

INTEGRATED CIRCUITS
UNITRODE
FULL BRIDGE POWER AMPLIFIER

UC3176
UC3177

FEATURES

- Dual Power Operational Amplifiers
- $\pm 2A$ Output Current Guaranteed
- Precision Current Sense Amplifier
- Two Supply Monitoring Inputs
- Parking Function and Under-Voltage Lockout
- Safe Operating Area Protection
- 3V to 35V Operation

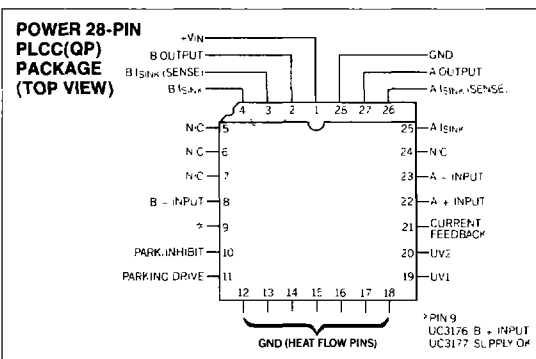
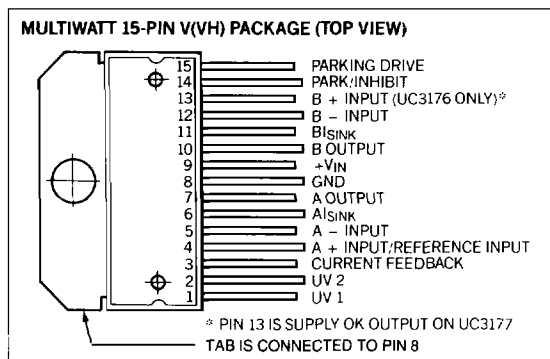
DESCRIPTION

The UC3176/7 family of full bridge power amplifiers is rated for a continuous output current of 2A. Intended for use in demanding servo applications such as disk head positioning, the onboard current sense amplifier can be used to obtain precision control of load current, or where voltage mode drive is required, a standard voltage feedback scheme can be used. Output stage protection includes foldback current limiting and thermal shutdown, resulting in a very rugged device.

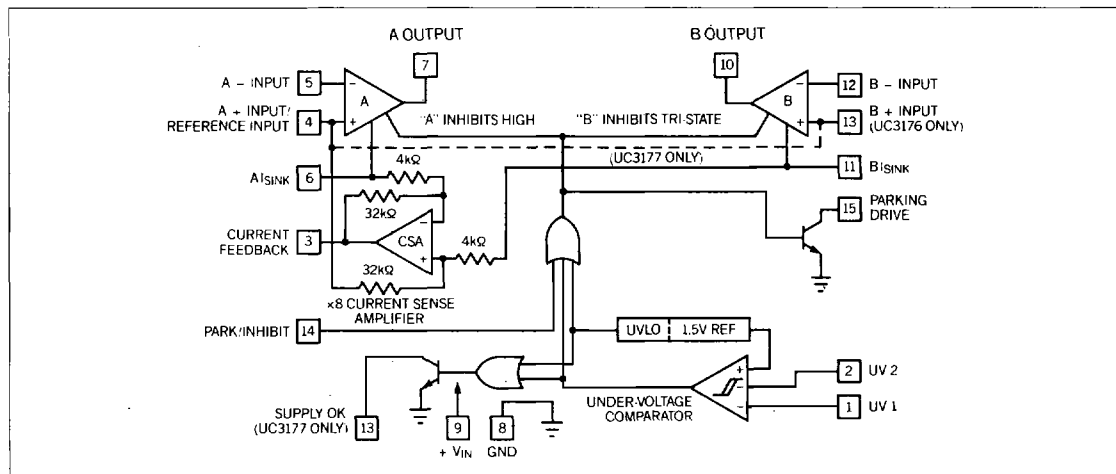
Auxiliary functions on this device include a dual input under-voltage comparator that can be programmed to respond to low voltage conditions on two independent supplies. In response to an under-voltage condition the power Op-Amps are inhibited and a high current, 100mA, open collector drive output is activated. A separate Park/Inhibit logic level input is also available to force this state. The above functions are easily combined to provide a head parking function in disk head positioning applications. In addition, on the UC3177 device a separate supply OK output is available to distinguish between a supply fault and a Park/Inhibit command input.

