

# MC1458, MC1558 DUAL GENERAL-PURPOSE OPERATIONAL AMPLIFIERS

SLOS069A – FEBRUARY 1971 – REVISED MAY1999

- **Short-Circuit Protection**
- **Wide Common-Mode and Differential Voltage Ranges**
- **No Frequency Compensation Required**
- **Low Power Consumption**
- **No Latch-Up**
- **Designed to Be Interchangeable With Motorola MC1558/MC1458 and Signetics S5558/N5558**

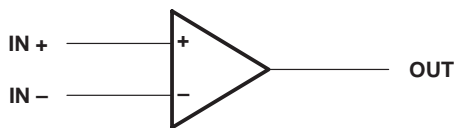
## description

The MC1458 and MC1558 are dual general-purpose operational amplifiers, with each half electrically similar to the  $\mu$ A741, except that offset null capability is not provided.

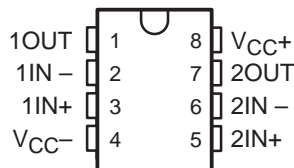
The high-common-mode input voltage range and the absence of latch-up make these amplifiers ideal for voltage-follower applications. The devices are short-circuit protected and the internal frequency compensation ensures stability without external components.

The MC1458 is characterized for operation from 0°C to 70°C. The MC1558 is characterized for operation over the full military temperature range of -55°C to 125°C.

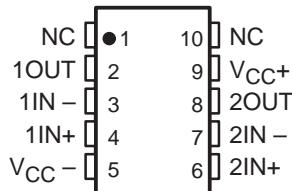
## symbol (each amplifier)



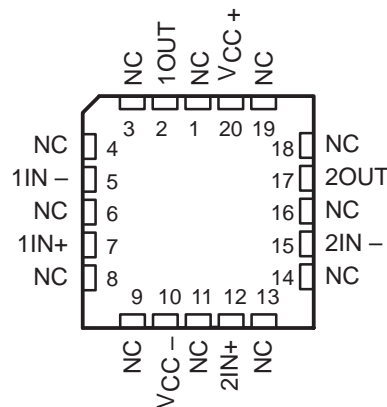
**MC1458 . . . D OR P PACKAGE**  
**MC1558 . . . JG PACKAGE**  
(TOP VIEW)



**MC1558 . . . U PACKAGE**  
(TOP VIEW)



**MC1558 . . . FK PACKAGE**  
(TOP VIEW)



NC – No internal connection

## AVAILABLE OPTIONS

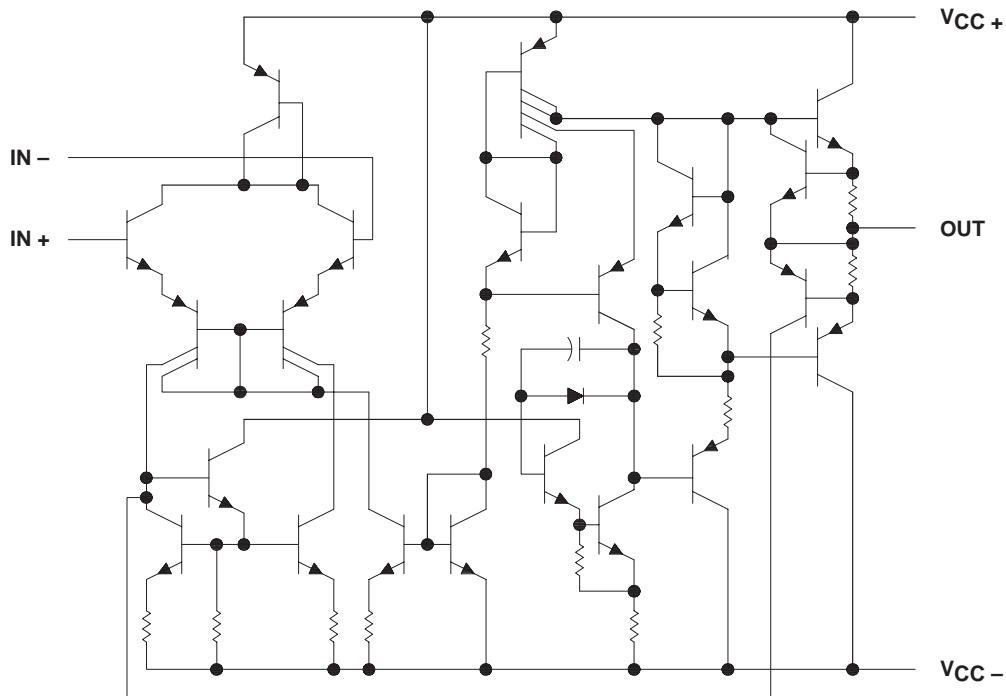
T <sub>A</sub>	V <sub>IO</sub> max AT 25°C	PACKAGE				
		SMALL OUTLINE (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	PLASTIC DIP (P)	CERAMIC FLAT PACK (U)
0°C to 70°C	6 mV	MC1458CD	—	—	MC1458CP	—
-55°C to 125°C	5 mV	—	MC1558MFK	MC1558MSG	—	MC1558MU

