

GT2202

5uA Low Quiescent current, 40V 150mA LDO

1 Features	2 Application
- Low Power Consumption:5.0uA (Typ) - Maximum Output Current:150mA - Small Dropout Voltage:740mV@100mA (VOUT=3.3V) 1300mV@150mA (VOUT=3.3V) - Input Voltage Range:3V~40V - Output Voltage Range:3.0V,3.3V,3.6V,4.4V,5.0V,9.0V,12V - Highly Accuracy: $\pm 2\%$ - Current Limit and Short Protection - Over Temperature Protection	- Wearables - Smart Home Application - Toys - Battery Powered equipment

3 Description	Circuit Diagram
The GT2202 series is a group of positive voltage output 3-terminal linear regulator, capable of delivering 150mA current and working under 40V input voltage. It also features extremely low standby current which is only 5uA, while still keeps very fast load transient response capability. GT2202 includes high accuracy voltage reference, error amplifier, and current limit circuit and output driver module. GT2202 has well load transient response and good temperature characteristic. GT2202 can provide 3.0V,3.3V,3.6V,4.4V,5.0V,9.0V,12V output value. It also can be customized on command. GT2202 is housed in 2 different types of packages, which are SOT23 and SOT89-3	

4 Device Summary, Pin and Packages

Table 4-1. Device Summary⁽¹⁾

Serial Name	Part Name	VOUT(V)	Package	VOUT Accuracy	Marking ⁽²⁾	MSL ⁽³⁾	Package Qty
GT2202	GT2202-3.0S3	3.0	SOT23-3	±2%	FWG XXXX	3	Tape and Reel,3000
	GT2202-3.3S3	3.3	SOT23-3	±2%	FXG XXXX	3	Tape and Reel,3000
	GT2202-5.0S3	5.0	SOT23-3	±2%	F2G XXXX	3	Tape and Reel,3000
	GT2202-3.0ST3	3.0	SOT89-3	±2%	FWI XXXX	3	Tape and Reel,1000
	GT2202-3.3ST3	3.3	SOT89-3	±2%	FXI XXXX	3	Tape and Reel,1000
	GT2202-3.6ST3	3.6	SOT89-3	±2%	FYI XXXX	3	Tape and Reel,1000
	GT2202-4.4ST3	4.4	SOT89-3	±2%	F0I XXXX	3	Tape and Reel,1000
	GT2202-5.0ST3	5.0	SOT89-3	±2%	F2I XXXX	3	Tape and Reel,1000

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

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

4 Device Summary, Pin and Packages(Continued)

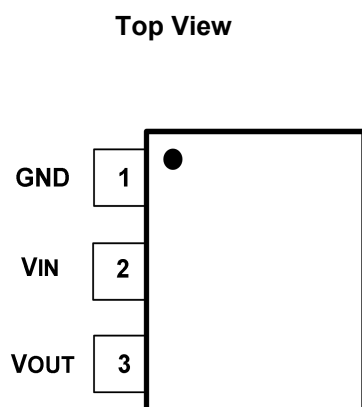


Fig.4-1. GT2202: ST3(SOT89-3) Package

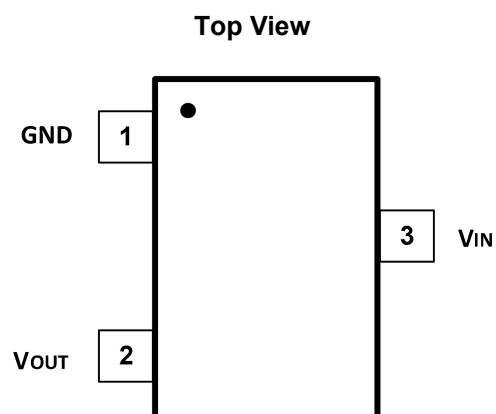


Fig.4-2. GT2202: S3(SOT23-3) Package

Table 4-2 Pin Definition

Name	Pin		I/O	Description
	ST3	S3		
V _{IN}	2	3	I	Input
GND	1	1	-	GND
V _{OUT}	3	2	O	Output

* It is suggested to leave the unconnected pins floating

5 Voltage, Temperature, ESD and Thermal Ratings

5.1 Absolute Maximum Ratings⁽¹⁾

Parameters	Min	Max	Unit
Supply input voltage	-	42	V
Operating free air temperature range	-40	85	°C
Maximum junction temperature	-	125	°C
Storage temperature range	-55	125	°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.

