75 VOLT 5 AMP MOSFET H-BRIDGE PWM MOTOR DRIVER/AMPLIFIER

4200

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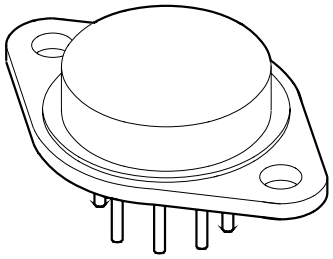
MIL-PRF-38534 CERTIFIED

FEATURES:

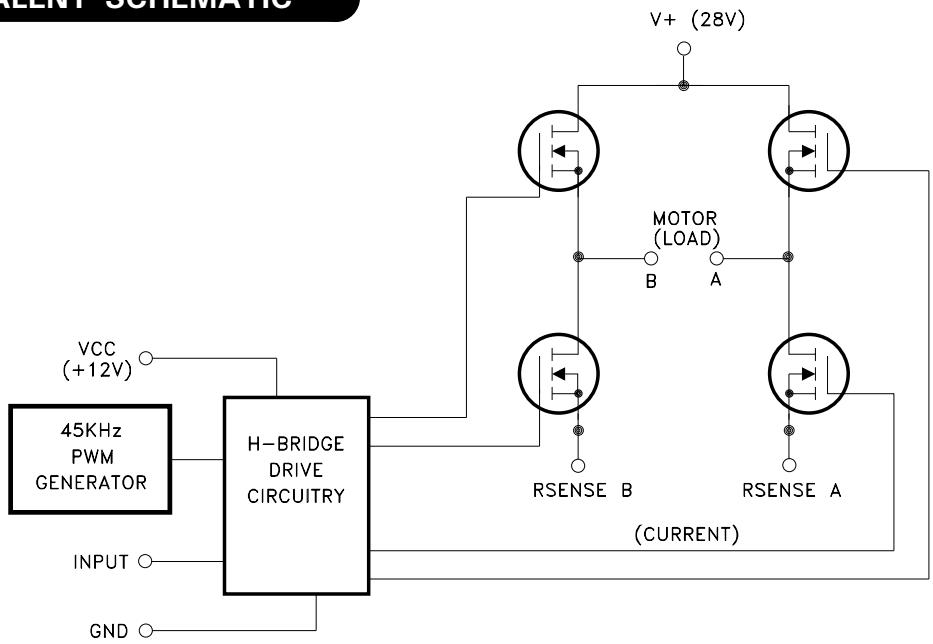
- Low Cost Complete H-Bridge
- 28 Volt, 5 Amp Capability, 75 Volt Maximum Rating
- Self-contained Smart Lowside/Highside Drive Circuitry
- Internal PWM Generation, Shoot-through Protection
- Isolated Case Allows Direct Heatsinking
- Four Quadrant Operation, Torque Control Capability
- Available Fully Screened To MIL-PRF-38534
- Replaces SA-50



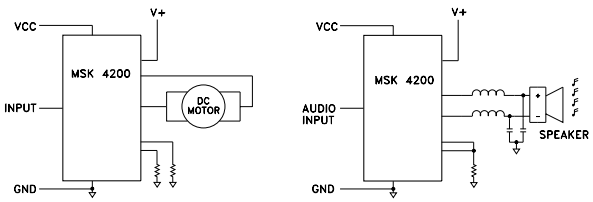
DESCRIPTION:

The MSK 4200 is a complete H-Bridge hybrid to be used for DC brushed motor control or Class D switchmode amplifier. All of the drive/control circuitry for the lowside and highside switches are internal to the hybrid. The PWM circuitry is internal as well, leaving the user to only provide an analog signal for the motor speed/direction, or audio signal for switchmode audio amplification. The MSK 4200 is packaged in a space efficient isolated 8 pin TO-3 that can be directly connected to a heatsink.

EQUIVALENT SCHEMATIC



TYPICAL APPLICATIONS



PIN-OUT INFORMATION

1	RSENSE B	5	RSENSE A
2	MOTOR B	6	Vcc
3	V+	7	GND
4	MOTOR A	8	INPUT

ABSOLUTE MAXIMUM RATINGS

$V+$	High Voltage Supply	75V	T_{ST}	Storage Temperature Range	-65°C to +150°C
V_{CC}	Logic Supply	16V	T_{LD}	Lead Temperature Range (10 Seconds)	300°C
I_{OUT}	Continuous Output Current	5A	T_C	Case Operating Temperature	
I_{PK}	Peak Output Current	37A		MSK4200	-40°C to +85°C
V_{OUT}	Output Voltage Range — GND-2V min. To V+ max.			MSK4200B/E	-55°C to +125°C
θ_{JC}	Thermal Resistance @ 125°C (Output Switches)	2.3°C/W	T_J	Junction Temperature	+175°C