The D packages are available taped and reeled. Add the suffix R to the device type (i.e., MC1458DR)

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## schematic (each amplifier)



## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

		MC1458	MC1558	UNIT
Supply voltage (see Note 1)	V <sub>CC</sub> +	18	22	V
	V <sub>CC</sub> -	-18	-22	
Differential input voltage (see Note 2)		±30	±30	V
Input voltage at either input (see Notes 1 and 3)		±15	±15	V
Duration of output short circuit (see Note 4)		unlimited	unlimited	
Continuous total dissipation		See Dissipation Rating Table		
Case temperature for 60 seconds: FK package			260	°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	JG or U package		300	°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	D or P package	260		°C
Storage temperature range		65 to 150	-65 to 150	°C

- NOTES: 1. All voltage values, unless otherwise noted, are with respect to the midpoint between V<sub>CC</sub> + and V<sub>CC</sub> -.  
 2. Differential voltages are at IN+ with respect to IN-.  
 3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.  
 4. The output can be shorted to ground or either power supply. For the MC1558 only, the unlimited duration of the short circuit applies at (or below) 125°C case temperature or 70°C free-air temperature.

DISSIPATION RATING TABLE

PACKAGE	T <sub>A</sub> ≤ 25°C POWER RATING	DERATING FACTOR	DERATE ABOVE T <sub>A</sub>	T <sub>A</sub> = 70°C POWER RATING	T <sub>A</sub> = 125°C POWER RATING
D	680 mW	5.8 mW/°C	33°C	464 mW	—
FK	680 mW	11.0 mW/°C	88°C	880 mW	275 mW
JG	680 mW	8.4 mW/°C	69°C	672 mW	210 mW
P	680 mW	8.0 mW/°C	65°C	640 mW	—
U	675 mW	5.4 mW/°C	25°C	432 mW	135 mW

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## recommended operating conditions

		MIN	MAX	UNIT
Supply voltage, $V_{CC\pm}$		$\pm 5$	$\pm 15$	V
Operating free-air temperature range, $T_A$	MC1458	0	70	°C
	MC1558	-55	125	

## electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15$ V

PARAMETER	TEST CONDITIONS†	MC1458			MC1558			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$V_{IO}$ Input offset voltage	$V_O = 0$	25°C	1	6	1	5	mV	
		Full range		7.5		6		
$I_{IO}$ Input offset current	$V_O = 0$	25°C	20	200	20	200	nA	
		Full range		300		500		
$I_{IB}$ Input bias current	$V_O = 0$	25°C	80	500	80	500	nA	
		Full range		800		1500		
$V_{ICR}$ Common-mode input voltage range		25°C	$\pm 12$	$\pm 13$	$\pm 12$	$\pm 13$	V	
		Full range	$\pm 12$		$\pm 12$			
$V_{OM}$ Maximum peak output voltage swing	$R_L = 10$ k $\Omega$	25°C	$\pm 12$	$\pm 14$	$\pm 12$	$\pm 14$	V	
	$R_L \geq 10$ k $\Omega$	Full range	$\pm 12$		$\pm 12$			
	$R_L = 2$ k $\Omega$	25°C	$\pm 10$	$\pm 13$	$\pm 10$	$\pm 13$		
	$R_L \geq 2$ k $\Omega$	Full range	$\pm 10$		$\pm 10$			
$A_{VD}$ Large-signal differential voltage amplification	$R_L \geq 2$ k $\Omega$ , $V_O = \pm 10$ V	25°C	20	200	50	200	V/mV	
		Full range	15		25			
$B_{OM}$ Maximum-output-swing bandwidth (closed loop)	$R_L = 2$ k $\Omega$ , $A_{VD} = 1$ , THD $\geq 5\%$	25°C	14		14		kHz	
$B_1$ Unity-gain bandwidth		25°C	1		1		MHz	
$\phi_m$ Phase margin	$A_{VD} = 1$	25°C	65		65		deg	
		Gain margin	25°C	11		11		dB
$r_i$ Input resistance		25°C	0.3	2	0.3*	2	M $\Omega$	
$r_o$ Output resistance	$V_O = 0$ , See Note 5	25°C	75		75		$\Omega$	
$C_i$ Input capacitance		25°C	1.4		1.4		pF	
$Z_{ic}$ Common-mode input impedance	$f = 20$ Hz	25°C	200		200		M $\Omega$	
CMRR Common-mode rejection ratio	$V_{IC} = V_{ICR}$ min, $V_O = 0$	25°C	70	90	70	90	dB	
		Full range	70		70			
$k_{SVS}$ Supply-voltage sensitivity ( $\Delta V_{IO}/\Delta V_{CC}$ )	$V_{CC} = \pm 9$ V to $\pm 15$ V, $V_O = 0$	25°C	30	150	30	150	$\mu$ V/V	
		Full range		150		150		
$V_n$ Equivalent input noise voltage (closed loop)	$A_{VD} = 100$ , $R_S = 0$ , $f = 1$ kHz, BW = 1 Hz	25°C	45		45		nV/ $\sqrt{\text{Hz}}$	

