Easy B series

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Never stop thinking

Overview

- Voltage class
  - 600V
  - 1200V
- Current
  - 600V up to 200A
  - 1200V up to 150A

"Easy2 (Y)"

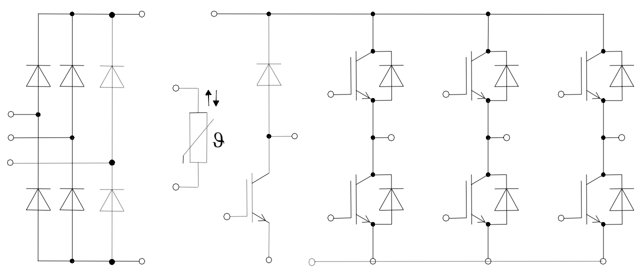
"Easy1 (X)"

"Easy750 (V)"

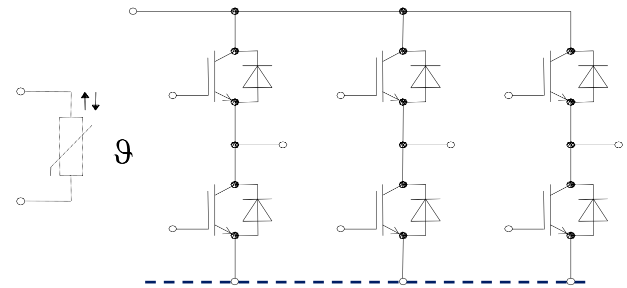
"Easy1B (W1)"

"Easy2B (W2)"

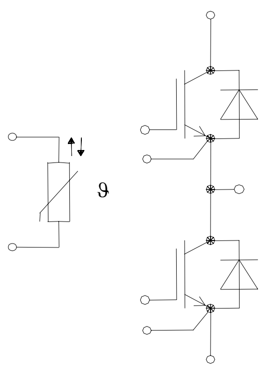
Circuit Configuration



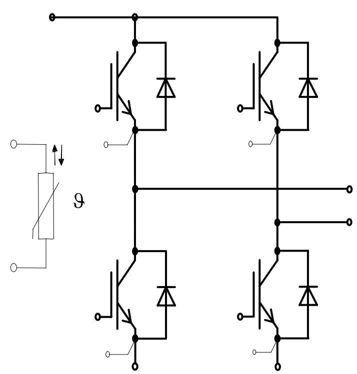
“EasyPIM”
FP/FB



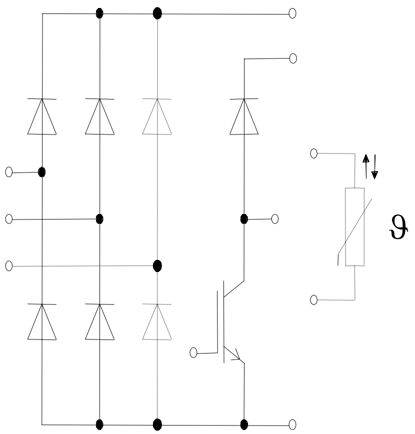
“EasyPACK”
FS



“EasyDUAL”
FF



“EasyFourPACK”
F4



“EasyBridge”
DD

Chip technology

- 1200V Trench Field Stop
  - T3 Easy1B
  - T4 (Latest) Easy1B, Easy2B
    - 20% Lower Switch losses than T3 with the same switching characteristics ;
    - Operational junction temperature Tvj.op=150℃;
    - The robustness with same SC withstand time;
- 600V
  - E3 Trench Field Stop Easy1B
    - Tvj.max=175 ℃, Tvj.op=150℃;
    - SC time 6us;
  - KL4 NPT

Mechanical Construction

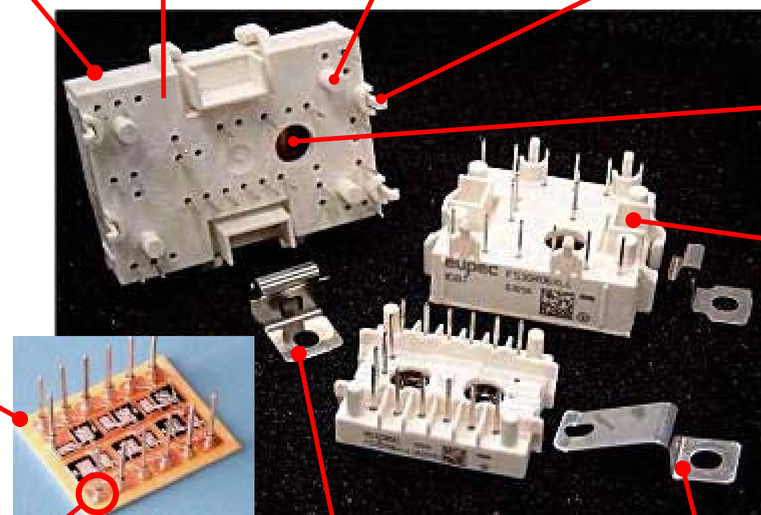
★ **Without Base Plate**
(Cost Saving & Compact)