ELECTRICAL SPECIFICATIONS

All Ratings: Tc = +25°C Unless Otherwise Specified

Parameter	Test Conditions	Subgroup Group A ⑤	MSK 4200B/E③ Min.	Typ.	Max.	MSK 4200 ② Min.	Typ.	Max.	Units
OUTPUT CHARACTERISTICS									
VDS(ON) Voltage (Each MOSFET)	I_D = 5A	1	-	1.5	1.8	-	1.5	2.16	V
		2	-	2.2	2.4	-	-	-	V
		3	-	1.1	1.2	-	-	-	V
Instantaneous Forward Voltage, Each MOSFET (Intrinsic Diode) ①	Is = 5A	1	-	1.0	2.1	-	1.0	2.2	V
		2	-	0.9	2.0	-	-	-	V
		3	-	1.1	2.2	-	-	-	V
Reverse Recovery Time (Intrinsic Diode) ①		-	-	-	240	-	-	240	nS
Leakage Current, Each MOSFET	V+ = 70V	1	-	1.0	25	-	1.0	30	uA
	V+ = 70V	2	-	2.0	250	-	-	-	uA
	V+ = 70V	3	-	0.5	25	-	-	-	uA
PWM Frequency	V_{CC} = 12V	4	40	45	50	40	45	50	KHz
Vcc SUPPLY CHARACTERISTICS									
Quiescent Bias Current	V_{CC} = 12V @ 50% Duty Cycle Output	1	-	15	20	-	15	20	mA
		2	-	15	20	-	-	-	mA
		3	-	15	20	-	-	-	mA
INPUT SIGNALS CHARACTERISTICS									
Analog Input Voltage	V_{CC} = 12V, Motor A,B = 50% Duty Cycle	-	-	6	-	-	6	-	V
Analog Input Voltage	V_{CC} = 12V, Motor A = 100% Duty Cycle High	-	-	8	-	-	8	-	V
Analog Input Voltage	V_{CC} = 12V, Motor B = 100% Duty Cycle High	-	-	4	-	-	4	-	V
SWITCHING CHARACTERISTICS ①	V+ = 28V, V_{CC} = 12V, I_C = 2A								
Rise-Time		-	-	36	54	-	36	-	nS
Fall-Time		-	-	170	255	-	170	-	nS
Dead-Time		-	-	100	-	-	100	-	nS

NOTES:

① Guaranteed by design but not tested. Typical parameters are representative of actual device performance but are for reference only.
② Industrial grade and "E" suffix devices shall be tested to subgroups 1 and 4 unless otherwise specified.
③ Military grade devices ("B" suffix) shall be 100% tested to subgroups 1,2,3 and 4.
④ Subgroups 5 and 6 testing available upon request.
⑤ Subgroup 1,4 $T_A = T_C$ = +25°C
2 $T_A = T_C$ = +125°C
3 $T_A = T_C$ = -55°C

APPLICATION NOTES

MSK 4200 PIN DESCRIPTION

VCC - Is the low voltage supply for powering internal logic and drivers for the lowside and highside MOSFETS. The supplies for the highside drivers are derived from this voltage.

V+ - Is the higher voltage H-bridge supply. The MOSFETS obtain the drive current from this supply pin. The voltage on this pin is limited by the drive IC. The MOSFETS are rated at 100 volts. Proper bypassing to **GND** with sufficient capacitance to suppress any voltage transients, and to ensure removing any drooping during switching, should be done as close to the pins on the hybrid as possible.

MOTOR A - Is the output pin for one half of the bridge. Increasing the input voltage causes increased duty cycles at this output.

MOTOR B - Is the output pin for the other half of the bridge. Decreasing the input voltage causes increased duty cycles at this output.

