



NATL SEMICOND (LINEAR)

T-79-25

LH0041/LH0041C 0.2 Amp Power Operational Amplifier

General Description

The LH0041/LH0041C is a general purpose operational amplifier capable of delivering large output currents. The LH0041 delivers currents of 200 mA at voltage levels closely approaching the available power supplies. In addition, both the inputs and outputs are protected against overload.

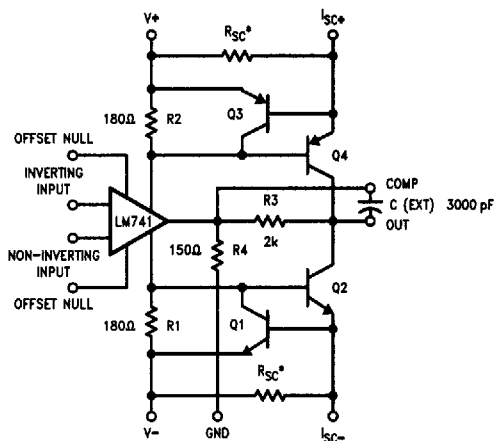
Features

- Output current 0.2 Amp (LH0041)
- Output voltage swing $\pm 14V$ into 100 Ω (LH0041)
- Low standby power 100 mW at $\pm 15V$
- High open loop gain 100 dB

The LH0041 is suited for applications such as torque driver for inertial guidance systems, diddle yoke driver for alpha-numeric CRT displays, cable drivers, and programmable power supplies for automatic test equipment.

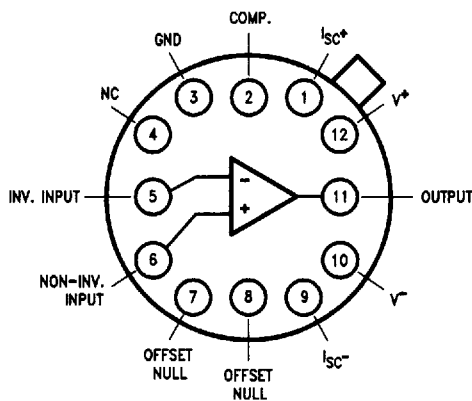
The LH0041 is supplied in both 12-pin TO-8 (2.5 watts with clip on heatsink) and a power 8-pin ceramic DIP (2 watts with suitable heatsink). The LH0041 is guaranteed over the temperature range of $-55^{\circ}C$ to $+125^{\circ}C$ while the LH0041C is guaranteed from $-25^{\circ}C$ to $+85^{\circ}C$.

Schematic and Connection Diagrams



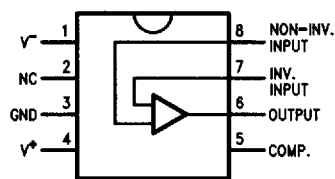
TL/K/10115-1

* R_{sc} external on "G" and "K" packages. R_{sc} internal on "J" package. Offset Null connections available only on "G" package.



TL/K/10115-3

Order Number LH0041G, LH0041G/883 or LH0041CG
See NS Package Number G12B



Top View

TL/K/10115-22

Order Number LH0041CJ
See NS Package Number HY08A

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage	± 18V
Power Dissipation	See curves
Differential Input Voltage	± 30V
Input Voltage (Note 1)	± 15V
Peak Output Current (Note 2)	
LH0041/LH0041C	0.5 Amps

NATL SEMICOND (LINEAR)

Output Short Circuit Duration (Note 3)	Continuous
Operating Temperature Range	
LH0041	-55°C to +125°C
LH0041C	-25°C to +85°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10 sec.)	300°C

DC Electrical Characteristics for LH0041/LH0041C (Note 4)

