GQ2171

CMOS Positive Voltage Regulator

Description

The GQ2171 series of positive, linear regulators feature low quiescent current (50μA typ.) with low dropout voltage and excellent PSRR, thus making them ideal for Telecommunications and other battery applications. These rugged devices have both Thermal Shutdown, and Current Fold-back to prevent device failure under the "Worst" of operating conditions.
As an additional feature, the GQ2171 is stable with an output capacitance of just extended 0.22μF or greater.

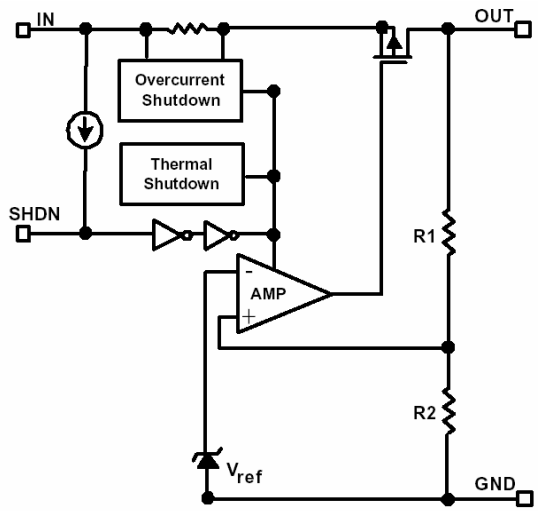
Features

- Very Low Dropout Voltage
- Guaranteed 150mA output
- Over-Temperature Shutdown
- Current Limiting
- Short Circuit Current Fold-back
- Excellent PSRR Type 70dB
- Noise Reduction Bypass Capacitor
- Power-saving Shutdown Mode
- Factor Pre-set Output Voltage

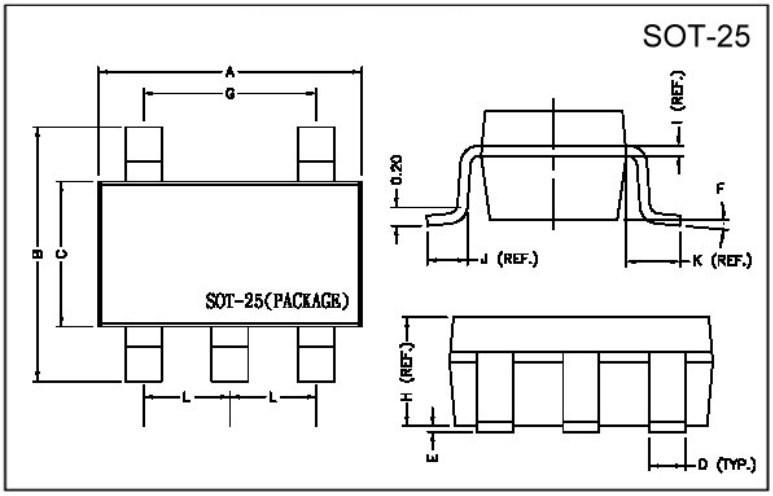
Applications

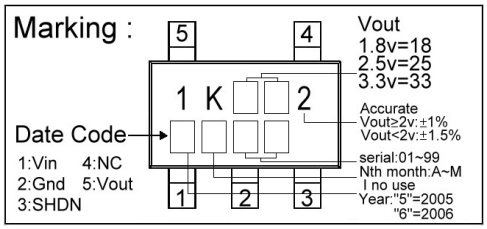
- Battery Powered Widgets
- Instrumentation
- Wireless Devices
- PC Peripherals
- Portable Electronics
- Cordless Phones
- Electronic Scales
- Cellular Phones
- Cameras
- Telecommunications

Functional Block Diagram



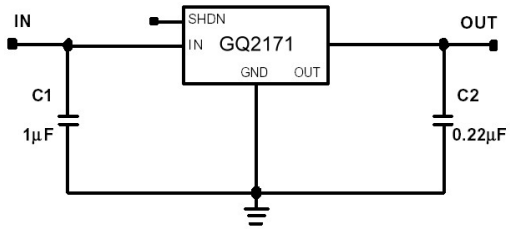
Package Dimensions





REF.	Millimeter		REF.	Dimensions
	Min.	Max.		Millimeter
A	2.70	3.10	G	1.90 REF.
B	2.60	3.00	H	1.20 REF.
C	1.40	1.80	I	0.12 REF.
D	0.30	0.55	J	0.37 REF.
E	0	0.10	K	0.60 REF.
F	0°	10°	L	0.95 REF.

