SL541

HIGH SLEW RATE OPERATIONAL AMPLIFIER

The SL541 is a monolitic amplifier designed for optimum pulse response and applications requiring high slew rate with fast setting 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. The SL541B has a guaranteed input offset voltage of ±5mV maximum and replaces the SL541C.

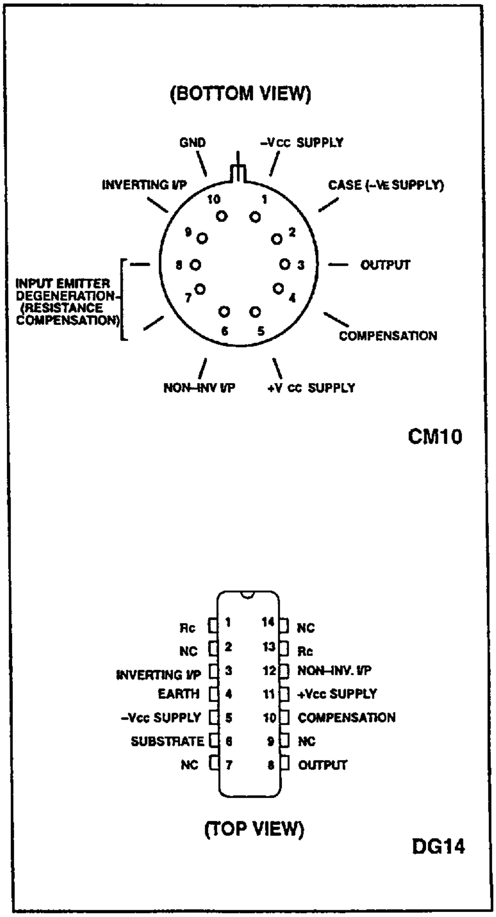

Fig. 1 pin connections

FEATURES

- High Slew Rate 175V/µs
- Fast Setting Time 1% in 50ns
- Open Loop Gain 70dB (SL541B)
- Wide Bandwidth DC to 100MHz at 10dB Gain
- Very Low Thermal Drift 0.02dB/°C Temperature Coefficient of Gain
- Guaranteed 5mV input offset maximum

APPLICATIONS

- Wideband IF Amplification
- Wideband Video Amplifiaction
- Fast setting 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 +150°C		
Chip operating temperature		+150°C
Thermal resistances		
Chip to ambient	TO–5	220°C/W
	DIL	125°C/W
Chip to case	TO–5	65°C/W
	DIL	40°C/W

ORDERING INFORMATION

SL541 B CM
SL541 B DG
SL541 NA IC (NAKED DIE)

