ISO 9001 CERTIFIED BY DSCC

HIGH SPEED, WIDEBAND OPERATIONAL AMPLIFIER 3554

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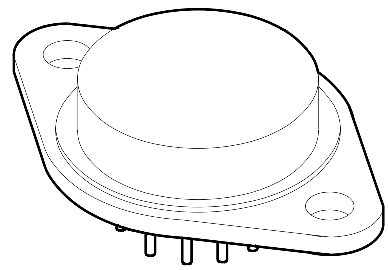
MIL-PRF-38534 QUALIFIED

FEATURES:

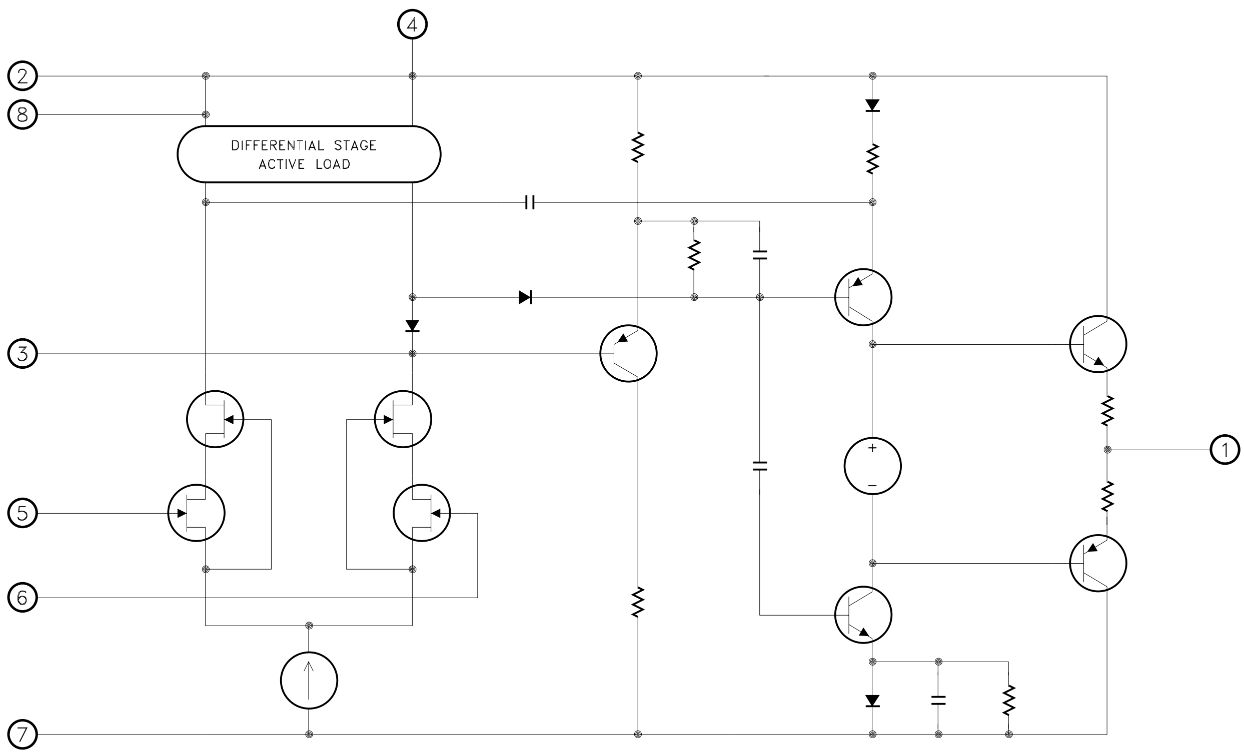
- Stable at Low Gain
- Fast Slew Rate - 1200V/μs Typical
- Gain Bandwidth Product - 1200 MHz Typical
- Low Quiescent Current - ±14.0 mA Typical
- Low Offset - 2 mV Maximum
- Drop In Replacement for OPA 3554 and TP 3554
- High Output Current - ±100mA Minimum



DESCRIPTION:

The MSK 3554 is a pin compatible, low gain stable, drop-in replacement for the OPA 3554 and TP 3554. The MSK 3554 does not exhibit high frequency output oscillations like other versions of the 3554 when operated at closed loop gains of less than 55 V/V. The extremely low input bias current and input offset voltage ratings coupled with a high slew rate and wide bandwidth make the MSK 3554 an excellent choice for fast D/A converters, buffers, pulse amplifiers and other high speed op-amp applications. The MSK 3554 is packaged in an 8-pin TO-3 using thick film hybrid technology to obtain high reliability and compact size.

