Dual 2μV V_{OS}, 17μA, Zero-Drift, CMOS Operational Amplifier

General Description

ET85302 uses auto calibration technique to simultaneously provide low offset voltage (15 μV, max) and near-zero drift over time and temperature at only 32μA (max) per amplifier of quiescent current. The ET85302 features rail-to-rail input and output in addition to near-flat 1/f noise, making this amplifier ideal for many applications and much easier to design into a system. ET85302 is optimized for low-voltage operation as low as 1.8 V (±0.9 V) and up to 5.5 V (±2.75 V).

ET85302 is specified for the extended industrial / automotive temperature range (-40°C to +125°C). It is offered in a SOP8 package.

Features

- Rail-to-rail input and output
- Low input offset voltage: 2 μV
- Zero Drift: 0.02 μV/°C
- Low noise:1.1 μV_{PP}, 0.1 Hz to 10 Hz
- Low quiescent current: 17 μA/Ch
- Internal EMI filter
- Supply Voltage: 1.8 V to 5.5 V

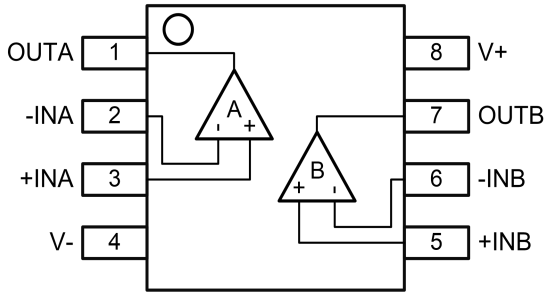
Applications

- Temperature Measurements
- Battery-Powered Instruments
- Transducer Applications
- Electronic Scales
- Medical Instrumentation
- Handheld Test Equipment
- Current Sense

Device information

Part No.	Package	Tape / Reel
ET85302M	SOP8	Tape and Reel

Pin Configuration



Top View

Pin Function

Pin Number	Symbol	Descriptions
1,7	OUT	Output
4	V-	Negative supply
3,5	+IN	Non-inverting input
2,6	-IN	Inverting input
8	V+	Positive supply

Absolute Maximum Ratings

Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are only stress ratings, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions are not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

Symbol	Parameter	Value	Unit
V_S	Supply Voltage	0 ~ 7	V
V_{IN}	Signal input terminals Voltage(1)	(V-)-0.3V ~ (V+)+0.3	V
I_{IN}	Signal input terminals Current(1)	-10 ~ 10	mA
I_{SC}	Output short-circuit current(2)	Continuous	
V_{ESD}	ESD (Human Body Model)	±4000	V
T_{STG}	Storage Temperature Range	-40 to +150	°C
$T_{J(MAX)}$	Max Junction Temperature Range	+150	°C

Note1: Input pins are diode-clamped to the power-supply rails. Input signals that can swing more than 0.3 V beyond the supply rails must be current limited to 10 mA or less.

Note2: Short-circuit to ground, one amplifier per package.

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
$R_{\theta JA}$	SOP8	Thermal Characteristics, Thermal Resistance, Junction-to-Air	124	°C/W

Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V_S	Supply Voltage: (V+) - (V-)	1.8(±0.9) ~ 5.5(±2.75)	V
T_A	Operating Temperature Range	-40 ~ +125	°C

