

- Short-Circuit Protection
- Offset-Voltage Null Capability
- Large Common-Mode and Differential Voltage Ranges
- No Frequency Compensation Required
- Low Power Consumption
- No Latch-Up
- Designed to Be Interchangeable With Fairchild μA741

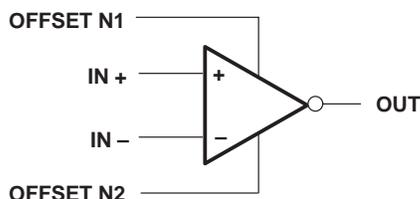
### description

The μA741 is a general-purpose operational amplifier featuring offset-voltage null capability.

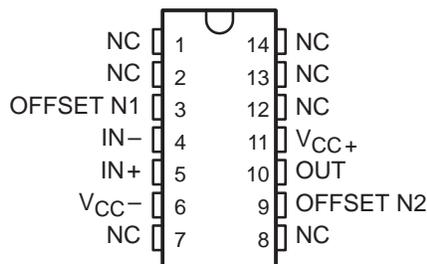
The high common-mode input voltage range and the absence of latch-up make the amplifier ideal for voltage-follower applications. The device is short-circuit protected and the internal frequency compensation ensures stability without external components. A low value potentiometer may be connected between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

The μA741C is characterized for operation from 0°C to 70°C. The μA741I is characterized for operation from -40°C to 85°C. The μA741M is characterized for operation over the full military temperature range of -55°C to 125°C.

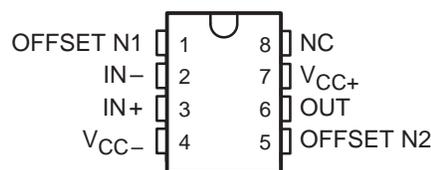
### symbol



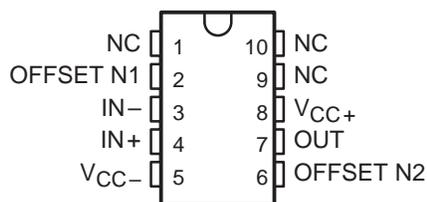
μA741M . . . J PACKAGE  
(TOP VIEW)



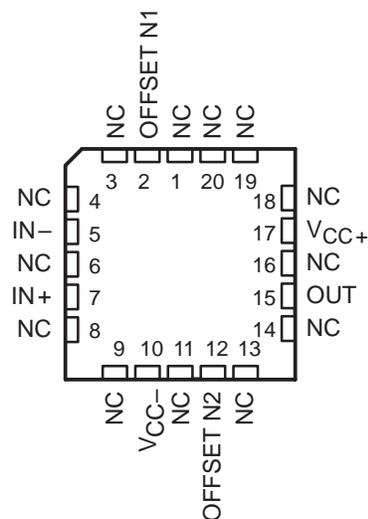
μA741M . . . JG PACKAGE  
μA741C, μA741I . . . D, P, OR PW PACKAGE  
(TOP VIEW)



μA741M . . . U PACKAGE  
(TOP VIEW)



μA741M . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

# μA741, μA741Y GENERAL-PURPOSE OPERATIONAL AMPLIFIERS

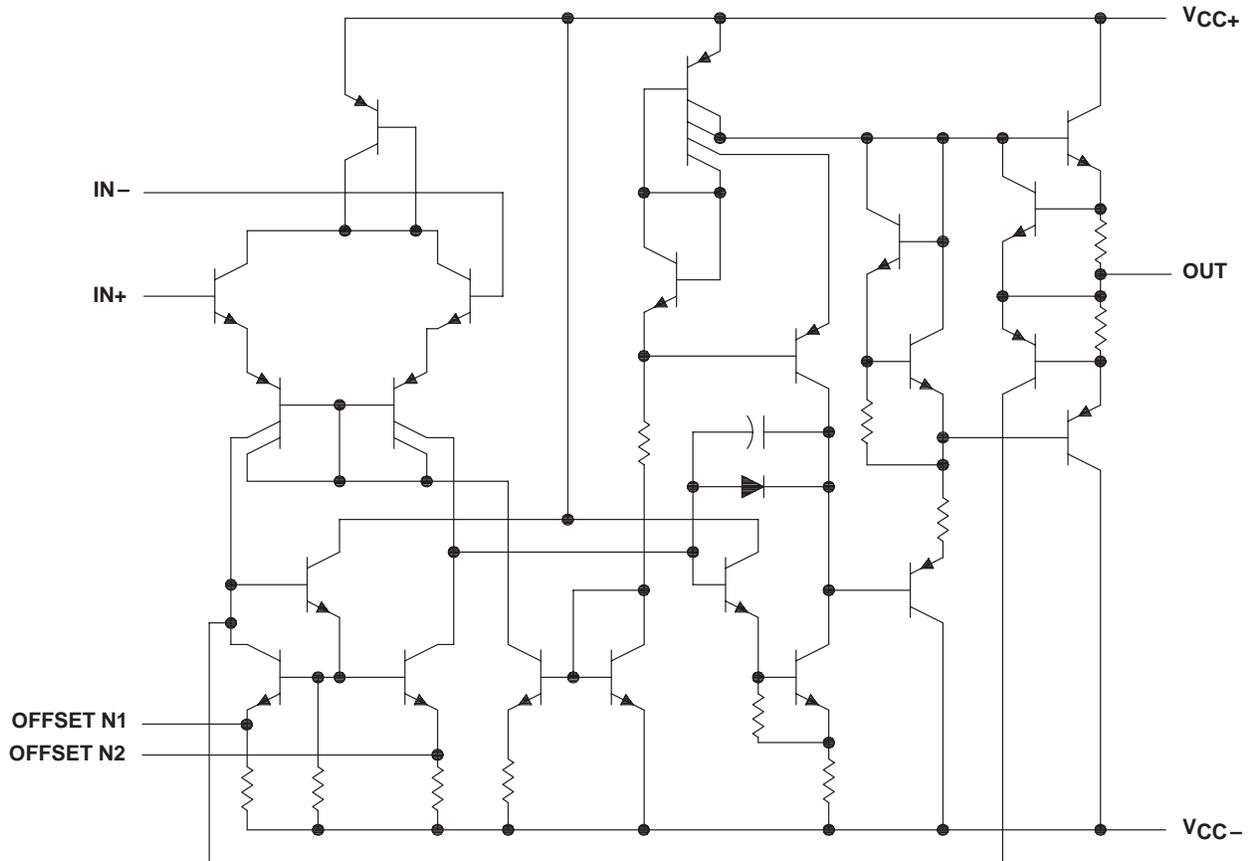
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## AVAILABLE OPTIONS

