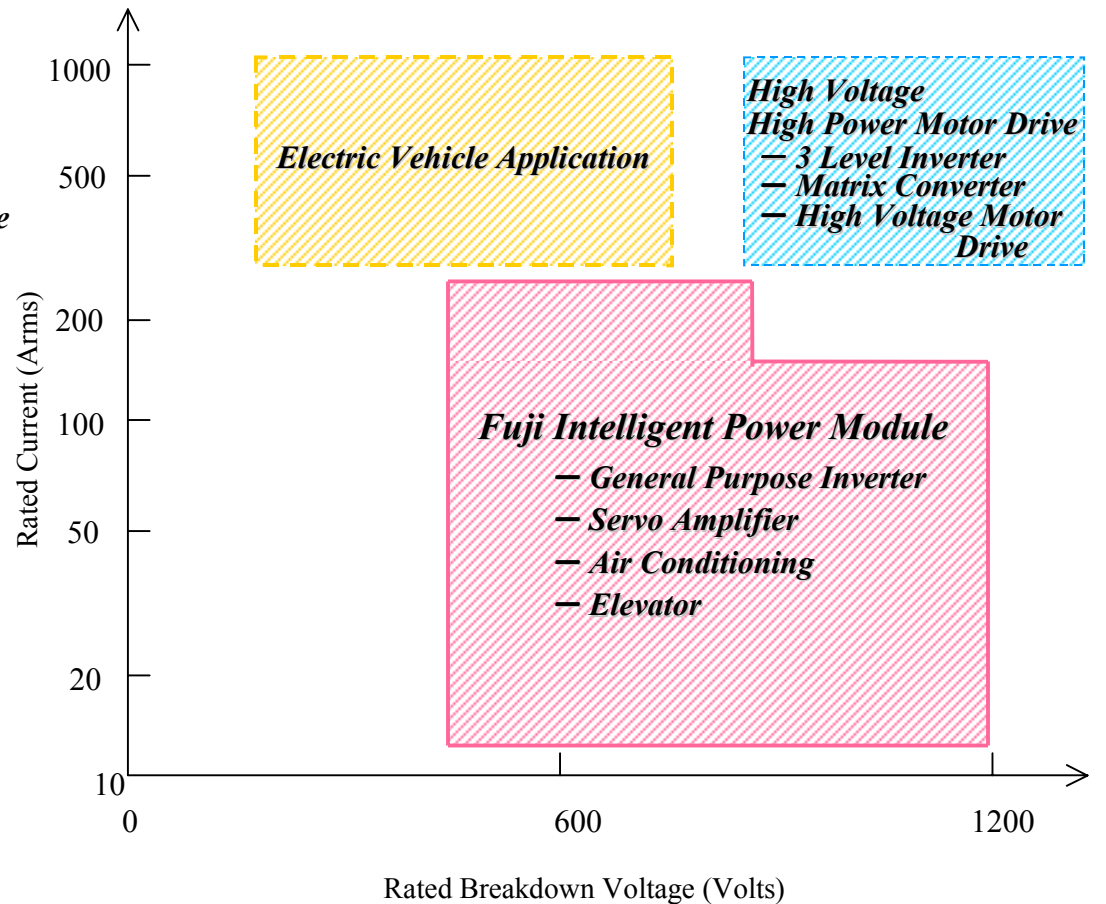
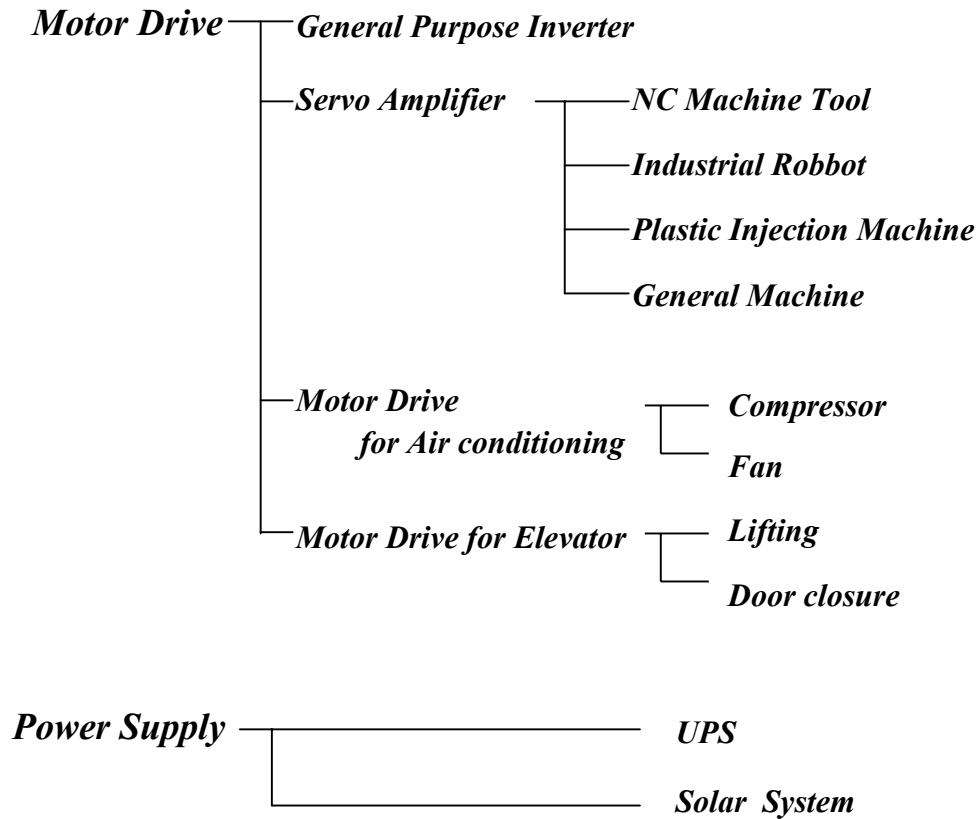


