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.

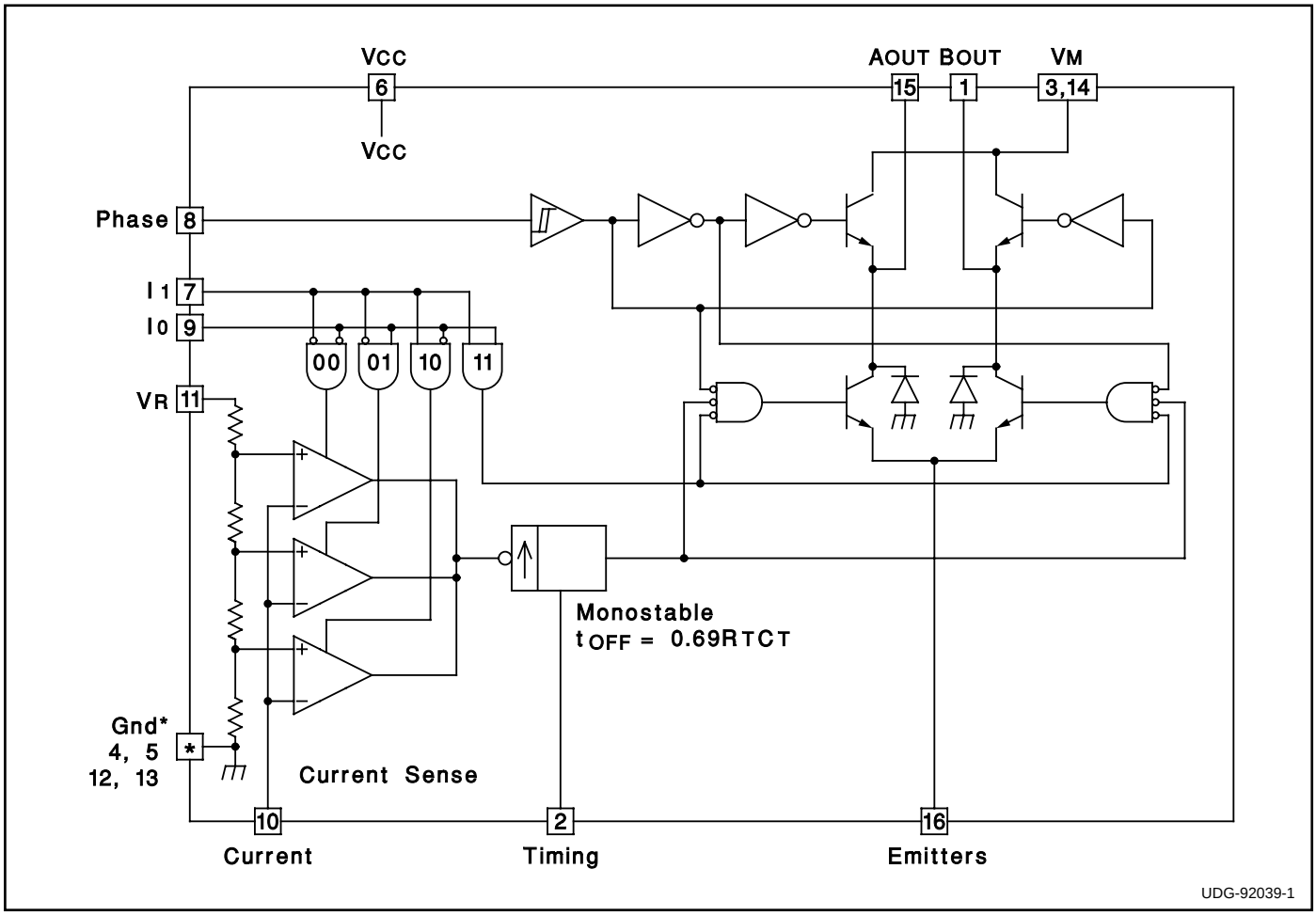
DESCRIPTION

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



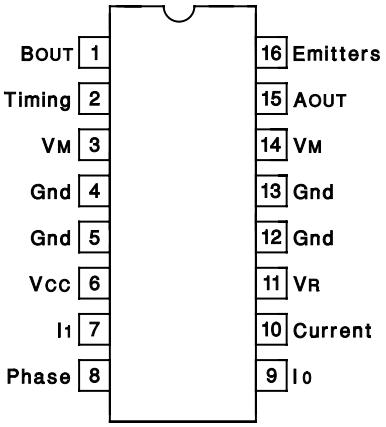
ABSOLUTE MAXIMUM RATINGS

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

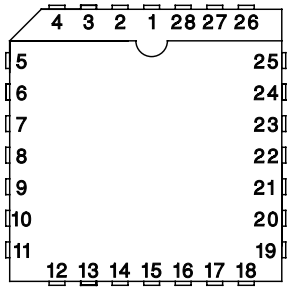
Note 1: All voltages are with respect to Gnd (DIL Pins 4, 5, 12, 13); all currents are positive into, negative out of the specified terminal.
Note 2: Consult Unitrode Integrated Circuits databook for thermal limitations and considerations of packages.

