

## TLC2262, TLC2264

## 先进的 LinCMOS™ 满电源幅度运算放大器

## 一、概述

## 1.1 一般说明

TLC2262 和 TLC2264 是德州仪器公司生产的双和四路运算放大器。这两种器件在单电源或分裂电源的应用中具有满电源幅度输出的性能以满足较大动态范围的要求。TLC226X 系列在 TLC225X 的微功率和 TLC227X 的交流性能方面提供一种兼顾性。它可在电池供电应用时消耗较低的电源电流而仍然具有足够好的交流性能。噪声性能已经较以前生产的 CMOS 放大器具有显著的改进。图 1 示出这种放大器噪声电压的低电平。每个放大器的电源电流只有 200  $\mu$  A (典型值)。

呈现高输入阻抗和低噪声的 TLC226X 极适合压电传感器之类高阻抗的小信号源条件。由于低功率损耗, 这些器件在手持监视和遥感应用中工作良好。另外, 单电源或分离电源的满电源幅度输出特性使这些器件在直接同 ADC 接口时成为重要的选择。TLC226XA 系列可以用于精密应用, 它的输入偏置电压最小为 950  $\mu$  V。在 5V 和  $\pm$  5V 电源电压时该系列可发挥其全部特性。

TLC2262/4 也是 TLC27M2/L4 或 TS27M2/L4 标准产品的重大升级。它们提供较大的输出动态范围, 低噪声电压和低输入偏置电压。这些特性的提高使它们有较宽的应用范围。对于需要较大的输出驱动和较宽的输入范围的应用, 请见 TLV2432 和 TLV2442。如果你的设计需要单放大器请见 TLV2211/21/31 系列。这些器件是单个的满电源幅度运算放大器, 以 SOT-23 封装。它们的小尺寸和低功耗, 使它们应用在电池供电的体积紧凑的仪器中是理想的。

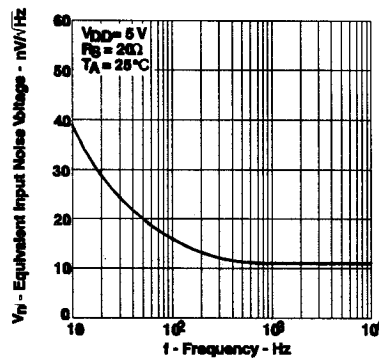


图 1 等效输入噪声电压与频率的关系

## TLC2262 可选项

TA	25 °C时 V <sub>DMAX</sub>	已封装器件						芯片形式 (Y)
		小型(D)	芯片载体(FK)	陶瓷DIP(J)	塑料DIP(P)	TSSOP(PW)	陶瓷平面封装(U)	
0 °C至70 °C	2.5mV	TLC2262CD	—	—	TLC2262CP	TLC2262CPWLE	—	TLC2262Y
-40 °C至125 °C	950 $\mu$ V	TLC2262AID	—	—	TLC2262AIP	TLC2262AIPWLE	—	
	2.5mV	TLC2262ID	—	—	TLC2262IP	—	—	
-55 °C至125 °C	950 $\mu$ V	—	TLC2262AMFK	TLC2262AMJG	—	—	TLC2262AMU	
	2.5mV	—	TLC2262MFK	TLC2262MJG	—	—	TLC2262MU	

D 封装在运输中可捆扎与卷绕。在器件型号加后缀 R (如 TLC2262CDR)。PW 封装仅适用于左端捆扎与卷绕。芯片在 25 °C 下测试。

## TLC2264 可选项

TA	25 °C时 V <sub>DMAX</sub>	已封装器件						芯片形式 (Y)
		小型(D)	芯片载体(FK)	陶瓷DIP(J)	塑料DIP(N)	TSSOP(PW)	陶瓷平面封装(W)	
0 °C至70 °C	2.5mV	TLC2264CD	—	—	TLC2264CN	TLC2264CPWLE	—	-----
-40 °C至125 °C	950 $\mu$ V	TLC2264AID	—	—	TLC2264AIN	TLC2264AIPWLE	—	
	2.5mV	TLC2264ID	—	—	TLC2264IN	—	—	

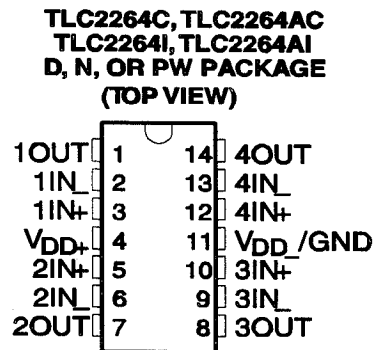
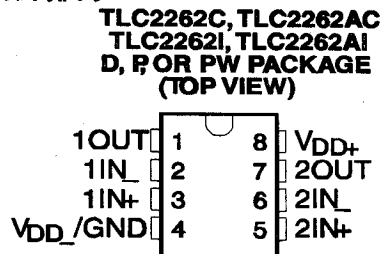
-55 °C 至 125 °C	950 $\mu$ V 2.5mV	— —	TLC2264AMFK TLC2264MFK	TLC2264AMJ TLC2264MJ	— —	— —	TLC2264AMW TLC2264MW
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D 封装在运输中可捆扎与卷绕。在器件型号加后缀 R（如 TLC2264CDR）。PW 封装仅适用于左端捆扎与卷绕。芯片在 25 °C 下测试。

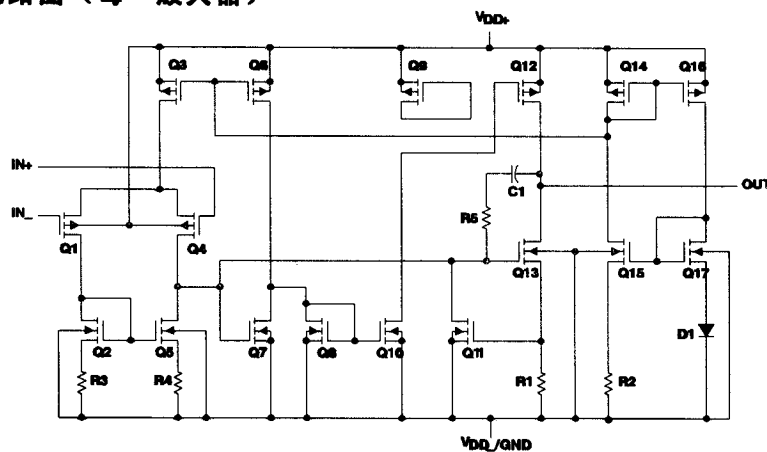
## 1.2 特点

- 输出摆幅包含两端电源电压
- 低噪声 典型值  $12\text{nV}/\sqrt{\text{Hz}}$ ， $f=1\text{kHz}$  时
- 低输入偏置电流 典型值  $1\text{pA}$
- 完全适合单电源和分离电源工作
- 低功率 最大  $500\ \mu\text{A}$
- 共模输入电压范围包含负电源电压
- 低输入失调电压 最大  $950\ \mu\text{A}$ ， $T_A=25\ ^\circ\text{C}$  时（TLC2262A）
- 包含宏模型
- 是 TS27M2/L4 和 TLC27M2/L4 的升级

## 1.3 引脚排列



## 1.4 等效电路图（每一放大器）



## 二、特性

### 2.1 自然通风工作温度范围内的极限参数（除非另有说明）+

电源电压 $V_{DD+}$ （见注 1）	8V
电源电压 $V_{DD-}$ （见注 1）	-8V
差分输入电压 $V_{ID}$ （见注 2）	$\pm 16\text{V}$
输入电压 $V_I$ （任何输入，见注 1）	$V_{DD-} - 0.3\text{V}$ 至 $V_{DD+}$
输入电流 $I_I$ （每个输入）	$\pm 5\text{mA}$
输出电流 $I_O$	$\pm 50\text{mA}$
流入 $V_{DD+}$ 的总电流	$\pm 50\text{mA}$
流出 $V_{DD-}$ 的总电流	$\pm 50\text{mA}$
25 °C（或以下）的短路电流期限（见注 3）	无限制

连续总功耗

自然通风工作温度范围  $T_A$ : C 后缀  
I 后缀  
M 后缀

存贮温度范围

引线温度, 距外壳 1.6mm (1/16 英寸), 10 秒

+ 强度超出所列的极限参数可能导致器件的永久性损坏。这些仅仅是极限参数, 并不意味着在极限参数条件或在任何其它超出推荐工作条件下所示参数的情况下器件能有效工作。延长在极限参数条件下的工作时间会影响器件的可靠性。

注: 1. 除差分电压外, 所有电压值都是对  $V_{DD+}$  和  $V_{DD-}$  的中点而言。2. 差分电压对  $IN-$  而言是  $IN+$ 。如果输入低于  $V_{DD-} - 0.3V$ , 则有过量电流流过。

3. 输出可短路到每一电源。温度和 (或) 电源电压必须限制, 以确保最大额定功耗不被超过。

见额定功耗表

0 °C 至 70 °C

-40 °C 至 125 °C

-55 °C 至 125 °C

-65 °C 至 150 °C

260 °C

## 2.2 推荐工作条件

	C SUFFIX		I SUFFIX		UNIT
	MIN	MAX	MIN	MAX	
Supply voltage, $V_{DD+}$	±2.2	±8	±2.2	±8	V
Input voltage range, $V_I$	$V_{DD-}$	$V_{DD+} - 1.5$	$V_{DD-}$	$V_{DD+} - 1.5$	V
Common-mode input voltage, $V_{IC}$	$V_{DD-}$	$V_{DD+} - 1.5$	$V_{DD-}$	$V_{DD+} - 1.5$	V
Operating free-air temperature, $T_A$	0	70	-40	125	°C

## 2.3 电特性和工作特性

### 2.3.1 TLC2262C 的特性

1. TLC2262C 规定自然通风温度下的电特性,  $V_{DD} = 5V$  (除非另有说明)

PARAMETER	TEST CONDITIONS	$T_A^†$	TLC2262C			UNIT
			MIN	TYP	MAX	
$V_{IO}$ Input offset voltage		25°C	300	2500		$\mu V$
		Full range		3000		
$\alpha_{VIO}$ Temperature coefficient of input offset voltage		25°C to 70°C		2		$\mu V/°C$
		Input of test voltage long-term drift (see Note 4)	$V_{IC} = 0$ , $V_{IO} = 0$ , $V_{DD\pm} = \pm 2.5 V$ , $R_S = 50 \Omega$	25°C	0.003	
$I_{IO}$ Input offset current		25°C		0.5		$pA$
		Full range		100		
$I_{IB}$ Input bias current		25°C		1		$pA$
		Full range		100		
$V_{ICR}$ Common-mode input voltage range	$R_S = 50 \Omega$ , $ M_O  \leq 5 mV$	25°C	0 to 4	-0.3 to 4.2		V
		Full range	0 to 3.5			
$V_{OH}$ High-level output voltage	$I_{OH} = -20 \mu A$ $I_{OH} = -100 \mu A$ $I_{OH} = -400 \mu A$	25°C		4.99		V
		25°C	4.85	4.94		
		Full range	4.82			
		25°C	4.70	4.85		
$V_{OL}$ Low-level output voltage	$V_{IC} = 2.5 V$ , $I_{OL} = 50 \mu A$ $V_{IC} = 2.5 V$ , $I_{OL} = 500 \mu A$ $V_{IC} = 2.5 V$ , $I_{OL} = 1 mA$ $V_{IC} = 2.5 V$ , $I_{OL} = 4 mA$	25°C		0.01		V
		25°C	0.09	0.15		
		Full range		0.15		
		25°C	0.2	0.3		
$A_{VD}$ Large-signal differential voltage amplification	$V_{IC} = 2.5 V$ , $V_{IO} = 1 V$ to 4 V $R_L = 50 k\Omega^+$ $R_L = 1 M\Omega^+$	25°C	80	170		V/mV
		Full range	55			
$\eta(d)$ Differential input resistance		25°C		$10^2$		$\Omega$
$\eta(c)$ Common-mode input resistance		25°C		$10^2$		$\Omega$
$C(c)$ Common-mode input capacitance	$f = 10 kHz$ , P package	25°C		8		pF
$Z_o$ Closed-loop output impedance	$f = 100 kHz$ , $A_V = 10$	25°C		240		$\Omega$
CMRR Common-mode rejection ratio	$V_{IC} = 0$ to 2.7 V, $V_{IO} = 2.5 V$ , $R_S = 50 \Omega$	25°C	70	83		dB
		Full range	70			
KSVR Supply-voltage rejection ratio ( $\Delta V_{DD}/\Delta V_{IC}$ )	$V_{DD} = 4.4 V$ to 16 V $V_{IC} = V_{DD}/2$ , No load	25°C	80	95		dB
		Full range	80			
$I_{DD}$ Supply current	$V_{IO} = 2.5 V$ , No load	25°C		400	500	$\mu A$
		Full range			500	

+ 全范围为 0 °C 至 70 °C。      卅 以 2.5V 为基准。

注：4. 典型值是基于在  $T_A=150\text{ }^\circ\text{C}$  下通过 500 小时工作寿命试验观察到的输入失调电压漂移，用 Arrhenius 方程并假设驱动能量为 0.96 电子伏特而外推到  $T_A=25\text{ }^\circ\text{C}$ 。

## 2. TLC2262C 规定自然通风温度下的工作特性, $V_{DD}=5V$

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLC2262C			UNIT
			MIN	TYP	MAX	
SR	Stew rate at unity gain $V_O=1.5V$ to $3.5V$ , $R_L=50k\Omega$ , $C_L=100pF$	25°C	0.35	0.55		$V/\mu s$
		Full range	0.3			
$V_n$	Equivalent input noise voltage $f=10\text{ Hz}$ $f=1\text{ kHz}$	25°C		40		$nV/\sqrt{Hz}$
		25°C		12		
$V_N(PP)$	Peak-to-peak equivalent input noise voltage $f=0.1\text{ Hz}$ to $1\text{ Hz}$ $f=0.1\text{ Hz}$ to $10\text{ Hz}$	25°C		0.7		$\mu V$
		25°C		1.3		
$I_n$	Equivalent input noise current	25°C		0.6		$fA/\sqrt{Hz}$
THD+N	Total harmonic distortion plus noise $V_O=0.5V$ to $2.5V$ $f=20\text{ kHz}$ $R_L=50k\Omega$	25°C	$A_V=1$ $A_V=10$	0.017%		
				0.03%		
	Gain-bandwidth product $f=10\text{ kHz}$ $C_L=100pF$	25°C		0.71		MHz
BOM	Maximum output-swing bandwidth $V_O(PP)=2V$ $R_L=50k\Omega$	25°C		186		kHz
$t_s$	Settling time $A_V=-1$ , Step = $0.5V$ to $2.5V$ $R_L=50k\Omega$ $C_L=100pF$	25°C	To 0.1%	64		$\mu s$
			To 0.01%	141		
$\phi_m$	Phase margin at unity gain Gain margin	25°C		56°		dB
		25°C		11		

