

# RC4136, RM4136, RV4136 QUAD HIGH-PERFORMANCE OPERATIONAL AMPLIFIERS

SLOS072 – MARCH 1978 – REVISED SEPTEMBER 1990

- Continuous-Short-Circuit Protection
- Wide Common-Mode and Differential Voltage Ranges
- No Frequency Compensation Required
- Low Power Consumption
- No Latch-Up
- Unity Gain Bandwidth . . . 3 MHz Typ
- Gain and Phase Match Between Amplifiers
- Designed To Be Interchangeable With Raytheon RC4136, RM4136, and RV4136
- Low Noise . . . 8 nV/√Hz Typ at 1 kHz

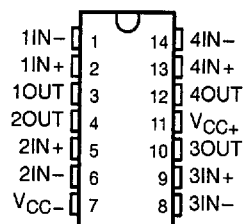
## description

The RC4136, RM4136, and RV4136 are quad high-performance operational amplifiers with each amplifier electrically similar to the  $\mu$ A741 except that offset null capability is not provided.

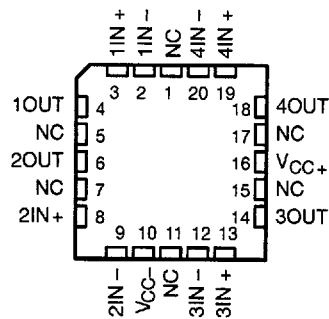
The high common-mode input voltage range and the absence of latch-up make these amplifiers ideal for voltage-follower applications. The devices are short circuit protected and the internal frequency compensation ensures stability without external components.

The RC4136 is characterized for operation from 0°C to 70°C, the RM4136 is characterized for operation over the full military temperature range of -55°C to 125°C, and the RV4136 is characterized for operation from -40°C to 85°C.

RM4136 . . . J OR W PACKAGE  
ALL OTHERS . . . D OR N PACKAGE  
(TOP VIEW)

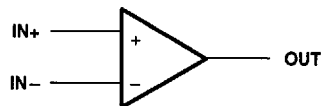


RM4136 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## symbol (each amplifier)



## AVAILABLE OPTIONS

T <sub>A</sub>	V <sub>IO</sub> max AT 25°C	PACKAGE				
		SMALL OUTLINE (D)	CHIP CARRIER (FK)	CERAMIC DIP (J)	PLASTIC DIP (N)	FLAT (W)
0°C to 70°C	6 mV	RC4136D	—	—	RC4136N	—
-40°C to 85°C	6 mV	RV4136D	—	—	RV4136N	—
-55°C to 125°C	4 mV	—	RM4136FK	RM4136J	—	RM4136W

The D packages are available taped and reeled. Add the suffix R to the device type (e.g., RC4136DR).

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**

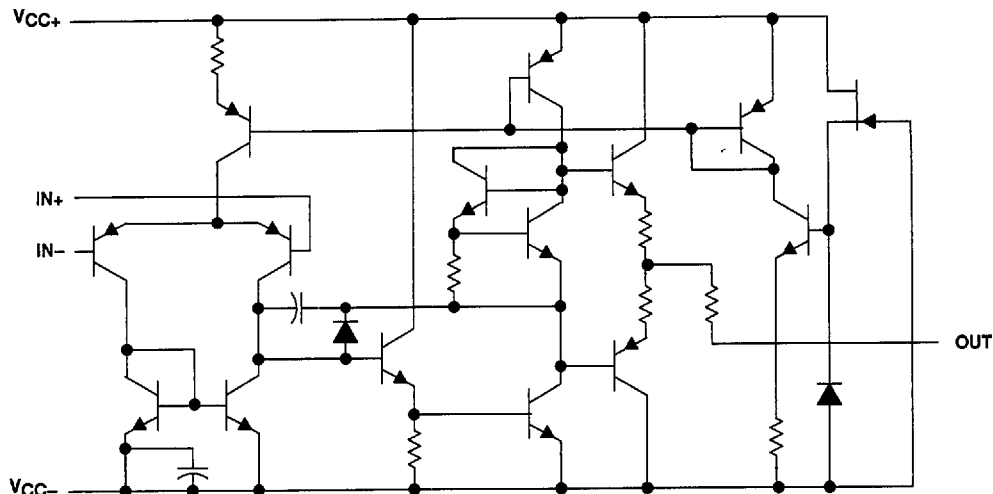
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On products compliant to MIL-STD-883, Class B, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

# RC4136, RM4136, RV4136 QUAD HIGH-PERFORMANCE OPERATIONAL AMPLIFIERS

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## schematic (each amplifier)



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

	RC4136	RM4136	RV4136	UNIT
Supply voltage $V_{CC+}$ (see Note 1)	18	22	18	V
Supply voltage $V_{CC-}$ (see Note 1)	-18	-22	-18	V
Differential input voltage (see Note 2)	$\pm 30$	$\pm 30$	$\pm 30$	V
Input voltage (any input, see Notes 1 and 3)	$\pm 15$	$\pm 15$	$\pm 15$	V
Duration of output short circuit to ground, one amplifier at a time (see Note 4)	unlimited	unlimited	unlimited	
Continuous total dissipation	See Dissipation Rating Table			
Operating free-air temperature range	0 to 70	-55 to 125	-40 to 85	$^{\circ}\text{C}$
Storage temperature range	-65 to 150	-65 to 150	-65 to 150	$^{\circ}\text{C}$
Case temperature for 60 seconds		FK package	—	$^{\circ}\text{C}$
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds		J or W package	—	$^{\circ}\text{C}$
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds		D or N package	260	$^{\circ}\text{C}$

NOTES: 1. All voltage values, unless otherwise noted, are with respect to the midpoint between  $V_{CC+}$  and  $V_{CC-}$ .

