

## Features

- Supply Voltage: 3V to 36V
- Low Supply Current: Maximum 1000μA per channel
- Differential Input Voltage Range to Supply Rail, can Work as Comparator
- Input Rail to -Vs, Rail to Rail Output
- Fast Response: 3.5 MHz Bandwidth, 15V/μs Slew Rate, 100ns Overload Recovery
- Low Offset Voltage:
  - ±2mV Maximum at 25°C,
  - ±2.5mV Maximum at -40°C to 85°C
  - ±3mV Maximum at -40°C to 125°C
- Very Low THD+N: 0.0005% at Gain = 1, 1kHz
- Excellent EMIRR: 60dB at 900MHz
- 2KV HBM, 1KV CDM, 150mA Latch Up
- -40°C to 125°C Operation Temperature Range

## Description

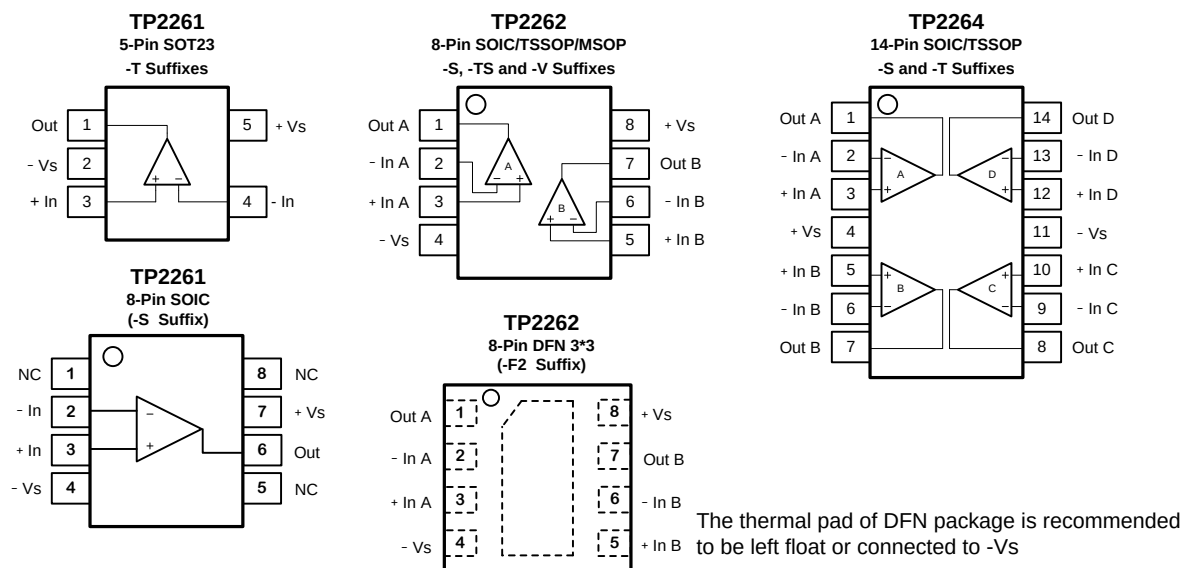
The TP226X series amplifiers are newest high supply voltage amplifiers with low offset, low power and stable high frequency response. They incorporate 3PEAK's proprietary and patented design techniques to achieve very good AC performance with 3.5MHz bandwidth, 15V/μs slew rate and low distortion while drawing only typical 700μA of quiescent current per amplifier. The input common-mode voltage range extends to V-, and the outputs swing rail-to-rail. The TP226X 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 TP226X ideal choices for industrial control, motor control and portable audio amplification, sound ports, and other consumer audio.

## Applications

- Sensor Interface
- Motor Control
- Industrial Control
- Audio

## Pin Configuration



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## Revision History

| Date       | Revision | Notes                                                                                                                                    |
|------------|----------|------------------------------------------------------------------------------------------------------------------------------------------|
| 2017/12/21 | Rev.Pre  | Pre-Release Version                                                                                                                      |
| 2018/9/9   | Rev.0    | Initial Version                                                                                                                          |
| 2018/12/21 | Rev.0.01 | Add New Part Number: TP2262L1-TSR, TP2261L1-TR.<br>Update mark information: Add "TP" before "226" on 8-Pin SOIC and 14-Pin SOIC Package. |
| 2019/2/15  | Rev.0.02 | Add New Part Number: TP2262-F2R.<br>Update Package Outline Dimensions.                                                                   |

## Order Information

| Order Number | Operating Temperature Range | Package       | Marking Information               | MSL | Transport Media, Quantity |
|--------------|-----------------------------|---------------|-----------------------------------|-----|---------------------------|
| TP2261-SR    | -40 to 125°C                | 8-Pin SOIC    | 2261<br>AAYW <sup>Note 1</sup>    | 3   | Tape and Reel, 4000       |
| TP2261-TR    | -40 to 125°C                | 5-Pin SOT23   | 226YW <sup>Note 1</sup>           | 3   | Tape and Reel, 3000       |
| TP2261L1-TR  | -40 to 125°C                | 5-Pin SOT23   | 226YW <sup>Note 1</sup>           | 1   | Tape and Reel, 3000       |
| TP2262-SR    | -40 to 125°C                | 8-Pin SOIC    | TP2262<br>AAYW <sup>Note 1</sup>  | 3   | Tape and Reel, 4000       |
| TP2262-F2R   | -40 to 125°C                | 8-Pin DFN 3*3 | 2262<br>AAYW <sup>Note 1</sup>    | 3   | Tape and Reel, 4000       |
| TP2262L1-SR  | -40 to 125°C                | 8-Pin SOIC    | TP2262<br>AAYWL <sup>Note 1</sup> | 1   | Tape and Reel, 4000       |
| TP2262-TSR   | -40 to 125°C                | 8-Pin TSSOP   | 2262<br>AAYW <sup>Note 1</sup>    | 3   | Tape and Reel, 3000       |
| TP2262L1-TSR | -40 to 125°C                | 8-Pin TSSOP   | 2262<br>AAYWL <sup>Note 1</sup>   | 3   | Tape and Reel, 3000       |
| TP2262-VR    | -40 to 125°C                | 8-Pin MSOP    | 2262<br>AAYW <sup>Note 1</sup>    | 3   | Tape and Reel, 3000       |
| TP2264-SR    | -40 to 125°C                | 14-Pin SOIC   | TP2264<br>AAYW <sup>Note 1</sup>  | 3   | Tape and Reel, 2500       |
| TP2264L1-SR  | -40 to 125°C                | 14-Pin SOIC   | TP2264<br>AAYWL <sup>Note 1</sup> | 1   | Tape and Reel, 2500       |
| TP2264-TR    | -40 to 125°C                | 14-Pin TSSOP  | 2264<br>AAYW <sup>Note 1</sup>    | 3   | Tape and Reel, 3000       |

Note 1: "AA" identify the manufacture site. "YW" is the date code means manufacture year and week as following, "L" means MSL 1 product.

The calendar year and the workweek coding scheme is as follows:

| Year | Code | Year | Code |               |   |               |   |               |   |               |   |               |   |
|------|------|------|------|---------------|---|---------------|---|---------------|---|---------------|---|---------------|---|
|      |      |      |      | Workweek Code |   | Workweek Code |   | Workweek Code |   | Workweek Code |   | Workweek Code |   |
| 2010 | A    | 2023 | N    | 1             | 1 | 14            | E | 27            | R | 40            | e | 53            | r |
| 2011 | B    | 2024 | O    | 2             | 2 | 15            | F | 28            | S | 41            | f |               |   |
| 2012 | C    | 2025 | P    | 3             | 3 | 16            | G | 29            | T | 42            | g |               |   |
| 2013 | D    | 2026 | Q    | 4             | 4 | 17            | H | 30            | U | 43            | h |               |   |
| 2014 | E    | 2027 | R    | 5             | 5 | 18            | I | 31            | V | 44            | i |               |   |
| 2015 | F    | 2028 | S    | 6             | 6 | 19            | J | 32            | W | 45            | j |               |   |
| 2016 | G    | 2029 | T    | 7             | 7 | 20            | K | 33            | X | 46            | k |               |   |
| 2017 | H    | 2030 | U    | 8             | 8 | 21            | L | 34            | Y | 47            | l |               |   |
| 2018 | I    | 2031 | V    | 9             | 9 | 22            | M | 35            | Z | 48            | m |               |   |
| 2019 | J    | 2032 | W    | 10            | A | 23            | N | 36            | a | 49            | n |               |   |
| 2020 | K    | 2033 | X    | 11            | B | 24            | O | 37            | b | 50            | o |               |   |
| 2021 | L    | 2034 | Y    | 12            | C | 25            | P | 38            | c | 51            | p |               |   |
| 2022 | M    | 2035 | Z    | 13            | D | 26            | Q | 39            | d | 52            | q |               |   |

