



AP434/434L

(Preliminary)

Dual Operational Amplifier and Voltage Reference

■ Features

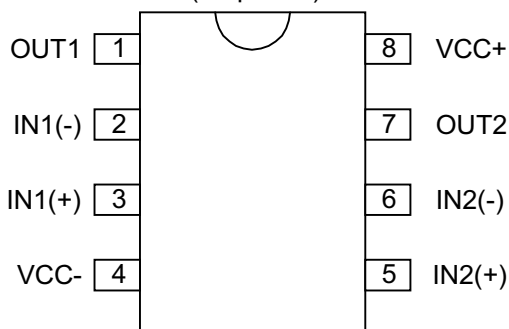
- Low input offset voltage: 0.5mV typ for AP434L.
- Low supply current: 800 μ A/op. (@ $V_{CC} = 5V$)
- Medium Bandwidth (unity gain): 0.9MHz
- Large output voltage swing: 0V to ($V_{CC} - 1.5V$)
- Input Common Mode voltage range includes Ground
- Wide power supply range: 3 to 32V, ± 1.5 to $\pm 16V$
- Fixed output voltage reference 1.25V
- Voltage precision: 0.4%(AP434L) and 1%(AP434)
- Sink current capability: 1 to 200mA
- Typical output impedance: 0.2 Ω

■ Applications

- Battery charger circuit
- Power supply protect
- PC peripheral

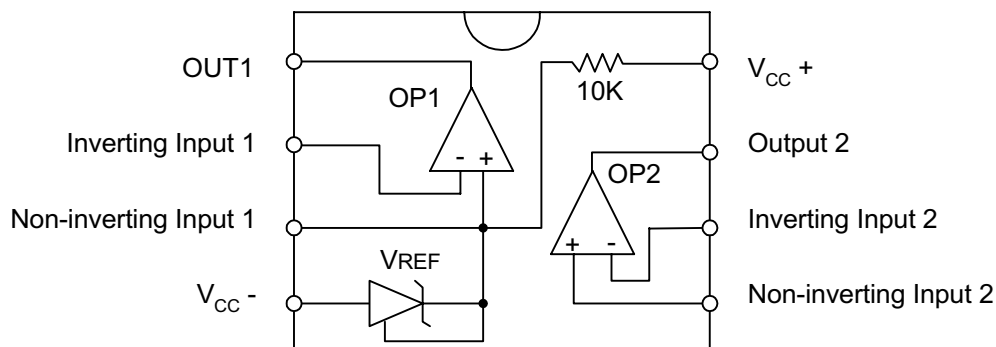
■ Pin Assignments

(Topview)



(DIP8/SO8)

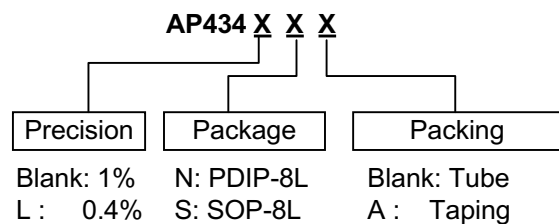
■ Block Diagram



■ General Descriptions

The AP434/434L is a monolithic IC that includes one independent op-amp and another op-amp for which the non-inverting input is wired to a 1.25V fixed Voltage Reference. This device is offering space and cost saving in many applications like power supply management or data acquisition systems.

■ Ordering Information



■ Pin Descriptions

Name	Descriptions
OUT1	OP-amp1 Output
IN1(+)	Non-inverting Input
IN1(-)	Inverting Input
$V_{CC}(+)$	Supply Voltage (+)
$V_{CC}(-)$	Supply Voltage (-)
IN2(+)	Non-inverting Input
IN2(-)	Inverting Input
OUT2	OP-amp2 Output



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■ Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_{CC}	Supply voltage	36	V
V_{ID}	Differential input voltage	36	V
V_{IN}	Input voltage	-0.3 ~ +36	V
T_{OP}	Operating temperature range	-55 ~ +125	°C
θ_{JA} (DIP package)	Thermal resistance junction to Ambient	100	°C/W
θ_{JA} (SOP package)		160	
T_J	Maximum junction temperature	150	°C

