GS2612

1A Low-Voltage LDO Regulator

Product Description

The GS2612 are 1A low-dropout linear voltage regulators that provide low-voltage, high-current output. The GS2612 offers extremely low dropout (typically410 mV at 1A) and low ground current (typically 12mA at 1A).

The GS2612 is ideal for PC add-in cards that need to convert from standard 5V to 3.3V, 3.3V to 2.5V or 2.5V to 1.8V. A guaranteed maximum dropout voltage of 630mV over all operating conditions allows the GS2612 to provide 2.5V from a supply as low as 3.13V and 1.8V from a supply as low as 2.43V.

The GS2612 is fully protected with over-current limiting, thermal shutdown, and reversed-battery protection.

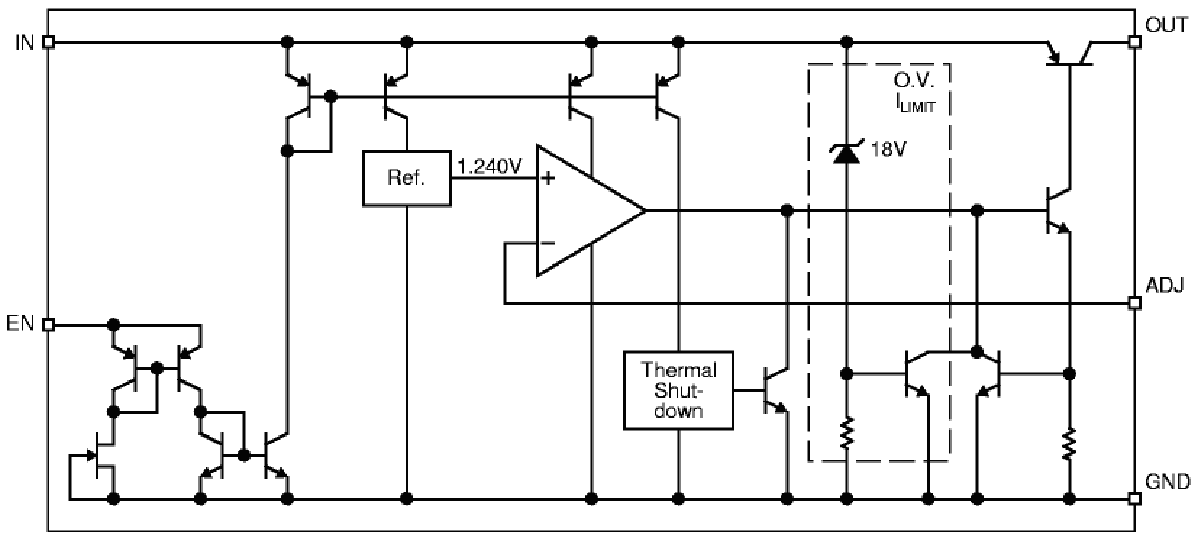
Features

- 410mV typical dropout at 1A
- Ideal for 3.0V to 2.5V conversion
- Ideal for 2.5V to 1.8V conversion
- 1A minimum guaranteed output current
- 1% initial accuracy
- Low ground current
- Current limiting and thermal shutdown
- Reversed-battery protection
- Reversed-leakage protection
- Fast transient response

Applications

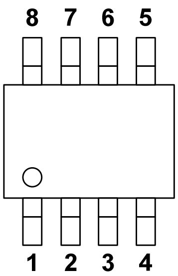
- LDO linear regulator for PC add-in cards
- High-efficiency linear power supplies
- SMPS post regulator
- Multimedia and PC processor supplies
- Battery chargers
- Low-voltage Micro-Controllers and digital logic

Block Diagram



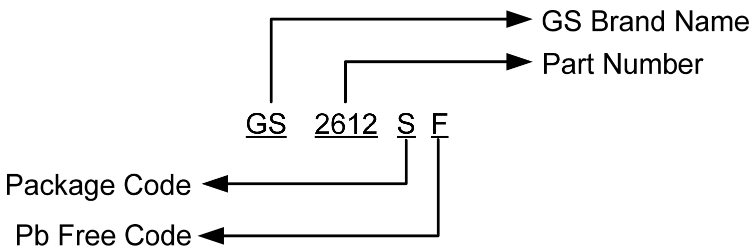
GS2612 Adjustable Regulator Block Diagram

