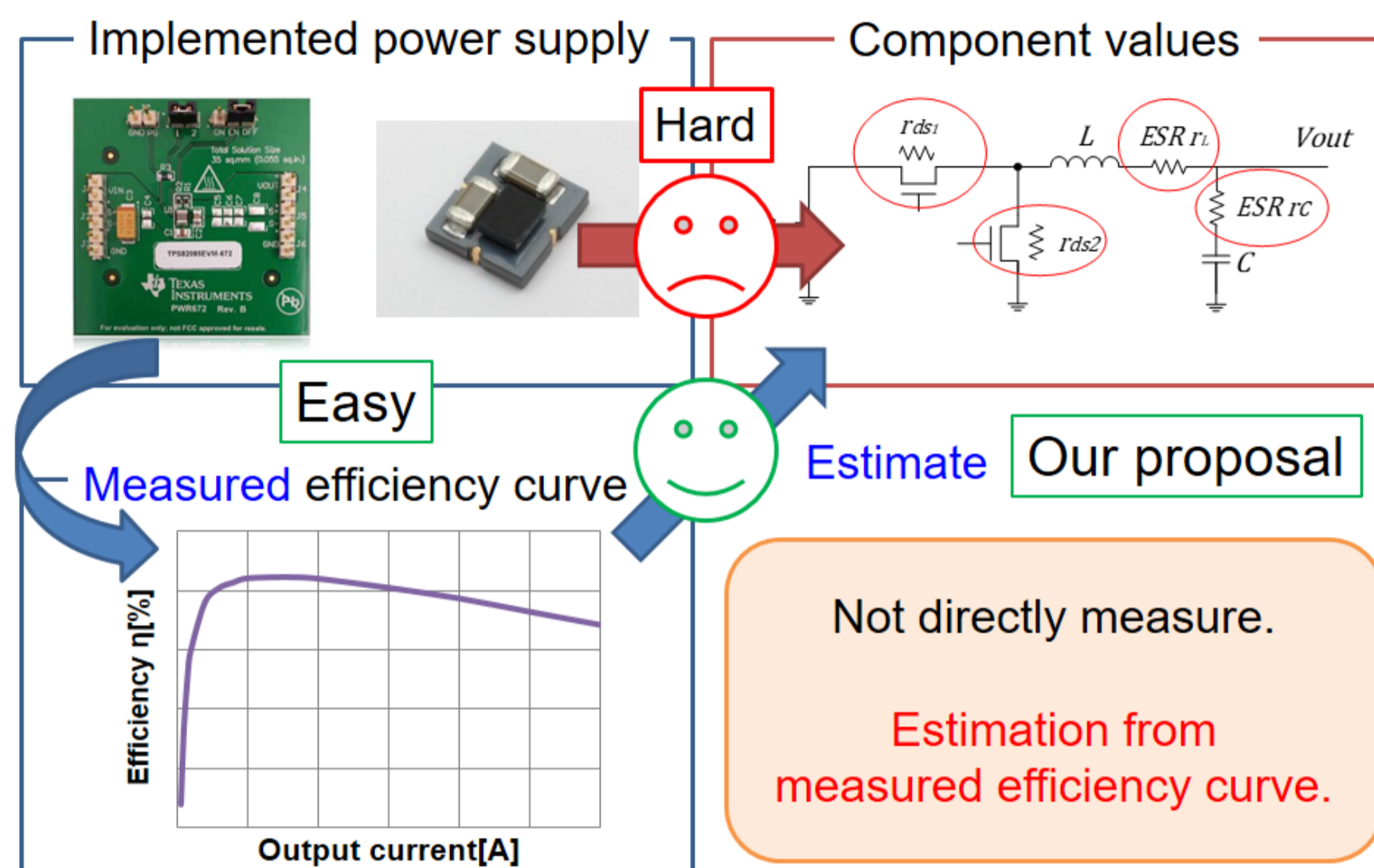


P61 Circuit Component Estimation in Buck Converter Using Efficiency Curve