Distance Bolts

Hooks (for Wave Soldering)

Hole (Filling in Soft Gel)

Double Cu-layer DCB Substrate
(Thermal Conduction & 2.5 kV Isolation)



Notches
(Clamp Fitting)

★ **Pin-rivet Connection**
(Low Contact Ohm & Process Automation)

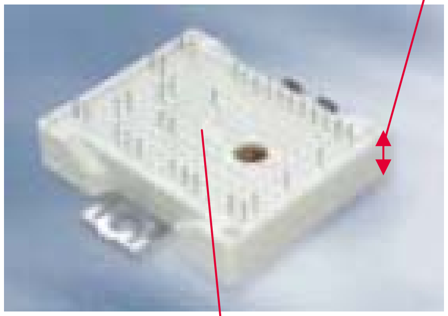
★ **Mounted with Clamps**
(Adapting to Plastic Deformation & Holding Mounting Force)

Mechanical Construction of Easy B series

Without Base Plate
(Cost Saving & Compact)

★ **Module height is 12mm**
Same with Easy750
Easy1,Easy2 height is 17mm

Pin-rivet Connection
(Low Contact Ohm & Process Automation)



★ **No hooks**
Connect PCB with screws or just by soldering

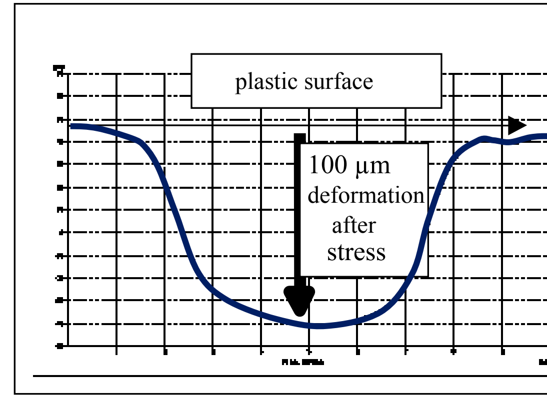
★ Pin grid
for max. flexibility separately

★ **Mounted with Clamps**
The clamps is pre-assembled

★ Protected ceramic
Like Easy750

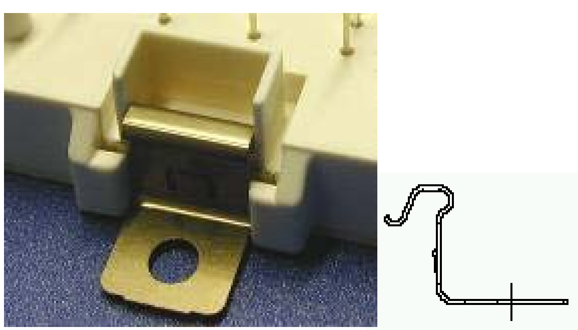
Why Clamping

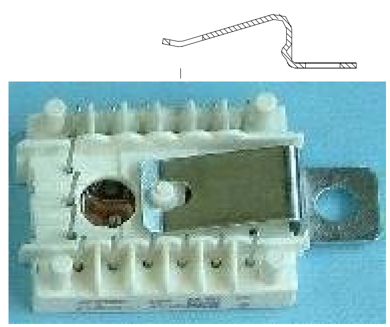
time, screwing force

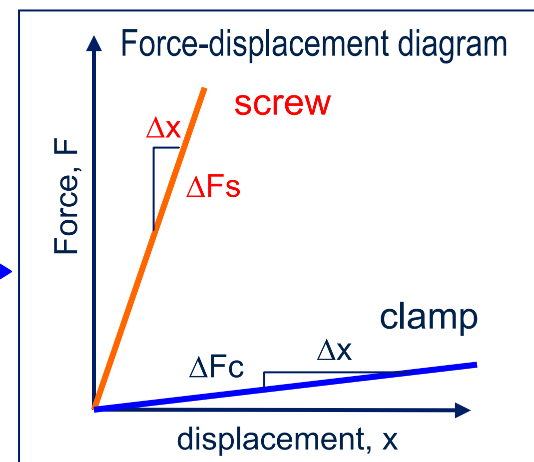


Clamping Features

- **Adapting to plastic deformation**
- **Holding & nearly mounting force constant over lifetime, Therefore keep better contact thermal resistance R_{thch}.**
- **DCB Safety – lower risk of Ceramics Cracks**

