1MHz, RRIO, CMOS Operational Amplifier

General Description

ET324 is low cost, voltage feedback amplifiers. The device can operate from 2.1V to 5.5V single supply, while consuming only 60μA quiescent current per Amplifier. It provides rail-to-rail input with a wide input common mode voltage range and rail-to-rail output voltage swing. This feature makes ET324 appropriate for buffering ASIC.

The ET324 offer a gain-bandwidth product of 1MHz and an ultra-low input bias current of 10pA. It is well suited for piezoelectric sensors, integrators and photodiode amplifiers.

The ET324 is designed into a wide range of applications, such as battery-powered instrumentation, safety monitoring, portable systems, and transducer interface circuits in low power systems.

It is available in SOP14/TSSOP14 packages.

Features

- Low offset voltage: ±4.5 mV (MAX)
- Ultra-Low Input Bias Current: ±10 pA
- Unity-gain stable
- Gain-Bandwidth Product: 1 MHz
- Rail-to-rail input and output
- Supply Voltage Range: 2.1V to 5.5V
- Input Voltage Range: -0.1V to 5.6V with Vs=5.5V
- Low Supply Current: 60μA/Amplifier

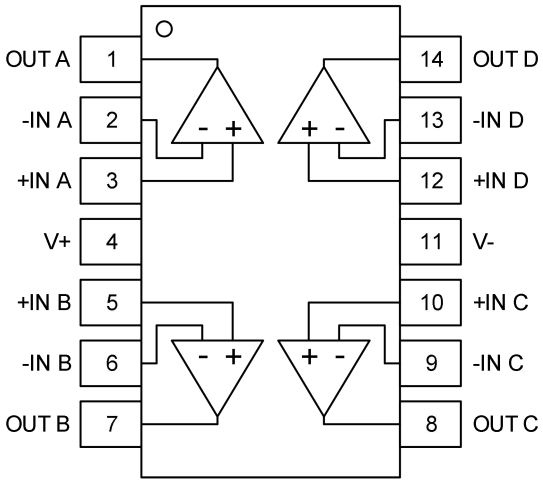
Applications

- ASIC Input or Output Amplifiers
- Piezoelectric Transducer Amplifiers
- Battery-Powered Equipment
- Portable Equipment
- Sensor Interfaces
- Medical Instrumentation
- Audio Outputs
- Smoke Detectors
- Notebook PCs

Device Information

Part No.	Package	Packing Option	MSL
ET324M	SOP14	Tube , 50	3
ET324V	TSSOP14	Tube , 50	3

Pin Configuration



ET324M/V
Top View

Pin Function

Symbol	Descriptions
OUT X	Output
V-	Negative supply
+IN X	Non-inverting input
-IN X	Inverting input
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,V+ to V-	0 to 6	V
V_{IN}	Signal input terminals Voltage	$(-V_S)$ - 0.3 to $(+V_S)$ + 0.3	V
$T_{J(MAX)}$	Maximum Junction Temperature	+150	°C
T_{STG}	Storage Temperature	-65 to +150	°C
V_{ESD}	Human body model (HBM), per ANSI/ESDA/JEDECJS-001(1)	±4000	V

Note1: JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500V HBM is possible if necessary precautions are taken.

Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V_S	Supply Voltage: (V+) - (V-)	2.1(±1.05) to 5.5(±2.75)	V
T_A	Operating Temperature Range	-40 to +125	°C

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
$R_{\theta JA}$	SOP14	Thermal Characteristics, Thermal Resistance, Junction-to-Air	104.5	°C/W
$R_{\theta JA}$	TSSOP14	Thermal Characteristics, Thermal Resistance, Junction-to-Air	90	°C/W

