

**LV321****LINEAR INTEGRATED CIRCUIT****SINGLE GENERAL PURPOSE,  
LOW VOLTAGE, RAIL-TO-RAIL  
OUTPUT OPERATIONAL  
AMPLIFIER****■ DESCRIPTION**

The UTC **LV321** is a single op amp with low supply current and low voltage (2.7-5.5V) well economic consideration. It brings nice performance and to low voltage, low power systems. With a 1MHz unity-gain frequency, The UTC **LV321** has a guaranteed 1 V/ $\mu$ s slew rate and low supply current. It provides heavy rail-to-rail (R-to-R) output swing loads and the input common-mode voltage range including ground. Besides, it is also capable for comfortably driving large capacitive loads.

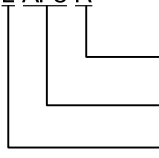
The UTC **LV321** has bipolar input and CMOS output for improved noise performance and higher output current drive. It's the most cost effective solution for the applications where low voltage operation, space saving and low price are required.

**■ FEATURES**

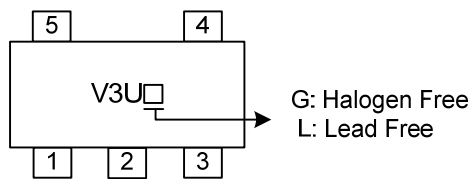
- \* 2.7V and 5V Performance Guaranteed
- \* No Crossover Distortion
- \* 130 $\mu$ A Low Supply Current
- \* Rail-to-Rail Output Swing @10k $\Omega$  Load:  $V^+$  -10mV  
 $V^-$  +65mV
- \*  $V_{CM}$  From -0.2V to  $V^+$  -0.8V

**■ ORDERING INFORMATION**

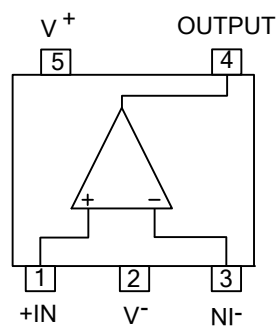
| Ordering Number |              | Package | Packing   |
|-----------------|--------------|---------|-----------|
| Lead Free       | Halogen Free |         |           |
| LV321G-AF5-R    | LV321G-AF5-R | SOT-25  | Tape Reel |
| LV321G-AL5-R    | LV321G-AL5-R | SOT-353 | Tape Reel |

|                                                                                                                                                                             |                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <div>LV321L-AF5-R</div>  <div>(1)Packing Type<br/>(2)Package Type<br/>(3)Lead Free</div> | <div>(1) R: Tape Reel<br/>(2) AF5: SOT-25, AL5: SOT-353<br/>(3) G: Halogen Free, L: Lead Free</div> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|

### ■ MARKING



### ■ PIN CONFIGURATION



## ■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER                        |       | SYMBOL        | RATINGS              | UNIT               |
|----------------------------------|-------|---------------|----------------------|--------------------|
| Supply Voltage                   |       | $V_{SS}$      | 2.7 ~ 5.5            | V                  |
| Supply Voltage ( $V^+$ - $V^-$ ) |       | $V_{SS}$      | 5.5                  | V                  |
| Differential Input Voltage       |       | $V_{I(DIFF)}$ | $\pm$ Supply Voltage |                    |
| Output Short Circuit             | $V^+$ | $I_{O(SC)}$   | (Note 2)             |                    |
|                                  | $V^-$ |               | (Note 3)             |                    |
| Infrared (15 sec)                |       |               | 215                  | $^{\circ}\text{C}$ |
| Junction Temperature             |       | $T_J$         | +150                 | $^{\circ}\text{C}$ |
| Operation Temperature            |       | $T_{OPR}$     | -40~+85              | $^{\circ}\text{C}$ |
| Storage Temperature              |       | $T_{STG}$     | -65~+150             | $^{\circ}\text{C}$ |

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Shorting output to  $V^+$  will adversely affect reliability

3. Shorting output to  $V^-$  will adversely affect reliability

## ■ THERMAL DATA

| PARAMETER           |         | SYMBOL        | RATING | UNIT                 |
|---------------------|---------|---------------|--------|----------------------|
| Junction to Ambient | SOT-25  | $\theta_{JA}$ | 265    | $^{\circ}\text{C/W}$ |
|                     | SOT-353 |               | 478    | $^{\circ}\text{C/W}$ |

## ■ 2.7V ELECTRICAL CHARACTERISTICS

All limits guaranteed for  $T_J = 25^{\circ}\text{C}$ ,  $V^+ = 2.7\text{V}$ ,  $V^- = 0\text{V}$ ,  $V_{CM} = 1.0\text{V}$ ,  $V_{OUT} = V^+/2$  and  $R_L > 1\text{M}\Omega$ , unless otherwise specified.