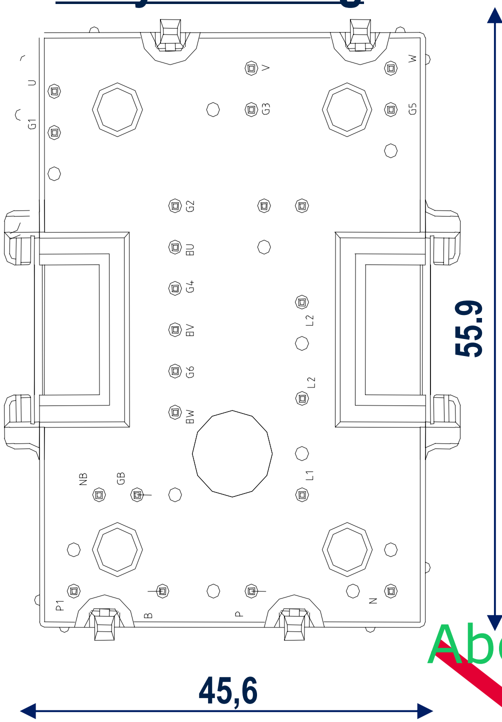




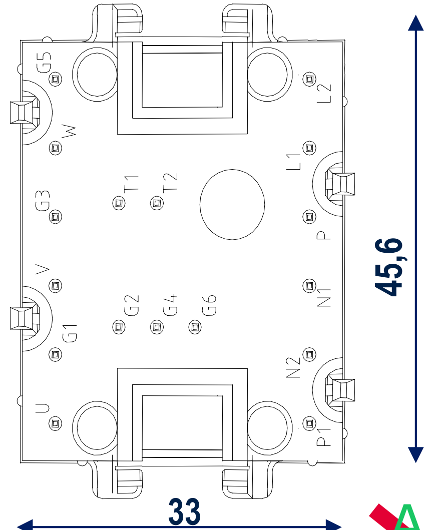


Frame size

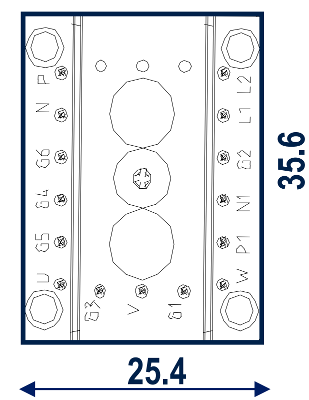
Easy2 housing



Easy1 housing



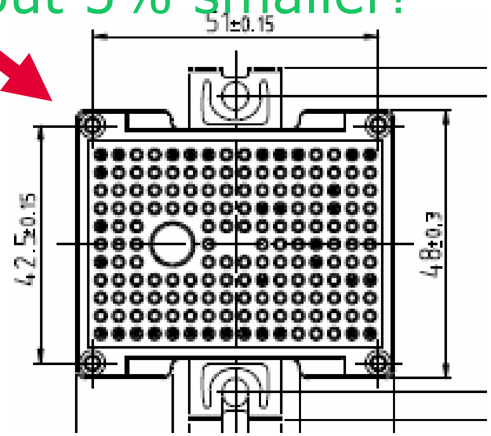
Easy750 housing



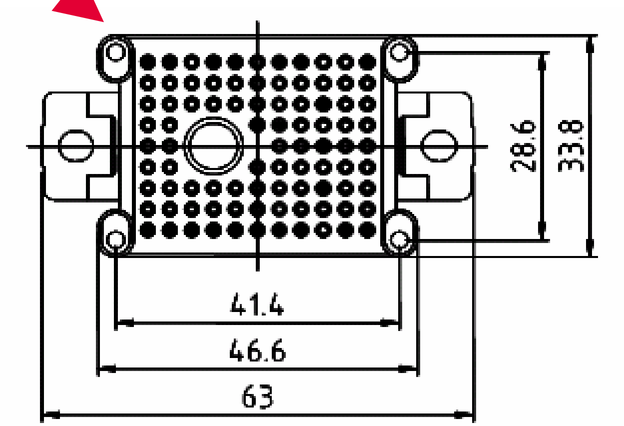
About 5% smaller!

About7% smaller!

Easy2B housing



Easy1B housing



Dimensions in [mm]

Easy™ Product Portfolio

 For internal use only

Type designation

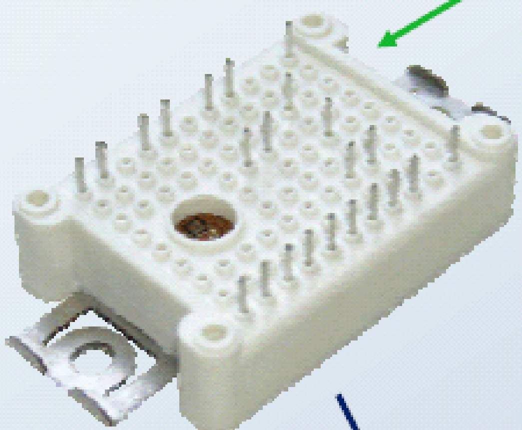
!! New indication for new housings !!