Econo IPM / R-IPM3

Aug-28-2002

Fuji Electric Co.,Ltd.

Application of Intelligent Power Module e-Front runners



Quality is our message

Issue for Intelligent Power Module

Market Requirements

Down Sizing of Equipment

- Thinner Frame
- Smaller Footprint

Save Energy, High Efficiency

Lower EMI Noise

Longer Life Cycle

Reliable Protections

Issues for IPM

Compact and Slim Package

- PC Board on the Top
- Common Height
with Converter Module

Improvement of IGBT Performance

Soft Recovery of FWD

Optimized Drive Circuit

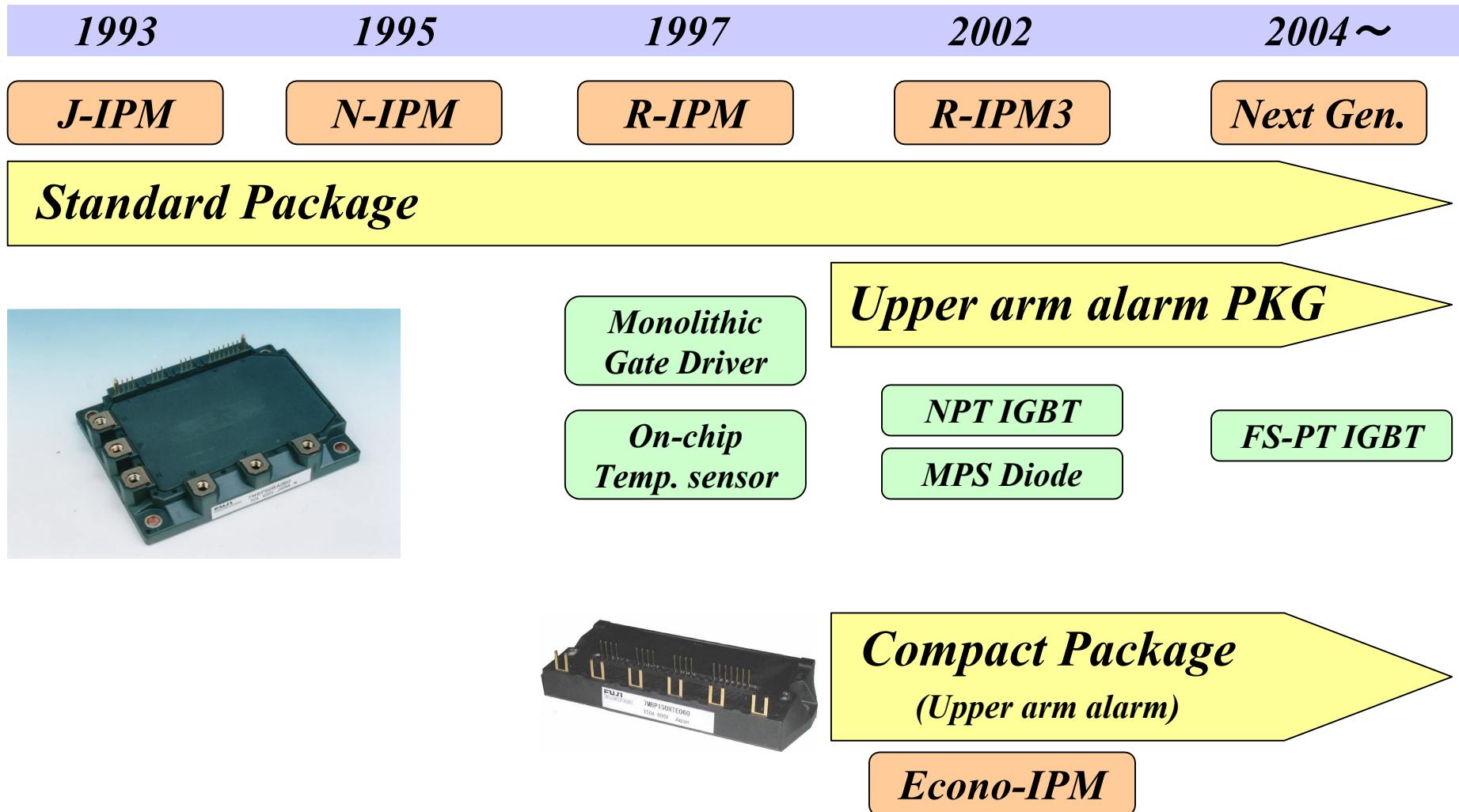
Improvement of Power Cycling Capability

Current Sensing IGBT of Over Current Protection.

On-chip Temperature Sensor for Tj Protection.

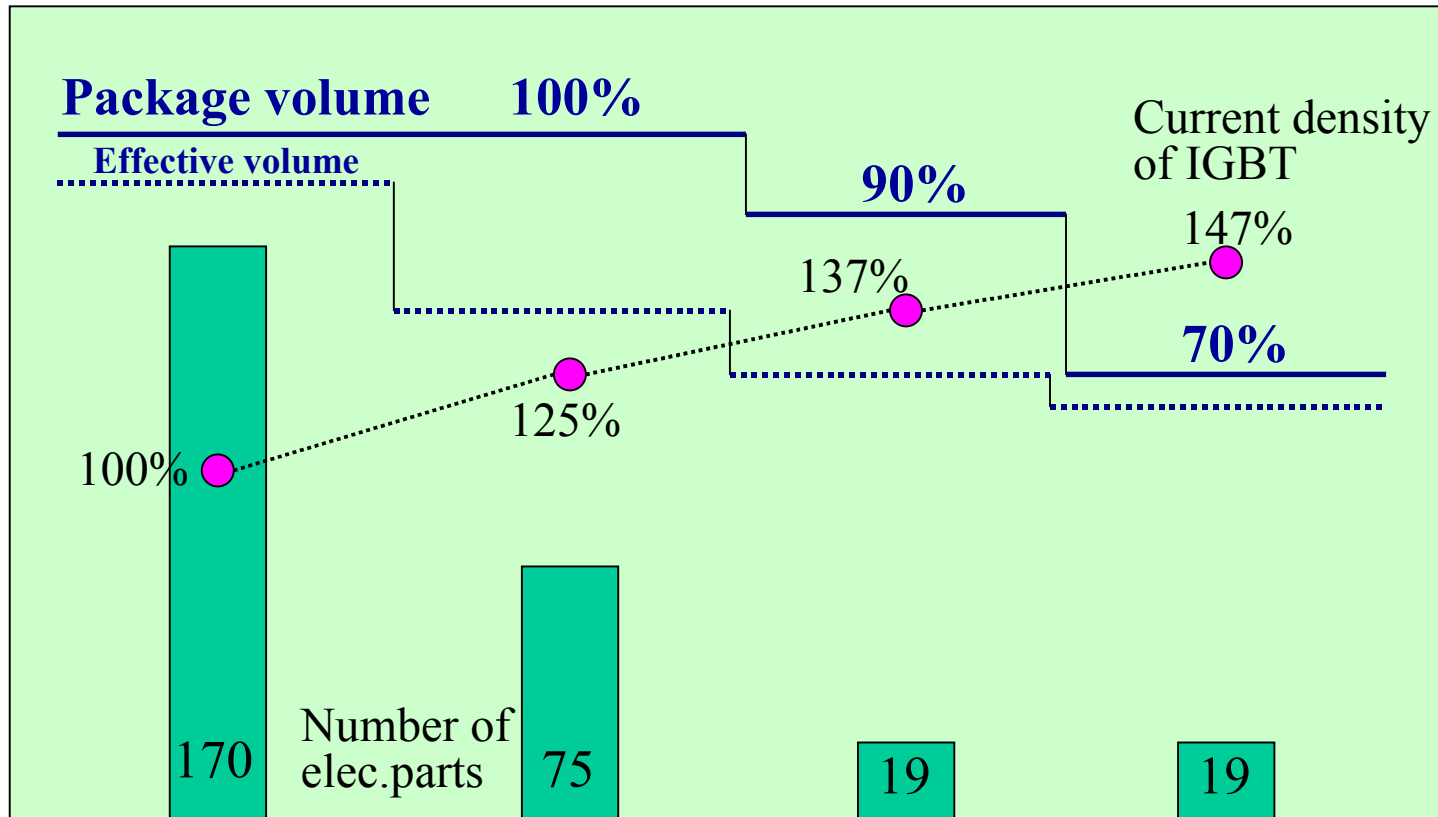
Alarm Output from upper arms.

