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A TDK Group Company

SSI 32H6510
5V Servo Driver

Preliminary Data

December 1992

DESCRIPTION

The SSI 32H6510 is a fully integrated power amplifier for use in disk drive head positioning systems employing linear or rotary voice coil motors. It is intended for use in 5V systems and is capable of generating ±1Amp motor currents. The part is internally thermal overload protected.

The SSI 32H6510 is a power transconductance amplifier for use in driving voice coil type servo motors (VCMs). The SSI 32H6510 has two primary modes of operation, normal (or linear) and retract. The retract mode is activated by a power supply failure or when $\overline{\text{RETRACT}}$ is asserted. Otherwise the device operates in linear mode.

FEATURES

- **36-pin SO package**
- **Internal 1A power devices**
- **NMOS output stage**
- **Total on resistance less than 1.3Ω at 500 mA**
- **Thermal overload protection**
- **No deadband, low distortion, class B output**
- **Low power sleep mode**
- **Gain select switch optimizes performance with 8-bit DACs**
- **Built in retract circuitry**
- **Power fault detection**

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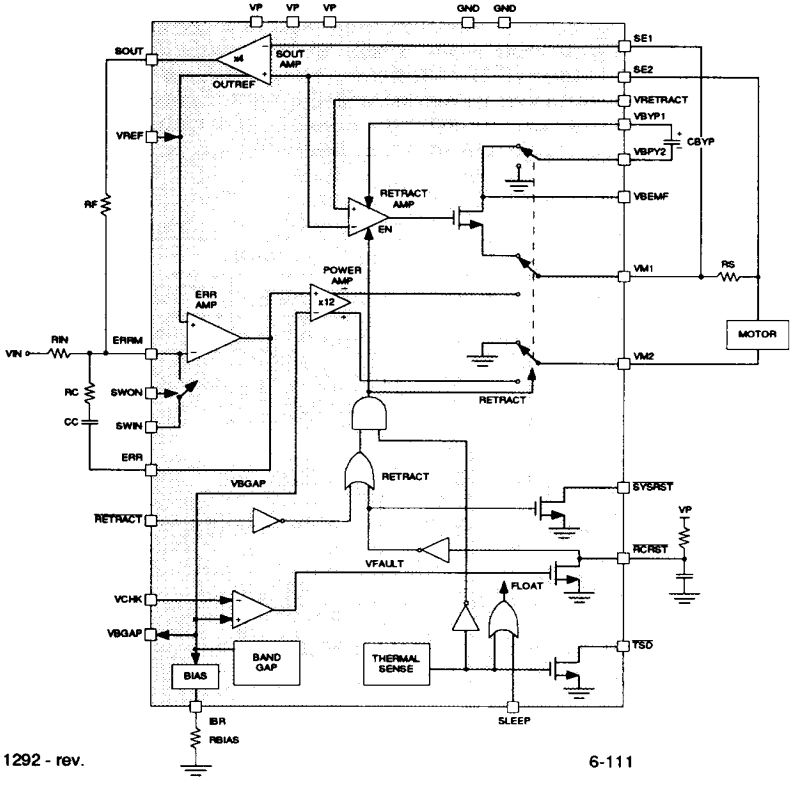
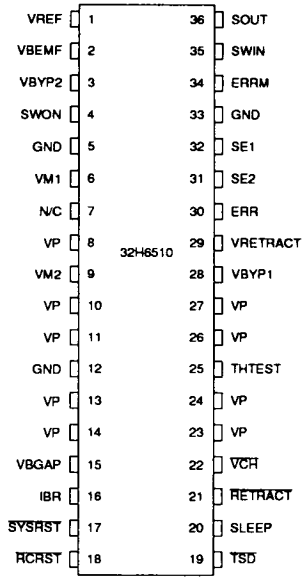
BLOCK DIAGRAM



PIN DIAGRAM



CAUTION: Use handling procedures necessary for a static sensitive component.

DESCRIPTION (continued)

The SSI 32H6510 consists of five major blocks: SOUT amplifier, ERR amplifier, retract amplifier, power amplifier, and control circuitry. These parts are each described in this section. External components needed for proper operation of the SSI 32H6510 are also described.