EQUIVALENT SCHEMATIC



TYPICAL APPLICATIONS

- Fast D/A Converters
- Pulse Amplifiers
- Video Instrumentation
- Fast Buffer/Follower
- Video Frequency Filters

PIN-OUT INFORMATION

1	Output	8	Balance
2	Positive Power Supply	7	Negative Power Supply
3	Compensation	6	Non-Inverting Input
4	Balance	5	Inverting Input

ABSOLUTE MAXIMUM RATINGS

$\pm V_{CC}$	Supply Voltage . . . . ±18V	T_{ST}	Storage Temperature Range -65°C to +150°C
I_{OUT}	Peak Output Current . . . . ±150mA	T_{LD}	Lead Temperature Range . . . . 300°C (10 Seconds)
V_{IN}	Differential Input Voltage . . . . ±25V	P_D	Power Dissipation . . . . See Curve
T_C	Case Operating Temperature MSK 3554B . . . . -55°C to +125°C MSK 3554 . . . . -40°C to +85°C	T_J	Junction Temperature . . . . 175°C

ELECTRICAL SPECIFICATIONS

Parameter	Test Conditions	Group A Subgroup	MSK 3554B Min.	MSK 3554B Typ.	MSK 3554B Max.	MSK 3554 Min.	MSK 3554 Typ.	MSK 3554 Max.	Units
STATIC									
Supply Voltage Range ③		-	±12	±15	±18	±12	±15	±18	V
Quiescent Current	V_{IN}=0V	1	-	±14	±20	-	±14	±20	mA
	A_V=-1V/V	2,3	-	-	±30	-	-	-	mA
Thermal Resistance ③	Junction to Case Output Devices	-	-	37	-	-	37	-	°C/W
INPUT									
Input Offset Voltage	Bal.Pins=N/C V_{IN}=0V A_V=-10V/V	1	-	±0.5	±2.0	-	±0.5	±3.0	mV
Input Offset Voltage Drift	V_{IN}=0V	2,3	-	±20	±50	-	±20	-	μV/°C
Input Offset Adjust ③	R_{POT}=20KΩ To +V_{CC} A_V=-1V/V	1,2,3		Adjust to Zero			Adjust to Zero		mV
Input Bias Current ⑩	V_{CM}=0V Either Input	1	-	±10	±50	-	±20	±100	pA
		2,3	-	±10	±50	-	-	-	nA
Input Offset Current	V_{CM}=0V	1	-	±2.0	±25	-	±2.0	±30	pA
		2,3	-	±2.0	±30	-	-	-	nA
Input Impedance ③	F=DC Differential	-	-	10^{11}	-	-	10^{11}	-	Ω
Power Supply Rejection Ratio ③	Δ V_{CC}=10V	-	80	110	-	80	110	-	dB
Input Noise Density ③	F=1KHz	-	-	15	-	-	15	-	nV√Hz
Input Noise Voltage ③	F=10Hz To 1MHz	-	-	10.0	-	-	10.0	-	μVrms
OUTPUT									
Output Voltage Swing	R_L=100Ω	4	±10.5	±12	-	±10	±12	-	V
Output Current	T_J<150°C	4	±100	±120	-	±100	±120	-	mA
Settling Time ② ③	0.1% 10V step	4	-	120	150	-	120	150	nS
Power Bandwidth ③	R_L=100Ω V_O=±10V C_C=0	4	16	19	-	15	19	-	MHz
Bandwidth (Small Signal) ③	C_C=0	4	70	90	-	70	90	-	MHz
TRANSFER CHARACTERISTICS									
Slew Rate	V_{OUT}=±10V R_L=100Ω C_C=0	4	800	1200	-	750	1200	-	V/μS
Open Loop Voltage Gain ③	C_C=0 R_L=100Ω F=1KHz V_{OUT}=±10V	4	90	96	-	88	96	-	dB

