



SiC modules

Solution for fast switching application

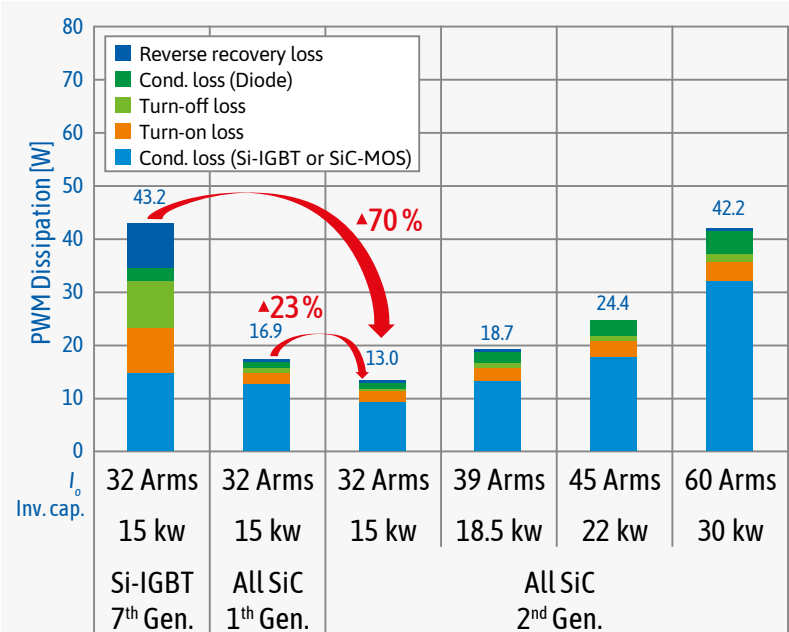
The Fuji Electric SiC (silicon carbide) chipset has excellent characteristics in case of power dissipation, blocking voltage and high temperature operation and is therefore ideal for next generation power semiconductors. The High power density combined with the low energy consumption is beneficial for smaller and lighter products. These devices have benefits for all applications which use high switching speed operation such as PCS, UPS, EV, power supply, high speed motor drive and so on.

- FEATURES**
 - Significant loss reduction realized by applying the 2nd generation trench gate MOSFET
 - 70 % reduction compared to Si die (7th Generation),
 - 23 % reduction to previous generation SiC (1st generation trench gate MOSFET)
 - Compatible packages to conventional Si-IGBT modules
 - Low inductance packages
 - HPnC: 76 % less than conventional HPM
 - 62 mm STD: 25 % less than conventional STD package
 - High temperature operation (T_{jmax} 175 °C)

Loss comparison

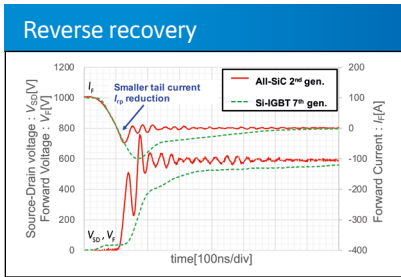
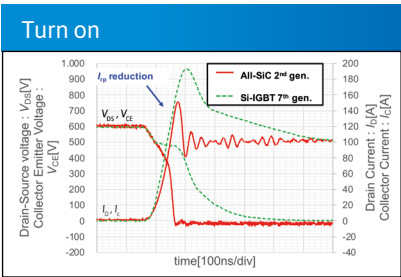
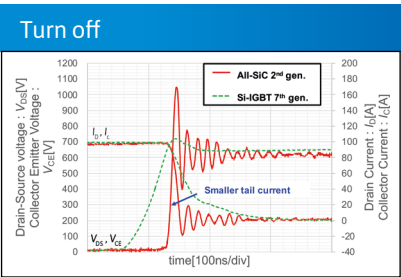
For inverter operating condition the use of an All SiC device can reduce the losses compared the 7th Gen. Si-IGBT by about 70 %. Compared to the 1st generation of trench gate MOSFET the losses can be reduced by 23 %. If the losses are kept at the same level the use of All SiC can increase the output current by a factor of two. The benefit will be even larger for higher switching frequencies because of the low switching losses of the SiC.

[Calc. condition]
 $V_{cc} = 600V, I_o = \text{vari}, f_c = \text{vari}, \cos\phi = 0.9, \lambda = 1, T_{vj} = 175^\circ C, f_c = 5kHz$
 Si 7th Gen.: $V_{ge} = +15/-15V, R_g = 5.1\Omega$
 All SiC 1G: $V_{gs} = +20/-3V, R_g(\text{on/off}) = 27/15\Omega$
 All SiC 2G: $V_{gs} = +15/-3V, R_g(\text{on/off}) = 15/5.6\Omega$



Switching comparison

The graphs below show the switching waveforms at turn on, turn off and reverse recovery for the All SiC of the 2nd generation and the Si-IGBT of the 7th generation. There you can see a reduced tail current at turn off, a lower I_{rp} current at turn on and a smaller tail and peak current during reverse recovery for the All SiC device in comparison to the Si-IGBT device.



All SiC 1G	$R_g = +27/-15\Omega$
All SiC 2G	$R_g = +15/-5.6\Omega$
Si-IGBT 7G	$R_g = 5.1\Omega$