5.2 ESD Ratings

ESD			Value	Unit
V(ESD)	Electrostatic Discharge	Human-Body Model (HBM) ⁽¹⁾	2K	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

5.3 Recommended Operating Conditions⁽¹⁾

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

Symbol	Parameter	Min	Max	Units
T _A	Operating Temperature	-40	85	°C

5.4 Thermal Information

Package Type	Power Dissipation	Unit
SOT89-3	1.25	W
SOT23-3	0.54	W

6 Electrical Specifications

Typical values are at TA=+25°C, C_{IN}=C_{OUT}=1μF. (unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input voltage range	V _{IN}		3		40	V
Output voltage range	V _{OUT}		3		12	V
Voltage accuracy			-2		+2	%
Quiescent current	I _Q	No load		5	10	μA
Max Output current	I _{OUT}	V _{IN} - V _{OUT} = 2V	150			mA
Line regulation	$\Delta V_{OUT}/(\Delta V_{IN} \cdot V_{OUT})$	I _{OUT} = 1mA		0.01	0.1	%/V
Load regulation	$\Delta V_{OUT}/(\Delta I_{OUT} \cdot V_{OUT})$	I _{OUT} = 1-100mA		2	4	%
Voltage drop	V _{DROP}	I _{OUT} = 100mA, V _{OUT} > 3.0V		740	1000	mV
Current limit	I _{LIMIT}			200		mA
Short current	I _{SHORT}			200		mA
Power ripple rejection rate	PSRR	V _{IN} = V _{OUT} + 0.5V, f = 100Hz, I _{OUT} = 1mA		65		dB
Startup time				500		μs
Over temp protect	OTP			165		°C
OTP hysteresis				30		°C

7 Typical Characteristics

Typical values are at $T_A = +25^\circ\text{C}$, $C_{IN} = C_{OUT} = 1\mu\text{F}$. (unless otherwise noted)

