36V Industry-Standard Operational Amplifier

General Description

LM358 is the industry-standard operational amplifier which include dual channel of high-voltage(36 V) op-amp. These devices provide outstanding value for cost-sensitive applications, with features including low offset, common-mode input range to ground.

LM358 could simplify circuit design with enhanced features, such as unity-gain stability and lower quiescent current of 250 μA per amplifier(typical).

LM358 is offered in SOP8 package.

Features

- Wide Supply: ±1.5 V to ±18 V, 3.0 V to 36 V
- Extended Temperature Range: -40 °C to +125 °C
- Offset Voltage: ±2 mV (typical)
- Offset Voltage Temperature Drift: 7 μV/°C
- Input Common-Mode Voltage Range Includes Ground
- Large Voltage Gain: 85 dB (typical)
- Gain Bandwidth: 0.7 MHz
- Slew Rate: 0.3 V/μs
- Quiescent Current: 250 μA/ch (typical)

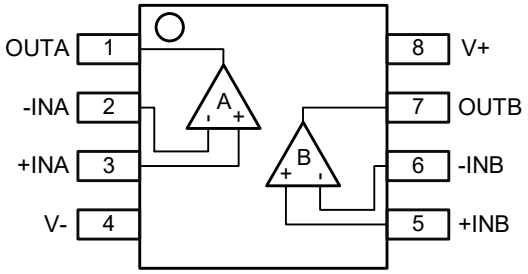
Applications

- Merchant Network and Server Power Supply Units
- Multi-function Printers
- Power Supplies and Mobile Chargers
- Motor control: AC Induction, BDC, BLDC and Stepper Motor.etc
- Indoor and Outdoor air Conditioners
- Washers, Dryers, and Refrigerators
- AC Inverters, String Inverters, Central Inverters
- Electronic Point-of-Sale Systems

Device Information

Part No.	Package	Packing Option	MSL
LM358M	SOP8	Tape and Reel , 4k/Reel	3

Pin Configuration



Top View

Pin Function

Pin Number	Symbol	Descriptions
LM358M		
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,V+ to V-	0 to 40	V
V_{IN}	Signal input terminals Voltage	($-V_S$) -0.3V to ($+V_S$) +0.3	V
I_{IN}	Signal input terminals Current	-10 to +10	mA
I_O	Output Short-Circuit Current	Continuous	
$T_{J(MAX)}$	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)	500	V
	Charged device model (CDM), per JEDEC specification JESD22-C101(2)	1000	V

Note1: JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500-V HBM is possible if necessary precautions are taken.
Note2: JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 250-V CDM is possible if necessary precautions are taken.

Recommended Operating Conditions

Symbol	Parameter	Value	Unit
V_S	Supply Voltage: (V+) - (V-)	3(±1.5) to 36(±18)	V
T_A	Operating Temperature Range	-40 to +125	°C

Thermal Characteristics

Symbol	Package	Ratings	Value	Unit
$R_{\theta JA}$	SOP8	Thermal Characteristics, Thermal Resistance, Junction-to-Air	150	°C/W

Electrical Characteristics

V_S = 5.0 V to 36 V, V_{CM} = V_{OUT} = V_S/2, and R_L = 10kΩ connected to V_S/2, T_A = 25°C, unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
OFFSET VOLTAGE						
V_{OS}	Input Offset Voltage	V_S = 5.0V to 30V, V_{CM} = 0		±2	±7	mV
		V_S = 5.0V to 30V, V_{CM} = 0 T_A = -40°C to +125°C			±10	mV
dV_{OS}/dT	V_{OS} vs Temperature	T_A = -40°C to +125°C		±7		µV/°C
PSRR	Power Supply Rejection Ratio	V_S = 3.0 to 30 V	60	100		dB
INPUT BIAS CURRENT						
I_B	Input Bias Current	V_{CM} = 0		±20	±200	nA
		V_{CM} = 0,T_A = -40°C to +125°C			±500	nA
I_{OS}	Input Offset Current	V_{CM} = 0		±5	±50	nA
		V_{CM} = 0,T_A = -40°C to +125°C			±150	nA
NOISE						
e_n	Input Voltage Noise Density	f = 1 kHz		70		nV/√Hz
INPUT VOLTAGE						
V_{CM}	Common-mode Voltage Range	V_S = 30V, T_A = -40°C to +125°C	-V_S		+V_S -2	V
CMRR	Common-mode Rejection Ratio	V_S = 30V, V_{CM} = 0V to (+V_S -2)	60	80		dB
OPEN-LOOP GAIN						
A_{OL}	Open-loop Voltage Gain	V_S = 15V, V_{OUT} = 1.0V to 11V, R_L > 2 kΩ		85	100	dB
FREQUENCY RESPONSE						
GBP	Gain Bandwidth Product			0.7		MHz
SR	Slew Rate	V_S = 5 V, G = +1		0.3		V/µs