T <sub>A</sub>	PACKAGED DEVICES							CHIP FORM (Y)
	SMALL OUTLINE (D)	CHIP CARRIER (FK)	CERAMIC DIP (J)	CERAMIC DIP (JG)	PLASTIC DIP (P)	TSSOP (PW)	FLAT PACK (U)	
0°C to 70°C	μA741CD				μA741CP	μA741CPW		μA741Y
-40°C to 85°C	μA741ID				μA741IP			
-55°C to 125°C		μA741MFK	μA741MJ	μA741MJG			μA741MU	

The D package is available taped and reeled. Add the suffix R (e.g., μA741CDR).

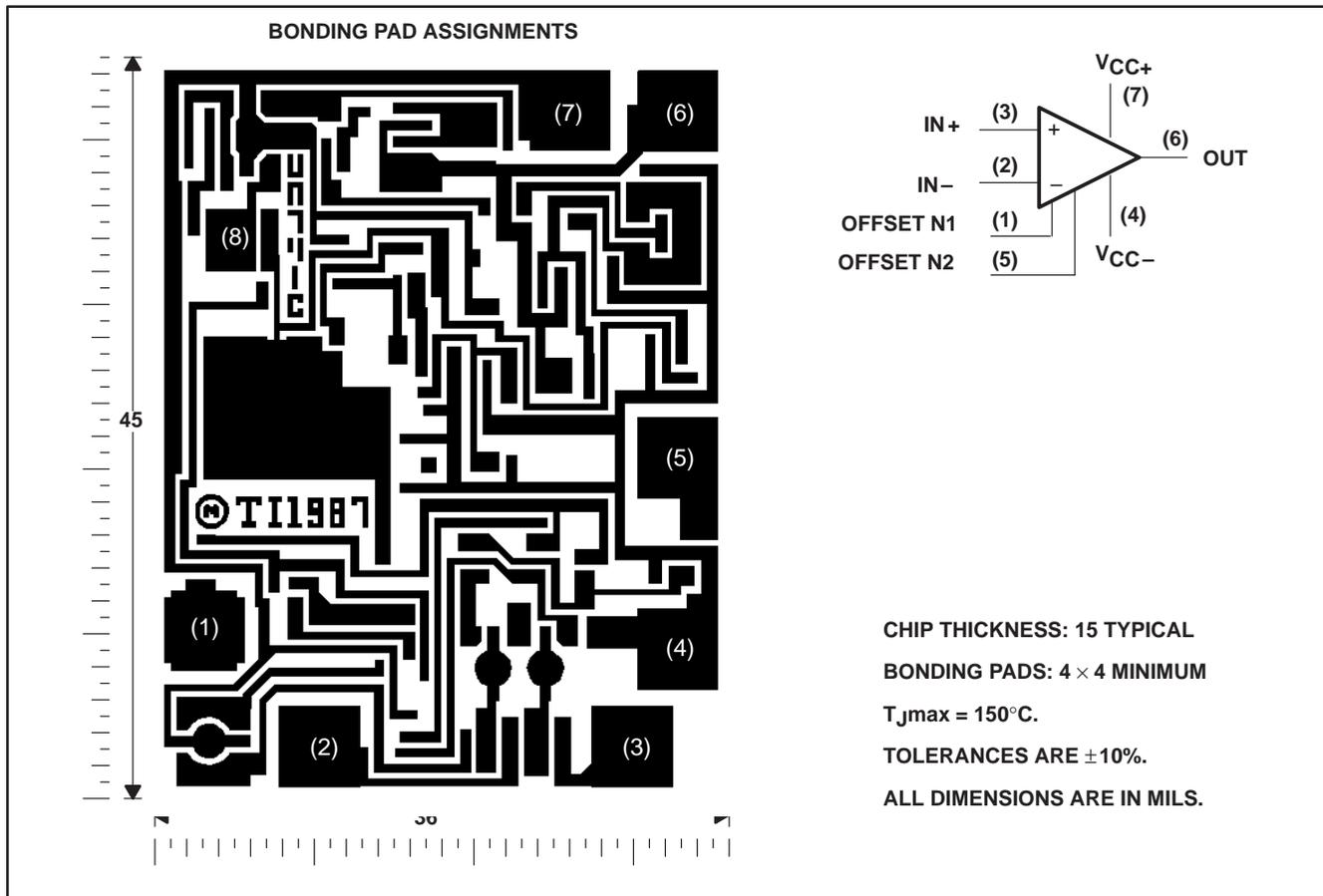
## schematic



Component Count	
Transistors	22
Resistors	11
Diode	1
Capacitor	1

### μA741Y chip information

This chip, when properly assembled, displays characteristics similar to the μA741C. Thermal compression or ultrasonic bonding may be used on the doped-aluminum bonding pads. Chips may be mounted with conductive epoxy or a gold-silicon preform.



# $\mu$ A741, $\mu$ A741Y GENERAL-PURPOSE OPERATIONAL AMPLIFIERS

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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

	$\mu$ A741C	$\mu$ A741I	$\mu$ A741M	UNIT
Supply voltage, $V_{CC+}$ (see Note 1)	18	22	22	V
Supply voltage, $V_{CC-}$ (see Note 1)	-18	-22	-22	V
Differential input voltage, $V_{ID}$ (see Note 2)	$\pm 15$	$\pm 30$	$\pm 30$	V
Input voltage, $V_I$ any input (see Notes 1 and 3)	$\pm 15$	$\pm 15$	$\pm 15$	V
Voltage between offset null (either OFFSET N1 or OFFSET N2) and $V_{CC-}$	$\pm 15$	$\pm 0.5$	$\pm 0.5$	V
Duration of output short circuit (see Note 4)	unlimited	unlimited	unlimited	
Continuous total power dissipation	See Dissipation Rating Table			
Operating free-air temperature range, $T_A$	0 to 70	-40 to 85	-55 to 125	$^{\circ}$ C
Storage temperature range	-65 to 150	-65 to 150	-65 to 150	$^{\circ}$ C
Case temperature for 60 seconds	FK package		260	$^{\circ}$ C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	J, JG, or U package		300	$^{\circ}$ C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	D, P, or PW package		260	$^{\circ}$ C

<sup>†</sup> Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- 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  $IN+$  with respect to  $IN-$ .  
 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  $\mu$ A741M only, the unlimited duration of the short circuit applies at (or below) 125 $^{\circ}$ C case temperature or 75 $^{\circ}$ C free-air temperature.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^{\circ}$ C POWER RATING	DERATING FACTOR	DERATE ABOVE $T_A$	$T_A = 70^{\circ}$ C POWER RATING	$T_A = 85^{\circ}$ C POWER RATING	$T_A = 125^{\circ}$ C POWER RATING
D	500 mW	5.8 mW/ $^{\circ}$ C	64 $^{\circ}$ C	464 mW	377 mW	N/A
FK	500 mW	11.0 mW/ $^{\circ}$ C	105 $^{\circ}$ C	500 mW	500 mW	275 mW
J	500 mW	11.0 mW/ $^{\circ}$ C	105 $^{\circ}$ C	500 mW	500 mW	275 mW
JG	500 mW	8.4 mW/ $^{\circ}$ C	90 $^{\circ}$ C	500 mW	500 mW	210 mW
P	500 mW	N/A	N/A	500 mW	500 mW	N/A
PW	525 mW	4.2 mW/ $^{\circ}$ C	25 $^{\circ}$ C	336 mW	N/A	N/A
U	500 mW	5.4 mW/ $^{\circ}$ C	57 $^{\circ}$ C	432 mW	351 mW	135 mW



**μA741, μA741Y**  
**GENERAL-PURPOSE OPERATIONAL AMPLIFIERS**

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**electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15$  V (unless otherwise noted)**

