

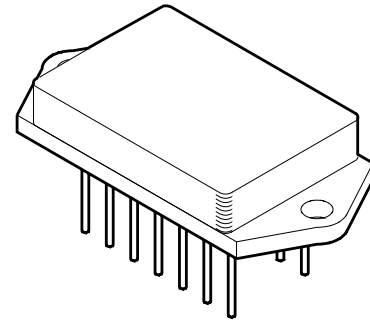


HIGH POWER DUAL OPERATIONAL AMPLIFIER

155

FEATURES:

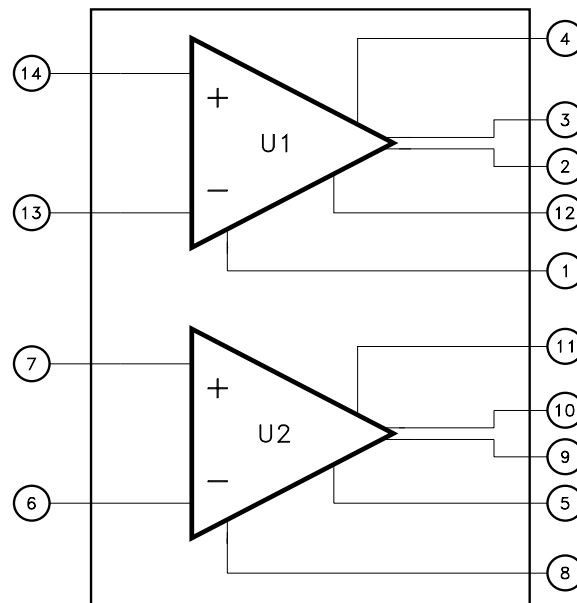
- Space Efficient Dual Power Amplifier
- Low Cost
- High Voltage Operation: Up to 80V
- Low Quiescent Current: 40mA Typ. Total
- High Output Current: 5A Min. Per Amp
- High Speed: 10V/ μ S Typ.
- Monolithic Technology
- Replaces obsolete MSK154 up to 80V



DESCRIPTION:

The MSK155 is a high power dual monolithic operational amplifier ideally suited for high power amplification and magnetic deflection applications. With a total supply voltage rating of 80 volts and 5A of available output current per amplifier, the MSK155 is also an excellent low cost choice for motor drive circuits. With both amplifiers in the same package, thermally induced output offset voltages are eliminated. Power dissipation is kept to a minimum with a total quiescent current rating of only 40mA. The MSK155 is packaged in a hermetically sealed 14 pin power dip with heat sink bolt down tabs.

EQUIVALENT SCHEMATIC



TYPICAL APPLICATIONS

- PA Audio
- Magnetic Deflection
- Motor Drive
- Noise Cancellation
- High Power Bridge Amplifier

PIN-OUT INFORMATION

1	-Vcc1	14	Non Inverting Input 1
2	Output Drive 1B	13	Inverting Input 1
3	Output Drive 1A	12	Current Sense1
4	+Vcc1	11	+Vcc 2
5	Current Sense 2	10	Output Drive 2A
6	Inverting Input 2	9	Output Drive 2B
7	Non Inverting Input 2	8	-Vcc 2

ABSOLUTE MAXIMUM RATINGS ^⑨

V _{CC}	Total Supply Voltage.....	80V
±I _{OUT}	Output Current (within S.O.A.).....	±5A
V _{IND}	Input Voltage (Differential).....	±V _{CC}
V _{IN}	Input Voltage (Common Mode).....	±V _{CC}
T _J	Junction Temperature.....	150°C

T _{ST}	Storage Temperature..... ^⑩	-65°C to +150°C
T _{LD}	Lead Temperature	300°C
T _C	Case Operating Temperature (MSK155H).....	-55°C to +125°C
	(MSK155).....	-40°C to +85°C
R _{TH}	Thermal Resistance (DC) Junction to Case.....	2.0°C/W

