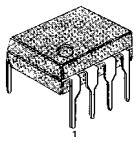
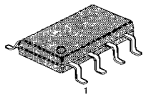
## SINGLE OPERATIONAL AMPLIFIERS

The LM741 series are general purpose operational amplifiers which feature improved performance over industry standards like the LM709. It is intended for a wide range of analog applications.
The high gain and wide range of operating voltage provide superior performance in integrator, summing amplifier, and general feedback applications.

8 DIP



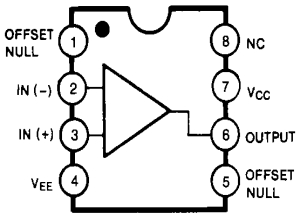
8 SOP



## FEATURES

- Short circuit protection
- Excellent temperature stability
- Internal frequency compensation
- High Input voltage range
- Null of offset

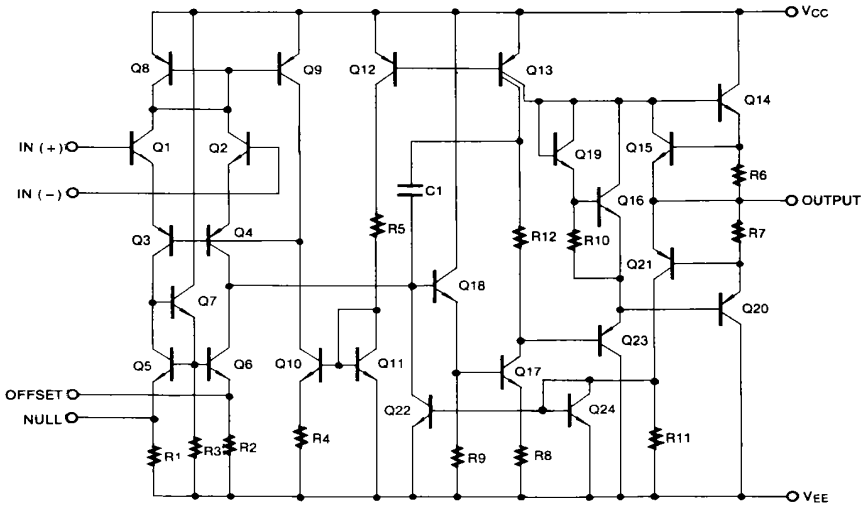
## BLOCK DIAGRAM




## ORDERING INFORMATION

| Device | Package | Operating Temperature |
|---|---|---|
| LM741N<br>LM741EN | 8 DIP | 0 ~ + 70°C |
| LM741M<br>LM741EM | 8 SOP | |
| LM741IN<br>LM741EIN | 8 DIP | -40 ~ +85 °C |
| LM741IM<br>LM741EIM | 8 SOP | |

## SCHEMATIC DIAGRAM




FAIRCHILD SEMICONDUCTOR TM

Rev. B

## ABSOLUTE MAXIMUM RATINGS ($T_A$=25 °C)

| Characteristic | Symbol | LM741 | LM741E | LM741I | Unit |
|---|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | ±18 | ±22 | ±18 | V |
| Differential Input Voltage | $V_{I(DIFF)}$ | 30 | 30 | 30 | V |
| Input Voltage | $V_I$ | ±15 | ±15 | ±15 | V |
| Output Short Circuit Duration | | Indefinite | Indefinite | Indefinite | |
| Power Dissipation | $P_D$ | 500 | 500 | 500 | mW |
| Operating Temperature Range | $T_{OPR}$ | 0 ~ + 70 | 0 ~ + 70 | -40 ~ + 85 | °C |
| Storage Temperature Range | $T_{STG}$ | -65 ~ + 150 | -65 ~ + 150 | -65 ~ + 150 | °C |

