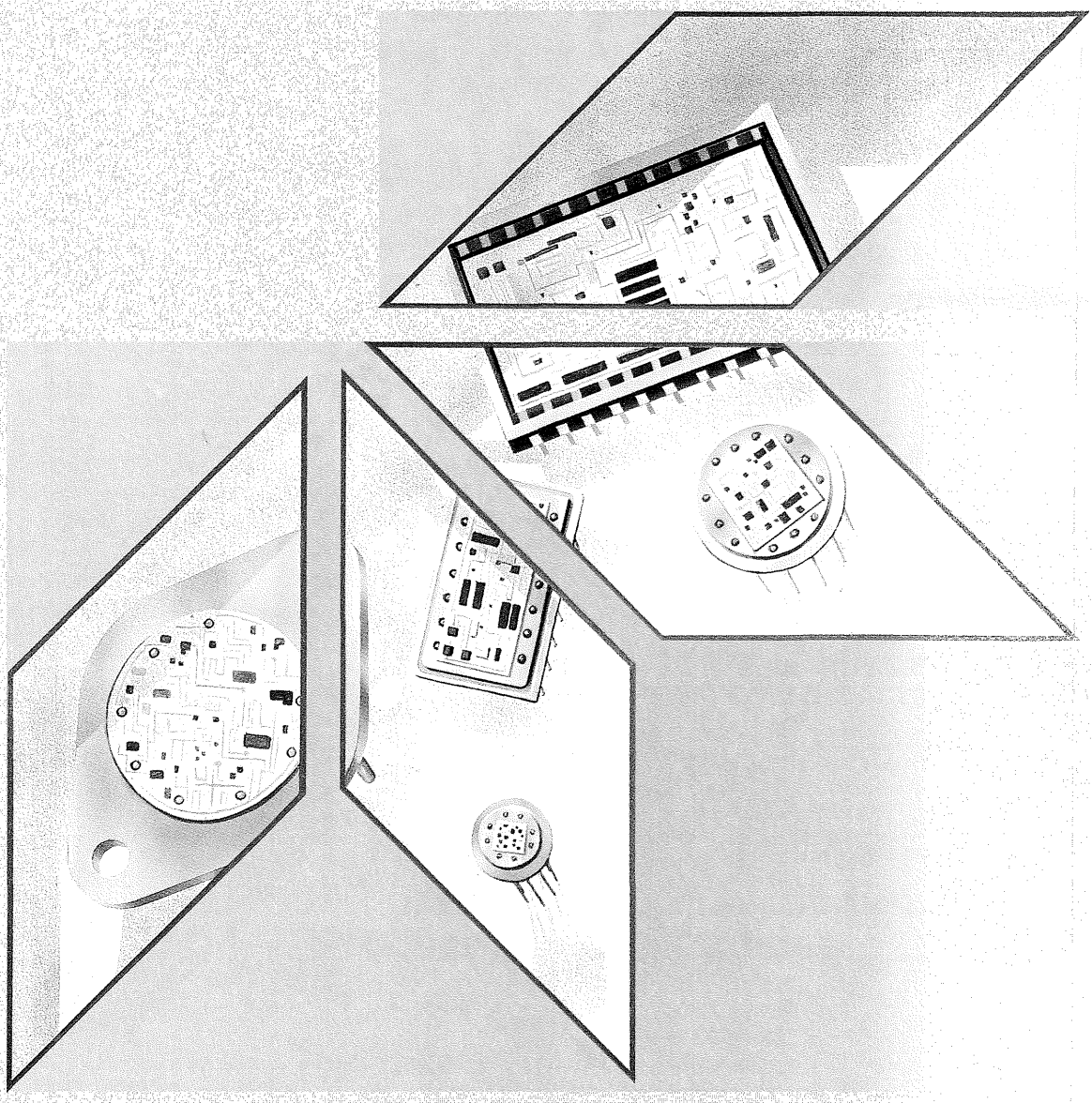
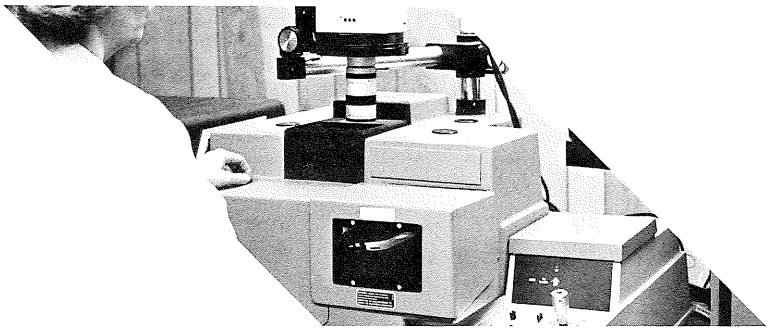


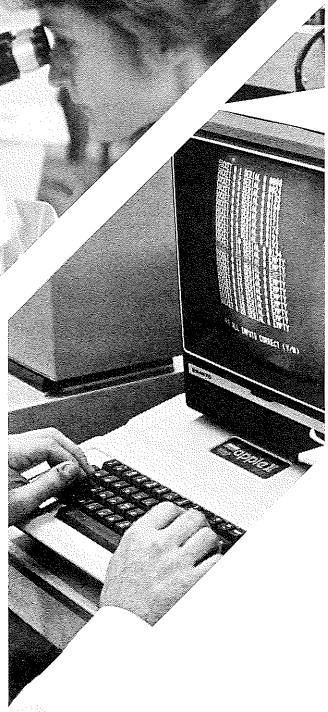
TELEDYNE PHILBRICK – MICROCIRCUITS

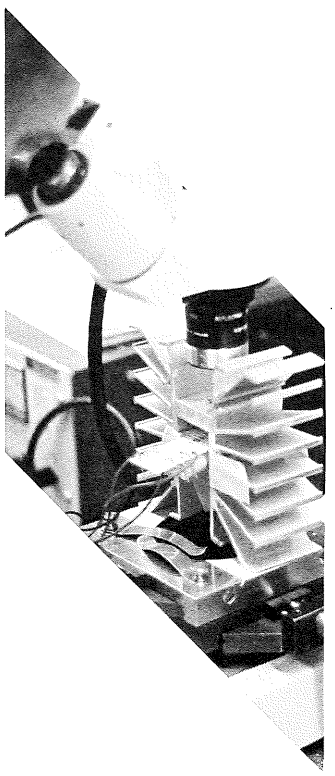
A Tradition of. . . .

- **Performance**
- **Dependability**
- **Quality**

Since 1946







The Standard Products:

- Wideband Op Amps
- Power Op Amps
- Digital-to-Analog Converters
- Analog-to-Digital Converters
- Sample-Hold Amplifiers
- Voltage-to-Frequency Converters
- Frequency-to-Voltage Converters
- Nonlinear Function Modules

Quality Assurance:

- MIL STD 9858
- MIL STD 38510
- MIL STD 883
- For Space Applications

The Custom Capabilities:

- Thick and thin-film laser trimming
- Beryllia or alumina substrates
- Multi-layer substrates
- Gold thermosonic or aluminum ultrasonic wirebonding
- All Popular package configurations
- Eutectic and epoxy chip mounting
- High Temperature (+275°C) Hybrids

TELEDYNE PHILBRICK – MICROCIRCUITS

Allied Drive @ Rte. 128, Dedham, Massachusetts 02026
Tel: (617) 329-1600, TWX: (710) 348-6726, Tlx: 92-4439

Index

Special Products

Product Selection Guides

TELEDYNE PHILBRICK – MICROCIRCUITS
Allied Drive @ Rte. 128, Dedham, Massachusetts 02026
Tel: (617) 329-1600, TWX: (710) 348-6726, Tlx: 92-4439

OPERATIONAL AMPLIFIERS

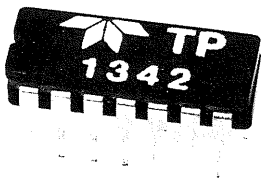
1321/1322 Wideband, High Slew Rate Operational Amplifiers

The 1321/1322 are low cost operational amplifiers designed specifically for high frequency, high speed and precision performance. Ability to drive a ±10V high frequency signal into a 500Ω to 1KΩ load, 100MHz unity gain bandwidth and 120V/μsec slew rate are ideal features for such high performance applications as fast integrators and high gain precision differential input video amplifiers.

SPECIFICATIONS (Typical, T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**1321**	**1322**	**Units**
OUTPUT RANGE: Voltage (R_L = 1KΩ)	±10		Volts
Current	±10		mA
OPEN LOOP VOLTAGE GAIN: (R_L = 2KΩ)	100	84	dB
FREQUENCY RESPONSE			
Full Power Bandwidth	600	1600	kHz
Gain-Bandwidth Product	100	20	MHz
TIME RESPONSE			
Slew Rate	35	120	V/μsec
Settling Time: 10V Step to ±0.01%	1	3	μsec
10V Step to ±0.1%	400	200	nsec
INPUT OFFSET VOLTAGE: Initial	±3	±5	mV
Drift	±30	±30	μV/°C
INPUT BIAS CURRENT: Initial	±5	±100	nA
Drift	±0.5	±0.1	nA/°C
SPECIFIED TEMPERATURE RANGE: 1321,1322	0°C to +75°C		
1321-01*, 1322-01*	−55°C to +125°C		

*Contact factory for availability of MIL-STD-883 screening.

1341/1342 High Performance, Wideband, Monolithic Operational Amplifier



These wideband, differential, monolithic operational amplifiers provide the highest performance available in any monolithic device of its kind. The 1341 features 400V/μsec slew rate, 400MHz gain-bandwidth product and 250nsec settling time for a 10V step to ±0.1%FSR. The 1342 offers 600V/μsec slew rate, 600MHz gain-bandwidth product and 350nsec settling time for a 10V step to ±0.1%FSR. Designed with bipolar dielectric isolation, these devices are suitable for high speed data acquisition systems, radar and sonar signal processing, video amplifiers and high frequency signal amplification.

SPECIFICATIONS (Typical, T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**1341**	**1342**	**Units**
OUTPUT RANGE: Voltage (R_L = 1KΩ)	±10	±10	Volts
Current	±10	±10	mA
OPEN LOOP VOLTAGE GAIN: (R_L = 1KΩ)	90	90	dB
FREQUENCY RESPONSE			
Gain-Bandwidth Product	400	600	MHz
Full Power Bandwidth	6	9.5	MHz
TIME RESPONSE			
Slew Rate	400	600	V/μsec
Settling Time: 10V Step to ±0.1% FSR	250	350	nsec
INPUT OFFSET VOLTAGE: Initial	3	3	mV
Drift	20	20	μV/°C
INPUT BIAS CURRENT: Initial	5	5	μA
Drift Over Specified Temperature Range	15	15	μA
SPECIFIED TEMPERATURE RANGE: 1341, 1342	0°C to +75+C		
1341-01, 1342-01*	−55°C to +125°C		

*Contact factory for availability of MIL-STD-883 screening.

