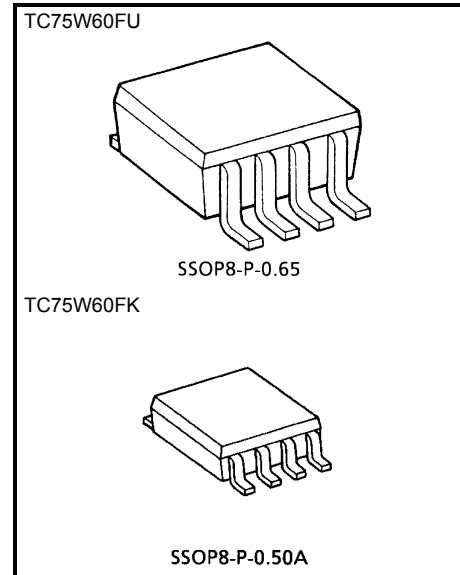


TC75W60FU, TC75W60FK

Dual Operational Amplifier

Features

- High slew rate : SR ($V_{DD} = 3\text{ V}$) = 5.1 V/ μs (typ.)
- Single and dual power Supply operations are possible.
: $V_{DD} = \pm 0.9\text{ to }3.5\text{ V}$ or 1.8 to 7 V
- Lower supply current than general-purpose bipolar type op amps
: $I_{DD} (V_{DD} = 3\text{ V}) = 660\ \mu\text{A}$ (typ.)
- The internally phase compensated operational amplifier.
- Small package



Weight
 SSOP8-P-0.65 : 0.021 g (typ.)
 SSOP8-P-0.50A : 0.01 g (typ.)

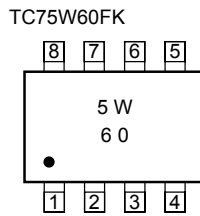
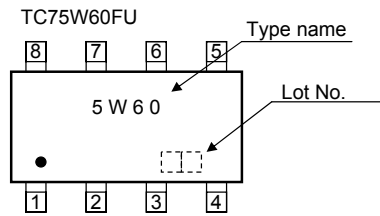
Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

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} to V_{SS}	V
Power dissipation	TC75W60FU	P_D	250	mW
	TC75W60FK		200	
Operating temperature		T_{opr}	-40 to 85	$^\circ\text{C}$
Storage temperature		T_{stg}	-55 to 125	$^\circ\text{C}$

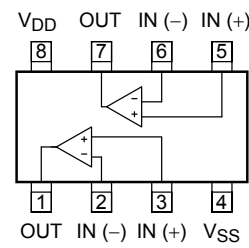
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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}	—	$R_S = 1\text{ k}\Omega$	—	2	7	mV
Input offset current	I_{IO}	—	—	—	1	—	pA
Input bias current	I_I	—	—	—	1	—	pA
Common mode input voltage	CMV_{IN}	—	—	0.0	—	2.1	V
Voltage gain (open loop)	G_V	—	—	60	70	—	dB
Maximum output voltage	V_{OH}	—	$R_L = 100\text{ k}\Omega$	2.9	—	—	V
	V_{OL}	—	$R_L = 100\text{ k}\Omega$	—	—	0.1	
Common mode rejection ratio	CMRR	—	$V_{IN} = 0.0\text{ to }2.1\text{ V}$	54	70	—	dB
Supply voltage rejection ratio	SVRR	—	$V_{DD} = 1.8\text{ to }7.0\text{ V}$	60	70	—	dB
Supply current	I_{DD}	—	—	—	660	1000	μA
Source current	I_{source}	—	—	330	700	—	μA
Sink current	I_{sink}	—	—	600	1250	—	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}	—	$R_S = 1\text{ k}\Omega$	—	2	7	mV
Input offset current	I_{IO}	—	—	—	1	—	pA
Input bias current	I_I	—	—	—	1	—	pA
Common mode input voltage	CMV_{IN}	—	—	0.3	—	0.9	V
Voltage gain (open loop)	G_V	—	—	—	70	—	dB
maximum output voltage	V_{OH}	—	$R_L = 100\text{ k}\Omega$	1.7	—	—	V
	V_{OL}	—	$R_L = 100\text{ k}\Omega$	—	—	0.1	
Common mode rejection ratio	CMRR	—	$V_{IN} = 0.3\text{ to }0.9\text{ V}$	50	60	—	dB
Supply current	I_{DD}	—	—	—	600	900	μA
Source current	I_{source}	—	—	300	700	—	μA
Sink current	I_{sink}	—	—	550	1150	—	μA

