

LT1178/LT1179

ABSOLUTE MAXIMUM RATINGS (Note 1)

Supply Voltage $\pm 22\text{V}$
 Differential Input Voltage $\pm 30\text{V}$
 Input Voltage Equal to Positive Supply Voltage
 Input Voltage 5V Below Negative Supply Voltage
 Output Short-Circuit Duration Indefinite

Operating Temperature Range
 LT1178I/LT1179I -40°C to 85°C
 LT1178C/LT1178S/LT1179C/LT1179S 0°C to 70°C
 Storage Temperature Range -65°C to 150°C
 Lead Temperature (Soldering, 10 sec.) 300°C

PACKAGE/ORDER INFORMATION

TOP VIEW OUT A 1 -IN A 2 IN A 3 V- 4 +IN B 5 -IN B 6 OUT B 7 V+ 8 H PACKAGE 8-LEAD TO-5 METAL CAN	ORDER PART NUMBER LT1178ACH LT1178CH	TOP VIEW OUT A 1 -IN A 2 +IN A 3 V- 4 OUT B 7 -IN B 6 +IN B 5 N PACKAGE 8-LEAD PDIP $T_{JMAX} = 100^{\circ}\text{C}$, $\theta_{JA} = 150^{\circ}\text{C/W}$ J PACKAGE 8-LEAD CERDIP	ORDER PART NUMBER LT1178ACN8 LT1178CN8 LT1178IN8	TOP VIEW +IN A 1 V- 2 +IN B 3 -IN B 4 OUT B 5 V+ 6 OUT A 7 -IN A 8 S8 PACKAGE 8-LEAD PLASTIC SO $T_{JMAX} = 150^{\circ}\text{C}$, $\theta_{JA} = 200^{\circ}\text{C/W}$	ORDER PART NUMBER LT1178S8 PART MARKING 1178
TOP VIEW OUT A 1 -IN A 2 +IN A 3 V+ 4 +IN B 5 -IN B 6 OUT B 7 OUT C 8 -IN C 9 +IN C 10 V- 11 +IN D 12 -IN D 13 OUT D 14 N PACKAGE 14-LEAD PDIP $T_{JMAX} = 110^{\circ}\text{C}$, $\theta_{JA} = 130^{\circ}\text{C/W}$ J PACKAGE 14-LEAD CERAMIC DIP	ORDER PART NUMBER LT1179ACN LT1179CN LT1179IN	Not Recommended. Use LT1178S8 for New Designs. TOP VIEW NC 1 OUT A 2 -IN A 3 IN A 4 V- 5 +IN B 6 -IN B 7 OUT B 8 NC 9 V+ 10 +IN C 11 -IN C 12 OUT C 13 -IN D 14 +IN D 15 NC 16 SW PACKAGE 16-LEAD PLASTIC SO WIDE $T_{JMAX} = 150^{\circ}\text{C}$, $\theta_{JA} = 90^{\circ}\text{C/W}$	ORDER PART NUMBER LT1178SW LT1179SW	TOP VIEW OUT A 1 -IN A 2 +IN A 3 V+ 4 +IN B 5 -IN B 6 OUT B 7 OUT C 8 NC 9 -IN C 10 +IN C 11 V- 12 +IN D 13 -IN D 14 OUT D 15 NC 16 SW PACKAGE 16-LEAD PLASTIC SO WIDE $T_{JMAX} = 150^{\circ}\text{C}$, $\theta_{JA} = 90^{\circ}\text{C/W}$	

LT11778/1179 • PO10

Consult LTC Marketing for parts specified with wider operating temperature ranges. Please note that the LT1178S8 surface mount pinout differs from that of the LT1178 standard plastic or ceramic dual-in-line packages. For similar performance with standard pinout, see the LT2178.

ELECTRICAL CHARACTERISTICS $V_S = 5\text{V}$, 0V ; $V_{CM} = 0.1\text{V}$, $V_O = 1.4\text{V}$, $T_A = 25^{\circ}\text{C}$, unless noted.

SYMBOL	PARAMETER	CONDITIONS (NOTE 2)	LT1178AC/LT1179AC			LT1178I/C/S/LT1179I/C/S			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{OS}	Input Offset Voltage	LT1178		30	70		40	120	μV
		LT1179		35	100		40	150	μV
		LT1178SW					80	450	μV
		LT1179SW					90	600	μV
		LT1178S8					60	180	μV
$\frac{\Delta V_{OS}}{\Delta \text{Time}}$	Long Term Input Offset Voltage Stability			0.5			0.6		$\mu\text{V/Mo}$
I_{OS}	Input Offset Current			0.05	0.25		0.05	0.35	nA

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ELECTRICAL CHARACTERISTICS

$V_S = 5V$, $0V$; $V_{CM} = 0.1V$, $V_O = 1.4V$, $T_A = 25^\circ C$, unless noted.

