RC5534/RC5534A

High Performance Low Noise Operational Amplifier

Features

- Small signal bandwidth – 10 MHz
- Output drive capability – 600Ω, 10 V_{RMS} at V_S = ±18V
- Input noise voltage – 4 nV/√Hz
- DC voltage gain – 100,000
- AC voltage gain – 6000 at 10 kHz
- Power bandwidth – 200 kHz
- Slew rate – 13 V/μS
- Large supply voltage range – ±3V to ±20V

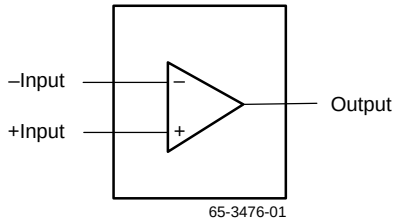
Description

The RC5534 is a high performance, low noise operational amplifier. This amplifier features popular pin-out, superior noise performance, and high output drive capability.

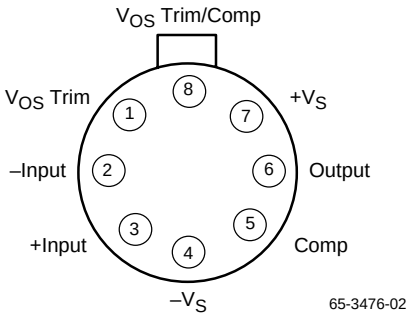
This amplifier also features guaranteed noise performance with substantially higher gain-bandwidth product, power bandwidth, and slew rate which far exceeds that of the 741 type amplifiers. The RC5534 is internally compensated for a gain of three or higher and may be externally compensated for optimizing specific performance requirements of various applications such as unity-gain voltage followers, drivers for capacitive loads or fast settling.

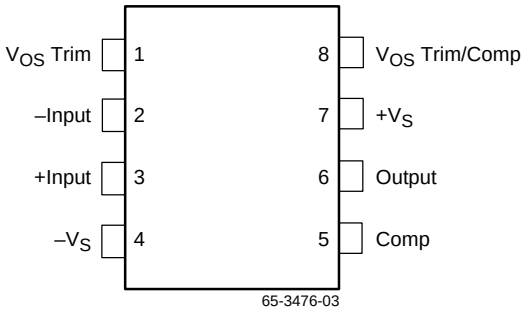
The specially designed low noise input transistors allow the RC5534 to be used in very low noise signal processing applications such as audio preamplifiers and servo error amplifiers.

Block Diagram



Pin Assignments





Absolute Maximum Ratings

(beyond which the device may be damaged)[1]

Parameter		Min	Typ	Max	Units
Supply Voltage				±22	V
Input Voltage				$\pm V_S$	V
Differential Input Voltage				0.5	V
$P_D T_A < 50°C$	PDIP			468	mW
	CerDIP			833	
	SOIC			658	
Junction Temperature	PDIP			125	°C
	CerDIP, TO-99			175	
Storage Temperature		-65		150	°C
Operating Temperature	RM5534/A	-55		125	°C
	RC5534/A	0		70	
Lead Soldering Temperature (60 sec)				300	°C
Output Short Circuit Duration[2]		Indefinite			

Notes:

1. Functional operation under any of these conditions is NOT implied. Performance and reliability are guaranteed only if Operating Conditions are not exceeded.
2. Short circuit may be to ground only. Rating applies to +125°C case temperature or +175°C junction temperature.

Operating Conditions

Parameter			Min	Typ	Max	Units
θ_{JC}	Thermal resistance	CerDIP		45		°C/W
		TO-99		50		
θ_{JA}	Thermal resistance	PDIP		160		°C/W
		CerDIP		150		
		TO-99		190		
For $T_A > 50°C$ Derate at		PDIP		6.25		mW/°C
		CerDIP		8.33		
		TO-99		5.26		

Operating Conditions

(RM = -55°C ≤ T_A ≤ +125°C; RC = 0°C ≤ T_A ≤ + 70°C, V_S = ±15V)

Parameter	Test Conditions	RM5534/A			RC5534/A			Units
Input Offset Voltage	R_S ≤ 1 kΩ			3.0			5.0	mV
Input Offset Current				500			400	nA
Input Bias Current				1500			2000	nA
Large Signal Voltage Gain	R_L ≥ 600Ω, V_{OUT} = ±10V	25			15			V/mV
Output Voltage Swing	R_L ≥ 600Ω	±10			±10			V
Supply Current	V_S = ±15V, R_L = ∞			9.0			14	mA