PARAMETER	TEST CONDITIONS	$T_A$ †	μA741C			μA741I, μA741M			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	$V_O = 0$	25°C		±15			±15		mV
$I_{IO}$ Input offset current	$V_O = 0$	25°C		20	200		20	200	nA
		Full range			300			500	
$I_{IB}$ Input bias current	$V_O = 0$	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	
$V_{OM}$ Maximum peak output voltage swing	$R_L = 10$ kΩ	25°C		±12	±14		±12	±14	V
	$R_L \geq 10$ kΩ	Full range			±12			±12	
	$R_L = 2$ kΩ	25°C		±10	±13		±10	±13	
	$R_L \geq 2$ kΩ	Full range			±10			±10	
$A_{VD}$ Large-signal differential voltage amplification	$R_L \geq 2$ kΩ	25°C		20	200		50	200	V/mV
	$V_O = \pm 10$ V	Full range			15			25	
$r_i$ Input resistance		25°C		0.3	2		0.3	2	MΩ
$r_o$ Output resistance	$V_O = 0$ , See Note 5	25°C			75			75	Ω
$C_i$ Input capacitance		25°C			1.4			1.4	pF
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICRmin}$	25°C		70	90		70	90	dB
		Full range			70			70	
$k_{SVS}$ Supply voltage sensitivity ( $\Delta V_{IO}/\Delta V_{CC}$ )	$V_{CC} = \pm 9$ V to $\pm 15$ 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	$V_O = 0$ , No load	25°C		1.7	2.8		1.7	2.8	mA
		Full range			3.3			3.3	
$P_D$ Total power dissipation	$V_O = 0$ , No load	25°C		50	85		50	85	mW
		Full range			100			100	

† All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. Full range for the μA741C is 0°C to 70°C, the μA741I is –40°C to 85°C, and the μA741M is –55°C to 125°C.

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,  $V_{CC\pm} = \pm 15$  V,  $T_A = 25^\circ$  C**

PARAMETER	TEST CONDITIONS	μA741C			μA741I, μA741M			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$t_r$ Rise time	$V_I = 20$ mV, $R_L = 2$ kΩ, $C_L = 100$ pF, See Figure 1		0.3			0.3		μs
Overshoot factor			5%			5%		
SR Slew rate at unity gain	$V_I = 10$ V, $C_L = 100$ pF, $R_L = 2$ kΩ, See Figure 1		0.5			0.5		V/μs



# μA741, μA741Y GENERAL-PURPOSE OPERATIONAL AMPLIFIERS

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electrical characteristics at specified free-air temperature,  $V_{CC\pm} = \pm 15\text{ V}$ ,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS	μA741Y			UNIT
			MIN	TYP	MAX	
$V_{IO}$	Input offset voltage	$V_O = 0$		1	6	mV
$\Delta V_{IO(\text{adj})}$	Offset voltage adjust range	$V_O = 0$		±15		mV
$I_{IO}$	Input offset current	$V_O = 0$		20	200	nA
$I_{IB}$	Input bias current	$V_O = 0$		80	500	nA
$V_{ICR}$	Common-mode input voltage range		±12	±13		V
$V_{OM}$	Maximum peak output voltage swing	$R_L = 10\text{ k}\Omega$	±12	±14		V
		$R_L = 2\text{ k}\Omega$	±10	±13		
$A_{VD}$	Large-signal differential voltage amplification	$R_L \geq 2\text{ k}\Omega$	20	200		V/mV
$r_i$	Input resistance		0.3	2		MΩ
$r_o$	Output resistance	$V_O = 0$ , See Note 5		75		Ω
$C_i$	Input capacitance			1.4		pF
CMRR	Common-mode rejection ratio	$V_{IC} = V_{ICR\text{min}}$	70	90		dB
$k_{SVS}$	Supply voltage sensitivity ( $\Delta V_{IO}/\Delta V_{CC}$ )	$V_{CC} = \pm 9\text{ V to } \pm 15\text{ V}$		30	150	μV/V
$I_{OS}$	Short-circuit output current			±25	±40	mA
$I_{CC}$	Supply current	$V_O = 0$ , No load		1.7	2.8	mA
$P_D$	Total power dissipation	$V_O = 0$ , No load		50	85	mW

† All characteristics are measured under open-loop conditions with zero common-mode voltage unless otherwise specified.

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, $V_{CC\pm} = \pm 15\text{ V}$ , $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	μA741Y			UNIT
			MIN	TYP	MAX	
$t_r$	Rise time	$V_I = 20\text{ mV}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , See Figure 1		0.3		μs
	Overshoot factor			5%		
SR	Slew rate at unity gain	$V_I = 10\text{ V}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , See Figure 1		0.5		V/μs