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

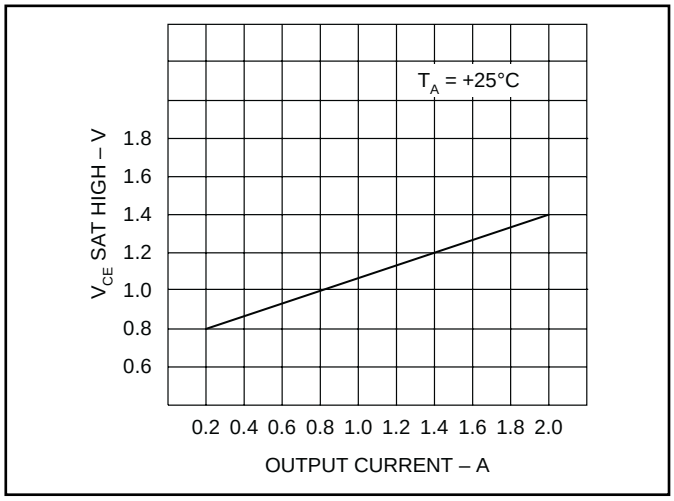


Figure 1. Typical source saturation voltages vs. load current

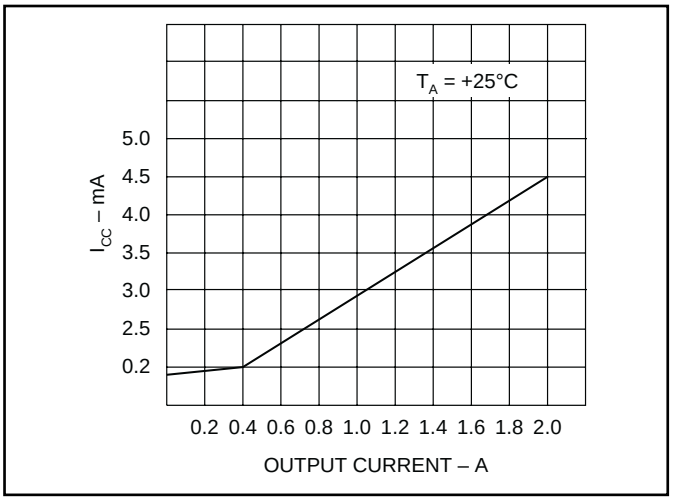


Figure 3. Typical supply current vs. load current.

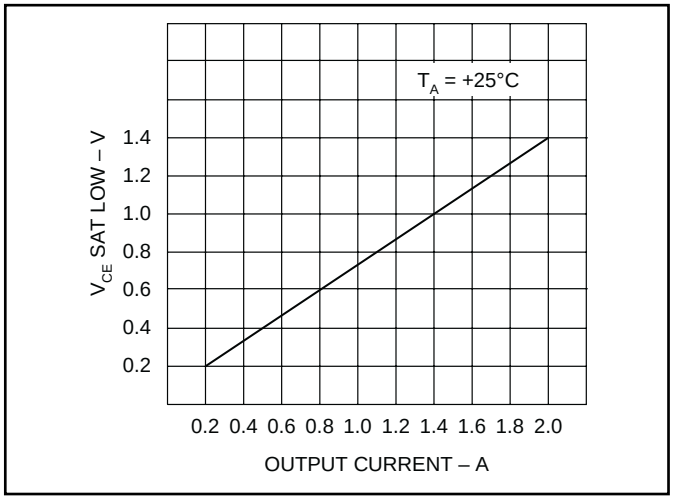


Figure 2. Typical sink saturation voltages vs. load current

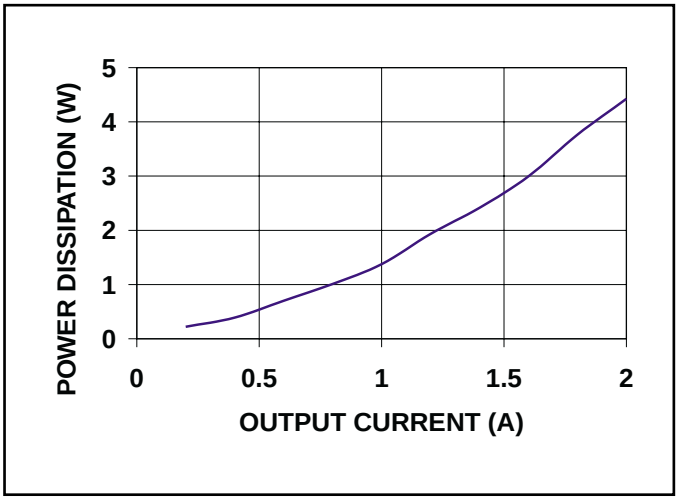


Figure 4. Typical power dissipation vs. output current.

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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
UC3770AN	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	0 to 70	UC3770AN	Samples
UC3770ANG4	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	0 to 70	UC3770AN	Samples
UC3770AQ	ACTIVE	PLCC	FN	28	37	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	0 to 70	UC3770AQ	Samples
UC3770AQTR	ACTIVE	PLCC	FN	28	750	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	0 to 70	UC3770AQ	Samples
UC3770BN	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	0 to 70	UC3770BN	Samples
UC3770BNG4	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	0 to 70	UC3770BN	Samples

(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.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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

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