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Calculated Datasheet Parameter

ISO-Nominal Load Current and Total Power Dissipation in HITFET® and PROFET® Datasheet

Automotive Power

Infineon technologies

Never stop thinking.

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1 Introduction

The Hitfet and Profet are power-MOSFET devices with integrated protection functions. In order to ensure a long lifetime the application should be designed in a way that overload conditions does not occur or are at least minimized. Therefore the power MOSFET devices Hitfet and Profet offer integrated protection functions. Under fault conditions, for example over temperature, overload or short circuit, the integrated protection will turn off the device. Of course this unwanted turn off can cause a malfunction of the application. The unwanted turn off due to over temperature or overload can be avoided by choosing a lower ohmic device.

In order to simplify this selection process the data sheets show the values ISO load current $I_{D(ISO)}$ and Nominal load current $I_{D(Nom)}$.

One other parameter for simplifying the device selection is the value of power loss P_{tot}.

2 Definition

The ISO current approach considers the thermal resistance between Junction and Lead frame R_{thJC} as shown in **Figure 1**. This assumes the lead frame as an isothermal area with the temperature $t_{ambient}$=85°C. Under this conditions the ISO current is calculated in a way that the voltage drop between Drain and Source becomes maximal V_{DS}=0.5V. If this current leads to a junction temperature of T_J>150°C then the ISO current is reduced to become T_J=150°C. The ISO current is interesting for devices directly mounted to the heatsink, but not for surface mounted devices (SMD) on a printed circuit board (PCB), because the thermal resistance between Junction and Case R_{thJC} is used.

The difference of the nominal load current $I_{D(Nom)}$ is that this approach considers the thermal resistor between Junction and Ambient R_{thJA}. Under this conditions the nominal load current is the current which meets both following conditions. First this current will heat up the junction to T_{Jmax}=150°C and second the voltage drop will be limited to V_{DS}≤0.5V.

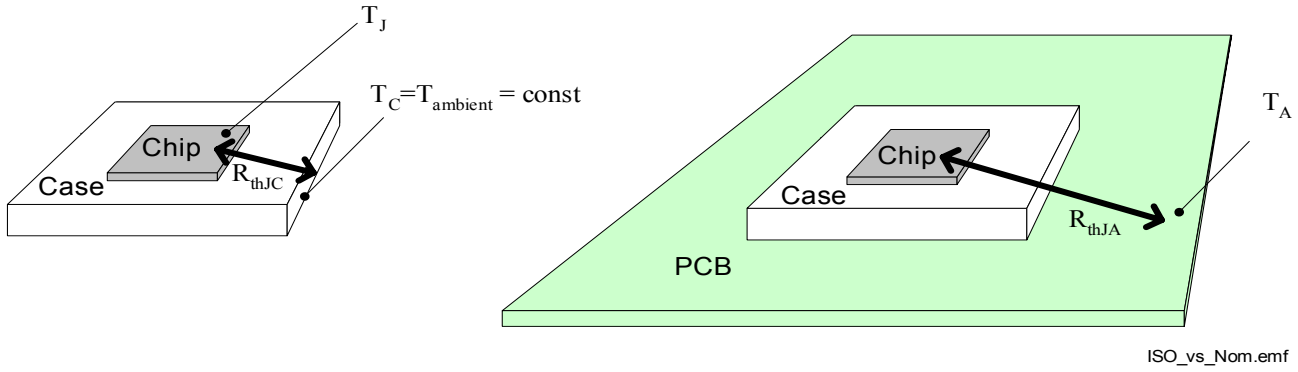

Figure 1 Device with constant Case temperature versus device on PCB related to ambient temperature.

3 Computation

Since the data sheet parameters Nominal load current and ISO load current are calculated values which can not be tested directly during production this application-note will describe how this parameters are calculated.

The computation process for the ISO load current is shown in **Figure 2**. Starting with the ambient temperature the $R_{DS(on)}$ is calculated. The ISO definition allows a voltage drop of 0.5V, which gives the current. Via the on-state-losses the junction temperature T_J comes out. This process is repeated until there is no more change in the junction temperature. If now the calculated junction temperature is below the maximum allowed value T_{Jmax} the ISO current is the value from the last iterative step. If the junction temperature is above the maximum allowed value then the ISO current is calculated from the maximum allowed power loss at T_{Jmax}.