The devices are operational over a 3V to 35V supply range. Internal under-voltage lockout provides predictable power-up and power-down characteristics. The parts are packaged in the 15 pin Multiwatt package with a maximum θ_{JC} of 3°C/Watt. For lower power applications a surface mount 28 pin PLCC package is available. Consult packaging section of catalog for package details.

CONNECTION DIAGRAMS



BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (note 1)

Input Supply Voltage, (+V _{IN})	40V
Park/Inhibit, UV1 and UV2 inputs (zener clamped)	
Maximum forced voltage	-0.3V to 10V
Maximum forced current	±10mA
Other Input Voltages	-0.3V to +V _{IN}
A _{ISINK} and B _{ISINK} Voltages	-0.3V to 6V
Open Collector Output Voltages	40V
A and B Output Currents (Continuous)	
Source	Internally Limited
Sink	2.5A
Total Supply Current (Continuous)	4A
Parking Drive Output Current (Continuous)	200mA
Supply OK Output Current, UC3177 (Continuous)	30mA
Operating Junction Temperature	-55°C to +150°C
Power Dissipation at T _C = +75°C	
V package	25W
QP package	4W
Storage Temperature	-65°C to +150°C

Note 1: Unless otherwise indicated, voltages are reference to ground and currents are positive into, negative out of, the specified terminals.

THERMAL DATA

V package:

Thermal Resistance Junction to Case, θ_{JC} 3°C/W

Thermal Resistance Junction to Ambient, θ_{JA} 35°C/W

QP package:

Thermal Resistance Junction to Leads, θ_{JC} 15°C/W

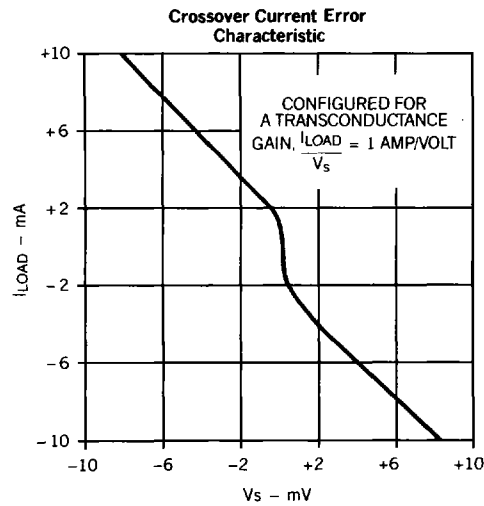
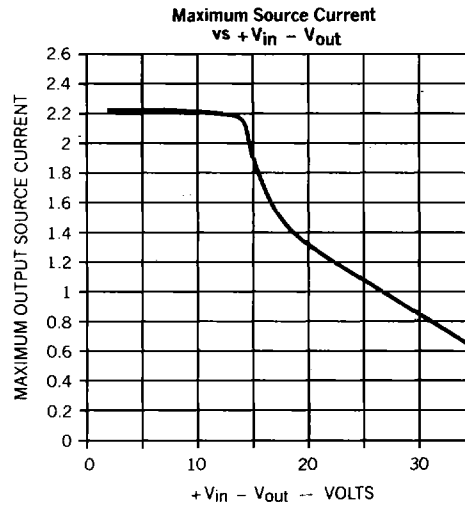
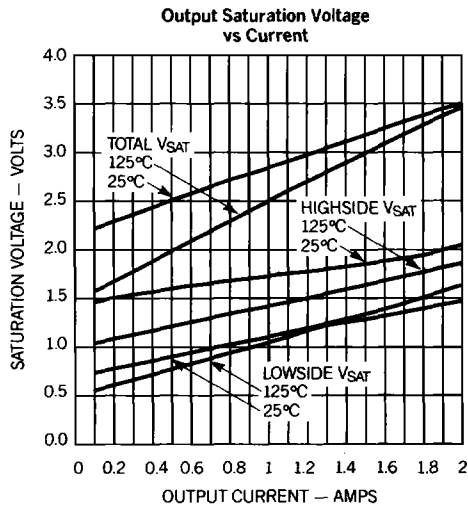
Thermal Resistance Junction to Ambient, θ_{JA} 50°C/W