Trend of Fuji's IGBT IPM



Progress of Fuji's IPM

600V/100A



year	1993	1995	1997	2002
Series	J-IPM	N-IPM	R-IPM	Econo-IPM
IGBT	PT-IGBT (J)	PT-IGBT (N)	PT-IGBT (R)	NPT-IGBT (T)

Concept of Econo IPM

R-IPM

All Silicon Concept

- Monolithic Gate Driver IC with wire bonding
- On-chip Temperature Sensor

Econo Module

Compact & Easy Mounting

- All Al-wire Bonding Technology
- PC Board on the Top with solder process
- Same Height with Converter Module

R-IPM3

Standard Package

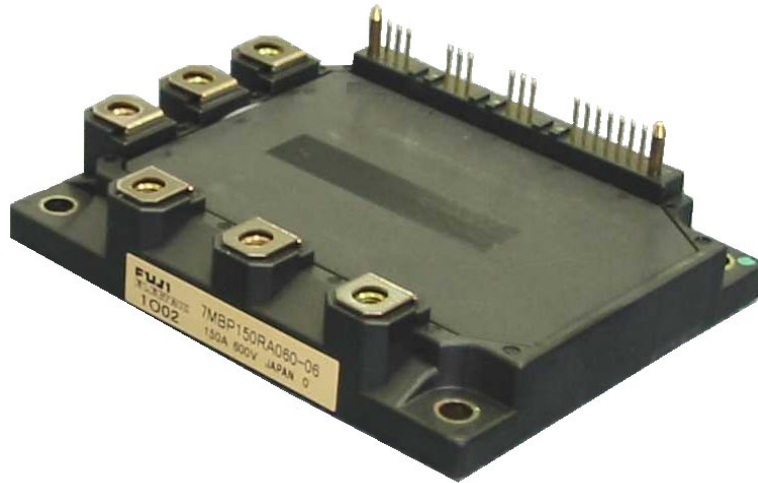
- Screw Terminal
- Monolithic Gate Driver
- On-chip Temperature Sensor

Econo IPM

- Compact & Thinner Package as Econo Module
- Monolithic Gate Driver
- On-chip Temperature Sensor

		<i>R – IPM3</i>	<i>Econo IPM</i>	<i>Econo Module</i>
<i>Terminal</i>	Main	Screw terminal	Pin terminal	Pin terminal
	Signal	Pin terminal	Pin terminal	Pin terminal
<i>Height of PCB</i>		22mm	17mm	17mm
<i>Dimensions</i> L × W × D(mm)		<i>P610,P611</i> 109 × 88 × 22	<i>P622</i> 122 × 55 × 17	<i>PC3,EP3</i> 122 × 62 × 17

