

WS726052

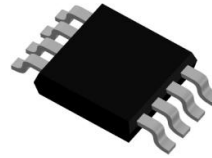
High Precision, Low Noise Operational Amplifiers

[Http://www.omnivision-group.com](http://www.omnivision-group.com)

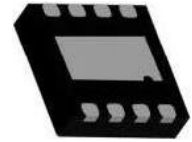
Descriptions

The WS726052 a dual high output drive CMOS operational amplifiers featured a peak output current of 350mA, and rail-to-rail output capability from a single 2.5V to 5.5V supply. This amplifier exhibits a high slew rate of 6V/ μ s and a gain-bandwidth product (GBP) of 11.5MHz. The WS726052 can drive typical headset levels (32 Ω), as well as bias an RF power amplifier in wireless handset applications.

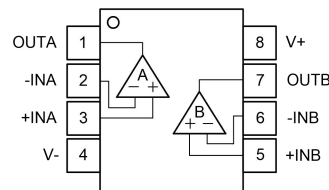
The WS726052 is available with MSL 3 Level in MSOP-8L package and MSL 2 Level in DFN2x2-8 package. Standard products are Pb-Free and halogen-Free.



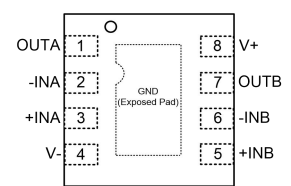
MSOP-8L



DFN2x2-8



MSOP-8L



DFN2x2-8

Pin configuration (Top view)

Applications

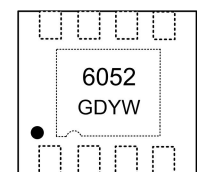
- RF Power Amplifier Biasing Controls
- Portable/Battery-Powered Audio Applications
- Portable Headphone Speaker Drivers (32 Ω)
- Audio Hands-Free Car Phones (Kits)
- Laptop/Notebook Computers/TFT Panels
- Set-Top Boxes
- Digital-to-Analog Converter Buffers
- Transformer/Line Drivers

Features

- 350mA Output Drive Capability
- Low Input Offset Voltage: 5 μ V (MAX)
- Low Noise: 40nV/ Hz at 1kHz
- 300mA Current Limitation
- Over-Temperature Protection
- Supply Voltage Range: 2.5V to 5.5V
- Supply Current: 0.95mA/Amplifier (TYP)
- Gain-Bandwidth Product: 11.5MHz
- High Slew Rate: 6V/ μ s
- Voltage Gain ($R_L = 2k\Omega$): 140dB
- Power Supply Rejection Ratio: 135dB
- No Phase Reversal for Over-Driven Inputs
- Unity-Gain Stable for Capacitive Loads to 780pF



MSOP-8L



DFN2x2-8

Marking

- 6052 = Device code
- GM = Special code
- GD = Special code
- Y = Year code
- W = Week code

Order Information

| Device | Package | Shipping |
|----------------|----------|-----------------|
| WS726052M-8/TR | MSOP-8L | 4000/Reel &Tape |
| WS726052D-8/TR | DFN2x2-8 | 3000/Reel &Tape |

Pin Descriptions

| Pin Number | Symbol | Descriptions |
|------------|--------|----------------------------------|
| 1 | OUTA | Output of Channel A |
| 2 | -INA | Inverting input of Channel A |
| 3 | +INA | Non-inverting input of Channel A |
| 4 | V- | Negative supply |
| 5 | +INB | Non-inverting input of Channel B |
| 6 | -INB | Inverting input of Channel B |
| 7 | OUTB | Output of Channel B |
| 8 | V+ | Positive supply |

Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|--------------------------------------|-------------|----------------------|------|
| Supply Voltage, ([V+] - [V-]) | $V_S^{(2)}$ | 5.5 | V |
| Operating Supply Voltage Range | V_{IDR} | 2.5 to 5.5 | V |
| All Other Pins | V_{ICR} | (V-)-0.3 to (V+)+0.3 | V |
| Operating Free-Air Temperature Range | T_A | -40 to 125 | °C |
| Storage Temperature Range | T_{STG} | -65 to 150 | °C |
| Junction Temperature Range | T_J | 150 | °C |
| Lead Temperature Range | T_L | 260 | °C |

Note:

1. 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.
2. All voltage values, except differential voltage are with respect to network terminal.

