SGS-THOMSON
MICROELECTRONICS

APPLICATION NOTE

SLIC L3000N/L3092
MAXIMUM LOOP RESISTANCE ANALYSIS

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1. INTRODUCTION

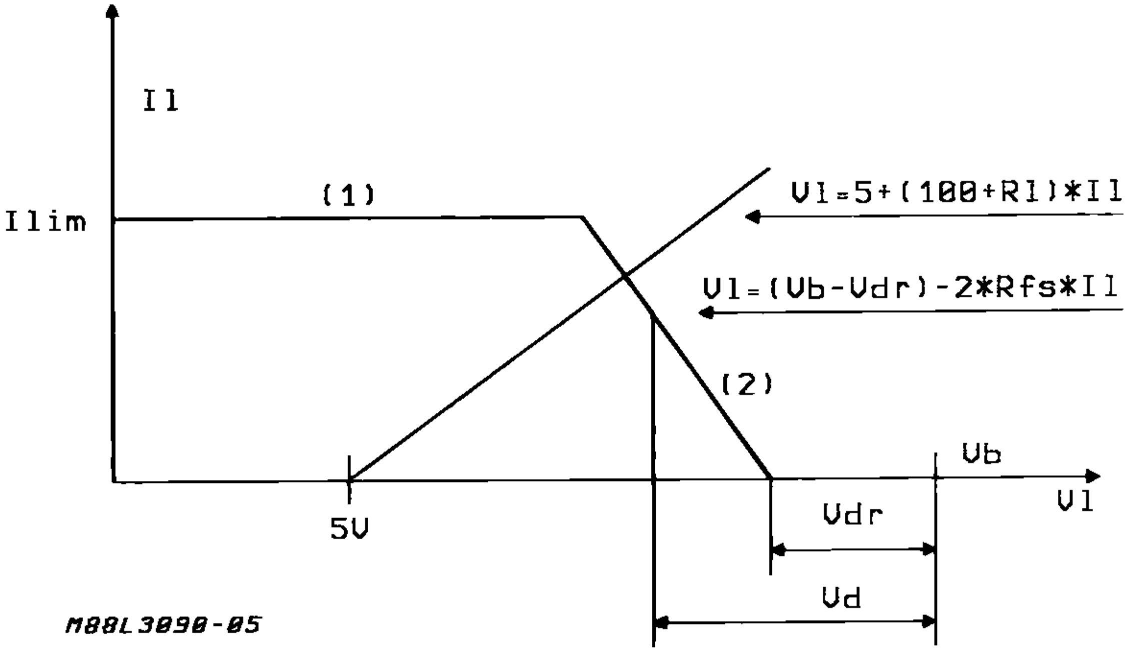
This evaluation was carried out in order to evaluate the maximum loop resistance allowed using the SLIC KIT L3000N/L3092.

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 sub-scriber telephone set. The subscriber telephone set is represented as the series of a 100Ω resistor and a 5V zener diode.

Figure 1 : SLIC Characteristic and Load Curve.



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

$Il1 = Ilim$

$Vl1 = 5 + (100+Rl) \times Ilim \qquad (1)$

Note : The slope of region (2) is 2xRfs 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) $Vl = (Vb-Vdr)-2 \times Rfs \times Il$

2) $Vl = 5+(100+Rl) \times Il$

obtaining :

$Il2 = (Vb-Vdr-5)/(100+Rl+2*Rfs)$

$Vl2 = 5+(100+Rl) \times (Vb-Vdr-5)/(100+Rl+2 \times Rfs) \qquad (2)$

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 (Vl). It can happens that for very 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 (Il, Vl) satisfy the following condition :

Vl ≤ Vb-Vd

with Vd=5+100xIl+60xIl+2+Vdcm

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 Rl (maximum loop length) imposing :

Vl = Vb-Vd

If the operating point is on region (1) solving the equation Vl1=Vb-Vd where Vl1 is given by the relation (1) you obtain :

Rlmax= (Vb-12-260xIlim-100xIcm)/Ilim (3)

If the operating point is on region (2) solving the equation Vl2=Vb-Vd where Vl2 is given by the relation (2) you obtain :

Rlmax = ((100+2xRfs)x(Vb-12-100xIcm)-260x(Vb-Vdr-5))/(7-Vdr+100xIcm)

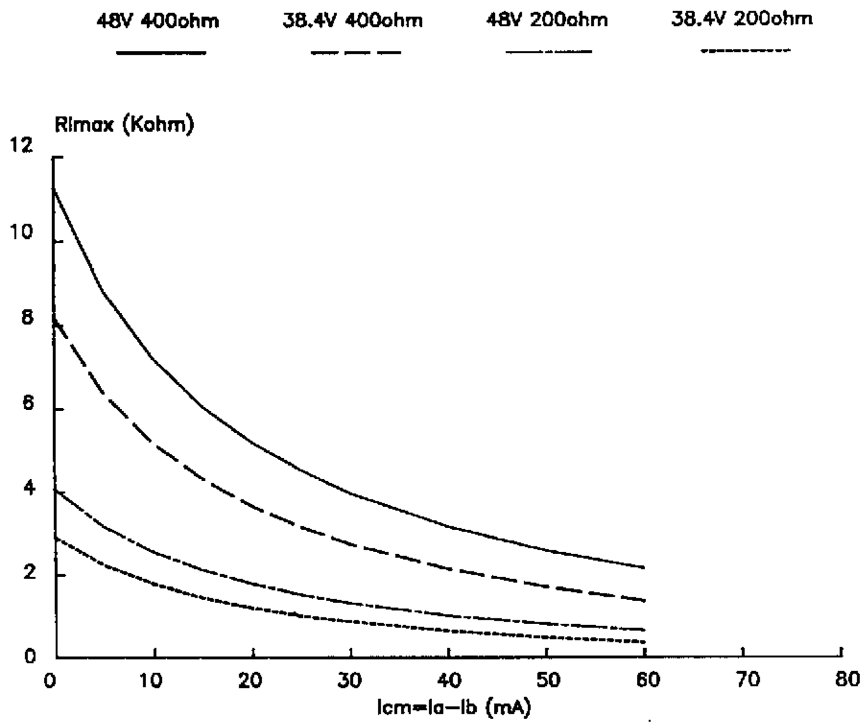
In the following you can find graphical representations of Rlmax versus Icm in four different situations :

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, Rfs = 200Ω 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 Rfs (see fig. 2).

The parameters of each curve are the battery voltage (Vb) and the feeding resistance (Rfs).

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



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