## Absolute Maximum Ratings <sup>Note 1</sup>

| Parameters                                                         | Rating                                               |
|--------------------------------------------------------------------|------------------------------------------------------|
| Supply Voltage, (+V <sub>S</sub> )– (–V <sub>S</sub> )             | 40 V                                                 |
| Input Voltage                                                      | (–V <sub>S</sub> ) – 0.3 to (+V <sub>S</sub> ) + 0.3 |
| Differential Input Voltage                                         | (+V <sub>S</sub> ) - (–V <sub>S</sub> )              |
| Input Current: +I <sub>N</sub> , –I <sub>N</sub> <sup>Note 2</sup> | ±10mA                                                |
| Output Short-Circuit Duration <sup>Note 3</sup>                    | 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     | ANSI/ESDA/JEDEC JS-001 | 2             | kV   |
| CDM    | Charged Device Model ESD | ANSI/ESDA/JEDEC JS-002 | 1             | kV   |

## Thermal Information

| Package Type  | θ <sub>JA</sub> | θ <sub>JC</sub> | Unit |
|---------------|-----------------|-----------------|------|
| 5-Pin SOT23   | 250             | 81              | °C/W |
| 8-Pin SOIC    | 158             | 43              | °C/W |
| 8-Pin TSSOP   | 191             | 44              | °C/W |
| 8-Pin DFN 3*3 | 120             | 50              | °C/W |
| 8-Pin MSOP    | 210             | 45              | °C/W |
| 14-Pin SOIC   | 120             | 36              | °C/W |
| 14-Pin TSSOP  | 180             | 35              | °C/W |

## Electrical Characteristics

All test condition is  $V_S = 30V$ ,  $T_A = 25^\circ C$ ,  $R_L = 10k\Omega$  to  $V_S/2$ , unless otherwise noted.

| Symbol                | Parameter                       | Conditions                                        | T <sub>A</sub> | Min  | Typ  | Max        | Unit  |
|-----------------------|---------------------------------|---------------------------------------------------|----------------|------|------|------------|-------|
| Power Supply          |                                 |                                                   |                |      |      |            |       |
| V <sub>S</sub>        | Supply Voltage Range            |                                                   |                | 3    |      | 36         | V     |
| I <sub>Q</sub>        | Quiescent Current per Amplifier | V <sub>S</sub> = 30V, TP2261                      |                |      | 1000 | 1500       | μA    |
|                       |                                 |                                                   | -40°C to 125°C |      |      | 1700       | μA    |
|                       |                                 | V <sub>S</sub> = 5V, TP2261                       |                |      | 850  | 1300       | μA    |
|                       |                                 |                                                   | -40°C to 125°C |      |      | 1500       | μA    |
|                       |                                 | V <sub>S</sub> = 30V, TP2262/TP2264               |                |      | 700  | 1000       | μA    |
|                       |                                 |                                                   | -40°C to 125°C |      |      | 1200       | uA    |
|                       |                                 | V <sub>S</sub> = 5V, TP2262/TP2264                |                |      | 600  | 850        | μA    |
|                       | -40°C to 125°C                  |                                                   |                | 1000 | μA   |            |       |
| PSRR                  | Power Supply Rejection Ratio    | V <sub>S</sub> = 3V to 36V                        |                | 95   | 120  |            | dB    |
|                       |                                 |                                                   | -40°C to 125°C | 90   |      |            | dB    |
| Input Characteristics |                                 |                                                   |                |      |      |            |       |
| V <sub>OS</sub>       | Input Offset Voltage            | V <sub>S</sub> = 30V, V <sub>CM</sub> = 0V to 28V |                | -2   | 0.1  | 2          | mV    |
|                       |                                 |                                                   | -40°C to 85°C  | -2.5 |      | 2.5        | mV    |
|                       |                                 |                                                   | -40°C to 125°C | -3   |      | 3          | mV    |
|                       |                                 | V <sub>S</sub> = 30V, V <sub>CM</sub> = 28.5V     |                | -3   |      | 3          | mV    |
|                       |                                 |                                                   | -40°C to 125°C | -4   |      | 4          | mV    |
|                       |                                 | V <sub>S</sub> = 5V, V <sub>CM</sub> = 2.5V       |                | -2   | 0.1  | 2          | mV    |
|                       |                                 |                                                   | -40°C to 125°C | -3   |      | 3          | mV    |
| V <sub>OS</sub> TC    | Input Offset Voltage Drift      |                                                   | -40°C to 125°C |      | 2    |            | μV/°C |
| I <sub>B</sub>        | Input Bias Current              |                                                   |                |      | 25   |            | pA    |
|                       |                                 |                                                   | -40°C to 85°C  |      | 80   |            | pA    |
|                       |                                 |                                                   | -40°C to 125°C |      | 1000 |            | pA    |
| I <sub>OS</sub>       | Input Offset Current            |                                                   |                |      | 25   |            | pA    |
| I <sub>IN</sub>       | Different Input Current         | V <sub>S</sub> = 36V, V <sub>ID</sub> = 36V       |                |      | 10   |            | nA    |
|                       |                                 |                                                   | -40°C to 125°C |      | 100  |            | nA    |
| C <sub>IN</sub>       | Input Capacitance               | Differential Mode                                 |                |      | 5    |            | pF    |
|                       |                                 | Common Mode                                       |                |      | 2.5  |            | pF    |
| A <sub>v</sub>        | Open-loop Voltage Gain          |                                                   |                | 105  | 120  |            | dB    |
|                       |                                 |                                                   | -40°C to 125°C | 100  |      |            | dB    |
| V <sub>CMR</sub>      | Common-mode Input Voltage Range |                                                   |                | (V-) |      | (V+) – 1.5 | V     |
| CMRR                  | Common Mode Rejection Ratio     | V <sub>CM</sub> = 0V to 28V                       |                | 105  | 130  |            | dB    |
|                       |                                 |                                                   | -40°C to 125°C | 100  |      |            | dB    |

| Output Characteristics |                                     |                                                                             |                |    |        |     |                   |
|------------------------|-------------------------------------|-----------------------------------------------------------------------------|----------------|----|--------|-----|-------------------|
| V <sub>OH</sub>        | Output Swing from Positive Rail     | R <sub>LOAD</sub> = 10kΩ to V <sub>S</sub> /2                               |                |    | 200    | 300 | mV                |
|                        |                                     |                                                                             | -40°C to 125°C |    |        | 450 | mV                |
|                        |                                     | R <sub>LOAD</sub> = 2kΩ to V <sub>S</sub> /2                                |                |    | 1.1    | 1.4 | V                 |
|                        |                                     |                                                                             | -40°C to 125°C |    |        | 2   | V                 |
| V <sub>OL</sub>        | Output Swing from Negative Rail     | R <sub>LOAD</sub> = 10kΩ to V <sub>S</sub> /2                               |                |    | 200    | 300 | mV                |
|                        |                                     |                                                                             | -40°C to 125°C |    |        | 450 | mV                |
|                        |                                     | R <sub>LOAD</sub> = 2kΩ to V <sub>S</sub> /2                                |                |    | 0.8    | 1   | V                 |
|                        |                                     |                                                                             | -40°C to 125°C |    |        | 1.6 | V                 |
| I <sub>SC</sub>        | Output Short-Circuit Current        |                                                                             |                | 25 | 32     |     | mA                |
|                        |                                     | -40°C to 85°C                                                               | 20             |    |        |     | mA                |
|                        |                                     | -40°C to 125°C                                                              | 15             |    |        |     | mA                |
| AC Specifications      |                                     |                                                                             |                |    |        |     |                   |
| GBW                    | Gain-Bandwidth Product              |                                                                             |                |    | 3.5    |     | MHz               |
| SR                     | Slew Rate                           | G = 1, 10V step                                                             |                |    | 15     |     | V/μs              |
|                        |                                     | Open Loop                                                                   |                | 9  | 15     |     | V/μs              |
|                        |                                     |                                                                             | -40°C to 85°C  | 7  |        |     | V/μs              |
|                        |                                     |                                                                             | -40°C to 125°C | 6  |        |     | V/μs              |
| t <sub>OR</sub>        | Overload Recovery                   |                                                                             |                |    | 100    |     | ns                |
| t <sub>S</sub>         | Settling Time, 0.1%                 | G = -1, 10V step                                                            |                |    | 0.8    |     | μs                |
|                        | Settling Time, 0.01%                |                                                                             |                |    | 1      |     | μs                |
| PM                     | Phase Margin                        | V <sub>S</sub> = 36V, R <sub>L</sub> =10K, C <sub>L</sub> =100pF            |                |    | 60     |     | °                 |
| GM                     | Gain Margin                         | V <sub>S</sub> = 36V, R <sub>L</sub> =10K, C <sub>L</sub> =100pF            |                |    | 15     |     | dB                |
| Noise Performance      |                                     |                                                                             |                |    |        |     |                   |
| E <sub>N</sub>         | Input Voltage Noise                 | f = 0.1Hz to 10Hz                                                           |                |    | 1.7    |     | μV <sub>RMS</sub> |
| e <sub>N</sub>         | Input Voltage Noise Density         | f = 1kHz                                                                    |                |    | 30     |     | nV/√Hz            |
| i <sub>N</sub>         | Input Current Noise                 | f = 1kHz                                                                    |                |    | 2      |     | fA/√Hz            |
| THD+N                  | Total Harmonic Distortion and Noise | f = 1kHz, G =1, R <sub>L</sub> = 10kΩ, V <sub>OUT</sub> = 6V <sub>RMS</sub> |                |    | 0.0005 |     | %                 |

## Typical Performance Characteristics

$V_S = \pm 15V$ ,  $V_{CM} = 0V$ ,  $R_L = 10k\Omega$ , unless otherwise specified.