OPERATIONAL AMPLIFIERS

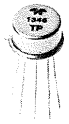
1344/1345 High Performance, High Speed Monolithic Operational Amplifiers

The 1344 and 1345 are high performance, wideband, uncompensated monolithic operational amplifiers. Combining JFET, bipolar and dielectric technologies, these devices offer the user excellent bandwidth and settling characteristics. Featuring 120V/μsec slew rate and 280nsec settling times for a 10V step to ±0.2%, the 1344 is recommended for applications requiring the utmost in speed and high performance. Designed as a pin-to-pin replacement for the LH0062, the 1345 meets or exceeds all specifications.

SPECIFICATIONS (Typical, T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**1344**	**1345**	**Units**
OUTPUT RANGE: Voltage	±11	±11	Volts
Current	±20	±20	mA
OPEN LOOP VOLTAGE GAIN: (R_L = 2K)	105	100	dB
FREQUENCY RESPONSE			
Gain-Bandwidth Product (A_v = 10)	100	100	MHz
Full Power Bandwidth (R_L = 2K)	1	1	MHz
TIME RESPONSE			
Slew Rate (A_v = 10)	120	70	V/μsec
Settling Time: 10V Step to 0.2%	280	400	nsec
INPUT OFFSET VOLTAGE: Initial	±1	±3	mV
Drift	±10	±20	μV/°C
INPUT BIAS CURRENT: Initial	±20	±5	pA
0°C to +75°C	±20	±5	nA
SPECIFIED TEMPERATURE RANGE: 1344, 1345	0°C to +75°C		
1344-01*	−55°C to +125°C		

*Contact factory for availability of MIL-STD-883 screening.

1346/1347 Precision, Monolithic Operational Amplifiers



The 1346 and 1347 are precision monolithic amplifiers featuring performance that is unmatched by any other monolithic device of its type. 2MHz bandwidth, ±0.5mV max. offset voltage, ±250fA bias current and ±0.01pA$\sqrt{Hz}$ input noise are superior characteristics for such applications as precision track/hold amplifiers, electrometers, precision integrators and low level signal amplification.

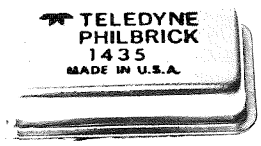
SPECIFICATIONS (Typical, T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**1346**	**1347**	**Units**
OUTPUT RANGE: Voltage	±12	±12	Volts
Current	±15	±15	mA
OPEN LOOP VOLTAGE GAIN: (R_L = 2KΩ)	120	120	dB
FREQUENCY RESPONSE			
Full Power Bandwidth	110	110	kHz
Unity Gain Bandwidth	2	2	MHz
TIME RESPONSE			
Slew Rate	7	7	V/μsec
Settling Time: (10V Step to ±0.1%)	2	2	μsec
INPUT OFFSET VOLTAGE: Initial	±0.1	±1	mV
Drift	±5	±5	μV/°C
INPUT BIAS CURRENT: Initial	±250	±250	fA
SPECIFIED TEMPERATURE RANGE: 1346, 1347	0°C to +75°C		
1346-01*, 1347-01*	−55°C to +125°C		

*Contact factory for availability of MIL-STD-883 screening.

OPERATIONAL AMPLIFIERS

1435 Fast Settling, 1GHz Operational Amplifier

The 1435 is the fastest settling precision op amp available. With a 1GHz gain-bandwidth product, it settles a full 10V step to ±0.01% (±1mV) in 70nsec. A 1V step settles to 1% in 10nsec. The 1435 was designed for the precision amplification (gain accuracies to 0.01%) of wide-band, complex waveforms with frequency components from DC to 100MHz. Such performance is made possible by a unique design with high open-loop gain, flat frequency response beyond 10kHz, and smooth 6dB/octave rolloff to greater than 100MHz. Applications include pulse amplifiers for radar and sonar applications, I/V converters for current output DAC's, and buffer/follower amps for high speed data acquisition systems.



SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
OUTPUT RANGE: Voltage (R_L = 500Ω) Current	±5 ±10	±7 ±14		Volts mA
OPEN LOOP VOLTAGE GAIN (R_L = 500Ω)	90	100		dB
FREQUENCY RESPONSE Gain-Bandwidth Product (C_c = 2pF, f = 10MHz) Unity Gain Bandwidth (C_c = 2pF)	700	1000 150		MHz MHz
TIME RESPONSE Slew Rate (C_c = 0.5pF) Settling Time: 10V Step to ±0.01% 10V Step to ±0.025%	250	300 70 60	 75	V/µsec nsec nsec
INPUT OFFSET VOLTAGE: Initial Drift		±2 ±5	±5 ±25	mV µV/°C
INPUT BIAS CURRENT: Initial Drift		±10 ±50	±20 ±100	µA nA/°C
SPECIFIED TEMPERATURE RANGE: 1435 1435-83*	0°C to +70°C −55°C to +85°C			

*Includes high reliability screening to MIL-STD-883. Temperature range −55°C to +125°C with 18°C/Watt heat sink.

1443 FET Input, Fully Differential Operational Amplifier

The combination of high speed, wide bandwidth, excellent DC characteristics, and low-gain stability places the 1443 at the forefront of high performance operational amplifiers. Its 2GHz gain-bandwidth product, 1000V/µsec slew rate (when compensated for unity gain), and 130nsec settling time clearly make it an outstanding high speed device. Yet it has been carefully engineered to eliminate the low-gain stability problems that have historically plagued high frequency op amps. External compensation with a single capacitor allows users to tailor 1443 performance for different applications.

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
OUTPUT RANGE: Voltage (R_L = 100Ω) Current	±10.25 ±100	±13 ±130		Volts mA
OPEN LOOP VOLTAGE GAIN (R_L = 100Ω)	100	110		dB
FREQUENCY RESPONSE Gain-Bandwidth Product (C_c = open, f = 100kHz) Unity Gain Bandwidth (C_c = short) R_L = 1kΩ		2 80		GHz MHz
TIME RESPONSE Slew Rate (C_c = short) R_L = 100Ω Settling Time: 10V Step to ±0.01% 10V Step to ± 0.1%	1000	1200 130 80	 150 	V/µsec nsec nsec
INPUT OFFSET VOLTAGE: Initial Drift		±0.5 ±25	±2 ±50	mV µV/°C
INPUT BIAS CURRENT: Initial Drift		−10 doubles every 10°C	−20	pA
SPECIFIED TEMPERATURE RANGE: 1443 1443-83*	0°C to +70°C −55°C to +125°C			

*Includes high reliability screening to MIL-STD-883.

OPERATIONAL AMPLIFIERS

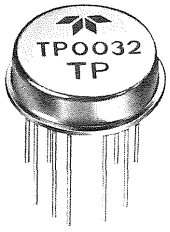
1437 Wideband, Fast Settling Operational Amplifier

The 1437 was designed to offer versatility in wideband, steady state and fast transient applications. The absence of large glitches and oscillations in the settling waveform makes the 1437 a dependable system element that helps solve settling problems associated with A/D's, D/A's and sampling circuits. The choice of a single external compensation capacitor allows for maintenance of a 40 MHz working bandwidth over a variety of gains. A true differential input ensures equally superior performance in all system configurations whether they are inverting, noninverting or differential. With its attractive price/performance ratio, the 1437 should prove to be a new industry workhorse in the fields of data acquisition and high speed, high accuracy signal processing.

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
OUTPUT RANGE: Voltage (Rated Load) Current	±10 ±20	±12 ±24		Volts mA
OPEN LOOP VOLTAGE GAIN (Rated Load)	88	95		dB
FREQUENCY RESPONSE Gain-Bandwidth Product (C_c = 0, f = 10MHz) Unity Gain Bandwidth		 350 40		 MHz MHz
TIME RESPONSE Slew Rate (C_c = 0) Settling Time: 10V Step to ±0.1% 10V Step to ±0.025%		 400 110 150	 140	 V/μsec nsec nsec
INPUT OFFSET VOLTAGE: Initial Drift		±0.5 ±15	±2 ±50	mV μV/°C
INPUT BIAS CURRENT: Initial Drift	±200 doubles every 10°C			pA
SPECIFIED TEMEPRATURE RANGE: 1437 1437-83*	0°C to +70°C −55°C to +125°C			

*Includes high reliability screening to MIL-STD-883.

TP0032 Fast, FET Input, Industry Standard Operational Amplifier



The TP0032 is a high slew rate, FET input, fully differential operational amplifier designed to replace all 0032 types in applications requiring the highest level of performance and reliability. Open loop gain has been increased, improving linearity and eliminating thermal tails as well as improved second stage biasing, yielding faster and more consistent settling times. Recent approval for use on military programs by the Defense Electronics Supply Center (D.E.S.C.) assures the user of controlled testing and screening in accordance with D.E.S.C. specification control drawing 80013. Qualification and quality conformance testing is performed by Teledyne Philbrick. Generic data is available upon request.

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
OUTPUT RANGE: Voltage (R_L = 1kΩ) Current	±10 ±10	±13.5 ±20		Volts mA
OPEN LOOP VOLTAGE GAIN (R_L = 1kΩ): T_A = +25°C T_C = −55°C to +125°C	60 57	85 83		dB dB
UNITY GAIN BANDWIDTH		80		MHz
TIME RESPONSE Slew Rate Settling Time: 20V Step to ±0.1% 20V Step to ±1%	 350	 600 100 75	 	 V/μsec nsec nsec
INPUT OFFSET VOLTAGE: T_A = +25°C T_C = −55°C to +125°C		±2 ±4	±5 ±10	mV mV
INPUT BIAS CURRENT: T_A = +25°C T_C = −55°C to +125°C		±10 ±5	±100 ±50	pA nA
SPECIFIED TEMPERATURE RANGE (case): TP0032 TP0032-80, -83*	−25°C to +85°C −55°C to +125°C			

*Includes high reliability screening to MIL-STD-883.

OPERATIONAL AMPLIFIERS

1461 High Speed, High Power, VMOS Output Op Amp

The 1461 is an extremely fast, FET input, VMOS output power op amp. It operates from ±15V to ±40V supplies and has output voltages to ±30V and output currents to ±600mA. Its unique VMOS output stage eliminates the safe operating area (SOA) restrictions and secondary breakdown problems that plague virtually all other presently available power op amps. Ability to handle high output currents at any voltage eliminates the normally intricate problems caused by driving reactive loads.