ESD, Electrostatic Discharge Protection

| Symbol | Parameter | Condition | Minimum level | Unit |
|--------|--------------------------|--|---------------|------|
| HBM | Human Body Model ESD | MIL-STD-883H Method 3015.8 JEDEC-EIA/JESD22-A114A | ±8000 | V |
| MM | Machine Model ESD | JEDEC-EIA/JESD22-A115 | ±400 | V |
| CDM | Charged Device Model ESD | JEDEC-EIA/JESD22-C101E | ±2000 | V |

Note:

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. Will Semiconductor Ltd. recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

Electronics Characteristics

The *denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^\circ\text{C}$, $V_S = 5\text{V}$, $V_{CM} = V_{OUT} = V_S/2$, $R_{load} = 2\text{k}\Omega$, $C_{load} = 20\text{pF}$.

| Symbol | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|-------------------------------|--------------------------------------|---|------------|------|------------|------------------------|
| INPUT CHARACTERISTICS | | | | | | |
| V_{OS} | Input Offset Voltage | | | 1 | 5 | μV |
| V_{CM} | Input Common Mode Voltage Range | | (V-) - 0.1 | | (V+) + 0.1 | V |
| CMRR | Common Mode Rejection Ratio | $(V-) - 0.1\text{V} < V_{CM} < (V+) + 0.1\text{V}$ | 120 | 135 | | dB |
| A_{OL} | Open-Loop Voltage Gain | $(V-) + 0.1\text{V} < V_{OUT} < (V+) - 0.1\text{V}$, $R_{load} = 2\text{k}\Omega$ | 120 | 140 | | dB |
| OUTPUT CHARACTERISTICS | | | | | | |
| V_{OH} | Output Voltage Swing from Rail to V+ | $R_{load} = 150\Omega$ | | 72 | 85 | mV |
| V_{OL} | Output Voltage Swing from Rail to V- | $R_{load} = 150\Omega$ | | 112 | 125 | mV |
| I_{SC+} | Output Short-Circuit Current to V+ | | 315 | 342 | | mA |
| I_{SC-} | Output Short-Circuit Current to V- | | 275 | 295 | | |
| POWER SUPPLY | | | | | | |
| V_S | Specified Voltage Range | | 2.5 | | 5.5 | V |
| I_Q | Quiescent Current/Amplifier | $I_{OUT} = 0$ | | 827 | 1300 | μA |
| PSRR | Power Supply Rejection Ratio | $V_+ = 2.5\text{V to } 5.5\text{V}$, $V_{CM} = V_+/2\text{V}$ | 120 | 135 | | dB |
| DYNAMIC PERFORMANCE | | | | | | |
| | Gain-Bandwidth Product | $G = +100$, $C_{load} = 20\text{pF}$ | | 11.5 | | MHz |
| | Slew Rate | $G = +1$, $V_{OUT} = 2V_{P-P}$ | | 6 | | V/ μs |
| NOISE | | | | | | |
| | Input Voltage Noise | $f = 0.1\text{Hz to } 10\text{Hz}$ | | 0.8 | | μV_{P-P} |
| | Input Voltage Noise Density | $f = 1\text{kHz}$ | | 40 | | nV/ $\sqrt{\text{Hz}}$ |
| | | $f = 10\text{kHz}$ | | 8 | | |

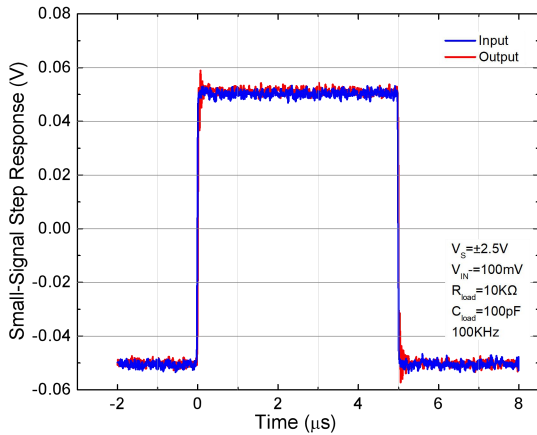
Note:

- 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.
- A heat sink may be required to keep the junction temperature below the absolute maximum rating when the output is shorted indefinitely.