Electrical Characteristics

V_S = (V+) – (V-) = 1.8 V to 5.5 V (±0.9 V to ±2.75 V), T_A = 25°C, R_L = 10 kΩ connected to V_S/2, and V_{CM} = V_{OUT} = V_S/2 (unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
OFFSET VOLTAGE						
V_{OS}	Input offset voltage	V_S = 5 V		2	15	µV
$\Delta V_{OS}/\Delta T$	Input offset voltage vs temperature	T_A = –40°C to +125°C		0.02		µV/°C
PSRR	Input offset voltage vs power supply	V_S = 1.8 to 5.5 V		1	8	µV/V
INPUT VOLTAGE RANGE						
V_{CM}	Common-mode voltage range		(V-)-0.1		(V+)+0.1	V
CMRR	Common-mode rejection ratio	(V-) - 0.1 V < V_{CM} < (V+) + 0.1 V	102	115		dB
INPUT BIAS CURRENT						
I_B	Input bias current	V_S = 5 V		±70		pA
		T_A = –40°C to +125°C		±150		pA
I_{OS}	Input offset current			±140		pA
NOISE						
E_n	Input voltage noise (peak to peak)	f = 0.1 Hz to 10 Hz		1.1		μV_{PP}
e_n	Input voltage noise density	f = 1 kHz		55		nV/√Hz
i_n	Input current noise density[(3)]	f = 10 Hz		100		fA/√Hz
INPUT CAPACITANCE						
C_{ID}	Differential			2		pF
C_{IC}	Common-mode			4		pF
OPEN-LOOP GAIN						
A_{OL}	Open-loop voltage gain	(V-) + 0.1 V < V_O < (V+) - 0.1 V	102	130		dB

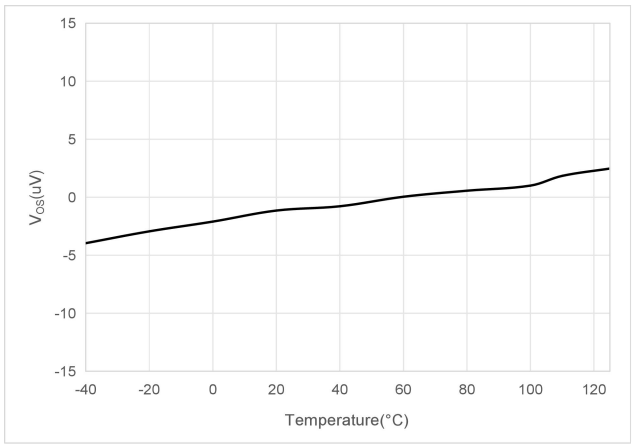
Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
FREQUENCY RESPONSE						
GBP	Gain-bandwidth product	CL = 100 pF		350		kHz
SR	Slew rate	G = 1		0.16		V/μs
OUTPUT						
V_O	Voltage output swing from supply rails	T_A= –40°C to +125°C		30	70	mV
I_{SC}	Short-circuit current			±5		mA
Z_O	Open-loop output impedance(3)	f = 350 kHz, I_O = 0 mA		2		kΩ
POWER SUPPLY						
V_S	Specified voltage range		1.8 (±0.9)		5.5 (±2.75)	V
I_Q	Quiescent current per amplifier	I_O = 0 mA		17	32	μA
Ton	Turn-on time	V_S = 5 V		100		μs

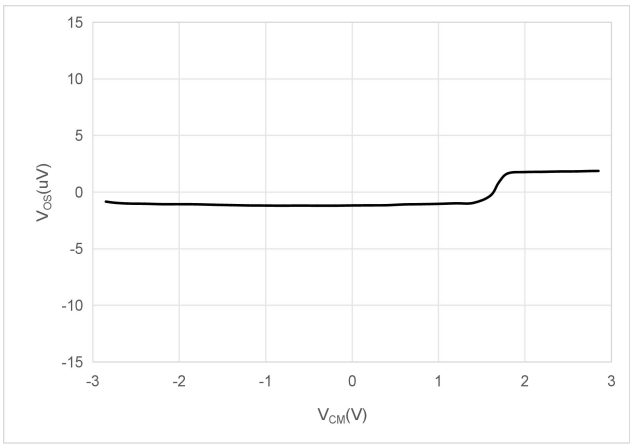
Note3: Guaranteed by design.

