# GSC2166

**600mA CMOS Positive Voltage Regulator**

## Description

The GSC2166 series of positive, linear regulators feature low quiescent current (30μA typ.) with low dropout voltage, making them ideal for battery applications. The space-saving SOP-8 package is attractive for “Pocket” and “Hand Held” applications.

These rugged devices have both Thermal Shutdown, and Current Fold-back to prevent device failure under the “Worst” of operating conditions.

In applications requiring a low noise, regulated supply, place a 1000pF capacitor between Bypass and ground. The GSC2166 is stable with an output capacitance of 2.2μF or greater.

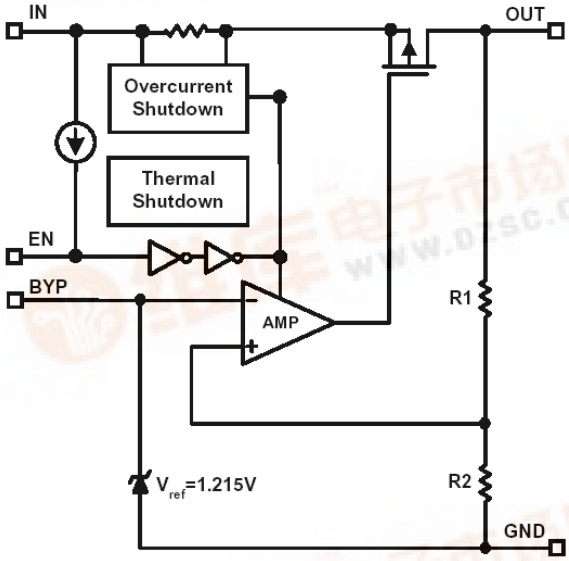
## Features

- Very Low Dropout Voltage
- Guaranteed 600mA output
- Over-Temperature Shutdown
- Current Limiting
- Short Circuit Current Fold-back
- Factory Pre-set Output Voltage
- Highly Accurate± 1.5%
- Noise Reduction Bypass Capacitor
- Low Temperature Coefficient

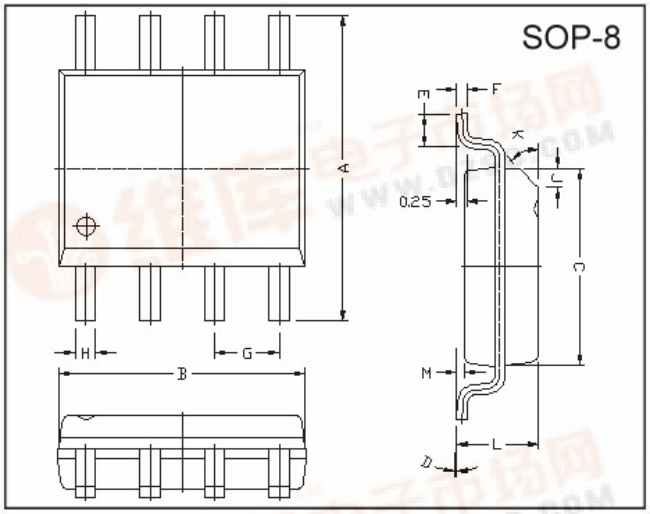
## Applications

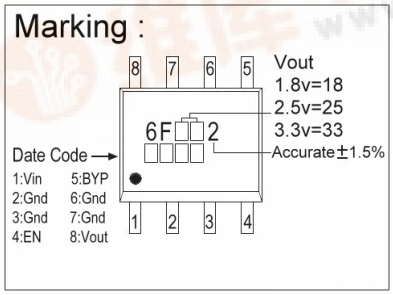
- Battery Powered Widgets
- Instrumentation
- Wireless Devices
- Cordless Phones
- PC Peripherals
- Portable Electronics
- Electronic Scales

## Block Diagram



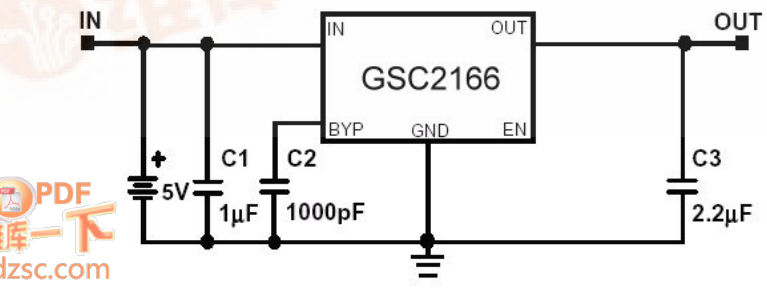

## Package Dimensions




| REF. | Millimeter | | REF. | Millimeter | |
|---|---|---|---|---|---|
| | Min. | Max. | | Min. | Max. |
| A | 5.80 | 6.20 | M | 0.10 | 0.25 |
| B | 4.80 | 5.00 | H | 0.35 | 0.49 |
| C | 3.80 | 4.00 | L | 1.35 | 1.75 |
| D | 0° | 8° | J | 0.375 REF. | |
| E | 0.40 | 0.90 | K | 45° | |
| F | 0.19 | 0.25 | G | 1.27 TYP. | |