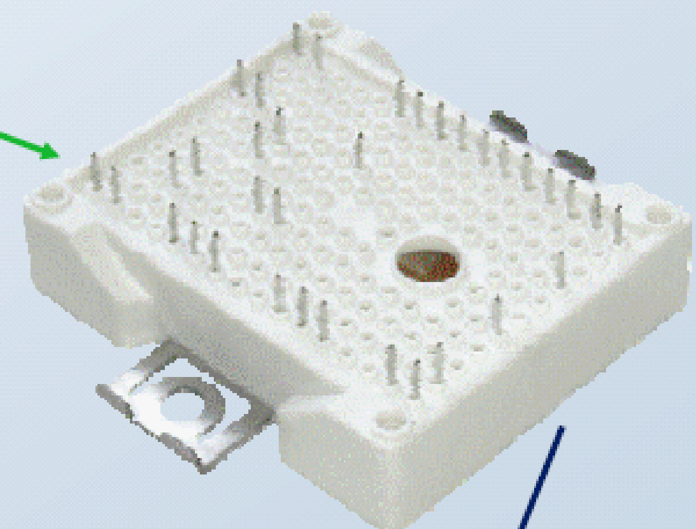
- **W for Easy B series**

•**An additional figure shows the footprint**

W1 =Easy 1B

W2 =Easy 2B





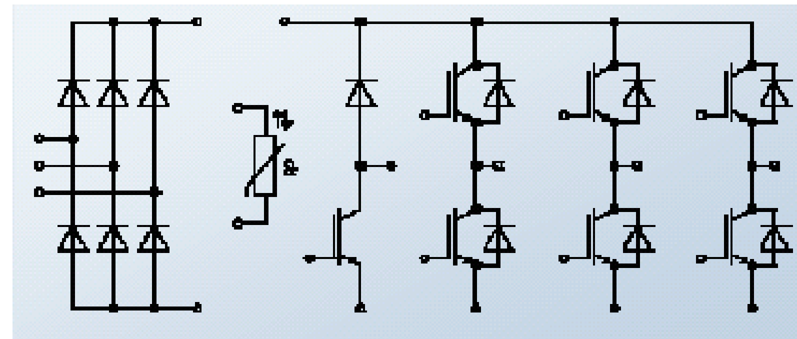
FP15R12W1T3

FP35R12W2T4

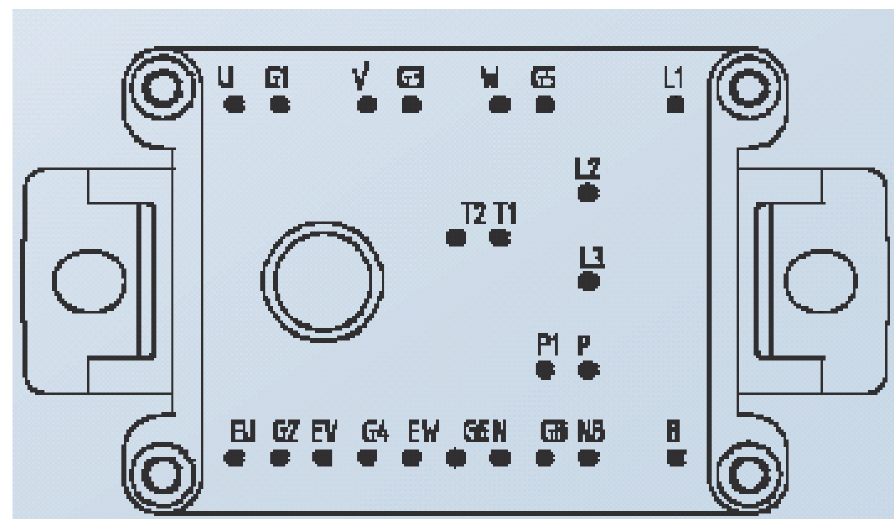
 For internal use only

EasyPIM™ module

- 1200V
  FP10/15R12W1T3
  FP06/10/15R12W1T4 (-B3)



- 600V
  FP10/15/20/30R06W1E3
  FB10/15/20/30R06W1E3



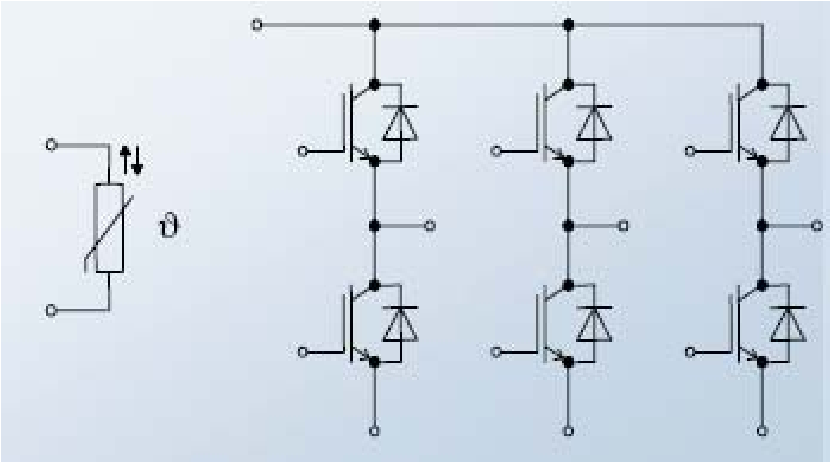
New 1200V IGBT4 inside!!

