HARRIS

HC-5508/09

PRELIMINARY

SLICs
Subscriber Line Interface Circuits

Features

- Monolithic Integrated Device
- DI High Voltage Process
- Compatible with Worldwide PBX Performance Requirements
- Controlled Supply of Battery Feed Current for Short Loops
- Internal Ring Relay Driver and Message Waiting Relay Driver
- Programmable Loop Current Limit and Self-Test Function (HC-5509)
- Low Power Consumption During Standby
- Switch Hook, Ground Key, Ring Trip and Message Waiting Detection Functions
- Selective Denial of Power to Subscriber Loops
- Two On Chip Op Amps for Transhybrid Balance and 2 Wire Impedance Matching

Applications

- Solid State Line Interface Circuit for PBX or Central Office Systems
- Hotel/Motel (Message/Waiting) Switching Systems
- Direct Inward Dialing (DID) Trunks
- Voice Messaging PBX's
- Analog Trunk Echo Cancellor Interface

Description

The HC-5508/09 SLICs incorporate many of the BORSHT functions on a monolithic IC. These include DC battery feed with loop current limiting, overvoltage protection, ringing, supervisory and hybrid functions. The devices are designed to maintain specified transmission performance in the presence of externally induced longitudinal currents.

The SLICs also provide selective denial of power, a 40mA loop current limit, line fault protection, and thermal current limiting. If a PBX/CO system becomes overloaded during an emergency or is subjected to line faults, the SLICs will provide system protection by denying power to selected subscriber loops or by limiting loop current. Switch hook, ground key, ring trip, and message waiting detection functions are also incorporated into the SLIC devices.

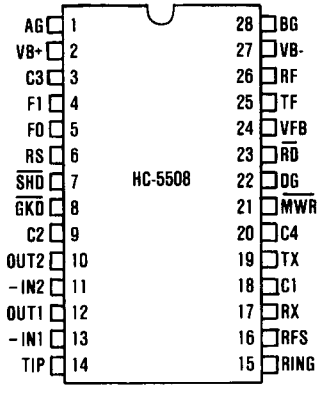
The Harris SLICs are ideally suited for the design of PBX and CO systems, replacing bulky hybrid transformers.

The HC-5508 SLIC is available in a 28 pin Dual-In-Line plastic package, or in die form. The HC-5509 is available in a 44 pin PLCC or in a die form which allow users the option to access additional functions including a self test function and an externally programmable loop current limit.

Both SLICs are ideally suited for use with the HC-5512/12A PCM filters, the HC-5510/11 PCM CODECs, and the HC-5552/3/4/7 serial interface PCM combos.