## Typical Application Circuit



## Absolute Maximum Ratings

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| Input Max Voltage | $V_{IN}$ | 8 | V |
| Output Current | $I_{OUT}$ | $P_D/(V_{IN}-V_O)$ | A |
| Output Voltage | $V_{OUT}$ | 1.5~3.8 | V |
| Operating Ambient Temperature | Topr | -40 ~ +85 | ℃ |
| Junction Temperature | Tj | -40 ~ +125 | ℃ |
| Maximum Junction Temperature | $T_{j\,Max}$ | 150 | ℃ |
| Thermal Resistance | θja | 123.7 | ℃/W |
| Power Dissipation(△T=100℃) | PD | 810 | mW |
| EDS Classification | | B | |

## Electrical Characteristics Ta=25℃ unless otherwise noted

| Parameter | Symbol | Condition | | Min | TYP | Max | Unit |
|---|---|---|---|---|---|---|---|
| Output Voltage | $V_{OUT}(E)$ (Note1) | $V_{IN}=V_{OUT}(T)+2V$, $I_O=1mA$ | | -1.5% | $V_{OUT}(T)$ (Note2) | 1.5% | V |
| Output Current | $I_O$ | $V_{IN}=V_{OUT}(T)+2V$, $V_O>1.2V$ | | 600 | - | - | mA |
| Current Limit | $I_{LIM}$ | $V_{IN}=V_{OUT}(T)+2V$, $V_O>1.2V$ | | 600 | 800 | - | mA |
| Load Regulation | $REG_{LOAD}$ | $V_{IN}=V_{OUT}(T)+2V$, $I_O=1mA$ to 600mA | | - | 0.2 | 1 | % |
| Dropout Voltage | $V_{DROPOUT}$ | $I_O=600mA$ $V_O=V_{OUT}(E)$-2% | 1.3V≦$V_{OUT}(T)$≦1.4V | - | - | 1900 | mV |
| | | | 1.4V<$V_{OUT}(T)$≦2.0V | - | - | 1400 | |
| | | | 2.0V<$V_{OUT}(T)$≦2.8V | - | - | 800 | |
| | | | 2.8V<$V_{OUT}(T)$ | - | - | 600 | |
| Quiescent Current | $I_Q$ | $V_{IN}=V_{OUT}(T)+1V$, $I_O=0mA$ | | - | 30 | 50 | μA |
| Line Regulation | $REG_{LINE}$ | $I_O=1mA$ $V_{IN}=V_{OUT}(T)+1$ to $V_{OUT}(T)+2$ | 1.3V≦$V_{OUT}(T)$≦1.4V | -0.2 | - | 0.2 | % |
| | | | 1.4V<$V_{OUT}(T)$≦2.0V | -0.15 | - | 0.15 | |
| | | | 2.0V<$V_{OUT}(T)$ | -0.1 | 0.02 | 0.1 | |
| Input Voltage | VIN | | | Note3 | - | 7 | V |
| Over Temperature Shutdown | OTS | | | - | 150 | - | ℃ |
| Over Temperature Hysterisis | OTH | | | - | 30 | - | ℃ |
| Output Voltage Temperature Coefficient | TC | | | - | 30 | - | ppm/℃ |
| Short Circuit Current(Note4) | $I_{SC}$ | $V_{IN}=V_{OUT}(T)+1V$, $V_{OUT}<0.8V$ | | - | 300 | 600 | mA |
| Power Supply Rejection | PSRR | Io=100mA Co=2.2μF ceramic $C_{BYP}$=0.01μF | f=1kHz | - | 75 | - | dB |
| | | | f=10kHz | - | 55 | - | |
| | | | f=100kHz | - | 30 | - | |
| Output Voltage Noise | eN | f=10Hz~100kHz Io=10mA, $C_{BYP}$=0.01μF | Co=2.2μF | - | 30 | - | μVrms |
| EN Input Threshold | $V_{EH}$ | $V_{IN}$=2.7V to 7V | | 2.0 | - | $V_{IN}$ | V |
| | $V_{EL}$ | $V_{IN}$=2.7V to 7V | | 0 | - | 0.4 | V |
| EN Input Bias Current | $I_{EH}$ | $V_{EN}=V_{IN}$, $V_{IN}$=2.7V to 7V | | - | - | 0.1 | μA |
| | $I_{EL}$ | $V_{EN}$= 0V, $V_{IN}$=2.7V to 7V | | - | - | 0.5 | μA |
| Shutdown Supply Current | $I_{SD}$ | $V_{IN}$=5V, $V_O$=0V, $V_{EN}<V_{EL}$ | | - | 0.5 | 0.1 | μA |