Package comparison between R-IPM3 and Econo IPM



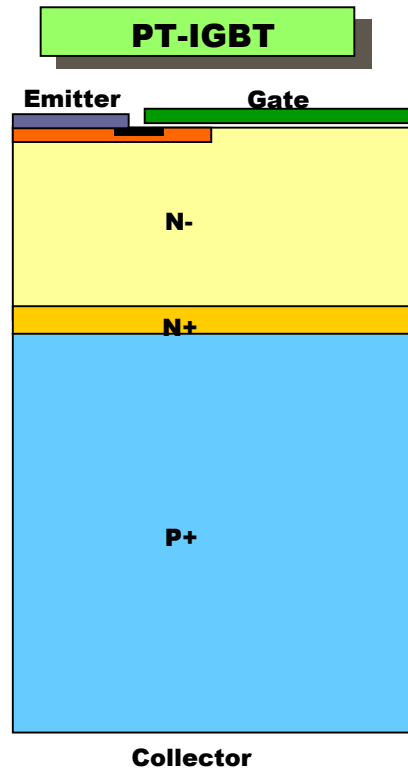
**R-IPM, R-IPM3
(Standard type)**



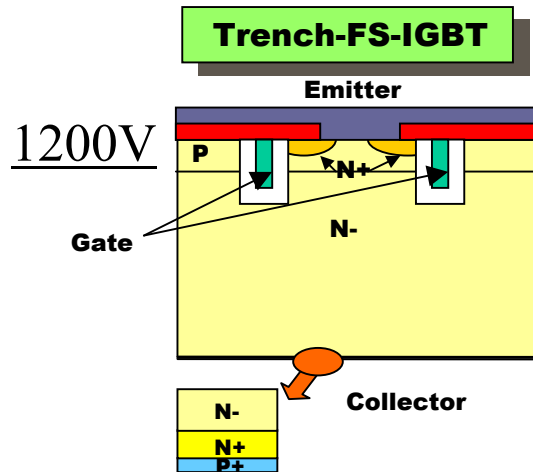
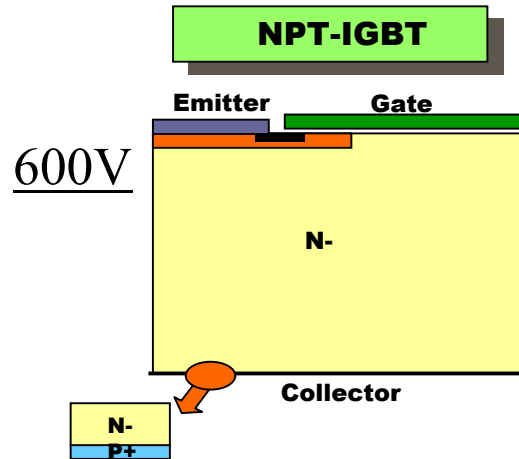
**Econo IPM
(Compact type)**

		<i>R – IPM3</i>	<i>Econo IPM</i>
<i>Terminal</i>	Main	Screw terminal	Pin terminal
	Signal	Pin terminal	Pin terminal
<i>Height of PCB</i>		22mm	17mm
<i>Dimensions</i> L × W × D(mm)		109 × 88 × 22	122 × 55 × 17