Packages & Pin Assignments

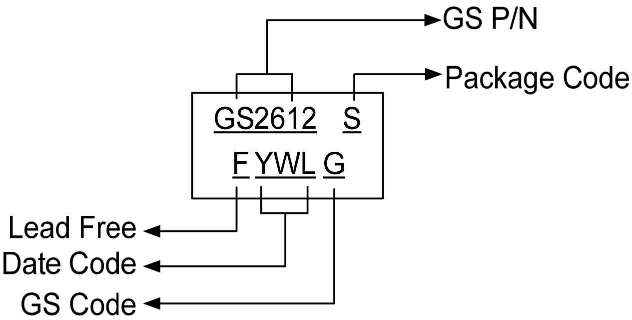
GS2612SF (SOP-8)	
	
1	EN
2	IN
3	OUT
4	ADJ
5-8	GND

Pin Name	Pin Function
EN	Enable (Input): CMOS compatible control input. Logic high=enable; logic low or open = shutdown.
IN	Supply (Input)
OUT	Regulator Output
ADJ	Adjustment Input: Feedback input. Connect to resistive voltage-divider network.
GND	Ground

Ordering Information



Marking Information



Absolute Maximum Ratings (NOTE1)

Symbol	Parameter	Ratings	Units
V_{IN}	Supply Input Voltage	-20 to +20	V
V_{EN}	Enable Input Voltage	+20	V
$P_{D(MAX)}$	Power Dissipation	(NOTE 2)	W
T_J	Operating Junction Temperature	-40 to +125	°C
T_{STG}	Storage temperature	-65 to +150	°C
T_{LEAD}	Lead Temperature (Soldering, 10 Seconds)	260	°C

ESD: Devices are ESD sensitive. Handling precautions recommended.

Operating Ratings (NOTE3)

Symbol	Parameter	Ratings	Units
V_{IN}	Supply Input Voltage	2.25 to 16	V
V_{EN}	Enable Input Voltage	2.25 to 16	V
θ_{JA}	Thermal Resistance Junction to Ambient	160	°C/W
θ_{JC}	Thermal Resistance Junction to Case	20	°C/W

Electrical Characteristics

V_{IN}= V_{OUT} +1V; V_{EN} = 2.25V; T_J = 25°C, bold values indicate -40°C ≤T_J≤+125°C; unless noted

Symbol	Parameter	Test Conditions	MIN	TYP	MAX	Unit
V_{OUT}	Output Voltage	10mA 10mA ≤I_{OUT} ≤1A ,V_{OUT}+1V ≤V_{IN} ≤8V	-1 -2		1 2	%
R_{Line}	Line Regulation	I_{OUT} =10mA , V_{OUT}+1V ≤V_{IN} ≤16V		0.06	0.5	%
R_{Load}	Load Regulation	V_{IN} = V_{OUT}+1V, 10mA≤I_{OUT}≤1A		0.2	1	%
$\Delta V_{OUT}/\Delta T$	Output Voltage Temp. Coefficient, (NOTE4)			40	100	ppm/°C
V_{DO}	Dropout Voltage (NOTE5)	I_{OUT} =100mA, ΔV_{OUT} = -1%		150	200 250	mV
		I_{OUT} =500mA, ΔV_{OUT} = -1%		275		
		I_{OUT} =750mA, ΔV_{OUT} = -1%		330	500	
		I_{OUT} =1A, ΔV_{OUT} = -1%		410	550 630	
I_{GND}	Ground Current (NOTE6)	I_{OUT} =100mA, V_{IN} = V_{OUT}+1V		700		uA
		I_{OUT} =500mA, V_{IN} = V_{OUT}+1V		4		mA
		I_{OUT} =750mA, V_{IN} = V_{OUT}+1V		7		
		I_{OUT} =1A, V_{IN} = V_{OUT}+1V		12	20	
$I_{OUT(lim)}$	Current Limit	V_{OUT} =0V, V_{IN} = V_{OUT}+1V		1.8	2.5	A
Enable Input						
V_{EN}	Enable Input Voltage	Logic Low (off)			0.8	V
		Logic High (on)	2.25			
I_{EN}	Enable Input Current	V_{EN} = 2.25V	1	15	30 75	uA
		V_{EN} = 0.8V			2 4	