SPECIFICATIONS (T_A = +25°C, ± V_{cc} = ±36V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
OUTPUT RANGE: Voltage: R_L = 50Ω	±27	±29		Volts
R_L > 10kΩ	±30	±34		Volts
Current: ± 15V ≤ V_{cc} ≤ ± 40V	±600	±750		mA
OPEN LOOP VOLTAGE GAIN (R_L = 10KΩ)	100	115		dB
FREQUENCY RESPONSE				
Gain-Bandwidth Product (C_c = 0pF, f = 100kHz)	800	1000		MHz
Unity Gain Bandwidth (C_c = 30pF)		15		MHz
TIME RESPONSE				
Slew Rate: C_c = 0pF, R_L > 1kΩ	900	1200		V/µsec
C_c = 30pF, R_L > 1kΩ		150		V/µsec
Settling Time: 25V Step to ± 0.1%		0.5	1	µsec
25V Step to ± 1%		350		nsec
SPECIFIED TEMPERATURE RANGE (case): 1461		0°C to +70°C		
1461-83*		−55°C to +125°C		

*Includes high reliability screening to MIL-STD-883.

1463 High Speed, High Power VMOS Output Operational Amplifier

PRELIMINARY

The 1463 is third in a series of high speed, FET input, VMOS power operational amplifiers from Teledyne Philbrick. Free from SOA restrictions and secondary breakdown problems, the 1463 provides 1A output current and high frequency response. Optimized for low gains and the ability to drive capacitive loads the 1463 is ideal for CRT displays, video yoke drivers and video distribution amplifiers.

SPECIFICATIONS (T_A = +25°C, ± V_{cc} = ±36V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
OUTPUT RANGE: Voltage (R_L = 30 Ω)		±29		V
Current	±1			A
OPEN LOOP VOLTAGE GAIN (R_L = 50 Ω)		100		dB
FREQUENCY RESPONSE				
Gain Bandwidth Product (f = 100kHz)		6		MHz
Unity Gain Bandwidth		6		MHz
TIME RESPONSE				
Slew Rate		80		V/µsec
Settling Time (25V step to ±0.1%)		250		nsec
SPECIFIED TEMPERATURE: (case) 1463		0°C to +70°C		
1463-83*		−55°C to +125°C		

*Includes high reliability screening to MIL-STD-883.

1464 High Speed, VMOS Operational Amplifier/Driver

PRELIMINARY

The 1464 is a new generation of high power devices. 1A to 10A output current is available through user selectable external Class AB complementary VMOS output stages. This new design technique features lower θ_{JC} ratings resulting in more effective heatsinking. This device is ideally suited for raster displays, video yoke drivers and video distribution amplifiers.

SPECIFICATIONS (T_A = +25°C, ± V_{cc} = ±36V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
OUTPUT RANGE:		±29(1)		V
OPEN LOOP VOLTAGE GAIN		100		dB
FREQUENCY RESPONSE		(2)		
SPECIFIED TEMPERATURE RANGE: 1464		0°C to 70°C		
1464-83*		−55°C to +125°C		

1. 1A to 10A or more depending on output devices used.
2. Dependent on output stage selected.

*Includes high reliability screening to MIL-STD-883.

OPERATIONAL AMPLIFIERS

1490 Fast Settling, FET Input Flash Buffer

The 1490 buffer is a high speed, fast settling, FET input follower which has been optimized for driving such "FLASH" Type A/D converters as the TRW TDC 1007, TDC 1019 and TDC 1025. Offering higher performance than previously available, the 1490 features reduced overshoot, elimination of thermal tails and faster settling times when driving capacitative loads up to 500pF. Housed in a TO-3 package, the 1490 is specified over the 0°C to +70°C temperature range. For military/aerospace applications, the 1490-83 is fully specified for −55°C to +85°C operation and is screened to the requirements of MIL-STD-883.

SPECIFICATIONS	Minimum	Typical	Maximum	Units
OUTPUT RANGE: Voltage (Rated Load) Current	±3 ±100	±5	$\pm V_{cc}$	Volts mA
VOLTAGE GAIN: (Rated Load)	0.98	0.99	1.00	V/V
FREQUENCY RESPONSE Bandwidth: $C_L = 50_pF$ $C_L = 300_pF$	 20	100 25		MHz MHz
TIME RESPONSE ($C_L = 300_pF$) Rise Time Delay Time		18 7	25 10	 nsec nsec
INPUT OFFSET VOLTAGE: Initial Drift		±3 ±150	±10 ±500	mV µV/°C
INPUT BIAS CURRENT: @ −55°C, +25°C @ +85°C			±100 ±100	pA nA
THERMAL RESISTANCE: θ_{JC} θ_{JA}		12 40		°C/W °C/W
SPECIFIED TEMPERATURE RANGE: 1490 1490-83*	0°C to +70°C −55°C to +85°C			

The 1490 requires heat sinking for proper operation.
*Includes high reliability screening to MIL-STD-883.

TP0033 High Speed Buffer Amplifier

The TP0033 is a high speed, high input impedance, unity gain buffer amplifier. Designed as a replacement for all 0033 types, it features 100MHz full power bandwidth, 1500V/µsec slew rate, $10^{11}\Omega$ input impedance and ultra fast settling times. High speed applications include input buffering for "FLASH" type ADC's, CRT deflection yoke drivers as well as high performance military and industrial applications. Recent approval by the Defense Electronics Supply Center (D.E.S.C.) guarantees controlled testing and screening with D.E.S.C. specification control drawing No. 80014. Qualification and quality conformance testing is performed by Teledyne Philbrick. Generic data is available upon request.

SPECIFICATIONS ($T_A = +25°C$, $\pm V_{cc} = \pm 15V$ unless otherwise indicated)	Minimum	Typical	Maximum	Units
OUTPUT RANGE: Output Voltage ($R_L = 1k\Omega$) ($R_L = 100\Omega$)	±12 ±9	±13		Volts Volts
OPEN LOOP VOLTAGE GAIN ($R_L = 1k\Omega$)	0.96	0.98	1.0	V/V
FREQUENCY RESPONSE Bandwidth (V_{in} = 1Vrms) Phase nonlinearity (BW = 1 to 20MHz)		100 2		MHz Degrees
TIME RESPONSE Slew Rate ($V_{in} = \pm 10V$) Rise Time ($\Delta V_{in} = 0.5V$) Propagation Delay ($\Delta V_{in} = 0.5V$)	1000	1500 2.9 1.2		V/µs ns ns
INPUT OFFSET VOLTAGE: Initial −55°C to +125°C		±5	±10 ±15	mV mV
INPUT BIAS CURRENT: Initial −55°C to +125°C		±0.5	±2.5 ±10	nA nA
SPECIFIED TEMPERATURE RANGE: TP0033 TP0033-80,-83*	−25°C to +85°C −55°C to +125°C			

*Includes high reliability screening to MIL-STD-883.

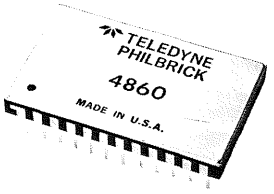
TRACK/HOLD AMPLIFIERS

4855 High Speed Track/Hold Amplifier

The 4855 Track/Hold Amplifier is designed for ultra-high speed data acquisition systems that require the ultimate in precision and reliability. 300nsec to ±0.01% max acquisition time and a guaranteed feedthrough error of less than 1mVpp for a 20Vpp 1MHz input signal, allow system input channels to be overlapped resulting in faster throughputs. Combining the 4855 with the TP4133-22, 12-bit A/D converter, provides system throughputs higher than 375kHz.

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
INPUT				
Voltage Range	±10	±11		Volts
Impedance		10^{11}//2		Ω//pF
TRANSFER CHARACTERISTICS				
Gain		−1.000		V/V
Gain Accuracy		±0.01	±0.02	%
Non Linearity Error		±0.003	±0.005	%FS
Offset Voltage (Sample Mode)		±2	±5	mV
Pedestal Voltage		±3	±7	mV
DYNAMIC CHARACTERISTICS				
Acquisition Time (10V step to ±0.01%)		250	300	nsec
Track/Hold Setting Time (to ±0.01%)		80	100	nsec
Aperture Delay Time		2	5	nsec
Aperture Jitter		±200		psec
Droop Rate		±5	±25	µV/µsec
POWER CONSUMPTION		2250	2700	mW
SPECIFIED TEMPERATURE RANGE:		0°C to +70°C		

4860 Fastest 12-Bit Track/Hold Amplifier



The 4860 is the fastest high resolution track/hold amplifier available. It is the only high speed track/hold that guarantees acquisition time and track-to-hold settling time (a T/H's two throughput limiting specifications) to ±0.01%. The 4860 will acquire a full 10V signal to ±0.01%FS (equivalent to ±0.005%FSR or ±1mV) in 200nsec maximum. A 24 pin dual-in-line package, a gain of −1, an input/output range of ±10V, and TTL compatibility make the 4860 pin compatible with the Analog Devices/Computer Labs HTC-0300. Being a second generation design however, it is superior to that unit in almost every performance specification. Applications include transient recorders, high speed data acquisition and distribution systems.

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
INPUT: Voltage Range	±10.25	±11.5		Volts
Impedance		1		kΩ
TRANSFER CHARACTERISTICS				
Gain		−1		V/V
Gain Accuracy		±0.05	±0.1	%
Gain Linearity Error		±0.005	±0.01	%FS
Offset Voltage (Track Mode)		±0.5	±5	mV
Pedestal		±2.5	±20	mV
DYNAMIC CHARACTERISTICS				
Acquisition Time (10V Step to ±0.01%)		160	200	nsec
Track/Hold Settling Time (to ±0.01%)		60	100	nsec
Aperture Delay Time		6		nsec
Aperture Jitter		±50		psec
Droop Rate		±0.5	±5	µV/µsec
POWER CONSUMPTION		730	875	mW
SPECIFIED TEMPERATURE RANGE: 4860		0°C to +70°C		
4860-83*		−55°C to +125°C		

*Includes high reliability screening to MIL-STD-883.

TRACK/HOLD AMPLIFIERS

4865 Flash Track/Hold Amplifier

PRELIMINARY

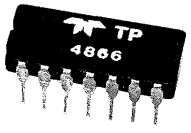
The 4865 Track/Hold amplifier was designed for Flash A/D Converters and other applications requiring up to 20MHz sampling rates and 9-bit accuracy. Large capacitive loads do not degrade acquisition time or cause significant overshoot. The 4865 is compatible with converters such as the TRW TDC1007, TDC1019 and TDC1025. In addition to very fast acquisition time, the 4865 has small aperture time, aperture uncertainty time and jitter, allowing accurate sampling of signals with fast slew rates as in high speed deglitcher applications.

