Full Bridge Power Amplifier

FEATURES

- Dual Power Operational Amplifiers
- ±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

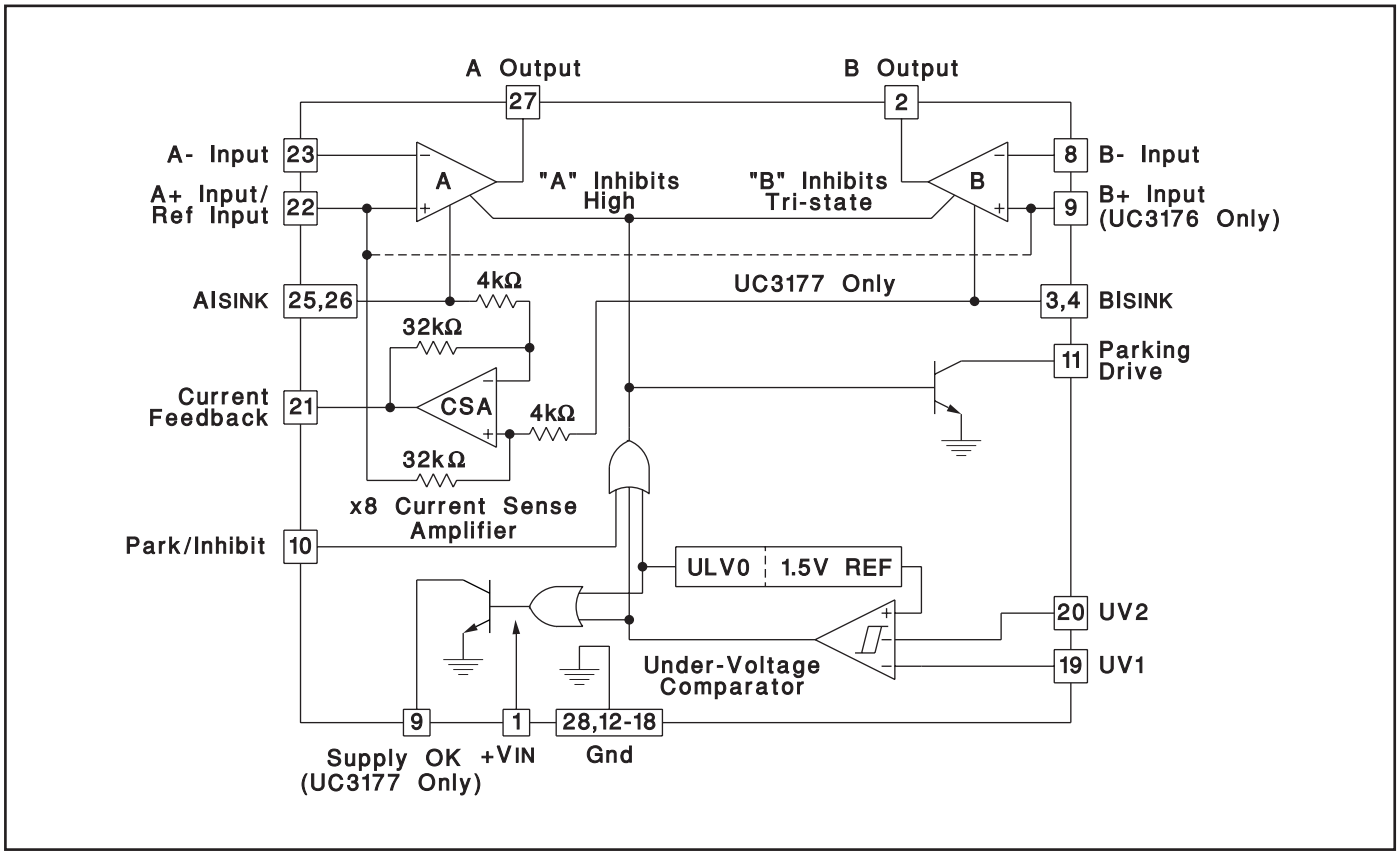
DESCRIPTION

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 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.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Note 1)

