## Description

The TP10 series are CMOS dual, and quad RRIO op-amps with low offset, low power and stable high frequency response. with 6MHz bandwidth, 4.5V/μs slew rate and low distortion while drawing only 600μA of quiescent current per amplifier. The input common-mode voltage range extends 300mV beyond V– and V+, and the outputs swing rail-to-rail. The TP10 family can be used as plug-in replacements for many commercially available op-amps to reduce power and improve input/output range and performance.

The combination of features makes the TP10 ideal choices for motor control and portable audio amplification, sound ports, and other consumer Audio. The TP10 Op-amp is very stable, and it is capable of driving heavy capacitive loads such as those found in LCDs. The ability to swing rail-to-rail at the inputs and outputs enables designers to buffer CMOS DACs, ASICs, or other wide output swing devices in single-supply systems.

## Features

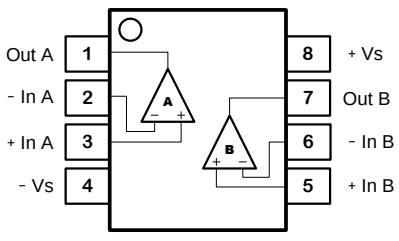
- Supply Voltage: 2.7V to 5.5V
- Low Supply Current: 600μA per channel
- Rail to Rail Input and Output
- Bandwidth: 6 MHz
- Slew Rate: 4.5V/μs
- Excellent EMI Suppress Performance
- Offset Voltage: ±3mV Maximum
- Offset Voltage Temperature Drift: 1 μV/°C
- Low Noise: 19 nV/√Hz at 1kHz
- High Output Capability: 100mA
- –40°C to 125°C Operation Temperature Range

## Applications

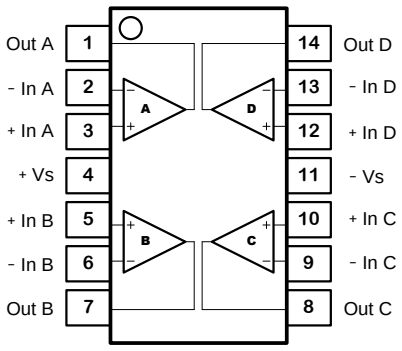
- E-Bike
- Motor Control
- Portable Audio

## Pin Configuration

**TP10-2**
**SOP-8**




**TP10-4**
**SOP-14/TSSOP-14**



## Absolute Maximum Ratings

| Parameters | Rating |
|---|---|
| Supply Voltage, $(+V_S)$– $(-V_S)$ | 7 V |
| Input Voltage | $(-V_S)$ – 0.3 to $(+V_S)$ + 0.3 |
| Differential Input Voltage | ±7V |
| Input Current: +IN, –IN Note 2 | ±10mA |
| Output Short-Circuit Duration Note 3 | Infinite |
| Maximum Junction Temperature | 150°C |
| Operating Temperature Range | –40 to 125°C |
| Storage Temperature Range | –65 to 150°C |
| Lead Temperature (Soldering, 10 sec) | 260°C |

**Note 1:** Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

**Note 2:** The inputs are protected by ESD protection diodes to each power supply. If the input extends more than 300mV beyond the power supply, the input current should be limited to less than 10mA.

**Note 3:** A heat sink may be required to keep the junction temperature below the absolute maximum. This depends on the power supply voltage and how many amplifiers are shorted. Thermal resistance varies with the amount of PC board metal connected to the package. The specified values are for short traces connected to the leads.

