

# Low-Loss Power IC for PV Cell-Level Balancing Using Diffusion Charge Redistribution (EGSR\_49)

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Shading is a big problem for traditional solar systems. The power extracted from solar panels will drop severely even partial shading happens. The output current of panels is mainly constrained by that of shaded or 'weaker' cells because of the series string structure. Diffusion Charge Redistribution (DCR) takes advantage of the intrinsic capacitors in PV cells to achieve a balance between different cells. Power efficiency of panels with ladder structure using DCR strategy is much improved compared to panels with series string structure cells.

The Low-loss power IC we investigated is applied to be connected between PV cells in solar panels to redistribute the intrinsic stored charge in cells. This minimizes the effect of 'weaker' cells and extract maximum power from the panels. The power IC contains several modules. The core modules are large switches and complementary gate drivers. These switches are capable to conduct up to 10 Amp current and provide built-in ESD protection. Gate drivers are designed to drive the switches for balancing the delay and eliminating power loss. The switches with gate drivers have been optimized to have ultra-low on resistance 5 mΩ and fast switching speed. Additional modules such as temperature sensors and clock recovery modules are on-chip to help customers and researchers to easily monitor the working condition of this IC and the whole solar panel.

This Power IC is able to be integrated into solar panels to obtain additional output power when shading happens. In addition, this cell-level IC has high compatibility in commercial use.

The principle and diagram of our IC is shown as following.

