High-Voltage Operational Amplifier

Description

The SG1536 series of monolithic amplifiers is designed specifically for use in high voltage applications up to ±40 V and where high common-mode input ranges, high output voltage swings, and low input currents are required. These devices are internally compensated and are pin compatible with industry standard operational amplifiers.

Features

- High Supply Voltage Capability
- High Output Voltage Swing
- High Common-mode Voltage Range
- Internal Frequency Compensation
- Input Current 35 nA Maximum Over Temperature

High Reliability Features

- Available to MIL-STD – 883, 1.2.1
- MSC-AMS level “S” Processing Available
- Available to DSCC

Circuit Schematic

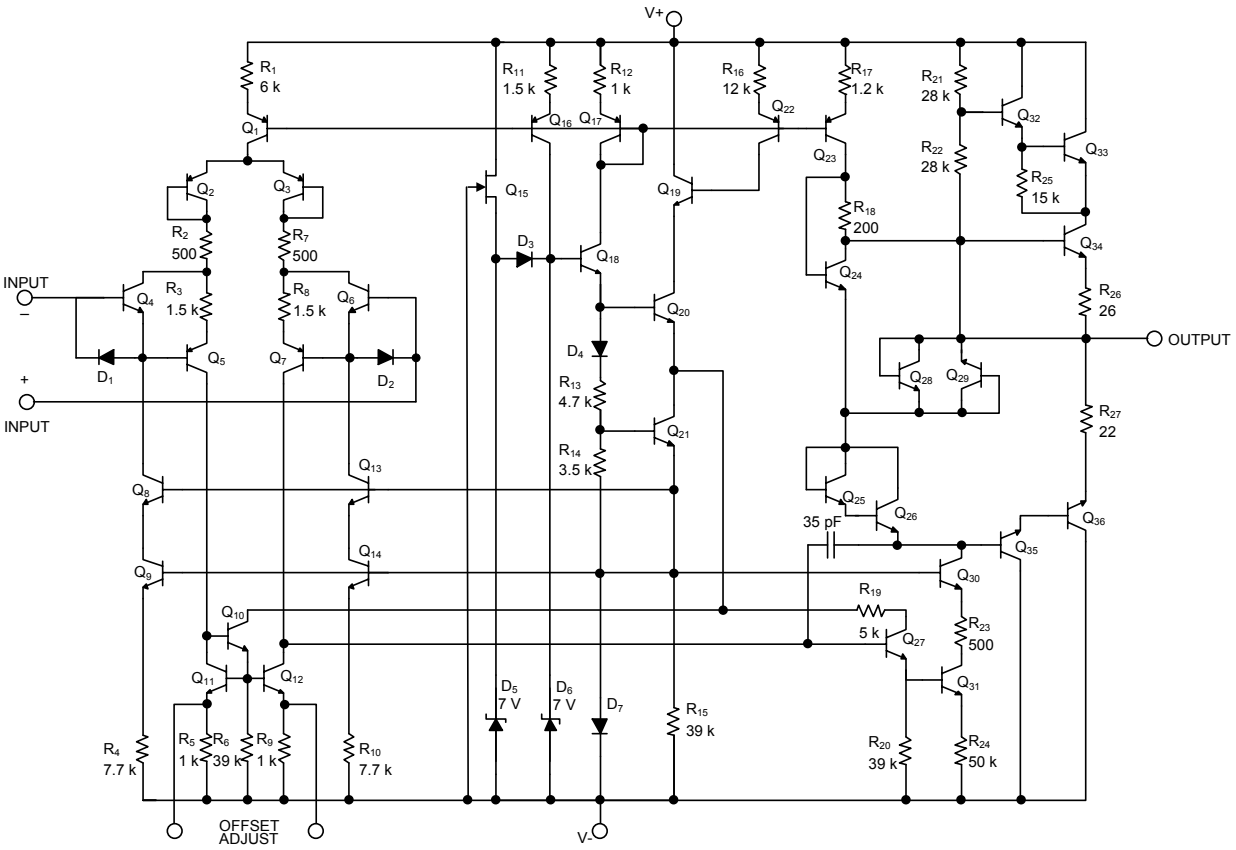
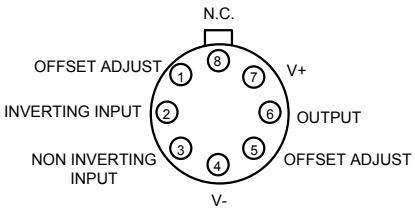
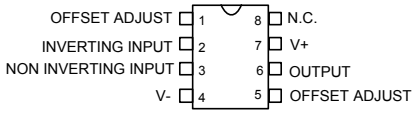