## ELECTRICAL CHARACTERISTICS

($V_{CC}$ = 15V, $V_{EE}$ = - 15V. $T_A$ = 25 °C, unless otherwise specified)

| Characteristic | Symbol | Test Conditions | | LM741E | | | LM741/LM741I | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage | $V_{IO}$ | $R_S$≤10KΩ | | | | | | 2.0 | 6.0 | mV |
| | | $R_S$≤50Ω | | | 0.8 | 3.0 | | | | |
| Input Offset Voltage Adjustment Range | $V_{IO(R)}$ | $V_{CC}$ = ±20V | | ±10 | | | | ±15 | | mV |
| Input Offset Current | $I_{IO}$ | | | | 3.0 | 30 | | 20 | 200 | nA |
| Input Bias Current | $I_{BIAS}$ | | | | 30 | 80 | | 80 | 500 | nA |
| Input Resistance | $R_I$ | $V_{CC}$ =±20V | | 1.0 | 6.0 | | 0.3 | 2.0 | | MΩ |
| Input Voltage Range | $V_{I(R)}$ | | | ±12 | ±13 | | ±12 | ±13 | | V |
| Large Signal Voltage Gain | $G_V$ | $R_L$≥2KΩ | $V_{CC}$ =±20V, $V_{O(P.P)}$ =±15V | 50 | | | | | | V/mV |
| | | | $V_{CC}$ =±15V, $V_{O(P.P)}$ =±10V | | | | 20 | 200 | | |
| Output Short Circuit Current | $I_{SC}$ | | | 10 | 25 | 35 | | 25 | | mA |
| Output Voltage Swing | $V_{O(P.P)}$ | $V_{CC}$ = ±20V | $R_L$≥10KΩ | ±16 | | | | | | V |
| | | | $R_L$≥10KΩ | ±15 | | | | | | |
| | | $V_{CC}$ = ±15V | $R_L$≥10KΩ | | | | ±12 | ±14 | | |
| | | | $R_L$≥10KΩ | | | | ±10 | ±13 | | |
| Common Mode Reiection Ratio | CMRR | $R_S$≤10KΩ, $V_{CM}$ = ±12V | | | | | 70 | 90 | | dB |
| | | $R_S$≤50KΩ, $V_{CM}$ = ±12V | | 80 | 95 | | | | | |
| Power Supply Rejection Ratio | PSRR | $V_{CC}$ = ±15V to $V_{CC}$ = ±15V $R_S$≤50Ω | | 86 | 96 | | | | | dB |
| | | $V_{CC}$ = ±15V to $V_{CC}$ = ±15V $R_S$≤10KΩ | | | | | 77 | 96 | | |

## ELECTRICAL CHARACTERISTICS (Continued)

| Characteristic | | Symbol | Test Conditions | LM741E | | | LM741/LM741I | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Typ | Max | |
| Transient Response | Rise Time | $t_R$ | Unity Gain | | 0.25 | 0.8 | | 0.3 | | μs |
| | Overshoot | OS | | | 6.0 | 20 | | 10 | | % |
| Bandwidth | | BW | | 0.43 | 1.5 | | | | | MHz |
| Slew Rate | | SR | Unity Gain | 0.3 | 0.7 | | | 0.5 | | V/μs |
| Supply Current | | $I_{CC}$ | $R_L = \infty\Omega$ | | | | | 1.5 | 2.8 | mA |
| Power Consumption | | $P_C$ | $V_{CC} = \pm 20V$ | | 80 | 150 | | | | mW |
| | | | $V_{CC} = \pm 15V$ | | | | | 50 | 85 | |

