

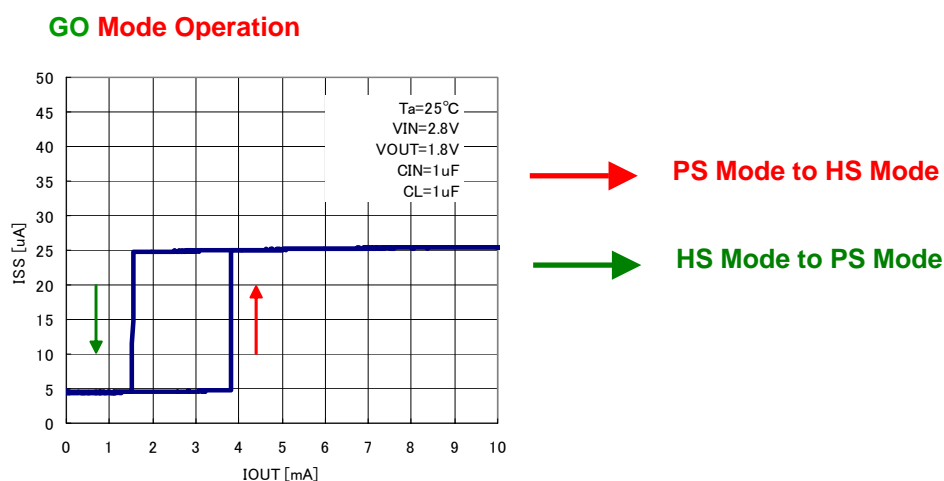
Regulators Realise Battery Power Gains

Andy Scott from Torex Semiconductor Europe looks at how regulator choice can influence battery life, a major battleground for handheld devices.

Handheld, battery powered devices – epitomised by next generation mobile phones that play host to applications such as mobile TV and web browsing – are tough customers to please. Not only are the latest features proving more power hungry than ever, but users have also come to expect longer battery life and further miniaturisation as a given. A relatively mature battery market, in which considerable improvements in energy density for Lithium Ion and alkaline batteries have already been achieved, means that the design engineer is obliged to look elsewhere to maximise battery life. Fortunately, power IC manufacturers are rising to the challenge, attempting to meet these conflicting challenges with a new breed of power ICs designed with handheld, battery powered devices directly in mind.

Just as much a distinguishing characteristic of many battery powered embedded devices is that they spend much of their lives in standby or idle mode, time spent in very high power mode is commensurately small. Using a power IC that has a standby feature ensures that current isn't drained when there is no load present. Similarly, by choosing a part that will only draw maximum current as and when it is needed will maximise battery life, especially if the regulator in question supplies the fast load demands of a high speed microprocessor core or ASIC, for example.

With this in mind, Torex Semiconductor has developed the XC6217 series, a range of low noise, high speed LDO regulators that provide three operating modes – high speed (HS), power saving (PS) and standby. The XC6217 series features Torex's 'Green Operation' (GO) circuitry, a function that automatically switches the regulator into PS mode when load current falls below a preset value (see Figure 1).



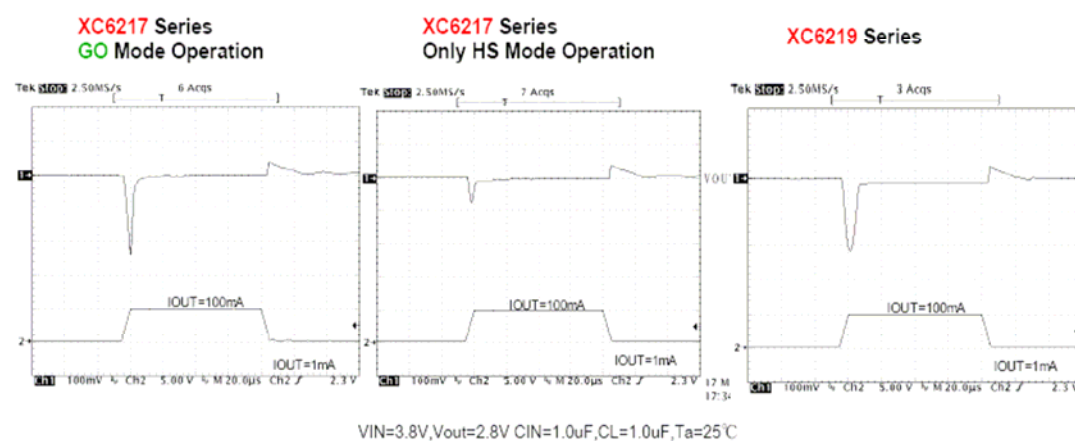
(Fig.1)

The XC6217 delivers all the benefits you would expect from a traditional high speed voltage regulator, yet also achieves extremely low quiescent current in power-save mode. Whilst the quiescent current for the XC6217 series in high speed operation is already an impressively low 25 μA (typ), Torex's GO functionality further reduces it at low output

loads to 4.5 μ A (typ). In standby mode, ground current is less than 0.1 μ A. Quiescent current reduction has been achieved without compromising ripple rejection –still an extremely fast 70dB at 1kHz – or dropout voltage, which registers at only 80mV at 100mA in HS mode.

