Adjustable shunt voltage reference IC

1 Features

- Reference Voltage Tolerance at 25°C
  – 0.5% (A Grade)
- Adjustable Output Voltage: V_{REF} to 36 V
- Typical Temperature Drift
  – 10mV (−40 to 85°C)
  – 20mV (−40 to 125°C)
- Low Output Noise
- Sink-Current Capability: 0.15 mA to 100 mA
- Operation From −40°C to 125°C

2 Applications

- Precision Voltage Reference
- Switching Power Supply
- Charger
- Voltage Adapter
- Adjusted Power Supply

3 Description

The GD30VR431 series ICs are three-terminal adjustable shunt regulators with guaranteed thermal stability over a full operation range. These ICs feature very sharp turn-on characteristics, low temperature coefficient and low output impedance, which make them ideal substitutes for Zener diodes in applications such as switching power supply, charger, and other adjustable regulators.

The GD30VR431 is especially suitable for industry applications types.

The GD30VR431 precision reference is offered in one band- gap tolerance: A Grade 0.5%.

The GD30VR431 are characterized for operation from –40°C to 125°C.

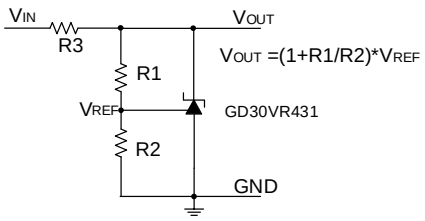
Device Information[1]

PART NUMBER	PACKAGE	BODY SIZE (NOM)
GD30VR431	SOT23-3	2.90mm × 1.30mm

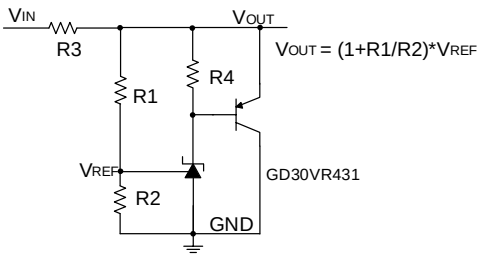
1. For packaging details, see *Package Information* section.

Simplified Application Schematic

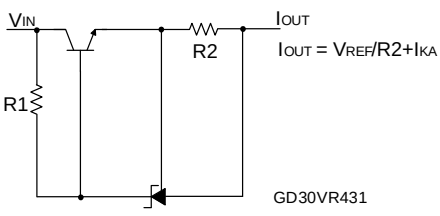
Shunt Regulator



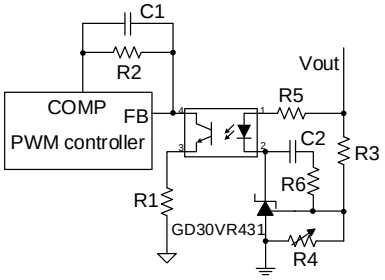
High Current Shunt Regulator



Current Source or Current Limit



PWM Converter with Reference



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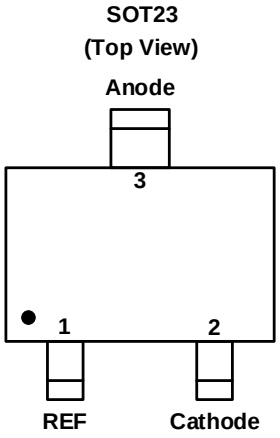
4 Device Overview

4.1 Pinout and Pin Assignment



4.2 Pin Description

PINS		PIN TYPE[1]	FUNCTION
NAME	SOT23		
REF	1	I	Threshold relative to common anode
Cathode	2	I/O	Shunt Current/Voltage input
Anode	3	O	Common pin, normally connected to ground

1. I = Input, O = Output, P = Power, G = Ground.

5 Parameter Information

5.1 Absolute Maximum Ratings

Exceeding the operating temperature range(unless otherwise noted)[1]

SYMBOL	PARAMETER	MIN	MAX	UNIT
V_{KA}	Cathode voltage		40	V
I_{KA}	Continuous cathode current	−100	100	mA
I_{REF}	Reference input current range	−0.05	10	mA
T_{JMAX}	Maximum junction temperature		150	°C
T_{LEAD}	Maximum lead temperature		260	°C
T_{STG}	Storage temperature	−65	150	°C

1. The maximum ratings are the limits to which the device can be subjected without permanently damaging the device. Note that the device is not guaranteed to operate properly at the maximum ratings. Exposure to the absolute maximum rating conditions for extended periods may affect device reliability.