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

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

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

4: To prevent the Short Circuit Current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.

## Ordering Information ( contd. )

| Part Number | Marking | Output Voltage | Part Number | Marking | Output Voltage |
|---|---|---|---|---|---|
| GSC2166-15 | 6F152<br>XXXX | 1.5V | GSC2166-18 | 6F182<br>XXXX | 1.8V |
| GSC2166-25 | 6F252<br>XXXX | 2.5V | GSC2166-27 | 6F272<br>XXXX | 2.7V |
| GSC2166-28 | 6F282<br>XXXX | 2.8V | GSC2166-2H | 6F2H2<br>XXXX | 2.85V |
| GSC2166-29 | 6F292<br>XXXX | 2.9V | GSC2166-30 | 6F302<br>XXXX | 3.0V |
| GSC2166-31 | 6F312<br>XXXX | 3.1V | GSC2166-33 | 6F332<br>XXXX | 3.3V |
| GSC2166-34 | 6F342<br>XXXX | 3.4V | GSC2166-35 | 6F352<br>XXXX | 3.5V |
| GSC2166-36 | 6F362<br>XXXX | 3.6V | GSC2166-37 | 6F372<br>XXXX | 3.7V |
| GSC2166-38 | 6F382<br>XXXX | 3.8V | | | |

## Detailed Description

The GSC2166 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 600mA. During thermal shutdown, the output voltage remains low. Normal operation is restored when the junction temperature drops below 120℃.

The GSC2166 switches from voltage mode to current mode when the load exceeds the rated output current. This prevents over-stress. The GSC2166 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 GSC2166 is stable with an output capacitance to ground of 2.2μF 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. Unfortunately, large value ceramic capacitors are comparatively expensive. One option is to parallel a 0.1μF ceramic capacitor with a 10μF Aluminum Electrolytic. The benefit is low ESR, high capacitance, and low overall cost.

A second capacitor is recommended between the input and ground to stabilize $V_{IN}$. The input capacitor should be at least 0.1μF to have a beneficial effect.

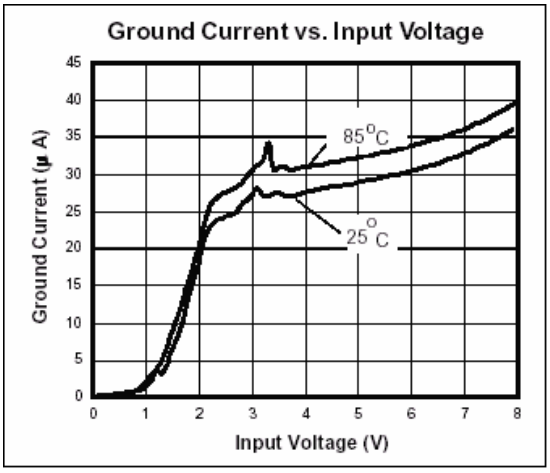
A third capacitor can be connected between the BY-PASS pin and GND. This capacitor can be a low cost Polyester Film variety between the value of 0.001~0.01μF. A large capacitor improves the AC ripple rejection, but also makes the output come up slowly. This “Soft” turn-on is desirable in some applications to limit turn-on surges.

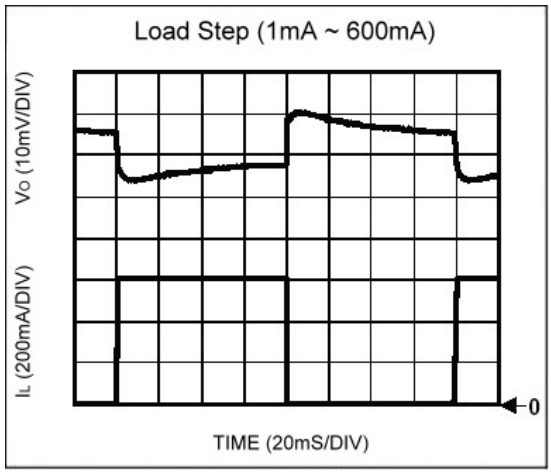
All capacitors should be placed in close proximity to the pins. A “Quiet” ground termination is desirable. This can be achieved with a “Star” connection.

