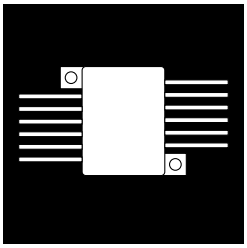
SMART POWER MODULE FOR 3-PHASE BRUSHLESS DC MOTORS



9 Amp, Push-Pull, Multi-Chip-Module Commutates And Directly Drives 3q BLDC Motors

FEATURES

- Merged Control and Power Electronics System
- NMOS and PMOS Power FETs with Low ON Resistance
- Output Current Continuous To 9 Amps
- Peak Output Current To 15 Amps
- Programmable Overcurrent With Internal Sense Resistor
- 12 Lead Industrial or Hermetic Military Packaging
- Internal Regulator Powers Sensors
- Compatible With Hall Effect Sensors
- Single Supply Operation
- Direction Control
- Output Enable Control
- Sensor Phasing: 120° (Standard) or 60° (Option)

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DESCRIPTION

The OM9303SF is a “smart-power” commutator/driver, multi-chip-module (MCM) designed for use with delta or wye connected 3-phase brushless dc (BLDC) motors. Only Hall effect sensors for rotational and directional signals are essential to complete the basic motor electronics. An internal regulator (optional connection) permits safe, reliable operation of Hall effect ICs to the maximum limits of the module. This “smart-power” module provides the benefits of high-density, performance, reliability, simplicity, and versatility as “turn-key”, self-contained electronics for 3-phase motors. Both industrial and hermetic MIL-rated types are available; and the circuitry is electrically isolated from the package.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage Range, V_{SS} . . . . . 10 V to 30 V
Input Voltage Range, V_{IN} . . . . . -0.3 V to V_{SS} +0.3 V
Peak Output Current (100ms, 10% duty), I_{DF} . . . . . 24 A
Continuous Output Current, I_{OUT} (+25°C) . . . . . 9.2 A
(+100°C) . . . . . 6.5 A
Operating Temperature Range, T_A
Industrial Module . . . . . -40° C to +85° C
MIL Hermetic Module . . . . . -55° C to +125° C
Storage Temperature Range, T_{stg} . . . . . -65° C to +150° C
Isolation Voltage, V_{ISO} . . . . . 1500 V

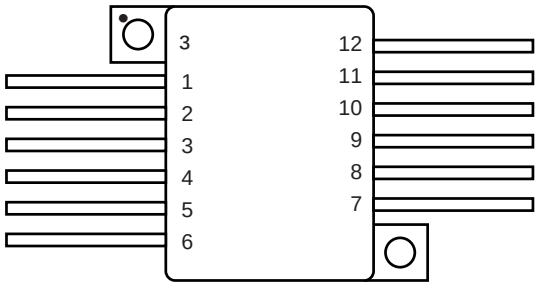
RECOMMENDED OPERATING CONDITIONS (Over Specified Temperature Range)

Supply Voltage, V_S . . . . . 10 V to 28 V
Continuous Output Current, I_{OUT} . . . . . 6 A
Junction Temperature, T_J . . . . . +150°C
Input Voltage, (High), V_{INH} . . . . . V_{SS} - 1.5 V (Min.) . . . . . V_{SS} (Max.)
(Low), V_{INL} . . . . . 0 V (Min.) . . . . V_{SS} -4 V (Max.)

ELECTRICAL CHARACTERISTICS T_A = +25°C, V_{SS} = 28 V, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Output Leakage Current	$I_{DS(OFF)}$	Enable = Low, Sink Outputs			100	µA
		Enable = Low, Source Outputs			-100	µA
Output ON Voltage	$I_{DS(ON)}$	I_{OUT} = 9 A (per truth table)			2.0	V
		I_{OUT} = 6 A, T_{CASE} = 85°C			2.3	V
		I_{OUT} = -9 A			3.3	V
		I_{OUT} = -6 A, T_{CASE} = 85°C			3.8	V
Input High Voltage	V_{INH}		26.5		28	V
Input Low Voltage	V_{INL}		0		24	V
Input Low Current	I_{INL}	V_{IN} = 0 V			400	µA
Turn-On Delay Time	$t_{d(on)}$	I_{OUT} = 6 A, (NMOS)			50	ns
		I_{OUT} = -6 A, (PMOS)			50	ns
Turn-Off Delay Time	$t_{d(off)}$	I_{OUT} = 6 A, (NMOS)			200	ns
		I_{OUT} = -6 A, (PMOS)			150	ns
Source Drain Diode	V_{SD}	I_{SD} = 9 A, (NMOS)			2.5	V
Forward Voltage		I_{SD} = 9 A, (PMOS)			5.0	V
Reverse Recovery Time	t_{rr}			325		ns
Input Resistance	R_{IN}	Sensor, Enable, Direction Inputs		150		K
Supply Current	I_{SS}	Enable = Low, Outputs = Off			6	mA
Reference Supply Voltage	v_{REF}	I_{REF} = 5.5 mA	8.65		9.55	V
Overcurrent Limit	I_{TRIP}	Externally Set				
Maximum Thermal Resistance	R_{qJC}	To Be Determined				