| PARAMETER                          | SYMBOL            | CONDITIONS                                                    | MIN         | TYP        | MAX | UNIT                                 |
|------------------------------------|-------------------|---------------------------------------------------------------|-------------|------------|-----|--------------------------------------|
| <b>DC CHARACTERISTICS</b>          |                   |                                                               |             |            |     |                                      |
| Input Offset Voltage               | $V_{OS}$          |                                                               |             | 1.7        | 7   | mV                                   |
| Input Common Mode Voltage Range    | $V_{CM}$          | For $\text{CMRR} \geq 50\text{dB}$                            | 0           | -0.2       |     | V                                    |
|                                    |                   |                                                               |             | 1.9        | 1.7 | V                                    |
| Output Swing                       | $V_{OUT}$         | $R_L = 10\text{k}\Omega$ to 1.35V                             | $V^+ - 100$ | $V^+ - 10$ |     | mV                                   |
|                                    |                   |                                                               |             | 60         | 180 | mV                                   |
| Input Offset Voltage Average Drift | $\text{TCV}_{OS}$ |                                                               |             | 5          |     | $\mu\text{V}/^{\circ}\text{C}$       |
| Input Bias Current                 | $I_{I(BIAS)}$     |                                                               |             | 11         | 250 | nA                                   |
| Input Offset Current               | $I_{I(OFF)}$      |                                                               |             | 5          | 50  | nA                                   |
| Common Mode Rejection Ratio        | CMRR              | $0\text{V} \leq V_{CM} \leq 1.7\text{V}$                      | 50          | 63         |     | dB                                   |
| Power Supply Rejection Ratio       | PSRR              | $2.7\text{V} \leq V^+ \leq 5\text{V}$ , $V_{OUT} = 1\text{V}$ | 50          | 60         |     | dB                                   |
| Supply Current                     | $I_{SS}$          |                                                               |             | 80         | 170 | $\mu\text{A}$                        |
| <b>AC CHARACTERISTICS</b>          |                   |                                                               |             |            |     |                                      |
| Gain Bandwidth Product             | GBWP              | $C_L = 200\text{pF}$                                          |             | 1          |     | MHz                                  |
| Phase Margin                       | $\Phi_m$          |                                                               |             | 60         |     | Deg                                  |
| Gain Margin                        | $G_m$             |                                                               |             | 10         |     | dB                                   |
| Input Referred Voltage Noise       | eN                | $F = 1\text{kHz}$                                             |             | 46         |     | $\frac{\text{nV}}{\sqrt{\text{Hz}}}$ |
| Input Referred Current Noise       | $i_n$             | $F = 1\text{kHz}$                                             |             | 0.17       |     | $\frac{\text{pA}}{\sqrt{\text{Hz}}}$ |

## ■ 5V ELECTRICAL CHARACTERISTICS

All limits guaranteed for  $T_J = 25^\circ\text{C}$ ,  $V^+ = 5\text{V}$ ,  $V^- = 0\text{V}$ ,  $V_{CM} = 2.0\text{V}$ ,  $V_{OUT} = V^+/2$  and  $R_L > 1\text{M}\Omega$ , unless otherwise specified.

