UGN-3077T/U AND UGS-3077T/U
HALL EFFECT LATCHES FOR BRUSHLESS DC MOTOR CONTROL
—Symmetrical Duty Cycle

FEATURES

- Symmetrical Output
- For Use with Multipole Ring Magnets
- High Reliability—No moving Parts
- Small Size
- Output Compatible with All Digital Logic Families
- 4.5 V to 24 V Operation
- High Hysteresis Level Minimizes Stray-Field Problems

The Sprague Type 3077 latching Hall Effect sensor is a bipolar integrated circuit designed for applications requiring a symmetrical duty cycle, such as control of high-efficiency brushless dc motors. Typically, the latch is used to sense the matched flux densities of alternating polarity created by small, inexpensive multipole ring magnets.

The integrated circuit includes a Hall voltage generator, operational amplifier, Schmitt trigger, bipolar output transistor, and voltage regulator. The regulator allows use of the IC with supply voltages ranging from 4.5 V to 24 V.

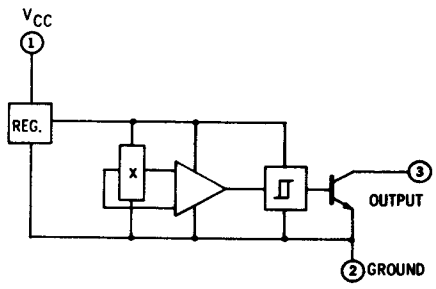
The output transistor saturates when the Hall element is exposed to a magnetic flux density equal to or greater than its ON threshold. The NPN output remains ON until magnetic flux density of equal strength but opposite polarity crosses the sensor's OFF threshold.

Types UGN-3077T and UGN-3077U are rated for operation over the temperature range of −20°C to +85°C. Types UGS-3077T and UGS-3077U have an operating range of −40°C to +125°C.

The Hall Effect switches are offered in two three-pin plastic packages—a 60-mil (1.54 mm) magnetically-optimized "U" package, and one 80 mils (2.03 mm) thick specified by the suffix "T."

A high-temperature hermetic device supplied with Sprague HYREL® screening is available as UGS-3077HH. For more information on surface-mount and hermetic switches, contact the factory.

FUNCTIONAL BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS

Power Supply, V_{CC}	25 V
Magnetic Flux Density, B	Unlimited
Output OFF Voltage	25 V
Output ON Current, I_{SINK}	50 mA
Operating Temperature Range, T_A	
UGN-3077	−20°C to +85°C
UGS-3077*	−40°C to +125°C
Storage Temperature Range, T_S	−65°C to +150°C

*Selected devices are available with a maximum T_A rating of +150°C.

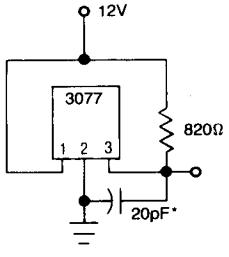
These Hall Effect sensors are also supplied in SOT 89 (TO-243AA) packages for surface-mount applications. The regular SOT-89 package is specified by substituting an "LT" for the last character of the part number. The long leaded SOT 89 package is specified by substituting an "LL" for the last character of the part number and the Low profile "U" package is available for substituting "UA" for the last character of the part number (e.g., UGN3XXXLT, UGN3XXXLL, UGN3XXXUA).

ELECTRICAL CHARACTERISTICS at $T_A = +25°C$, $V_{CC} = 4.5$ V to 24 V (unless otherwise noted)

Characteristic	Test Conditions	Limits			
		Min.	Typ.	Max.	Units
Operate Point, B_{OP}*	$T_A = +25°C$	50	100	150	Gauss
	$-20°C < T_A < +85°C$	25	100	200	Gauss
	$-40°C < T_A < +125°C$	25	100	200	Gauss
Release Point, B_{RP}*	$T_A = +25°C$	−150	−100	−50	Gauss
	$-20°C < T_A < +85°C$	−200	−100	−25	Gauss
	$-40°C < T_A < +125°C$	−200	−100	−25	Gauss
Hysteresis, B_H*	$T_A = +25°C$	100	200	—	Gauss
	$-20°C < T_A < +85°C$	100	200	—	Gauss
	$-40°C < T_A < +125°C$	100	200	—	Gauss
Output Saturation Voltage, $V_{CE(sat)}$	$B > 200$ G, $I_{OUT} = 20$ mA, $-40°C < T_A < +125°C$	—	85	400	mV
Output Leakage Current, I_{OFF}	$B < -200$ G, $V_{OUT} = 24$ V, $-40°C < T_A < +125°C$	—	0.2	1.0	μA
Supply Current, I_{CC}	$B < -200$ G, $V_{CC} = 24$ V, Output Open, $-40°C < T_A < +125°C$	—	3.0	7.0	mA
Output Rise Time, t_r	$V_{CC} = 12$ V, $R_L = 820\Omega$, $C_L = 20$ pF, $-40°C < T_A < +125°C$	—	100	—	ns
Output Fall Time, t_f	$V_{CC} = 12$ V, $R_L = 820\Omega$, $C_L = 20$ pF, $-40°C < T_A < +125°C$	—	200	—	ns

*Magnetic flux density is measured at the most sensitive area of the device.