+ 全范围为 0 °C 至 70 °C。      卅 以 2.5V 为基准。

## 3. TLC2262C 规定自然通风温度下的电特性, $V_{DD}=\pm 5V$ (除非另有说明)

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	TLC2262C			UNIT
			MIN	TYP	MAX	
$V_{IO}$	Input offset voltage	25°C		300	2500	$\mu V$
		Full range		300		
$\alpha_{VIO}$	Temperature coefficient of input offset voltage	25°C to 70°C		2		$\mu V/^\circ C$
	Input offset voltage long-term drift (see Note 4)	25°C		0.003		$\mu V/mo$
$I_{IO}$	Input offset current	25°C		0.5		pA
		Full range		100		
$I_{IB}$	Input bias current	25°C		1		pA
		Full range		100		
$V_{ICR}$	Common-mode input voltage range	25°C	-5 to 4	-5.3 to 4.2		V
		Full range	-5 to 3.5			
$V_{OM+}$	Maximum positive peak output voltage	25°C		4.99		V
		25°C		4.85	4.94	
		Full range		4.82		
		25°C		4.7	4.85	
$V_{OM-}$	Maximum negative peak output voltage	25°C		-4.99		V
		25°C		-4.85	-4.91	
		Full range		-4.85		
		25°C		-4.7	-4.8	
		Full range		-4.7		
		25°C		-4	-4.3	
$A_{VD}$	Large-signal differential voltage amplification $V_O=\pm 4V$	25°C		80	200	V/mV
		Full range		55		
$r_{i(d)}$	Differential input resistance	25°C		10 <sup>12</sup>		$\Omega$
$r_{i(c)}$	Common-mode input resistance	25°C		10 <sup>12</sup>		$\Omega$
$C_{i(c)}$	Common-mode input capacitance	25°C		8		pF
$Z_o$	Closed-loop output impedance	25°C		220		$\Omega$
CMRR	Common-mode rejection ratio $V_{IC}=-5V$ to $2.7V$ $V_O=0V$ , $R_S=50\Omega$	25°C		75	88	dB
		Full range		75		
$^kSVR$	Supply-voltage rejection ratio ( $\Delta V_{DD}/\Delta V_O$ ) $V_{DD}=\pm 2.2V$ to $\pm 8V$ $V_{IC}=0$ , No load	25°C		80	95	dB
		Full range		80		
$I_{DD}$	Supply current $V_O=0V$ , No load	25°C		425	500	$\mu A$
		Full range		500		

+ 全范围为 0 °C 至 70 °C。

注：4. 典型值是基于在  $T_A=150\text{ }^\circ\text{C}$  下通过 500 小时工作寿命试验观察到的输入失调电压漂移，用 Arrhenius 方程并假设驱动能量为 0.96 电子伏特而外推到  $T_A=25\text{ }^\circ\text{C}$ 。

4. TLC2262C 规定自然通风温度下的工作特性,  $V_{DD} = \pm 5V$ 

PARAMETER	TEST CONDITIONS	T <sub>A</sub> <sup>†</sup>	TLC2262C			UNIT
			MIN	TYP	MAX	
SR Slew rate at unity gain	V <sub>O</sub> = ±1.9 V Q <sub>L</sub> = 100 pF R <sub>L</sub> = 50 kΩ	25°C	0.35	0.55		V/μs
		Full range	0.3			
V <sub>n</sub> Equivalent input noise voltage	f = 10 Hz	25°C		43		nV/√Hz
	f = 1 kHz	25°C		12		
V <sub>N(PP)</sub> Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz	25°C		0.8		μV
	f = 0.1 Hz to 10 Hz	25°C		1.3		
I <sub>n</sub> Equivalent input noise current		25°C		0.6		fA/√Hz
THD+N Total harmonic distortion pulse duration	V <sub>O</sub> = ±2.3 V f = 2.0 kHz R <sub>L</sub> = 50 kΩ	A <sub>V</sub> = 1 A <sub>V</sub> = 10	25°C		0.014%	
			25°C		0.024%	
Gain-bandwidth product	f = 10 kHz Q <sub>L</sub> = 100 pF	R <sub>L</sub> = 50 kΩ	25°C		0.73	MHz
BOM Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 4.6 V R <sub>L</sub> = 50 kΩ	A <sub>V</sub> = 1 C <sub>L</sub> = 100 pF	25°C		85	kHz
t <sub>s</sub> Settling time	A <sub>V</sub> = -1, Step = -2.3 V to 2.3 V R <sub>L</sub> = 50 kΩ Q <sub>L</sub> = 100 pF	To 0.1% To 0.01%	25°C		7.1	μs
			25°C		165	
φ <sub>m</sub> Phase margin at unity gain	R <sub>L</sub> = 50 kΩ	Q <sub>L</sub> = 100 pF	25°C		57°	dB
Gain margin			25°C		11	

+ 全范围为 0 °C 至 70 °C。

## 2.3.2 TLC2264C 的特性

1. TLC2264C 规定自然通风温度下的电特性,  $V_{DD} = 5V$  (除非另有说明)

PARAMETER	TEST CONDITIONS	T <sub>A</sub> <sup>†</sup>	TLC2264C			UNIT
			MIN	TYP	MAX	
V <sub>IO</sub> Input offset voltage		25°C		300	2500	μV
		Full range			3000	
α <sub>VIO</sub> Temperature coefficient of input offset voltage		25°C to 70°C		2		μV/°C
Input of test voltage long-term drift (see Note 4)	V <sub>IC</sub> = 0, V <sub>O</sub> = 0, V <sub>DD</sub> = ±2.5 V, R <sub>S</sub> = 50 Ω	25°C		0.003		μV/mo
I <sub>IO</sub> Input offset current		25°C		0.5		pA
		Full range			100	
I <sub>IB</sub> Input bias current		25°C		1		pA
		Full range			100	
V <sub>ICR</sub> Common-mode input voltage range	R <sub>S</sub> = 50 Ω,  M <sub>QI</sub>   ≤ 5 mV	25°C	0 to 4	-0.3 to 4.2		V
		Full range	0 to 3.5			
V <sub>OH</sub> High-level output voltage	I <sub>OH</sub> = -20 μA	25°C		4.99		V
	I <sub>OH</sub> = -100 μA	25°C		4.85	4.94	
	I <sub>OH</sub> = -400 μA	25°C		4.70	4.85	
		Full range		4.60		
V <sub>OL</sub> Low-level output voltage	V <sub>IC</sub> = 2.5 V, I <sub>OL</sub> = 50 μA	25°C		0.01		V
	V <sub>IC</sub> = 2.5 V, I <sub>OL</sub> = 500 μA	25°C		0.09	0.15	
		Full range			0.15	
	V <sub>IC</sub> = 2.5 V, I <sub>OL</sub> = 1 mA	25°C		0.2	0.3	
		Full range			0.3	
	V <sub>IC</sub> = 2.5 V, I <sub>OL</sub> = 4 mA	25°C		0.7	1	
		Full range			1.2	
A <sub>VD</sub> Large-signal differential voltage amplification	V <sub>IC</sub> = 2.5 V V <sub>O</sub> = 1 V to 4 V	R <sub>L</sub> = 50 kΩ <sup>†</sup> R <sub>S</sub> = 1 M Ω <sup>†</sup>	25°C	80	170	V/mV
			Full range	55		
ℓ <sub>i(d)</sub> Differential input resistance		25°C		10 <sup>12</sup>		Ω
ℓ <sub>i(c)</sub> Common-mode input resistance		25°C		10 <sup>12</sup>		Ω
C <sub>i(c)</sub> Common-mode input capacitance	f = 10 kHz, N package	25°C		8		pF
Z <sub>o</sub> Closed-loop output impedance	f = 100 kHz, A <sub>V</sub> = 10	25°C		240		Ω
CMRR Common-mode rejection ratio	V <sub>IC</sub> = 0 to 2.7 V R <sub>S</sub> = 50 Ω, V <sub>O</sub> = 2.5 V	25°C		70	83	dB
		Full range		70		
KS <sub>VR</sub> Supply-voltage rejection ratio (ΔV <sub>DD</sub> /ΔV <sub>O</sub> )	V <sub>DD</sub> = 4.4 V to 16 V V <sub>IC</sub> = V <sub>DD</sub> /2, No load	25°C		80	95	dB
		Full range		80		
I <sub>DD</sub> Supply current	V <sub>O</sub> = 2.5 V, No load	25°C		0.8	1	mA
		Full range		1		

+ 全范围为 0 °C 至 70 °C。 † 以 2.5V 为基准。

注：4. 典型值是基于在 T<sub>A</sub> = 150 °C 下通过 500 小时工作寿命试验观察到的输入失调电压漂移，用 Arrhenius 方程并假设驱动能量为 0.96 电子伏特而外推到 T<sub>A</sub> = 25 °C。

2. TLC2264C 规定自然通风温度下的工作特性,  $V_{DD}=5V$ 

PARAMETER	TEST CONDITIONS	T <sub>A</sub> <sup>†</sup>	TLC2264C			UNIT
			MIN	TYP	MAX	
SR Slew rate at unity gain	$V_O=1.4V \pm 0.2\Delta V$ , $R_L=50k\Omega$ , $C_L=100pF$	25°C	0.35	0.55		V/ $\mu s$
		Full range	0.3			
V <sub>n</sub> Equivalent input noise voltage	f = 10 Hz	25°C	40			nV/Hz
	f = 1 kHz	25°C	12			
V <sub>n(PP)</sub> Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz	25°C	0.7			$\mu V$
	f = 0.1 Hz to 10 Hz	25°C	1.3			
I <sub>n</sub> Equivalent input noise current		25°C	0.6			fA/Hz
THD+N Total harmonic distortion plus noise	$V_O=0.5V$ to $2.5V$ , f=20 kHz, $R_L=50k\Omega$	A <sub>v</sub> = 1	0.017%			
		A <sub>v</sub> = 10	0.03%			
Gain-bandwidth product	f = 10 kHz, $C_L=100pF$	$R_L=50k\Omega$ , 25°C	0.71			MHz
BOM Maximum output-swing bandwidth	$V_O(PP)=2V$ , $R_L=50k\Omega$	A <sub>v</sub> = 1, $C_L=100pF$ , 25°C	185			kHz
t <sub>s</sub> Settling time	A <sub>v</sub> = -1, Step = 0.5 V to 2.5 V, $R_L=50k\Omega$ , $C_L=100pF$	To 0.1%	64			$\mu s$
		To 0.01%	141			
$\phi_m$ Phase margin at unity gain	$R_L=50k\Omega$ , $C_L=100pF$	25°C	56°			dB
		25°C	11			

+ 全范围为 0 °C 至 70 °C。 ‡ 以 2.5V 为基准。

3. TLC2264C 规定自然通风温度下的电特性,  $V_{DD} = \pm 5V$  (除非另有说明)

PARAMETER	TEST CONDITIONS	T <sub>A</sub> <sup>†</sup>	TLC2264C			UNIT	
			MIN	TYP	MAX		
V <sub>IO</sub> Input offset voltage	$V_C=0$ , $R_B=50\Omega$ , $V_O=0$	25°C	300	2500		$\mu V$	
$\alpha/V_O$ Temperature coefficient of input offset voltage		Full range	3000				
Input offset voltage long-term drift (see Note 4)		25°C to 70°C	25°C	2			$\mu V/^\circ C$
		25°C	25°C	0.003			
I <sub>IO</sub> Input offset current	$V_C=0$ , $R_B=50\Omega$	25°C	0.5			pA	
I <sub>IB</sub> Input bias current		Full range	100				
		25°C	25°C	1			pA
Full range		Full range	100				
V <sub>ICR</sub> Common-mode input voltage range	M <sub>Q1</sub>   ≤ 5mV, $R_B=50\Omega$	25°C	-5 to 4	-5.3 to 4.2		V	
		Full range	-5 to 3.5				
V <sub>OM+</sub> Maximum positive peak output voltage	$I_O=-20\mu A$ , $I_O=-100\mu A$ , $I_O=-400\mu A$	25°C	4.99			V	
		25°C	4.85				
		Full range	4.82				
		25°C	4.7				
V <sub>OM-</sub> Maximum negative peak output voltage	$V_C=0$ , $I_O=50\mu A$	25°C	-4.99			V	
		25°C	-4.85				
	Full range	-4.85					
	$V_C=0$ , $I_O=500\mu A$	25°C	-4.7				
		25°C	-4.8				
	$V_C=0$ , $I_O=1mA$	Full range	-4.7				
25°C		-4					
$V_C=0$ , $I_O=4mA$	Full range	-4.3					
	Full range	-3.8					
A <sub>V(D)</sub> Large-signal differential voltage amplification	$V_O=\pm 4V$ , $R_L=50k\Omega$ , $R_L=1M\Omega$	25°C	80	200		V/mV	
		Full range	55				
r <sub>i(d)</sub> Differential input resistance		25°C	1000			$\Omega$	
r <sub>i(c)</sub> Common-mode input resistance		25°C	10 <sup>12</sup>			$\Omega$	
C <sub>i(c)</sub> Common-mode input capacitance	f = 10 kHz, P package	25°C	8			pF	
Z <sub>o</sub> Closed-loop output impedance	f = 100 kHz, A <sub>v</sub> = 10	25°C	220			$\Omega$	
CMRR Common-mode rejection ratio	$V_C=-5V$ to $2.7V$ , $V_O=0V$ , $R_B=50\Omega$	25°C	75	88		dB	
		Full range	75				
K <sub>SVR</sub> Supply-voltage rejection ratio ( $\Delta V_{ODS}/\Delta V_C$ )	$V_{DD}=\pm 2.2V$ to $\pm 8V$ , $V_C=0$ , No load	25°C	80	95		dB	
		Full range	80				
I <sub>DD</sub> Supply current	$V_O=0V$ , No load	25°C	0.85	1		$\mu A$	
		Full range	1				

+ 全范围为 0 °C 至 70 °C。

注：4. 典型值是基于在 T<sub>A</sub>=150 °C 下通过 500 小时工作寿命试验观察到的输入失调电压漂移，用 Arrhenius 方程并假设驱动能量为 0.96 电子伏特而外推到 T<sub>A</sub>=25 °C。

4. TLC2264C 规定自然通风温度下的工作特性,  $V_{DD} = \pm 5V$ 

PARAMETER	TEST CONDITIONS	$T_A^{\dagger}$	TLC2264C			UNIT
			MIN	TYP	MAX	
SR Slew rate at unity gain	$V_O = \pm 1.9V$ $Q_L = 100pF$ $R_L = 50k\Omega$	25°C Full range	0.35	0.55	0.3	V/ $\mu s$
$V_n$ Equivalent input noise voltage	$f = 10Hz$ $f = 1kHz$	25°C 25°C		43		nV/Hz
$V_n(PP)$ Peak-to-peak equivalent input noise voltage	$f = 0.1Hz$ to 1 Hz $f = 0.1Hz$ to 10 Hz	25°C 25°C		0.8		$\mu V$
$I_n$ Equivalent input noise current		25°C		0.6		fA/Hz
THD+N Total harmonic distortion pulse duration	$V_O = \pm 2.3V$ $f = 20kHz$ $R_L = 50k\Omega$	$A_V = 1$ 25°C		0.014%		
Gain-bandwidth product	$f = 10kHz$ $Q_L = 100pF$	$R_L = 50k\Omega$ 25°C		0.73		MHz
BOM Maximum output-swing bandwidth	$V_O(PP) = 4.8V$ $R_L = 50k\Omega$	$A_V = 1$ $C_L = 100pF$ 25°C		85		kHz
$t_s$ Settling time	$A_V = -1$ Step = -2.3V to 2.3V $R_L = 50k\Omega$ $Q_L = 100pF$	To 0.1% To 0.01% 25°C		7.1		$\mu s$
$\phi_m$ Phase margin at unity gain	$R_L = 50k\Omega$	$Q_L = 100pF$ 25°C		57°		
Gain margin		25°C		11		dB

