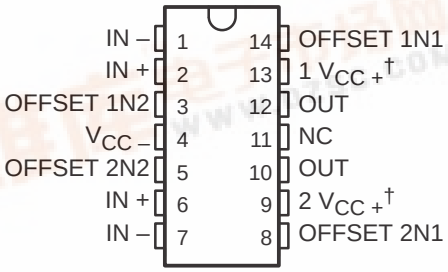
# uA747C, uA747M
# DUAL GENERAL-PURPOSE OPERATIONAL AMPLIFIERS

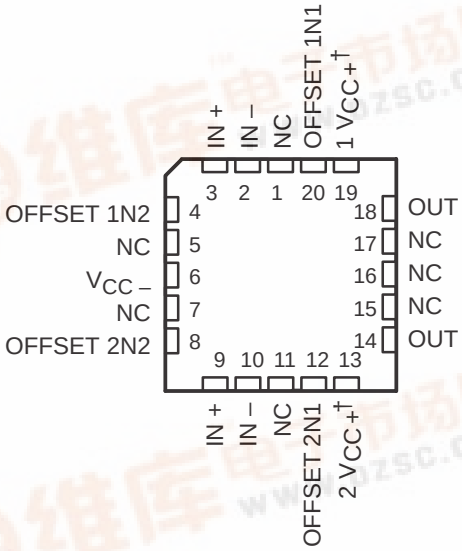
SLOS009A – D971, FEBRUARY 1971 – REVISED OCTOBER 1990

- **No Frequency Compensation Required**
- **Low Power Consumption**
- **Short-Circuit Protection**
- **Offset-Voltage Null Capability**
- **Wide Common-Mode and Differential Voltage Ranges**
- **No Latch-Up**
- **Designed to Be Interchangeable With Fairchild μA747C and μA747M**

**D, J, N, OR W PACKAGE**
**(TOP VIEW)**




**uA747m . . . FK PACKAGE**
**(TOP VIEW)**




NC – No internal connection

† The two positive supply terminals (1 $V_{CC+}$ and 2 $V_{CC+}$) are connected together internally.

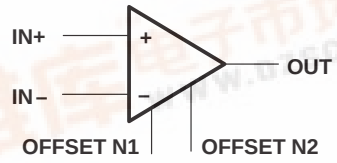
## description

The uA747 is a dual general-purpose operational amplifier featuring offset-voltage null capability. Each half is electrically similar to uA741.

The high common-mode input voltage range and the absence of latch-up make this amplifier ideal for voltage-follower applications. The device is short-circuit protected and the internal frequency compensation ensures stability without external components. A low-value potentiometer may be connected between the offset null inputs to null out the offset voltage as shown in Figure 2.

The uA747C is characterized for operation from 0°C to 70°C; the uA747M is characterized for operation over the full military temperature range of –55°C to 125°C.