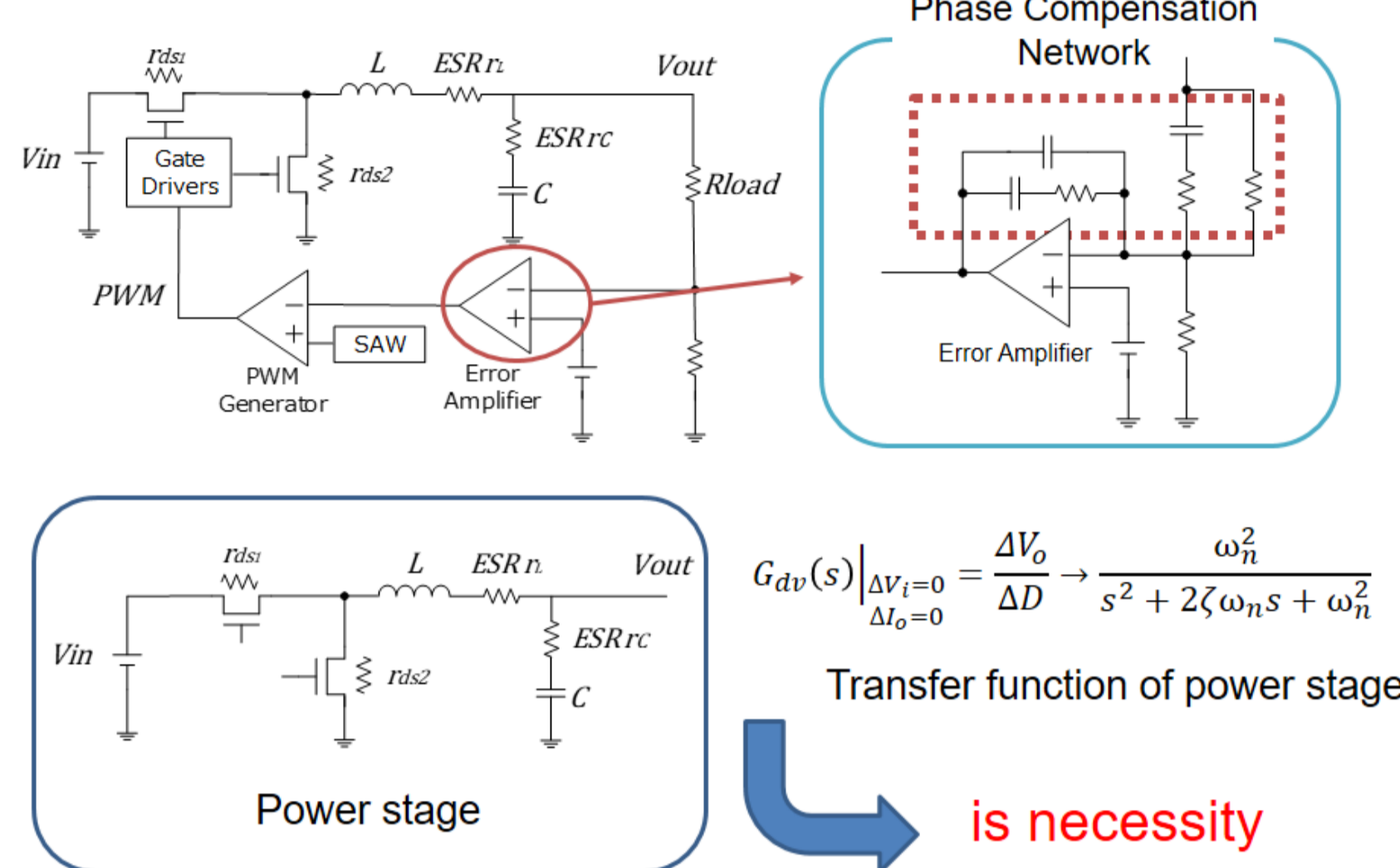
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Introduction

