HEWLETT PACKARD

ITA-12300, ITA-12318
MagIC™ Silicon Bipolar MMIC
0.8 Gb/s Transimpedance Amplifier

Features

- **High Transimpedance Gain: A_Z = 4200 Ω (72.5 dB)**
- **High Data Rates: 0.8 Gb/s NRZ**
- **Wide Band width: 900 MHz (Chip)**
  750 MHz (Packaged)
- **Low Noise: 2.8 pA/√Hz at 100 MHz**
- **Single Power Supply: +5 V or -5.2 V**
- **Low Power Consumption: 210 mW**
- **Available in Chip Form and Hermetic Glass–Metal Surface Mount Package**

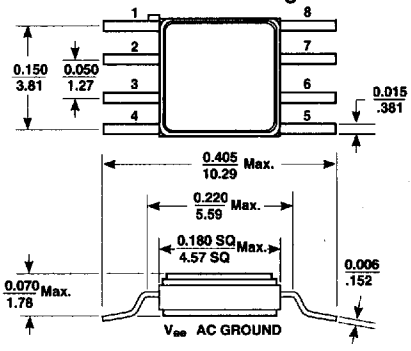
Description

The ITA-123 series of high-performance transimpedance amplifiers is available in either chip form, ITA-12300 or housed in a miniature glass-metal hermetic surface-mount package, ITA-12318. These devices are designed for use in fiber-optic receivers that require high transimpedance gain, wide bandwidth, reduced power consumption, and low noise.

Typical applications include fiber-optic systems such as high-speed data communications, point to point (Fiber Channel), networks (LAN, MAN), and telecommunications (SONET) with data rates up to 0.8 Gb/s.

The ITA series of transimpedance amplifiers is fabricated using HP's 10 GHz f_T, 25 GHz f_{max} ISOSAT™-1 silicon bipolar process which uses nitride self-alignment, submicrometer lithography, trench isolation, ion implantation, gold metalization and polyimide inter-metal dielectric and scratch protection to achieve excellent performance, uniformity and reliability. The recommended assembly procedure for the ITA-12300 chip is gold eutectic die attach at 400°C and either wedge or ball bonding using 0.7 mil. gold wire.[1]

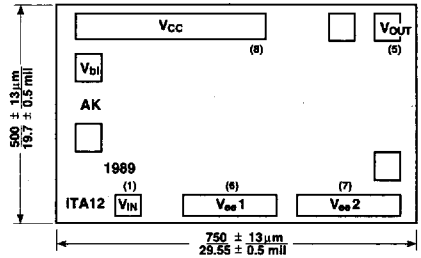
180 mil Package



PIN DESCRIPTION			
1	Input	8	V_{cc}
2	V_{ee}, AC Ground	7	V_{ee}
3	V_{ee}, AC Ground	6	V_{ee}
4	NC	5	V_{out}
Bottom of Package is V_{ee} (AC Ground)			

Notes:
(unless otherwise specified)
1. Dimensions are in / mm
2. Tolerances
   in .xxx = ±.005
   mm .xx = ±.13

ITA-12300 Chip Outline



Chip Thickness is 140 µm / 5.5 mil. (nominal)
Bond Pads are 50 µm / 1.97 mil. (nominal)

Electrical Specifications[2], T_A = 25°C

Symbol	Parameters and Test Conditions: V_{cc} = 5V, V_{ee} = 0V, Z_L = 50 Ω		Units	ITA-12318 180 mil.			ITA-12300[3] 00 (Chip)		
				Min.	Typ.	Max.	Min.	Typ.	Max.
A_Z	Transimpedance Gain	f = 100 MHz	ohms	3800	4200			4200	
F_{3dB}	Small Signal -3 dB Bandwidth[4, 5]		MHz	600	750			900	
ΔA_Z	Frequency Response Gain Peak[4, 5]		dB		0.2	0.7		0.2	
I_n	Input Current Noise Spectral Density[4]	f = 100 MHz	pA/√Hz		2.8			2.8	
V_{op-p}	Output Voltage Swing (peak to peak)	f = 50 MHz	V_{p-p}		1.2			1.2	
VSWR	Output VSWR	f = 50 to 1000 MHz			2:1			2:1	
I_{MAX}	Maximum Input Current Before Input Overload[6]	f = 50 MHz	μA_{p-p}		400			400	
I_d	Device Quiescent Current		mA	30	43	55	30	43	55
V_{in}	Input Quiescent Voltage (Pin 1)		Vdc		2.2			2.2	
V_{OUT}	Output Quiescent Voltage (Pin 5)		Vdc		2.2			2.2	

