MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

LMT358, LMT2904

ADVANCE INFORMATION

DUAL LOW POWER OPERATIONAL AMPLIFER

DUAL DIFFERENTIAL INPUT OPERATIONAL AMPLIFIERS

SILICON MONOLITHIC INTEGRATED CIRCUIT

These dual operational amplifiers feature 1) low power drain, 2) a common mode input voltage range extending to ground/VEE, 3) Single Supply or Split Supply operation and 4) pin outs compatible with the popular MC1558 dual operational amplifier. The LMT358 series are equivalent to one-half of an LMT324.

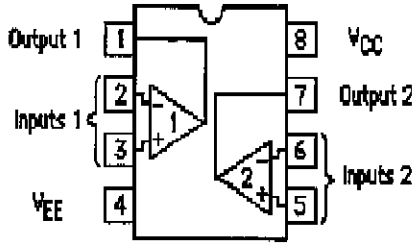
These amplifiers have several distinct advantages over standard operational amplifier types in single supply applications. They can operate at supply voltages as low as 3.0 Vdts or as high as 32 Volts with quiescent currents about one-fifth of those associated with the MC1741 (on a per amplifier basis). The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing components in many applications. The output voltage range also includes the negative power supply voltage.

- Short Circuit Protected Outputs
- True Differential Input Stage
- Single Supply Operation: 3.0 to 32 Volts
- Low Input Bias Currents
- Internally Compensated
- Common Mode Range Extends to Negative Supply
- Single and Split Supply Operation
- Similar Performance to theMC1558

N SUFFIX
PLASTIC PACKAGE
CASE 626

D SUFFIX
PLASTIC PACKAGE
CASE 751-02
SO-8

DUAL PIN OUTS



(Top View)

MAXIMUM RATINGS (TA = 25°C Unless otherwise noted)

Rating	Symbol	LMT358	LMT2904	Unit
Power Supply Voltages Single Supply Split Supplies	V_{CC} V_{CC}, V_{EE}	32 ±16	26 ±13	Vdc
Input Differential Voltage Range	V_{IDR}	±32	±26	Vdc
Input Common Mode Voltage Range	V_{ICR}	-0.3 to 32	-0.3 to 26	Vdc
Output Short Circuit Duration	t_S	Continuous	Continuous	Sec
Junction Temperature	T_J	150	150	°C
Storage Temperature Range	T_{STG}	-55 to +125	-55 to +125	°C
Ambient Operating Temperature Range	T_A	0 to +70	-40 to +105	°C

CAUTION: These devices do not have internal ESD protection circuitry and are rated as CLASS 1 devices per the ESD test method in Mil-Std-833D. They should be handled using standard ESD prevention methods to avoid damage to the device.

ORDERING INFORMATION		
Device	Package	Temperature Range
LMT358N LMT358D	8 Pin Plastic DIP SO-8	0°C to 70°C
LMT2904N LMT2904D	8 Pin Plastic DIP SO-8	-40°C to 105°C

Mac Rev 3.0

ELECTRICAL CHARACTERISTICS (V_{CC}= +5.0V, V_{EE}= Ground, T_A=25°C unless otherwise noted)

CHARACTERISTICS	SYMBOL	LMT358			LMT2904			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage V_{CC} = 5.0 V to 30.0 V, V_{ICR} = 0 V to V_{CC} -1.7 V, V_O = 1.4 V, R_S = 0 Ω	V_{IO}							mV
T_A = +25°C		—	2.0	7.0	—	2.0	7.0	
T_A = T_{high} to T_{low} (Note 1)		—	—	9.0	—	—	10	
Average Temperature Coefficient of Input Offset Voltage, T_A = T_{high} to T_{low}	$\Delta V_{IO}/\Delta T$	—	7.0	—	—	7.0	—	μV/°C
Input Offset Current	I_{IO}	—	5.0	50	—	5.0	50	nA
T_A = T_{high} to T_{low} (Note 1)		—	—	150	—	45	200	
Average Temperature Coefficient of Input Offset Current, T_A = T_{high} to T_{low}	$\Delta I_{IO}/\Delta T$	—	10	—	—	10	—	pA/°C
Input Bias Current	I_{IB}	—	-45	-250	—	-45	-250	nA
T_A = T_{high} to T_{low}		—	-50	-500	—	-50	-500	
Input Common-Mode Voltage range (Note 2)	V_{ICR}							V
V_{CC} = 30 V, T_A = +25°C		0	—	28.3	0	—	24.3	
V_{CC} = 30 V, T_A = T_{high} to T_{low}		0	—	28	0	—	24	
Differential Input Voltage Range	V_{IDR}	—	—	V_{CC}	—	—	V_{CC}	V
Large Signal Open-Loop Voltage Gain	A_{VOL}							V/mV
R_L = 2.0 kΩ, V_{CC} = 15 V, For Large V_O Swing,		25	100	—	25	100	—	
T_A = T_{high} to T_{low}		15	—	—	15	—	—	
Channel Separation	CS							dB
1.0 kHz ≤ f ≤ 20 kHz, Input Referenced		—	-120	—	—	-120	—	
Common-Mode Rejection Ratio	CMRR	65	85	—	50	85	—	dB
R_S ≤ 10 kΩ								
Power Supply Rejection Ratio	PSRR	65	100	—	50	100	—	dB
Output Voltage Range	V_{OR}	0	—	3.3	0	—	3.3	V
R_L = 2.0 kΩ								
Output Voltage - High Limit (T_A = T_{high} to T_{low})	V_{OH}							V
V_{CC} = 30 V, R_L = 2.0 kΩ		26	—	—	22	—	—	
V_{CC} = 30 V, R_L = 10 kΩ		27	28	—	23	24	—	
Output Voltage - Low Limit	V_{OL}							mV
V_{CC} = 5.0 V, R_L = 10 kΩ, T_A = T_{high} to T_{low}		—	5.0	20	—	5.0	20	
Output Source Current (V_{ID} = +1.0 V, V_{CC} = 15 V)	I_{O+}	20	40	—	20	40	—	mA
Output Sink Current	I_{O-}							
V_{ID} = -1.0 V, V_{CC} = 15 V		10	20	—	10	20	—	mA
V_{ID} = -1.0 V, V_O = 200 mV, T_A = 25°C		12	50	—	—	—	—	μA
Output Short Circuit to Ground (Note 3)	I_{SC}	—	40	60	—	40	60	mA
Power Supply Current (T_A = T_{high} to T_{low})	I_{CC}							mA
V_{CC} = 30 V, V_O = 0 V, R_L = ∞		—	1.5	3.0	—	1.5	3.0	
V_{CC} = 5.0 V, V_O = 0 V, R_L = ∞		—	0.7	1.2	—	0.7	1.2	

NOTES:
1. T_{low} = 0°C, T_{high} = +70°C for LMT358, T_{low} = -40°C, T_{high} = +105°C for LMT2904
2. The input common-mode(**cm**) voltage or either input signal voltage **should not** be allowed to go **NEG** by more than 0.3 V. The upper end of the **cm** voltage range is V_{CC} -1.7V; either or both inputs can go to +32V w/o damage.
3. Short circiuts from the output to V_{CC} can cause excessive heating and eventual destruction. Destructive dissipation can result from simultaneous shorts on all amplifiers.

This data sheet contains preliminary information and design objectives. All specifications are subject to change without notice.