Typical Application Circuit



Absolute Maximum Ratings

Parameter	Symbol	Ratings	Unit
Input Max Voltage	V_{IN}	6	V
Output Current	I_{OUT}	$P_D/(V_{IN}-V_O)$	mA
Output Voltage	V_{OUT}	1.5~3.3	V
Operating Ambient Temperature	Topr	-40 ~ +85	℃
Junction Temperature	Tj	-40 ~ +125	℃
Maximum Junction Temperature	$T_{j\,Max}$	150	℃
Power Dissipation(△T=100℃)	PD	380	mW
EDS Classification		B	

Electrical Characteristics T_A=25℃ unless otherwise noted

($V_{OUT}(T)$>2.0V $V_{IN}=V_{OUT}(T)+0.5V$; $V_{OUT}(T)\leq 2.0V$ $V_{IN}=V_{OUT}(T)+1V$; $V_{SHDN}=V_{IN}$, $C_{IN}=C_{OUT}$=1uF)

Parameter	Symbol	Condition		Min	TYP	Max	Unit
Output Voltage	$V_{OUT}(E)$ (Note1)	I_O=0.1mA, $V_{OUT}(T)\geq 2.0V$		-1.0	$V_{OUT}(T)$ (Note2)	1.0	%
		I_O=0.1mA, $V_{OUT}(T)<2.0V$		-1.5		1.5	
		I_O=150mA		-2.0		2.0	
Current Limit	I_{LIM}	V_O>800mV		150	200	-	mA
Fold-back Current	I_{FB}	V_O=0V		-	80	-	μA
Load Regulation	REG_{LOAD}	I_O=0.1 to 150mA	V_{OUT}>2.0V $V_{IN}=V_{OUT}(T)+0.5V$	-1	0.5	1	%
			$V_{OUT}\leq 2.0V$ $V_{IN}=V_{OUT}(T)+1V$	-2	-	2	
Dropout Voltage	$V_{DROPOUT}$	I_O=150mA $V_O=V_{OUT}(E)$-2%	$V_{OUT}(T)\geq 2.0V$	-	300	500	mV
			1.8V≤$V_{OUT}(T)$<2.0V	-	700	1000	
			1.5V≤$V_{OUT}(T)$<1.8V	-	900	1300	
Quiescent Current	I_Q	V_{IN}=5V, I_O=0mA		-	60	-	μA
Ground Pin Current	I_{GND}	V_{IN}=5V, I_O=1mA to150mA		-	50	-	μA
Line Regulation	REG_{LINE}	I_O=0.1mA, V_{OUT}>2.0V $V_{IN}=V_{OUT}(T)+0.5V$ to 5.5V		-0.2	0.1	0.2	%
		I_O=0.1mA, $V_{OUT}\leq 2.0V$ $V_{IN}=V_{OUT}(T)+1V$ to 5.5V		-0.4	-	0.4	
Input Voltage	V_{IN}			Note3	-	5.5	V
Over Temperature Shutdown	OTS			-	137	-	℃
Over Temperature Hysterisis	OTH			-	23	-	℃
Output Voltage Temperature Coefficient	TC			-	30	-	ppm/℃
Power Supply Rejection	PSRR	Ro=100Ω,Co=2.2mF, f=1kHz		-	70	-	dB
Output Voltage Noise	eN	f=10Hz~100kHz, Io=10mA, Co=2.2μF		-	30	-	μVrms
SHDN Input Threshold	V_{SHDNH}	V_{SHDN}=0.8* V_{IN}		0.8* V_{IN}	-	V_{IN}	V
	V_{SHDNL}	V_{SHDN}=0.6V		0	-	0.6	V
SHDN Input Bias Current		V_{IN}=5V, EN=0v, or 5V		-	0.01	-	μA
Shutdown Supply Current	I_{SD}	V_{IN}=5V, V_O=0V		-	0.5	1	μA
Shutdown Output Voltage	$V_{O,SD}$	Output Loading≤1200Ω, Vo=0V		0	-	0.4	V