5.2 Recommended Operation Conditions

SYMBOL[1,2]	PARAMETER	MIN	TYP	MAX	UNIT
V_{KA}	Cathode Voltage	V_{REF}		40	V
I_{KA}	Cathode Current	0.4		80	mA
T_A	Operating Ambient Temperature Range	−40		125	°C

1. The device is not guaranteed to function outside of its operating conditions.
2. Refer to the *Application Information* section for further information.

5.3 Electrical Sensitivity

SYMBOL	CONDITIONS	VALUE	UNIT
$V_{ESD(HBM)}$	Human-body model (HBM), ANSI/ESDA/JEDEC JS-001-2017[1]	±5000	V
$V_{ESD(CDM)}$	Charge-device model (CDM), ANSI/ESDA/JEDEC JS-002-2022[2]	±1000	V

1. JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
2. JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

5.4 Thermal Resistance

SYMBOL[1]	CONDITIONS	PACKAGE	VALUE	UNIT
Θ_{JA}	Junction-to-ambient thermal resistance	SOT23-3	206	°C/W
Θ_{JC}	Junction-to-case thermal resistance	SOT23-3	76	°C/W

1. Thermal characteristics are based on simulation, and meet JEDEC document JESD51-7.

5.5 Electrical Characteristics

T_J = 25°C, unless otherwise noted.

SYMBOL	PARAMETER		CONDITIONS		TEST CIRCUIT	MIN	TYP	MAX	UNIT
V_{REF}	Reference Voltage	A:0.5%	$V_{KA}=V_{REF}$,I_{KA}=10mA		Figure 1	2.484	2.497	2.509	V
ΔV_{REF}	Deviation of Reference Voltage Over-Temperature		$V_{KA}=V_{REF}$ I_{KA}= 10mA	−40 to 85°C	Figure 1		10	15	mV
				−40 to 125°C			10	25	
ΔV_{REF} / ΔV_{KA}	Ratio of Change in Reference Voltage to the Change in Cathode Voltage		I_{KA}=10mA	ΔV_{KA}=10V to V_{REF}	Figure 2		−1.0	−2.7	mV/V
				ΔV_{KA}=36V to 10V			−0.5	−2.0	
I_{REF}	Reference Current		I_{KA}=10mA, R1=10kΩ, R2=∞		Figure 2		0.7	4	μA
ΔI_{REF}	Deviation of Reference Current Over Full Temperature Range		I_{KA}=10mA, R1=0KΩ, R2=∞,T_A=-40 to 105°C		Figure 2		0.4	1.2	μA
I_{KA} (MIN)	Minimum Cathode Current for Regulation		$V_{KA}=V_{REF}$		Figure 2		0.15	0.5	mA
I_{KA} (OFF)	Off-State Cathode Current		V_{KA}=36V, V_{REF}=0		Figure 3		0.1	0.5	μA
$\|Z_{KA}\|$	Dynamic Impedance		$V_{KA}=V_{REF}$, I_{KA}=1 to 80mA, f ≤1.0kHz		Figure 1		0.2	0.5	Ω

5.6 Parameter Measurement Information

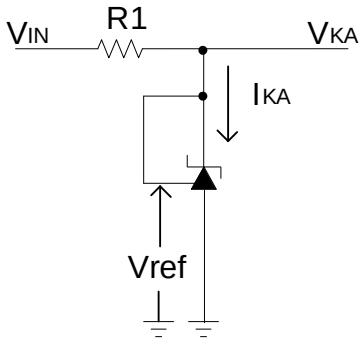


Figure 1.Test Circuit for V_{KA}=Vref

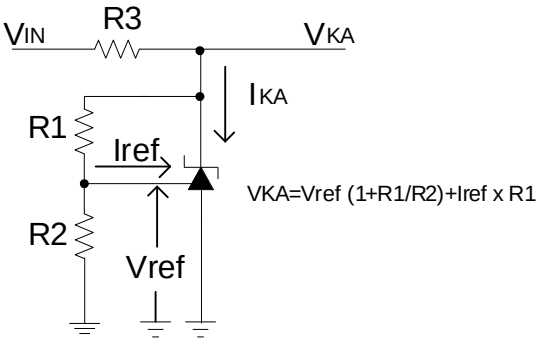


Figure 2.Test Circuit for V_{KA}>Vref

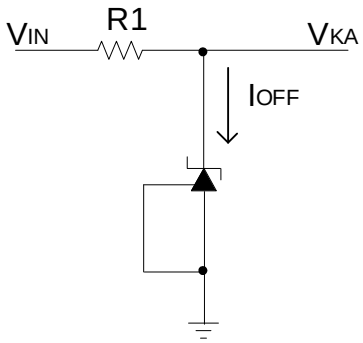


Figure 3.Test Circuit for I_{OFF}

5.7 Typical Characteristics

T_A = 25°C, unless otherwise noted.