Electrical Characteristics

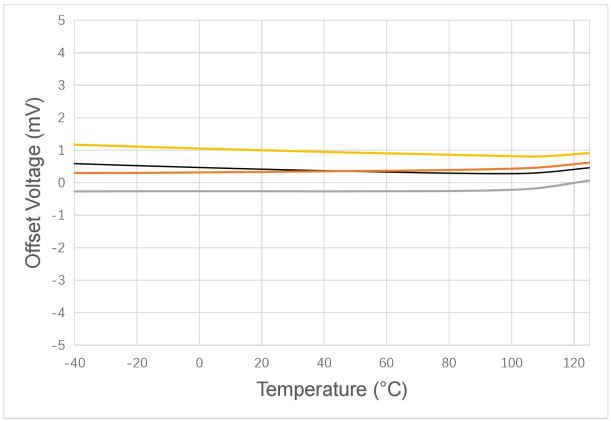
At T_A=+25°C, V_S=5V, R_L=100kΩ connected to V_S/2, and V_{OUT}=V_S/2, -40°C to +125°C, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
INPUT CHARACTERISTICS						
V_{OS}	Input offset Voltage	V_{CM} = V_S/2		±0.8	±4.5	mV
I_B	Input Bias Current			±10		pA
I_{OS}	Input Offset Current			±10		pA
V_{CM}	Input Common Mode Voltage Range	V_S=5.5V	-0.1		5.6	V
CMRR	Common-Mode Rejection Ratio	V_S = 5.5 V, V_{CM}= -0.1V to 4V	62	70		dB
		V_S = 5.5 V, V_{CM} = -0.1 V to 5.6 V,	55	68		
A_{OL}	Open-Loop Voltage Gain	R_L=5kΩ, V_{OUT}=0.1V to 4.9V	70	80		dB
		R_L=100kΩ, V_{OUT}=0.035V to 4.965V	80	84		
$\Delta V_{OS}/\Delta T$	Input Offset Voltage Drift			2.7		μV/°C
OUTPUT CHARACTERISTICS						
V_{OH}	Output Voltage Swing from Rail	R_L=100kΩ	4.980	4.997		V
V_{OL}		R_L=100kΩ		5	20	mV
V_{OH}		R_L=10kΩ	4.970	4.992		V
V_{OL}		R_L=10kΩ		8	30	mV
I_{SOURSE}	Output Current	R_L=10Ω to V_S/2	60	85		mA
I_{SINK}			60	75		mA
POWER SUPPLY						
V_S	Specified Voltage Range		2.1		5.5	V
PSRR	Power Supply Rejection Ratio	V_S=2.5V to 5.5V, V_{CM}=0.5V	60	82		dB
I_Q	Quiescent Current /Amp.	V_S=5V, V_{CM}=2.5V		60	85	μA
DYNAMIC PERFORMANCE						
GBP	Gain-Bandwith Product			1		MHz
SR	Slew Rate	G=+1, 2 V Output Step		0.6		V/μs
tor	Overload recovery time	VIN × G = VS		2.6		μs
t_S[(2)]	Setting Time to 0.1%	G=+1, 2 V Output Step		5.3		μs
NOISE PERFORMANCE						
E_n	Input voltage noise (peak to peak)	f = 0.1 Hz to 10 Hz		6		μV_{PP}
e_n	Input Voltage Noise Density	f=1kHz		25		nV/√Hz
		f=10kHz		20		nV/√Hz

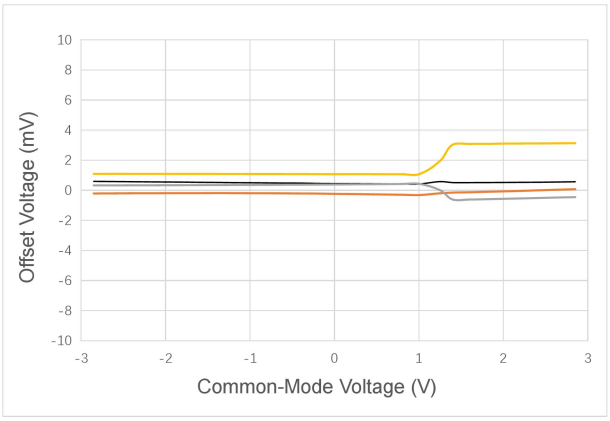
Note2:Guaranteed by design.