Comparison of cross section structures for IGBTs



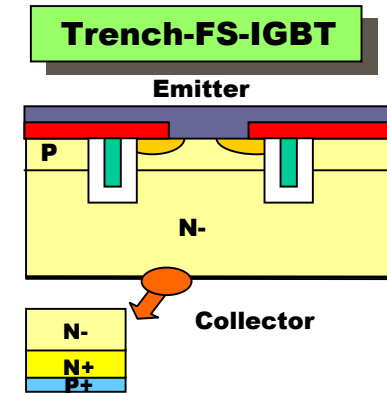
Conventional Process with Epi wafer



100 μ m Process with FZ wafer



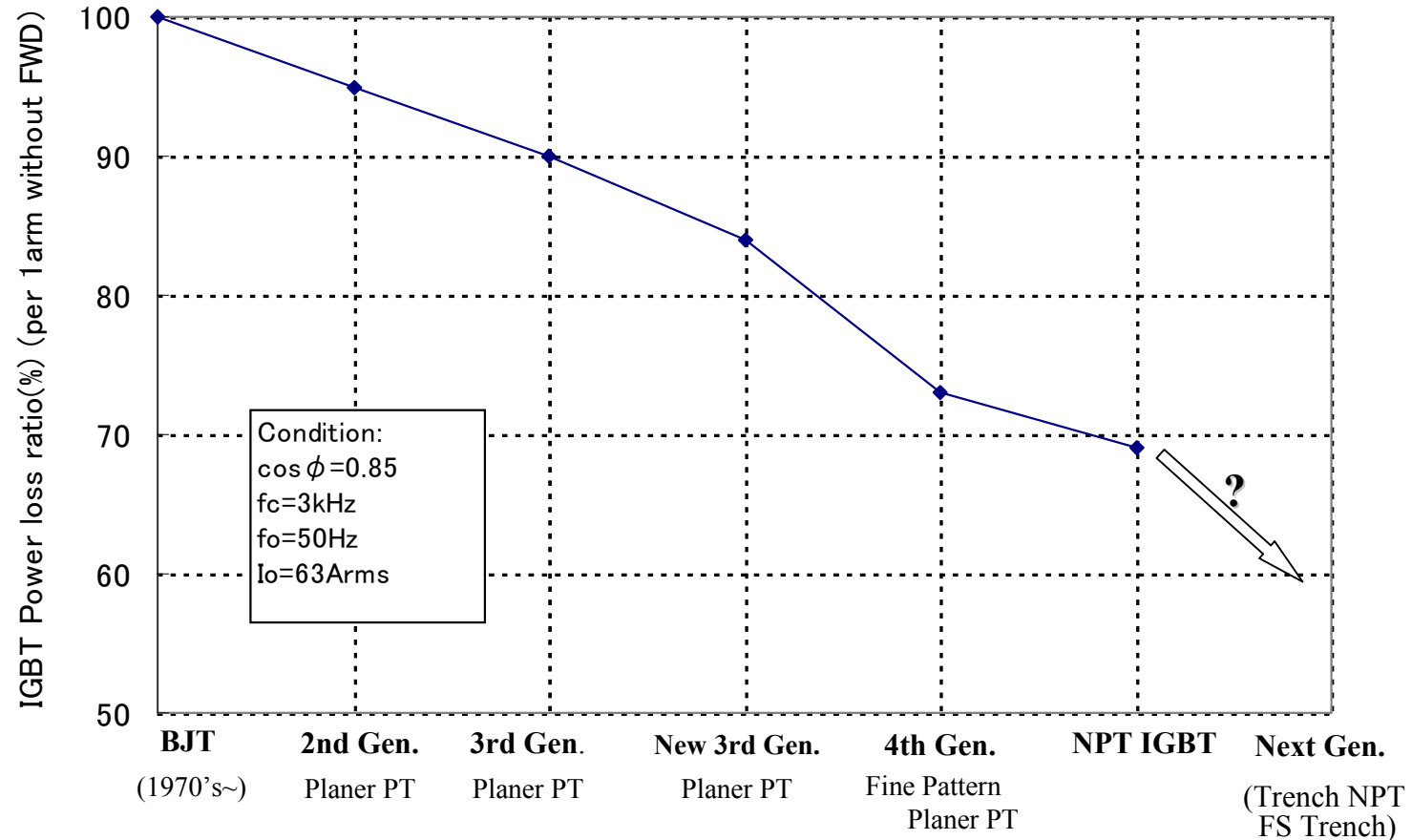
Next Gen.