Electrical Characteristics (Continue)

Symbol	Parameter	Test Conditions	MIN	TYP	MAX	Unit
	Reference Voltage	(NOTE8)	1.228 1.215 1.203	1.240	1.252 1.265 1.277	V V
	Adjust Pin Bias Current			40	80 120	ppm/°C
	Reference Voltage Temp. Coefficient, (NOTE4)			20		nA/°C
	Adjust Pin Bias Current Temp. Coefficient			0.1	99.2	

(NOTE1) Exceeding the absolute maximum ratings may damage the device

(NOTE2) $P_{D\ (max)} = (T_{J\ (max)} - T_A) \div \theta_{JA}$

(NOTE3) The device is not guaranteed to function outside its operating rating

(NOTE4) Output voltage temperature coefficient is ΔV_{OUT} (worst case)$\div(T_{J(max)} - T_{J(min)})$ where $T_{J\ (max)}$ is +125°C and $T_{J(min)}$ is -40°C

$V_{DO} = V_{IN} - V_{OUT}$ when V_{OUT} decreases to 99% of its nominal output voltage with $V_{IN} = V_{OUT}$ +1V

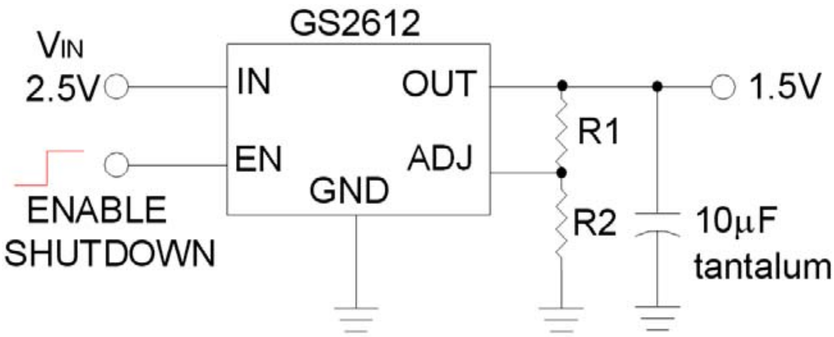
(NOTE5) For Output voltages below 2.25V, dropout voltage is the input-to-output voltage differential with the minimum input voltage being 2.25V. Minimum input operating voltage is 2.25V

(NOTE6) I_{GND} is the quiescent current. $I_{IN} = I_{GND} + I_{OUT}$

(NOTE7) For adjustable device and fixed device with $V_{OUT} \leq 2.5V$

(NOTE8) $V_{REF} \leq V_{OUT} \leq (V_{IN} - 1V)$, $2.25V \leq V_{IN} \leq 16V$, $10mA \leq I_L \leq 1A$

Typical Applications



1.5V/1A Adjustable Regulator

Application Introduction

The GS2612 is a high-performance low-dropout voltage regulator suitable for moderate to high-current voltage regulator applications. Its 630mV dropout voltage at full load and over temperature makes it especially valuable in battery-powered systems and as high-efficiency noise filters in post-regulator applications. Unlike older NPN-pass transistor de- signs, where the minimum dropout voltage is limited by the base-to-emitter voltage drop and collector-to-emitter saturation voltage, dropout performance of the PNP output of these devices is limited only by the low V_{CE} saturation voltage.

The GS2612 regulator is fully protected from damage due to fault conditions. Linear current limiting is provided. Output current during overload conditions is constant. Thermal shutdown disables the device when the die temperature exceeds the maximum safe operating temperature. Transient protection allows device (and load) survival even when the input voltage spikes above and below nominal. The output structure of these regulators allows voltages in excess of the desired output voltage to be applied without reverse current flow.

Output capacitor：

The GS2612 requires an output capacitor to maintain stability and improve transient response. Proper capacitor selection is important to ensure proper operation.

