ISO-9001 CERTIFIED BY DSCC

M.S.KENNEDY CORP.

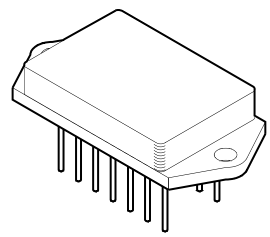
DUAL HIGH VOLTAGE/ HIGH CURRENT OPERATIONAL AMPLIFIER 182/183

4707 Dey Road Liverpool, N.Y. 13088 (315) 701-6751

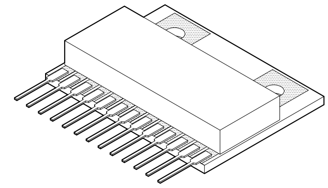
MIL-PRF-38534 CERTIFIED

FEATURES:

- Space Efficient Dual Amplifier
- High Voltage Operation:
  Single Supply: +8V to +60V
  Dual Supply: ±4V to ±30V
- High Output Current: 3 Amp Continuous per amplifier
- High Speed: 10V/μS
- Low Quiescent Current: 20 mA per amplifier Typ.
- Adjustable Current Limits
- Thermal Shutdown
- Monolithic Technology
- Enable/Status Pin For Output Disable Control



MSK182



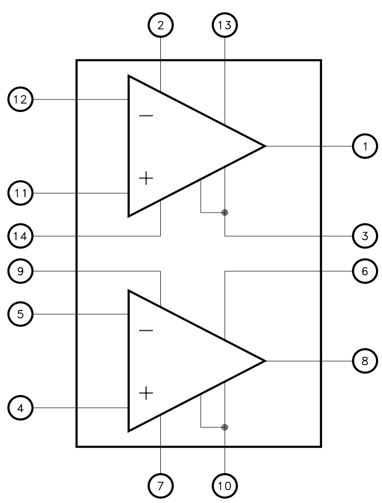
MSK183

DESCRIPTION:

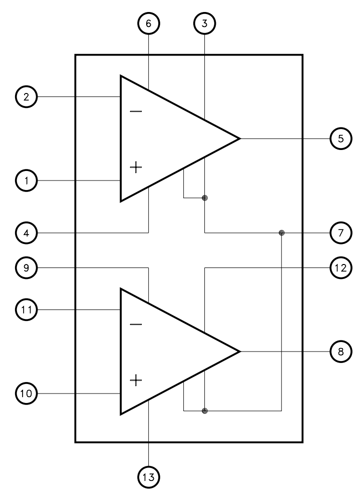
The MSK 182 and 183 are dual high power monolithic operational amplifiers ideal for use with a wide variety of loads. With operation from either single or dual supplies, they offer excellent design flexibility. Power dissipation is kept to a minimum with a quiescent current rating of only 20mA per amplifier, while 3 Amps of continuous available output current makes the MSK 182 or MSK 183 a very good low cost choice for motor drive circuits and audio amplification. The design is internally protected against current overloads and overtemperature conditions. Current limit can also be user-selected through the use of a resistor/potentiometer or voltage out/current out DAC. The MSK 182 is packaged in a hermetically sealed 14 pin power DIP with bolt down tabs for applications that require heat sinking. The MSK 183 is packaged in a low cost ceramic SIP.

EQUIVALENT SCHEMATIC

MSK182



MSK183



TYPICAL APPLICATIONS

- Servo Driver
- Actuator Driver
- Audio Amplifier
- Power Supplies
- Bridge Amps
- Stereo Amps

PIN-OUT INFORMATION

1	OUTPUT 1	14	E/S 1
2	+VCC 1	13	ILIM 1
3	-VCC 1	12	-VIN 1
4	+VIN 2	11	+VIN 1
5	-VIN 2	10	-VCC 2
6	ILIM 2	9	+VCC 2
7	E/S 2	8	OUTPUT 2

MSK 182 PINOUT

1	+VIN 1		
2	-VIN 1	13	E/S 2
3	ILIM 1	12	ILIM 2
4	E/S 1	11	-VIN 2
5	OUTPUT 1	10	+VIN 2
6	+VCC 1	9	+VCC 2
7	-VCC 1/2	8	OUTPUT 2

