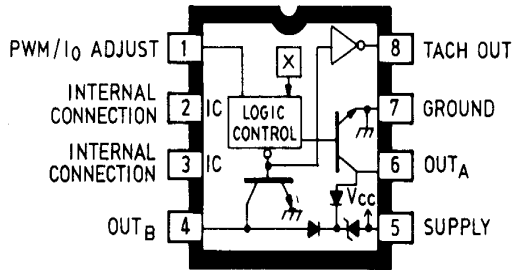


3625 AND 3626

POWERHALL[®] SENSOR/DRIVERS FOR BRUSHLESS DC MOTORS



Dwg. No. PP-012

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V_{CC}	See Table
Output Current, I_O	See Table
PWM Current Control Voltage, V_{ADJ}	See Applications
Magnetic Flux Density, B	Unlimited
Package Power Dissipation, P_D	See Graph
Operating Temperature Range, T_A	-20°C to +85°C
Storage Temperature Range, T_S	-65°C to +150°C

	UDN3625M	UDN3626M
$V_{CC(MAX)}$	14 V	26 V
$I_{O(CONT)}$	1.0 A	0.45 A
$I_{O(PEAK)}$	1.6 A	0.75 A

Output current rating will be limited by ambient temperature, supply voltage, and duty cycle. Under any set of conditions, do not exceed a junction temperature of +150°C.

Requiring a minimum of external components, the UDN3625M and UDN3626M are monolithic ICs that provide single-chip control and direct drive solutions for many small, single-phase, unipolar brushless dc motor applications. Integrated into the ICs are a high-sensitivity Hall-effect sensor, control and commutating logic, a stable voltage regulator, extensive self and system protective functions, and two high-current saturated npn outputs. Both ICs include thermal shutdown, output over-current limiting, and output transient protection/flyback diodes. The UDN3625M is nominally for 12 V motor applications while the UDN3626M is better suited to 24 V motors.

Output over-current limiting (relating to startup surge or a locked rotor condition) and short-circuit protection are provided by an internal current-sense resistor. The maximum (default) output load current is typically 1.3 A for the UDN3625M or 600 mA for the UDN3626M, but may be decreased by user selection of an external low-wattage resistor.

A separate low-level output provides tachometer capability for motor speed control or sensing a locked rotor condition. With appropriate external logic, pulse-width modulated (PWM) speed control can be accomplished at the output current adjust pin.

These sensor/drivers are supplied in an 8-pin mini-DIP plastic package with a copper leadframe for increased package power handling capability.