## symbol (each amplifier)

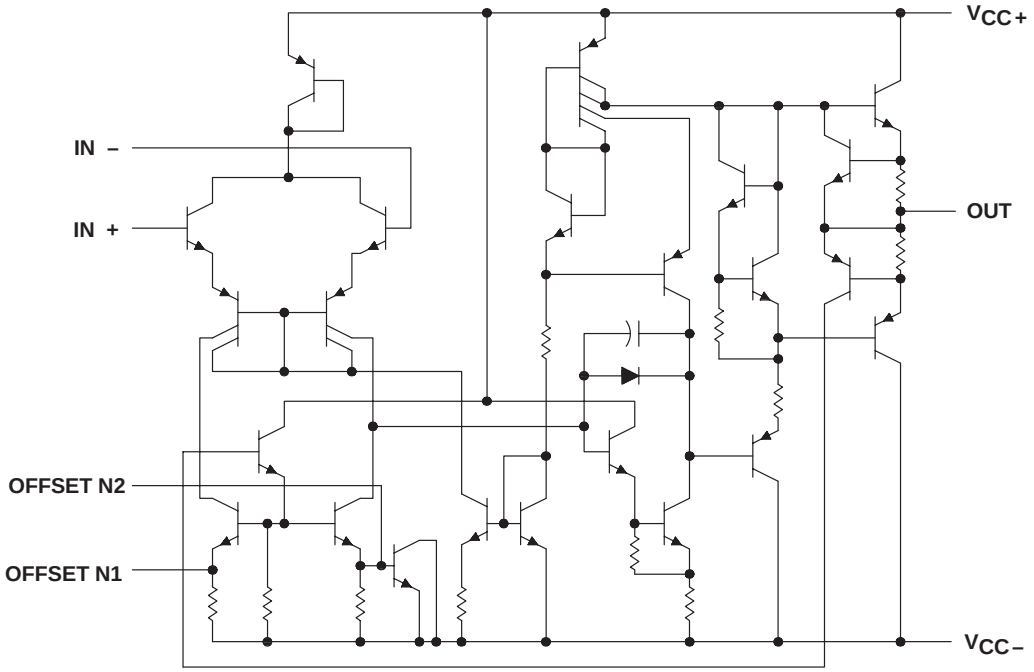



**AVAILABLE OPTIONS**

| $T_A$ | $V_{IO}$ Max AT 25°C | PACKAGE | | | | |
|---|---|---|---|---|---|---|
| | | 14-PIN | | | | 20-PIN |
| | | SMALL OUTLINE (D) | CERAMIC DIP (J) | PLASTIC DIP (N) | FLAT PACK (W) | CHIP CARRIER (FK) |
| 0°C to 70°C | 6 mV | uA747CD | — | uA747CN | — | — |
| –55°C to 125°C | 5 mV | — | uA747MJ | — | uA747MW | uA747MFK |

The D package is available taped and reeled. Add the suffix R to the device type, (i.e., uA747CDR).

## schematic (each amplifier)




## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

| | | uA747C | uA747M | UNIT |
|---|---|---|---|---|
| Supply voltage, $V_{CC+}$ (see Note 1) | | 18 | 22 | V |
| Supply voltage, $V_{CC-}$ (see Note 1) | | –18 | –22 | V |
| Differential input voltage (see Note 2) | | ±30 | ±30 | V |
| Input voltage any input (see Notes 1 and 3) | | ±15 | ±15 | V |
| Voltage between any offset null terminal (N1/N2) and $V_{CC-}$ | | ±0.5 | ±0.5 | V |
| Duration of output short circuit (see Note 4) | | unlimited | unlimited | |
| Continuous total dissipation | | See Dissipation Rating Table | | |
| Operating free-air temperature range | | 0 to 70 | –55 to 125 | °C |
| Storage temperature range | | –65 to 150 | –65 to 150 | °C |
| Case temperature for 60 seconds | FK package | | 260 | °C |
| Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds | J or W package | | 300 | °C |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds | D or N package | 260 | | °C |

NOTES: 1. All voltage values, unless otherwise noted, are with respect to the midpoint between $V_{CC+}$ and $V_{CC-}$.
2. Differential voltages are at the noninverting input terminal with respect to the inverting input terminal.
3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.
4. The output may be shorted to ground or either power supply. For the uA747M only, the unlimited duration of the short circuit applies at (or below) 125°C case temperature or 75°C free-air temperature.

**DISSIPATION RATING TABLE**

| PACKAGE | $T_A \le 25°C$ POWER RATING | DERATING FACTOR | DERATE ABOVE $T_A$ | $T_A = 70°C$ POWER RATING | $T_A = 125°C$ POWER RATING |
|---|---|---|---|---|---|
| D | 800 mW | 7.6 mW/°C | 45°C | 608 mW | — |
| FK | 800 mW | 11.0 mW/°C | 77°C | 800 mW | 275 mW |
| J | 800 mW | 11.0 mW/°C | 77°C | 800 mW | 275 mW |
| N | 800 mW | 9.2 mW/°C | 63°C | 736 mW | — |
| W | 800 mW | 8.0 mW/°C | 50°C | 640 mW | 200 mW |

## electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V

| PARAMETER | | TEST CONDITIONS† | $T_A$‡ | uA747C | | | uA747M | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_{IO}$ | Input offset voltage | $V_O$ = 0 | 25°C | | 1 | 6 | | 1 | 5 | mV |
| | | | Full range | | | 7.5 | | | 6 | |
| $\Delta V_{IO(adj)}$ | Offset voltage adjust range | | 25°C | | ±15 | | | ±15 | | mV |
| $I_{IO}$ | Input offset current | | 25°C | | 20 | 200 | | 20 | 200 | nA |
| | | | Full range | | | 300 | | | 500 | |
| $I_{IB}$ | Input bias current | | 25°C | | 80 | 500 | | 80 | 500 | nA |
| | | | Full range | | | 800 | | | 1500 | |
| $V_{ICR}$ | Common-mode input voltage range | | 25°C | ±12 | ±13 | | ±12 | ±13 | | V |
| | | | Full range | ±12 | | | ±12 | | | |
| $V_{O(PP)}$ | Maximum peak-to-peak output voltage swing | $R_L$ = 10 kΩ | 25°C | 24 | 28 | | 24 | 28 | | V |
| | | $R_L$ ≥ 10 kΩ | Full range | 24 | | | 24 | | | |
| | | $R_L$ = 2 kΩ | 25°C | 20 | 26 | | 20 | 26 | | |
| | | $R_L$ ≥ 2 kΩ | Full range | 20 | | | 20 | | | |
| $A_{VD}$ | Large-signal differential voltage amplification | $R_L$ ≥ 2 kΩ, $V_O$ = ± 10 V | 25°C | 25 | 200 | | 50 | 200 | | V/mV |
| | | | Full range | 15 | | | 25 | | | |
| $r_i$ | Input resistance | | 25°C | 0.3 | 2 | | 0.3* | 2 | | MΩ |
| $r_o$ | Output resistance | See Note 5 | 25°C | | 75 | | | 75 | | Ω |
| $C_i$ | Input capacitance | | 25°C | | 1.4 | | | 1.4 | | pF |
| CMRR | Common-mode rejection ratio | $V_{IC}$ = $V_{ICR}$ | 25°C | 70 | 90 | | 70 | 90 | | dB |
| | | | Full range | 70 | | | 70 | | | |
| $k_{SVS}$ | Supply-voltage sensitivity ($\Delta V_{IO}$ / $\Delta V_{CC}$) | $V_{CC}$ = ± 9 V to ± 15 V | 25°C | | 30 | 150 | | 30 | 150 | µV/V |
| | | | Full range | | | 150 | | | 150 | |
| $I_{OS}$ | Short-circuit output current | | 25°C | | ±25 | ±40 | | ±25 | ±40 | mA |
| $I_{CC}$ | Supply current (each amplifier) | No load | 25°C | | 1.7 | 2.8 | | 1.7 | 2.8 | mA |
| | | | Full range | | | 3.3 | | | 3.3 | |
| $P_D$ | Power dissipation (each amplifier) | No load, $V_O$ = 0 | 25°C | | 50 | 85 | | 50 | 85 | mW |
| | | | Full range | | | 100 | | | 100 | |
| $V_{o1}/V_{o2}$ | Channel separation | | 25°C | | 120 | | | 120 | 0 | dB |

† All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified.
‡ Full range for uA747C is 0°C to 70°C and for uA747M is –55°C to 125°C.
*On products compliant to MIL-STD-883, Class B, this parameter is not production tested.
NOTE 5: This typical value applies only at frequencies above a few hundred hertz because of the effects of drift and thermal feedback.

## operating characteristics, $V_{CC\pm}$ = ± 15 V, $T_A$ = 25°C

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| $t_r$ | Rise time | $V_I$ = 20 mV, $R_L$ = 2 kΩ, $C_L$ = 100 pF, See Figure 1 | | 0.3 | | µs |
| | Overshoot factor | | | 5% | | |
| SR | Slew rate at unity gain | $V_I$ = 10 mV, $R_L$ = 2 kΩ, $C_L$ = 100 pF, See Figure 1 | | 0.5 | | V/µs |