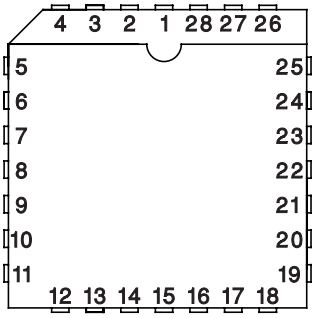
Input Supply voltage, ($+V_{IN}$) 40V
Park/Inhibit, UV1 and UV2 inputs (zener clamped)
  Maximum forced voltage . . . . . –0.3V to 10V
  Maximum forced current . . . . . ±10mA
Other Input Voltages . . . . . –0.3V to $+V_{IN}$
AI_{SINK} and BI_{SINK} Voltages . . . . . –0.3V to 6V
Open Collector Output 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 TC = +75°C
  QP package 4W
Storage Temperature . . . . . –65°C to +150°C

THERMAL DATA

QP package:
  Thermal Resistance Junction to Leads, θ_{JL} . . . . . 15°C/W
  Thermal Resistance Junction to Ambient, θ_{JA} . . . . . 50°C/W
  Thermal Resistance Junction to C_{OSC}, θ_{JC} . . . . . 30°C/W

CONNECTION DIAGRAM

PLCC-28 (Top View)
QP Package



*Pin 9: UC3176, B+ Input
UC3177, Supply OK

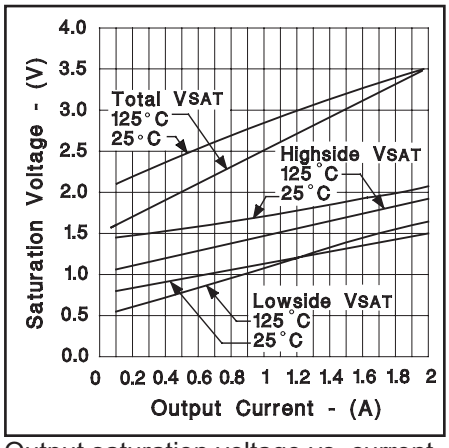
PACKAGE PIN FUNCTION	
FUNCTION	**PIN**
$+V_{IN}$	1
B Output	2
BI_{SINK} (Sense)	3
BI_{SINK}	4
N/C	5-7
B– Input	8
*	9
Park/Inhibit	10
Parking Drive	11
Gnd (Heat Flow Pins)	12-18
UV1	19
UV2	20
Current Feedback	21
A+ Input	22
A– Input	23
N/C	24
AI_{SINK}	25
AI_{SINK} (Sense)	26
A Output	27
Gnd	28

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

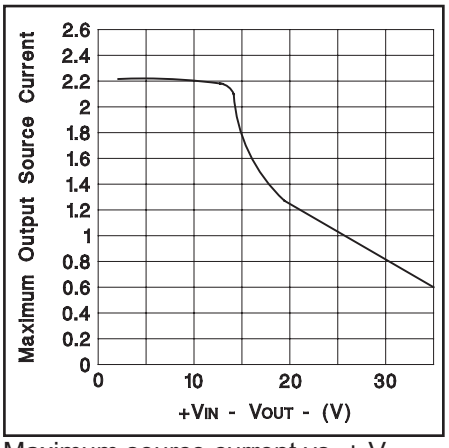
PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Input Supply					
Supply Current	$+V_{IN}$ = 12V		18	25	mA
	$+V_{IN}$ = 35V		21	30	mA
UVOL Threshold	$+V_{IN}$ low to high		2.8	3.0	V
	Threshold Hysteresis		220	300	mV
Power, Amplifier, A and B					
Input Offset Voltage	V_{CM} = 6V, V_{OUT} = 6V			8	mV
Input Bias Current	V_{CM} = 6V, Except A+ Input	–500	–100		nA
Input Bias Current at A+/Reference Input	(A+/REF - BI_{SINK}) /36kΩ; T_J = 25°C	23	28	35	µA/V
Input Offset Current B Amp (UC3176 Only)	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, Pd = 20W at opposite output		25	200	µV/W
Saturation Voltage	I_{OUT} = –2A, High Side, T_J = 25°		1.9		V
	CI_{OUT} = 2A, Low Side, T_J = 25°C		1.6		V
	Total V_{SAT} at 2A, T_J = 25°C		3.5	3.7	V
Unity Gain Bandwidth			1		MHz
Slew Rate			1		V/µs
Differential I_{OUT} Sense Error Current in Bridge Configuration	$I_{OUT}(A) = -I_{OUT}(B)$, $/I_{OUT}/ - /AI_{SINK} - BI_{SINK}/$				
	$I_{OUT} \le 200mA$		3.0	6.0	mA
	$I_{OUT} \le 2A$		5.0	10	mA
High Side Current Limiting	$=V_{IN} - V_{OUT} < 12V$		–2.7	–2.0	A