## ESD Rating

| Symbol | Parameter | Condition | Minimum Level | Unit |
|---|---|---|---|---|
| HBM | Human Body Model ESD | MIL-STD-883H Method 3015.8 | 8 | kV |
| CDM | Charged Device Model ESD | JEDEC-EIA/JESD22-C101E | 2 | kV |

## Electrical Characteristics

**All test condition is $V_S$ = 5V, $T_A$ = 25°C, $R_L$ = 2kΩ, $C_L$ =100pF, unless otherwise noted.**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_S$ | Supply Voltage Range | | 2.7 | | 5.5 | V |
| $I_Q$ | Quiescent Current per Amplifier | | | 600 | 900 | μA |
| PSRR | Power Supply Rejection Ratio | $V_S$ = 2.7V to 5.5V | 70 | 95 | | dB |
| $V_{OS}$ | Input Offset Voltage | $V_{CM}$ = 0V to 3V | -3 | | 3 | mV |
| $V_{OS}$ TC | Input Offset Voltage Drift | $T_A$ = -40°C to 125°C | | 2 | | μV/°C |
| $I_B$ | Input Bias Current | $T_A$ = 25 °C | | 1 | | pA |
| | | $T_A$ = 85 °C | | 25 | | pA |
| $I_{OS}$ | Input Offset Current | | | 1 | | pA |
| $C_{IN}$ | Input Capacitance | Differential Mode | | 10 | | pF |
| | | Common Mode | | 10 | | pF |
| Av | Open-loop Voltage Gain | $R_{LOAD}$ = 10kΩ | 80 | 100 | | dB |
| $V_{CMR}$ | Common-mode Input Voltage Range | | (V-) - 0.1 | | (V+) + 0.1 | V |
| CMRR | Common Mode Rejection Ratio | $V_{CM}$ = 0V to 3V | 70 | 100 | | dB |
| Xtalk | Channel Separation | f = 1kHz, RL = 2kΩ | | 110 | | dB |
| $V_{OH}$, $V_{OL}$ | Maximum Output Voltage Swing | $R_{LOAD}$ = 10kΩ | | 5 | 15 | mV |
| $I_{SC}$ | Output Short-Circuit Current | | | 100 | | mA |
| $I_O$ | Output Current | 1V Output Drop Voltage | | 50 | | mA |
| GBW | Gain-Bandwidth Product | | | 6 | | MHz |
| SR | Slew Rate | $A_V$ = 1, $V_{OUT}$ = 1.5V to 3.5V, $C_{LOAD}$ = 60pF, $R_{LOAD}$ = 1kΩ | | 4.5 | | V/μs |
| $t_S$ | Settling Time, 0.1% | AV = 1, 2V Step, $C_{LOAD}$ = 60pF, $R_{LOAD}$ = 1kΩ | | 0.8 | | μs |
| | Settling Time, 0.01% | | | 1 | | μs |
| PM | Phase Margin | $R_{LOAD}$ = 1kΩ, $C_{LOAD}$ = 60pF | | 60 | | ° |
| GM | Gain Margin | $R_{LOAD}$ = 1kΩ, $C_{LOAD}$ = 60pF | | 15 | | dB |
| $E_N$ | Input Voltage Noise | f = 0.1Hz to 10Hz | | 8 | | $μV_{PP}$ |
| $e_N$ | Input Voltage Noise Density | f = 1kHz | | 19 | | nV/√Hz |
| $i_N$ | Input Current Noise | f = 1kHz | | 2 | | fA/√Hz |
| THD+N | Total Harmonic Distortion and Noise | f = 1kHz, AV =1, RL = 2kΩ, VOUT = 1Vp-p | | 0.003 | | % |

