

# SHORT-CIRCUIT PROTECTION IN DC LOW-VOLTAGE SYSTEMS



■ PRATIK PANCHAL

Many a times you need to power an adjoining accessory circuit from the power supply used in the main module cir-

cuit. Here is a circuit to derive the additional power supply from the main circuit. The main circuit is protected from any damage due to short-circuit in the

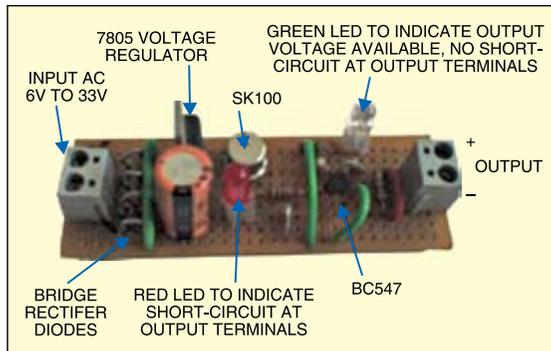


Fig. 1: Prototype of short-circuit protection in DC low-voltage systems

additional power supply circuit by cutting off the derived supply voltage. The derived supply voltage restores automatically when shorting is removed. An LED is used to indicate whether short-circuit exists or not. Author's prototype of short-circuit protection module is shown in Fig. 1.

In the main power supply circuit, 230V AC is stepped down by transformer X1 (230V AC primary to 0-9V, 300mA secondary), rectified by a full-wave rectifier comprising diodes D1 through D4, filtered by capacitor C1 and regulated by IC 7805 to give regulated 5V (O/P1).

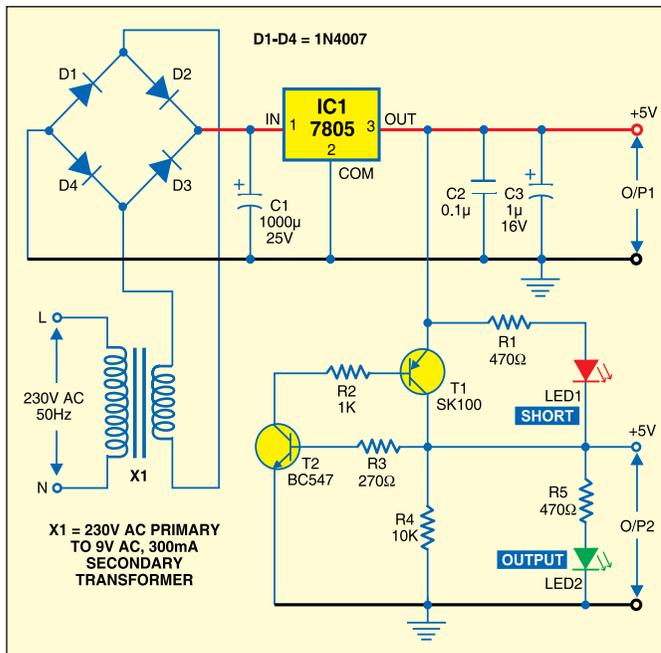


Fig. 2: Circuit diagram of short-circuit protection

Working of the circuit is simple. When the 5V DC output from regulator IC 7805 is available, transistor BC547 conducts through resistors R1 and R3 and LED1. As a result, transistor SK100 conducts and short-circuit protected 5V DC output appears across O/P2 terminals. The green LED (LED2) glows to indicate the same, while the red LED (LED1) remains off due to the presence of the same voltage at both of its ends.

When O/P2 terminals short, BC547 cuts off due to grounding of its base. As a result, SK100 is also cut-off. Thus during short-circuit, the green LED (LED2) turns off and the red LED (LED1) glows. Capacitors C2 and C3 across the main 5V output (O/P1) absorb the voltage fluctuations occurring due to short-circuit in O/P2, ensuring disturbance-free O/P1. The design of the circuit is based on the relationship given below:

$$R_B = (H_{FE} \times V_s) / (1.3 \times I_L)$$

where,

$R_B$  = Base resistances of transistors of SK100 and BC547

$H_{FE}$  = 200 for SK100 and 350 for BC547

Switching Voltage  $V_s = 5V$

1.3 = Safety factor

$I_L$  = Collector-emitter current of transistors

Transistors SK100 and BC547 are used to derive the secondary output of around 5V (O/P2) from the main 5V supply (O/P1).

Assemble the circuit on a general-purpose PCB and enclose in a suitable cabinet. Connect O/P1 and O/P2 terminals on the front panel of the cabinet. Also connect the mains power cord to feed 230V AC to the transformer. Connect LED1 and LED2 for visual indication. ●