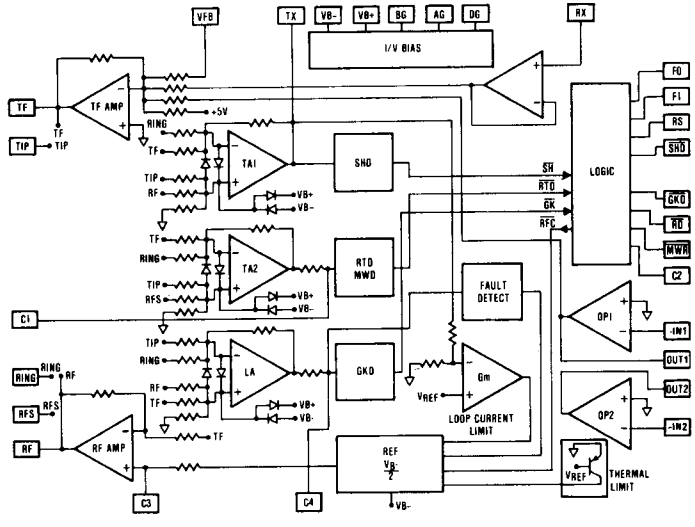
Pinout

TOP VIEW



HC-5509
AVAILABLE IN
SURFACE MOUNT
44 PIN PLCC

Functional Diagram



Description of Pin Functions

PIN	SYMBOL	DESCRIPTION
1	AG	Analog Ground — To be connected to zero potential. Serves as a reference for the transmit output (TX) and receive input (RX) terminals.
2	V_B^+	Positive Voltage Source — Most positive supply. V_B^+ is typically 12 volts with an operational range of 10.8 to 13.2 volts.
3	C3	Capacitor #3 — An external capacitor to be connected between this terminal and analog ground. Required for proper operation of the loop current limiting function, and for filtering -48V supply. Typical value is 0.3μF, 30V.
4	F1	Function Address 1 — TTL and CMOS compatible input used with F0 function address line to externally select logic functions; ring command, message waiting, and loop power denial. The three selectable functions are mutually exclusive. (See Truth Table 1.)
5	F0	Function Address 0 — TTL and CMOS compatible input used with F1 function address line to externally select logic functions; ring command, message waiting, and loop power denial. The three selectable functions are mutually exclusive. (See Truth Table 1.)
6	RS	Ring Synchronization Input — A TTL compatible clock input. The clock is arranged such that a positive pulse (50-500μs) occurs on the negative going zero crossing of the ring voltage source, ensuring that the ring relay is activated and deactivated when the instantaneous ring voltage is near zero. If synchronization is not required, then tie to +5V.
7	$\overline{SHD}$	Switch Hook Detection — A low active LS TTL compatible logic output. This output is typically enabled for loop currents exceeding 12mA and typically disabled for loop currents less than 12mA.
8	$\overline{GKD}$	Ground Key Detection — A low active LS TTL compatible logic output. This output is typically enabled if the DC current into the ring lead exceeds the DC current out of the tip lead by more than 15mA and typically disabled if this current difference is less than 15mA.
9	C2	Capacitor #2 — An external capacitor to be connected between this terminal and digital ground. Prevents false ground key indications from occurring during ring trip detection. Typical value is 0.15μF, 10V. This capacitor is not needed if ground key function is not required and may be left open or connected to digital ground.
10	OUT2	The analog output of spare operational amplifier Number 2. The output voltage swing is typically ±5V.
11	-IN2	The inverting analog input of spare operational amplifier Number 2.
12	OUT1	The analog output of spare operational amplifier Number 1. The output voltage swing is typically ±5V.
13	-IN1	The inverting analog input of spare operational amplifier Number 1.
14	TIP	An analog input connected to the TIP (more positive) side of subscriber loop through a 50Ω feed resistor and a ring relay. Functions with the RING terminal to receive voice signals from the telephone and for loop monitoring purposes.

Description of Pin Functions (Continued)

