

Integrated
Circuits

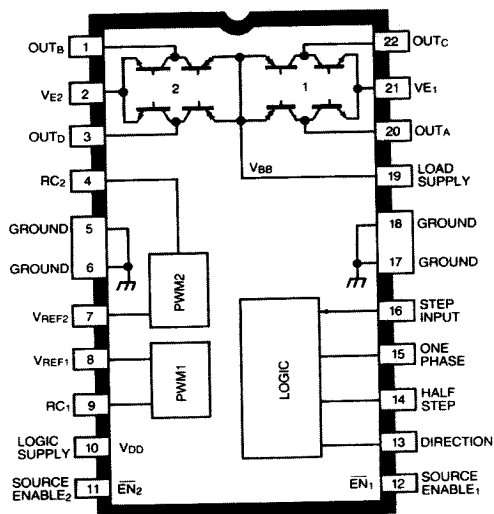
UCN5871B

UCN5871EB

Data Sheet
26184-20

BiMOS II TRANSLATOR/DRIVERS FOR BIPOLAR STEPPER MOTORS

UCN5871B



Dwg. PP-002

ABSOLUTE MAXIMUM RATINGS at $T_A = 25^\circ\text{C}$

Motor Supply Voltage, V_{BB}	45 V
Output Current, I_{OUT} (Continuous)	1.0 A
(Peak)	1.5 A
Logic Supply Voltage, V_{DD}	7.0 V
Logic Input Voltage Range, V_{IN} ...	-0.3 V to $V_{DD} + 0.3$ V
Sense Voltage, V_E	1.0 V
Package Power Dissipation, P_D . See Graph	
Operating Temperature Range, T_A	-20°C to +85°C
Storage Temperature Range, T_S	-55°C to +150°C

Output current rating may be limited by duty cycle, ambient temperature, and heat sinking. Under any set of conditions, do not exceed the specified peak current or a junction temperature of +150°C.

Caution: Sprague CMOS devices have input static protection but are susceptible to damage when exposed to extremely high static electrical charges.

Combining low-power CMOS control logic with two high-current, high-voltage bipolar power bridges, the UCN5871B and UCN5871EB provide complete control and drive for two-phase bipolar stepper motors with continuous output current ratings to 1 ampere per phase (1.5 A startup) at 45 V.

The CMOS logic section provides the sequencing logic, DIRECTION and OUTPUT SOURCE ENABLE control, and a power-ON reset function. Three stepper-motor drive formats are externally available. The inputs are compatible with standard CMOS, PMOS, and NMOS circuits. TTL or LSTTL may require the use of appropriate pull-up resistors to insure a proper input-logic high.

The two high-current bipolar bridges include both ground clamp and flyback diodes for protection against inductive transients. For PWM current control, the output source current is determined by the user's selection of a reference voltage and sensing resistor, while the OFF pulse duration is set by an external RC timing network. Thermal protection circuitry disables the outputs if the chip temperature exceeds safe operating limits.

The UCN5871B is supplied in a 22-pin dual in-line plastic batwing package with a copper lead frame and heat sinkable tabs for improved power dissipation capabilities. The UCN5871EB is supplied in a 44-lead power PLCC for surface mount applications. Its batwing construction provides for maximum package power dissipation in the smallest possible construction.

FEATURES

- 1 A Continuous Output Current
- 45 V Output Sustaining Voltage
- Wave-Drive, Two-Phase, & Half-Step Drive Formats
- Internal PWM Current Control
- Internal Clamp Diodes
- Low Output Saturation Voltage
- Output Enable and Direction Control
- Power-ON Reset
- Internal Thermal Shutdown Circuitry