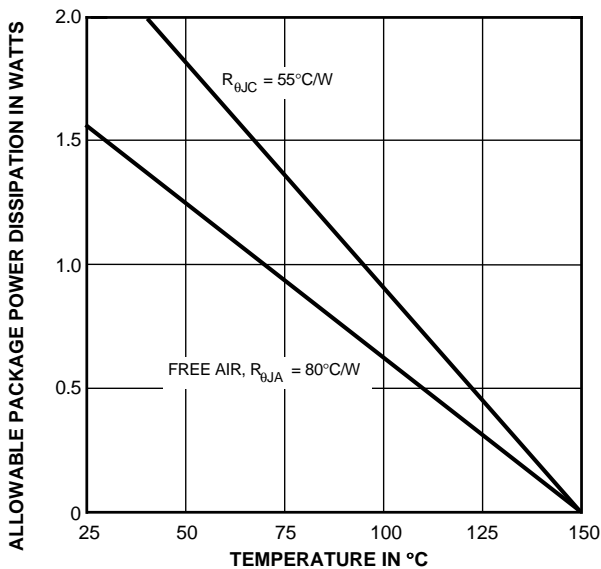
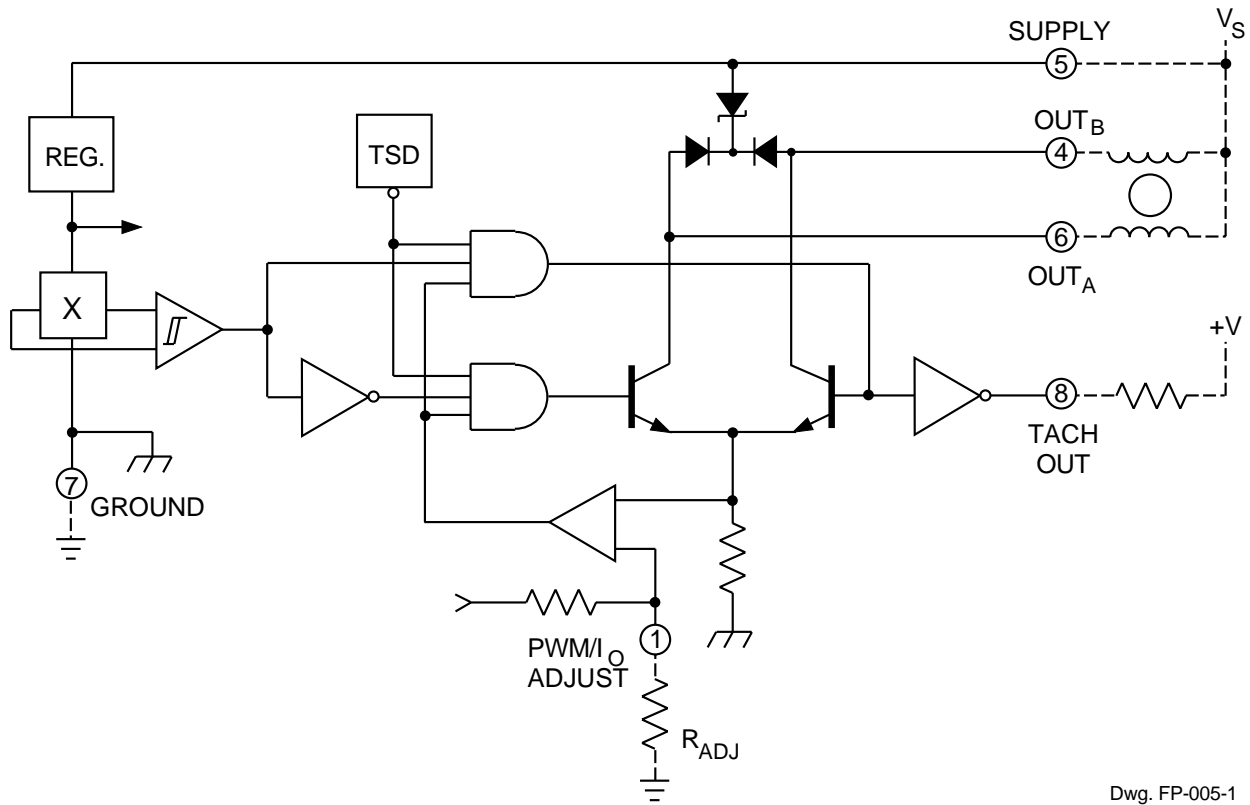
FEATURES

- 900 mA/12 V or 400 mA/24 V Operation
- Speed-Control (PWM) Capability
- Locked-Rotor Indication
- Minimum External Components
- Over-Current Protected
- Thermal Protection
- Enhanced Reliability
- Reduced Cost

Always order by complete part number, e.g., **UDN3625M**.
See Maximum Ratings at left.

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FUNCTIONAL BLOCK DIAGRAM



Dwg. GP-009-1B

TRUTH TABLE

Mag. Field	PWM/I _O ADJ	OUT _A	OUT _B
> +B _{OP}	Open	Low	High
> -B _{OP}	Open	High	Low
Any	<0.3 V	High	High



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ELECTRICAL CHARACTERISTICS at $T_A = +25^\circ\text{C}$, $R_{ADJ} = \infty$, Over Operating Voltage Range (unless otherwise noted).

Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units
UDN3625M						
Operating Voltage Range	V_S		6.5	12	14	V
Output Leakage Current	I_O	$V_{CC} = V_O = 24\text{ V}$	—	—	100	μA
Output Breakdown Voltage	$V_{(BR)CEX}$	$V_{CC} = 24\text{ V}$, $I_O = 10\text{ mA}^*$	34	—	—	V
Output Saturation Voltage	$V_{O(SAT)}$	$I_O = 450\text{ mA}$, $V_S = 6.5\text{ V}$	—	0.25	0.4	V
		$I_O = 900\text{ mA}$, $V_S = 12\text{ V}$	—	0.5	0.8	V
Output Current Limit	$I_O\text{ MAX}$	$R_{ADJ} = \infty$, $V_O = 2\text{ V}$	1.0	1.3	1.6	A
Output Clamp Voltage (Test Fig. 1)	V_{CL}	$I_{CL} = 10\text{ mA}$, $V_{CC} = 0$	11	12	13	V
		$I_{CL} = 450\text{ mA}$, $V_{CC} = 0$	13	14	15	V
Output Switching Time	t_{PLH}	50% V_{ADJ} to $V_O = 3.0\text{ V}$, $I_O = 450\text{ mA}$	—	—	5.0	μs
Supply Current (Test Fig. 2)	I_{CC}	$R_{ADJ} = \infty$, $V_S = 14\text{ V}$, One Output ON	—	30	38	mA
		$R_{ADJ} = 0\ \Omega$, $V_S = 14\text{ V}$, Outputs OFF	—	8.0	10	mA
UDN3626M						
Operating Voltage Range	V_S		‡	24	26	V
Output Leakage Current	I_O	$V_{CC} = V_O = 30\text{ V}$	—	—	100	μA
Output Breakdown Voltage	$V_{(BR)CEX}$	$V_{CC} = 30\text{ V}$, $I_O = 10\text{ mA}^*$	50	—	—	V
Output Saturation Voltage	$V_{O(SAT)}$	$I_O = 250\text{ mA}$, $V_S = 6.5\text{ V}$	—	0.15	0.3	V
		$I_O = 400\text{ mA}$, $V_S = 24\text{ V}$	—	0.3	0.5	V
Output Current Limit	$I_O\text{ MAX}$	$R_{ADJ} = \infty$, $V_O = 2\text{ V}$	450	600	750	mA
Output Clamp Voltage (Test Fig. 1)	V_{CL}	$I_{CL} = 10\text{ mA}$, $V_{CC} = 0$	17	18	20	V
		$I_{CL} = 250\text{ mA}$, $V_{CC} = 0$	19	20	22	V
Output Switching Time	t_{PLH}	50% V_{ADJ} to $V_O = 3.0\text{ V}$, $I_O = 250\text{ mA}$	—	—	5.0	μs
Supply Current (Test Fig. 2)	I_{CC}	$R_{ADJ} = \infty$, $V_S = 26\text{ V}$, One Output ON	—	—	24	mA
		$R_{ADJ} = 0\ \Omega$, $V_S = 26\text{ V}$, Outputs OFF	—	8.0	10	mA

* I_O is almost entirely Zener clamp current.

† Pulse test.

‡ Dependent on value of external series Zener diode (see Applications), 6.5 V without a Zener diode.