+ 全范围为 0 °C 至 70 °C。

## 2.3.3 TLC2262I 的特性

1. TLC2262I 规定自然通风温度下的电特性,  $V_{DD} = 5V$  (除非另有说明)

PARAMETER	TEST CONDITIONS	$T_A^{\dagger}$	TLC2262I			TLC2262AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
$V_{IO}$ Input offset voltage		25°C Full range	300	2500	3000	300	950	1500	$\mu V$
$\Delta V_{IO}$ Temperature coefficient of input offset voltage		25°C to 85°C	2			2			$\mu V/^\circ C$
Input offset voltage long-term drift (see Note 4)	$V_{DD} = \pm 2.5V$ $V_O = 0$ $V_{IC} = 0$ $R_S = 50\Omega$	25°C	0.003			0.003			$\mu V/mo$
$I_{IO}$ Input offset current		25°C Full range	0.5	500	500	0.5	500	500	PA
$I_{IB}$ Input bias current		25°C Full range	1	500	500	1	500	500	PA
$V_{ICR}$ Common-mode input voltage range	$R_S = 50\Omega$ $ V_{IO}  \leq 5mV$	25°C Full range	0 to 4	-0.3 to 4.2	0 to 4	0 to 4	-0.3 to 4.2	0 to 4	V
$V_{OH}$ High-level output voltage	$I_{OH} = -20\mu A$ $I_{OH} = -100\mu A$ $I_{OH} = -400\mu A$	25°C 25°C Full range	4.88	4.84	4.82	4.88	4.84	4.82	V
$V_{OL}$ Low-level output voltage	$V_{IC} = 2.5V$ , $I_{OL} = 50\mu A$ $V_{IC} = 2.5V$ , $I_{OL} = 500\mu A$ $V_{IC} = 2.5V$ , $I_{OL} = 4mA$	25°C 25°C Full range	0.01	0.09	0.15	0.01	0.09	0.15	V
$A_{VD}$ Large-signal differential voltage amplification	$V_{IC} = 2.5V$ $V_O = 1V$ to 4V $R_L = 50k\Omega^{\ddagger}$ $R_L = 1M\Omega^{\ddagger}$	25°C Full range	80	100	50	80	170	550	V/mV
$r_i(d)$ Differential input resistance		25°C	10 <sup>12</sup>			10 <sup>12</sup>			$\Omega$
$r_i(c)$ Common-mode input resistance		25°C	10 <sup>12</sup>			10 <sup>12</sup>			$\Omega$
$C_i(c)$ Common-mode input capacitance	$f = 10kHz$ , P package	25°C	8			8			pF
$Z_o$ Closed-loop output impedance	$f = 100kHz$ , $A_V = 10$	25°C	240			240			$\Omega$
CMRR Common-mode rejection ratio	$V_{IC} = 0$ to 2.7V, $V_O = 2.5V$ $R_S = 50\Omega$	25°C Full range	70	83	70	70	83	70	dB
$\psi_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{DD}/\Delta V_O$ )	$V_{DD} = 4.4V$ to 16V $V_{IC} = V_{DD}/2$ , No load	25°C Full range	80	95	80	80	95	80	dB
$I_{DD}$ Supply current	$V_O = 2.5V$ , No load	25°C Full range	400	500	500	400	500	500	$\mu A$

+ 全范围为 -40 °C 至 125 °C。 † 以 2.5V 为基准。

注：4. 典型值是基于在  $T_A = 150^\circ C$  下通过 500 小时工作寿命试验观察到的输入失调电压漂移，用 Arrhenius 方程并假设驱动能量为 0.96 电子伏特而外推到  $T_A = 25^\circ C$ 。

2. TLC2262I 规定自然通风温度下的工作特性,  $V_{DS} = 5V$

PARAMETER	TEST CONDITIONS	T <sub>A</sub> <sup>†</sup>	TLC2262I			TLC2262AI			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
SR	Slew rate at unity gain	$V_O = 1.5V$ to $3.5V$ , $R_L = 50k\Omega$ <sup>†</sup> , $C_L = 100 pF$ <sup>†</sup>	25°C	035	055	035	055		V/μs	
V <sub>n</sub>	Equivalent input noise voltage	$f = 10 Hz$	25°C		40		40		nV/√Hz	
		$f = 1 kHz$	25°C		12		12			
V <sub>n(PP)</sub>	Peak-to-peak equivalent input noise voltage	$f = 0.1 Hz$ to $1 Hz$	25°C		0.7		0.7		μV	
		$f = 0.1 Hz$ to $10 Hz$	25°C		1.3		1.3			
I <sub>n</sub>	Equivalent input noise current		25°C		0.6		0.6		fA/√Hz	
THD+N	Total harmonic distortion plus noise	$V_O = 0.5 V$ to $2.5 V$ , $f = 20 kHz$ , $R_L = 50 k\Omega$ <sup>†</sup>	25°C	$A_V = 1$		0.017%		0.017%		
		$A_V = 10$		0.03%		0.03%				
	Gain-bandwidth product	$f = 50 kHz$ , $C_L = 100 pF$ <sup>†</sup> , $R_L = 50 k\Omega$ <sup>†</sup>	25°C			082		082		MHz
BOM	Maximum output-swinging bandwidth	$V_O(PP) = 2 V$ , $R_L = 50 k\Omega$ <sup>†</sup>	25°C			185		185		kHz
t <sub>s</sub>	Settling time	$A_V = -1$ , Step = $0.5 V$ to $2.5 V$ , $R_L = 50 k\Omega$ <sup>†</sup> , $C_L = 100 pF$ <sup>†</sup>	25°C	To 0.1%		64		64		μs
				To 0.01%		141		141		
φ <sub>m</sub>	Phase margin at unity gain	$R_L = 50 k\Omega$ <sup>†</sup> , $C_L = 100 pF$ <sup>†</sup>	25°C			56°		56°		
	Gain margin		25°C			11		11		dB

+ 全范围为 -40 °C 至 125 °C。 † 以 2.5V 为基准。

3. TLC2262I 规定自然通风温度下的电特性,  $V_{DS} = \pm 5V$  (除非另有说明)

PARAMETER	TEST CONDITIONS	T <sub>A</sub> <sup>†</sup>	TLC2262I			TLC2262AI			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V <sub>IO</sub>	Input offset voltage	$V_{IC} = 0$ , $V_O = 0$ , $R_S = 50\Omega$	25°C	300	2500	300	950		μV	
α <sub>VIO</sub>	Temperature coefficient of input offset voltage		25°C to 85°C	2			2			μV/°C
	Input offset voltage long-term drift (see Note 4)		25°C	0.003			0.003			μV/mo
I <sub>IO</sub>	Input offset current		25°C	0.5			0.5			pA
I <sub>IB</sub>	Input bias current		25°C	1			1			pA
			Full range	500			500			
V <sub>ICR</sub>	Common-mode input voltage range	$R_S = 50\Omega$ , $ M_{CI}  \leq 5mV$	25°C	-5 to 4	-5.3 to 4.2	-5 to 4	-5.3 to 4.2		V	
			Full range	-5 to 3.5	-5 to 3.5	-5 to 3.5	-5 to 3.5			
V <sub>OM+</sub>	Maximum positive peak output voltage	$I_O = -20\mu A$	25°C	4.99			4.99			V
		$I_O = -100\mu A$	25°C	4.85			4.85			
		$I_O = -400\mu A$	25°C	4.82			4.82			
		Full range	25°C	4.7			4.7			
V <sub>OM-</sub>	Maximum negative peak output voltage	$V_{IC} = 0$ , $I_O = 50\mu A$	25°C	-4.99			-4.99			V
		$V_{IC} = 0$ , $I_O = 500\mu A$	25°C	-4.85			-4.85			
		$V_{IC} = 0$ , $I_O = 4mA$	25°C	-4			-4			
		Full range	25°C	-3.8			-3.8			
A <sub>VD</sub>	Largest signal differential voltage amplification	$V_O = \pm 4V$ , $R_L = 50k\Omega$	25°C	80		200		80		V/mV
		$R_L = 1M\Omega$	25°C	50		50		50		
			25°C	1000		1000		1000		
ℓ <sub>i(d)</sub>	Differential input resistance		25°C	10 <sup>12</sup>			10 <sup>12</sup>			Ω
ℓ <sub>i(c)</sub>	Common-mode input resistance		25°C	10 <sup>12</sup>			10 <sup>12</sup>			Ω
Q <sub>i(c)</sub>	Common-mode input capacitance	$f = 10 kHz$ , Ppackage	25°C	8			8			pF
Z <sub>o</sub>	Closed-loop output impedance	$f = 100 kHz$ , $A_V = 10$	25°C	220			220			Ω
CMRR	Common-mode rejection ratio	$V_{IC} = -5V$ to $2.7V$ , $V_O = 0$ , $R_S = 50\Omega$	25°C	75		88		75		dB
		Full range	25°C	75		75		75		
K <sub>SVR</sub>	Supply-voltage rejection ratio (ΔV <sub>DD</sub> /ΔV <sub>IO</sub> )	$V_{DD} = 4.4V$ to $16V$ , $V_{IC} = V_{DD}/2$ No load	25°C	80		95		80		dB
		Full range	25°C	80		80		80		
I <sub>DD</sub>	Supply current	$V_O = 2.5V$ , No load	25°C	425		500		425		μA
		Full range	25°C	500		500		500		

+ 全范围为 -40 °C 至 125 °C。

注：4. 典型值是基于在 T<sub>A</sub> = 150 °C 下通过 500 小时工作寿命试验观察到的输入失调电压漂移，用 Arrhenius 方程并假设驱动能量为 0.96 电子伏特而外推到 T<sub>A</sub> = 25 °C。



4. TLC2262I 规定自然通风温度下的工作特性,  $V_{DD} = \pm 5V$ 

PARAMETER	TEST CONDITIONS	T <sub>A</sub> <sup>†</sup>	TLC2262I			TLC2262AI			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
SR	Slew rate at unity gain $V_O = \pm 1.9V$ , $C_L = 100pF$	$R_L = 50k\Omega$	25°C	0.35	0.55	0.35	0.55		V/ $\mu$ s	
V <sub>n</sub>	Equivalent input noise voltage $f = 1kHz$		25°C	43			43			nV/ $\sqrt{Hz}$
			Full range	0.25			0.25			
V <sub>n(PP)</sub>	Peak-to-peak equivalent input noise voltage $f = 0.1Hz$ to 1 Hz		25°C	0.8			0.8			$\mu$ V
			Full range	1.3			1.3			
I <sub>n</sub>	Equivalent input noise current		25°C	0.6			0.6			nA/ $\sqrt{Hz}$
THD+N	Total harmonic distortion plus noise $V_O = \pm 2.3V$ , $R_L = 50k\Omega$ , $f = 20kHz$	$A_V = 1$ $A_V = 10$	25°C	0.014%			0.014%			
			Full range	0.024%			0.024%			
	Gain-bandwidth product $f = 10kHz$ , $C_L = 100pF$	$R_L = 50k\Omega$	25°C	0.73			0.73			MHz
BOM	Maximum output-swing bandwidth $V_O(PP) = 4.6V$ , $R_L = 50k\Omega$	$A_V = 1$ , $C_L = 100pF$	25°C	85			85			kHz
t <sub>s</sub>	Settling time $A_V = -1$ , Step = -2.3V to 2.3V $R_L = 50k\Omega$ , $C_L = 100pF$	To 0.1% To 0.01%	25°C	7.1			7.1			$\mu$ s
			Full range	185			185			
$\phi_{m}$	Phase margin at unity gain $R_L = 50k\Omega$ , $C_L = 100pF$		25°C	57°			57°			
			Full range	11			11			
	Gain margin		25°C	11			11			dB

+ 全范围为-40℃至125℃。

## 2.3.4 TLC2264I 的特性

1. TLC2264I 规定自然通风温度下的电特性,  $V_{DD} = 5V$  (除非另有说明)

PARAMETER	TEST CONDITIONS	T <sub>A</sub> <sup>†</sup>	TLC2264I			TLC2264AI			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
V <sub>IO</sub>	Input offset voltage		25°C	300	2500	300	950		$\mu$ V	
$\alpha_{VIO}$	Temperature coefficient of input offset voltage		25°C to 85°C	2			2			$\mu$ V/°C
			Full range	3000			1500			
	Input offset voltage long-term drift (see Note 4)		25°C	0.003			0.003			$\mu$ V/mo
I <sub>IO</sub>	Input offset current		25°C	0.5			0.5			nA
			Full range	500			500			
I <sub>IB</sub>	Input bias current		25°C	1			1			nA
			Full range	500			500			
V <sub>CMR</sub>	Common-mode input voltage range	$R_S = 50\Omega$ , $I_{OQ} \leq 5mV$	25°C	0 to 10	-0.3 to 4.2	0 to 10	-0.3 to 4.2		V	
			Full range	0 to 3.5		0 to 3.5				
V <sub>OH</sub>	High-level output voltage	$I_{OH} = -20\mu A$ $I_{OH} = -100\mu A$ $I_{OH} = -400\mu A$	25°C	4.99			4.99			V
			25°C	4.85			4.85			
			Full range	4.82			4.82			
			25°C	4.7			4.7			
V <sub>OL</sub>	Low-level output voltage	$V_{IC} = 2.5V$ , $I_{OL} = 50\mu A$ $V_{IC} = 2.5V$ , $I_{OL} = 500\mu A$ $V_{IC} = 2.5V$ , $I_{OL} = 4mA$	25°C	0.01			0.01			V
			25°C	0.09			0.15			
			Full range	0.15			0.15			
			25°C	0.8			1			
A <sub>VD</sub>	Large-signal differential voltage amplification $V_O = 1V$ to 4V	$R_L = 50k\Omega$ <sup>†</sup> $R_L = 1M\Omega$ <sup>†</sup>	25°C	80	100	80	170		V/mV	
			Full range	50			50			
r <sub>i(d)</sub>	Differential input resistance		25°C	10 <sup>12</sup>			10 <sup>12</sup>			$\Omega$
r <sub>i(c)</sub>	Common-mode input resistance		25°C	10 <sup>12</sup>			10 <sup>12</sup>			$\Omega$
C <sub>i(c)</sub>	Common-mode input capacitance	$f = 10kHz$ , N package	25°C	8			8			pF
Z <sub>o</sub>	Closed-loop output impedance	$f = 100kHz$ , $A_V = 10$	25°C	240			240			$\Omega$
CMRR	Common-mode rejection ratio $V_{IC} = 0$ to 2.7V, $V_O = 2.5V$ $R_S = 50\Omega$		25°C	70	83	70	83		dB	
			Full range	70			70			
KSVR	Supply-voltage rejection ratio (AV <sub>DD</sub> /AV <sub>IC</sub> ) $V_{DD} = 4.4V$ to 1.6V $V_{IC} = V_{DD}/2$ , No load		25°C	80	95	80	95		dB	
			Full range	80			80			
I <sub>DD</sub>	Supply current $V_O = 2.5V$ , No load		25°C	0.8			1			$\mu$ A
			Full range	1			1			

