



M.S.KENNEDY CORP.

# DUAL HIGH POWER BRIDGE AMPLIFIER

# 121 SERIES

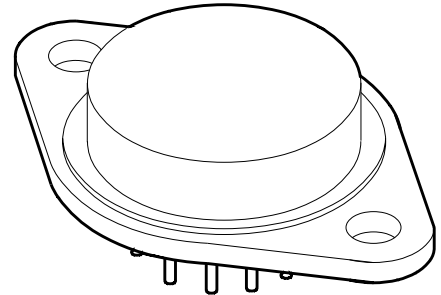
4707 Dey Road Liverpool, N.Y. 13088

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### FEATURES:

- Ultra Low Cost/Minimal External Components Required
- Complete Bridge/Dual Phase Output Configuration Up to 60 Watts
- Internal RC Output Snubber Networks For Ultra-Stable Operation
- Single or Dual Supply Operation 5V to 40V Total
- Internal Power Supply Decoupling Capacitor Provided
- Internal Output Current Limit 4A Typical
- Gain BW Product 600KHz Typical

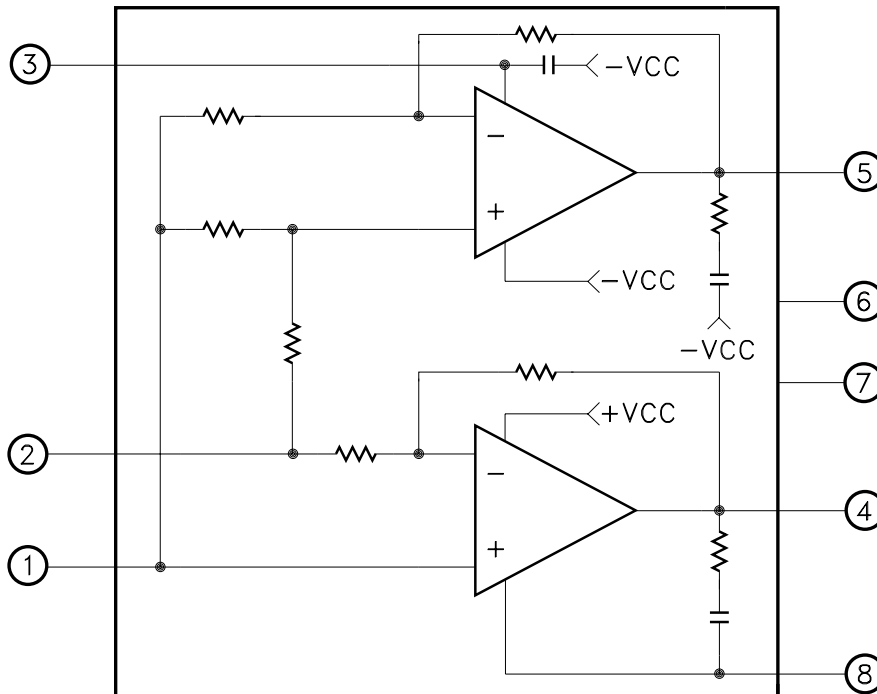
MIL-PRF-38534 QUALIFIED



### DESCRIPTION:

The MSK 121(B) is a low cost monolithic dual bridge amplifier capable of delivering 60 watts per package and is available in many preset gain configurations. Internal RC snubber networks ensure stable operation and an internal current limit of 4 amps improves product reliability under abnormal loading conditions. The MSK 121 Series can be powered from a split supply of  $\pm 2.5V$  to  $\pm 20V$  or single ended from 5V to 40V. A minimum of 3 amps of load current is available and the highly efficient driver section allows the output to swing to within 2.2 volts of the power supply rail when delivering 2.5 amps of load current. The MSK 121 Series is packaged in a hermetically sealed 8-pin TO-3 package that can be attached directly to a heat sink for maximum thermal efficiency. Consult factory for alternate package configurations.

