

Convenient transformer secondary voltages might be 225v for the largest #1 inverter, 75v for the #2 inverter (exactly 1/3) 25v for the #3 inverter (exactly 1/9) and 8.33v for #4 inverter (exactly 1/27).

If all inverters switch on together in the same direction we will get $225v + 75v + 25v + 8.33v = 333.33v$ peak. That equals 235.7v rms, which works out quite nicely.

There are a couple of peculiarities about all this that are fairly important to understand. The first is that some inverters will be switching their output voltage in opposition to other inverters.

If the 225v inverter switches on positive we get +225v. If at the same time the 75v inverter switches on negative we get -75v, and the combined output produced would be +150v.

What is really weird though is that the 225v inverter will be producing excess power at +225v which then flows backwards through the -75v inverter back onto the dc input power rail. There will be power shuffling back and forth through all four inverters as the complete sinewave is being generated. These mosfet inverters are all bi directional, and heavy out of phase reactive load currents produced by motors, fluorescent lights, and other really nasty reactive loads can feed power backwards onto the dc bus without creating any dramas. So the whole thing is pretty much bullet proof for highly reactive loads.

It's a curious thing, but the voltages throughout the inverter are all square waves, but the currents in the inverter are all sine waves, or chopped up sine waves. All four transformers can be designed as conventional 50Hz sine wave transformers, and it will work fine.

Another other odd thing about this is that each inverter in the zero volt output condition must still carry the final output current of the other inverters as they are all connected in series. So it's not just a case of simultaneously switching off all four mosfets in any zero volt output bridge. That would create an open circuit across the transformer primary, reflected as an open circuit across the transformer secondary.

There absolutely must be a continuous current path through all inverter secondary's even right at the zero crossing where all four are putting out zero voltage.

What we need to do is short out the primaries in the zero output volt condition, and we can do that very easily by turning both lower mosfets on together. So we switch mosfets on in diagonal pairs for either +ve or -ve output in the usual way, and turn on both lower mosfets together for the zero volt shorted output condition. This is a rather unconventional way to drive a bridge, but the gate drive waveforms to do it are really simple.

Please see the mosfet gate drive timing diagram below which is shown without dead time for simplicity."

