

High Performance Stepper Motor Drive Circuit

FEATURES

- Full-Step, Half-Step and Micro-Step Capability.
- Bipolar Output Current up to 2A.
- Wide Range of Motor Supply Voltage: 10–50V
- Low Saturation Voltage
- Wide Range of Current Control: 5mA–2A.
- Current Levels Selected in Steps or Varied Continuously.
- Thermal Protection and Soft Intervention.

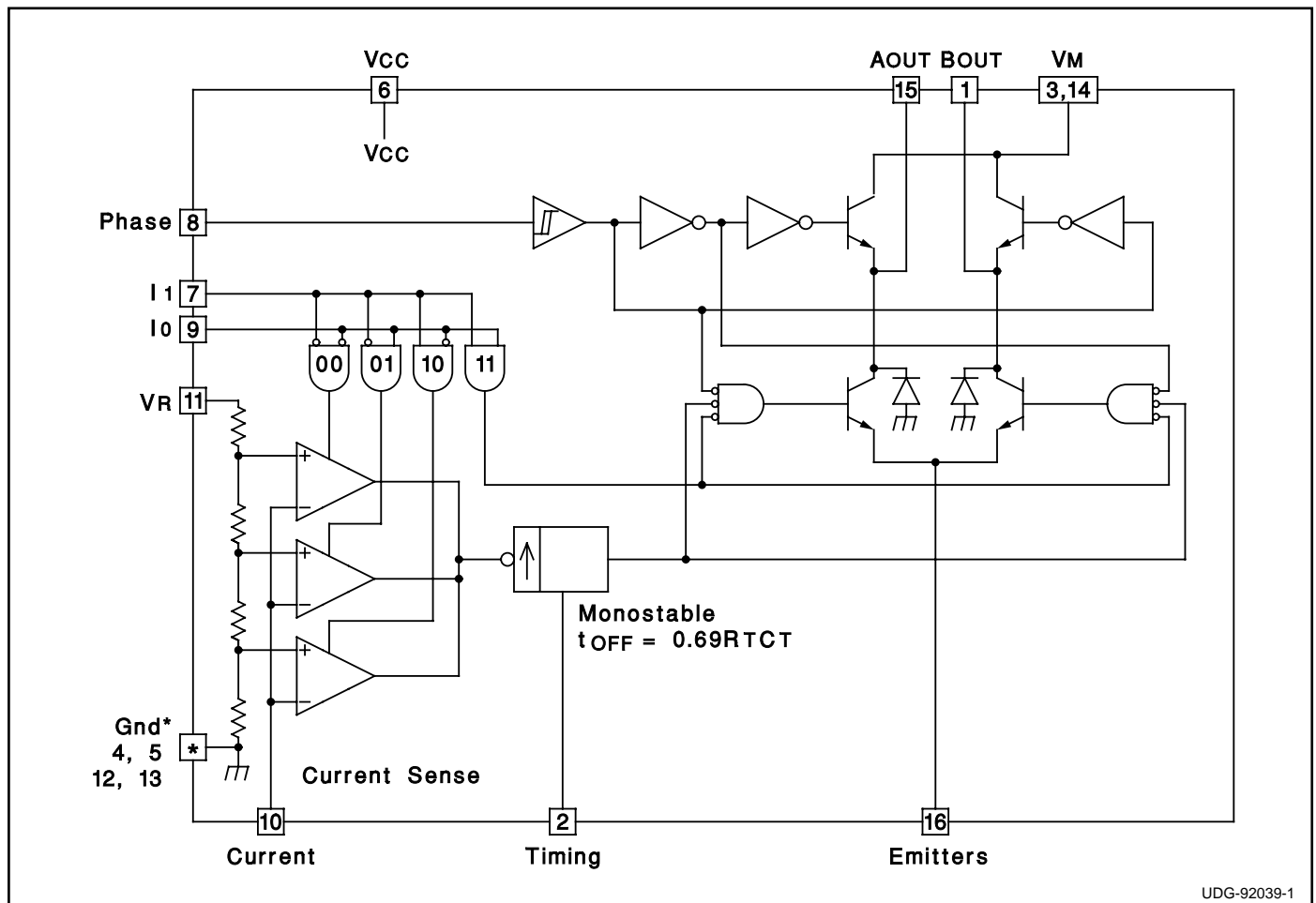
DESCRIPTION

The UC3770A and UC3770B are high-performance full bridge drivers that offer higher current and lower saturation voltage than the UC3717 and the UC3770. Included in these devices are LS-TTL compatible logic inputs, current sense, monostable, thermal shut-down, and a power H-bridge output stage. Two UC3770As or UC3770Bs and a few external components form a complete micro-processor-controllable stepper motor power system.

Unlike the UC3717, the UC3770A and the UC3770B require external high-side clamp diodes. The UC3770A and UC3770B are identical in all regards except for the current sense thresholds. Thresholds for the UC3770A are identical to those of the older UC3717 permitting drop-in replacement in applications where high-side diodes are not required. Thresholds for the UC3770B are tailored for half stepping applications where 50%, 71%, and 100% current levels are desirable.