PIN	SYMBOL	DESCRIPTION
15	RING	An Analog input connected to the RING (more negative) side of the subscriber loop through a 50Ω feed resistor. Functions with the TIP terminal to receive voice signals from the telephone and for loop monitoring purposes.
16	RFS	Senses ring side of loop for ground key detection. During Ring Injected ringing, the ring signal is inserted into the line at this node to isolate RF from the ring signal via the ring relay. For balanced or Tip Injected Ringing, the RF and RFS pins must be shorted.
17	RX	Receive Input, Four Wire Side — A high impedance analog input which is internally biased. Capacitive coupling to this input is required. AC signals appearing at this input differentially drive the Tip Feed and Ring Feed terminals, which in turn drive TIP and RING through 100 ohms of feed resistance on each side of the line.
18	C1	Capacitor #1 — An external capacitor to be connected between this terminal and ground. It prevents false ring trip detection and false message waiting detection from occurring when longitudinal currents are induced onto the subscriber loop from power lines and other noise sources. Typical value is 0.5μF to 1.0μF, 20V. This capacitor should be nonpolarized.
19	TX	Transmit Ouput, Four Wire Side — A low impedance (10Ωmax) analog output which represents the differential voltage across TIP and RING. Transhybrid balancing must be performed (using the SLIC microcircuit spare op amps) beyond this output to completely implement two to four wire conversion. This output is referenced to analog ground. Since the DC level of this output varies with loop current, capacitive coupling to the next stage is necessary.
20	C4	Capacitor #4 — An external capacitor to be connected between this terminal and analog ground. This capacitor prevents false ground key indication from occurring when longitudinal currents are induced into the subscriber loop from power lines and other noise sources. Typical value is 0.5 μF to 1.0μF, 20V. This capacitor should be nonpolarized.
21	$\overline{MWR}$	Message Waiting Relay Driver — A active low open collector logic output. Used to switch a high voltage onto the line to drive a telephone set neon lamp to indicate a message is waiting.
22	DG	Digital Ground — To be connected to zero potential. Serves as a reference for all digital inputs and outputs on the SLIC microcircuit.
23	$\overline{RD}$	Ring Relay Driver — A active low open collector logic output. Used to switch ring signals onto the 2 wire line.
24	VFB	Feedback signal from the tip feed amplifier. To be used in conjunction with transmit output signal (TX) and the spare op-amps to accommodate 2W line impedance matching.
25	TF	Tip Feed — A low impedance analog output connected to the TIP terminal through a 50Ω feed resistor. Functions with the RF terminal to provide loop current, feed voice signals to the telephone set, and sink longitudinal currents.
26	RF	Ring Feed — A low impedance analog output connected to the RING terminal through a 50Ω feed resistor. Functions with the TF terminal to provide loop current, feed voice signals to the telephone set, and sink longitudinal currents.
27	V_B-	Negative Voltage Source — Most negative supply. V_B- is typically -48 volts with an operational range of -25 to -58 volts. Frequently referred to as "battery".
28	BG	Battery Ground — To be connected to zero potential. All loop current and some quiescent current flows into this ground terminal.

Absolute Maximum Ratings

Max. Continuous Supply Voltages (VB+) .....-0.5V to +15V
(VB+)-(VB-) ..... +75V
Operating Ambient Temperature (TA) .....0°C to +75°C
Storage Temperature Range (TS) ...-25°C to +125°C

Recommended Operating Conditions

Positive Power Supply (VB+) ..... +12V ±5%
Negative Power Supply (VB-) ..... -25V to -58V
Ambient Operating Temperature Range
(TA) .....0°C to +75°C

Electrical Characteristics

Typical Conditions Unless Otherwise Stated:

VB- = -48V, VB+ = 12V, AG = DG = BG = 0V, TA = 25°C,
All AC Parameters are Specified at 600Ω

TABLE 1.

F1	F0	ACTION
0	0	Normal Loop Feed
0	1	$\overline{RD}$ Active
1	0	$\overline{MWR}$ Active
1	1	Loop Power Denial Active

A.C. Transmission Performance

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
RX Input Impedance	300Hz to 3.4KHz	1			MΩ
4W Input Overload Level	300Hz to 3.4KHz	+4			dBm
2W Input Overload Level	300Hz to 3.4KHz	+4			dBm
2W Longitudinal Impedance	Per Lead		100		Ω
2W Return Loss					
SRL LO	200Hz to 500Hz	25	35		dB
ERL	500Hz to 2.5KHz	25	40		dB
SRL HI	2.5KHz to 3.2KHz	25	40		dB
2W Longitudinal to Metallic Balance	per ANSI/IEEE STD 455-1976				
Off Hook	300Hz to 3400Hz	55	65		dB
On Hook	10Hz to 3400Hz	60	63		dB
4W Longitudinal to Metallic Balance	per ANSI/IEEE STD 455-1976				
Off Hook	300Hz to 3400Hz	50	55		dB
Low Frequency Longitudinal Balance				-67	dBmop
2W and 4W	R.E.A. Method			23	dBrnC
Longitudinal Current Capability	Per Lead			15	mArms