TEST CIRCUIT



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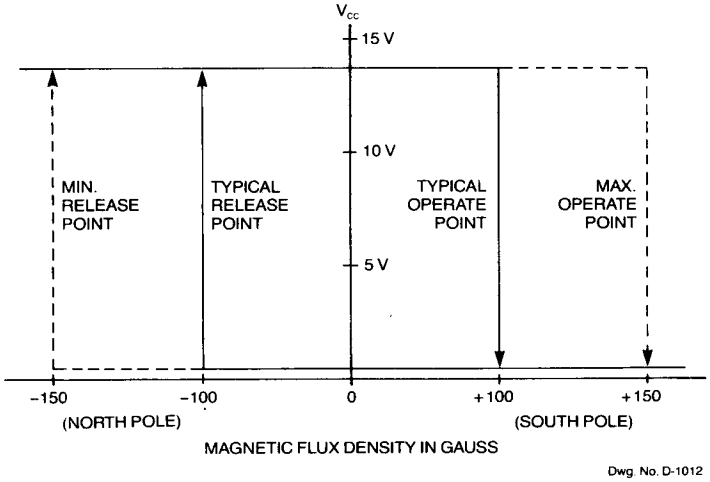
*Includes probe and test fixture capacitance.

TRANSFER CHARACTERISTICS AT $T_A = +25°C$



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OPERATION

Under power-up conditions, and in the absence of an externally applied magnetic field, the output transistor of most Type 3077 latches is ON and capable of sinking 25 mA of current. This is, however, a formally ambiguous state and should be treated as such.

In normal operation, the output transistor turns ON as the strength of the magnetic field perpendicular to the surface of the chip reaches the Operate Point. The output transistor switches OFF as magnetic field reversal takes magnetic flux density to the Release Point.

Note that the device latches: That is, a south pole of sufficient strength, presented to the branded face of the assembly, turns the device ON. Removal of the south pole leaves the device ON. The presence of a north magnetic pole of sufficient strength is required to turn the switch OFF.

The Type 3077 digital latch is primarily intended for operation with a multipole ring magnet, as shown in Figure 1. Other methods of operation are possible.

With the branded surface of the assembly facing you, and with pins pointing down, "T" and "U" package pinouts are: 1—V_{CC}, 2—Ground, 3—V_{OUT}.

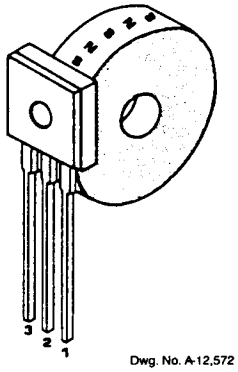

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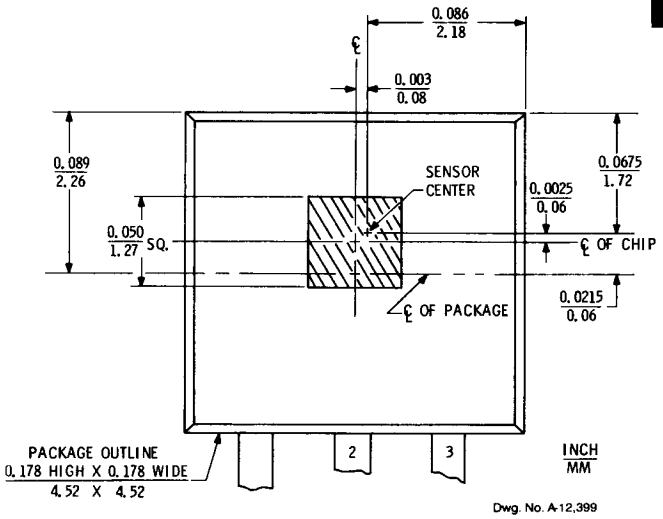
Figure 1

SENSOR-CENTER LOCATION



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GUIDE TO INSTALLATION

1. All Hall Effect integrated circuits are susceptible to mechanical stress effects. Caution should be exercised to minimize the application of stress to the leads or the epoxy package. Use of epoxy glue is recommended. Other types may deform the epoxy package.

2. To prevent permanent damage to the Hall cell, heat-sink the leads during hand-soldering. Recommended maximum conditions for wave soldering are shown in the graph at right. Solder flow should be no closer than 0.125" (3.18 mm) to the epoxy package.