Parameter	Conditions	Limits						Units
		LH0041			LH0041C			
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	$R_S \leq 100\Omega$, $T_A = 25^\circ\text{C}$ $R_S \leq 100\Omega$		1.0	3.0		3.0	6.0	mV mV
Voltage Drift with Temperature	$R_S \leq 100\Omega$		3			5		$\mu\text{V}/^\circ\text{C}$
Offset Voltage Drift with Time			5			5		$\mu\text{V}/\text{week}$
Offset Voltage Change with Output Power			15			15		$\mu\text{V}/\text{watt}$
Offset Voltage Adjustment Range	(Note 5)		20			20		mV
Input Offset Current	$T_A = 25^\circ\text{C}$		30	100		50	200	nA nA
Offset Current Drift with Temperature			0.1	1.0		0.2	1.0	$\text{nA}/^\circ\text{C}$
Input Bias Current	$T_A = 25^\circ\text{C}$		100	300		200	500	nA μA
Input Resistance	$T_A = 25^\circ\text{C}$	0.3	1.0		0.3	1.0		M Ω
Input Capacitance			3			3		pF
Common Mode Rejection Ratio	$R_S \leq 100\Omega$, $\Delta V_{\text{CM}} = \pm 10\text{V}$	70	90		70	90		dB
Input Voltage Range	$V_S = \pm 15\text{V}$	± 12			± 12			V
Power Supply Rejection Ratio	$R_S \leq 100\Omega$, $\Delta V_S = \pm 10\text{V}$	80	96		70	90		dB
Voltage Gain	$V_S = \pm 15\text{V}$, $V_O = \pm 10\text{V}$ $R_L = 1\text{ k}\Omega$, $T_A = 25^\circ\text{C}$ $V_S = \pm 15\text{V}$, $V_O = \pm 10\text{V}$ $R_L = 100\Omega$	100	200		100	200		V/mV V/mV
Output Voltage Swing	$V_S = \pm 15\text{V}$, $R_L = 100\Omega$	± 13.0	± 14.0		± 13.0	± 14.0		V
Output Short Circuit Current	$V_S = \pm 15\text{V}$, $T_A = 25^\circ\text{C}$ (Note 6)		200	300		200	300	mA
Power Supply Current	$V_S = \pm 15\text{V}$, $V_{\text{OUT}} = 0$		2.5	3.5		3.0	4.0	mA
Power Consumption	$V_S = \pm 15\text{V}$, $V_{\text{OUT}} = 0$		75	105		90	120	mW

AC Electrical Characteristics for LH0041/LH0041C ($T_A = 25^\circ\text{C}$, $V_S = \pm 15\text{V}$, $C_C = 3000\text{ pF}$)

Slew Rate	$A_V = +1$, $R_L = 100\Omega$	1.5	3.0		1.0	3.0		$\text{V}/\mu\text{s}$
Power Bandwidth	$R_L = 100\Omega$		20			20		kHz
Small Signal Overshoot			5	20		10	30	%
Settling Time (0.1%)	$\Delta V_{IN} = 10\text{V}$, $A_V = +1$		4			4		μs
Overload Recovery Time			3			3		μs
Harmonic Distortion	$f = 1\text{ kHz}$, $P_O = 0.5\text{W}$		0.2			0.2		%
Input Noise Voltage	$R_S = 50\Omega$, B.W. = 10 Hz to 10 kHz		5			5		$\mu\text{V rms}$
Input Noise Current	B.W. = 10 Hz to 10 kHz		0.05			0.05		nA rms

Note 1: Rating applies for supply voltages above $\pm 15\text{V}$. For supplies less than $\pm 15\text{V}$, rating is equal to supply voltage.

Note 2: Rating applies for LH0041G with $R_{SC} = 0\Omega$.

Note 3: Rating applies as long as package power rating is not exceeded.

Note 4: Specifications apply for $V_S = \pm 5\text{V}$ to $\pm 18\text{V}$, and $-55^\circ\text{C} \leq T_C \leq +125^\circ\text{C}$ for LH0041G, and $-25^\circ\text{C} \leq T_C \leq +85^\circ\text{C}$ for LH0041CG and LH0041CJ unless otherwise specified. Typical values are for 25°C only.

Note 5: TO-8 "G" packages only.