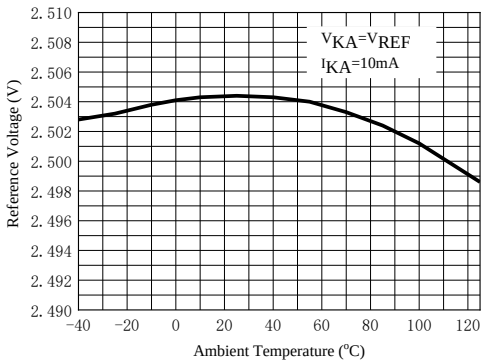


Figure 4. Reference Voltage vs. Ambient Temperature

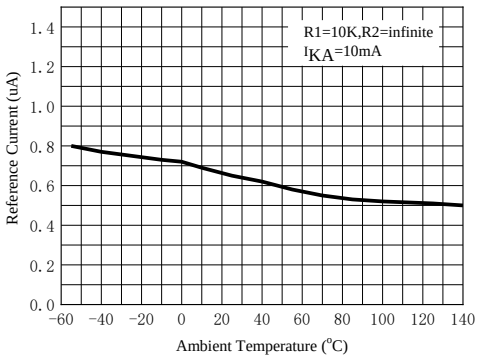


Figure 5. Reference Current vs. Ambient Temperature

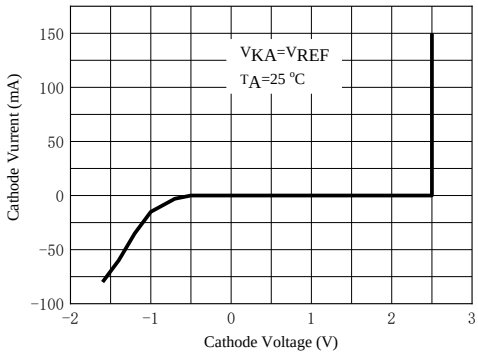


Figure 6. Cathode Current vs. Cathode voltage

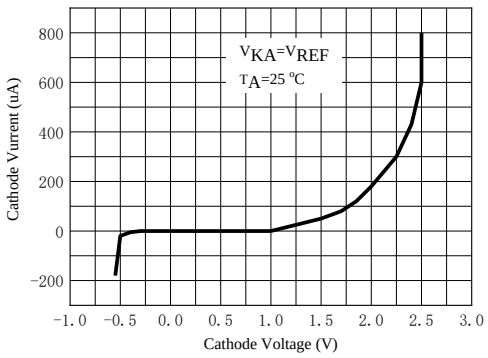


Figure 7. Cathode Current vs. Cathode voltage

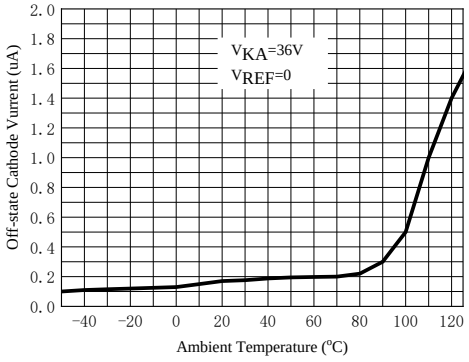


Figure 8. Off-state Cathode Current vs. Ambient Temperature

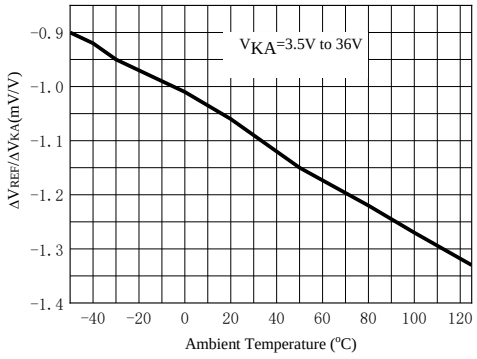


Figure 9. Ratio of delta reference voltage to the ratio of delta to the cathode voltage

Typical Characteristics (continued)

T_A = 25°C, unless otherwise noted.