Typical Characteristics

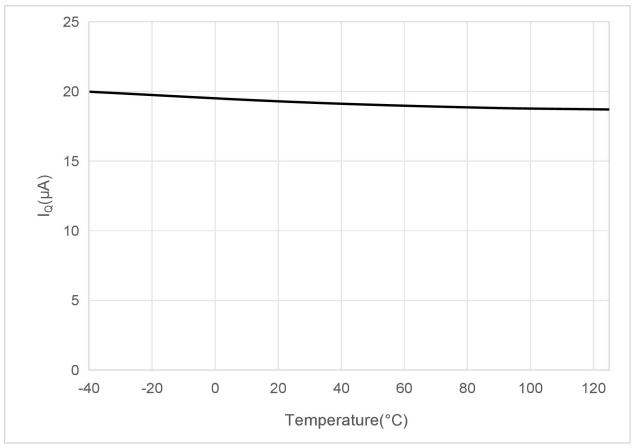
V_S = 5.5 V(±2.75V), V_{CM} = V_{OUT} = V_S/2, and R_L = 10kΩ connected to V_S/2,T_A = 25°C (unless otherwise noted)



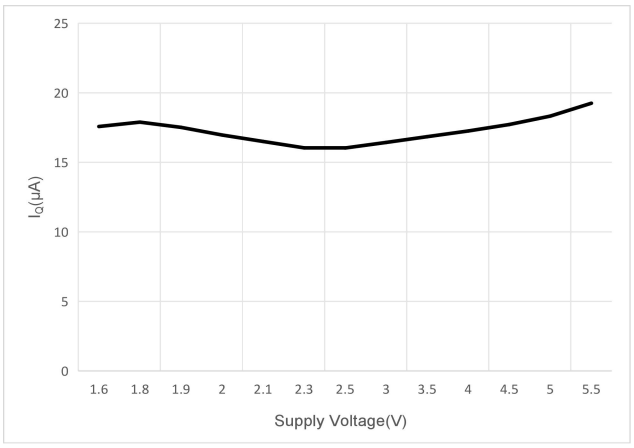
Offset Voltage vs Temperature



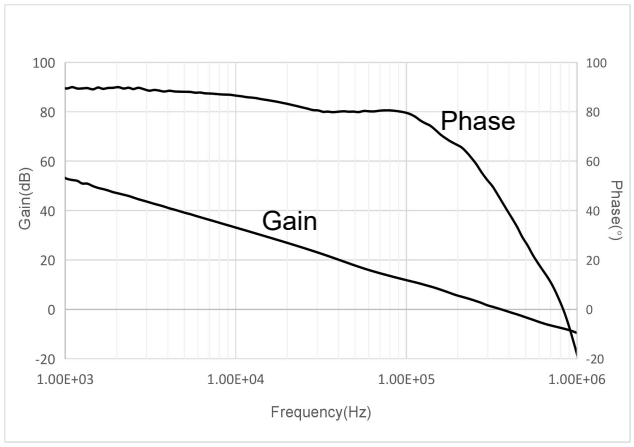
Offset Voltage vs Common-Mode Voltage



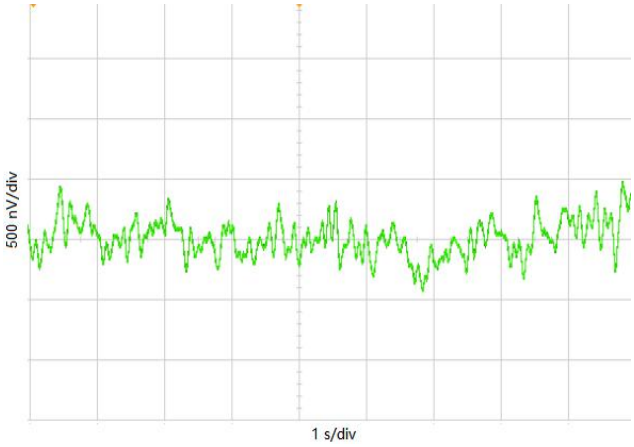
Quiescent Current vs Temperature



Quiescent Current vs Supply Voltage

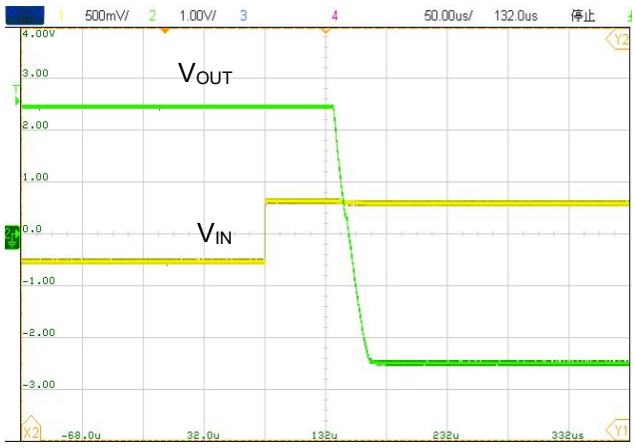


Open-Loop Gain vs Frequency