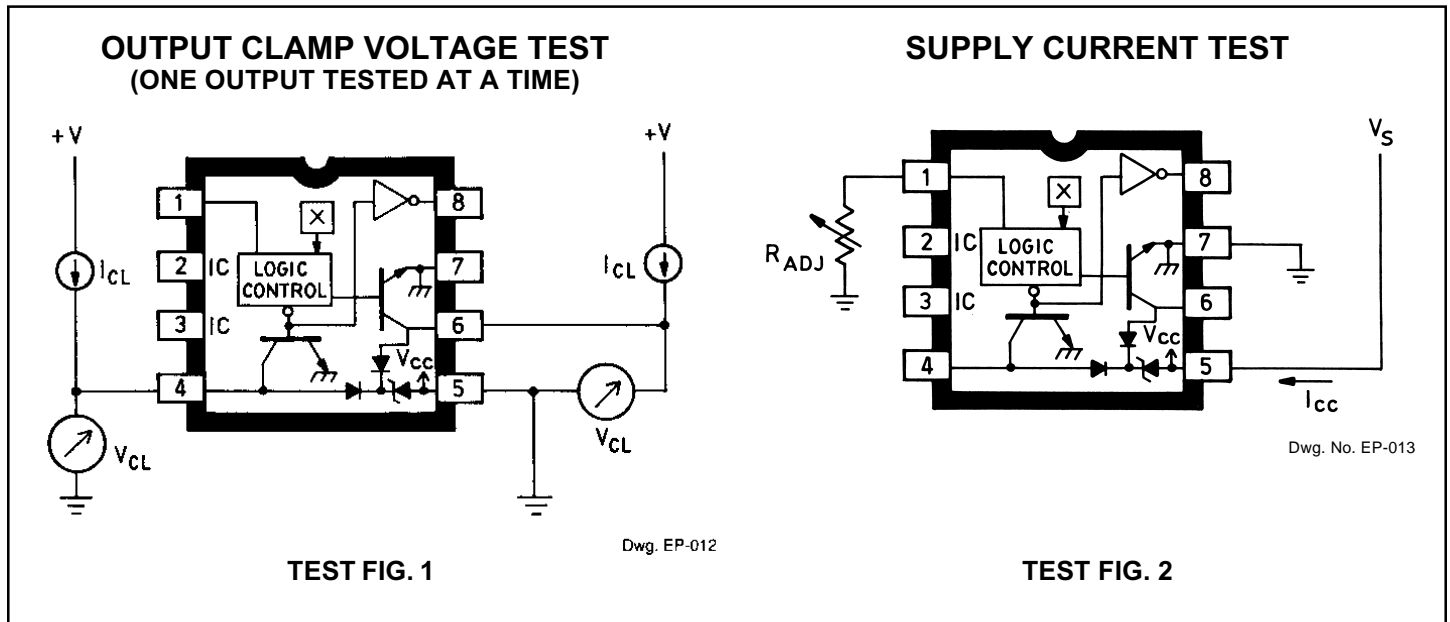
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ELECTRICAL CHARACTERISTICS continued

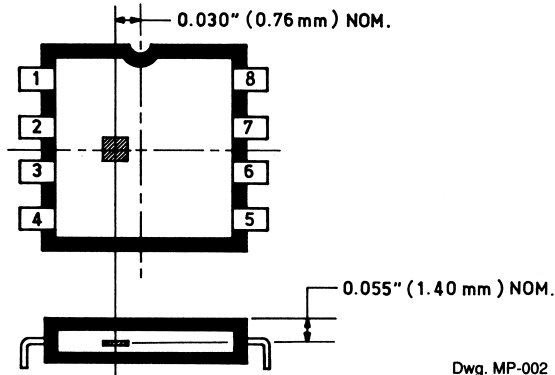
Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Units
Both						
Operate Point§	B _{OP}		—	±100	±150	G
Hysteresis	B _H		—	200	—	G
Output Current Limit Ratio	I _O /I _O MAX	R _{ADJ} = 39 kΩ	—	0.75	—	—
		R _{ADJ} = 17 kΩ	—	0.50	—	—
		R _{ADJ} = 10 kΩ	—	0.25	—	—
PWM Control Current	I _{ADJ}	V _{ADJ} = 0	—	-350	-500	μA
Tach Output Leak. Current	I _T	V _T = 14 V	—	—	10	μA
Tach Output Sat. Voltage	V _{T(SAT)}	I _T = 750 μA	—	0.2	0.4	V
Thermal Shutdown	T _J		—	165	—	°C
Thermal Hysteresis	ΔT _J		—	10	—	°C

§ Magnetic flux density is measured at most sensitive area of device, nominally located 0.055" (1.40 mm) below the top of the package.



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SENSOR LOCATION



APPLICATIONS INFORMATION

Power Dissipation. Care should be taken in evaluating the package power dissipation of these devices. Total power dissipated by the device will consist of power due to the internal regulator, logic and drive circuitry ($I_{CC} \times V_{CC}$), power due to the output drivers ($I_O \times V_{O(SAT)}$), and power due to the clamp circuitry ($I_{CL} \times V_{CL} \times \text{duty cycle}$).

