

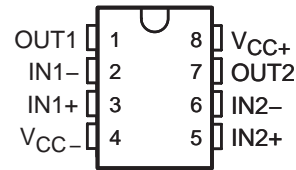
# MC33078, MC33079

## DUAL AND QUAD HIGH-SPEED LOW-NOISE OPERATIONAL AMPLIFIERS

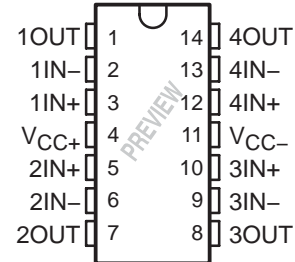
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- Dual-Supply Operation . . .  $\pm 5$  V to  $\pm 18$  V
- Low Noise Voltage . . .  $4.5 \text{ nV}/\sqrt{\text{Hz}}$
- Low Input Offset Voltage . . .  $0.15 \text{ mV}$
- Low Total Harmonic Distortion . . .  $0.002\%$
- High Slew Rate . . .  $7 \text{ V}/\mu\text{s}$
- High-Gain Bandwidth Product . . .  $16 \text{ MHz}$
- High Open-Loop AC Gain . . .  $800 @ 20 \text{ kHz}$
- Large Output-Voltage Swing . . .  $14.1 \text{ V}$  to  $-14.6 \text{ V}$
- 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 <sub>A</sub>	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	Dual	PDIP (P)	Tube of 50	MC33078P
		SOIC (D)	Tube of 75	MC33078D
			Reel of 2500	
		VSSOP/MSOP (DGK)	Reel of 2500	MC33078DGKR
			Reel of 250	
	Quad	PDIP (P)	Tube of 50	MC33079P
		SOIC (D)	Tube of 75	MC33079D
			Reel of 2500	MC33079DR

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



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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.

**TEXAS  
INSTRUMENTS**

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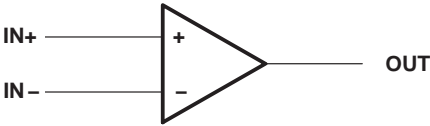
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# MC33078, MC33079

## 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)<sup>†</sup>

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, $\theta_{JA}$ (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

<sup>†</sup> 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  $T_J(\text{max})$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$ . 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

# MC33078, MC33079

## DUAL AND QUAD HIGH-SPEED LOW-NOISE OPERATIONAL AMPLIFIERS

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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
		$T_A = -40^\circ\text{C to } 85^\circ\text{C}$			3	
$\alpha V_{IO}$ Input offset voltage temperature coefficient	$V_O = 0$ , $R_S = 10\ \Omega$ , $V_{CM} = 0$	$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		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
		$T_A = -40^\circ\text{C to } 85^\circ\text{C}$			800	
$I_{IO}$ Input offset current	$V_O = 0$ , $V_{CM} = 0$	$T_A = 25^\circ\text{C}$		25	150	nA
		$T_A = -40^\circ\text{C to } 85^\circ\text{C}$			175	
$V_{ICR}$ Common-mode input voltage range	$\Delta V_{IO} = 5\text{ mV}$ , $V_O = 0$		$\pm 13$	$\pm 14$		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
		$T_A = -40^\circ\text{C to } 85^\circ\text{C}$	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	$V_{CC+} = 5\text{ V to } 15\text{ V}$ , $V_{CC-} = -5\text{ V to } -15\text{ V}$		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
		$T_A = -40^\circ\text{C to } 85^\circ\text{C}$			2.75	

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

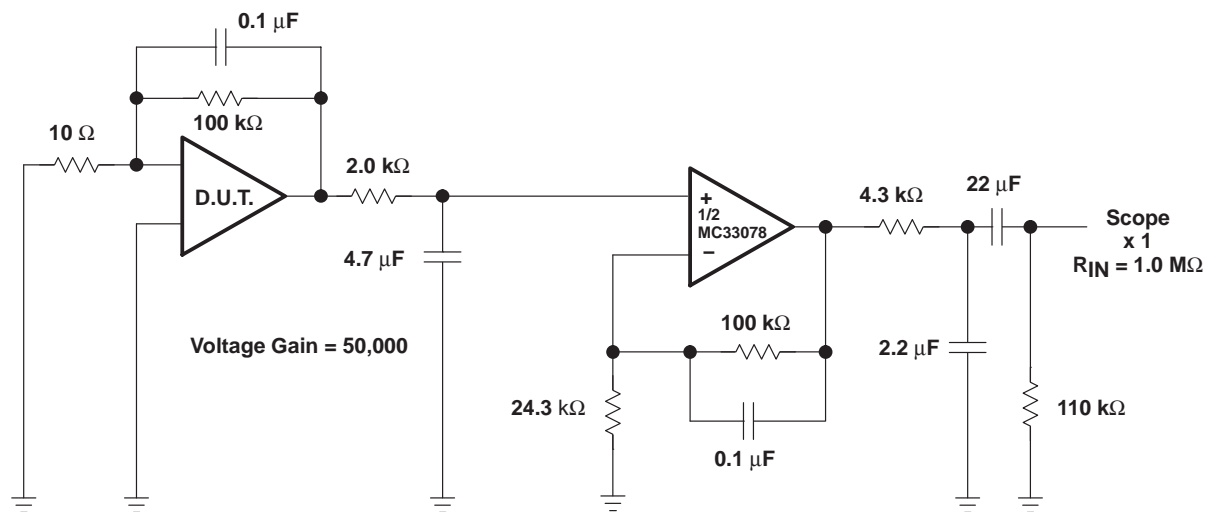
**operating characteristics,  $V_{CC-} = -15\text{ V}$ ,  $V_{CC+} = 15\text{ V}$ ,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)**

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
SR Slew rate at unity gain	$A_{VD} = 1$ , $V_{IN} = -10\text{ V to } 10\text{ V}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$		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		
$\phi_m$ 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	$f = 20\text{ Hz to } 20\text{ kHz}$		-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	$V_O = 3\text{ V}_{\text{RMS}}$ , $A_{VD} = 1$ , $R_L = 2\text{ k}\Omega$ , $f = 20\text{ Hz to } 20\text{ kHz}$			0.002		%
$z_o$ Open-loop output impedance	$V_O = 0$ , $f = 9\text{ MHz}$			37		$\Omega$
$r_{id}$ 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<sub>p-p</sub>)

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
MC33078D	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MC33078DE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MC33078DGKR	ACTIVE	MSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MC33078DGKRG4	ACTIVE	MSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MC33078DGKT	ACTIVE	MSOP	DGK	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MC33078DGKTG4	ACTIVE	MSOP	DGK	8	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MC33078DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MC33078DRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MC33078P	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
MC33078PE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
MC33079D	PREVIEW	SOIC	D	14	50	TBD	Call TI	Call TI
MC33079DR	PREVIEW	SOIC	D	14	2500	TBD	Call TI	Call TI

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSELETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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