

HT18/19 Parameters

In this section, the importance of the primary electrical parameters of the HT18/19 and how they relate to the application are explained. The primary requirements for an electronic line switch for a handset are:

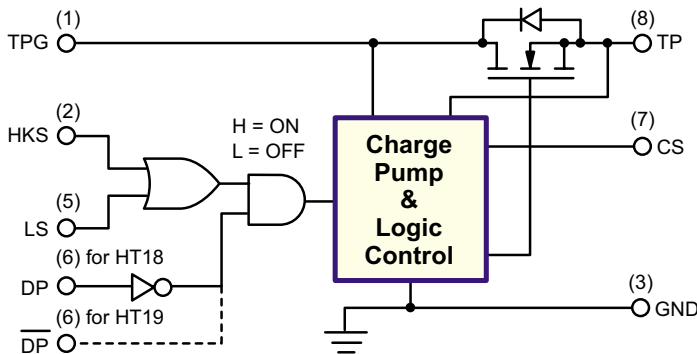
- ▶ High breakdown voltage
- ▶ Low leakage current
- ▶ Low switch resistance
- ▶ Low operating voltage
- ▶ T_{ON}/T_{OFF} switching time

Breakdown Voltage

The internal MOSFET line switch shown in Figure 2 must be able to withstand high voltages which come from ring voltages and residual voltages from lightning strikes. Ring voltages as high as $300V_{PP}$ superimposed on a DC offset of -52.5V can result in peak voltages just over 200V. The 350V rating provides an ample safety margin.

It is quite common for phone lines to encounter lightning surges. Even with proper lightning protection devices, voltage transients of 350V can be encountered. The guaranteed minimum breakdown voltage of 350V ensures devices will not be damaged.

Figure 2: HT18/HT19 Block Diagram



Protection

The HT18 and HT19 require secondary protection from overvoltage and overcurrent. The overvoltage protection must not allow the voltage between TPG and GND to exceed the IC's maximum rating. Placement of the overvoltage protection is usually directly between tip and ring.

Overcurrent protection is required to prevent excessive power dissipation in the HT18/HT19. This can occur when the HT18/19 goes into current limiting with a high input voltage. For example, if the HT18/19 is limiting at 150mA with an input voltage of 10V, power dissipation can approach 1.5 watts. To prevent failure of the HT18/19, an external fuse or other form of protection rated at less than the current limit value should be employed.

Figure 3 shows the typical current limit versus R_{SENSE} . When in current limiting, the power dissipation in the HT18/19 will increase, causing die temperature to rapidly rise. This temperature rise has the effect of lowering the initial current limit value. The steady-state value is dependent on several variables, including input voltage, output voltage, load current, ambient temperature, junction-ambient thermal resistance, and process variations.

The upper line represents the initial current limit. The lower line shows the steady state limit due to self heating effects with an output voltage of 5.2V and an input voltage of about 12V.

Low Leakage

Regulations require that devices connected to the public switched telephone network (PSTN) present an on-hook resistance greater than $5.0M\Omega$ up to 100V. Lower resistances may give a false indication that the line is damaged. The HT18/19 are rated for $2.0\mu A$ max at 100V, equating to $50M\Omega$. Under low voltage conditions of 42.5V, the $2.0\mu A$ rating equates to $21.25M\Omega$, well within the requirements.

Switch Resistance

The amount of current flowing into the instrument will depend on how far it is from the central office. Currents can vary from 5.0 to 140mA. The switch resistance is important in both cases. For the high current condition where the instrument is close to the central office, the switch resistance should be kept low to minimize power dissipation. The HT18/HT19 are rated as 18Ω . The power dissipation is therefore $(140mA)^2 \times 18\Omega = 353mW$.

For the long loop condition, low current, 20mA is available. The phone needs to be fully functional under this condition. The amount of voltage available during this condition is 3.0V. The HT18/HT19 guarantee a switch resistance of 18Ω when conducting 20mA with an input voltage of only 3.0V, resulting in a drop across the line switch of only 0.36V.

Low Operating Voltage

Consider a long loop condition where the phone is off-hook. 20mA will be flowing to the phone. A common situation would be for a second phone on the same line to go off-hook where the second user is not aware that the phone line is in use. More current will be drawn from the line and voltage will be further reduced. Under this condition, it is not necessary for the phones to be fully functional. It is, however, required that the speech circuitry be functional on both phones. This will allow the first user to inform the second user that the line is in use and to go on hook.

Further compounding the condition would be if one of the phones was old. The old phone would draw more current to

maintain speech functionality. To provide more current for the old phone, the HT18/19 must operate under very low current and voltage conditions. The HT18/19 might draw only 5mA whereas the old phone will consume 20mA. The HT18/19 therefore guarantees a maximum of 30Ω switch resistance at 5.0mA with an input voltage of 2.0V.

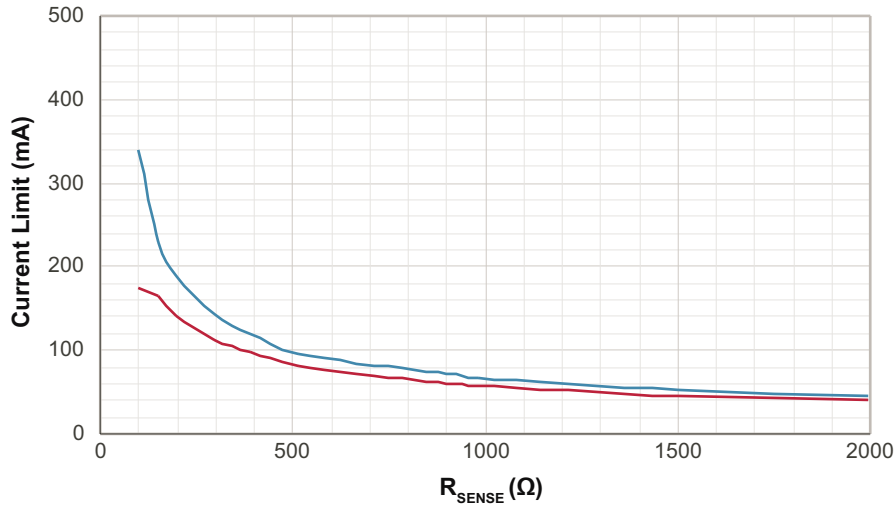
T_{ON}/T_{OFF} Switching Time

The DP pin for the HT18 and the \overline{DP} pin for the HT19 are used for pulse dialing. Pulse dialing requires 40ms on-time and 60ms off-time. For proper pulse dialing recognition, T_{ON} and T_{OFF} must be less than 2.0ms. The HT18/19 guarantee a T_{ON} and T_{OFF} of no greater than 1.0ms, well within the requirements.

Conclusion

The HT18/19 are specifically designed to replace the mechanical hook switch in telephone handset applications. The strict electrical requirements imposed on telephone instruments has been taken into consideration. Designs currently incorporating a discrete electronic line switch will also benefit from the simplification and component reduction when redesigned for the HT18/19. The HT18/19 will allow for a more reliable, higher performance and more compact solution.

Figure 3: HT18/HT19 Current Limit



Summarizing the switch resistance and operating voltage requirements:

Condition	Current (mA)	Voltage (V)	Switch Resistance (Ω)
Short loop	130	4.3	18
Long loop	20	4.0	18
Long loop with 2 phones	5.0	2.0	30

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