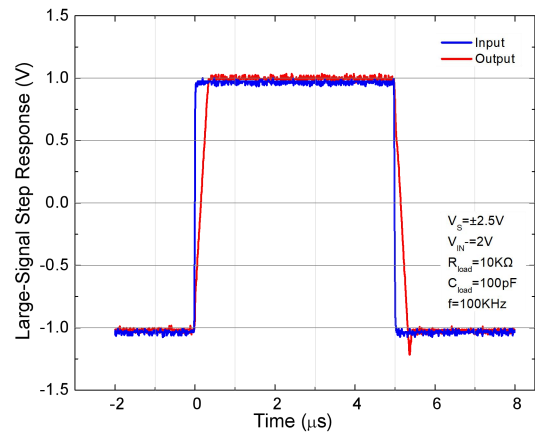
Typical Characteristics

At $T_A=25^{\circ}\text{C}$, $V_S=\pm 2.5\text{V}$, $V_{CM}=0\text{V}$, $R_{load} = 2\text{k}\Omega$, $C_{load} = 20\text{pF}$, unless otherwise noted.

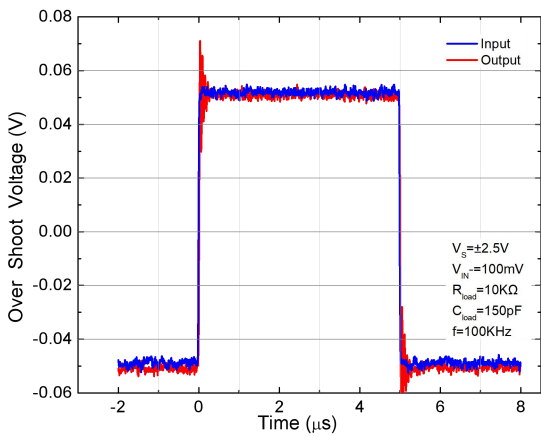
Small - signal Step Response, 100mV Step



