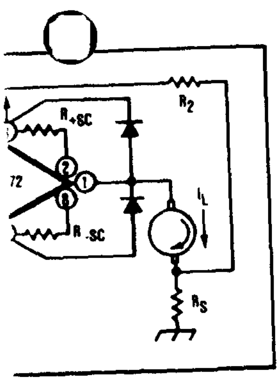
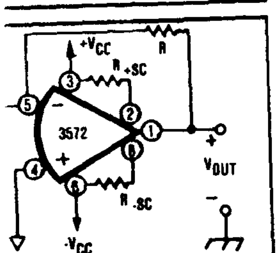
ints on the output voltage
just due to the maximum
f the amplifiers. These are
econdary breakdown in the
se restrictions are shown in
ves in the Typical Perform-

lamaging the output stage if
tions) occurs, applications
h will activate the current
nited to a load impedance
leading, over the frequency
Increasing the load's series
angle, if necessary. Larger
plied if current limit is not

compensation capacitor is
eramic capacitor is recom-
capacitor should be used
is and at all amplifier gains
gram).





BURR-BROWN®

3573

High Current - High Power OPERATIONAL AMPLIFIER

FEATURES

- HIGH OUTPUT POWER
  100 Watts Peak
  40 Watts Continuous
- WIDE SUPPLY RANGE
  ±10 to ±34 Volts
- HIGH OUTPUT CURRENT
  ±5 Amps Peak
  ±2 Amps Continuous
- SMALL SIZE: TO-3 PACKAGE
- LOW COST

APPLICATIONS

- DC MOTORS
- AC MOTORS
- ACTUATORS
- ELECTRONIC VALVES
- SYNCROS

DESCRIPTION

If you need to supply 100 watts peak or 40 watts continuous, yet must choose a small, easy to use op amp, you'll find the 3573 a logical solution. This hybrid IC delivers ±5A peak minimum at ±20V minimum to the load when operated from ±28V power supplies. The design of this op amp has been optimized for low cost while preserving moderately good input and distortion characteristics.

Output circuitry provides for external current limiting resistors for both positive and negative currents. This allows current limits to be set to values dictated by the op amp's application. 3573 is internally frequency compensated and is unconditionally stable with capacitive loads to 3300pF.

Housed in a small, rugged, hermetically sealed 8-lead TO-3 package, 3573 will withstand severe environments far better than discrete component amplifiers. The metal case is completely electrically isolated from the amplifier circuitry. Thus, mounting is easier (no isolation washers or spacers) and the hazards of a case connected to the output or supply voltage is eliminated.

International Airport Industrial Park · P.O. Box 11400 · Tucson, Arizona 85734 · Tel. (602) 746-1111 · Twx: 910-952-1111 · Cable: BBRCORP · Telex: 66-6491

PDS-393B

ELECTRICAL SPECIFICATIONS

At T_{case} = 25°C and $\pm V_{CC}$ = ±28VDC unless otherwise noted.

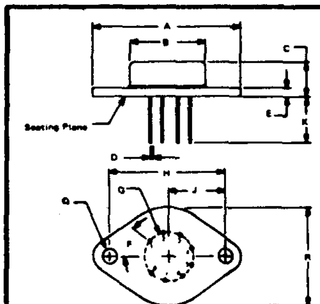
PARAMETER	CONDITIONS	3573AM MIN	3573AM TYP	3573AM MAX	UNITS
OPEN LOOP GAIN, DC	$R_L \geq 30\Omega$	94	115		dB
RATED OUTPUT					
Power to Load[1]					
Continuous		40			W
Peak		100			W
Output Current					
Continuous		±2			A
Peak		±5			A
Output Voltage	I_{out} = ±5A[4]	±20	±23		V
DYNAMIC RESPONSE					
Bandwidth, Unity Gain	Small Signal		1		MHz
Full Power Bandwidth		15	23		kHz
Slew Rate		1.35	1.5		V/μs
INPUT OFFSET VOLTAGE					
Initial Offset			±5	±10	mV
vs Temperature	-25°C ≤ T_{case} ≤ 85°C		±10	±65	μV/°C
vs Supply Voltage			±35		μV/V
INPUT BIAS CURRENT					
Initial	T_{case} = 25°C		15	40	nA
vs Temperature			±0.05		nA/°C
vs Supply Voltage			±0.02		nA/V
INPUT DIFFERENCE CURRENT					
Initial	T_{case} = 25°C		±5	±10	nA
vs Temperature	-25°C ≤ T_{case} ≤ 85°C		±0.01		nA/°C
INPUT IMPEDANCE					
Differential			10		MΩ
Common-mode			250		MΩ
INPUT NOISE					
Voltage Noise	f_o = 0.3Hz to 10Hz		3		μV p-p
	f_o = 10Hz to 10kHz		5		μVrms
Current Noise	f_o = 0.3Hz to 10Hz		20		pA p-p
	f_o = 10Hz to 10kHz		4.5		pA rms
INPUT VOLTAGE RANGE					
Common-mode Voltage	Linear Operation	±(|V_{CC}|-6)	±(|V_{CC}|-3)		V
Common-mode Rejection	f = DC, V_{CM} = ±22	70	110		dB
POWER SUPPLY					
Rated Voltage			±28		V
Voltage Range, derated		±10		±34	V
Current, quiescent			±2.6	±5	mA
TEMPERATURE RANGE					
Specification		-25		+85	°C
Operating, derated performance		-25		+85	°C
Storage		-65		+150	°C