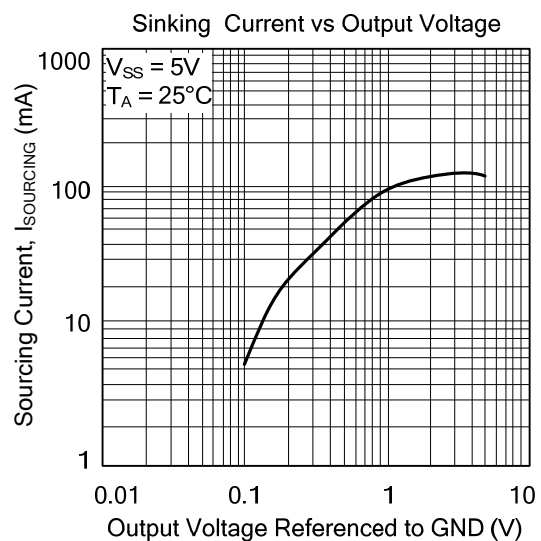
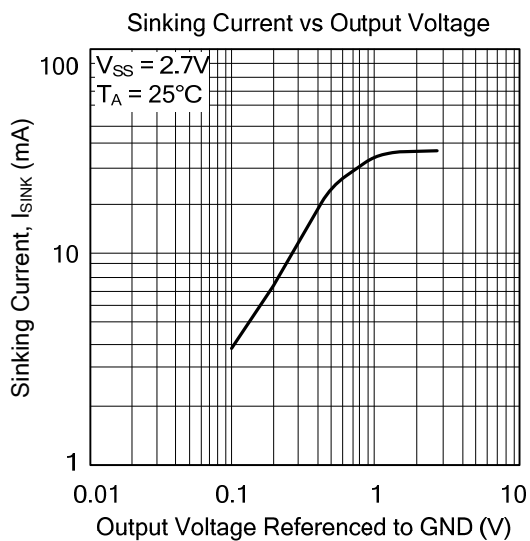
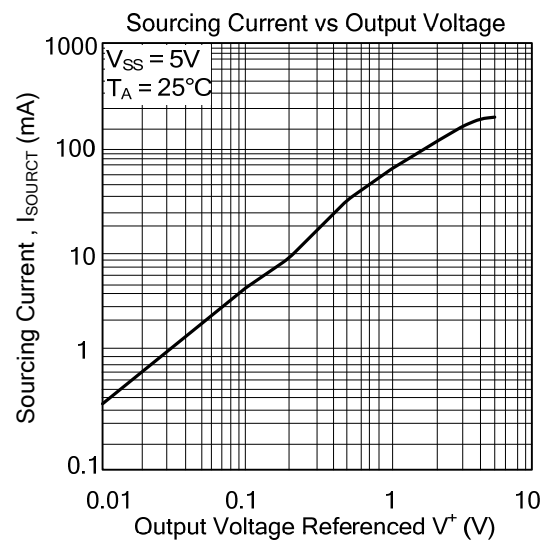
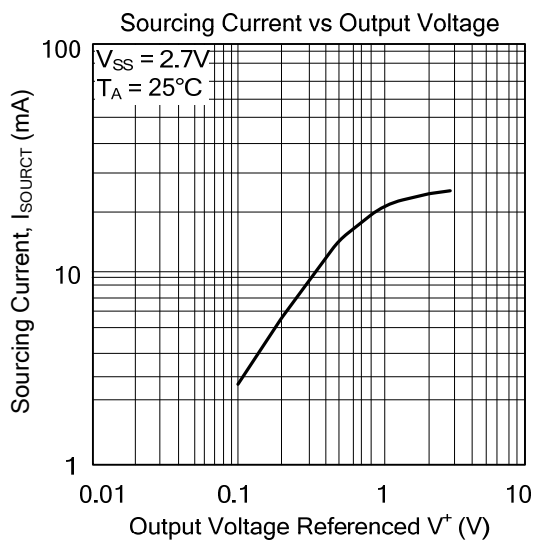
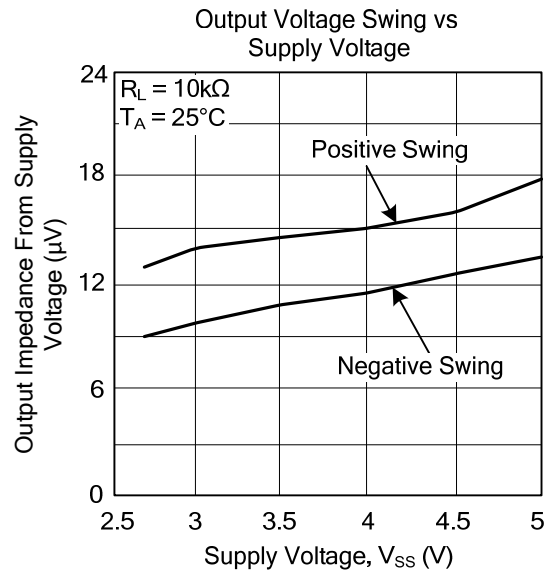
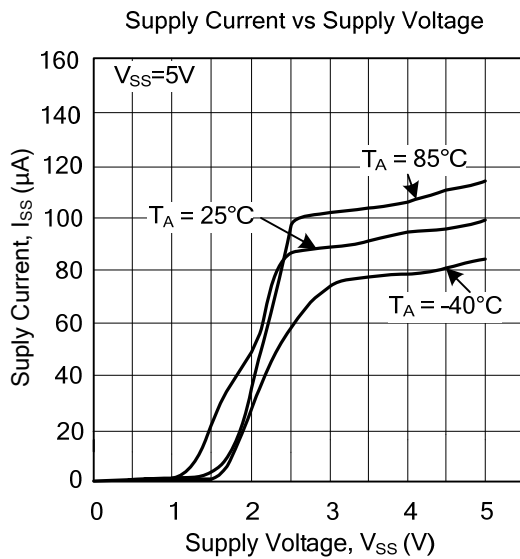
| PARAMETER                          | SYMBOL               | CONDITIONS                                                                            | MIN      | TYP         | MAX        | UNIT                                 |
|------------------------------------|----------------------|---------------------------------------------------------------------------------------|----------|-------------|------------|--------------------------------------|
| <b>DC CHARACTERISTICS</b>          |                      |                                                                                       |          |             |            |                                      |
| Input Offset Voltage               | $V_{OS}$             |                                                                                       |          | 1.7         | 7          | mV                                   |
| Input Common-Mode Voltage Range    | $V_{CM}$             | For $\text{CMRR} \geq 50\text{dB}$                                                    | 0        | -0.2        |            | V                                    |
|                                    |                      |                                                                                       |          | 4.2         | 4          | V                                    |
| Output Swing                       | $V_{OUT}$            | $R_L = 2\text{k}\Omega$ to $2.5\text{V}$                                              | $V_{OH}$ | $V^+ - 300$ | $V^+ - 40$ | mV                                   |
|                                    |                      |                                                                                       | $V_{OL}$ | 120         | 300        | mV                                   |
|                                    |                      | $R_L = 10\text{k}\Omega$ to $2.5\text{V}$                                             | $V_{OH}$ | $V^+ - 100$ | $V^+ - 10$ | mV                                   |
|                                    |                      |                                                                                       | $V_{OL}$ | 65          | 180        | mV                                   |
| Input Offset Voltage Average Drift | $\text{TCVos}$       |                                                                                       |          | 5           |            | $\mu\text{V}/^\circ\text{C}$         |
| Input Bias Current                 | $I_{I(\text{BIAS})}$ |                                                                                       |          | 15          | 250        | nA                                   |