DC Electrical Characteristics

(V_S = ±15V and T_A = +25°C unless otherwise noted)

Parameters	Test Conditions	RM5534/A			RC5534/A			Units
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	$R_S \le 1k\Omega$		0.5	2.0		0.5	4.0	mV
Input Offset Current			10	200		20	300	nA
Input Bias Current			400	800		500	1500	nA
Input Resistance (Diff. Mode)			100			100		kΩ
Large Signal Voltage Gain	$R_L \ge 600\Omega$, V_{OUT} = ±10V	50	100		25	100		V/mV
Output Voltage Swing	$R_L \ge 600\Omega$	±12	±13		±12	±13		V
Input Voltage Range		±12	±13		±12	±13		V
Common Mode Rejection Ratio	$R_S \le 1k\Omega$	80	100		70	100		dB
Power Supply Rejection Ratio	$R_S \le 1k\Omega$	86	100		86	100		dB
Supply Current	$R_L = \infty$		4.0	6.5		4.0	8.0	mA
Transient Response Rise Time	V_{IN} = 50 mV, R_L = 600Ω, C_L = 100 pF, C_C = 22 pF		35			35		nS
Overshoot			17			17		%
Slew Rate	C_C = 0		13			13		V/μS
Gain Bandwidth Product	C_C = 22 pF, C_L = 100 pF		10			10		MHz
Power Bandwidth	$V_{OUT} = 20V_{p-p}$, C_C = 0		200			200		kHz
Input Noise Voltage	F = 20 Hz to 20 kHz		1.0			1.0		μV_{RMS}
Input Noise Current	F = 20 Hz to 20 kHz		25			25		pA_{RMS}
Channel Separation	F = 1 kHz, R_S = 5 kΩ		110			110		dB

AC Electrical Characteristics

(V_S = ±15V and T_A = +25°C unless otherwise noted)

Parameters	Test Conditions	RC/RM5534A			RC/RM5534			Units
Input Noise Voltage Density	F_O = 30 Hz		5.5	7.0		7.0		nV/$\sqrt{Hz}$
	F_O = 1 kHz		3.5	4.5		4.0		
Input Noise Current Density	F_O = 30 Hz		1.5			2.5		pA/$\sqrt{Hz}$
	F_O = 1 kHz		0.4			0.6		
Broadband Noise Figure	F = 10 Hz - 20 kHz, RS = 5 kΩ		0.9					dB