ABSOLUTE MAXIMUM RATINGS

Supply Voltage Range	±34VDC
Internal Power Dissipation[1]	45W
Differential Input Voltage[2]	±62VDC
Input Voltage Range[2]	±31VDC
Storage Temperature Range	-65°C to 150°C
Lead Temperature (soldering, 10 sec)	300°C
Output Short-Circuit Duration[3]	Continuous
Junction Temperature	150°C

1. Package must be derated based on a junction to case thermal resistance of 2.8°C/W, or a junction to ambient thermal resistance of 30°C/W.
2. For supply voltages less than ±34VDC, the absolute maximum voltage is three volts less than supply voltage.
3. Safe Operating Area and Power Derating Curves must be observed.
4. With R±SC = 0.

MECHANICAL

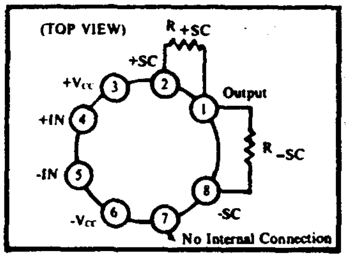


NOTE: Leads in true position within .010" (.25mm) R at MMC at seating plane.

Pin numbers shown for reference only.
Numbers may not be marked on package.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	1.510	1.550	38.35	39.37
B	.745	.770	18.92	19.56
C	.260	.300	6.60	7.62
D	.038	.042	0.97	1.07
E	.080	.105	2.03	2.67
F	40° BASIC		40° BASIC	
G	.500 BASIC		12.7 BASIC	
H	1.186 BASIC		30.12 BASIC	
J	.593 BASIC		15.06 BASIC	
K	.400	.500	10.16	12.70
Q	.151	.161	3.84	4.09
R	.980	1.020	24.89	25.91

CONNECTION DIAGRAM



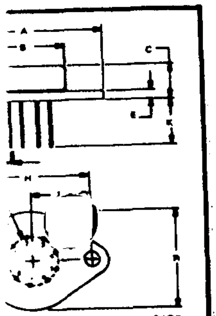
XIMUM RATINGS

	±34VDC
on[1]	45W
e[2]	±62VDC
	±31VDC
ange	-65°C to 150°C
ering, 10 sec)	300°C
uration[1]	Continuous
	150°C

sted based on a junction to c of 2.8°C/W, or a junction sistance of 30°C/W.

ess than ±34VDC, the ltage is three volts less than

and Power Derating Curves



true position within .010" R at MMC at seating plane.

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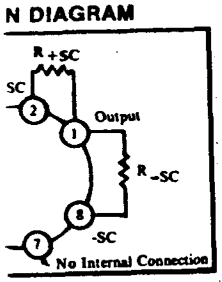
HES		MILLIMETERS	
	MAX	MIN	MAX
	1.550	38.35	39.37
	.770	18.92	19.56
	.300	6.60	7.62
	.042	0.97	1.07
	.105	2.03	2.67
BASIC		40° BASIC	
BASIC		12.7 BASIC	
BASIC		30.12 BASIC	
BASIC		15.06 BASIC	
	.500	10.16	12.70
	.161	3.84	4.09
	1.020	24.89	25.91