MSK 183 PINOUT

ABSOLUTE MAXIMUM RATINGS

V_{CC}	Total Supply Voltage	60V
$\pm I_{OUT}$	Output Current (within S.O.A.)	5A
V_{IND}	Input Voltage (Differential)	±29.5V
V_{IN}	Input Voltage (Common Mode)	+27V/-29V
T_J	Junction Temperature	Internal Protection (See Application Note)
T_{ST}	Storage Temperature Range	-65°C to +150°C
T_{LD}	Lead Temperature Range (10 seconds)	300°C
T_C	Case Operating Temperature	
	(MSK182H/E)	-55°C to +125°C
	(MSK182/183)	-40°C to +85°C
R_{TH}	Thermal Resistance	
	Junction to Case (Per Amplifier)MSK182	1.8°C/W
	Junction to Case (Per Amplifier)MSK183	3.0°C/W

ELECTRICAL SPECIFICATIONS

Parameter	Test Conditions ① ②	Group A Subgroup	MSK182H/E Min.	MSK182H/E Typ.	MSK182H/E Max.	MSK182/MSK 183 Min.	MSK182/MSK 183 Typ.	MSK182/MSK 183 Max.	Units
STATIC									
Supply Voltage Range ③		-	±4	-	±30	±4	-	±30	V
Quiescent Current (Per Amp)	V_{IN}=0V	1	-	±17	±20	-	±17	±23	mA
		2,3	-	±17	±20	-	-	-	mA
Quiescent Current (Per Amp)	Shutdown Mode V_{IN}=0V	-	-	±6	-	-	±6	-	mA
INPUT									
Input Offset Voltage	V_{IN}=0V	1	-	±2	±10	-	±2	±15	mV
Input Offset Voltage Drift	V_{IN}=0V	-	-	±30	-	-	±30	-	μV/°C
Input Bias Current ③	V_{IN}=0V	1	-	±100	±500	-	±100	±750	nA
Input Offset Current ③	V_{IN}=0V	1	±1	±5	±50	-	±5	±75	nA
Input Impedance	f=DC	-	-	10^7	-	-	10^7	-	Ω
Input Capacitance	f=DC	-	-	6	-	-	6	-	pF
Common Mode Rejection Ratio ③	$(-V_{CC})-0.1 \leq V_{IN} \leq (+V_{CC})-3V$	1	80	95	-	75	95	-	dB
Input Voltage Noise Density	f=1KHz	-	-	90	-	-	90	-	nV/√Hz
OUTPUT									
Output Voltage Swing	I_{OUT}=0.6A ③	4	±27	±28	-	±27	±28	-	V
	I_{OUT}=3.0A	4	±25.5	±26	-	±25	±26	-	V
Output Current	DC=Continuous	4	±3	-	-	±3	-	-	A
Shutdown Input Mode	V_{ES} High- Output Enabled E/S Open or High	4	-27.5	-	-	-27.5	-	-	V
	V_{ES} Low- Output Disabled E/S Forced Low	4	-	-	-29	-	-	-29	V
Output Disable Time		-	-	1	-	-	1	-	μS
Output Enable Time		-	-	3	-	-	3	-	μS
TRANSFER CHARACTERISTICS									
Slew Rate	A_V=1 V_{OUT}= 50Vp-p R_L=8Ω	-	-	10	-	-	8	-	V/μS
Open Loop Voltage Gain ③	V_{OUT}=±25V R_L=1KΩ	4	90	98	-	88	98	-	dB
Settling Time ±0.1% ③	A_V=10 50V Step	-	-	15	-	-	18	-	μS

NOTES:

① Unless otherwise specified $\pm V_{CC}$= ±30VDC and E/S pin is open.
② All electrical specifications apply to each amplifier.
③ Devices shall be capable of meeting the parameter, but need not to be tested. Typical parameters are for reference only.
④ Industrial grade and 'E' suffix devices shall be tested to subgroups 1 and 4 unless otherwise specified.
⑤ Military grade devices ('H' suffix) shall be 100% tested to subgroups 1,2,3 and 4.
⑥ Subgroup 1,4 $T_A=T_C$=+25°C
Subgroup 2 $T_A=T_C$=+125°C
Subgroup 3 $T_A=T_C$=-55°C

APPLICATION NOTES

POWER SUPPLIES:

For the MSK 182/183 maximum total supply voltage is specified as 60V. However, dual and unbalanced power supply operation is permissible as long as total supply voltage does not exceed 60V.