SPECIFICATIONS (T_A = +25°C, + V_{CC} = +15V, − V_{DD} = −5V)	**Minimum**	**Typical**	**Maximum**	**Units**
INPUT: Voltage Range(1)	−2.5		+0.5	V
Impedance		10^{12}/2		Ω/pF
TRANSFER CHARACTERISTICS				
Gain		1		V/V
Gain Accuracy		±.01		%
Offset Voltage		±10		mV
Pedestal		±10		mV
DYNAMIC CHARACTERISTICS				
Acquisition Time (0.1%, 2V step)		25		nsec
Track/Hold Settling Time		10		nsec
Aperture Delay Time		2		nsec
Aperture Jitter		±5		psec
Droop Rate		±1		mV/μs
POWER CONSUMPTION		1400		mW
SPECIFIED TEMPERATURE RANGE: 4865*		0°C to 70°C		

1. Output may be offset from input, output range is ±2.5V
*Contact factory for availability of high reliability screening to MIL-STD-883 and extended temperature range.

4866 High Speed, Precision Track/Hold Amplifier

The 4866 is a precision monolithic track/hold amplifier designed specifically for high speed A/D and D/A converters requiring high performance at a low cost. Adjustable closed loop gain, 1μsec acquisition time, 0.08μV/μsec droop rate and low feedthrough error are features that make this device ideally suited for multiplexed data acquisition systems.



Specifications (T_A = +25°C, ± V_{cc} = ±15 unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
INPUT: Voltage Range	±10			Volts
Impedance	1	5		MΩ
TRANSFER CHARACTERISTICS				
Gain Accuracy (Av = +1)		$\pm 0.5 \times 10^{-4}$		%FSR
Offset Voltage (Sample Mode)	±0.2	±0.5	±1.0	mV
Pedestal		±1		mV
DYNAMIC CHARACTERISTICS				
Acquisition Time (10V step to ±0.01%)		1		μsec
Sample-Hold Settling Time (10V step to ±0.01%)		185		nsec
Aperture Delay Time		30		nsec
Aperture Jitter		1		nsec
Droop Rate		±0.08		μV/μsec
POWER CONSUMPTION		330	390	mW
SPECIFIED TEMPERATURE RANGE: 4866		0°C to +75°C		
4866-01*		−55°C to +125°C		

*Contact factory for availability of MIL-STD-883 screening.

ANALOG/DIGITAL CONVERTERS

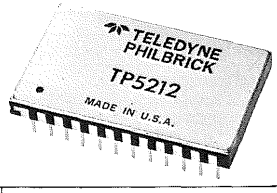
4130 Series, 8, 10, 12-bit Ultra High Speed A/D Converters

The 4130 Series ultra high speed A/D converters were designed for applications demanding high linearity, excellent stability, fast conversion rates and guaranteed operation over a wide temperature range. The successive approximation techique allows the device to achieve faster and more accurate conversion times. Wide selection of input ranges, buffered digital outputs, guaranteed monotonicity over the specified temperature range and fast acquisition times are features that make the 4130 Series superior devices.

SPECIFICATIONS (T_A = +25°C, ± V_{cc} = ±15V and +5 unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
RESOLUTION: 4130 4131 4132-22, 4133-22		8 10 12		Bits Bits Bits
ANALOG INPUT: 4130, 4131 4132-22, 4133-22		0 to −5, 0 to −10, ±5, ±10 0 to −10, 0 to −20, ±5, ±10		Volts Volts
DIGITAL OUTPUT (Parallel and Serial) Logic Coding: Unipolar Ranges Bipolar Ranges		Binary Offset Binary, 2's complement		
TRANSFER CHARACTERISTICS Integral Linearity Error Differential Linearity Error Offset Error Gain Error		 ±1/2	±1 ±10 ±0.1	 LSB LSB mV %
CONVERSION TIME: 4130 4131 4132-22 4133-22		735 980 3.4 2.4	750 1000 3.5 2.5	nsec nsec µsec µsec
NO MISSING CODES		Guaranteed over Temperature		
SPECIFIED TEMPERATURE RANGE		0°C to +70°C		

TP5210 Series 12-bit, Military Standard A/D Converters

The TP5210 Series, 12-bit A/D converters are the military/aerospace industry's most widely accepted 12-bit A/D's. Utilizing a proprietary comparator preamplifier results in much cleaner, more repeatable digital output transitions by reducing comparator oscillations present in other designs. Features include 7µsec conversion time, guaranteed no missing codes over the specified temperature range and 1W max power consumption. Currently awaiting QPL approval, the TP5210 Series is an excellent choice for military/aerospace data acquisition applications.



SPECIFICATIONS (T_A = +25°C, ± V_{cc} = ±15V and +5V unless otherwise indicated)				
ANALOG INPUT: Input Range 0 to −10V −5V to +5V −10V to +10V 0 to +10V	MODEL NO. (Internal Reference) 5210 5211 5212 5216		MODEL NO. (External Reference) 5213 5214 5215 5217	
DIGITAL OUTPUT Unipolar Ranges Bipolar Ranges	Complementary Binary Complementary Offset Binary			
TRANSFER CHARACTERISTICS	**Minimum**	**Typical**	**Maximum**	**Units**
Integral Linearity Error Differential Linearity Error Offset Error Gain Error		±¼ ±½ ±0.01 ±0.025	±½ ±0.025 	LSB LSB %FSR %
GUARANTEED NO MISSING CODES		Over the specified temperature range		
CONVERSION TIME		7	13	µsec
POWER CONSUMPTION		560	915	mW
SPECIFIED TEMPERATURE RANGE: TP521X TP521X-83*		0°C to +70°C −55°C to +125°C		

*Includes high reliability screening to MIL-STD-883.

DIGITAL/ANALOG CONVERTERS

4058 Fast, 12-bit, High Reliability D/A Converter

The 4058 is a true 12-bit digital to analog converter with TTL compatible inputs. User programmable output voltage ranges of 0 to −5V, 0 to −10V, ±2.5V, ±5V and ±10V; output current ranges of 0 to +4mA and ±2mA allow this device to be used in a wide range of applications. Settling to ±½LSB in 2.5μsec max. for a 20V step and 200nsec max. for a 4mA step, the 4058 is one of the fastest devices of its kind available. Excellent glitch characteristics, 645 mW max. power dissipation, guaranteed performance over the specified temperature range and excellent track record for reliability and durability have made this device the most popular D/A converter for military/aerospace display applications.

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
DIGITAL INPUTS: Resolution		12		
Logic Compatibility		TTL		
Logic Coding: Unipolar		Complementary Binary		
Bipolar		Complementary Offset Binary		
ANALOG OUTPUTS: Voltage		±2.5, ±5.0, ±10, 0 to −5, 0 to −10		Volts
Current		±2.0, 0 to +4		mA
TRANSFER CHARACTERISTICS				
Integral Linearity Error		±¼	±½	LSB
Voltage Offset Error (Current Output)		±1 (±¼)	±4 (±½)	LSB
Voltage Gain Error (Current Output)		±0.05 (±0.1)	±0.2 (±1)	%
SETTLING TIME: 10V Step to ±½ LSB		1.2	2.0	μsec
20V Step to ±½ LSB		1.9	2.5	μsec
4mA Step to ±½ LSB		150	200	nsec
SPECIFIED TEMPERATURE RANGE: 4058		0°C to +70°C		
4058-83*		−55°C to +125°C		

*Includes high reliability screening to MIL-STD-883.

4065 12bit, 60nsec Current Output D/A Converter

The 4065 D/A converter is a thin-film hybrid that combines a proprietary, dielectrically isolated low capacitance switching network, high stability thin film resistor network and a low drift zener diode reference. Settling a full scale step to ±0.01% FSR in 100nsec maximum, the 4065 offers the user the utmost in versatility with programmable output ranges of 0 to +4mA and ±2mA. The excellent stability of the thin film enables the 4065 to guarantee monotonicity over its entire specified temperature range. Power consumption at 645mW maximum is extremely low for a device of this speed. Applications include precision CRT displays, data distribution system and high reliability industrial equipment.

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
DIGITAL INPUTS: Resolution		12		
Logic Compatibility		TTL		
Logic Coding: Unipolar		Binary		
Bipolar		Offset Binary		
ANALOG OUTPUTS: Current		±2, 0 to +4		mA
TRANSFER CHARACTERISTICS				
Integral Linearity Error		±¼	±½	LSB
Offset Error		±¼	±½	LSB
Gain Error		±0.1	±1	%
MONOTONICITY		Guaranteed over Specified Temperature Range		
SETTLING TIME: 4mA Step to ±½LSB		60		100 nsec
SPECIFIED TEMPERATURE RANGE: 4065		0°C to +70°C		
4065-83*		−55°C to +125°C		

*Includes high reliability screening to MIL-STD-883.

DIGITAL/ANALOG CONVERTERS

4080 Series Fastest 12-Bit Voltage Output D/A Converters

The 4080 Series of 12-bit voltage output D/A converters provide the ultimate in high speed, high performance digital to analog conversion. Fully three times faster than their nearest competitors, these D/A's settle a 10V step to ±0.02% FSR (±2mV) in 250nsec maximum. Only Teledyne Philbrick—the one thin-film hybrid manufacturer possessing state-of-the-art expertise in both fast current output D/A converters and precision high speed operational amplifiers—is presently capable of designing and manufacturing such high speed voltage DAC's. 4080 Series devices are true 12 bit performers. Integral linearity error is guaranteed less than ±½LSB, and monotonicity is guaranteed over each device's entire operating temperature range. Power consumption, at 900mW maximum, is extremely low for devices of this speed. Applications include digitally controlled VCO's, high speed displays and high speed servo systems.

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	Minimum	Typical	Maximum	Units
DIGITAL INPUTS: Resolution		12		Bits
Logic Compatibility		TTL		
Logic Coding: Unipolar		Complementary Binary		
Bipolar		Complementary Offset Binary		
ANALOG OUTPUTS: 4080		0 to −5, 0 to −10		Volts
4081		±2.5, ±5		Volts
4082		0 to +5, 0 to +10		Volts
TRANSFER CHARACTERISTICS				
Integral Linearity Error		±¼	±½	LSB
Offset Error		±0.01		%FSR
Gain Error		±0.1		%
MONOTONICITY		Guaranteed Over Temperature		
SETTLING TIME				
10V Step to ±0.1%FSR		125	170	nsec
10V Step to ±0.02%FSR		150	250	nsec
SPECIFIED TEMEPRATURE RANGE: 408X		0°C to +70°C		
408X-83*		−55°C to +125°C		

*Includes high reliability screening to MIL-STD-883.

TPDAC80V/TPDAC80I 12-Bit Monolithic D/A Converters

PRELIMINARY

The TPDAC80 Series are monolithic, digital-to-analog converters that directly replace all DAC80 and DAC85 types. Both devices feature ±½LSB max linearity error, fast settling times, guaranteed monotonicity, internal reference and wide power supply range. Available in both voltage (TPDAC80V) and current (TPDAC80I) models, these devices are housed in 24-pin ceramic packages and are specified over the 0°C to +75°C temperature range.