## ELECTRICAL CHARACTERISTICS

( -40 °C ≤$T_A$≤85 °C for the KA741I °C ≤$T_A$≤70 °C for the LM741 and LM741E. $V_{CC}$ = ±15V, unless otherwise specified)

| Characteristic | Symbol | Test Conditions | | LM741E | | | LM741/LM741I | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Typ | Max | |
| Input Offset Voltage | $V_{IO}$ | $R_S \leq 50\Omega$ | | | | 4.0 | | | | mV |
| | | $R_S \leq 10K\Omega$ | | | | | | | 7.5 | |
| Input Offset Voltage Drift | $\Delta V_{IO}/\Delta T$ | | | | 15 | | | | | μV/ °C |
| Input Offset Current | $I_{IO}$ | | | | | 70 | | | 300 | nA |
| Input Offset Current Drift | $\Delta I_{IO}/\Delta T$ | | | | | 0.5 | | | | nA/ °C |
| Input Bias Current | $I_{BIAS}$ | | | | | 0.21 | | | 0.8 | μA |
| Input Resistance | $R_I$ | $V_{CC} = \pm 20V$ | | 0.5 | | | | | | MΩ |
| Input Voltage Range | $V_{I(R)}$ | | | ±12 | ±13 | | ±12 | ±13 | | V |
| Output Voltage Swing | $V_{O(P.P)}$ | $V_{CC}$ =±20V | $R_S \geq 10K\Omega$ | ±16 | | | | | | V |
| | | | $R_S \geq 2K\Omega$ | ±15 | | | | | | |
| | | $V_{CC}$ =±15V | $R_S \geq 10K\Omega$ | | | | ±12 | ±14 | | |
| | | | $R_S \geq 2K\Omega$ | | | | ±10 | ±13 | | |
| Output Short Circuit Current | $I_{SC}$ | | | 10 | | 40 | 10 | | 40 | mA |
| Common Mode Rejection Ratio | CMRR | $R_S \leq 10K\Omega$, $V_{CM} = \pm 12V$ | | | | | 70 | 90 | | dB |
| | | $R_S \leq 50K\Omega$, $V_{CM} = \pm 12V$ | | 80 | 95 | | | | | |
| Power Supply Rejection Ratio | PSRR | $V_{CC}$ = ±20V to ±5V | $R_S \leq 50\Omega$ | 86 | 96 | | | | | dB |
| | | | $R_S \leq 10K\Omega$ | | | | 77 | 96 | | |
| Large Signal Voltage Gain | $G_V$ | $R_S \geq 2K\Omega$ | $V_{CC} = \pm 20V$, $V_{O(P-P)} = \pm 15V$ | 32 | | | | | | V/mV |
| | | | $V_{CC} = \pm 15V$, $V_{O(P.P)} = \pm 10V$ | | | | 15 | | | |
| | | | $V_{CC} = \pm 15V$, $V_{O(P-P)} = \pm 2V$ | 10 | | | | | | |