SYMBOL	PARAMETER	CONDITIONS (NOTE 2)	LT1178AC/LT1179AC			LT1178I/C/S/LT1179I/C/S			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
I_B	Input Bias Current			3	5		3	6	nA
e_n	Input Noise Voltage	0.1Hz to 10Hz (Note 3)		0.9	2.0		0.9		μV_{P-P}
	Input Noise Voltage Density	$f_0 = 10Hz$ (Note 3) $f_0 = 1000Hz$ (Note 3)		50 49	75 65		50 49		$nV/\sqrt{Hz}$ $nV/\sqrt{Hz}$
i_n	Input Noise Current	0.1Hz to 10Hz (Note 3)		1.5	2.5		1.5		pA _{p-p}
	Input Noise Current Density	$f_0 = 10Hz$ (Note 3) $f_0 = 1000Hz$		0.03 0.01	0.07		0.03 0.01		$pA/\sqrt{Hz}$ $pA/\sqrt{Hz}$
	Input Resistance Differential Mode Common Mode	(Note 4)	0.8	2.0 12		0.6	2.0 12		$G\Omega$ $G\Omega$
	Input Voltage Range		3.5 0	3.9 -0.3		3.5 0	3.9 -0.3		V V
CMRR	Common Mode Rejection Ratio	$V_{CM} = 0V$ to $3.5V$	93	103		90	102		dB
PSRR	Power Supply Rejection Ratio	$V_S = 2.2V$ to $12V$	94	104		92	104		dB
A_{VOL}	Large Signal Voltage Gain	$V_O = 0.03V$ to $4V$, No Load (Note 4) $V_O = 0.03V$ to $3.5V$, $R_L = 50k$	140 80	700 200		110 70	700 200		V/mV V/mV
	Maximum Output Voltage Swing	Output Low, No Load Output Low, 2k to GND Output Low, $I_{SINK} = 100\mu A$ Output High, No Load Output High 2k to GND		6.5 0.2 120 4.2 3.5	9 0.6 160		6.5 0.2 120 4.4 3.8		mV mV mV V V
SR	Slew Rate	$A_V = 1$, $C_L = 10pF$ (Note 4)	0.013	0.025		0.013	0.025		V/ μs
GBW	Gain Bandwidth Product	$f_0 \leq 5kHz$		60			60		kHz
I_S	Supply Current per Amplifier	$V_S = \pm 1.5V$, $V_O = 0V$		13 12	18 17		14 13	21 20	μA μA
	Channel Separation	$\Delta V_{IN} = 3V$, $R_L = 10k$		130			130		dB
	Minimum Supply Voltage	(Note 5)		2.0	2.2		2.0	2.2	V

ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range of $-40^{\circ}\text{C} \leq T_A \leq 85^{\circ}\text{C}$ for I grades, $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$ for SW grades, $V_S = 5\text{V}$, 0V ; $V_{CM} = 0.1\text{V}$, $V_O = 1.4\text{V}$, unless noted. (Note 7)

SYMBOL	PARAMETER	CONDITIONS		LT1178I/LT1179I			LT1178SW/LT1179SW			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{OS}	Input Offset Voltage	LT1178 LT1179	● ●		80 80	315 345	120 130	650 800		μV μV
$\Delta V_{OS}/\Delta T$	Input Offset Voltage Drift	(Note 6)	●		0.6	3.0	0.8	4.5		$\mu\text{V}/^{\circ}\text{C}$
I_{OS}	Input Offset Current		●		0.07	0.7	0.06	0.50		nA
I_B	Input Bias Current		●		4	8	3	7		nA
CMRR	Common Mode Rejection Ratio	$V_{CM} = 0.05\text{V}$ to 3.2V I grade $V_{CM} = 0\text{V}$ to 3.4V S grade	●	84	98		86	100		dB
PSRR	Power Supply Rejection Ratio	$V_S = 3.0\text{V}$ to 12V I grade $V_S = 2.5\text{V}$ to 12V S grade	●	86	100		88	102		dB
A_{VOL}	Large-Signal Voltage Gain	$V_O = 0.05\text{V}$ to 4V , No Load (Note 4) $V_O = 0.05\text{V}$ to 3.5V , $R_L = 50\text{k}$	● ●	55 35	350 130		80 45	500 160		V/mV V/mV
	Maximum Output Voltage Swing	Output Low, No Load Output Low, $I_{SINK} = 100\mu\text{A}$ Output High, No Load Output High, 2k to GND	● ● ● ●		9 160 4.2 3.7	13 220		8 140 4.3 3.8	11 190	mV mV V V
I_S	Supply Current per Amplifier		●		15	27	15	24		μA

The ● denotes specifications which apply over the full operating temperature range of $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$, $V_S = 5\text{V}$, 0V , $V_{CM} = 0.1\text{V}$, $V_O = 1.4\text{V}$, unless noted.

SYMBOL	PARAMETER	CONDITIONS		LT1178AC/LT1179AC			LT1178C/S8/LT1179C			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{OS}	Input Offset Voltage	LT1178 LT1178S8 LT1179	● ● ●		50 60	170 200	65 85 70	250 350 290		μV μV μV
$\Delta V_{OS}/\Delta T$	Input Offset Voltage Drift	(Note 6) LT1178S8	● ●		0.5	2.2	0.6 0.6	3.0 3.5		$\mu\text{V}/^{\circ}\text{C}$ $\mu\text{V}/^{\circ}\text{C}$
I_{OS}	Input Offset Current		●		0.06	0.35	0.06	0.50		nA
I_B	Input Bias Current		●		3	6	3	7		nA
CMRR	Common Mode Rejection Ratio	$V_{CM} = 0\text{V}$ to 3.4V	●	90	101		86	100		dB
PSRR	Power Supply Rejection Ratio	$V_S = 2.5\text{V}$ to 12V	●	90	102		88	102		dB
A_{VOL}	Large-Signal Voltage Gain	$V_O = 0.05\text{V}$ to 4V , No Load (Note 4) $V_O = 0.05\text{V}$ to 3.5V , $R_L = 50\text{k}$	● ●	105 55	500 160		80 45	500 160		V/mV V/mV
	Maximum Output Voltage Swing	Output Low, No Load Output Low, $I_{SINK} = 100\mu\text{A}$ Output High, No Load Output High, 2k to GND	● ● ● ●		8 140 4.3 3.8	11 190		8 140 4.3 3.8	11 190	mV mV V V
I_S	Supply Current per Amplifier		●		14	21	15	24		μA

ELECTRICAL CHARACTERISTICS $V_S = \pm 15V$, $T_A = 25^\circ C$, unless noted.