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	Minimum	Typical	Maximum	Units
DITIGAL INPUTS: Resolution		12		Bits
Logic Compatibility		TTL		
Logic Coding: Unipolar		Complementary Binary		
Bipolar		Complementary Offset Binary		
ANALOG OUTPUTS: TPDAC80V		0 to +5, 0 to +10, ±2.5, ±5, ±10		Volts
TPDAC80I		0 to −2, ±1		mA
TRANSFER CHARACTERISTICS				
Integral Linearity Error		±1/4	±1/2	LSB
Offset Error		±0.05	±0.15	%FSR
Gain Error		±0.1	±0.3	%
MONOTONICITY		Guaranteed Over Temperature		
SETTLING TIME (to ±0.01% FSR)				
TPDAC80V: 10V Step		1.5		µsec
20V Step		3.0		µsec
TPDAC80I: 0 to 100Ω Load		300		nsec
1KΩ Load		1.0		µsec
SPECIFIED TEMPERATURE RANGE		0°C to +75°C		

DIGITAL/ANALOG CONVERTERS

TP7541 Series 12-Bit Monolithic, Multiplying D/A Converters

The TP7541 Series are high performance, 12-bit monolithic digital-to-analog converters capable of full four quadrant multiplication. Pin-to-pin replacements for all 7541 types, these D/A's provide fast 1μsec settling times to ±0.01%, guaranteed monotonicity and less than 60mW power dissipation. Dielectrically isolated CMOS technology combined with a laser trimmed thin film ladder network, assures the user consistent settling times as well as true 12-bit accuracy over the specified temperature range. Applications include CRT displays, vector generation and variable gain amplifiers.

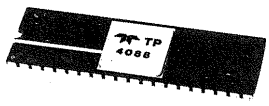
PRELIMINARY

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V, V_{REF} = +10 unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
DIGITAL INPUTS: Resolution		12		
Logic Compatibility		TTL		
Logic Coding: Unipolar		Binary		
Bipolar		Offset Binary		
ANALOG OUTPUT				
In conjunction with an external amplifier		0 to $-V_{REF}(1-2^{-12})$		Volts
TRANSFER CHARACTERISTICS				
Integral Linearity Error			±0.01	%FSR
Gain Error			±0.1	%
Output Leakage Current			±50	nA
MONOTONICITY		Guaranteed Over Temperature		
SETTLING TIME				
Full Scale Current Step to ±0.01%FSR			1.0	μs
SPECIFIED TEMPERATURE RANGE: TP7541		0°C to +75°C		
TP7541-01*		−55°C to +125°C		

*Contact factory for availability of MIL-STD-883 screening.

4088 16-Bit, Monolithic Digital-To-Analog Converter

The 4088 is a high performance monolithic 16-bit current output D/A converter. Features include 1μsec max settling time to ±0.003% FSR, 450mW power dissipation as well as low voltage offset and gain drifts. By itself, the 4088 can supply output current ranges of 0 to −2mA and ±1mA. When combined with an external op amp; 0 to +5V, 0 to +10V, ±2.5V, ±5V and ±10V output ranges are available. Applications include high resolution CRT displays, 16 bit A/D's and high fidelity audio equipment.



SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V, V_{REF} = +10V, unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
DIGITAL INPUTS: Resolution		12		Bits
Logic Compatibility		TTL		
Logic Coding: Unipolar		Binary		
Bipolar		Offset Binary, 2's Complement		
ANALOG OUTPUTS				
Unipolar		0 to −2		mA
Bipolar		±1		mA
TRANSFER CHARACTERISTICS				
Integral Linearity Error		±0.0023		%FSR
Differential Linearity Error		±0.0023		%FSR
Offset Error: Unipolar		±0.002	±0.5	%FSR
Bipolar		±0.5	±0.85	%FSR
Gain Error		±0.1	±0.25	%
SETTLING TIME				
Full Scale Current Step to ±0.003% FSR		1		μsec
SPECIFIED TEMPERATURE RANGE		0°C to +75°C		

FREQUENCY/VOLTAGE CONVERTERS

4702 10kHz General Purpose F/V Converter

The 4702 is a general purpose, 10kHz frequency-to-voltage converter featuring ±0.03% maximum nonlinearity, ±1% max full scale error, thirty percent overrange and optional bipolar output. High performance, maximum reliability and low cost make the 4702 the most widely used F/V of its type. Applications include industrial speed measurements, FM demodulation and data transmission.

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
INPUT/OUTPUT RANGE				
Input Frequency Range	10 to 10k	10 to 13k		Hz
Output Voltage Range	0 to 10			Volts
ACCURACY				
Nonlinearity (1Hz to 11KHz)		±0.008	±0.03	%FS
Full Scale Accuracy (1MHz input)			±1	%
RESPONSE TIME				
Filter Time Constant		240		µsec
OUTPUT OFFSET VOLTAGE: Initial			±10	mV
Drift			±50	µV/°C
GAIN DRIFT			±100	ppm/°C
SUPPLY REQUIREMENTS				
Voltage Range	±14	±15 ±5%	±16	Volts
Power Consumption		540		mW
SPECIFIED TEMPERATURE RANGE		−40°C to +70°C		

4732/4734 High Reliability Hybrid F/V Converters

The 4732 (10kHz) and 4734 (100kHz) are precision, frequency-to-voltage converters that meet the requirements of the most demanding applications. ±0.005% nonlinearity error, ±0.05% zero offset error, thirty percent overrange as well as low full scale and zero offset drift are superior features for motor speed monitoring, communication signal conditioning and phase locked loops. Both converters are housed in a 24-pin hermetically sealed metal package and are available with processing to MIL-STD-883.

SPECIFICATIONS (Typical, T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**4732**	**4734**	**Units**
INPUT/OUTPUT RANGE			
Input Frequency Range	0 to 13	0 to 130	kHz
Output Voltage Range	0 to 10	0 to 10	Volts
ACCURACY			
Nonlinearity	±0.001	±0.002	%FS
Full Scale Accuracy	±0.1	±0.1	%
RESPONSE TIME			
Internal Filter Constant	560	56	msec
OUTPUT OFFSET VOLTAGE			
Initial	±1	±1	mV
Drift	±5	±5	µV/°C
GAIN DRIFT	±15	±15	ppm/°C
SUPPLY REQUIREMENTS			
Voltage Range	±12 to ±18	±12 to ±18	Volts
Power Consumption	540	750	mW
SPECIFIED TEMPERATURE RANGE: 4732/4734	−25°C to +85°C		
4732-83*/4734-83*	−55°C to +125°C		

*Includes high reliability screening to MIL-STD-883.

VOLTAGE/FREQUENCY CONVERTERS

4705 1MHz, High Performance Voltage-to-Frequency Converter

The 4705 is a 1MHz, high performance voltage to frequency converter. Twenty percent overrange, ±0.05% signal nonlinearity, 16-bit resolution as well as low full scale and offset drifts allow the 4705 to be used in such demanding applications as digital frequency synthesis, FM telemetry and synchronous speed control. For applications requiring greater linearity, the 4705-01 is available with a guaranteed ±0.0005% FS plus ±0.02% signal nonlinearity error.

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**Typical**	**Guaranteed**	**Units**
INPUT/OUTPUT RANGE			
Input Voltage Range	10μ to 12	100μ to 10.5	Volts
Output Frequency Range	1μ to 1.2M	10μ to 1.05M	Hz
ACCURACY			
Nonlinearity (100μV to 10.5V)	±0.0002	±0.001	%FS + % Signal
Full Scale Accuracy (10V input)	±0.012	±0.05 ±5	kHz
OFFSET FREQUENCY			
Initial	±3	±10	mV
Drift	±10	±50	μV/°C
GAIN DRIFT	±44	±200	ppm/°C
SUPPLY REQUIREMENTS			
Voltage Range	±15 to ±18	±15 ±5%	Volts
Power Consumption		720	mW
SPECIFIED TEMPERATURE RANGE	−25°C to +85°C	0°C to +70°C	

4735 1MHz Differential Input Voltage-to-Frequency Converter

The 4735 is a precision, low drift 1MHz Voltage-to-Frequency Converter that is ideal for applications requiring high resolution and maximum reliability. Features include ±0.015% FS max nonlinearity, 70dB CMRR, 126dB dynamic range (equivalent to 20 bits) and the ability to handle both positive and negative voltage inputs. Housed in a 24-pin hermetically sealed metal package, the 4735 is specified over the 0°C to +70°C temperature range. For maximum reliability and performance, this device is available screened to MIL-STD-883 and is specified over the −55°C to +125° temperature range.

SPECIFICATIONS (T_A = +25°C, $\pm V_{cc}$ = ±15V unless otherwise indicated)	**Typical**	**Guaranteed**	**Units**
INPUT/OUTPUT RANGE			
Input Voltage Range	+10μ to +21	+100μ to +12	Volts
Output Frequency Range	0 to 2.1	0 to 1.2	MHz
ACCURACY			
Nonlinearity (+100μV to +12V)	±0.005	±0.015	%FS
Full Scale Accuracy (10V input)		±0.5	%
OFFSET FREQUENCY			
Initial		±500	Hz
Drift	±10	±50	μV/°C
GAIN DRIFT	±30	±50	ppm/°C
SUPPLY REQUIREMENTS			
Voltage Range	±7 to ±18	±9 to ±18	Volts
Power Consumption	1050	1350	mW
SPECIFIED TEMEPRATURE RANGE: 4735	0°C to +70°C		
4735-83*	−55°C to +125°C		

*Includes high reliability screening to MIL-STD-883.

VOLTAGE/FREQUENCY CONVERTERS

4739 High Performance 5MHz Voltage-to-Frequency Converter

The 4739 is a high performance, high reliability 5MHz voltage-to-frequency converter. Featuring differential inputs, high common mode voltage range, better than 100dB dynamic range and hybrid construction, it is easily adaptable to a wide range of applications. Housed in a 24 pin metal DIP, the 4739 is specified over the 0°C to +70°C temperature range and is available with processing to MIL-STD-883.

SPECIFICATIONS (Typical T_A = +25°C, ± V_{cc} = ±15V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
INPUT/OUTPUT RANGE				
Input Voltage Range	±100µ		±10.5	Volts
Output Frequency Range	0	5		MHz
ACCURACY				
Nonlinearity (10mV to 10.5V)		±0.05 ±0.001		%FS + % Signal
Full Scale Accuracy (10V input)		±50		kHz
OFFSET FREQUENCY (+10mV input)				
Initial		±4		kHz
Drift		±50		Hz/°C
GAIN DRIFT		±375		Hz/°C
DYNAMIC CHARACTERISTICS				
Response Time (10V Input Step to ±0.01%)		14		µsec
Overload Recovery Time		10		Cycles
SPECIFIED TEMPERATURE RANGE*		0°C to +70°C		

*Contact factory for availability of MIL-STD-883 screening.

