

0.5 MHz, Low power RRIO CMOS Automotive Amplifier

■ Features

- AEC-Q100 qualified:
 - Device ambient temperature: $-40^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$
 - Device junction temperature: $-40^{\circ}\text{C} \leq T_J \leq 150^{\circ}\text{C}$
- Wide supply range:
 - Single power supply: 1.8 V to 5.5 V
 - Dual power supply: $\pm 0.9\text{ V}$ to $\pm 2.75\text{ V}$
- Rail-to-rail input and output
- Gain bandwidth product: 0.5 MHz
- Low supply current: 24 μA typical per channel
- Low input bias current: 20 pA
- Low input offset voltage: $\pm 3\text{ mV}$
- Input offset voltage drift: 2.5 $\mu\text{V}/^{\circ}\text{C}$

■ Applications

- Infotainment and cluster
- Advanced driver assistance systems (ADAS)
- HEV / EV inverter and motor control
- Sensor interfaces
- Body electronics and lighting
- On-board (OBC) and wireless charger
- Power-train current sensor

■ Package Information

Part Number	Package	Body Size
DIA32051	SOT23-5	2.9 mm × 1.6 mm

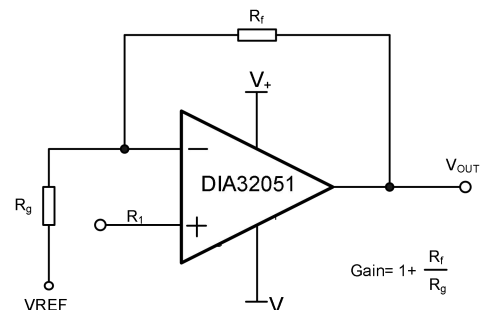
■ Description

The DIA32051 is a low power, high precision CMOS operational amplifiers for automotive application. It provides rail-to-rail input and output operation from a supply range of 1.8 V to 5.5 V. The device is designed for a wide range of general-purpose applications

The device operates at single power supply or dual power supply and offer 0.5 MHz bandwidth, 0.29 V/ μs slew rate and only 24 μA of quiescent current per channel. The DIA32051 offers low input offset voltage of $\pm 3\text{ mV}$ and low input bias current of 20 pA.

The DIA32051 is available in standard package SOT23-5. It is specified over ambient temperature range of -40°C to 125°C , which meets the requirements of automotive applications.

■ Simplified Schematic



■ Package Information

Ordering Part No.	Top Marking	MSL	RoHS	T _A	Package	
DIA32051ST5	A5AYW	1	Green	-40 to 125 °C	SOT23-5	Tape & Reel, 3000

If you encounter any issue in the process of using the device, please contact our customer service at marketing@dioo.com or phone us at (+86)-21-62116882. If you have any improvement suggestions regarding the datasheet, we encourage you to contact our technical writing team at docs@dioo.com. Your feedback is invaluable for us to provide a better user experience.

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1. Pin Assignment and Functions

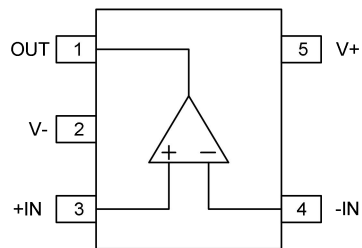


Figure 1. SOT23-5 (Top view)

Pin No.	Name	Description
1	OUT	Output
2	V-	Negative supply
3	+IN	Positive input
4	-IN	Negative input
5	V+	Positive supply

2. Absolute Maximum Ratings

Exceeding the maximum ratings listed under Absolute Maximum Ratings when designing is likely to damage the device permanently. Do not design to the maximum limits because long-time exposure to them might impact the device's reliability. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Ratings	Unit
V ₊	Supply voltage	7	V
V _{IN}	Input voltage	(V ₋) - 0.1 to (V ₊) +0.1	V
T _{STG}	Storage temperature range	-65 to 150	°C
T _J	Junction temperature	150	°C
T _L	Lead temperature range	260	°C

3. Recommended Operating Condition

Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Symbol	Parameter	Ratings	Unit
V ₊	Supply voltage	1.8 to 5.5	V
V _{IN}	Input voltage	0 to V ₊	V
T _A	Operating temperature range	-40 to 125	°C

4. ESD Ratings

When a statically-charged person or object touches an electrostatic discharge sensitive device, the electrostatic charge might be drained through sensitive circuitry in the device. If the electrostatic discharge possesses sufficient energy, damage might occur to the device due to localized overheating.

