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a Penn Central unit

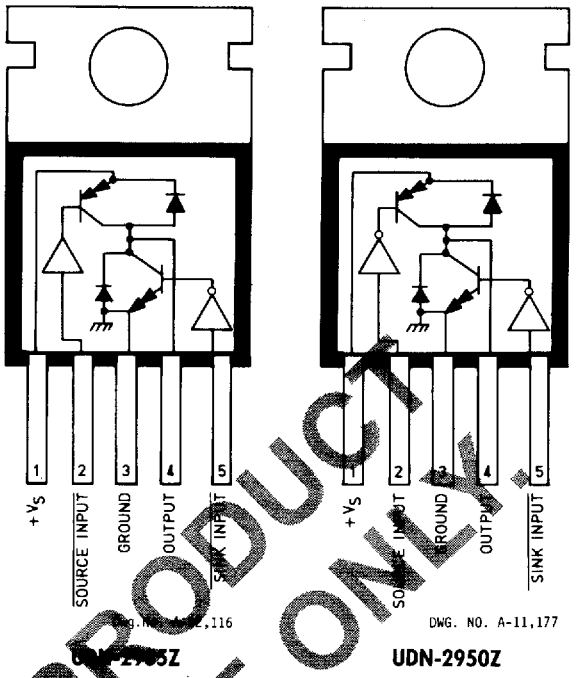
INTEGRATED CIRCUIT
ENGINEERING BULLETIN

UDN-2935Z
UDN-2950Z

UDN-2935Z AND UDN-2950Z BIPOLAR HALF-BRIDGE MOTOR DRIVERS

FEATURES

- 3.5 A Peak Output
- 37 V Min. Output Breakdown
- Output Transient Protection
- Tri-State Outputs
- TTL, CMOS, PMOS, NMOS Compatible Inputs
- Internal Thermal Shutdown
- High-Speed Chopper (to 100 kHz)
- UDN-2935Z Replaces SG3635P
- UDN-2950Z Replaces UDN-2949Z, SN75605
- TO-220 Style Packages



BOTH Type UDN-2935Z and UDN-2950Z integrated circuits are designed for servo-motor applications using pulse-width modulation. These two high-current, monolithic half-bridge motor drivers combine a sink-and-source driver with diode transient protection, input gain, level shifting, logic stages, and a voltage regulator for single-supply operation.

The UDN-2935Z output goes high with an active low input at pin 2; it is especially desirable in NMOS microprocessor applications. The UDN-2950Z output goes high with an active high input at pin 2; its inputs can be tied together for single-wire control. The input circuitry of both devices is compatible with TTL and low-voltage CMOS, PMOS, and NMOS logic. Both ICs have logic lockout (tri-state output) that prevents source and sink drivers from turning ON simultaneously.

In typical applications, the chopper-drive mode is characterized by low power-dissipation levels, low saturation voltages, and short chopper-storage times for the sink drivers. The motor drivers can be used in pairs for full-bridge operation, or as triplets in three-phase brushless d-c motor-drive applications. They can also be teamed with the Sprague Electric UCN-4202A stepper motor translator/driver for bipolar d-c stepper motor control (see Engineering Bulletin 26184).

The motor drivers' single-chip construction and power-tab TO-220 package enable cost-effective and reliable system designs supported by excellent power-dissipation ratings, minimum size, and ease of installation; because the package's heat tab is at ground potential, several devices can share a common heat sink without insulating hardware.

The Type UDN-2950Z half-bridge motor driver is an improved version of the popular Sprague Type UDN-2949Z, described in Engineering Bulletin 29318. The new driver has a higher output-breakdown rating, logic lockout, and an internal high-temperature shutdown that is triggered at approximately 175°C.

DISCONTINUED PRODUCT
FOR REFERENCE ONLY

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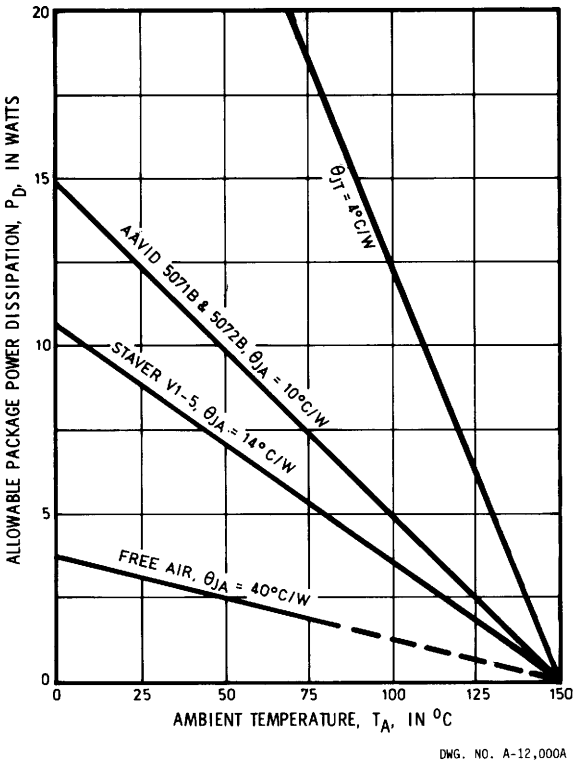
UDN-2935Z AND UDN-2950Z
BIPOLAR HALF-BRIDGE MOTOR DRIVERS