4743 Precision 10MHz Voltage-to-Frequency Converter

The 4743 is the most accurate 10MHz voltage-to-frequency converter available. ±0.05% signal nonlinearity and 15µsec response time are excellent specifications for such applications as long term precision integrators and high performance voltage controlled oscillators. Housed in a 24 pin metal DIP, the 4743 is specified over the 0°C to +70°C temperature range and is available with processing to MIL-STD-883.

SPECIFICATIONS (T_A = +25°C, ± V_{cc} = ±15V unless otherwise indicated)	**Minimum**	**Typical**	**Maximum**	**Units**
INPUT/OUTPUT RANGE				
Input Voltage Range	±100µ		±10.5	Volts
Output Frequency Range	0	10		MHz
ACCURACY				
Nonlinearity (10mV to 10.5V)		±0.05 ±0.05		%FS + % Signal
Full Scale Accuracy (10V input)		±50		kHz
OFFSET FREQUENCY (+10mV input)				
Initial		±8		kHz
Drift		±75		Hz/°C
GAIN DRIFT		±500		Hz/°C
DYNAMIC CHARACTERISTICS				
Response Time (10V Input Step to ±0.01%)		15		µsec
Overload Recovery Time		10		Cycles
SPECIFIED TEMPERATURE RANGE*		0°C to +70°C		

*Contact factory for availability of MIL-STD-883 screening.

Microcircuit Operational Amplifiers

Wideband, Fast Settling

Part No.	Features	Output Range (Volts/mA)	Minimum Open Loop Gain (dB)	Gain-BW Product (MHz)	Minimum Slew Rate (V/μsec)	Settling Time to ±0.1% (nsec)	Offset Voltage (mV, Max)	Input Bias Current (pA, Max)	Specified Temperature Range (°C)	Pkg.
TP0032 (1)	Industry Standard, FET Input, LH0032 Compatible	±10/±10	70	80 (2)	350	300	±5	±100	−55 to +125	A
TP0033 (1)	High Speed Buffer/Driver Amplifier	±5/ ±100	0.98	100 (3)	250	20	±10	±100	0 to +70 −55 to +125	A
1321 (4)	Monolithic, High Gain, Wideband, Fast Settling	±10/±10	98	100	20	400	±5	±25nA	0 to +75 −55 to +125	B
1322 (4)	Monolithic, High Slew Rate, 1.6MHz Full Power BW	±10/±10	76	20	80	200	±10	±250nA	0 to +75 −55 to +125	B
1341 (4)	Monolithic, Wideband, Fast Settling	±10/±10	83.5	n/a	350	250	±15	±100	0 to +75 −55 to +125	C
1342 (4)	Monolithic, 9.5MHz Full Power B/W	±10/±10	83.5	n/a	550	350	±15	±20	0 to +75 −55 to +125	C
1344 (4)	Monolithic, JFET Input, Wideband	±11/±20	98	100	100	280	±3	±50	0 to +75 −55 to +125	B
1345	Monolithic, JFET Input, High Slew Rate, Wideband	±11/±20	88	100	50	400	±15	±65	0 to +75	B
1346 (4)	Monolithic, Ultra Low Bias Current, JFET Input	±12/±15	106	n/a	4	2000	±0.5	±1	0 to +75 −55 to +125	B
1347 (4)	Monolithic, Ultra Low Bias Current, JFET Input	±12/±15	106	n/a	4	2000	±3	±1	0 to +75 −55 to +125	B
1430 (5)	Fast Settling to ±0.01%, Made for Current-Output DAC's	±10/±50	106	100	500 (6)	100	±2	−500	−55 to +125	D
1435 (5)	Fastest Settling to ±0.01%, 100MHz Working Bandwidth	±5/±10	90	1000	250	40	±5	±20μA	0 to +70 −55 to +125	D

Microcircuit Operational Amplifiers (continued)

Wideband, Fast Settling

1437 (5)	Best Available Combination of Price, Package, Performance	±10/±20	88	350	400 (6)	110	±2	±200 (6)	0 to +70 −55 to +125	B
1443	Outstanding Performance and Low Gain Stability	±10/±100	95	2000	900	80	±3	−50	0 to +70	E
1443-83 (7)	1443 with Extended Temp Range and 883 Screening	±10/±100	100	2000	1000	80	±2	−20	−55 to +125	E
1490 (5)	"FLASH" Buffer, High Performance, Fast Settling	±5/±100	0.98	100 (3)	250	20	±10	±100	0 to +70 −55 to +85	E
TP3554 (1)	BB3554 Equivalent, Improved Low-Gain Stability	±10/±100	100	2000	1000	100	±2	±50	−25 to +85 −55 to +125	E

High Speed, High Output

Part Number	Features	Output Range (Volts/mA)	Minimum Open Loop Gain (dB)	Gain-BW Product (MHz)	Minimum Slew Rate (V/μsec)	Offset Voltage (mV, Max)	Input Bias Current (pA, Max)	Specified Temperature Range (°C)	Pkg.
1460 (8)	VMOS Output, No SOA Restrictions, High Speed	±30/±150	80	1000	300 (6)	±5	±10μA	0 to +70	E
1461 (5)	VMOS Output, FET Input, No SOA, Higher Speed	±30/±600	100	1000	900	±5	±100	0 to +70 −55 to +125	F
1463 (5)	1A VMOS Output, FET Input, No SOA	±30/±1000	100 Typ	6	80 Typ	±10	±50	0 to +70 −55 to +125	E
1464 (5)	Selectable VMOS Output, FET input	±30/ (9)	100 Typ	(10)	(10)	±10	±50	0 to +70 −55 to +125	E
1480 (5)	$\pm V_{cc}$ = ±15V to ±150V, FET Input, Fast Settling	±140/±75	95	18	100 (6)	±3	±200	0 to +70 −55 to +125	E

Notes:
1. Add "−80" to part number for specified −55°C to +125°C operation. Add "−83" for specified −55°C to +125°C operation and 100% screening to MIL-STD-883, Method 5008.
2. Unity Gain Bandwidth
3. Full Power Bandwidth
4. Add "−01" to part number for specified −55°C to +125°C operation.
5. Add "−83" to part number for specified −55°C to +125°C operation and 100% screening to MIL-STD-883, Method 5008.
6. Typical specification
7. Includes 100% screening to MIL-STD-883, Method 5008.
8. Add "−83" to part number for 100% screening to MIL-STD-883, Method 5008.
9. User Selectable output current ±1A to ±10A.
10. Dependent on output stage selected.

Packages:
A. TO-8
B. TO-99
C. 14 pin ceramic dual-in-line, 0.79" × 0.31" × 0.20"
D. 14 pin metal dual-in-line, 0.88" × 0.52" × 0.2"
E. TO-3
F. 14 pin metal dual-in-line with ears, 1.18" × 0.56" × 0.2"

Microcircuit Operational Amplifiers (continued)

General Purpose

Part Number	Features	Output Range (Volts/mA)	Minimum Open Loop Gain (dB)	Unity Gain Bandwidth (MHz, Typ)	Minimum Slew Rate (V/μsec)	Offset Voltage (mV, Max)	Input Bias Current (pA, Max)	Specified Temperature Range (°C)	Pkg.*
1340	Chopper Stabilized, Low Offset, High Gain and CMRR	±10/±7	120	3 (1)	2.5 (2)	±0.02 (2)	±150 (2)	0 to +75	A
1421	Monolithic, FET, 10mA Output, 741 Pin Compatible	±10/±10	94	2	3	±15	−50	−25 to +85	A
1421-01	Monolithic, FET, 1421 with Lower Offset Drift	±10/±10	94	2	3	±15	−15	−25 to +85	A
1421-02	1421 with Lower Bias Current and Offset Drift	±10/±10	94	2	3	±15	−10	−25 to +85	A
1426	FET Input, Low Offset and Bias, 741 Compatible	±10/±5	94	2	3	±2	−25	−25 to +85	A
1426-01	1426 with Lower Offset, Offset Drift and Bias Current	±10/±5	94	2	3	±1	−10	−25 to +85	A
1426-02	1426 with Lower Offset and Offset Drift	±10/±5	94	2	3	±1	−25	−25 to +85	A
1426-03	1426 with Lower Offset and Offset Drift	±10/±5	94	2	3	±1	−25	−25 to +85	A

Logarithmic and Instrumentation Amplifiers

Part No.	Description	Dynamic Range (dB)		Log Conformity (3)				Frequency Response (Hz)	Specified Temperature Range (°C)	Pkg.
		Current	Voltage	Input Current	% Max	Input Voltage	(% Typ)			
4362	Positive Input Logarithmic Amplifier	120	80	1nA to 10nA 10nA to 100μA 100μA to 1mA	±1 ±0.5 ±1	1mV to 1V 1V to 10V	±0.5 ±1	80k	0 to +70	B
4363	Negative Input Logarithmic Amplifier	120	80	1nA to 10nA 10nA to 100μA 100μA to 1mA	±1 ±0.5 ±1	1mV to 1V 1V to 10V	±0.5 ±1	80k	0 to +70	B

Instrumentation Amplifier

Part No.	Description	Output Range (V/mA)	Unity Gain Bandwidth (KHz Typ)	Settling to ±0.1% (μsec)	Offset Voltage (mV, Max)	Input Bias Current (4) (pA, Max)	Specified Temperature Range (°C)	Pkg.
4253	High Performance FET Input	±10/±5	75	5	±1	−10	0 to +50	C

Notes:
1. Gain-bandwidth product (G = 10).
2. Typical specification.
3. Log Conformity is the deviation from a straight line (ideal logarithmic behavior) on a semi-log plot over the specified range. Three input ranges with associated errors are listed since error is not constant over 1nA to 1mA input range.
4. Input bias Current doubles every 10°C.

Packages:
A. TO-99
B. Module, 1.5″ × 1.5″ × 0.4″
C. Module, 2.0″ × 2.0″ × 0.4″

Modular Operational Amplifiers

Category	Part Number	Features	Output Range (V/mA)	Minimum Open Loop Gain (dB)	Full Power BW/ Slew Rate (kHz/V/μsec)	Input Offset Voltage		Input Bias Current		Pkg.
						Initial (mV, Max)	Drift (μV/°C, Max)	Initial (pA, Max)	Drift (pA/°C, Max)	
Ultra Low Offset and Drift	**1701**	Chopper Stabilized, 40kHz Full Power BW, High CMRR	±12/±5	112	40/1.2	±15μV	±0.25	±50	±1	A
	1701-01		±12/±5	112	40/1.2	±15μV	±0.1	±50	±1	A
	1703	Chopper Stabilized, High A_{OL}, CMRR, Supplies to ±6V	±10/±5	120	9/0.25	±40μV	±1	±50	±2	A
	1703-01		±10/±5	120	9/0.25	±15μV	±0.3	±50	±1	A
Ultra Low Bias and Drift	**1702**	Parametric Op Amps, Lowest Bias Current Available	±10/±5	100	(1)	±5	±30	±0.005	±0.002	A
	1702-01		±10/±5	100	(1)	±5	±10	±0.005	±0.002	A
High Voltage Output	**1022**	±140V Output, High A_{OL}, CMV	(2)	120	30/30	±2	±50	−30	(3)	B
	1032	±115V Output, Low Bias	(4)	100	10/10	±5	±50	−10	(3)	B
Instrumentation	**4253**	FET Input, High CMRR	±10/±5	(5)	(6)	±1	±10	−10	(3)	C

Notes:
1. Undistorted full power bandwidth is 20Hz minimum. Slew Rate = 2.5V/msec.
2. $V_{out} = \pm \mid V_{cc} - 10 \mid$ volts, $I_{out} = \pm 20mA$, $\pm V_{cc} = \pm 40V$ to $\pm 150V$.
3. Doubles every 10°C.
4. $V_{out} = \pm \mid V_{cc} - 10 \mid$ volts, $I_{out} = \pm 10mA$, $\pm V_{cc} = \pm 18V$ to $\pm 125V$.
5. Closed-loop gains from 1 to 10,000 determined by choice of a single external resistor.
6. Undistorted full power bandwidth is 5kHz minimum.