| Input Offset Current               | $I_{I(\text{OFF})}$  |                                                                                       |          | 5           | 50         | nA                                   |
| Common Mode Rejection Ratio        | CMRR                 | $0\text{V} \leq V_{CM} \leq 4\text{V}$                                                | 50       | 65          |            | dB                                   |
| Power Supply Rejection Ratio       | PSRR                 | $2.7\text{V} \leq V^+ \leq 5\text{V}$<br>$V_{OUT} = 1\text{V}$ , $V_{CM} = 1\text{V}$ | 50       | 60          |            | dB                                   |
| Large Signal Voltage Gain(Note 1)  | $G_V$                | $R_L = 2\text{k}\Omega$                                                               | 15       | 100         |            | V/mV                                 |
| Output Short Circuit Current       | $I_{OUT}$            | Sourcing, $V_{OUT} = 0\text{V}$                                                       | 5        | 60          |            | mA                                   |
|                                    |                      | Sinking, $V_{OUT} = 5\text{V}$                                                        | 10       | 160         |            | mA                                   |
| Supply Current                     | $I_{SS}$             |                                                                                       |          | 130         | 250        | $\mu\text{A}$                        |
| <b>AC CHARACTERISTICS</b>          |                      |                                                                                       |          |             |            |                                      |
| Slew Rate                          | SR                   | (Note 2)                                                                              |          | 1           |            | V/ $\mu\text{s}$                     |
| Gain Bandwidth Product             | GBWP                 | $C_L = 200\text{pF}$                                                                  |          | 1           |            | MHz                                  |
| Phase Margin                       | $\Phi_m$             |                                                                                       |          | 60          |            | Deg                                  |
| Gain Margin                        | $G_m$                |                                                                                       |          | 10          |            | dB                                   |
| Input Referred Voltage Noise       | eN                   | $f = 1\text{kHz}$                                                                     |          | 39          |            | $\frac{\text{nV}}{\sqrt{\text{Hz}}}$ |
| Input Referred Current Noise       | $i_n$                | $f = 1\text{kHz}$                                                                     |          | 0.21        |            | $\frac{\text{pA}}{\sqrt{\text{Hz}}}$ |

