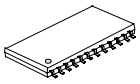
DUAL FULL-BRIDGE PWM MOTOR DRIVER



SOP-24

DESCRIPTION

The L6219 motor driver is designed to drive both windings of a bipolar stepper motor or bidirectionally control two dc motors. Both bridges are capable of sustaining 45V and include internal pulse-width modulation (PWM) control of the output current to 750mA .The outputs have been optimized for a low output saturation voltage drop (less than 1.8V total source plus sink at 500mA).

For PWM current control, the maximum output current is determined by the user's selection of a reference voltage and sensing resistor. Two logic-level inputs select output current limits of 0,33,67,or 100% of the maximum level. A phase input to each bridge determines load current direction.

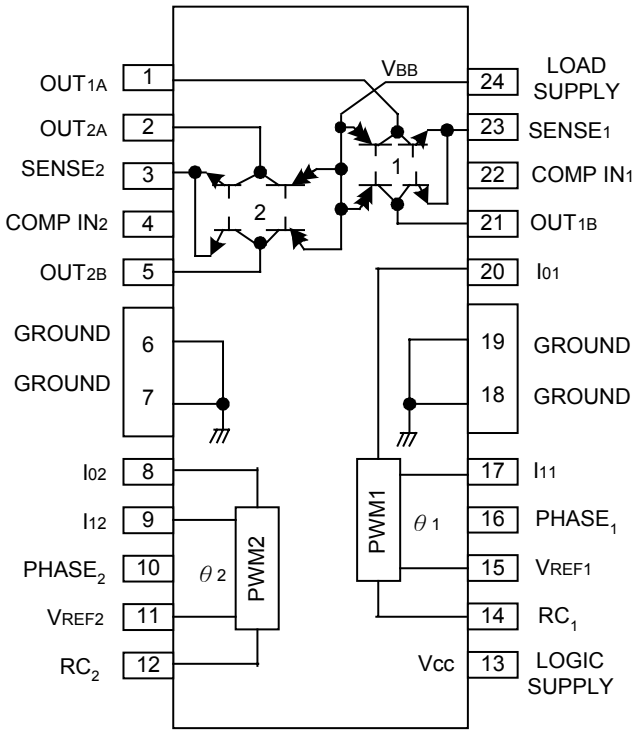
The bridges include both ground clamp and flyback diodes for protection against inductive transients. Internally generated delays prevent cross-over currents when switching current direction. Special power-up sequencing is not required. Thermal protection circuitry disables the outputs if the chip temperature exceeds safe operating limits.

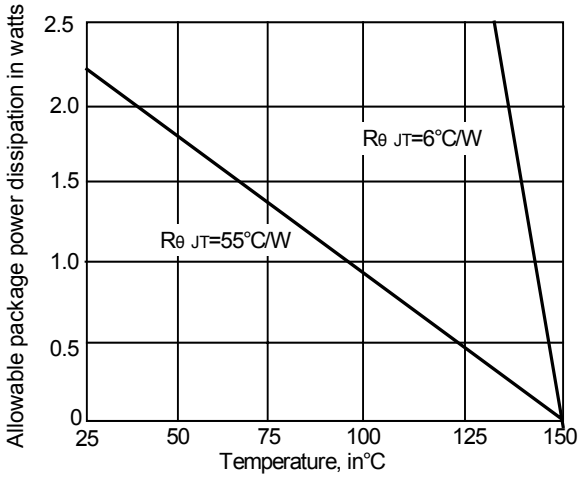
The L6219 is supplied in a 24-lead surface-mountable SSOP. Its batwing construction provides for maximum package power dissipation in the smallest possible construction. This device is also available on special order for operation from –40°C to+85°C or to+105°C

FEATURES

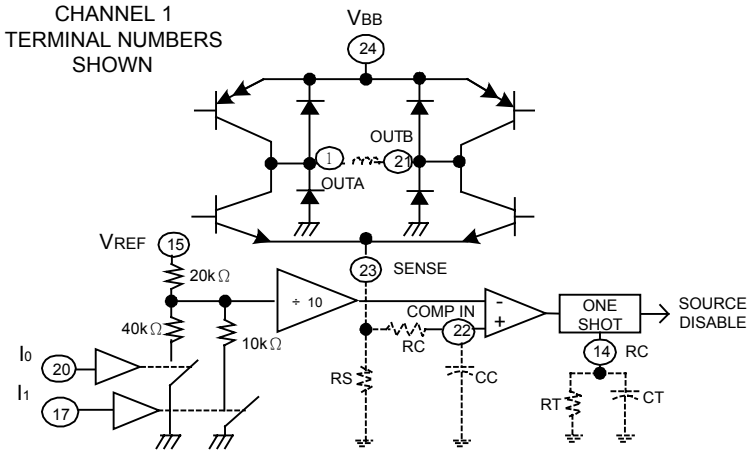
*Interchangeable with SGS L6219
*750mA Continuous Output Current
*45V Output Sustaining Voltage
*Internal Clamp Diodes
*Internal PWM Current Control
*low Output Saturation Voltage
*Internal Thermal Shutdown Circuitry