POWER SUPPLY BYPASSING:

Power supply terminals must be effectively decoupled with a high and low frequency bypass circuit to avoid power supply induced oscillation. An effective decoupling scheme consists of a 0.1μF ceramic capacitor in parallel with a 10μF tantalum capacitor for each power supply pin to ground. In addition, it is recommended that a 0.01μF capacitor be placed between ±Vcc as close to the MSK 182 as possible.

CURRENT LIMIT:

The MSK 182 and MSK 183 offer accurate, user-selectable current limit. Unlike typical designs that use a power resistor in series with the output to sense load, the MSK 182 and MSK 183 sense the load indirectly and therefore do not require a resistor to handle the full output current. Current limit is selected by controlling the input to the I_{LIM} pin.

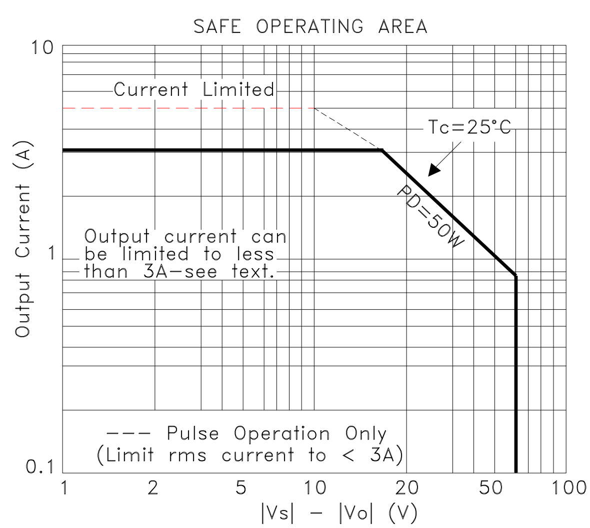
The easiest method is to use a resistor or potentiometer connected between-Vcc and the I_{LIM} pin. Use the following equation to select proper resistor value:

$$Rcc = \frac{71{,}250}{I_{LIM}} - 13.75K\Omega$$

A low level control signal (0-330μA) can also be used to control the current level digitally. If the pin is left open, the current is programmed to OA, while connecting I_{LIM} directly to -Vcc sets the output current to it's maximum, typically 5A.

SAFE OPERATING AREA:

The safe operating area curve is a graphical representation of the power handling capability of the amplifier under various conditions. Power dissipation of the device is equal to the product of the voltage across the output transistor times the output current. As can be seen in the curve, safe operating current decreases with an increase in temperature as well as an increase in the voltage across the output transistor. Therefore, for maximum amplifier performance it is important to keep case temperature as low as possible and to keep ±Vcc as close to the output rail as achievable.



THERMAL PROTECTION:

The MSK 182 and MSK 183 are equipped with thermal protection circuitry that protects each amplifier from damage caused by excessive junction temperature. The output is disabled when the junction temperature reaches approximately 160°C. After the junction temperature cools to approximately 140°C, the output is again enabled. The thermal protection may cycle on and off depending on the output load and signal conditions; this may have an undesirable effect on the load.

It should be noted that even though this internal protection circuitry does protect against overload conditions, it does not take the place of proper heat sinking. For reliable operation, junction temperature should be limited to 150°C, maximum.

ENABLE/STATUS PIN:

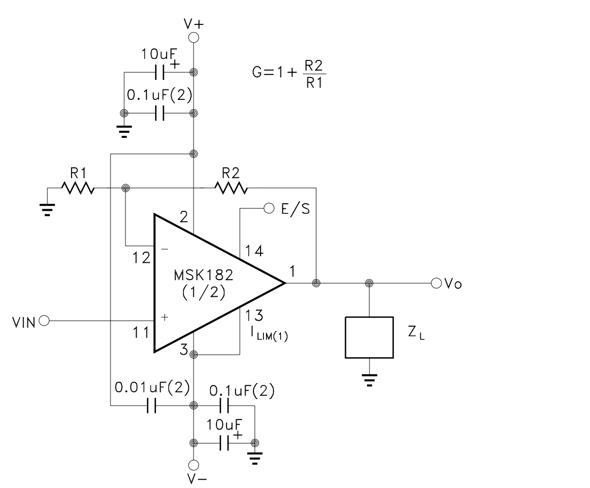
This pin actually has a dual function. First, when the pin is forced low, the output stage is disabled. Second, it can be monitored to determine if the device is in thermal shutdown. These functions can be used on the same device with either single or dual supplies. For normal operation, the E/S pin must be left open or pulled at least 2.4 volts above the negative rail. In noisy applications, a small value capacitor between the E/S pin and -Vcc may be required.