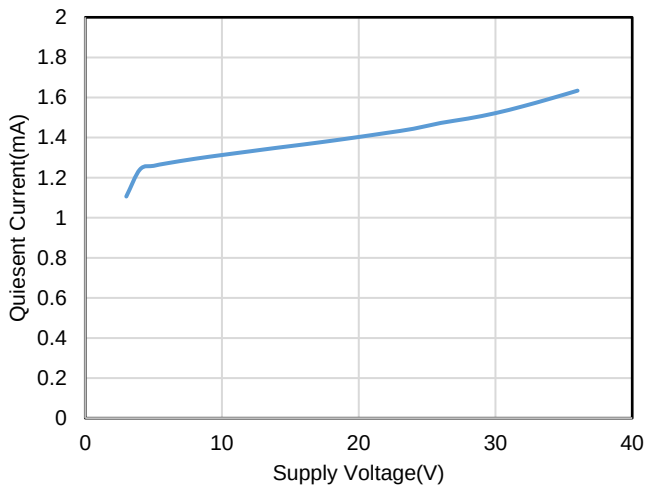


Figure 1. Quiescent Current vs. Supply Voltage, 2ch TP2262

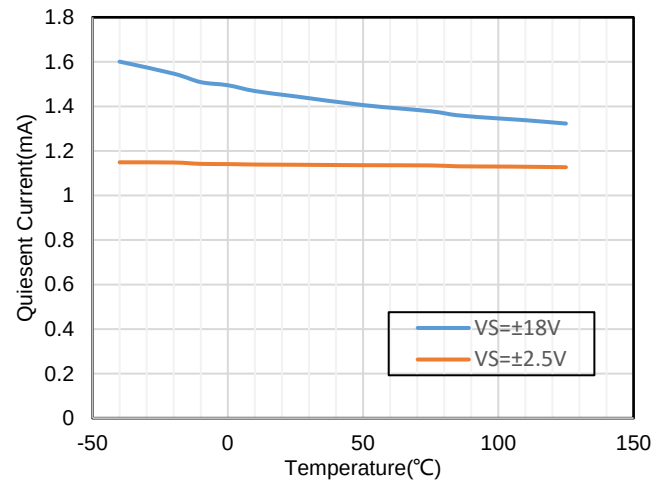


Figure 2. Quiescent Current vs. Temperature, 2ch TP2262

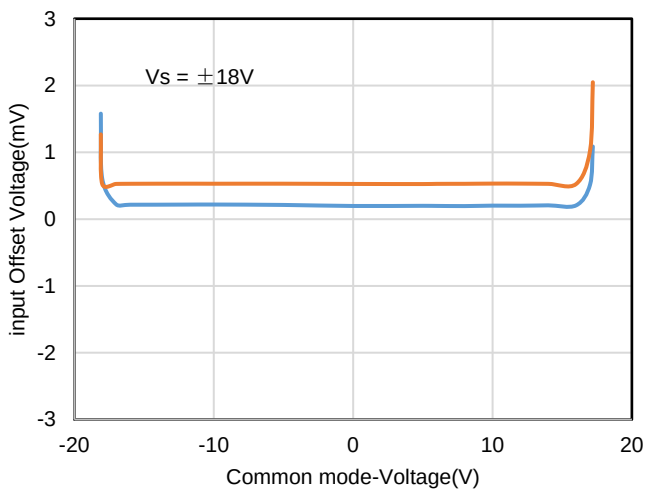


Figure 3. Offset Voltage vs. Common Mode Voltage

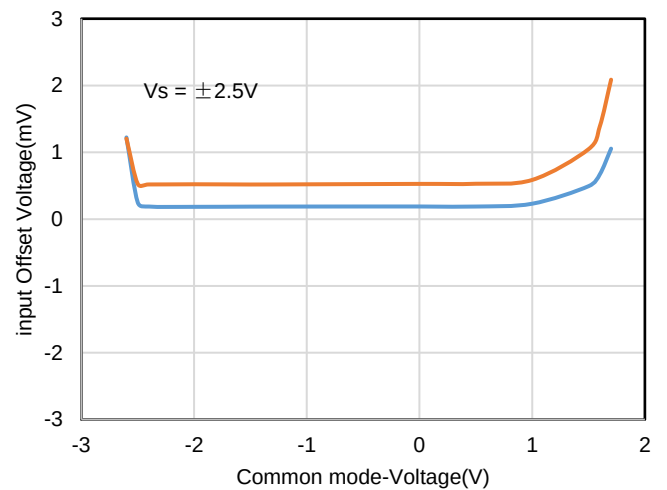


Figure 4. Offset Voltage vs. Common Mode Voltage

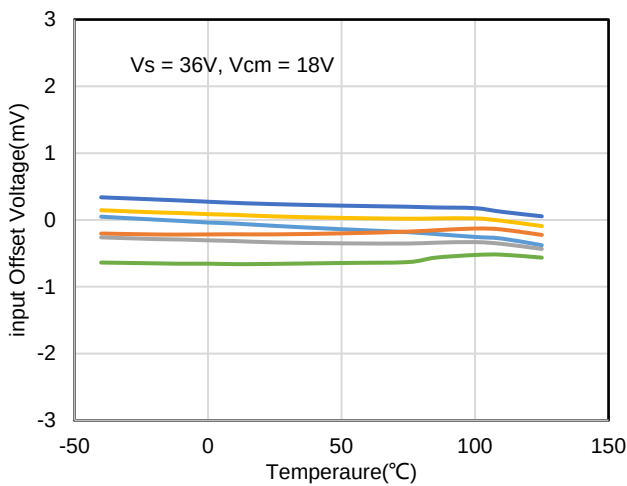


Figure 5.  $V_{OS}$  vs. Temperature

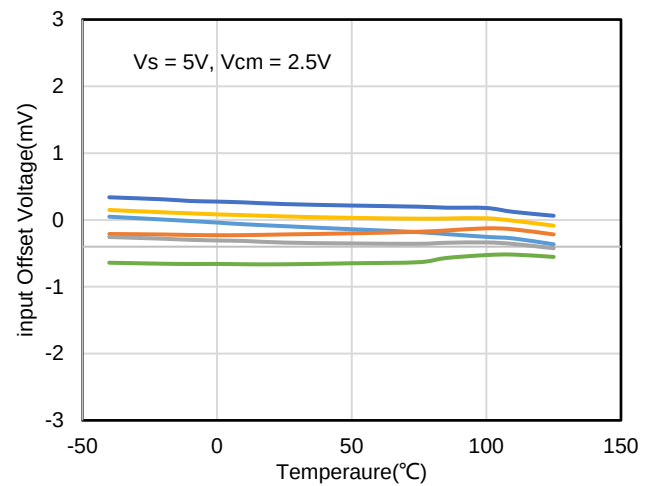


Figure 6.  $V_{OS}$  vs. Temperature

$V_s = \pm 15V$ ,  $V_{CM} = 0V$ ,  $R_L = 10k\Omega$ , unless otherwise specified.