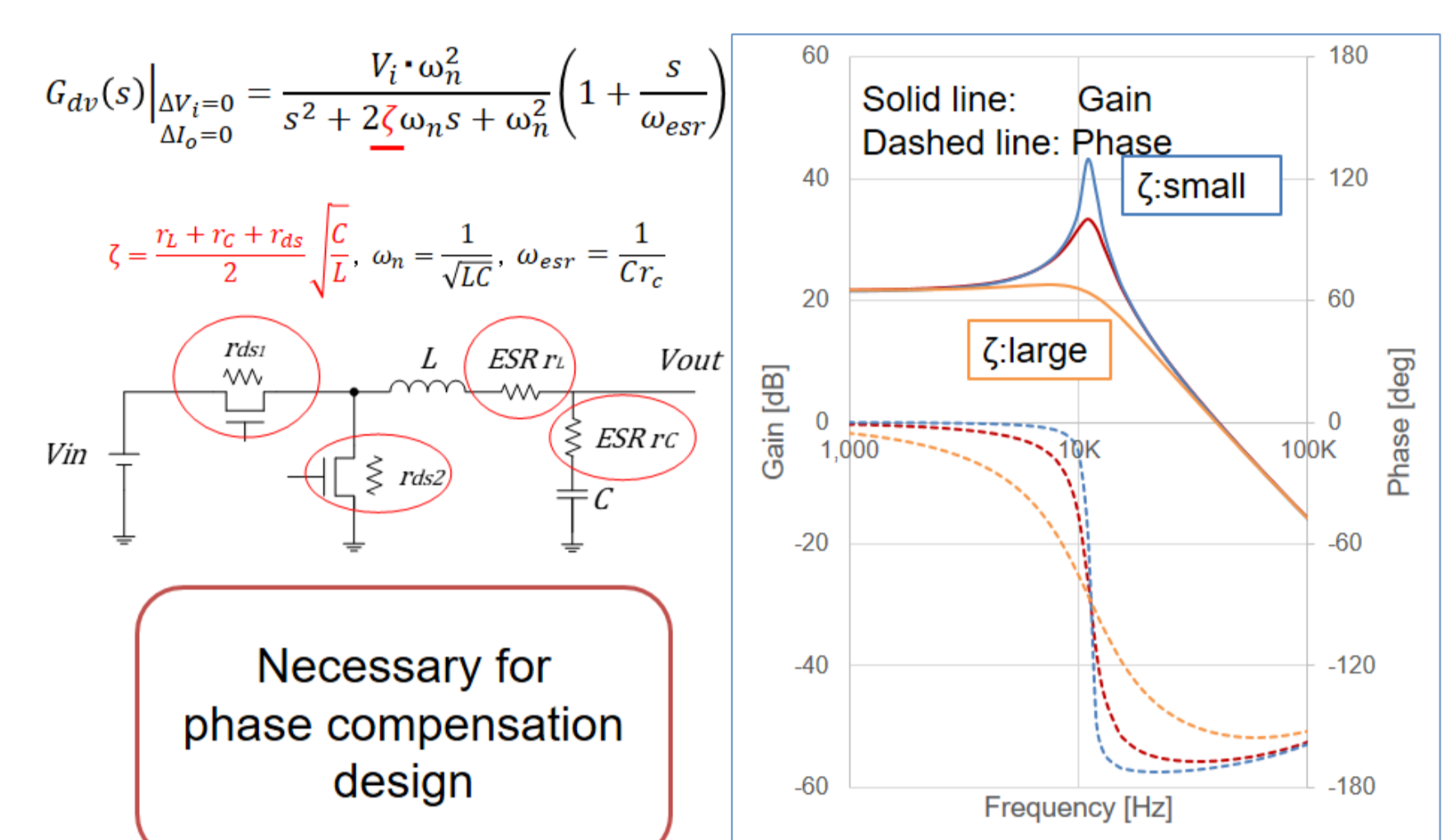
Proposed method



Phase Compensation Design

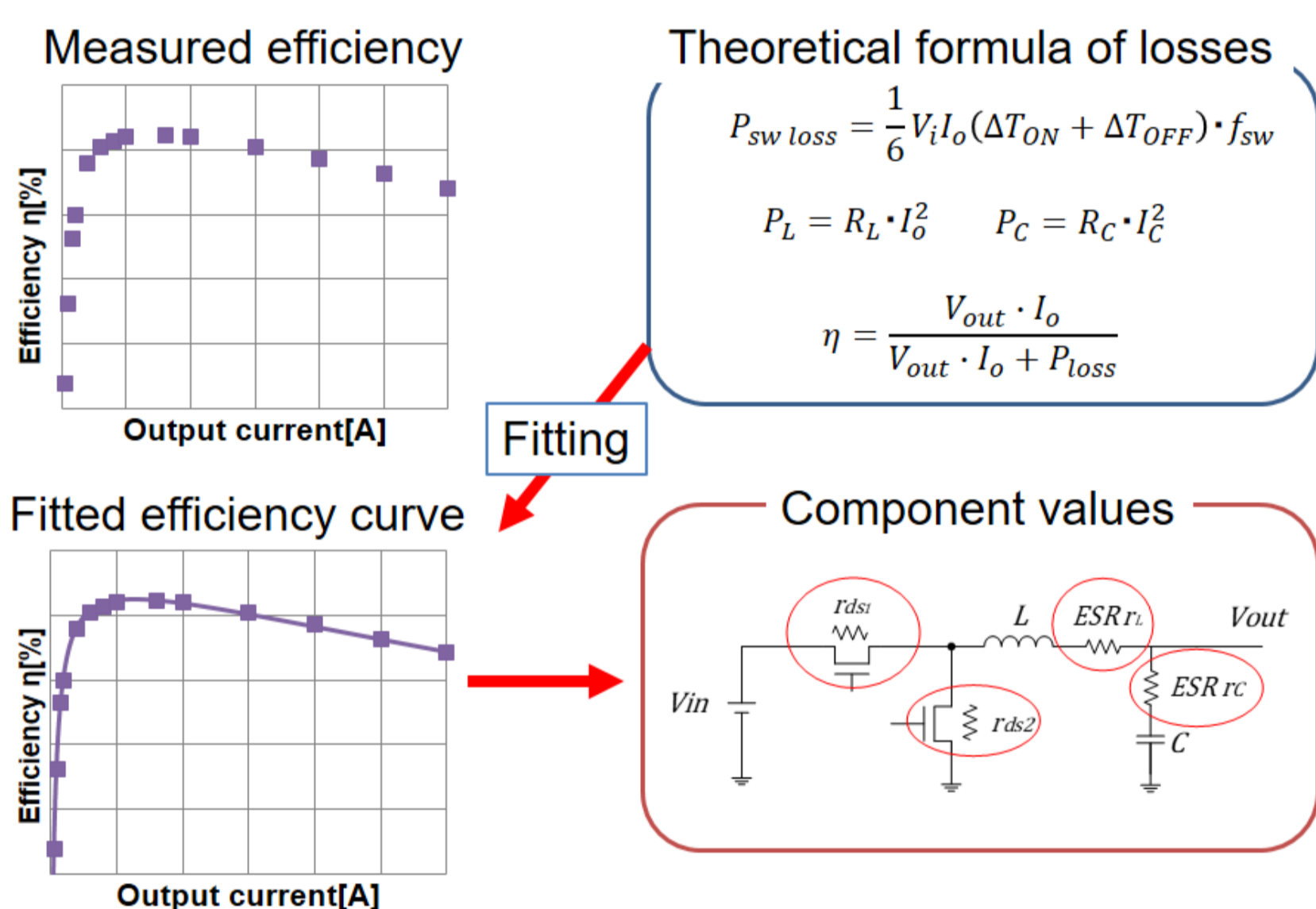


Importance of Component Values

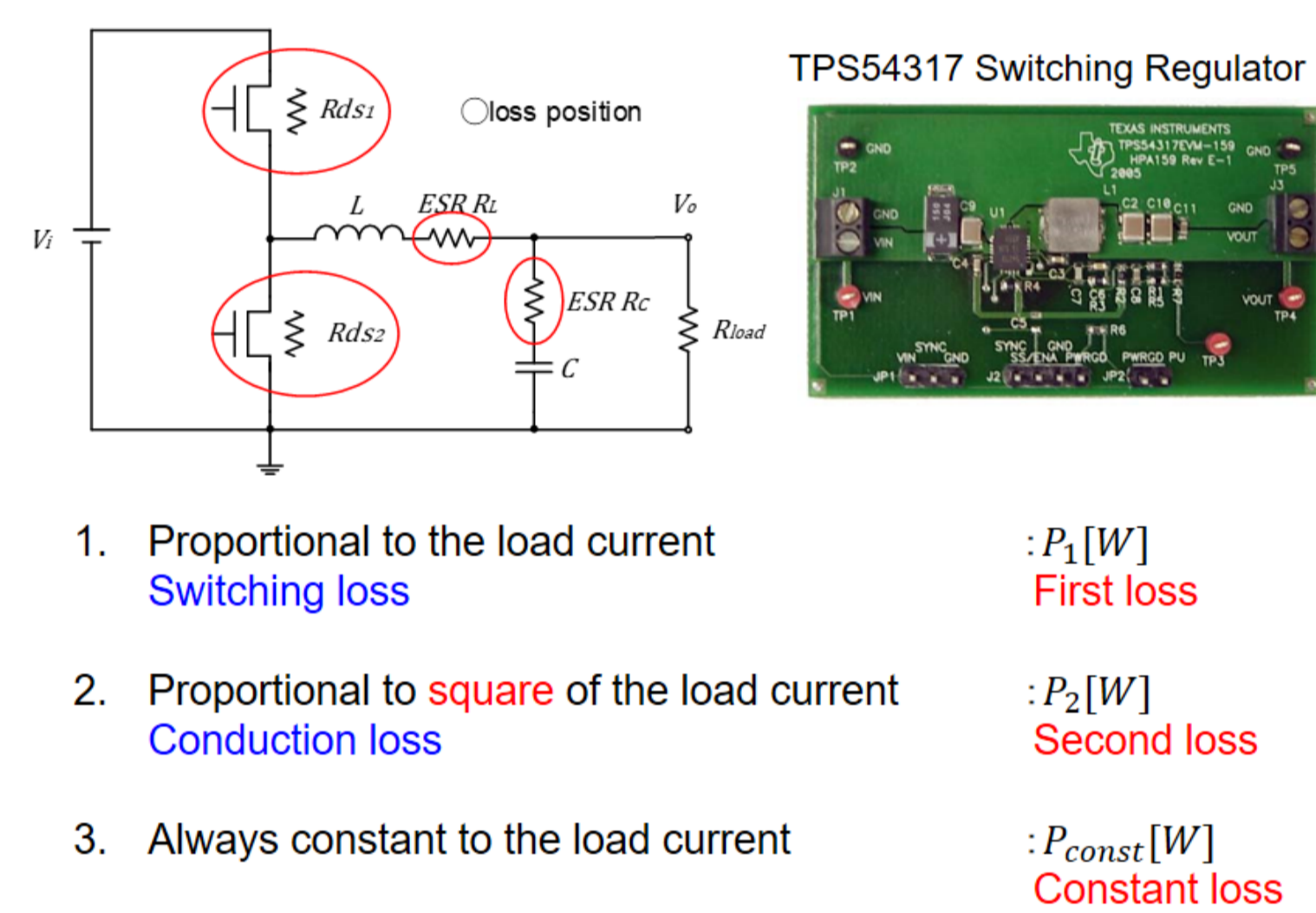


