

**TABLE 3 COMPARISON OF RESONANT POWER SUPPLIES**

Converter	Advantages	Disadvantages
Series resonant	Behaves as a current source and best suited to high-voltage, high-power designs Provides good handling of overload and fault conditions Requires small or no output filter	Poor regulation at light- and no-load conditions Continuous-current mode below resonance causes high component stress and premature failure if not carefully designed
Parallel resonant	Behaves as a voltage source and suitable for low-voltage outputs, good no- and light-load regulation Discontinuous mode of operation is similar to standard PWM buck conversion	Requires snubbers, consuming efficiency Does not self-protect in overload or short-circuit conditions, requiring additional protection Constant resonant circulating current at all load conditions can cause problems
Zero-current switching, quasiresonant, fixed on-time	Low turn-off losses in silicon Recycles any remaining leakage current	Power components contain high peak currents
Zero-voltage switching, quasiresonant, fixed off-time	Virtually eliminates switching losses Recycles any remaining leakage current	Operates above resonant range Power devices require at least three times the supply voltage; multiresonant techniques offset this problem
Series-parallel resonant	Excellent performance at light-load, no-load, and short-circuit or fault conditions	Produces parasitic elements that can be troublesome, requiring additional passive components
Multiresonant, zero-voltage-switching Class E	Virtually eliminates switching losses, virtually no frequency shift compared with other methods	Can cause stability issues and generates high peak voltage and current across semiconductors
Clamped PWM	Simple control loop with low-voltage stress Current-mode capable and fixed frequency of operation	Turn-on losses can be high; operates best at medium- to full-load conditions
PWM, zero-voltage switching	Fixed-frequency design with maintained switching losses at low levels across all power devices High efficiency at high switching frequency	Creates problematic switching noise at light loads and does not achieve zero-voltage switching in the light-load mode of operation
LLC resonant	High efficiency with excellent line/load regulation Outperforms series-resonant mode	Performance is superior to other modes of operation, but design is critical Possible N+1-redundancy concerns