ELECTRICAL SPECIFICATIONS

Parameter	Test Conditions ^①	Group A Subgroup	MSK155H			MSK155 ^⑤			Units
			Min.	Typ.	Max.	Min.	Typ.	Max.	
STATIC									
Supply Voltage Range ^④		-	±10	±35	±40	±10	±35	±40	V
Quiescent Current	Each Amp V _{IN} = 0V	1	-	±20	±30	-	±20	±35	mA
		2	-	±20	±30	-	-	-	mA
		3	-	±20	±30	-	-	-	mA
INPUT									
Offset Voltage	V _{IN} = 0V	1	-	±0.1	±2	-	±0.1	±10	mV
		2, 3	-	±2	±10	-	-	-	mV
Offset Voltage Drift ^④	V _{IN} = 0V	2, 3	-	±10	±50	-	±10	-	µV/°C
Offset Voltage vs ±V _{CC} ^②	V _{IN} = 0V	-	-	±5	-	-	±5	-	µV/V
Input Bias Current ^④	V _{CM} = 0V	1	-	±20	±100	-	±20	±200	pA
		2, 3	-	-	±150	-	-	-	nA
Input Impedance ^②	(DC)	-	-	10	-	-	10	-	Ω
Input Capacitance ^②		-	-	5	-	-	5	-	pF
Common Mode Rejection ^④	V _{CM} = ±22VDC	4	95	110	-	90	110	-	dB
Noise ^②	F = 10Hz to 1KHz	-	-	10	-	-	10	-	µVRMS
OUTPUT									
Output Voltage Swing ^②	R _L = 10K	-	-	±33.5	-	-	±33.5	-	V
output Voltage Swing	I _{OUT} = 5A Pk	4	±29	±30	-	±29	±30	-	V
Power Bandwidth ^④	R _L = 10Ω V _{OUT} = 20VRMS	4	45	55	-	40	55	-	KHz
Settling Time to 0.1% ^{③②}	2V Step	-	-	2	-	-	2	-	µS
Capacitive Load ^④	A _V = +10V/V	-	10	-	-	10	-	-	nF
TRANSFER CHARACTERISTICS									
Slew Rate ^④	V _{OUT} = ±10V R _L = 10Ω	4	6	10	-	6	10	-	V/µS
Open Loop Voltage Gain ^④	F = 10Hz R _L = 10KΩ	4	95	100	-	90	100	-	dB

NOTES:

- ① Unless otherwise noted ±V_{CC} = ±35VDC, R_{CL} = 0Ω and specifications apply to each amplifier.
- ② Typical parameters are for reference only.
- ③ A_V = -1V/V measured in false summing junction circuit.
- ④ Guaranteed by design but not tested. Typical parameters are for reference only.
- ⑤ Industrial grade devices shall be tested to subgroups 1 and 4 unless otherwise requested.
- ⑥ Military grade devices ('H' suffix) shall be 100% tested to subgroups 1, 2, 3 and 4.
- ⑦ Subgroup 5 and 6 testing available upon request.
- ⑧ Subgroup 1, 4 T_C = +25°C
Subgroup 2, 5 T_C = +125°C
Subgroup 3, 6 T_A = -55°C
- ⑨ Continuous operation at or above absolute maximum ratings may adversely effect the device performance and/or life cycle.
- ⑩ Internal solder reflow temperature is 180°C, do not exceed.

APPLICATION NOTES

CURRENT LIMIT (SEE TYPICAL CONNECTION DIAGRAM)

A value of current limit resistance can be calculated as follows:

$$R_{CL} = (0.809V / I_{CL}) - 0.057\Omega$$

Where:

R_{CL} is the current limit resistor value.

I_{CL} is the current limit desired.

0.057Ω is the drop in the current limit path across internal impedances other than the actual current limit resistor.

0.809Ω volts is the voltage drop that must be developed across the current limit connections to activate the current limit circuit at 25°C .

It is recommended the user limit output current to a value as close to the required output current as possible, without clipping output voltage swing. Current limit will vary with case temperature. Refer to the typical performance curves to predict current limit drift. If current limit is not required replace the resistor with a short.

STABILITY

It is recommended that the parallel sum of the input and feedback resistor be 1000 ohms or less to minimize phase shift caused by the R-C network formed by the input resistor, feedback resistor and input capacitance. An effective method of checking amplifier stability is to apply the worst case capacitive load to the output of the amplifier and drive a small signal square wave across it. If overshoot is less than 25%, the system will typically be stable.

INPUT PROTECTION

Input protection circuitry within the MSK155 will clip differential input voltages greater than V_{CC} . The inputs are also protected against common mode voltages up to the supply rails as well as static discharge. There are current limiting resistors in series with each input. These resistors may become damaged in the event the input overload is capable of driving currents above 1mA. If severe overload conditions are expected, external input current limiting resistors are recommended.

