A.4: Laser diode driver for laser marker system

Compact, PCB mounted laser diode drivers (LDD) are required for miniaturization of laser marker systems. Efforts are being made to indigenise LDDs tailored to specific application requirements. A 80 A, 6 V board mounted LDD having output current ripple less than ±0.5%, operating on 230 V±10%, 50 Hz single-phase ac mains, has been developed, tested at SMPCL/PCD, RRCAT and successfully integrated in the laser markers at HPLDL/LDIAD, RRCAT.

The reported LDD is developed using an interleaved series-input parallel-output (ISIPO) forward converter operating at 100 kHz as the topology offers various advantages like (a) capability to handle high output current due to series-input, parallel-output architecture (b) better themal management due to distributed losses (c) reduced output ripple and smaller filter capacitor due to interleaved opeartion (d) inherent transformer reset and (e) voltage stress on each MOSFET clamped to maximum input voltage. Circuit diagram of ISIPO forward converter is shown in Fig. A.4.1. Two MOSFET switches S_1 and S_2 are driven in the interleaved fashion (with 180° phase shift). Diodes D_1 and D_2 are used for resetting the transformer windings. Due to interleaved operation, net ripple in the output currents reduces, thereby reducing the size and stored energy in the output filter capacitor.

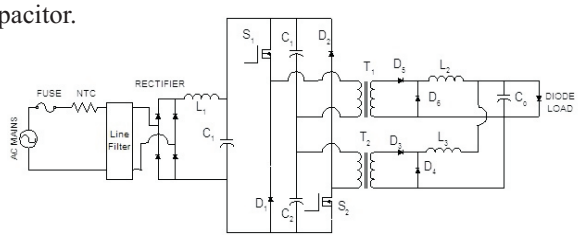

Fig. A.4.1: Schematic of the LDD based on ISIPO forward converter

The application constrains the allowable size of the laser diode power supply to be less than 225 mm X 300 mm. The photograph of power supply is shown in Fig. A.4.2.

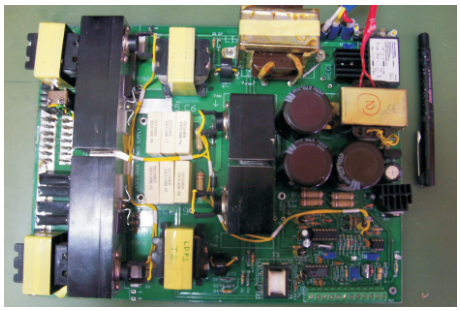

Fig. A.4.2: Photograph of developed power supply

Photograph clearly shows the compactness and small size of the power supply. Such small size makes it possible to accommodate this power supply inside compact laser marker machine. Two such power supplies have been developed for HPLDL/LDIAD, RRCAT where they have been successfully tested and integrated in the laser marker systems. Fig. A.4.3 shows the photograph of the power supply integrated laser marker system.

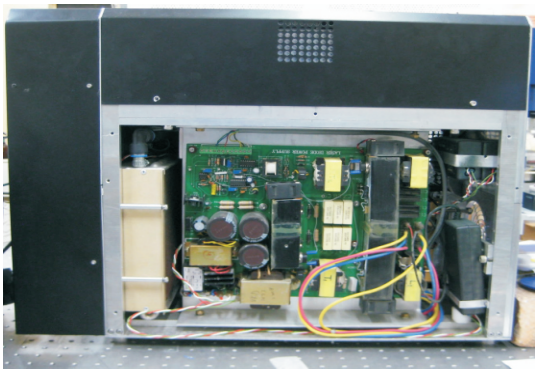

Fig. A.4.3: Photograph of LDD integrated in laser marker system

The PCB for LDD has been designed to keep the length of high current carrying tracks to minimum. Output current is sensed using an on-board zeranin shunt. The LDD is equipped with output over current protection and over temperature protection. On-board EMI filter is used to reduce conducted EMI. It is capable of being operated in dc as well as in slow pulse mode. Results of pulse mode testing is shown in Fig. A.4.4. The current is seen to follow the pulse reference without any overshoot.

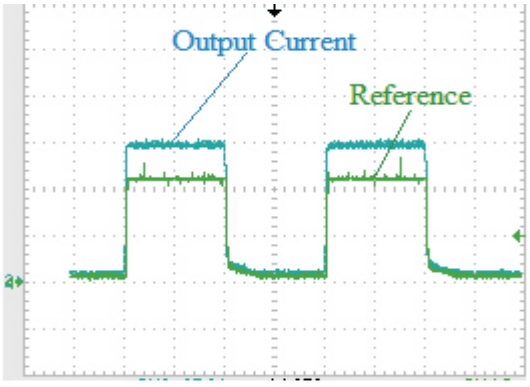

Fig. A.4.4: Output current (25 A/div) of LDD in pulsed mode following the current reference signal (2 V/div).

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