Smart Relays for Solar Inverters

TEXAS INSTRUMENTS

TI DRV110 relay driver

+


Panasonic ALFG relay

or

Panasonic HE relay

0.2% efficiency gains for inverters

Texas Instruments relay drivers bring innovation for solar inverters and help accelerate payback time. This flyer looks especially at two specific Panasonic relays: ALFG and HE.

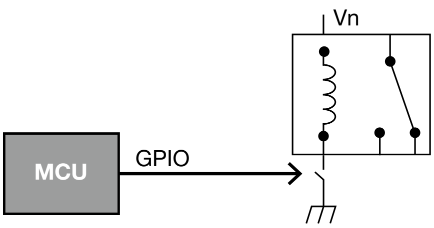
Technically the benefits of the increased efficiency when driving relays are:

- Reduces temperature in the inverter casing
- Reduces ventilation / heat-sinking costs
- Enables the reduction of casing
- Enables system reliability improvements

Benefits for a 3 phase hypothetical 2kWp inverter system based in Munich are as follows:

- System will generate 2000kWh [1]
- HE Relay dissipation is 7.8kWh, 3.1kWh, 2.6kWh (resp. case 1,2,3)
- 424Wh saved thanks to DRV110 (Case 3 vs Case 2)
- Equivalent to 0.2% efficiency gains

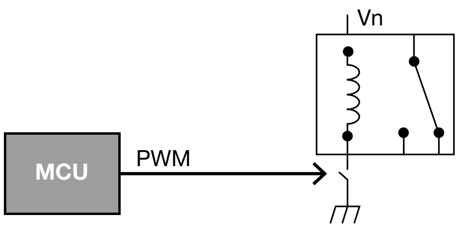
Typical system implementations for driving relays in solar inverters:



Case 1
The relay is activated via a switch which is controlled by a GPIO from the MCU.
GPIO ‘high’ <=> relay closed
GPIO ‘low’ <=> relay open

Yearly cumulative hold power for HE relay = 7.8kWh

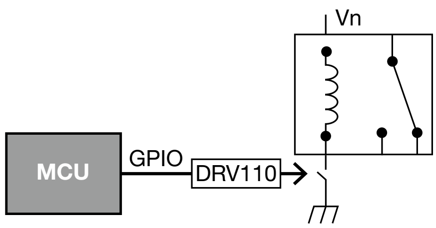
Yearly cumulative hold power for ALFG relay = 5.8kWh



Case 2
The relay is activated via a switch which is controlled by a PWM from the MCU.
PWM duty cycle ‘high’ <=> high current in relay
PWM duty cycle ‘low’ <=> low current in relay

Yearly cumulative hold power for HE relay = 3.1kWh

Yearly cumulative hold power for ALFG relay = 2.2kWh



Case 3
The relay is controlled by DRV110. Power consumption in hold mode includes the Iq from DRV110.

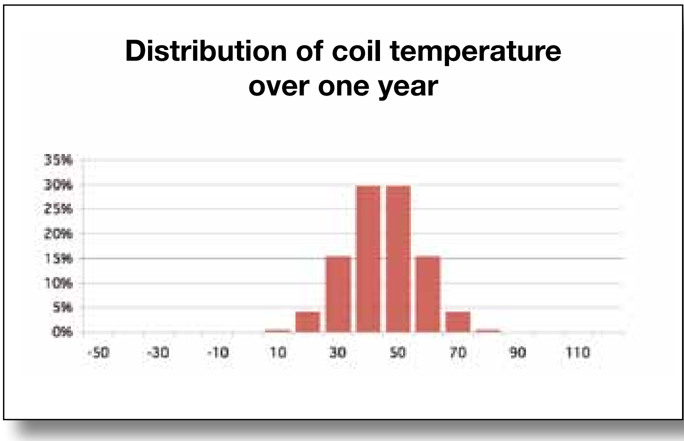
Yearly cumulative hold power for HE relay = 2.6kWh