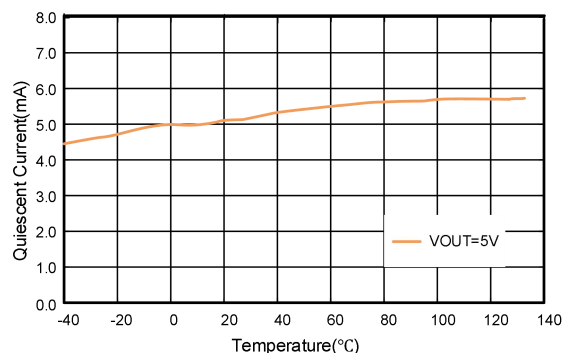


Fig.7-1. I_q VS Temp

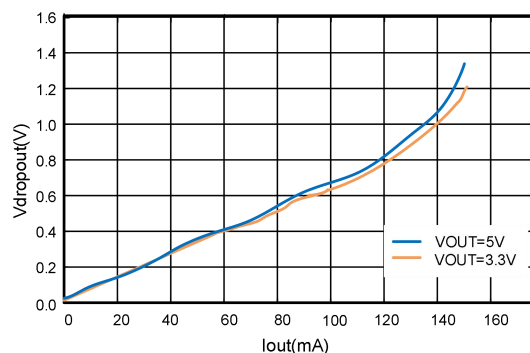


Fig.7-2. I_{OUT} VS Dropout

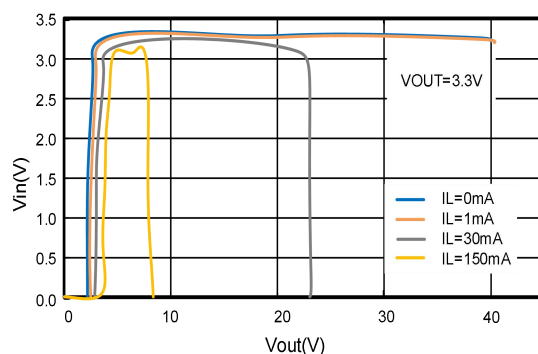


Fig.7-3. Line Regulation

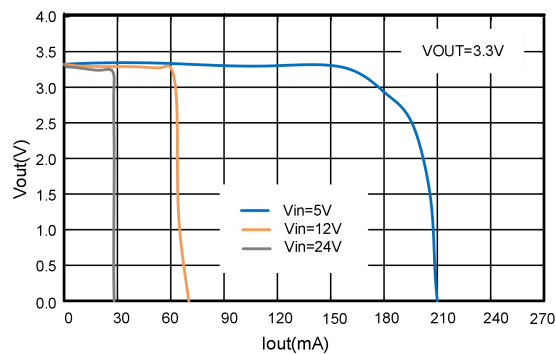


Fig.7-4. Load Regulation

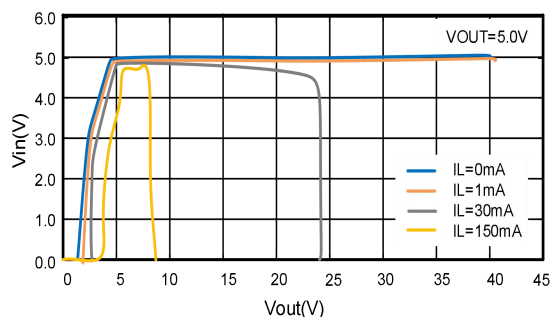


Fig.7-5. Line Regulation

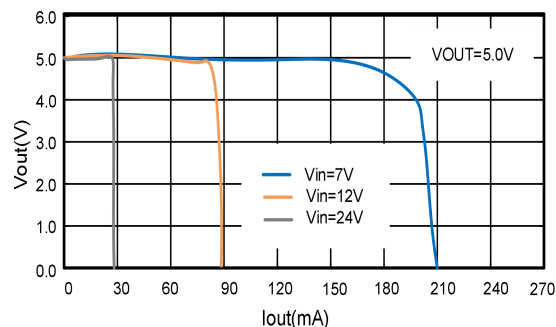


Fig.7-6. Load Regulation

8 Detailed Description

8.1 Overview

The GT2202 series is a group of positive voltage output 3-terminal linear regulator, capable of delivering 150mA current and working under 40V input voltage. It also features extremely low standby current which is only 5uA, while still keeps very fast load transient response capability. GT2202 includes high accuracy voltage reference, error amplifier, and current limit circuit and output driver module. GT2202 has well load transient response and good temperature characteristic.

8.2 Capacitor Requirements

A minimum of 1uF capacitor must be connected from Vout to ground to insure stability. Input capacitor of 1uF is recommended to ensure the input voltage does not sag below the minimum dropout voltage during load transient event. Vin pin must always be dropout voltage higher than Vout in order for the device to regulate properly.

9 Application Note

Like any low-dropout regulators, GT2202 requires input and output decoupling capacitors. These capacitors must be correctly selected for good performance. Both input and output capacitors are recommended to be placed as close to chip pin as possible.

9.1 Capacitor Selection

Normally, use a 1uF capacitor on the input and a 1uF capacitor on the output of the GT2202. Larger input capacitor values and lower ESR (X5R, X7R) provide better supply noise rejection and transient response.

9.2 Input-Output(Dropout) Voltage

A regulator's minimum input-to-output voltage differential (dropout voltage) determines the lowest usable supply voltage. In battery-powered systems, this determines the useful end-of-life battery voltage. Because the device uses a PMOS, its dropout voltage is a function of drain to source on resistance, RDS (on), multiplied by the load current:

$$V_{\text{dropout}} = V_{\text{in}} - V_{\text{out}} = R_{\text{DS (on)}} \times I_{\text{out}}$$

9.3 Current-Limit and Short-Circuit Protection

In order to prevent overloading or thermal condition from damaging the device, GT2202 has internal thermal and current limiting functions designed to protect the device. It will rapidly shut off PMOS pass element during overloading or over temperature condition.

9.4 Thermal Considerations

The GT2202 series can deliver a current of up to 150mA over the full operating junction temperature range. However, the maximum output current must be controlled at higher ambient temperature to ensure the junction temperature does not exceed 150°C. With all possible conditions, the junction temperature must be within the range specified under operating conditions. Power dissipation can be calculated based on the output current and the voltage drop across regulator.