ABSOLUTE MAXIMUM RATINGS

Supply Voltage Range, V_S . . . . . 8.0 V to 35 V
Output Voltage Range, V_{OUT} . . . . . -2.0 V to $V_S + 2.0$ V
Input Voltage Range, V_{IN} . . . . . -0.3 V to $+7.0$ V
Peak Output Current (100 ms, 10% d-c), I_{OP} . . . . . ± 3.5 A
Continuous Output Current, I_{OUT} . . . . . ± 2.0 A
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 $+85°C$

ALLOWABLE POWER DISSIPATION AS A FUNCTION OF AMBIENT TEMPERATURE



DWG. NO. A-12,000A

TRUTH TABLE

Source Driver, Pin 2	Sink Driver, Pin 5	Output, Pin 4	
		UDN-2935Z	UDN-2950Z
Low	Low	High	Low
Low	High	High	High Z
High	Low	Low	High
High	High	High Z	High

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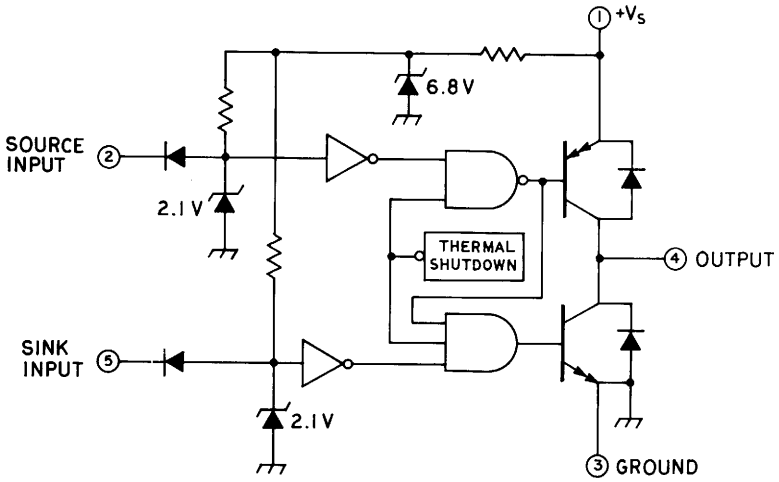
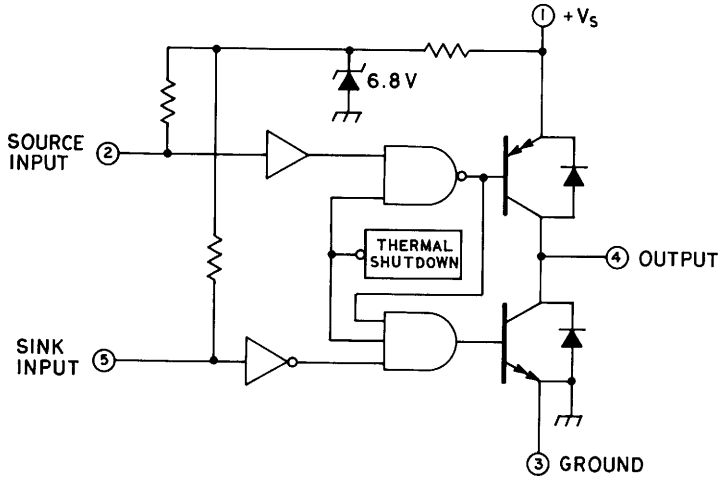
FUNCTIONAL BLOCK DIAGRAMS

