

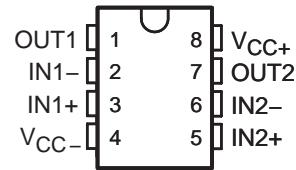
MC33078, MC33079

DUAL AND QUAD HIGH-SPEED LOW-NOISE OPERATIONAL AMPLIFIERS

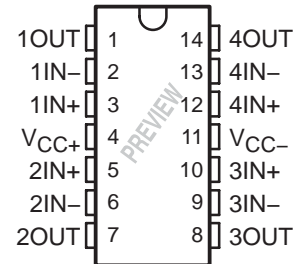
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- Dual-Supply Operation . . . ± 5 V to ± 18 V
- Low Noise Voltage . . . $4.5 \text{ nV}/\sqrt{\text{Hz}}$
- Low Input Offset Voltage . . . 0.15 mV
- Low Total Harmonic Distortion . . . 0.002%
- High Slew Rate . . . 7 V/ μs
- High-Gain Bandwidth Product . . . 16 MHz
- High Open-Loop AC Gain . . . 800 @ 20 kHz
- Large Output-Voltage Swing . . . 14.1 V to -14.6 V
- Excellent Gain and Phase Margins

MC33078 . . . D (SOIC), DGK (MSOP), OR P (PDIP) PACKAGE
(TOP VIEW)



MC33079 . . . D (SOIC) OR P (PDIP) PACKAGE
(TOP VIEW)



description/ordering information

The MC33078 and MC33079 are bipolar dual/quad operational amplifiers with high-performance specifications for use in quality audio and data-signal applications. These devices operate over a wide range of single- and dual-supply voltages and offer low noise, high-gain bandwidth, and high slew rate. Additional features include low total harmonic distortion, excellent phase and gain margins, large output voltage swing with no deadband crossover distortion, and symmetrical sink/source performance.

ORDERING INFORMATION

T _A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING	
-40°C to 85°C	Dual	PDIP (P)	Tube of 50	MC33078P	MC33078P
		SOIC (D)	Tube of 75	MC33078D	M33078
			Reel of 2500	MC33078DR	
		VSSOP/MSOP (DGK)	Reel of 2500	MC33078DGKR	PREVIEW
	Reel of 250		MC33078DGKT		
	Quad	PDIP (P)	Tube of 50	MC33079P	PREVIEW
		SOIC (D)	Tube of 75	MC33079D	PREVIEW
			Reel of 2500	MC33079DR	

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



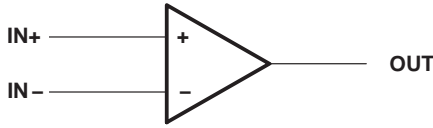
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MC33078, MC33079 DUAL AND QUAD HIGH-SPEED LOW-NOISE OPERATIONAL AMPLIFIERS

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symbol (each amplifier)



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

Supply voltage, V_{CC+} (see Note 1)	18 V
Supply voltage, V_{CC-} (see Note 1)	-18 V
Supply voltage, (V_{CC-} to V_{CC+})	36 V
Input voltage, either input (see Notes 1 and 2)	V_{CC-} or V_{CC+}
Input current (see Note 3)	± 10 mA
Duration of output short circuit (see Note 4)	Unlimited
Package thermal impedance, θ_{JA} (see Notes 5 and 6):	
D package	97°C/W
DGK package	172°C/W
P package	85°C/W
Operating virtual junction temperature, T_J	150°C
Storage temperature range, T_{stg}	-65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES:
1. All voltage values, except differential voltages, are with respect to the midpoint between V_{CC+} and V_{CC-} .
 2. The magnitude of the input voltage must never exceed the magnitude of the supply voltage.
 3. Excessive input current will flow if a differential input voltage in excess of approximately 0.6 V is applied between the inputs, unless some limiting resistance is used.
 4. The output may be shorted to ground or either power supply. Temperature and/or supply voltages must be limited to ensure the maximum dissipation rating is not exceeded.
 5. Maximum power dissipation is a function of $T_{J(max)}$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_{J(max)} - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
 6. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