Current (A) **Voltage (V)**

EasyPACK™ module

- 1200V
  FS25R12W1T4
  FS35R12W1T4

- 600V
  FS20/30/50R06W1E3



EasyPIMTM module

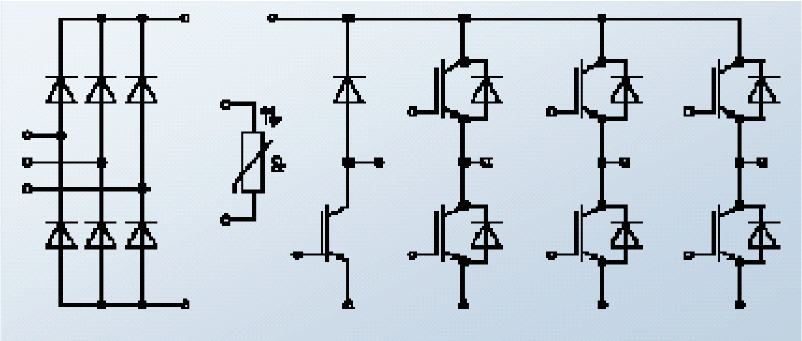
- 1200V
  FP25R12W2T4
  FP35R12W2T4

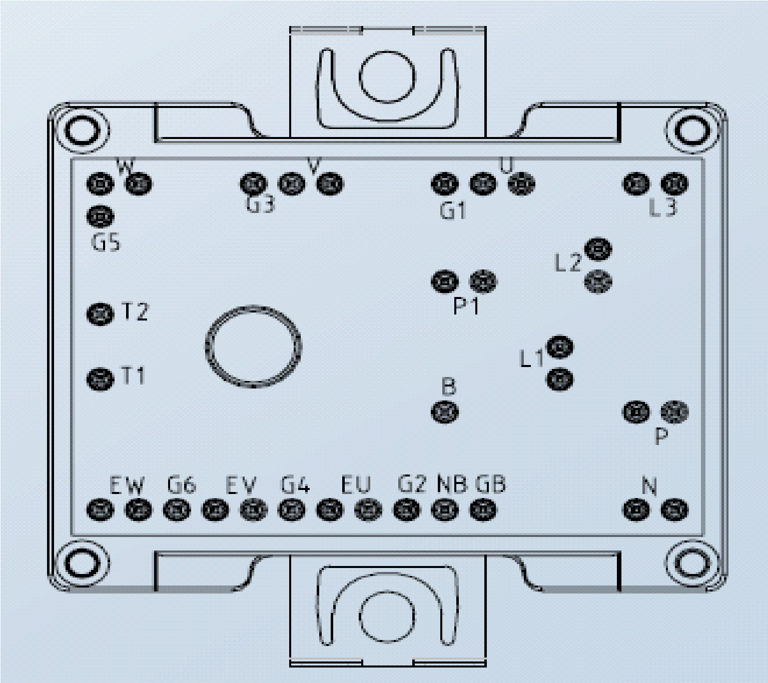
- 600V
  FP35R06W2E3
  FP50R06W2E3

Coming later

1200V IGBT4 in new housing!!