For example:

$$I_{CC} \times V_{CC} = 38 \text{ mA (max)} \times 14 \text{ V} = 532 \text{ mW (max)}$$

$$I_O \times V_{O(SAT)} = 450 \text{ mA} \times 0.4 \text{ V (max)} = 180 \text{ mW (max)}$$

$$I_{CL} \times V_{CL} \times \text{duty cycle} = 450 \text{ mA} \times 15 \text{ V (max)} \times 1\% = 67.5 \text{ mW (max)}$$

$$\text{Total package power dissipation} = 779.5 \text{ mW (max)}$$

Some of the power dissipated by the device ($I_{CC} \times V_{CC}$) can be reduced by inserting a Zener diode in the supply line (Z_A in the figure). Note that the voltage at the V_{CC} pin under worst-case conditions must be greater than the minimum operating voltage (6.5 V).

Transient Protection. A note of caution concerns negative (below ground) excursions of the outputs. In application, the coupling of the two motor windings can provide for just such a case. Reducing the coupling between windings will help, but ground clamp diodes **or** diodes in series with the motor windings might be required (D_C **or** D_S in the figure). Most small brushless motors will not require these diodes.

System requirements usually utilize a diode type of reverse-polarity protection. If series diode protection is used with an inductive load (the usual fan application), a Zener clamp between V_S and ground (Z_B in the figure) is required. The Zener voltage must be greater than the supply voltage but less than the rated maximum allowable supply voltage.

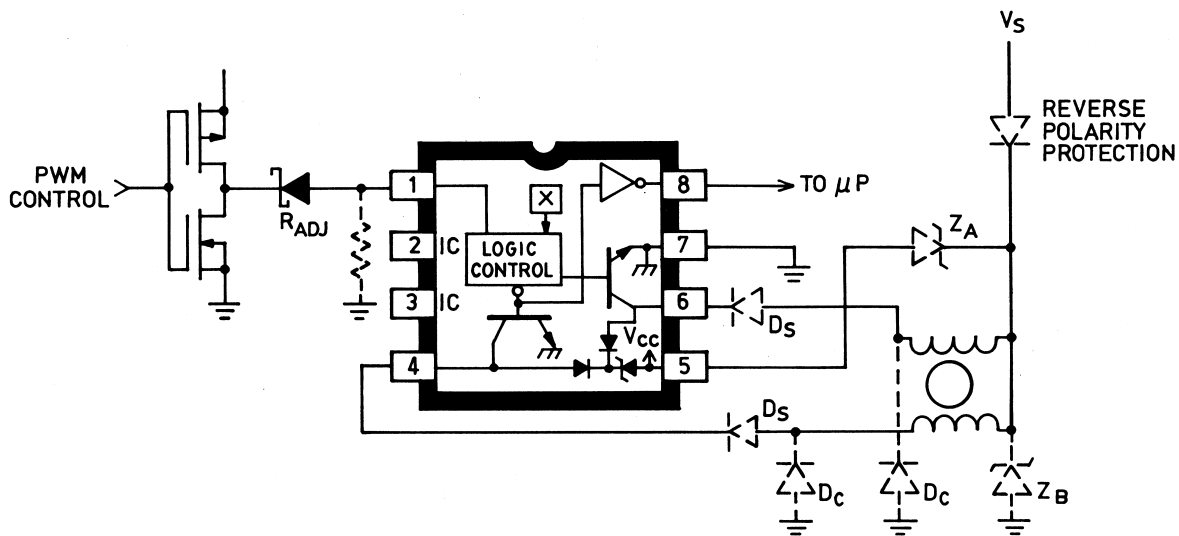
With diode reverse-polarity protection, a high-impedance supply, or a switched supply line, high-voltage spikes will be generated (especially with high-current or high-inductance loads) during normal operation, coasting, or immediately after turn-off. In these situations, a Zener clamp (Z_B) from V_S to ground will be required.

