

SLIC L3000N/L3092 MAXIMUM LOOP RESISTANCE ANALYSIS

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1. INTRODUCTION

This evaluation was carried out in order to evaluate the maximum loop resistance allowed using the SLIC KIT L3000N/L3092.

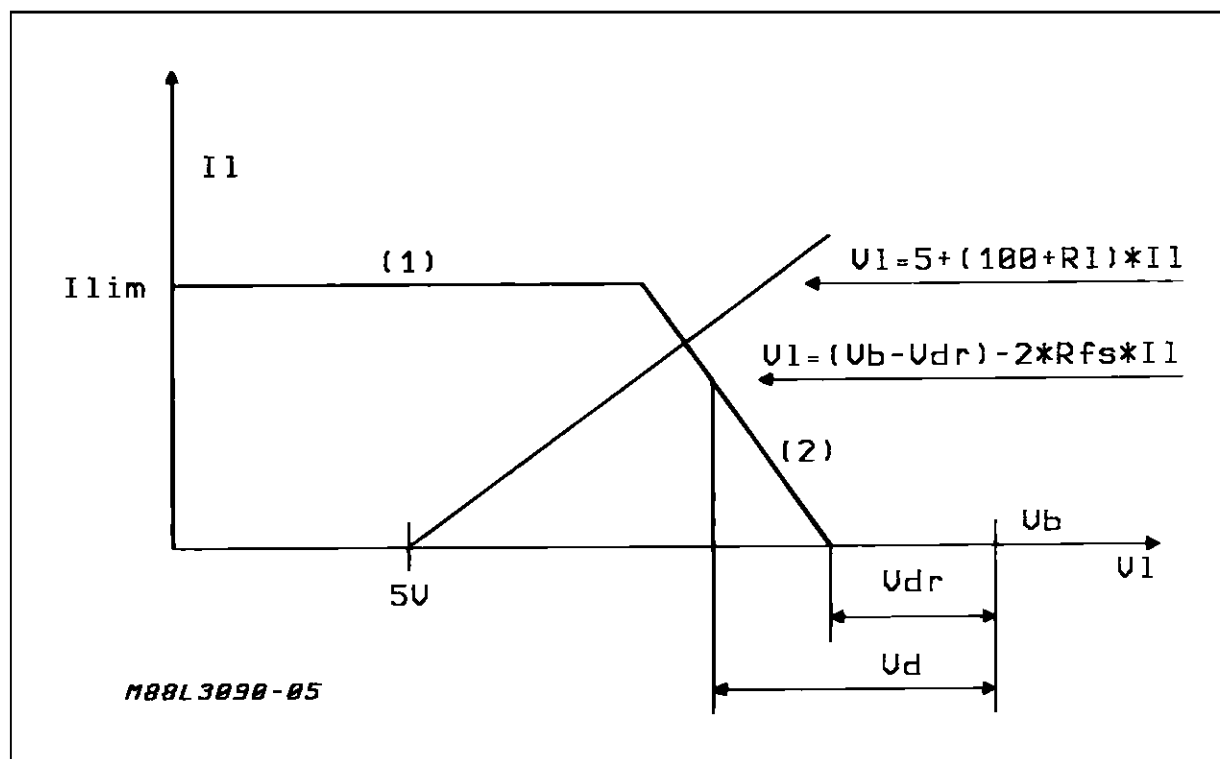
The evaluation is performed in conversation mode ; it shows how the maximum loop resistance (Rl) is influenced by the battery voltage (Vb), the feeding resistance (Rfs) and the common mode current (Icm).

2. MAXIMUM LOOP RESISTANCE EVALUATION

In fig. 1 you can see the L3000N+ L3092 DC characteristic and the load curve. The load curve is obtained as the series of the loop resistance (Rl) and the subscriber telephone set. The subscriber telephone set is represented as the series of a 100Ω resistor and a 5V zener diode.

If the operating point is on region (1) its coordinates

Figure 1 : SLIC Characteristic and Load Curve.



are :

$$I1 = Ilim$$

$$V1 = 5 + (100 + Rl) \times Ilim \quad (1)$$

Note : The slope of region (2) is $2 \times Rfs$ where the feeding resistor Rfs is fixed by an external resistor.

If the operating point is on region (2) you can find its coordinates solving the system of two equations :

$$1) V1 = (Vb - Vdr) - 2 \times Rfs \times I1$$

$$2) V1 = 5 + (100 + Rl) \times I1$$

obtaining :

$$I1 = (Vb - Vdr - 5) / (100 + Rl + 2 \times Rfs)$$

$$V1 = 5 + (100 + Rl) \times (Vb - Vdr - 5) / (100 + Rl + 2 \times Rfs) \quad (2)$$

If you consider the DC characteristic of the device you can see that the longer is the line the lower is the voltage drop between the battery voltage (Vb) and the line voltage (V1). It can happens that for very