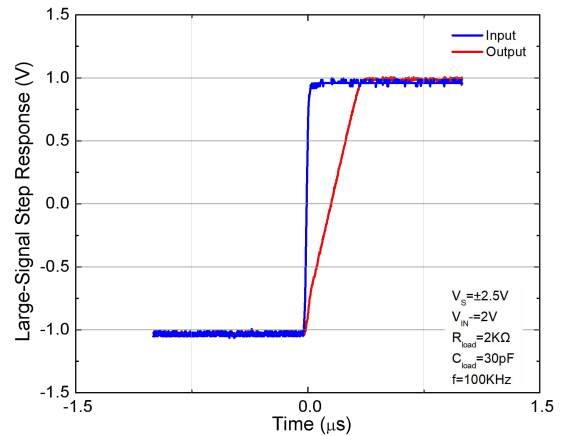
Large - Signal Step Response, 2V Step



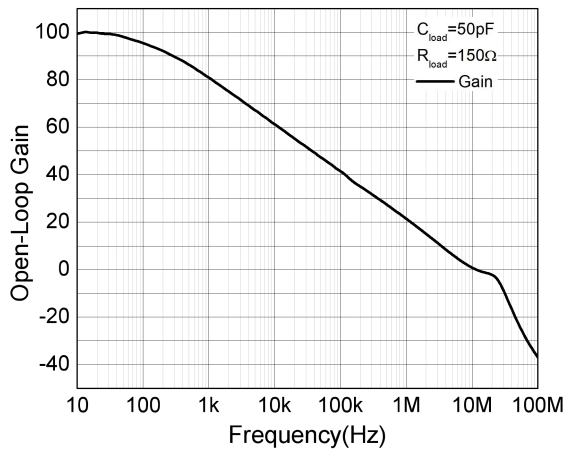
Over Shoot Voltage



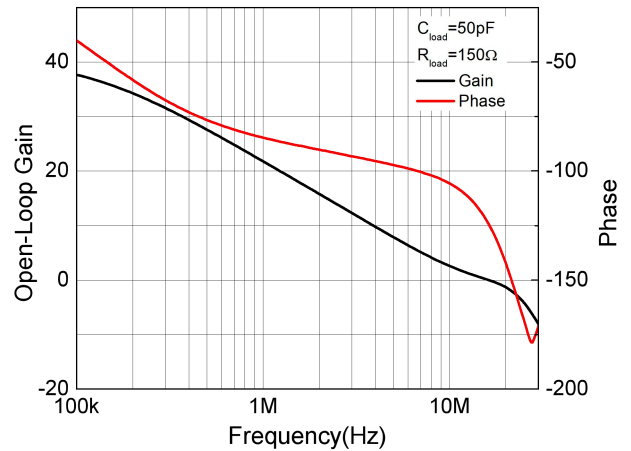
Large-Signal Step Response2, 2V Step



Open-Loop Gain

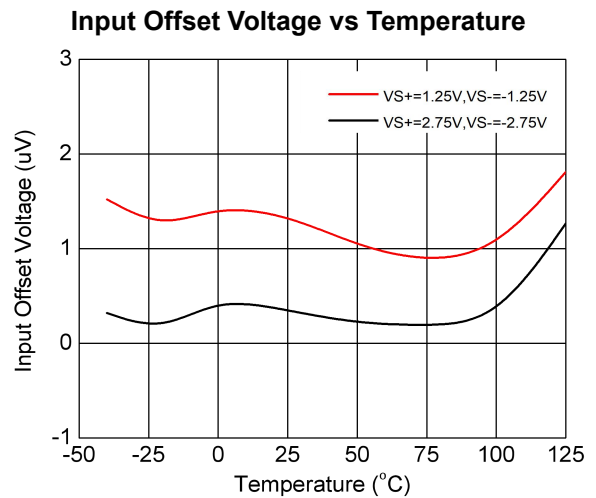
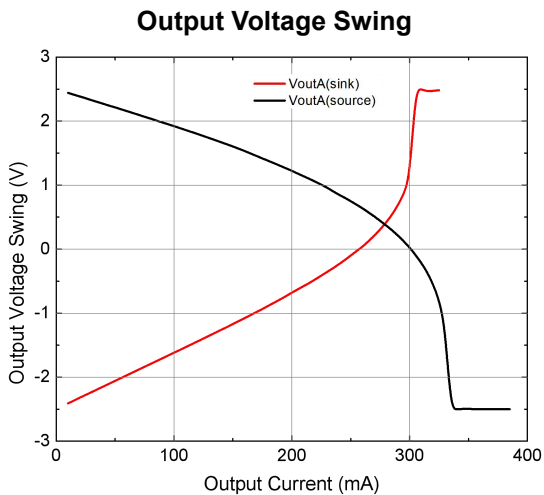
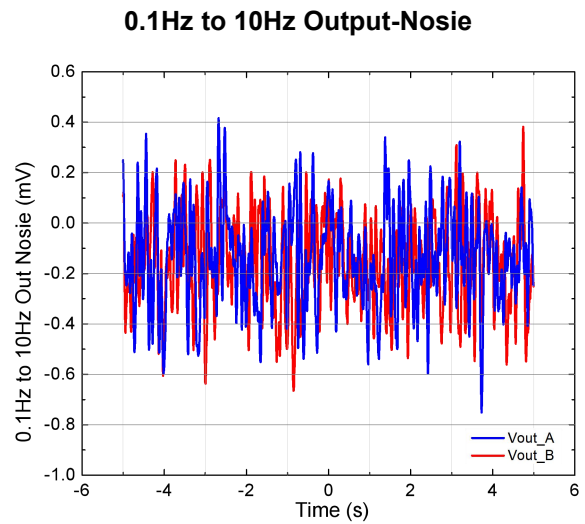
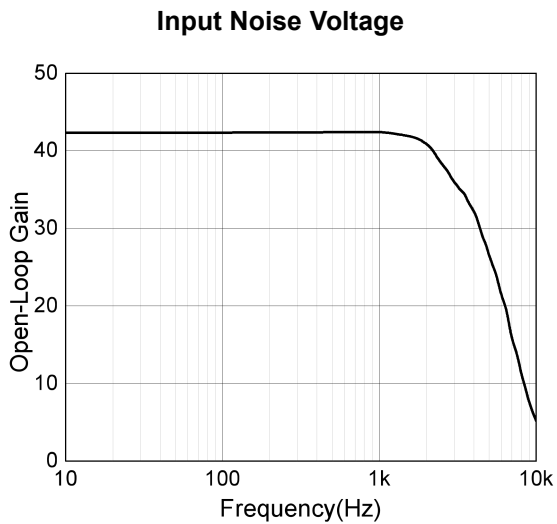
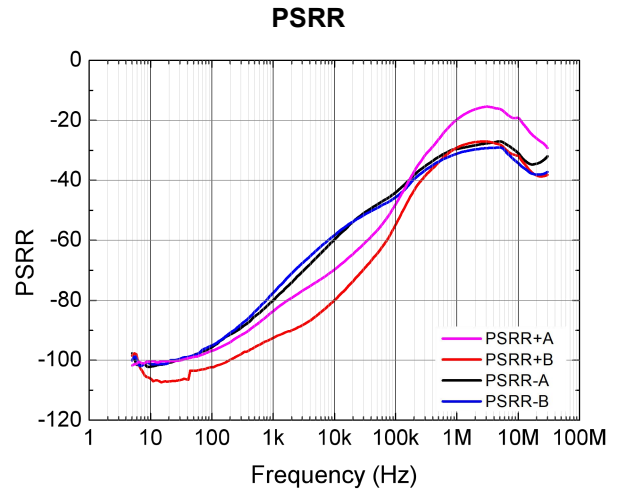
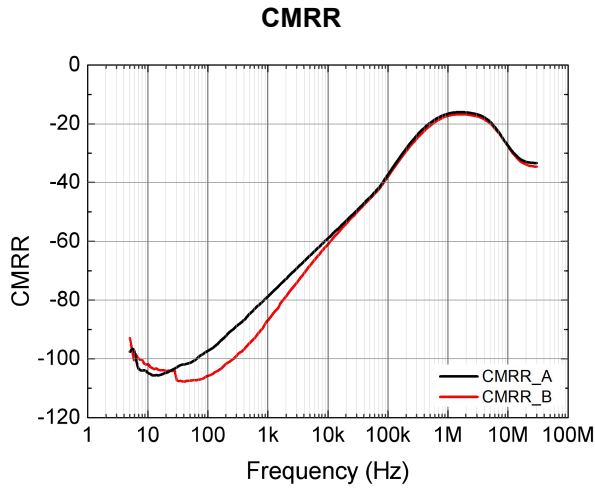


