

# General purpose operational amplifier

# $\mu$ A741/ $\mu$ A741C/SA741C

## DESCRIPTION

The  $\mu$ A741 is a high performance operational amplifier with high open-loop gain, internal compensation, high common mode range and exceptional temperature stability. The  $\mu$ A741 is short-circuit-protected and allows for nulling of offset voltage.

## FEATURES

- Internal frequency compensation
- Short circuit protection
- Excellent temperature stability
- High input voltage range

## PIN CONFIGURATION

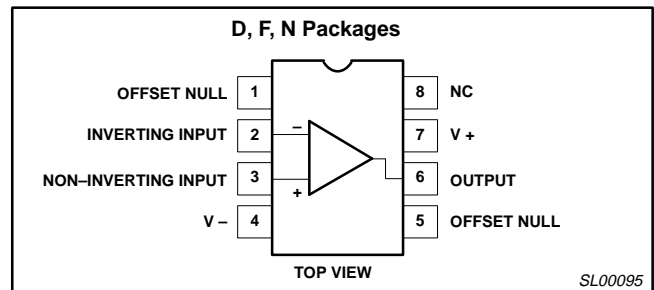


Figure 1. Pin Configuration

## ORDERING INFORMATION

| DESCRIPTION                                 | TEMPERATURE RANGE | ORDER CODE   | DWG #   |
|---|-------------------|--------------|---------|
| 8-Pin Plastic Dual In-Line Package (DIP)    | -55°C to +125°C   | $\mu$ A741N  | SOT97-1 |
| 8-Pin Plastic Dual In-Line Package (DIP)    | 0 to +70°C        | $\mu$ A741CN | SOT97-1 |
| 8-Pin Plastic Dual In-Line Package (DIP)    | -40°C to +85°C    | SA741CN      | SOT97-1 |
| 8-Pin Ceramic Dual In-Line Package (CERDIP) | -55°C to +125°C   | $\mu$ A741F  | 0580A   |
| 8-Pin Ceramic Dual In-Line Package (CERDIP) | 0 to +70°C        | $\mu$ A741CF | 0580A   |
| 8-Pin Small Outline (SO) Package            | 0 to +70°C        | $\mu$ A741CD | SOT96-1 |

## ABSOLUTE MAXIMUM RATINGS

| SYMBOL     | PARAMETER                              | RATING      | UNIT |
|------------|--|-------------|------|
| $V_S$      | Supply voltage                         |             |      |
|            | $\mu$ A741C                            | $\pm 18$    | V    |
|            | $\mu$ A741                             | $\pm 22$    | V    |
| $P_D$      | Internal power dissipation             |             |      |
|            | D package                              | 780         | mW   |
|            | N package                              | 1170        | mW   |
|            | F package                              | 800         | mW   |
| $V_{IN}$   | Differential input voltage             | $\pm 30$    | V    |
| $V_{IN}$   | Input voltage <sup>1</sup>             | $\pm 15$    | V    |
| $I_{SC}$   | Output short-circuit duration          | Continuous  |      |
| $T_A$      | Operating temperature range            |             |      |
|            | $\mu$ A741C                            | 0 to +70    | °C   |
|            | SA741C                                 | -40 to +85  | °C   |
|            | $\mu$ A741                             | -55 to +125 | °C   |
| $T_{STG}$  | Storage temperature range              | -65 to +150 | °C   |
| $T_{SOLD}$ | Lead soldering temperature (10sec max) | 300         | °C   |

### NOTES:

1. For supply voltages less than  $\pm 15V$ , the absolute maximum input voltage is equal to the supply voltage.

## General purpose operational amplifier

 $\mu$ A741/ $\mu$ A741C/SA741C**DC ELECTRICAL CHARACTERISTICS** $T_A = 25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$ , unless otherwise specified.

