NE/SE538-N,T • NE/SE5538-F,K,N,N-14,T

DESCRIPTION

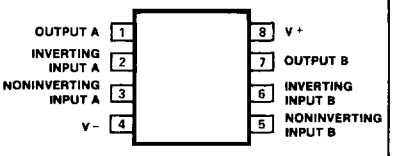
The 538/5538 are new generation operational amplifiers featuring high slew rates combined with improved input characteristics. Internally compensated for gains of 5 or larger, the SE538/SE5538 offer guaranteed minimum slew rates of 40V/μs or larger. Featuring 2mV max input offset voltage, the 538 is a single amplifier while the 5538 is a dual version. Industry standard pin out and internal compensation allow the user to upgrade system performance by directly replacing general purpose amplifiers, such as 748, 101A, 741, 747 and 1458.

FEATURES

- **2mV max input offset voltage**
- **60nA max input offset current**
- **Short circuit protected**
- **Offset null capability**
- **Large common mode and differential voltage ranges**
- **60V/μs slew rate (gain of +5, -4 min)**
- **6MHz gain bandwidth product (gain +5, -4 minimum)**
- **Internal frequency compensation (gain of +5, -4 minimum)**
- **Pin out: 538 same as 741 (single)**
  5538 same as 747, 1458 (dual)

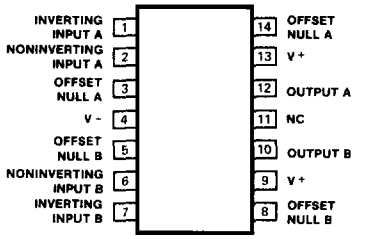
PIN CONFIGURATIONS

N PACKAGE



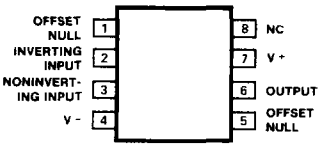
ORDER PART NO.
SE5538N, NE5538N

N-14, F PACKAGE



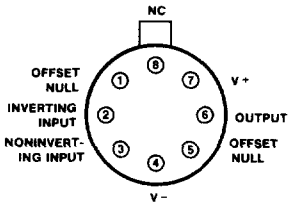
ORDER PART NO.
SE5538 N-14, F
NE5538 N-14, F

N PACKAGE



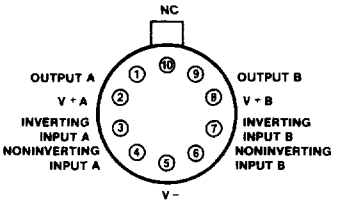
ORDER PART NO.
SE538N, NE538N

T PACKAGE



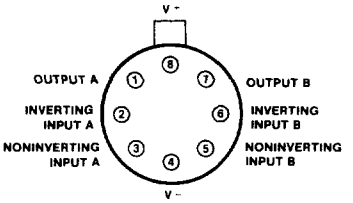
ORDER PART NO.
SE538T, NE538T

K PACKAGE



ORDER PART NO.
SE5538K, NE5538K

T PACKAGE



ORDER PART NO.
SE5538T, NE5538T

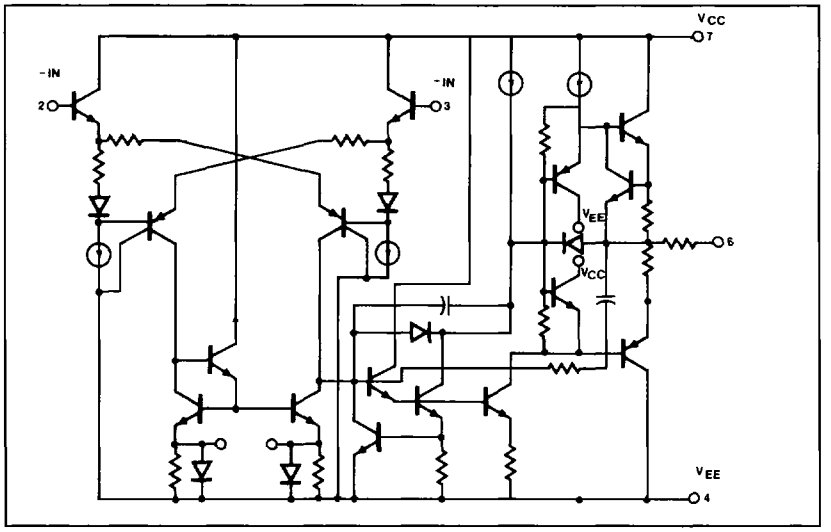
ABSOLUTE MAXIMUM RATINGS[1,2,3]