Note 1: V_{OUT} (E) =Effective Output Voltage (i.e. the output voltage when "$V_{OUT}(T)$>2.0V $V_{IN}=V_{OUT}(T)+0.5V$; $V_{OUT}(T)\leq 2.0V$ $V_{IN}=V_{OUT}(T)+1V$; $V_{SHDN}=V_{IN}$" is provided at the V_{IN} pin while maintaining a certain I_{OUT} value).

2: V_{OUT} (T) =Specified Output Voltage

3: $V_{IN\,(MIN)}=V_{OUT}+V_{DROPOUT}$

Ordering Information (contd.)

Part Number	Marking	Output Voltage	Part Number	Marking	Output Voltage
GQ2171-15	1K152 XXXX	1.5V	GQ2171-18	1K182 XXXX	1.8V
GQ2171-20	1K202 XXXX	2.0V	GQ2171-25	1K252 XXXX	2.5V
GQ2171-27	1K272 XXXX	2.7V	GQ2171-28	1K282 XXXX	2.8V
GQ2171-2H	1K2H2 XXXX	2.85V	GQ2171-30	1K302 XXXX	3.0V
GQ2171-32	1K322 XXXX	3.2V	GQ2171-33	1K332 XXXX	3.3V

Detailed Description

The GQ2171 series of COMS regulators contain a PMOS pass transistor, voltage reference, error amplifier, over-current protection, and thermal shutdown.

The P-channel pass transistor receives data from the error amplifier, over-current shutdown, and thermal protection circuits. During normal operation, the error amplifier compares the output voltage to a precision reference. Over-current and Thermal shutdown circuits become active when the junction temperature exceeds 150℃, or the current exceeds 150mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120℃.

The GQ2171 switches from voltage mode to current mode when the load exceeds the rated output current. This prevents over-stress. The GQ2171 also incorporates current fold-back to reduce power dissipation when the output is short circuited. This feature becomes active when the output drops below 0.8 volts, and reduces the current flow by 65%. Full current is restored when the voltage exceeds 0.8 volts.

External Capacitors

The GQ2171 is stable with an output capacitance to ground of 0.22μF or greater. Ceramic capacitors have the lowest ESR, and will offer the best AC performance. Conversely, Aluminum Electrolytic capacitors exhibit the highest ESR, resulting in the poorest AC response.

A second capacitor is recommended between the input and ground to stabilize Vin. The input capacitor should be at least 1μF to have a beneficial effect.

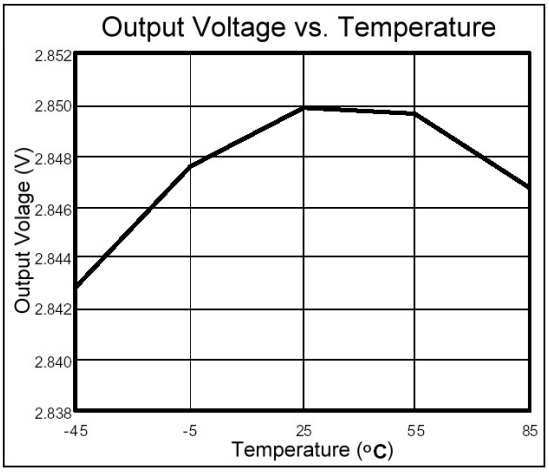
A large capacitor improves the AC ripple rejection, but also makes the output come up slowly. This “Soft” turn-on is desirable in some applications to limit turn-on surges.