Notes: 1.  $R_L$  is connected to  $V^-$ . The output voltage is  $0.5\text{V} \leq V_{OUT} \leq 4.5\text{V}$ .

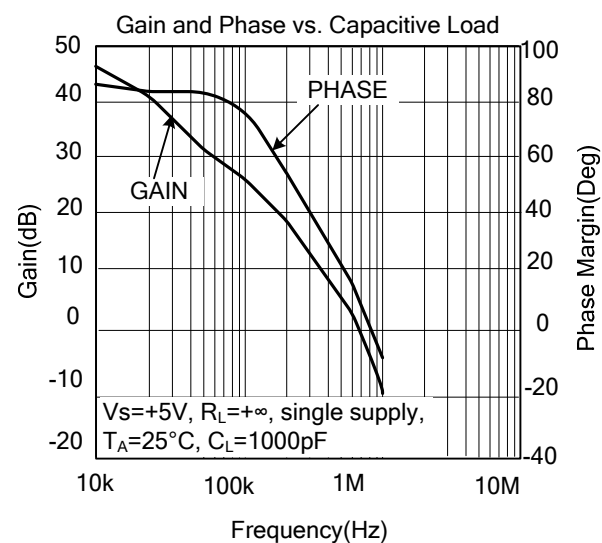
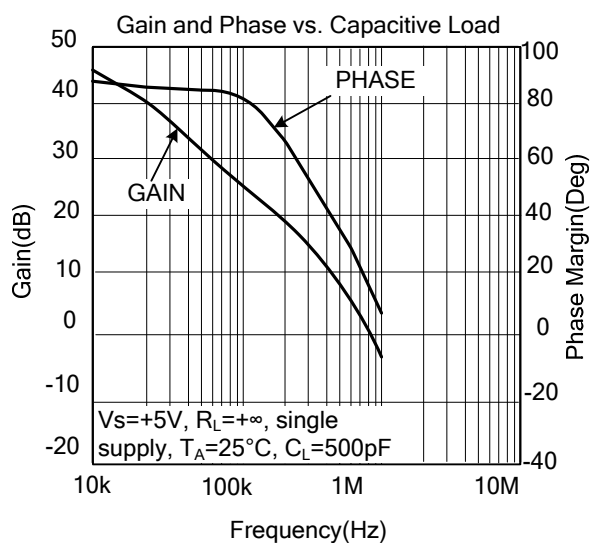
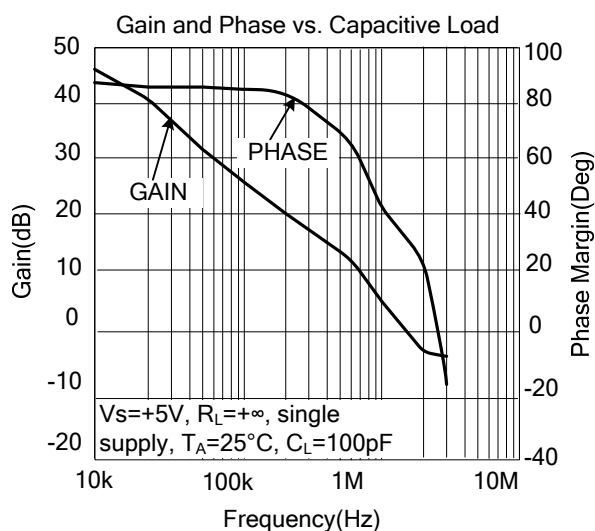
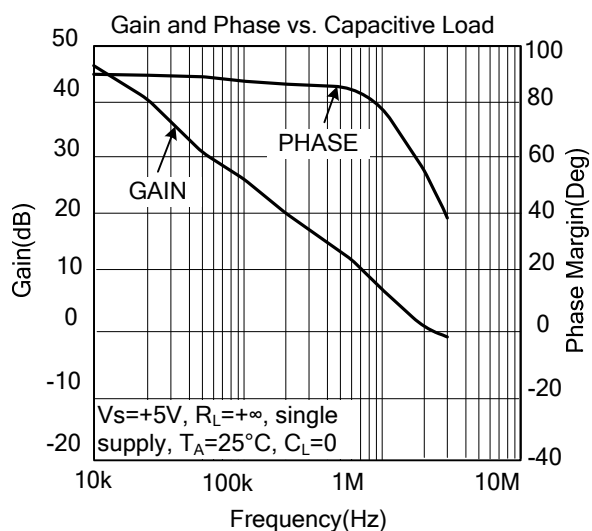
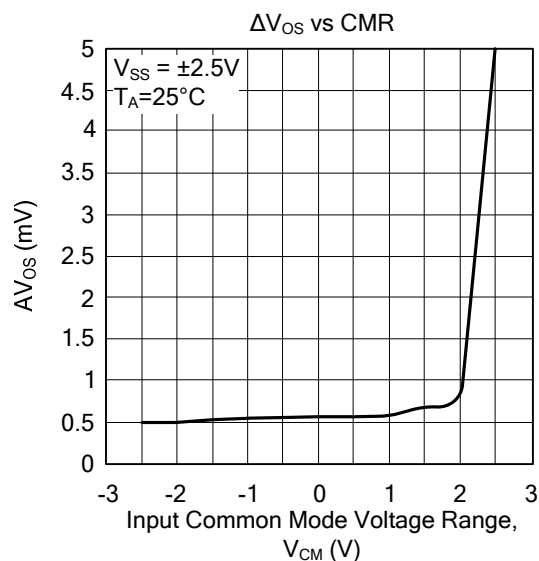
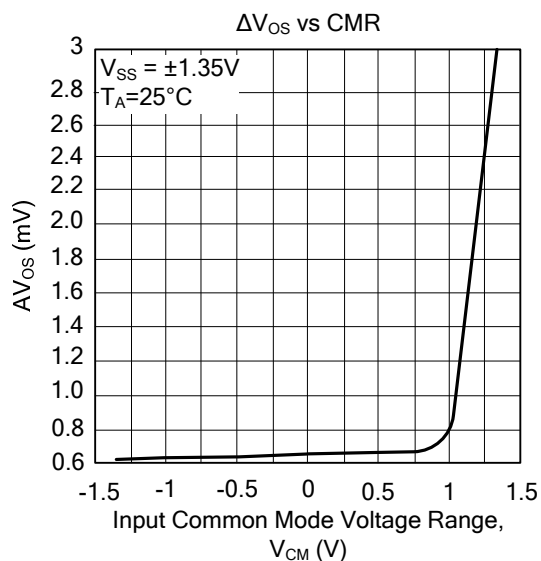
2. Connected as voltage follower with 3V step input. Number specified is these lower of the positive and negative slew rates

3. all numbers are typical, and apply for packages soldered directly note a PC board is still air.