The GS2612 output capacitor selection is dependent upon the ESR (equivalent series resistance) of the output capacitor to maintain stability.

When the output capacitor is 10uF or greater, the output capacitor should have an ESR less than 2Ω. This will improve transient response as well as promote stability. Ultra-low-ESR capacitors (<100mΩ), such as ceramic chip capacitors, may promote instability. These very low ESR levels may cause an oscillation and/or under damped transient response. A low-ESR solid tantalum capacitor works extremely well and provides good transient response and stability over temperature. Aluminum electrolytes can also be used, as long as the ESR of the capacitor is<2Ω.

The value of the output capacitor can be increased without limit. Higher capacitance values help to improve transient response and ripple rejection and reduce output noise.

Enable Input：

The GS2612 versions feature an active high enable input (EN) that allows on-off control of the regulator. Current drain reduces to “zero” when the device is shutdown, with only microamperes of leakage current. The EN input has TTL/CMOS compatible thresholds for simple logic interfacing. EN may be directly tied to VIN and pulled up to the maximum supply voltage.

Transient Response and 3.3V to 2.5V or 2.5V to 1.8V Conversion:

The GS2612 has excellent transient response to variations in input voltage and load current. The device has been designed to respond quickly to load current variations and input voltage variations. Large output capacitors are not required to obtain this performance. A standard 10µF output capacitor, preferably tantalum, is all that is required. Larger values help to improve performance even further.

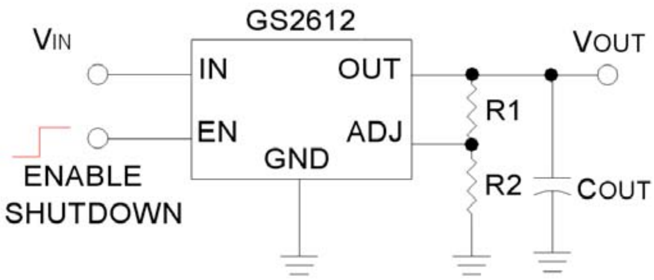
By virtue of its low-dropout voltage, this device does not saturate into dropout as readily as similar NPN-based designs. When converting from 3.3V to 2.5V or 2.5V to 1.8V, the NPN based regulators are already operating in dropout, with typical dropout requirements of 1.2V or greater. To convert down to 2.5V or 1.8V without operating in dropout, NPN based regulators require an input voltage of 3.7V at the very least. The GS2612 regulator will provide excellent performance with an input as low as 3.0V or 2.5V respectively. This gives the PNP based regulators a distinct advantage over older, NPN based linear regulators.

Application Introduction (Continue)

Minimum load Current：

The GS2612 regulator is specified between finite loads. If the output current is too small, leakage currents dominate and the output voltage rises. A 10mA minimum load current is necessary for proper regulation.

Adjustable Regulator Design :



$$V_{OUT} = 1.240V\left(1 + \frac{R1}{R2}\right)$$

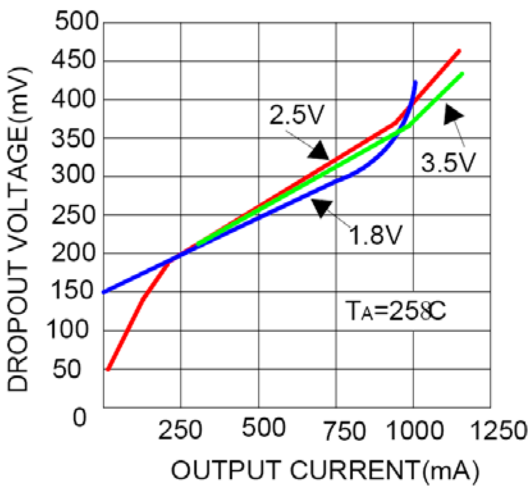
Figure 2. Adjustable Regulator with Resistors

The GS2612 allows programming the output voltage anywhere between 1.24V and the 16V maximum operating rating of the family. Two resistors are used. Resistors can be quite large, up to 1MΩ, because of the very high input impedance and low bias current of the sense comparator: The resistor values are calculated by:

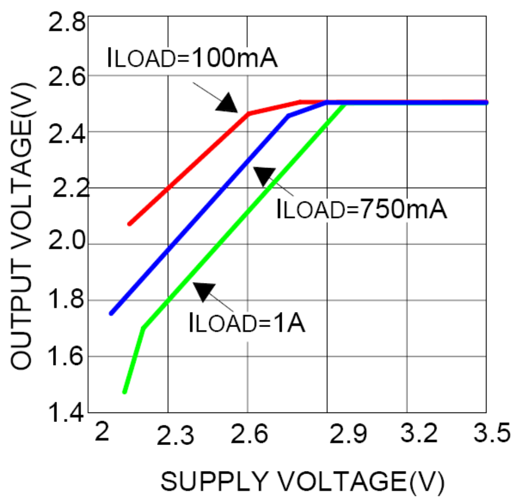
$$R1 = R2\left(\frac{V_{OUT}}{1.240} - 1\right)$$

Where V_{OUT} is the desired output voltage. Figure 2 shows component definition. Applications with widely varying load currents may scale the resistors to draw the minimum load current required for proper operation.

Typical Performance Characteristics

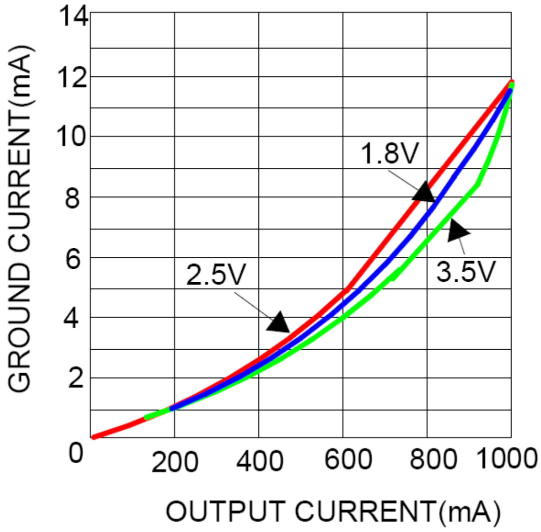


Dropout Voltage VS. Output Current

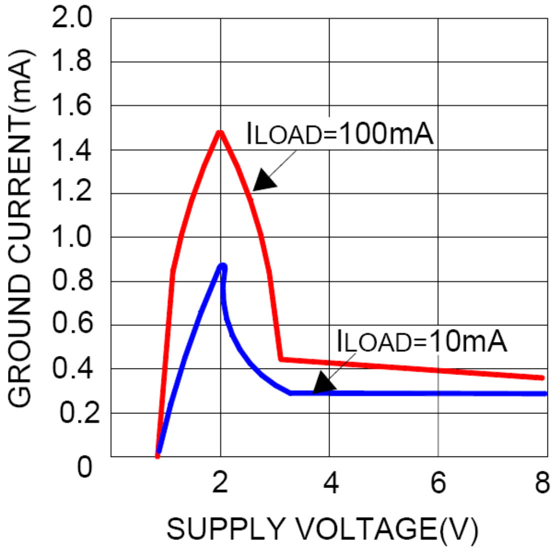


Dropout Characteristics(2.5V)

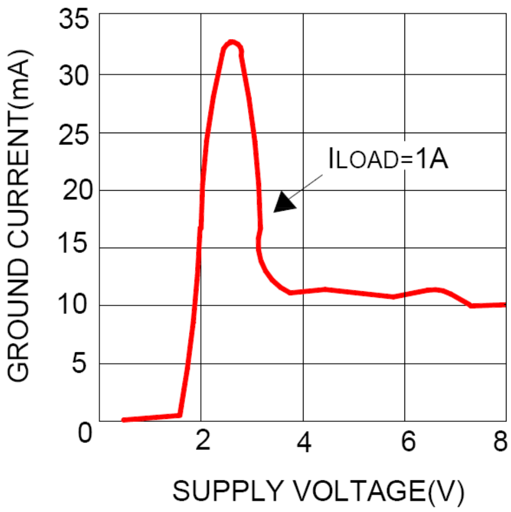
Typical Performance Characteristics (Continue)