■ Electrical Characteristics ($T_{AMB}=25^{\circ}C$, $V_{CC}=5V$)

Symbol	Parameter	Conditions	Rating			Unit
			Min.	Typ.	Max.	
I_{CC}	Supply current	$V_{CC(+)}=5V$, No Load $T_{MIN}<T_{AMB}<T_{MAX}$		0.7	1.2	mA
		$V_{CC(+)}=30V$, No Load $T_{MIN}<T_{AMB}<T_{MAX}$			2	



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■ Electrical Characteristic (Continued)

OP-Amp2($V_{CC(+)}=5V, V_{CC(-)}=Gnd, V_o=1.4V$)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
V_{IO}	Input Offset voltage	AP434		$T_{AMB}=25^{\circ}C$	1	4	mV
				$T_{MIN}<T_{AMB}<T_{MAX}$		5	
		AP434L		$T_{AMB}=25^{\circ}C$	0.5	2	
				$T_{MIN}<T_{AMB}<T_{MAX}$	0.5	3	
DV_{IO}	Input Offset voltage Drift			7		$\mu V/^{\circ}C$	
SVRR	Supply voltage rejection ratio	$V_{CC}^{+}=5\sim 30V$	65	100		dB	
I_{SOURCE}	Output current source	$V_{CC}=+15V, V_o=2V, V_{ID}=+1V$	20	40		mA	
I_{SHORT}	Short circuit to Ground	$V_{CC}=+15V$		40	60	mA	
I_{SINK}	Output current Sink	$V_{CC}=+15V, V_o=2V, V_{ID}=-1V$	10	20		mA	
I_{IO}	Input offset current	$T_{MIN}<T_{AMB}<T_{MAX}$		2	30 50	nA	
I_{IB}	Input bias current	$T_{MIN}<T_{AMB}<T_{MAX}$		20	150 200	nA	
V_{OH}	High Level output voltage	$V_{CC}^{+}=30V$ $T_{AMB}=25^{\circ}C, R_L=10K$ $T_{MIN}<T_{AMB}<T_{MAX}$	27	28		V	
V_{OL}	Low Level output voltage	$R_L=10K$ $T_{MIN}<T_{AMB}<T_{MAX}$		5	20	mV	
V_{ICM}	Input common mode voltage range	$V_{CC}^{+}=30V$ (Note 1) $T_{MIN}<T_{AMB}<T_{MAX}$	0 0		$V_{CC}-1.5$ $V_{CC}-2.0$	V	
A_{VD}	Large signal voltage gain	$V_{CC}=+15V, V_o=1.4\sim 11.4V, R_L=2K$ $T_{MIN}<T_{AMB}<T_{MAX}$	50 25	100		V/mV	
SR	Slew rate at unity gain	$V_i=0.5\sim 3V, V_{CC}=15V, R_L=2K,$ $C_L=100pF, \text{unity gain}$	0.2	0.4		$V/\mu s$	
GBP	Gain bandwidth product	$V_{CC}=30V, R_L=2K, C_L=100Pf$ $f = 100KHz, V_{IN}=10mV$	0.5	0.9		MHz	
THD	Total Harmonic Distortion	$V_{CC}=30V, R_L=2K, C_L=100Pf$ $f = 1KHz, V_o=2V_{P-P}, A_V=20dB$		0.02		%	
CMRR	Common mode rejection ratio	$T_{MIN}<T_{AMB}<T_{MAX}$	70	85		dB	
			60				

Note 1 : The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is $V_{CC}^{+} - 1.5V$
But either of both inputs can go to +36V without damage.