Open-Loop Gain and Phase



Typical Characteristics (continued)

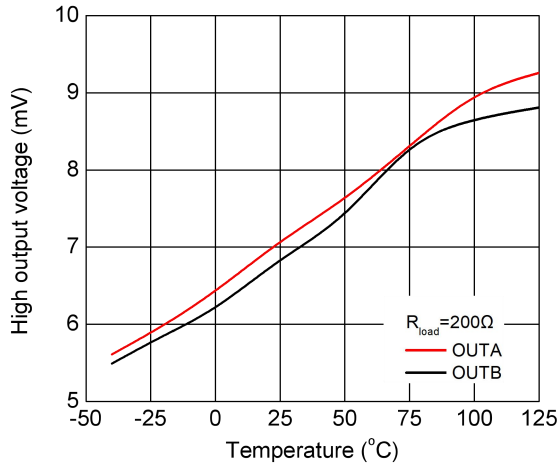
$T_A=25^\circ\text{C}$, $V_S=\pm 2.5\text{V}$, $V_{CM}=0\text{V}$, $R_{load}=2\text{k}\Omega$, $C_{load}=20\text{pF}$, unless otherwise noted.



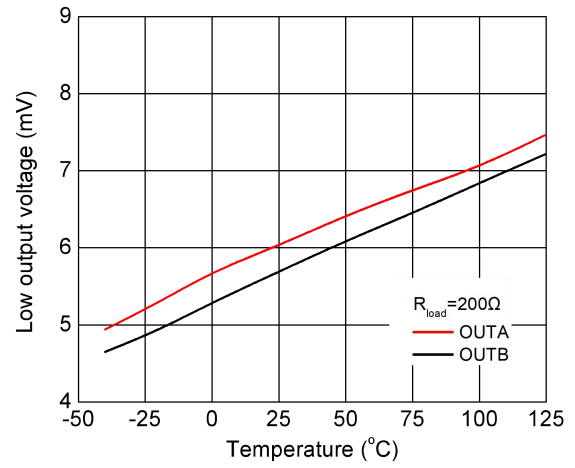
Typical Characteristics (continued)

$T_A=25^{\circ}\text{C}$, $V_S=\pm 2.5\text{V}$, $V_{\text{CM}}=0\text{V}$, $R_{\text{load}}=2\text{k}\Omega$, $C_{\text{load}}=20\text{pF}$, unless otherwise noted.