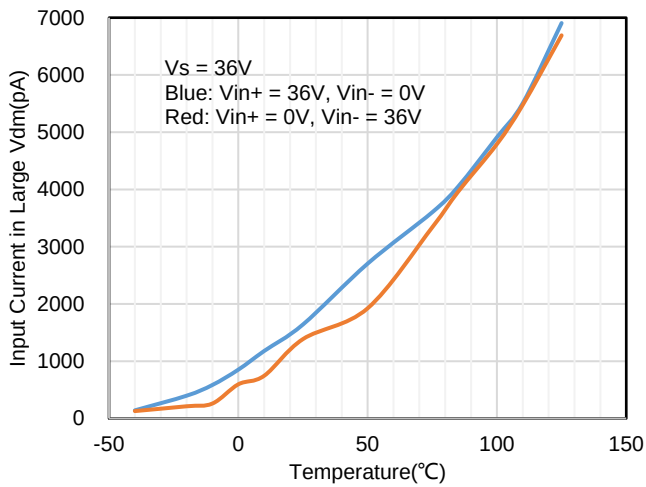


Figure 7. Input Current in Large Vdm vs. Temperature

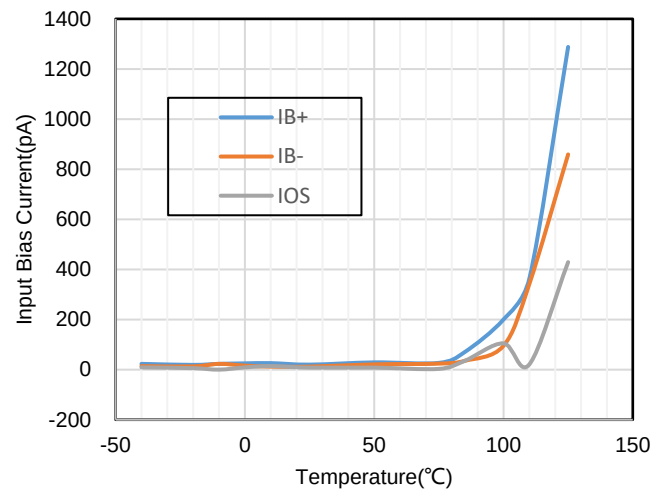


Figure 8.  $I_B$  vs. Temperature

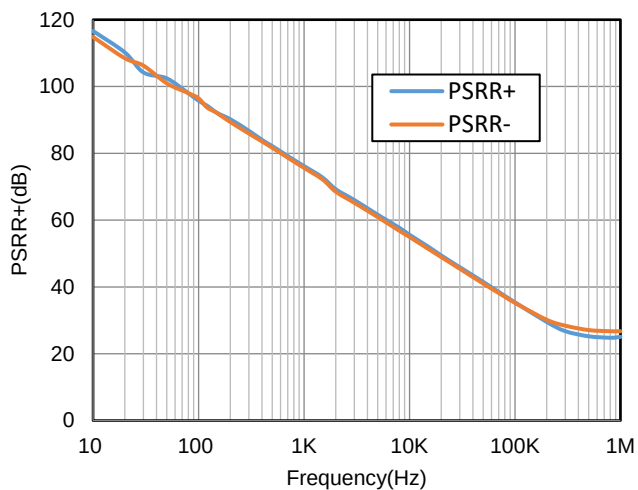


Figure 9. PSRR vs. Frequency

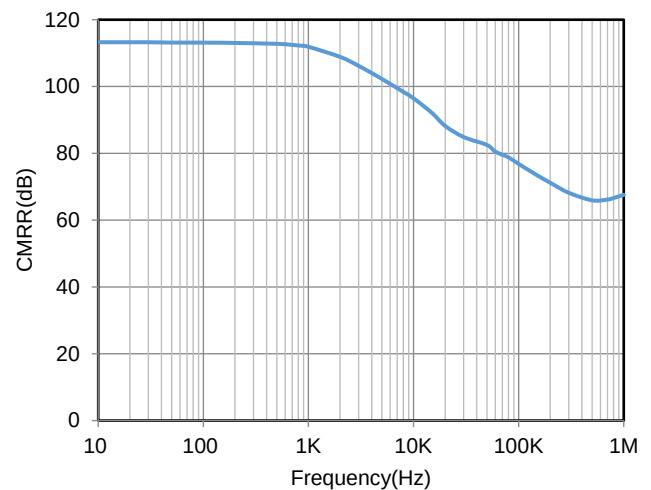


Figure 10. CMRR vs. Frequency

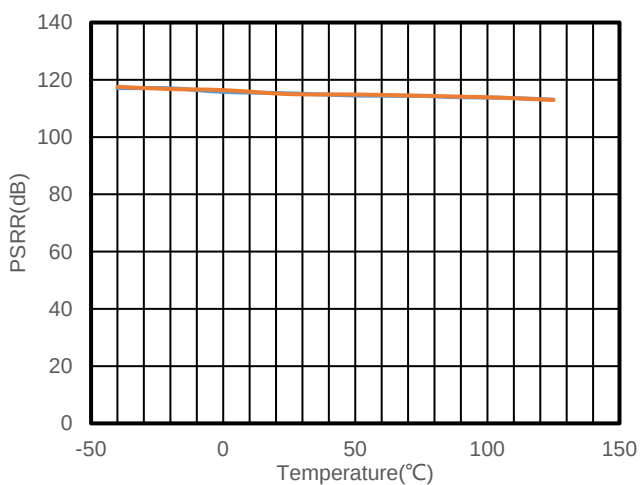


Figure 11. PSRR vs. Temperature

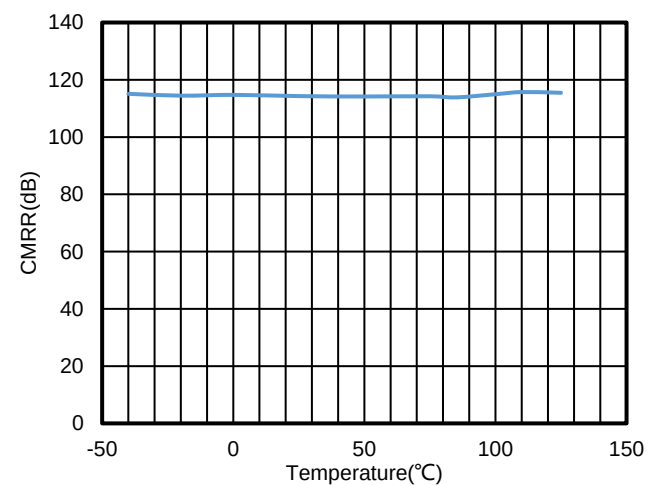


Figure 12. CMRR vs. Temperature

$V_S = \pm 15V$ ,  $V_{CM} = 0V$ ,  $R_L = 10k\Omega$ , unless otherwise specified.

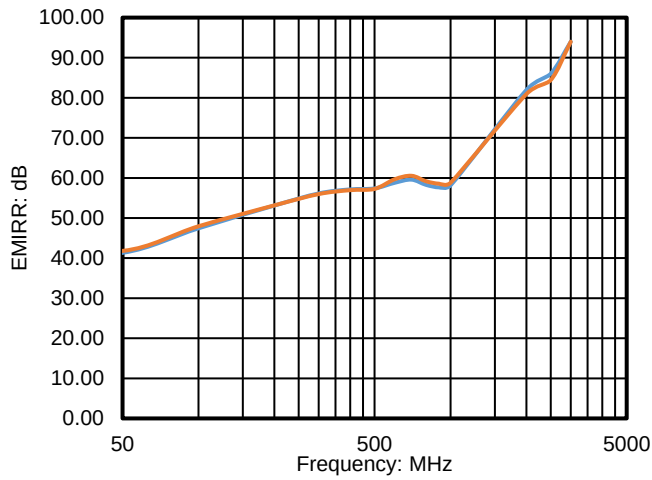


Figure 13. EMIRR+ vs. Frequency

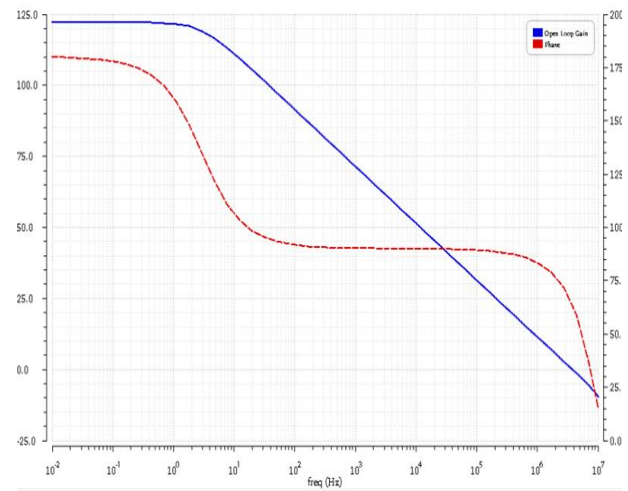


Figure 14. Open Loop Gain and Phase vs. Frequency

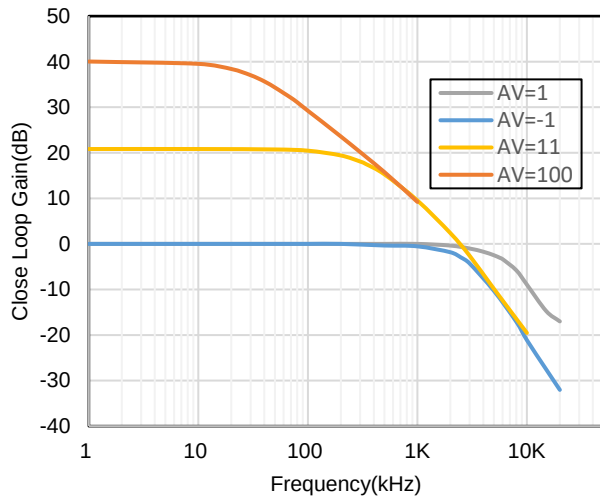
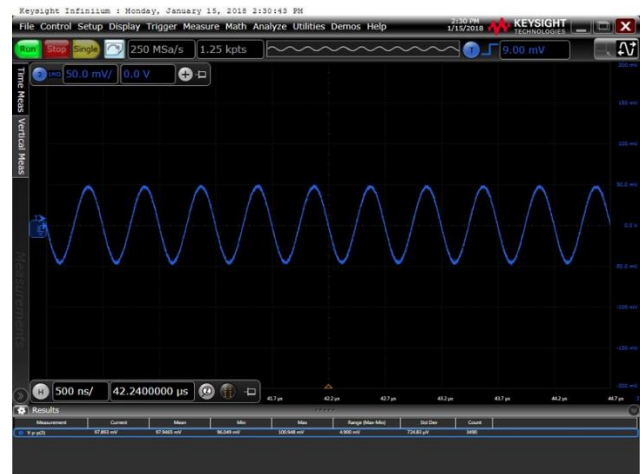