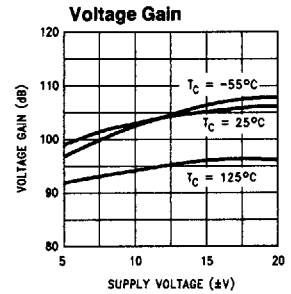
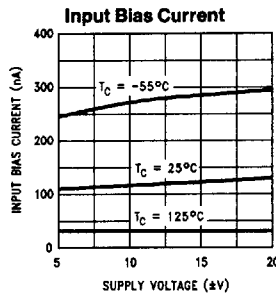
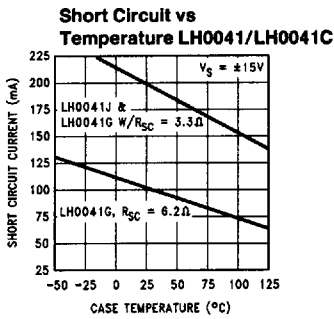
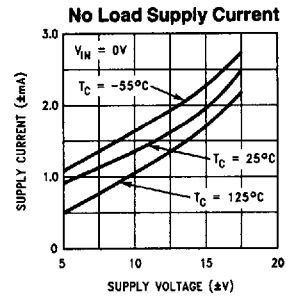
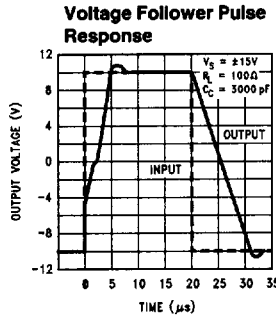
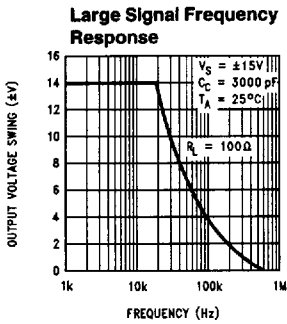
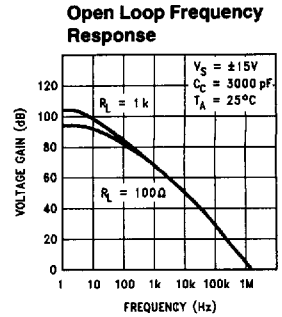
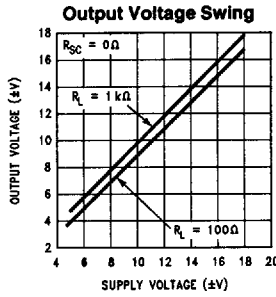
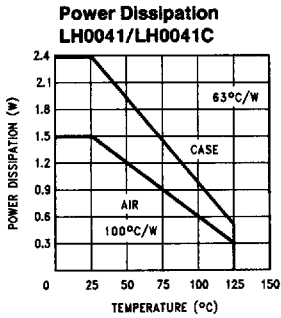
Note 6: Rating applies for "J" DIP package and for TO-8 "G" package with $R_{SC} = 3.3\Omega$.

Note 7: See RETS0041X for LH0041G military specifications.

NATL SEMICON (LINEAR)

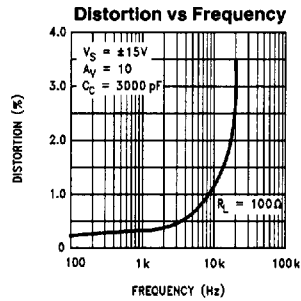
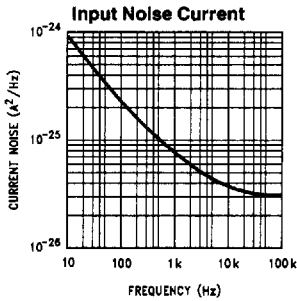
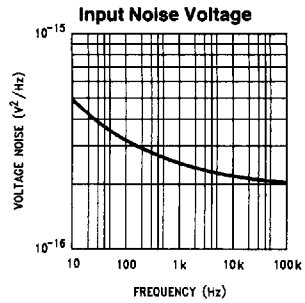
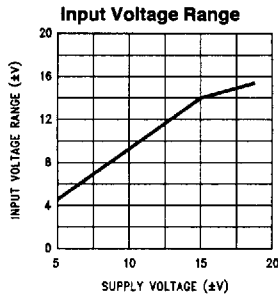
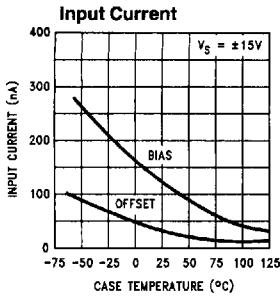
Typical Performance Characteristics