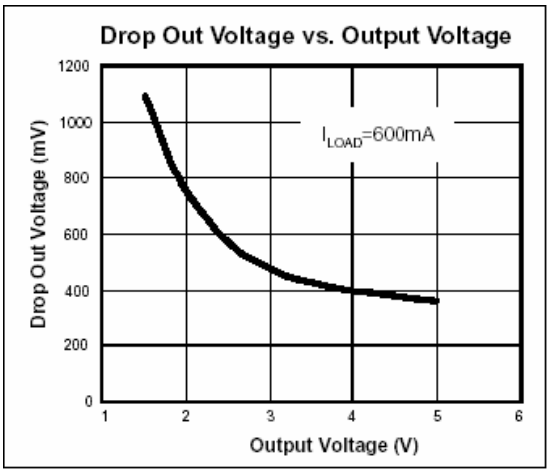
## Enable

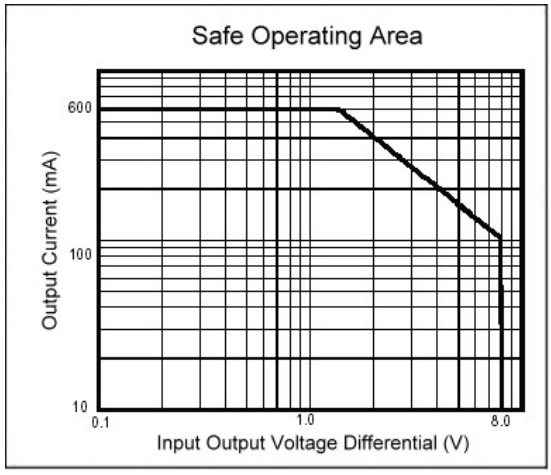
The Enable pin normally floats high. When actively, pulled low, the PMOS pass transistor shuts off, and all internal circuits are powered down. In this state, the quiescent current is less than 1μA. This pin behaves much like an electronic switch.