POWER SUPPLY DECOUPLING

A 0.1 microfarad ceramic disc and low ESR capacitor with a value of 10 microfarads per amp of output current should be placed in parallel from each power supply pin to ground. These capacitors must be rated for the full power supply voltage. Since the MSK155 is commonly used in circuits where the loop gain is greater than 10 V/V, high frequency noise that enters the op-amp through the power supply lines will be amplified and could cause the amplifier to break into oscillation. In addition, without supply bypassing, the inductance of the power supply lines interacts with capacitive loads to form an oscillatory LC tank circuit. The power supply decoupling capacitors will minimize this effect and keep the circuit stable.

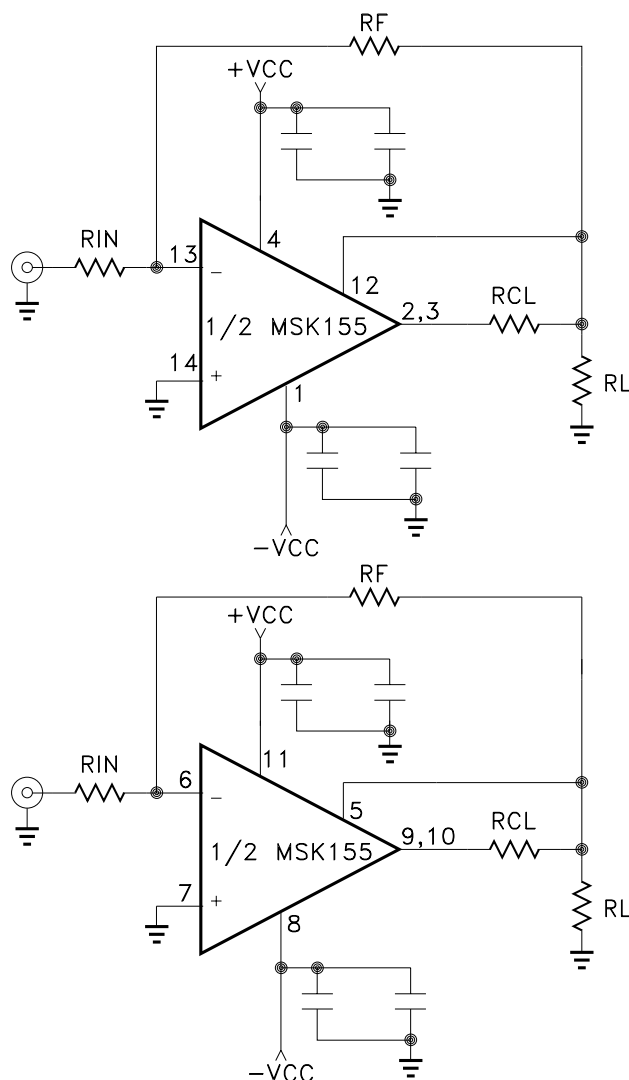
SAFE OPERATING AREA (SOA)

The output stage of this power operational amplifier has three distinct limitations:

1. The current handling capability of the die metallization.
2. The junction temperature of the output device's.
3. Secondary breakdown.

