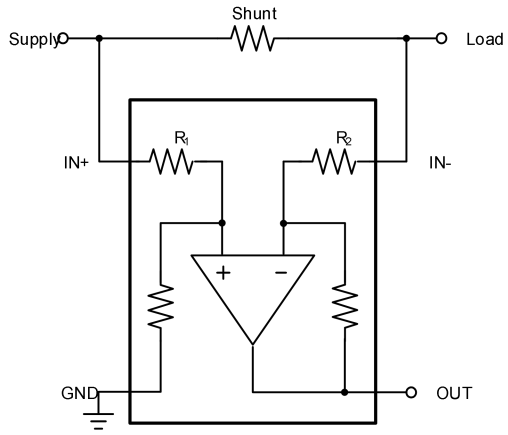
GT216
Small Size, Low-Power, Unidirectional, Current Shunt Monitor

1 Features	2 Application
- Common-mode range: +1.8 V to +5.5 V - Rail-to-rail output - Offset voltage: ±120 μV max - Gain error: ±0.4% max - Quiescent current: 24 μA	- Notebook computers - Cell phones - Telecom equipment - Power management - Battery chargers

3 Description	Circuit Diagram
The GT216 is a high-side voltage output current shunt monitor that can sense drops across shunts at common-mode voltages from +1.8V to +5.5V. Four fixed gains are available: 25V/V, 50V/V, 100V/V, and 200V/V. The low offset of the Zerø-Drift architecture enables current sensing with maximum drops across the shunt as low as 10mV full-scale, or with wide dynamic ranges of over 1000:1. These devices operate from a single +1.8V to +5.5V power supply, drawing a maximum of 25pA of supply current. The GT216 series are specified over the temperature range of –40°C to +125°C, and offered in a chip-scale package.	

4 Revision History

Revision	Date	Note
Rev. A1. 0	2023. 09. 02	Original Version
Rev. A1. 1	2023. 12. 15	1.Updated Package Qty 2.Added Tape and Reel Information 3. Added Application Note
Rev. A1. 2	2024. 05. 24	1. Added Marking 2. Added MSL

The latest datasheet version should be checked on the GTIC official website, as the company does not actively inform customers about updates to the datasheet.

5 Device Summary, Pin and Packages

Table 5-1. Device Summary(1)

Serial Name	Part Name	Package	Body Size (Nom)	Marking(2)	MSL(3)	Package Qty
GT216	GT216A1QA	QFN1.4×1.8-10L	1.40mm×1.80mm×0.55mm	2161 XXXX	3	Tape and Reel,4000
GT216	GT216A2QA	QFN1.4×1.8-10L	1.40mm×1.80mm×0.55mm	2162 XXXX	3	Tape and Reel,4000
GT216	GT216A3QA	QFN1.4×1.8-10L	1.40mm×1.80mm×0.55mm	2163 XXXX	3	Tape and Reel,4000
GT216	GT216A4QA	QFN1.4×1.8-10L	1.40mm×1.80mm×0.55mm	2164 XXXX	3	Tape and Reel,4000

(1) For all available packages, please contact product sales.

(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

(4) "XXXXX" in Marking will be appeared as the batch code.

5 Device Summary, Pin and Packages(Continued)

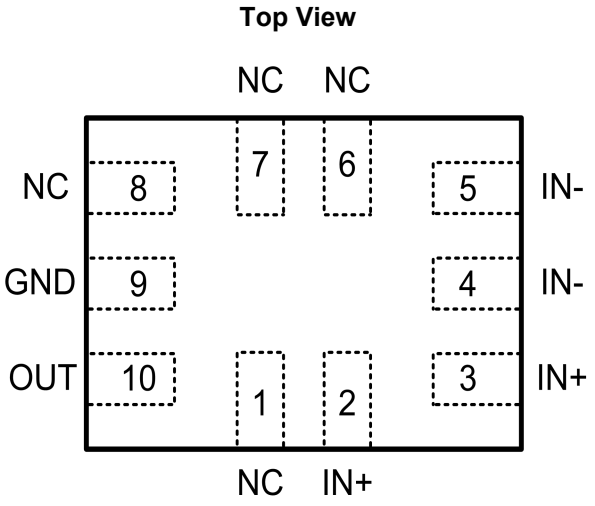


Fig.5-1. GT216: QA (10-Pin QFN1.4x1.8-10L) Package

Table 5-2 Pin definition

Pin		I/O	Description
Name	QA		
IN+	2,3	I	Positive(noninverting) input
IN-	4,5	I	Negative (inverting) input
GND	9	-	Negative (lowest) supply
OUT	10	O	Output
NC	1,6,7,8	-	-

* It is suggested to leave the unconnected pins floating.