		MIN	MAX	UNIT
V_{CC-}	Supply voltage	-5	-18	V
V_{CC+}		5	18	
T_A	Operating free-air temperature range	-40	85	°C

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electrical characteristics, $V_{CC-} = -15\text{ V}$, $V_{CC+} = 15\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	$V_O = 0$, $R_S = 10\ \Omega$, $V_{CM} = 0$	$T_A = 25^\circ\text{C}$	0.15	2	mV	
			$T_A = -40^\circ\text{C}$ to 85°C		3		
αV_{IO}	Input offset voltage temperature coefficient	$V_O = 0$, $R_S = 10\ \Omega$, $V_{CM} = 0$	$T_A = -40^\circ\text{C}$ to 85°C		2	$\mu\text{V}/^\circ\text{C}$	
I_{IB}	Input bias current	$V_O = 0$, $V_{CM} = 0$	$T_A = 25^\circ\text{C}$	300	750	nA	
			$T_A = -40^\circ\text{C}$ to 85°C		800		
I_{IO}	Input offset current	$V_O = 0$, $V_{CM} = 0$	$T_A = 25^\circ\text{C}$	25	150	nA	
			$T_A = -40^\circ\text{C}$ to 85°C		175		
V_{ICR}	Common-mode input voltage range	$\Delta V_{IO} = 5\text{ mV}$, $V_O = 0$		± 13	± 14	V	
A_{VD}	Large-signal differential voltage amplification	$R_L \geq 2\text{ k}\Omega$, $V_O = \pm 10\text{ V}$	$T_A = 25^\circ\text{C}$	90	110	dB	
			$T_A = -40^\circ\text{C}$ to 85°C	85			
V_{OM}	Maximum output voltage swing	$V_{ID} = \pm 1\text{ V}$	$R_L = 600\ \Omega$	V_{OM+}	10.7	V	
				V_{OM-}	-11.9		
			$R_L = 2\text{ k}\Omega$	V_{OM+}	13.2		13.8
				V_{OM-}	-13.2		-13.7
			$R_L = 10\text{ k}\Omega$	V_{OM+}	13.5		14.1
				V_{OM-}	-14		-14.6
CMMR	Common-mode rejection ratio	$V_{IN} = \pm 13\text{ V}$		80	100	dB	
k_{SVR}^\dagger	Supply-voltage rejection ratio	$V_{CC+} = 5\text{ V}$ to 15 V , $V_{CC-} = -5\text{ V}$ to -15 V		80	105	dB	
I_{OS}	Output short-circuit current	$ V_{ID} = 1\text{ V}$, Output to GND	(Source current)	15	29	mA	
			(Sink current)	-20	-37		
I_{CC}	Supply current (per channel)	$V_O = 0$	$T_A = 25^\circ\text{C}$	2.05	2.5	mA	
			$T_A = -40^\circ\text{C}$ to 85°C		2.75		