Figure 1 · Circuit Schematic

Connection Diagrams and Ordering Information

Ambient Temperature	Type	Package	Part Number	Packaging Type	Connection Diagram
-55°C to 125°C	T	8-pin metal can	SG1536T-883B SG1536T-DESC SG1536T	TO-99	
-55°C to 125°C	Y	8-pin ceramic DUAL INLINE PACKAGE	SG1536Y-883B SG1536Y-DESC SG1536Y	CERDIP	

Notes:
1. Contact factory for DESC product availability.
2. All packages are viewed from the top.
3. Hermetic Packages T, & Y use Sn63/ Pb37 hot solder lead finish, contact factory for availability of RoHS versions.

Absolute Maximum Ratings

Parameter	Value	Units
Supply Voltage	±40	V
Differential Input Signal	$\pm(V^+ + \lvert V^- \rvert - 3)$	V
Common-Mode Input Swing	$+V^+, -(\lvert V^- \rvert - 3)$	V
Output Short Circuit Duration (V+ = |V-| = 28 V, VO = 0 V)	5	s
Operating Junction Temperature		
Hermetic (T, Y Packages)	150	°C
Storage Temperature Range	-65 to 150	°C
Lead Temperature (Soldering, 10 seconds)	300	°C

Note: Exceeding these ratings could cause damage to the device.

Thermal Data

Parameter	Value	Units
T Package		
Thermal Resistance-Junction to Case, θ_{JC}	25	°C/W
Thermal Resistance-Junction to Ambient, θ_{JA}	130	°C/W
Y Package		
Thermal Resistance-Junction to Case, θ_{JC}	50	°C/W
Thermal Resistance-Junction to Ambient, θ_{JA}	130	°C/W

Notes:
1. Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.
2. The above numbers for θ_{JC} are maximums for the limiting thermal resistance of the package in a standard mounting configuration. The θ_{JA} numbers are meant to be guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.

Recommended Operating Conditions

Parameter	Value	Units
Supply Voltage Range		
SG1536	±12 to ±36	V
Operating Ambient Temperature Range		
SG1536	-55 to 125	°C

Note: Range over which the device is functional.

Electrical Characteristics

Unless otherwise specified, these specifications apply over the operating ambient T_A = 25°C and V_S = ±28 V. Low duty cycle pulse testing techniques are used that maintains junction and case temperatures equal to the ambient temperature.