6 Voltage, Temperature, ESD and Thermal Ratings

6.1 Absolute Maximum Ratings

Parameters	Min.	Max.	Unit
Supply Voltage		6.5	V
Select Input Voltage	V-0.5	V+0.5	V
Maximum Junction Temperature	-55	150	°C
Storage Temperature Range	-55	150	°C

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.3V beyond the supply rails should be current- limited to 10mA or less.

6.2 ESD Ratings

ESD			Value	Unit
V(ESD)	Electrostatic Discharge	Human-Body Model (HBM)	5 K	V
		Charged-Device Model(CDM)	2 K	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.

6.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

Symbol	Parameter	Min	Max	Unit
V_{CC}	Single-Supply, V_S=(V+) - (V-)	1.8	5.5	V
TA	Operating Temperature	-40	125	°C

6.4 Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
QFN1.4×1.8-10L	115	66	°C/W

7 Electrical Specifications

V_{CM}=V_{IN+}=4.2V. FULL=–40°C to +125°C, Typical values are at TA=+25°C. (unless otherwise noted)

Parameter	Symbol	Test Conditions	V_{CC}	TA	Min	Typ	Max	Units
Power Supply								
Operating Voltage	V_S		1.8V to 5.5V	FULL	1.8		5.5	V
Quiescent Current (per Amplifier)	IQ	T_A=25°C, V_{IN+}=+4.2V	4.2V	+25°C		24	30	μA
		T_A=–40°C to +125°C		FULL			38	μA
Power-Supply Rejection Ratio	PSRR	V_{IN+}=+1.8V to +5.5V						
GT216A1			1.8V to 5.5V	+25°C	80	100		dB
GT216A2			1.8V to 5.5V	+25°C	85	108		dB
GT216A3			1.8V to 5.5V	+25°C	85	108		dB
GT216A4			1.8V to 5.5V	+25°C	85	108		dB
Turn-on Time		V_{IN+}=0 to +2.5V; V_{SENSE}=10mV; V_{OUT}±0.5%	0 to 2.5V	+25°C		200		μs
Input								
Input Bias Current	I_{IN-}		4.2V	+25°C		4.5		μA
Offset Voltage	V_{OS}							
GT216A1						±40	±120	μV
vs Temperature	dV_{OS}/dT					0.1	0.3	μV/°C
GT216A2						±40	±100	μV
vs Temperature	dV_{OS}/dT					0.1	0.3	μV/°C
GT216A3						±20	±75	μV
vs Temperature	dV_{OS}/dT					0.1	0.3	μV/°C
GT216A4						±20	±75	μV
vs Temperature	dV_{OS}/dT					0.1	0.3	μV/°C
Common-Mode Voltage	V_{CM}		1.8V to 5.5V	FULL	1.8		5.5	V
Common-Mode Rejection Ratio	CMRR	V_{IN+}=+1.8V to +5.5V						
GT216A1			1.8V to 5.5V	+25°C	80	100		dB
GT216A2			1.8V to 5.5V	+25°C	85	108		dB
GT216A3			1.8V to 5.5V	+25°C	85	108		dB
GT216A4			1.8V to 5.5V	+25°C	85	108		dB

7 Electrical Specifications (Continued)

V_{CM}=V_{IN+}=4.2V. FULL=–40°C to +125°C, Typical values are at TA=+25°C. (unless otherwise noted)