To disable the output, the user must pull the E/S pin low, no greater than 0.8V above -Vcc. To once again enable the device, the E/S pin must be brought at least 2.4 volts above -Vcc or be disconnected. It should be noted that when the E/S pin is high, the internal thermal shutdown is still active.

If the E/S pin is used to monitor thermal shutdown, during normal operation the voltage on the E/S pin is typically 3.5V above -Vcc. Once shutdown has occurred this voltage will drop to approximately 350mV above -Vcc.

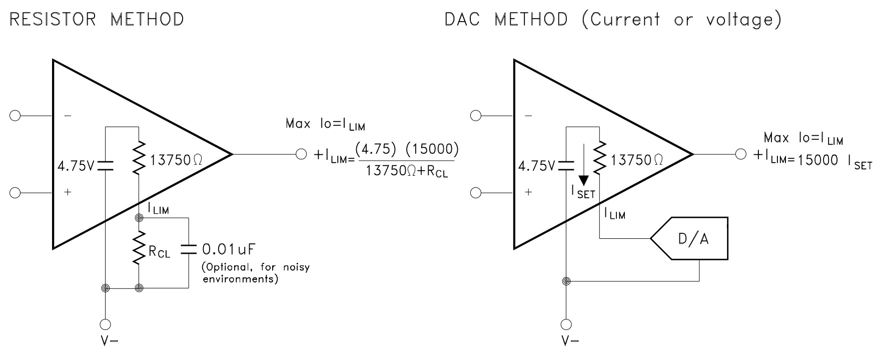
COMPENSATION:

For normal operation output compensation is not typically required. However, if the MSK 182 or MSK 183 is intended to be driven into current limit the user may find that an R/C network is required. A snubber network from the output to ground for each amplifier will provide stability. If driving large capacitive or inductive loads, a snubber network will also enhance stability. Typically 3Ω to 10Ω in series with 0.01μF is acceptable.



NOTE: (1) I_{LIM} connected to V− achieves the maximum current limit, 5A(peak). (2) Connect capacitors directly to package power supply pins.

TYPICAL CONNECTION DIAGRAM



$$R_{CL}=\frac{15000\ (4.75V)}{I_{LIM}}-13750\Omega$$

$I_{SET} = I_{LIM}/15000$

$V_{SET} = (V-)+4.75V-(13750\Omega)(I_{LIM})/15000$

DESIRED CURRENT LIMIT	RESISTOR(1) (R_{CL})	CURRENT (I_{SET})	VOLTAGE (V_{SET})
0A	I_{LIM} Open	0uA	(V−)+4.75V
1A	57.6KΩ	67uA	(V−)+3.8V
2.5A	14.7KΩ	167uA	(V−)+2.5V
3A	10KΩ	200uA	(V−)+2V
4A	4.02KΩ	267uA	(V−)+1.1V
5A	I_{LIM} Connected to V−	333uA	(V−)

NOTE: (1) Resistors are nearest standard 1% values.

