

# The EasyPIM / EasyPACK IGBT Module Family for Compact Inverter Design

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## 1 Introduction

The reduction in size and cost makes low power drives available for an increasing number of applications. Variable speed drives are gradually replacing conventional drives even in home appliances or providing new solutions previously set up by mechanical parts. The high reliability and performance required is achieved by new highly integrated semiconductor devices, both for power and data processing. New devices from eupec GmbH + Co KG and the mother company Infineon Technologies AG, such as an integrated IGBT module for voltage source inverters, the EasyPIM / EasyPACK, a control IC for switched mode power supplies, the CoolSET, and an 8-bit microcontroller, C508, are designed to meet the demands of competitive inverter design in the low power range. They are a significant step towards the total integration of high and low voltage semiconductor devices with communication interfaces on the same heat conducting substrate and in a single package.

## 2 EasyPIM / EasyPACK Modules

Integrated power modules, such as the EasyPIM IGBT module family, allow an optimum inverter design with smallest possible space demand. They include a voltage source inverter bridge, a rectifier, optionally a brake chopper, and an NTC for temperature monitoring ( shown in Figure 1 and Figure 2 ).

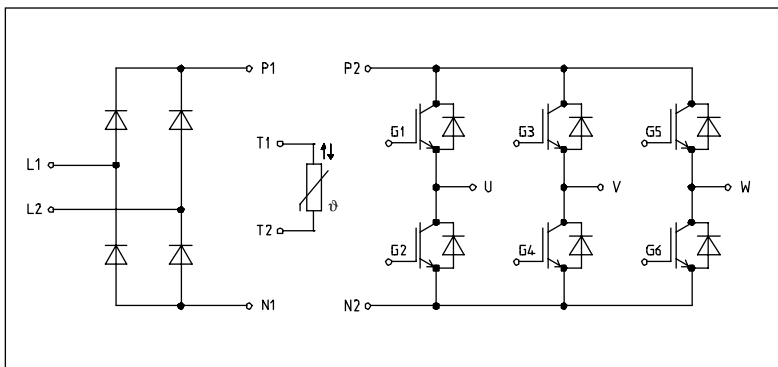


Figure 1: Configuration EasyPIM1

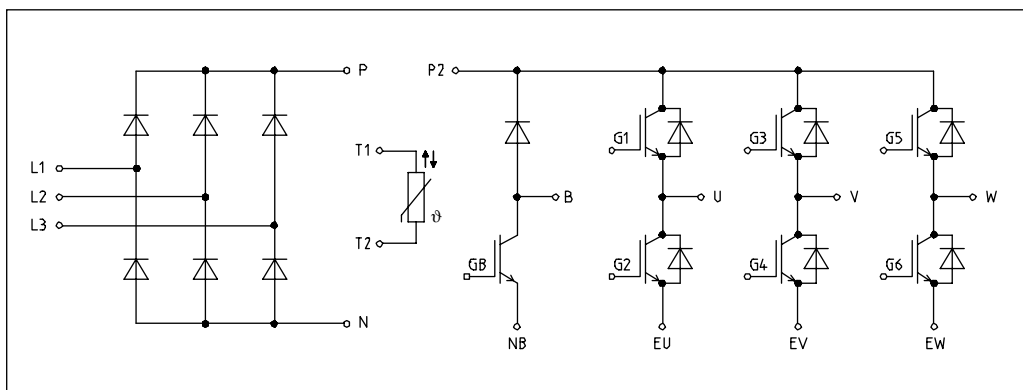


Figure 2: Configuration EasyPIM2

A SixPACK configuration as shown in Figure 3 will be available, too.

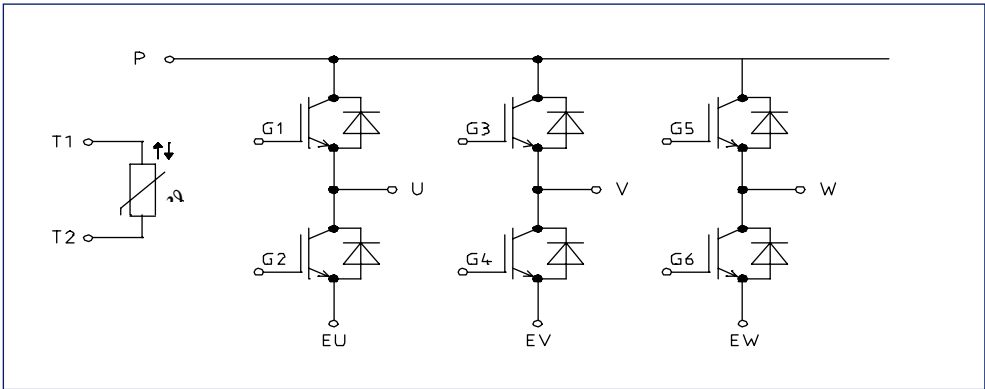


Figure 3: Configuration of the EasyPACK module series

They have been equipped with pins mounted by a new, flexible concept to the DCB. So the EasyPIM / EasyPACK module can be soldered to the PCB just as any other through-hole device. The package has been designed for clamping allowing high reliability as known from automotive electronics. The smaller package, EasyPIM1/ EasyPACK1, is presented in Figure 4, while the 70 % longer EasyPIM2 / EasyPACK2 is shown in Figure 5.