## Typical Performance Characteristics

**$V_S$ = 5V, $V_{CM}$ = 2.5V, RL = Open, unless otherwise specified.**

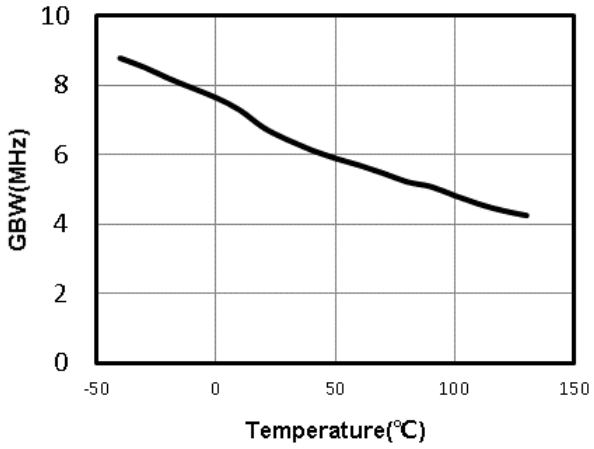



Figure 1. Unity Gain Bandwidth vs. Temperature

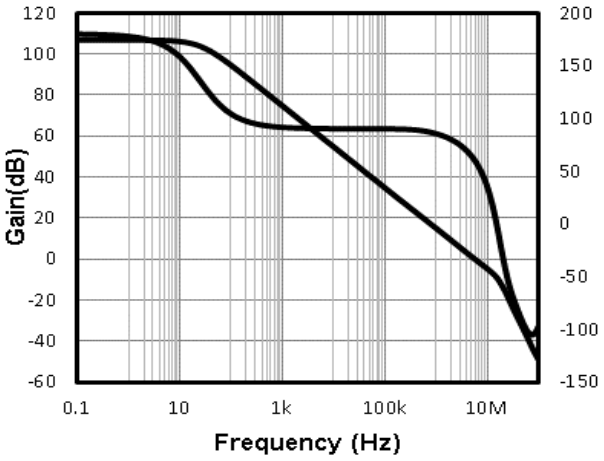



Figure 2. Open-Loop Gain and Phase

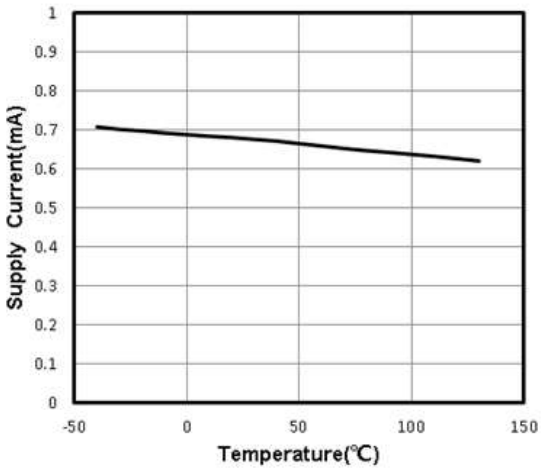