| SYMBOL                   | PARAMETER                       | TEST CONDITIONS   | $\mu$ A741 |          |     | $\mu$ A741C |          |                            | UNIT                         |    |
|--------------------------|---------------------------------|---|------------|----------|-----|-------------|----------|----------------------------|------------------------------|----|
|                          |                                 |   | Min        | Typ      | Max | Min         | Typ      | Max                        |                              |    |
| $V_{OS}$                 | Offset voltage                  | $R_S=10\text{k}\Omega$<br>$R_S=10\text{k}\Omega$ , over temp.     |            | 1.0      | 5.0 |             | 2.0      | 6.0                        | mV                           |    |
| $\Delta V_{OS}/\Delta T$ |                                 |   |            | 1.0      | 6.0 |             | 10       | 7.5                        | mV                           |    |
|                          |                                 |   |            |          | 10  |             |          | 10                         | $\mu\text{V}/^\circ\text{C}$ |    |
| $I_{OS}$                 | Offset current                  | Over temp.<br>$T_A=+125^\circ\text{C}$<br>$T_A=-55^\circ\text{C}$ |            | 20       | 200 |             | 20       | 200                        | nA                           |    |
| $\Delta I_{OS}/\Delta T$ |                                 |   |            | 7.0      | 200 |             |          | 300                        | nA                           |    |
|                          |                                 |   |            |          | 20  | 500         |          | 200                        | nA                           |    |
| $I_{BIAS}$               | Input bias current              | Over temp.<br>$T_A=+125^\circ\text{C}$<br>$T_A=-55^\circ\text{C}$ |            | 80       | 500 |             | 80       | 500                        | nA                           |    |
| $\Delta I_B/\Delta T$    |                                 |   |            | 30       | 500 |             |          | 800                        | nA                           |    |
|                          |                                 |   |            |          | 300 | 1500        |          | 1                          | nA                           |    |
|                          |                                 |   | 1          |          |     |             |          | $\text{nA}/^\circ\text{C}$ |                              |    |
| $V_{OUT}$                | Output voltage swing            | $R_L=10\text{k}\Omega$  | $\pm 12$   | $\pm 14$ |     | $\pm 12$    | $\pm 14$ |                            | V                            |    |
|                          |                                 | $R_L=2\text{k}\Omega$ , over temp.                                | $\pm 10$   | $\pm 13$ |     | $\pm 10$    | $\pm 13$ |                            | V                            |    |
| $A_{VOL}$                | Large-signal voltage gain       | $R_L=2\text{k}\Omega$ , $V_O=\pm 10\text{V}$                      | 50         | 200      |     | 20          | 200      |                            | V/mV                         |    |
|                          |                                 | $R_L=2\text{k}\Omega$ , $V_O=\pm 10\text{V}$ ,<br>over temp.      | 25         |          |     | 15          |          |                            | V/mV                         |    |
|                          | Offset voltage adjustment range |   |            | $\pm 30$ |     |             | $\pm 30$ |                            | mV                           |    |
| PSRR                     | Supply voltage rejection ratio  | $R_S \leq 10\text{k}\Omega$                                       |            |          |     |             | 10       | 150                        | $\mu\text{V}/\text{V}$       |    |
|                          |                                 | $R_S \leq 10\text{k}\Omega$ , over temp.                          |            | 10       | 150 |             |          |                            | $\mu\text{V}/\text{V}$       |    |
| CMRR                     | Common-mode rejection ratio     |   |            |          |     | 70          | 90       |                            | dB                           |    |
|                          |                                 | Over temp.  | 70         | 90       |     |             |          |                            | dB                           |    |
| $I_{CC}$                 | Supply current                  | $T_A=+125^\circ\text{C}$<br>$T_A=-55^\circ\text{C}$               |            | 1.4      | 2.8 |             | 1.4      | 2.8                        | mA                           |    |
|                          |                                 |   |            |          | 1.5 | 2.5         |          |                            |                              | mA |
|                          |                                 |   |            |          | 2.0 | 3.3         |          |                            |                              | mA |
| $V_{IN}$                 | Input voltage range             | ( $\mu$ A741, over temp.)   | $\pm 12$   | $\pm 13$ |     | $\pm 12$    | $\pm 13$ |                            | V                            |    |
| $R_{IN}$                 | Input resistance                |   | 0.3        | 2.0      |     | 0.3         | 2.0      |                            | M $\Omega$                   |    |
| $P_D$                    | Power consumption               | $T_A=+125^\circ\text{C}$<br>$T_A=-55^\circ\text{C}$               |            | 50       | 85  |             | 50       | 85                         | mW                           |    |
|                          |                                 |   |            |          | 45  | 75          |          |                            |                              | mW |
|                          |                                 |   |            |          | 45  | 100         |          |                            |                              | mW |
| $R_{OUT}$                | Output resistance               |   |            | 75       |     |             | 75       |                            | $\Omega$                     |    |
| $I_{SC}$                 | Output short-circuit current    |   | 10         | 25       | 60  | 10          | 25       | 60                         | mA                           |    |

