SPRAGUE
THE MARK OF RELIABILITY

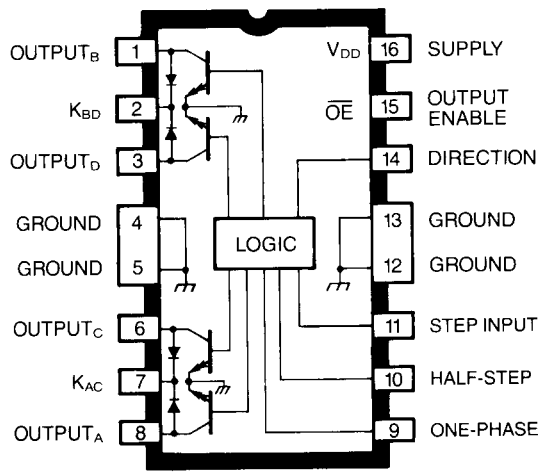
UCN-5804B
Integrated Circuit

DATA SHEET 26184.12

BiMOS II TRANSLATOR/DRIVER

FEATURES

- 1.5 A Maximum Output Current
- 35 V Output Sustaining Voltage
- Wave-Drive, Two-Phase, and Half-Step Drive Formats
- Internal Clamp Diodes
- Output Enable and Direction Control
- Power-ON Reset
- Internal Thermal Shutdown Circuitry



Dwg. No. W-194

Combining low-power CMOS logic with high-current and high-voltage bipolar outputs, the UCN-5804B BiMOS II translator/driver provides complete control and drive for a four-phase unipolar stepper-motor with continuous output current ratings to 1.25 A per phase (1.5 A startup) and 35 V.

The CMOS logic section provides the sequencing logic, DIRECTION and OUTPUT ENABLE control, and a power-ON reset function. Three stepper-motor drive formats, wave-drive (one-phase), two-phase, and half-step are externally selectable. 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 wave-drive format consists of energizing one motor phase at a time in an A-B-C-D (or D-C-B-A) sequence. This excitation mode consumes the least power and assures positional accuracy regardless of any winding inbalance in the motor. Two-phase drive energizes two adjacent phases in each detent position (AB-BC-CD-DA). This sequence mode offers an improved torque-speed product, greater detent torque, and is less susceptible to motor resonance. Half-step excitation alternates between the one-phase and two-phase modes (A-AB-B-BC-C-CD-D-DA), providing an eight-step sequence.

The bipolar outputs are capable of sinking up to 1.5 A and withstanding 50 V in the OFF state (sustaining voltages up to 35 V). Ground clamp and flyback diodes provide protection against inductive transients. Thermal protection circuitry disables the outputs when the chip temperature is excessive.

The UCN-5804B is rated for operation over the temperature range of −20°C to +85°C. It is supplied in a 16-pin dual in-line plastic batwing package with a copper lead frame and heat-sinkable tabs for improved power dissipation capabilities.

ABSOLUTE MAXIMUM RATINGS

Output Voltage, V_{CE}	50 V
Output Sustaining Voltage, $V_{CE(sus)}$	35 V
Output Sink Current, I_{OUT}	1.5 A
Logic Supply Voltage, V_{DD}	7.0 V
Input Voltage, V_{IN}	7.0 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 +125°C

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SEMICONDUCTOR GROUP
SPRAGUE ELECTRIC COMPANY
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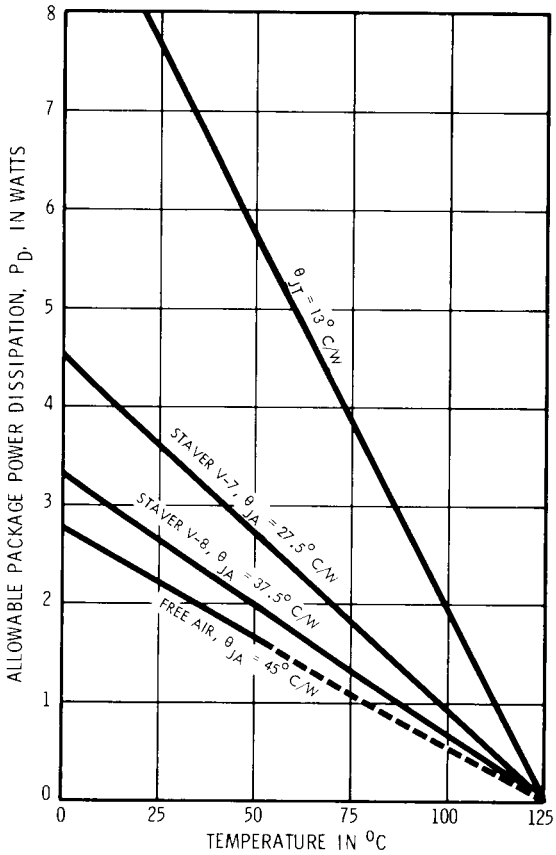
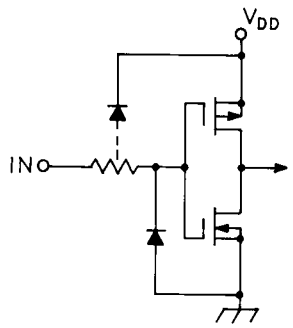
115 Northeast Cutoff Worcester, MA 01606