Typical Performance Characteristics

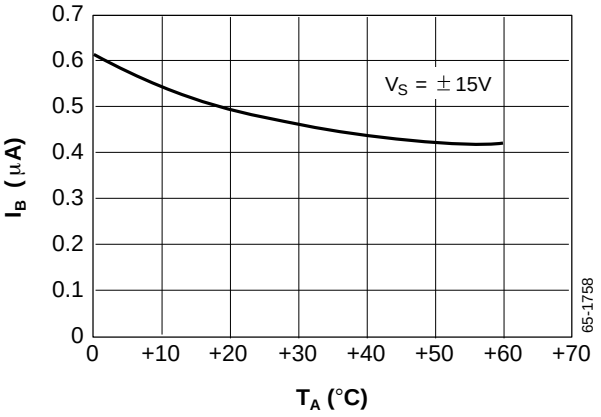


Figure 1. Input Bias Current vs. Temperature

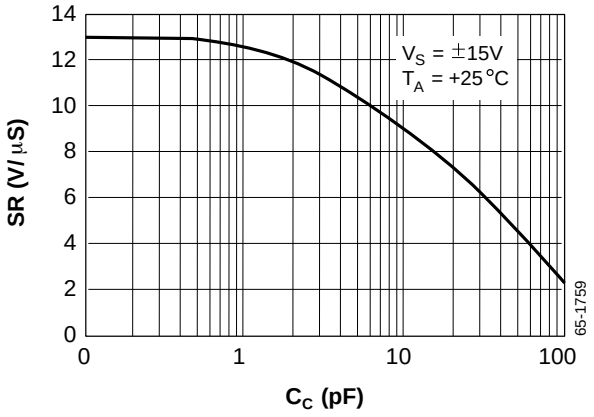


Figure 2. Slew Rate vs. Compensation Capacitor

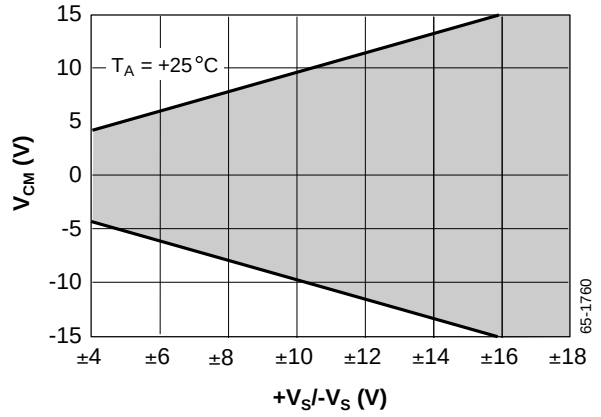


Figure 3. Common Mode Input Range vs. Supply Voltage

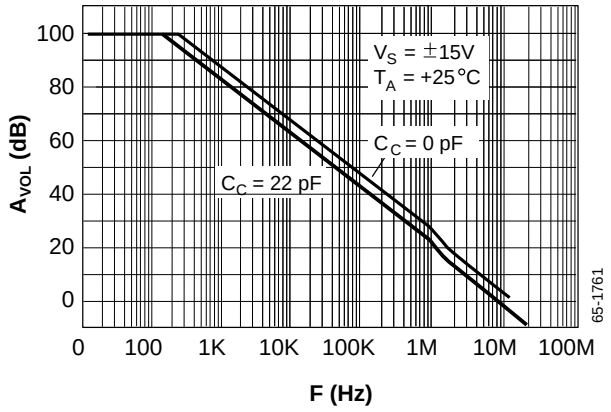


Figure 4. Open Loop Gain vs. Frequency

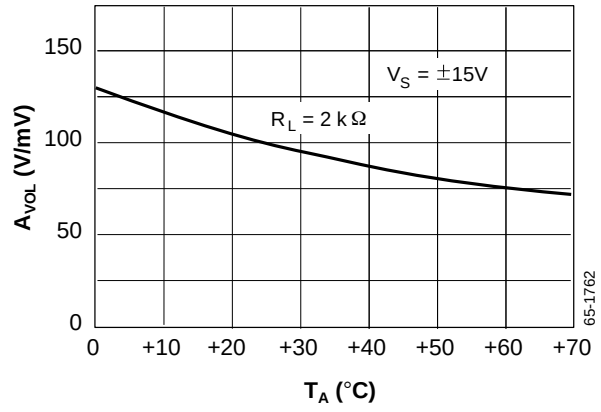


Figure 5. Open Loop Gain vs. Temperature

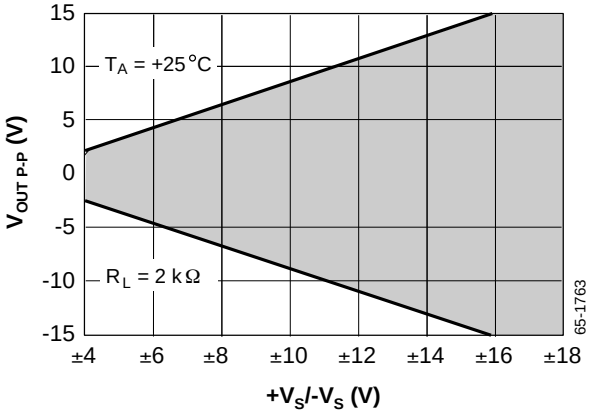


Figure 6. Output Voltage Swing vs. Supply Voltage

Typical Performance Characteristics (continued)

