

Product brief

LLC resonant mode controller ICs

Best-in-class converters to support LLC HB resonant mode topology

Resonant mode power supplies are a variation over SMPS circuits where the switching losses are significantly reduced by adapting zero-voltage or zero-current switching techniques, also known as soft-switching technique. Whereas in non-resonant mode SMPS circuits, the switches are subjected to hard switching. Thus, resonant mode power supplies are more preferred to achieve higher efficiency.

LLC HB resonant operates under the ZVS mode, whereby switching loss is reduced so that the converter is at a higher switching frequency. In addition, it can optimize the converter further at a high input voltage. This topology allows to eliminate the secondary filter inductor, adopt better rectifier diodes and reduce secondary conduction loss. The converter utilizes leakage and magnetizing inductance of a transformer. With magnetic integration concept, all the magnetic components can be built in one magnetic core.

Key features

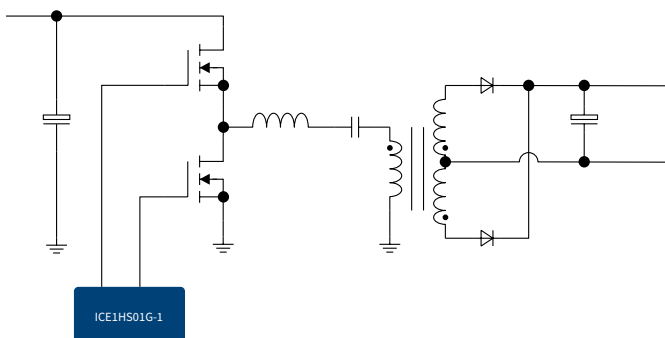
Resonant LLC half-bridge controller IC

- > Novel and simple design (12 components + HB driver)
- > Minimum operating frequency is adjustable externally
- > Burst mode operation for output voltage regulation during no load and/or bus overvoltage
- > Multiple protections in case of fault
- > Input voltage sense for brown-out protection
- > Open loop/overload fault detection by FB pin with auto restart and adjustable blanking/restart time
- > Frequency shift for overcurrent protection
- > Lead-free, RoHS compliant package
- > DSO-8 package

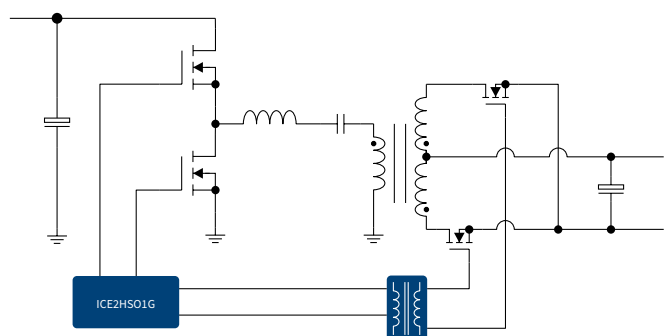
Resonant LLC half-bridge controller IC with integrated synchronized rectifier control

- > Novel LLC/SR operation mode and controlled by primary side controller
- > Multiple protections for SR operation
- > Tight tolerance control
- > Accurate setting of switching frequency and dead time
- > Simple system design
- > Optimized system efficiency
- > Multiple converter protections: OTP, OLP, OCP, latch-off enable
- > External disable for either SR switching or HB switching
- > Lead-free, RoHS compliant package
- > DSO-20 package

LLC resonant (no SR)



LLC resonant + SR



LLC resonant mode controller ICs

Best-in-class converters to support LLC HB resonant mode topology

ICE1HS01G-1 resonant mode converter, housed in a DSO-8 package, is an easy-to-design component to realize a LLC HB resonant application. An oscillator is built in, allowing designers to set the suitable operation frequency range with a resistor. In addition, ICE1HS01G-1 offers a programmed soft-start function to limit both the inrush current and the overshoot in output voltage. To protect the system during operation, mains input undervoltage protection and overcurrent protection are also built in. Hence, it is able to operate in resonant mode with the highest reliability possible.

ICE2HS01G is a high performance resonant mode controller designed especially for high efficiency half-bridge or full-bridge LLC resonant converter with synchronous rectification at the secondary side. With its new driving techniques, the synchronous rectification can be realized for LLC converter operated with secondary switching current in both CCM and DCM conditions. No special synchronous rectification controller IC is needed at the secondary side. The maximum switching frequency is supported up to 1 MHz. Except the patented SR driving techniques, this IC provides very flexible design and integrates full protection functions as well. It is adjustable for maximum/minimum switching frequency, soft-start time and frequency, dead time between primary switches, turn-on and turn-off delay for secondary SR MOSFETs. The integrated protections include input voltage brownout, primary three-levels overcurrent, secondary overload protection and no-load regulation.

LLC half-bridge controller IC	ICE1HS01G-1	ICE2HS01G
Package	DSO-8	DSO-20
Switching frequency range	up to 600 kHz	up to 1 MHz
LLC soft start	✓	✓
LLC burst mode	✓	✓
Adjustable minimum frequency	✓	✓
Overload/open loop protection	✓	✓
Mains undervoltage protection with hysteresis	✓	✓
Overcurrent protection	2-level	3-level
Drive signal for synchronous rectification	-	✓
Adjustable dead time	-	✓
External latch-off and OTP	-	✓
Target application	LCD-TV, audio, etc.	Server, PC, LCD-TV, etc.

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