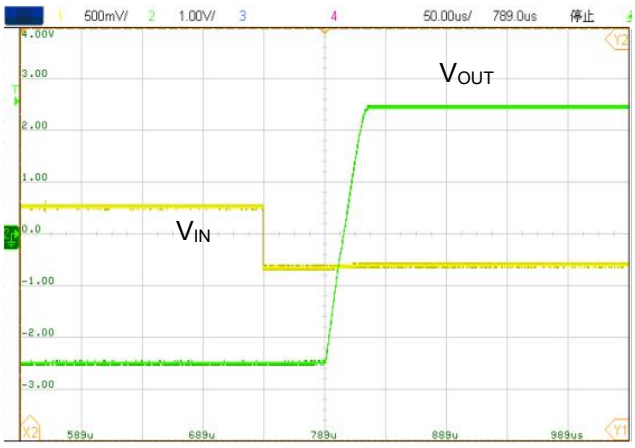
0.1 Hz to 10 Hz Noise

Typical Characteristics (Continued)



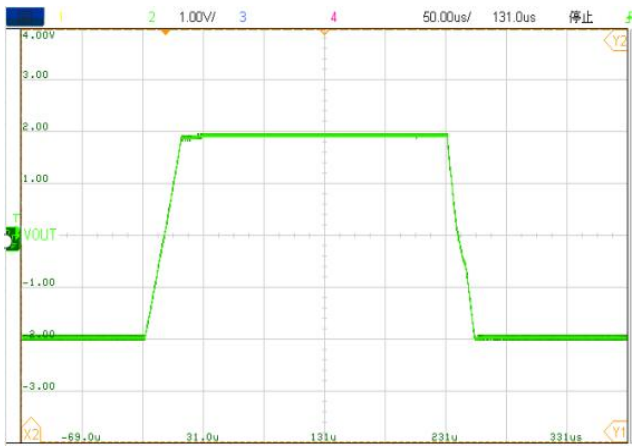
Positive Overload Recovery

(G = -10)



Negative Overload Recovery

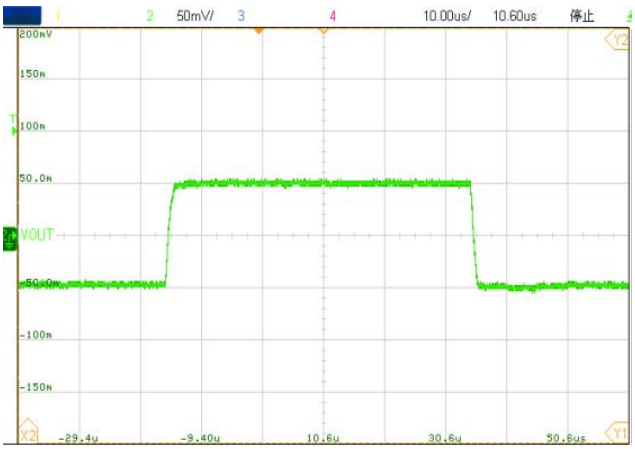
(G = -10)



Large-Signal Step Response

(G = +1,R_L = 10 kΩ)

V_{IN}



Small-Signal Step Response(100 mV)

(G = +1,R_L = 10 kΩ)

Functional Description

Overview

ET85302 can be used with single or dual supplies from an operating range of VS = 1.8 V (±0.9 V) up to 5.5 V (±2.75 V).