PARAMETER MEASUREMENT INFORMATION

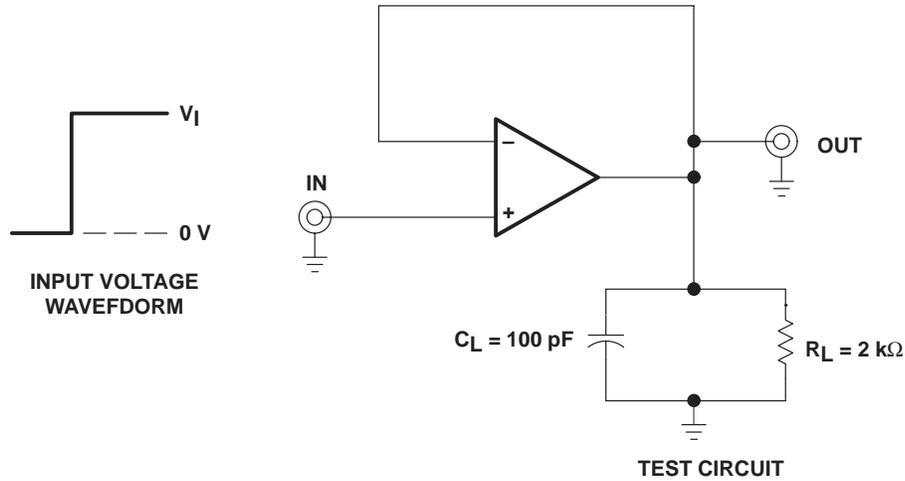


Figure 1. Rise Time, Overshoot, and Slew Rate

APPLICATION INFORMATION

Figure 2 shows a diagram for an input offset voltage null circuit.