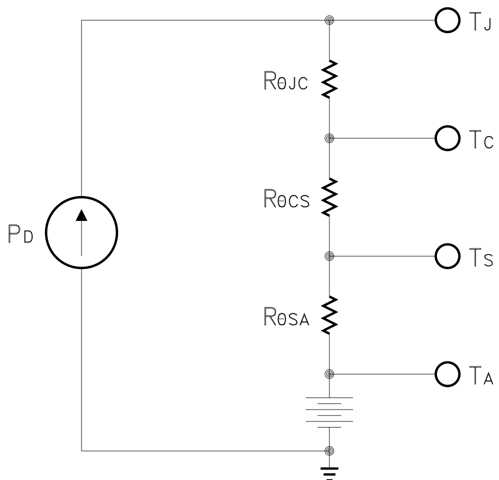
NOTES:

① Unless otherwise specified $\pm V_{CC} = \pm 15V_{DC}$
② AV=-1, measured in false summing junction circuit.
③ Devices shall be capable of meeting the parameter, but need not be tested. Typical parameters are for reference only.
④ Industrial grade devices shall be tested to subgroups 1 and 4 unless otherwise specified.
⑤ Military grade devices ('B' suffix) shall be 100% tested to subgroups 1,2,3 and 4.
⑥ Subgroup 5 and 6 testing available upon request.
⑦ Subgroup 1,4 $T_A=T_C=+25°C$
⑧ Subgroup 2,5 $T_A=T_C=+125°C$
⑨ Subgroup 3,6 $T_A=T_C=-55°C$
⑩ Measurement taken .5 second after application of power using automatic test equipment.

HEAT SINKING

Refer to the following thermal model and governing equations to determine appropriate heat sinking for your application.

Thermal Model:



Governing Equation:

$T_J = P_D \times (R_{\theta JC} + R_{\theta CS} + R_{\theta SA}) + T_A$

Where
- T_J = Junction Temperature
- P_D = Total Power Dissipation
- $R_{\theta JC}$ = Junction to Case Thermal Resistance
- $R_{\theta CS}$ = Case to Heat Sink Thermal Resistance
- $R_{\theta SA}$ = Heat Sink to Ambient Thermal Resistance
- T_C = Case Temperature
- T_A = Ambient Temperature
- T_S = Sink Temperature

Example:

This example demonstrates a worst case analysis for the op-amp output stage. This occurs when the output voltage is 1/2 the power supply voltage. Under this condition, maximum power transfer occurs and the output is under maximum stress.

Conditions:
- $V_{CC} = \pm 16VDC$
- $V_O = \pm 8Vp$ Sine Wave, Freq. = 1KHZ
- $R_L = 100\Omega$

For a worst case analysis we will treat the +8Vp sine wave as an 8 VDC output voltage.

1.) Find Driver Power Dissipation

$$P_D = (V_{CC} - V_O)(V_O/R_L) = (16V-8V)(8V/100\Omega) = .64W$$

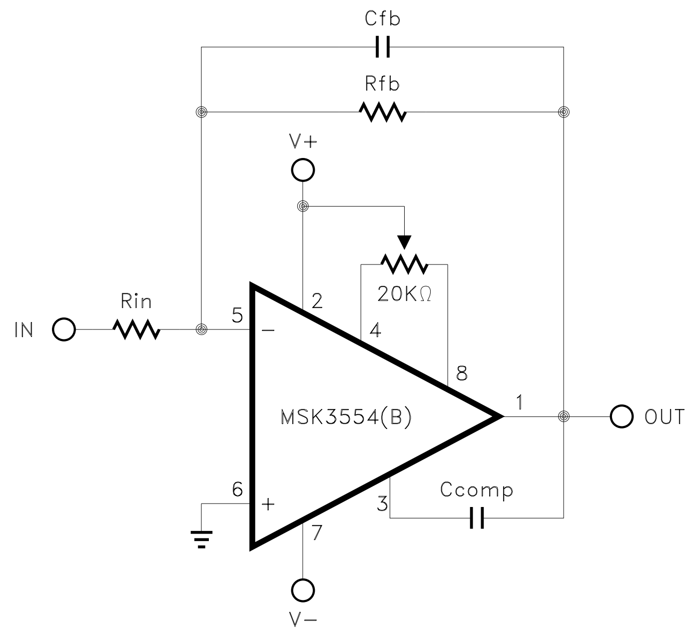
2.) For conservative design, set $T_J = +125°C$
3.) For this example, worst case $T_A = +90°C$
4.) $R_{\theta JC}$ = 37°C/W from MSK 3554B Data Sheet
5.) $R_{\theta CS}$ = 0.15°C/W for most thermal greases
6.) Rearrange governing equation to solve for $R_{\theta SA}$

$$R_{\theta SA} = ((T_J - T_A)/P_D) - (R_{\theta JC}) - (R_{\theta CS})$$
$$= ((125°C - 90°C) / .64W) - 37°C/W - .15°C/W$$
$$= 54.7 - 37.15$$
$$= 17.54°C/W$$

The heat sink in this example must have a thermal resistance of no more than 17.54°C/W to maintain a junction temperature of no more than +125°C.

