CHAPTER 6

EXPERIMENTAL RESULTS

Experimental results for five test cases are performed to access the closed-loop performance of Quasi-Resonant Buck Converter and hence to validate the control strategy. Switch S is replaced by Power MOSFET IRF940 whose advantages are high commutation speed and good efficiency at low voltages. It is a voltage controlled, unipolar device which evolved from the CMOS technology and was developed for manufacturing integrated circuits in the late 1970s and to solve the performance limitations experienced with power bi-polar transistors. The high input impedance is a primary feature which greatly simplifies the gate drive circuitry and reduces the cost of power electronics. It can withstand simultaneous application of high voltage and current for a shorter duration without undergoing destructive failure due to secondary breakdown. It shall be easily paralleled because its forward voltage-drop increases with increase in temperature and this feature promotes an even current distribution between paralleled devices. Pin Diagram and details of IRF940 MOSFET are depicted in Appendix 3. A linear PI controller is implemented using a low-cost, quadruple National Semiconductor Corporation’s LM324 which has advantages such as compatibility with all forms of logic and low power drain with an input common-mode voltage range from 0V to V ±1.5V appropriate for battery operation. It consists of four independent, high gain internally compensated two stage operational amplifiers on a single monolithic substrate designed specifically to operate from either single supply at voltages as low as 3.0V or as high as 32V or dual.
supply at 1.5V or 15V and the differential input voltage range is equal to the maximum rated supply voltage. The first stage performs gain function and in addition level shifting and transconductance reduction functions; another feature is that the input common mode range includes the ground in single supply operation thereby eliminating the necessity for external biasing components in many applications; the second stage consists of a standard current source load amplifier and each amplifier is biased from an internal voltage regulator which has a low temperature co-efficient thus offering good temperature characteristics and excellent power supply rejection. An ON-Chip capacitor in each stage provides frequency compensation for unity gain and applications include multivibrators, oscillators, transducer amplifiers, and the other operational amplifier circuits which can be implemented in single-supply-voltage systems. Pin diagram and details of LM324 are depicted in Appendix 4. Experimental arrangement of linear PI controller for $J_i/H_i$ parameter = -0.2 for Maximum line and Light load condition is depicted hereunder in Figure 6.1 and its line diagram is depicted in Figure 6.7 and the output waveform for five different operating conditions are depicted between Figures 6.2 and 6.6 and such results illustrates the effectiveness of the control strategy of Quasi-Resonant Buck Converter.

![Figure 6.1 Experimental arrangement of PI controller for case 5](image)
Figure 6.2 Maximum line and light load

Figure 6.3 Minimum line and maximum load
Figure 6.4 Minimum line and light load

Figure 6.5 Mid range line and load
Figure 6.6 Maximum line and maximum load

![Figure 6.6](image1)

Figure 6.7 Line Diagram of Experimental arrangement of Quasi-Resonant Buck Converter using PI controller

![Figure 6.7](image2)