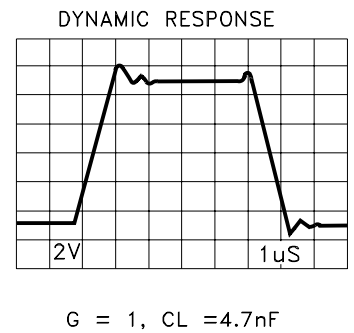
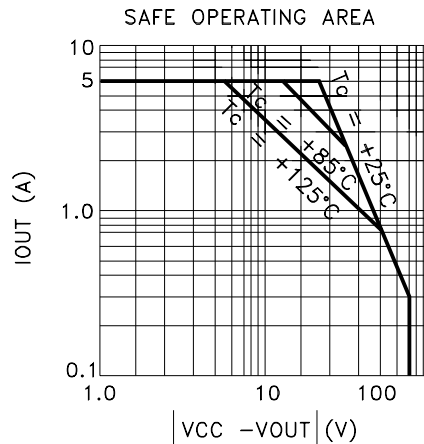
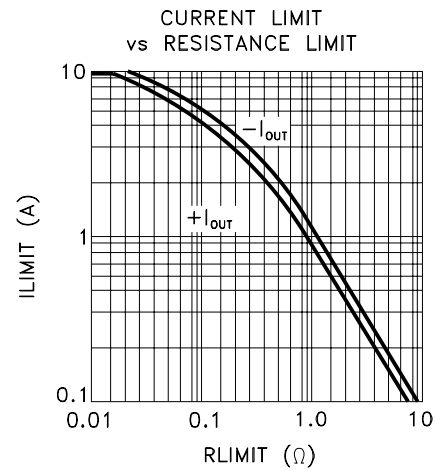
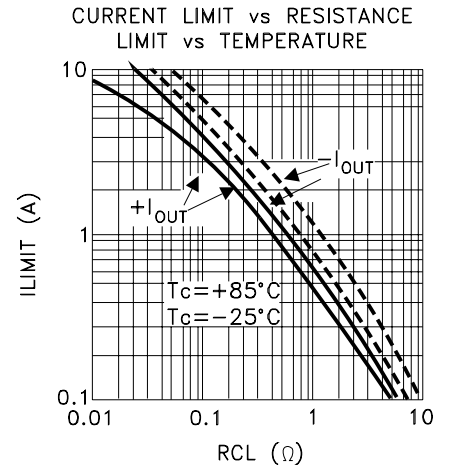
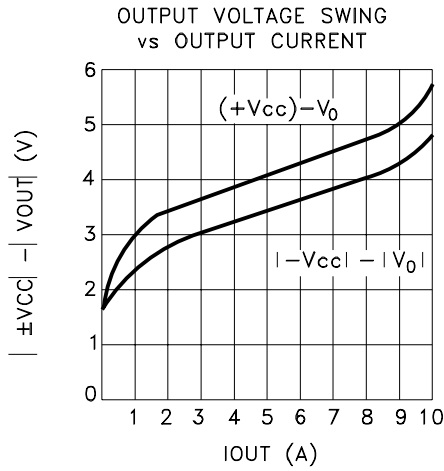
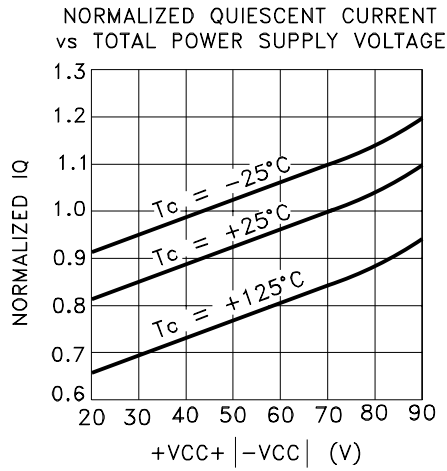
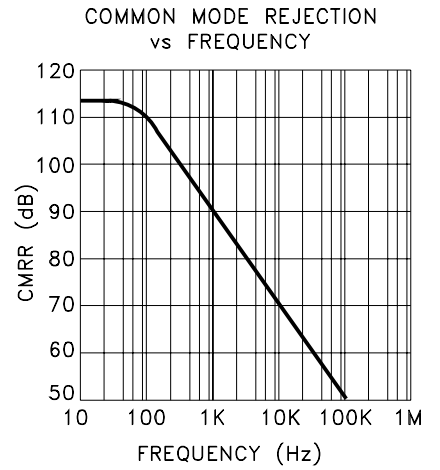
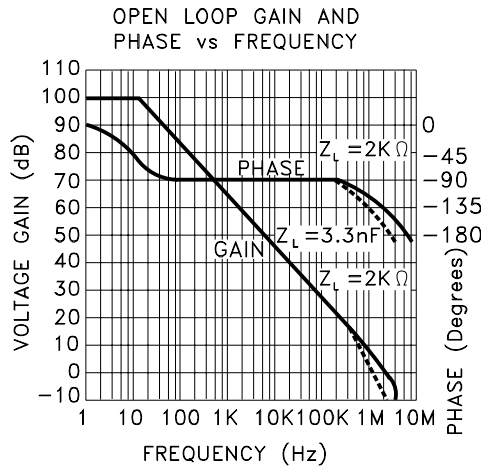
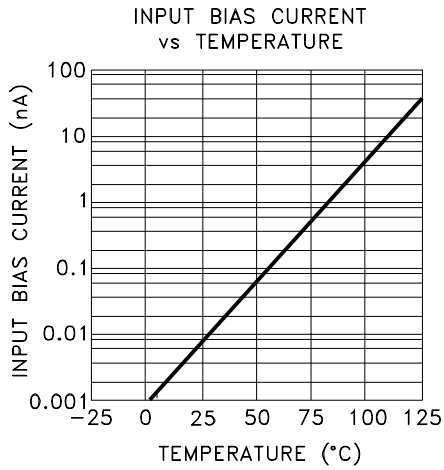
All applications should be checked against the SOA curves.