NATL SEMICOND (LINEAR)



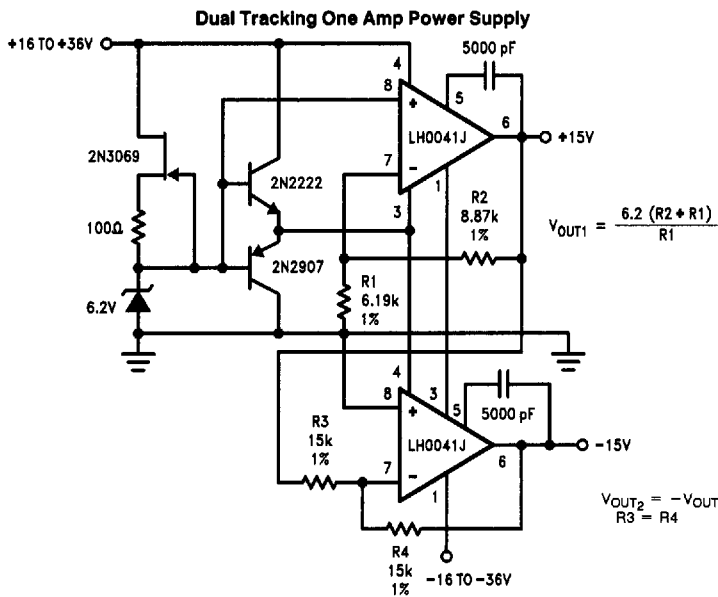
TL/K/10115-4

Typical Performance Characteristics (Continued)



TL/K/10115-5

Typical Applications

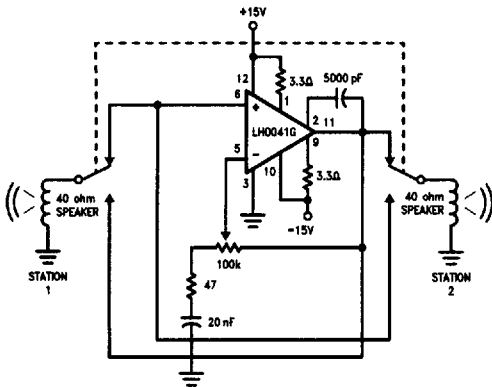


TL/K/10115-8

NATL SEMICOND (LINEAR)

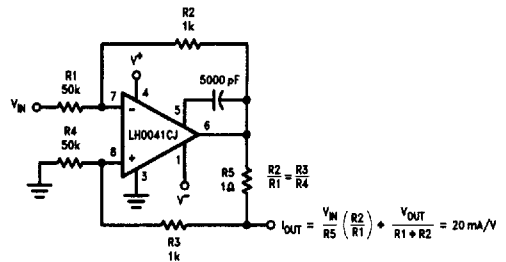
Typical Applications (Continued) NATL SEMICOND (LINEAR)

Two Way Intercom



TL/K/10115-10

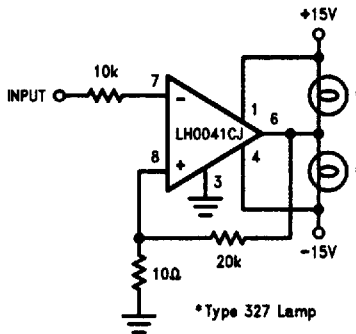
Programmable High Current Source/Sink



$$I_{OUT} = \frac{V_{IN}}{R_5} \cdot \frac{R_2}{R_1} + \frac{V_{OUT}}{R_1 + R_2} = 20 \text{ mA/V}$$

TL/K/10115-11

Power Comparator

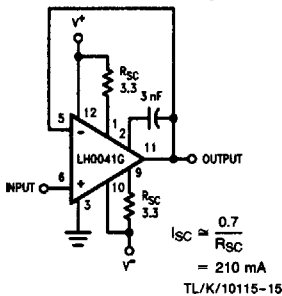


*Type 327 Lamp

TL/K/10115-12

Auxiliary Circuits

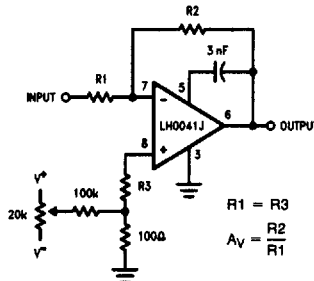
LH0041G Unity Gain with Short Circuit Limiting