Over-Current Adjust Pin. The over-current limit may be reduced from the default value ($I_O \text{ MAX}$) by selection of an external resistor (R_{ADJ}) at the PWM/ I_O ADJ pin.

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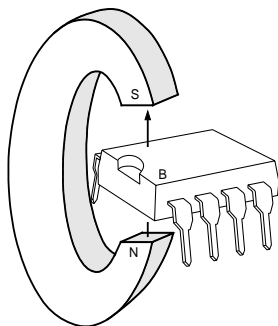
The external overcurrent adjust and the thermal shutdown are commoned at the PWM/I_O ADJ pin and tying it to V_{CC} will disable the thermal shut-down. PWM current/speed control can be performed at the PWM/I_O ADJ pin from a standard totem-pole logic output with a series Schottky diode (1N5818, 1N5819, or equivalent) or by pulling it low through an open-collector transistor (no pull-up resistor). PWM/I_O ADJ input voltages greater than 0.3 V are not recommended and may create an unstable operating condition.

TYPICAL FAN APPLICATION

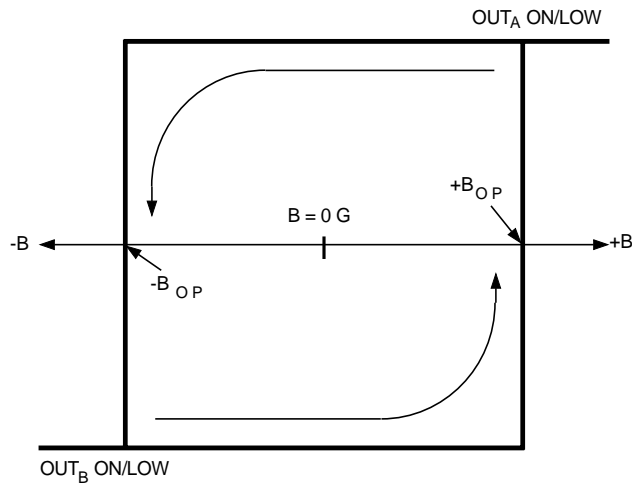


Dwg. EP-014

MAGNETIC FIELD DEFINITIONS



Dwg. AP-001-1

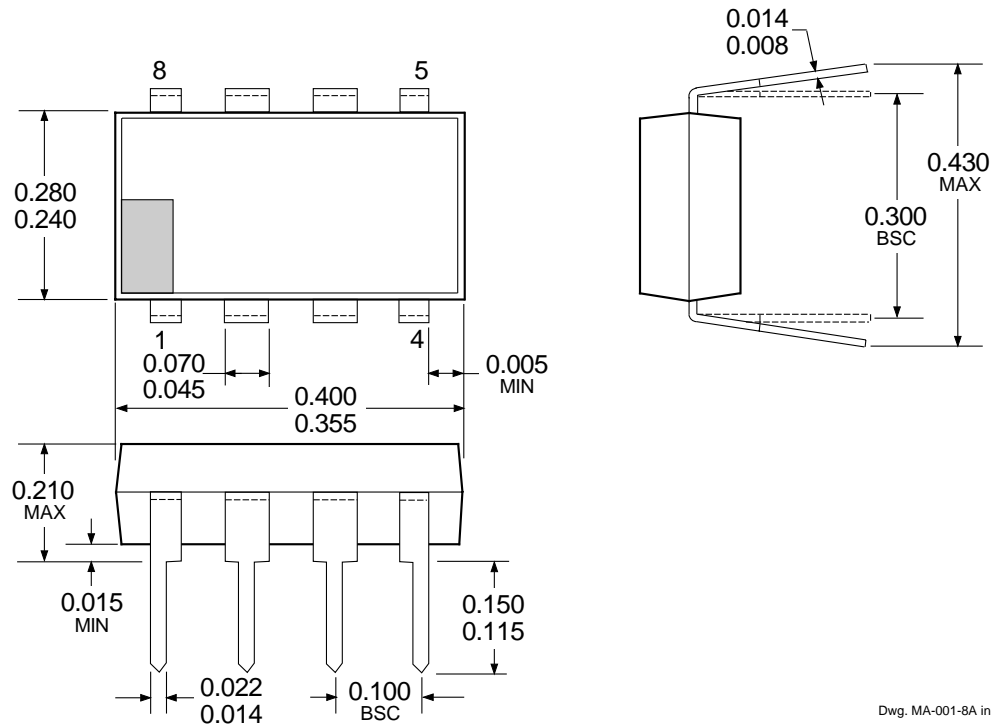


Dwg. GP-008

By accepted magnetic convention, lines of flux emanate from the north pole of a magnet and enter the south pole.