Typical Characteristics

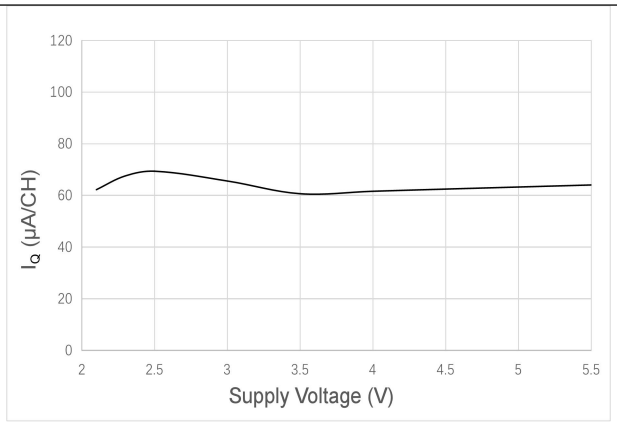
V_S = 5 V(±2.5V), V_{CM} = V_{OUT} = V_S/2, and R_L = 100kΩ connected to V_S/2,T_A = 25°C (unless otherwise noted)



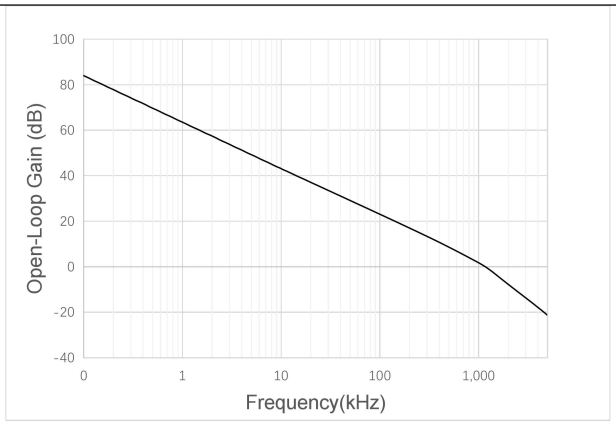
Offset Voltage vs Temperature



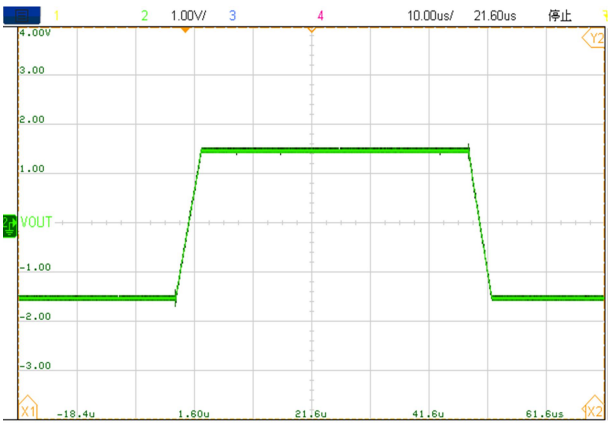