The nominal load current is calculated in a similar way, as shown in **Figure 3**. After the temperature dependent $R_{DS(on)}$ is calculated two currents will be taken into account. The first current is the value coming from 0.5V voltage drop. The second value is given by the maximal power loss at the given Junction temperature. The lowest of this two values is chosen as nominal load current $I_{D(Nom)}$. Via the on-state-losses the new junction temperature T_J is calculated. This process is repeated until there is no more change in the junction temperature.

The parameter P_{tot} is also a calculated value. It shows the maximum allowed on state loss for a constant Case temperature T_C. Therefore the thermal resistance R_{THJC} is used. The formula is

$$P_{tot} = \frac{T_{JCmax} - T_C}{R_{thJC}}$$

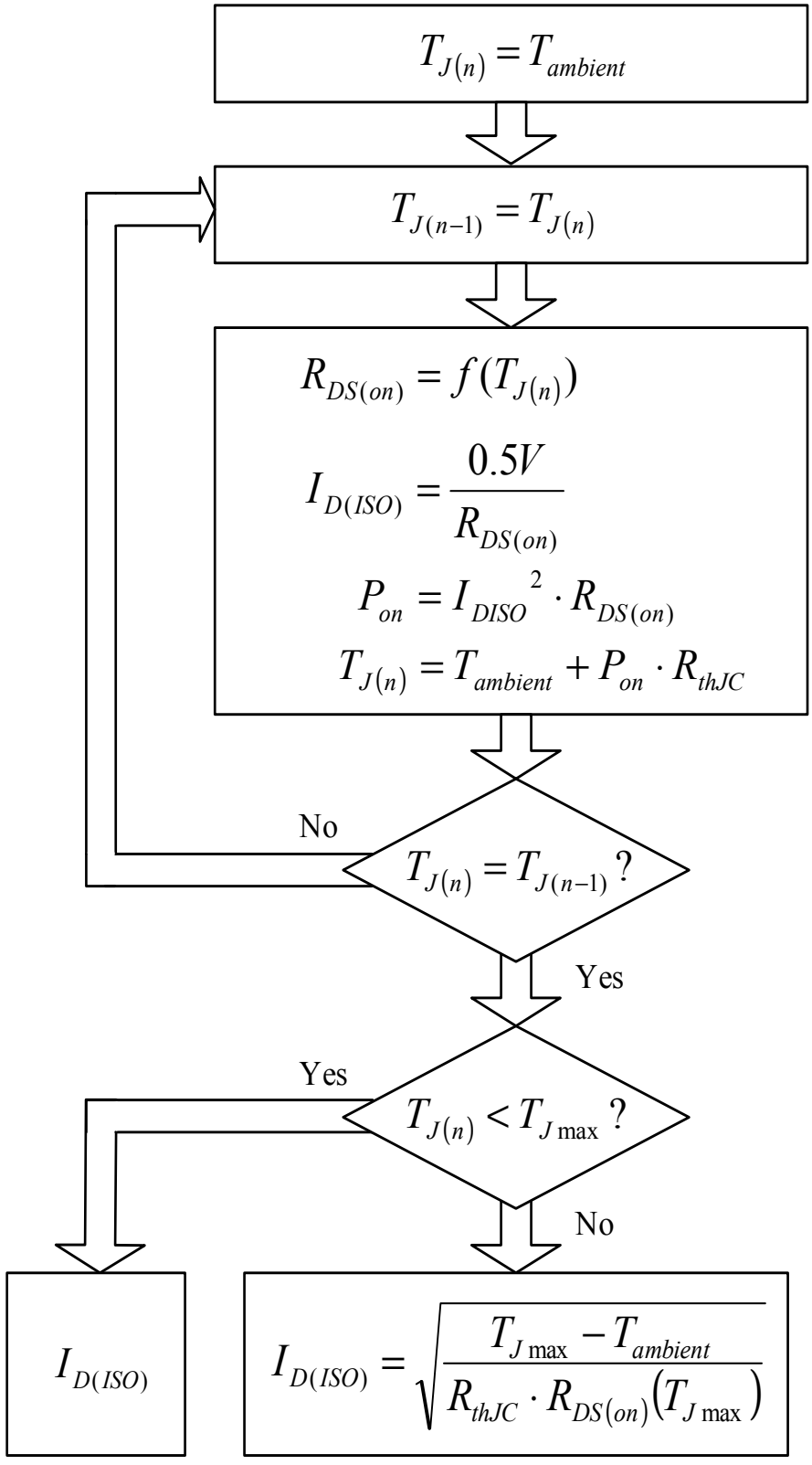

Figure 2 Iterative computation process for $I_{D(ISO)}$ current

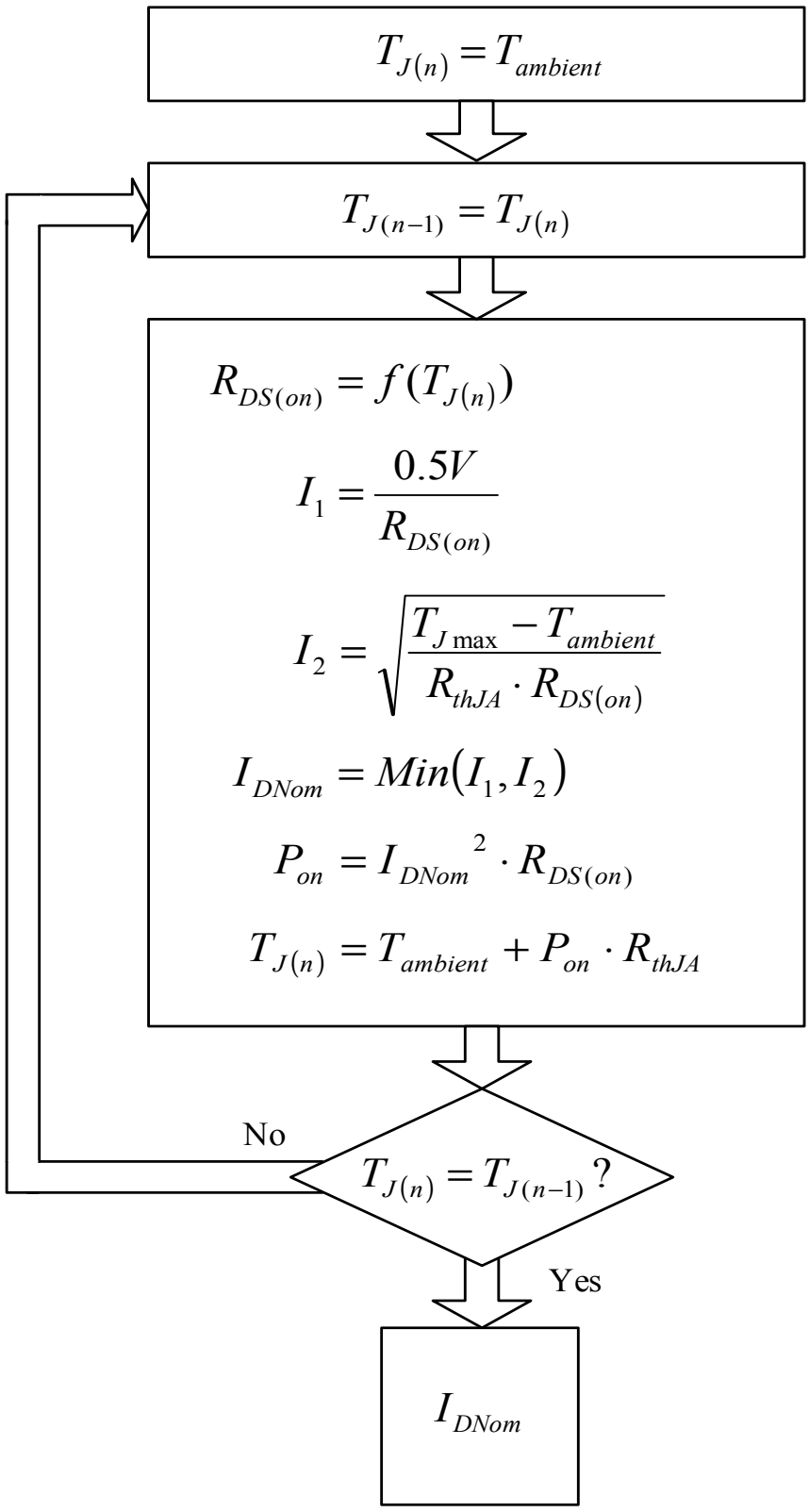

Figure 3 Iterative computation process for Nominal load current $I_{D(Nom)}$

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Previous Version:	none	

Page	Subjects (major changes since last revision)

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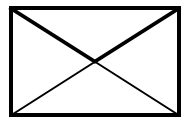

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