SYMBOL	PARAMETER	CONDITIONS	LT1178AC/LT1179AC			LT1178I/C/S/LT1179I/C/S			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{OS}	Input Offset Voltage	LT1178SW LT1179SW LT1178S8		80	350		100 150 160 120	480 900 1050 350	μV μV μV μV
I_{OS}	Input Offset Current			0.05	0.25		0.05	0.35	nA
I_B	Input Bias Current			3	5		3	6	nA
	Input Voltage Range		13.5 -15.0	13.9 -15.3		13.5 -15.0	13.9 -15.3		V V
CMRR	Common Mode Rejection Ratio	$V_{CM} = 13.5V, -15V$	97	106		94	106		dB
PSRR	Power Supply Rejection Ratio	$V_S = 5V, 0V$ to $\pm 18V$	96	112		94	112		dB
A_{VOL}	Large-Signal Voltage Gain	$V_O = \pm 10V, R_L = 50k$ $V_O = \pm 10V$, No Load	300 600	1200 2500		250 400	1000 2500		V/mV V/mV
V_{OUT}	Maximum Output Voltage Swing	$R_L = 50k$ $R_L = 2k$	± 13.0 ± 11.0	± 14.2 ± 12.7		± 13.0 ± 11.0	± 14.2 ± 12.7		V V
SR	Slew Rate	$A_V = 1$	0.02	0.04		0.02	0.04		V/ μs
GBW	Gain Bandwidth Product	$f_0 \leq 5kHz$		85			85		kHz
I_S	Supply Current per Amplifier			16	21		17	25	μA

The ● denotes specifications which apply over the full operating temperature range of $-40^\circ C \leq T_A \leq 85^\circ C$ for I grades, $0^\circ C \leq T_A \leq 70^\circ C$ for SW grades, $V_S = \pm 15V$, unless noted.

SYMBOL	PARAMETER	CONDITIONS		LT1178I/LT1179I			LT1178SW/LT1179SW			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{OS}	Input Offset Voltage	LT1178 LT1179	● ●		130 130	740 740		190 200	1150 1300	μV μV
$\Delta V_{OS}/\Delta T$	Input Offset Voltage Drift	(Note 6)	●		0.7	4.0		0.9	5.5	$\mu V/^\circ C$
I_{OS}	Input Offset Current		●		0.07	0.7		0.06	0.35	nA
I_B	Input Bias Current		●		4	8		3	7	nA
A_{VOL}	Large-Signal Voltage Gain	$V_O = \pm 10V, R_L = 50k$	●		100	500		150	750	V/mV
CMRR	Common Mode Rejection Ratio	$V_{CM} = 13V, -14.9V$	●		88	103		91	104	dB
PSRR	Power Supply Rejection Ratio	$V_S = 5V, 0V$ to $\pm 18V$	●		88	109		91	110	dB
	Maximum Output Voltage Swing	$R_L = 5k$	●	± 11.0	± 13.5		± 11.0	± 13.5		V
I_S	Supply Current per Amplifier		●		19	30		18	28	μA

LT1178/LT1179

ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range of $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$, $V_S = \pm 15\text{V}$, unless noted.

The ● denotes specifications which apply over the full operating temperature range of $0^{\circ}\text{C} \leq T_A \leq 70^{\circ}\text{C}$, $V_S = \pm 15\text{V}$, unless noted.

SYMBOL	PARAMETER	CONDITIONS		LT1178AC/LT1179AC			LT1178C/S8/LT1179C			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{OS}	Input Offset Voltage	LT1178S8	●		100	480		130	660	μV
			●					150	540	μV
$\Delta V_{OS}/\Delta T$	Input Offset Voltage Drift	(Note 6) LT1178S8	●		0.6	2.8		0.7	4.0	$\mu\text{V}/^{\circ}\text{C}$
			●					0.7	3.8	$\mu\text{V}/^{\circ}\text{C}$
I_{OS}	Input Offset Current		●		0.06	0.35		0.06	0.35	nA
I_B	Input Bias Current		●		3	6		3	7	nA
A_{VOL}	Large-Signal Voltage Gain	$V_O = \pm 10\text{V}$, $R_L = 50\text{k}$	●	200	800		150	750		V/mV
CMRR	Common Mode Rejection Ratio	$V_{CM} = 13\text{V}$, -15V	●	94	104		91	104		dB
PSRR	Power Supply Rejection Ratio	$V_S = 5\text{V}$, 0V to $\pm 18\text{V}$	●	93	110		91	110		dB
	Maximum Output Voltage Swing	$R_L = 5\text{k}$	●	± 11.0	± 13.6		± 11.0	± 13.6		V
I_S	Supply Current per Amplifier		●		17	24		18	28	μA

Note 1: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Note 2: Typical parameters are defined as the 60% yield of parameter distributions of individual amplifiers; (i.e., out of 100 LT1179s, or 100 LT1178s, typically 240 op amps, or 120, will be better than the indicated specification).

Note 3: This parameter is tested on a sample basis only. All noise parameters are tested with $V_S = \pm 2.5$, $V_O = 0\text{V}$.

Note 4: This parameter is guaranteed by design and is not tested.

