PLESSEY
Semiconductors

SL541A & B

HIGH SLEW RATE OPERATIONAL AMPLIFIERS

The SL541 is a monolithic amplifier designed for optimum pulse response and applications requiring high slew rate with fast settling time to high accuracy. The high open loop gain is stable with temperature, allowing the desired closed loop gain to be achieved using standard operational amplifier techniques. The device has been designed for optimum response at a gain of 20dB when no compensation is required. Both the SL541A and SL541B have a guaranteed input offset voltage of ±5 mV maximum.

FEATURES

- High Slew Rate: 175V/μs
- Fast Settling Time: 1% in 50ns
- Open Loop Gain: 70dB (SL541B), 54dB (SL541A)
- Wide Bandwidth: DC to 100MHz at 20dB Gain
- Very Low Thermal Drift: 0.02dB/°C Temperature Coefficient of Gain
- Guaranteed 5mV input offset maximum
- Full Military Temperature Range (DIL Only)
- Package: 10 Lead TO-5
  14 Lead DIL Ceramic

APPLICATIONS

- Wideband IF Amplification
- Wideband Video Amplification
- Fast Settling Pulse Amplifiers
- High Speed Integrators
- D/A and A/D Conversion
- Fast Multiplier Preamps

ABSOLUTE MAXIMUM RATINGS

Supply voltage (V+ to V−)	24V
Input voltage (Inv. I/P to non inv. I/P)	±9V
Storage temperature	−55°C to +175°C
Chip operating temperature	+175°C
Operating temperature:	TO-5: −55°C to +85°C
	DIL: −55°C to +125°C
Thermal resistances	
Chip-to-ambient: TO-5	220°C/W
DIL	125°C/W
Chip-to-case: TO-5	60°C/W
DIL	40°C/W

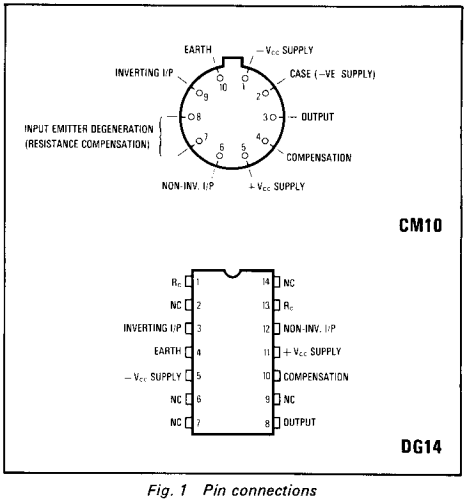

Fig. 1 Pin connections

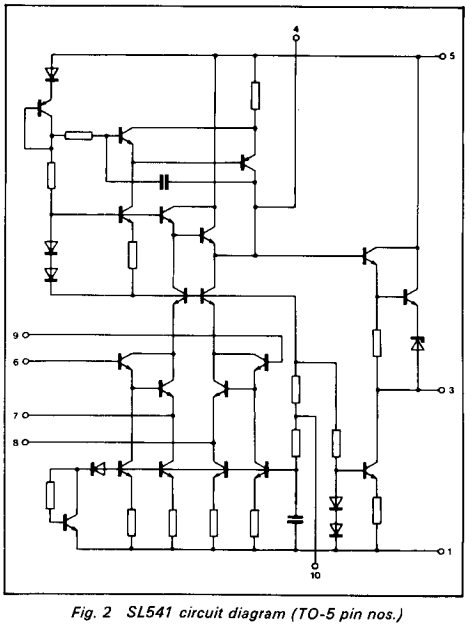

Fig. 2 SL541 circuit diagram (TO-5 pin nos.)

ELECTRICAL CHARACTERISTICS

Test conditions (unless otherwise stated):

$T_{amb} = 25°C$
$R_c = 0\Omega$

Test circuits: see Fig. 8

Characteristic	Circuit	Value			Units	Conditions
		Min.	Typ.	Max.		
Static nominal supply current	A,B		16	21	mA	
Input bias current	A,B		7	25	μA	
Input offset voltage	A,B			5	mV	
Dynamic open loop gain	A	45	54		dB	600 Ω load
	B	60	71		dB	
Open loop temperature coefficient	A,B		−0.02		dB/°C	
Closed loop bandwidth (−3dB)	A,B		100		MHz	X10 gain
Slew rate (4V peak)	A,B	100	175		V/μs	X10 gain
Settling time to 1%	A,B		50	100	ns	
Maximum output voltage						
(+ve)	A	5.5	5.7		V	
(−ve)	A		−1.9	−1.5	V	
(+ve)	B	2.5	3.0		V	
(−ve)	B		−3.0	−2.5	V	
Maximum output current	A,B	4	6.5		mA	
Maximum input voltage						
(+ve)	A			5	V	Non inverting modes
(−ve)	A	−1			V	
(+ve)	B			3	V	
(−ve)	B	−3			V	
Supply line rejection						
(+ve)	A,B	54	66		dB	
(−ve)	A,B	46	54		dB	

