

**1.0 SCOPE**

This specification covers the detail requirements for a very low-noise quad operational amplifier.

It is highly recommended that this data sheet be used as a baseline for new military or aerospace spec control drawings.

**1.2 Part Number.** The complete part numbers per Table I of this specification follow:

<u>Device</u>	<u>Part Number</u>	<u>Package</u>
A	OP-470AY/883	Y
A	OP-470ATC/883	TC

**1.2.3 Case Outline.**

<u>Letter</u>	<u>Case Outline (Lead finish per MIL-M-38510)</u>
Y	14-lead ceramic dual-in-line package (CERDIP)
TC	28-contact hermetic leadless chip carrier (LCC)

**1.3 Absolute Maximum Ratings.** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

Supply Voltage.....	$\pm 18\text{V}$
Differential Input Voltage (Note 1).....	$\pm 1\text{V}$
Differential Input Current (Note 1).....	$\pm 25\text{mA}$
Input Voltage.....	Supply Voltage
Output Short-Circuit Duration .....	Continuous
Storage Temperature Range.....	$-65^\circ\text{C}$ to $+150^\circ\text{C}$
Operating Temperature Range .....	$-55^\circ\text{C}$ to $+125^\circ\text{C}$
Lead Temperature (Soldering, 60 sec).....	$+300^\circ\text{C}$
Maximum Junction Temperature ( $T_J$ ).....	$+150^\circ\text{C}$

**NOTES:**

- The OP-470's inputs are protected by back-to-back diodes. Current limiting resistors are not used in order to achieve low noise performance. If the differential input voltage exceeds  $\pm 1\text{V}$ , the input current should be limited to  $\pm 25\text{mA}$ .

**1.5 Thermal Characteristics:**

Thermal Resistance, CERDIP (Y) package:

Junction-to-Case ( $\theta_{JC}$ ) =  $29^\circ\text{C/W MAX}$

Junction-to Ambient ( $\theta_{JA}$ ) =  $100^\circ\text{C/W MAX}$

Thermal Resistance, LCC (TC) package:

Junction-to-Case ( $\theta_{JC}$ ) =  $35^\circ\text{C/W MAX}$

Junction-to Ambient ( $\theta_{JA}$ ) =  $110^\circ\text{C/W MAX}$

# OP-470

**TABLE 1**

$V_S = \pm 15V$ ;  $R_S = 50\Omega$ ;  $T_A = T_J = 25^\circ C$  unless otherwise specified.

Characteristics	Symbol	Special Conditions	OP-470/883		Units	
			LIMITS A			
			Min	Max		
Input Offset Voltage	$V_{OS}$		--	0.4	mV	
		$-55^\circ C \leq T_A \leq +125^\circ C$	--	0.6	mV	
Input Offset Current	$I_{OS}$	$V_{CM} = 0V$	--	10	nA	
		$V_{CM} = 0V$ $-55^\circ C \leq T_A \leq +125^\circ C$	--	20	nA	
Input Bias Current	$I_B$	$V_{CM} = 0V$	--	$\pm 25$	nA	
		$V_{CM} = 0V$ $-55^\circ C \leq T_A \leq +125^\circ C$	--	$\pm 50$	nA	
Input Noise Voltage	$E_{nt}$	$f_O = 1\text{Hz to } 100\text{Hz}$ , see test circuit	--	110	$nV_{RMS}$	
Large-Signal Voltage Gain	$A_{VO}$	$V_O = \pm 10V, R_L = 10k\Omega$	1000	--	V/mV	
		$V_O = \pm 10V, R_L = 10k\Omega$	750	--	V/mV	
		$-55^\circ C \leq T_A \leq +125^\circ C$				
		$V_O = \pm 10V, R_L = 2k\Omega$	500	--	V/mV	
		$V_O = \pm 10V, R_L = 2k\Omega$ $-55^\circ C \leq T_A \leq +125^\circ C$	400	--	V/mV	
Output Voltage Swing	$V_O$	$R_L = 2k\Omega$	$\pm 12$	--	V	
		$R_L = 2k\Omega$ $-55^\circ C \leq T_A \leq +125^\circ C$	$\pm 12$	--	V	
Common-Mode Rejection (Note 1)	CMR	$V_{CM} = IVR = \pm 11V$	110	--	dB	
		$V_{CM} = IVR = \pm 11V$ $-55^\circ C \leq T_A \leq +125^\circ C$	100	--	dB	
Power Supply Rejection Ratio	PSRR	$V_S = \pm 4.5V \text{ to } \pm 18V$	--	1.8	$\mu V/V$	
		$V_S = \pm 4.5V \text{ to } \pm 18V$ $-55^\circ C \leq T_A \leq +125^\circ C$	--	5.6	$\mu V/V$	