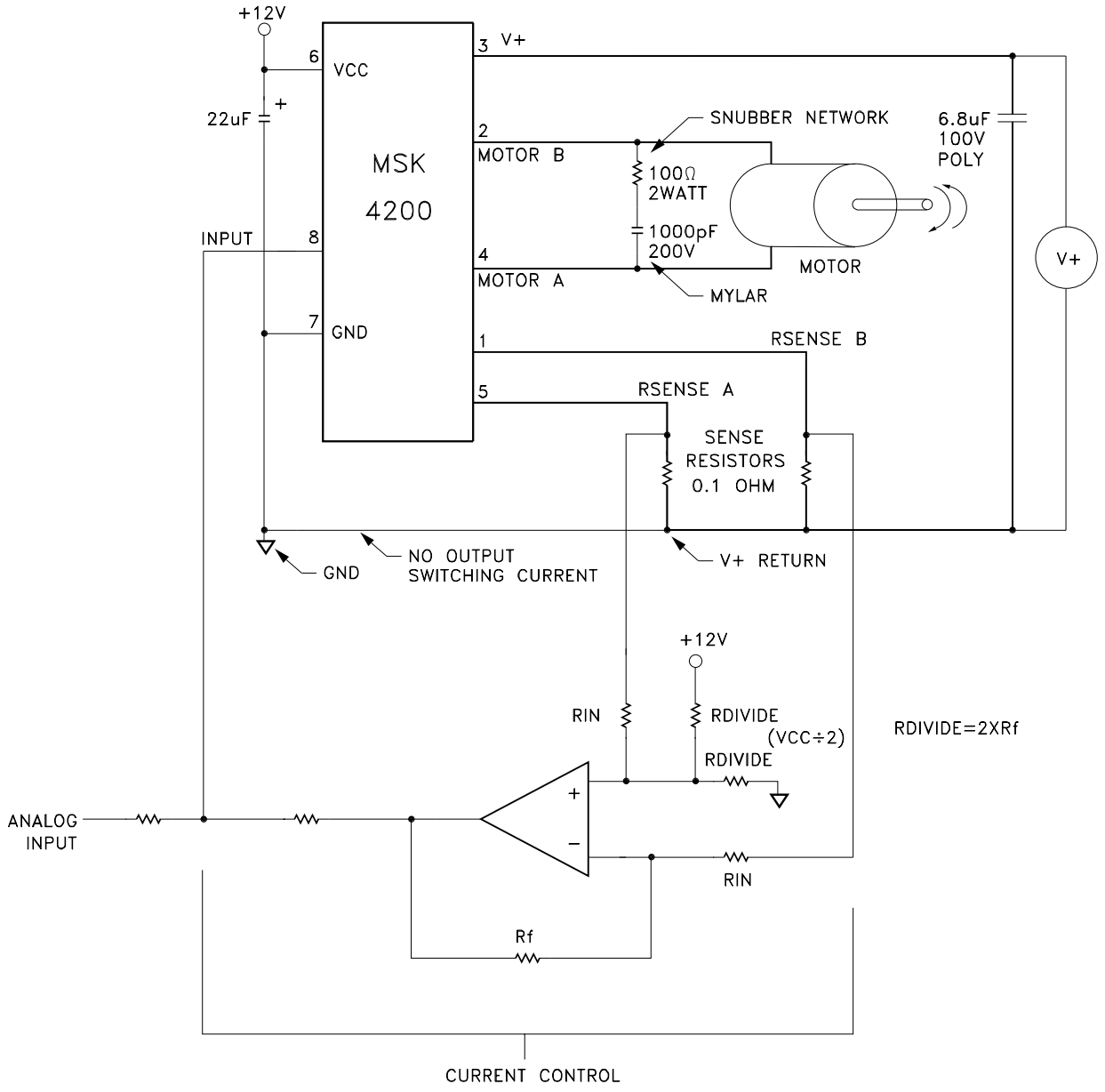
RSENSE A - This is the connection for the bottom of the A half bridge. This can have a sense resistor connected to the V+ return ground for current limit sensing, or can be connected directly to ground. The maximum voltage on this pin is ±2 volts with respect to GND.

GND - Is the return connection for the input logic and Vcc.

RSENSE B - This is the connection for the bottom of the B half bridge. This can have a sense resistor connected to the V+ return ground for current limit sensing, or can be connected directly to ground. The maximum voltage on this pin is ±2 volts with respect to GND.

INPUT - Is an analog input for controlling the PWM pulse width of the bridge. A voltage higher than Vcc/2 will produce greater than 50% duty cycle pulses out of MOTOR A. A voltage lower than Vcc/2 will produce greater than 50% duty cycle pulses out of MOTOR B.