NOTE: The output stage is protected against transient flyback. However, for protection against sustained, high energy flyback, external fast-recovery reverse biased diodes should be connected from the output to ground.

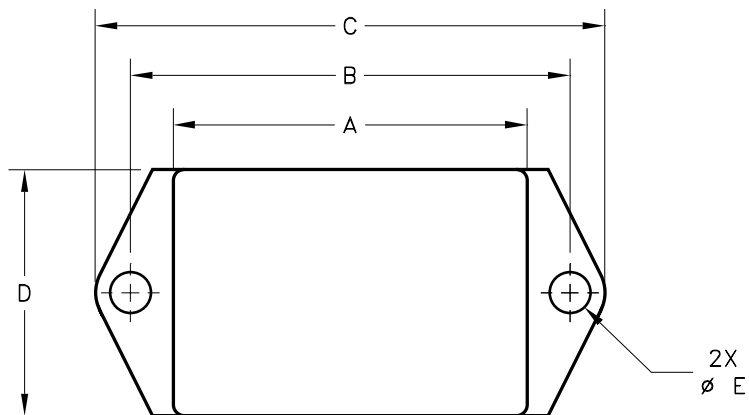


TYPICAL CONNECTION DIAGRAM

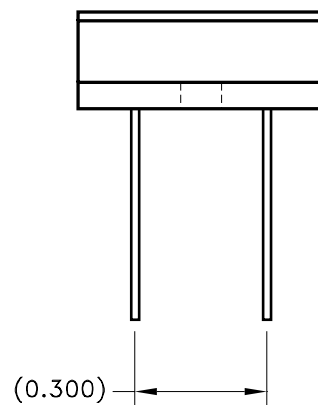
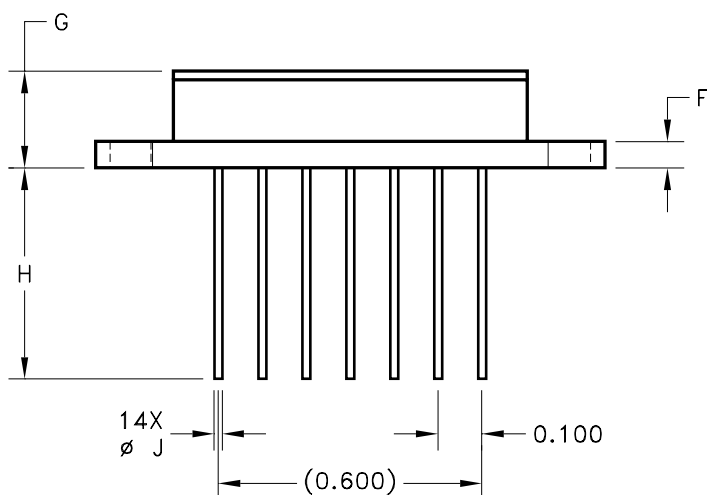
TYPICAL PERFORMANCE CURVES



MECHANICAL SPECIFICATIONS



REF	MIN	MAX
A	0.800	0.810
B	0.995	1.005
C	1.175	1.185
D	0.555	0.565
E	0.088	0.098
F	0.055	0.065
G		0.220
H	0.480	
J	0.016	0.020



ESD TRIANGLE INDICATES PIN 1
WEIGHT = 7.2 GRAMS TYPICAL

ALL DIMENSIONS ARE SPECIFIED IN INCHES

ORDERING INFORMATION

Part Number	Screening Level
MSK155	Industrial
MSK155H	MIL-PRF-38534, CLASS H

REVISION HISTORY

REV	STATUS	DATE	DESCRIPTION
E	Released	06/14	Add new note for solder reflow, clarify mechanical outline and assign new form number.
F	Released	09/17	Clarify GBD specification and update format
G	Released	09/21	Remove MIL-PRF-38535

TTM Technologies
www.ttmtech.com

The information contained herein is believed to be accurate at the time of printing. TTM Technologies reserves the right to make changes to its products or specifications without notice, however and assumes no liability for the use of its products. Please visit our website for the most recent revision of this data sheet.