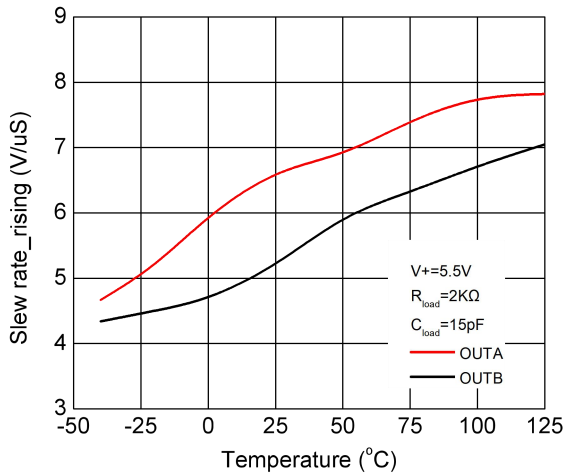
High Output Voltage vs Temperature



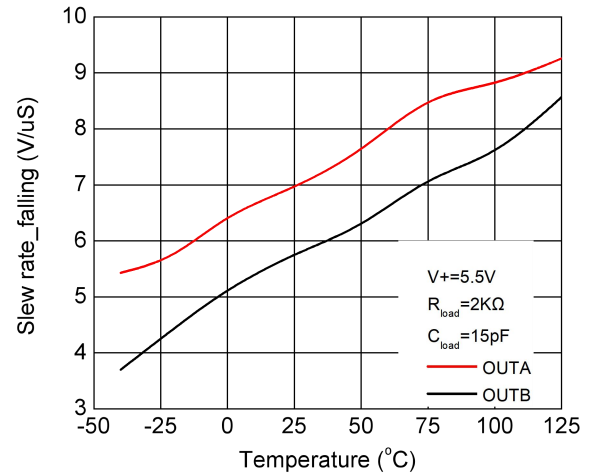
Low Output Voltage vs Temperature



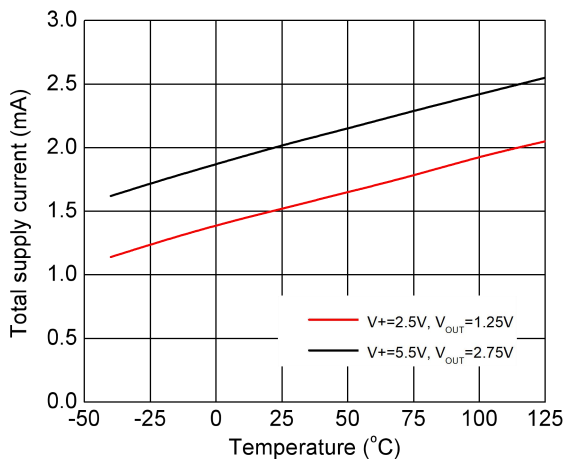
Slew Rate rising vs Temperature



Slew Rate falling vs Temperature

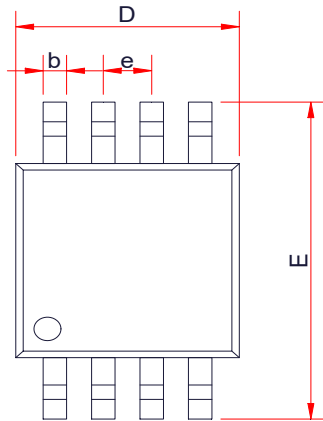


Total Supply Current vs Temperature

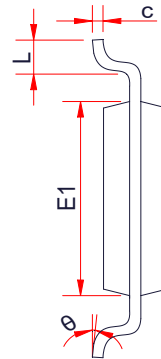


PACKAGE OUTLINE DIMENSIONS

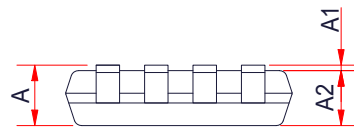
MSOP-8L



TOP VIEW



SIDE VIEW



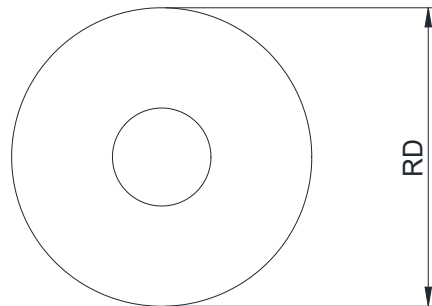
SIDE VIEW

| Symbol | Dimensions In Millimeters (mm) | | |
|----------|--------------------------------|------|------|
| | Min. | Typ. | Max. |
| A | - | - | 1.10 |
| A1 | 0.02 | - | 0.15 |
| A2 | 0.75 | 0.80 | 0.95 |
| b | 0.25 | - | 0.38 |
| c | 0.09 | - | 0.23 |
| D | 2.90 | 3.00 | 3.10 |
| E | 4.75 | 4.90 | 5.05 |
| E1 | 2.90 | 3.00 | 3.10 |
| e | 0.65 BSC | | |
| L | 0.40 | - | 0.80 |
| θ | 0° | - | 6° |