Figure 3. Supply Current vs. Temperature

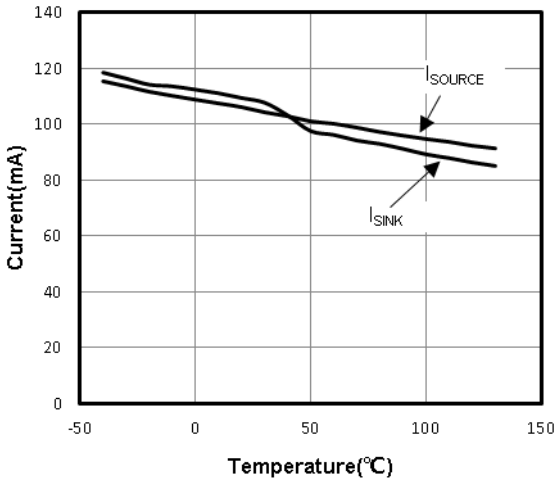



Figure 4. Short Circuit Current vs. Temperature

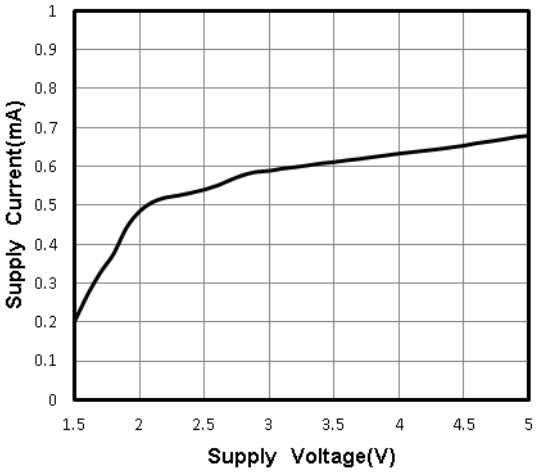



Figure 5. Quiescent Current vs. Supply Voltage

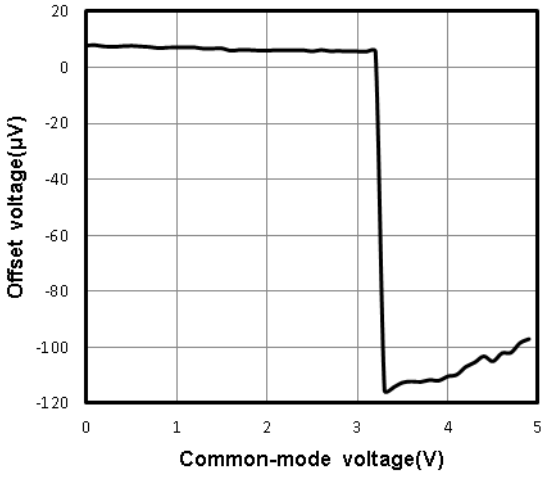



Figure 6. Offset Voltage vs. Common-Mode Voltage