Parameter	Test Conditions	SG1536			Units
		Min	Typ	Max	
Input Offset Voltage			2.0	5.0	mV
	$T_A = T_{MIN}$ to T_{MAX}			7.0	mV
Input Offset Current			1.0	3.0	nA
	$T_A = T_{MIN}$			7.0	nA
	$T_A = T_{MAX}$			4.5	nA
Input Bias Current			8.0	20	nA
	$T_A = T_{MIN}$ to T_{MAX}			35	nA
Differential Input Impedance	Open loop, ≤ 5.0 Hz		10		MΩ
Common-Mode Input Impedance	f ≤ 5.0 Hz		250		MΩ
Common-Mode Input Voltage Range (Peak)		±24	±25		V
Common-Mode Rejection Ratio		80	110		dB
Large Signal Voltage Gain	R_L = 10 kΩ, V_O = ±10 V		200 k		V/V
	R_L = 100 kΩ, V_O = ±10 V	100 k	500 k		V/V
	$T_A = T_{MIN}$ to T_{MAX}	50 k			V/V
Power Supply Rejection Ratio	V^- constant, R_S ≤10 kΩ		15	100	µV/V
	V^+ constant, R_S ≤ 10 kΩ		15	100	µV/V
Output Impedance	f ≤ 5.0 Hz		1.0		kΩ
Short Circuit Output Current			±17		mA
Output Voltage Swing (Peak)	R_L = 5.0 kΩ, V_S = ±28 V	±22			V
	R_L = 5.0 kΩ, V_S = ±36 V	±30			V
Power Bandwidth	A = +1, R_L = 5 kΩ, THD ≤ 5%, V_O = 40 V_{p-p}		23		kHz
Unity Gain Crossover Frequency	Open loop		1.0		MHz
Slew Rate	Unity gain		2.0		V/µs
Phase Margin	Open loop, unity gain		50		deg
Gain Margin			18		dB

Electrical Characteristics (continued)

Parameter	Test Conditions	SG1536			Units
		Min	Typ	Max	
Equivalent Input Noise	A_V = 100, R_s = 10 kΩ, f = 1.0 kHz, BW = 1.0 Hz		50		nV/√Hz
Power Supply Current	(Note)		2.2	4.0	mA
Power Consumption	V_O = 0, V_S = ±36 V		124	224	mW

Note: VCC = VEE = 36 V for SG1536. VCC = VEE = 28 V for SG1436.

Characteristic Curves

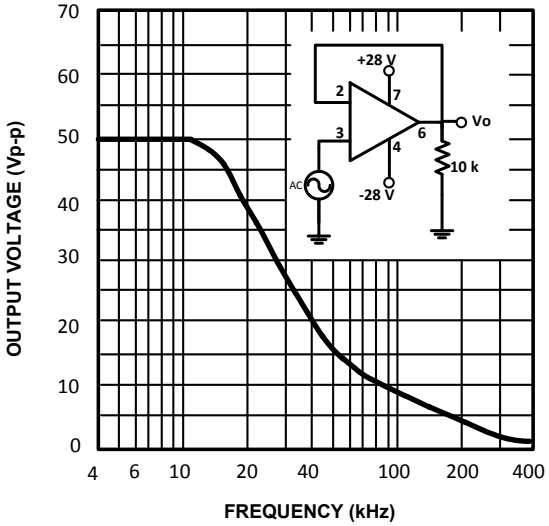


Figure 2 · Power Bandwidth

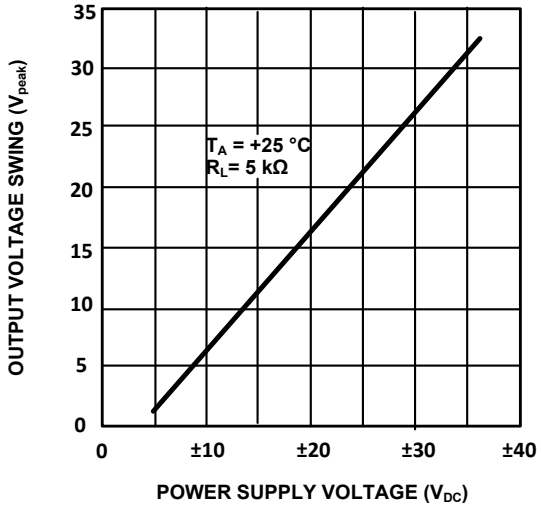


Figure 3 · Peak Output Voltage Swing vs. Power Supply Voltage

Characteristic Curves (continued)