PIN CONFIGURATION





PWM CURRENT-CONTROL CIRCUITRY



TRUTH TABLE

PHASE	OUT_A	OUT_B
H	H	L
L	L	H

ABSOLUTE MAXIMUM RATINGS(at Tj≦150°C)

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNIT
Motor Supply Voltage	V_{BB}		45	V
Output Current	I_{OUT}	Peak	1.0	A
		Continuous	750	mA
Logic Supply Voltage	V_{CC}		7.0	V
Logic Input Voltage Range	V_{IN}		-0.3 ~ +7.0	V
Output Emitter Voltage	V_{SENSE}		1.5	V
Storage Temperature	Tstg		-55 ~ +150	°C
Operating Temperature	Topr		-20 ~ +85	°C
Package Power Dissipation	Pd	See graph		

*Output current rating may be limited by duty cycle, ambient temperature, and heat sinking. Under any set of conditions, do not exceed the specified peak current rating or a junction temperature of +150°C

ELECTRICAL CHARACTERISTICS(T_a=25°C, V_{CC}=4.75V to 5.25V,V_{BB}=45V,T_J≤150°C,V_{REF}=5.0V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Drivers(OUT_A or OUT_B)						
Motor Supply Range	V_{BB}		10	-	45	V
Output Leakage Current	I_{CEX}	V_{OUT}=V_{BB}	-	<1.0	50	μA
		V_{OUT}=0	-	<-1.0	-50	μA
Output Sustaining Voltage	$V_{CE(SUS)}$	I_{OUT}=±750mA,L=3.0mH	45	-	-	V
Output Saturation Voltage	$V_{CE(SAT)}$	Sink Driver, I_{OUT}=+500mA	-	0.4	0.6	V
		Sink Driver, I_{OUT}=+750mA	-	1.0	1.2	V
		Source Driver, I_{OUT}= -500mA	-	1.0	1.2	V
		Source Driver, I_{OUT}= -750mA	-	1.3	1.5	V
Clamp Diode Leakage Current	I_R	V_R=45V	-	<1.0	50	μA
Clamp Diode Forward Voltage	V_F	I_F=750mA	-	1.6	2.0	V
Driver Supply Current	$I_{BB(ON)}$	Both Bridges On, No Load	-	20	25	mA
	$I_{BB(OFF)}$	Both Bridge Off	-	5.0	10	mA
Control Logic						
Input Voltage	$V_{IN(1)}$	All Inputs	2.4	-	-	V
	$V_{IN(0)}$	All Inputs	-	-	0.8	V
Input Current	$I_{IN(1)}$	V_{IN}=2.4V	-	<1.0	20	μA
		V_{IN}=0.8V	-	-3.0	-200	μA
Reference Voltage Range	V_{REF}	Operating	1.5	-	7.5	V
Current Limit Threshold (at trip point)	V_{REF}/V_{COMPIN}	I_0=I_1=0.8V	9.5	10	10.5	-
		I_0=2.4V,I_1=0.8V	13.5	15	16.5	-
		I_0=0.8V,I_1=2.4V	25.5	30	34.5	-
Thermal Shutdown Temperature	T_J		-	170	-	°C
Total Logic Supply Current	$I_{CC(ON)}$	I_0=I_1=0.8V ,No Load	-	40	50	mA
	$I_{CC(OFF)}$	I_0=I_1=2.4V ,No Load	-	10	12	

APPLICATIONS INFORMATION

PWM CURRENT CONTROL

The L6219 dual bridge is designed to drive both windings of a bipolar stepper motor. Output current is sensed and controlled independently in each bridge by an external sense resistor (Rs), internal comparator, and monostable multivibrator.