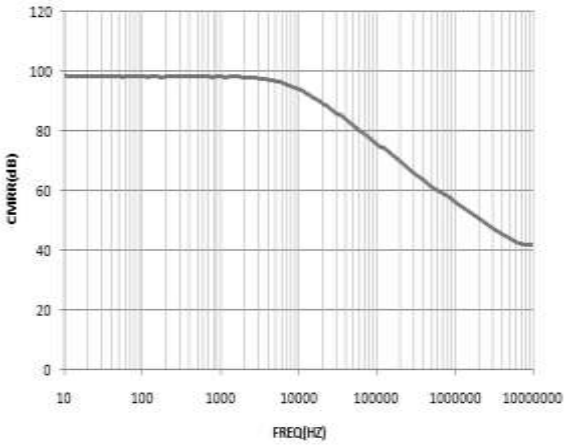



Figure 7. CMRR vs. Frequency

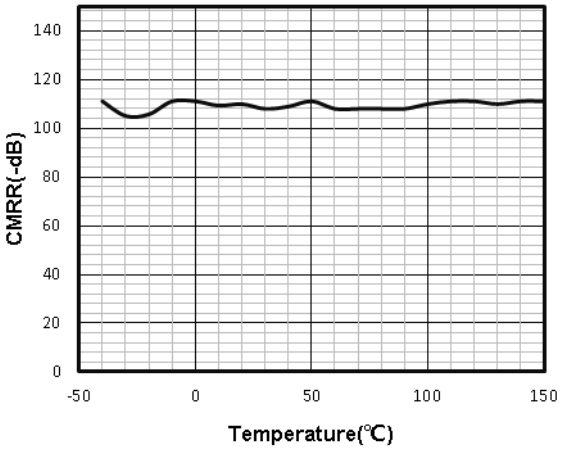



Figure 8. CMRR vs. Temperature

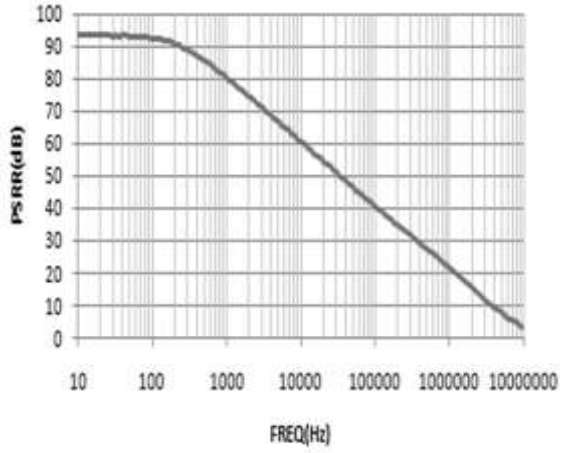



Figure 9. Power-Supply Rejection Ratio

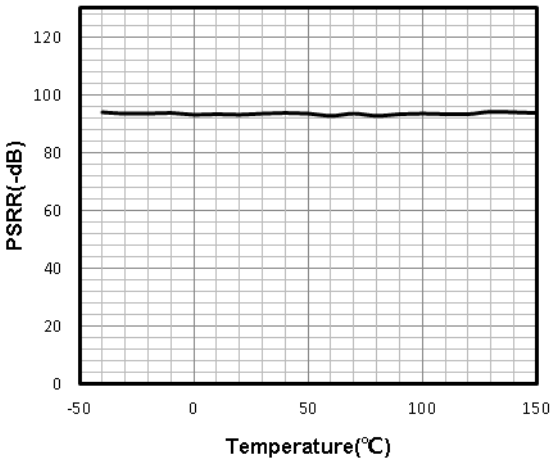



Figure 10. PSRR vs. Temperature

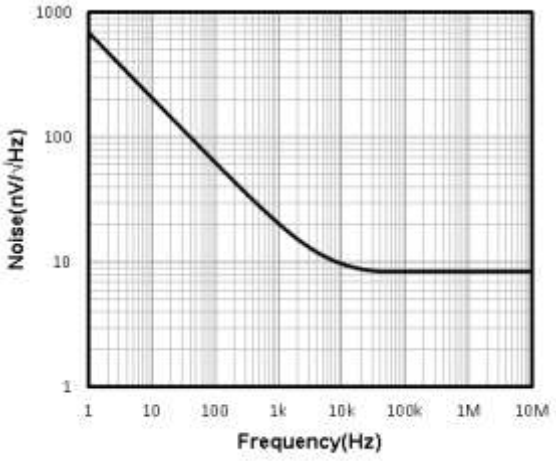