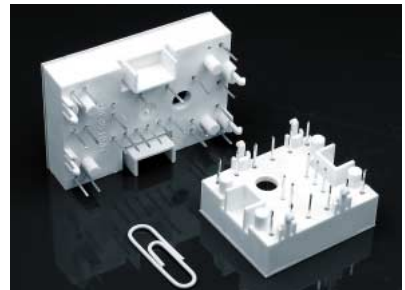
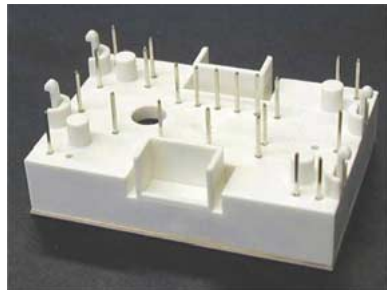
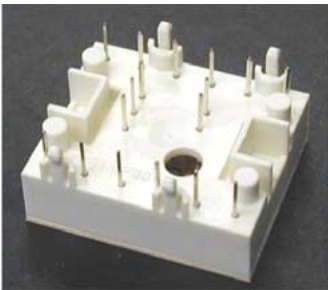


Figure 4: EasyPIM1 / EasyPACK1

Figure 5: EasyPIM2 / EasyPACK2

Figure 6: EasyPIM1 and EasyPIM2

The product range of the EasyPIM / EasyPACK family will be available as illustrated in the following tables:

Voltage Nom. Current	600V		1200V	
	EasyPIM1	EasyPIM2	EasyPIM1	EasyPIM2
Ic [A]				
10	FB 10R06KL4	FP 10R06KL4	X	FP 10R12KE3
15		FP 15R06KL4		FP 15R12KE3
20		FP 20R06KL4		

Table 1: Product range of the EasyPIM module series

Voltage Nom. Current	600V		1200V	
	EasyPACK1	EasyPACK2	EasyPACK1	EasyPACK2
Ic [A]	FS10R06KL4	FS20R06KL4	X	FS10R12KE3
10	FS15R06KL4			FS15R12KE3
15				
20				FS25R12KE3
25				

Table 2: Product range of the EasyPACK module series

### 3 Realised Drives

For low power voltage source inverters with increased power density at lower costs improved power semiconductors with decreased total losses and new packaging techniques are required. The EasyPIM / EasyPACK modules are designed to meet all the requirements of low cost / low power voltage source inverters used for industrial and consumer electronics applications from 0.2 kW upwards, e.g. variable speed drive inverters for general purpose drives, pumps, fans, washing machines or air-conditioning systems. The realised drives represent solutions for general purpose applications, but due to their low cost design and power ratings, they also address the market of washing machines and air conditioners.

The driving circuit utilises a three-phase level shift IC, the control unit being based on C508 or C164CI with CAN-Bus interface. The microcontroller is fed by a low voltage drop voltage controller, such as TLE4269, providing a rather constant temperature. Since the pulse patterns of the microcontroller's PWM unit are initially not defined for a short time (this might cause a short circuit in the inverter bridges) the voltage controller ensures a safe transition aided by its reset function. The implemented circuit is shown in Figure 7 for the 8-Bit microcontroller C508.