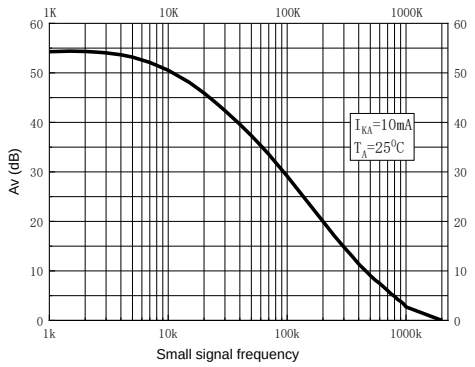


Figure 10. Small signal voltage amplification vs. frequency

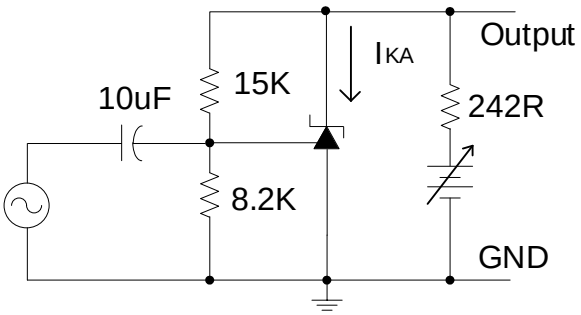


Figure 11. Test Circuit for Voltage Amplification

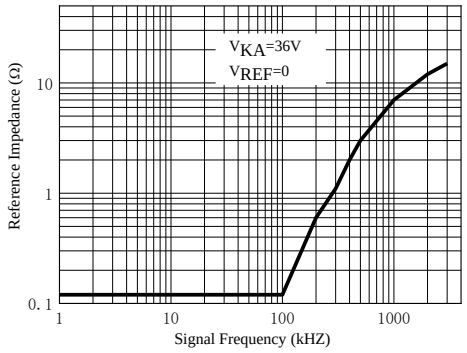


Figure 12. Reference Impedance vs. Frequency

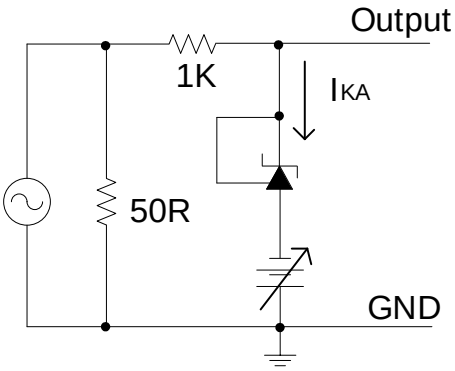


Figure 13. Test Circuit for Reference Impedance

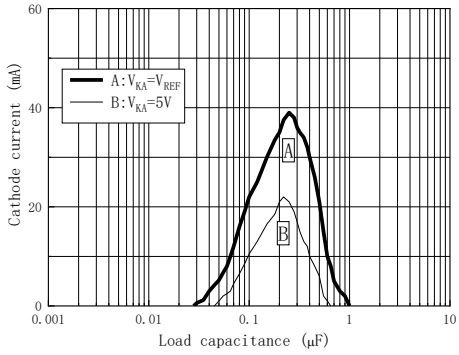


Figure 14.Stability Boundary Conditions

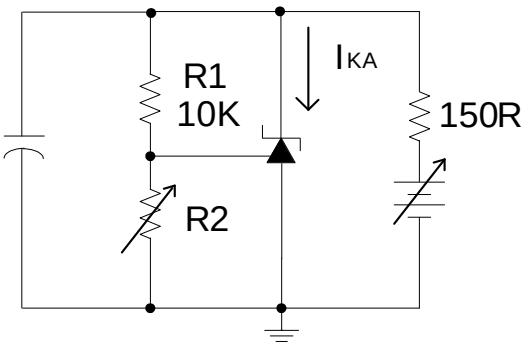


Figure 15. Test Circuits for Stability Boundary Conditions

Typical Characteristics (continued)

T_A = 25°C, unless otherwise noted.

