FORCE TECHNOLOGIES LTD

FT1007/FT1037

Low Noise, High Speed Precision Operational Amplifiers

Features

- *Guaranteed* 4.5nV/√Hz 10Hz Noise
- *Guaranteed* 3.8nV/√Hz 1kHz Noise
- 0.1Hz to 10Hz Noise, 60nV$_{P-P}$ Typical
- *Guaranteed* 7 Million Min Voltage Gain, R_L = 2k
- *Guaranteed* 3 Million Min Voltage Gain, R_L = 600Ω
- *Guaranteed* 25μV Max Offset Voltage
- *Guaranteed* 0.6μV/°C Max Drift with Temperature
- *Guaranteed* 11V/μs Min Slew Rate (FT1037)
- *Guaranteed* 117dB Min CMRR

Applications

- Low Noise Signal Processing
- Microvolt Accuracy Threshold Detection
- Strain Gauge Amplifiers
- Direct Coupled Audio Gain Stages
- Sine Wave Generators
- Tape Head Preamplifiers
- Microphone Preamplifiers

Description

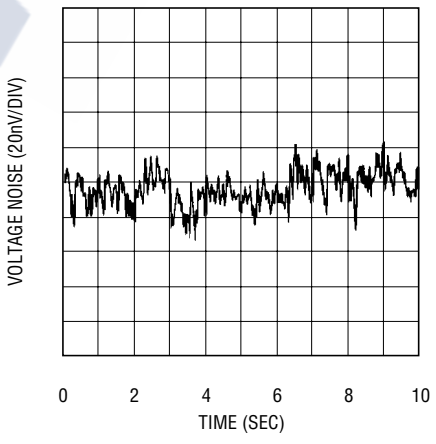
The FT1007/FT1037 series features the lowest noise performance available to date for monolithic operational amplifiers: 2.5nV/√Hz wideband noise (less than the noise of a 400Ω resistor), 1/f corner frequency of 2Hz and 60nV peak-to-peak 0.1Hz to 10Hz noise. Low noise is combined with outstanding precision and speed specifications: 10μV offset voltage, 0.2μV/°C drift, 130dB common mode and power supply rejection, and 60MHz gain bandwidth product on the decompensated FT1037, which is stable for closed-loop gains of 5 or greater.

The voltage gain of the FT1007/FT1037 is an extremely high 20 million driving a 2kΩ load and 12 million driving a 600Ω load to ±10V.

In the design, processing and testing of the device, particular attention has been paid to the optimisation of the entire distribution of several key parameters. Consequently, the specifications of even the lowest cost grades (the FT1007C and the FT1037C) have been spectacularly improved compared to equivalent grades of competing amplifiers.

The sine wave generator application shown below utilises the low noise and low distortion characteristics of the FT1037.

0.1Hz to 10Hz Noise



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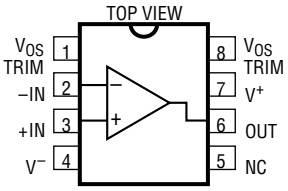
FT1007/FT1037

Low Noise, High Speed Precision Operational Amplifiers

Absolute Maximum Ratings (Note 1)

Supply Voltage ..... ±22V
Input Voltage ..... Equal to Supply Voltage
Output Short-Circuit Duration ..... Indefinite
Differential Input Current (Note 9) ..... ±25mA
Storage Temperature Range ..... −65°C to 150°C
Lead Temperature (Soldering, 10 sec.) ..... 300°C
Operating Temperature Range
FT1007/FT1037AC, C ..... 0°C to 70°C
FT1007/FT1037I ..... −40°C to 85°C
FT1007/FT1037AM, M ..... −55°C to 125°C



N8 PACKAGE
8-LEAD PDIP

T_{JMAX} = 100°C, θ_{JA} = 130°C/W (N8)

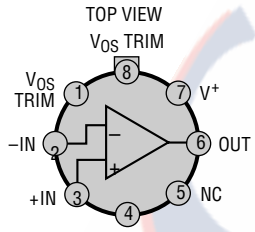
ORDER PART NUMBER

FT1007ACN8 FT1037ACN8
FT1007CN8 FT1037CN8
FT1007IN8 FT1037IN8

J8 PACKAGE
LEAD CERDIP

T_{JMAX} = 150°C, θ_{JA} = 100°C/W (J8)