AC Characteristics (V_{DD} = 3.0 V, V_{SS} = GND, Ta = 25°C)

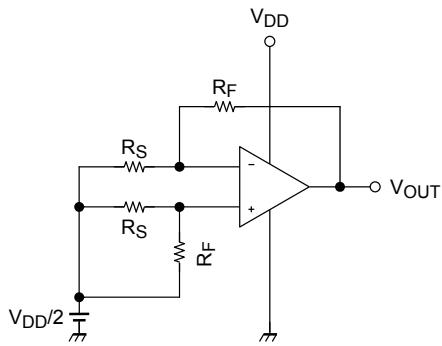
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Slew rate	SR	—	—	—	5.1	—	V/μs
Unity gain cross frequency	f _T	—	—	—	3.7	—	MHz

AC Characteristics (V_{DD} = 1.8 V, V_{SS} = GND, Ta = 25°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Slew rate	SR	—	—	—	4.0	—	V/μs
Unity gain cross frequency	f _T	—	—	—	3.0	—	MHz

TEST CIRCUIT

(1) SVRR, V_{IO}



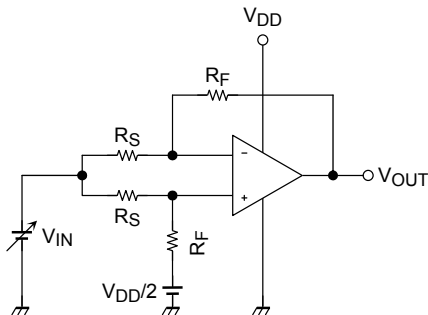
- SVRR
 V_{DD} = 1.5 V : V_{DD} = V_{DD1}, V_{OUT} = V_{OUT1}
 V_{DD} = 7.0 V : V_{DD} = V_{DD2}, V_{OUT} = V_{OUT2}

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

- V_{IO}

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

(2) CMRR, CMV_{IN}

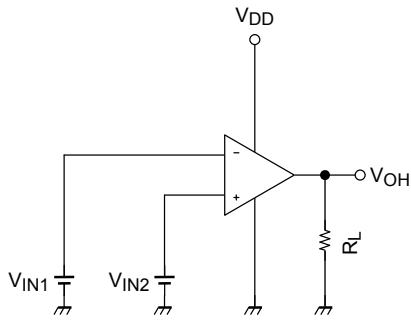


- CMRR
 V_{IN} = 0.0 V : V_{IN} = V_{DD1}, V_{OUT} = V_{OUT1}
 V_{IN} = 2.5 V : V_{IN} = V_{DD2}, V_{OUT} = V_{OUT2}

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

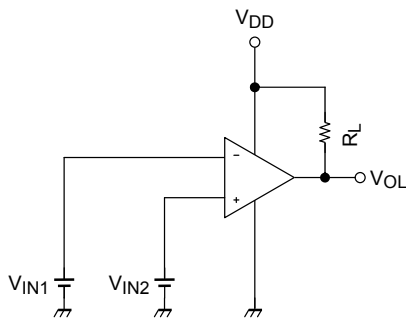
- CMV_{IN}

(3) VOH



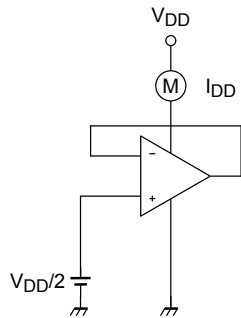
- VOH
- $V_{IN1} = \frac{V_{DD}}{2} - 0.05 \text{ V}$
- $V_{IN2} = \frac{V_{DD}}{2} + 0.05 \text{ V}$