Model	Condition	Value	Unit
Human-body model	JEDEC: JESD22-A114	±8	kV
Charged Device Model	JEDEC: JESD22-C101	±2	kV

5. Thermal Considerations

The thermal resistance determines the heat insulation property of a material. The higher the thermal resistance is, the lower the heat loss. Accumulation of heat energy degrades the performance of semiconductor components.

Symbol	Metric	Value	Unit
$R_{\theta JA}$	Junction-to-ambient thermal resistance	TBD	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	TBD	°C/W

6. Electrical Characteristics

Typical value: $V_+ = 5\text{ V}$, $R_L = 100\text{ k}\Omega$ to $V_+/2$, $T_A = 25^\circ\text{C}$, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Input characteristics						
V _{OS}	Input offset voltage	-40°C ≤ T _A ≤ 125°C, V ₊ = 1.8 V to 5 V, V _{CM} = V ₊ /2	-3	0	3	mV
I _B	Input bias current	-40°C ≤ T _A ≤ 125°C, V ₊ = 1.8 V to 5 V		20		pA
I _{OS}	Input offset current	-40°C ≤ T _A ≤ 125°C, V ₊ = 1.8 V to 5 V		5		pA
V _{CM}	Common mode voltage range		0.1		V ₊	V
CMRR	Common mode rejection ratio	-40°C ≤ T _A ≤ 125°C, V _{CM} = 0.1 to V ₊		75		dB
A _{OL} ⁽²⁾	Open loop voltage gain	R _L = 5 kΩ, V _O = 0.1 to (V ₊) - 0.1	80	102		dB
		R _L = 200 kΩ, V _O = 0.1 to (V ₊) - 0.1	100	128		
d _{VOS} /dt	Input offset voltage drift	-40°C ≤ T _A ≤ 125°C		2.5		μV/°C
Output characteristics						
V _{OH}	Output voltage high	V ₊ = 5 V, R _L = 100 kΩ, -40°C ≤ T _A ≤ 125°C		4.995		V
		V ₊ = 1.8 V, R _L = 100 kΩ, -40°C ≤ T _A ≤ 125°C		1.79		
V _{OL}	Output voltage low	V ₊ = 5 V, R _L = 100 kΩ, -40°C ≤ T _A ≤ 125°C		5		mV
		V ₊ = 1.8 V, R _L = 100 kΩ, -40°C ≤ T _A ≤ 125°C		5		
I _{SC}	Output short circuit current	Source I _{SC} , V ₊ = 5 V		28		mA
		Sink I _{SC} , V ₊ = 5 V		28		
Power supply						
PSRR	Power supply rejection ration			85		dB
I _S	Supply current	-40°C ≤ T _A ≤ 125°C		24		μA
Dynamic performance						
GBP	Gain bandwidth product	R _L = 100 KΩ, C _L = 100 pF		0.5		MHz
SR	Slew rate	G = 1, 2 V output step		0.29		V/μs
t _s	Settling time	G = 1, 20 mV output step		4		μs
Noise performance						
THD	Total harmonic distortion	f = 10 kHz, 2 V output step, R _L = 10 kΩ		0.02		%
e _n	Voltage noise density	f = 1 kHz		66		nV/√Hz
		f = 10 kHz		40		

Note:

(1) Specifications subject to change without notice.

(2) Guaranteed by design.

7. Typical Characteristics

Typical value: $V_+ = 5\text{ V}$, $V_- = 0\text{ V}$, $R_L = 100\text{ k}\Omega$ to $V_+/2$, $T_A = 25^\circ\text{C}$, unless otherwise specified.

