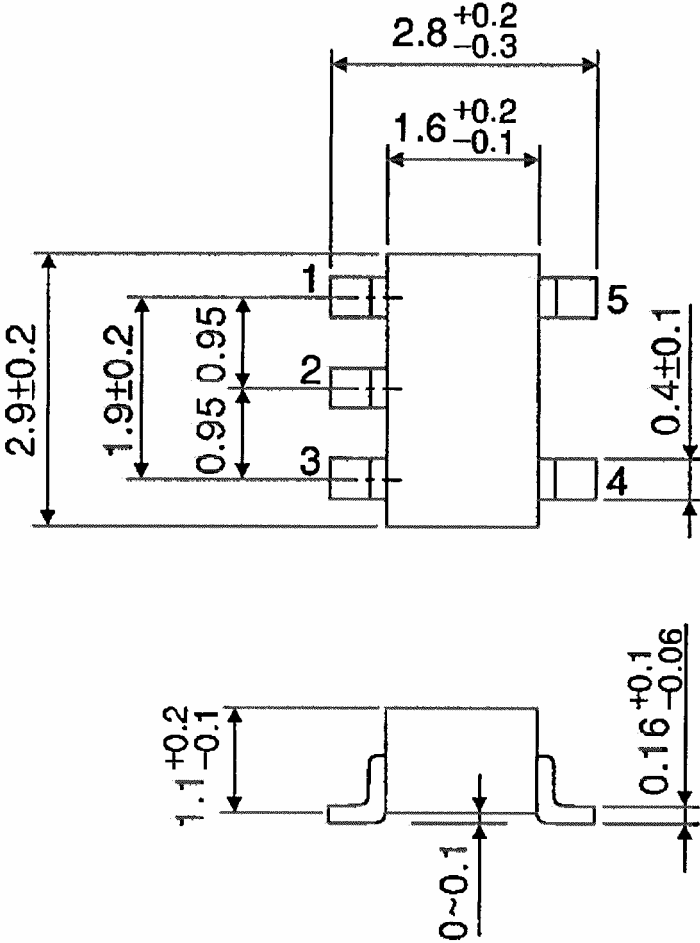




Package Dimensions

SSOP5-P-0.95

Unit : mm

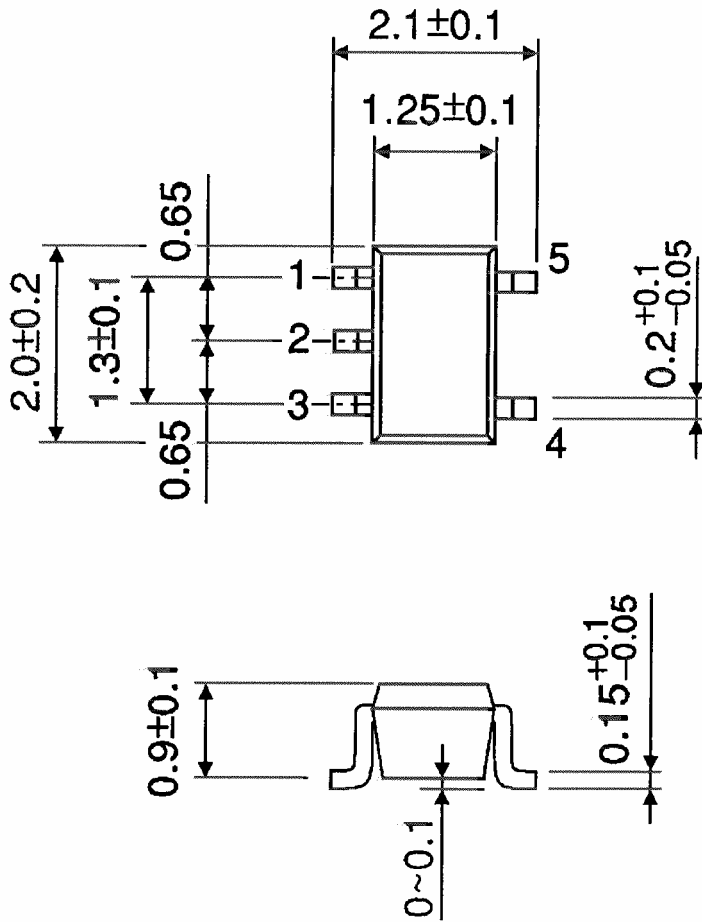


Weight: 0.014 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm

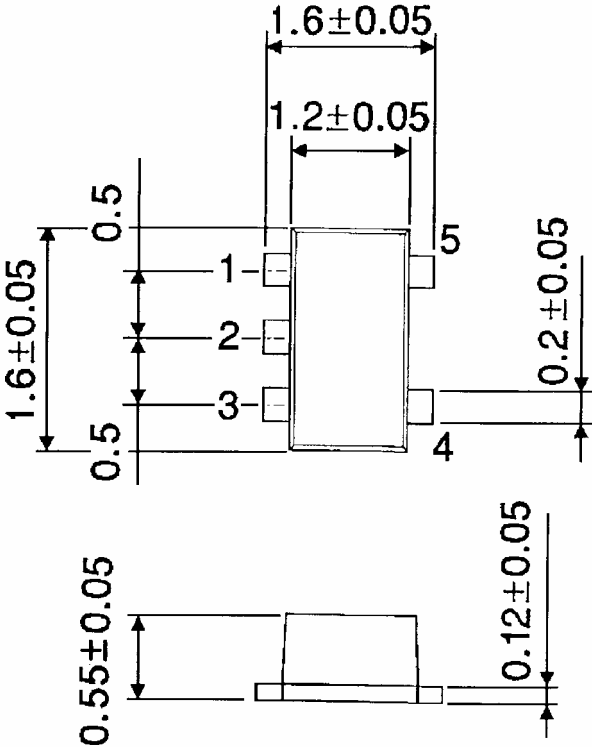


Weight: 0.006 g (typ.)

Package Dimensions

SON5-P-0.50

Unit : mm



Weight: 0.003 g (typ.)

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20070701-EN GENERAL

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