ELECTRICAL CHARACTERISTICS: Unless otherwise stated specifications hold for T_A = 0 to 70°C, +V_{IN} = 12V. T_A=T_J

PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Input Supply					
Supply Current	+V _{in} = 12V +V _{in} = 35V		18 21	25 30	mA mA
UVLO Threshold	+V _{in} low to high Threshold hysteresis		2.8 220	3.0 300	V mV
Power Amplifiers, A and B					
Input Offset Voltage	V _{cm} = 6V, V _{out} = 6V			8	mV
Input Bias Current	V _{cm} = 6V, Except A+ input	-500	-100		nA
Input Bias Current at A+ /Reference Input	(A+ /Ref - B _{Isink})/36Kohms T _j = 25 °C	23	28	35	μA/V
Input Offset Current B Amp Only on UC3176	V _{cm} = 6V			200	nA
CMRR	V _{cm} = 1 to 33V, +V _{in} = 35V, V _{out} = 6V	70	100		dB
PSRR	+V _{in} = 5 to 35V, V _{cm} = 2.5V	70	100		dB
Large Signal Voltage Gain	V _{out} = 3V w/ I _{out} = 1A, to V _{out} = 9V w/ I _{out} = -1A	1.5	4		V/mV
Thermal Feedback	+V _{in} = 20V, P _d = 20W at opposite output		25	200	μV/W
Saturation Voltage	I _{out} = -2A, High side, T _j = 25 °C I _{out} = 2A, Low side, T _j = 25 °C Total V _{sat} at 2A, T _j = 25 °C		1.9		V
			1.6		V
			3.5	3.7	V
Unity Gain Bandwidth			1		MHz
Slew Rate			1		V/μs

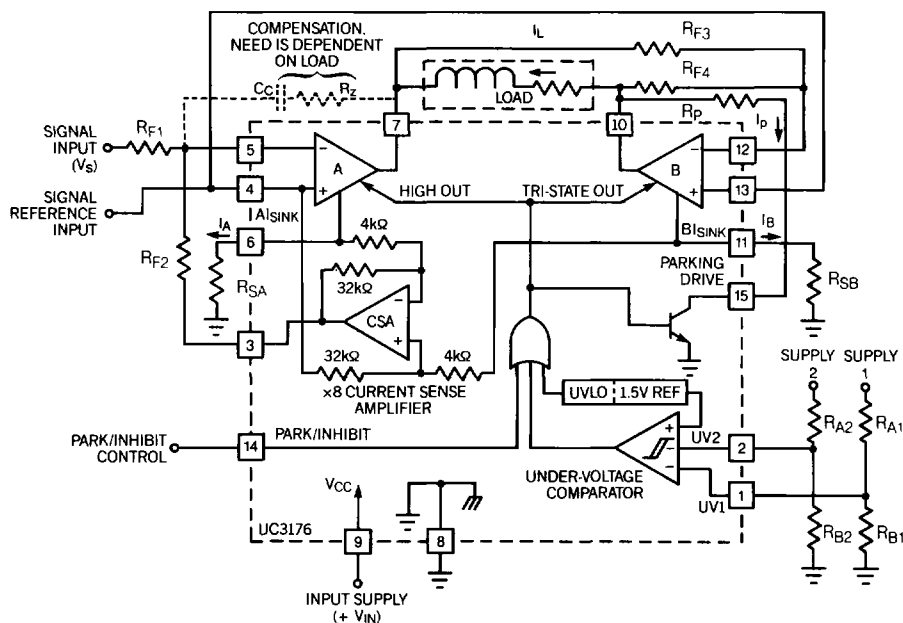
ELECTRICAL CHARACTERISTICS: Unless otherwise stated specifications hold for $T_A = 0$ to 70°C ,
 $+V_{in} = 12\text{V}$. $T_A = T_J$

PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Power Amplifiers, A and B (continued)					
Differential I_{out} Sense Error Current in Bridge Configuration	$I_{out(A)} = -I_{out(B)}$, $ I_{out} - I_{sink} - B I_{sink} $ $I_{out} \leq 200\text{mA}$ $I_{out} \leq 2\text{A}$		3.0 5.0	6.0 10	mA mA
High Side Current Limiting	$+V_{in} - V_{out} < 12\text{V}$		-2.7	-2.0	A
Current Sense Amplifier					
Input Offset Voltage	$V_{cm} = 0\text{V}$, $A+ / \text{Ref}$ at 6V			3	mV
	$\text{Ref} = 2\text{V}$ to 20V , $+V_{in} = 35$, change with Reference input voltage			600	$\mu\text{V/V}$
Thermal Gradient Sensitivity	$+V_{in} = 20\text{V}$, $\text{Ref} = 10\text{V}$ $P_d = 20\text{W}$ @ A or B output		5.0	75	$\mu\text{V/W}$
PSRR	$\text{Ref} = 2.5\text{V}$, $+V_{in} = 5$ to 35V	70	100		dB
Gain	$ A I_{sink} - B I_{sink} \leq 0.5\text{V}$	7.8	8	8.1	V/V
Slew Rate			2		V/ μS
3dB Bandwidth			1		MHz
Max Output Current	I_{source} , $+V_{in} - V_{out} = 0.5\text{V}$	2.5	3.5		mA
Output Saturation Voltage	$I_{source} = 1.5\text{mA}$, High side		0.15	0.30	V
	$I_{sink} = 5\text{mA}$, Low side		1.4	1.7	V
Under-Voltage Comparator					
Threshold Voltage	Low to High, other input at 5V	1.44	1.50	1.56	V
	Threshold hysteresis	50	70	80	mV
Input Current	Input = 2V , other input at 5V	-2	-0.5		μA
Supply OK V_{sat} UC3177 Only	$I_{out} = 5\text{mA}$			0.45	V
Supply OK Leakage UC3177 Only	$V_{out} = 35\text{V}$			5	μA
Park/Inhibit					
Park/Inhibit Th'l'd		1.1	1.3	1.7	V
Park/Inhibit Input Current	At threshold		60	100	μA
Parking Drive Saturation Voltage	$I_{out} = 100\text{mA}$		0.3	0.7	V
Parking Drive Leakage	$V_{out} = 35\text{V}$			15	μA
Thermal Shutdown					
Shutdown Temperature			165		$^\circ\text{C}$

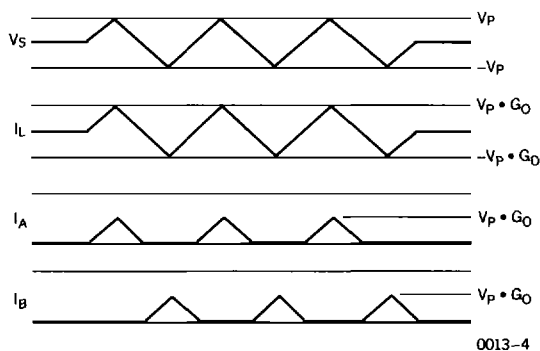


APPLICATION AND OPERATION INFORMATION

THE UC3176 IN A FULL BRIDGE TRANSCONDUCTANCE AMPLIFIER



WAVEFORMS FOR ABOVE APPLICATION



DESIGN EQUATIONS

$$\text{Transconductance } (G_O) = \frac{1_L}{R_S} = \frac{R_{F2}}{R_{F1}} \cdot \left(\frac{1}{8R_S} \right)$$

With: $R_{SA} = R_{SB} = R_S$, and $R_{B1} = R_{B2}$

$$\text{Parking Current (I}_p\text{)} = \frac{V_{IN} - 15}{R_P + R_L}$$

Where: R_l = load resistance

Under-Voltage Thresholds, at Supplies

High to Low Threshold, (V_{LH}) = $1.425 (R_A + R_B)/R_B$

Low to High Threshold, $(V_{HL}) = 1.5 (R_A + R_B)/R_B$