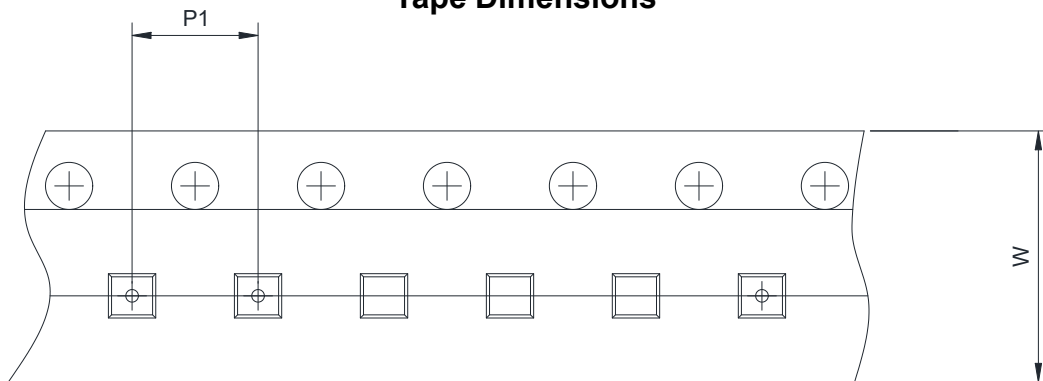
TAPE AND REEL INFORMATION

MSOP-8L

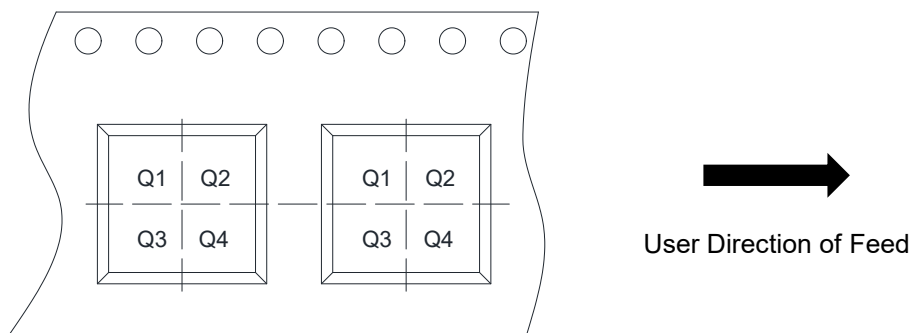
Reel Dimensions



Tape Dimensions



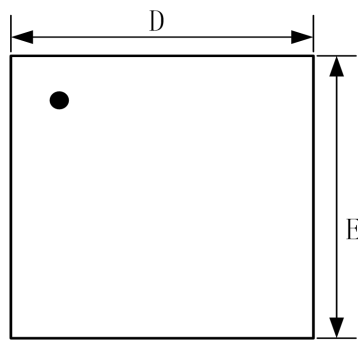
Quadrant Assignments For PIN1 Orientation In Tape



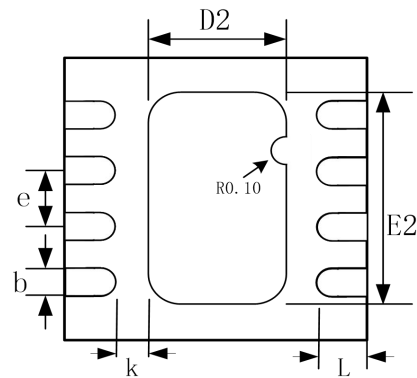
| | | | | | |
|------|---|--|--|---|-----------------------------|
| RD | Reel Dimension | <input type="checkbox"/> 7inch | <input checked="" type="checkbox"/> 13inch | | |
| W | Overall width of the carrier tape | <input type="checkbox"/> 8mm | <input checked="" type="checkbox"/> 12mm | | |
| P1 | Pitch between successive cavity centers | <input type="checkbox"/> 2mm | <input type="checkbox"/> 4mm | <input checked="" type="checkbox"/> 8mm | |
| Pin1 | Pin1 Quadrant | <input checked="" type="checkbox"/> Q1 | <input type="checkbox"/> Q2 | <input type="checkbox"/> Q3 | <input type="checkbox"/> Q4 |

