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.

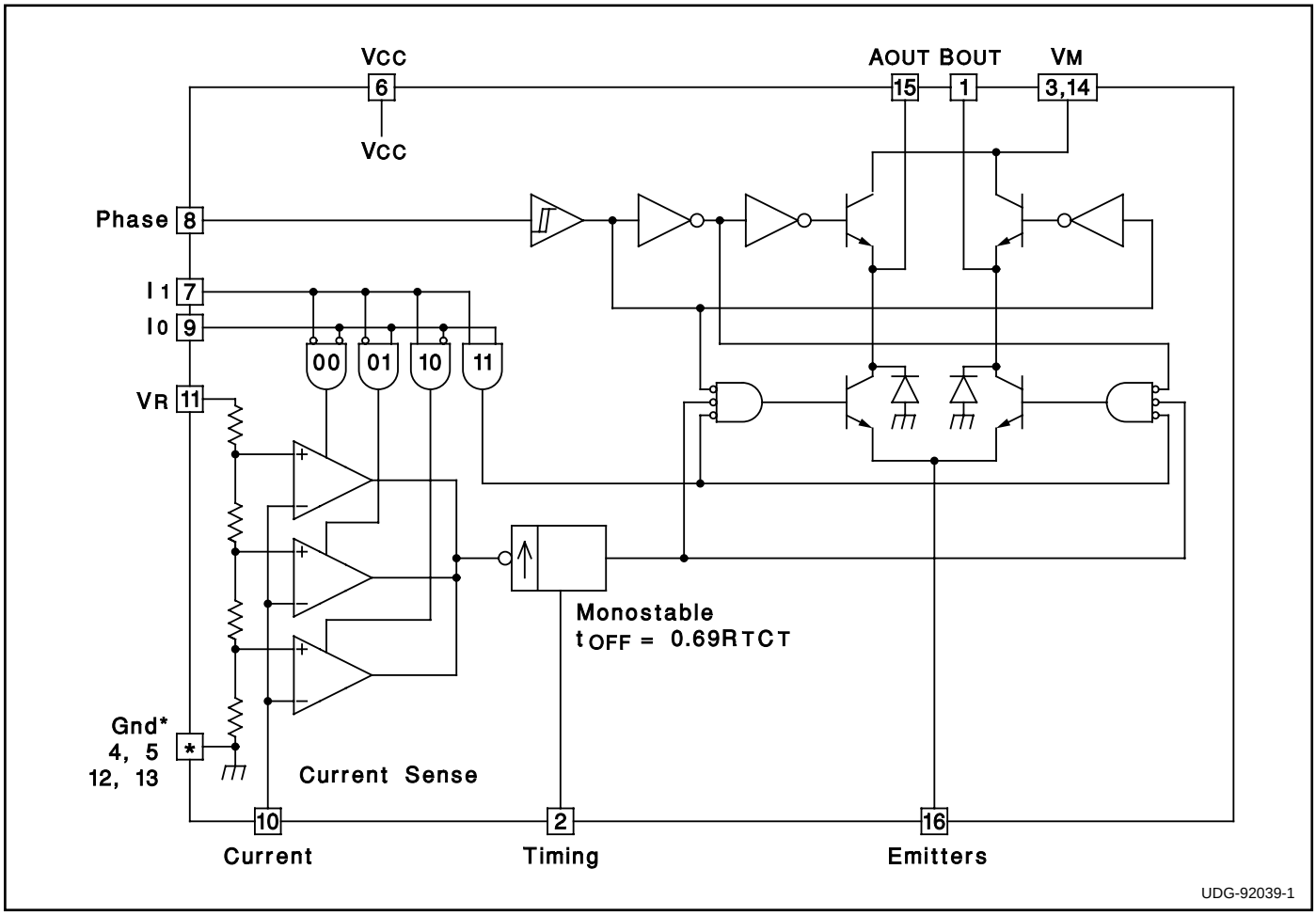
DESCRIPTION

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 shutdown, and a power H-bridge output stage. Two UC3770As or UC3770Bs and a few external components form a complete microprocessor-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



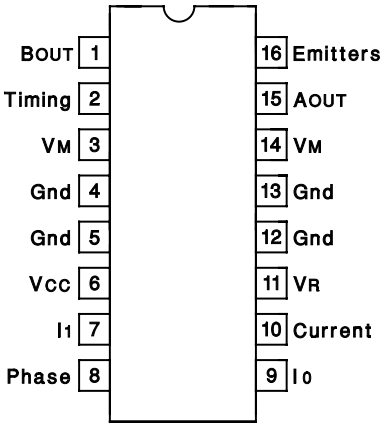
ABSOLUTE MAXIMUM RATINGS

Logic Supply Voltage, V_{CC} 7V
Output Supply Voltage, VMM 50V
Logic Input Voltage (Pins 7, 8, 9) 6V
Analog Input Voltage (Pin 10) . . . . . V_{CC}
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, T_J . . . . . +150°C

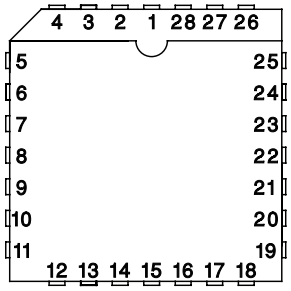
Note 1: All voltages are with respect to Gnd (DIL Pins 4, 5, 12, 13); all currents are positive into, negative out of the specified terminal.
Note 2: Consult Unitrode Integrated Circuits databook for thermal limitations and considerations of packages.