Figure 15. Close Loop Gain and Phase vs. Frequency



$V_S = \pm 1.5V$ ,  $V_{IN} = 100mV_{PP}$ ,  $R_L = 10K$ ,  $C_L = 100pF$ ,  $G = 1$

Figure 16. Waveform under 3V Supply Voltage

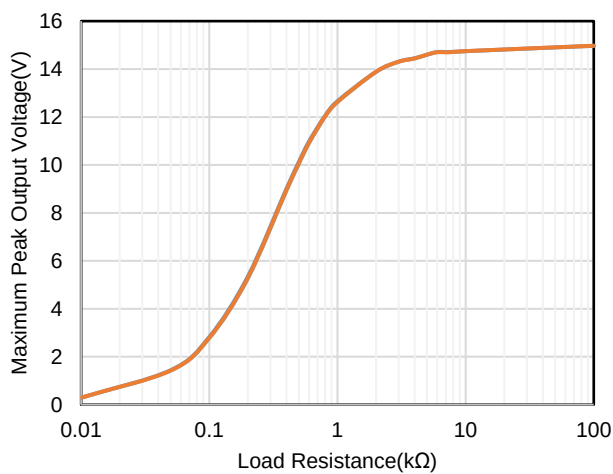


Figure 17. Maximum Peak Output Voltage vs. Load Resistance

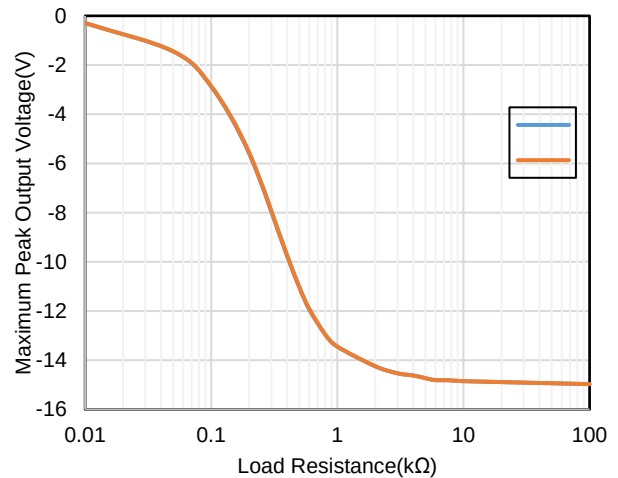


Figure 18. Maximum Peak Output Voltage vs. Load Resistance

$V_S = \pm 15V$ ,  $V_{CM} = 0V$ ,  $R_L = 10k\Omega$ , unless otherwise specified.

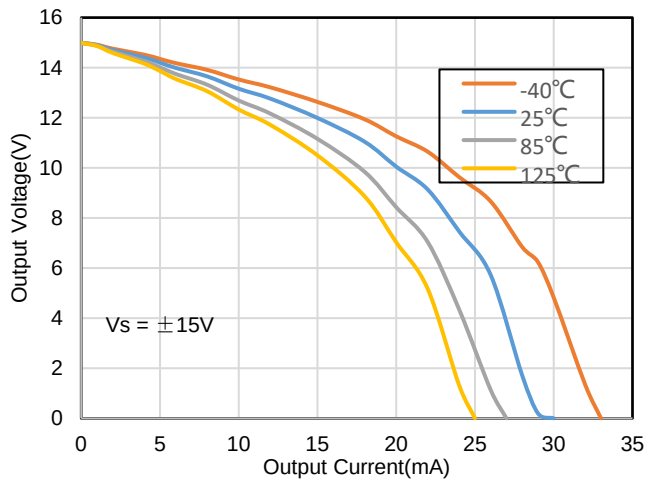


Figure 19. Positive Output Voltage vs. Output Current

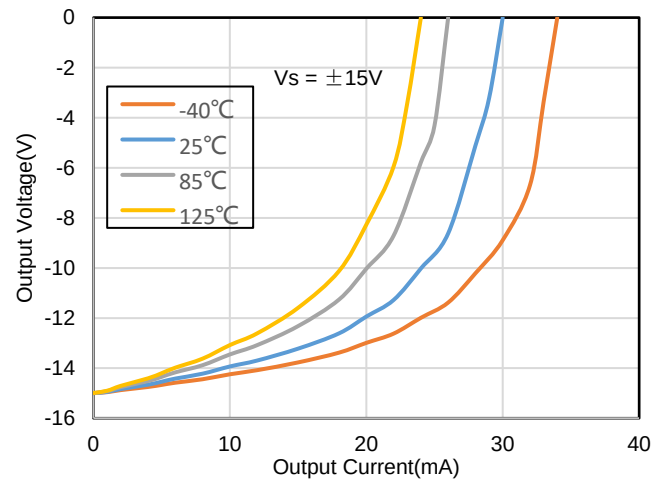


Figure 20. Negative Output Voltage vs. Output Current

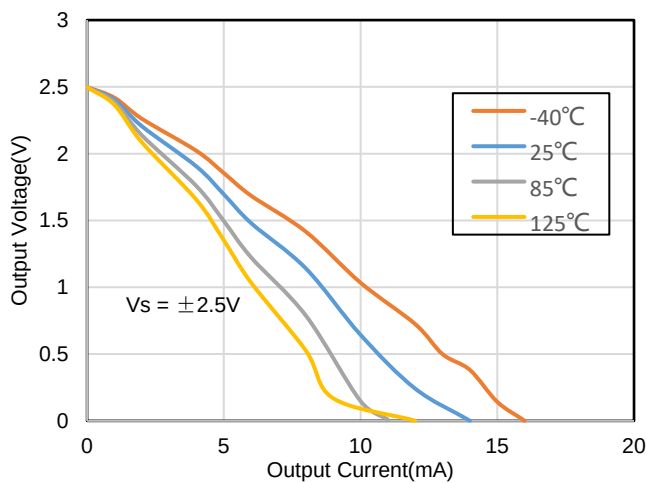


Figure 21. Positive Output Voltage vs. Output Current

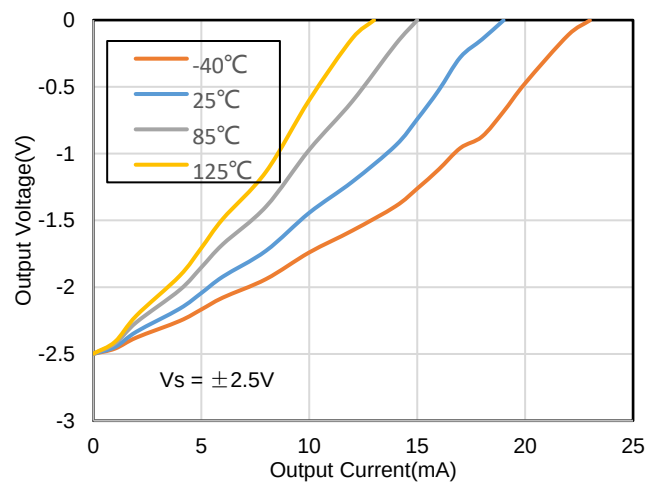


Figure 22. Negative Output Voltage vs. Output Current



Voltage: 1V/div, Time: 200ns/div  
 $V_S = 5V$ ,  $V_{IN} = 2V$ ,  $R_L = \text{Open}$ ,  $G = 3$   
 Figure 23. Positive Overload Recovery



Voltage: 1V/div, Time: 200ns/div  
 $V_S = 5V$ ,  $V_{IN} = 2V$ ,  $R_L = \text{Open}$ ,  $G = 3$   
 Figure 24. Negative Overload Recovery

$V_S = \pm 15V$ ,  $V_{CM} = 0V$ ,  $R_L = 10k\Omega$ , unless otherwise specified.