### EQUIVALENT SCHEMATIC



### TYPICAL APPLICATIONS

- Bridge Audio Amplifier
- Bi-Directional Motor Driver
- Dual Precision Power Regulator
- Dual Solenoid Controller

### PIN-OUT INFORMATION

1 VREF	8 -VCC
2 INPUT	7 N/C
3 +VCC	6 N/C
4 OUTPUT 2	5 OUTPUT 1

## ABSOLUTE MAXIMUM RATINGS

$\pm V_{CC}$	Total Supply Voltage . . . . .	40V
$I_{OUT}$	Peak Output Current . . . . .	SOA
$V_{IND}$	Differential Input Voltage . . . . .	$\pm V_{CC}$
$V_{INC}$	Common Mode Range . . . . .	$\pm V_{CC}-0.5V$

$T_{ST}$	Test Storage Temperature Range	-65°C to +150°C
$T_{LD}$	Lead Temperature Range . . . . .	300°C (Soldering 10 Seconds)
$T_C$	Case Operating Temperature	
	MSK121 . . . . .	-40°C to +85°C
	MSK121B . . . . .	-55°C to +125°C
$T_J$	Junction Temperature . . . . .	+175°C

## ELECTRICAL SPECIFICATIONS

Parameter	Test Conditions ①	Group A Subgroup	MSK 121B			MSK 121			Units
			Min.	Typ.	Max.	Min.	Typ.	Max.	
<b>STATIC</b>									
Supply Voltage Range ②		-	±2.5	±15	±20	±2.5	±15	±20	V
Quiescent Current	Total - Both Amplifiers $V_{IN} = 0V$	1	-	35	60	-	35	90	mA
<b>INPUT</b>									
Output Offset Voltage	$V_{IN} = 0V$	1	-	±0.5	±5	-	±1.5	±10	(mV)(Av)
Output Offset Voltage Drift ②	$V_{IN} = 0V$	2,3	-	±10	±50	-	±15	±75	μV/°C
Input Bias Current ②		1	-	±30	±500	-	±30	±1500	nA
		2,3	-	±75	±1000	-	±75	-	nA
Input Capacitance ②		-	-	10	-	-	10	-	pF
Power Supply Rejection Ratio ②	$V_{CC} = \pm 10V$ to $\pm 15V$	-	60	80	-	60	80	-	dB
<b>OUTPUT</b>									
Output Voltage Swing	$R_L = 1K\Omega$ ; $F = 10KHz$	4	±14	±14.2	-	±14	±14.2	-	V
	$R_L = 10\Omega$ ; $F = 10KHz$	4	±13	±13.7	-	±13	±13.7	-	V
Output Peak Current	$F = 10KHz$	4	±3	±4	-	±2.5	±3.5	-	A
Power Bandwidth ③	$R_L = 10\Omega$ ; $V_{OUT} = 10V_{PP}$	-	-	40	-	-	40	-	kHz
<b>TRANSFER CHARACTERISTICS</b>									
Slew Rate ②	$V_{OUT} = \pm 10V$	4	0.5	1.5	-	0.5	1.5	-	V/μS
Voltage Gain	MSK121-1	4	±0.95	±1.0	±1.05	±0.9	±1.0	±1.1	V/V
	MSK121-2	4	±1.9	±2.0	±2.1	±1.8	±2.0	±2.2	V/V
	MSK121-5	4	±4.75	±5.0	±5.25	±4.8	±9.0	±5.4	V/V
	MSK121-10	4	±9.5	±10.0	±10.5	±9.3	±10.0	±10.7	V/V
<b>THERMAL RESISTANCE</b>									
$\theta_{JC}$ (Junction to Case)	One Amplifier, DC Output	-	-	5.0	-	-	5.0	-	°C/W
$\theta_{JC}$	One Amplifier, AC Output $F > 60Hz$	-	-	3.7	-	-	3.7	-	°C/W
$\theta_{JC}$	Both Amplifiers, DC Output	-	-	3.4	-	-	3.4	-	°C/W
$\theta_{JC}$	Both Amplifiers, AC Output $F > 60Hz$	-	-	2.4	-	-	2.4	-	°C/W
$\theta_{JA}$ (Junction to Ambient)	No Heat Sink	-	-	30	-	-	30	-	°C/W

### NOTES:

- ①  $\pm V_{CC} = \pm 15V$ ,  $V_{REF} = 0V = GND$ ,  $R_L = 1K\Omega$  unless otherwise specified.
- ② Parameter is guaranteed by design but not tested.
- ③ Typical specifications are representative of actual device performance at 25°C but are for reference only.
- ④ Military grade devices ('B' suffix) shall be 100% tested to subgroups 1,2,3 and 4.
- ⑤ Subgroup 5 and 6 testing available upon request.
- ⑥ Subgroup 1,4  $T_A = T_C = +25^\circ C$   
 Subgroup 2,5  $T_A = T_C = +125^\circ C$   
 Subgroup 3,6  $T_A = T_C = -55^\circ C$

## APPLICATION NOTES

### POWER SUPPLY CONNECTIONS

The MSK 121 maximum supply voltage is specified as  $\pm 20V$ . However, single sided or unbalanced power supply operation is permissible as long as the total power supply voltage does not exceed 40V. Caution should be exercised when routing high current printed circuit paths. Generally, these paths should not be placed near low level, high impedance input circuitry to avoid oscillations.