## General purpose operational amplifier

 $\mu$ A741/ $\mu$ A741C/SA741C**DC ELECTRICAL CHARACTERISTICS** $T_A = 25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$ , unless otherwise specified.

| SYMBOL                   | PARAMETER                       | TEST CONDITIONS   | SA741C   |          |      | UNIT                         |
|--------------------------|---------------------------------|---|----------|----------|------|------------------------------|
|                          |                                 |   | Min      | Typ      | Max  |                              |
| $V_{OS}$                 | Offset voltage                  | $R_S=10\text{k}\Omega$                                    |          | 2.0      | 6.0  | mV                           |
| $\Delta V_{OS}/\Delta T$ |                                 | $R_S=10\text{k}\Omega$ , over temp.                       |          | 10       | 7.5  | $\mu\text{V}/^\circ\text{C}$ |
| $I_{OS}$                 | Offset current                  | Over temp.  |          | 20       | 200  | nA                           |
| $\Delta I_{OS}/\Delta T$ |                                 |   |          | 200      | 500  | $\text{pA}/^\circ\text{C}$   |
| $I_{BIAS}$               | Input bias current              | Over temp.  |          | 80       | 500  | nA                           |
| $\Delta I_B/\Delta T$    |                                 |   |          | 1        | 1500 | $\text{nA}/^\circ\text{C}$   |
| $V_{OUT}$                | Output voltage swing            | $R_L=10\text{k}\Omega$                                    | $\pm 12$ | $\pm 14$ |      | V                            |
|                          |                                 | $R_L=2\text{k}\Omega$ , over temp.                        | $\pm 10$ | $\pm 13$ |      | V                            |
| $A_{VOL}$                | Large-signal voltage gain       | $R_L=2\text{k}\Omega$ , $V_O=\pm 10\text{V}$              | 20       | 200      |      | V/mV                         |
|                          |                                 | $R_L=2\text{k}\Omega$ , $V_O=\pm 10\text{V}$ , over temp. | 15       |          |      | V/mV                         |
|                          | Offset voltage adjustment range |   |          | $\pm 30$ |      | mV                           |
| PSRR                     | Supply voltage rejection ratio  | $R_S \leq 10\text{k}\Omega$                               |          | 10       | 150  | $\mu\text{V}/\text{V}$       |
| CMRR                     | Common mode rejection ratio     |   | 70       | 90       |      | dB                           |
| $V_{IN}$                 | Input voltage range             | Over temp.  | $\pm 12$ | $\pm 13$ |      | V                            |
| $R_{IN}$                 | Input resistance                |   | 0.3      | 2.0      |      | $\text{M}\Omega$             |
| $P_d$                    | Power consumption               |   |          | 50       | 85   | mW                           |
| $R_{OUT}$                | Output resistance               |   |          | 75       |      | $\Omega$                     |
| $I_{SC}$                 | Output short-circuit current    |   |          | 25       |      | mA                           |