+ 全范围为-40℃至125℃。 † 以2.5V为基准。

注：4. 典型值是基于在 T<sub>A</sub>=150℃下通过500小时工作寿命试验观察到的输入失调电压漂移，用 Arrhenius 方程并假设驱动能量为0.96电子伏特而外推到 T<sub>A</sub>=25℃。

2. TLC2264I 规定自然通风温度下的工作特性,  $V_{DD}=5V$ 

PARAMETER	TEST CONDITIONS	$T_A^1$	TLC2264I			TLC2264AJ			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain $V_O=1.4V$ to $2.6V$ $C_L=100pF^+$	25°C	035	055		035	055		V/μs
		Full range	025			025			
$V_n$	Equivalent input noise voltage $f=10Hz$ $f=1kHz$	25°C		40			40		nV/√Hz
		25°C		12			12		
$V_n(PP)$	Peak-to-peak equivalent input noise voltage $f=0.1Hz$ to $1Hz$ $f=0.1Hz$ to $10Hz$	25°C		0.7			0.7		μV
		25°C		1.3			1.3		
$I_n$	Equivalent input noise current	25°C		0.6			0.6		fA/√Hz
THD+N	Total harmonic distortion plus noise $V_O=0.5V$ to $2.5V$ $f=20kHz$ $R_L=50k\Omega^+$	$A_V=1$	25°C		0.017%			0.017%	
		$A_V=10$	25°C		0.03%			0.03%	
	Gain-bandwidth product $f=50kHz$ $C_L=100pF^+$	$R_L=50k\Omega^+$	25°C		082			082	MHz
BOB	Maximum output-swing bandwidth $V_O(PP)=2V$ $R_L=50k\Omega^+$	$A_V=1$ $C_L=100pF^+$	25°C		185			185	kHz
$t_s$	Settling time $A_V=-1$ Step = $0.5V$ to $2.5V$ $R_L=50k\Omega^+$ $C_L=100pF^+$	To 01%	25°C		64			64	μs
		To 001%	25°C		141			141	
$\phi_m$	Phase margin at unity gain $R_L=50k\Omega^+$	$C_L=100pF^+$	25°C		56°			56°	
			25°C		11			11	
	Gain margin		25°C		11			11	dB

+ 全范围为-40℃至125℃。 ≠ 以2.5V为基准。

3. TLC2264I 规定自然通风温度下的电特性,  $V_{DD}=\pm 5V$  (除非另有说明)

PARAMETER	TEST CONDITIONS	$T_A^1$	TLC2264I			TLC2264AJ			UNIT	
			MIN	TYP	MAX	MIN	TYP	MAX		
$V_{IO}$	Input offset voltage	$V_{IC}=0, V_{OC}=0, R_S=50\Omega$	25°C		300	2500		300	950	μV
$\alpha_{VIO}$	Temperature coefficient of input offset voltage		25°C to 85°C		2			2		
			25°C		0.003			0.003		μV/mo
$I_{IO}$	Input offset current	25°C		0.5			0.5		pA	
$I_{IB}$	Input bias current	25°C		1			1		pA	
		Full range		500			500			
$V_{ICR}$	Common-mode input voltage range	$R_S=50\Omega,  V_{IC} \leq 5mV$	25°C	-5 to 4	-5.3 to 4.2		-5 to 4	-5.3 to 4.2	V	
			Full range		-5 to 3.5			-5 to 3.5		
$V_{OM+}$	Maximum positive peak output voltage	$I_O=-20\mu A$ $I_O=-100\mu A$ $I_O=-400\mu A$	25°C		4.99			4.99	V	
			25°C		4.85	4.94		4.85		4.94
			Full range		4.82			4.82		
$V_{OM-}$	Maximum negative peak output voltage	$V_{IC}=0, I_O=50\mu A$ $V_{IC}=0, I_O=500\mu A$ $V_{IC}=0, I_O=4mA$	25°C		-4.99			-4.99	V	
			25°C		-4.85	-4.91		-4.85		-4.91
			Full range		-4.85			-4.85		
$A_{VD}$	Large signal differential voltage amplification $V_O=-34V$	$R_L=50k\Omega$ $R_L=1M\Omega$	25°C		80	200		80	200	V/mV
			Full range		50			50		
$r_{i(d)}$	Differential input resistance		25°C		$10^2$			$10^2$	$\Omega$	
$r_{i(c)}$	Common-mode input resistance		25°C		$10^2$			$10^2$	$\Omega$	
$C_{i(c)}$	Common-mode input capacitance	$f=10kHz, N$ package	25°C		8			8	pF	
$Z_o$	Closed-loop output impedance	$f=100kHz, A_V=10$	25°C		220			220	$\Omega$	
CMRR	Common-mode rejection ratio	$V_{IC}=-5V$ to $2.7V$ $V_O=0, R_S=50\Omega$	25°C		75	88		75	88	dB
			Full range		75			75		
KSVR	Supply-voltage rejection ratio ( $\Delta V_{DD}/\Delta V_{IC}$ )	$V_{DD}=\pm 2.2V$ to $\pm 8V$ $V_{IC}=V_{DD}^2$ , No load	25°C		80	95		80	95	dB
			Full range		80			80		
$I_{DD}$	Supply current	$V_O=0$ , No load	25°C		0.85	1		0.85	1	μA
			Full range		1			1		

+ 全范围为-40℃至125℃。

注：4. 典型值是基于在  $T_A=150^\circ C$  下通过 500 小时工作寿命试验观察到的输入失调电压漂移，用 Arrhenius 方程并假设驱动能量为 0.96 电子伏特而外推到  $T_A=25^\circ C$ 。

4. TLC2264I 规定自然通风温度下的工作特性,  $V_{DD} = \pm 5V$ 

PARAMETER	TEST CONDITIONS	T <sub>A</sub> <sup>+</sup>	TLC2264I			TLC2264AI			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
SR Slew rate at unity gain	V <sub>O</sub> = ±1.9 V, R <sub>L</sub> = 50 kΩ, C <sub>L</sub> = 100 pF	25°C	0.35	0.55		0.35	0.55		V/μs
		Full range	0.25			0.25			
V <sub>n</sub> Equivalent input noise voltage	f = 10 Hz	25°C	43			43			nV/√Hz
	f = 1 kHz	25°C	12			12			
V <sub>N(PP)</sub> Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz	25°C	0.8			0.8			μV
	f = 0.1 Hz to 10 Hz	25°C	1.3			1.3			
I <sub>n</sub> Equivalent input noise current		25°C	0.6			0.6			fA/√Hz
THD+N Total harmonic distortion plus noise	V <sub>O</sub> = ±2.3 V, R <sub>L</sub> = 50 kΩ, f = 20 kHz	A <sub>V</sub> = 1	0.014%			0.014%			
			A <sub>V</sub> = 10	0.024%			0.024%		
Gain-bandwidth product	f = 10 kHz, C <sub>L</sub> = 100 pF	25°C	0.73			0.73			MHz
BOM Maximum output-swing bandwidth	V <sub>O(PP)</sub> = 4.6 V, R <sub>L</sub> = 50 kΩ	25°C	85			85			kHz
t <sub>s</sub> Settling time	A <sub>V</sub> = -1, Step = -2.3 V to 2.3 V, R <sub>L</sub> = 50 kΩ, C <sub>L</sub> = 100 pF	To 0.1%	7.1			7.1			μs
		To 0.01%	165			165			
Phase margin at unity gain	R <sub>L</sub> = 50 kΩ, C <sub>L</sub> = 100 pF	25°C	57°			57°			
Gain margin		25°C	11			11			dB

+ 全范围为-40℃至125℃。

## 2.3.5 TLC2262Y 的特性

1. TLC2262Y 在 V<sub>DD</sub> = 5V 和 T<sub>A</sub> = 25℃ 时的电特性 (除非另有说明)

PARAMETER	TEST CONDITIONS	TLC2262Y			UNIT
		MIN	TYP	MAX	
V <sub>IO</sub> Input offset voltage	V <sub>IC</sub> = 0, V <sub>O</sub> = 0, V <sub>DD</sub> = ±2.5 V, R <sub>S</sub> = 50Ω	300	2500		μV
I <sub>IO</sub> Input offset current		0.5	100		pA
I <sub>IB</sub> Input bias current		1	100		pA
V <sub>ICR</sub> Common-mode input voltage range	V <sub>IO</sub>   ≤ 5 mV, R <sub>S</sub> = 50Ω	0 to 4	-0.3 to 4.2		V
V <sub>OH</sub> High-level output voltage	I <sub>OH</sub> = -20 μA	4.99			V
	I <sub>OH</sub> = -100 μA	4.85	4.94		
	I <sub>OH</sub> = -400 μA	4.7	4.85		
V <sub>OL</sub> Low-level output voltage	V <sub>IC</sub> = 2.5 V, I <sub>OL</sub> = 50 μA	0.01			V
	V <sub>IC</sub> = 2.5 V, I <sub>OL</sub> = 500 μA	0.09	0.15		
	V <sub>IC</sub> = 2.5 V, I <sub>OL</sub> = 4 mA	0.8	1		
A <sub>VD</sub> Large-signal differential voltage amplification	V <sub>IC</sub> = 2.5 V, V <sub>O</sub> = 1 V to 4 V	R <sub>L</sub> = 50 kΩ <sup>+</sup>	80	170	V/mV
		R <sub>L</sub> = 1 MΩ <sup>+</sup>	550		
r <sub>i(d)</sub> Differential input resistance		10 <sup>12</sup>			Ω
r <sub>i(c)</sub> Common-mode input resistance		10 <sup>12</sup>			Ω
Q <sub>(c)</sub> Common-mode input capacitance	f = 10 kHz	8			pF
Z <sub>o</sub> Closed-loop output impedance	f = 100 kHz, A <sub>V</sub> = 10	240			Ω
CMRR Common-mode rejection ratio	V <sub>IC</sub> = 0 to 2.7 V, V <sub>O</sub> = 2.5 V, R <sub>S</sub> = 50Ω	70	83		dB
K <sub>SVR</sub> Supply-voltage rejection ratio (ΔV <sub>DD</sub> /ΔV <sub>IO</sub> )	V <sub>DD</sub> = 4.4 V to 16 V, V <sub>IC</sub> = V <sub>DD</sub> /2, No load	80	95		dB
I <sub>DD</sub> Supply current	V <sub>O</sub> = 2.5 V, No load	400	500		μA

+ 以 2.5V 为基准。

2. TLC2262Y 在  $V_{DD} = \pm 5V$  和  $T_A = 25^\circ C$  时的电特性 (除非另有说明)

PARAMETER	TEST CONDITIONS	TLC2262Y		UNIT	
		MIN	TYP		MAX
$V_{IO}$ Input offset voltage	$V_{IC} = 0,$ $V_{O} = 0,$ $R_S = 50\Omega$	300	2500	$\mu V$	
$I_{IO}$ Input offset current		0.5	100	pA	
$I_{IB}$ Input bias current		1	100	pA	
$V_{ICR}$ Common-mode input voltage range	$ V_{IO}  \leq 5 mV$ $R_S = 50\Omega$	-5 to 4	-5.9 to 4.2	V	
$V_{OM+}$ Maximum positive peak output voltage	$I_O = -20\mu A$	4.99		V	
	$I_O = -100\mu A$	4.85	4.94		
	$I_O = -200\mu A$	4.7	4.85		
$V_{OM-}$ Maximum negative peak output voltage	$V_{IC} = 0,$ $I_{OL} = 50\mu A$	-4.99		V	
	$V_{IC} = 0,$ $I_{OL} = 500\mu A$	-4.85	-4.91		
	$V_{IC} = 0,$ $I_{OL} = 4 mA$	-3.8	-4.1		
$A_{VD}$ Large-signal differential voltage amplification	$V_O = \pm 4V$	$R_L = 50 k\Omega$	80	200	V/mV
		$R_L = 1 M\Omega$	1000		
$r_{i(d)}$ Differential input resistance		$10^2$		$\Omega$	
$r_{i(c)}$ Common-mode input resistance		$10^2$		$\Omega$	
$q_{(c)}$ Common-mode input capacitance	$f = 10 kHz$	8		pF	
$z_o$ Closed-loop output impedance	$f = 100 kHz,$ $A_V = 10$	220		$\Omega$	
CMRR Common-mode rejection ratio	$V_{IC} = -5V$ to $2.7 V,$ $V_O = 0,$ $R_S = 50\Omega$	75	88	dB	
$k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{DD} / \Delta V_{IO}$ )	$V_{DD} = \pm 2.2V$ to $\pm 8V,$ $V_{IC} = 0,$ No load	80	95	dB	
$I_{DD}$ Supply current	$V_O = 0,$ No load	425	500	$\mu A$	

## 2.3.6 TLC2264Y 的特性

1. TLC2264Y 在  $V_{DD} = 5V$  和  $T_A = 25^\circ C$  时的电特性 (除非另有说明)

PARAMETER	TEST CONDITIONS	TLC2264Y		UNIT	
		MIN	TYP		MAX
$V_{IO}$ Input offset voltage	$V_{IC} = 0,$ $V_O = 0,$ $R_S = 50\Omega$ $V_{DD} = \pm 2.5 V$	300	2500	$\mu V$	
$I_{IO}$ Input offset current		0.5	100	pA	
$I_{IB}$ Input bias current		1	100	pA	
$V_{ICR}$ Common-mode input voltage range	$ V_{IO}  \leq 5 mV$ $R_S = 50\Omega$	0 to 4	-0.3 to 4.2	V	
$V_{OH}$ High-level output voltage	$I_{OH} = -20\mu A$	4.99		V	
	$I_{OH} = -100\mu A$	4.85	4.94		
	$I_{OH} = -400\mu A$	4.7	4.85		
$V_{OL}$ Low-level output voltage	$V_{IC} = 2.5 V,$ $I_{OL} = 50\mu A$	0.01		V	
	$V_{IC} = 2.5 V,$ $I_{OL} = 500\mu A$	0.09	0.15		
	$V_{IC} = 2.5 V,$ $I_{OL} = 4 mA$	0.8	1		
$A_{VD}$ Large-signal differential voltage amplification	$V_{IC} = 2.5 V,$ $V_O = 1 V$ to $4 V$	$R_L = 50 k\Omega^+$	80	170	V/mV
		$R_L = 1 M\Omega^+$	550		
$r_{i(d)}$ Differential input resistance		$10^2$		$\Omega$	
$r_{i(c)}$ Common-mode input resistance		$10^2$		$\Omega$	
$q_{(c)}$ Common-mode input capacitance	$f = 10 kHz$	8		pF	
$z_o$ Closed-loop output impedance	$f = 100 kHz,$ $A_V = 10$	240		$\Omega$	
CMRR Common-mode rejection ratio	$V_{IC} = 0$ to $2.7 V,$ $V_O = 2.5 V,$ $R_S = 50\Omega$	70	83	dB	
$k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{DD} / \Delta V_{IO}$ )	$V_{DD} = 4.4 V$ to $16V,$ $V_{IC} = V_{DD}/2,$ No load	80	95	dB	
$I_{DD}$ Supply current	$V_O = 2.5 V,$ No load	0.8	1	$\mu A$	