Yearly cumulative hold power for ALFG relay = 2kWh

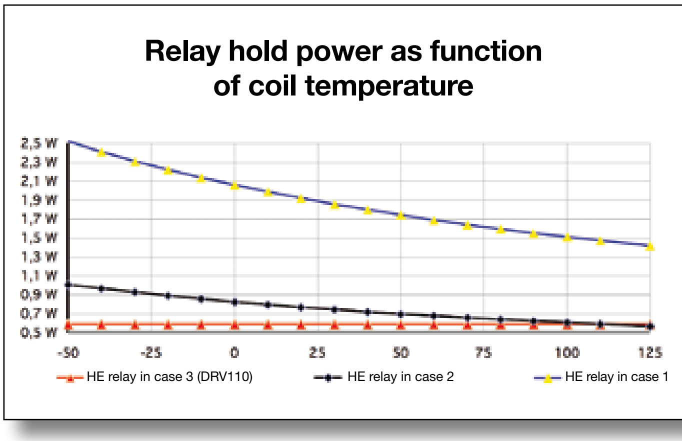
Influence of temperature on “hold power” dissipation

The key to see the benefit of driving relays with DRV110 is to look at the distribution of the relays coil temperature over one year. The below graphs give temperature distribution as a Gaussian centered on 40C with 12C variant (graph 1). This then needs to be combined with the power dissipation in hold mode across temperature for the different cases (graph 2) to be able to extract the yearly savings (graph 3 and 4). The graph 2 is based on TI calculations for driving Panasonic HE and ALFG relays in the different options presented on page 1.

Graph 1

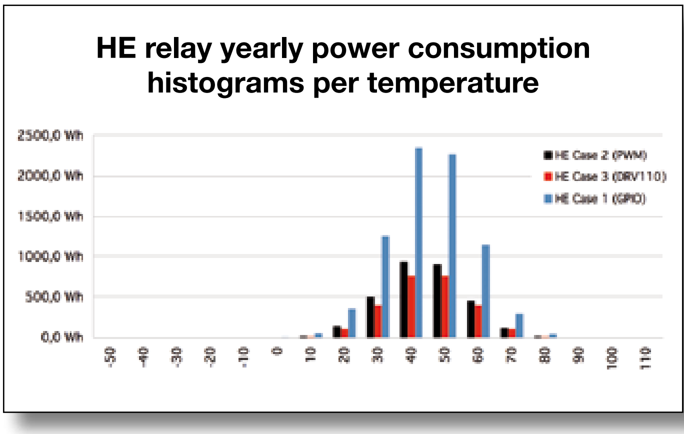


Graph 2

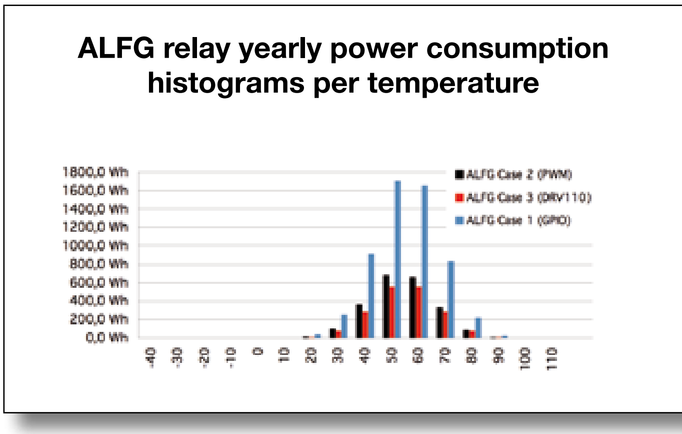


Energy savings shown in graph 3 and 4 are derived from graph 1 and 2 combination

Graph 3



Graph 4



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[1] European Commission Joint Research Centre: Photovoltaic Solar Electricity Potential in European Countries

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