Figure 11. Input Voltage Noise Spectral Density

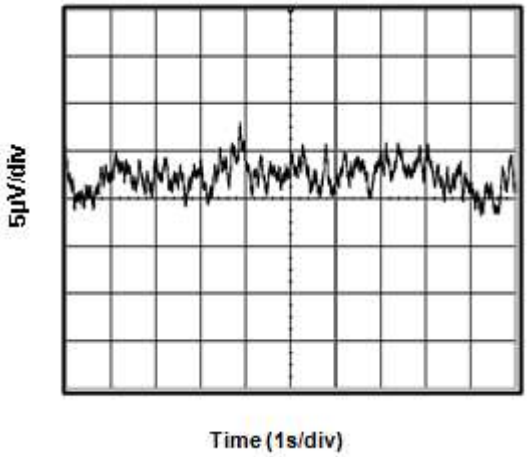



Figure 12. 0.1 Hz to 10 Hz Input Voltage Noise

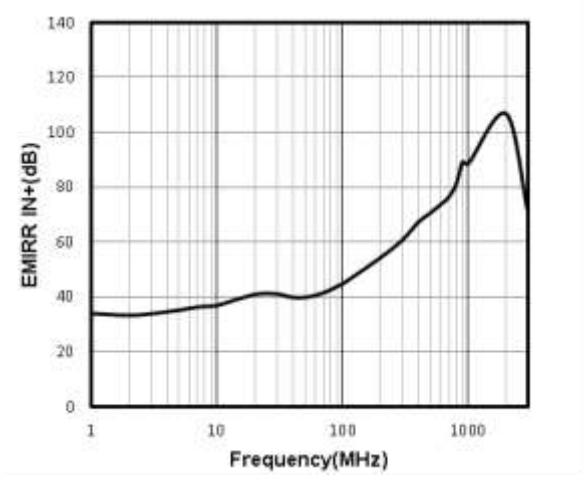



Figure 13. EMIRR IN+ vs. Frequency

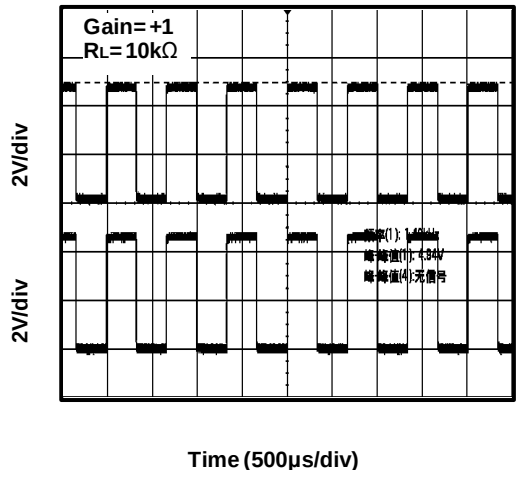



Figure 14. Large-Scale Step Response