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Dimensions in Inches
 (controlling dimensions)

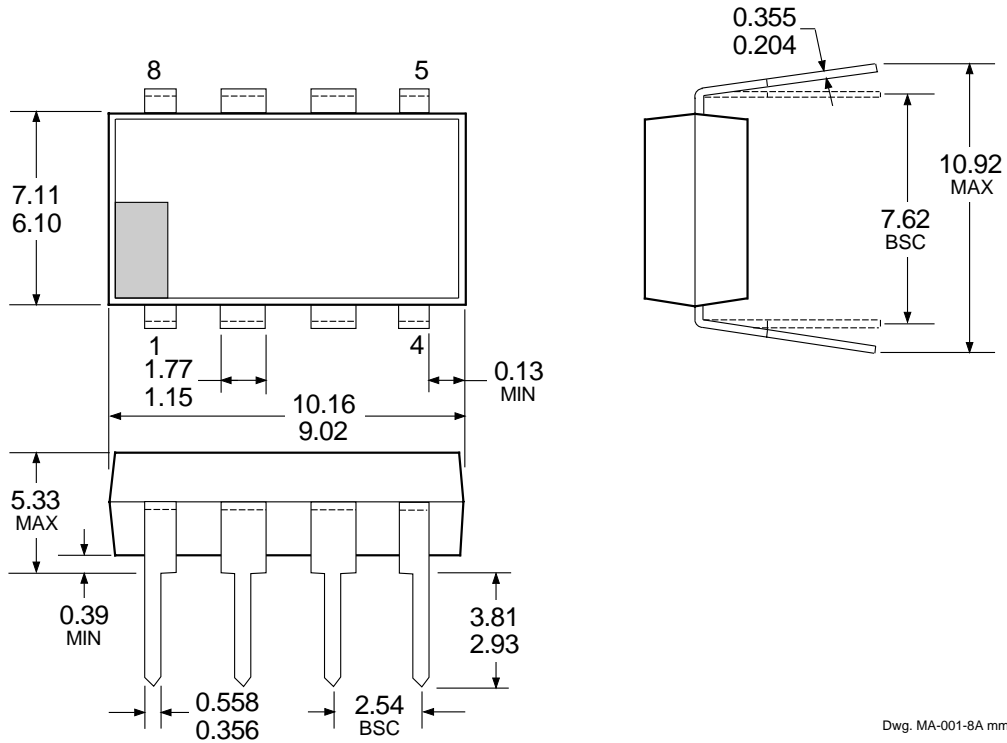


Dwg. MA-001-8A in

- NOTES: 1. Leads 1, 4, 5, and 8 may be half leads at vendor's option.
 2. Lead thickness is measured at seating plane or below.
 3. Lead spacing tolerance is non-cumulative.
 4. Exact body and lead configuration at vendor's option within limits shown.

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Dimensions in Millimeters
(for reference only)



Dwg. MA-001-8A mm

- NOTES: 1. Leads 1, 4, 5, and 8 may be half leads at vendor's option.
2. Lead thickness is measured at seating plane or below.
3. Lead spacing tolerance is non-cumulative.
4. Exact body and lead configuration at vendor's option within limits shown.

The products described herein are manufactured under one or more of the following U.S. patents: 5,045,920; 5,264,783; 5,442,283; 5,389,889; 5,581,179; 5,517,112; 5,619,137; 5,621,319; 5,650,719; 5,686,894; 5,694,038; 5,729,130; 5,917,320; and other patents pending.

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