Offset Voltage vs Common-Mode Voltage



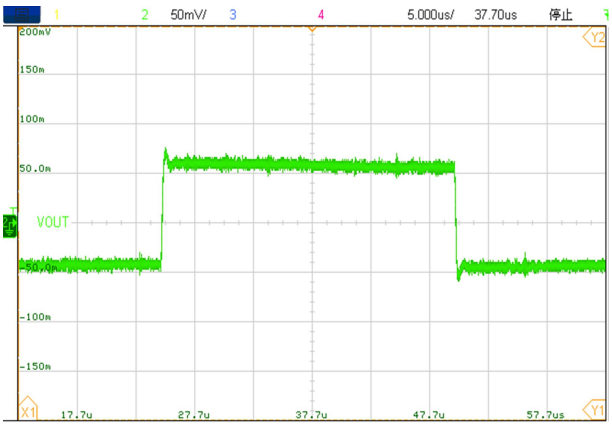
Quiescent Current vs Supply Voltage



Open-Loop Gain vs Frequency



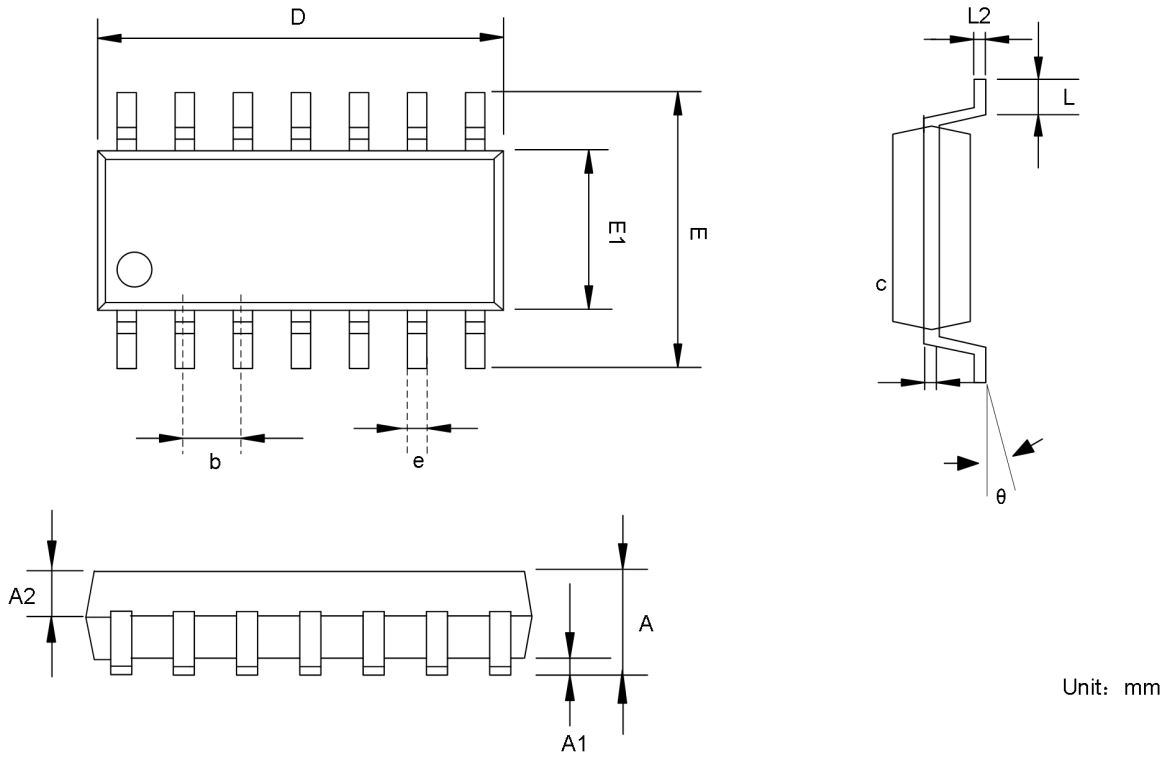
Large-Signal Step Response
(G = +1,R_L = 100 kΩ,C_L = 100 pF)



Small-Signal Step Response(100 mV)
(G = +1,R_L = 100 kΩ,C_L = 100 pF)