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■ Electrical Characteristic (Continued)

OP-Amp1 (with non-inverting input connected to the internal V_{REF}) $V_{CC}(+)=5V, V_{CC}(-)=Gnd$

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
V_{IO}	Input Offset voltage	AP434	$T_{AMB}=25^{\circ}C$		1	4	mV
			$T_{MIN}<T_{AMB}<T_{MAX}$			5	
		AP434L	$T_{AMB}=25^{\circ}C$		0.5	2	
			$T_{MIN}<T_{AMB}<T_{MAX}$		0.5	3	
DV_{IO}	Input Offset voltage Drift			7		$\mu V/^{\circ}C$	
$SVRR$	Supply voltage rejection ratio	$V_{ICM}=0V$ $V_{CC}^{+}=5\sim 30V$	65	100		dB	
I_{SOURCE}	Output current source	$V_{CC}=+15V, V_O=2V, V_{ID}=+1V$	20	40		mA	
I_{SHORT}	Short circuit to Ground	$V_{CC}=+15V$		40	60	mA	
I_{SINK}	Output current Sink	$V_{CC}=+15V, V_O=2V, V_{ID}=-1V$	10	20		mA	
I_{IB}	Input bias current	Negative input		20		nA	
V_{OH}	High Level output voltage	$V_{CC}^{+}=30V$ $T_{AMB}=25^{\circ}C, R_L=10K$ $T_{MIN}<T_{AMB}<T_{MAX}$	27	28		V	
V_{OL}	Low Level output voltage	$R_L=10K$ $T_{MIN}<T_{AMB}<T_{MAX}$		5	20	mV	
A_{VD}	Large signal voltage gain	$V_{CC}=+15V, V_O=1.4\sim 11.4V, R_L=2K$ $T_{MIN}<T_{AMB}<T_{MAX}$		100		V/mV	
SR	Slew rate at unity gain	$V_i=0.5\sim 2V, V_{CC}=15V, R_L=2K,$ $C_L=100pF, \text{unitygain}$	0.2	0.4		V/ μs	
GBP	Gain bandwidth product	$V_{CC}=30V, R_L=2K, C_L=100pF$ $f = 100KHz, V_{IN}=10mV$	0.5	0.9		MHz	
THD	Total Harmonic Distortion	$V_{CC}=30V, R_L=2K, C_L=100pF$ $f = 1KHz, V_o=2V_{P-P}, A_v=20dB$		0.02		%	