CONNECTION DIAGRAMS

DIL-16 (Top View)
J Or N Package



PLCC-28 (Top View)
Q Package



PACKAGE PIN FUNCTION	
FUNCTION	**PIN**
Gnd	1-3
V_M	4
N/C	5
A_{OUT}	6
N/C	7
Emitters	8
Gnd	9
B_{OUT}	10
Timing	11
V_M	12
Gnd	13-17
V_{CC}	18
I_1	19
Phase	20
I_0	21
N/C	22
Current	23
V_R	24
N/C	25-27
Gnd	28

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

		UC3770A			UC3770B			
PARAMETER	**TEST CONDITIONS**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**UNITS**
Supply Voltage V_M (Pins 3, 14)		10		45	10		45	V
Logic Supply Voltage V_{CC} (Pin 6)		4.75	5	5.3	4.75	5	5.3	V
Logic Supply Current I_{CC} (Pin 6)	I_O = I_1 = H, I_M = 0		15	25		15	25	mA
	I_O = I_1 = L, I_M = 0		18	28		18	28	mA
	I_O = I_1 = H, I_M = 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)	V_I = 0.4V			-100			-100	µA
Input Current Low (Pins 7, 9)	V_I = 0.4V			-400			-400	µA
Input Current High (Pins 7, 8, 9)	V_I = 2.4V			10			10	µA
Comparator Threshold (Pin 10)	V_R = 5V, I_0 = L, I_1 = L	400	415	430	400	415	430	mV
	V_R = 5V, I_0 = H, I_1 = L	240	255	265	290	300	315	mV
	V_R = 5V, I_0 = L, I_1 = H	70	80	90	195	210	225	mV
Comparator Input Current (Pin 10)				±20			±20	µA
Off Time	R_T = 56k, C_T = 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°C<T_A<70°C, unless otherwise stated, T_A = T_J.)

		UC3770A			UC3770B			
PARAMETER	**TEST CONDITIONS**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**UNITS**
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

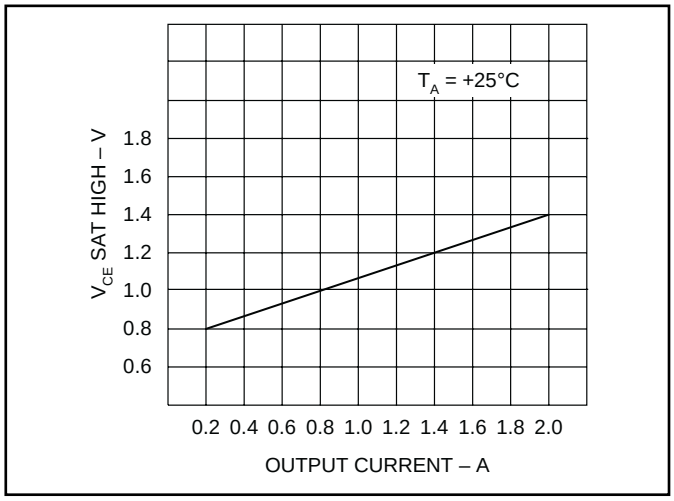


Figure 1. Typical source saturation voltages vs. load current

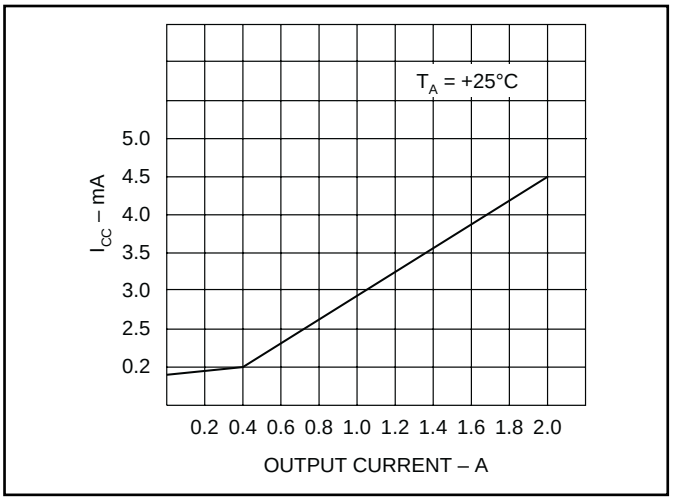


Figure 3. Typical supply current vs. load current.