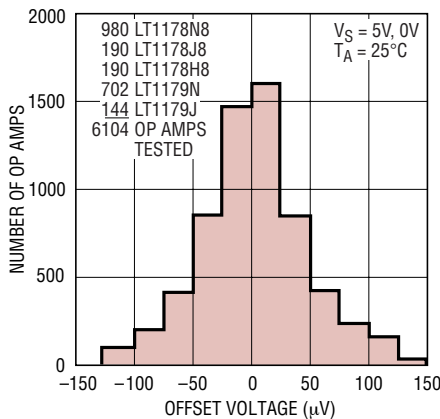
Note 5: Power supply rejection ratio is measured at the minimum supply voltage. The op amps actually work at 1.7V supply but with a typical offset skew of $-300\mu\text{V}$.

Note 6: This parameter is not 100% tested.

Note 7: During testing at -40°C , the 5V power supply turn on-time is less than 0.5 seconds.

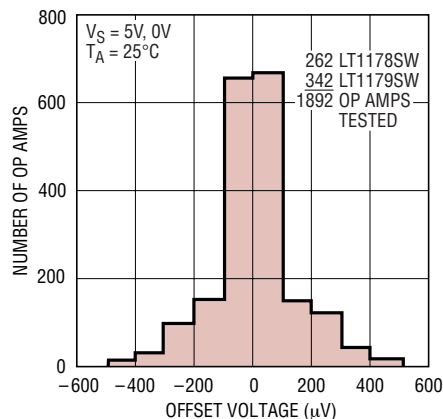
TYPICAL PERFORMANCE CHARACTERISTICS

Input Offset Voltage Distribution
N, J, H Package



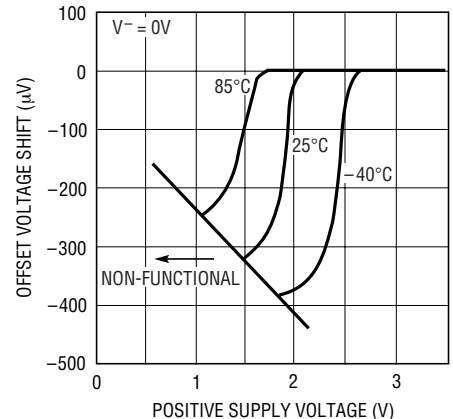
LT1178/LT1179 • TP001

Input Offset Voltage Distribution
Surface Mount Package



LT1178/LT1179 • TP002

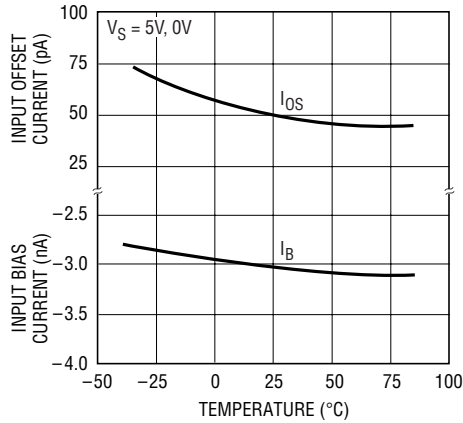
Minimum Supply Voltage



LT1178/LT1179 • TP003

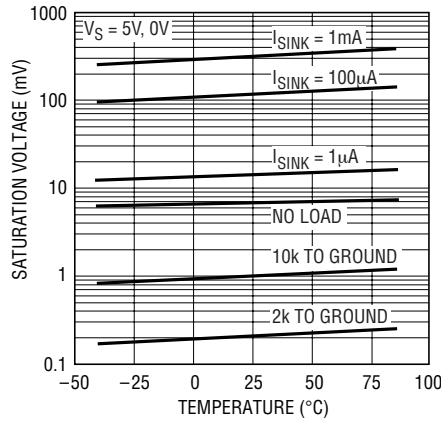
TYPICAL PERFORMANCE CHARACTERISTICS

Input Bias and Offset Currents vs Temperature



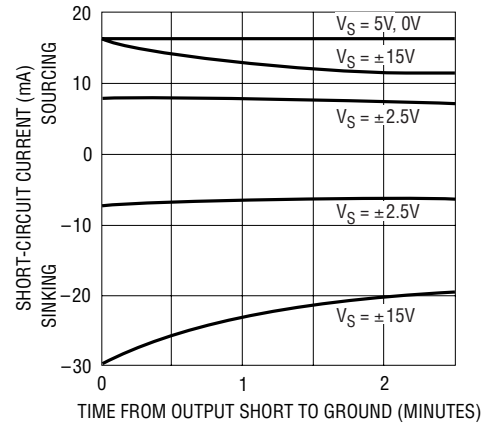
LT1178/LT1179 • TPC04

Output Saturation vs Temperature vs Sink Current



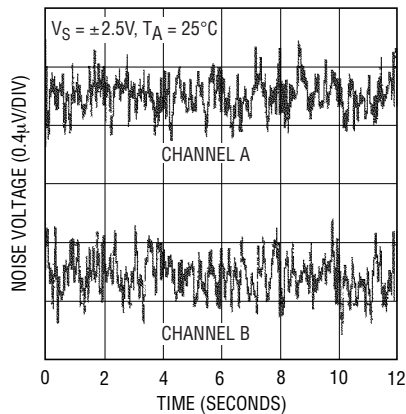