Parameter	Symbol	Conditions	V_{CC}	TA	Min	Typ	Max	Units
Frequency Response								
Bandwidth	BW	C_{LOAD}=10pF						
GT216A1			4.2V	+25°C		20		kHz
GT216A2			4.2V	+25°C		10		kHz
GT216A3			4.2V	+25°C		5		kHz
GT216A4			4.2V	+25°C		2.5		kHz
Slew Rate	SR		4.2V	+25°C		0.03		V/μs
Voltage Noise Density	en		1.8V to 5.5V	+25°C		60		nV/√Hz
Output								
Gain	G							
GT216A1			1.8V to 5.5V	+25°C		25		V/V
GT216A2			1.8V to 5.5V	+25°C		50		V/V
GT216A3			1.8V to 5.5V	+25°C		100		V/V
GT216A4			1.8V to 5.5V	+25°C		200		V/V
Gain Error	GE							
GT216A1		V_{OUT}=0.2V to 2.5V	4.2V	+25°C		±0.1	±0.4	%
vs Temperature		V_{OUT}=0.2V to 2.5V	4.2V	FULL		0.1	0.3	m%
GT216A2			4.2V	+25°C		±0.1	±0.4	%
vs Temperature			4.2V	FULL		0.1	0.3	m%
GT216A3			4.2V	+25°C		±0.1	±0.4	%
vs Temperature			4.2V	FULL		0.1	0.3	m%
GT216A4			4.2V	+25°C		±0.1	±0.4	%
vs Temperature			4.2V	FULL		0.1	0.3	m%
Nonlinearity			1.8V to 5.5V	FULL		±0.01		%
Maximum Capacitive Load	C_{LOAD}	No Sustained Oscillation	1.8V to 5.5V	FULL		750		pF
Swing to V+		R_L=10kΩ to GND	1.8V to 5.5V	FULL		(V+)-0.1	(V+)-0.3	V
Swing to GND		R_L=10kΩ to GND	1.8V to 5.5V	FULL		(V_{GND}) +0.001	(V_{GND}) +0.002	V

8 Typical Characteristics

V_{CM}=V_{IN+}=4.2V. FULL=–40°C to +125°C, Typical values are at TA=+25°C. (unless otherwise noted)

