

#### Low power, Dual Operational Amplifier in bare die form

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#### Description

The LM158A consists of x2 independent, high gain, internally frequency compensated operational amplifiers operating from a single power supply as low as 3V or as high as 32V. The device is useful in interface circuits with digital systems and can be operated from the single common 5V power supply. The device also finds use in transducer amplifiers, DC gain blocks & many other conventional op-amp circuits which benefit from the single power supply capability.  $I_{\rm Q}$  per amplifier is about 1/5 of the industry 741. Split-supply operation is also possible with supply current drain independent of voltage supplied for low power. The die size is one of the smallest in the industry.

### **Ordering Information**

The following part suffixes apply:

- No suffix MIL-STD-883 /2010B Visual Inspection
- "H" MIL-STD-883 /2010B Visual Inspection+ MIL-PRF-38534 Class H LAT
- "K" MIL-STD-883 /2010A Visual Inspection (Space)
  + MIL-PRF-38534 Class K LAT

LAT = Lot Acceptance Test.

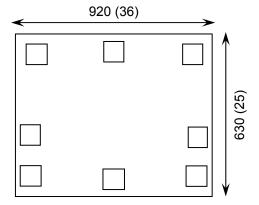
For further information on LAT process flows see below.

www.siliconsupplies.com\quality\bare-die-lot-qualification

#### Features:

- Temperature compensated bandwidth (unity gain)
- Temperature compensated I<sub>B</sub>: 20nA
- Wide power supply range, single supply: 3V-32V or dual supplies: ±1.5V to ±16V
- Low V<sub>OS</sub>: 1mV, and I<sub>OS</sub>: 2nA
- Differential input voltage range equal to the power supply voltage
- Large output voltage: 0V to V<sub>CC</sub> -1.5V swing
- Input Common-Mode Voltage range includes GND

### Die Dimensions in µm (mils)



#### **Supply Formats:**

- Default Die in Waffle Pack (400 per tray capacity)
- Sawn Wafer on Tape On request
- Unsawn Wafer On request
- Die Thickness <> 350µm(15 Mils) On request
- Assembled into Ceramic Package On request

### **Mechanical Specification**

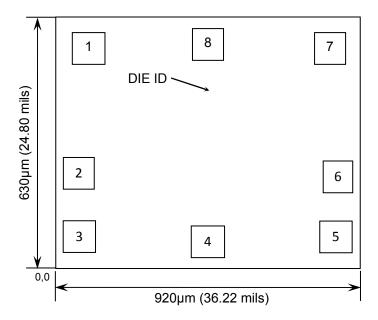
Die Size (Unsawn)	920 x 630 36 x 25	μm mils
Minimum Bond Pad Size	85 x 85 3.35 x 3.35	μm mils
Die Thickness	350 (±20) 13.78 (±0.79)	μm mils
Top Metal Composition	Al 1%Si 1.1μ	m
Back Metal Composition	N/A – Bare S	Si





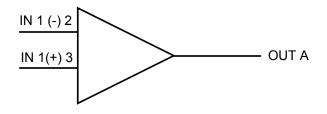
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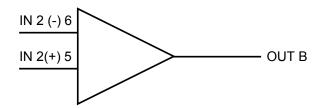
## Pad Layout and Functions



PAD	FUNCTION	COORDINATES (mm)			
		X	Y		
1	OUTPUT A	0.1285	0.5015		
2	– INPUT A	0.1125	0.2425		
3	+ INPUT A	0.1125 0.112			
4	GND	0.4600	0.1075		
5	+ INPUT B	0.8075	0.1125		
6	– INPUT B	0.8075	0.2425		
7	OUTPUT B	0.7915	0.5015		
8	V <sub>cc</sub>	0.4600	0.5175		
CHIP BACK POTENTIAL IS FLOAT					

## Logic Diagram





PAD  $8 = V_{CC}$ 

PAD 4 = GND



Absolute Maximum Ratings<sup>1</sup>

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PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage – Single Supply	V <sub>cc</sub>	32	V
Supply Voltage – Split Supply	<b>V</b> CC	±16	V
Input Differential Voltage Range	$V_{IDR}$	32	V
Input Common Mode Voltage Range	V <sub>ICR</sub>	-0.3 to 32	V
Output Short Circuit to Ground	-	Continuous	-
Junction Temperature	TJ	150	°C
Input Current (per pin) <sup>2</sup>	I <sub>IN</sub>	50	mA

Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability.