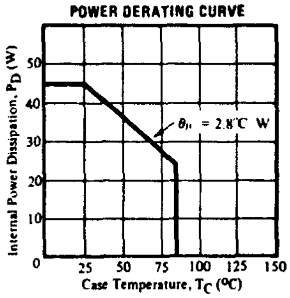
N DIAGRAM



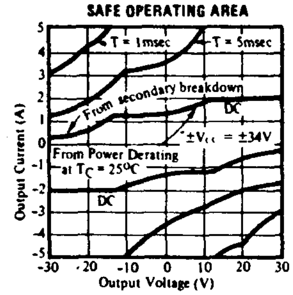
TYPICAL PERFORMANCE CURVES

(Typical at 25°Case and ±V_{CC} = ±28 VDC unless otherwise noted.)

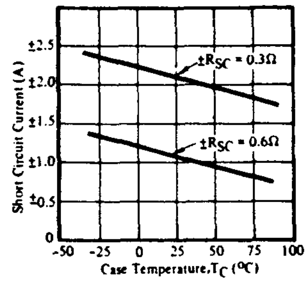
POWER DERATING CURVE



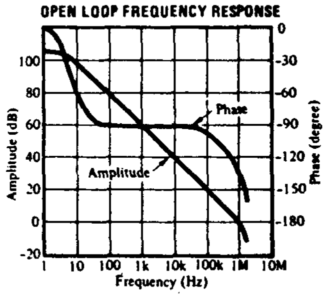
SAFE OPERATING AREA



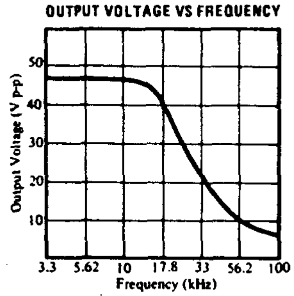
CURRENT LIMITING



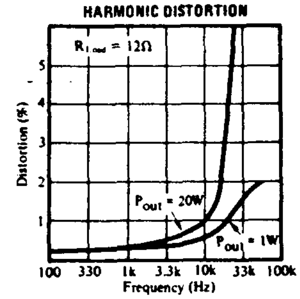
OPEN LOOP FREQUENCY RESPONSE



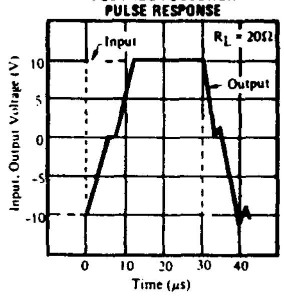
OUTPUT VOLTAGE VS FREQUENCY



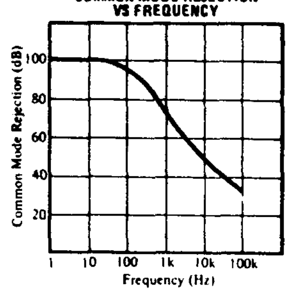
HARMONIC DISTORTION



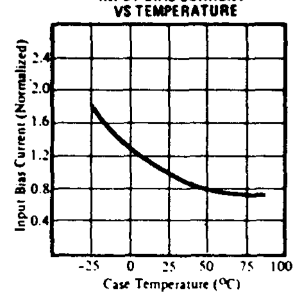
VOLTAGE FOLLOWER PULSE RESPONSE



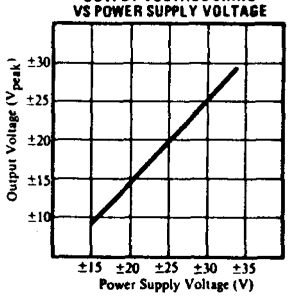
COMMON MODE REJECTION VS FREQUENCY



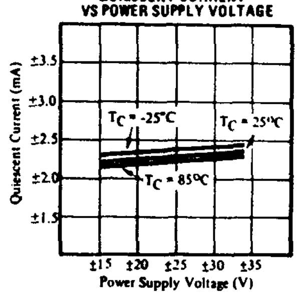
INPUT BIAS CURRENT VS TEMPERATURE



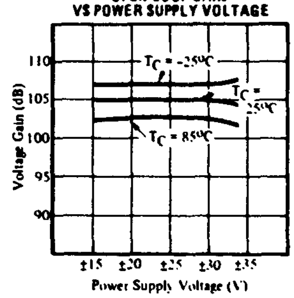
OUTPUT VOLTAGE SWING VS POWER SUPPLY VOLTAGE