	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage		
	SE military grade	±22	V
	NE commercial grade	±18	V
P_D	Internal power dissipation F package	1000	mW
P_D	Internal power dissipation[1] N package	500	mW
P_D	Internal power dissipation[1] K, T package	800	mW
	Differential input voltage	±30	V
	Input voltage[2]	±15	V
	Operating temperature range		
	SE military grade	-55 to +125	°C
	NE commercial grade	0 to 70	°C
	Output short circuit[3]	indefinite	
	Storage temperature range	-65 to +150	°C
	Lead temperature (solder, 60sec.)	300	°C

NOTES

1. Rating applies for thermal resistances of 240° C/W and 150° C/W junction to ambient for N and K, T packages, respectively. Maximum chip temperature is 150° C
2. For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.
3. Short circuit may be to ground or either supply. Rating applies to 125° C case temperature or 75° C ambient temperature

EQUIVALENT SCHEMATIC (EACH AMPLIFIER)



DC ELECTRICAL CHARACTERISTICS

$T_A = 25°C$, $V_S = \pm 15V$ unless otherwise specified.

PARAMETER		TEST CONDITIONS	SE538/SE5538			NE538/NE5538			UNIT
			Min	Typ	Max	Min	Typ	Max	
V_{OS}	Input offset voltage	$R_S \leq 10k\Omega$		0.7	2.0		2.0	5.0	mV
V_{OS}	Input offset voltage	$R_S \leq 10k\Omega$, over temp.			3.0			6.0	mV
ΔV_{OS}	Input offset voltage drift	$R_S = 0\Omega$, over temp.		3.0	15		6.0		$\mu V/°C$
I_{OS}	Input offset current			5	10		15	40	nA
I_{OS}	Input offset current	Over temp.			20			80	nA
I_B	Input current			45	60		65	150	nA
I_B	Input current	Over temp.			100			200	nA
V_{CM}	Input common mode voltage range		±12	±13		±12	±13		V
C_{MRR}	Common mode rejection ratio	$R_S \leq 10k\Omega$, over temp.	70	90		70	90		dB
P_{SRR}	Power supply rejection	$R_S \leq 10k\Omega$, over temp.		30	150		30	150	$\mu V/V$
R_{IN}	Input resistance		3	10		1	6		MΩ
A_{VOL}	Large signal voltage gain	$R_L \geq 2k\Omega$, $V_{OUT} = \pm 10V$	50	200		50	200		V/mV
A_{VOL}	Large signal voltage gain	Over temp., $R_L \geq 2k\Omega$, $V_{OUT} = \pm 10V$	25			25			V/mV
V_{OUT}	Output voltage	Over temp., $R_L \geq 2k\Omega$	±10	±13		±10	±13		V
V_{OUT}	Output voltage	Over temp., $R_L \geq 10k\Omega$	±12	±14		±12	±14		V
I_{CC}	Supply current	Per amplifier		2	3		2	3	mA
I_{CC}	Supply current	Over temp., per amplifier		2.2	3.6		2.2		mA
P_D	Power dissipation	Per amplifier		60	90		60	90	mW
P_D	Power dissipation	Over temp., per amplifier		66	108		66		mW
I_{SC}	Output short circuit current			25			25		mA
R_{OUT}	Output resistance			100			100		Ω