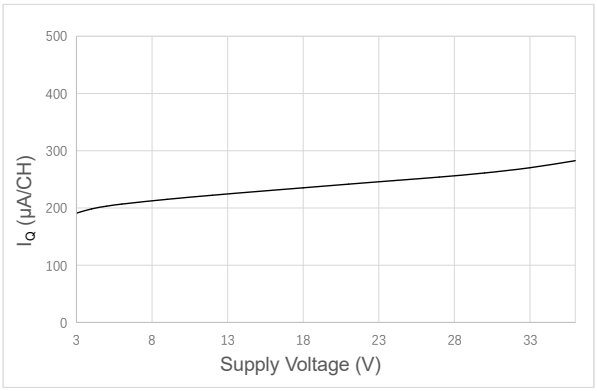
Electrical Characteristics (Continued)

V_S = 5 to 36 V, V_{CM} = V_{OUT} = V_S/2, and R_L = 10kΩ connected to V_S/2, T_A = 25°C, unless otherwise noted.

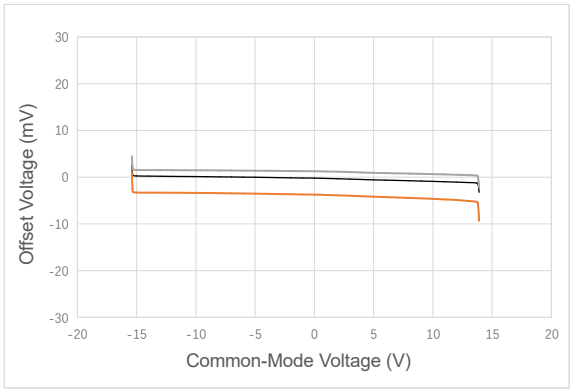
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
OUTPUT						
V_{OH}	High output voltage swing	V_S = 30V, R_L = 2kΩ, T_A = −40°C to +125°C			+V_S -8	V
		V_S = 30V, R_L = 10kΩ, T_A = −40°C to +125°C			+V_S -8	V
V_{OL}	Low output voltage swing	V_S = 5V, R_L = 10kΩ, T_A = −40°C to +125°C			-V_S +2	V
I_{SOURCE}	Out Source Current	V_S = 15V, V_{OUT} = 0V, V_{ID} = 1V	20	35		mA
		V_S = 15V, V_{OUT} = 0V,V_{ID} = 1V, T_A = −40°C to +125°C	10			
I_{SINK}	Out Sink Current	V_S = 15V, V_{OUT} = 0V, V_{ID} = 1V, T_A = −40°C to +125°C	5			mA
POWER SUPPLY						
V_S	Specified Voltage Range	T_A = −40°C to +125°C	3		36	V
I_Q	Quiescent Current per Amplifier	V_S = 5V		200	400	μA
		V_S = 30V		250	500	μA

Typical Characteristics

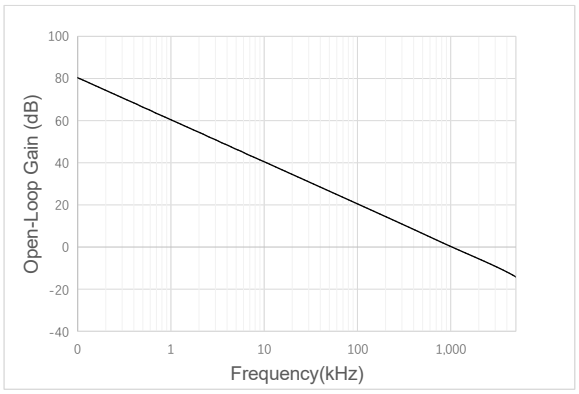
V_S = 5 to 36 V, V_{CM} = V_{OUT} = V_S/2, and R_L = 10kΩ connected to V_S/2, T_A = 25°C, unless otherwise noted.