Importantly, the transient performance of the XC6217 – how quickly output voltage settles after changes in output current – is also extremely fast, when compared with a standard high speed LDO like Torex's XC6219 family. Fast transient response is an important design criterion as most circuits are not tolerant to large voltage transients, a by-product of the need to adjust from one operating mode to the other. For example, a sudden leap in output requirement from a few milliamps to 100mA might result in a 0.1 or 0.2V drop on the output voltage. Figure 2 illustrates the extremely quick load transient performance for the XC6217 series.

Load Transient Response Comparison: XC6217 vs. Standard High Speed LDO (XC6219 Series)

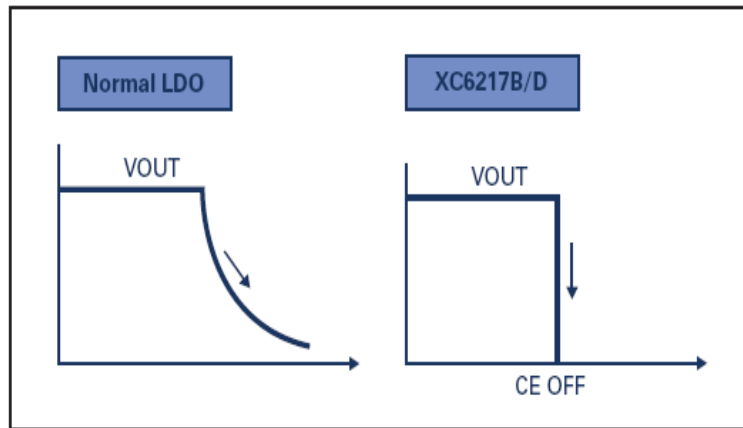
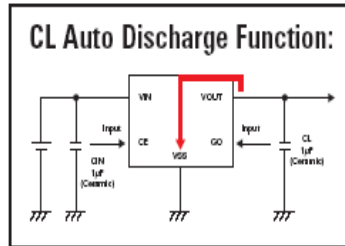


(Fig.2)

The XC6217 incorporates Torex's second generation GO circuitry. This generation halves the quiescent current of the previous XC6217 series in high speed operation, while customer feedback from the first generation has resulted in a change of preset value for the PS to HS switch point up to around 4mA. With the switch point fixed internally for automatic operation, the device can be set to high speed only operation by applying an external high level signal to the chip's GO pin. This allows the engineer complete flexibility to select the most appropriate operating mode for their application.

By applying a low signal to the chip enable (CE) pin, the IC can be put into an OFF state, with a stand-by current of 0.1 μ A. When the XC6217B/D series is in an OFF state, a short is created via the internal switch, located between the VOUT and VSS pins, allowing the stored charge in the output capacitor (CL) to be discharged quickly via the internal auto-discharge resistance. This feature results in the VOUT pin swiftly returning to the VSS level (see Figure 3).

When CE (Chip Enable) is turned off, the output voltage (VOUT) level goes to zero quickly through the XC6217B/D's internal N channel FET.



(Fig.3)

With a built in constant current limiter circuit and additional current fold-back mode, the XC6217 offers excellent short circuit protection. It also operates happily using inexpensive low ESR ceramic capacitors.

The XC6217 is available in three packages sizes, including SOT25, SSOT24 and an ultra small USP-4D chip scale package, that is 1.2mm x 1.6mm with a maximum height of 0.6mm. For the USP-4D package, the XC6217 uses the centre tab for the ground connection (VSS), helping to improve the overall thermal efficiency of the package and making the USP-4D ideal for any applications demanding high power dissipation while minimising the required PCB area.

For all package types except SSOT-24, the GO function can be disabled, allowing XC6217 regulators to operate as standard high speed LDO devices. This eliminates the need for users to order and stock different parts for GO and non GO applications, making it even simpler to choose the 'Green Operation' option and reap impressive battery power rewards when the situation allows.

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