Voltage: 20mV/div, Time: 100ns/div

$V_S = \pm 15V$ ,  $R_L = 2K$ ,  $C_L = 100pF$ ,  $G = 1$

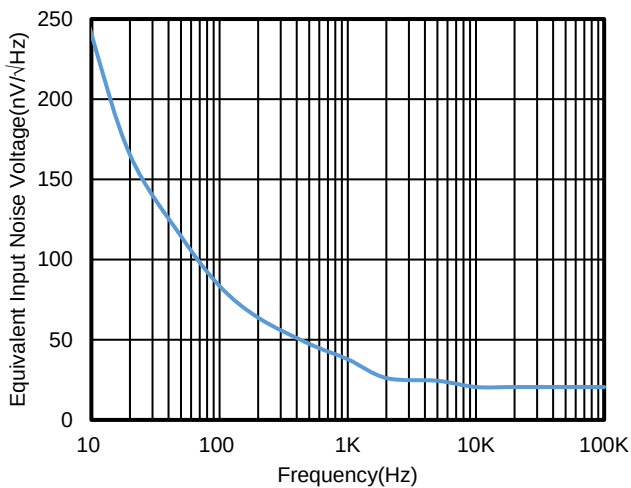
Figure 25. 100mV Signal Step Response



Voltage: 2V/div, Time: 1μs/div

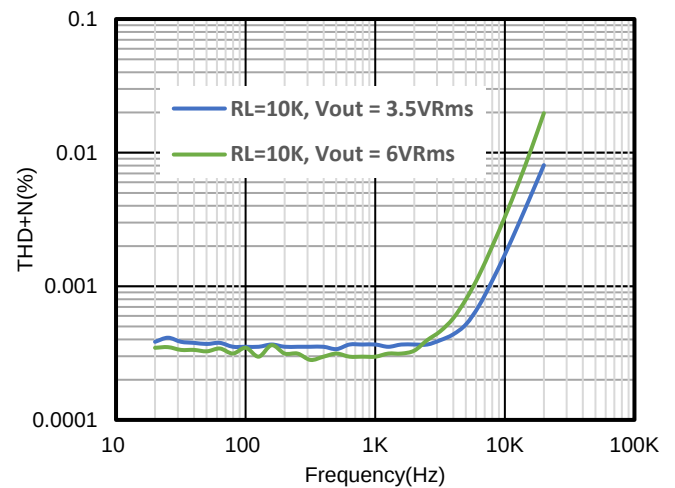
$V_S = \pm 15V$ ,  $R_L = 2K$ ,  $C_L = 100pF$ ,  $G = 1$

Figure 26. 10V Signal Step Response



$V_S = \pm 15V$ ,  $V_{CM} = 0V$

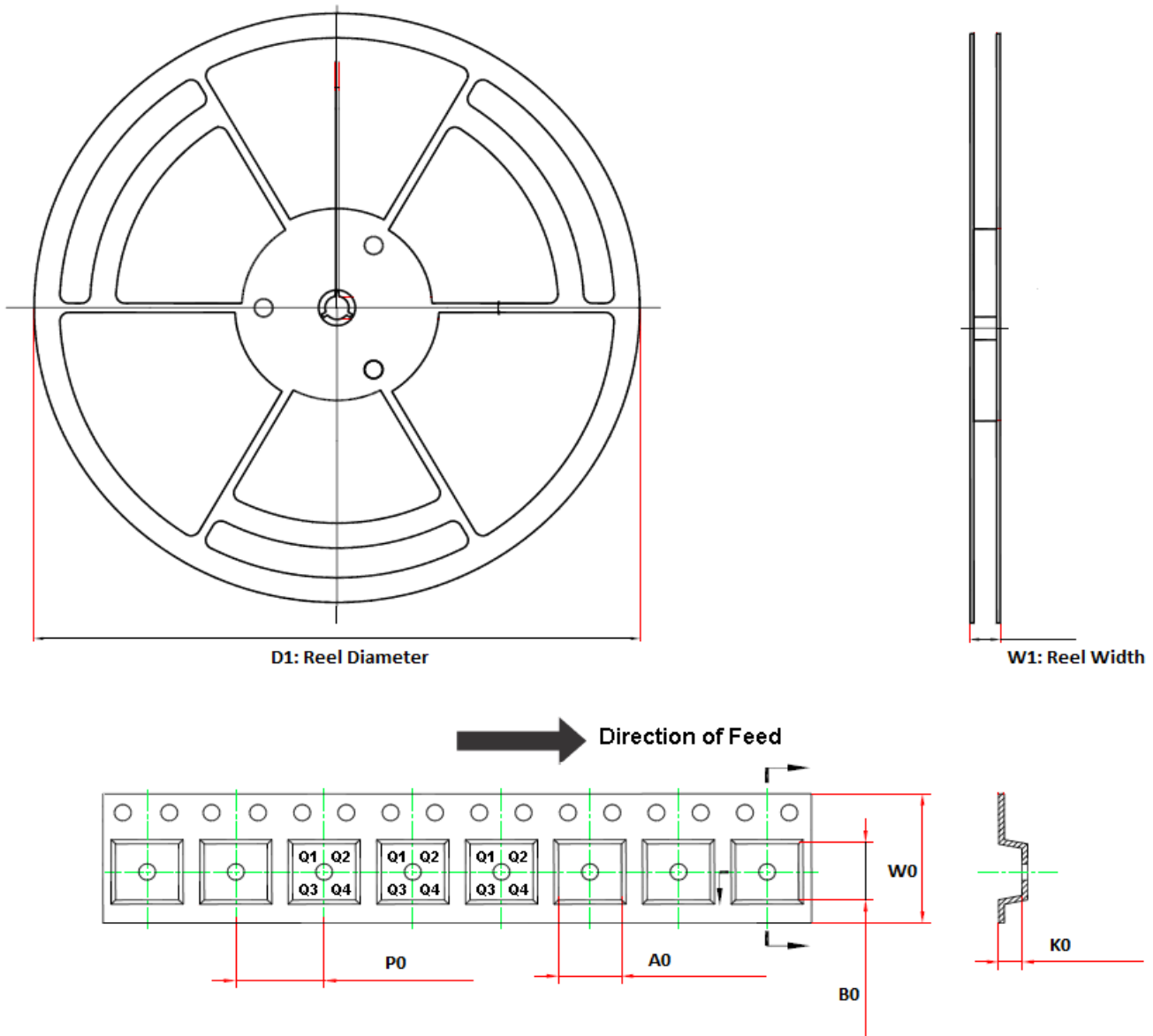
Figure 27. Voltage Noise Spectral Density vs. Frequency