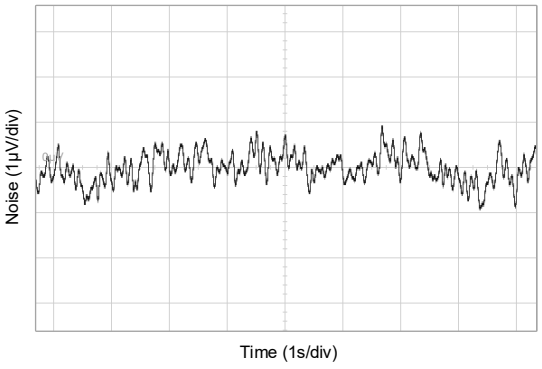
Quiescent Current vs Supply Voltage



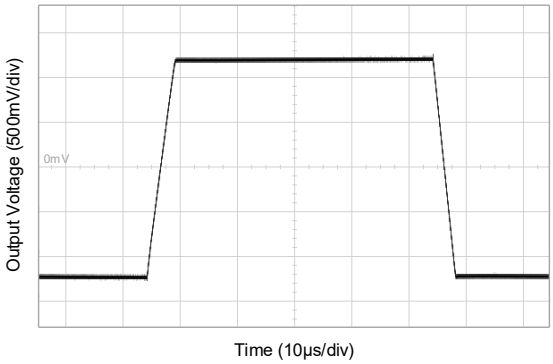
Offset Voltage vs Common-Mode Voltage(V_S = ±15V)