ALLOWABLE POWER DISSIPATION AS A FUNCTION OF TEMPERATURE



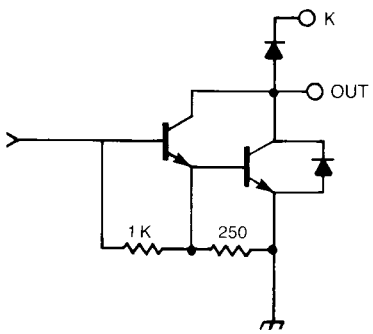
Dwg. No. W-195

TYPICAL INPUT CIRCUIT



Dwg. No. A-13,035

TYPICAL OUTPUT DRIVER



Dwg. No. D-196

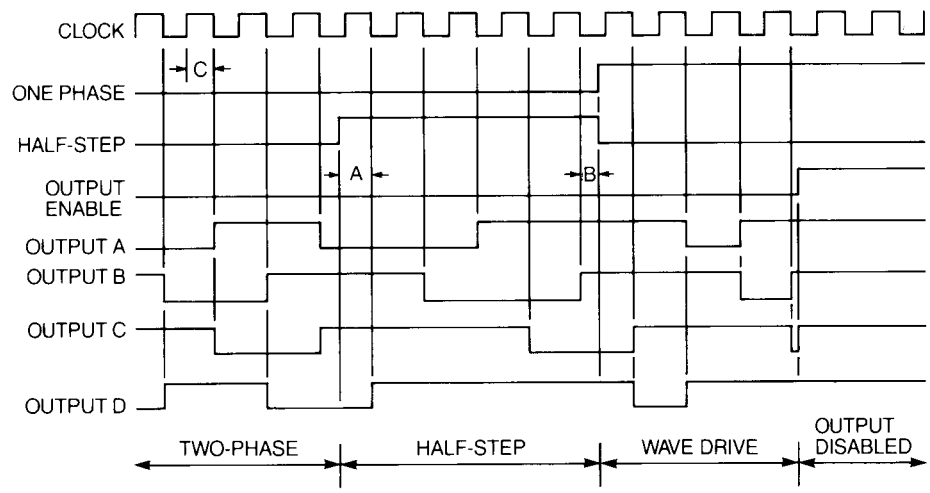
TRUTH TABLE

	PIN 9	PIN 10
TWO-PHASE	L	L
ONE-PHASE	H	L
HALF-STEP	L	H
STEP-INHIBIT	H	H

ELECTRICAL CHARACTERISTICS at $T_A = 25°C$, $T_{TAB} \leq 70°C$, $V_{DD} = 4.5\ V$ to $5.5\ V$ (unless otherwise noted)

Characteristic	Symbol	Test Conditions	Limits			Units
			Min.	Typ.	Max.	
Output Leakage Current	I_{CEX}	$V_{OUT} = 50\ V$	—	10	50	μA
Output Sustaining Voltage	$V_{CE(sus)}$	$I_{OUT} = 1.25\ A$, $L = 3\ mH$	35	—	—	V
Output Saturation Voltage	$V_{CE(SAT)}$	$I_{OUT} = 700\ mA$	—	1.0	1.2	V
		$I_{OUT} = 1\ A$	—	1.1	1.4	V
		$I_{OUT} = 1.25\ A$	—	1.2	1.5	V
Clamp Diode Leakage Current	I_R	$V_R = 50\ V$	—	10	50	μA
Clamp Diode Forward Voltage	V_F	$I_F = 1.25\ A$	—	—	3.0	V
Input Current	$I_{IN(1)}$	$V_{IN} = V_{DD}$	—	0.5	5.0	μA
	$I_{IN(0)}$	$V_{IN} = 0.8\ V$	—	−0.5	−5.0	μA
Input Voltage	$V_{IN(1)}$	$V_{DD} = 5\ V$	3.5	—	5.3	V
	$V_{IN(0)}$		−0.3	—	0.8	V
Supply Current	I_{DD}	2 Outputs ON	—	20	30	mA
Turn-Off Delay	t_{ON}	50% Step Inputs to 50% Output	—	—	10	μs
Turn-On Delay	t_{OFF}	50% Step Inputs to 50% Output	—	—	10	μs
Thermal Shutdown Temperature	T_j		—	165	—	°C

TIMING CONDITIONS



Dwg. No. W-110A

A. Minimum data set up time..... 100 ns
B. Minimum data hold time ..... 100 ns
C. Minimum step input pulse width ..... 500 ns

APPLICATIONS INFORMATION

Internal power-ON reset (POR) circuitry resets $OUTPUT_A$ (and $OUTPUT_D$ in the two-phase drive format) to the ON state with initial application of the logic supply voltage. After reset, the circuit then steps according to the tables shown below.