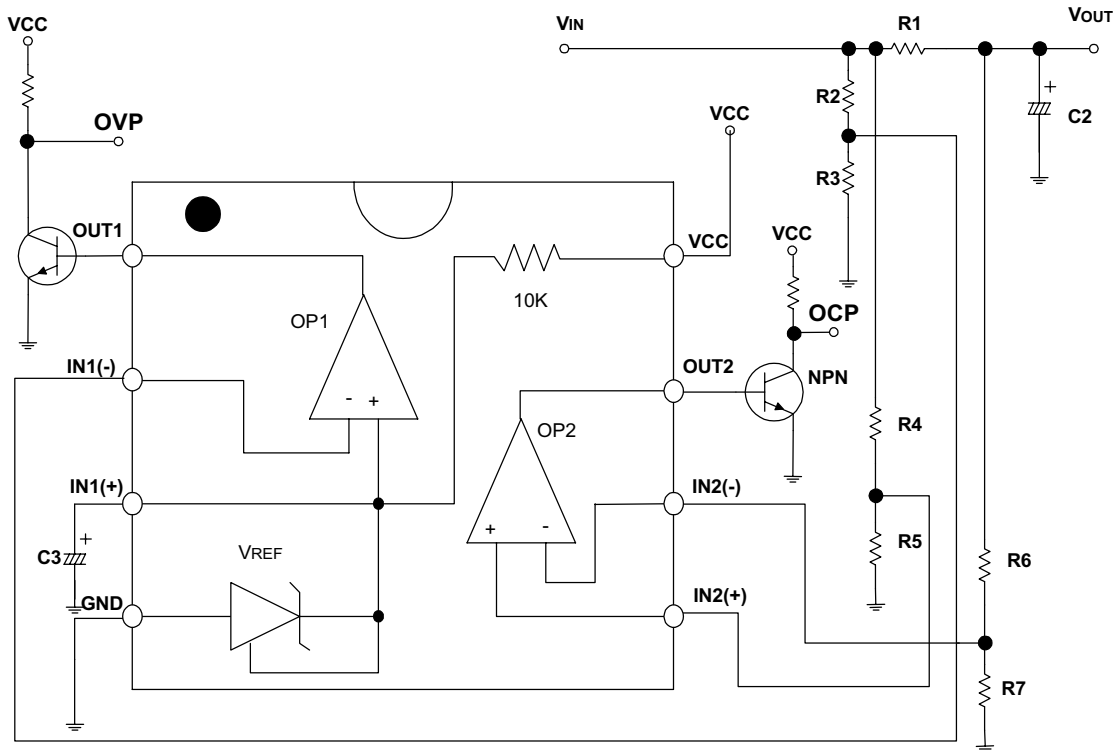
Voltage reference

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	
V_{REF}	Reference input voltage	AP434	$T_{AMB}=25^{\circ}C$	1.237	1.25	1.263	V
			$T_{MIN}<T_{AMB}<T_{MAX}$	1.225		1.275	
		AP434L	$T_{AMB}=25^{\circ}C$	1.245		1.255	
			$T_{MIN}<T_{AMB}<T_{MAX}$	1.237		1.263	
ΔV_{REF}	Reference input voltage deviation over Temperature range	$V_{KA}=V_{REF}, I_K=10mA$ $T_{MIN}<T_{AMB}<T_{MAX}$		3.0	20	mV	
I_{MIN}	Minimum cathode current for regulation	$V_{KA}=V_{REF}$		0.15	0.3	mA	
I_k	Cathode Current			0.2	1	mA	
$ Z_{KA} $	Dynamic impedance (note2)	$V_{KA}=V_{REF}$ $\Delta I_K=1\sim 100mA, f=0$		0.2	0.5	Ω	

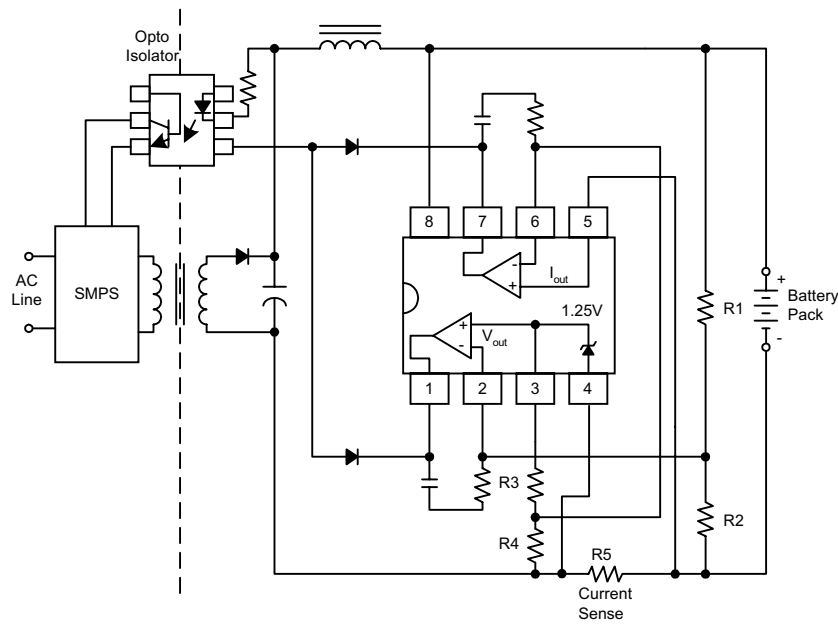
Note 2 : The dynamic impedance is defined as $|Z_{KA}| = \Delta V_{KA} / \Delta I_K$

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■ Test Circuit:

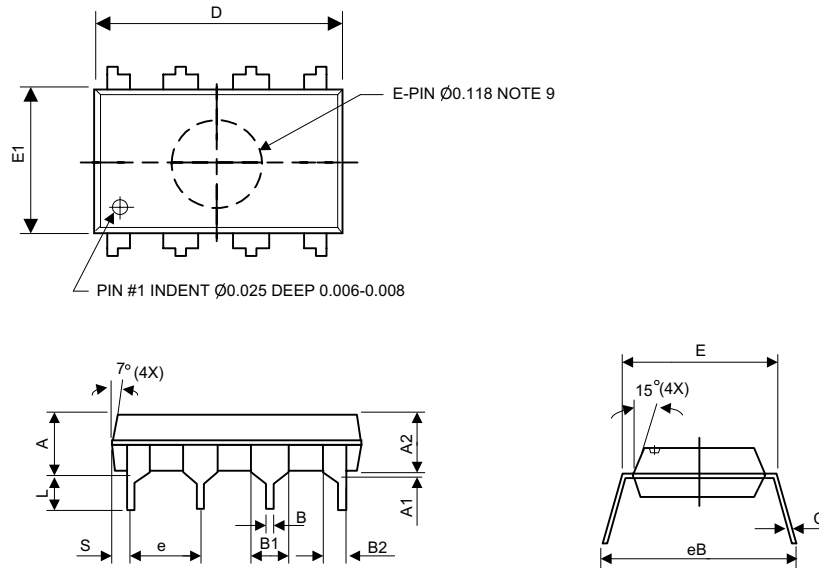


■ Application circuit:



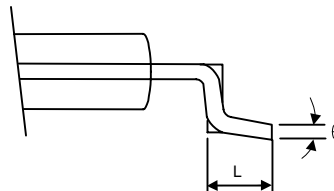
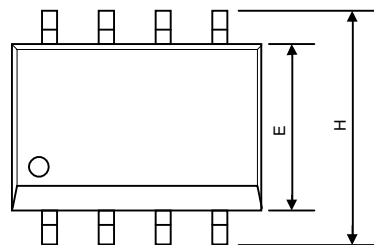
■ Package Outline

(1) Plastic Dual-in-line Package (PDIP8)

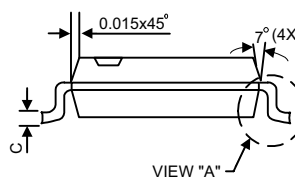
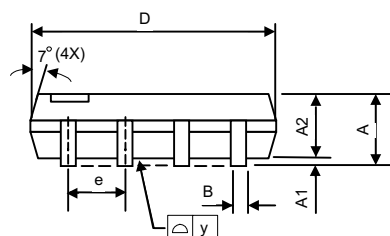


Symbols	Dimensions in millimeters			Dimensions in inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	–	–	5.33	–	–	0.210
A1	0.38	–	–	0.015	–	–
A2	3.1	3.30	3.5	0.122	0.130	0.138
B	0.36	0.46	0.56	0.014	0.018	0.022
B1	1.4	1.52	1.65	0.055	0.060	0.065
B2	0.81	0.99	1.14	0.032	0.039	0.045
C	0.20	0.25	0.36	0.008	0.010	0.014
D	9.02	9.27	9.53	0.355	0.365	0.375
E	7.62	7.94	8.26	0.300	0.313	0.325
E1	6.15	6.35	6.55	0.242	0.250	0.258
e	–	2.54	–	–	0.100	–
L	2.92	3.3	3.81	0.115	0.130	0.150
eB	8.38	8.89	9.40	0.330	0.350	0.370
S	0.71	0.84	0.97	0.028	0.033	0.038

(2) JEDEC Small Outline Package (SO8)



VIEW "A"



VIEW "A"

Symbols	Dimensions in millimeters			Dimensions in inches		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.40	1.60	1.75	0.055	0.063	0.069
A1	0.10	—	0.25	0.040	—	0.100
A2	1.30	1.45	1.50	0.051	0.057	0.059
B	0.33	0.41	0.51	0.013	0.016	0.020
C	0.19	0.20	0.25	0.0075	0.008	0.010
D	4.80	4.85	5.05	0.189	0.191	0.199
E	3.80	3.91	4.00	0.150	0.154	0.157
e	—	1.27	—	—	0.050	—
H	5.79	5.99	6.20	0.228	0.236	0.244
L	0.38	0.71	1.27	0.015	0.028	0.050
y	—	—	0.10	—	—	0.004
θ	0°	—	8°	0°	—	8°