LT1178/LT1179 • TPC05

Short-Circuit Current



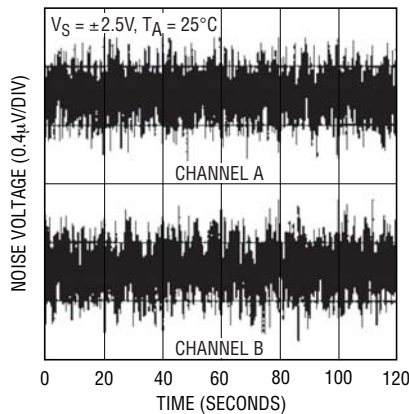
LT1178/LT1179 • TPC06

0.1Hz to 10Hz Noise



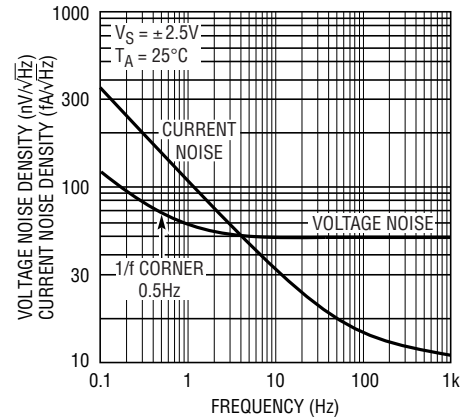
LT1178/LT1179 • TPC07

0.01Hz to 10Hz Noise



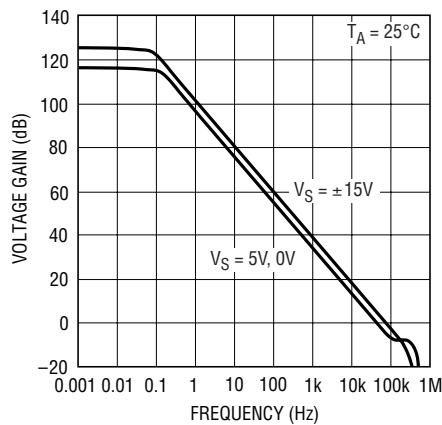
LT1178/LT1179 • TPC08

Noise Spectrum



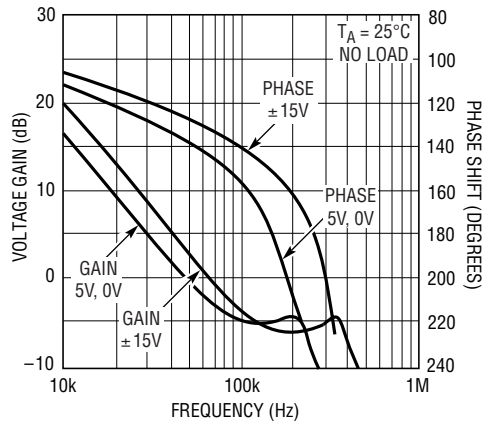
LT1178/LT1179 • TPC09

Voltage Gain vs Frequency



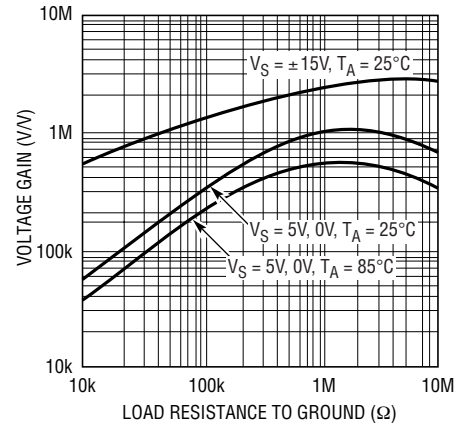
LT1178/LT1179 • TPC10

Gain, Phase vs Frequency



LT1178/LT1179 • TPC11

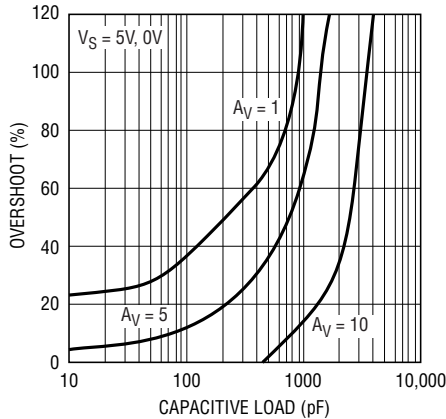
Voltage Gain vs Load Resistance



LT1178/LT1179 • TPC12

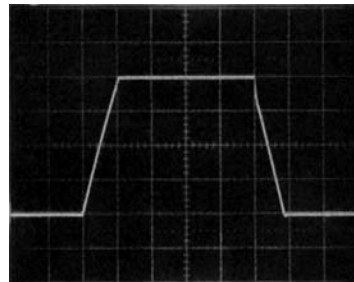
TYPICAL PERFORMANCE CHARACTERISTICS

Capacitive Load Handling



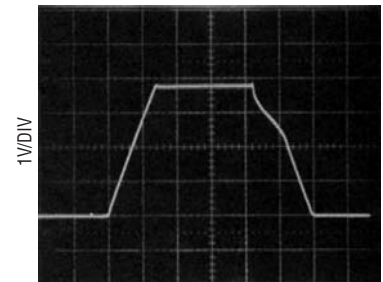
LT1178/LT1179 • TPC13

Large-Signal Transient Response
 $V_S = \pm 15V$



$A_V = 1$
 $C_L = 12pF$

Large-Signal Transient Response
 $V_S = 5V, 0V$



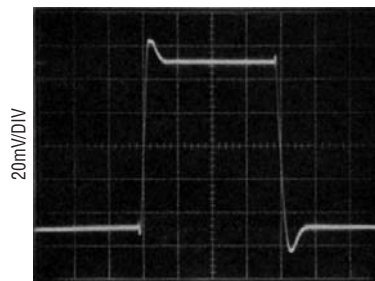
$A_V = 1$
 $C_L = 12pF$
INPUT PULSE = 0V TO 3.8V