PACKAGE OUTLINE DIMENSIONS

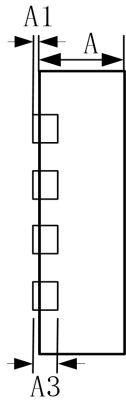
DFN2×2-8



TOP VIEW



BOTTOM VIEW



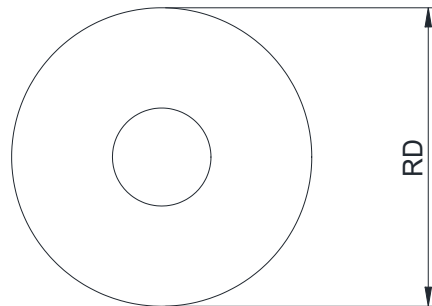
SIDE VIEW

| Symbol | Dimensions In Millimeters (mm) | | |
|--------|--------------------------------|----------|------|
| | Min. | Typ. | Max. |
| A | 0.70 | 0.75 | 0.80 |
| A1 | 0.00 | 0.02 | 0.05 |
| A3 | - | 0.20 REF | - |
| b | 0.19 | 0.24 | 0.29 |
| D | 2.00 BSC | | |
| E | 2.00 BSC | | |
| D2 | 0.75 | 0.80 | 0.85 |
| E2 | 1.25 | 1.30 | 1.35 |
| e | 0.50 BSC | | |
| L | 0.30 | 0.35 | 0.40 |
| k | 0.20 | - | - |

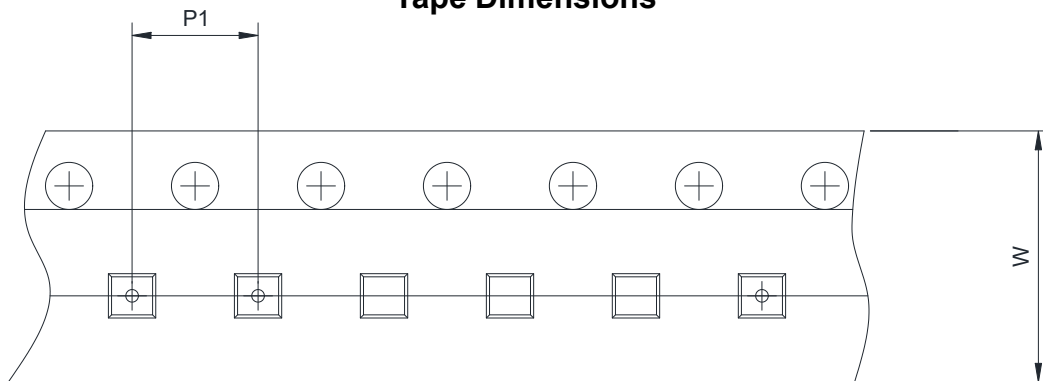
TAPE AND REEL INFORMATION

DFN2×2-8

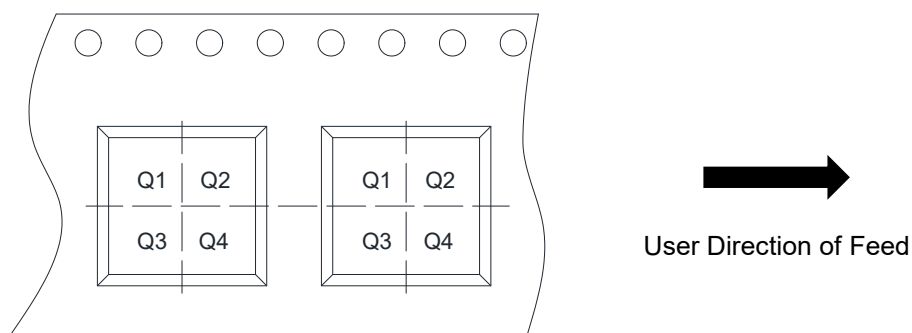
Reel Dimensions



Tape Dimensions



Quadrant Assignments For PIN1 Orientation In Tape



| | | | | | |
|------|---|---|---|---|-----------------------------|
| RD | Reel Dimension | <input checked="" type="checkbox"/> 7inch | <input type="checkbox"/> 13inch | | |
| W | Overall width of the carrier tape | <input checked="" type="checkbox"/> 8mm | <input type="checkbox"/> 12mm | | |
| P1 | Pitch between successive cavity centers | <input type="checkbox"/> 2mm | <input checked="" type="checkbox"/> 4mm | <input checked="" type="checkbox"/> 8mm | |
| Pin1 | Pin1 Quadrant | <input type="checkbox"/> Q1 | <input checked="" type="checkbox"/> Q2 | <input type="checkbox"/> Q3 | <input type="checkbox"/> Q4 |