Current (A) **Voltage (V)**



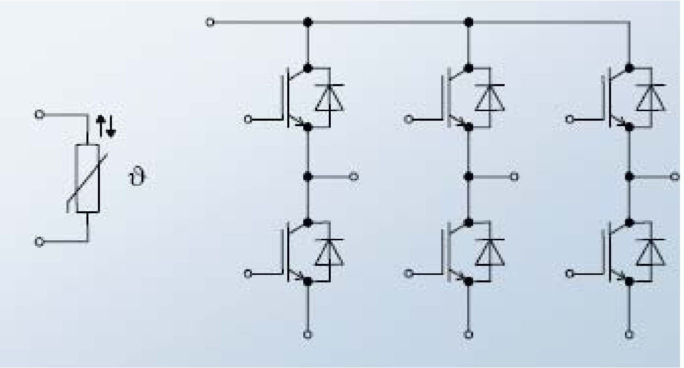


EasyPACK™ module

- 1200V
  FS50R12W2T4
  FS75R12W2T4

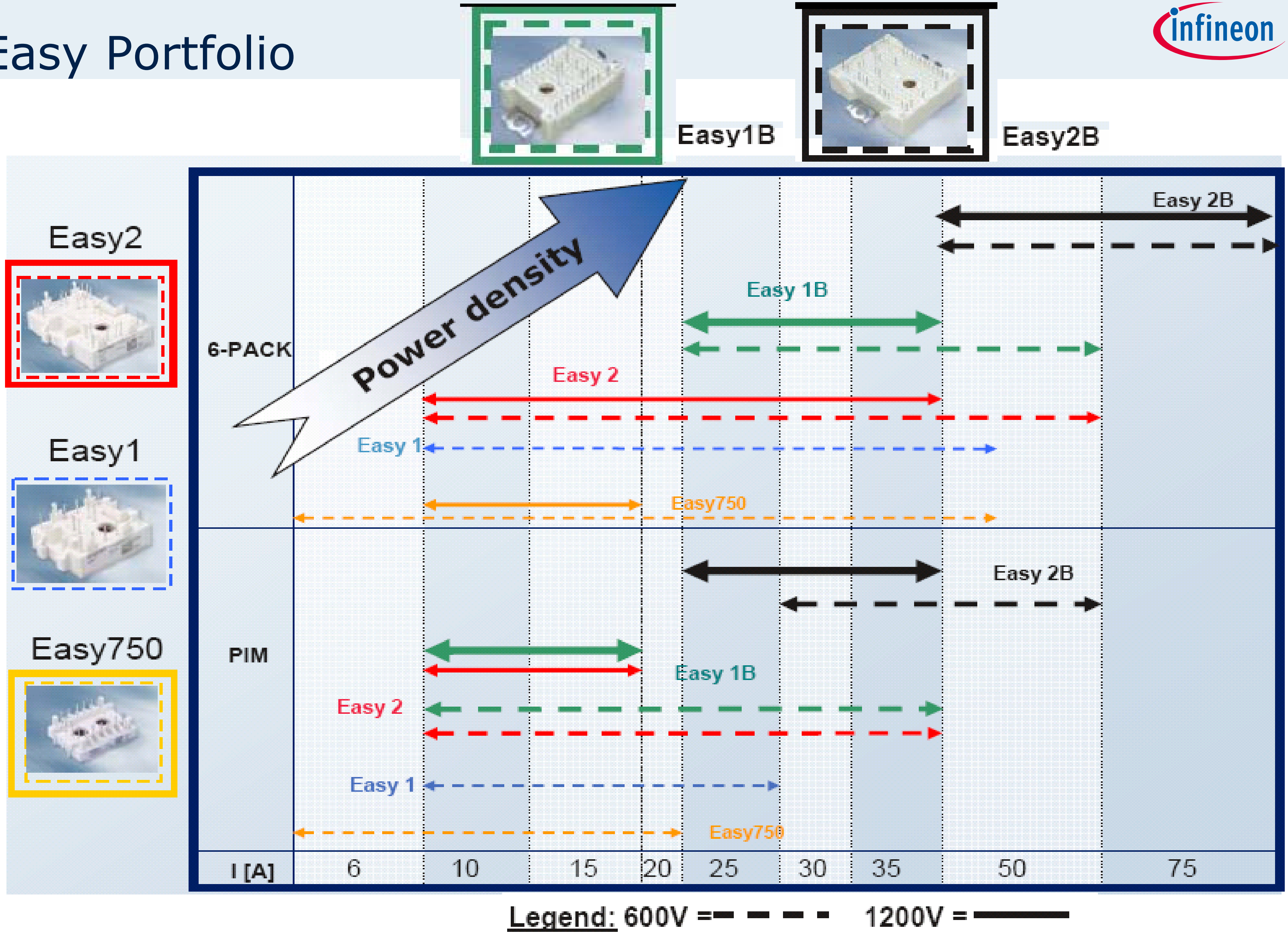
- 600V
  FS50R06W2E3
  FS75R06W2E3

Coming later



Current (A) **Voltage (V)**

Easy Portfolio

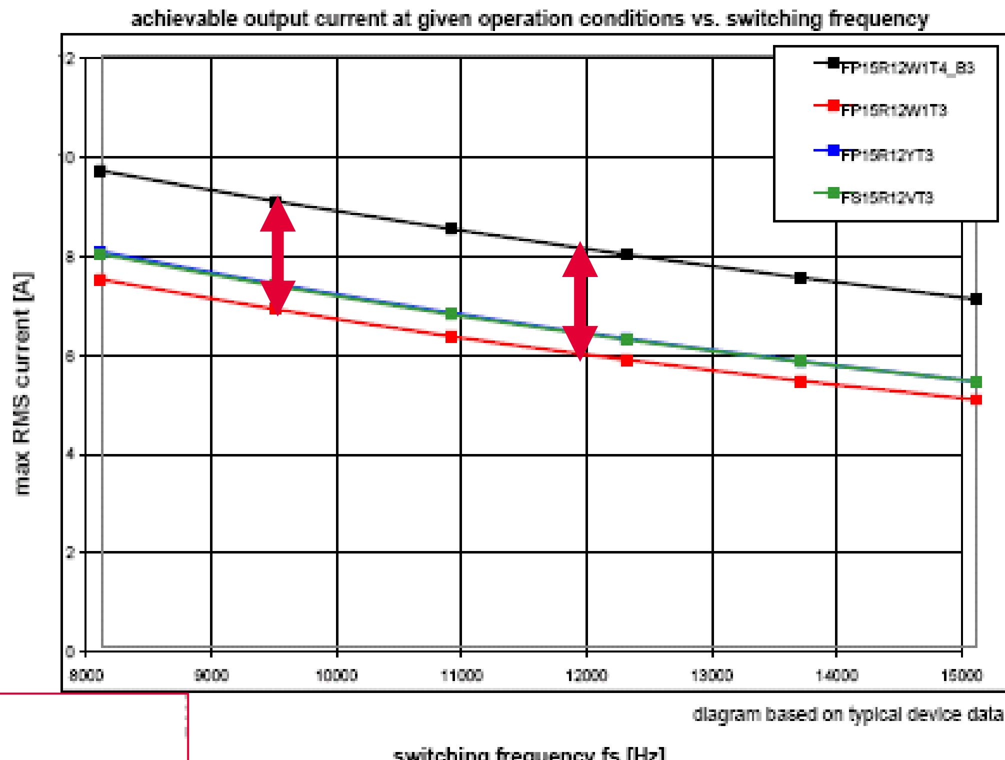


Benchmark for 1200V 15A T4 vs.T3

Please specify your inverter application in the green layered fields:	application parameters:			simulation parameters:	limits:
					nom. voltage 600 V +-20%
DC link voltage Vdc [V]	513			513	480 V ▪ Vdc ▪ 720 V
frequency f0 [Hz]	50			50	1 Hz ▪ f0 ▪ 1000 Hz
switching frequency fs [Hz]	8000	to	15000	8000...15000	5 x f0 ▪ fs ▪ 10000 x f0
modulation factor m	1.14			1.14	0 ▪ m ▪ 4/p
cos f	0.80			0.80	-1 ▪ cos f ▪ 1
max. ambient temperature Ta [°C]	40			40	0 °C ▪ Ta ▪ Th

choose:

IGBT Diode



IGBT Diode

select up to three modules for benchmark	housing type	Rth IGBT j-junction to heat sink	Rth case to heat sink per IGBT [K/W]	Rth heat sink per module arm [K/W]	max. junction temp. Tj [°C]
FP15R12W1T4_B3	EasyPIM1B	2.2000	0.000	4.400	150
FP15R12W1T3	EasyPIM1B	2.2500	0.000	4.400	125
FP15R12YT3	EasyPIM2	1.8500	0.000	4.400	125
FS15R12VT3	EasyPACK750	2.0500	0.000	4.400	125

Output current capability:
T4>T3!

Comparison of 2.2kW inverter

- **Condition:**

I_{orms}=5.5A, V_{dc}=513V, f_{sw}=14kHz,OL=150%,T_a=40℃,

R_{thha} per arm=4.4k/W