Figure 1
Adjustable Current Limit

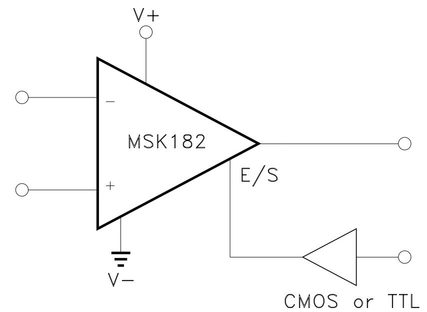


Figure 2
Output Disable with a Single Supply

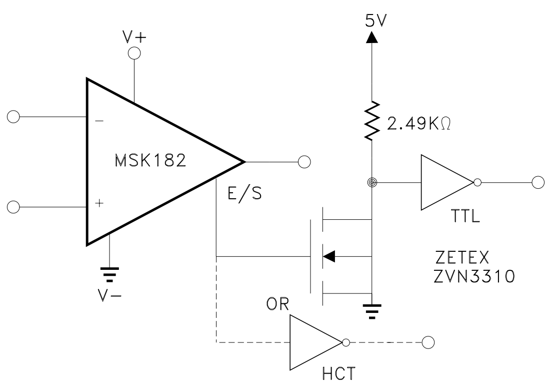


Figure 3
Thermal Shutdown Status With a Single Supply

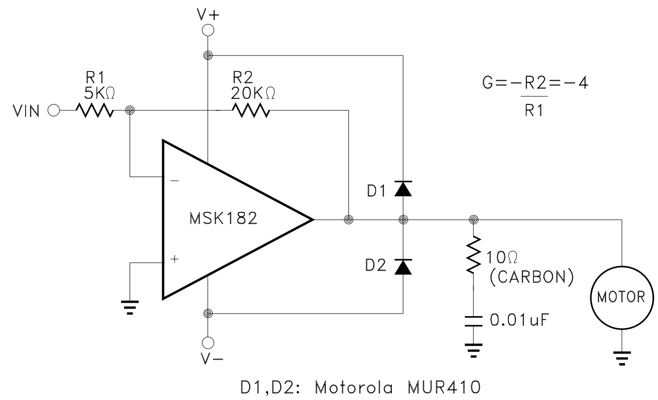
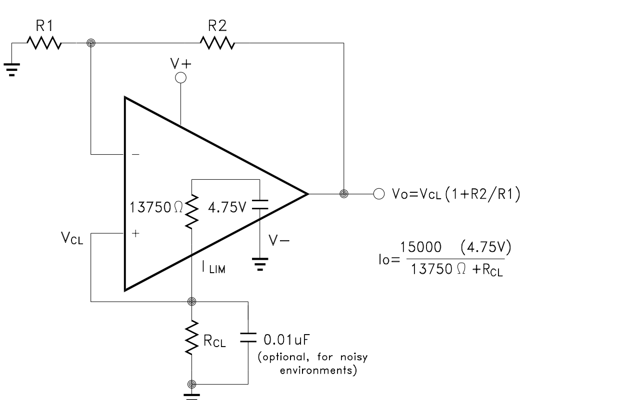


Figure 4
Motor Drive Circuit



For Example:
If I_{LIM} =3A, R_{CL} =10KΩ

$$V_{CL}=\frac{10K\Omega\cdot 4.75V}{(10K\Omega\ +13750\Omega)}=2V$$

Desired Vo= 20V, $G=\frac{20}{2}=10$
R1=1KΩ and R2= 9KΩ

Uses voltage developed at I_{LIM} pin as a moderately accurate reference voltage.

