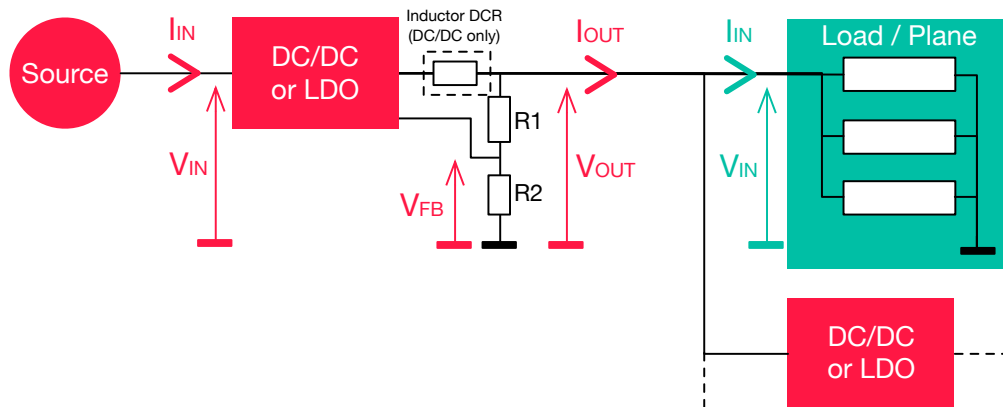


Summary of equations for electrical characteristics of DC/DC, LDO and power planes (loads).

Characteristic	LDO	DC/DC (step down)	Perfect	Dummy	Power plane / Load
V_{IN}	$V_{OUT\ SOURCE}$				
$I_{IN\ TYP}$	$I_{OUT\ TYP} + I_{Q\ TYP}$	$\frac{P_{IN\ TYP}}{V_{IN\ TYP}}$		I_{OUT}	$\sum^{PART} I_{PART}$
$I_{IN\ MAX}$	$I_{OUT\ MAX} + I_{Q\ MAX}$	$\frac{P_{IN\ MAX}}{V_{IN\ TYP}}$			
$P_{IN\ TYP}$	$V_{IN\ TYP} \times I_{IN\ TYP}$	$\frac{P_{OUT\ TYP} + DCR_{TYP} \times I_{OUT\ TYP}^2}{Chip\ Efficiency}$	$P_{OUT\ TYP}$	$V_{IN\ TYP} \times I_{IN\ TYP}$	
$P_{IN\ MAX}$	$V_{IN\ TYP} \times I_{IN\ MAX}$	$\frac{P_{OUTMAX} + DCR_{MAX} \times I_{OUT\ MAX}^2}{Chip\ Efficiency}$	$P_{OUT\ MAX}$	$V_{IN\ TYP} \times I_{IN\ MAX}$	
$V_{OUT\ (FIXED)}$	V_{OUT}			V_{IN}	N/A
$V_{OUT\ TYP\ (ADJ)}$	$V_{REFTYP} \cdot \left(1 + \frac{R_{1\ TYP}}{R_{2\ TYP}}\right)$		N/A	N/A	
$V_{OUT\ MAX\ (ADJ)}$	$V_{REFMAX} \cdot \left(1 + \frac{R_{1\ MAX}}{R_{2\ MIN}}\right)$				
I_{OUT}	$\sum^{CHILD} I_{IN\ CHILD}$				
$P_{OUT\ TYP}$	$V_{OUT\ TYP} \times I_{OUT\ TYP}$				
$P_{OUT\ MAX}$	$V_{OUT\ TYP} \times I_{OUT\ MAX}$				
P_{LOSS}	$P_{IN} - P_{OUT}$		0		
Total Efficiency	$\frac{P_{OUT}}{P_{IN}}$	$Chip\ Efficiency + \frac{DCR \times I_{OUT}^2}{P_{IN}}$	1		N/A



Comment 1

In component datasheets, maximum currents are given for a typical voltage. Therefore, for simplification, those equations are only expressed with a typical voltage.

If the maximum voltage has to be considered (for example, in case of a badly regulated DC/DC), the currents will decrease and the equations will be balanced with minor differences in most cases.

Comment 2

The plane is considered as perfect. In reality, a voltage drop should be considered between the regulator output and the component input because of the copper resistance induced by the power plane shape. Especially if the current is high (CPU cores, for example) and the feedback is close to the regulator. DC/DC inductors also have a parasitic resistance. All of those reduce the efficiency.