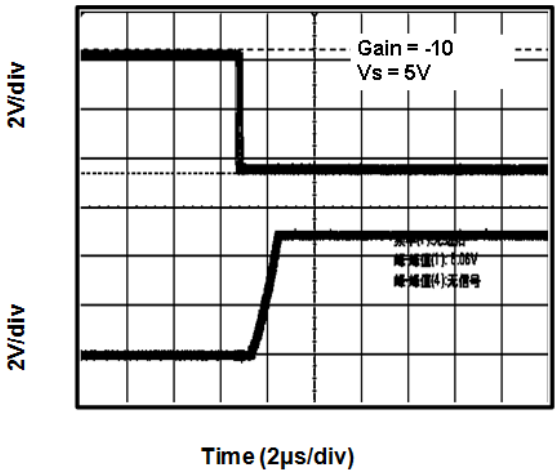



Figure 15. Negative Over-Voltage Recovery

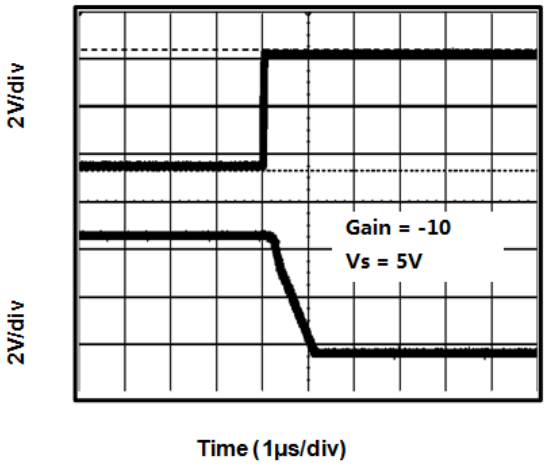



Figure 16. Positive Over-Voltage Recovery

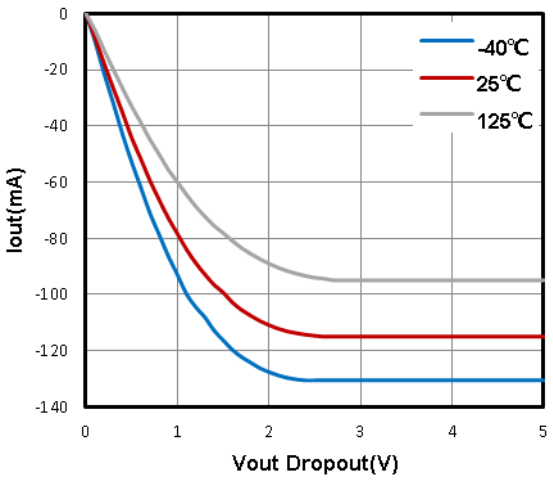



Figure 17. Negative Output Swing vs. Load Current

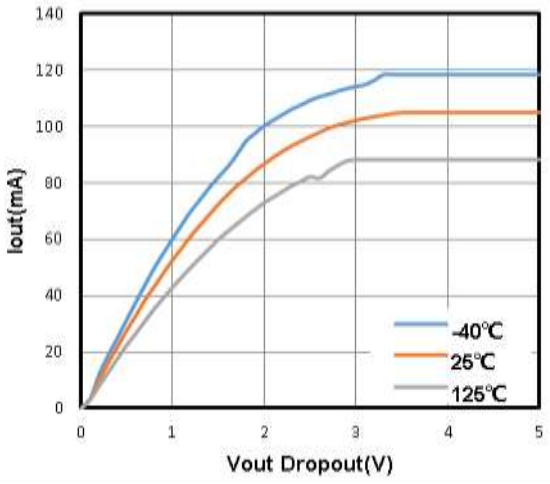
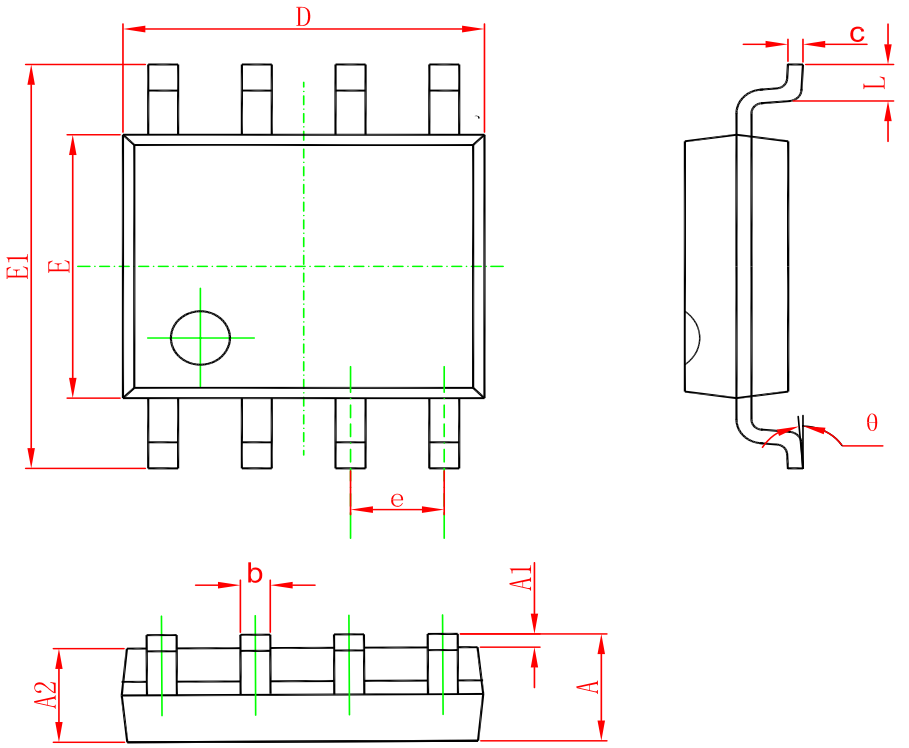