(4) VOL

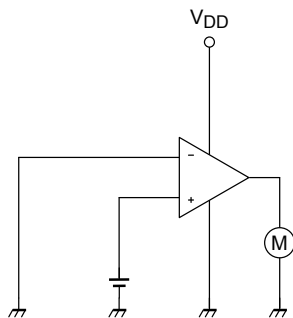


- VOL
- $V_{IN1} = \frac{V_{DD}}{2} + 0.05 \text{ V}$
- $V_{IN2} = \frac{V_{DD}}{2} - 0.05 \text{ V}$

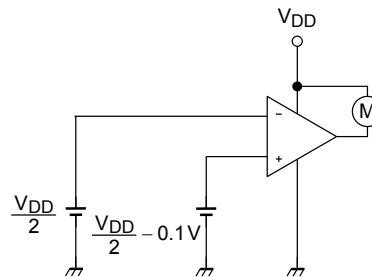
(5) IDD

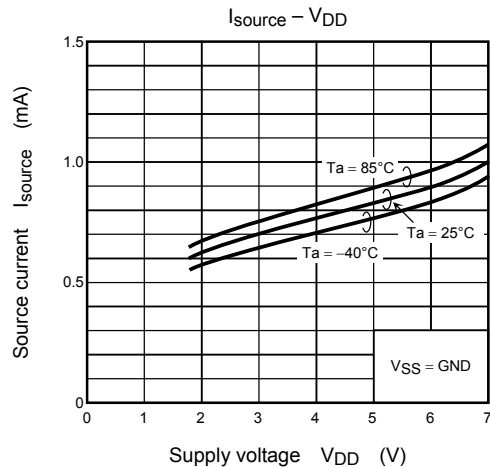
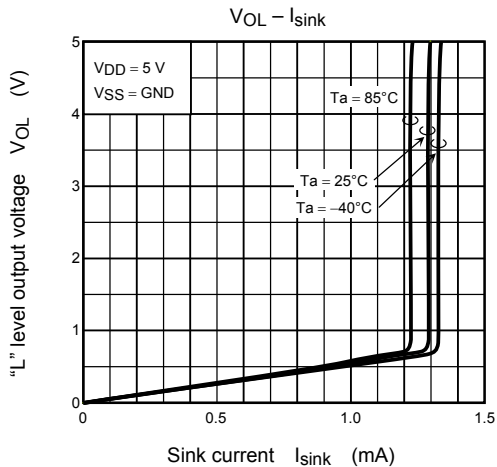
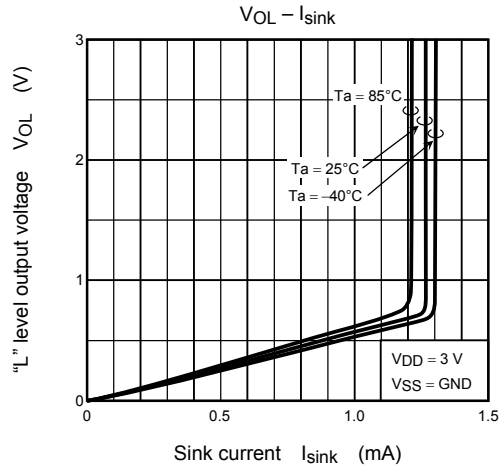
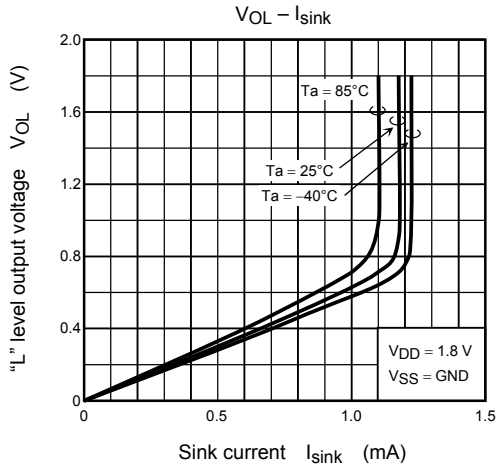
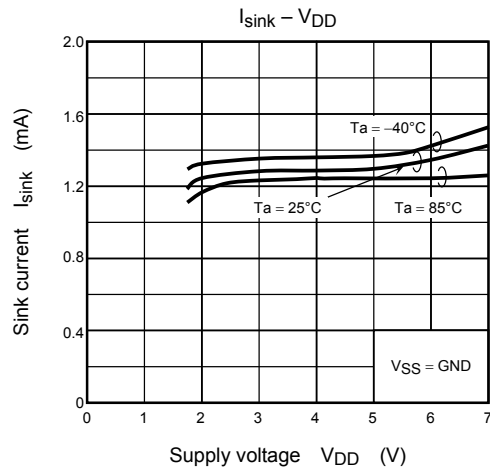
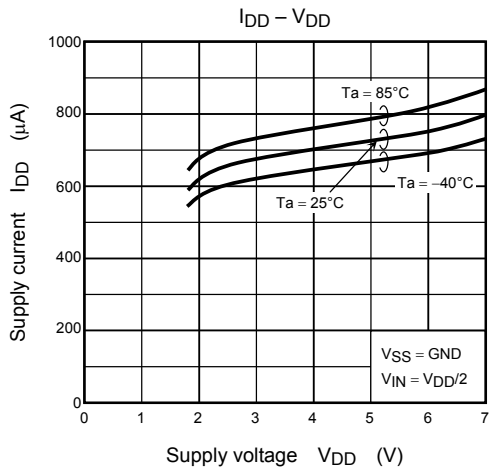