† Measured with $V_{CC\pm}$ differentially varied at the same time

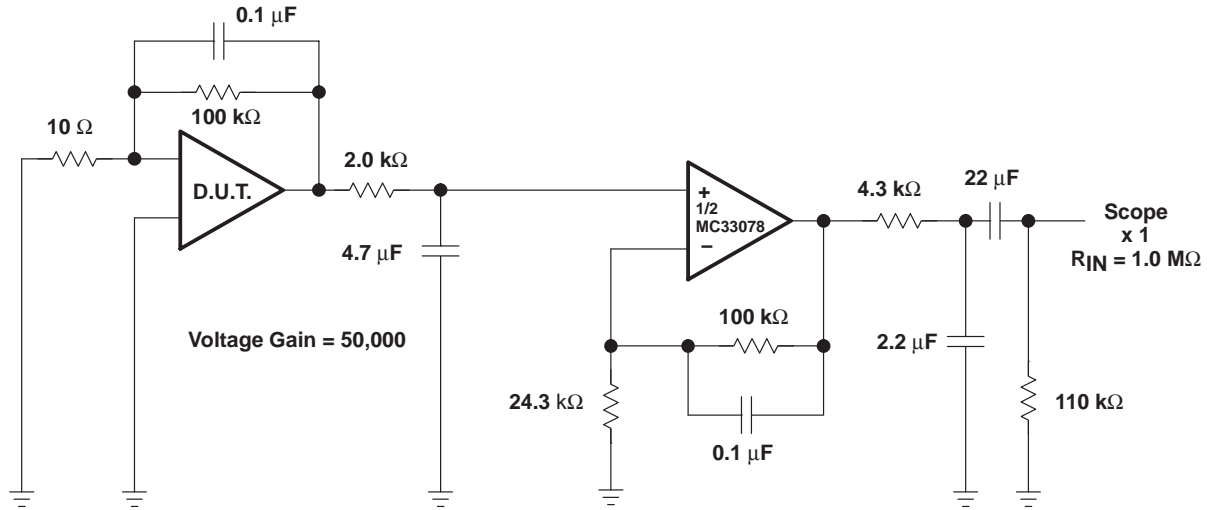
operating characteristics, $V_{CC-} = -15\text{ V}$, $V_{CC+} = 15\text{ V}$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	$A_{VD} = 1$, $V_{IN} = -10\text{ V}$ to 10 V , $R_L = 2\text{ k}\Omega$, $C_L = 100\text{ pF}$		5	7		$\text{V}/\mu\text{s}$
GBW	Gain bandwidth product	$f = 100\text{ kHz}$		10	16		MHz
B_1	Unity gain frequency	open loop			9		MHz
	Gain margin	$R_L = 2\text{ k}\Omega$	$C_L = 0\text{ pF}$		-11		dB
			$C_L = 100\text{ pF}$		-6		
ϕ_m	Phase margin	$R_L = 2\text{ k}\Omega$	$C_L = 0\text{ pF}$		55		deg
			$C_L = 100\text{ pF}$		40		
	Amp-to-amp isolation	$f = 20\text{ Hz}$ to 20 kHz			-120		dB
	Power bandwidth	$V_O = 27\text{ V(PP)}$, $R_L = 2\text{ k}\Omega$, $\text{THD} \leq 1\%$			120		kHz
THD	Total harmonic distortion	$V_O = 3\text{ V}_{\text{RMS}}$, $A_{VD} = 1$, $R_L = 2\text{ k}\Omega$, $f = 20\text{ Hz}$ to 20 kHz			0.002		%
z_o	Open-loop output impedance	$V_O = 0$, $f = 9\text{ MHz}$			37		Ω
r_{id}	Differential input resistance	$V_{CM} = 0$			175		$\text{k}\Omega$
C_{id}	Differential input capacitance	$V_{CM} = 0$			12		pF
V_n	Equivalent input noise voltage	$f = 1\text{ kHz}$, $R_S = 100\ \Omega$			4.5		$\text{nV}/\sqrt{\text{Hz}}$
I_n	Equivalent input noise current	$f = 1\text{ kHz}$			0.5		$\text{pA}/\sqrt{\text{Hz}}$



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NOTE: All capacitors are non-polarized.

