

ZVP4424 and ZVN4424 in Telephone Hook-Switch and Earth Recall Applications

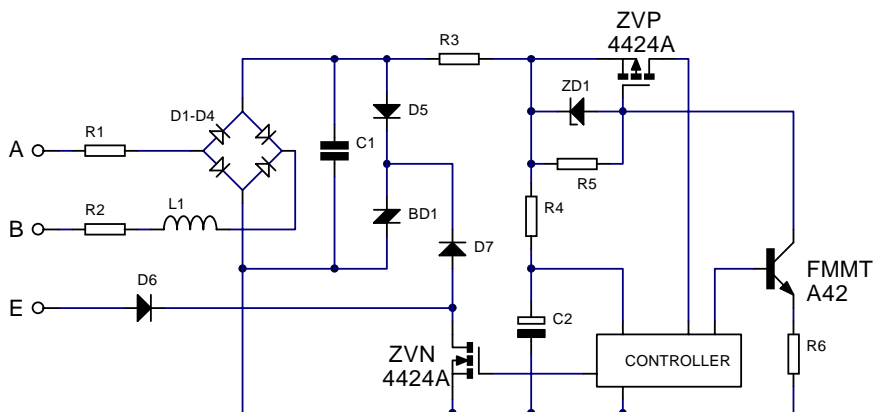


Figure 1
Line Interface Circuitry

Figure 1 shows the line interface circuitry of a "feature" telephone. Its major components are:- An input bridge rectifier, a transient protection circuit, an electronic hook switch, an earth recall switch and a logic controller.

The input bridge rectifier is necessary as the polarity of the voltage input lines is not defined (and for signalling purposes, can be switched). The line input is a DC supply of around 50V with a source resistance that can be as low as 500 ohms. When the phone is taken off-hook, it clamps the line input at a low voltage,

causing a line current that is recognised by the exchange and captures the line. The off-hook current can vary from 30mA to 120mA depending on line length (resistance). When on-hook, the phone can take a small current from the line to charge batteries, maintain memories etc., but this current must be kept low if unwanted line capture is to be avoided. The exchange initiates ringing by adding a high voltage low frequency signal to the line. This boosts the normal line input voltage of the phone to around 180V peak.

The maximum input voltage to the phone can be much higher however. Lightning strikes occurring near telephone lines can induce voltage transients of several thousand volts sourced from a low impedance. Gas discharge suppressors mounted in dwelling entry sockets kill much of this unwanted energy, but they are slow and present too high an impedance to provide a total solution. The breakover device BD1 and associated limiting resistors R1, R2 and R3 deal with what reaches the phone. The trip voltage of BD1 must be high enough to ensure that it does not conduct under normal line and ringing conditions, yet must protect the hook and recall switches. It is helpful in selecting BD1, if the breakdown voltages of the hook and line switches are well over 180V.

The hook-switch employs a ZVP4424 P-Channel MOSFET as the switching element. With a BV_{DSS} of 240V, it makes selection of BD1 relatively easy. Since when the hook-switch turns on, it pulls the line voltage down to a few volts, it is vital that the switch can give a low on-resistance with low gate drive. The ZVP4424 has an on-resistance of only 11 ohms, even with just 3.5V gate drive. This low resistance allows the values of R1, R2 and R3 to be maximised (improving transient resistance) without raising the total phone resistance so high that it compromises long line performance. Since the MOSFET has a continuous current rating of 200mA, it can handle short lines well too.

Although the polarity of the phone input lines is not fixed, one line is always negative with respect to ground. This allows the Earth Recall signalling function to be achieved. The ZVN4424 N-Channel MOSFET shown in Figure 1 grounds whichever input line is most negative, causing a change in line current that can be recognised at the exchange. A MOSFET is used since the switch action shorts out the phone's power supply (the lines) so the function must be maintained for several seconds purely on the charge in C2, so minimal drive power is essential. The MOSFET must meet the breakdown voltage, operating current and low threshold on-resistance requirements vital to the hook-switch function already discussed and so has a similar specification. The ZVN4424 is a 240V, 260mA part with an on-resistance of only 6 ohms maximum when used with a gate drive of 2.5V.

(Both the ZVN4424 and the ZVP4424 MOSFETs are available in through-hole (E-Line, TO92 style) and surface mount (SOT223) packages. The part numbers for each case are suffixed "A" and "G" respectively.)