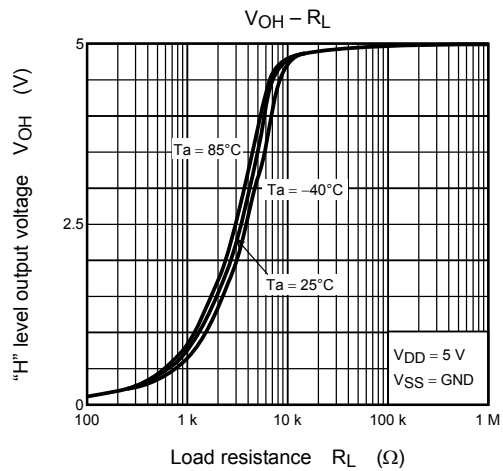
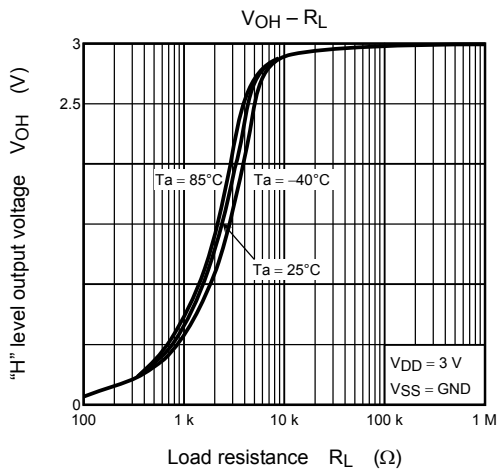
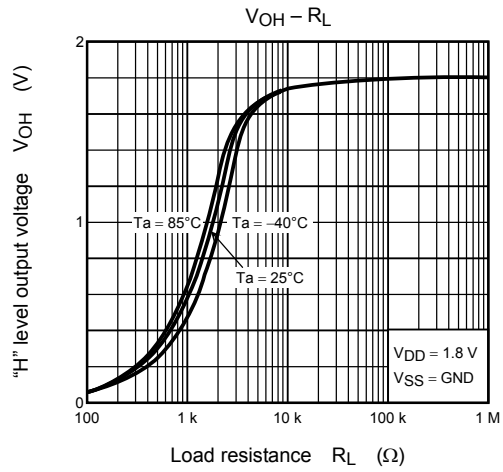
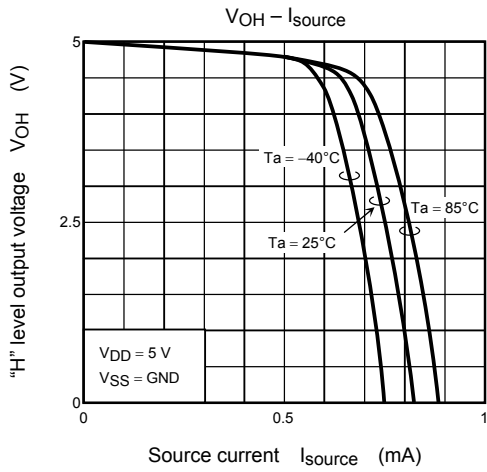
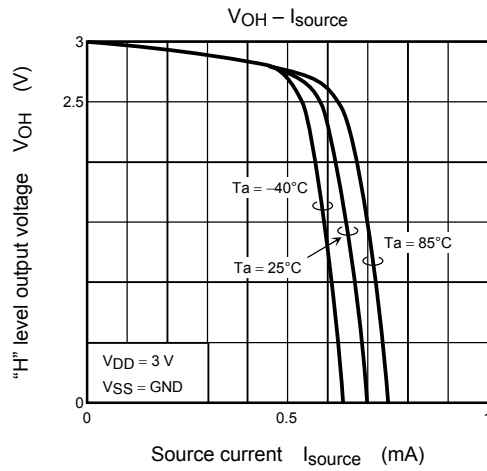
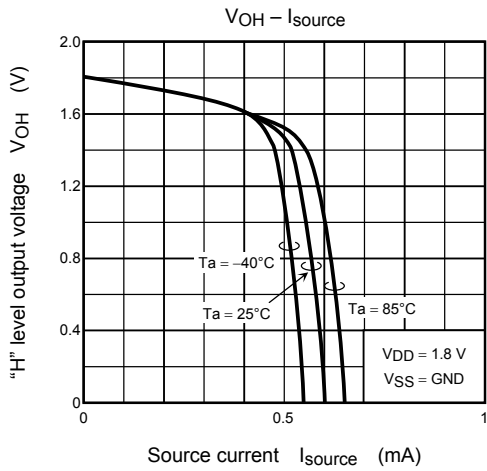
(6) Isource