Input Voltage

The input common-mode voltage range extends 100 mV beyond the supply rails. ET85302 is designed to cover the full range without the troublesome transition region found in some other rail-to-rail amplifiers.

Layout Guidelines

For best operational performance of the device, use good PCB layout practices, including:

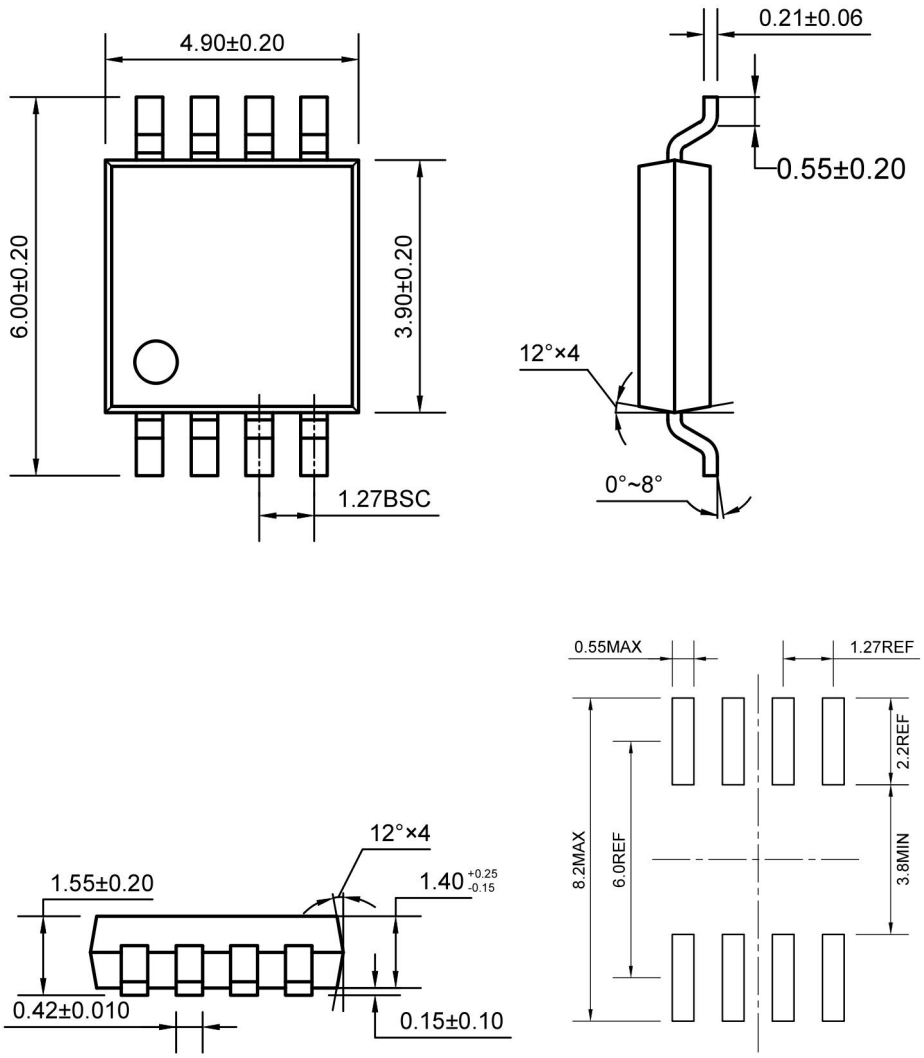
Place the external components as close to the device as possible. This configuration prevents parasitic errors (such as the Seebeck effect) from occurring.

To reduce parasitic coupling, run the input traces as far away from the supply lines and digital signal as possible. Low-ESR, 0.1μF ceramic bypass capacitors must be connected between each supply pin and ground, placed as close to the device as possible. A single bypass capacitor from V+ to ground is applicable to single supply applications.

Consider a driven, low-impedance guard ring around the critical traces. A guard ring can significantly reduce leakage currents from nearby traces that are at different potentials.

Package Dimension

SOP8



Recommended Land Pattern

Unit: mm

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2025-03-05	Original Version	Huyt	Chenh	Liujy