+ 以 2.5V 为基准。

2. TLC2264Y 在  $V_{DD} = \pm 5V$  和  $T_A = 25^\circ C$  时的电特性 (除非另有说明)

PARAMETER	TEST CONDITIONS	TLC2264Y		UNIT	
		MIN	TYP		MAX
$V_{IO}$ Input offset voltage	$V_{IC} = 0,$ $V_O = 0,$ $R_S = 50\Omega$	300	2500	$\mu V$	
$I_{IO}$ Input offset current		0.5	100	$\mu A$	
$I_{IB}$ Input bias current		1	100	$\mu A$	
$V_{ICR}$ Common-mode input voltage range	$ V_{IO}  \leq 5 mV$ $R_S = 50\Omega$	-5 to 4	-5.3 to 4.2	V	
$V_{OM+}$ Maximum positive peak output voltage	$I_O = -20\mu A$	4.99		V	
	$I_O = -100\mu A$	4.85	4.94		
	$I_O = -200\mu A$	4.7	4.85		
$V_{OM-}$ Maximum negative peak output voltage	$V_{IC} = 0,$ $I_{OL} = 50\mu A$	-4.99		V	
	$V_{IC} = 0,$ $I_{OL} = 500\mu A$	-4.85	-4.91		
	$V_{IC} = 0,$ $I_{OL} = 4 mA$	-3.8	-4.1		
$A_{VD}$ Large-signal differential voltage amplification	$V_O = \pm 4V$	$R_L = 50 k\Omega$	80	200	V/mV
		$R_L = 1 M\Omega$	1000		
$r_{i(d)}$ Differential input resistance		$10^{12}$		$\Omega$	
$r_{i(c)}$ Common-mode input resistance		$10^{12}$		$\Omega$	
$Q_{i(c)}$ Common-mode input capacitance	$f = 10 kHz$	8		pF	
$Z_o$ Closed-loop output impedance	$f = 100 kHz,$ $A_V = 10$	220		$\Omega$	
CMRR Common-mode rejection ratio	$V_{IC} = -5V$ to $2.7V,$ $V_O = 0,$ $R_S = 50\Omega$	75	88	dB	
$k_{SVR}$ Supply-voltage rejection ratio ( $\Delta V_{DD} / \Delta V_{IO}$ )	$V_{DD} = \pm 2.2V$ to $\pm 8V,$ $V_{IC} = 0,$ No load	80	95	dB	
$I_{DD}$ Supply current	$V_O = 0,$ No load	0.85	1	$\mu A$	