$V_S = \pm 15V$ ,  $V_{CM} = 0V$ ,  $G = 1$

Figure 28. THD+N vs. Frequency

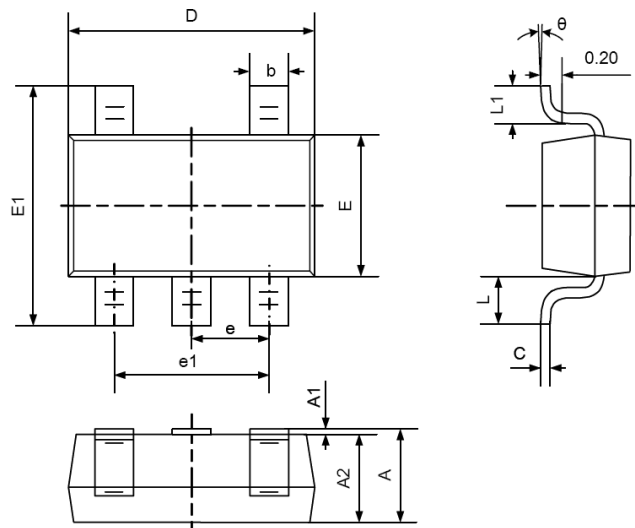
## Tape and Reel Information



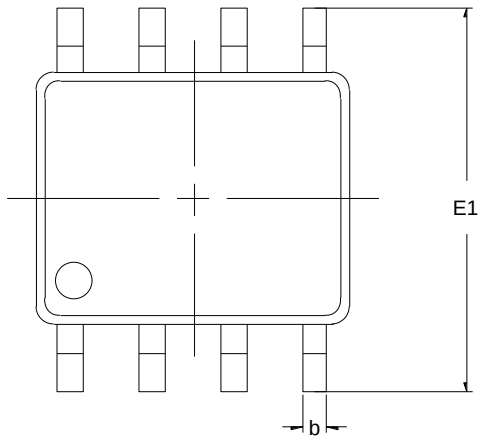
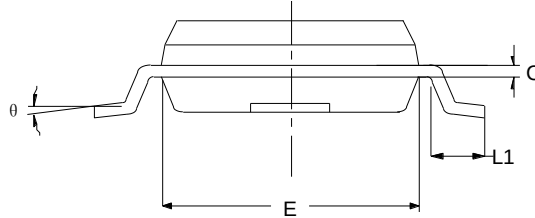
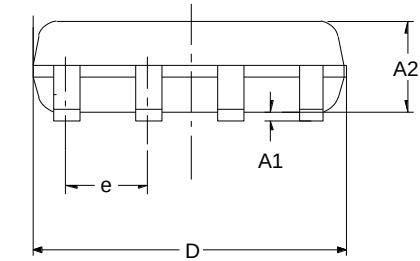
| Order Number | Package      | D1    | W1   | A0   | B0   | K0   | P0  | W0   | Pin1<br>Quadrant |
|--------------|--------------|-------|------|------|------|------|-----|------|------------------|
| TP2261-TR    | 5-Pin SOT23  | 180.0 | 13.1 | 3.2  | 3.2  | 1.4  | 4.0 | 8.0  | Q3               |
| TP2261-SR    | 8-Pin SOIC   | 330.0 | 17.6 | 6.4  | 5.4  | 2.1  | 8.0 | 12.0 | Q1               |
| TP2262-SR    | 8-Pin SOIC   | 330.0 | 17.6 | 6.4  | 5.4  | 2.1  | 8.0 | 12.0 | Q1               |
| TP2262L1-SR  | 8-Pin SOIC   | 330.0 | 17.6 | 6.4  | 5.4  | 2.1  | 8.0 | 12.0 | Q1               |
| TP2262-VR    | 8-Pin MSOP   | 330.0 | 17.6 | 5.2  | 3.3  | 1.5  | 8.0 | 12.0 | Q1               |
| TP2262-TSR   | 8-Pin TSSOP  | 330.0 | 17.6 | 6.8  | 3.3  | 1.2  | 8.0 | 12.0 | Q1               |
| TP2262-F2R   | 8-Pin DFN3*3 | 330.0 | 17.6 | 3.35 | 3.35 | 1.13 | 8.0 | 12.0 | Q1               |
| TP2264-SR    | 14-Pin SOIC  | 330.0 | 21.6 | 6.5  | 9.0  | 2.1  | 8.0 | 16.0 | Q1               |
| TP2264L1-SR  | 14-Pin SOIC  | 330.0 | 21.6 | 6.5  | 9.0  | 2.1  | 8.0 | 16.0 | Q1               |
| TP2264-TR    | 14-Pin TSSOP | 330.0 | 17.6 | 6.8  | 5.4  | 1.2  | 8.0 | 12.0 | Q1               |

## Package Outline Dimensions

### SOT23-5

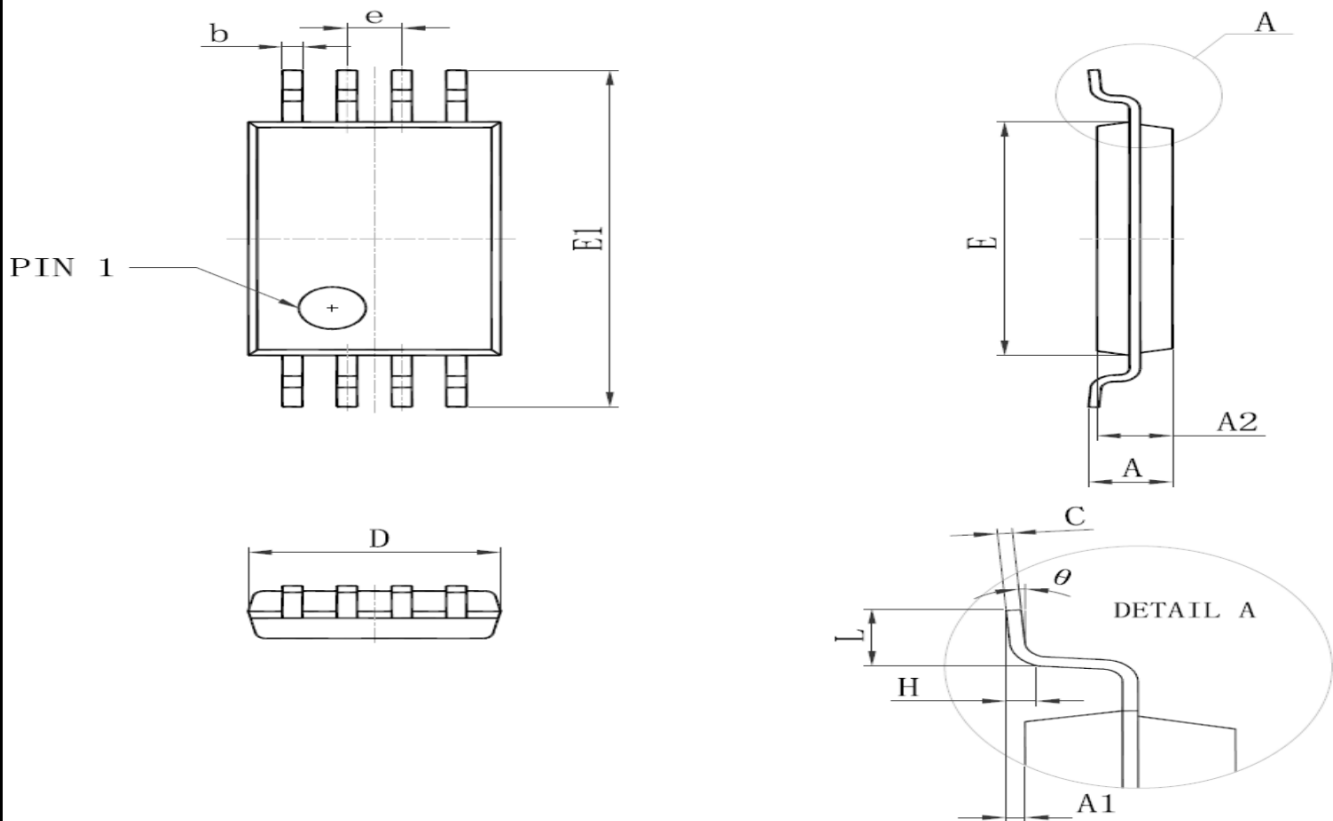


| Symbol | Dimensions<br>In Millimeters |       |
|--------|------------------------------|-------|
|        | Min                          | Max   |
| A      | 1.050                        | 1.250 |
| A1     | 0.000                        | 0.100 |
| A2     | 1.000                        | 1.150 |
| b      | 0.300                        | 0.500 |
| C      | 0.100                        | 0.200 |
| D      | 2.820                        | 3.020 |
| E      | 1.500                        | 1.700 |
| E1     | 2.600                        | 3.000 |
| e      | 0.950TYP                     |       |
| e1     | 1.800                        | 2.000 |
| L      | 0.600REF                     |       |
| L1     | 0.300                        | 0.600 |
| θ      | 0°                           | 8°    |

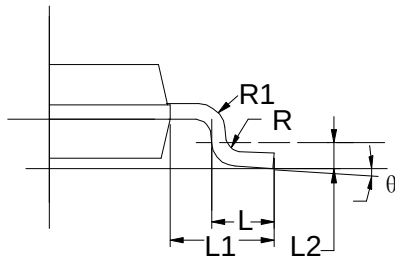
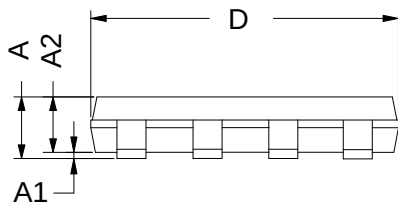
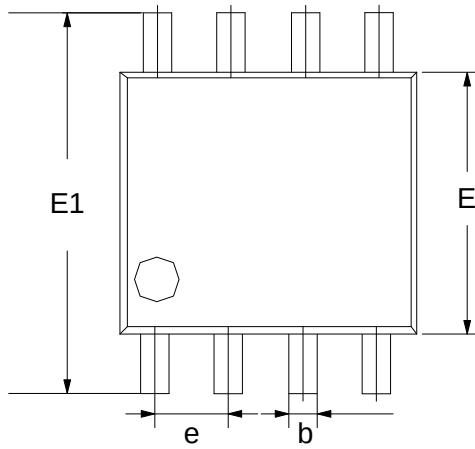
**SOIC-8**


| Symbol | Dimensions<br>In Millimeters |       |
|--------|------------------------------|-------|
|        | Min                          | Max   |
| A1     | 0.100                        | 0.250 |
| A2     | 1.300                        | 1.550 |
| b      | 0.330                        | 0.510 |
| C      | 0.170                        | 0.250 |
| D      | 4.700                        | 5.100 |
| E      | 3.800                        | 4.000 |
| E1     | 5.800                        | 6.300 |
| e      | 1.270TYP                     |       |
| L1     | 0.400                        | 0.900 |
| θ      | 0°                           | 8°    |