OFFSET NULL

Typically, the MSK 3554(B) has an input offset voltage of less than ±0.5mV. If it is desirable to adjust the offset closer to "zero", or to a value other than "zero", the circuit below is recommended. Rp should be a ten-turn 20KΩ potentiometer. Typical offset adjust is ±20mV.

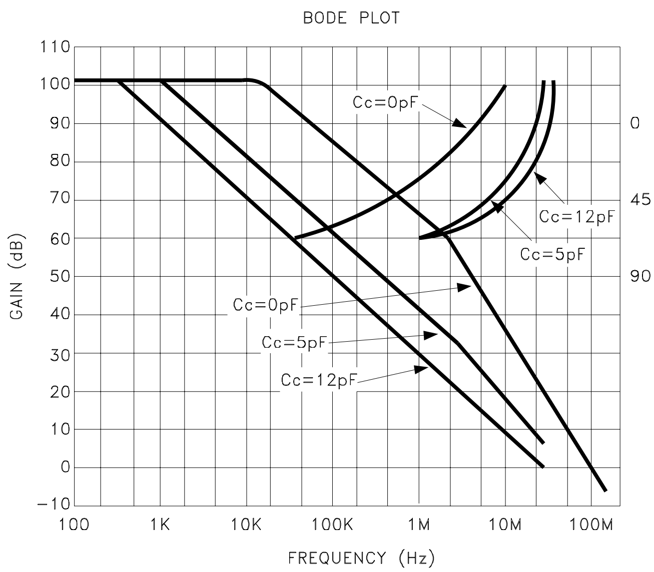


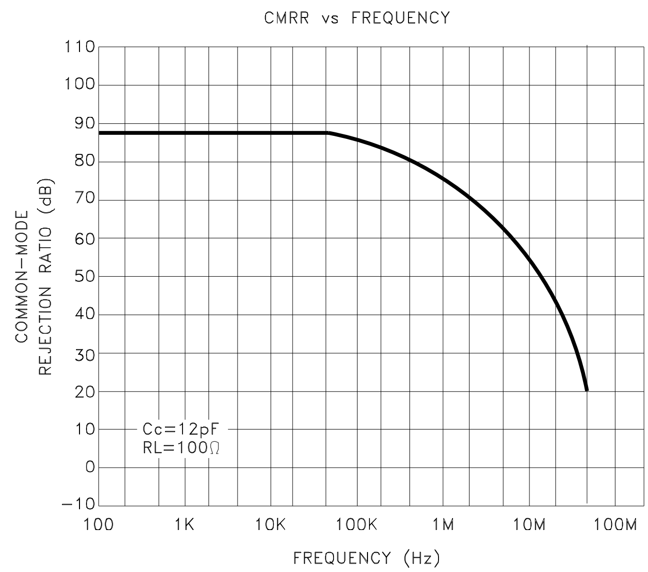
COMPENSATION

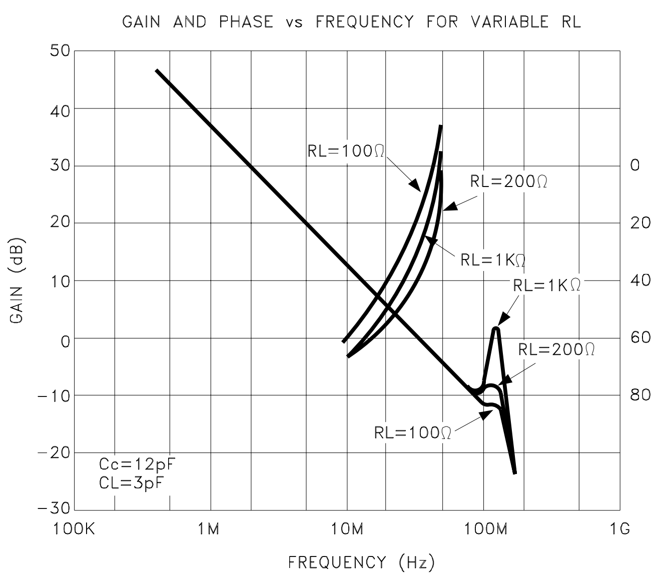
The compensation capacitor is connected between pins 1 and 3 and is used to optimize bandwidth and slew rate while maintaining circuit stability. The effect of compensation capacitance can be seen in the Bode Plot under the Typical Performance Curves. As closed loop gain increases, compensation capacitance can decrease and higher slew rates and wider bandwidths will be realized. See the component selection table for recommended values of input and feedback resistance as well as feedback capacitance and compensation capacitance.