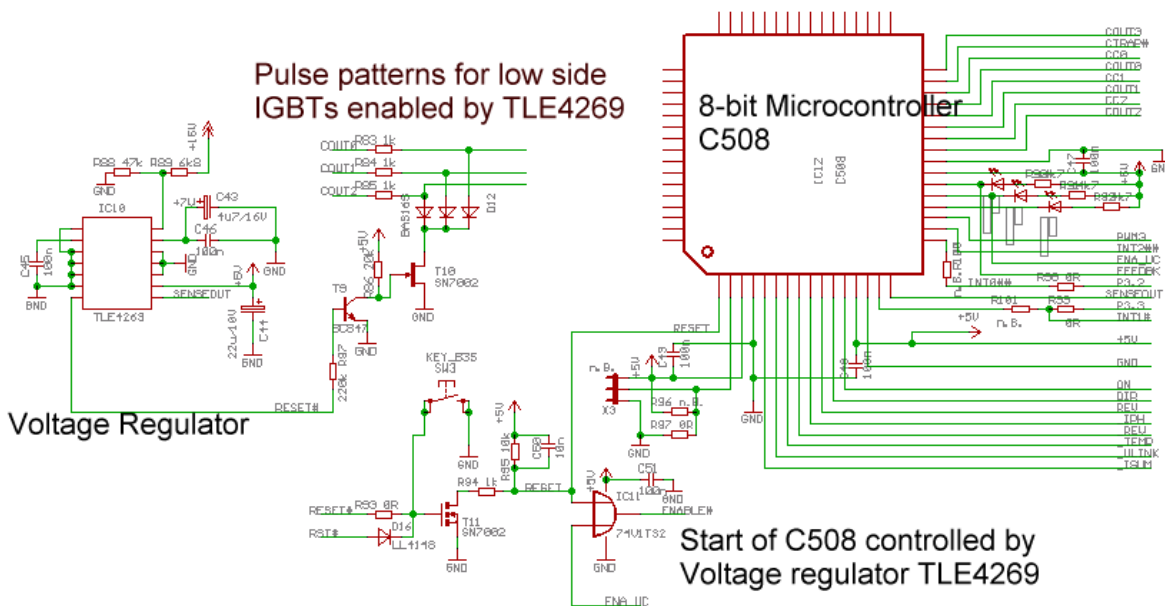


Figure 7: Microcontroller C508 controlled by voltage regulator TLE4269

The smaller drive, Figure 8, can operate an electrical motor with 1 kW shaft power due to the power stage of EasyPIM1 with 600 V, 10 A. The larger drive, Figure 5, incorporates an EasyPIM2 IGBT module with 600 V and 20 A, allowing the operation of an electrical machine with 2.2 kW shaft power. The IGBT module EasyPIM2 is also available with 1200 V and maximum current of 15 A at 80 °C. The emitter terminals of the low side IGBTs of EasyPIM2 are not connected to the minus DC link bar but they are separately offered as pins allowing the insertion of shunts on the PCB board.

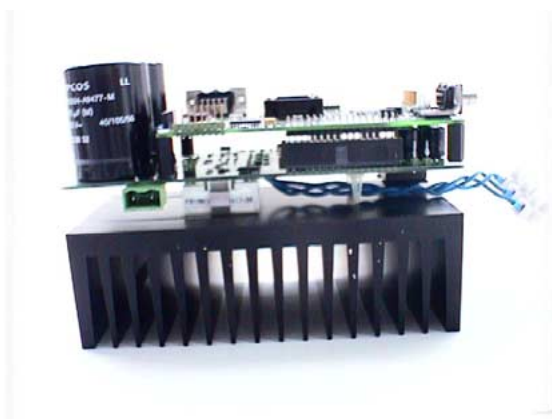


Figure 8: Inverter drive for 1 kW motor shaft power

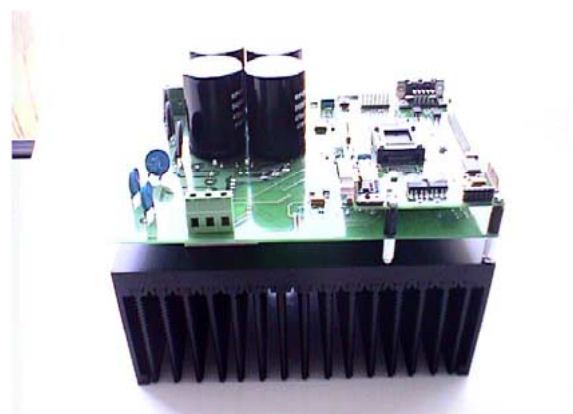


Figure 9: Inverter drive for 2.2 kW motor shaft power

#### 4 Conclusion

Low cost motor drive systems require components exactly specified and designed for the given high volume application. eupec GmbH + Co KG and Infineon Technologies AG responded to this challenge by providing dedicated products for the power stages, the data processing and the communication. These semiconductor devices cover a wide range of applications.

The novel EasyPIM / EasyPACK-series developed by eupec based on state-of-the-art IGBT technology and with a new housing concept leads to a compact, low cost inverter design. The mounting concept allows a fast and cheap inverter assembly. The product range from 10A/600V up to 25A/1200V in PIM and SixPack configurations meets the requirements of various low power voltage source inverters used for industrial and consumer electronics applications from 0.2 kW upwards, e.g. variable speed drive inverters for general purpose drives, pumps, fans, washing machines or air-conditioning systems.