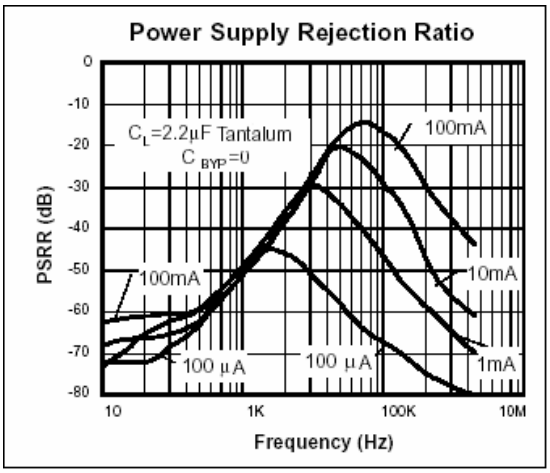
## Characteristics Curve

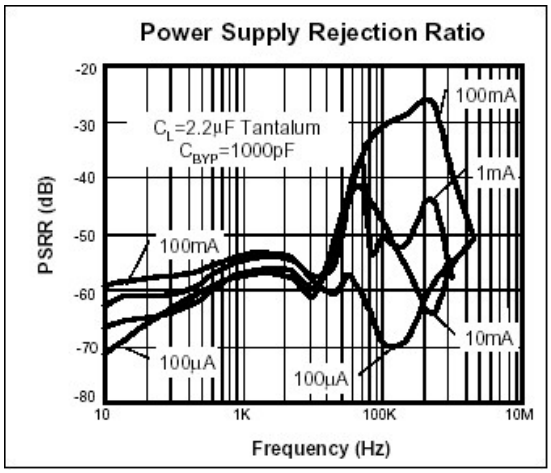


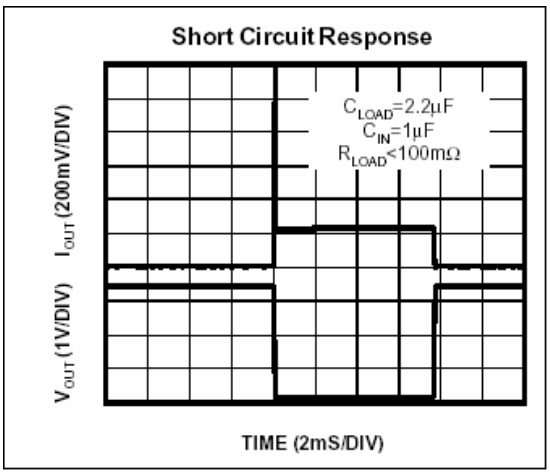



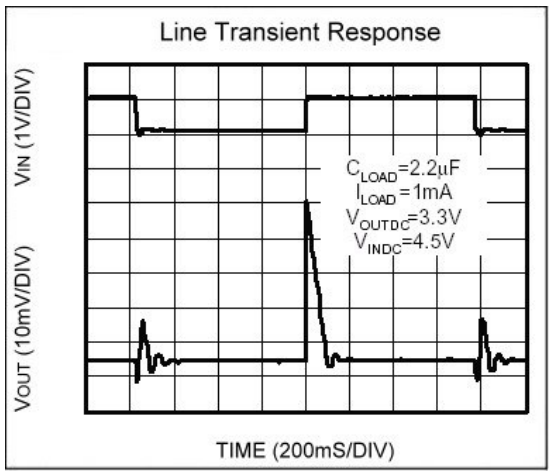



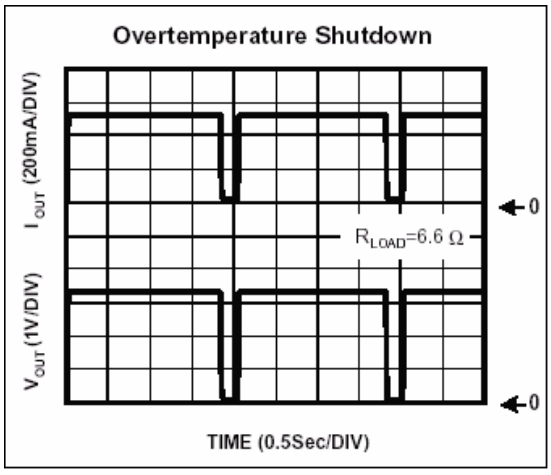



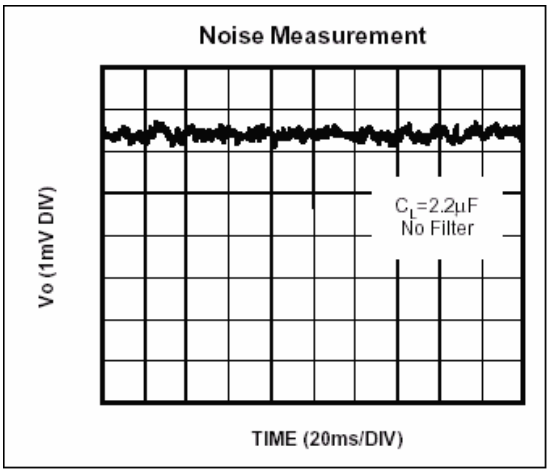



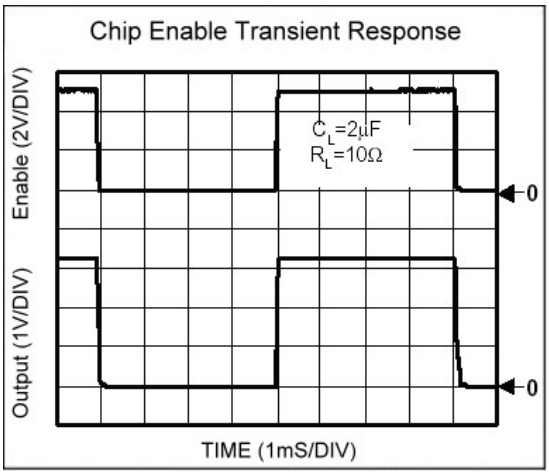



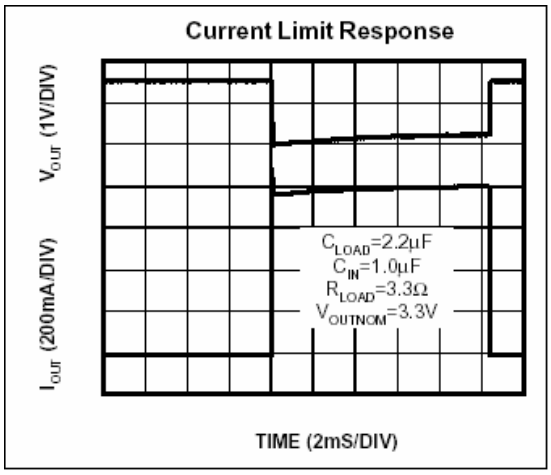


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