The UC3770A and UC3770B are specified for operation from 0°C to 70°C ambient.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| | |
|------------------------------------|--------|
| Logic Supply Voltage, Vcc | 7V |
| Output Supply Voltage, VMM | 50V |
| Logic Input Voltage (Pins 7, 8, 9) | 6V |
| Analog Input Voltage (Pin 10) | Vcc |
| Reference Input Voltage (Pin 11) | 15V |
| Logic Input Current (Pins 7, 8, 9) | -10mA |
| Analog Input Current (Pins 10, 11) | -10mA |
| Output Current (Pins 1, 15) | ±2A |
| Junction Temperature, Tj | +150°C |

Note 1: All voltages are with respect to Gnd (DIL Pins 4, 5, 12, 13); all currents are positive into, negative out of the specified terminal.

Note 2: Consult Unitorde Integrated Circuits databook for thermal limitations and considerations of packages.

CONNECTION DIAGRAMS

DIL-16 (Top View)
J Or N Package

PLCC-28 (Top View)
Q Package

| PACKAGE PIN FUNCTION | |
|----------------------|-------|
| FUNCTION | PIN |
| Gnd | 1-3 |
| VM | 4 |
| N/C | 5 |
| AOUT | 6 |
| N/C | 7 |
| Emitters | 8 |
| Gnd | 9 |
| BOUT | 10 |
| Timing | 11 |
| VM | 12 |
| Gnd | 13-17 |
| Vcc | 18 |
| I1 | 19 |
| Phase | 20 |
| Io | 21 |
| N/C | 22 |
| Current | 23 |
| VR | 24 |
| N/C | 25-27 |
| Gnd | 28 |

ELECTRICAL CHARACTERISTICS: (All tests apply with VM = 36V, Vcc = 5V, VR = 5V, No Load, and 0°C < TA < 70°C, unless otherwise stated, TA = Tj.)