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

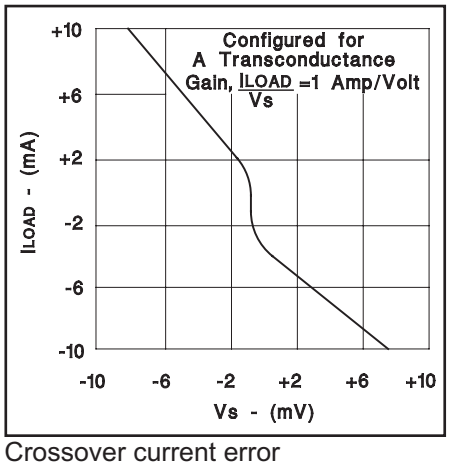
PARAMETER	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Current Sense Amplifier					
Input Offset Voltage	V_{CM} = 0V, A+ / REF at 6V			3	mV
	REF = 2V to 20V, $+V_{IN}$ = 35, change with REF Input voltage			600	µV/V
Thermal Gradient Sensitivity	$+V_{IN}$ = 20V, REF = 10V Pd = 20W @ A or B Output		5.0	75.0	µV/W
PSRR	REF = 2.5V, $+V_{IN}$ = 5 to 35V	70	100		dB
Gain	$/\Delta I_{SINK}$-$B I_{SINK}$ / ≤ 0.5V	7.8	8.0	8.1	V/V
Slew Rate			2		V/µS
3dB Bandwidth			1		MHz
MAX Output Current	$I_{SOURCE} = +V_{IN} - V_{OUT}$ = 0.5V	2.5	3.5		mA
Output Saturation Voltage	I_{SOURCE} = 1.5mA, High Side		0.15	0.30	V
	I_{SINK} = 5mA, Low Side		1.4	1.85	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	–2.00	–.05		µA
Supply OK V_{SAT} (UC3177 Only)	I_{OUT} = 5mA			0.45	V
Supply OK Leakage (UC3177 Only)	V_{OUT} = 35V			5	µA
Park/Inhibit					
Park/Inhibit Thl'd		1.1	1.3	1.7	V
Park/Inhibit Input Current	At threshold		60	100	µA
Parking Drive Saturation Voltage	I_{OUT} = 100mA		0.3	0.7	V
Parking Drive Leakage	V_{OUT} = 35V			15	µA
Thermal Shutdown					
Shutdown Temperature			165		°C



Output saturation voltage vs. current.