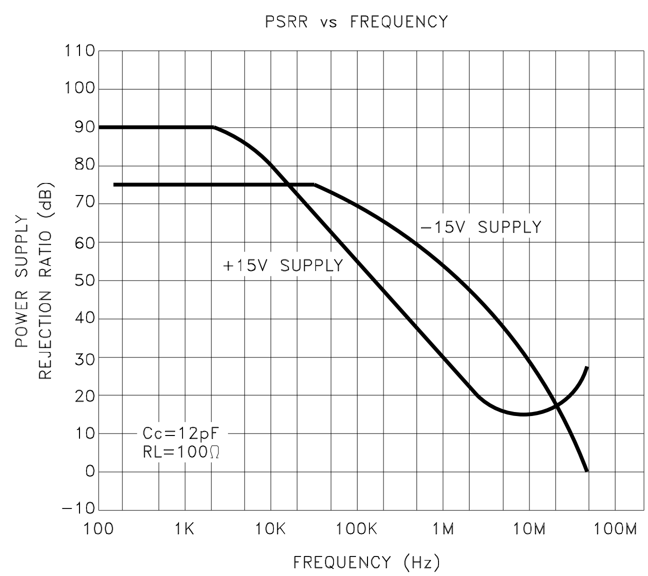
COMPONENT SELECTION TABLE				
GAIN	Rin	Rfb	Cfb	Ccomp
-1	5.6KΩ	5.6KΩ	2.0pF	10pF
-10	560Ω	5.6KΩ	1.2pF	10pF
-100	100Ω	10KΩ	0.0pF	0.0pF
follower	0Ω	0Ω	0pF	12pF