Notes:
1. See Application Note, "AN-A005: Transistor Chip Use" for additional information.
2. The recommended operating voltage range for this device is 4.75 to 5.5 V.
3. RF performance of chip is determined by testing 10 devices per wafer in a 180 mil package.
4. Assumes photodiode capacitance, C_{PD},<0.5 pF.
5. Referenced from 100 MHz.
6. Input overload is defined as output duty cycle distortion ≥ ±10%.

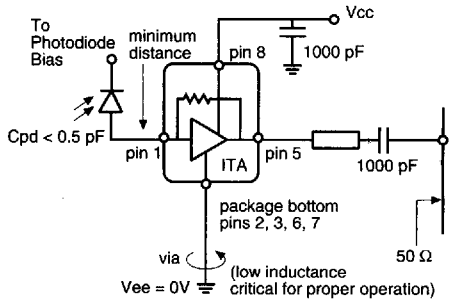
Absolute Maximum Ratings

Parameter	Absolute Maximum[1]
Device Voltage	8 V
Power Dissipation[2, 3]	700 mW
V_{in}-V_{ee}	3.0 V
Junction Temperature	200°C
Storage Temperature	-65 to 200°C

Thermal Resistance: θ_{jc} = 50°C/W (ITA-12318)
θ_{jc} = 25°C/W (ITA-12300)

Notes:
1. Permanent damage may occur if any of these limits are exceeded.
2. T_{case} = 25°C (ITA-12318), $T_{mounting\ surface}$ = 25°C (ITA-12300)
3. Derate at 20 mW/°C for T_{case} > 165°C (ITA-12318)
   Derate at 40 mW/°C for $T_{mounting\ surface}$ > 182°C (ITA-12300)

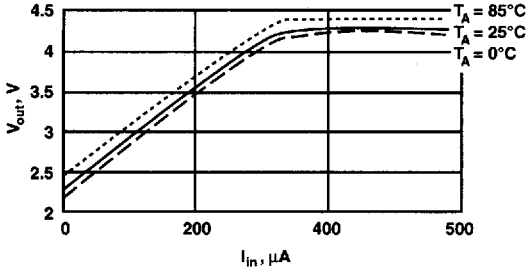
ITA-12318 Typical Biasing Configuration and Functional Block Diagram



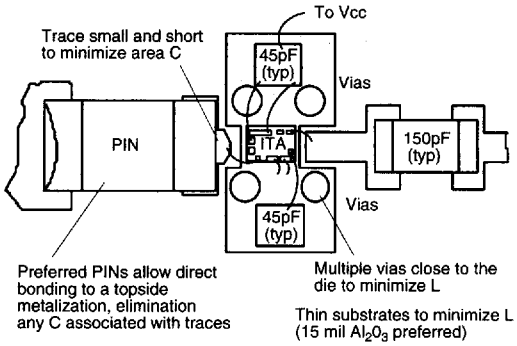
Typical Performance, T_A = 25°C, V_{cc} = 5V, V_{ee} = 0V, Z_L = 50 Ω, C_{PD} < 0.5 pF

(Unless otherwise noted)

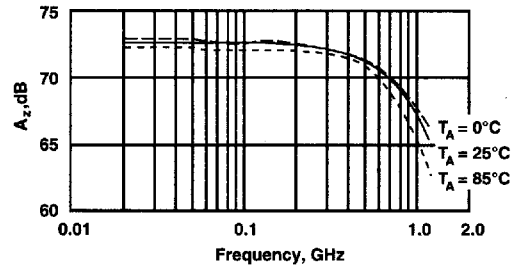
ITA-12300/ITA-12318 DC Input/Output Characteristics No Load