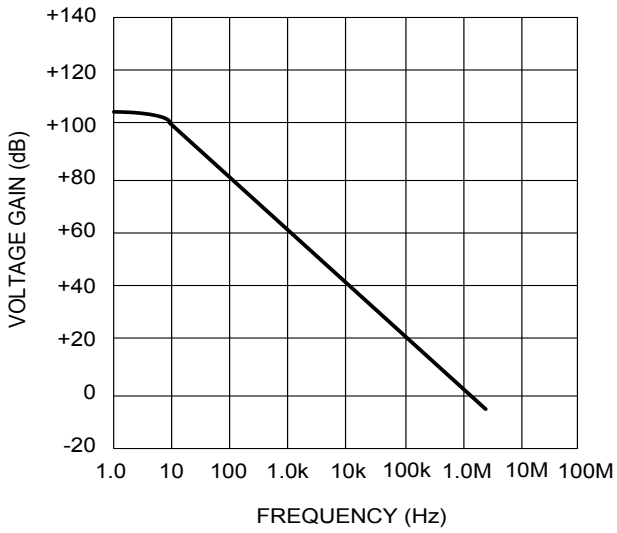


Figure 4 · Open-loop Frequency Response

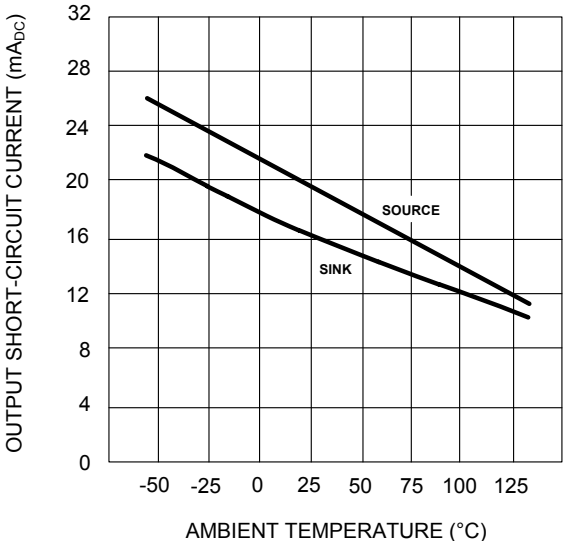


Figure 5 · Output Short-Circuit Current vs. Temperature

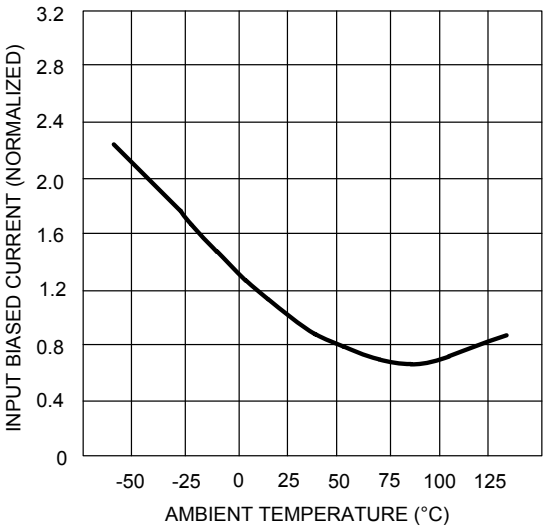


Figure 6 · Input Bias Current vs. Temperature

Application Information

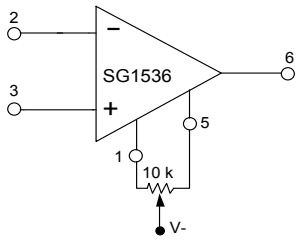


Figure 7 · Voltage Offset Null Circuit