FT1007ACJ8 FT1037ACJ8
FT1007AMJ8 FT1037AMJ8
FT1007CJ8 FT1037CJ8
FT1007MJ8 FT1037MJ8

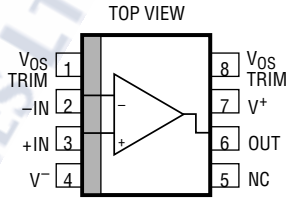


V− (CASE)
H PACKAGE
8-LEAD TO-5 METAL CAN

T_{JMAX} = 150°C, θ_{JA} = 150°C/W, θ_{JC} = 45°C/W

ORDER PART NUMBER

FT1007ACH FT1037ACH
FT1007AMH FT1037AMH
FT1007CH FT1037CH
FT1007MH FT1037MH



S8 PACKAGE
8-LEAD PLASTIC SO

T_{JMAX} = 150°C, θ_{JA} = 190°C/W

ORDER PART NUMBER

FT1007CS8 FT1037CS8
FT1007IS8 FT1037IS8

S8 PART MARKING

1007 1037
1007I 1037I

Electrical Characteristics

V_S = ±15V, T_A = 25°C, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	FT1007AC/AM FT1037AC/AM MIN	TYP	MAX	FT1007C/I/M FT1037C/I/M MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	(Note 2)		10	25		20	60	µV
$\frac{\Delta V_{OS}}{\Delta Time}$	Long Term Input Offset Voltage Stability	(Notes 3, 4)		0.2	1.0		0.2	1.0	µV/Mo
I_{OS}	Input Offset Current			7	30		12	50	nA
I_B	Input Bias Current			±10	±35		±15	±55	nA
e_n	Input Noise Voltage	0.1Hz to 10Hz (Notes 4, 6)		0.06	0.13		0.06	0.13	μV_{P-P}
	Input Noise Voltage Density	f_O = 10Hz (Notes 4, 5) f_O = 1000Hz (Note 4)		2.8 2.5	4.5 3.8		2.8 2.5	4.5 3.8	nV/√Hz nV/√Hz
i_n	Input Noise Current Density	f_O = 10Hz (Notes 4, 7) f_O = 1000Hz (Notes 4, 7)		1.5 0.4	4.0 0.6		1.5 0.4	4.0 0.6	pA/√Hz pA/√Hz

Electrical Characteristics $V_S = \pm15V$, $T_A = 25°C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	FT1007AC/AM FT1037AC/AM MIN	TYP	MAX	FT1007C/I/M FT1037C/I/M MIN	TYP	MAX	UNITS
	Input Resistance, Common Mode			7			5		GΩ
	Input Voltage Range		±11.0	±12.5		±11.0	±12.5		V
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm11V$	117	130		110	126		dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm4V$ to $\pm18V$	110	130		106	126		dB
A_{VOL}	Large-Signal Voltage Gain	$R_L \geq 2k$, $V_O = \pm12V$	7.0	20.0		5.0	20.0		V/μV
		$R_L \geq 1k$, $V_O = \pm10V$	5.0	16.0		3.5	16.0		V/μV
		$R_L \geq 600\Omega$, $V_O = \pm10V$	3.0	12.0		2.0	12.0		V/μV
V_{OUT}	Maximum Output Voltage Swing	$R_L \geq 2k$	±13.0	±13.8		±12.5	±13.5		V
		$R_L \geq 600\Omega$	±11.0	±12.5		±10.5	±12.5		V
SR	Slew Rate FT1007	$R_L \geq 2k$	1.7	2.5		1.7	2.5		V/μs
	FT1037	$A_{VCL} \geq 5$	11	15		11	15		V/μs
GBW	Gain Bandwidth Product FT1007	$f_O = 100kHz$ (Note 8)	5.0	8.0		5.0	8.0		MHz
	FT1037	$f_O = 10kHz$ (Note 8) ($A_{VCL} \geq 5$)	45	60		45	60		MHz
Z_O	Open-Loop Output Resistance	$V_O = 0V$, $I_O = 0$		70			70		Ω
P_D	Power Dissipation FT1007			80	120		80	140	mW
	FT1037			80	130		85	140	mW

The ● denotes the specifications which apply over the temperature range $0°C \leq T_A \leq 70°C$, $V_S = \pm15V$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		FT1007AC FT1037AC MIN	TYP	MAX	FT1007C FT1037C MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	(Note 2)	●		20	50		35	110	μV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Input Offset Drift	(Note 10)	●		0.2	0.6		0.3	1.0	μV/°C
I_{OS}	Input Offset Current		●		10	40		15	70	nA
I_B	Input Bias Current		●		±14	±45		±20	±75	nA
	Input Voltage Range		●	±10.5	±11.8		±10.5	±11.8		V
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm10.5V$	●	114	126		106	120		dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm4.5V$ to $\pm18V$	●	106	126		102	120		dB
A_{VOL}	Large-Signal Voltage Gain	$R_L \geq 2k$, $V_O = \pm10V$	●	4.0	18.0		2.5	18.0		V/μV
		$R_L \geq 1k$, $V_O = \pm10V$	●	2.5	14.0		2.0	14.0		V/μV
V_{OUT}	Maximum Output Voltage Swing	$R_L \geq 2k$	●	±12.5	±13.6		±12.0	±13.6		V
P_D	Power Dissipation		●		90	144		90	160	mW

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