The outputs will advance one sequence position on the high-to-low transition of the STEP INPUT pulse. Logic levels on the HALF-STEP and ONE-PHASE inputs will determine the drive format (one-phase, two-phase, or half-step). The DIRECTION pin determines the rotation sequence of the outputs. Note that the STEP INPUT must be in the low state when changing the state of ONE-PHASE, HALF-STEP, or DIRECTION to prevent erroneous stepping.

All outputs are disabled (OFF) when OUTPUT ENABLE is at a logic high. That input can be used for chopping applications without affecting the stepping logic. If the function is not required, OUTPUT ENABLE should be tied low. In that condition, all outputs depend only on the state of the step logic.

Internal thermal protection circuitry disables all outputs when the junction temperature reaches approximately 165°C. The outputs are enabled again when the junction cools down to approximately 145°C.

WAVE-DRIVE SEQUENCE

←DIRECTION = L	Half Step = L, One Phase = H				→DIRECTION = H
Step	**A**	**B**	**C**	**D**	
POR	ON	OFF	OFF	OFF	
1	ON	OFF	OFF	OFF	
2	OFF	ON	OFF	OFF	
3	OFF	OFF	ON	OFF	
4	OFF	OFF	OFF	ON	

TWO-PHASE DRIVE SEQUENCE

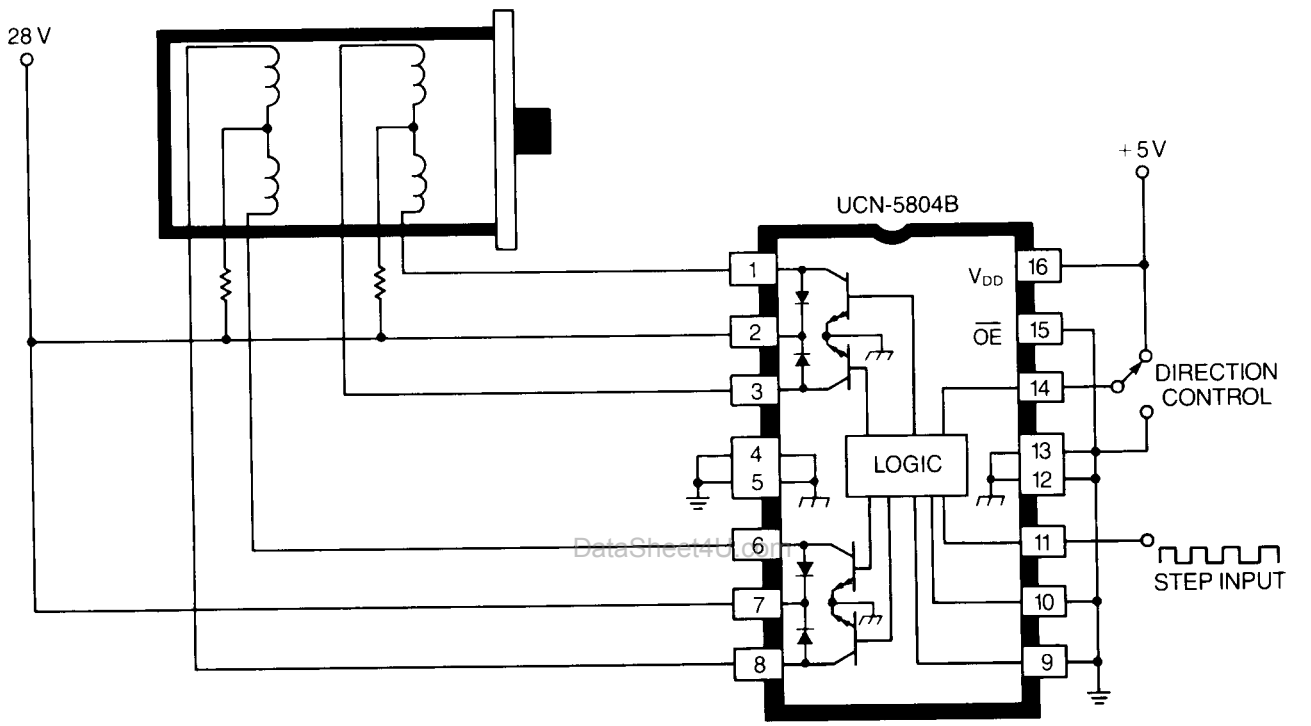
←DIRECTION = L	Half Step = L, One Phase = L				→DIRECTION = H
Step	**A**	**B**	**C**	**D**	
POR	ON	OFF	OFF	ON	
1	ON	OFF	OFF	ON	
2	ON	ON	OFF	OFF	
3	OFF	ON	ON	OFF	
4	OFF	OFF	ON	ON	