PIN CONNECTION



Pin 1: Output A
Pin 2: Output B
Pin 3: V_{SS}
Pin 4: Output C
Pin 5: V_{DD}
Pin 6: V_{REF}

Pin 12: Forward/Reverse
Pin 11: Sensor Input C
Pin 10: Sensor Input B
Pin 9: Sensor Input A
Pin 8: Overcurrent Sense
Pin 7: Output Enable

TRUTH TABLE

120° SENSOR SPACING			FORWARD			REVERSE		
S1	S2	S3	OUT A	OUT B	OUT C	OUT A	OUT B	OUT C
0	0	1	+	-	Off	-	+	Off
1	0	1	Off	-	+	Off	+	-
1	0	0	-	Off	+	+	Off	-
1	1	0	-	+	Off	+	-	Off
0	1	0	Off	+	-	Off	-	+
0	1	1	+	Off	-	-	Off	+
0	0	0	ALL OUTPUTS DISABLED					
1	1	1	ALL OUTPUTS DISABLED					

60° SENSOR SPACING			FORWARD			REVERSE		
S1	S2	S3	OUT A	OUT B	OUT C	OUT A	OUT B	OUT C
0	0	0	+	-	Off	-	+	Off
1	0	0	Off	-	+	Off	+	-
1	1	0	-	Off	+	+	Off	-
1	1	1	-	+	Off	+	-	Off
0	1	1	Off	+	-	Off	-	+
0	0	1	+	Off	-	-	Off	+
0	1	0	ALL OUTPUTS DISABLED					
1	0	1	ALL OUTPUTS DISABLED					

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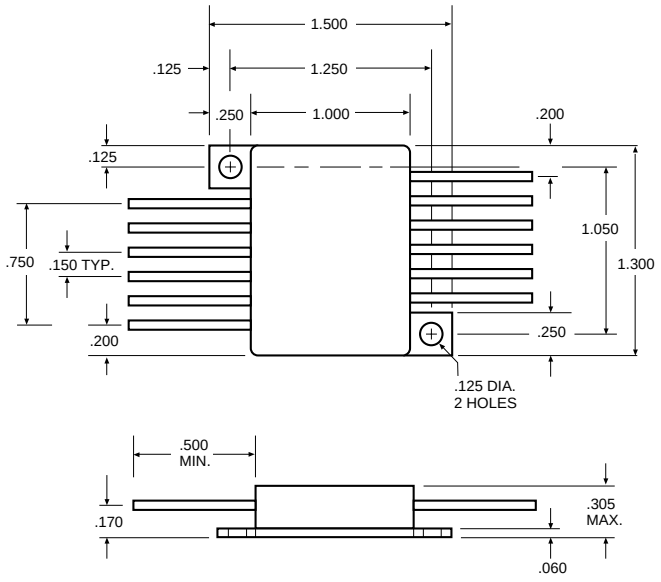
MECHANICAL OUTLINE



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APPLICATIONS NOTES: Reference Figure 1

1. Hall Sensor Operation (above ²20 V): The internal zener reference allows operation of Hall ICs to the maximum limits of the module. Most Hall sensors are rated for 4.5 V to 24 V, and the ground terminal connections shown are valid for any operation 15 V. For operation 20 V the "floating" ground is recommended, or very necessary (i.e. 24 V).

2. Overcurrent Trip Adjust: The module includes a 0.100 sense resistor and another 39K from overcurrent sense to V_{DD}. Either a fixed resistor from overcurrent (pin 8) to V_{SS}, or potentiometer (rheostat connected) may be used to select a desired current trip point. Variable (potentiometer) adjustment connections: wiper to pin 8 (overcurrent), and end terminals to V_{SS} and V_{DD}. An internal oscillator resets the overcurrent function.

3. Transient Voltage Protection (with Reverse Polarity Protection Diode): Any design with a reverse polarity protection diode **must** include external inductive transient protection. Without external clamping or snubber protection, the "flyback" voltage (at turn-off) will exceed the module maximum voltage rating and is likely to damage or destroy it. Typical clamping is accomplished via power FET body (source-drain) diodes; however, the reverse polarity protection diode blocks the normal recirculation through the supply. The arrows in Figure 1 indicate normal ON current (B to A) and OFF recirculation paths. Induced OFF current reverses and flows through the PMOS body diode, into the (low impedance) supply, and returns via the NMOS body diode. A polarity diode blocks (body diode) current flow and induces high-voltage transients which will avalanche the lowest device breakdown. The V_{SS} supply should not be allowed to exceed 30 V under any conditions.

NOTE: Other options, including custom versions, of this module are well within the scope of this design; contact your sales representative or Omnirel for additional details.

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Figure 1