Estimation Method and Losses

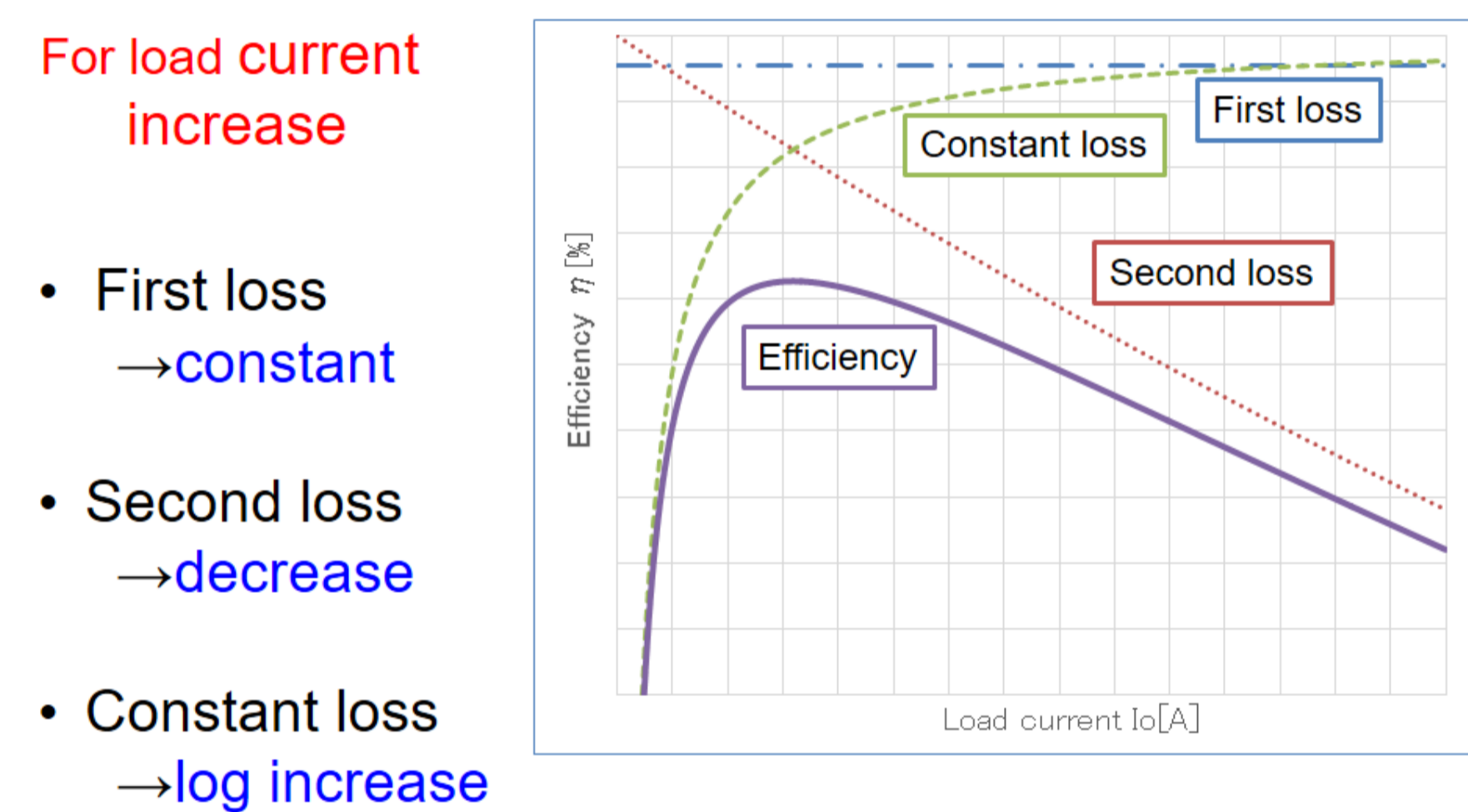
Estimation Principle



Loss Classification of Switching Regulator

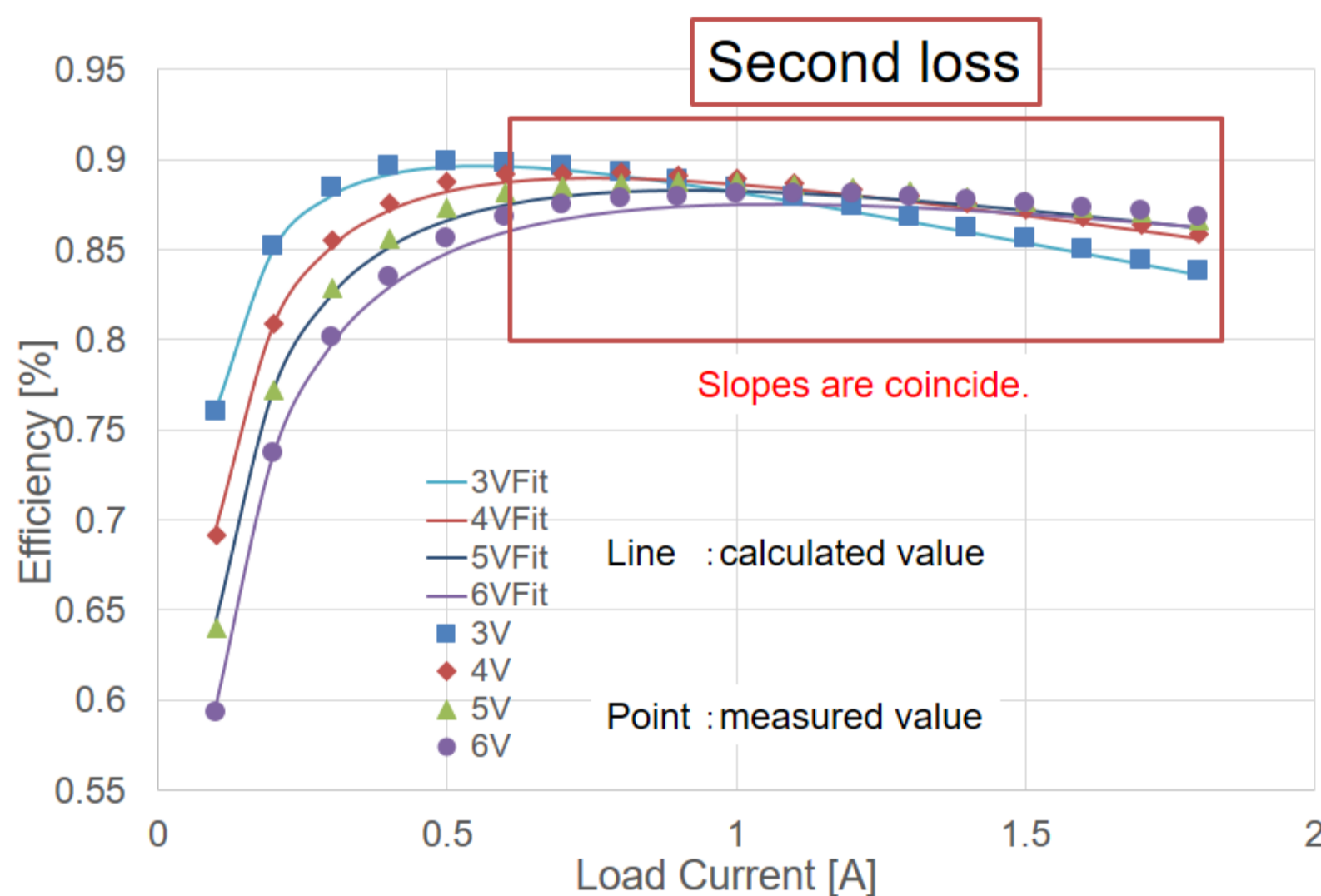