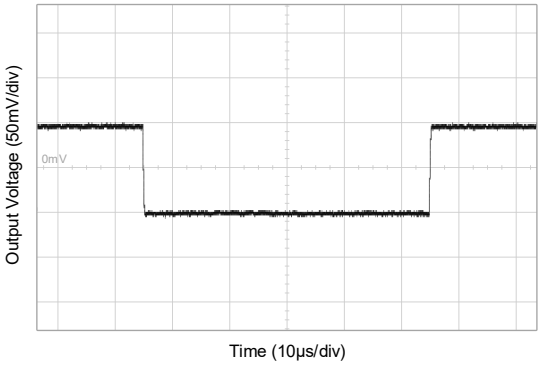
Open-Loop Gain vs Frequency



0.1 Hz to 10 Hz Noise



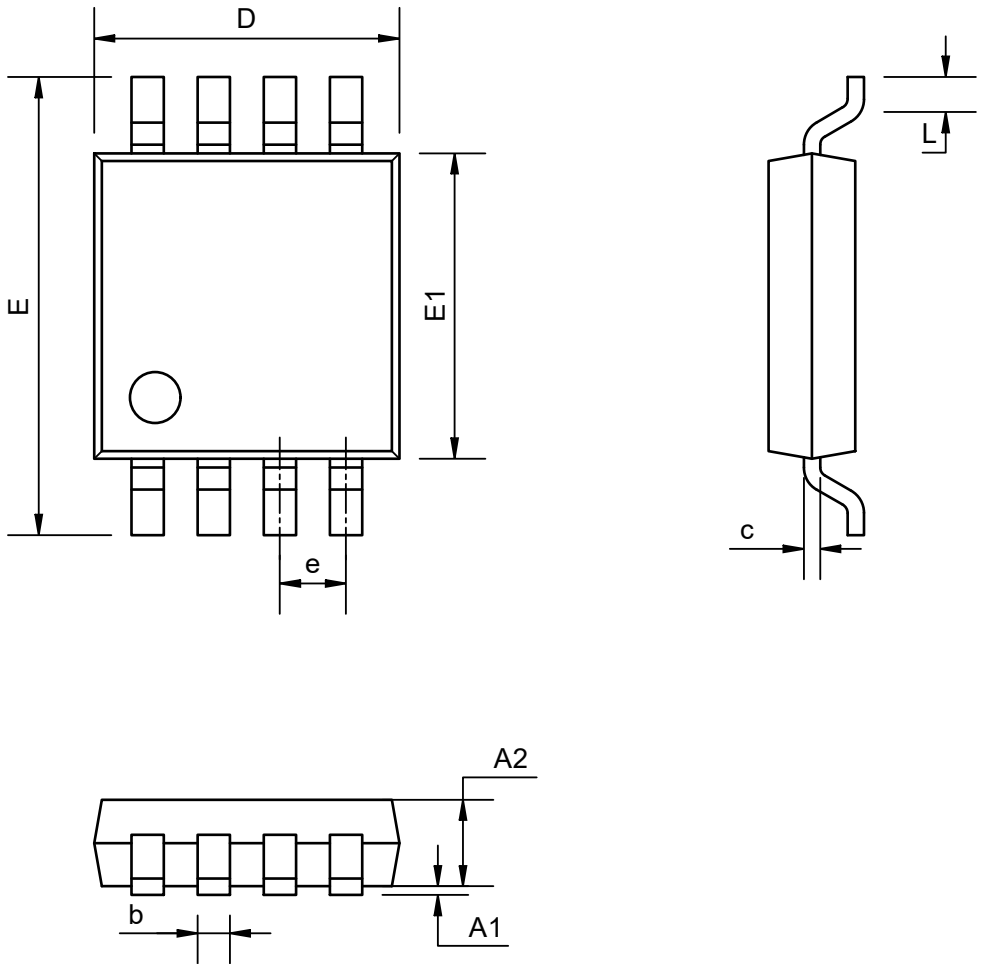
Large-Signal Step Response



Small-Signal Step Response(100 mV)

Package Dimension

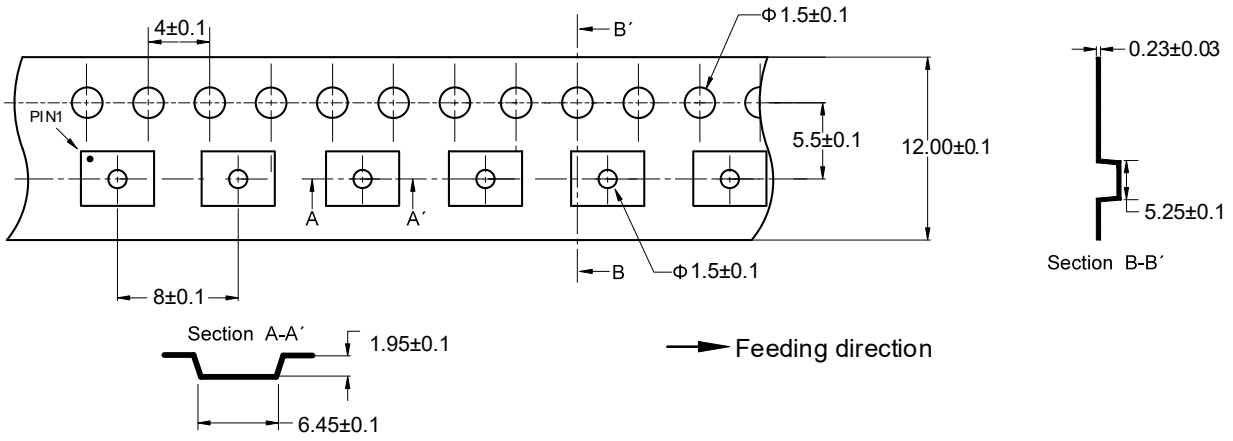
SOP8



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

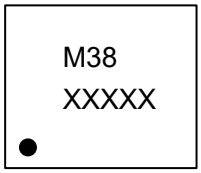
SYMBOL	MIN	NOM	MAX
A1	0.15	—	0.22
A2	1.40	1.55	1.50
b		0.40 BSC	
c	0.20	—	0.25
D	4.85	4.90	4.95
E	5.99	6.04	6.09
E1	3.85	3.90	3.95
e		1.27 BSC	
L	0.50	0.60	0.70

Tape Information



Marking Information

SOP8



M38 - 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
1.0	2024-03-07	Original Version	Jiangqp	Shibo	Liujy