Packages:
A. 1.52″ × 1.52″ × 0.62″
B. 2.42″ × 1.82″ × 0.62″
C. 2.02″ × 2.02″ × 0.41″

Track/Hold Amplifiers and Deglitcher

Part Number	Acquisition Time (10V Step to ±0.01%FS)	Sample-Hold Settling Time (to ±0.01%FS)	Maximum Droop Rate (μV/μsec)	Aperture Jitter (1) (nsec)	Maximum Gain Error (2) (%)	Typical Input Impedance	Specified Temperature Range (°C)	Package
4853	1μsec Max	300nsec Max	±1	±1 Max	±0.05	(2)	0 to +70	A
4855	300nsec Max	100nsec Max	±25	±0.2 Typ	±0.02	$10^{11}\Omega$//2pF	0 to +70	A
4856	5μsec Typ (3)	(3)	(3)	±7 Typ	(4)	$10^{7}\Omega$	0 to +75	B
4860 (5)	200nsec Max	100nsec Max	±5	±0.05 Typ	±0.1	1kΩ	0 to +70 −55 to +125	C
4865	25nsec Typ	50nsec Typ	±1000 Typ	±0.005 Typ	±0.01	$10^{12}\Omega$//2pF	0 to +70	C
4866 (6)	1μsec Typ	185nsec Typ	0.08 Typ	±30 Typ	±0.0005	5MΩ//3pF	0 to +75 −55 to +125	C

Deglitcher

4902 (5)	1μsec Max	200nsec Max	±25	N/A	±0.05	N/A	0 to +70 −55 to +125	C

Notes:
1. Defined as the sample to sample variation in aperture delay time.
2. 2kΩ//(20pF in series with 2kΩ).
3. Determined by value of external hold capacitor.
4. All units have a gain of −1 except the 4856. The gain of the 4856 is determined by a choice of external resistors.
5. Add "−83" to part number for specified −55°C to +125°C operation and 100% screening to MIL-STD-883, Method 5088.
6. Add "−01" to part number for −55°C to +125°C temperature range.

Packages:
A. Module, 2″ × 2″ × 0.4″
B. 14 pin plastic dual-in-line, 0.7″ × 0.3″ × 0.14″
C. 24 pin ceramic dual-in-line, 1.34″ × 0.83″ × 0.23″

Analog to Digital Converters

Resolution (Bits)	Part Number	Maximum Conversion Time (1)	Input Voltage Ranges (V)	Integral Linearity Error (LSB's, Max)	Differential Linearity Error (LSB's, Max)	Temperature Range for No Missing Codes (°C)	Maximum Power Consumption (mW)	Package
8	**4130 Series (2)**	750nsec	−5, −10 ±5, ±10	±½	±¼	0 to +70	3275	A
10	**4131 Series (3)**	1μsec	−5, −10 ±5, ±10	±1	±½ (Typ)	0 to +70	3275	A
12	**TP5210 Series (4)**	13μsec	−10, +10 ±5, ±10	±½	±½ (Typ)	0 to +70	915	B
12	**4132-22**	3.5μsec	−10, −20, ±5, ±10	±1	b±½ (Typ)	0 to +50	3275	A
12	**4133-22**	2.5μsec	−10, −20, ±5, ±10	±1	±½ (Typ)	0 to +50	3275	A

Notes:
1. All Teledyne Philbrick A/D converters, with the exception of the TP5210 Series, have internal clocks, and maximum conversion time refers to the slowest conversion time a user can expect from these devices. They may run faster. For the TP5210 Series, maximum conversion time refers to the fastest conversion rate at which these devices can be externally clocked and still guarantee accuracy and linearity.
2. Includes part numbers 4130-10 (0 to −5V input), 4130-20 (0 to −10V), 4130-30 (±5V), and 4130-40 (±10V).
3. Includes part numbers 4131-10 (0 to −5V), 4131-20 (0 to −10V), 4131-30 (±5V), and 4131-40 (±10V).
4. Includes part numbers TP5210/TP5213 (0 to −10V input), TP5211/5214 (±5V), TP5212/5215 (±10V), and TP5216/TP5217 (0 to +10V) Add "−83" to part number for specified −55°C to +125°C operation and 100% screening to MIL-STD-883, Method 5008.

Packages:
A. Module, 4" × 2" × 0.4"
B. 24 pin ceramic dual-in-line, 1.34" × 0.83" × 0.26"

Digital to Analog Converters

Resolution (Bits)	Part Number	Output Ranges (Volts, mA)	Maximum Settling Time (Step Size/Error Band/ Time)	Integral Linearity Error (LSB's, Max)	Differential Linearity Error (LSB's, Max)	Temperature Range For Guaranteed Monotonicity (°C)	Maximum Power Consumption (mW)	Package
12	**4058 (1)**	Voltage: −5, ±10, ±2.5, ±5, ±10 Current: +4, ±2	20V/0.01%/2.5μs 4mA/0.01%/ 200nsec	±½	±½	0 to +70 −55 to +125	645	A
12	**4065 (1)**	Current: +4, ±2	4mA/0.01%/100ns	±½	±½	0 to +70 −55 to +125	645	A
12	**4068**	Current: −5, ±2.5	5mA/0.01%/400ns	±½	±½	0 to +70	465 (Typ)	B
12	**4072**	Multiplying (2)	20V/0.01%/650ns	±½	±½	0 to +50	1500	C
12	**4080 Series (1)**	Voltage: 4080: −5, −10 4081: ±2.5, ±5 4082: +5, +10	10V/0.02%/250ns	±½	±½	0 to +70 −55 to +125	900	A
12	**TP7541 Series (3)**	Multiplying (2)	20V/0.01%/1μS	±½	±½	0 to +75 −55 to +125	450	D
12	**TPDAC80V**	Voltage: +5, +10, ±2.5, ±5 ±10	10V/0.01%/1.5μS Typ	±½	±½	0 to +75	1000	B
12	**TPDAC80I**	Current: −2, ±1	2mA/0.01%/300nsec Typ	±½	±½	0 to +75	1000	B
12	**4088**	Current: −2, ±1	2mA/0.003%/1μS Typ	±½	±½	0 to +75	1000	E

Notes:
1. Add "−83" to part number for specified −55°C to +125°C operation and 100% screening to MIL-STD-883, Method 5008.
2. The 4072 and 4085 are multiplying DACs. Their output voltages (±10V) will be equal to the product of their input voltages (−1V to +10V) and their digitally programmable scale factors (−1 to +1).
3. Add "02" for −25°C to +85°C temperature range and "−04" for −55°C to +125°C temperature range.

Packages:
A. 24 pin metal dual-in-line 1.39" × 0.8" × 0.2"
B. 24 pin ceramic dual-in-line 1.25" × 0.61" × 0.19"
C. Module 3" × 2.5" × 0.4"
D. 18 pin ceramic dual-in-line 0.95" × 0.31" × 0.20"
E. 40 pin ceramic dual-in-line

Frequency to Voltage Converters

General Purpose

Frequency Range	Part Number	Absolute Accuracy			Temperature Stability		Specified Temperature Range (°C)	Pkg.
		Nonlinearity (%FS, Max)	Zero Offset (%FS, Max)	Full Scale (%FS, Max)	Zero Offset (μV/°C, Max)	Full Scale (ppm of FS/°C, Max)		
10kHz	**4722**	±0.03 plus ±0.03 (1)	±0.1	±1	±50	±300	0 to +70	A
	4702	±0.03	±0.1	±1	±50	±100	−40 to ±70	B
100kHz	**4704**	±0.05	±0.1	±1	±50	±150	−40 to +85	B
	4780 (2)	±0.05	±0.5	±10 Typ	±50	±40	0 to +70	C
	4781 (2)	±0.02	±0.5	±10 Typ	±50	±40	0 to +70	C
1MHz	**4706**	±0.008 plus ±0.02 (1)	±0.1	±0.5	±100	±150	0 to +70	D

Precision

Frequency Range	Part Number	Absolute Accuracy			Temperature Stability		Specified Temperature Range (°C)	Pkg.
		Nonlinearity (%FS, Max)	Zero Offset (%FS, Max)	Full Scale (%FS, Max)	Zero Offset (μV/°C, Max)	Full Scale (ppm of FS/°C, Max)		
10kHz	**4708**	±0.007 plus ±0.013 (1)	±0.05	±0.5	±50	±50	0 to +70	B
	4732	±0.005	±0.05	±0.5	±25	±25	−25 to +85	E
	4732-83 (3)	±0.005	±0.05	±0.5	±50	±50	−55 to +125	E
100kHz	**4710**	±0.007 plus ±0.013 (1)	±0.05	±0.5	±50	±50	0 to +70	B
	4710-02	±0.005 plus ±0.01 (1)	±0.05	±0.5	±50	±15	0 to +70	B
	4734	±0.005	±0.05	±0.5	±25	±25	−25 to +85	E
	4734-83 (3)	±0.005	±0.05	±0.5	±50	±50	−55 to +125	E
1MHz	**4736**	±0.008	±0.05	±0.1	±50	±50	0 to +70	E
	4736-83 (3)	±0.008	±0.05	±0.1	±80	±100	−55 to +125	E

Notes:
1. Nonlinearity specification includes ±%FS plus ±% signal.
2. 4780 and 4781 perform both voltage to frequency and frequency to voltage conversion in same package.
3. Screened to the high reliability requirements of MIL-STD-883, Method 5008.

