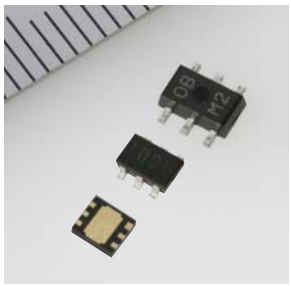
1A high-speed LDO regulator supporting a 0.5V low input voltage

TOREX
New Product Leaflet

# XC6602/XC6603/XC6604 Series

Digital Camera　Smartphone　Notebook PC

The XC6602/XC6603/XC6604 series is capable of operation from an input voltage of 0.5V and has a low on-resistance, making these products ideal for applications that require high current output with high efficiency at a low voltage range.
Each series has a soft-start function, and the XC6603 series enables the rise time of the soft-start function to be adjusted with an external capacitor. The XC6604 series has an externally adjustable current limiting circuit, enabling adjustment of the current limit using an external resistor.



USP-6C, SOT-26W
SOT-89-5

## POINT 1 Low input voltage, low dropout voltage, and low output voltage are achieved with an N-channel MOS driver

Fig.1 P-ch MOS Driver LDO

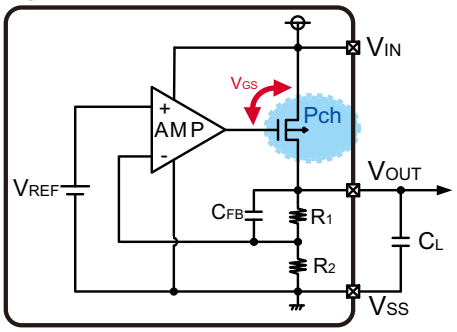



Fig.2 N-ch MOS Driver LDO

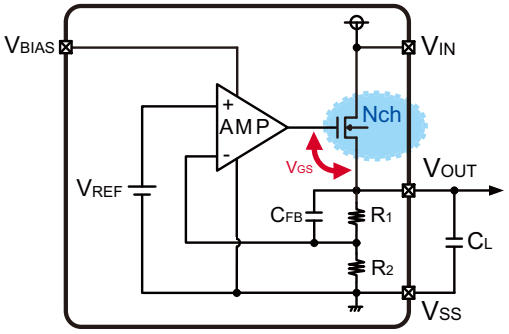
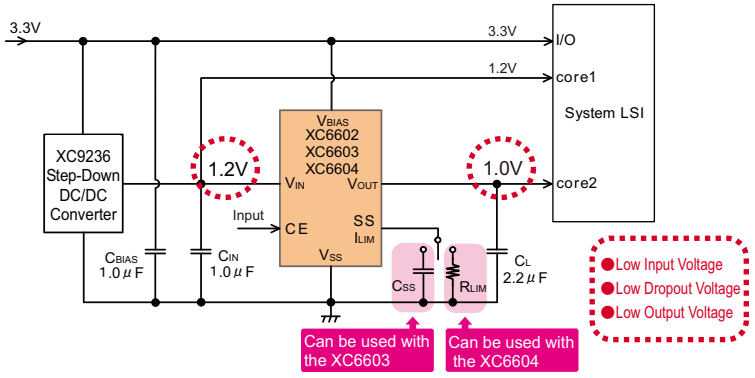



Fig.3 TYPICAL APPLICATION CIRCUIT




As shown in Fig.1, previous LDOs used a P-channel MOS transistor as a driver transistor. In this case, VGS of the driver transistor can reach as a maximum the voltage between VIN and VSS, and VGS falls as VIN falls, causing the on-resistance to grow higher as the voltage becomes lower. In addition, VIN cannot be lowered below the voltage required for the IC to operate.

By contrast, when an N-channel MOS transistor is used as the driver transistor as shown in Fig.2, VGS of the driver transistor can reach as a maximum the voltage between VBIAS and VOUT. As such, VBIAS is biased from a high level such as a 3V or 5V system, and VGS grows higher as VOUT becomes lower, making operation at a low on-resistance possible.

Using an N-channel MOS transistor for the driver transistor, a large current can be supplied at a low dropout voltage such as VIN=1.2V and VOUT=1.0V. (Fig.3)

| Features | | | |
|---|---|---|---|
| Maximum Output Current | 1A (1.3A Limit) | Ripple Rejection | 60dB@f=1kHz (VBIAS) |
| ON Resistance | 0.15Ω@VBIAS=3.6V, VOUT=1.2V | | 75dB@f=1kHz (VIN) |
| Bias Voltage Range | 2.5V～6.0V | Low Power Consumption | 100μA (VBIAS), 6.5μA (VIN)@VOUT=1.2V |
| Input Voltage Range | 0.5V～3.0V | Stand-by Current | 0.01μA (VBIAS), 0.01μA (VIN) |
| Output Voltage Range | 0.5V～1.8V (0.1V increments) | Function | Soft-start (Please refer to Table. 1), CL High Speed Discharge |
| Output Voltage Accuracy | ±0.015V@VOUT＜1.2V | | CE Pull-Down (Active High) |
| | ±0.020V@VOUT≧1.2V | Packages | USP-6C, SOT-26W, SOT89-5 (XC6602 only) |

RoHS Compliant　Halogen Antimony FREE

# 1A high-speed LDO regulator supporting a 0.5V low input voltage XC6602/XC6603/XC6604 Series

## POINT 2 XC6603 series: Soft-start can be adjusted externally

Because the soft-start circuit prevents rush current from VIN to VOUT when the IC starts, voltage fluctuations in the VIN line due to rush current can be held down. In a circuit like the example shown in Fig.3, there is no concern that over-current protection will activate due to rush current in the front end IC, and the sequence can be controlled. Even with a low on-resistance, smooth power-on is achieved with no adverse effects on other ICs due to rush current.