$$P_d = (V_{\text{in}} - V_{\text{out}}) \times I_{\text{out}}$$

The final operating junction temperature for any set of conditions can be estimated by the following thermal equation:

$$P_d (\text{max}) = (T_j (\text{max}) - T_a) / \theta_{ja}$$

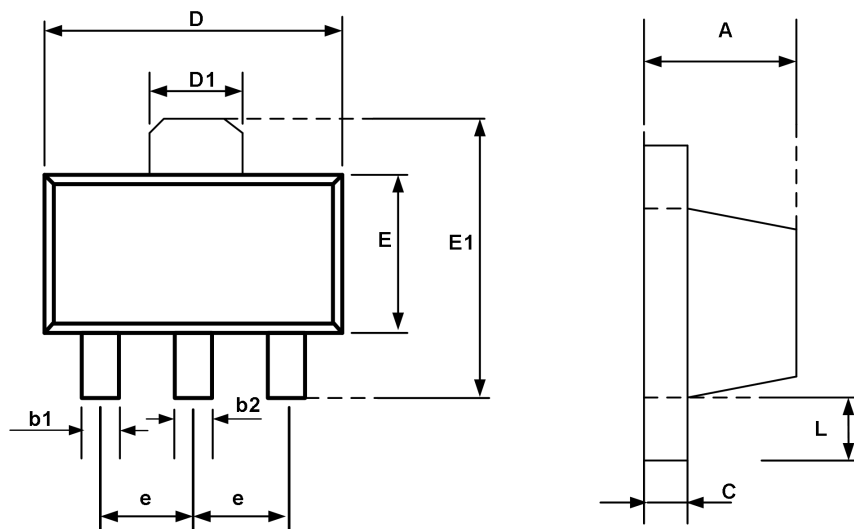
Where $T_j (\text{max})$ is the maximum junction temperature of the die (150°C) and T_a is the maximum ambient temperature. When junction temperature exceeds 150°C, over temperature protection may be triggered to prevent device from over heat.

9.5 PCB Layout

An input capacitance of 1uF is required between the GT2202 input pin and ground (the amount of the capacitance may be increased without limit), this capacitor must be located a distance of not more than 1cm from the input and return to a clean analog ground. Input capacitor can filter out the input voltage spikes caused by the surge current due to the inductive effect of the package pin and the printed circuit board's routing wire. Otherwise, the actual voltage at the Vin pin may exceed the absolute maximum rating. The output capacitor also must be located a distance of not more than 1cm from output to a clean analog ground. Because it can filter out the output spike caused by the surge current due to the inductive effect of the package pin and the printed circuit board's routing wire.

10 Package Outline Dimension

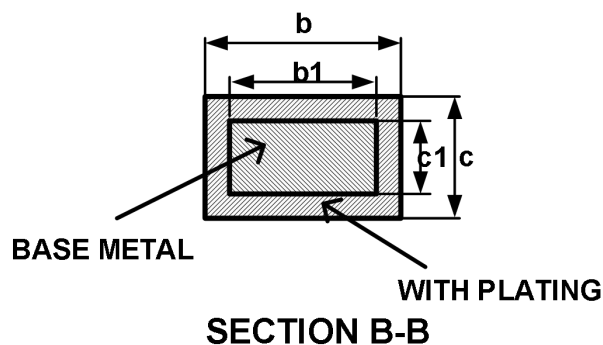
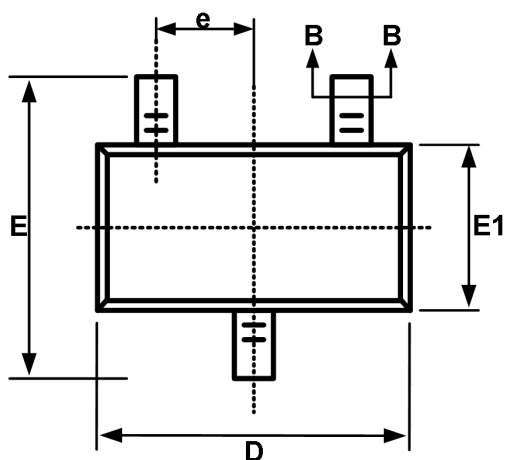
SOT-89



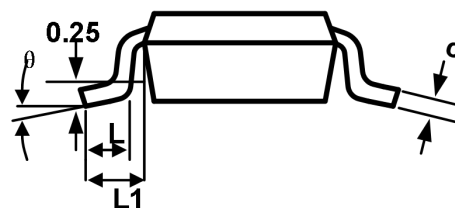
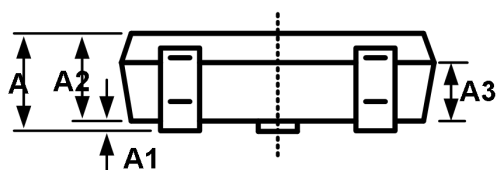
Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
A	1.40	1.60	0.551	0.63
b1	0.35	0.50	0.0138	0.0197
b2	0.45	0.60	0.0177	0.0236
c	0.36	0.46	0.0142	0.0181
D	4.30	4.70	0.169	0.185
D1	1.40	1.80	0.551	0.0709
E	4.00	4.40	0.157	0.173
E1	2.30	2.70	0.0906	0.106
e	1.50(BSC)		0.591(BSC)	
L	0.80	1.20	0.315	0.0472