### 三、典型特性曲线

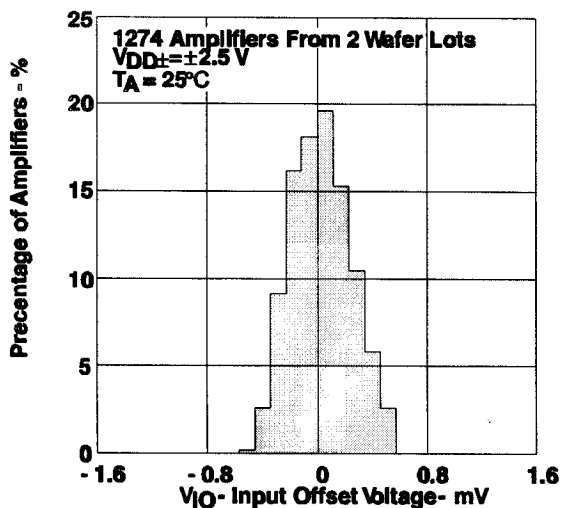


图2 TLC2262 输入失调电压的分布

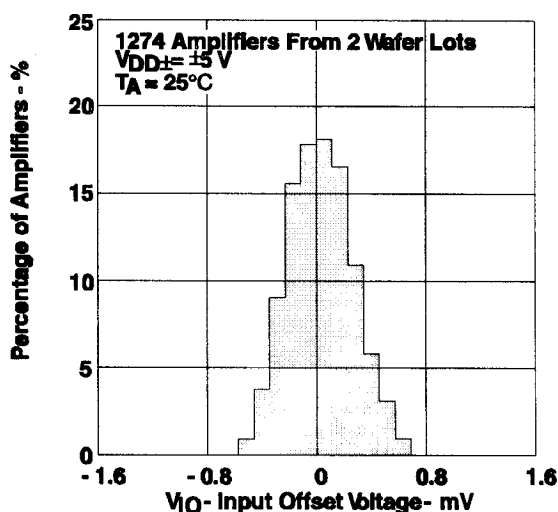


图3 TLC2262 输入失调电压的分布

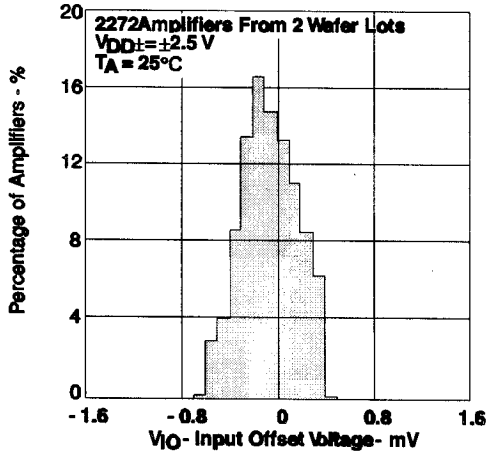


图4 TLC2264 输入失调电压的分布

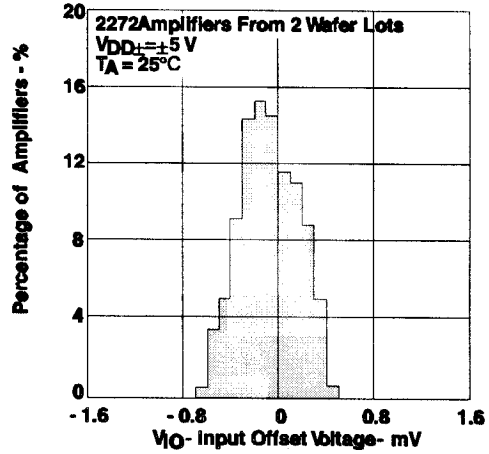


图5 TLC2264 输入失调电压的分布

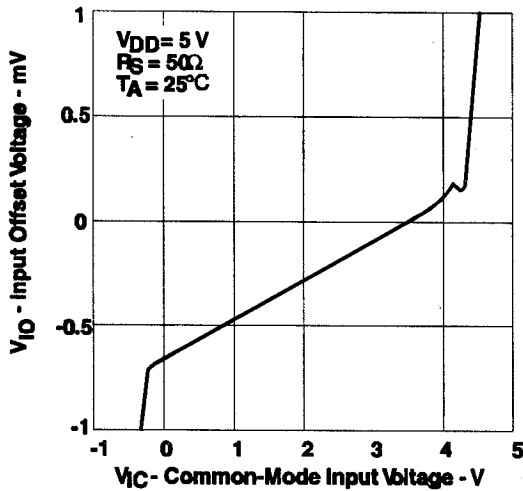


图6 输入失调电压与共模输入电压的关系

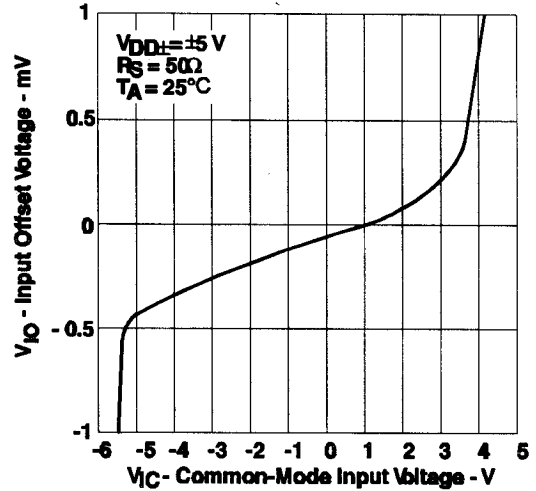


图7 输入失调电压与共模输入电压的关系

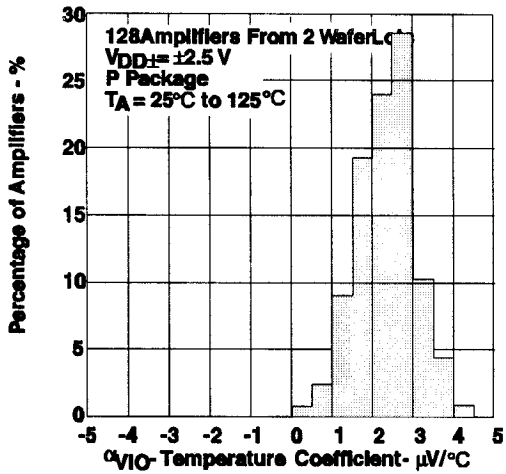


图8 TLC2262 输入失调电压温度系数的分布

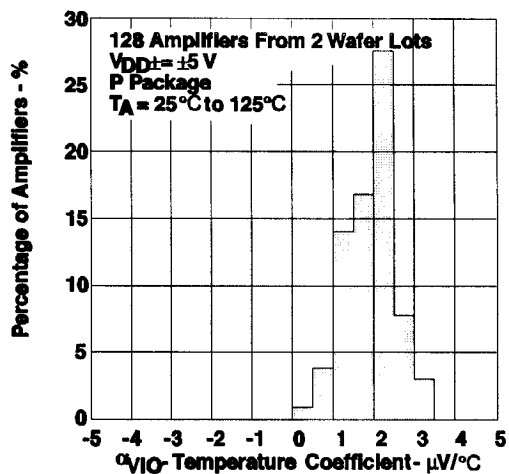


图9 TLC2262 输入失调电压温度系数的分布

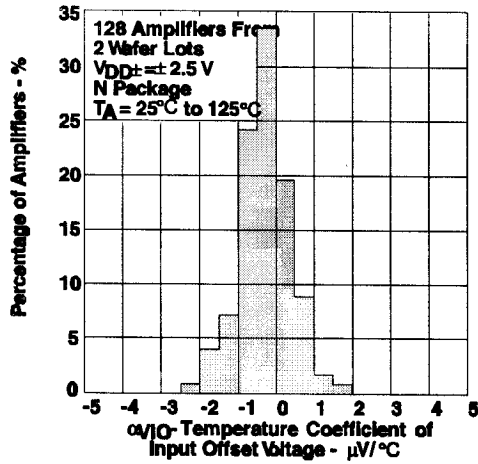


图 10 TLC2264 输入失调电压温度系数的分布

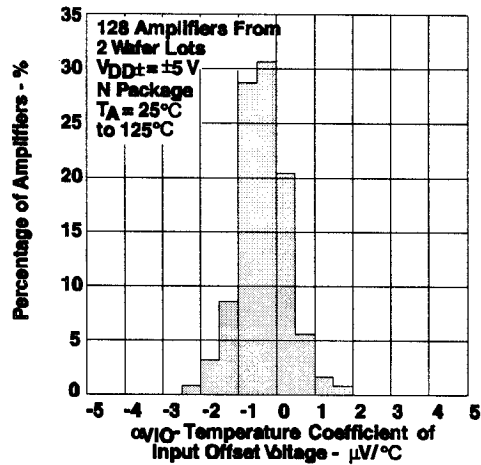


图 11 TLC2264 输入失调电压温度系数的分布

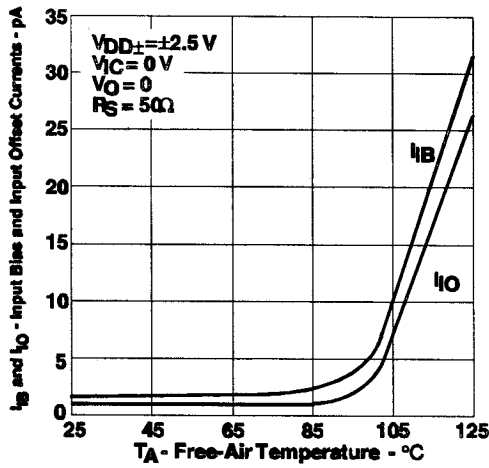


图 12 输入偏置和输入失调电流与自然通风温度的关系

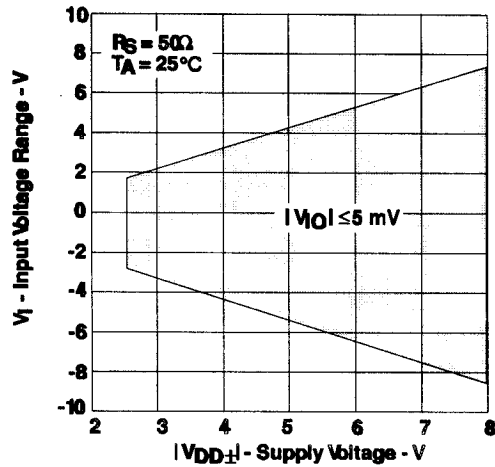


图 13 输入电压范围与电源电压的关系

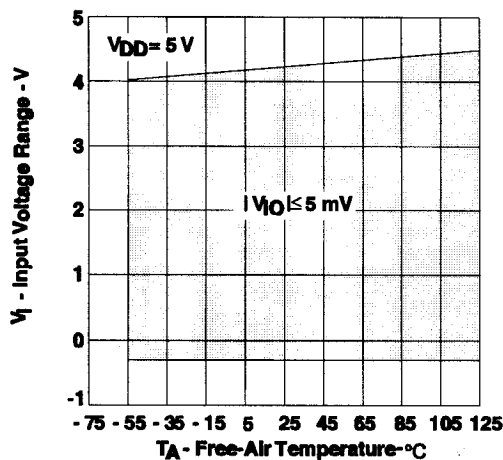


图 14 输入电压范围与自然通风温度的关系\*

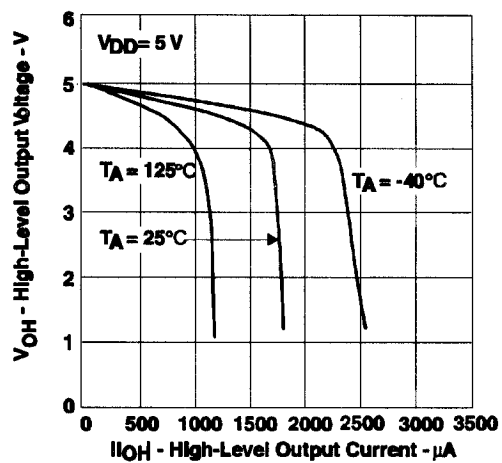


图 15 高电平输出电压与高电平输出电流的关系\*

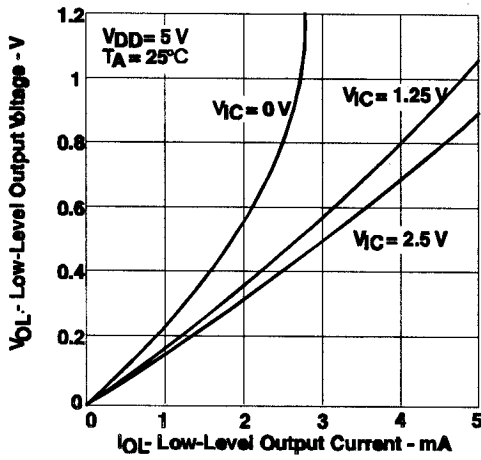


图 16 低电平输出电压与低电平输出电流的关系\*

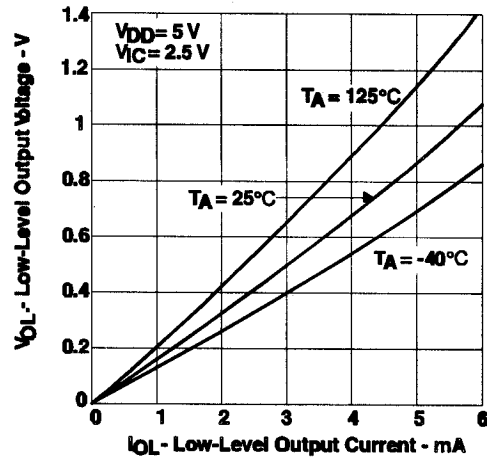


图 17 低电平输出电压与低电平输出电流的关系\*

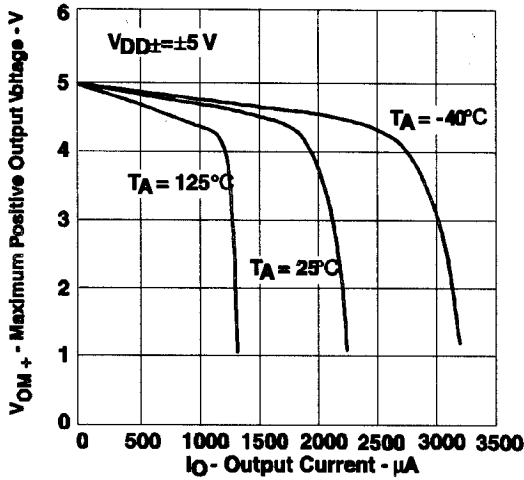


图 18 最大正输出电压与输出电流的关系+

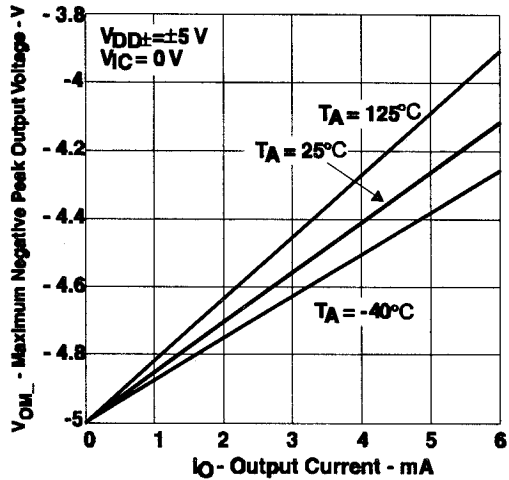


图 19 最大负输出电压与输出电流的关系+

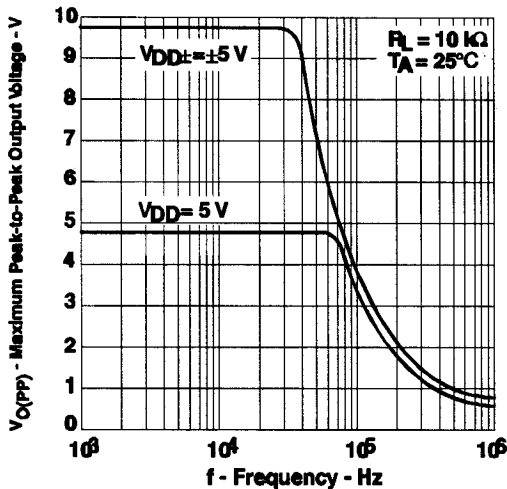


图 20 最大峰-峰输出电压与频率的关系\*

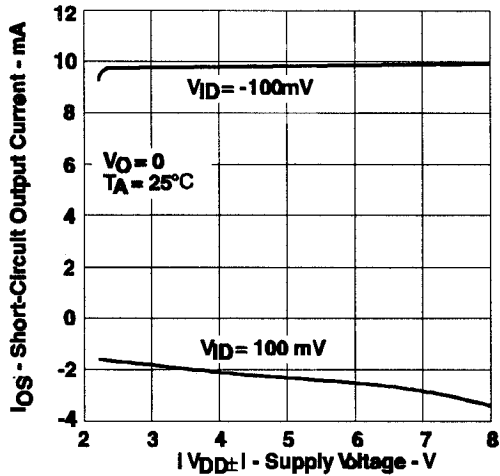


图 21 短路输出电流与电源电压的关系



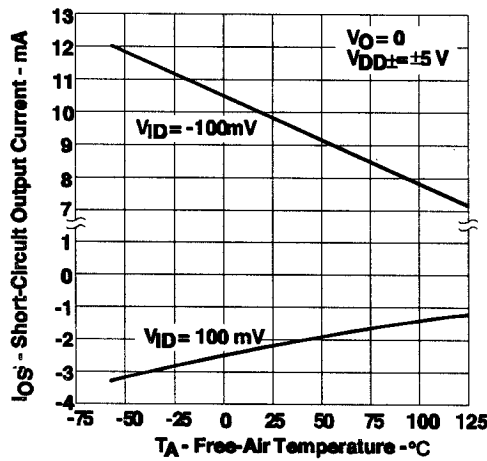


图 22 短路输出电流与自然通风温度的关系+

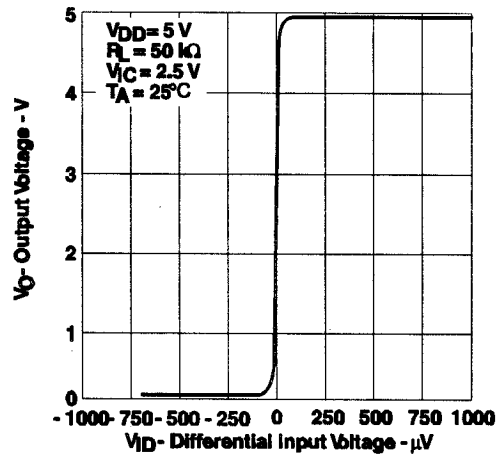


图 23 输出电压与差分输入电压的关系+

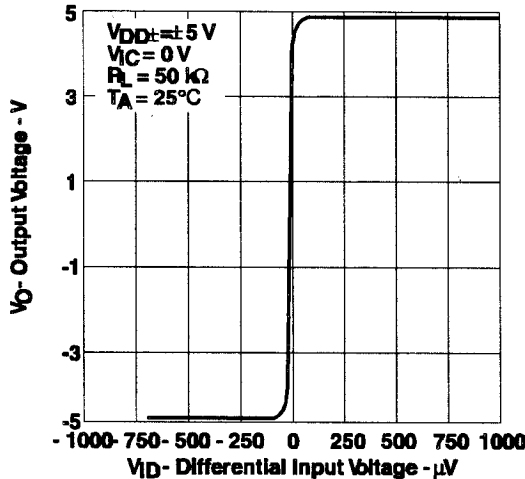


图 24 输出电压与差分输入电压的关系

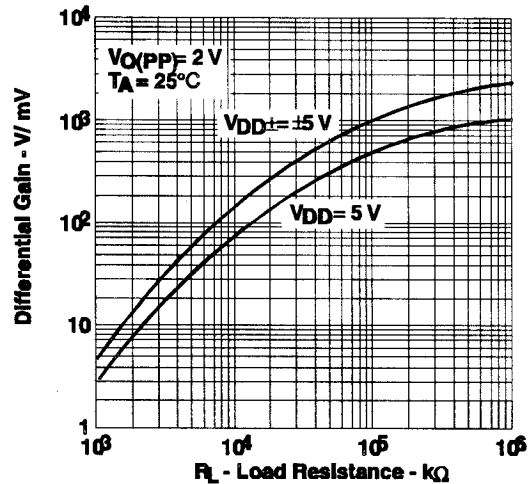


图 25 差分增益与负载电阻的关系\*

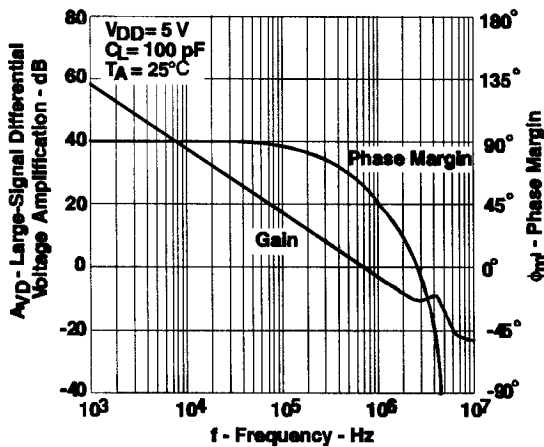


图 26 大信号差分电压放大量和相位容限与频率的关系

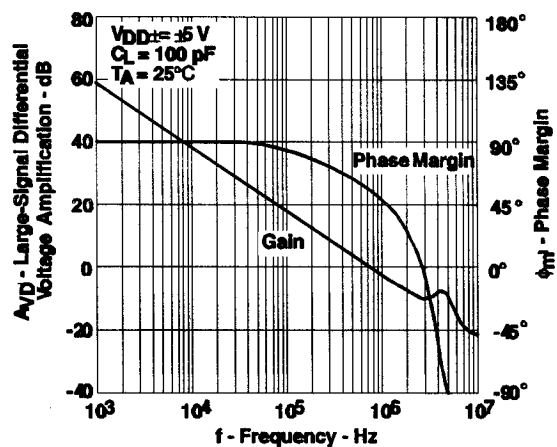


图 27 大信号差分电压放大量和相位容限与频率的关系

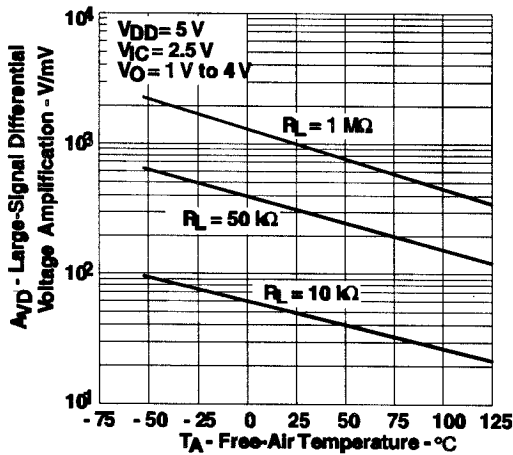


图 28 大信号差分电压放大量\* 与自然通风温度的关系

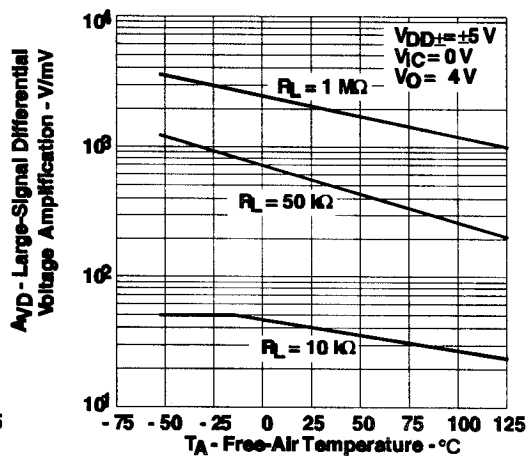


图 29 大信号差分电压放大量 与自然通风温度的关系

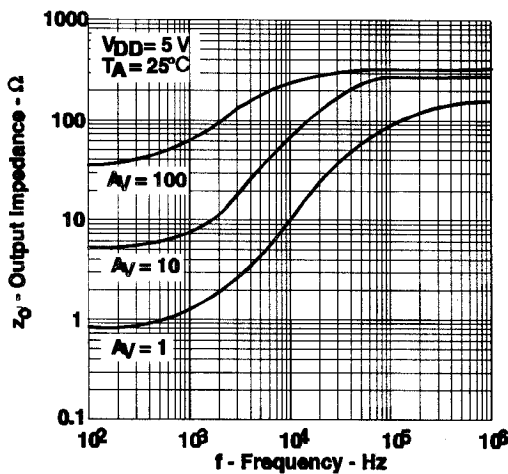


图 30 输出阻抗与频率的关系\*