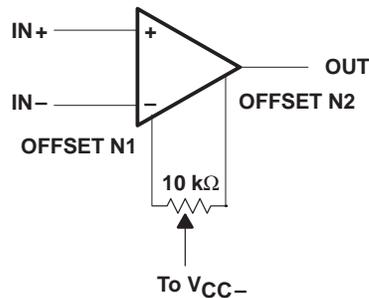


Figure 2. Input Offset Voltage Null Circuit

# μA741, μA741Y GENERAL-PURPOSE OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS†

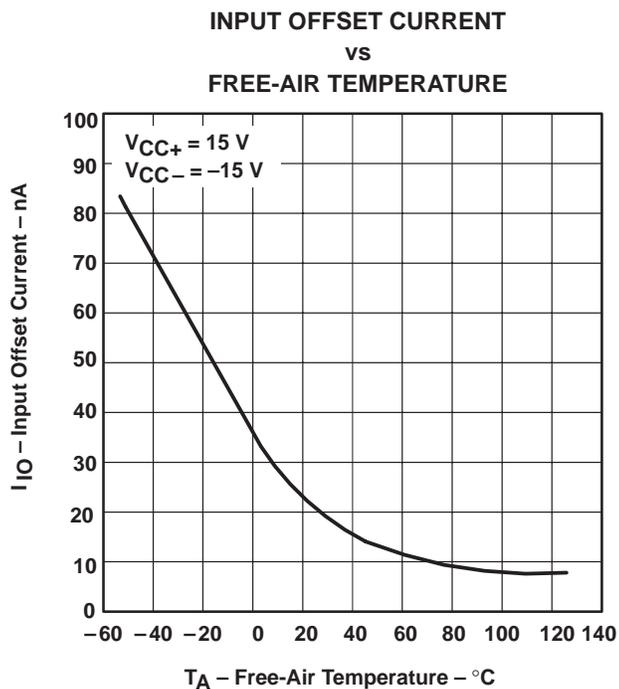


Figure 3

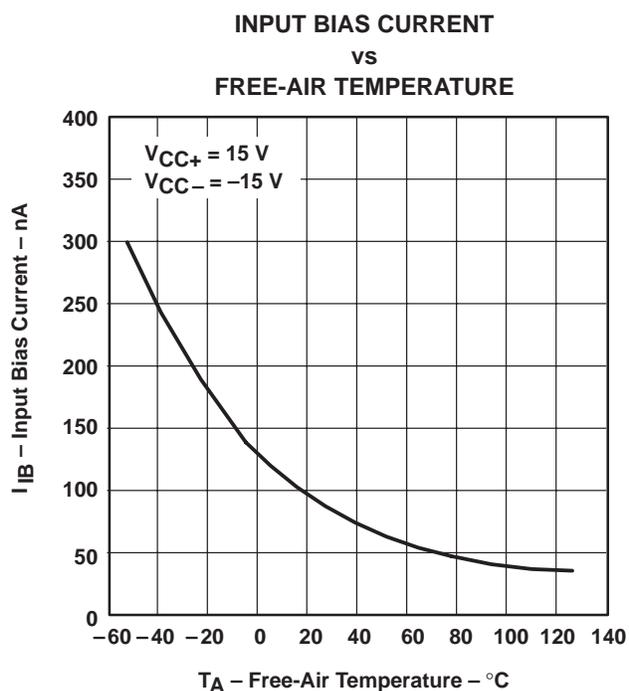


Figure 4

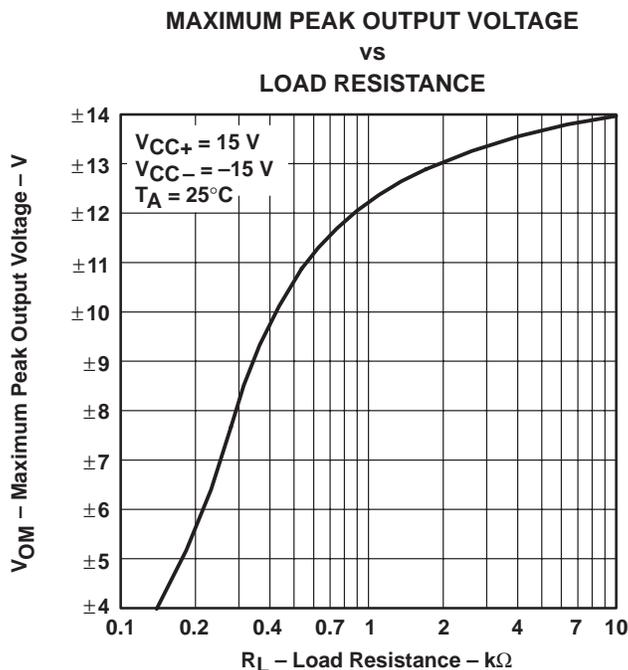