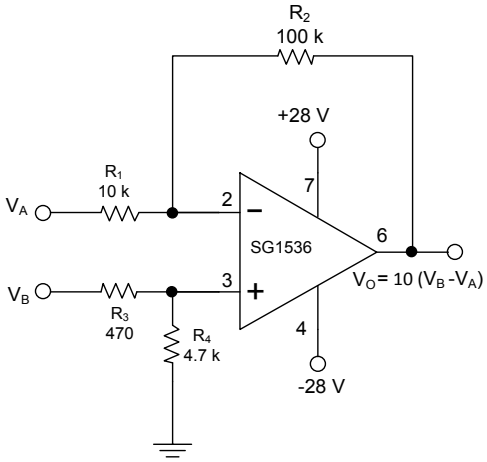


Figure 8 · Differential Amplifier With ±20 V Common-Mode Input Voltage Range

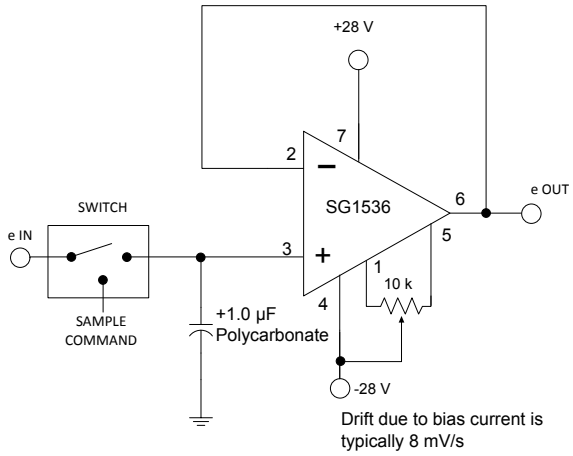


Figure 9 · Low-Drift Sample and Hold

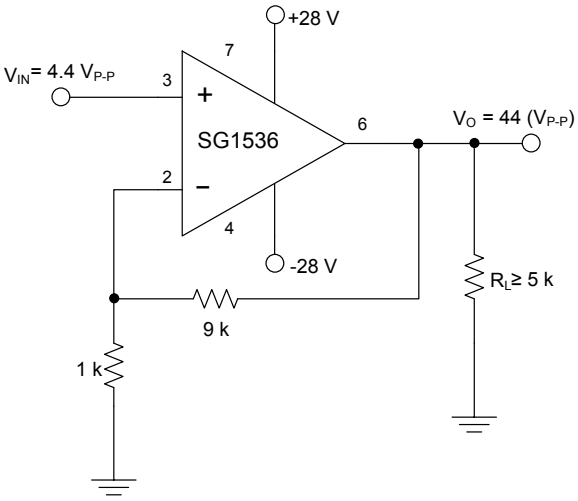


Figure 10 · Typical Non-inverting x 10 Voltage Amplifier

Application Information (continued)

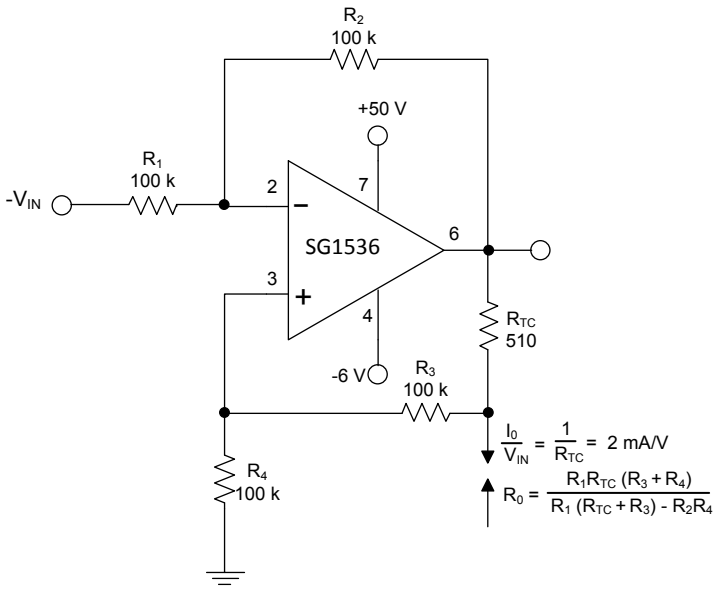
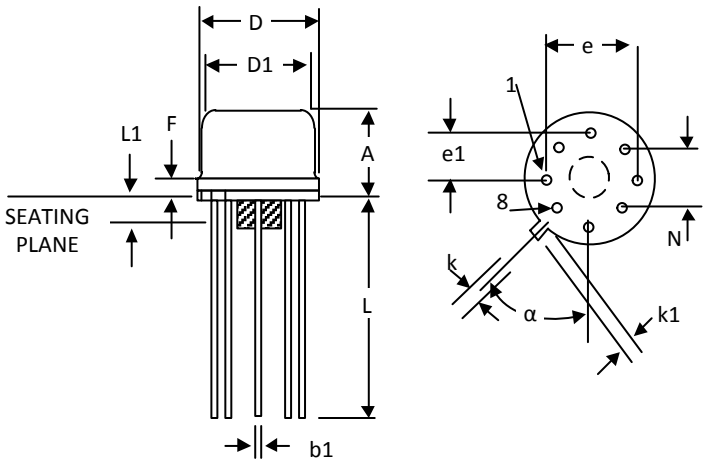