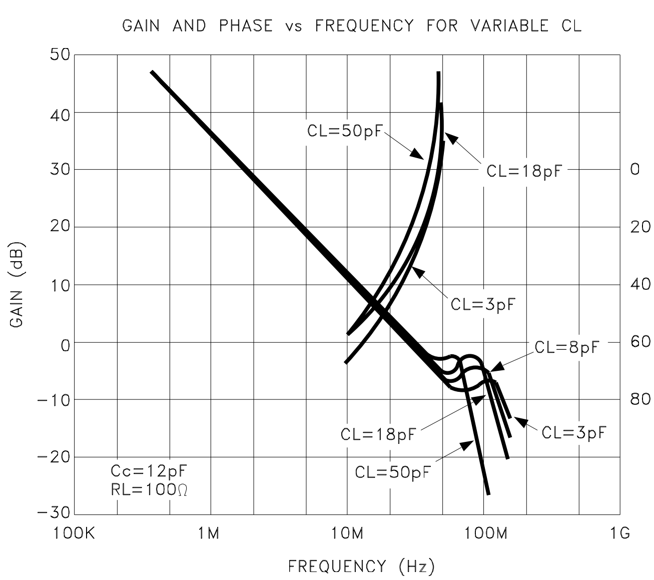
TYPICAL PERFORMANCE CURVES

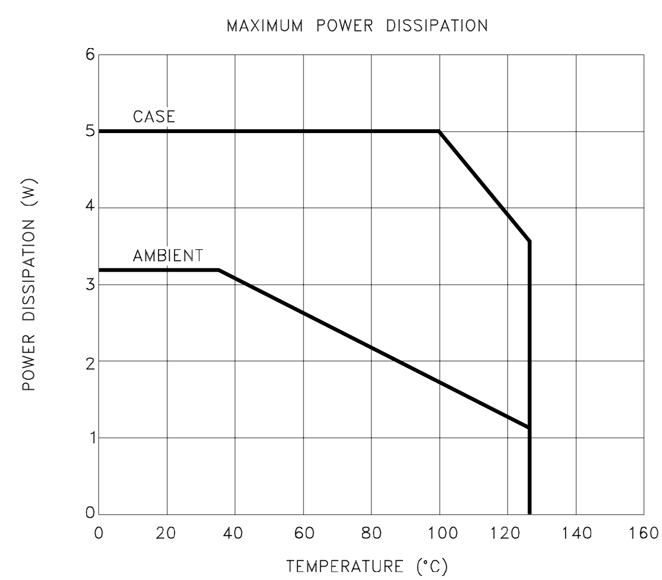




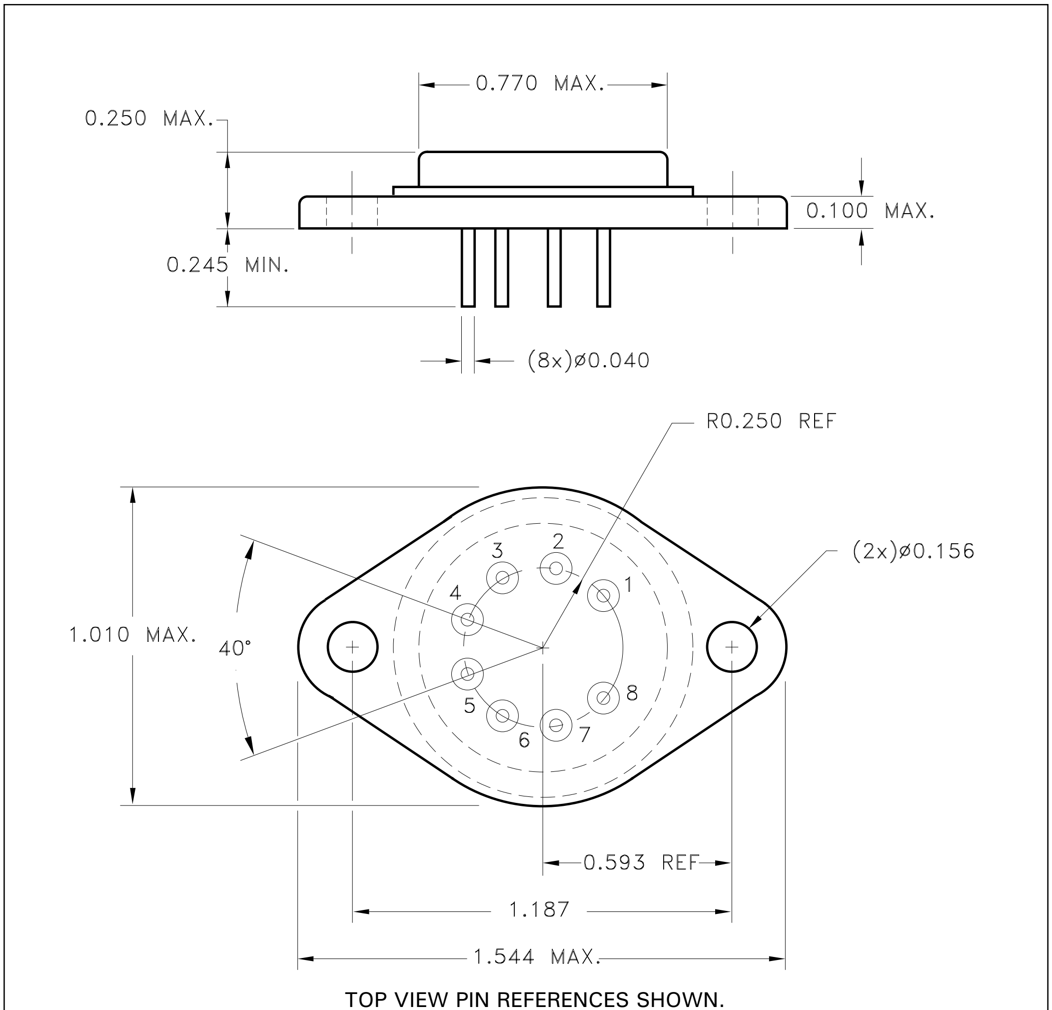








MECHANICAL SPECIFICATIONS



ALL DIMENSIONS ARE ±0.010 INCHES UNLESS OTHERWISE LABELED

ORDERING INFORMATION

Part Number	Screening Level
MSK3554	Industrial
MSK3554B	Military-Mil-PRF-38534

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