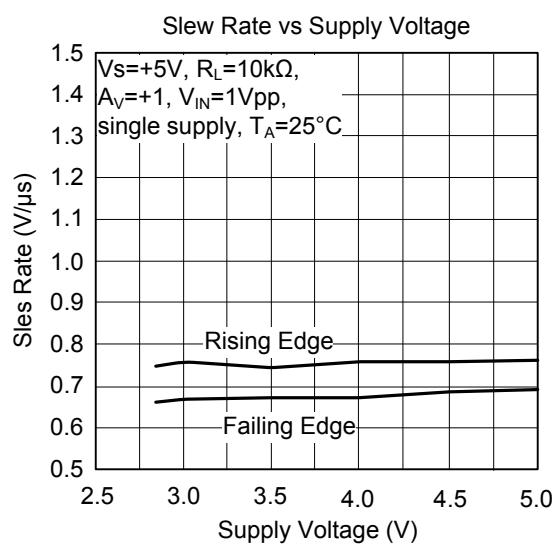
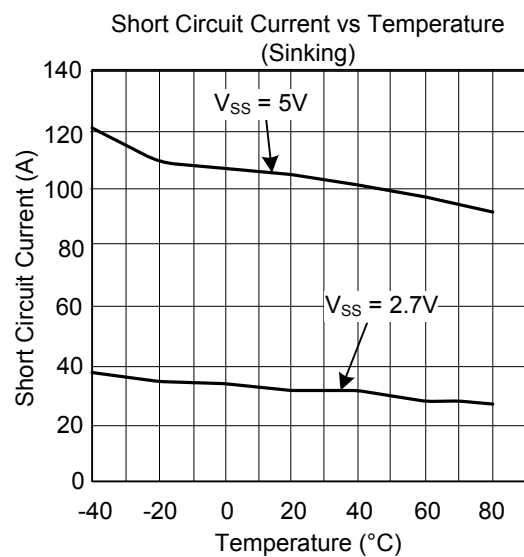
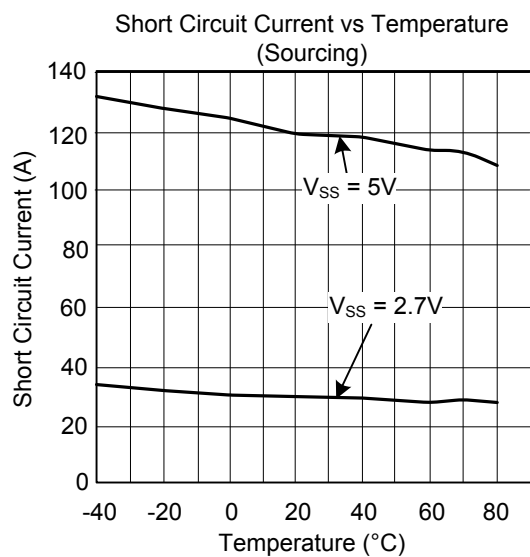
## TYPICAL CHARACTERISTICS