**TABLE 1 (Continued)**

$V_S = \pm 15V$ ;  $R_S = 50\Omega$ ;  $T_A = T_J = 25^\circ C$  unless otherwise specified.

Characteristics	Symbol	Special Conditions	OP-470/883		Units
			LIMITS A		
			Min	Max	
Supply Current (Note 2)	$I_{SY}$	No Load	-	11	mA
		No Load	-	11	mA
		$-55^\circ C \leq T_A \leq +125^\circ C$			
Slew Rate	SR	$A_{VCL} = +20, R_L = 10k\Omega$	$\pm 1.4$	-	V/ $\mu s$

NOTES:

1. IVR is defined as the  $V_{CM}$  range used for the CMR test.
2.  $I_{SY}$  limit = total all four amplifiers.

**TABLE 2**

OP-470/883

**Electrical Test Requirements  
For Class B Devices**

MIL-STD-883 Test Requirements	Subgroups (see Table 3)
Interim Electrical Parameters (pre Burn-In)	1
Final Electrical Test Parameters	1*, 2, 3, 4, 5, 6
Group A Test Requirements	1, 2, 3, 4, 5, 6, 7

\* PDA applies to Subgroup 1 only.  
No other Subgroups are included in PDA.

**TABLE 3**

**Group A Inspection**

$V_S = \pm 15V$ ;  $R_S = 50\Omega$ ;  $T_A = T_J$  unless otherwise specified.

Subgroup	Symbol	Special Conditions	OP-470/883		Units
			LIMITS A		
			Min	Max	
<b>Subgroup 1</b>	$V_{OS}$		--	0.4	mV
$T_A = +25^\circ C$	$I_{OS}$	$V_{CM} = 0V$	--	10	nA
	$I_B$	$V_{CM} = 0V$	--	$\pm 25$	nA
	CMR	$V_{CM} = \pm 11V$	110	--	dB
	PSRR	$V_S = \pm 4.5V, \pm 18V$	--	1.8	$\mu V/V$
	$I_{SY}$	No Load (Note 1)	--	11	mA
<b>Subgroup 2</b>	$V_{OS}$		--	0.6	mV
$T_A = +125^\circ C$	$I_{OS}$	$V_{CM} = 0V$	--	20	nA
	$I_B$	$V_{CM} = 0V$	--	$\pm 50$	nA
	CMR	$V_{CM} = \pm 11V$	100	--	dB
	PSRR	$V_S = \pm 4.5V, \pm 18V$	--	5.6	$\mu V/V$
	$I_{SY}$	No Load (Note 1)	--	11	mA
<b>Subgroup 3</b>		All Tests, Limits and Conditions are the same as for Subgroup 2.			
$T_A = -55^\circ C$					
<b>Subgroup 4</b>	$A_{VO}$	$V_O = \pm 10V, R_L = 10k\Omega$	1000	--	V/mV
		$V_O = \pm 10V, R_L = 2k\Omega$	500	--	V/mV
	$T_A = +25^\circ C$	$V_O$	$R_L = 2k\Omega$	$\pm 12$	--

**TABLE 3**

**Group A Inspection (Continued)**

$V_S = \pm 15V$ ;  $R_S = 50\Omega$ ;  $T_A = T_J$  unless otherwise specified.