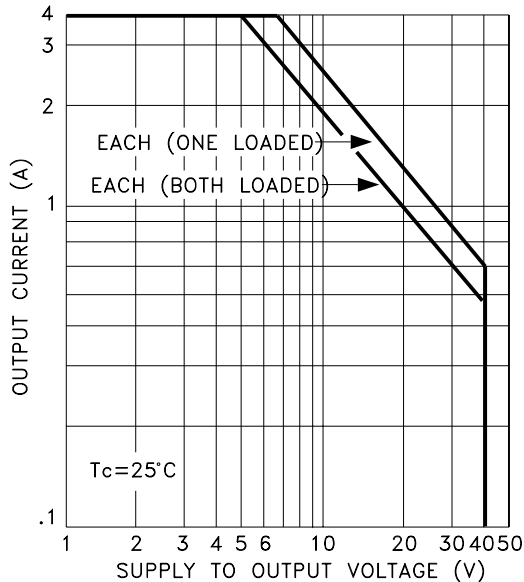
During initial evaluation, power supply current limiting is strongly advised to avoid damaging the device. The MSK 121 has an internal  $0.1\mu F$  capacitor for high frequency decoupling. However, both the negative and positive power supplies must also be effectively decoupled with a low frequency bypass capacitor to avoid power supply induced oscillation. An effective decoupling scheme consists of  $10\mu F$  of capacitance for every 1 Amp of output current from each power supply pin to ground. The capacitors will eliminate any peak output voltage clipping which may occur due to poor power supply load regulation. Power supply decoupling capacitors should be placed as close to the package power supply pins as possible (pins 3 and 8).

### CURRENT LIMIT

The current limit circuitry is internal to the device. The typical value is shown in the parameter table. For protection against high energy flyback conditions (inductive loads), fast recovery reverse biased diodes should be connected from each output to the power supplies. (See Figure 1.)

### SAFE OPERATING AREA

The safe operating area curve is a graphical representation of the power handling capability of the amplifier under various conditions. The wire bond current carrying capability, transistor junction temperature and secondary breakdown limitations are all incorporated into the safe operation area curves. All applications should be checked against the S.O.A. curves to ensure high M.T.B.F.



### VREF PIN CONNECTIONS

The VREF pin is brought out to allow the user to bias the outputs at a predetermined DC level. When the input signal is AC coupled the output of each amplifier will be at the same DC level as the VREF pin. This feature is very useful when using a single supply voltage. The user can simply connect a resistor voltage divider to VREF to bias the output at one half of the supply voltage by using 2 equal value resistors from +VCC to -VCC (GND).

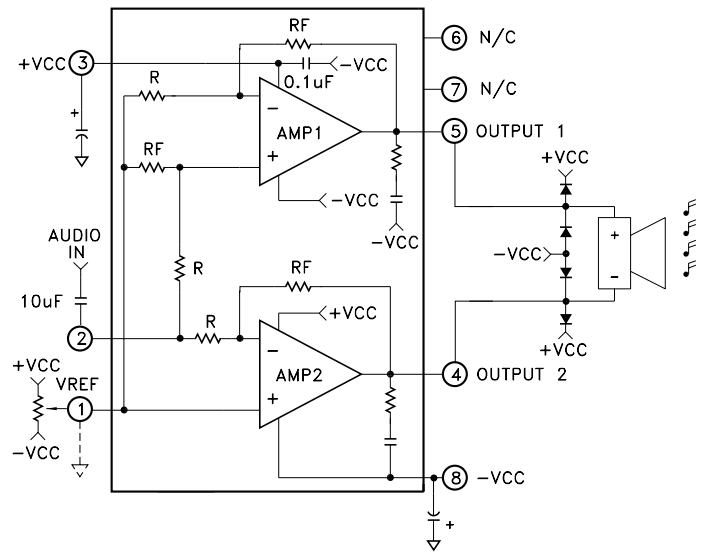
### GAIN CONFIGURATIONS

The MSK 121 is available with preset gains of  $\pm 1$ ,  $\pm 2$ ,  $\pm 5$  and  $\pm 10V/V$ . Refer to figure 1 for typical values of the internal components.