Figure 18. Positive Output Swing vs. Load Current

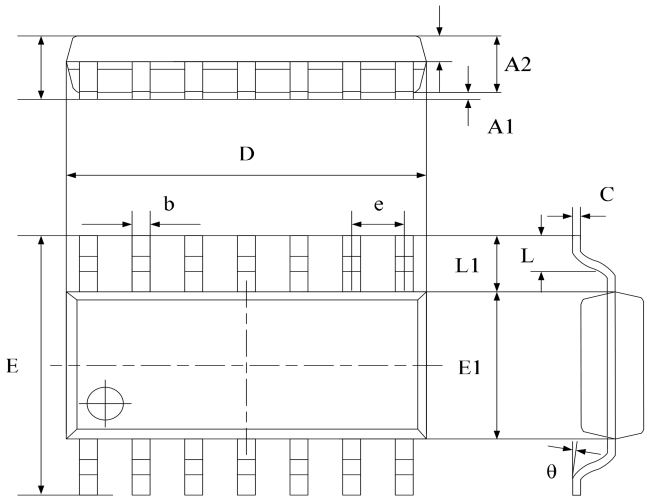
## Package Dimension

### SOP-8



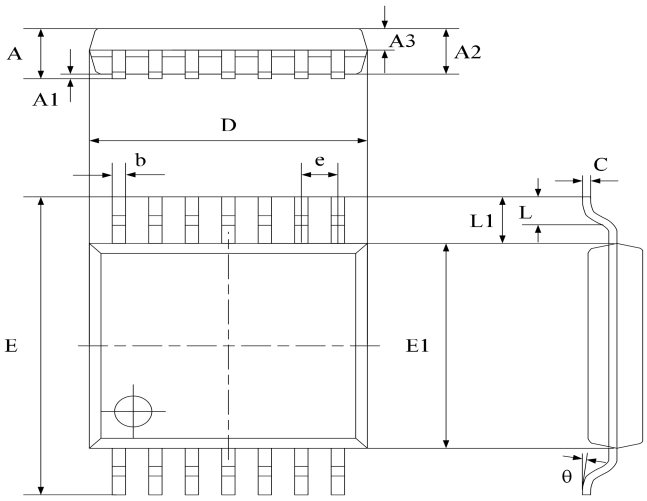

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.006 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.200 |
| E | 3.800 | 4.000 | 0.150 | 0.157 |
| E1 | 5.800 | 6.200 | 0.228 | 0.244 |
| e | 1.270(BSC) | | 0.050(BSC) | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |

## SOP-14




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.450 | 1.850 | 0.059 | 0.076 |
| A1 | 0.100 | 0.300 | 0.004 | 0.012 |
| A2 | 1.350 | 1.550 | 0.055 | 0.063 |
| A3 | 0.550 | 0.750 | 0.022 | 0.031 |
| b | 0.406typ. | | 0.017typ. | |
| C | 0.203typ. | | 0.008typ. | |
| D | 8.630 | 8.830 | 0.352 | 0.360 |
| E | 5.840 | 6.240 | 0.238 | 0.255 |
| E1 | 3.850 | 4.050 | 0.157 | 0.165 |
| e | 1.270 typ. | | 0.050 typ. | |
| L1 | 1.040 ref. | | 0.041 ref. | |
| L | 0.350 | 0.750 | 0.014 | 0.031 |
| θ | 2° | 8° | 2° | 8° |

## TSSOP-14




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | - | 1.200 | - | 0.0472 |
| A1 | 0.050 | 0.150 | 0.002 | 0.006 |
| A2 | 0.900 | 1.050 | 0.037 | 0.043 |
| A3 | 0.390 | 0.490 | 0.016 | 0.020 |
| b | 0.200 | 0.290 | 0.008 | 0.012 |
| C | 0.130 | 0.180 | 0.005 | 0.007 |
| D | 4.860 | 5.060 | 0.198 | 0.207 |
| E | 6.200 | 6.600 | 0.253 | 0.269 |
| E1 | 4.300 | 4.500 | 0.176 | 0.184 |
| e | 0.650 typ. | | 0.0256 typ. | |
| L1 | 1.000 ref. | | 0.0393 ref. | |
| L | 0.450 | 0.750 | 0.018 | 0.031 |
| θ | 0° | 8° | 0° | 8° |

## Ordering information

| Order code | Package | Baseqty | Deliverymode | Marking |
|---|---|---|---|---|
| UMW TP10-2-SR | SOP-8 | 2500 | Tape and reel | T102 |
| UMW TP10-4-SR | SOP-14 | 2500 | Tape and reel | T104 |
| UMW TP10-4-TR | TSSOP-14 | 4000 | Tape and reel | T104 |

# X-ON Electronics

Largest Supplier of Electrical and Electronic Components

***Click to view similar products for*** Operational Amplifiers - Op Amps ***category:***

***Click to view products by*** Youtai ***manufacturer:***

Other Similar products are found below :

430227FB LT1678IS8 NCV33202DMR2G NJM324E M38510/13101BPA NTE925 AZV358MTR-G1 AP4310AUMTR-AG1 AZV358MMTR-G1 SCY33178DR2G NCV20034DR2G NTE778S NTE871 NTE937 NJU7057RB1-TE2 SCY6358ADR2G NJM2904CRB1-TE1 UPC4570G2-E1-A UPC4741G2-E1-A UPC4574GR-9LG-E1-A NJM8532RB1-TE1 EL2250CS EL5100IS EL5104IS EL5127CY EL5127CYZ EL5133IW EL5152IS EL5156IS EL5162IS EL5202IY EL5203IY EL5204IY EL5210CS EL5210CYZ EL5211IYE EL5220CY EL5223CLZ EL5223CR EL5224ILZ EL5227CLZ EL5227CRZ EL5244CS EL5246CS EL5246CSZ EL5250IY EL5251IS EL5257IS EL5260IY EL5261IS