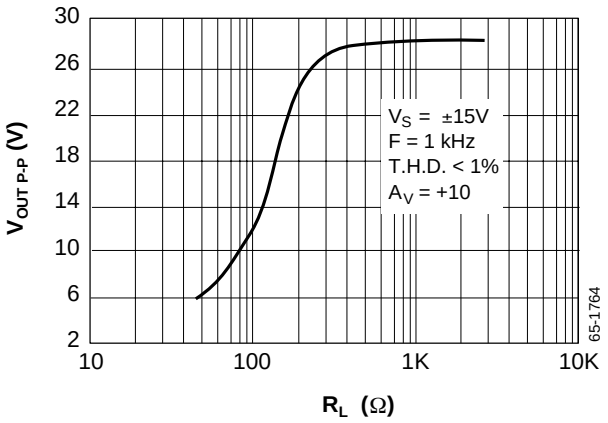


Figure 7. Output Voltage Swing vs. Load Resistance

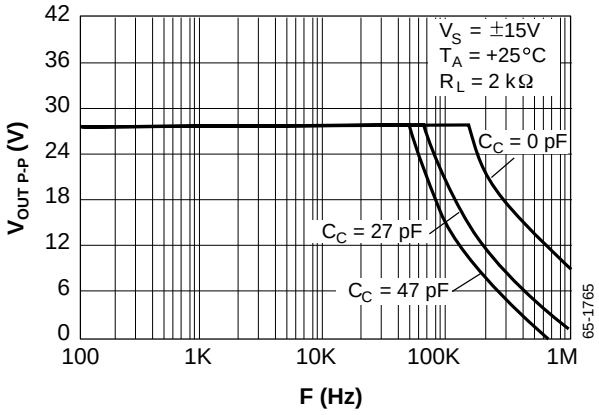


Figure 8. Output Voltage Swing vs. Frequency

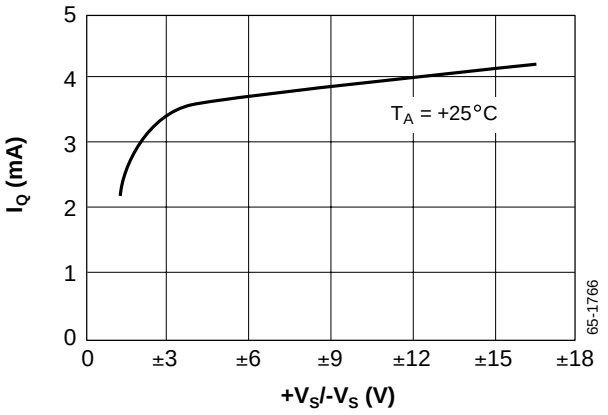


Figure 9. Quiescent Current vs. Supply Voltage

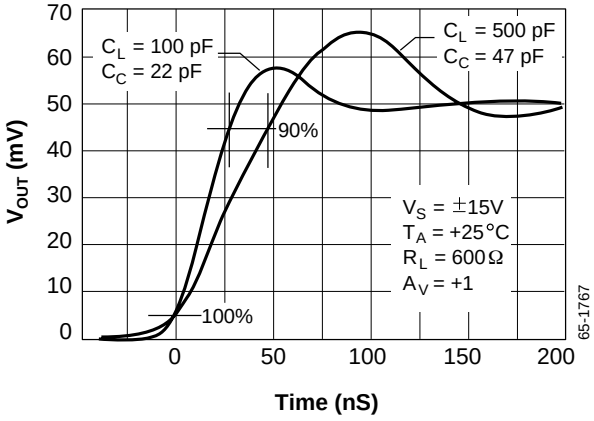


Figure 10. Transient Response Output Voltage vs. Time

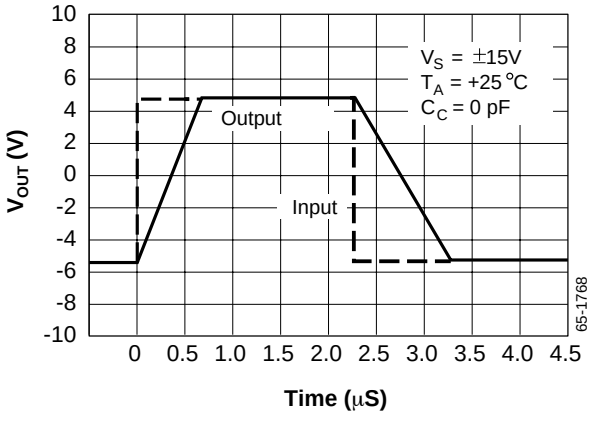


Figure 11. Follower Large Signal Pulse Response Output Voltage vs. Time

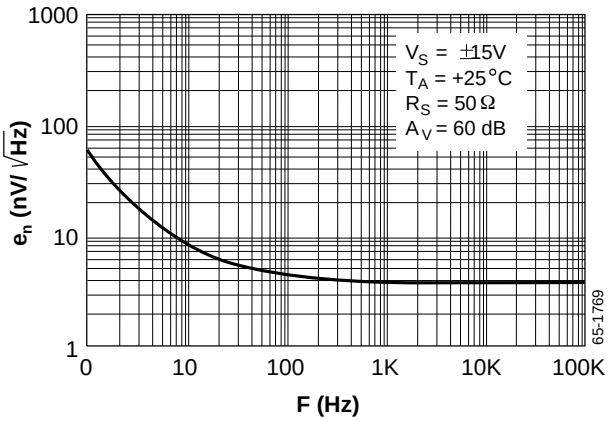


Figure 12. Input Noise Density vs. Frequency

Typical Performance Characteristics (continued)