A.C. Transmission Performance (Continued)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Insertion Loss 2W/4W, 4W/2W	0dBm @ 300Hz to 3400Hz			±0.2	dB
Level Linearity 2W/4W 4W/2W	Ref. to -10dBm +3 to -40dBm -40 to -50dBm -50 to -55dBm +3 to -40dBm -40 to -50dBm -50 to -55dBm			 ±0.05 ±0.1 ±0.3 ±0.05 ±0.1 ±0.3	 dB dB dB dB dB dB
Absolute Delay 2W/4W 4W/2W	 300Hz to 3400Hz 300Hz to 3400Hz			 2 2	 μs μs
Envelope Delay Distortion 2W/4W, 4W/2W	 500Hz to 1KHz 1KHz to 2.6KHz 2.6KHz to 2.8KHz			 2 2 2	 μs μs μs
Transhybrid Loss, THL	0dBm @ 1KHz	36	40		Dβ
Total Harmonic Distortion 2W/4W, 4W/2W, 4W/4W	Ref. Level 0dBm 300Hz to 3400Hz			 -52	 dB
Idle Channel Noise 2W and 4W	 C-Message Psophometric 3KHz Flat			 5 -85 15	 dBrnC dBmop dBrn
Power Supply Rejection Ratio VB+ to 2W VB+ to 4W VB- to 2W VB- to 4W VB+ to 2W VB+ to 4W VB- to 2W VB- to 4W	30Hz to 200Hz V_{NOISE} = 100mVrms 200Hz to 16KHz V_{NOISE} = 100mVrms	 25 25 25 25 30 30 30 30			 dB dB dB dB dB dB dB dB

8 TELECOM-MUNICATIONS

D.C. Performance

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Loop Current Limit			40	46	mA
Loop Current During Power Denial				±2	mA
Fault Currents					
TIP to Ground			40		mA
RING to Ground			60		mA
TIP and RING to Ground			100		mA
TIP to RING			40		mA
Switch Hook Detection Threshold			12		mA
Ground Key Detection Threshold			15		mA
Message Waiting Detection Threshold			15		mA
Ring Trip Detection Threshold			15		mA
Ring Trip Detection Period			2	3	Cycles
Dial Pulse Distortion			0.1		mS
Relay Driver Outputs ($\overline{RD}$, $\overline{MWR}$)					
On Current	V_{SAT} = 1.2V		50		mA
Off Leakage Current			±10		μA
Delay Time				10	μs
Rise and Fall Time	+12V to 0V			10	μs
TTL/CMOS Logic Inputs					
(F0, F1, RS)					
Logic '0' V_{IL}				0.8	V
Logic '1' V_{IH}		2.0		5.5	V
Input Current (F0, F1, RS)	$0V \leq V_{IN} \leq 5V$			±100	μA
Ring Synchronization (RS)					
Pulse Width		25			μs
Delay Time, Sync to Driver Off		20		20	μs
Logic Inputs					
Logic '0' V_{IL}		0.0		0.8	V
Logic '1' V_{IH}		2.0		5.5	V
Logic Outputs	Max Two LS Loads				
Logic '0' V_{IL}			0.1	0.5	V
Logic '1' V_{IH}		2.7		5.5	V
Power Dissipation					
On Hook			200		mW

Uncommitted Op Amps

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Offset Voltage			10	15	mV
Input Offset Current				100	nA
Input Bias Current				400	nA
Differential Input Resistance			1		MΩ
Input Noise Voltage	f = 1KHz		20		nV/ Hz
Output Voltage Swing	R_L = 10KΩ		±5		V
Output Resistance				10	Ω
Small Signal GBW			1		MHz

Overvoltage Protection and Longitudinal Current Rejection

The SLIC devices, in conjunction with an external protection bridge, will withstand high voltage lightning surges and power line crosses.