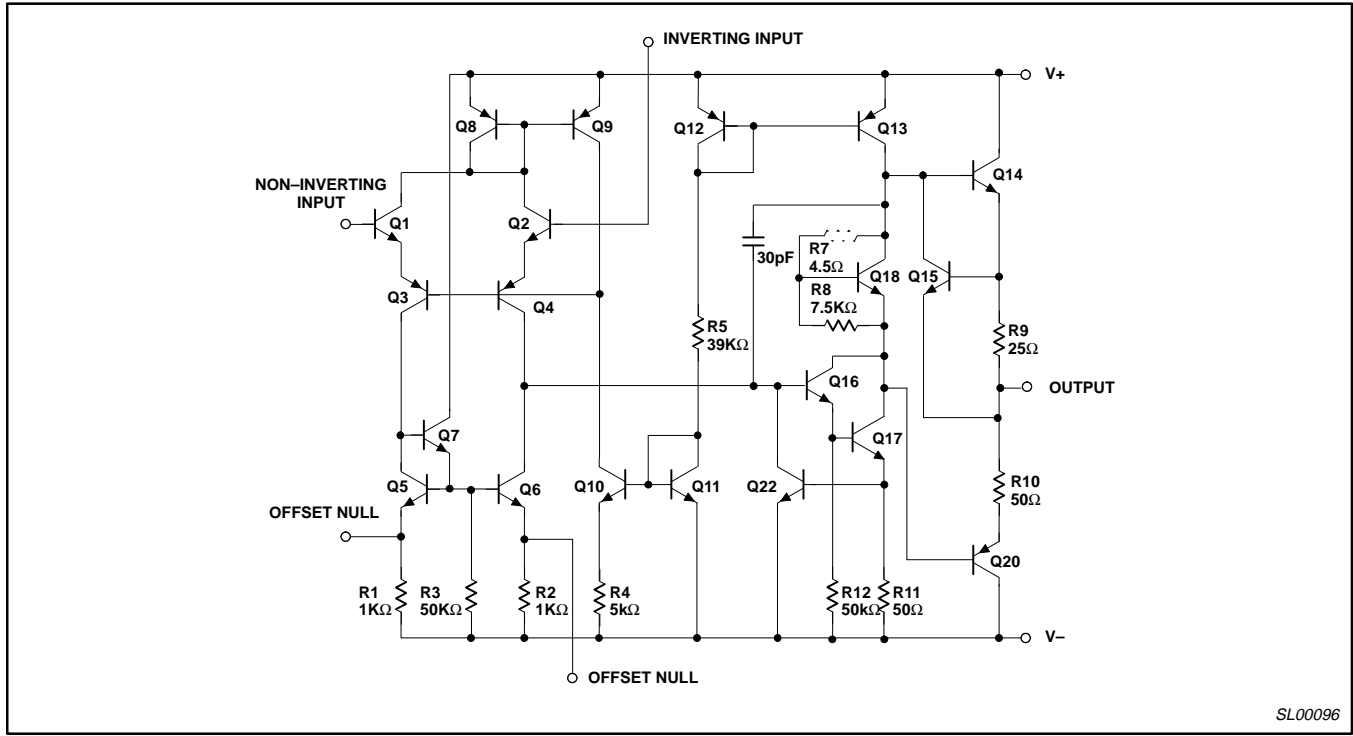
**AC ELECTRICAL CHARACTERISTICS** $T_A=25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$ , unless otherwise specified.

| SYMBOL   | PARAMETER                                  | TEST CONDITIONS  | $\mu$ A741, $\mu$ A741C |     |     | UNIT                   |
|----------|--|--|-------------------------|-----|-----|------------------------|
|          |  |  | Min                     | Typ | Max |                        |
| $R_{IN}$ | Parallel input resistance                  | Open-loop, $f=20\text{Hz}$   | 0.3                     |     |     | $\text{M}\Omega$       |
| $C_{IN}$ | Parallel input capacitance                 | Open-loop, $f=20\text{Hz}$   |                         | 1.4 |     | pF                     |
|          | Unity gain crossover frequency             | Open-loop  |                         | 1.0 |     | MHz                    |
| $t_R$    | Transient response unity gain<br>Rise time | $V_{IN}=20\text{mV}$ , $R_L=2\text{k}\Omega$ , $C_L \leq 100\text{pF}$       |                         | 0.3 |     | $\mu\text{s}$          |
|          |  |  |                         | 5.0 |     | %                      |
| SR       | Slew rate                                  | $C \leq 100\text{pF}$ , $R_L \geq 2\text{k}\Omega$ , $V_{IN}=\pm 10\text{V}$ |                         | 0.5 |     | $\text{V}/\mu\text{s}$ |