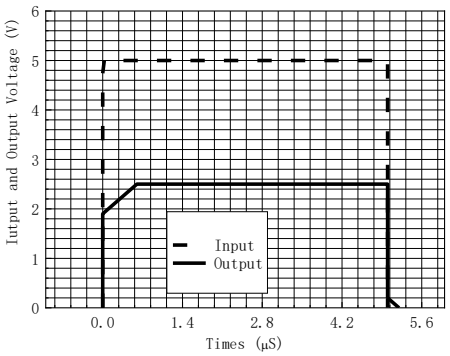


Figure 16. Pulse Response

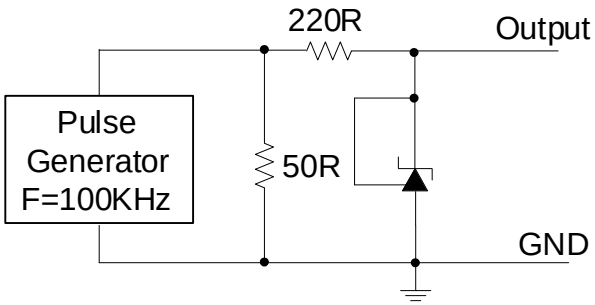


Figure 17. Test Circuit for Pulse Response

6 Functional Description

6.1 Block Diagram

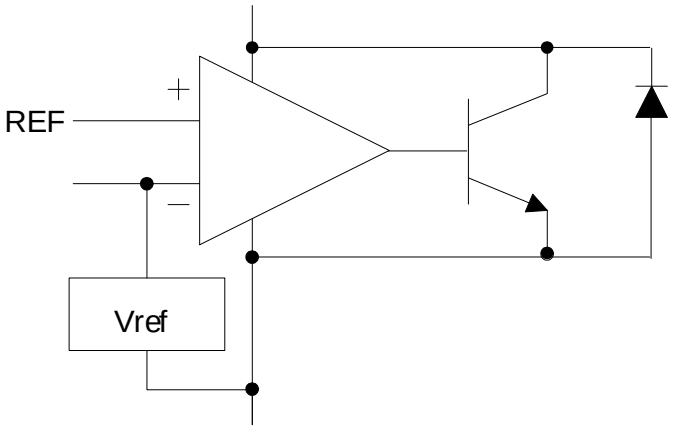


Figure 18. Functional Block Diagram of GD30VR431

7 Application Information

7.1 Typical Application Circuit

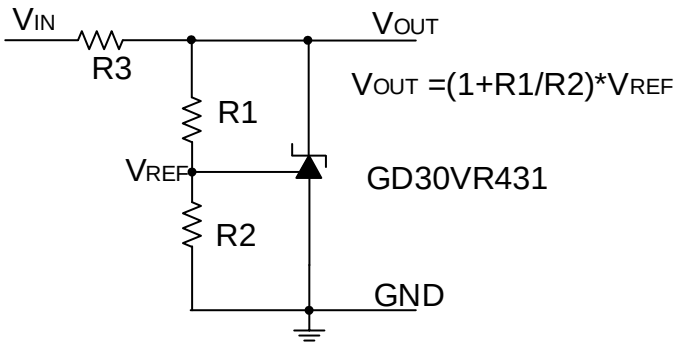


Figure 19.Shunt Regulator

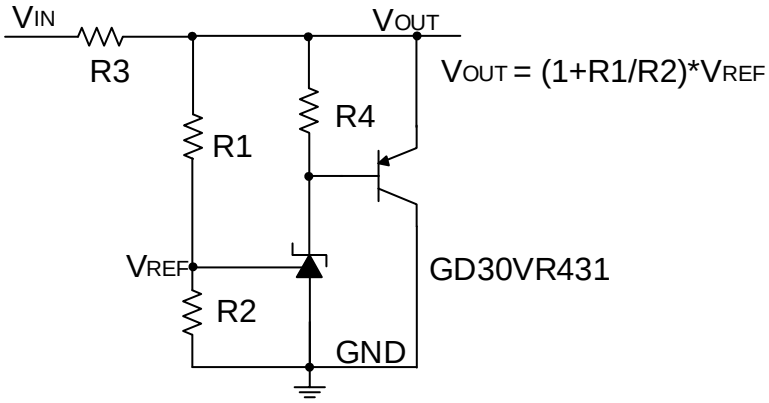


Figure 20.High Current Shunt Regulator

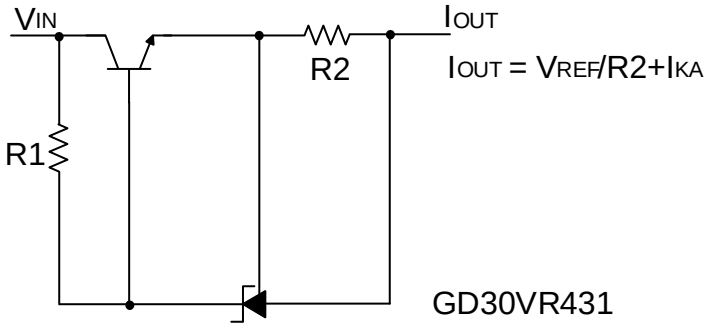


Figure 21.Current Source or Current Limit

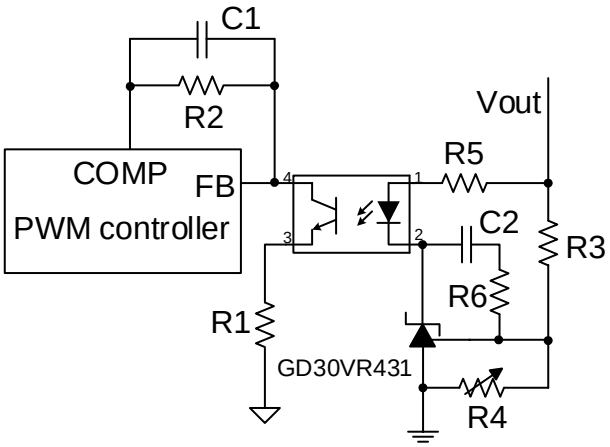
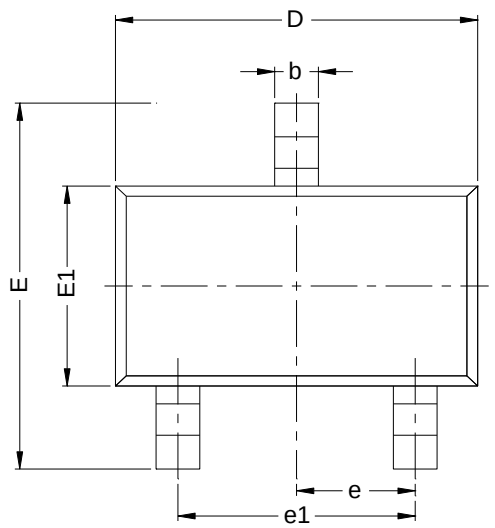


Figure 22.PWM Converter with Reference

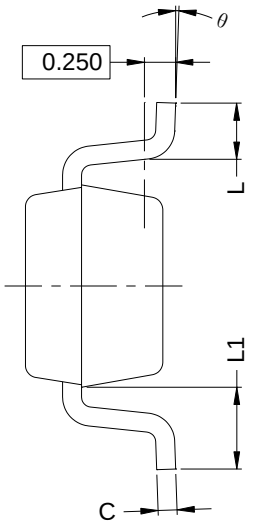
8 Package Information

8.1 Outline Dimensions