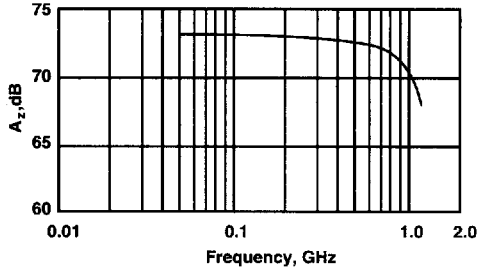
ITA-12300 Circuit Layout



ITA-12318 Typical Transimpedance Gain vs. Frequency

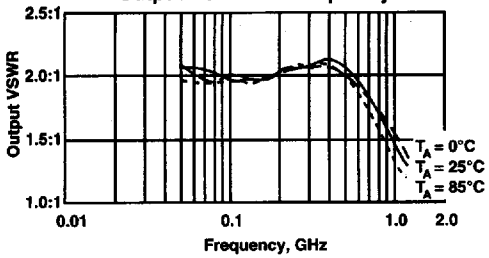


ITA-12300 Typical Transimpedance Gain vs. Frequency

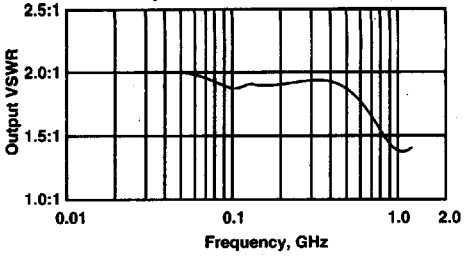


FIBER OPTICS

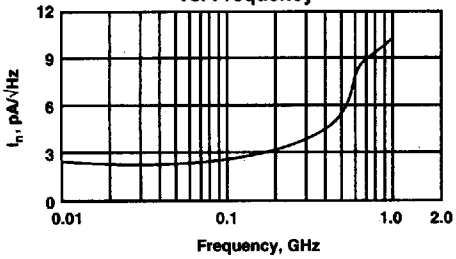
ITA-12318
Output VSWR vs. Frequency



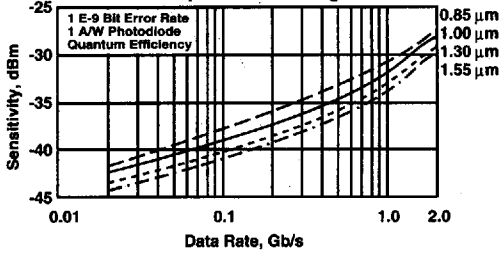
ITA-12300
Output VSWR vs. Frequency



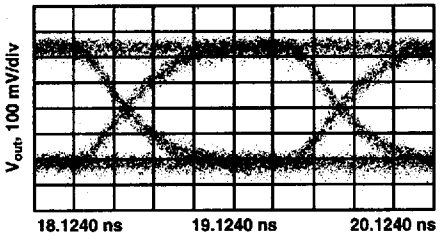
ITA-12300/ITA-12318
Equivalent Input Current Noise
vs. Frequency