HALF-STEP DRIVE SEQUENCE

←DIRECTION = L	Half Step = H, One Phase = L				→DIRECTION = H
Step	**A**	**B**	**C**	**D**	
POR	ON	OFF	OFF	OFF	
1	ON	OFF	OFF	OFF	
2	ON	ON	OFF	OFF	
3	OFF	ON	OFF	OFF	
4	OFF	ON	ON	OFF	
5	OFF	OFF	ON	OFF	
6	OFF	OFF	ON	ON	
7	OFF	OFF	OFF	ON	
8	ON	OFF	OFF	ON	

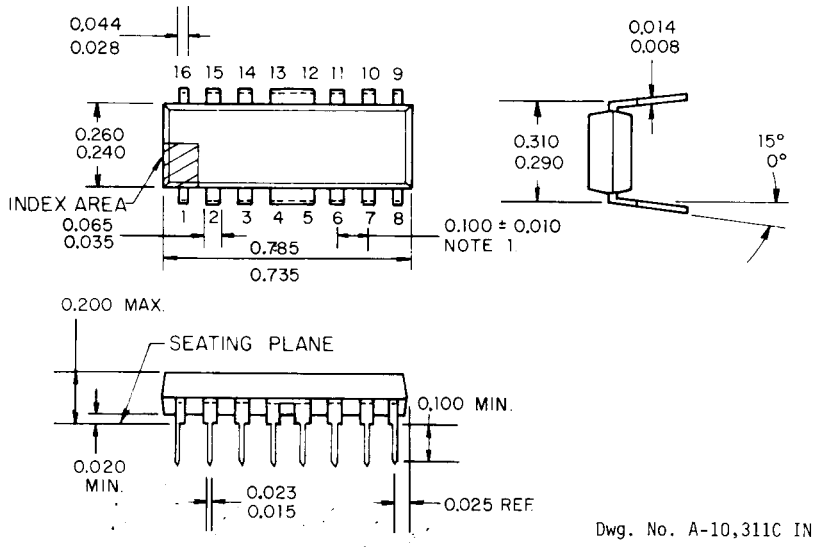
TYPICAL APPLICATION

L/R STEPPER-MOTOR DRIVE



Dwg. No. D-197

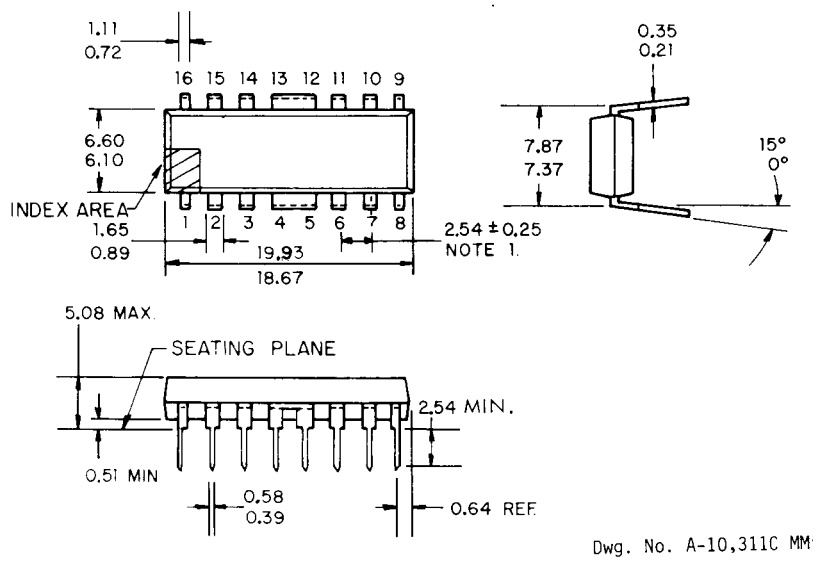
DIMENSIONS IN INCHES



Dwg. No. A-10,311C IN

DIMENSIONS IN MILLIMETERS

Based on 1" = 25.4 mm



Dwg. No. A-10,311C MM

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.

NOTES:

1. Lead spacing tolerance is non-cumulative.
2. Exact body and lead configuration at vendor's option within limits shown.
3. Lead gauge plane is 0.030" (0.76 mm) max. below seating plane.