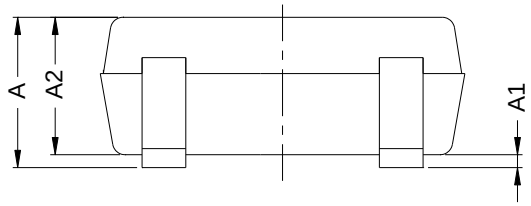
SOT23 Package Outline



TOP VIEW



SIDE VIEW



FRONT VIEW

NOTES:

1. All dimensions are in millimeters.
2. Package dimensions does not include mold flash, protrusions, or gate burrs.
3. Refer to the Table 1 *SOT23-3 dimensions(mm)*.

Table 1. SOT23-3 dimensions(mm)

SYMBOL	MIN	NOM	MAX
A		1.05 REF	
A1	0.01		0.10
A2	0.90		1.10
b	0.3		0.51
c	0.08		0.18
D	2.80	2.90	3.00
E	2.30	2.40	2.50
E1	1.20	1.30	1.40
e	0.89		1.03
e1		1.90 REF	
L	0.20		
L1		0.55 REF	
θ	0°		10°

9 Ordering Information

Ordering Code	Package Type	ECO Plan	Packing Type	MOQ	OP Temp(°C)
GD30VR431ABSTR-I	SOT23-3	Green	Tape & Reel	3000	−40°C to +125°C

10 Revision History

REVISION NUMBER	DESCRIPTION	DATE
1.0	Initial release and device details	2024

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