| PARAMETER | TEST CONDITIONS | UC3770A | | | UC3770B | | | UNITS |
|-----------------------------------|-------------------------|---------|------|------|---------|------|------|-------|
| | | MIN | TYP | MAX | MIN | TYP | MAX | |
| Supply Voltage VM (Pins 3, 14) | | 10 | | 45 | 10 | | 45 | V |
| Logic Supply Voltage Vcc (Pin 6) | | 4.75 | 5 | 5.3 | 4.75 | 5 | 5.3 | V |
| Logic Supply Current Icc (Pin 6) | Io = I1 = H, Im = 0 | | 15 | 25 | | 15 | 25 | mA |
| | Io = I1 = L, Im = 0 | | 18 | 28 | | 18 | 28 | mA |
| | Io = I1 = H, Im = 1.3A | | 33 | 40 | | 33 | 40 | mA |
| Thermal Shutdown Temperature | | | +170 | | | +170 | | °C |
| Logic Threshold (Pins 7, 8, 9) | | 0.8 | | 2.0 | 0.8 | | 2.0 | V |
| Input Current Low (Pin 8) | Vi = 0.4V | | | -100 | | | -100 | µA |
| Input Current Low (Pins 7, 9) | Vi = 0.4V | | | -400 | | | -400 | µA |
| Input Current High (Pins 7, 8, 9) | Vi = 2.4V | | | 10 | | | 10 | µA |
| Comparator Threshold (Pin 10) | VR = 5V, Io = L, I1 = L | 400 | 415 | 430 | 400 | 415 | 430 | mV |
| | VR = 5V, Io = H, I1 = L | 240 | 255 | 265 | 290 | 300 | 315 | mV |
| | VR = 5V, Io = L, I1 = H | 70 | 80 | 90 | 195 | 210 | 225 | mV |
| Comparator Input Current (Pin 10) | | | | ±20 | | | ±20 | µA |
| Off Time | RT = 56k, CT = 820pF | 25 | 30 | 35 | 25 | 30 | 35 | ms |

ELECTRICAL CHARACTERISTICS (cont.): (All tests apply with $V_M = 36V$, $V_{CC} = 5V$, $V_R = 5V$, No Load, and $0^\circ C < T_A < 70^\circ C$, unless otherwise stated, $T_A = T_J$.)

| PARAMETER | TEST CONDITIONS | UC3770A | | | UC3770B | | | UNITS |
|----------------------------------|-----------------|---------|-----|-----|---------|-----|-----|---------|
| | | MIN | TYP | MAX | MIN | TYP | MAX | |
| Turn Off Delay | | | | 2 | | | 2 | ms |
| Sink Driver Saturation Voltage | $I_M = 1.0A$ | | | 0.8 | | | 0.8 | V |
| | $I_M = 1.3A$ | | | 1.3 | | | 1.3 | V |
| Source Driver Saturation Voltage | $I_M = 1.0A$ | | | 1.3 | | | 1.3 | V |
| | $I_M = 1.3A$ | | | 1.6 | | | 1.6 | V |
| Output Leakage Current | $V_M = 45V$ | | | 100 | | | 100 | μA |

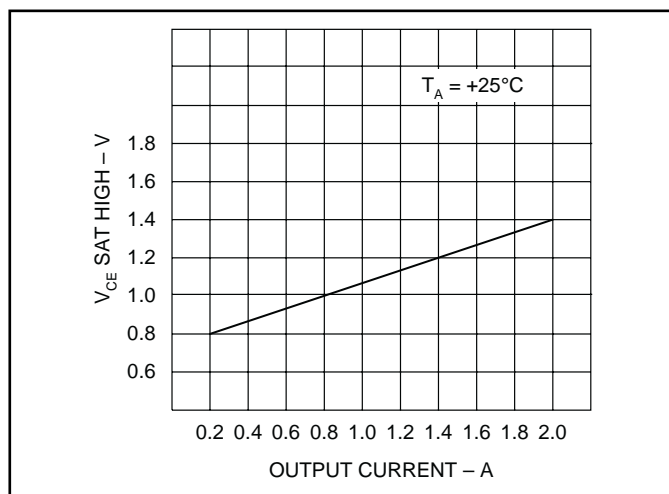


Figure 1. Typical source saturation voltages vs. load current

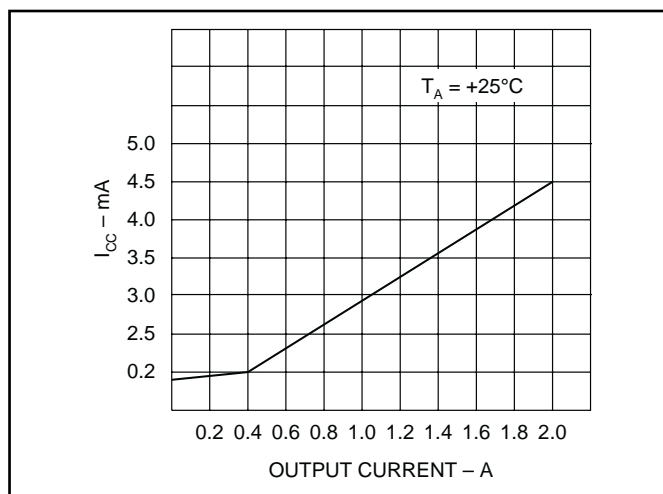


Figure 3. Typical supply current vs. load current.