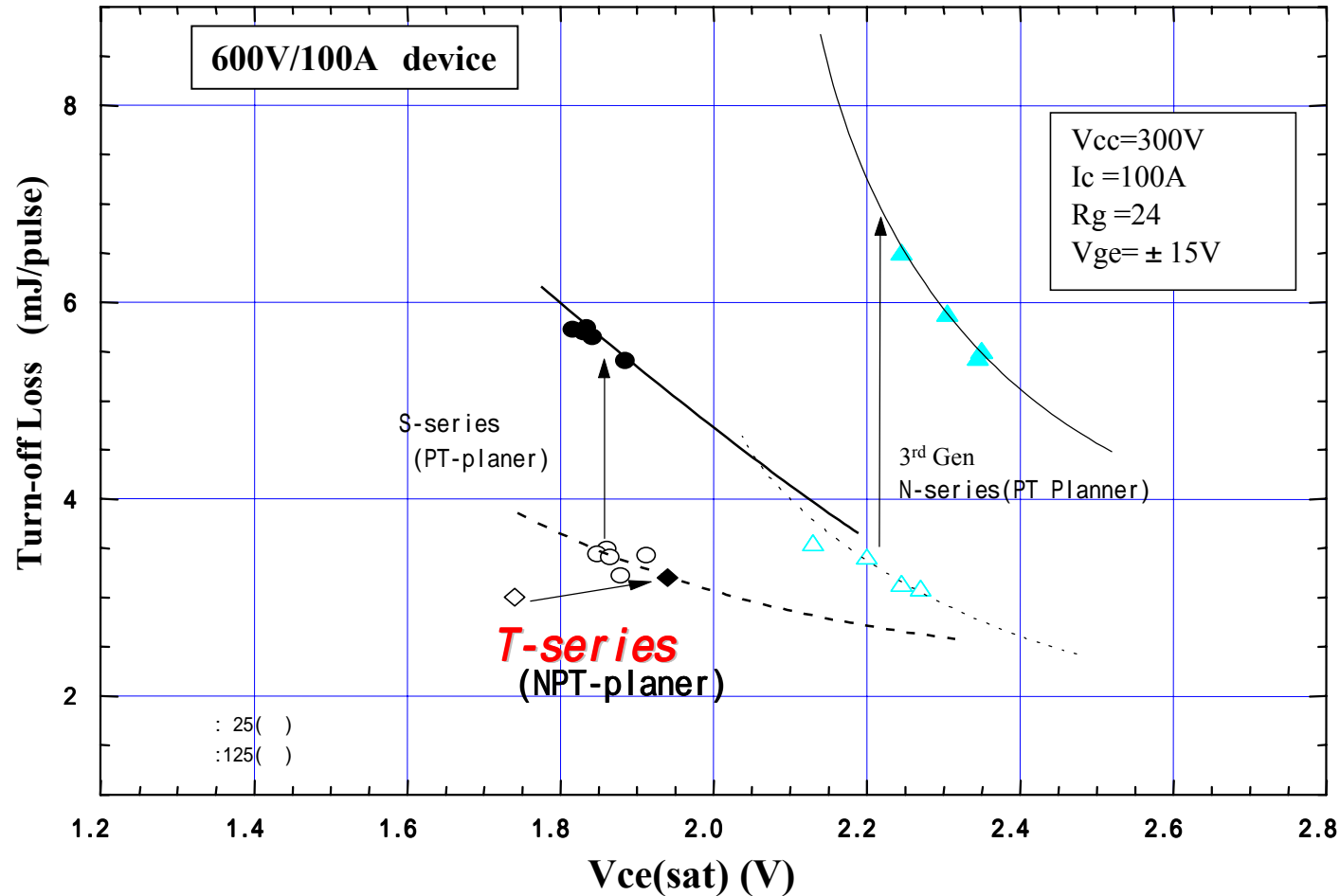
70 μ m Process for 600V IGBT

Power loss trend for IGBT

Power loss transition for IGBT (600V/150A)