\*On products compliant to MIL-PRF-38535, this parameter is not production tested.

† All characteristics are specified under open-loop operating conditions with zero common-mode input voltage unless otherwise specified. Full range for MC1458 is 0°C to 70°C and for MC1558 is -55°C to 125°C.

NOTE 5: This typical value applies only at frequencies above a few hundred hertz because of the effect of drift and thermal feedback.



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## electrical characteristics at specified free-air temperature, $V_{CC\pm} = \pm 15\text{ V}$ (continued)

PARAMETER	TEST CONDITIONST	MC1458			MC1558			UNIT	
		MIN	TYP	MAX	MIN	TYP	MAX		
$I_{OS}$	Short-circuit output current		25°C	±25	±40		±25	±40	mA
$I_{CC}$	Supply current (both amplifiers)	$V_O = 0$ , No load	25°C	3.4	5.6		3.4	5	mA
			Full range			6.6		6.6	
$P_D$	Total power dissipation (both amplifiers)	$V_O = 0$ , No load	25°C	100	170		100	150	mW
			Full range			200		200	
$V_{O1}/V_{O2}$	Crosstalk attenuation		25°C	120			120		dB

† All characteristics are specified under open-loop operating conditions with zero common-mode input voltage unless otherwise specified. Full range for MC1458 is 0°C to 70°C and for MC1558 is -55°C to 125°C.

## operating characteristics, $V_{CC\pm} = \pm 15\text{ V}$ , $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	MC1458			MC1558			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$t_r$	Rise time	$V_I = 20\text{ mV}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , See Figure 1			0.3			$\mu\text{s}$
	Overshoot factor				5%			
SR	Slew rate at unity gain	$V_I = 10\text{ V}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , See Figure 1			0.5			$\text{V}/\mu\text{s}$

### PARAMETER MEASUREMENT INFORMATION

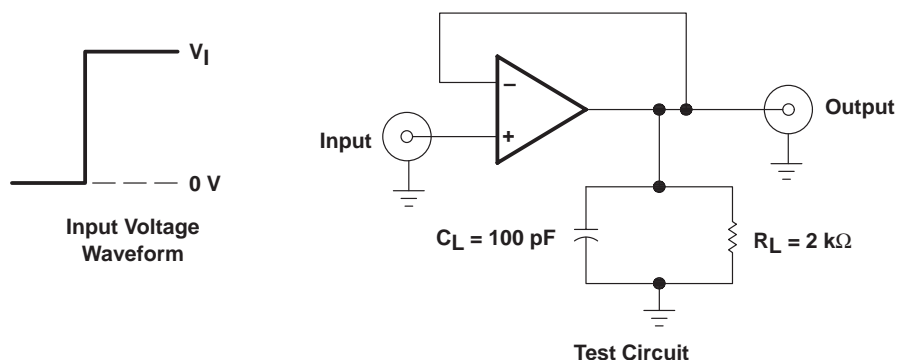


Figure 1. Rise-Time, Overshoot, and Slew-Rate Waveform and Test Circuit

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