## TYPICAL PERFORMANCE CHARACTERISTICS

Fig. 7 OUTPUT RESISTANCE vs FREQUENCY

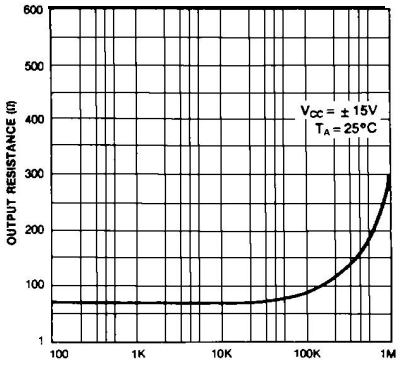



Fig. 8 INPUT RESISTANCE AND INPUT CAPACITANCE vs FREQUENCY

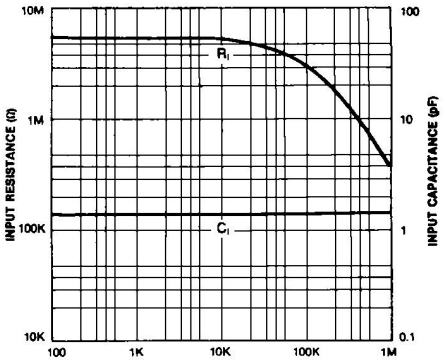



Fig. 9 INPUT BIAS CURRENT vs AMBIENT TEMPERATURE

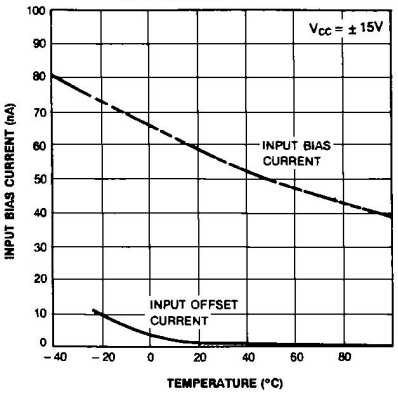



Fig. 10 POWER CONSUMPTION vs AMBIENT TEMPERATURE

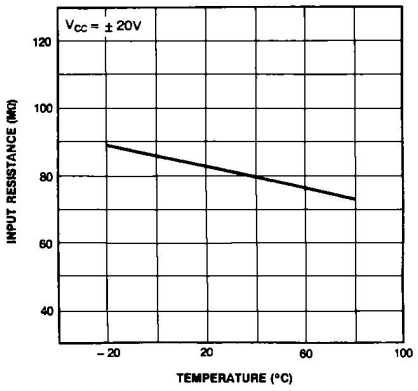



Fig. 11 INPUT OFFSET CURRENT vs AMBIENT TEMPERATURE

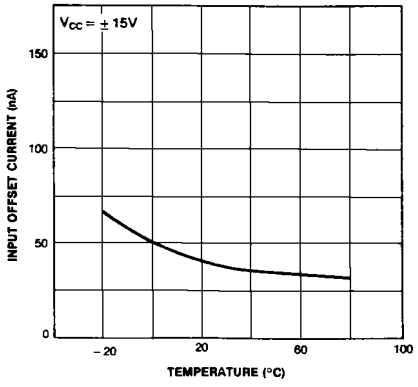



Fig. 12 INPUT RESISTANCE vs AMBIENT TEMPERATURE

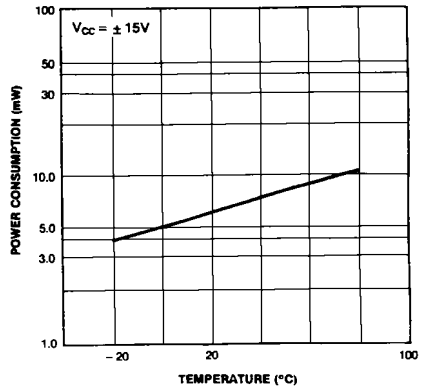


**Fig. 13 NORMALIZED DC PARAMETERS vs AMBIENT TEMPERATURE**

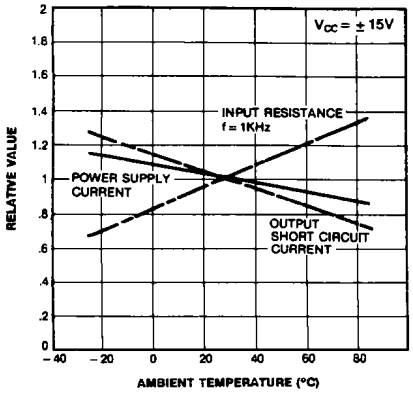