Small-Signal Transient Response
 $V_S = \pm 2.5V$



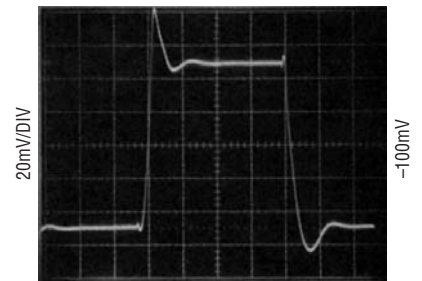
$A_V = 1$
 $C_L = 12pF$

Small-Signal Transient Response
 $V_S = \pm 15V$



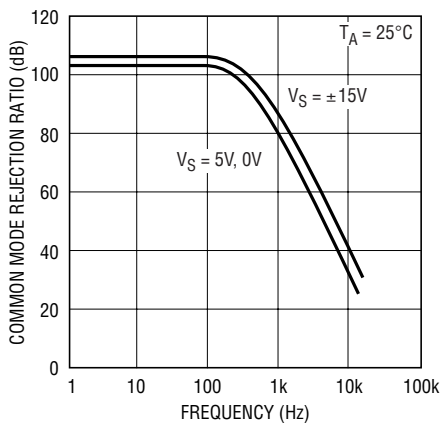
$A_V = 1$
 $C_L = 12pF$

Small-Signal Transient Response
 $V_S = 5V, 0V$



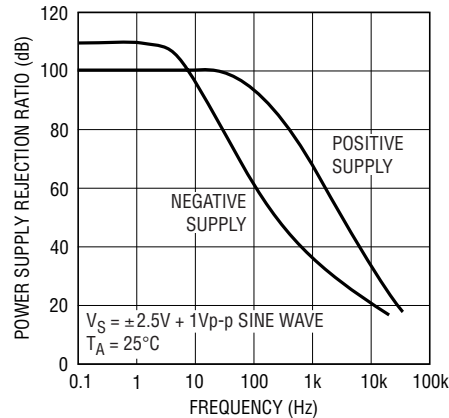
$A_V = 1$
 $C_L = 12pF$
INPUT 50 TO 150mV

Common Mode Rejection Ratio vs Frequency



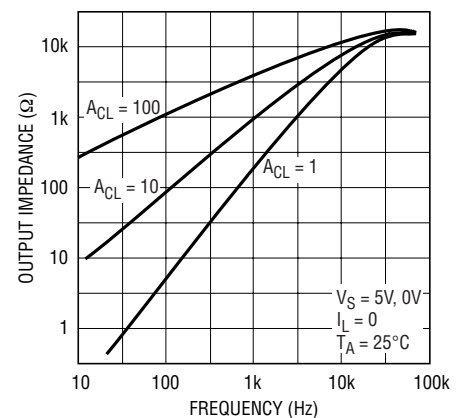
LT1178/LT1179 • TPC19

Power Supply Rejection Ratio vs Frequency



LT1188/LT1189 • TPC20

Closed Loop Output Impedance



LT1178/LT1179 • TPC21

supply operation and phase reversal protection are directly applicable to the LT1178/LT1179.

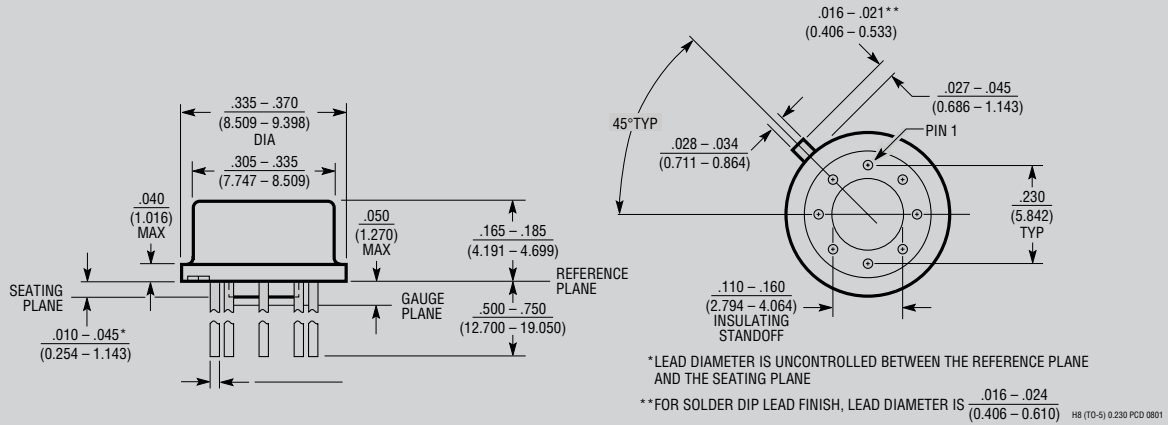
LINEARITY IS 0.02%
 QUIESCENT CURRENT IS 90µA
 SUPPLY CURRENT IS 360µA AT 1MHz
 DRIFT = 50ppm/°C
 *TRW MTR/5 + 120ppm/°C