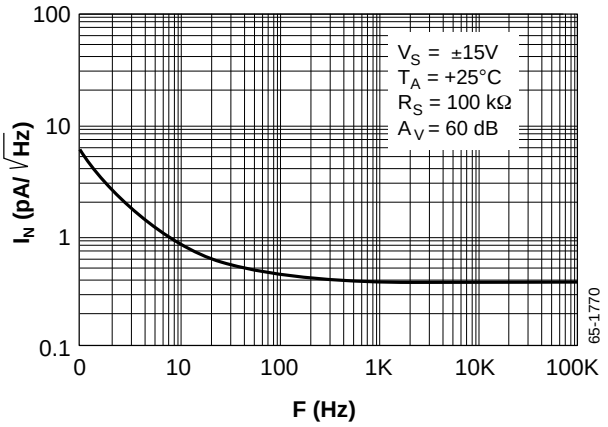


Figure 13. Input Noise Current Density vs. Frequency

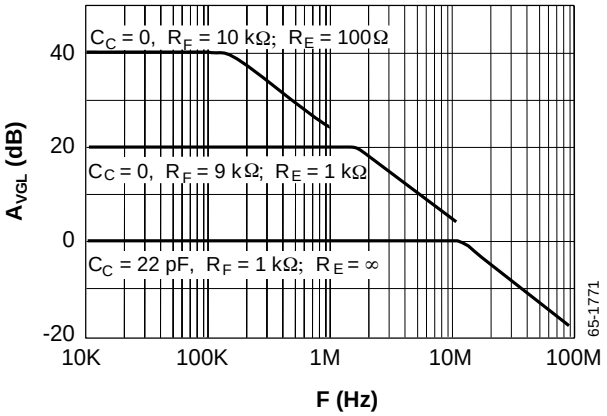


Figure 14. Closed Loop Gain vs. Frequency

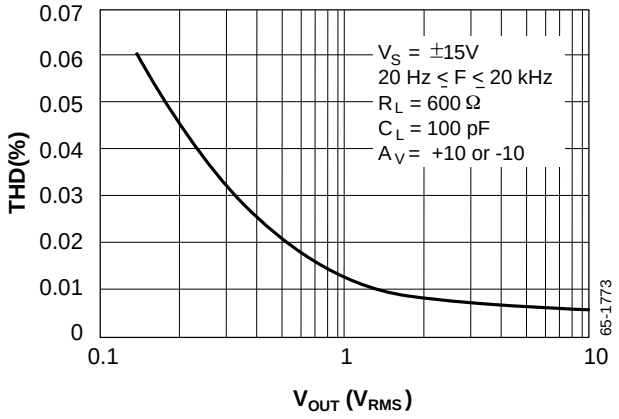