NOTE

Temperature Range

SE Types $-55°C \leq T_A \leq 125°C$

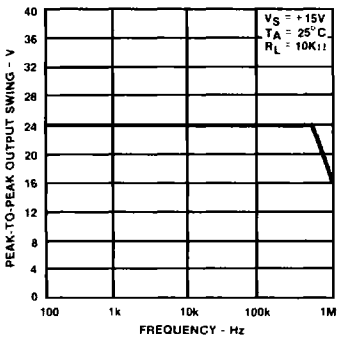
NE Types $0°C \leq T_A \leq 70°C$

AC ELECTRICAL CHARACTERISTICS $T_A = 25°C$ unless otherwise specified.

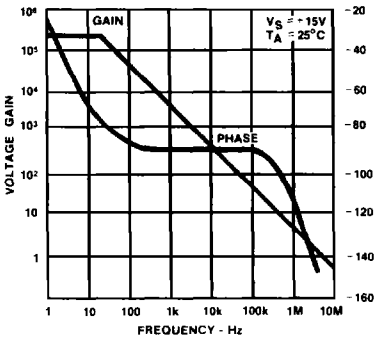
PARAMETER	TEST CONDITIONS	SE538/SE5538			NE538/NE5538			UNIT
		Min	Typ	Max	Min	Typ	Max	
Gain bandwidth product (Gain +5, -4 minimum)			6			6		MHz
Transient response Small signal rise time Small signal overshoot			0.25 6			0.25 6		μs %
Settling time	To 0.1%		1.2			1.2		μs
Slew rate	Minimum gain = 5 Noninverting $R_L \geq 2k\Omega$	40	60			60		V/μs