ITA-12300/ITA-12318
Calculated Sensitivity vs. Data Rate
and Optical Wavelength



ITA-12318
Eye Diagram, 622 Mb/s
Photo current = 100 µA P-P, PRBS = 2^{31} - 1



Typical ITA-12318 Scattering Parameters: $Z_O = 50\ \Omega$

$T_A = 25°C$, Vcc = 5 V

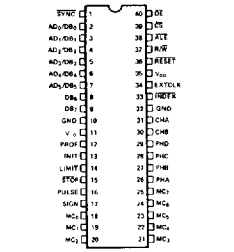
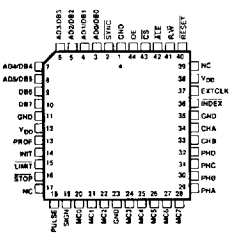
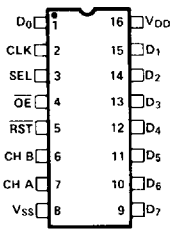
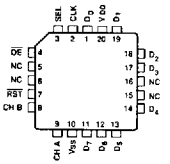
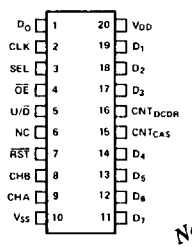
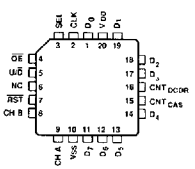
Freq.	S_{11}		S_{21}			S_{12}			S_{22}		
MHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang	k
50	.57	-1.0	31.70	38.57	-10.0	-49.50	.003	-131.0	.36	164.0	2.23
100	.57	1.0	31.50	37.60	-22.0	-49.60	.003	18.0	.33	160.0	2.65
150	.59	2.0	31.20	36.14	-32.0	-55.00	.002	-59.0	.33	157.0	4.68
200	.60	2.0	30.70	34.32	-41.0	-64.00	.001	148.0	.34	151.0	12.92
250	.62	1.0	30.40	32.91	-50.0	-55.50	.002	-32.0	.34	144.0	5.15
300	.63	0.0	30.00	31.58	-59.0	-56.80	.002	-83.0	.35	137.0	5.37
350	.63	-2.0	29.60	30.29	-66.0	-55.80	.002	-26.0	.35	129.0	5.55
400	.64	-3.0	29.30	29.21	-74.0	-57.10	.001	74.0	.35	122.0	6.47
450	.65	-4.0	29.00	28.25	-81.0	-54.80	.002	-135.0	.35	115.0	4.84
500	.65	-5.0	28.80	27.52	-89.0	-66.60	0.000	145.0	.35	106.0	9.06
550	.65	-7.0	28.60	26.85	-96.0	-57.50	.001	20.0	.35	98.0	7.30
600	.65	-8.0	28.40	26.26	-104.0	-52.40	.002	114.0	.33	90.0	4.03
650	.65	-9.0	28.20	25.52	-112.0	-61.30	.001	-56.0	.33	83.0	11.82
700	.65	-10.0	27.90	24.91	-120.0	-53.40	.002	-169.0	.31	72.0	4.73
750	.65	-11.0	27.70	24.17	-128.0	-62.70	.001	-117.0	.29	63.0	15.10
800	.65	-12.0	27.50	23.57	-136.0	-54.90	.002	155.0	.27	52.0	6.21
850	.65	-13.0	27.20	22.78	-144.0	-47.40	.004	177.0	.25	40.0	2.69
900	.65	-14.0	26.90	22.05	-153.0	-64.50	.001	-168.0	.23	28.0	20.61
950	.65	-15.0	26.40	20.86	-161.0	-49.60	.003	131.0	.21	15.0	3.96
1000	.65	-15.0	26.10	20.15	-169.0	-61.40	.001	-167.0	.18	4.0	16.16
1050	.65	-16.0	25.60	19.07	-177.0	-55.40	.002	-176.0	.17	-12.0	8.57
1100	.65	-16.0	25.10	18.04	175.0	-50.10	.003	144.0	.15	-24.0	4.96
1150	.65	-17.0	24.60	17.06	168.0	-44.80	.006	157.0	.14	-41.0	2.82
1200	.65	-18.0	24.10	16.05	160.0	-47.20	.004	163.0	.12	-58.0	4.01