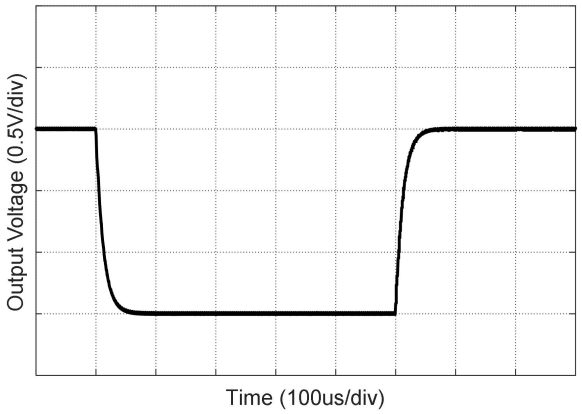


Fig.8-1.Small Signal Response

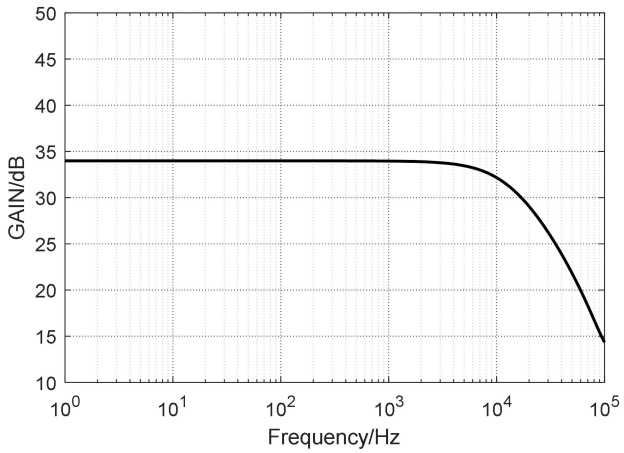


Fig.8-2. Small Signal Frequency Response

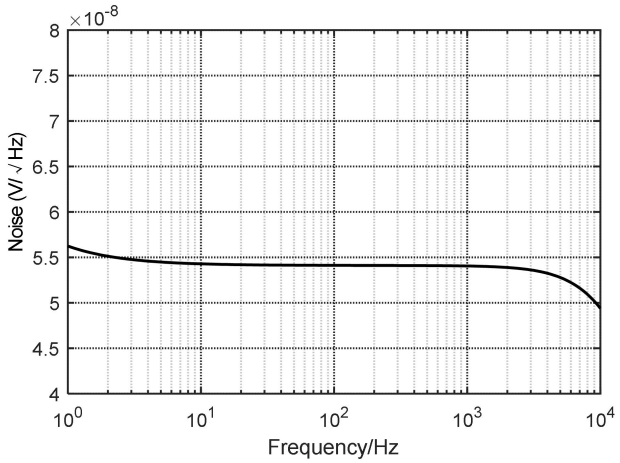


Fig.8-3. Noise Response

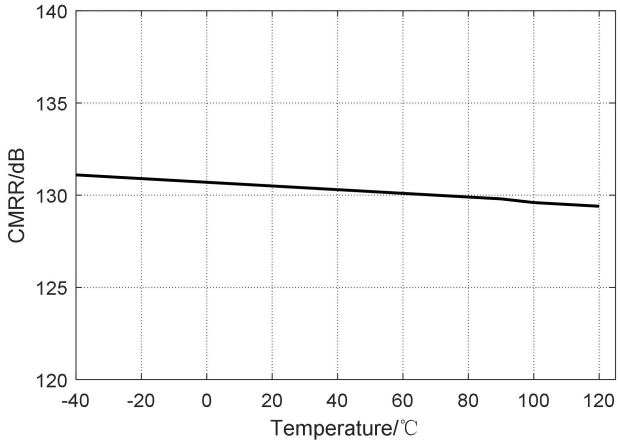


Fig.8-4. CMRR/PSRR vs Temperature

9 Detailed Description

The GT216 is a high-side voltage output current shunt monitor that can sense drops across shunts at common-mode voltages from +1.8V to +5.5V. Four fixed gains are available: 25V/V, 50V/V, 100V/V, and 200V/V. The low offset of the Zerø-Drift architecture enables current sensing with maximum drops across the shunt as low as 10mV full-scale, or with wide dynamic ranges of over 1000:1.

10 Application Note

Fig.10-1 shows the basic connections of the GT216. The input pins, IN+ and IN-, should be connected as closely as possible to the shunt resistor to minimize any resistance in series with the shunt resistance.

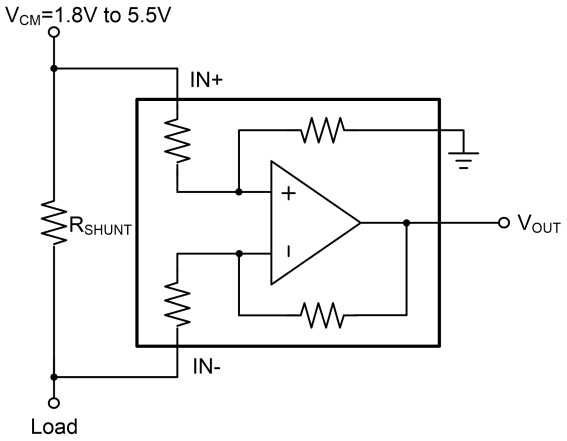


Fig.10-1. Typical Application

Fig.10-2 illustrates the GT216 connected to a shunt resistor with additional trace resistance in series with the shunt placed between where the current shunt monitors the input pins. With the typically low shunt resistor values commonly used in these applications, even small amounts of additional impedance in series with the shunt resistor can significantly affect the differential voltage present at the GT216 input pins.

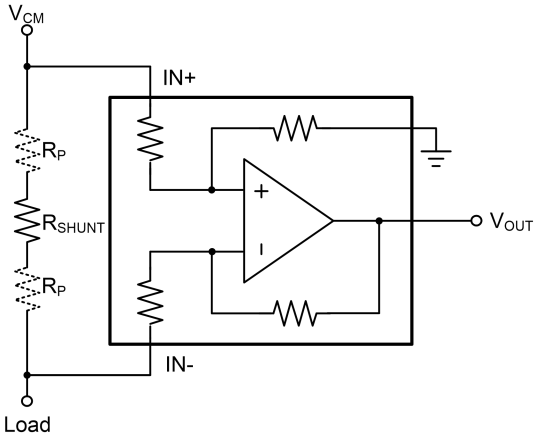
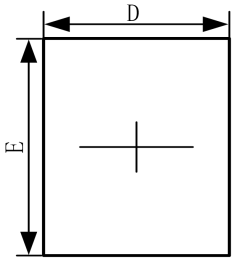