TYPICAL PERFORMANCE CHARACTERISTICS

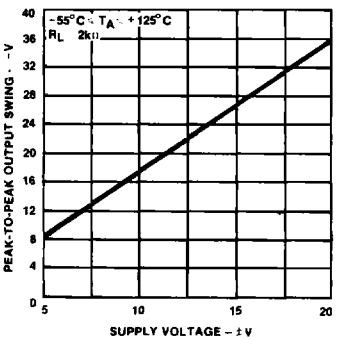
OUTPUT VOLTAGE SWING AS A FUNCTION OF FREQUENCY



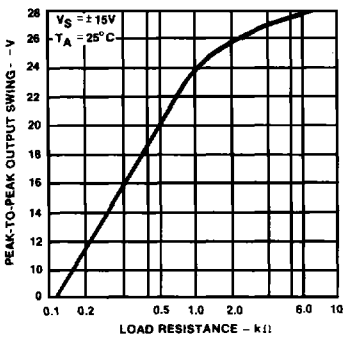
OPEN LOOP VOLTAGE GAIN AS A FUNCTION OF FREQUENCY



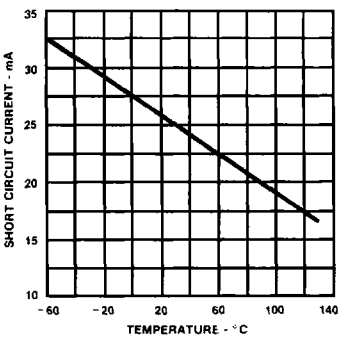
OUTPUT VOLTAGE SWING AS A FUNCTION OF SUPPLY VOLTAGE



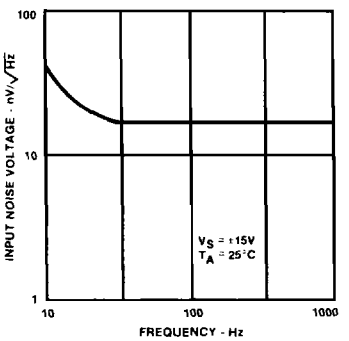
OUTPUT VOLTAGE SWING AS A FUNCTION OF LOAD RESISTANCE



OUTPUT SHORT-CIRCUIT CURRENT AS A FUNCTION OF AMBIENT TEMPERATURE

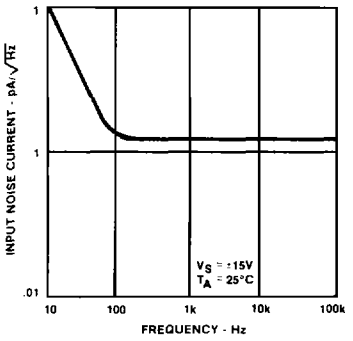


INPUT NOISE VOLTAGE AS A FUNCTION OF FREQUENCY

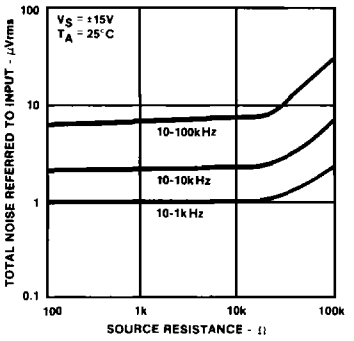


TYPICAL PERFORMANCE CHARACTERISTICS (Cont'd)

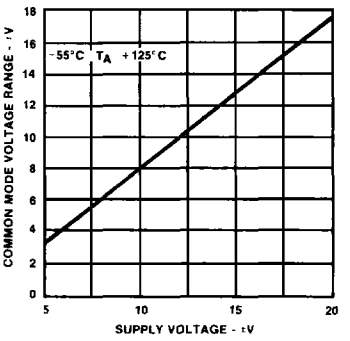
INPUT NOISE CURRENT AS A FUNCTION OF FREQUENCY



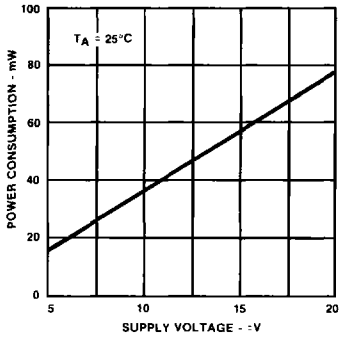
BROADBAND NOISE FOR VARIOUS BANDWIDTHS



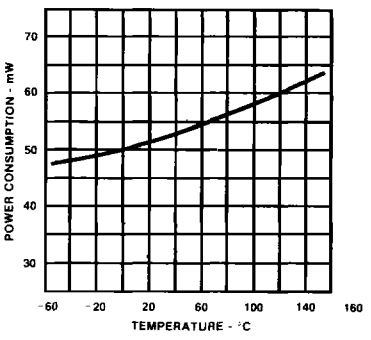
INPUT COMMON MODE VOLTAGE RANGE AS A FUNCTION OF SUPPLY VOLTAGE



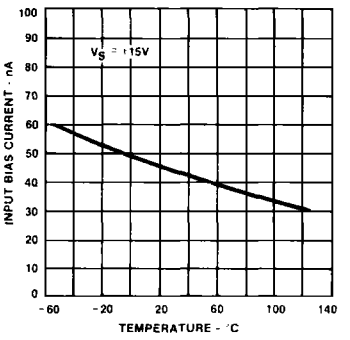
POWER CONSUMPTION AS A FUNCTION OF SUPPLY VOLTAGE