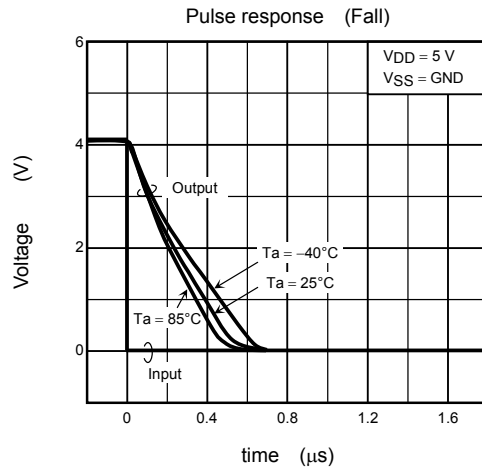
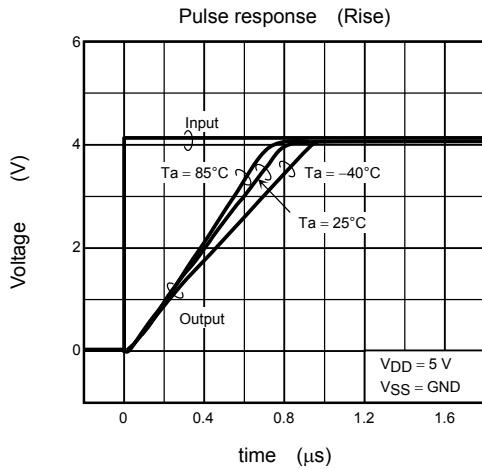
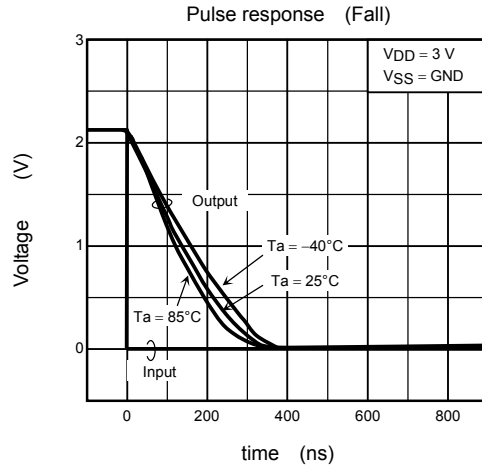
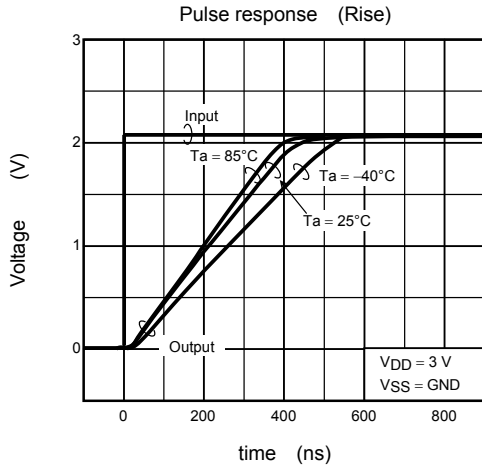
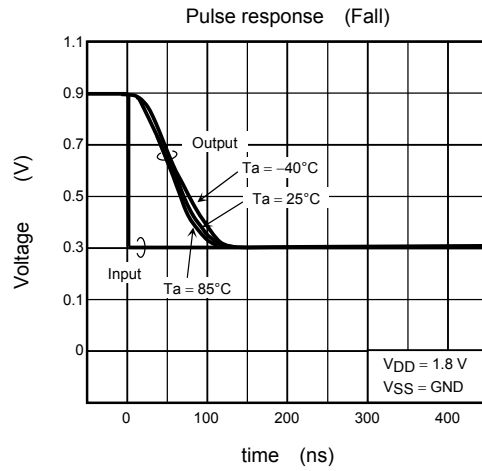
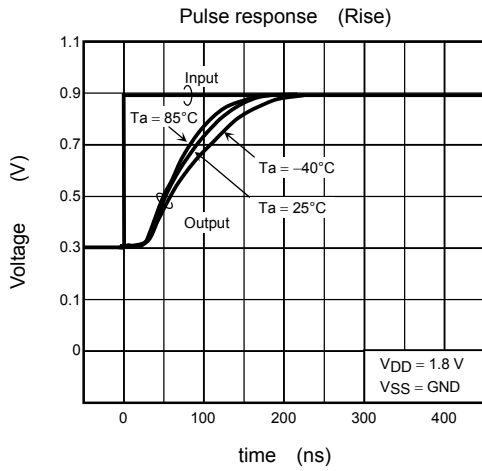