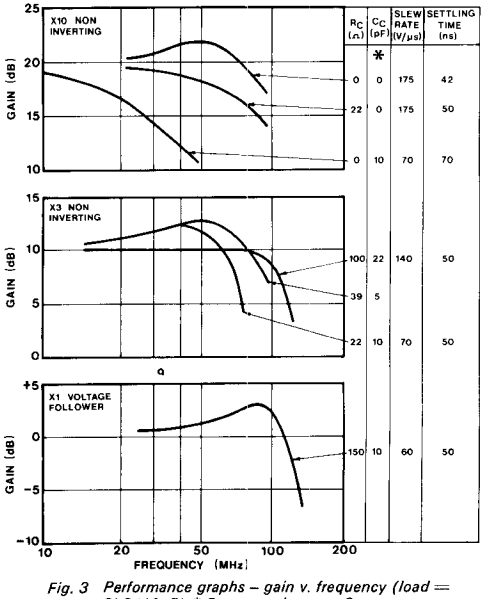

*Fig. 3 Performance graphs – gain v. frequency (load = 2kΩ/10pF) * See operating note 2*

OPERATING NOTES

The SL541 may be used as a normal, but non saturating operational amplifier, in any of the usual configurations (amplifiers, integrators etc.), provided that the following points are observed:

1. Positive supply line decoupling back to the output load earth should always be provided close to the device terminals.
2. Compensation capacitors should be connected between pins 4 and 5. These may have any value greater than that necessary for stability without causing side offsets.
3. The circuit is generally intended to be fed from a fairly low impedance (<1kΩ), as seen from pins 6 and 9 – 100Ω or less results in optimum speed.
4. The circuit is designed to withstand a certain degree of capacitive loading (up to 20pF) with virtually no effect. However, very high capacitive loads will cause loss of speed due to the extra compensation required and asymmetric output slew rates.
5. Pin 10 does not need to be connected to zero volts except where the clipping levels need to be defined accurately w.r.t. zero. If disconnected, an extra ±0.5 volt uncertainty in the clipping levels results, but the separation remains. However, the supply line rejection is improved if pin 10 can be left open-circuit.

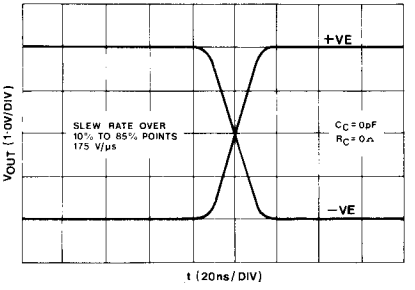

Fig. 4 Slew rate – X10 non-inverting mode Input square wave 0.4V p/p

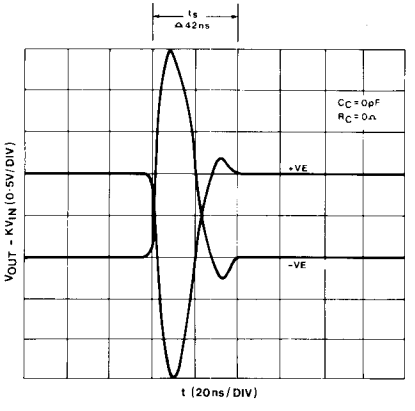

Fig. 5 Settling time – X10 non-inverting mode

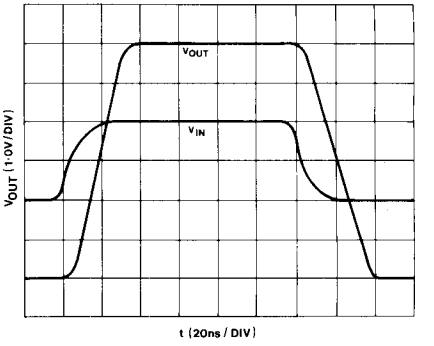

Fig. 6 Output clipping levels – X10 non-inverting mode Input moderately overdriven, so that ouput goes into clipping both sides