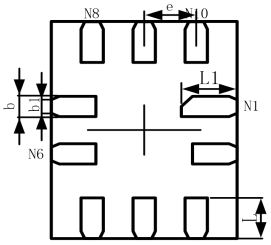
Fig.10-2. Shunt Resistance Measurement Including Trace Resistance

11 Package Outline Dimension

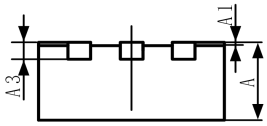
QFN1.4x1.8-10L



TOP VIEW



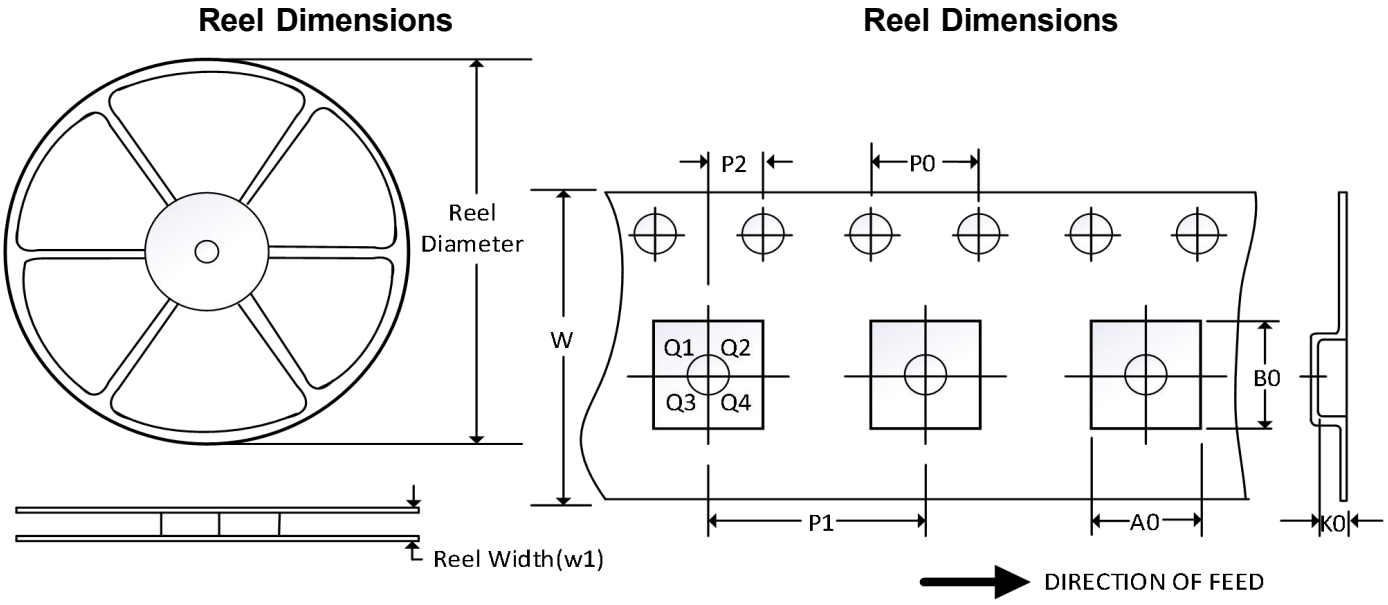
BOTTOM VIEW



SIDE VIEW

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A3	0.152REF		0.006REF	
D	1.350	1.450	0.053	0.057
E	1.750	1.850	0.069	0.073
D1	—	—	—	—
E1	—	—	—	—
k	—		—	
b	0.150	0.250	0.006	0.010
b1	0.100	0.200	0.004	0.008
e	0.400TYP		0.016TYP	
L	0.350	0.450	0.014	0.018
L1	0.450	0.550	0.018	0.022

12 Tape and Reel Information



NOTE: The picture is only for reference. Please make the object as the standard.

Key Parameter List of Tape and Reel

Package Type	Reel Diameter	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
QFN-1.4x1.8-10L	7''	9.0	1.60	2.00	0.85	4.0	4.0	2.0	8.0	Q1

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.