The soft-start time of the XC6602 type A and XC6604 type A is set internally to 430μs (TYP.). The soft-start time of the XC6603 series can be adjusted by external capacitor (CSS), enabling optimization of the soft-start time for the rush current.

Fig.4 Soft-start Characteristics (XC6603 Series)
CE Rise Transient Response

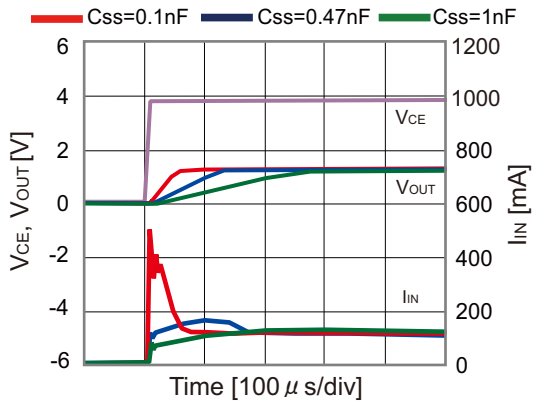
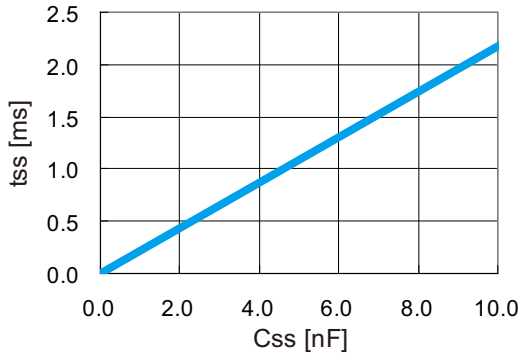



Fig.5 Soft-start Time vs. Capacitor Capacitance




Test Condition: VBIAS=3.6V, VIN=1.5V, VOUT=1.2V, VCE=0V→3.6V(tr=5μs), IOUT=100mA, CBIAS=CIN=1.0μF, CL=10μF, Ta=25℃

Table.1 Soft-start Function Selection Guide

| SERIES | TYPE | Soft-start Function |
|---|---|---|
| XC6602 | A | Soft-start Internal Fixed |
| | B | Without Soft-start |
| XC6603 | A | Soft-start External Setting* |
| XC6604 | A | Soft-start Internal Fixed |
| | B | Without Soft-start |

* When the SS pin is open, the soft-start circuit does not operate and operation is the same as the non soft-start product. When VSS is shorted, VOUT does not rise.

## POINT 3 XC6604 series: The current limit value can be set as desired

When the maximum output current is exceeded and the current reaches a specific value, the current limiting circuit (foldback current limiting characteristic) of the XC6602/XC6603/XC6604 series activates and gradually reduces the current to prevent IC damage.

The current limit value of each series is set internally to 1.3A (TYP.), and the XC6604 series further allows the value to be set with an external resistor (RLIM) to match the required current range.

Fig.6 Current Limiting Characteristics (XC6604 Series)

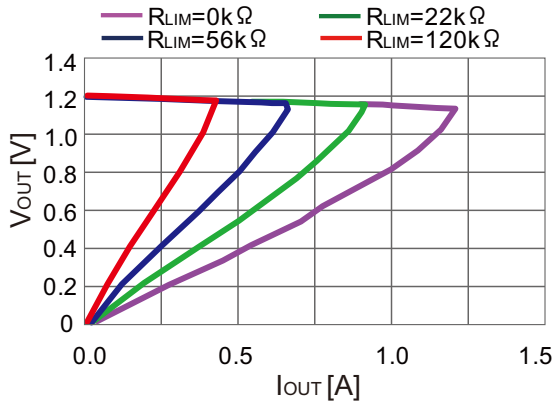
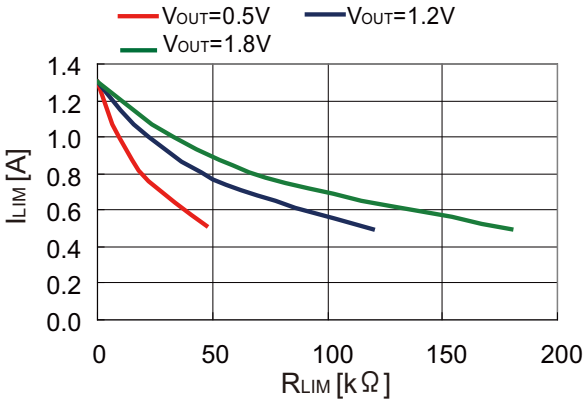



Fig.7 Current Limit Value vs. External Resistance




Test Condition: VBIAS=3.6V, VIN=1.5V, VOUT=1.2V, VCE=VBIAS, CBIAS=CIN=1.0μF, CL=2.2μF, Ta=25℃