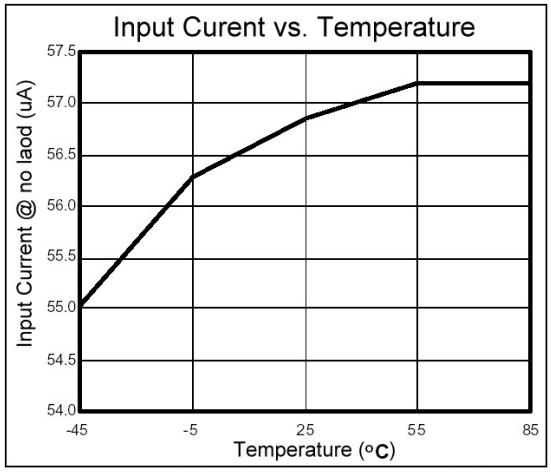
All capacitors should be placed in close proximity to the pins. A “Quiet” ground termination is desirable. This can be achieved with a “Star” connection.

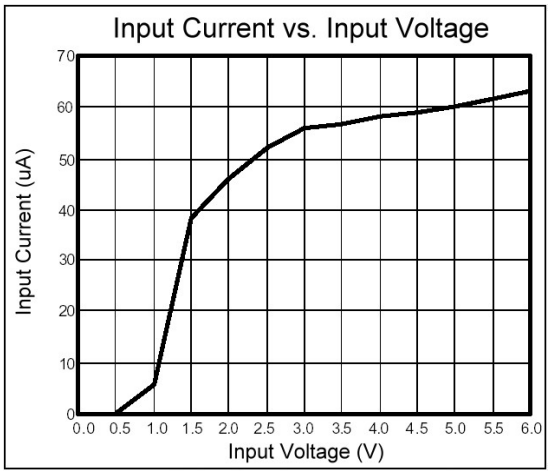
Shutdown

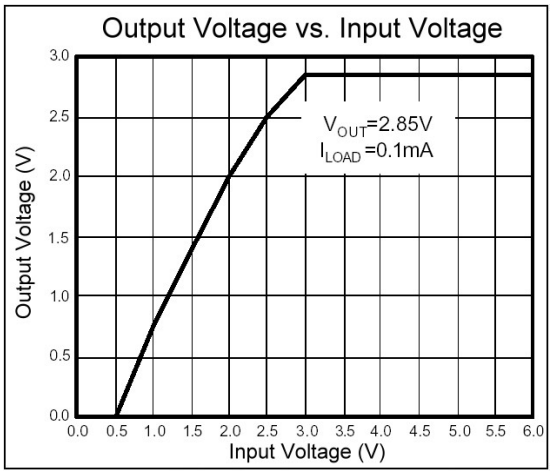
When actively, pulled low, the PMOS pass transistor shuts off, and all internal circuits are powered down. In this state, the quiescent current is less than 1μA. This pin behaves much like an electronic switch.