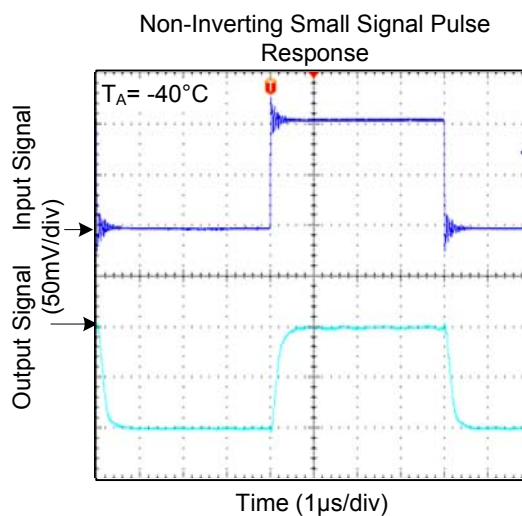
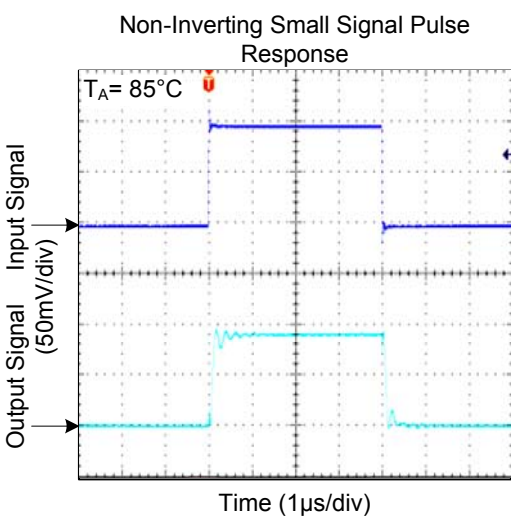
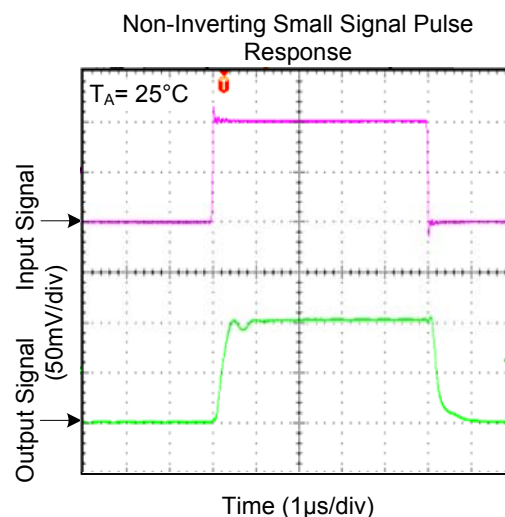
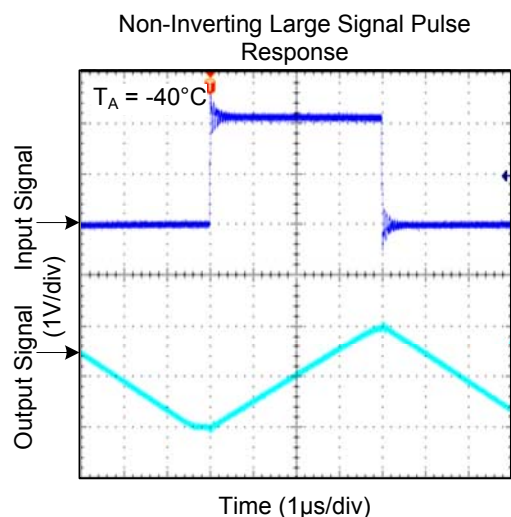
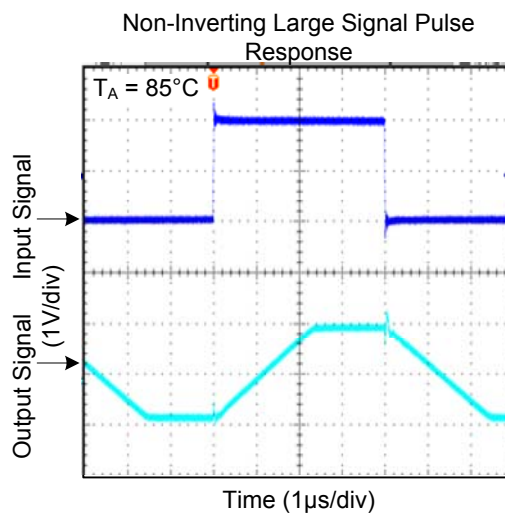
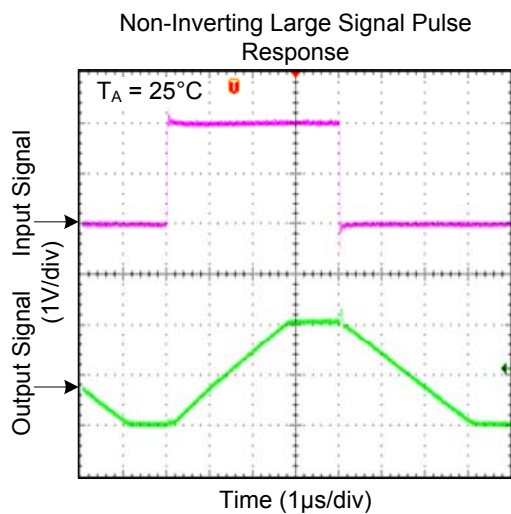
## ■ TYPICAL CHARACTERISTICS (Cont.)