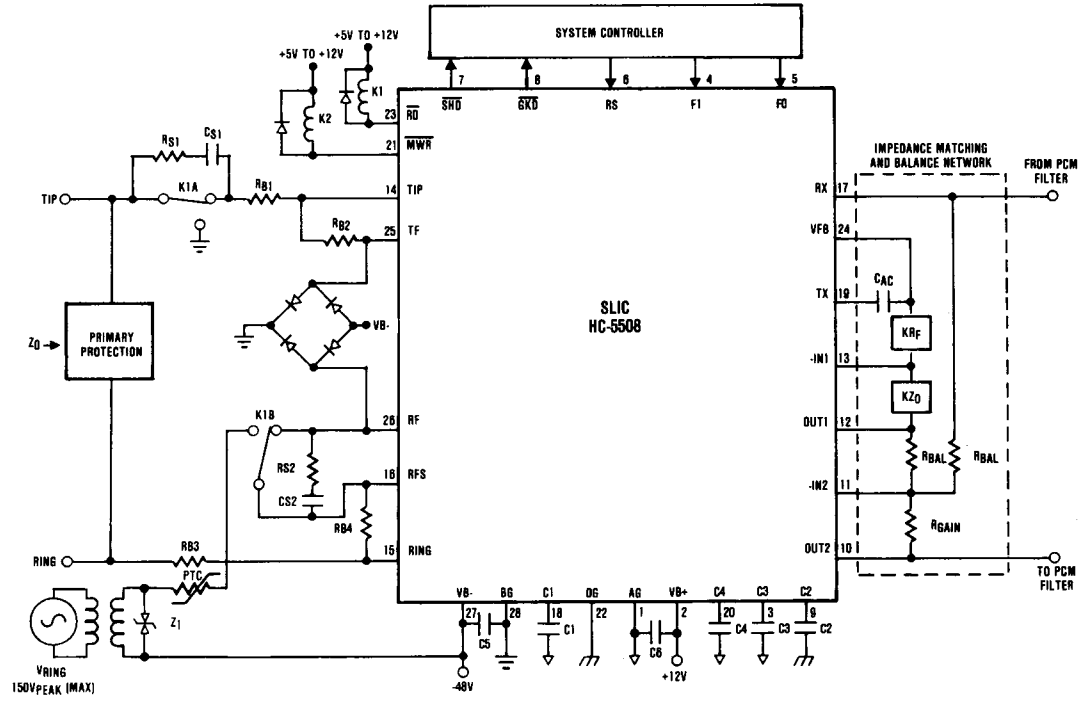
High voltage surge conditions are as specified in Table 2.

The SLICs will withstand longitudinal currents up to a maximum total of 30mArms (15mArms per leg) without any performance degradation.

TABLE 2.

PARAMETER	TEST CONDITION	PERFORMANCE (MAXIMUM)	UNITS
Longitudinal Surge	10μs Rise/ 1000μs Fall	±1000 (Plastic) ±500 (Ceramic)	V Peak V Peak
Metallic Surge	10μs Fall 1000μs Fall	±1000 (Plastic) ±500 (Ceramic)	V Peak V Peak
T/GND R/GND	10μs Rise/ 1000μs Fall	±1000 (Plastic) ±500 (Ceramic)	V Peak V Peak
50/60Hz Current T/GND R/GND	700V rms Limited to 10A rms	11	Cycles

Applications Diagram



Typical Component Values:

C1 = 0.5μF to 1μF, 20V (Nonpolarized)
C2 = 0.15μF, 10V
C3 = 0.3μF, 30V
C4 = 0.5μF - 1.0μF ± 10%, 20V (Should be Nonpolarized)
C5 = 0.01μF, 100V ±20%
C6 = 0.01μF, 20V ±20%
C_{AC} = 0.5μF, 20V
KZ_0 = 60KΩ (Z_0 = 600Ω, K = Scaling Factor)
R_{GAIN} = User Defined
R_{BAL} = 100KΩ
KR_F = 20KΩ (RF = 2(RB_1 + RB_4)), K = Scaling Factor)
R_{B1} = R_{B2} = R_{B3} = R_{B4} = 50Ω (1% Absolute, 0.1% Match Required)
R_{S1} = R_{S2} = 1KΩ Typically
C_{S1} = C_{S2} = 0.1μF, 200V Typically, Depending on V_{RING} and Line Length.

Z_1 = 150 to 200V Transient Protector. PTC used as Ring Generator Ballast.

Secondary Protection Diode Bridge Recommended is an MDA 220 or equivalent.

NOTE: HC-5508 applications diagram shows Ring Injected Ringing Configuration. A Balanced or Tip injected configuration may also be used. For additional applications information refer to Applications Note 549 by Geoff Phillips, "The HC-550X Telephone SLICs."