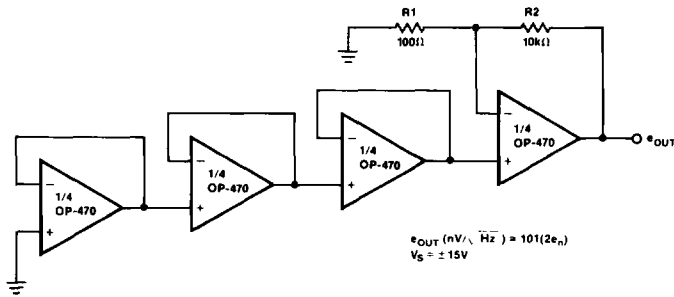
Subgroup	Symbol	Special Conditions	OP-470/883		Units
			LIMITS A		
			Min	Max	
Subgroup 5 $T_A = +125^\circ C$	$A_{VO}$	$V_O = \pm 10V, R_L = 10k\Omega$	750	--	V/mV
		$V_O = \pm 10V, R_L = 2k\Omega$	400	--	V/mV
	$V_O$	$R_L = 2k\Omega$	$\pm 12$	--	V
Subgroup 6 $T_A = -55^\circ C$		All Tests, Limits and Conditions are the same as for Subgroup 5.			
Subgroup 7 $T_A = +25^\circ C$	SR	$A_{VCL} = +20, R_L = 10k\Omega$	$\pm 1.4$	--	V/ $\mu s$
	$E_{nt}$	$f_O = 1Hz$ to 100Hz, see test circuit	--	110	nV <sub>RMS</sub>

NOTES:

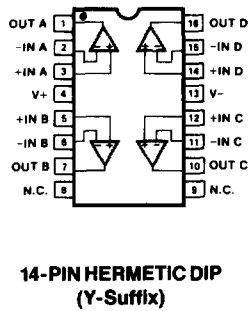
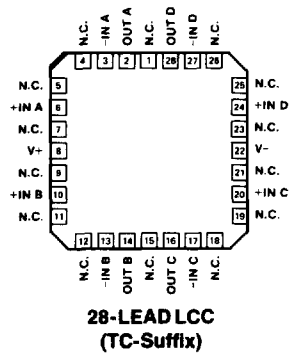
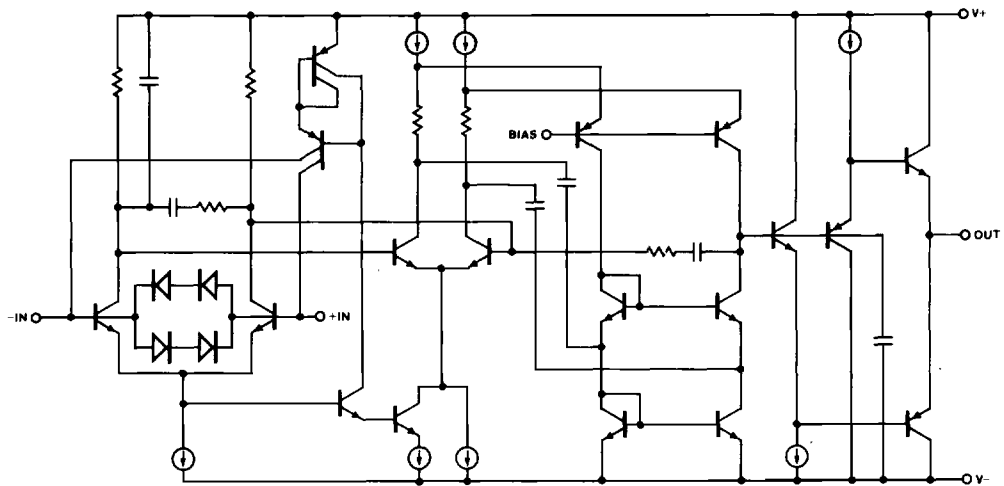
1.  $I_{SY}$  limit = total all four amplifiers.

# OP-470

## Noise Voltage Density Test Circuit



### 3.2.1 Simplified Schematic and Pin Connections.



3.2.4 **Microcircuit Group Assignment.** This microcircuit is covered by microcircuit group 49.

4.2 **Life Test/Burn-In Circuit.**