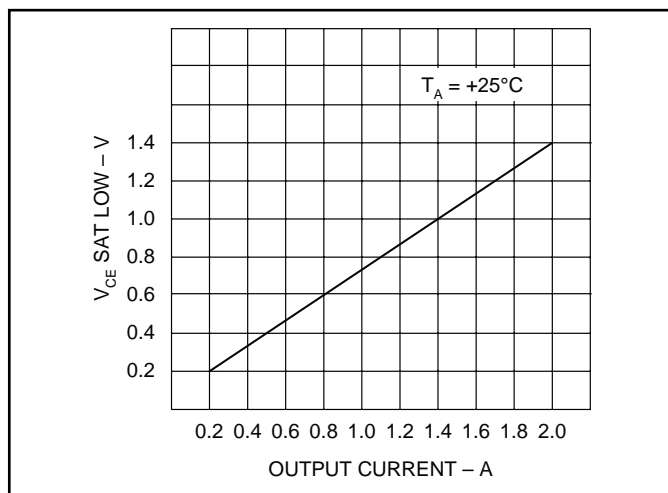


Figure 2. Typical sink saturation voltages vs. load current

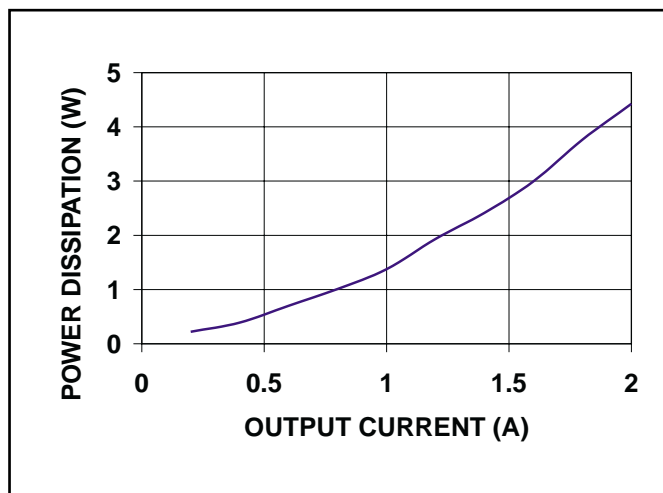


Figure 4. Typical power dissipation vs. output current.

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| UC3770AN | ACTIVE | PDIP | N | 16 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | N / A for Pkg Type |
| UC3770ANG4 | ACTIVE | PDIP | N | 16 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | N / A for Pkg Type |
| UC3770AQ | ACTIVE | PLCC | FN | 28 | 37 | TBD | Cu NiPdAu | Level-2-220C-1 YEAR |
| UC3770AQTR | ACTIVE | PLCC | FN | 28 | 750 | TBD | Cu NiPdAu | Level-2-220C-1 YEAR |
| UC3770BN | ACTIVE | PDIP | N | 16 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | N / A for Pkg Type |
| UC3770BNG4 | ACTIVE | PDIP | N | 16 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | N / A for Pkg Type |

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBsolete: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|------------|--------------|-----------------|------|-----|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| UC3770AQTR | PLCC | FN | 28 | 750 | 330.0 | 24.4 | 12.95 | 12.95 | 5.0 | 16.0 | 24.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|------------|--------------|-----------------|------|-----|-------------|------------|-------------|
| UC3770AQTR | PLCC | FN | 28 | 750 | 346.0 | 346.0 | 41.0 |

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