# General purpose operational amplifier

# $\mu$ A741/ $\mu$ A741C/SA741C

## EQUIVALENT SCHEMATIC



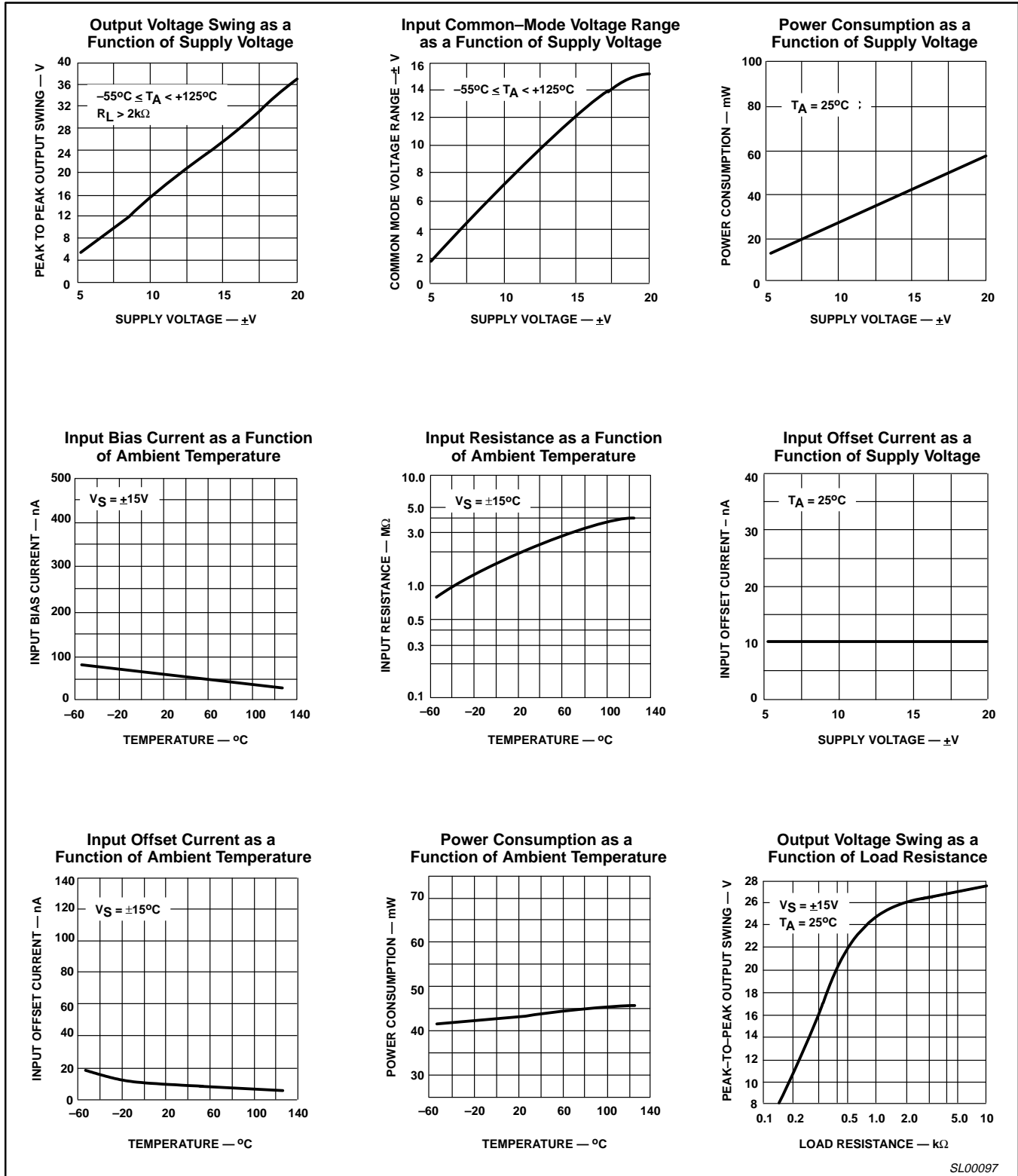
SL00096

Figure 2. Equivalent Schematic

# General purpose operational amplifier

# $\mu$ A741/ $\mu$ A741C/SA741C

## TYPICAL PERFORMANCE CHARACTERISTICS



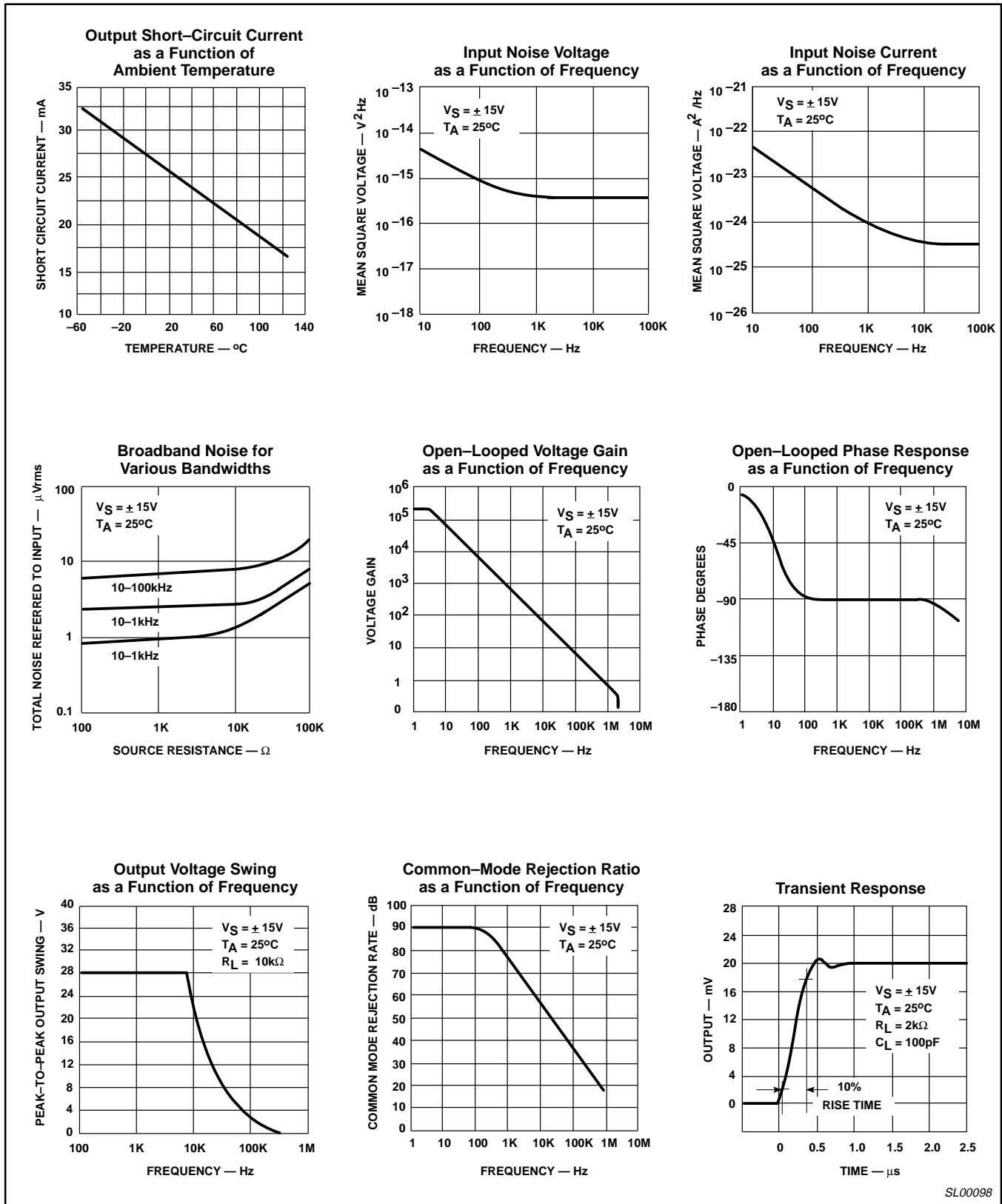
SL00097

Figure 3. Typical Performance Characteristics