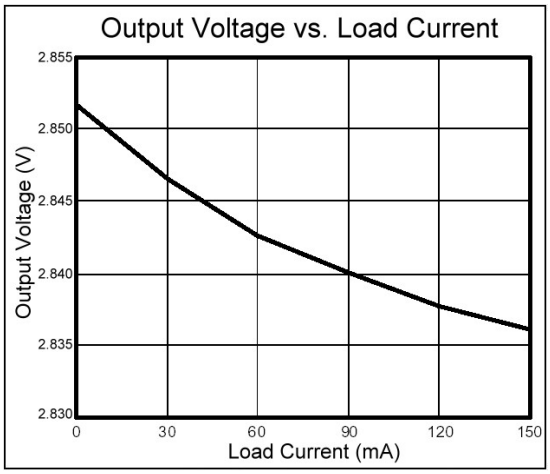
Characteristics Curve

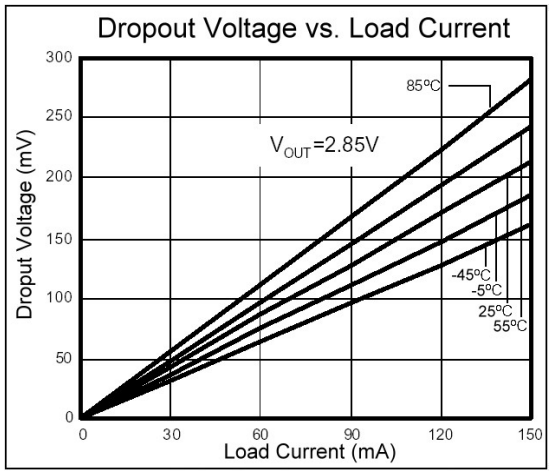


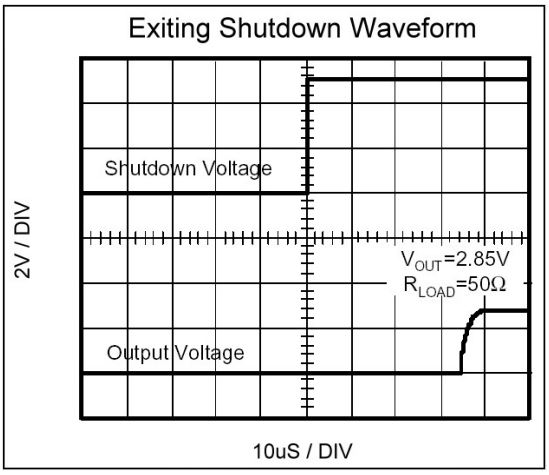


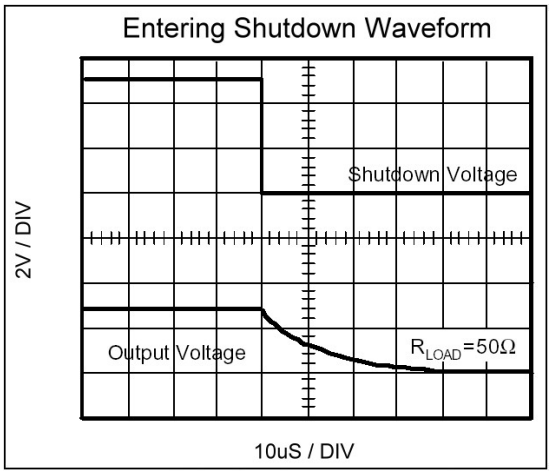

Input Current vs. Input Voltage
Input Current (uA)
Input Voltage (V)
0 10 20 30 40 50 60 70
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0


Output Voltage vs. Input Voltage
Output Voltage (V)
Input Voltage (V)
VOUT=2.85V
ILOAD=0.1mA
0.0 0.5 1.0 1.5 2.0 2.5 3.0
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0


Output Voltage vs. Load Current
Output Voltage (V)
Load Current (mA)
2.830 2.835 2.840 2.845 2.850 2.855
0 30 60 90 120 150


Dropout Voltage vs. Load Current
Dropout Voltage (mV)
Load Current (mA)
VOUT=2.85V
85ºC
-45ºC
-5ºC
25ºC
55ºC
0 50 100 150 200 250 300
0 30 60 90 120 150