### **Recommended Operating Conditions**

PARAMETER	SYMBOL	MIN	MAX	UNITS
DC Supply Voltage	V <sub>CC</sub>	±2.5 or 5	±15 or 30	V
Operating Temperature	T <sub>A</sub>	-55	+125	°C

### DC Electrical Characteristics (T<sub>A</sub> = -55°C to +125°C unless otherwise specified)

DADAMETED	0)(11001	CONDITIONS		LIMITS			
PARAMETER	SYMBOL			MIN	TYP	MAX	UNITS
Input Offset Voltage	V <sub>IO</sub>	$V_{O} = 1.4V,$ $V_{CC} = 5V - 30V;$	25°C	-	1	2	mV
input Onset voltage	VIO	$R_S = 0\Omega$ , $V_{ICM}=0V$ to $V_{CC}-1.7V$	125°C	-	-	5	IIIV
Input Offset Voltage Drift	ΔV <sub>IO</sub> /ΔΤ	$V_{CC} = 30V; R_S = 0\Omega$		-	7	20	μV/°C
land Office to Commont		\\\ - <b>F</b> \\	25°C	-	2	10	A
Input Offset Current	et Current I <sub>IO</sub>	V <sub>CC</sub> = 5V	125°C	-	-	75	nA
Input Offset Current Drift	ΔΙ <sub>ΙΟ</sub> /ΔΤ	$V_{CC} = 30V; R_S = 0\Omega$		-	10	300	pA/°C
Input Bias Current	1	V <sub>CC</sub> = 5V	25°C	-	20	50	nA
Input bias Current	IB	$I_{IB}$ $V_{CC} = 5V$		-	40	200	IIA
Supply Current		R <sub>L</sub> =∞,V <sub>CC</sub> =5V, V <sub>O</sub> :	= 0V	-	0.5	1.2	mA
Supply Current	I <sub>CC</sub>	$R_L=\infty, V_{CC}=30V, V_O=0V$		-	1	2	IIIA
Common Mode Input	V	\/ - 20\/	25°C	0	-	V <sub>CC</sub> -1.5	V
Voltage range	$V_{CC} = 30V$ 125°C		0	-	V <sub>CC</sub> -2	<b>V</b>	
Differential Input Voltage range	V <sub>IDR</sub>	All $V_{IN} \ge GND$ or $V_{CC}$ - (if used	)	-	-	V <sub>CC</sub>	V



<sup>2.</sup>  $V_{IN}$  < -0.3V. This input current exists when voltage is driven negative at any of the input leads



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### DC Electrical Characteristics continued (T<sub>A</sub> = -55°C to +125°C unless otherwise specified)