QUIESCENT CURRENT VS POWER SUPPLY VOLTAGE



OPEN LOOP GAIN VS POWER SUPPLY VOLTAGE



INSTALLATION AND OPERATING INSTRUCTIONS

GENERAL PRECAUTIONS

CURRENT LIMITING

It is recommended that during initial amplifier setup, particularly in breadboarding and when a lack of familiarity with the amplifier exists, that the current limit be set at about 250mA ($R_{SC} \cong 2.6\Omega$). This will allow verification of the circuit and will minimize the possibility of damaging the amplifier. Later, when the circuit configuration and connections have been proven, the current limits can be raised to the desired value.

PROPER GROUNDING & POWER SUPPLY BYPASSING

Particular attention should be given to proper grounding practices because the large output currents can cause significant ground loop errors. Figure 1 illustrates proper connections.

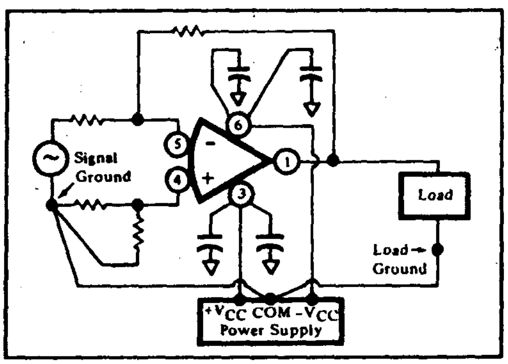


FIGURE 1. Proper Power Supply Connections.

Note that the connections are such that the load current does not flow through the wire connecting the signal ground point to the power supply common. Also, power supply and load leads should be run physically separated from the amplifier input and signal leads.

The amplifier should be power supply bypassed with $50\mu F$ tantalum capacitors connected in parallel with 0.01 μF ceramic capacitors connected as close to pins 3 and 6 as possible. The capacitors should be connected to the load ground rather than the signal ground.

CURRENT LIMITS

The amplifier is designed so that both the positive and negtive load current limits can be adjusted with external resistors, R_{+SC} and R_{-SC} respectively. The value of the resistors are given by the following equation:

$$R_{SC} \cong \frac{0.65 \text{ (volts)}}{I_{limit} \text{ (amps)}}$$

I_{limit} is the desired maximum current. The maximum power dissipation of the resistors is $P_{max} = R_{SC}(I_{limit})^2$. The current limits determined by the equations above are accurate to about $\pm 10\%$. The variation of I_{limit} vs temperature is shown in the Typical Performance Curves.

The amplifier should be used with as low a current limit as possible for the particular application. This will minimize the chance of damaging the amplifier under abnormal load conditions and increase reliability by limiting the internal power dissipation of the amplifier.

THERMAL CONSIDERATIONS

The 3573AM is rated for 150°C maximum junction temperature. The thermal resistance from junction to case (θ_{jc}) is 2.8°C/W per watt. The corresponding Power Derating Curve is given in the Typical Performance Curves section.

The internal power dissipation of the amplifier is given by the equation $P_D = P_{DQ} + P_{DL}$ where P_{DQ} is the quiescent power dissipation and P_{DL} is the power dissipated in the output stage due to the load.

The thermal resistance of the required heat sink (θ_{hs}) can be determined from the equation:

$$\theta_{hs} = \frac{T_J - T_A}{P_D} - \theta_{jc}$$

where T_J is the desired amplifier junction temperature (+150°C max), T_A is the ambient temperature, P_D is the amplifier's dissipation, $P_D = P_{DQ} + P_{DL}$, and θ_{jc} is the junction to case thermal resistance of the amplifier.

The electrically isolated case of the 3573AM simplifies mounting the amplifiers to the heat sink (and the heat sink to any other assemblies) since there is no need for electrical insulation. Thermal joint compound and lock washers should be used to prevent mechanical relaxation due to thermal stresses.

SAFE OPERATING AREA

There are additional constraints on the output voltage and current other than those just due to the maximum internal power dissipation of the amplifiers. These are related to the prevention of secondary breakdown in the output stage transistors. These restrictions are shown in the SAFE OPERATING AREA CURVES in the Typical Performance Curves.