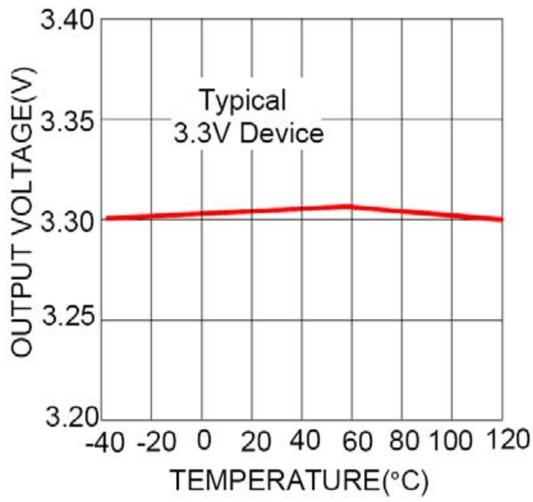
Ground Current VS. Output Current



Ground Current VS. Supply Current



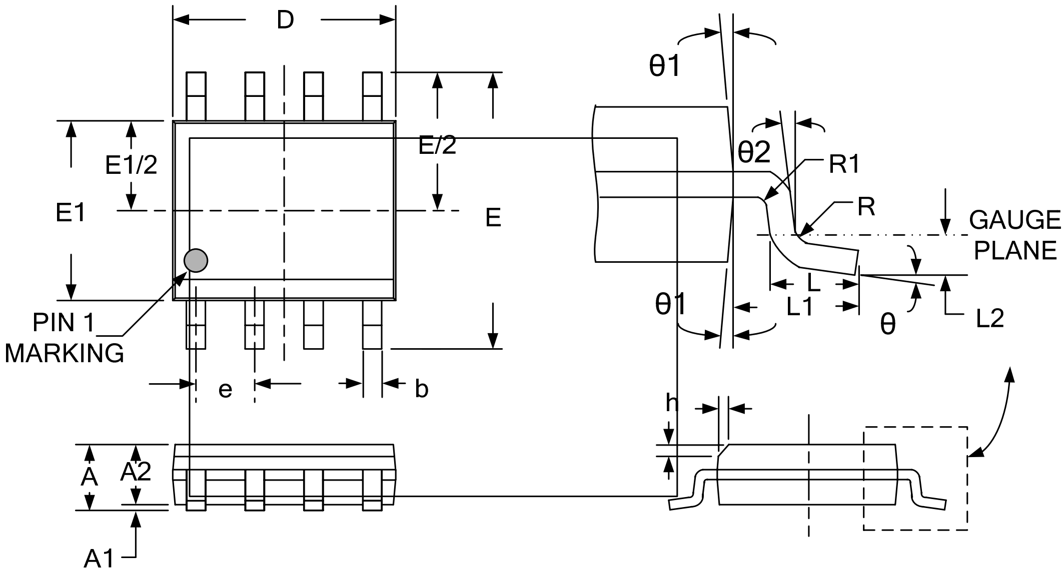
Ground Current VS. Supply Current



Output voltage VS. temperature

Package Dimension

SOP-8 PLASTIC PACKAGE



Dimensions				
SYMBOL	Millimeters		Inches	
	MIN	MAX	MIN	MAX
A	1.35	1.75	.053	.069
A1	0.10	0.25	.004	.010
A2	1.25	1.65	.049	.065
b	0.31	0.51	.012	.020
c	0.17	0.25	.007	.010
D	4.90 (TYP)		.193 (TYP)	
E	6.00 (TYP)		.236 (TYP)	
E1	3.90 (TYP)		.154 (TYP)	
e	1.27 (TYP)		.050 (TYP)	
L	0.40	1.27	.016	.050
L1	1.04 (TYP)		.041 (TYP)	
L2	0.25 (TYP)		.010 (TYP)	
R	0.07	-	.003	-
R1	0.07	-	.003	-
h	0.25	0.50	.010	.020
θ	0°	8°	0°	8°
θ1	5°	15°	5°	15°

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