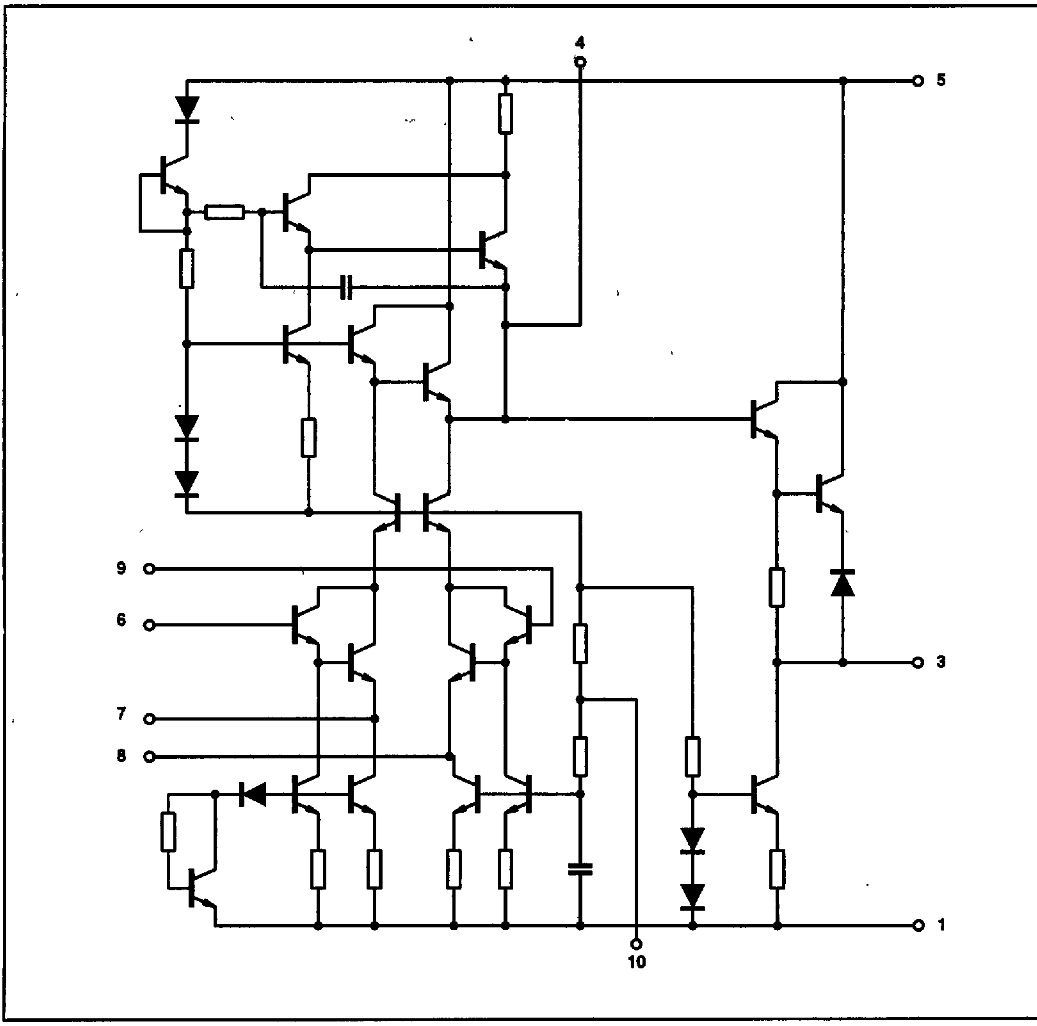

Fig. 2 SL541 circuit diagram (TO–5 pin nos)

ELECTRICAL CHARACTERISTICS

T_{amb}= 22°C ±2°C, Rc=0Ω. These characteristics are guaranteed over the following conditions. They apply within the specified ambient temperature and supply voltage ranges unless otherwise stated.

Characteristics	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	B			5	mV	
Input offset voltage	A			10	mV	
Dynamic open loop gain	A	45	54		dB	600Ω 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
Setting 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	
(-ve)	A	-1			V	Non-inverting
(+ve)	B			3	V	Modes
(-ve)	B	-3			V	
Supply line rejection						
(+ve)	A, B	54	66		dB	
(-ve)	A, B	46	54		dB	
Input offset current	A, B			9.85	µA	
Common mode rejection	A, B	60.7			dB	
Input offset voltage drift	A		25		µV/°C	

ELECTRICAL CHARACTERISTICS (Typical)

T_{amb}= –40°C to 85°C, Rc=0Ω. Test circuit B These characteristics are guaranteed over the following conditions. They apply within the specified ambient temperature and supply voltage ranges unless otherwise stated.

Characteristics		Value		Units	Conditions
	Min	Typ	Max		
Static nominal supply current		16	25	mA	
Input bias current			35	µA	
Input offset voltage (+ve)			8	mV	
(–ve)	–8			mV	
Maximum output current	3.5	6.5		mA	
Maximum input voltage (+ve)			3	V	Non–inverting modes
(–ve)	–3			V	
Supply line rejection (+ve)	50			dB	
(–ve)	42			dB	
Maximum output voltage (+ve)	2.3			V	
(–ve)			2.5	V	
Common mode rejection	55			dB	
Input offset current			16	µA	
Output voltage drift		15		µV/°C	
Input bias current drift		60		nA/°C	
Output current drift		40		nA/°C	

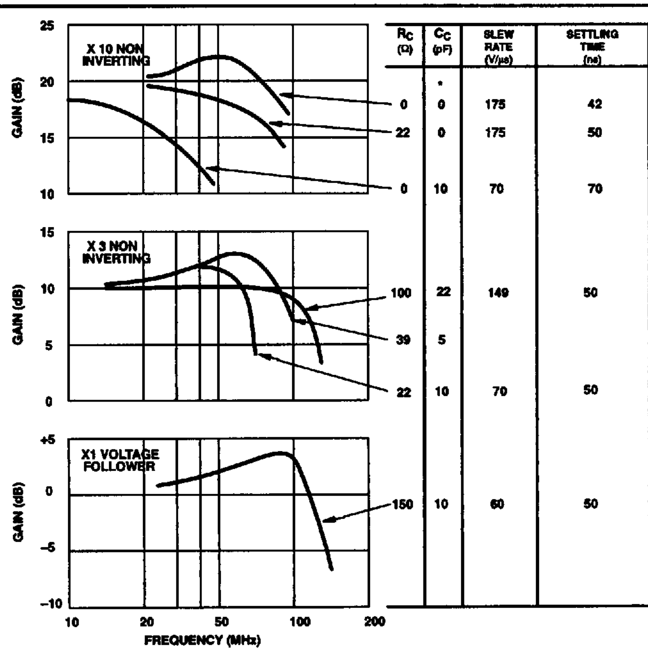

*Fig. 3 Performance graphs – gain v. frequency (load=2kΩ/10pF) *See operating note 2*