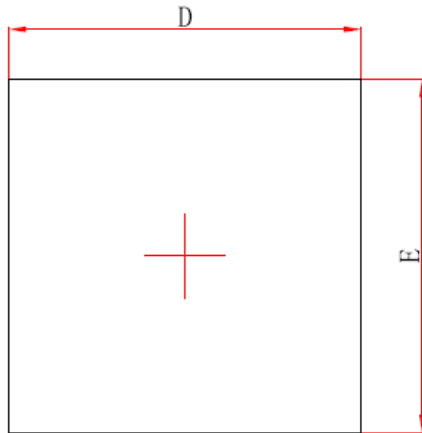
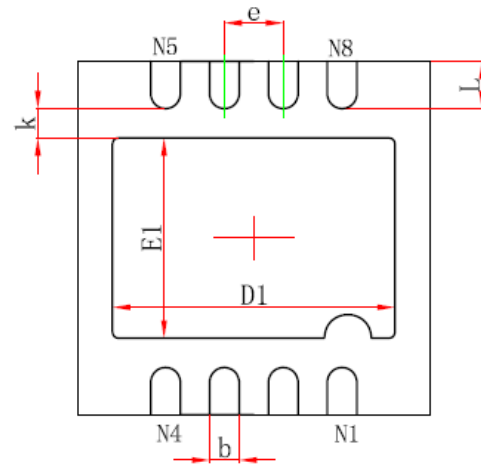
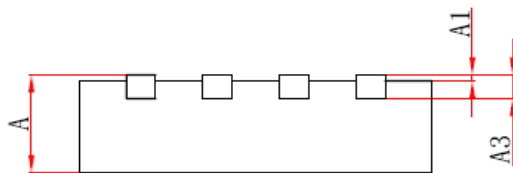
## TSSOP-8



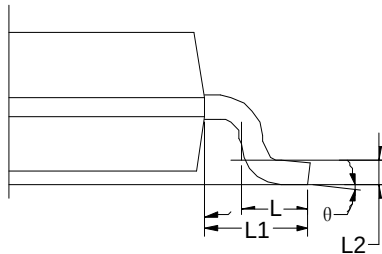
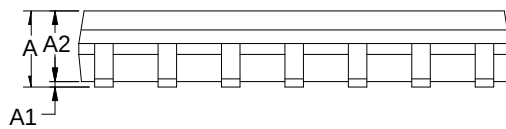
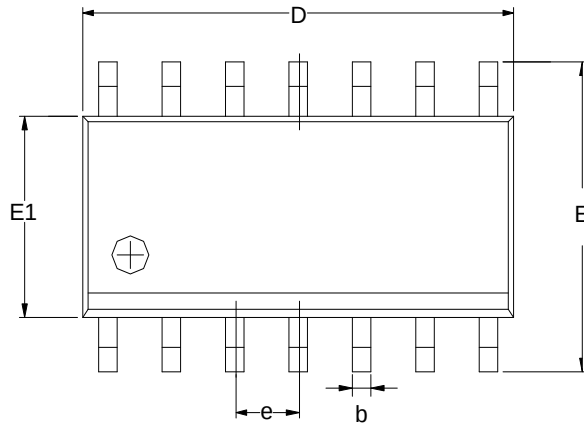
| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | Min                       | Max   | Min                  | Max   |
| D        | 2.900                     | 3.100 | 0.114                | 0.122 |
| E        | 4.300                     | 4.500 | 0.169                | 0.177 |
| b        | 0.190                     | 0.300 | 0.007                | 0.012 |
| c        | 0.090                     | 0.200 | 0.004                | 0.008 |
| E1       | 6.250                     | 6.550 | 0.246                | 0.258 |
| A        |                           | 1.200 |                      | 0.047 |
| A2       | 0.800                     | 1.000 | 0.031                | 0.039 |
| A1       | 0.050                     | 0.150 | 0.002                | 0.006 |
| e        | 0.65(BSC)                 |       | 0.026 (BSC)          |       |
| L        | 0.500                     | 0.700 | 0.020                | 0.028 |
| H        | 0.25(BSC)                 |       | 0.01 (BSC)           |       |
| $\theta$ | 1°                        | 7°    | 1°                   | 7°    |

**MSOP-8**


| Symbol | Dimensions<br>In Millimeters |       |
|--------|------------------------------|-------|
|        | Min                          | Max   |
| A      | 0.800                        | 1.200 |
| A1     | 0.000                        | 0.200 |
| A2     | 0.750                        | 0.950 |
| b      | 0.30 TYP                     |       |
| C      | 0.15 TYP                     |       |
| D      | 2.900                        | 3.100 |
| e      | 0.65 TYP                     |       |
| E      | 2.900                        | 3.100 |
| E1     | 4.700                        | 5.100 |
| L      | 0.400                        | 0.800 |
| L1     | 0.95 TYP                     |       |
| L2     | 0.25 TYP                     |       |
| θ      | 0°                           | 6°    |

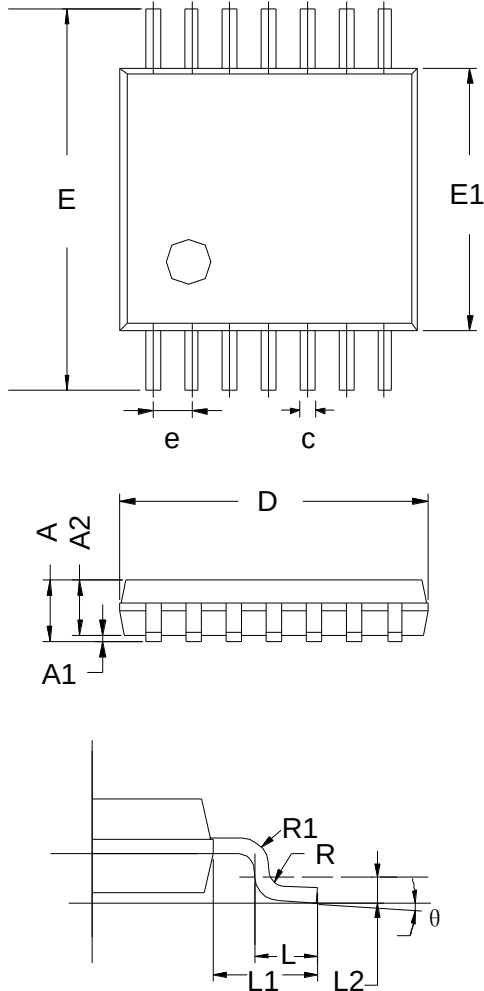
**DFN8 3\*3**

**Top View**

**Bottom View**

**Side View**

| Symbol | Dimensions In Millimeters |             | Dimensions In Inches |             |
|--------|---------------------------|-------------|----------------------|-------------|
|        | Min.                      | Max.        | Min.                 | Max.        |
| A      | 0.700/0.800               | 0.800/0.900 | 0.028/0.031          | 0.031/0.035 |
| A1     | 0.000                     | 0.050       | 0.000                | 0.002       |
| A3     | 0.203REF.                 |             | 0.008REF.            |             |
| D      | 2.924                     | 3.076       | 0.115                | 0.121       |
| E      | 2.924                     | 3.076       | 0.115                | 0.121       |
| D1     | 2.300                     | 2.500       | 0.091                | 0.098       |
| E1     | 1.600                     | 1.800       | 0.063                | 0.071       |
| k      | 0.200MIN.                 |             | 0.008MIN.            |             |
| b      | 0.200                     | 0.300       | 0.008                | 0.012       |
| e      | 0.500TYP.                 |             | 0.020TYP.            |             |
| L      | 0.324                     | 0.476       | 0.013                | 0.019       |

**SOIC-14**


| Symbol | Dimensions<br>In Millimeters |      |      |
|--------|------------------------------|------|------|
|        | MIN                          | TYP  | MAX  |
| A      | 1.35                         | 1.60 | 1.75 |
| A1     | 0.10                         | 0.15 | 0.25 |
| A2     | 1.25                         | 1.45 | 1.65 |
| b      | 0.31                         |      | 0.51 |
| D      | 8.45                         | 8.63 | 8.85 |
| E      | 5.80                         | 6.00 | 6.20 |
| E1     | 3.80                         | 3.90 | 4.00 |
| e      | 1.27 BSC                     |      |      |
| L      | 0.40                         | 0.60 | 0.80 |
| L1     | 1.05 REF                     |      |      |
| L2     | 0.25 BSC                     |      |      |
| θ      | 0°                           |      | 8°   |

## TSSOP-14



| Symbol | Dimensions<br>In Millimeters |      |      |
|--------|------------------------------|------|------|
|        | MIN                          | TYP  | MAX  |
| A      | -                            | -    | 1.20 |
| A1     | 0.05                         | -    | 0.15 |
| A2     | 0.80                         | -    | 1.05 |
| c      | 0.19                         | -    | 0.30 |
| D      | 4.86                         | 5.00 | 5.10 |
| E      | 6.20                         | 6.40 | 6.60 |
| E1     | 4.30                         | 4.40 | 4.50 |
| e      | 0.65 BSC                     |      |      |
| L      | 0.45                         | 0.60 | 0.75 |
| L1     | 1.00 REF                     |      |      |
| L2     | 0.25 BSC                     |      |      |
| R      | 0.09                         | -    | -    |
| θ      | 0°                           | -    | 8°   |

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