Figure 15. Total Harmonic Distortion vs. Output Voltage

Typical Test Circuits

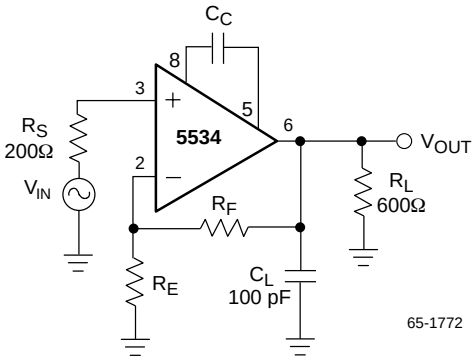


Figure 16. Closed Loop Frequency Response Test Circuit

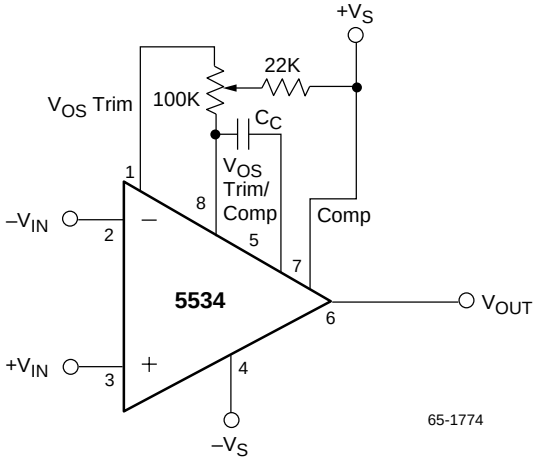
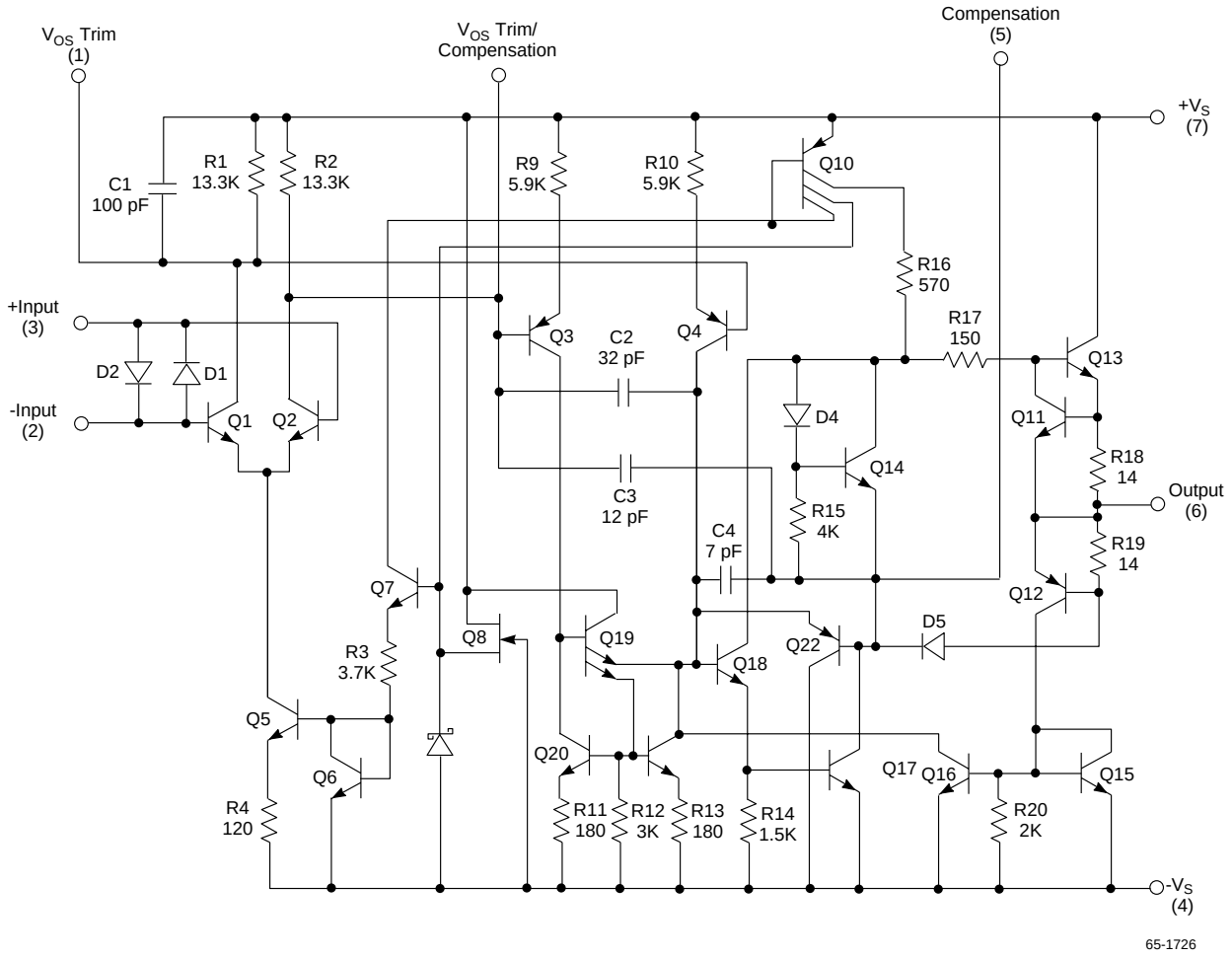