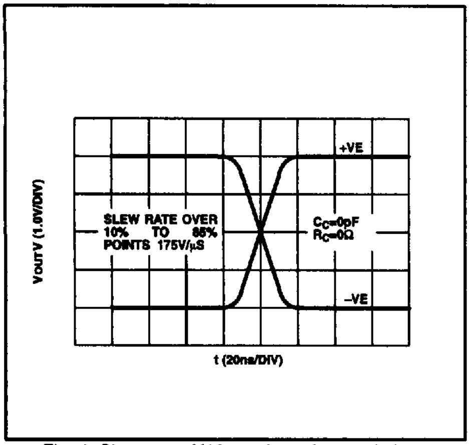

Fig. 4. Slew rate –X10 non inverting mode input square wave 0.4V p/p

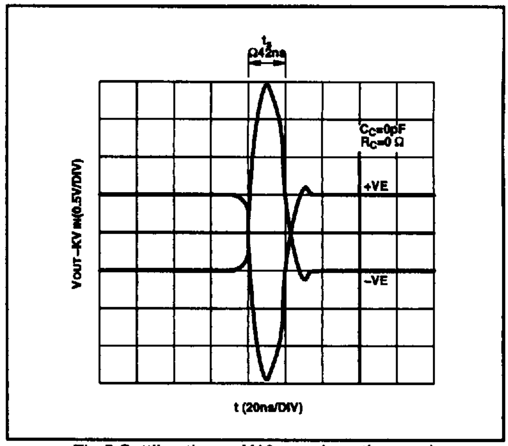

Fig.5 Settling time – X10 non–inverting mode

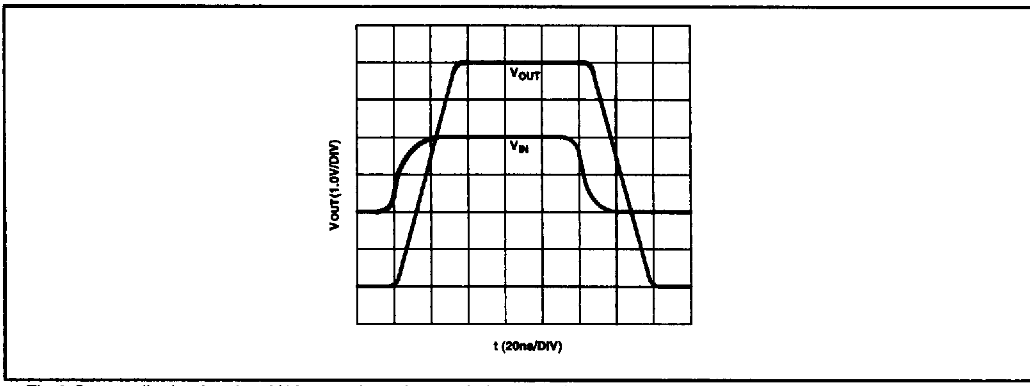

Fig.6 Output clipping levels – X10 non – inverting mode input moderately overdriven, so that output goes into clipping both sides.

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 inthe clipping levels results, but the separation remains. However, the supply line rejection is improved if pin 10 can be left open–circuit (circuit B only).

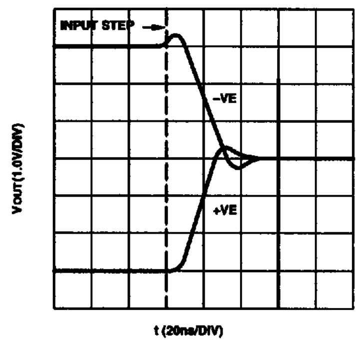

Fig. 7 Output clippings level – X10 non–inverting mode. Output goes from clipping to zero volts. V_{IN}=3V peak step, offset +ve or –ve.