LT1178 T1178-A01

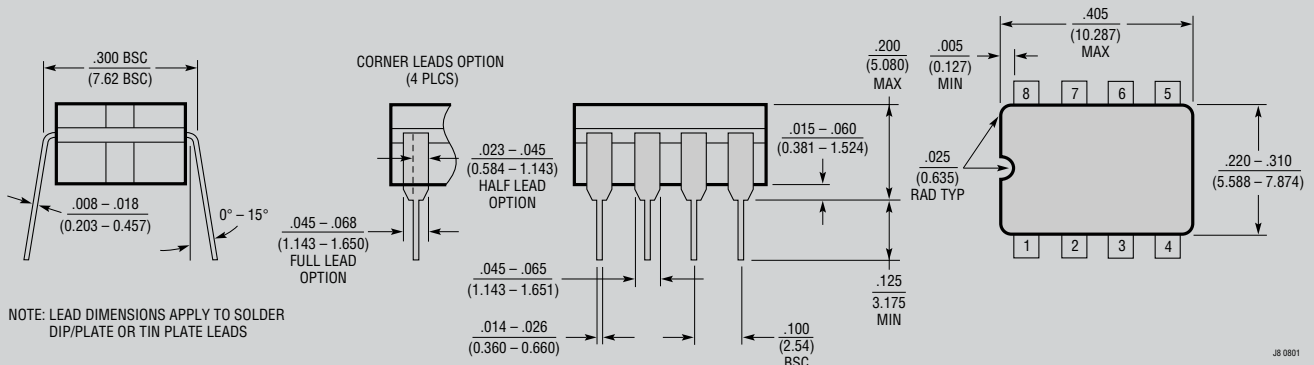
SIMPLIFIED SCHEMATIC

PACKAGE DESCRIPTION

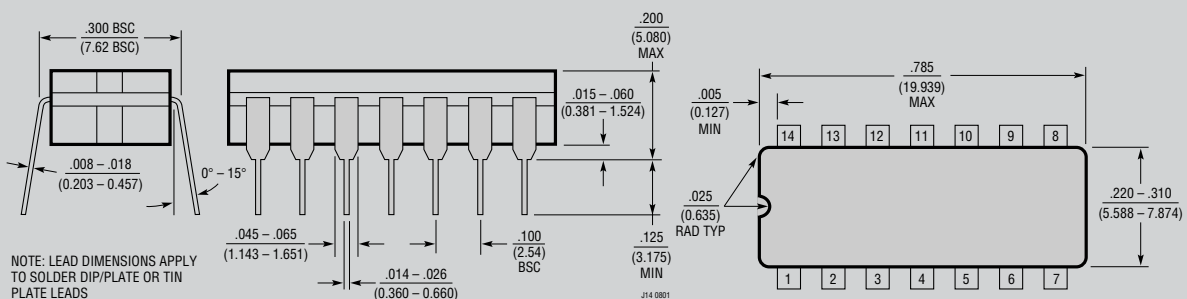
H Package
8-Lead TO-5 Metal Can (.230 Inch PCD)
 (Reference LTC DWG # 05-08-1321)



J8 Package
8-Lead Cerdip (Narrow .300 Inch, Hermetic)
 (Reference LTC DWG # 05-08-1110)



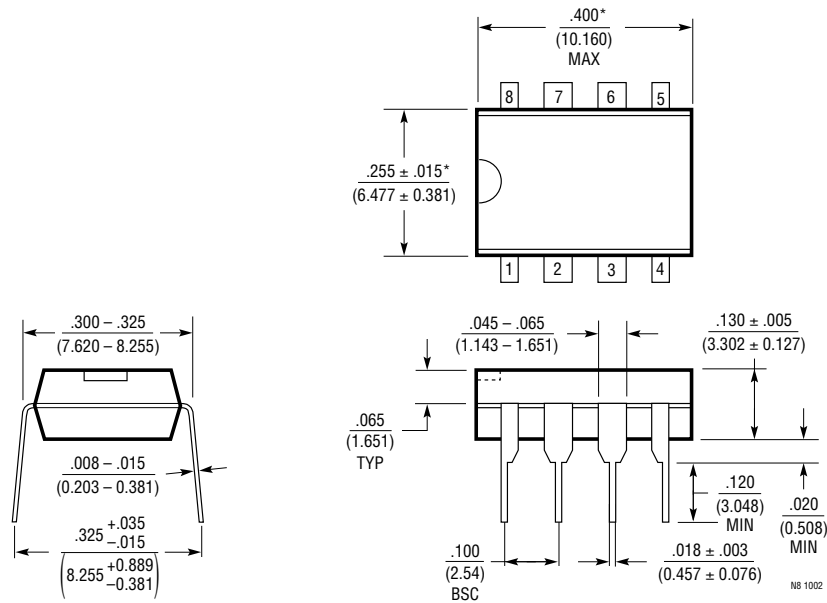
J Package
14-Lead Cerdip (Narrow .300 Inch, Hermetic)
 (Reference LTC DWG # 05-08-1110)