Figure 17. Offset Voltage Trim Circuit

Simplified Schematic Diagram



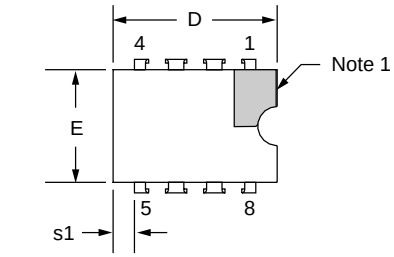
Mechanical Dimensions

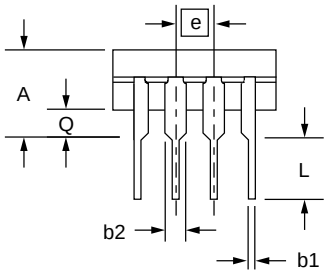
8-Lead Ceramic DIP Package

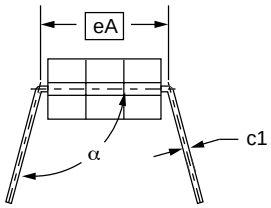
Symbol	Inches		Millimeters		Notes
	Min.	Max.	Min.	Max.	
A	—	.200	—	5.08	
b1	.014	.023	.36	.58	8
b2	.045	.065	1.14	1.65	2, 8
c1	.008	.015	.20	.38	8
D	—	.405	—	10.29	4
E	.220	.310	5.59	7.87	4
e	.100 BSC		2.54 BSC		5, 9
eA	.300 BSC		7.62 BSC		7
L	.125	.200	3.18	5.08	
Q	.015	.060	.38	1.52	3
s1	.005	—	.13	—	6
α	90°	105°	90°	105°	

Notes:

1. Index area: a notch or a pin one identification mark shall be located adjacent to pin one. The manufacturer's identification shall not be used as pin one identification mark.
2. The minimum limit for dimension "b2" may be .023 (.58mm) for leads number 1, 4, 5 and 8 only.
3. Dimension "Q" shall be measured from the seating plane to the base plane.
4. This dimension allows for off-center lid, meniscus and glass overrun.
5. The basic pin spacing is .100 (2.54mm) between centerlines. Each pin centerline shall be located within ±.010 (.25mm) of its exact longitudinal position relative to pins 1 and 8.
6. Applies to all four corners (leads number 1, 4, 5, and 8).
7. "eA" shall be measured at the center of the lead bends or at the centerline of the leads when "α" is 90°.
8. All leads – Increase maximum limit by .003 (.08mm) measured at the center of the flat, when lead finish applied.
9. Six spaces.







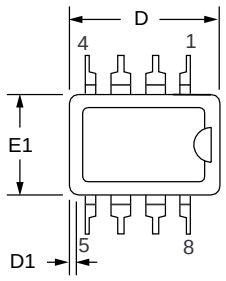
Mechanical Dimensions (continued)

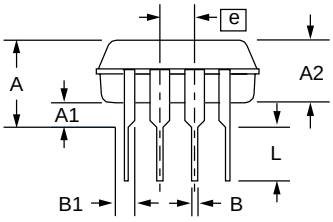
8-Lead Plastic DIP Package

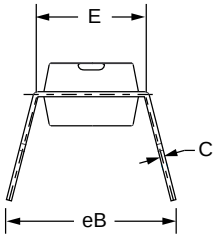
Symbol	Inches		Millimeters		Notes
	Min.	Max.	Min.	Max.	
A	—	.210	—	5.33	
A1	.015	—	.38	—	
A2	.115	.195	2.93	4.95	
B	.014	.022	.36	.56	
B1	.045	.070	1.14	1.78	
C	.008	.015	.20	.38	4
D	.348	.430	8.84	10.92	2
D1	.005	—	.13	—	
E	.300	.325	7.62	8.26	
E1	.240	.280	6.10	7.11	2
e	.100 BSC		2.54 BSC		
eB	—	.430	—	10.92	
L	.115	.160	2.92	4.06	
N	8°		8°		5

Notes:

1. Dimensioning and tolerancing per ANSI Y14.5M-1982.
2. "D" and "E1" do not include mold flashing. Mold flash or protrusions shall not exceed .010 inch (0.25mm).
3. Terminal numbers are for reference only.
4. "C" dimension does not include solder finish thickness.
5. Symbol "N" is the maximum number of terminals.