Typical ITA-12300 Scattering Parameters: $Z_O = 50\ \Omega$

$T_A = 25°C$, Vcc = 5 V

Freq.	S_{11}		S_{21}			S_{12}			S_{22}		
MHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang	k
50	.52	-2.0	32.40	41.51	-9.0	-48.00	.004	1.0	.35	171.0	2.20
100	.53	2.0	32.20	40.62	-19.0	-69.80	0.000	-159.0	.34	169.0	7.67
150	.54	4.0	31.90	39.43	-28.0	-52.20	.002	-97.0	.35	166.0	3.19
200	.55	4.0	31.60	38.21	-37.0	-57.60	.001	86.0	.35	162.0	6.18
250	.56	4.0	31.30	36.65	-45.0	-62.20	.001	29.0	.35	157.0	10.77
300	.58	4.0	31.00	35.31	-52.0	-54.60	.002	48.0	.35	151.0	4.65
350	.58	4.0	31.00	34.26	-60.0	-53.20	.002	43.0	.35	145.0	4.10
400	.59	3.0	30.40	33.17	-67.0	-67.00	0.000	95.0	.34	138.0	8.79
450	.60	2.0	30.20	32.16	-74.0	-60.90	.001	-96.0	.33	132.0	9.69
500	.61	2.0	29.90	31.31	-81.0	-53.70	.002	164.0	.32	125.0	4.28
550	.61	2.0	29.70	30.57	-88.0	-58.70	.001	-175.0	.31	117.0	7.82
600	.62	1.0	29.50	29.77	-95.0	-58.90	.001	-7.0	.29	110.0	8.54
650	.62	0.0	29.20	28.93	-103.0	-48.10	.004	-139.0	.27	101.0	2.37
700	.63	0.0	29.00	28.20	-110.0	-49.70	.003	159.0	.25	92.0	3.02
750	.63	-1.0	28.70	27.36	-117.0	-55.00	.002	41.0	.23	82.0	5.99
800	.63	-1.0	28.40	26.30	-125.0	-46.40	.005	136.0	.20	72.0	2.27
850	.64	-2.0	28.10	25.26	-133.0	-47.30	.004	164.0	.18	59.0	2.60
900	.64	-3.0	27.70	24.21	-140.0	-52.20	.002	179.0	.15	47.0	4.76
950	.64	-3.0	27.30	23.20	-147.0	-45.60	.005	161.0	.13	31.0	2.37
1000	.64	-4.0	26.80	21.81	-155.0	-45.50	.005	-178.0	.11	12.0	2.48
1050	.65	-4.0	26.40	20.85	-161.0	-43.20	.007	125.0	.10	-6.0	2.01
1100	.65	-5.0	25.90	19.64	-169.0	-45.20	.006	157.0	.10	-32.0	2.64
1150	.65	-5.0	25.30	18.45	-175.0	-45.60	.005	166.0	.10	-52.0	2.96
1200	.65	-6.0	24.80	17.30	178.0	-44.50	.006	153.0	.11	-65.0	2.75

Motion Control ICS – HCTL-XXXX Series

Package Outline Drawing	Part No.	Package	Description	Page No.
	HCTL-1100	PDIP	CMOS General Purpose Motion Control IC	1-104
	HCTL-1100 OPT PLC	PLCC	CMOS General Purpose Motion Control IC	
	HCTL-2000	PDIP	CMOS Quadrature Decoder/Counter IC, 12-bit Counter	1-86
	HCTL-2016	PDIP	CMOS Quadrature Decoder/Counter IC, 16-bit Counter	
	*New* HCTL-2016 OPT PLC	PLCC	CMOS Quadrature Decoder/Counter IC, 16-bit Counter	1-102
	HCTL-2020	PDIP	CMOS Quadrature Decoder/Counter IC, 16-bit Counter, Quadrature Decoder Output Signals, Cascade Output Signals	1-86
	*New* HCTL-2020 OPT PLC	PLCC	CMOS Quadrature Decoder/Counter IC, 16-bit Counter, Quadrature Decoder Output Signals, Cascade Output Signals	1-102

Accessories for Encoders and Encoder Modules

Package Outline Drawing	Part No.	Description	Page No.
	HEDS-8902	4-wire connector with 15.5 cm (6.1 in.) flying leads. Locks into HEDS-5500 and HEDS-5600 2 channel encoders. Also fits HEDS-9000, HEDS-9100, and HEDS-9200 2 channel encoder modules.	1-61 1-22 1-28
	HEDS-8903	5-wire connector with 15.5 cm (6.1 in.) flying leads. Locks into HEDS-5540 and HEDS-5640 three channel encoders. Also fits HEDS-9040 and HEDS-9140 three channel encoder modules.	1-61 1-32
	HEDS-8905	Alignment Tool for HEDS-9140	1-32
	HEDS-8906	Alignment Tool for HEDS-9040	1-32
	HEDS-8901	Gap Setting shown for film codewheels	1-51
	HEDS-8932	Gap Setting shown for glass codewheels	1-51
	HEDS-8910 OPT 0 □□	Alignment Tool for HEDS-5540/5545 and HEDS-5640/5645. Order in appropriate shaft size.	1-61