Figure 5

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

**TYPICAL CHARACTERISTICS**

**MAXIMUM PEAK OUTPUT VOLTAGE  
vs  
FREQUENCY**

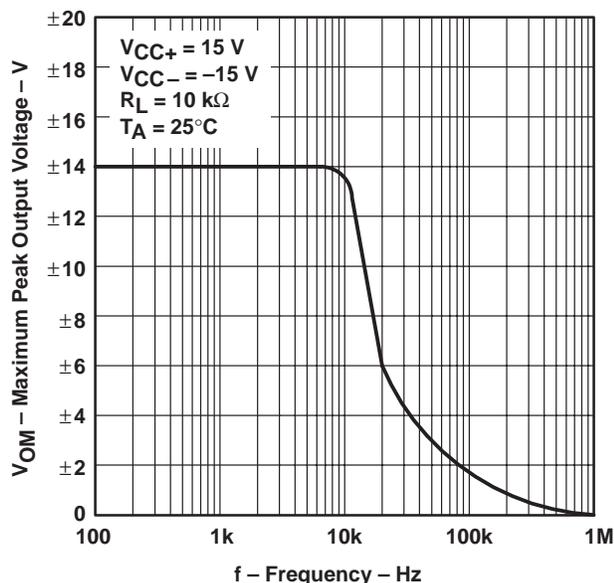


Figure 6

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

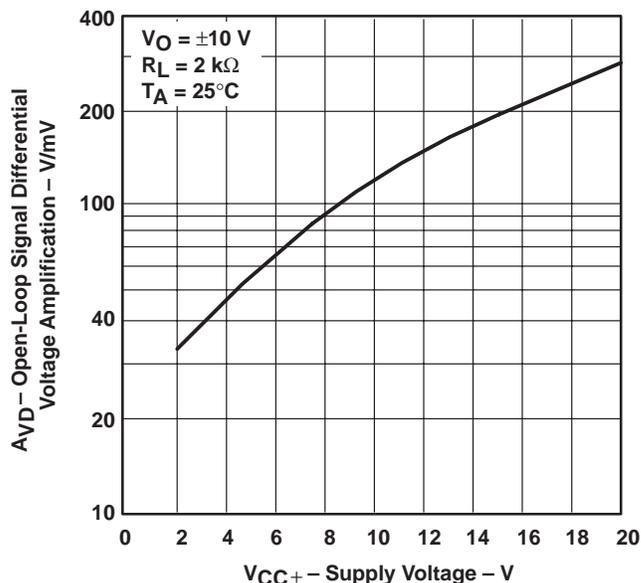
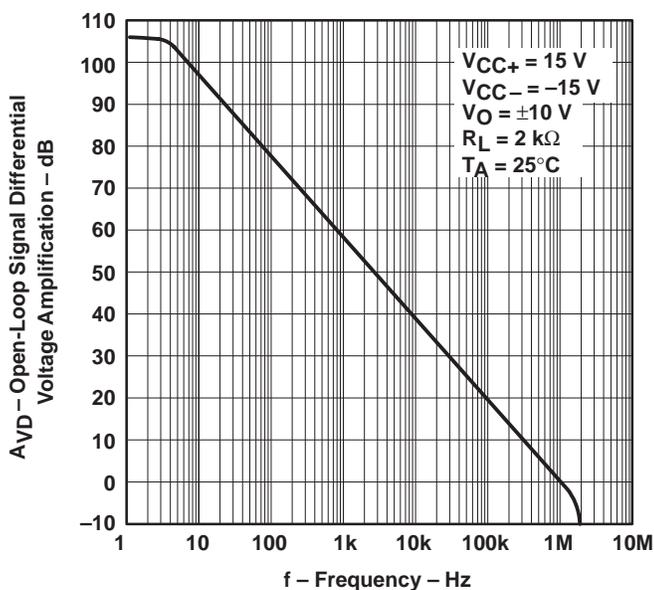