## PARAMETER MEASUREMENT INFORMATION

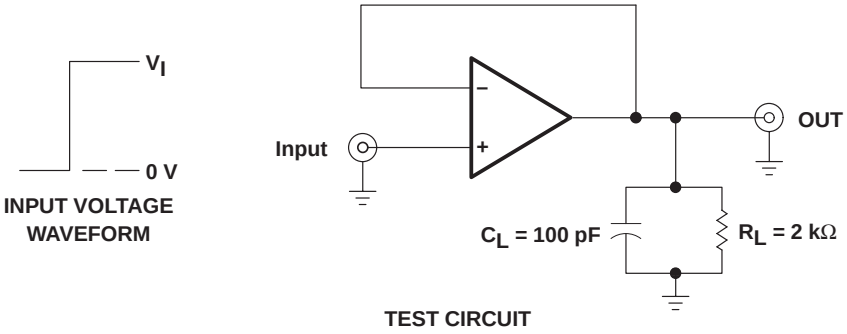



**Figure 1. Rise Time, Overshoot, and Slew Rate**

## APPLICATION INFORMATION

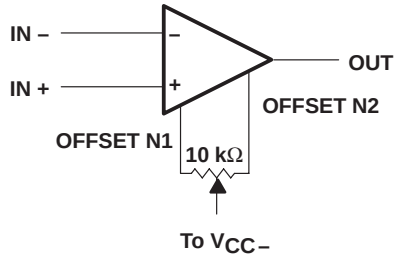



**Figure 2. Input Offset Voltage Null Circuit**

## TYPICAL CHARACTERISTICS†

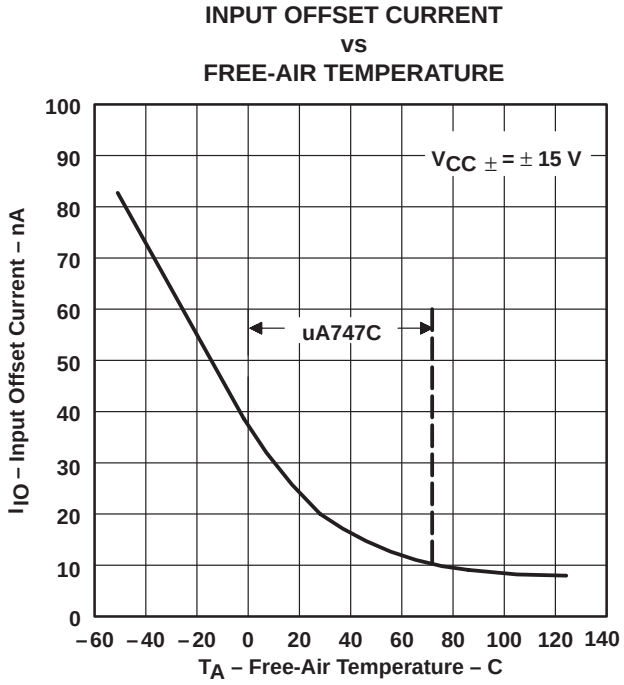



**Figure 3**

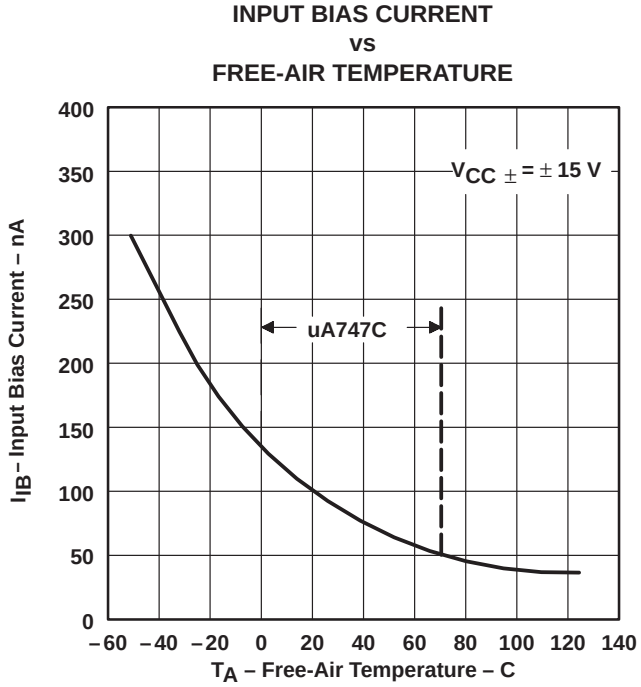



**Figure 4**

† Data at high and low temperatures are applicable only within the rated operating free-air temperature range of the particular devices.