UDN-2935Z



Dwg.No. A-12,113

UDN-2950Z



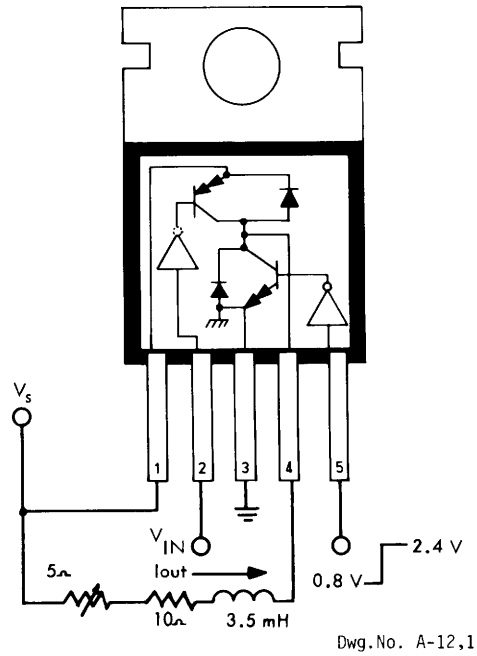
Dwg.No. A-12,112

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$, $T_{TAB} = +70°C$, $V_S = 35$ V (unless otherwise noted)

Characteristic	Source Driver Input, Pin 2		Sink Driver Input, Pin 5	Output, Pin 4	Other	Limits		
	UDN-2935Z	UDN-2950Z				Min.	Max.	Units
Output Leakage Current	2.4 V	0.8 V	2.4 V	0 V	—	—	−500	μA
	2.4 V	0.8 V	2.4 V	35 V	—	—	500	μA
Output Sustaining Voltage	2.4 V	0.8 V	0.8 to 2.4 V	2.0 A	Fig. 1	35	—	V
Output Saturation Voltage	0.8 V	2.4 V	2.4 V	−2.0 A	—	33	—	V
	2.4 V	0.8 V	0.8 V	2.0 A	—	—	2.0	V
Output Source Current	0.8 V	2.4 V	2.4 V	—	—	−2.0	—	A
Output Sink Current	2.4 V	0.8 V	0.8 V	—	—	2.0	—	A
Input Open-Circuit Voltage	−250 μA	−250 μA	−250 μA	—	—	—	7.5	V
Input Current	—	2.4 V	2.4 V	NC	—	—	−700	μA
	2.4 V	—	2.4 V	NC	—	—	10	μA
	0.8 V	0.8 V	0.8 V	NC	—	—	−1.6	mA
Propagation Delay	2.4 V	0.8 V	0.8 to 2.4 V	2.0 A	—	—	750	ns
	0.8 to 2.4 V	2.4 to 0.8 V	2.4 V	2.0 A	—	—	2.0	μs
Clamp Diode Forward Voltage	NC	NC	NC	2.0 A	Fig. 2	—	2.2	V
Supply Current	0.8 V	2.4 V	NC	NC	—	—	35	mA

NOTE: Positive (negative) current is defined as going into (coming out of) the specified device pin.

TEST FIGURE 1



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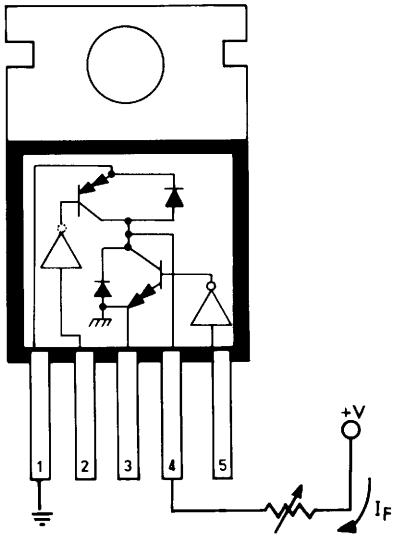
TEST FIGURE 2



Dwg.No. A-12,118

APPLICATION NOTES

It should be noted that an additional power dissipation component may arise from crossover currents flowing from supply to ground when current direction through the load is reversed. This is due to differences in the switching speeds between the source and sink drivers. Although the internal logic lockout protects these devices from catastrophic failure, the crossover power component can cause device operation at substantially higher junction temperatures.

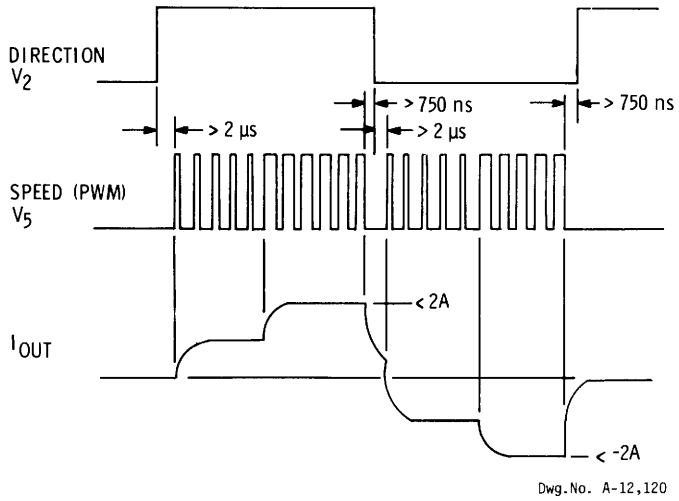
If timing conditions are ignored, the magnitude of this power can be approximated as:

$$P_D = V_S \times I_C \times t \times f$$

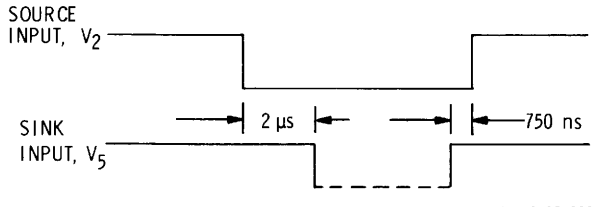
where V_S = *supply voltage*
I_C = *crossover current (≈ 3.5 A max.)*
t = *crossover current duration (≈ 1 μs)*
f = *frequency of direction change*

In some applications (high switching speeds or high package power dissipation), it is recommended that the inputs be driven separately, and that the sink driver not be turned ON for at least 2 μs (maximum source t_{PD}) after the source driver input is turned OFF. The sink driver should be turned OFF at least 750 ns (maximum sink t_{PD}) before the source driver is turned ON.

RECOMMENDED TIMING CONDITIONS
(UDN-2950Z shown)



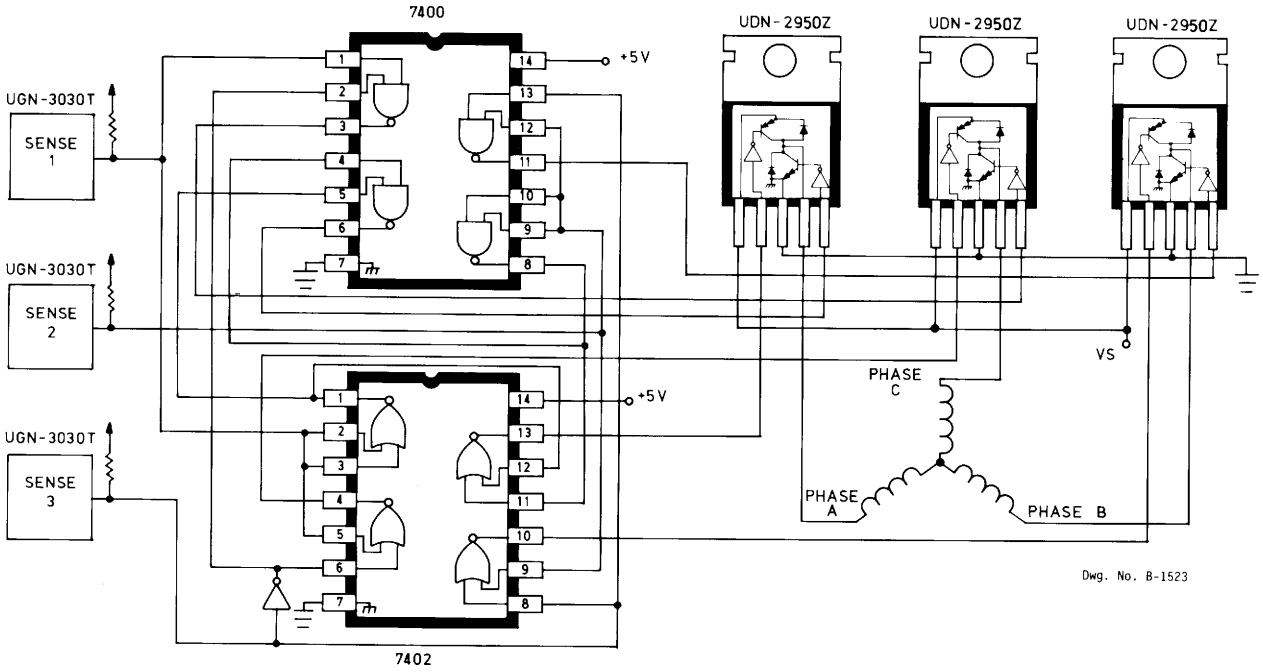
Dwg.No. A-12,120



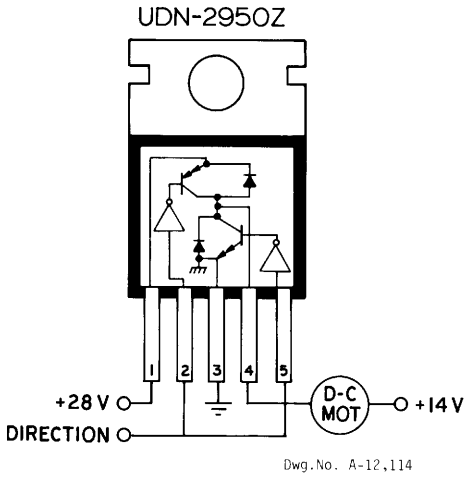
Dwg.No. A-12,119

TYPICAL APPLICATIONS

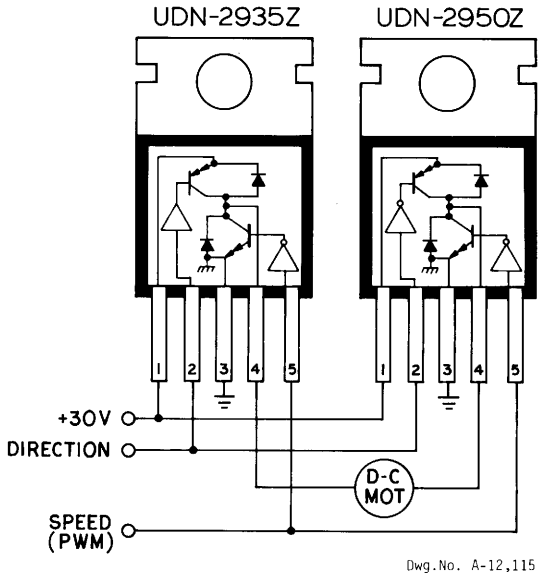
3-PHASE BRUSHLESS D-C MOTOR DRIVE



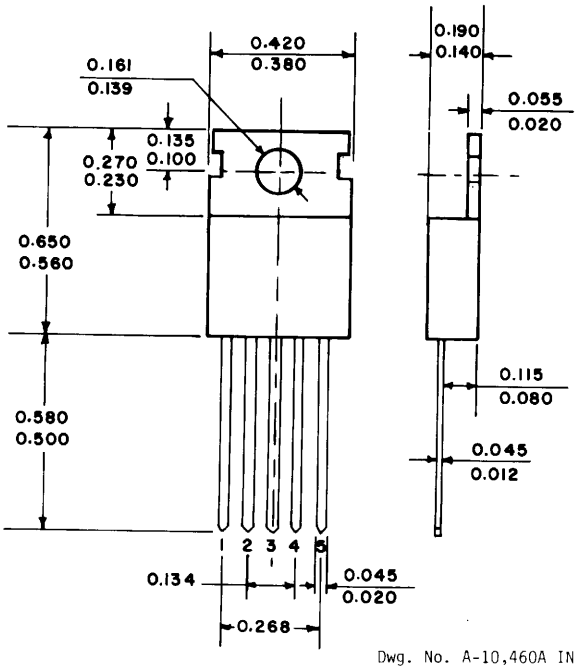
SINGLE-WINDING D-C OR STEPPER MOTOR DRIVE



FULL-BRIDGE D-C SERVO MOTOR DRIVE



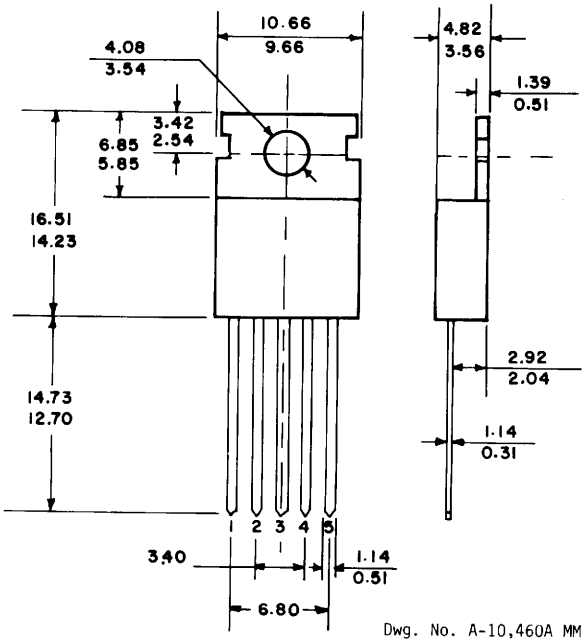
DIMENSIONS IN INCHES



Dwg. No. A-10,460A IN

DIMENSIONS IN MILLIMETRES

Based on 1" = 25.4 mm



Dwg. No. A-10,460A MM

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.

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