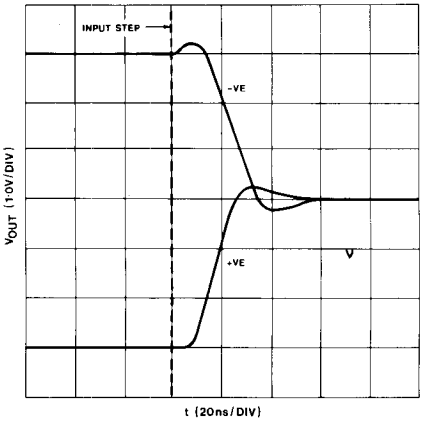

Fig. 7 Output clippings levels -X10 non inverting mode. Output goes from clipping to zero volts. $V_{in} = 3V$ peak step, offset +ve or – ve.

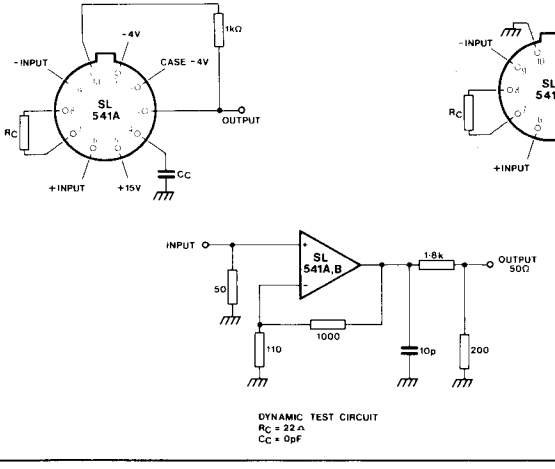

Fig. 8 Test circuits

TEST CONDITIONS AND DEFINITIONS

Both slew rate and settling time are measures of an amplifier's speed of response to an input. Slew rate is an inherent characteristic of the amplifier and is generally less subject to misinterpretation than is settling time, which is often more dependent upon the test circuit than the amplifier's ability to perform.

Slew rate defines the maximum rate of change of output voltage for a large step input change and is related to the full power frequency response (fp) by the relationship.

$$S = 2\pi f_p E_o$$

where E_o is the peak output voltage

Settling time is defined as the time elapsed from the application of a fast input step to the time when the amplifier output has entered and remained within a specified error band that is symmetrical about the final value. Settling time, therefore, is comprised of an initial propagation delay, an additional time for the amplifier to slew to the vincinity of some value of output voltage, plus a period to recover from overload and settle within the given error band.

The SL541 is tested for slew rate in a X10 gain configuration.

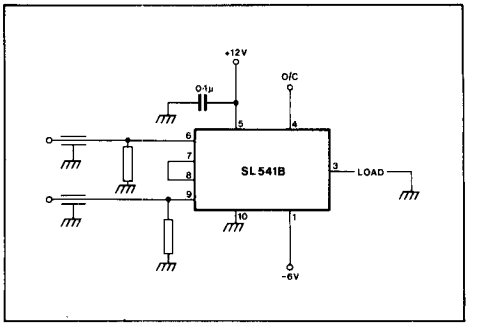

Fig. 9 Non-saturating sense amplifier (30V/μs for 5mV) Note: the output may be caught at a pre-determined level. (TO-5 pin nos.)

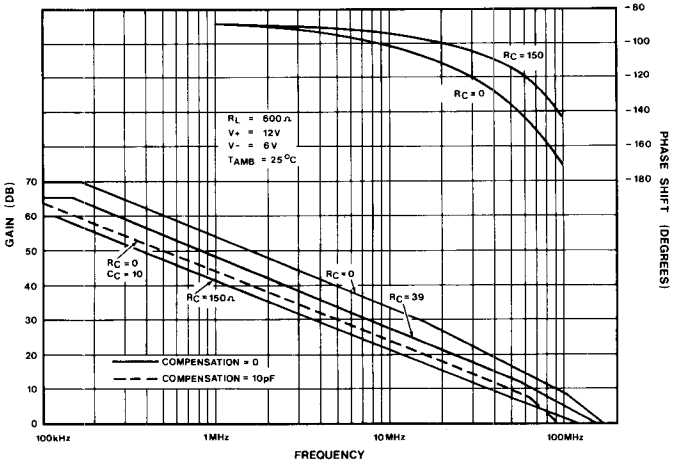

Fig.10 SL541B open loop gain and phase shift v. frequency