OBSOLETE PACKAGES

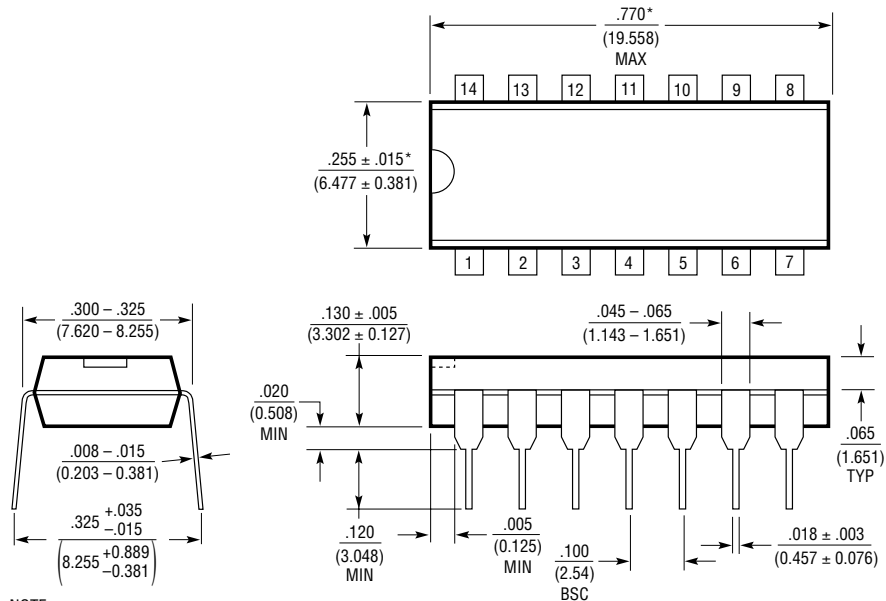
PACKAGE DESCRIPTION

N8 Package 8-Lead PDIP (Narrow .300 Inch) (Reference LTC DWG # 05-08-1510)



NOTE:
1. DIMENSIONS ARE $\frac{\text{INCHES}}{\text{MILLIMETERS}}$
*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

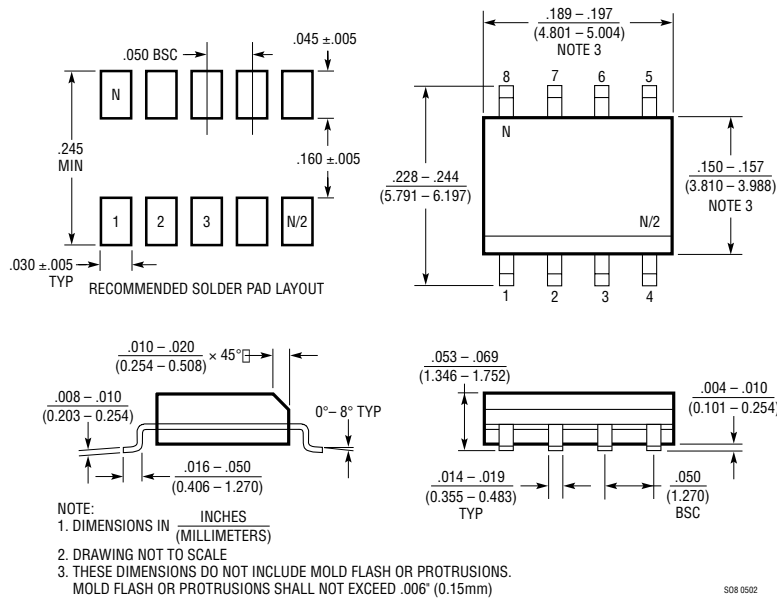
N Package 14-Lead PDIP (Narrow .300 Inch) (Reference LTC DWG # 05-08-1510)



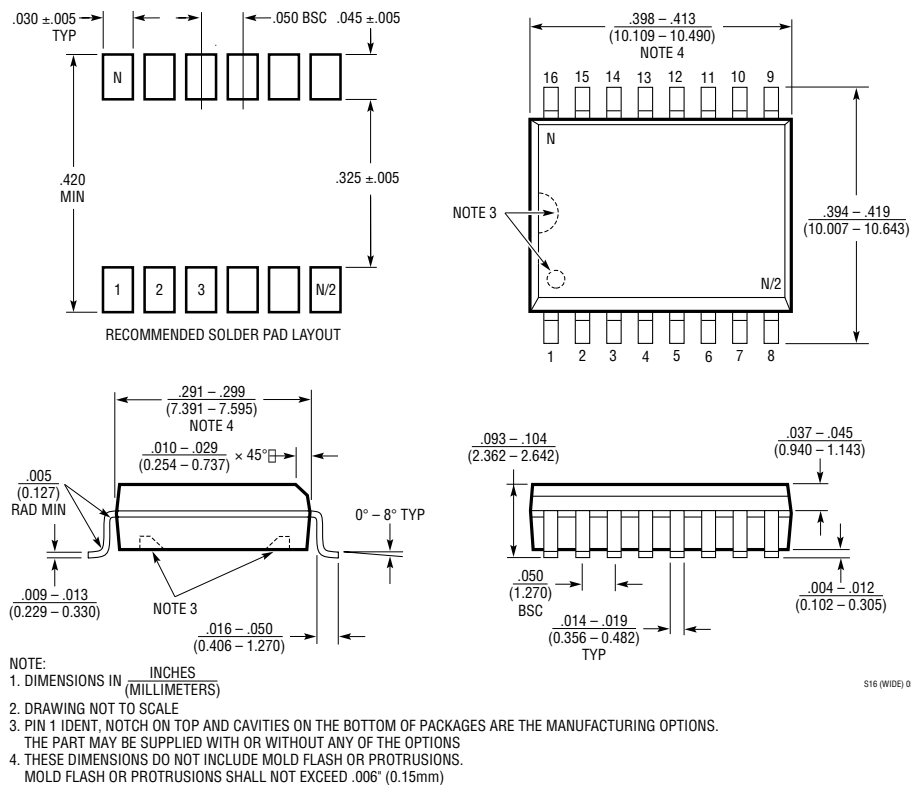
NOTE:
1. DIMENSIONS ARE $\frac{\text{INCHES}}{\text{MILLIMETERS}}$
*THESE DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCH (0.254mm)

PACKAGE DESCRIPTION

S8 Package 8-Lead Plastic Small Outline (Narrow .150 Inch) (Reference LTC DWG # 05-08-1610)



SW Package 16-Lead Plastic Small Outline (Wide .300 Inch) (Reference LTC DWG # 05-08-1620)



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Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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