Figure 7

**OPEN-LOOP LARGE-SIGNAL DIFFERENTIAL  
VOLTAGE AMPLIFICATION  
vs  
FREQUENCY**



TYPICAL CHARACTERISTICS

COMMON-MODE REJECTION RATIO  
 VS  
 FREQUENCY

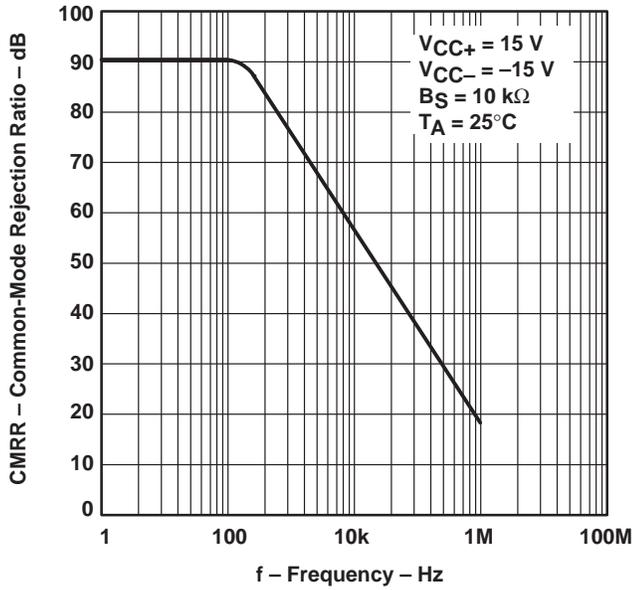


Figure 8

OUTPUT VOLTAGE  
 VS  
 ELAPSED TIME

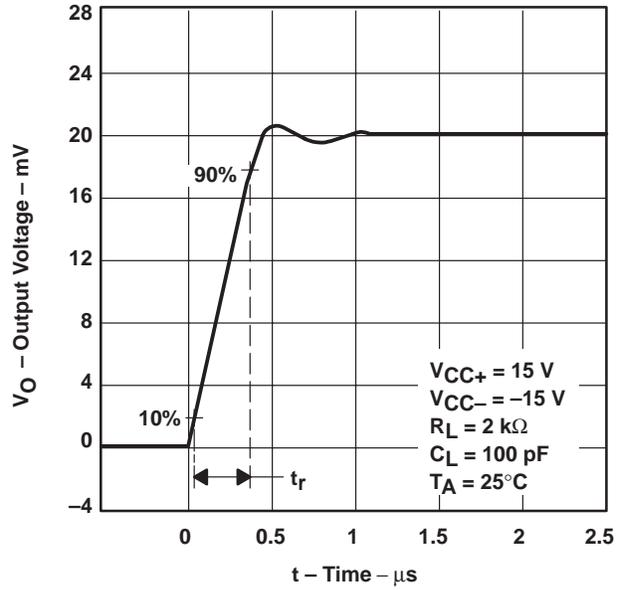


Figure 9

VOLTAGE-FOLLOWER  
 LARGE-SIGNAL PULSE RESPONSE

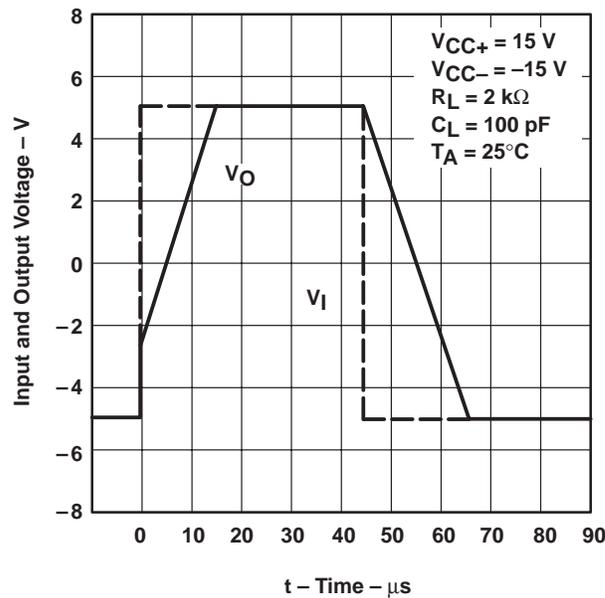


Figure 10

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PRODUCT SUPPORT: [DEVELOPMENT TOOLS](#) | [APPLICATIONS](#)

## UA741, General-Purpose Operational Amplifier

DEVICE STATUS: **ACTIVE**

PARAMETER NAME	UA741
Vs (max) (V)	36
Vs (min) (V)	7
IQ per channel (max) (mA)	2.8
IQ per channel (typ) (mA)	1.7
GBW (typ) (MHz)	1
Slew Rate (typ) (V/us)	0.5
VIO (Full Range) (max) (mV)	7.5
VIO (25 deg C) (max) (mV)	6
IIB (max) (pA)	500000
CMRR (min) (dB)	70
Number of Channels	1
Spec'd at Vs (V)	+/-15
Open Loop Gain (min) (dB)	86

### FEATURES

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- Short-Circuit Protection
- Offset-Voltage Null Capability
- Large Common-Mode and Differential Voltage Ranges
- No Frequency Compensation Required
- Low Power Consumption
- No Latch-Up
- Designed to Be Interchangeable With Fairchild uA741

### DESCRIPTION

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The uA741 is a general-purpose operational amplifier featuring offset-voltage null capability.