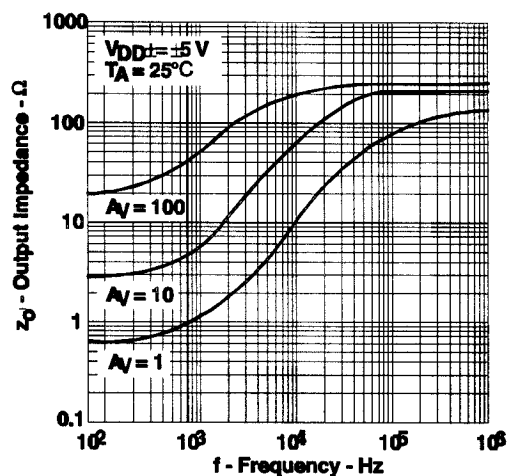


图 31 输出阻抗与频率的关系

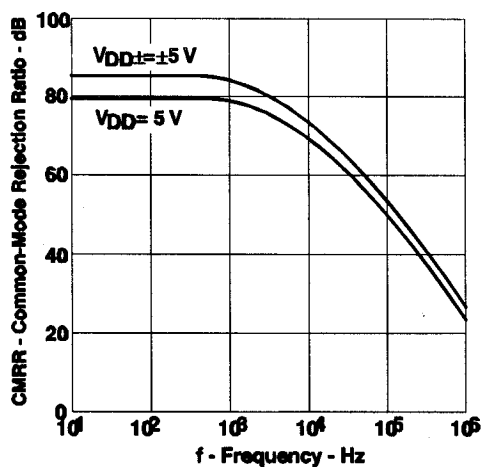


图 32 共模抑制比与频率的关系\*

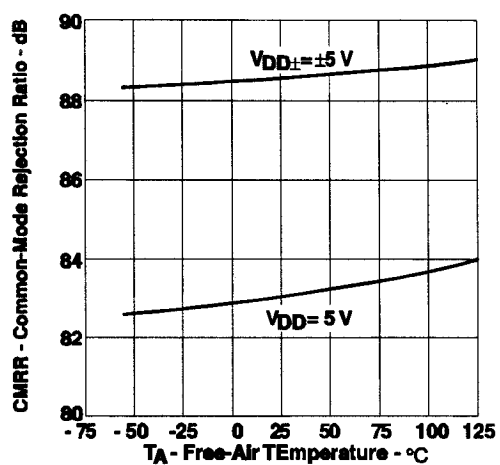


图 33 共模抑制比与自然通风温度的关系\*

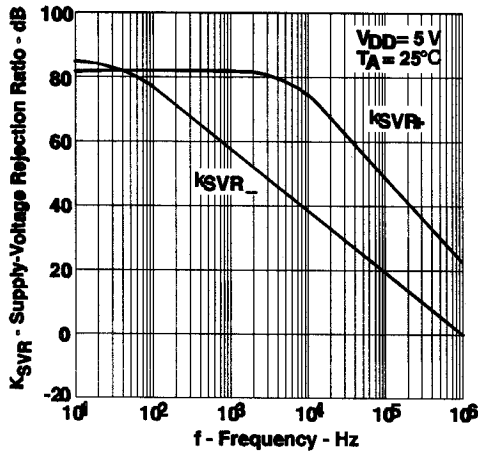


图 34 电源电压抑制比与频率的关系\*

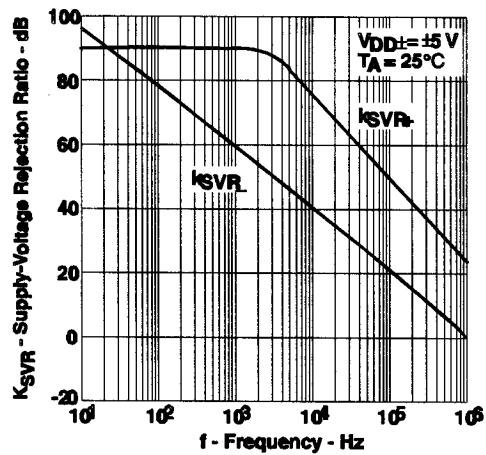


图 35 电源电压抑制比与频率的关系\*

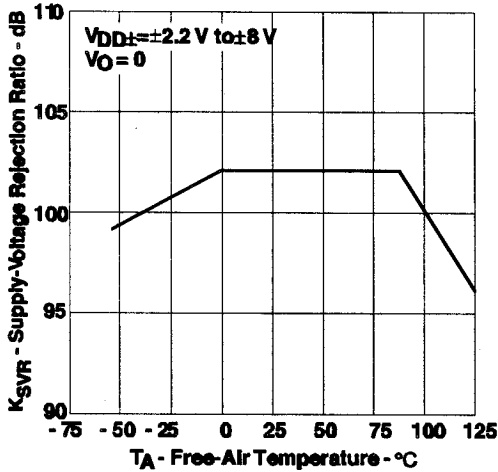


图 36 电源电压抑制比与自然通风温度的关系

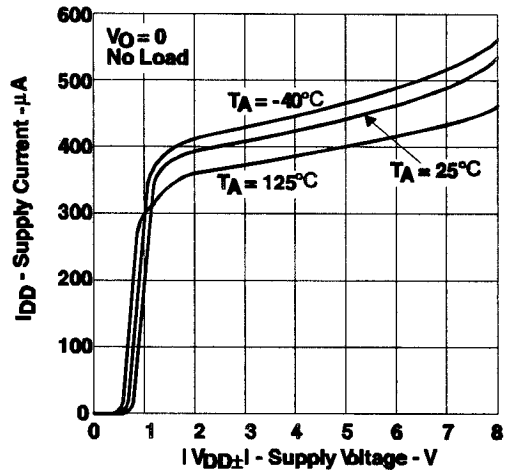


图 37 TLC2262 电源电流与电源电压的关系

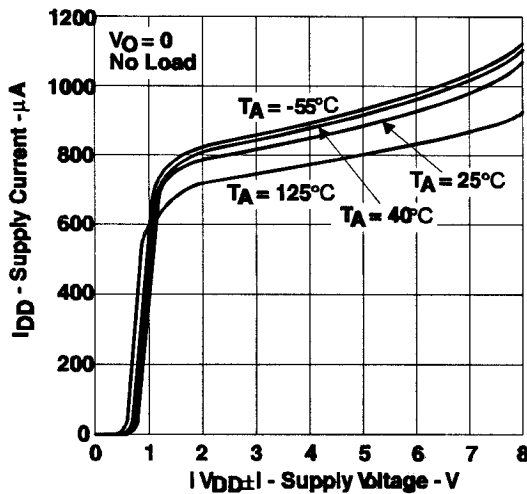


图 38 TLC2264 电源电流与电源电压的关系+

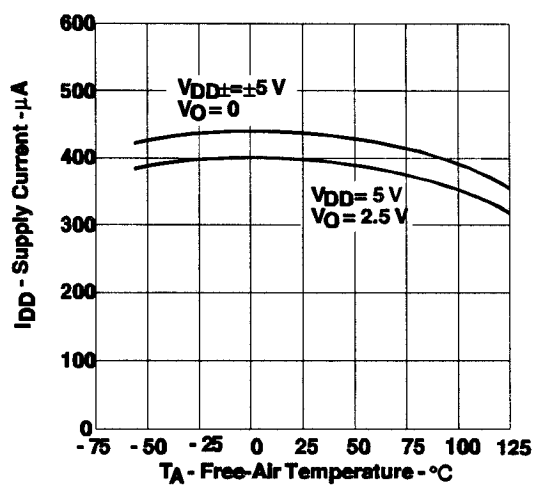


图 39 TLC2262 电源电流与自然通风温度的关系+

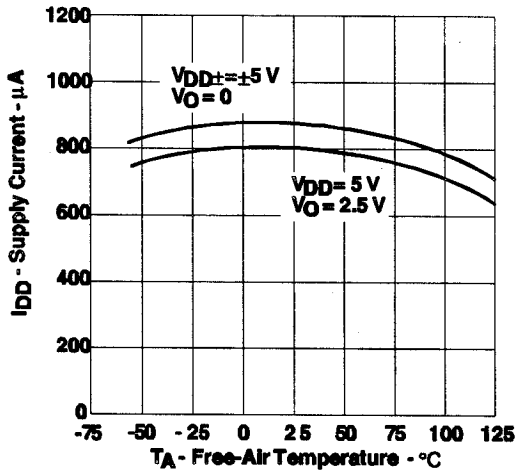


图 40 TLC2264 电源电流与自然通风温度的关系\*

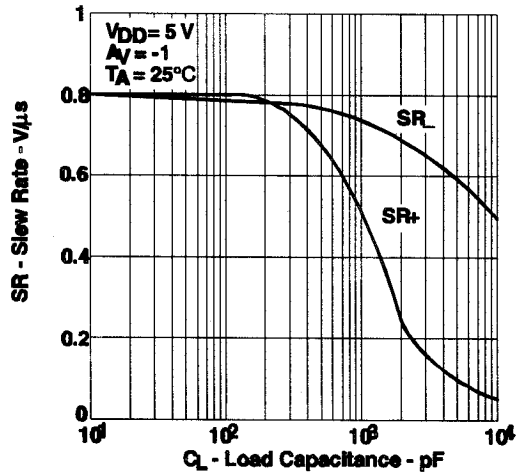


图 41 转换速率与负载电容的关系\*

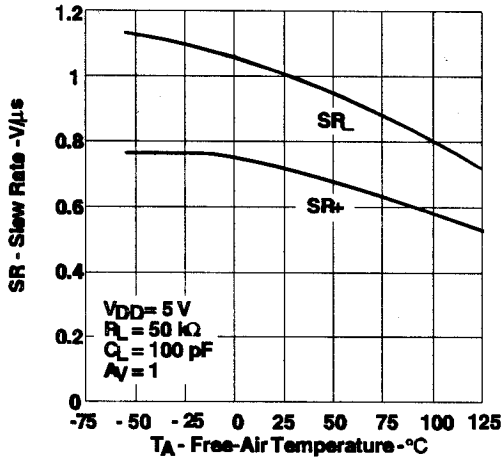


图 42 转换速率与自然通风温度的关系\*

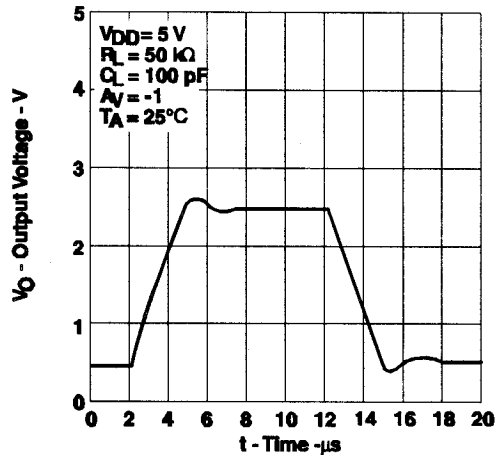


图 43 反相大信号脉冲响应\*

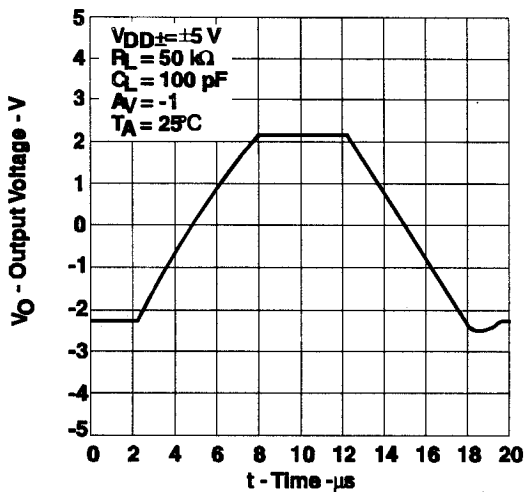


图 44 反相大信号脉冲响应

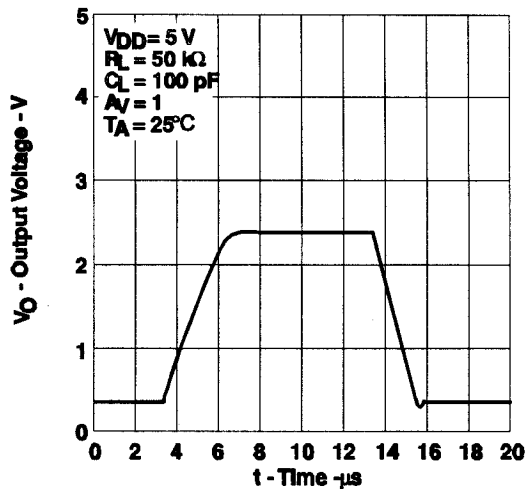


图 45 电压跟随器大信号脉冲响应

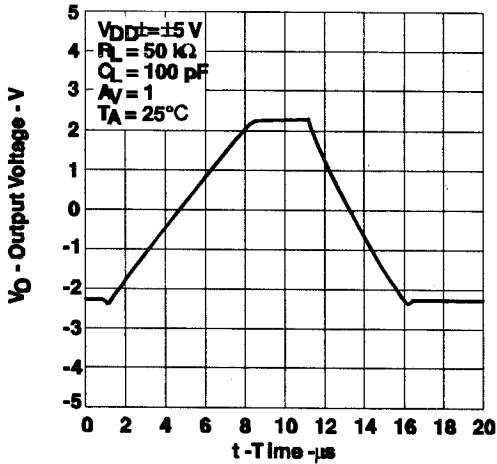


图 46 电压跟随器大信号脉冲响应

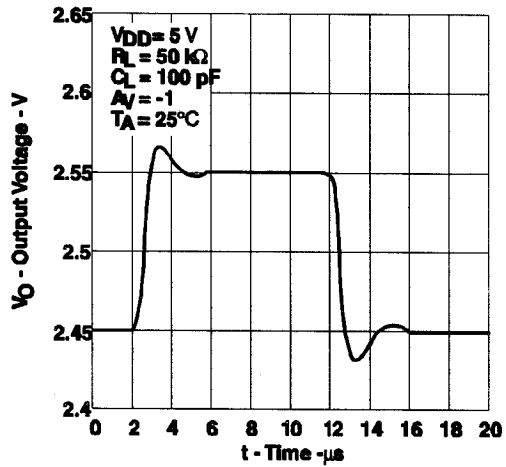


图 47 反相小信号脉冲响应+

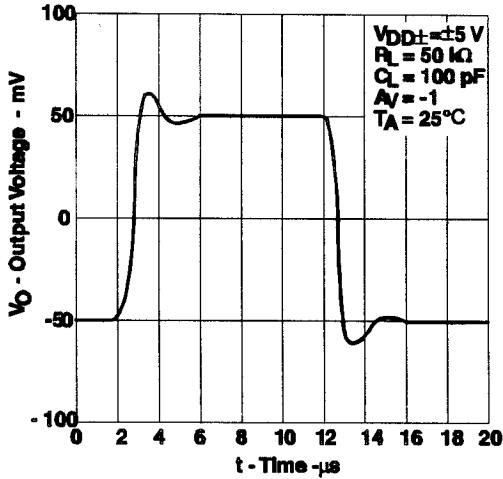


图 48 反相小信号脉冲响应-

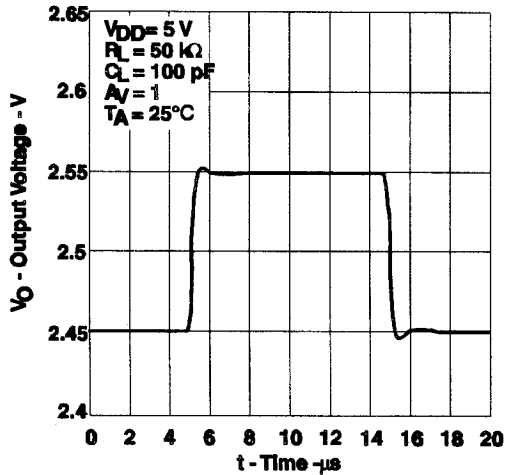


图 49 电压跟随器小信号脉冲响应+

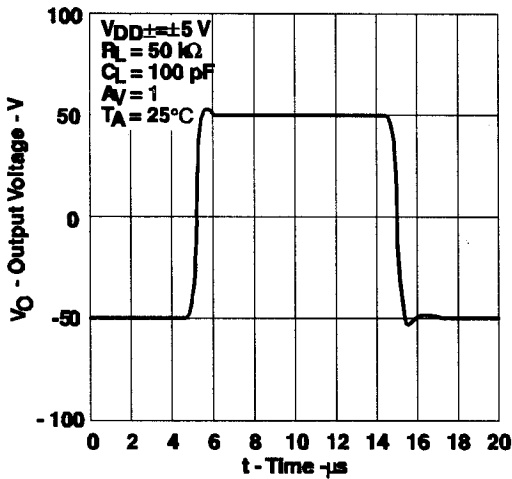


图 50 电压跟随器小信号脉冲响应-

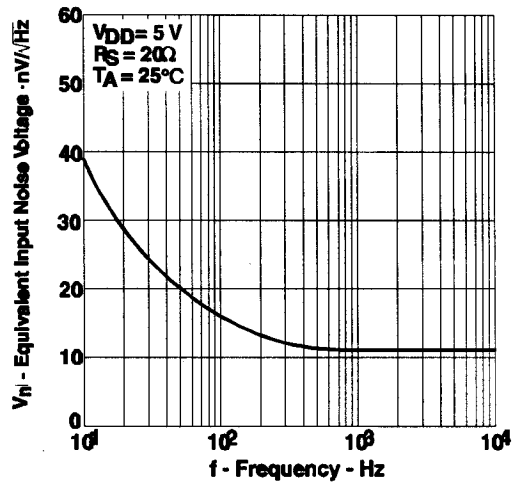


图 51 等效输入噪声电压与频率的关系+

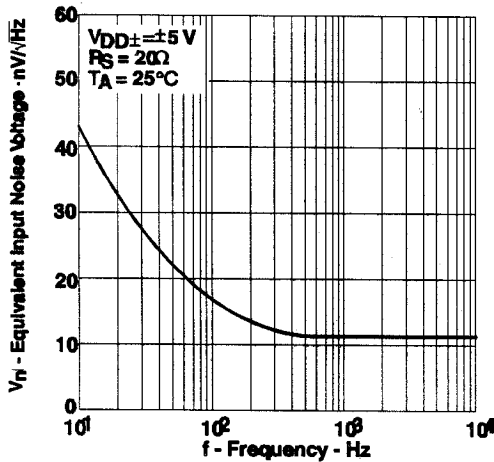


图 52 等效输入噪声电压与频率的关系

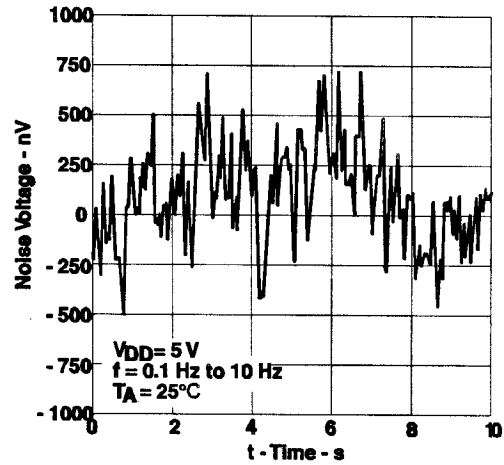


图 53 10 秒钟期间的输入噪声电压

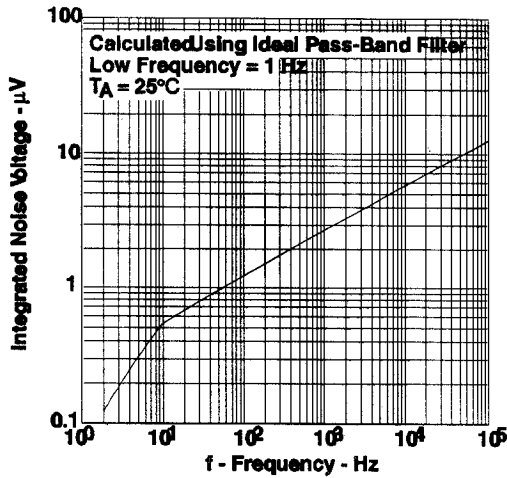


图 54 集成噪声电压与频率的关系

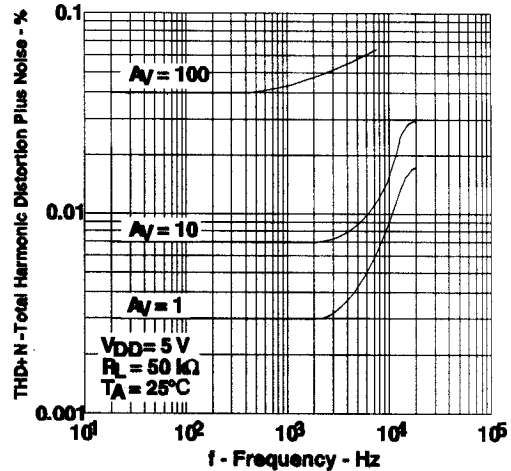


图 55 总谐波失真加噪声与频率的关系\*

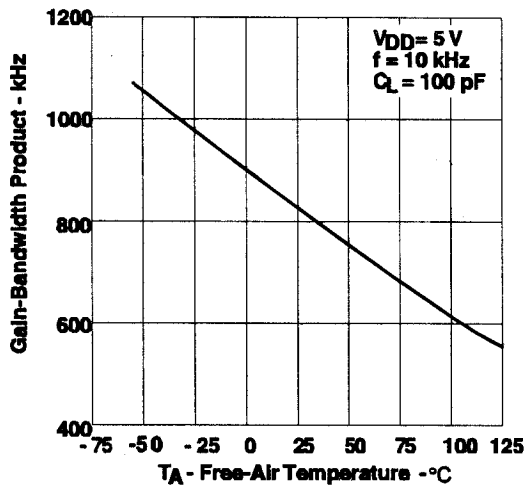


图 56 增益带宽积与电源电压的关系

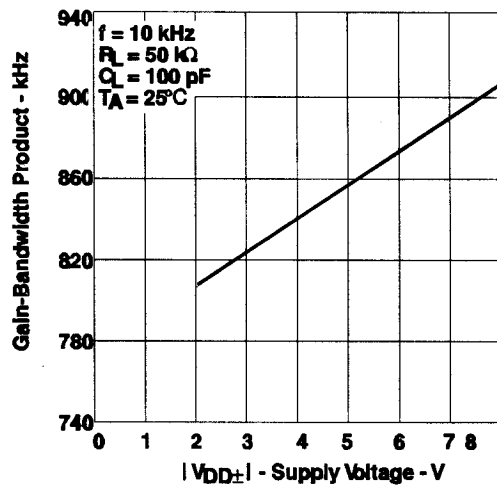


图 57 增益带宽积与自然通风温度的关系\*

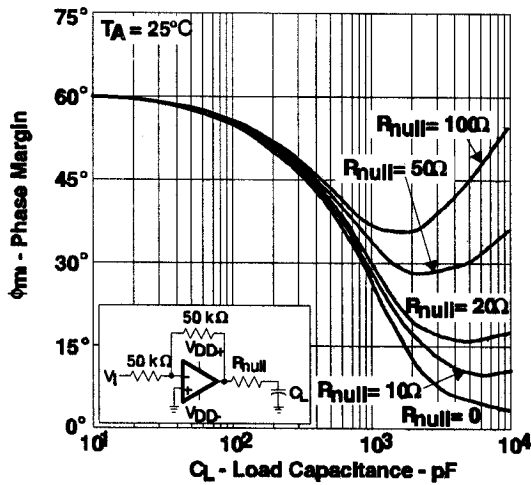


图 58 相位容限与负载电容的关系

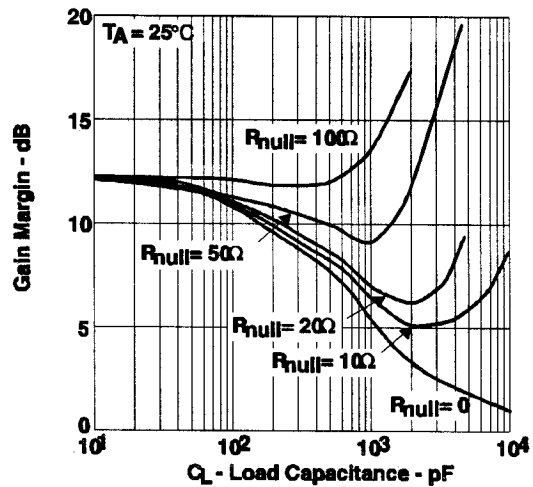


图 59 增益容限与负载电容的关系

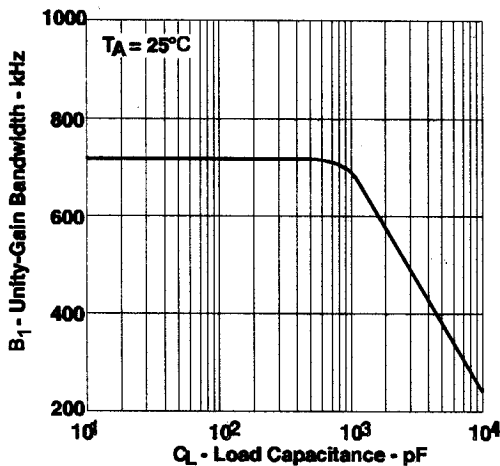


图 60 单位增益带宽与负载电容的关系

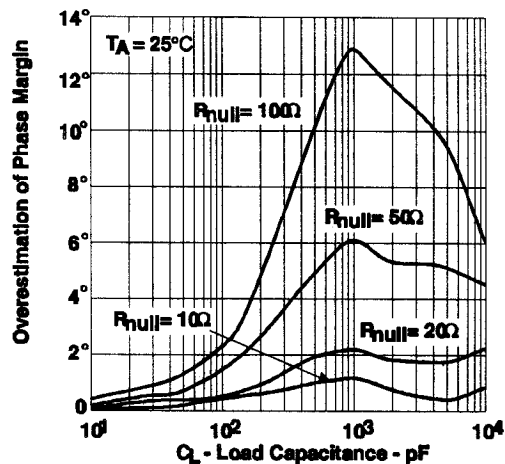