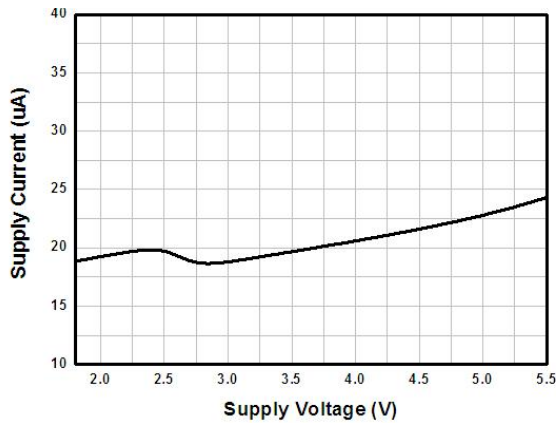


Figure 2. Supply current vs. Supply voltage

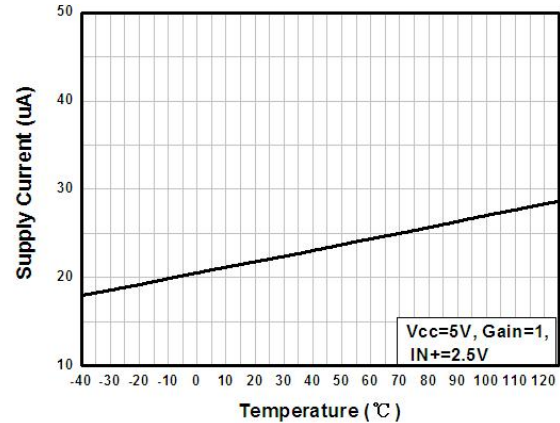


Figure 3. Supply current vs. Temperature

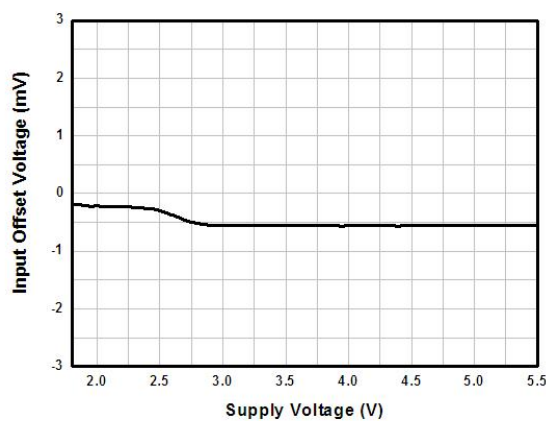


Figure 4. Input offset voltage vs. Supply voltage

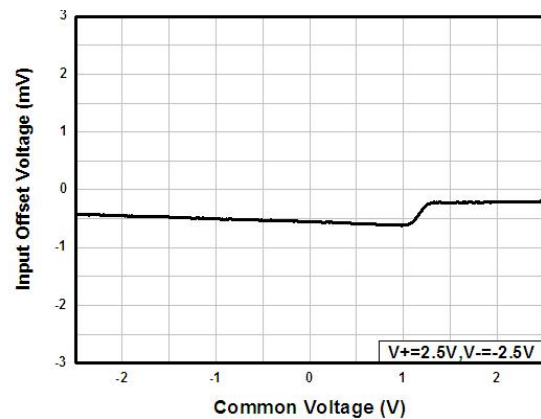


Figure 5. Input offset voltage vs. Common voltage

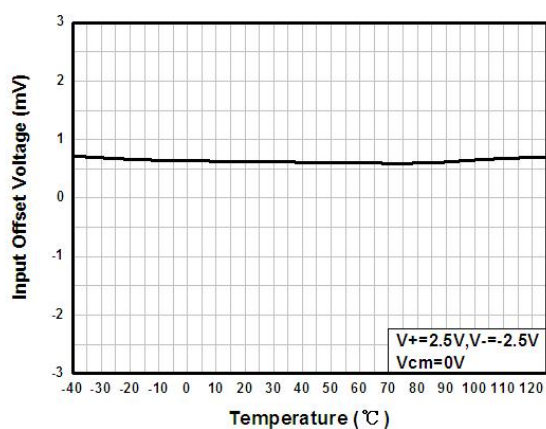


Figure 6. Input offset voltage vs. Temperature