Exiting Shutdown Waveform
Shutdown Voltage
VOUT=2.85V
RLOAD=50Ω
Output Voltage
2V / DIV
10uS / DIV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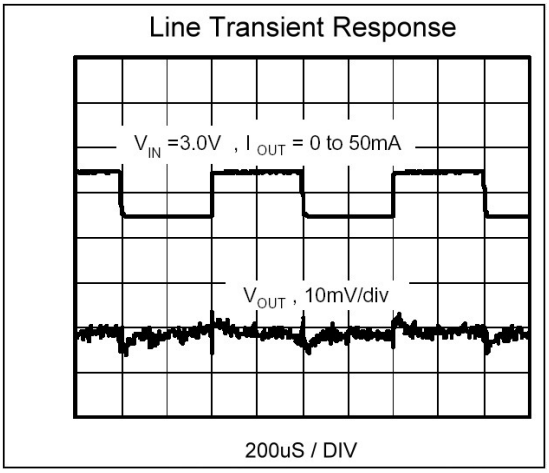
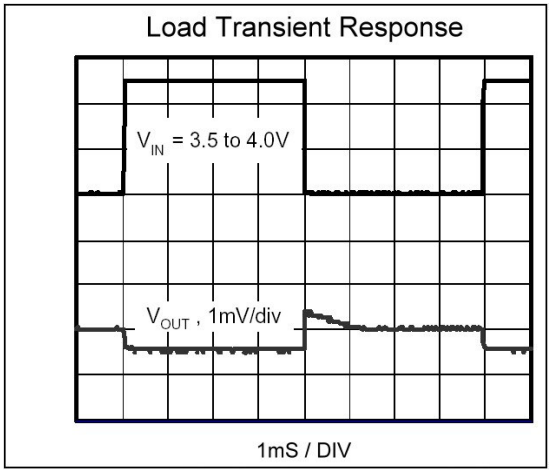
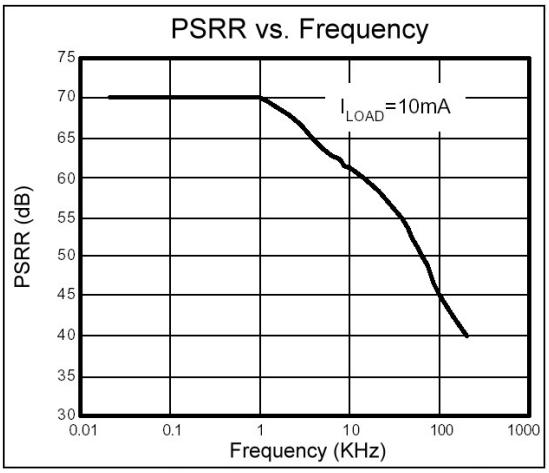
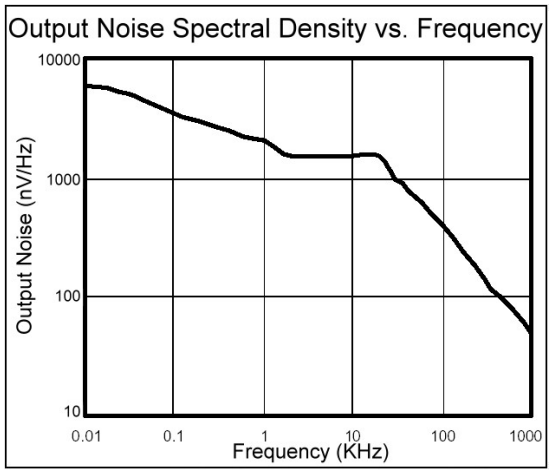
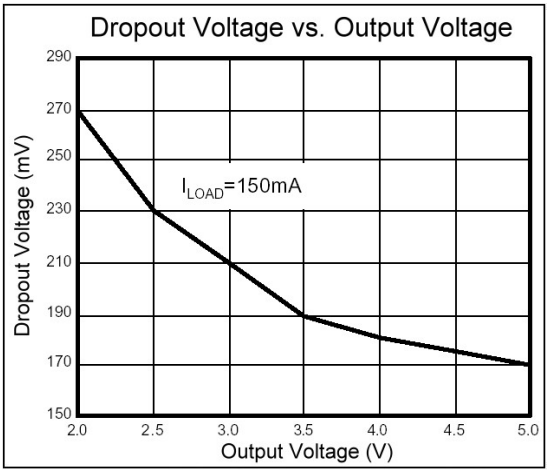
Output Voltage
RLOAD=50Ω
2V / DIV
10uS / DIV

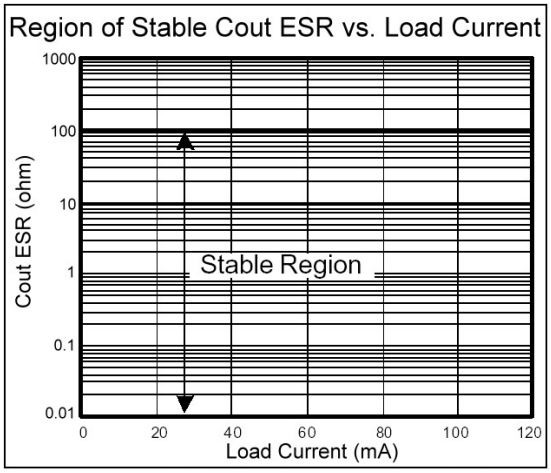












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