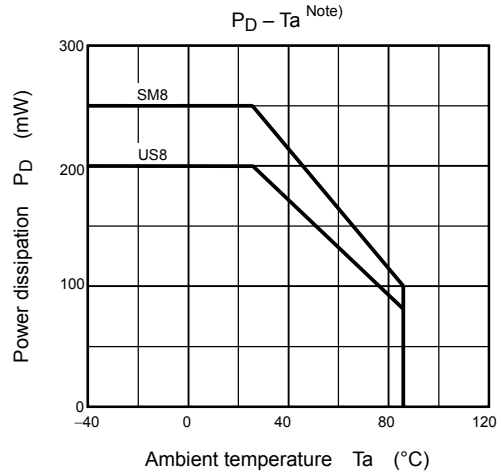
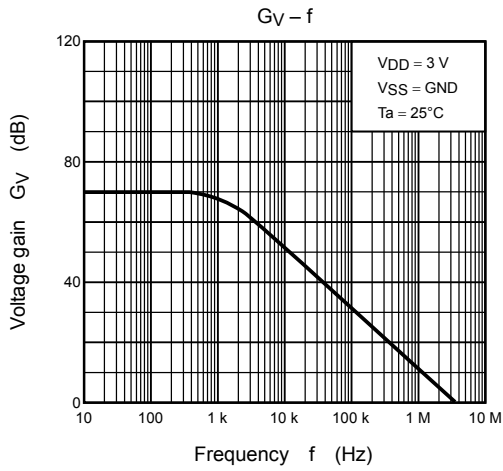
(7) Isink