$$I_{SC} \approx \frac{0.7}{R_{SC}} = 210 \text{ mA}$$

TL/K/10115-15

LH0041 Offset Voltage Null Circuit (LH0041CJ Pin Connections Shown)*

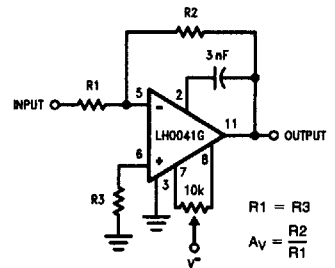


$$R_1 = R_3$$

$$A_v = \frac{R_2}{R_1}$$

TL/K/10115-18

LH0041G Offset Voltage Null Circuit*



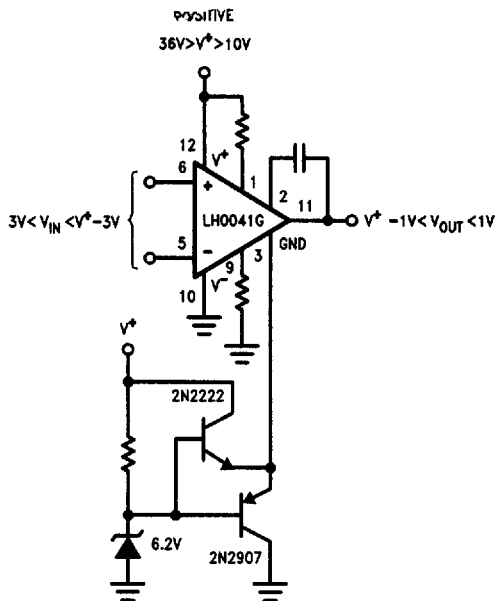
$$R_1 = R_3$$

$$A_v = \frac{R_2}{R_1}$$

TL/K/10115-17

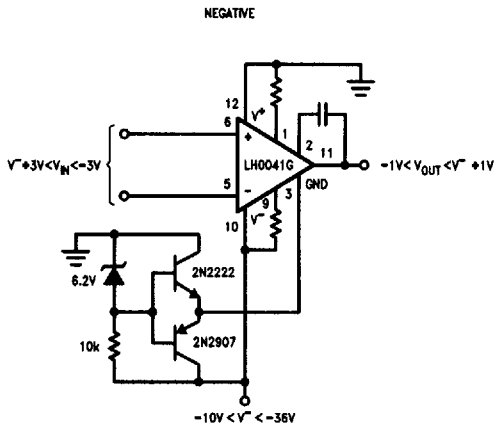
Auxiliary Circuits (Continued)

NATL SEMICOND (LINEAR)

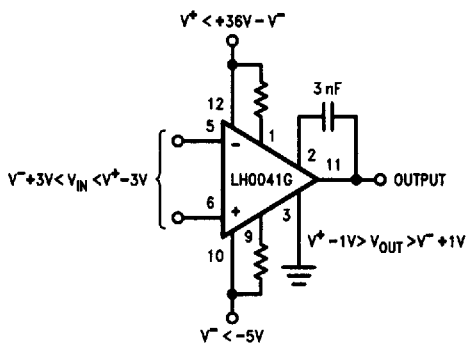


TL/K/10115-18

Operation from Single Supplies

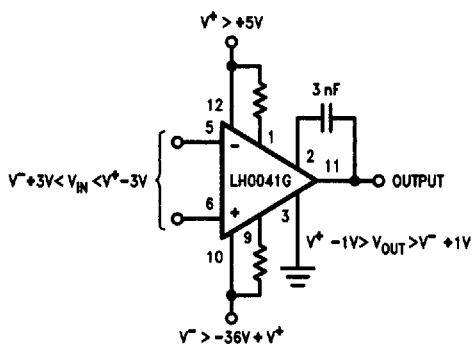


TL/K/10115-19



TL/K/10115-20

Operation from Non-Symmetrical Supplies



TL/K/10115-21

*For additional offset null circuit techniques see National Linear Applications Handbook.