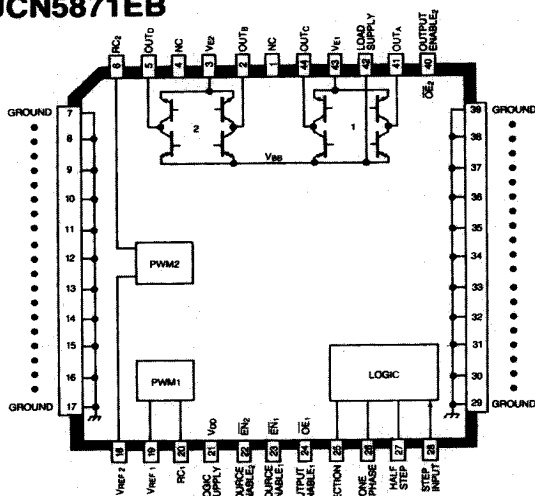
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SEMICONDUCTOR GROUP

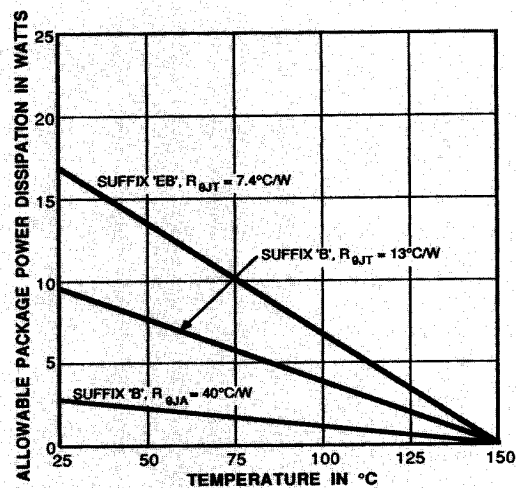
UCN5871B/EB

BiMOS II TRANSLATOR/DRIVERS

UCN5871EB



Dwg. PP-003



Dwg. GP-005

ELECTRICAL CHARACTERISTICS at $T_A = +25^\circ\text{C}$, $T_{TAB} \leq +70^\circ\text{C}$, $V_{BB} = 45\text{ V}$, $V_{DD} = 4.5\text{ V to }5.5\text{ V}$, $V_E = 0\text{ V}$, $R_C = 5.0\text{ V}$ (unless otherwise noted)

Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units

Output Drivers (OUT₁ or OUT₂)

Motor Supply Range	V_{BB}		10	—	45	V
Output Leakage Current	I_{CEX}	$V_{OUT} = V_{BB}$	—	<1.0	50	μA
		$V_{OUT} = 0$	—	<-1.0	-50	μA
Output Sustaining Voltage	$V_{CE(SUS)}$	$I_{OUT} = \pm 1.0\text{ A}$	45	—	—	V
Output Saturation Voltage	$V_{CE(SAT)}$	Sink Driver, $I_{OUT} = +0.5\text{ A}$	—	—	0.5	V
		Source Driver, $I_{OUT} = -0.5\text{ A}$	—	—	1.1	V
		Sink Driver, $I_{OUT} = +1.0\text{ A}$	—	—	0.7	V
		Source Driver, $I_{OUT} = -1.0\text{ A}$	—	—	1.3	V
Clamp Diode Leakage Current	I_R	$V_R = 45\text{ V}$	—	—	100	μA
Clamp Diode Forward Voltage	V_F	$I_F = 1.0\text{ A}$	—	—	2.0	V
Driver Supply Current	I_{BB}	Both Bridges ON, No Load	—	—	10	mA

Control Logic

Input Voltage	$V_{IN(1)}$	$V_{DD} = 5.0\text{ V}$	3.5	—	5.3	V
	$V_{IN(0)}$	$V_{DD} = 5.0\text{ V}$	-0.3	—	0.8	V
Input Current	$I_{IN(1)}$	$V_{IN} = V_{DD}$	—	—	0.5	μA
	$I_{IN(0)}$	$V_{IN} = 0.8\text{ V}$	—	—	-0.5	μA
V_{REF} Input Resistance	R_{IN}		—	50	—	k Ω
Current Limit Threshold	—	V_{REF}/V_{SENSE} at trip point	47	50	53	—
Thermal Shutdown Temp.	T_J		—	160	—	$^\circ\text{C}$
Logic Supply Current	$I_{DD(1)}$	Both Bridges ON	—	—	70	mA
	$I_{DD(0)}$	Both Bridges OFF (Suffix "EB" only)	—	—	10	mA

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APPLICATIONS

The UCN5871B and UCN5871EB dual full-bridge drivers are application specific for driving two-phase bipolar stepper motors with pulse-width modulation (PWM) current control. Output current is controlled by using external sense resistors, RC networks, and reference voltages for internal fixed-frequency PWM circuits, or by using an external PWM source.