APPLICATION NOTE

long line the voltage drop is not large enough to guarantee the fully AC performance of the device. In such condition the device is still working, but large signal can appear slightly distorted on the line. If you want guarantee the optimum behavior of the device you must be sure that the operating point of the device (I_L , V_L) satisfy the following condition :

$$V_L \leq V_b - V_d$$

$$\text{with } V_d = 5 + 100 \times I_L + 60 \times I_L + 2 + V_{dcm}$$

where :

5 : internal drop

100xIL : drop on sensing resistors (2x50Ω max)

60xIL : drop on external resistors (2x30Ω)

2 : maximum AC signal peak

Vdcm : (=100xIcm) drop for common mode current (Icm)

You can obtain the maximum value for RI (maximum loop length) imposing :

$$V_L = V_b - V_d$$

If the operating point is on region (1) solving the equation $V_{L1} = V_b - V_d$ where V_{L1} is given by the relation (1) you obtain :

$$R_{Lmax} = (V_b - 12 - 260 \times I_{lim} - 100 \times I_{cm}) / I_{lim} \quad (3)$$

If the operating point is on region (2) solving the equation $V_{L2} = V_b - V_d$ where V_{L2} is given by the relation (2) you obtain :

$$R_{Lmax} = ((100 + 2 \times R_{fs}) \times (V_b - 12 - 100 \times I_{cm}) - 260 \times (V_b - V_{dr} - 5)) / (7 - V_{dr} + 100 \times I_{cm})$$

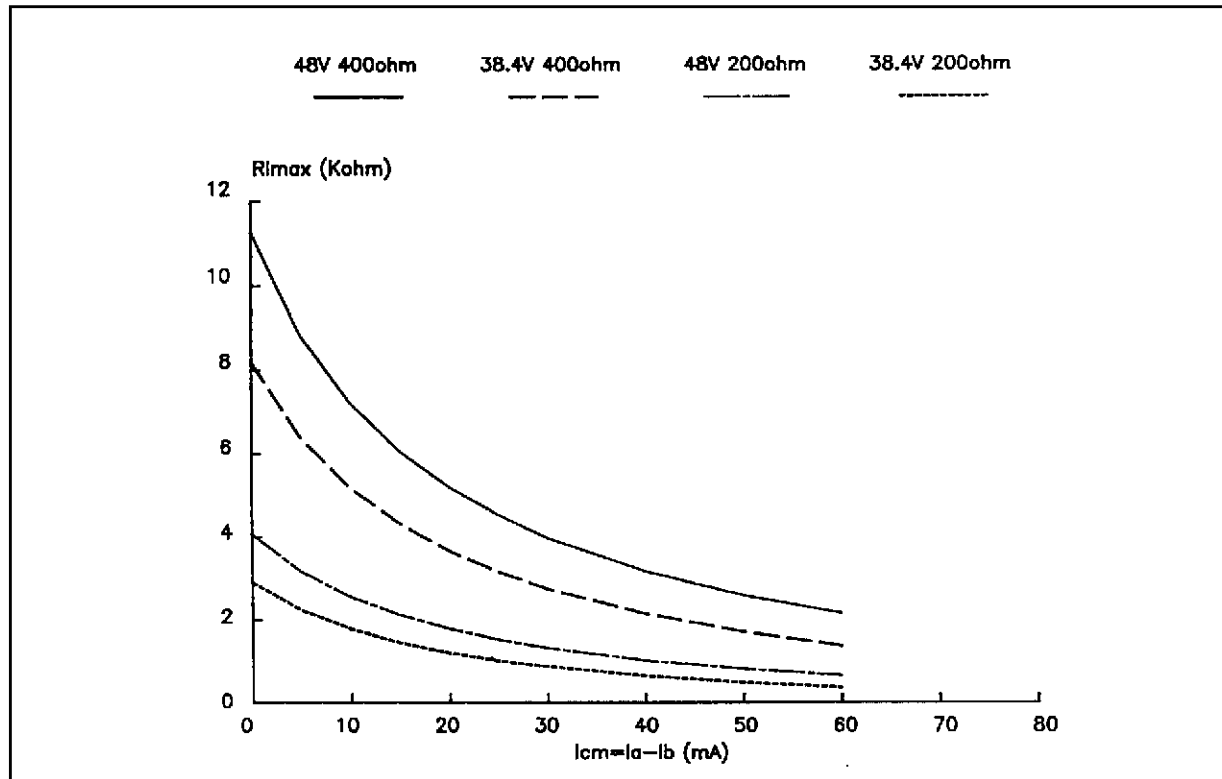
In the following you can find graphical representations of R_{Lmax} versus I_{cm} in four different situations :

3. CONCLUSION

The above relations show the possibility to work with good performances also in presence of common mode current. With a battery voltage of -48V, $R_{fs} = 200\Omega$ and no common mode current, the maximum loop resistance is over 3KΩ ; in the same condition but with a common mode current of 20mA the maximum loop resistance is about 2KΩ. Higher loop resistance can be obtained increasing R_{fs} (see fig. 2).

The parameters of each curve are the battery voltage (V_b) and the feeding resistance (R_{fs}).

Figure 2 : Maximum Line Resistance Versus Common Mode Current (conversation mode).



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