PARAMETER	SYMBOL	L CONDITIONS		LIMITS			UNITS
PARAWEIER	STIVIBUL			MIN	TYP	MAX	UNITS
Large-Signal Open-	A <sub>VOL</sub>	V <sub>CC</sub> =15V	25°C	50	100	-	V/mV
Loop Voltage Gain	AVOL	R <sub>L</sub> ≥ 2KΩ	125°C	25	-	_	V/IIIV
Output High-Level	W	V <sub>CC</sub> =30V, R <sub>L</sub> =2h	<b>Κ</b> Ω	26	-	-	- V
Voltage swing	V <sub>OH</sub>	V <sub>CC</sub> =30V, R <sub>L</sub> =10	ΚΩ	27	28	-	V
Output Low-Level Voltage swing	V <sub>OL</sub>	$V_{CC}$ =5V, $R_L$ =10K $\Omega$		-	5	20	mV
Common-Mode Rejection Ratio	CMRR	$V_{CC}$ =30V, R <sub>S</sub> =10KΩ, T <sub>A</sub> = 25°C		70	85	-	dB
Power Supply Rejection Ratio	PSSR	V <sub>CC</sub> =30V, T <sub>A</sub> = 25°C		65	100	-	dB
Crosstalk Attenuation	V <sub>O1</sub> /V <sub>O2</sub>	f =1KHz to 20KHz, $V_{CC}$ =30V, $T_A$ = 25°C		-	-120	-	dB
Output Short-Circuit current to GND	I <sub>SC</sub>	$V_{CC} = 5V, V_{O} = 0V$ $T_{A} = 25^{\circ}C$		-	40	60	mA
Output Source	LOGUEGE	$V_{IN}$ + = 1V, $V_{IN}$ - =0V,	25°C	20	40	-	mA
Current		$V_{CC} = 15V, V_{O} = 2V$	125°C	10	20	-	IIIA
V		$V_{IN}$ + = 0V, $V_{IN}$ - =1V,	25°C	10	20	-	m A
		$V_{CC} = 15V, V_{O} = 2V, 125^{\circ}C$		10	15	-	mA
Output Sink Current I <sub>SINK</sub>		$V_{IN}$ + = 0V, $V_{IN}$ - =1V, $V_{CC}$ =15V, $V_{O}$ = 0.2V, $T_{A}$ = 25°C		12	50	-	μА

## **Typical Characteristics**

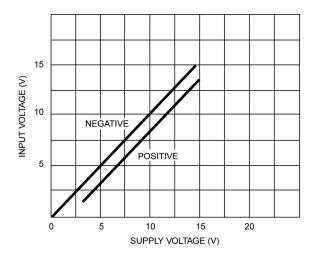


FIGURE 1. Input Voltage Range versus Supply Voltage

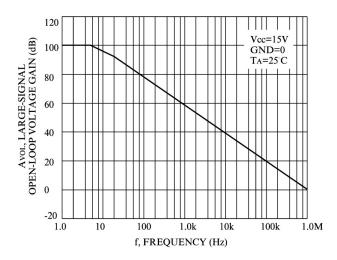


FIGURE 2. Open-Loop Frequency





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### Typical Characteristics continued

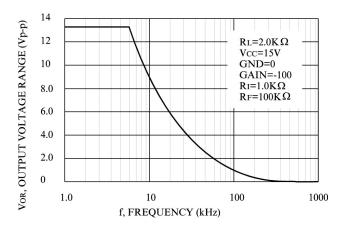


FIGURE 3. Large-Signal Frequency response

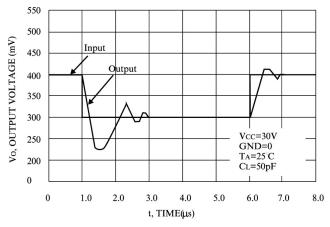


FIGURE 4. Small-Signal Voltage Follower Pulse Response (Non-inverting)

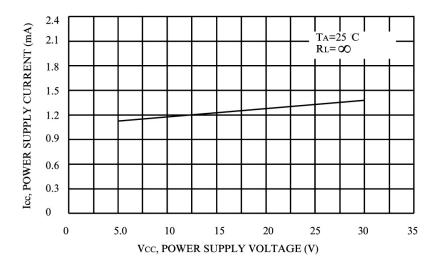


FIGURE 5. Power Supply Current versus Power Supply Voltage





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### Typical Characteristics continued

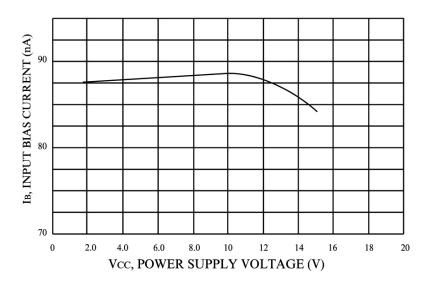


FIGURE 6. Low frequency Op-Amp with Offset adjust

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