Effect of Each Loss to Efficiency

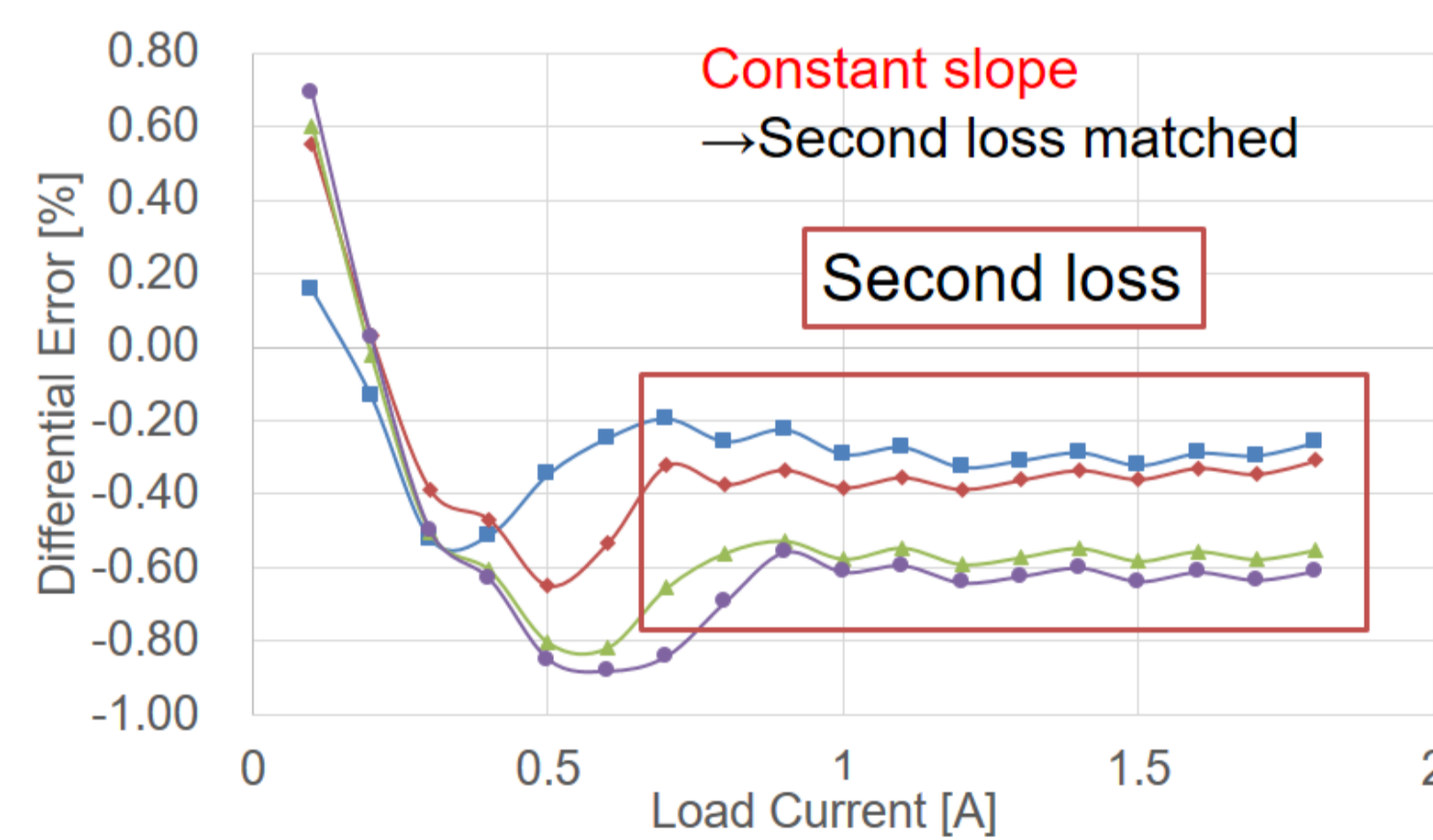


Fitting Result and Estimation of Transfer Function

Fitting Result



Fitting Result – Error



Component Value Estimation Result

Estimation result	
Inductor ESR	15mΩ
Capacitor ESR	1mΩ
High side ON resistor of MOSFET R_{ds1}	30mΩ at 3V 20mΩ at 4V 15mΩ at 5V 10mΩ at 6V
Low side ON resistor of MOSFET R_{ds2}	45mΩ at 3V 30mΩ at 4V 24mΩ at 5V 20mΩ at 6V
Turn-on time of MOSFET T_{on}	2nsec
Turn-off time of MOSFET T_{off}	4nsec
Quiescent current of IC I_{IC}	4.8mA at 3V 5.1mA at 4V 5.2mA at 5V 5.3mA at 6V