图 61 相位容限的过量估计与负载电容的关系

+ 上述四图高、低温度的数据仅适用于各器件额定自然通风温度范围之内。

\* 对于  $V_{DD}=5V$  的曲线，所有负载以 2.5V 为基准。

## 四、应用资料

### 4.1 驱动大电容负载

TLC226X 设计得比大多数 CMOS 运放能驱动更大的电容负载。图 58 和图 59 表明其驱动负载的能力大于 400pF，且保持良好的增益和相位容限 ( $R_{null}=0$ )。

当驱动大电容负载时，器件输出端的小串联电阻  $R_{null}$  (见图 62) 改善增益和相位容限。图 58 和图 59 显示加 10  $\Omega$ 、20  $\Omega$ 、50  $\Omega$  和 100  $\Omega$  串联电阻的效果。加串联电阻有两种效果：首先是对传输函数加入一个零点，其次是在传输函数中降低了与输出负载有关的极点频率。

引入传输函数的零点等于串联电阻乘以负载电容。方程 (1) 可用来计算相位容限的改善。

$$\Delta \theta_{ml} = \tan^{-1} (2 \times \pi \times UGBW \times R_{null} \times C_L) \quad (1)$$

式中  $\Delta \theta_{ml}$  = 相位容限改善

UGBW = 单位增益带宽频率

$R_{null}$  = 输出串联电阻

$C_L$  = 负载电容

单位增益带宽（UGBW）频率随电容负载的增加而减小（见图 60）。用方程（1）时，UGBW 必须从图 60 获取近似值。

如图 61 所示，单独用方程（1）会过高估计相位容限改善。这种过高估计由与负载有关的极点频率的降低所造成，于是提供附加的相移和减小总的相位容限改善。与负载有关的极点按方程（2）计算的因子减小。

$$F = \frac{1}{1 + g_m + R_{null}} \quad (2)$$

其中：F=减小极点频率的因子

$g_m$ =小信号输出互导（典型值  $4.83 \times 10^{-3}$  mhos）

对于 TLC226X，与负载有关的极点在 100pF 负载电容时的典型值为 7MHz。这一数值随  $C_L$  反向变化： $C_L=10$ pF 时用 70MHz， $C_L=1000$ pF 时用 700kHz 等等。

减小与负载有关的极点会引入相位移，从而减小相位容限。这将导致单用方程（1）考虑零点而预计增加相位容限的误差。方程（3）近似计算出由于与负载有关的极点移动造成的相位容限的减小。从方程（1）的结果减去这一方程的结果可更好地近似相位容限的改善。

加相位容限的误差。方程（3）近似计算出由于与负载有关的极点移动造成的相位容限的减小。从方程（1）的结果减去这一方程的结果可更好地近似相位容限的改善。

$$\Delta \theta_{m2} = \tan^{-1} \left[ \frac{UGBW}{(F \times P_2)} \right] - \tan^{-1} \left( \frac{UGBW}{P_2} \right) \quad (3)$$

其中： $\Delta \theta_{m2}$  = 相位容限的减小

UGBW=单位增益带宽频率

F=来自方程（2）的因子

$P_2$ =未调整的极点（70MHz@10pF，7MHz@100pF，等）。

用这些方程和图 60 及图 61，设计者能够选择适当的输出串联电阻以优化驱动大电容负载电路的设计。

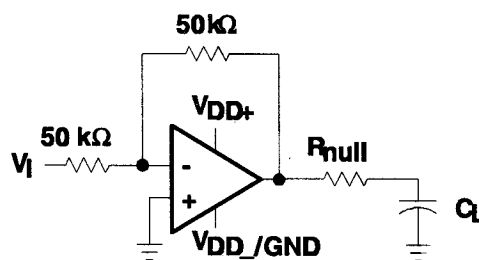


图 62 串联电阻电路

### 4.3 宏模型资料

所提供的宏模型资料是由 PSpice™Parts™ 模型产生软件导出。图 63 中的 Boyle 宏模型和子电路用  $T_A=25$  °C 时 TLC226X 的典型电特性及工作特性产生。使用此资料，下述关键参数的输出模拟可在 20% 的容限内得以实现（在大多数情况下）：

- 最大正输出电压摆幅
- 最大负输出电压摆幅
- 转换速率
- 静态功耗
- 输入偏置电流



- 开环电压放大量
- 单位增益频率
- 共模抑制比
- 相位容限
- DC 输出电阻
- AC 输出电阻
- 短路输出电流极限

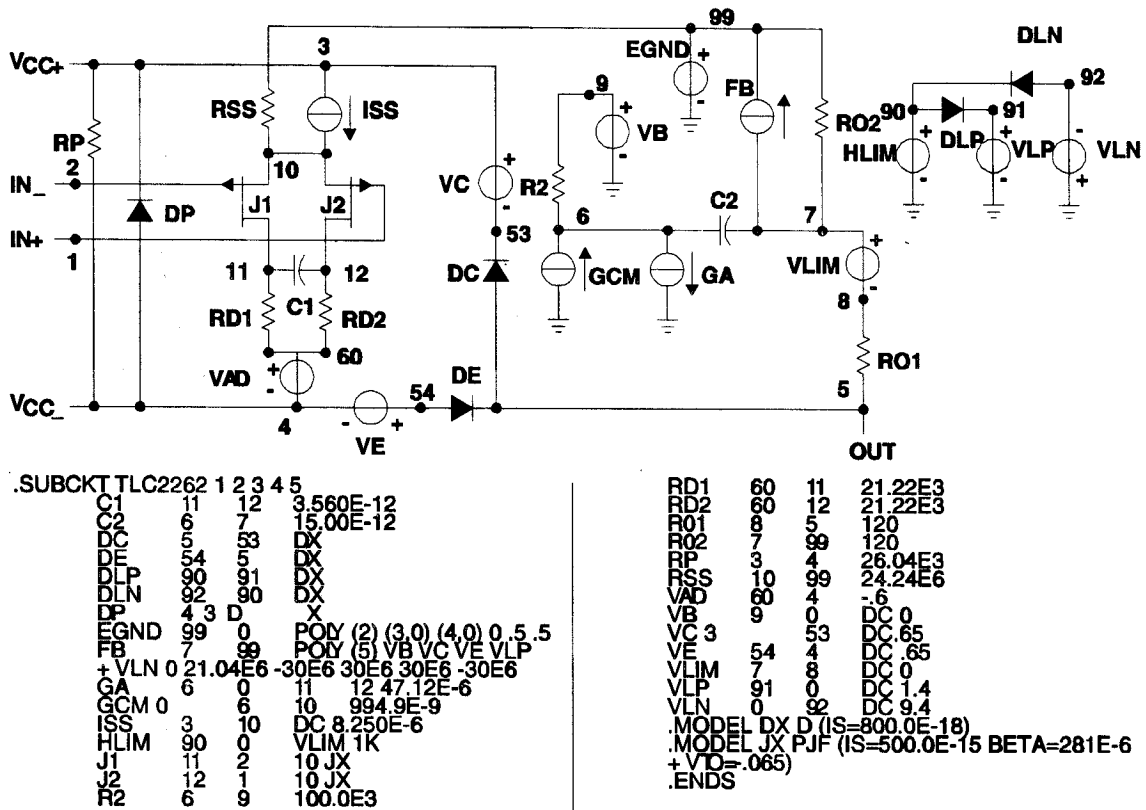


图 63 Boyle 宏模型和子电路

PSpice 和 Parts 是 MicroSim 公司的商标。