SOUT AMPLIFIER

This amplifier generates a voltage at SOUT that is proportional to positioner current. It does this by sensing the voltage across Rs, amplifying it, and referencing the result to VREF. Since the common mode voltage on Rs can range over the full power supply, while the differential voltage is a few millivolts, the SOUT amplifier is designed to have very high input common mode rejection, and very low input offset.

ERR AMPLIFIER

The ERR amplifier is a high gain op amp. Due to the fixed gain of the power amp, ERR is proportional to the VCM voltage. The negative input of this amplifier is the system summing junction--currents proportional to the desired VCM current, the measured VCM current, and the VCM voltage are summed here.

POWER AMPLIFIER

The power amplifier is a fixed gain voltage amplifier with differential inputs and outputs. Its input is the differential voltage between ERR and VBGAP. Its output drives the VCM directly.

RETRACT AMPLIFIER

When a voltage fault is sensed, or when $\overline{\text{RETRACT}}$ is asserted, the SSI 32H6510 enters retract mode. In this mode, it is assumed that no current is available from VP (VP may actually be at GND potential). Thus power for this mode comes from VBEMF, the rectified spindle back EMF voltage, and from VBYP1, a voltage generated from the external storage capacitor CBYP. The retract amplifier is powered by VBYP1. It senses the voltage at VRETRACT and raises VM1 to be equal to VRETRACT. The drain of the source follower is VBEMF.

CONTROL CIRCUITRY

The control circuitry consists of voltage monitoring circuitry, a thermal overload circuit, and control logic. The inputs to the control circuitry are the external signals $\overline{\text{RETRACT}}$, VCHK, and SLEEP, along with internal signal from the thermal overload detector (visible externally on $\overline{\text{TSD}}$). Table 1 describes the behavior of the part in response to these inputs.

TABLE 1: IC Mode Selection

INPUT				CHIP FUNCTION		
SLEEP	$\overline{\text{RETRACT}}$	VCHK>VBGAP	$\overline{\text{TSD}}$	BRIDGE	RETRACT	$\overline{\text{SYSRST}}$
X	X	0	0	Off	Off	0
X	X	0	1	Off	On	0
X	X	1	0	Off	Off	1
X	0	1	1	Off	On	1
0	1	1	1	On	Off	1
1	1	1	1	Off	Off	1

PIN DESCRIPTION

NAME	TYPE	DESCRIPTION
VP	Power	The positive power supply. The VP pins are thermally connected to the die and provide a low thermal resistance path to the circuit board. All VP pins should be shorted together.
GND	Power	The negative power supply. All GND pins should be shorted together.
SWON	Dig In	Turns on the switch between ERRM and SWIN.
SWIN	An In	One side of an analog switch connected to ERRM.
SOUT	An Out	The current sense amplifier output. SOUT is referenced to VREF.
ERR	An Out	The error amplifier output. ERR is used to provide compensation to the transconductance loop. ERR is referenced to VBGAP.
ERRM	An In	The error amplifier negative input.
VREF	An In	The reference voltage for the error amplifier and the current sense amplifier.
$\overline{\text{RETRACT}}$	Dig In	When low, forces a retract.
THTEST	Dig In	Test input.
VCHK	An In	Comparator input for power supply monitoring. When VCHK is below VBGAP, an internal voltage fault is generated.
VBGAP	An Out	An internal voltage reference for use with the power supply monitor comparator.
IBR	An Out	A resistor is tied from this pin to ground to establish the bias current for internal circuitry.
SLEEP	Dig In	Turns off the output drivers. Does not override the retract function when a voltage fault occurs. Powers down all but the voltage monitor and retract circuitry.
$\overline{\text{TSD}}$	O/C Out	Thermal Shut Down. When low, this open collector output indicates that the junction temperature has exceeded the recommended operating range and that the part is in thermal shutdown.
$\overline{\text{RCRST}}$	O/C Out	This pin serves the dual purpose of providing power-on-reset and stretching short VFAULT pulses to a width suitable for the host microcontroller. An external RC network sets the minimum width of any $\overline{\text{SYSRST}}$ pulse.
$\overline{\text{SYSRST}}$	O/C Out	When low, this open collector output indicates that an internal voltage fault has occurred.
VRETRACT	An In	The retract voltage. Supplied externally by a diode reference.
VBYP1	An In	The bypassed power supply. An external capacitor is connected to this node to store charge for use by the retract circuitry.
VBYP2	An In	The other side of the bypass capacitor is connected here.
VBEMF	An In	Rectified spindle back emf voltage. This input provides current to the internal retract power FET.