Transfer Function Calculation

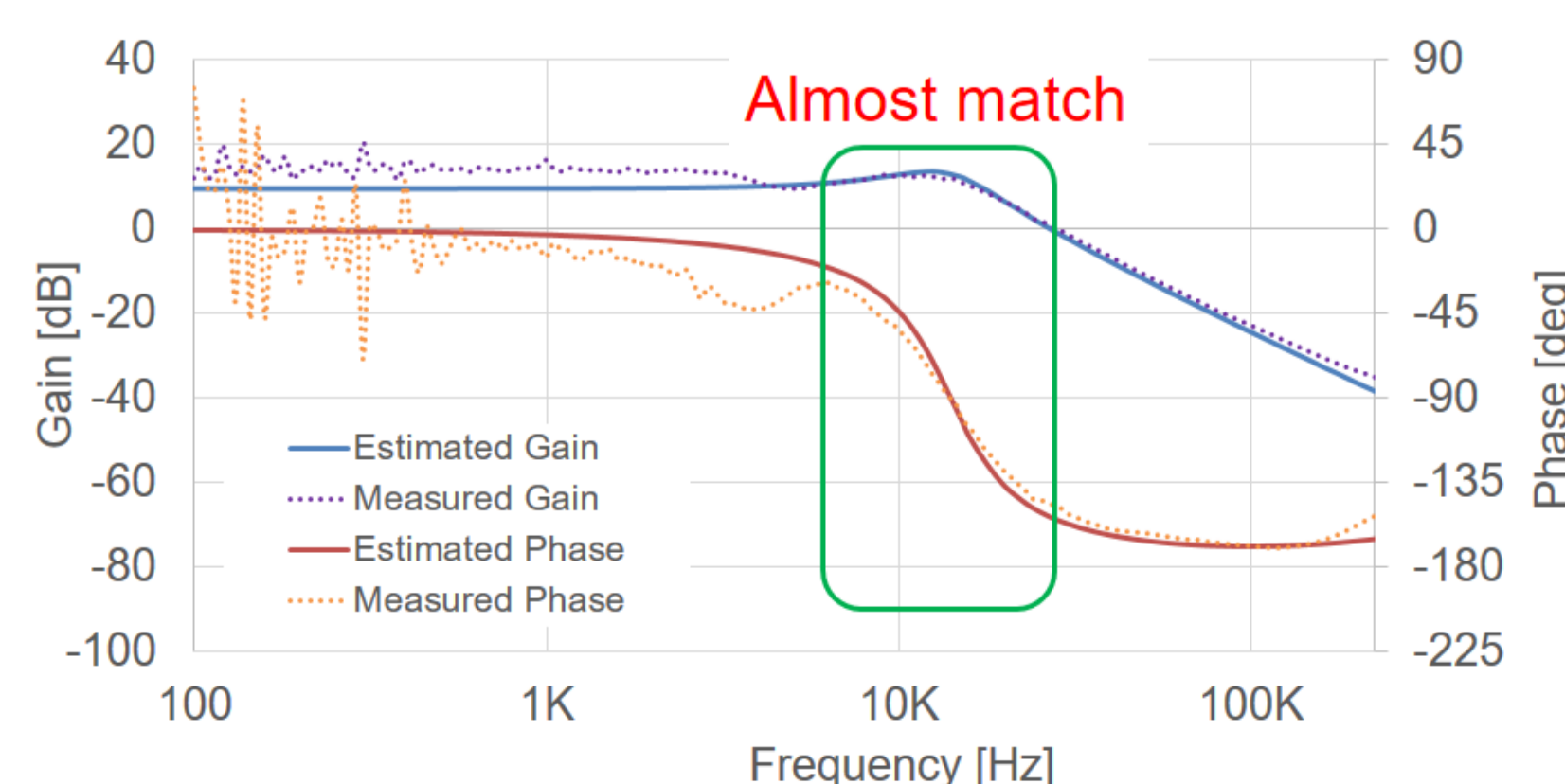
Transfer function of power stage is necessary for phase compensation

Possible to use estimated values

Parameters of G_{dv} at 3.0V

Switching Frequency f_{sw}	550kHz	Input Voltage V_i	3.0V
Inductor L (68%)	1.0μH	Capacitor C (68%)	135μF
Inductor ESR r_L	10mΩ	Capacitor ESR r_C	1mΩ
High side MOSFET DC resistance r_{ds1}	30mΩ	Low side MOSFET DC resistance r_{ds2}	45mΩ

Transfer Function Comparison



Estimation result can be used for phase compensation

summary

Summary

- Proposed a method to derive DC-DC converter component values from measured efficiency curve.
- Calculated the transfer function of power stage using estimation result.
- Measured and estimated results are well matched.

Proposed method helps for adjusting phase compensation in buck converter!