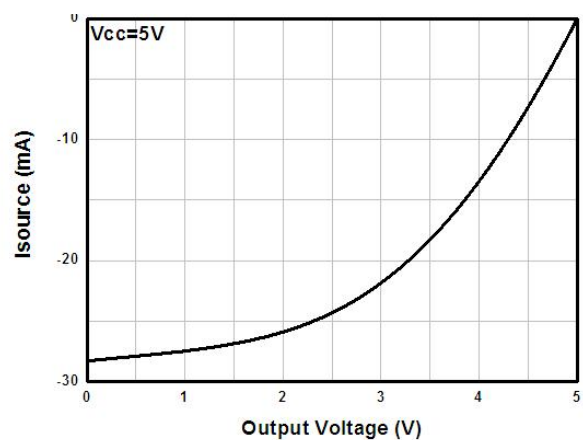


Figure 7. I_{SOURCE} vs. Output voltage

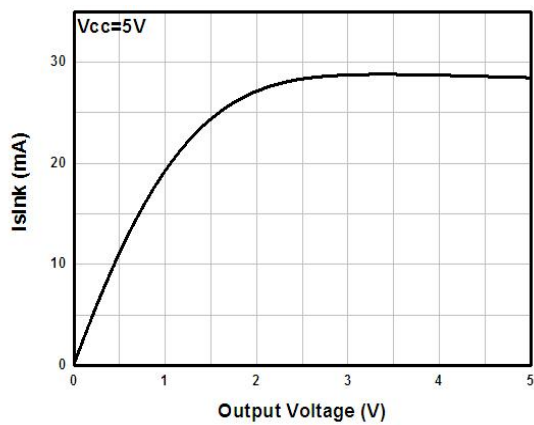


Figure 8. I_{SINK} vs. Output voltage

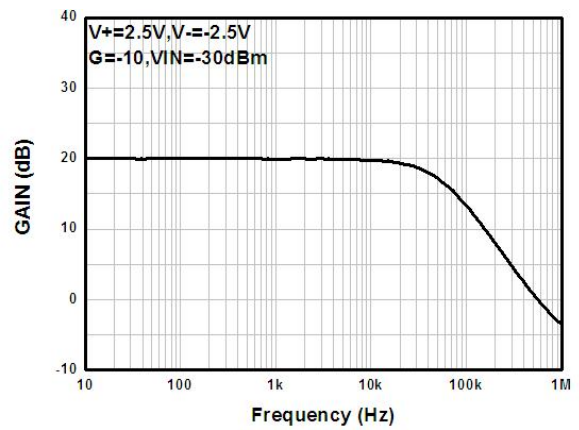


Figure 9. Gain vs. Frequency

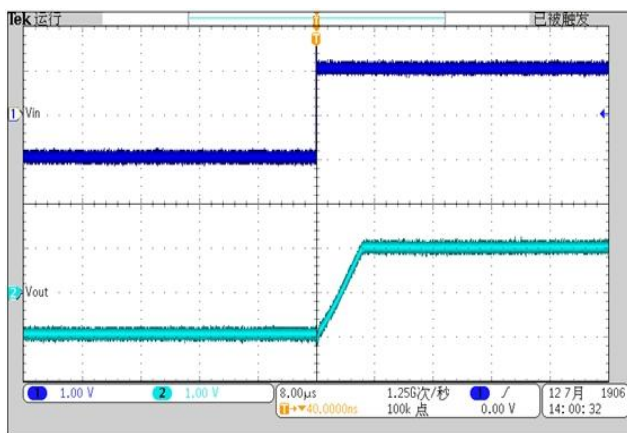


Figure 10. Slew rate

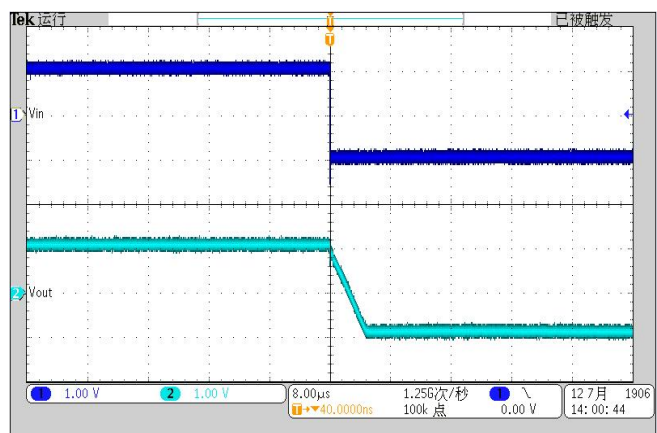
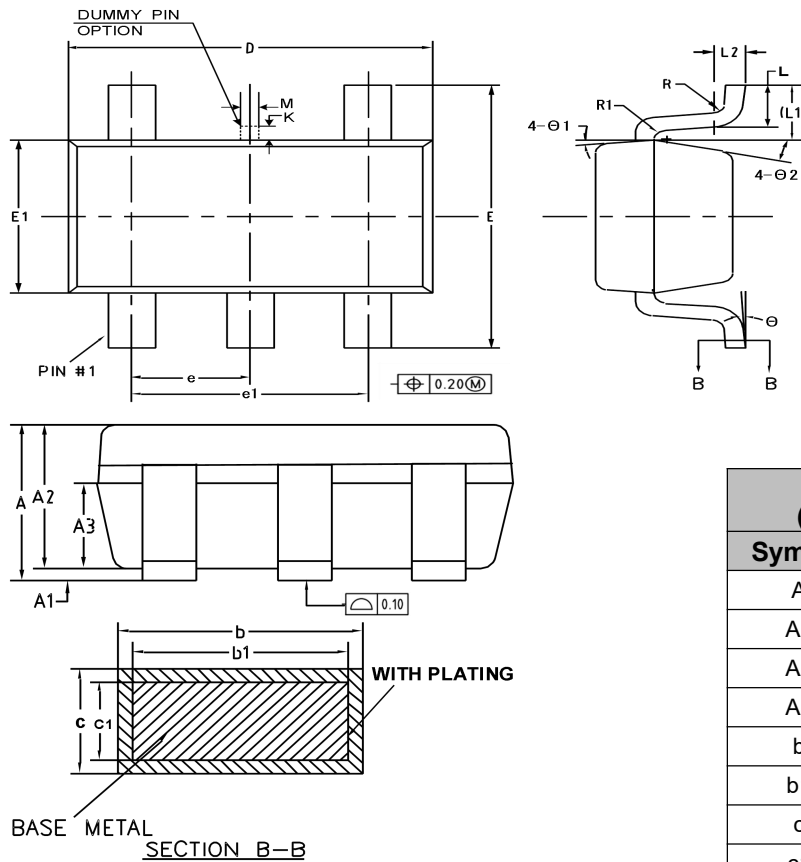


Figure 11. Slew rate

8. Physical Dimensions: SOT23-5



Common Dimensions (Units of measure = Millimeter)			
Symbol	Min	Nom	Max
A	-	-	1.25
A1	0	-	0.15
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.36	-	0.45
b1	0.35	0.38	0.41
c	0.14	-	0.20
c1	0.14	0.15	0.16
D	2.826	2.926	3.026
E	2.60	2.80	3.00
E1	1.526	1.626	1.726
e	0.90	0.95	1.00
e1	1.80	1.90	2.00
K	0	-	0.25
L	0.30	0.40	0.60
L1	0.59 REF		
L2	0.25 BSC		
M	0.10	0.15	0.25
R	0.05	-	0.20
R1	0.05	-	0.20
Θ	0°	-	8°
Θ1	8°	10°	12°
Θ2	10°	12°	14°

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