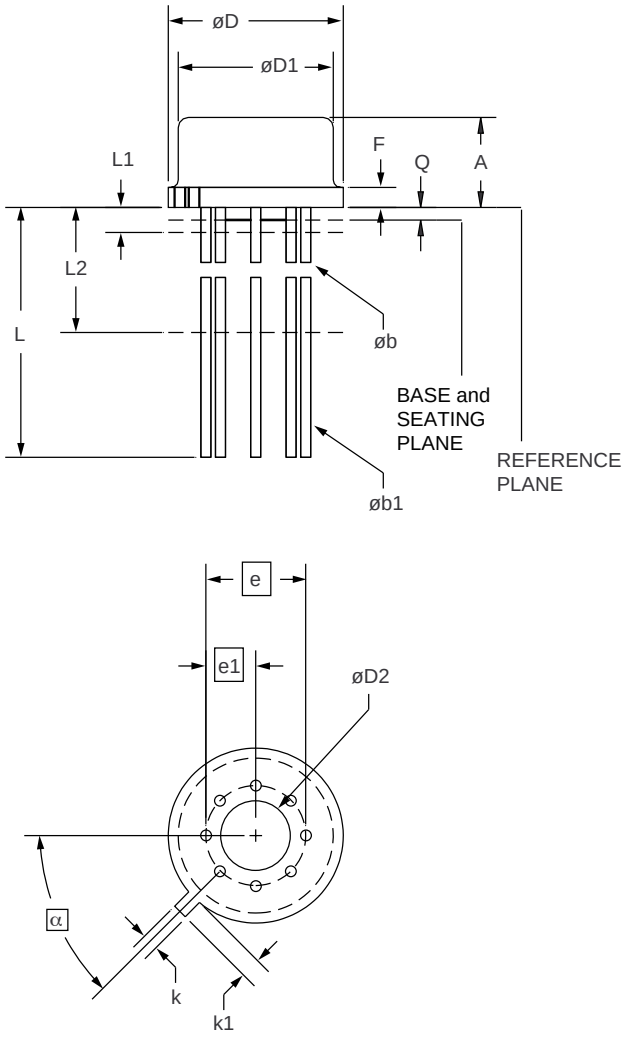






Mechanical Dimensions (continued)

8-Lead Metal Can IC Header Package



Symbol	Inches		Millimeters		Notes
	Min.	Max.	Min.	Max.	
A	.165	.185	4.19	4.70	
øb	.016	.019	.41	.48	1, 5
øb1	.016	.021	.41	.53	1, 5
øD	.335	.375	8.51	9.52	
øD1	.305	.335	7.75	8.51	
øD2	.110	.160	2.79	4.06	
e	.200 BSC		5.08 BSC		
e1	.100 BSC		2.54 BSC		
F	—	.040	—	1.02	
k	.027	.034	.69	.86	
k1	.027	.045	.69	1.14	2
L	.500	.750	12.70	19.05	1
L1	—	.050	—	1.27	1
L2	.250	—	6.35	—	1
Q	.010	.045	.25	1.14	
α	45° BSC		45° BSC		

Notes:

1. (All leads) øb applies between L1 & L2. øb1 applies between L2 & .500 (12.70mm) from the reference plane. Diameter is uncontrolled in L1 & beyond .500 (12.70mm) from the reference plane.
2. Measured from the maximum diameter of the product.
3. Leads having a maximum diameter .019 (.48mm) measured in gauging plane, .054 (1.37mm) +.001 (.03mm) –.000 (.00mm) below the reference plane of the product shall be within .007 (.18mm) of their true position relative to a maximum width tab.
4. The product may be measured by direct methods or by gauge.
5. All leads – increase maximum limit by .003 (.08mm) when lead finish is applied.

Ordering Information

Product Number	Temperature Range	Screening	Package
RC5534D/RC5534AD	0°C to +70°C	Commercial	8 Pin Ceramic DIP
RC5534N/RC5534AN	0°C to +70°C	Commercial	8 Pin Plastic DIP
RM5534D/RM5534AD	-55°C to +125°C	Commercial	8 Pin Ceramic DIP
RM5534D/883	-55°C to +125°C	Military	8 Pin Plastic DIP
RM5534AD/883	-55°C to +125°C	Military	8 Pin Plastic DIP
RM5534T/RM5534AT	-55°C to +125°C	Commercial	8 Pin TO-99 Metal Can
RM5534T/883	-55°C to +125°C	Military	8 Pin TO-99 Metal Can
RM5534AT/883	-55°C to +125°C	Military	8 Pin TO-99 Metal Can

Note: /883 denotes MIL-STD-883, Par. 1.2.1 compliant device.

5/20/98 0.0m 001
Stock#DS30005534