**Fig. 14 FREQUENCY CHARACTERISTICS vs AMBIENT TEMPERATURE**

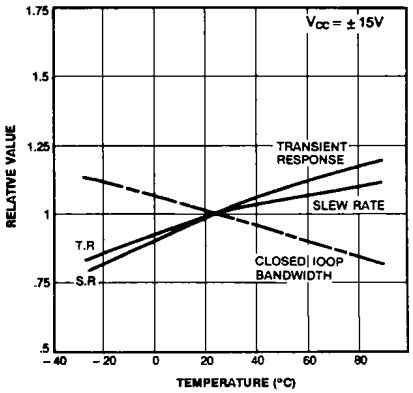



**Fig. 15 FREQUENCY CHARACTERISTICS vs SUPPLY VOLTAGE**

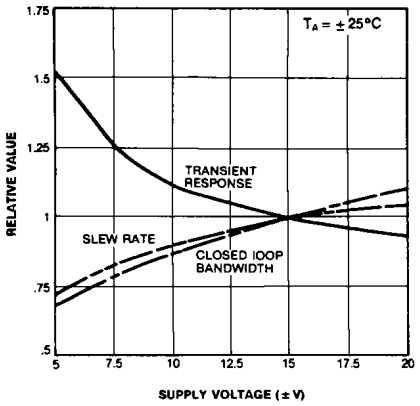



**Fig. 16 OUTPUT SHORT CIRCUIT CURRENT vs AMBIENT TEMPERATURE**

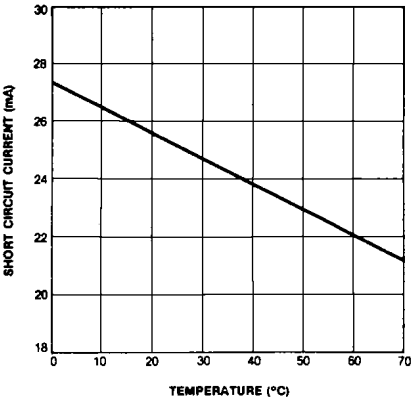



**Fig. 17 TRANSIENT RESPONSE**

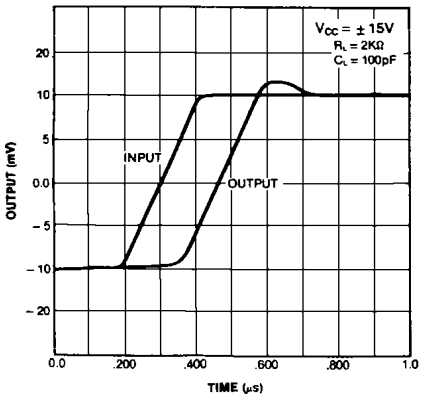



**Fig. 18 COMMON-MODE REJECTION RATIO vs FREQUENCY**

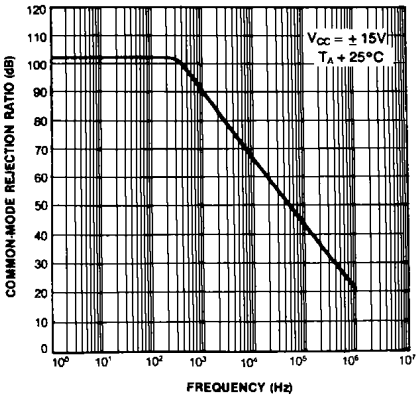


Fig. 18 VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE

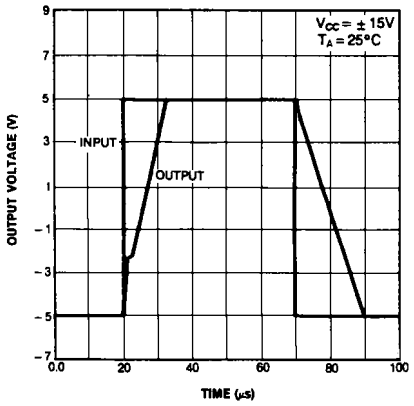
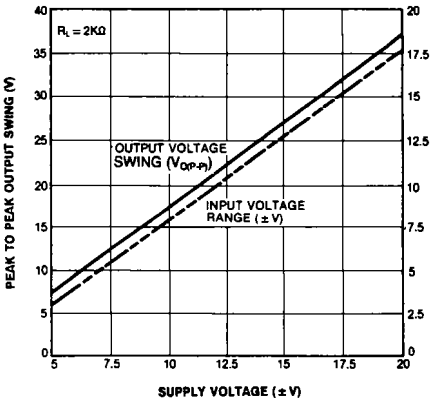



Fig. 19 OUTPUT SWING AND INPUT RANGE vs SUPPLY VOLTAGE



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