10 Package Outline Dimension(Continued)

SOT23-3

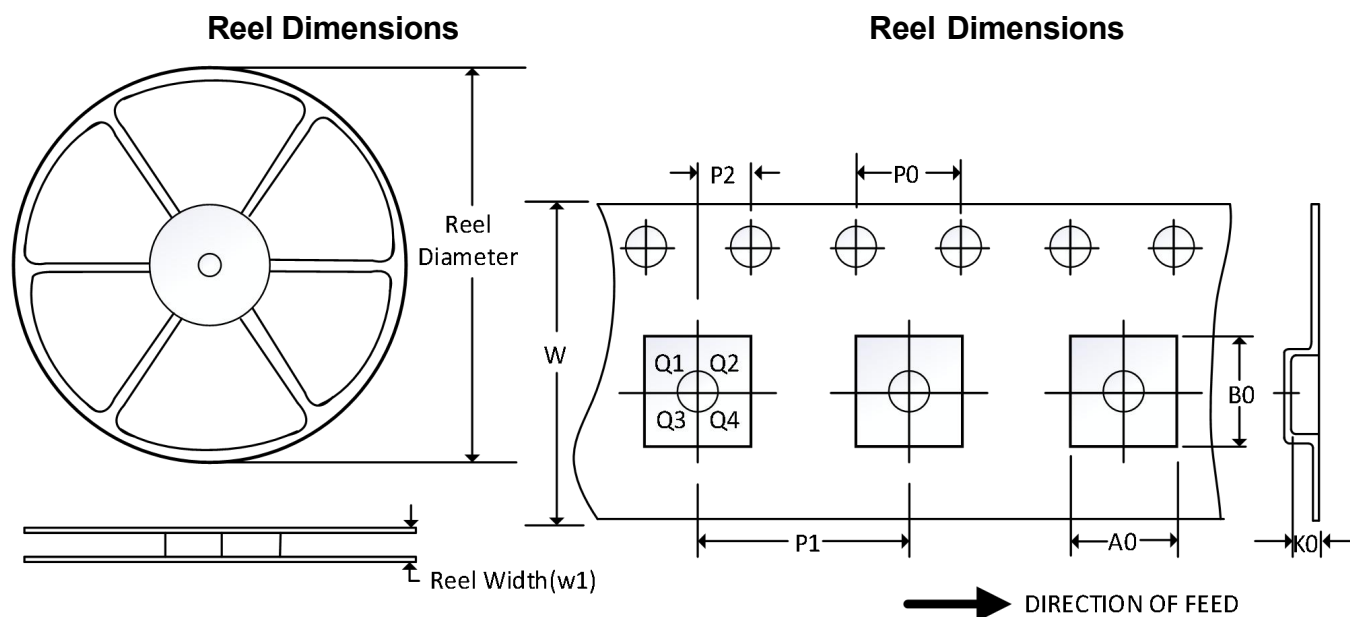


Recommended Land Pattern (Unit: mm)



Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min.	Max.	Min.	Max.
A	1.05	1.25	0.041	0.049
A1	0.04	0.10	0.001	0.004
A2	1.00	1.20	0.039	0.047
A3	0.60	0.70	0.024	0.028
b	0.33	0.41	0.013	0.016
b1	0.32	0.38	0.013	0.015
c	0.15	0.19	0.006	0.007
c1	0.14	0.16	0.006	0.006
D	2.82	3.02	0.111	0.119
E	2.60	3.00	0.102	0.118
E1	1.50	1.70	0.059	0.067
e	0.95BSC		0.037BSC	
L	0.30	0.60	0.012	0.024
L1	0.60REF		0.024REF	
θ	0°	8°	0°	8°

11 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(m m)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT-89	18	16.5	4.6	4.78	1.91	4.0	8.0	2.0	12.0	Q3
SOT23-3	7	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3

NOTE:

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