- Module: EasyPIM™1B FP15R12W1T4 Vs. FP15R12W1T3

temperature distribution

selected module	FP15R12W1T4_B3			
	simulation parameters:			temperature at Irms = 6 A
			Tjmax [° C]	120.6
DC link voltage Vdc [V]	513		Tc [° C]	93.6
RMS current Irms [A]	5.5		Th [° C]	93.6
frequency f0 [Hz]	50			max. current for Tj <= 150° C
switching frequency fsw [Hz]	14000			
max. junction temperature Tj [° C]	150		Irms [A]	7.4
modulation factor m	1.14			
cos f	0.80		choose:	
Rth IGBT-junction to heat sink [K/W]	2.2	IGBT		Diode
Rth case to heat sink per arm [K/W]	0.000	0.000		0.000

Please specify heat sink and ambient temperature in the green layered fields	application parameters:		
Rth heat sink per arm [K/W]	4.400		
max. ambient temperature Ta [° C]	40	40	0 ° C = Ta = Th
static IGBT losses [W]	03		
dynamic IGBT losses [W]	06	Σ 09	
static diode losses [W]	00		
dynamic diode losses [W]	02	Σ 02	

temperature distribution

selected module	FP15R12W1T3			
	simulation parameters:			temperature at Irms = 6 A
			Tjmax [° C]	128.4
DC link voltage Vdc [V]	513		Tc [° C]	99.1
RMS current Irms [A]	5.5		Th [° C]	99.1
frequency f0 [Hz]	50			max. current for Tj <= 125° C
switching frequency fsw [Hz]	14000			
max. junction temperature Tj [° C]	125		Irms [A]	5.3
modulation factor m	1.14			
cos f	0.80		choose:	
Rth IGBT-junction to heat sink [K/W]	2.25	IGBT		Diode
Rth case to heat sink per arm [K/W]	0.000	0.000		0.000