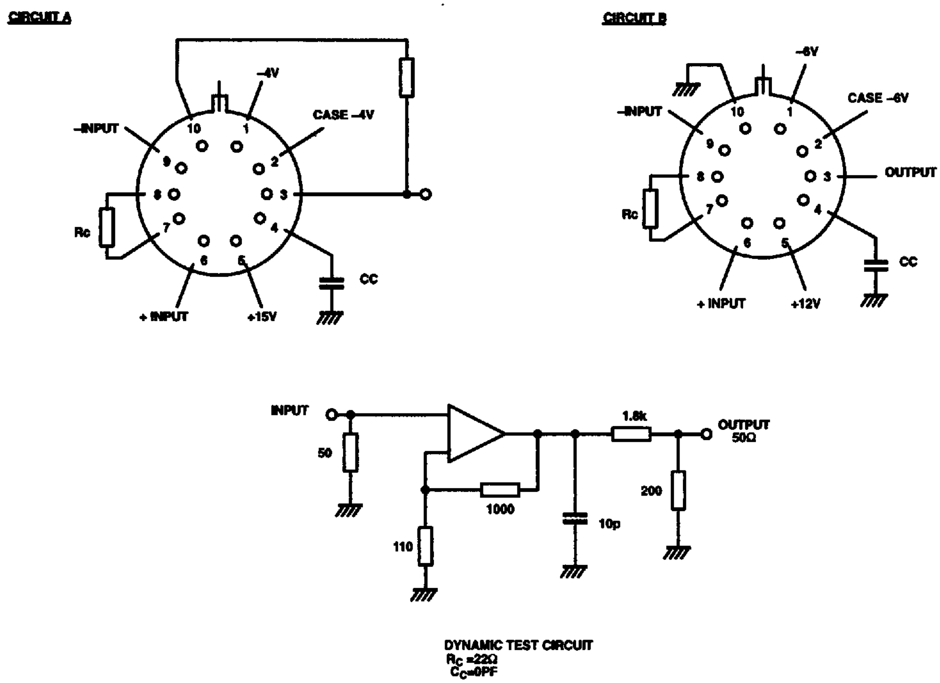

Fig. 8 Test circuit

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 dependant 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.

$$S = 2\pi f_p E_0$$

where E_0 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 the 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.

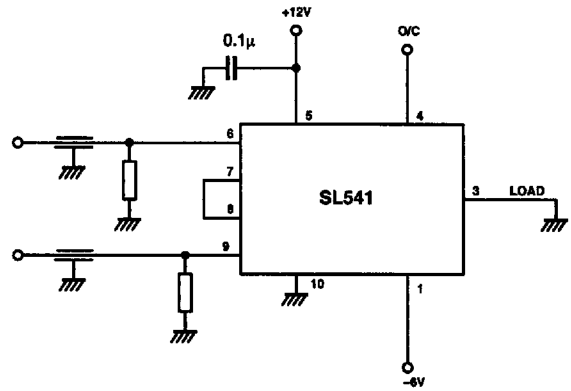

Fig. 9 Non saturating sense amplifier (30V/µs for 5mV).
Note: the output may be caught at a pre determined level. (T0–5 pin nos.)

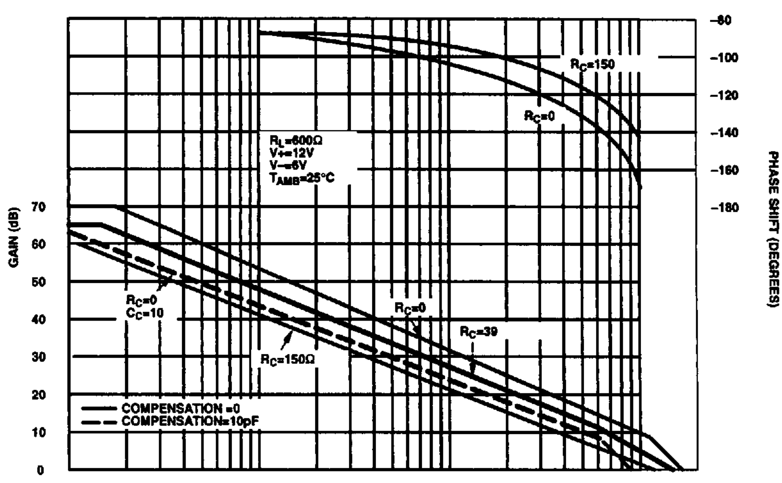

Fig. 10 SL541B open loop gain and phase shift v. frequency