Note):

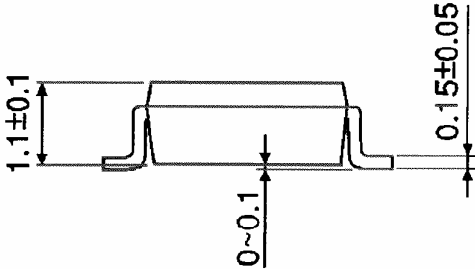
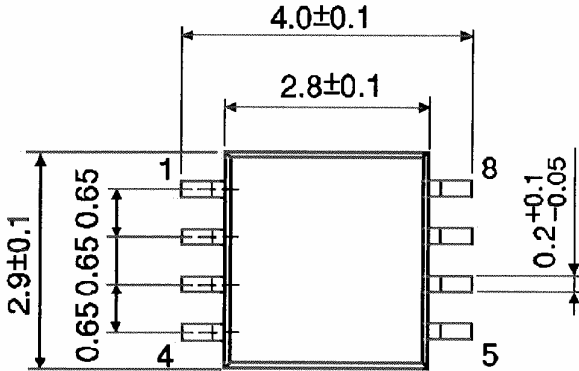
These power dissipation curves are given by measurement of only IC on the air and, in general, it become higher when mounted on PCB.

Since the power dissipation depends on mounted condition, please be sure to design.

Package Dimensions

SSOP8-P-0.65

Unit : mm

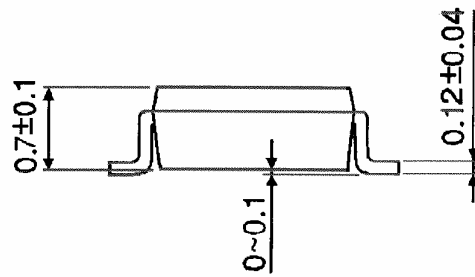
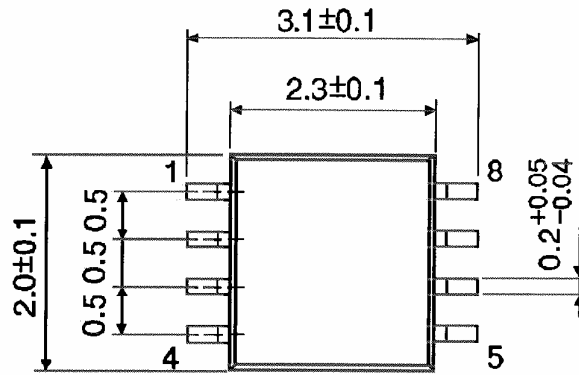


Weight: 0.021 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

RESTRICTIONS ON PRODUCT USE

20070701-EN GENERAL

- The information contained herein is subject to change without notice.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc.
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document shall not be used or embedded to any downstream products of which manufacture, use and/or sale are prohibited under any applicable laws and regulations.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patents or other rights of TOSHIBA or the third parties.
- Please contact your sales representative for product-by-product details in this document regarding RoHS compatibility. Please use these products in this document in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances. Toshiba assumes no liability for damage or losses occurring as a result of noncompliance with applicable laws and regulations.