General purpose operational amplifier

$\mu$ A741/ $\mu$ A741C/SA741C

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)



SL00098

Figure 4. Typical Performance Characteristics (cont.)

# General purpose operational amplifier

# $\mu$ A741/ $\mu$ A741C/SA741C

## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

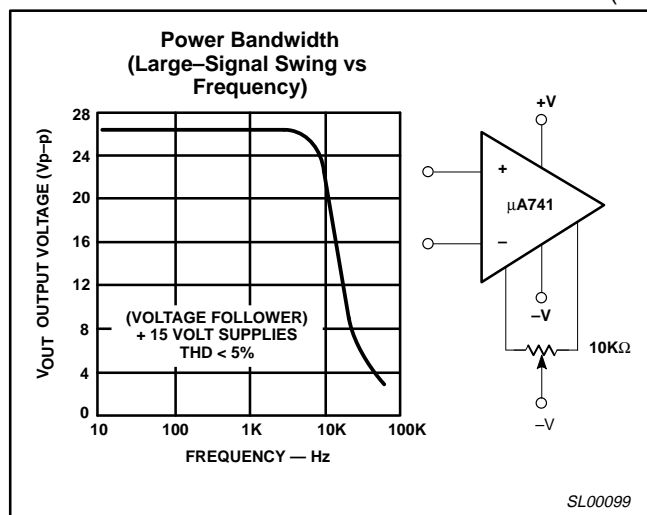


Figure 5. Typical Performance Characteristics (cont.)