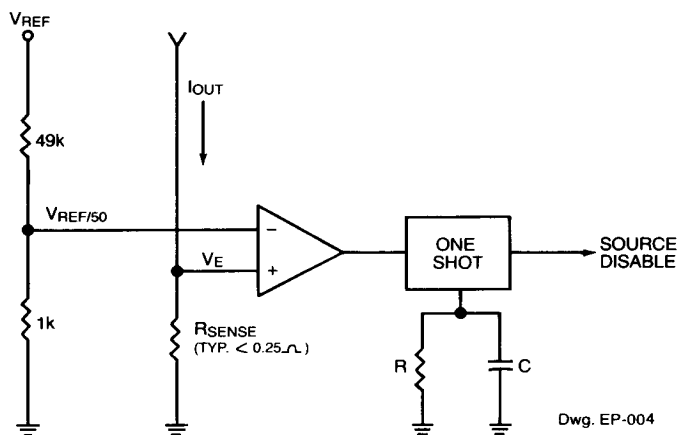
The output current trip point is set by:

$$I_{OUT} = V_{REF}/50 R_{SENSE}$$

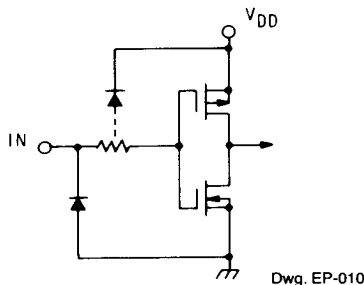
When the current in the sense resistor (typically $\leq 0.25 \Omega$) reaches the set point, an internal one-shot turns OFF the source drivers for a time period determined by the RC time constant. The actual peak current will be slightly higher than the trip point because of the internal logic and switching delays.

Average motor current can also be adjusted by external pulse-width modulation of the SOURCE ENABLE pins. With the UCN5871EB, the OUTPUT ENABLE pins can be used to shut OFF both the source and sink drivers, resulting in very-fast current decay. In either mode, the RC pins should be connected to V_{DD} .

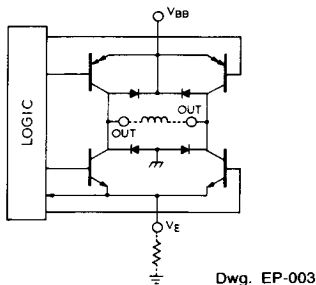
Thermal protection circuitry is activated and turns OFF all drivers at a junction temperature of typically 160°C . It is only intended to protect the chip from catastrophic failures due to excessive junction temperatures.



TYPICAL INPUT CIRCUIT



TYPICAL
OUTPUT DRIVER
(ONE OF TWO)



WAVE-DRIVE SEQUENCE

Half-Step = L, One Phase = H				
Step	Out _A	Out _B	Out _C	Out _D
POR	H	Z	L	Z
1	H	Z	L	Z
2	Z	H	Z	L
3	L	Z	H	Z
4	Z	L	Z	H

TWO-PHASE DRIVE SEQUENCE

Half-Step = L, One Phase = L				
Step	Out _A	Out _B	Out _C	Out _D
POR	H	L	L	H
1	H	L	L	H
2	H	H	L	L
3	L	H	H	L
4	L	L	H	H

HALF-STEP DRIVE SEQUENCE

Half-Step = H, One Phase = L				
Step	Out _A	Out _B	Out _C	Out _D
POR	H	Z	L	Z
1	H	Z	L	Z
2	H	H	L	L
3	Z	H	Z	L
4	L	H	H	L
5	L	Z	H	Z
6	L	L	H	H
7	Z	L	Z	H
8	H	L	L	H