Please specify heat sink and ambient temperature in the green layered fields	application parameters:		
Rth heat sink per arm [K/W]	4.400		
max. ambient temperature Ta [° C]	40	40	0 ° C = Ta = Th
static IGBT losses [W]	03		
dynamic IGBT losses [W]	07	Σ 10	
static diode losses [W]	00		
dynamic diode losses [W]	03	Σ 03	

Simulation results:

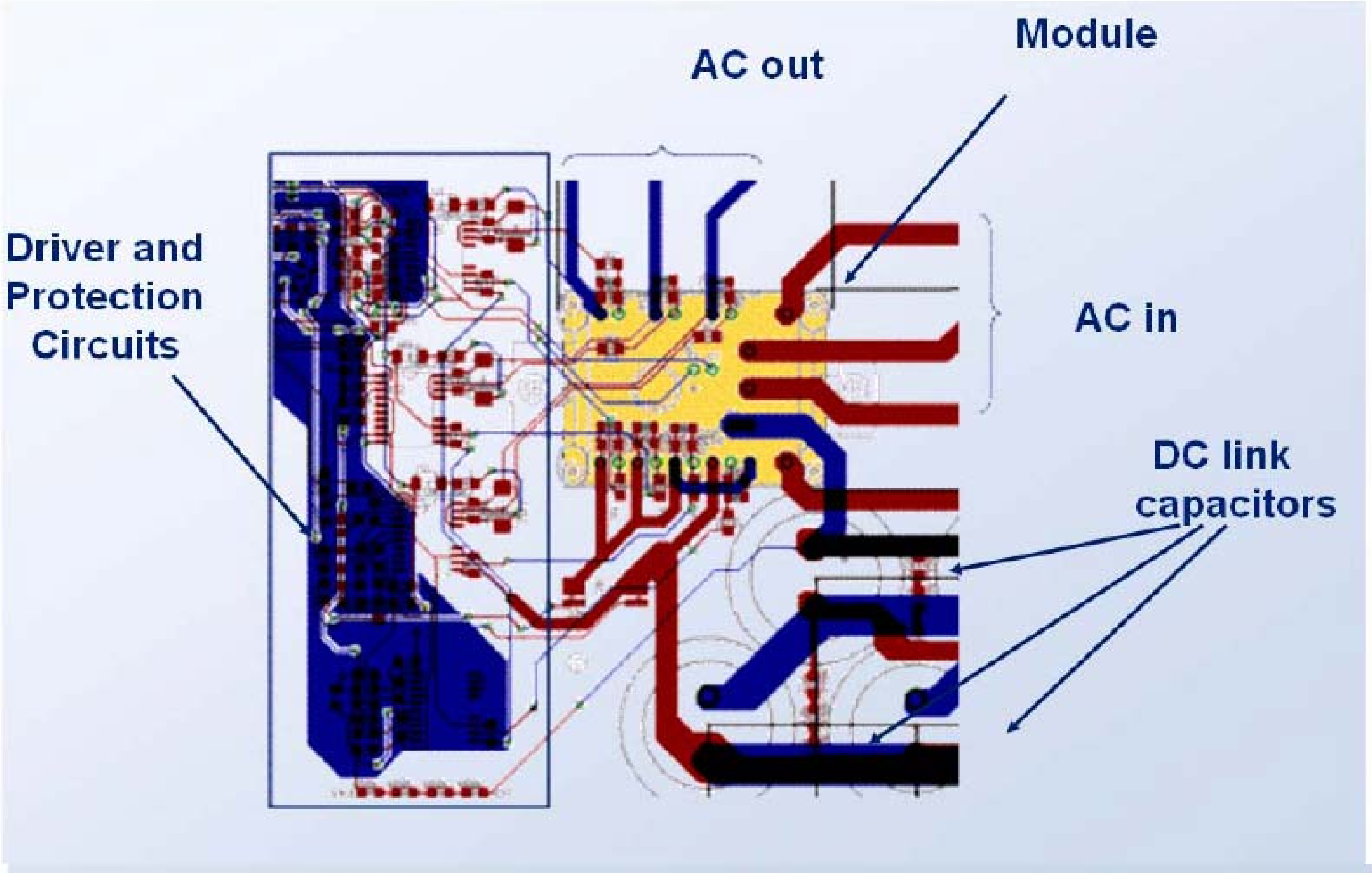
- **Heatsink T_h**

  T4(93.6℃) <T3 (99.1℃)

- **Operational T_{vj}**

  T4 (120.6℃)<T3 (128.4℃)

Possible layout for FP15R12W1T3



System reference layout

Possible Inverter Design with FP15R12W1T3

A very compact Inverter Design!