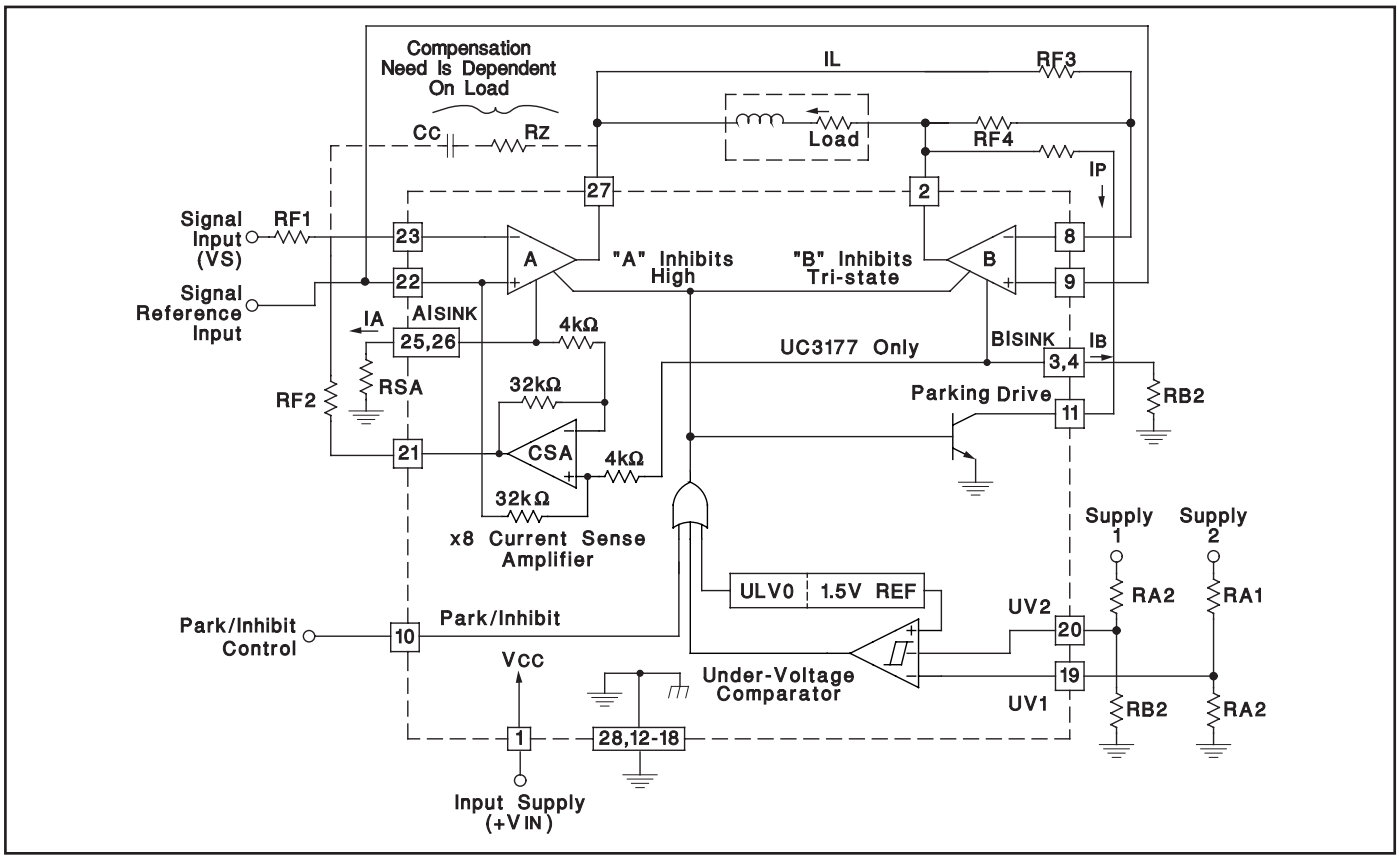


Maximum source current vs. + V_{IN} – V_{OUT}.

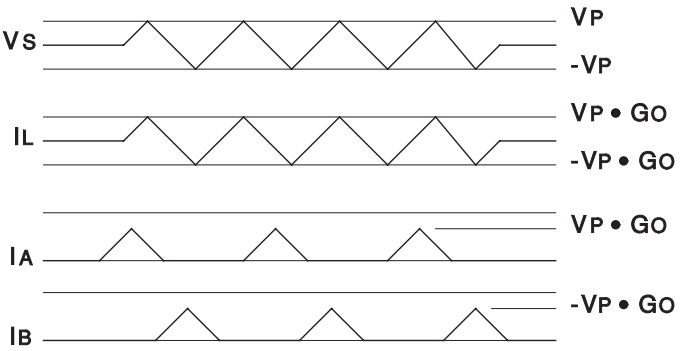


Crossover current error characteristic.

APPLICATION AND OPERATION INFORMATION



WAVEFORMS FOR ABOVE APPLICATION



DESIGN EQUATIONS

Transconductance (G_O) = $\frac{I_L}{V_S} = \frac{R_{F2}}{R_{F1}} \times \left(\frac{1}{8R_S}\right)$

with: $R_{SA} = R_{SB}$ and $R_{F3} = R_{F4}$

Parking Current (I_P) = $\frac{V_{IN} - 1.5}{R_P + R_L}$

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