Z = High Impedance

POR = Power on Reset

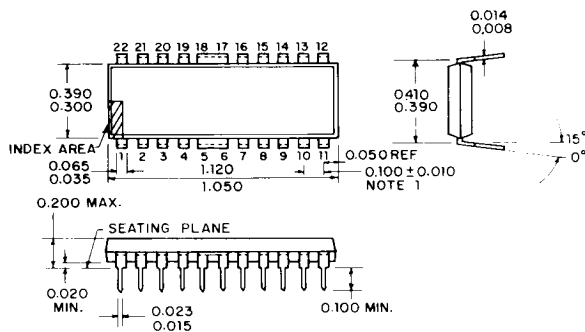
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BiMOS II TRANSLATOR/DRIVERS

PLASTIC DIP

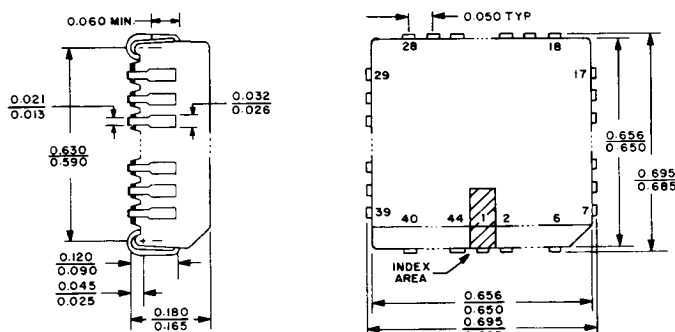
DIMENSIONS IN INCHES



Dwg. No. A-12, 669 IN

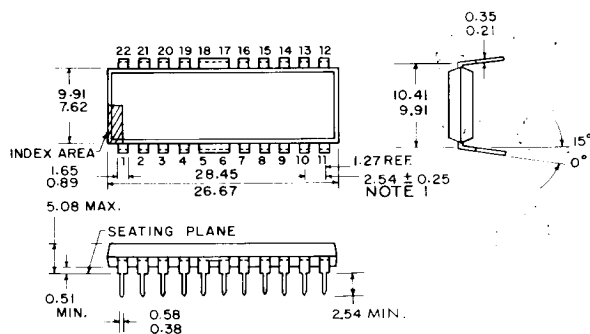
PLASTIC LEADED CHIP CARRIER

DIMENSIONS IN INCHES



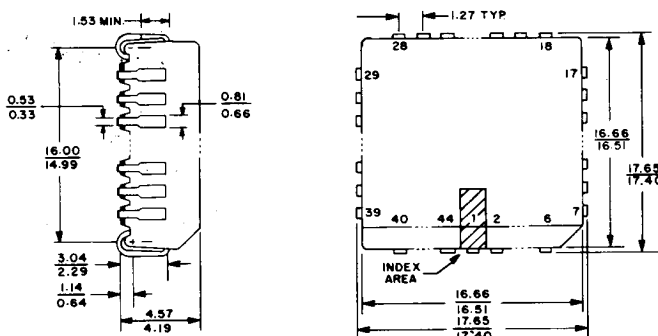
Dwg. No. A-13, 038 IN

DIMENSIONS IN MILLIMETERS Based on 1" = 25.4 mm



Dwg. No. A-12, 669 MM

DIMENSIONS IN MILLIMETERS Based on 1" = 25.4 mm



Dwg. No. A-13, 038 MM

NOTES:

1. Lead spacing tolerances is non-cumulative.
2. Exact body and lead configuration at vendor's option within limits shown.
3. Notch or dot at manufacturer's option.

In the construction of the components described, the full intent of the specification will be met. The Sprague Electric Company, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products. Components made under military approvals will be in accordance with the approval requirements.

The information included herein is believed to be accurate and reliable. However, the Sprague Electric Company assumes no responsibility for its use; nor for any infringements of patents or other rights of third parties which may result from its use.

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