### STABILITY CONSIDERATIONS

The MSK 121 has an internal RC snubber network on each output for excellent stability for most applications. Good layout practices should be used, however, when designing the printed circuit board.

### TYPICAL APPLICATION CIRCUIT



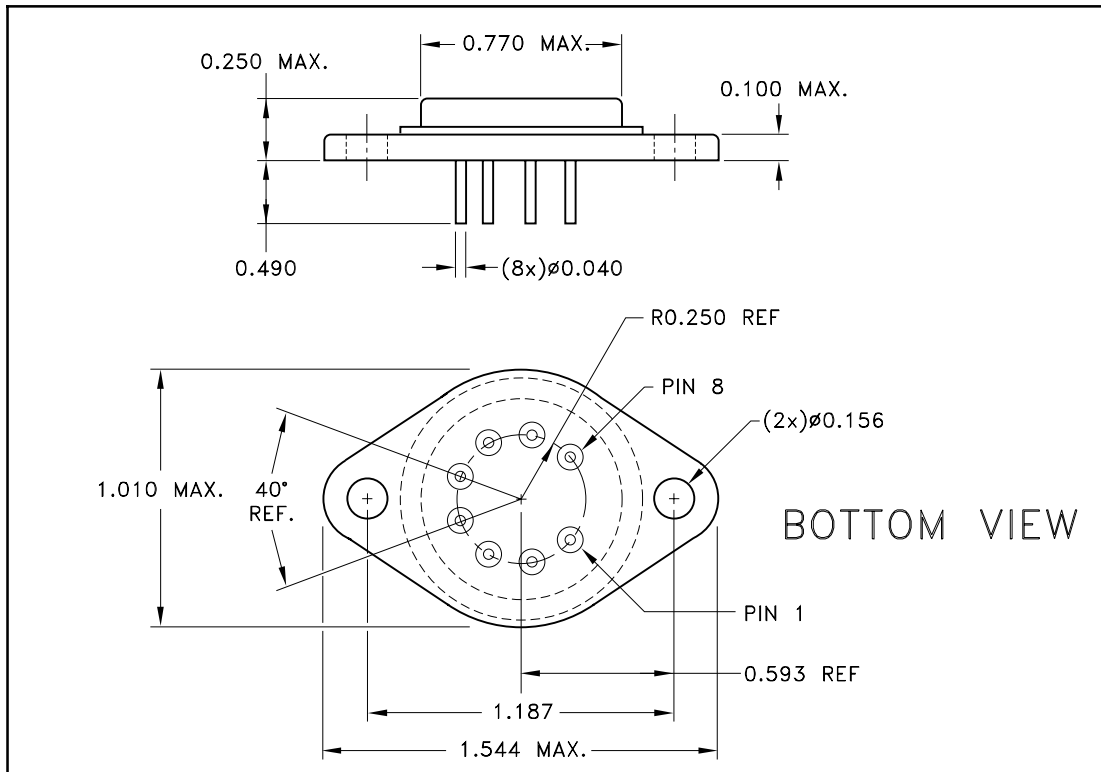
P/N	$A_v$	$R_f$	$R$	$Z_{IN}(V_{REF} = GND)$
MSK121-1	$\pm 1$	50K $\Omega$	50K $\Omega$	33.3K $\Omega$
MSK121-2	$\pm 2$	50K $\Omega$	25K $\Omega$	18.8K $\Omega$
MSK121-5	$\pm 5$	50K $\Omega$	10K $\Omega$	8.6K $\Omega$
MSK121-10	$\pm 10$	100K $\Omega$	10K $\Omega$	9.2K $\Omega$

Figure 1





## MECHANICAL SPECIFICATIONS



ALL DIMENSIONS ARE  $\pm 0.010$  INCHES UNLESS OTHERWISE LABELED

## ORDERING INFORMATION

Part Number	Screening Level	Voltage Gain*
MSK121-1	Industrial	$\pm 1$
MSK121B-1	Military Mil-PRF-38534	$\pm 1$
MSK121-2	Industrial	$\pm 2$
MSK121B-2	Military Mil-PRF-38534	$\pm 2$
MSK121-5	Industrial	$\pm 5$
MSK121B-5	Military Mil-PRF-38534	$\pm 5$
MSK121-10	Industrial	$\pm 10$
MSK121B-10	Military Mil-PRF-38534	$\pm 10$

\* Please consult factory if alternate package or gain is required.

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# TYPICAL PERFORMANCE CURVES