2. Differential voltages are at  $\text{IN+}$  with respect to  $\text{IN-}$ .

3. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 V, whichever is less.

4. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^{\circ}\text{C}$ POWER RATING	DERATING FACTOR	DERATE ABOVE $T_A$	$T_A = 70^{\circ}\text{C}$ POWER RATING	$T_A = 85^{\circ}\text{C}$ POWER RATING	$T_A = 125^{\circ}\text{C}$ POWER RATING
D	800 mW	7.6 mW/ $^{\circ}\text{C}$	45 $^{\circ}\text{C}$	608 mW	494 mW	—
FK	800 mW	11.0 mW/ $^{\circ}\text{C}$	77 $^{\circ}\text{C}$	800 mW	715 mW	275 mW
J	800 mW	11.0 mW/ $^{\circ}\text{C}$	77 $^{\circ}\text{C}$	800 mW	715 mW	275 mW
N	800 mW	9.2 mW/ $^{\circ}\text{C}$	63 $^{\circ}\text{C}$	736 mW	598 mW	—
W	800 mW	8.0 mW/ $^{\circ}\text{C}$	50 $^{\circ}\text{C}$	640 mW	520 mW	200 mW

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## recommended operating conditions

	MIN	MAX	UNIT
Supply voltage, $V_{CC+}$	5	15	V
Supply voltage, $V_{CC-}$	-5	-15	V

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

PARAMETER	TEST CONDITIONS†	RC4136			RM4136			RV4136			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$V_{IL}$ Input offset voltage	$V_O = 0$	25°C	0.5	6	0.5	4	0.5	6	mV		
		Full range	7.5			6				7.5	
$I_{IO}$ Input offset current	$V_O = 0$	25°C	5	200	5	1.50	5	200	nA		
		Full range	300			500				500	
$I_{IB}$ Input bias current	$V_O = 0$	25°C	140	500	140	400	140	500	nA		
		Full range	800			1500				1500	
$V_i$ Input voltage range		25°C	$\pm 12$	$\pm 14$	$\pm 12$	$\pm 14$	$\pm 12$	$\pm 14$	V		
$V_{OM}$ Maximum peak output voltage swing	$R_L = 10\text{ k}\Omega$	25°C	$\pm 12$	$\pm 14$	$\pm 12$	$\pm 14$	$\pm 12$	$\pm 14$	V		
	$R_L = 2\text{ k}\Omega$	25°C	$\pm 10$	$\pm 13$	$\pm 10$	$\pm 13$	$\pm 10$	$\pm 13$			
	$R_L \geq 2\text{ k}\Omega$	Full range	$\pm 10$			$\pm 10$				$\pm 10$	
$A_{VD}$ Large-signal differential voltage amplification	$V_O = \pm 10\text{ V}$ , $R_L \geq 2\text{ k}\Omega$	25°C	20	300	50	350	20	300	V/mV		
		Full range	15			25				15	
$B_1$ Unity-gain bandwidth		25°C	3			3.5			3	MHz	
$r_i$ Input resistance		25°C	0.3*	5	0.3*	5	0.3*	5	M $\Omega$		
CMRR Common-mode rejection ratio	$V_O = 0$ , $R_S = 50\text{ }\Omega$	25°C	70	90	70	90	70	90	dB		
$k_{SVS}$ Supply voltage sensitivity ( $\Delta V_{IO}/\Delta V_{CC}$ )	$V_{CC} = \pm 9\text{ V}$ to $\pm 15\text{ V}$ , $V_O = 0$	25°C	30	150	30	150	30	150	$\mu\text{V/V}$		
$V_n$ Equivalent input noise voltage (closed-loop)	$A_{VD} = 100$ , BW = 1 Hz, $f = 1\text{ kHz}$ , $R_S = 100\text{ }\Omega$	25°C	8			8			8	nV/ $\sqrt{\text{Hz}}$	
$I_{CC}$ Supply current (all four amplifiers)	$V_O = 0$ , No load	25°C	5	11.3	5	11.3	5	11.3	mA		
		MIN $T_A$	6	13.7	6	13.3	6	13.7			
		MAX $T_A$	4.5	10	4.5	10	4.5	10			
$P_D$ Total power dissipation (all four amplifiers)	$V_O = 0$ , No load	25°C	150	340	150	340	150	340	mW		
		MIN $T_A$	180	400	180	400	180	400			
		MAX $T_A$	135	300	135	300	135	300			
Crosstalk attenuation ( $V_{O1}/V_{O2}$ )	$A_{VD} = 100$ , $f = 10\text{ kHz}$ , $R_S = 1\text{ k}\Omega$	25°C	105			105			105	dB	

\* This parameter is not production tested.

† All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise specified. Full range is 0°C to 70°C for RC4136, -55°C to 125°C for RM4136, and -40°C to 85°C for RV4136. Minimum  $T_A$  is 0°C for RC4136, -55°C for RM4136, and -40°C for RV4136. Maximum  $T_A$  is 70°C for RC4136, 125°C for RM4136, and 85°C for RV4136.



**RC4136, RM4136, RV4136**  
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**operating characteristics,  $V_{CC+} = 15\text{ V}$ ,  $V_{CC-} = -15\text{ V}$ ,  $T_A = 25^\circ\text{C}$**

PARAMETER	TEST CONDITIONS	RC4136, RV4136			RM4136			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$t_r$ Rise time	$V_I = 20\text{ mV}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$	0.13			0.13			$\mu\text{s}$
		5%			5%			
SR Slew rate at unity gain	$V_I = 10\text{ V}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$	1.7			1.7			$\text{V}/\mu\text{s}$