Figure 5
Voltage Source

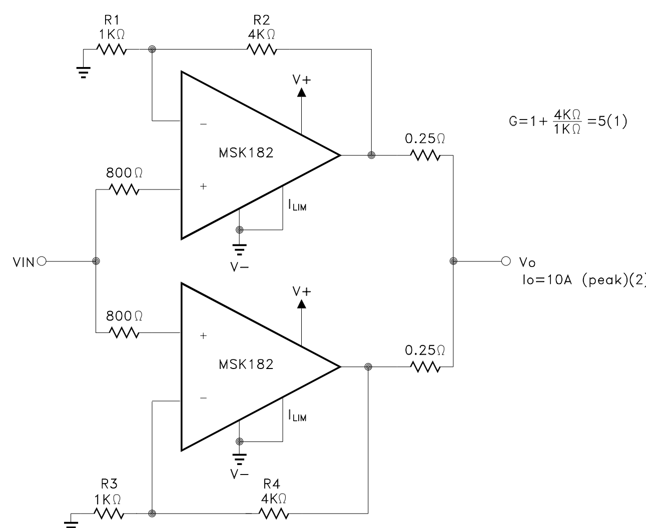
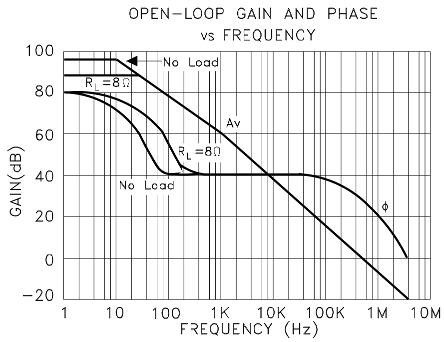
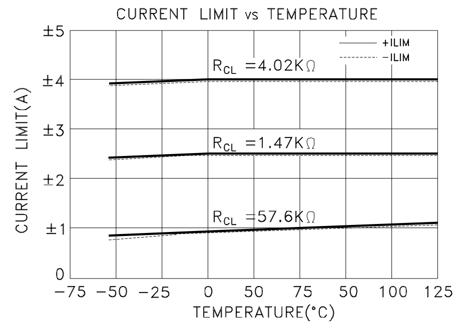
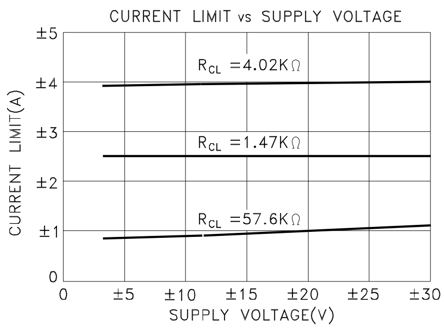


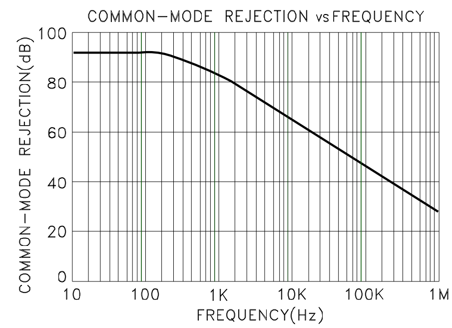
Figure 6
Parallel Output For Increased Output Current