Figure 1. Voltage Noise Test Circuit (0.1 Hz to 10 Hz_{p-p})

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE

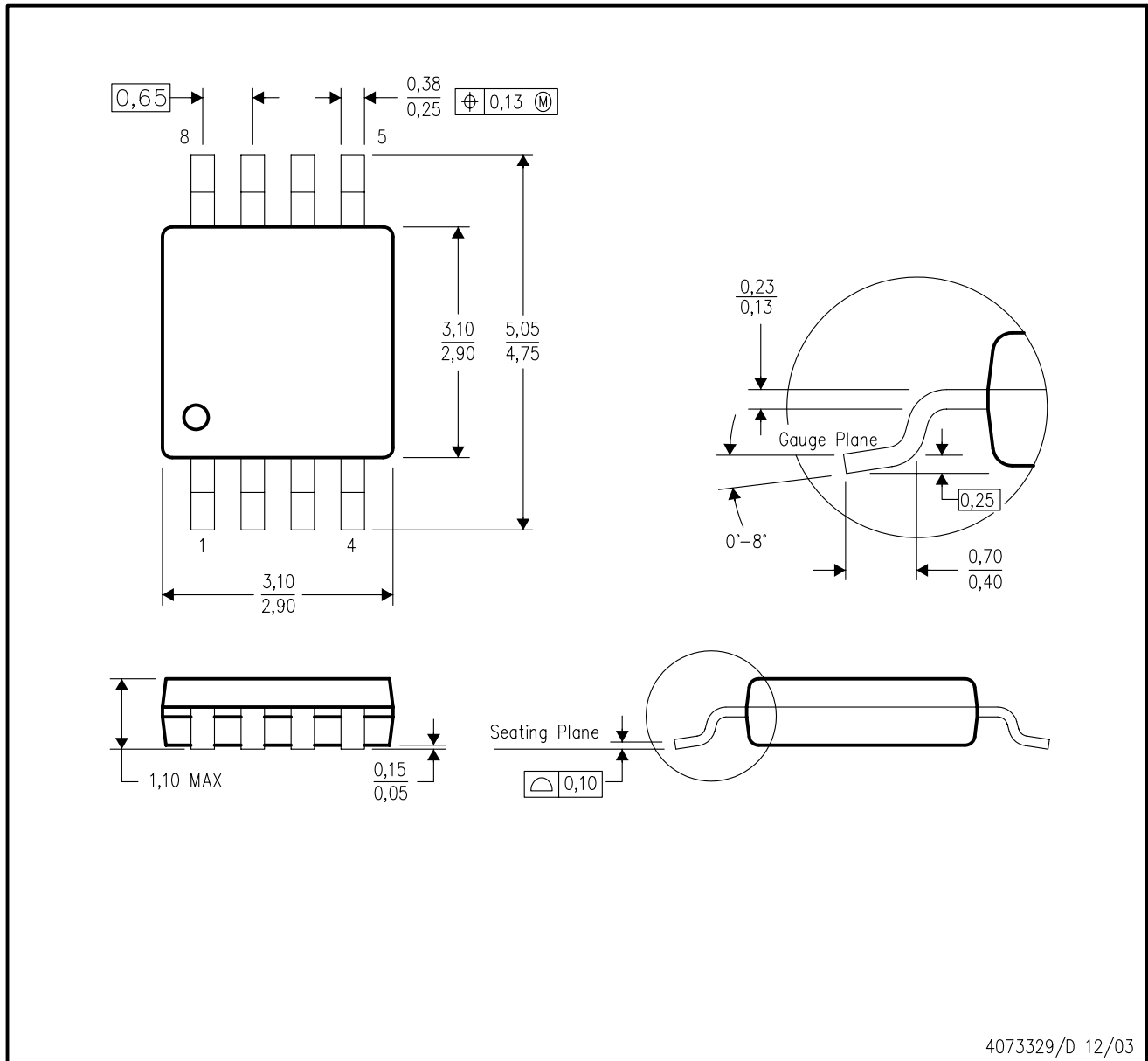


- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Falls within JEDEC MS-001

For the latest package information, go to http://www.ti.com/sc/docs/package/pkg_info.htm

DGK (S-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion.
 - D. Falls within JEDEC MO-187 variation AA.

D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-012 variation AB.

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