## TYPICAL CHARACTERISTICS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs LOAD RESISTANCE

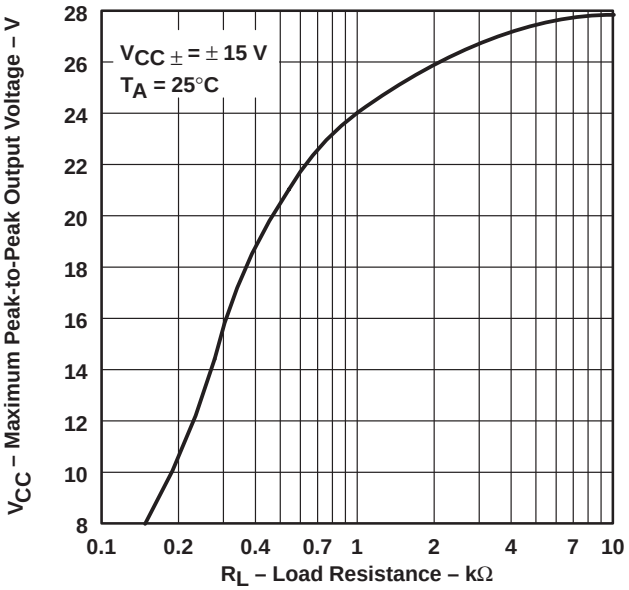



Figure 5

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs FREQUENCY

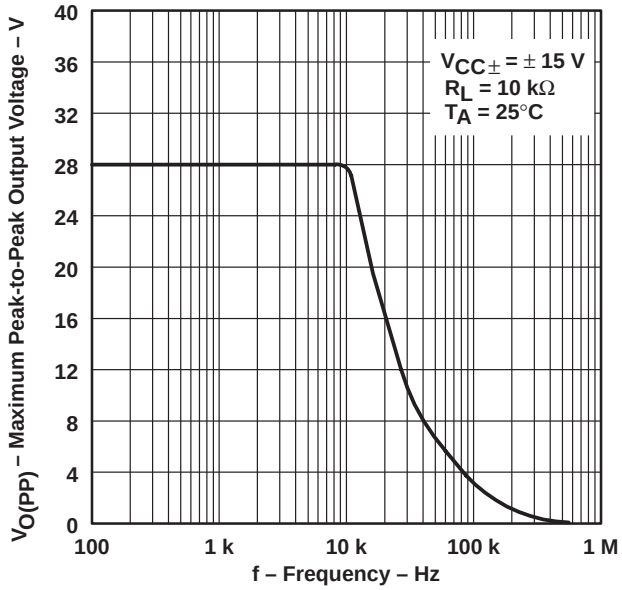



Figure 6

OPEN-LOOP LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION vs SUPPLY VOLTAGE