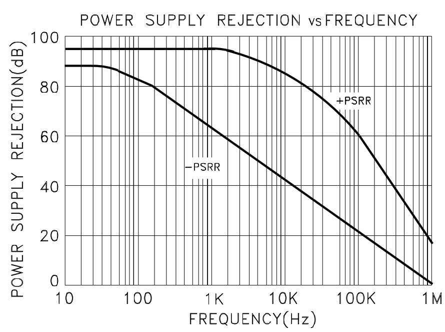
TYPICAL PERFORMANCE CURVES

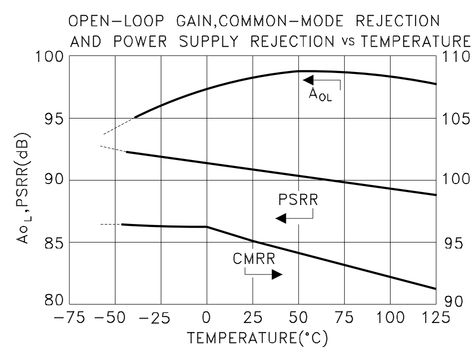


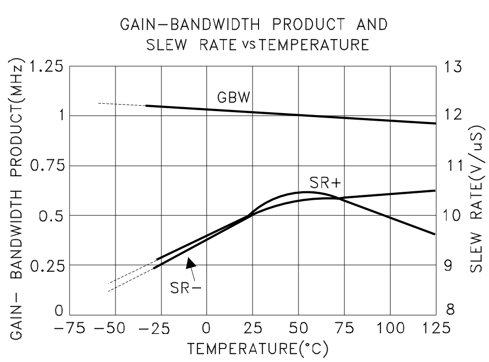


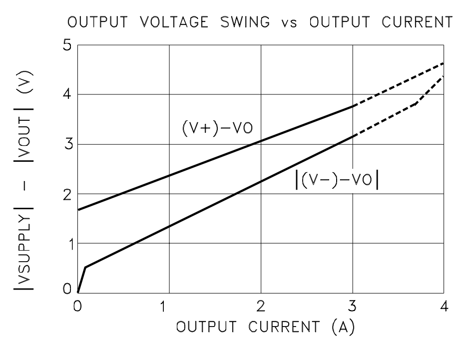


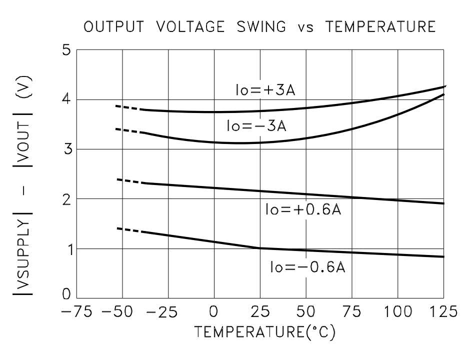






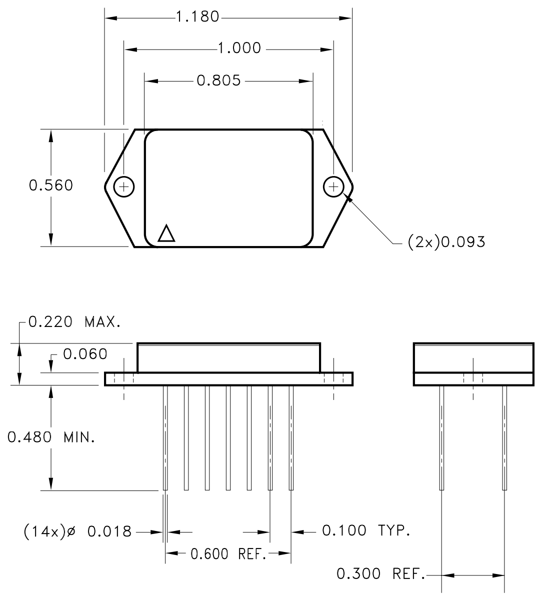




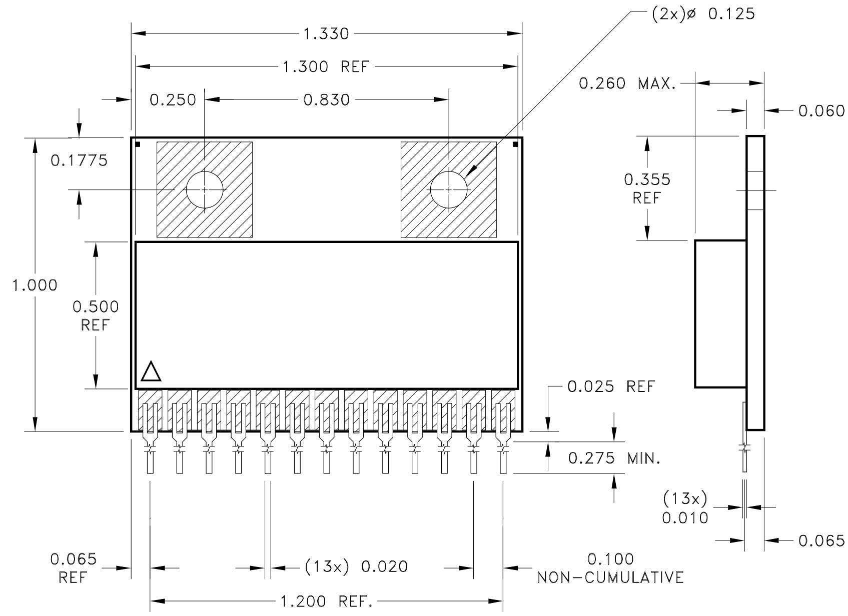


MECHANICAL SPECIFICATIONS

MSK182



MSK183



ESD TRIANGLE INDICATES PIN 1.
ALL DIMENSIONS ARE ±0.010 INCHES UNLESS OTHERWISE LABELED.

ORDERING INFORMATION

MSK 182 H

SCREENING
BLANK = INDUSTRIAL; E = EXTENDED RELIABILITY
H = MIL-PRF-38534

GENERAL PART NUMBER

NOTE: THE MSK 183 IS NOT AVAILABLE WITH E OR H SUFFIX.

M.S. Kennedy Corp.
4707 Dey Road, Liverpool, New York 13088
Phone (315) 701-6751
FAX (315) 701-6752
www.mskennedy.com