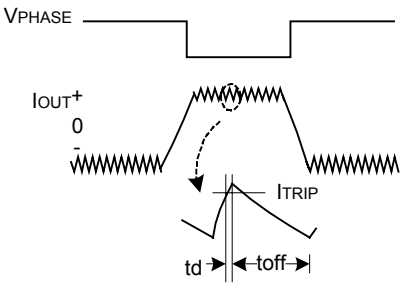
When the bridge is turned on, current increases in the motor winding and it is sensed by the external sense resistor until the sense voltage (V_{COMPIN}) reaches the level set at the comparator's input :I_{TRIP}=V_{REF}/10Rs

The comparator then triggers the monostable which turns off the source driver of the bridge. The actual load current peak will be slightly higher than the trip point (especially for low-inductance loads) because of the internal logic and switching delays. This delay (td)is typically 2μs.After turn-off, the motor current decays, circulating through the ground-clamp diode and sink transistor. The source driver's off time (and therefore the magnitude of the current decrease)is determined by the monostable's external RC timing components, where toff=R_TC_T within the range of 20kΩ to 100kΩ and 100Pf to 1000pF

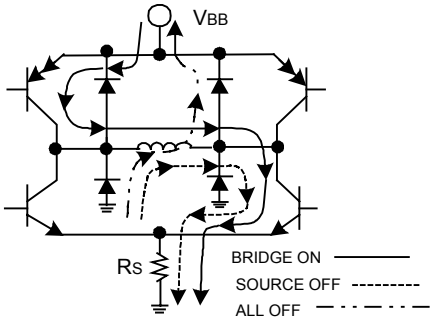
When the source driver is re-enabled, the winding current (the sense voltage) is again allowed to rise to the comparator's threshold. This cycle repeats itself, maintaining the average motor winding current at the desired level.

Loads with high distributed capacitances may result in high turn-on current peaks. This peak (appearing across Rs) will attempt to trip the comparator, resulting in erroneous current control or high-frequency oscillations. An external R_CC_C time delay should be used to further delay the action of the comparator. Depending on load type, many applications will not require these external components (SENSE connected to COMP IN).

PWM OUTPUT CURRENT WAVE FORM



LOAD CURRENT PATHS



LOGIC CONTROL OF OUTPUT CURRENT

Two logic level inputs(I_0 and I_1) allow digital selection of the motor winding current at 100%,67%,33%,or 0% of the maximum level per the table. The 0% output current condition turns off all drivers in the bridge and can be used as an OUTPUT ENABLE function.

CURRENT-CONTROL TRUTH TABLE

I_0	I_1	Output Current
L	L	$V_{REF}/10R_S=I_{TRIP}$
H	L	$V_{REF}/15R_S=2/3\ I_{TRIP}$
L	H	$V_{REF}/30R_S=1/3\ I_{TRIP}$
H	H	0

These logic level inputs greatly enhance the implementation of µP-controlled drive formats.

During half-step operations, the I_0 and I_1 allow the µP to control the motor at a constant torque between all positions in an eight-step sequence. This is accomplished by digitally selection 100% drive current when only one phase is on and 67% drive current when two phases are on. Logic highs on both I_0 and I_1 turn off all drivers to allow rapid current decay when switching phases. This helps to ensure proper motor operation at high step rates.

The logic control inputs can also be used to select a reduced current level (and reduced power dissipation) for “hold” conditions and/or increased current (and available torque)for start-up conditions.

GENERAL

The PHASE input to each bridge determines the direction motor winding current flows. An internally generated deadtime (approximately 2µs)prevents crossover currents that can occur when switching the PHASE input.

All four drivers in the bridge output can be tuned off between steps ($I_0=I_1\geq2.4V$) resulting in a fast current decay through the internal output clamp and flyback diodes. The fast current decay is desirable in half-step and high-speed applications. The PHASE,I_0,and I_1 inputs float high.

Varying the reference voltage (V_{REF}) provides continuous control of the peak load current for microstepping applications.

Thermal protection circuitry turns off all drivers when the junction temperature reaches +170°C. It is only intended to protect the device from failures due to excessive junction temperature and should not imply that output short circuits are permitted. The output drivers are re-enabled when the junction temperature cools to +145°C.

The L6219 output drivers are optimized for low output saturation voltages-less than 1.8V total (source plus sink)at 500mA.Under normal operating conditions, when combined with the excellent thermal properties of the batwing package design, this allows continuous operation of both bridges simultaneously at 500mA.

TYPICAL APPLICATION