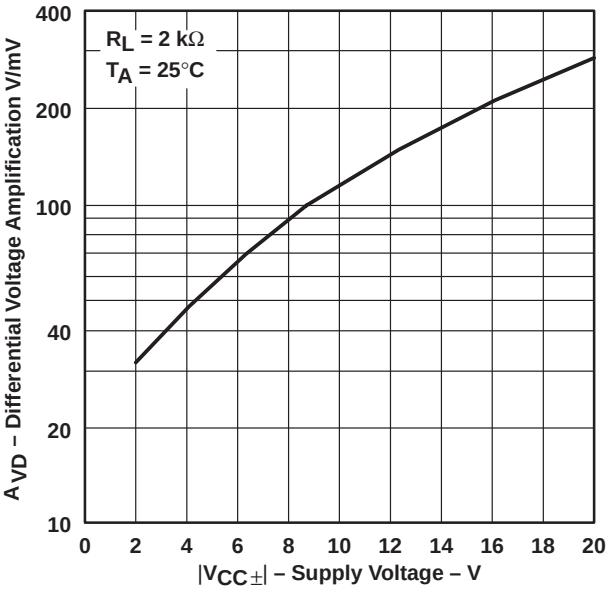



Figure 7

OPEN-LOOP LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION vs FREQUENCY

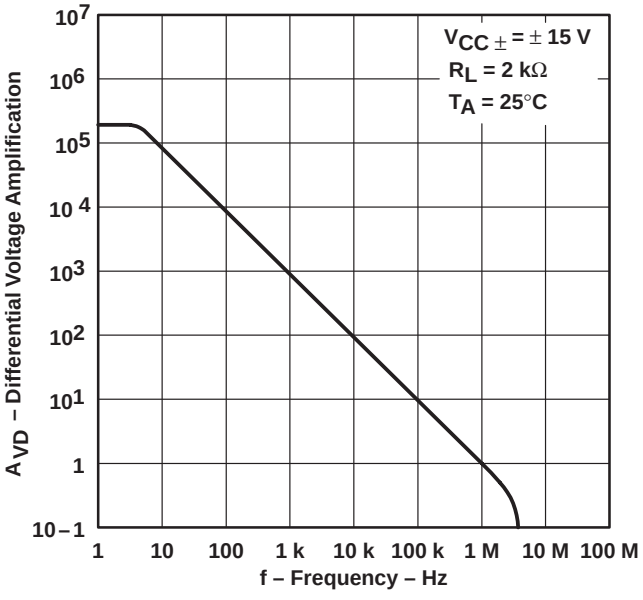



Figure 8

## TYPICAL CHARACTERISTICS

**COMMON-MODE REJECTION RATIO vs FREQUENCY**

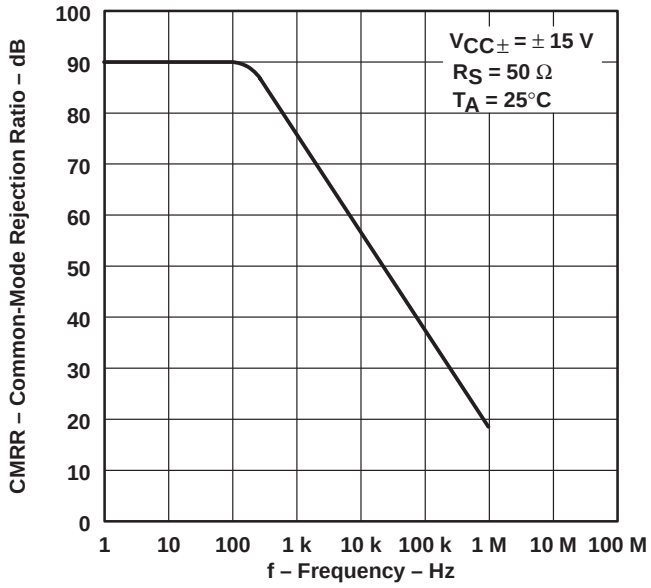



Figure 9

**OUTPUT VOLTAGE vs ELAPSED TIME**

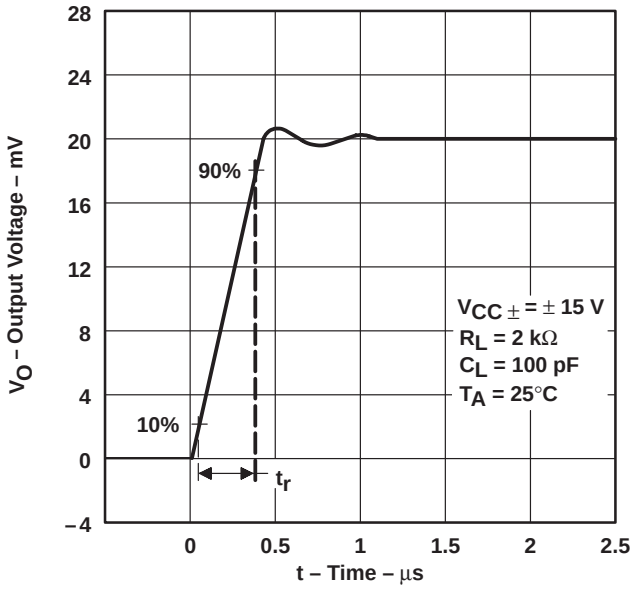



Figure 10

**VOLTAGE-FOLLOWER LARGE-SIGNAL PULSE RESPONSE**

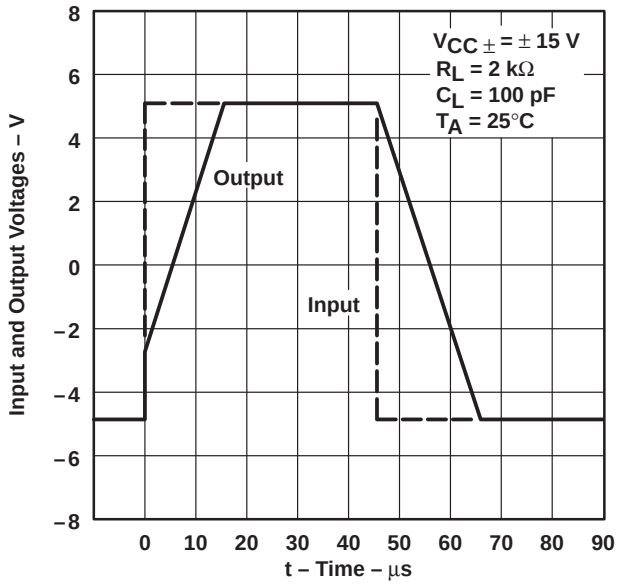



Figure 11

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