TYPICAL SYSTEM OPERATION

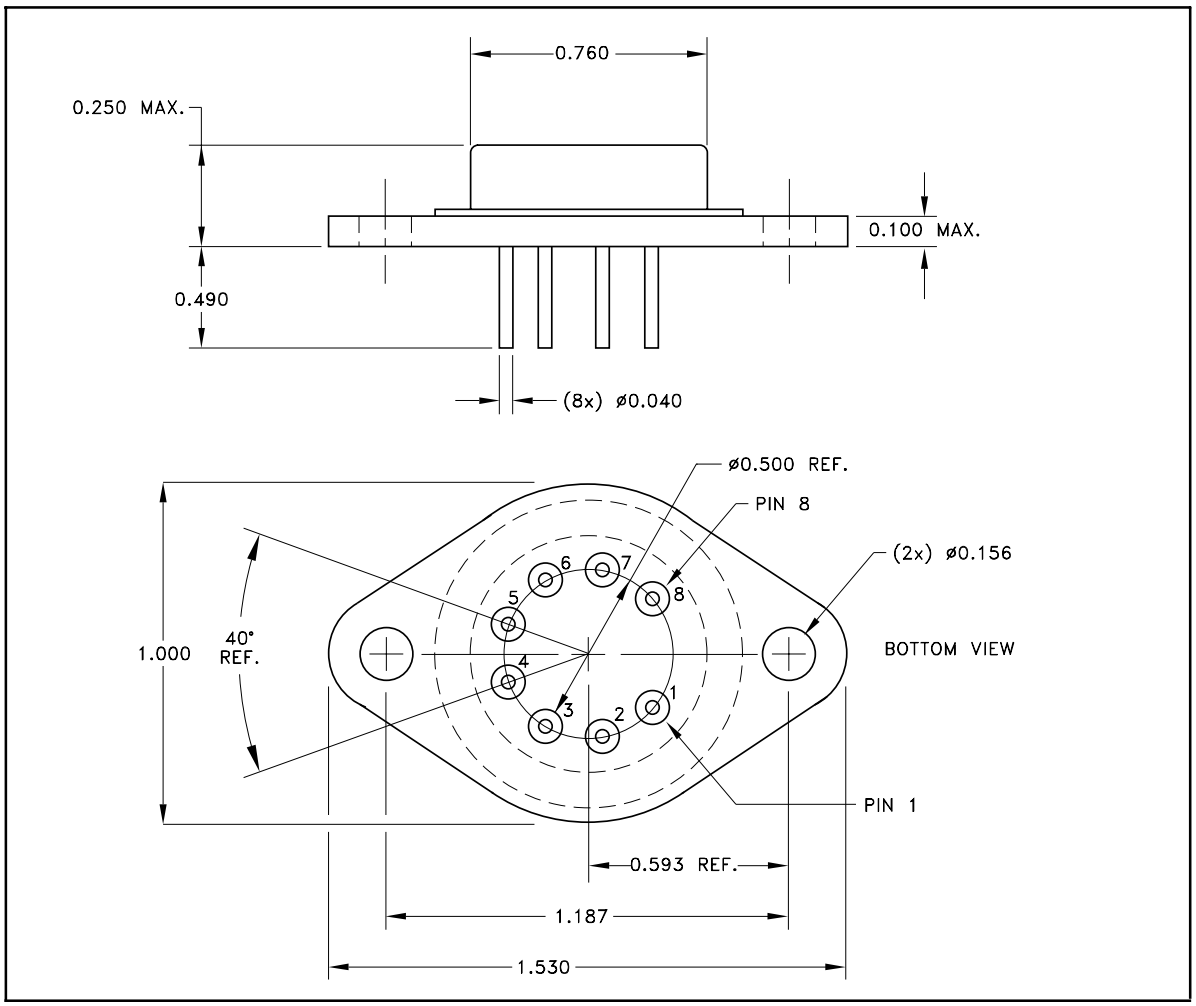


This is a diagram of a typical application of the MSK 4200. The design Vcc voltage is +12 volts and should have a good low ESR bypass capacitor such as a tantalum electrolytic. The analog input can be an analog speed control voltage from a potentiometer, other analog circuitry or by microprocessor and a D/A converter. This analog input gets pulled by the current control circuitry in the proper direction to reduce the current flow in the bridge if it gets too high. The gain of the current control amplifier will have to be set to obtain the proper amount of current limiting required by the system.

Current sensing is done in this case by a 0.1 ohm sense resistor to sense current from both legs of the bridge separately. It is important to make the high current traces as big as possible to keep inductance down. The storage capacitor connected to the V+ and the hybrid should be large enough to provide the high energy pulse without the voltage sagging too far. A low ESR ceramic capacitor or large polypropylene capacitor will be required. Mount capacitor as close to hybrid as possible. The connection between GND and the V+ return should not be carrying any motor current. The sense resistor signal is common mode filtered as necessary to feed the limiting circuitry for the microprocessor. This application will allow full four quadrant torque control for a closed loop servo system.

A snubber network is usually required, due to the inductance in the power loop. It is important to design the snubber network to suppress any positive spikes above 75V and negative spikes below -2V with respect to pin 5 (gnd).

MECHANICAL SPECIFICATIONS



ALL DIMENSIONS ARE ±0.01 INCHES UNLESS OTHERWISE LABELED

ORDERING INFORMATION

Part Number	Screening Level
MSK4200	Industrial
MSK4200E	Extended Reliability
MSK4200B	Mil-PRF-38534 Class H

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