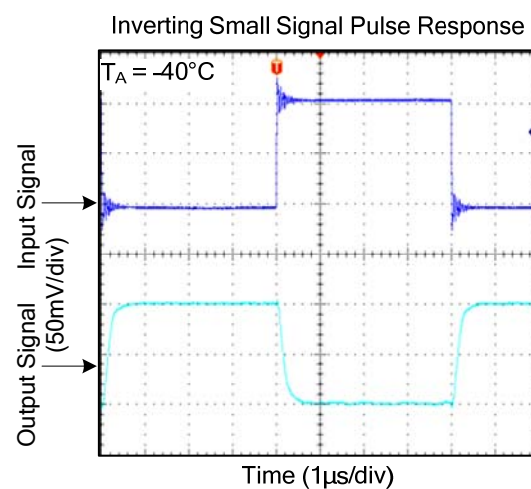
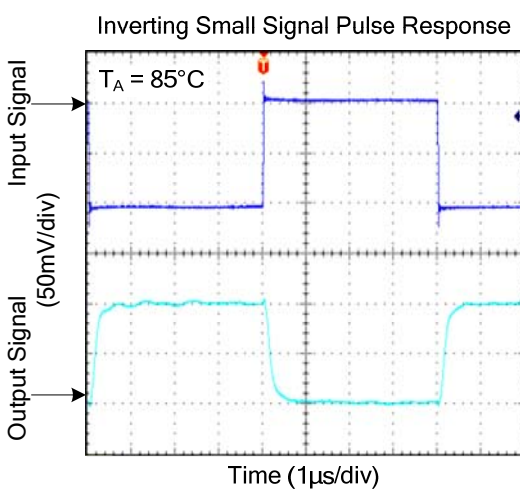
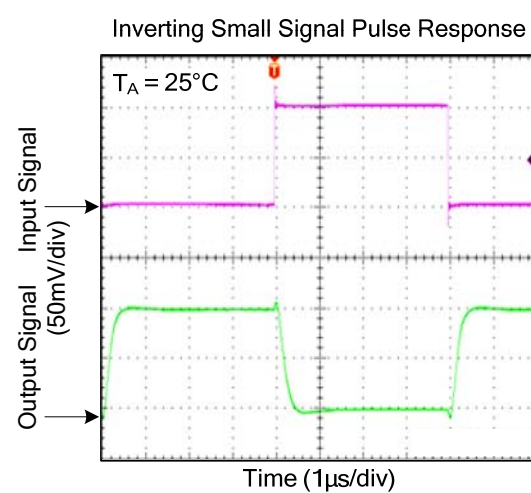
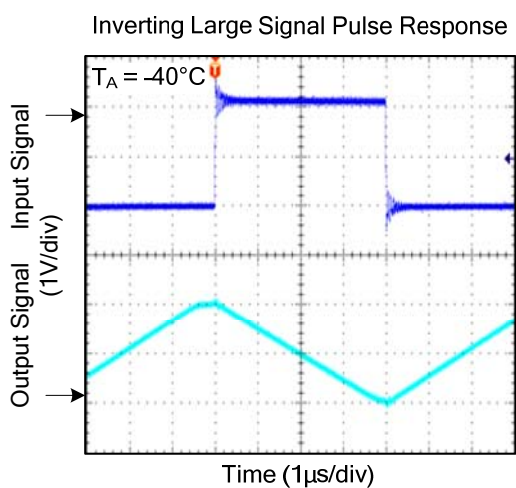
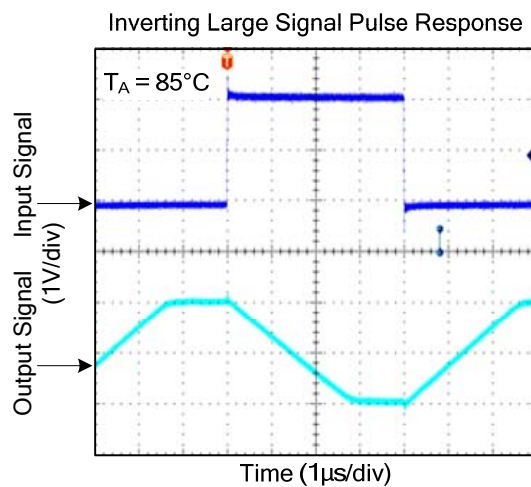
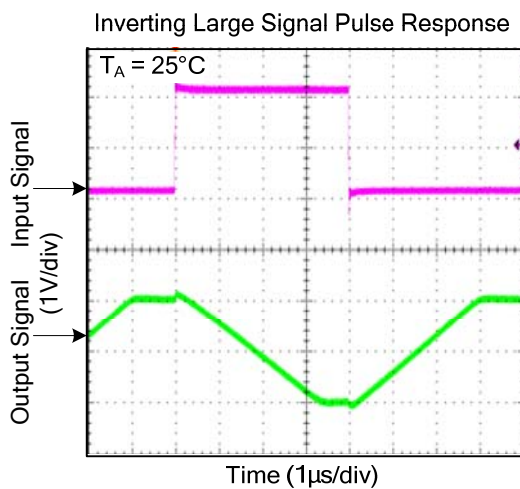
### ■ TYPICAL CHARACTERISTICS (Cont.)

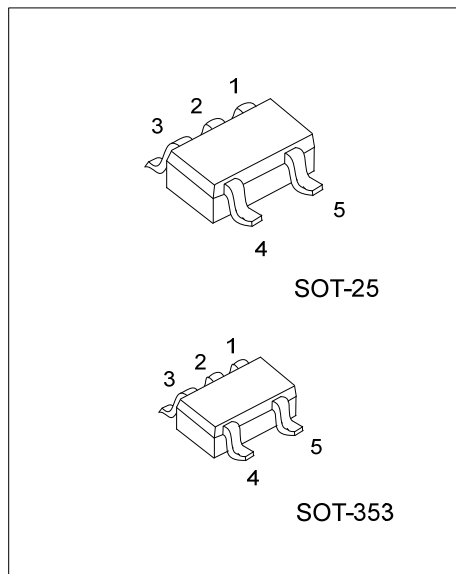


## ■ TYPICAL CHARACTERISTICS (Cont.)



## ■ TYPICAL CHARACTERISTICS (Cont.)





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