Packages:
A. Module, 1.14″ × 1.14″ × 0.4″
B. Module, 1.5″ × 1.5″ × 0.4″
C. 14 pin plastic dual-in-line, 0.79″ × 0.33″ × 0.2″
D. Module, 2.0″ × 2.0″ × 0.4″
E. 24 pin metal dual-in-line, 1.39″ × 0.8″ × 0.2″

Voltage to Frequency Converters

General Purpose

Output Frequency Range	Part Number	Absolute Accuracy			Temperature Stability		Specified Temperature Range (°C)	Pkg.
		Nonlinearity (%FS, Max)	Zero Offset (%FS, Max)	Full Scale (%FS, Max)	Zero Offset (μV/°C, Max)	Full Scale (ppm of FS/°C, Max)		
10kHz	**4701**	±0.05	±0.1	±0.75	±100	±100	0 to +70	A
100kHz	**4703**	±0.05	±0.1	±0.75	±100	±100	−25 to +85	A

Precision

Output Frequency Range	Part Number	Absolute Accuracy			Temperature Stability		Specified Temperature Range (°C)	Pkg.
		Nonlinearity (%FS, Max)	Zero Offset (%FS, Max)	Full Scale (%FS, Max)	Zero Offset (μV/°C, Max)	Full Scale (ppm of FS/°C, Max)		
10kHz	**4715**	±0.01 plus ±0.01 (1)	±0.03	±0.50	±20	±50	0 to +70	B
	4715-01	±0.005 plus ±0.005 (1)	±0.03	±0.50	±20	±15	0 to +70	B
	4731	±0.005	±0.05	±0.50	±20	±15	0 to +70	C
	4731-83 (2)	±0.005	±0.05	±0.50	±20	±15	−55 to +125	C
100kHz	**4709**	±0.005 plus ±0.02 (1)	±0.03	±0.50	±30	±44	0 to +70	B
	4709-02	±0.005 plus ±0.02 (1)	±0.03	±0.50	±30	±12	0 to +70	B
	4733	±0.005	±0.05	±0.50	±20	±20	0 to +70	C
	4733-83 (2)	±0.005	±0.05	±0.50	±20	±20	−55 to +125	C
1MHz	**4705**	±0.001 plus ±0.05 (1)	±0.1	±0.50	±50	±200	0 to +70	B
	4705-01	±0.0005 plus ±0.02 (1)	±0.1	±0.50	±50	±200	0 to +70	B
	4735	±0.015	±0.05	±0.50	±50	±30	0 to +70	C
	4735-83 (2)	±0.015	±0.05	±0.50	±50	±30	−55 to +125	C
5MHz	**4707**	±0.01 plus ±0.05 (1)	±0.1	±0.50	±100	±150	0 to +70	D
	4739 (3)	±0.05 plus ±0.001 (1)	±0.08 Typ	±1.0 Typ	±100 Typ	±75 Typ	0 to +70	C
10MHz	**4743 (3)**	±0.05 plus ±0.05 (1)	±0.08 Typ	±0.50 Typ	±100 Typ	±100 Typ	0 to +70	C

Notes:
1. Nonlinearity specification includes ±%FS plus ±% signal.
2. Screened to the high reliability requirements of MIL-STD-883, Method 5008.
3. Contact factory for extended temperature range and high reliability screening.

Packages:
A. Module, 1.5″ × 1.5″ × 0.4″
B. Module, 2.0″ × 2.0″ × 0.4″
C. 24 pin metal dual-in-line, 1.39″ × 0.8″ × 0.2″
D. Module, 3.0″ × 2.0″ × 0.4″

Modular Power Supplies

2200 SERIES **50Hz to 400Hz, 115V ±10V. For optional 230V ±20V operation, add −21 to**
2400 SERIES **model number. Models 2203, 2204, and 2206 operate from 115V or 230 Vac.**

		Model	Output		Regulation, Max.		Ripple and Noise	Limit Current mA (typ)	Case Size
			Voltage	Current	Line	Load			
PC Board Mounted	5 Volts	2206	5V DC	500mA	±0.10%	±0.15%	2mV p-p	250	C1
		2213	5V DC	1000mA	±0.6%	±0.1%	1mV p-p	1750	C5
		2223	5V DC	2000mA	±0.02%	±0.05%	1mV RMS	2700	C7
	±15 Volts	2203	±15V DC	±100mA	±0.03%	±0.03%	1mV RMS	50	C1
		2204	±15V DC	±50mA	±0.03%	±0.015%	1mV RMS	25	C1
		2208	±15V DC	±100mA	±0.03%	±0.03%	1mV RMS	50	C3
		2209	±15V DC	±50mA	±0.03%	±0.015%	1mV RMS	25	C4
		2215	±15V DC	±200mA	±0.02%	±0.05%	1mV RMS	60	C5
		2218	±15V DC	±350mA	±0.02%	±0.02%	0.5mV RMS	800	C7
	High Voltage	2217	±120V DC ±2%	±40mA	±0.1%	±0.1%	2mV RMS	60	C6
	Triple Output	2243	±15V 5V	±100mA 500mA	±0.02% ±0.02%	±0.03% ±0.05%	1mV RMS 1mV RMS	175 850	C8
Chassis Mounted	5 V	2413	±5V DC	+1000mA	±0.5%	±0.15%	2mV RMS	1750	Z
	+15 Volts	2415	±15V DC	±200mA	±0.05%	±0.05%	1mV RMS	350	Z
		2419	±15V DC	±500mA	±0.05%	±0.05%	1mV RMS	1100	Z

2300 SERIES DC to DC Converters

	Model	Output		Input			Regulation, Max.		Noise			Limit Current mA (typ)	Case Size
					Current								
		Voltage	Current	Voltage	No Load	Full Load	Line	Load	Output Voltage Noise, Max.	Reflected Input Ripple Current, Max.	Common Mode Noise Current		
PC BOARD MOUNTED	2301	±15V DC	±100mA	+5V DC	200mA	1000mA	±0.07%	±0.07%	1mV RMS	35mA p-p	200µA p-p	150	X
	2302	±15V DC	±150mA	+5V DC	200mA	1380mA	±0.07%	±0.07%	1mV RMS	48mA p-p	200µA p-p	225	X
	2331	±15V DC +5V DC	±165mA +750mA	+5V DC	500mA	3480mA	±0.1% ±1.0%	±0.1% ±1.0%	1mV RMS	122mA p-p	500µA p-p 700µA p-p	300 750	Y

CASE SIZES [inches (mm)]:
C1 = 3.55 × 2.5 × 1.05 (9.02 × 6.48 × 2.68)
C3 = 3.55 × 2.55 × 1.00 (9.02 × 6.48 × 2.54)
C4 = 3.55 × 2.55 × 0.88 (9.02 × 6.48 × 2.23)
C5 = 3.55 × 2.55 × 1.25 (9.02 × 6.48 × 3.17)
C6 = 3.55 × 2.55 × 2.00 (9.02 × 6.48 × 5.08)
C7 = 3.55 × 2.55 × 1.62 (9.02 × 6.48 × 4.11)
C8 = 3.55 × 2.55 × 1.88 (9.02 × 6.48 × 4.77)

X = 2 × 2 × 0.39 (5.13 × 5.13 × 0.99)
Y = 3 × 2.5 × 0.75 (7.62 × 6.50 × 1.90)
Z = 4.05 × 2.75 × 1.50 (10.29 × 6.99 × 3.81)

Application Note Packages

Linear Amplifiers

AN-3 Designing Femtoampere Circuits Requires Special Considerations

AN-4 Band-Pass Active Filter with Easy Trim for Center Frequency

AN-7 Typical Operational Amplifier Applications

AN-23 Operational Amplifier Parameter Definition and Measurement Guide

AN-29 The Instrumentation Amp vs. the Op Amp (connected as a differential amplifier); Which, When and How to Use Them

Nonlinear Products

AN-12 Designer's Guide to Logarithmic Amplifiers

AN-14 Applications for Models 4350/51 and 4362/63 Logarithmic Amplifiers

AN-15 How to Specify Parameters of Nonlinear Circuits

AN-27 Logarithmic Amplifiers and Operators Parameter Definition and Measurement

Power Supplies

AN-26 Modular DC Output Power Supply Parameter Definition and Measurement

Data Converters

AN-17 Current-Steering Chip Upgrades Performance of D/A Converter

AN-19 Using the 4130 ADC Series, 4855 Sample-Hold, and 4550 Multiplexer in High Speed Data Acquisition Systems

AN-21 Designing High Speed Data Acquisition Systems

AN-24 Specifying and Testing Analog to Digital Converters

AN-25 Specifying and Testing Digital to Analog Converters

AN-28 Repetitive Mode Operation for Models 4109/4111 Integrating A/D Converters

AN-30 Specifying and Testing Sample-Hold Amplifiers

AN-31 Specifying and Testing Multiplexers

Voltage-Frequency-Voltage

AN-1 Voltage-to-Frequency Converters

AN-2 Need a 1kHz Full Scale V/F?

AN-6 Magnitude-Plus-Sign ADC Using a V/F Converter

AN-9 V/F's as Long-Term Integrators

AN-11 V/F's, F/V's, and Audio Tape Recorders

AN-20 Solve Your Measurement Problems with V/F's and F/V's

AN-22 How to specify and Test Voltage-to-Frequency and Frequency-to-Voltage Converters

AN-32 V/F's and F/V's: Simple Solutions to Everyday Conversion Problems

Printed in U.S.A. 6/83

TELEDYNE PHILBRICK – MICROCIRCUITS

U.S.A.

TELEDYNE PHILBRICK
MICROCIRCUITS

Headquarters

Allied Drive @ Route 128
Dedham, MA. 02026

Tel: (617) 329-1600
TWX: 710 348-6726
Telex: 92-4439

East

Allied Drive @ Route 128
Dedham, MA. 02026

Tel: (617) 329-1600
TWX: 710 348-6726
Telex: 92-4439

Midwest

7918 North Mississippi Lane
Brooklyn Park (Mpls.), MN 55444

Tel: (612) 560-3705

West

30941 Agoura Road
Suite 220
Westlake Village, CA 91361

Tel: (213) 889-3827
TWX: 910 494-1949

Europe

TELEDYNE PHILBRICK
MICROCIRCUITS

France:

85 Rue Anatole France
92300 Levallois Perret, France

Tel: (1) 757.19.40
Telex: (842) 611752

United Kingdom:

Heathrow House, Bath Road
Cranford, Hounslow, Middlesex
TW5 9QQ UK

Tel: (01) 897-2501
Telex: (851) 935008

West Germany:

Abraham-Lincoln-Str. 38-42
6200 Wiesbaden, West Germany

Tel: 06121-768-0
Telex: (841) 4186846

Falkenstr. 12
2800 Bremen 1, West Germany

Tel: 0421-313919
Telex: (841) 244016

Japan:

TELEDYNE PHILBRICK
MICROCIRCUITS

Nihon Seimei Akasaka
8-1-19, Akasaka
Minato-ku, Tokyo 107, Japan

Tel: (03) 403-8921
Telex: (781) 02424241

Osaka:

Tel: (06) 647-0936