Figure 11 · Voltage Controlled Current Source or Trans-conductance Amplifier with 0 V to 40 V Compliance

Package Outline Dimensions

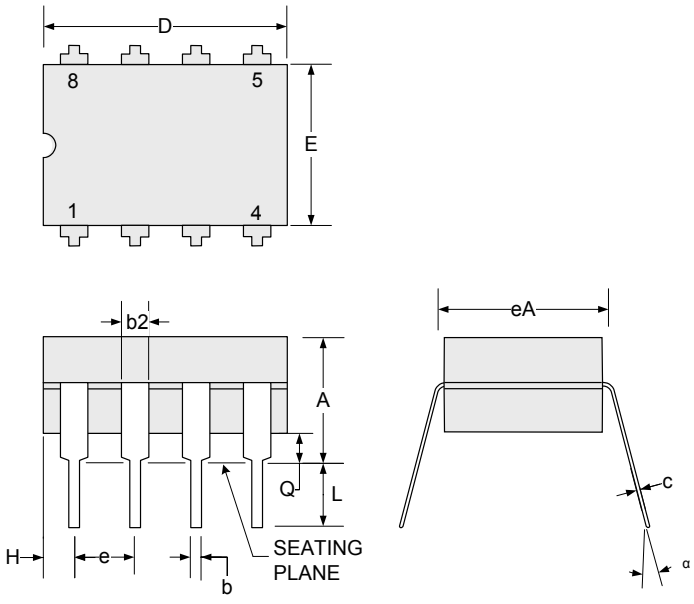


DIM	Millimeters		Inches	
	Min	Max	Min	Max
D	8.89	9.40	0.350	0.370
D1	8.00	8.51	0.315	0.335
A	4.191	4.699	0.165	0185
b1	0.406	0.533	0.016	0.021
F	-	1.016	-	0.040
e1	2.54 Typ		0.100 Typ	
e	5.08 Typ		0.200 Typ	
k	0.711	0.864	0.028	0.034
k1	0.737	1.14	0.029	0.045
L	12.70	14.48	0.500	0.570
α	45° Typ		45° Typ	
N	3.556	4.064	0.140	0.160
L1	0.254	1.016	0.010	0.040

Note:

Dimensions do not include protrusions; these shall not exceed 0.155 mm (0.006″) on any side. Lead dimension shall not include solder coverage.

Figure 12 · T 8-Pin Metal Can TO-99



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	4.32	5.08	0.170	0.200
b	0.38	0.51	0.015	0.020
b2	1.04	1.65	0.045	0.065
c	0.20	0.38	0.008	0.015
D	9.52	10.29	0.375	0.405
E	5.59	7.11	0.220	0.280
e	2.54 BSC		0.100 BSC	
eA	7.37	7.87	0.290	0.310
H	0.63	1.78	0.025	0.070
L	3.18	4.06	0.125	0.160
α	-	15°	-	15°
Q	0.51	1.02	0.020	0.040

Note:

Dimensions do not include protrusions; these shall not exceed 0.155 mm (0.006″) on any side. Lead dimension shall not include solder coverage.

Figure 13 · Y 8-Pin CERDIP Package Dimensions

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