The high common-mode input voltage range and the absence of latch-up make the 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 uA741C is characterized for operation from 0°C to 70°C. The uA741I is characterized for operation from -40°C to 85°C. The uA741M is characterized for operation over the full military temperature range of -55°C to 125°C.

## TECHNICAL DOCUMENTS

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To view the following documents, [Acrobat Reader 3.x](#) is required.

To download a document to your hard drive, right-click on the link and choose 'Save'.

## DATASHEET

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Full datasheet in Acrobat PDF: [slos094b.pdf](#) (161 KB) (Updated: 09/28/2000)

Full datasheet in Zipped PostScript: [slos094b.psz](#) (156 KB)

## APPLICATION NOTES

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View Application Reports for [Signal Amplifiers \(Less than equal to 100MHz\)](#)

- [Analog Applications Journal May 2000](#) (SLYT015 - Updated: 04/20/2000)
- [Analog Applications Journal, September 1999 edition](#) (SLYT005 - Updated: 07/15/1999)
- [Analysis Of The Sallen-Key Architecture](#) (SLOA024A - Updated: 07/27/1999)
- [Current Feedback Amplifiers: Review, Stability Analysis, and Applications](#) (SBOA081 - Updated: 11/20/2000)

## USER MANUALS

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- [Universal Op Amp Single, Dual, Quad \(SOIC\) Evaluation Module With Shutdown](#) (SLOU061, 1160 KB - Updated: 10/22/1999)
- [Universal Operational Amplifier EVM](#) (SLVU006A, 387 KB - Updated: 03/22/1999)
- [Universal Operational Amplifier Evaluation Module Selection Guide](#) (SLOU060A, 16 KB - Updated: 09/28/2000)
- [Universal Operational Amplifier Single, Dual, Quad \(MSOP/TSSOP\)](#) (SLOU055, 1196 KB - Updated: 10/22/1999)
- [Universal Operational Amplifier Single, Dual, Quad \(PDIP\)](#) (SLOU062, 1211 KB - Updated: 10/22/1999)

## SAMPLES

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<u>ORDERABLE DEVICE</u>	<u>PACKAGE</u>	<u>PINS</u>	<u>TEMP (°C)</u>	<u>STATUS</u>	<u>DSCC NUMBER</u>	<u>SAMPLES</u>
UA741CD	<u>D</u>	8		ACTIVE		<a href="#">Request Samples</a>

## PRICING/AVAILABILITY

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<u>ORDERABLE DEVICE</u>	<u>PACKAGE</u>	<u>PINS</u>	<u>TEMP (°C)</u>	<u>STATUS</u>	<u>BUDGETARY PRICE US\$/UNIT QTY=1000+</u>	<u>PACK QTY</u>	<u>DSCC NUMBER</u>	<u>PRICING/AVAILABILITY</u>
UA741CD	<u>D</u>	8		ACTIVE	0.33	75		<a href="#">Check stock or order</a>
UA741CDR	<u>D</u>	8		ACTIVE	0.37	2500		<a href="#">Check stock or order</a>

UA741CJG	<u>JG</u>	8		OBSOLETE				
UA741CJG4	<u>JG</u>	8		OBSOLETE				
UA741CP	<u>P</u>	8		ACTIVE	0.33	50		<u>Check stock or order</u>
UA741CPS	<u>PS</u>	8		OBSOLETE				
UA741MFKB	<u>FK</u>	20	-55 TO 125	ACTIVE	6.65	1		<u>Check stock or order</u>
UA741MJ	<u>J</u>	14	-55 TO 125	ACTIVE	1.57	500		<u>Check stock or order</u>
UA741MJB	<u>J</u>	14	-55 TO 125	ACTIVE	1.93	1		<u>Check stock or order</u>
UA741MJG	<u>JG</u>	8	-55 TO 125	ACTIVE	1.29	1		<u>Check stock or order</u>
UA741MJGB	<u>JG</u>	8	-55 TO 125	ACTIVE	1.93	1		<u>Check stock or order</u>

**DEVELOPMENT TOOLS**[▲ Back to Top](#)

Tool Part Number	Tool Title	Tool Type
<a href="#">UNIV-OPAMP-1B</a>	Universal EVM for Single/Dual OpAmps without Shutdown in MSOP/SOIC/SOT-23 packages	Evaluation Modules (EVM)
<a href="#">UNIV-OPAMP-2B</a>	Universal EVM for Single/Dual OpAmps with Shutdown in MSOP/SOIC/SOT-23 packages	Evaluation Modules (EVM)
<a href="#">UNIV-OPAMP-3B</a>	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in MSOP/TSSOP packages	Evaluation Modules (EVM)
<a href="#">UNIV-OPAMP-4B</a>	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in SOIC packages	Evaluation Modules (EVM)
<a href="#">UNIV-OPAMP-5B</a>	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in PDIP packages	Evaluation Modules (EVM)

Table Data Updated on: 11/30/2000