Package Dimension

SOP14

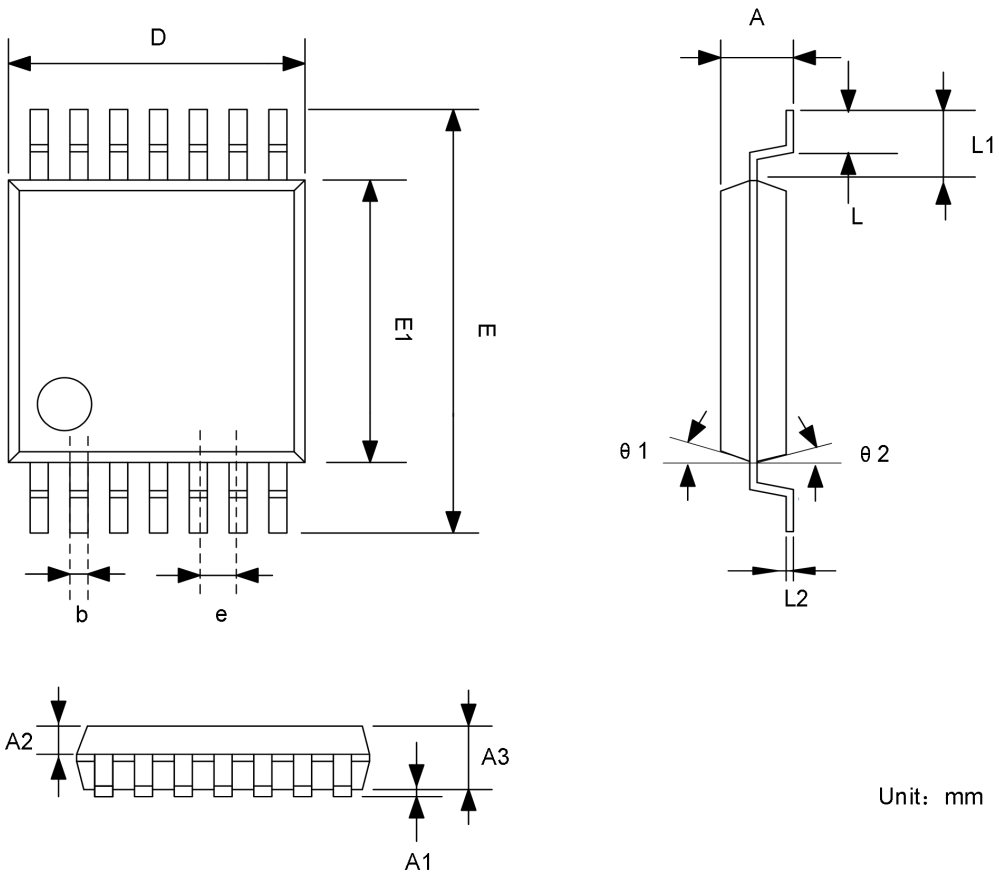


Unit：mm

COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	MAX
A	1.4	1.5
A1	0.1	0.2
A2	0.65	0.75
b	1.27	
c	0.203	
D	8.48	8.58
E	6.05	6.25
E1	3.75	3.85
e	0.406	
L	0.4	0.7
L2	0.203	
θ	0°	8°

TSSOP14



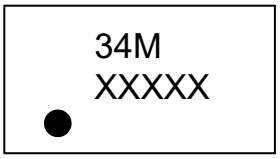
Unit：mm

COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	—	—	1.20
A1	0.05	0.08	0.11
A2	0.39	0.44	0.49
A3	0.95	1.00	1.05
e		0.65 BSC	
D	4.95	5.00	5.05
E	6.35	6.40	6.45
E1	4.35	4.40	4.45
b	0.20	—	0.29
L	0.55	0.60	0.65
L1		1.00 BSC	
L2	0.13	—	0.18
θ1	—	13°	—
θ2	—	12°	—

Marking Information

SOP14

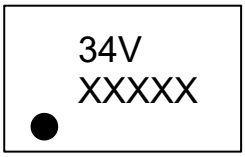


34M - Part Number

XXXXX - Tracking Number

Note：X (Tracking Number) is variable, according to the wafer lot number.

TSSOP14



34V - Part Number

XXXXX - Tracking Number

Note：X (Tracking Number) is variable, according to the wafer lot number.

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2025-11-14	Preliminary Version	Jiangqp	Chenh	Liujy
0.1	2025-12-29	Add TSSOP14 Package	Huyt	Chenh	Liujy
1.0	2026-03-20	Original Version	Huyt	Chenh	Liujy