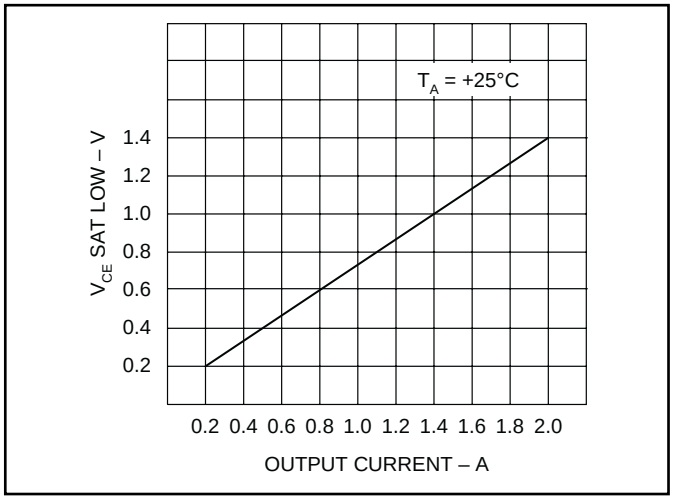


Figure 2. Typical sink saturation voltages vs. load current

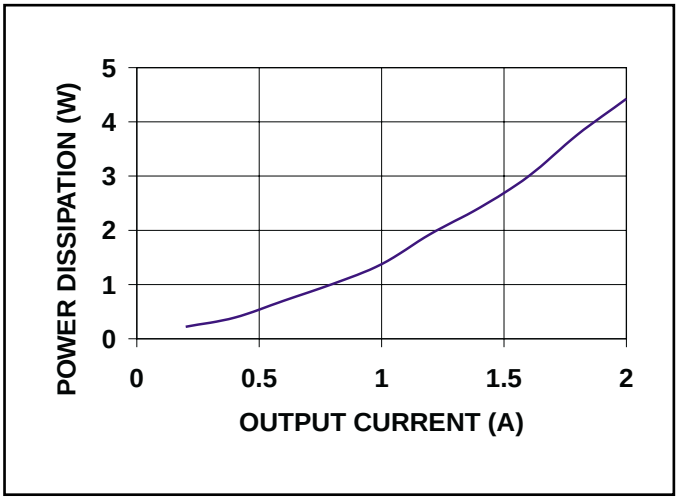


Figure 4. Typical power dissipation vs. output current.

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PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
UC3770AN	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	UC3770AN
UC3770AN.A	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	UC3770AN
UC3770ANG4	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	UC3770AN
UC3770AQ	Obsolete	Production	PLCC (FN) | 28	-	-	Call TI	Call TI	-	UC3770AQ
UC3770BN	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	UC3770BN
UC3770BN.A	Active	Production	PDIP (N) | 16	25 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	UC3770BN

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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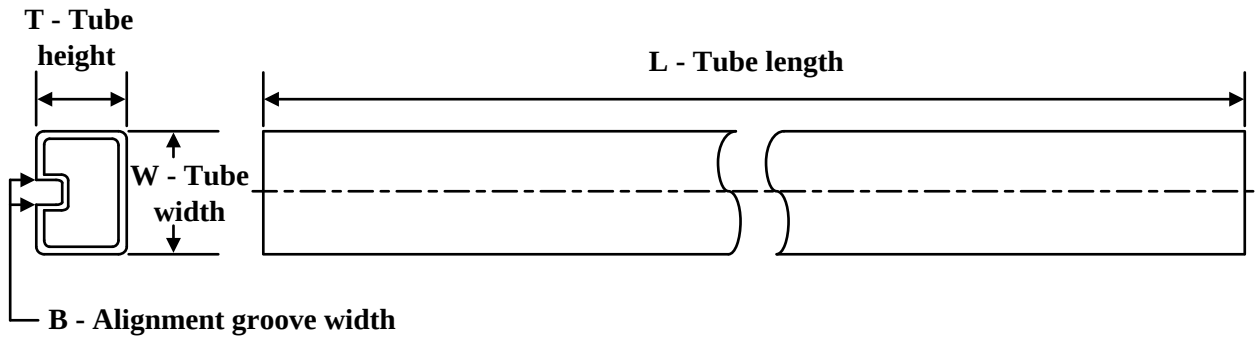
TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
UC3770AN	N	PDIP	16	25	506	13.97	11230	4.32
UC3770AN.A	N	PDIP	16	25	506	13.97	11230	4.32
UC3770ANG4	N	PDIP	16	25	506	13.97	11230	4.32
UC3770BN	N	PDIP	16	25	506	13.97	11230	4.32
UC3770BN.A	N	PDIP	16	25	506	13.97	11230	4.32

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