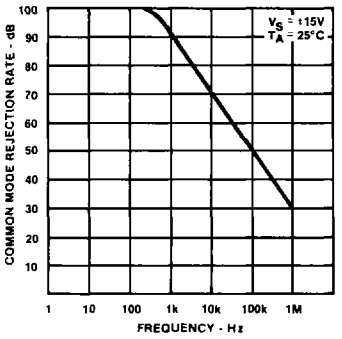
POWER CONSUMPTION AS A FUNCTION OF AMBIENT TEMPERATURE



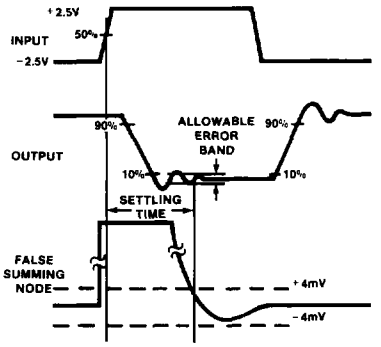
INPUT BIAS CURRENT AS A FUNCTION OF AMBIENT TEMPERATURE



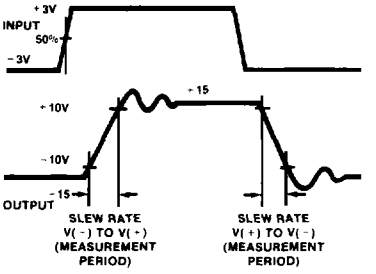
COMMON MODE REJECTION RATIO AS A FUNCTION OF FREQUENCY



SETTLING TIME MEASUREMENT WAVEFORMS

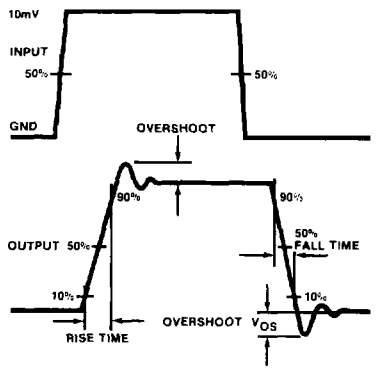


SLEW RATE MEASUREMENT VCC = ±20V



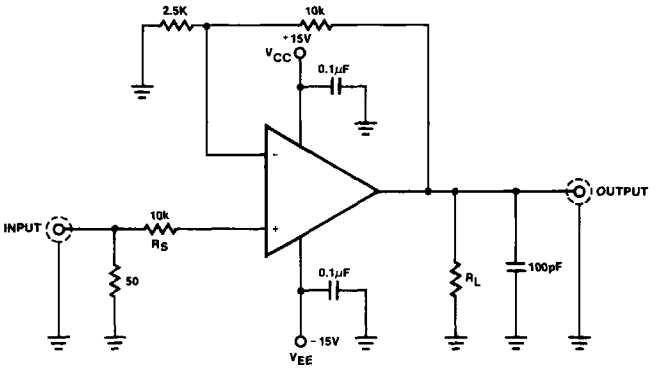
TYPICAL PERFORMANCE CHARACTERISTICS (Cont'd)

SMALL-SIGNAL TRANSIENT RESPONSE DEFINITIONS



TEST LOAD CIRCUITS

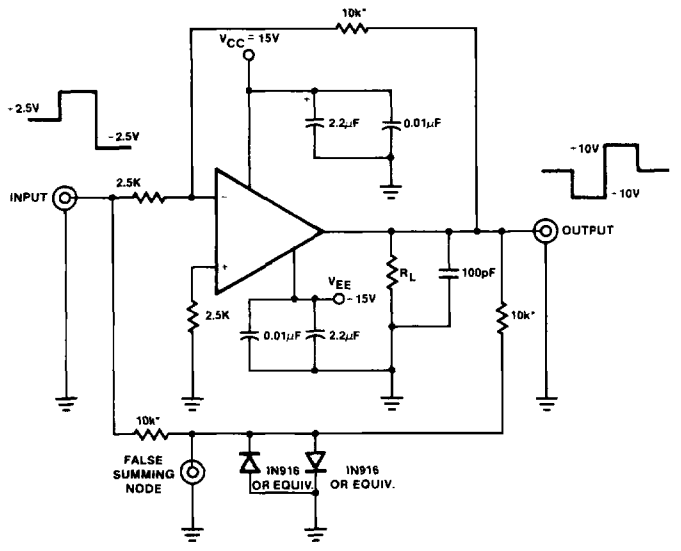
SLEW RATE AND SMALL SIGNAL TRANSIENT RESPONSE TEST CIRCUIT



NOTE
Pins not shown are not connected.
All resistors values are typical and in ohms.

TEST LOAD CIRCUITS (Cont'd)

SETTLING TIME TEST CIRCUIT



*Match to within 0.01%
NOTE
Pins not shown are not connected.
All resistors values are typical and in ohms.