PIN DESCRIPTION (continued)

NAME	TYPE	DESCRIPTION
VM2	An Out	One side of the voice coil motor.
VM1	An Out	The other side of the voice coil motor and sense resistor combination.
SE1, SE2	An In	The sense voltages around the sense resistor.

ELECTRICAL SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS

Operation of the part outside these limits may result in degradation or failure of the device.

PARAMETER	RATING	UNITS
Power Supply, VP	7	V
Voltage on any pin		
VBEMF, VBYP1, VBYP2, $\overline{\text{SYSRST}}$, $\overline{\text{RCRST}}$	-0.3 to 16	V
VM1, VM2, SE1, SE2	-0.3 to 12	V
All others	-0.3 to VP+.3	V
Storage Temperature	-45 to 165	°C
Solder Temperature (10 sec duration)	260	°C
Output Current - I(VM1), I(VM2)	2	Amp
Junction Temperature	150	°C

RECOMMENDED OPERATING CONDITIONS

The performance specifications for this part apply only when the operating environment is within this specified range.

PARAMETER	CONDITIONS	MIN	NOM	MAX	UNIT
Power Supply, VP		4.75		5.25	V
Junction Temperature		0		125	°C
Output Current - I(VM1), I(VM2)				1.0	Amp
VBEMF		1.0		14	V
VREF		0.5		VP-2	V
RF		10			kΩ
RC		10			kΩ
RBIAS		21.5		22.5	kΩ
VBYP1 - Retract Mode		3		14	V

PERFORMANCE SPECIFICATIONS

DESCRIPTION	CONDITIONS	MIN	NOM	MAX	UNITS
VP Supply Current:					
Normal operation, Imotor = 0				15	mA
Sleep mode				2	mA
SOUT gain		3.9		4.1	V/V
SOUT input offset (SOUT = VREF)		-3		3	mV
SOUT output swing		0.15		VP-1	V
ERRM input offset (ERR = ERRM)		-10		10	mV
ERR output swing		1.6		3.25	V
GAIN (VM1-VM2)/(ERR-VBGAP)		11		13	V/V
VBGAP		2.13		2.37	V
VCHK offset		-15		15	mV
Retract offset					
VRETRACT = 0.5V		-50		50	mV
VRETRACT input impedance		500			kΩ
Output voltage drop: VP-|VM1-VM2|					
Imotor = ± 0.5A, Tj = 25°C				0.65	V
Imotor = ± 0.1A, Tj = 25°C				0.15	V
Thermal shutdown temperature		120		140	°C
Thermal shutdown hysteresis		3		7	°C
Crossover time					
Imotor = 10mA p 1000 Hz				45	µs
Crossover distortion					
Imotor = 10mA p 1000 Hz				2	%THD
Digital open collector output, sink current:					
$\overline{SYSRST}$, $\overline{RC\_RST}$, $\overline{TSD}$					
Vol = 0.4V		1.6			mA
SWIN on resistance				250	Ω

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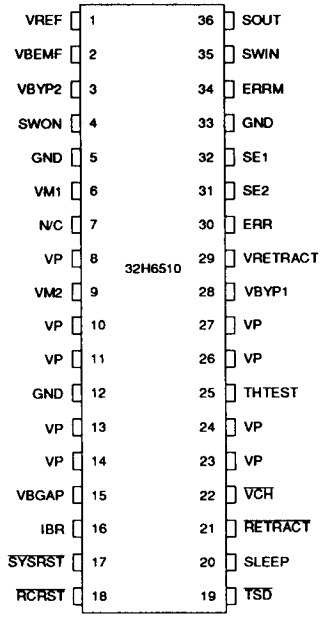
PACKAGE PIN DESIGNATIONS

(Top View)



36-Lead SOM

Preliminary Data: Indicates a product not completely released to production. The specifications are based on preliminary evaluations and are not guaranteed. Small quantities are available, and Silicon Systems should be consulted for current information.

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