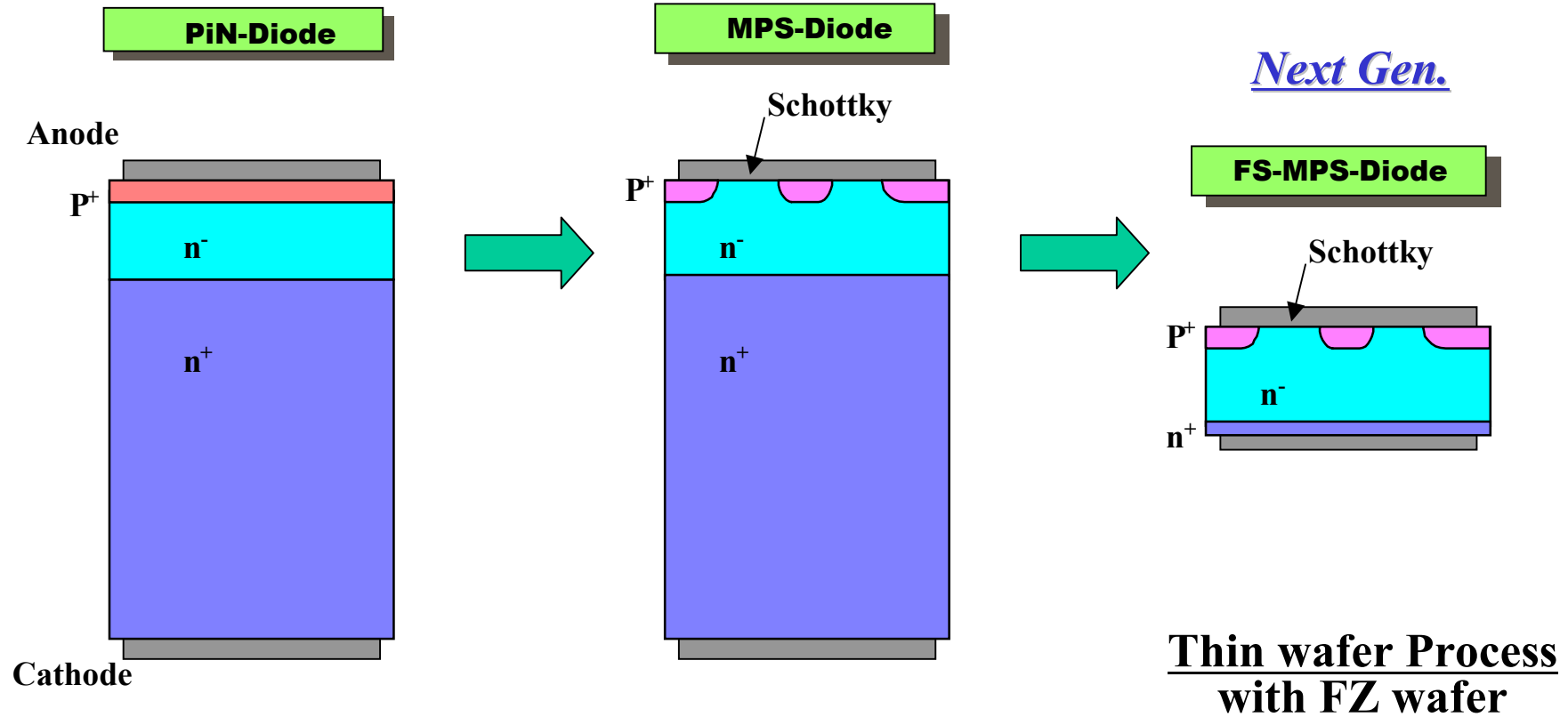


Features of the NPT-IGBT



Trade-off of Vce(sat) and Turn-off Loss

Comparison between MPS and PiN Diodes

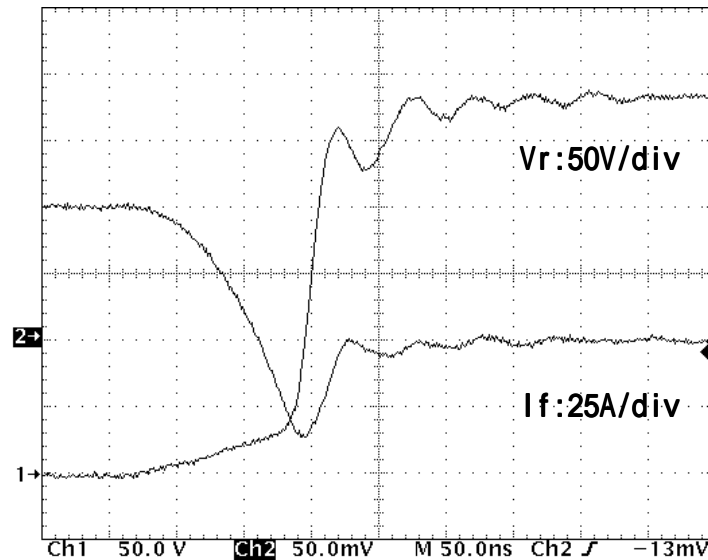


Conventional Process with Epi wafer

MPS: Merged PiN Schottky Diode

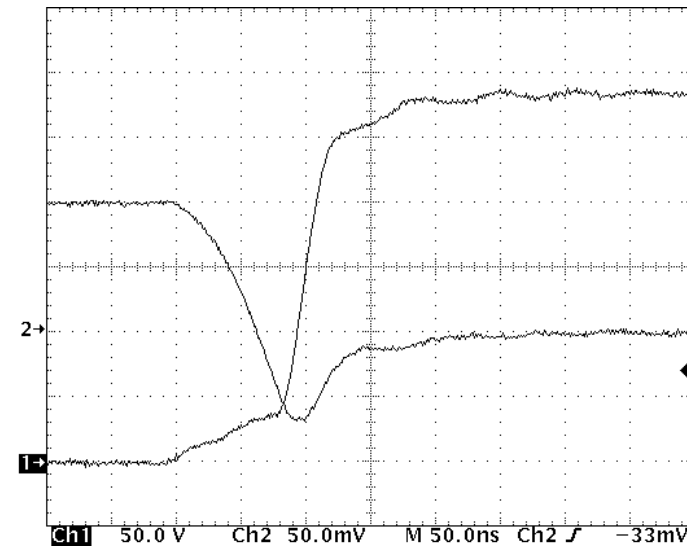
Soft-switching FWD

Conventional PiN Diode



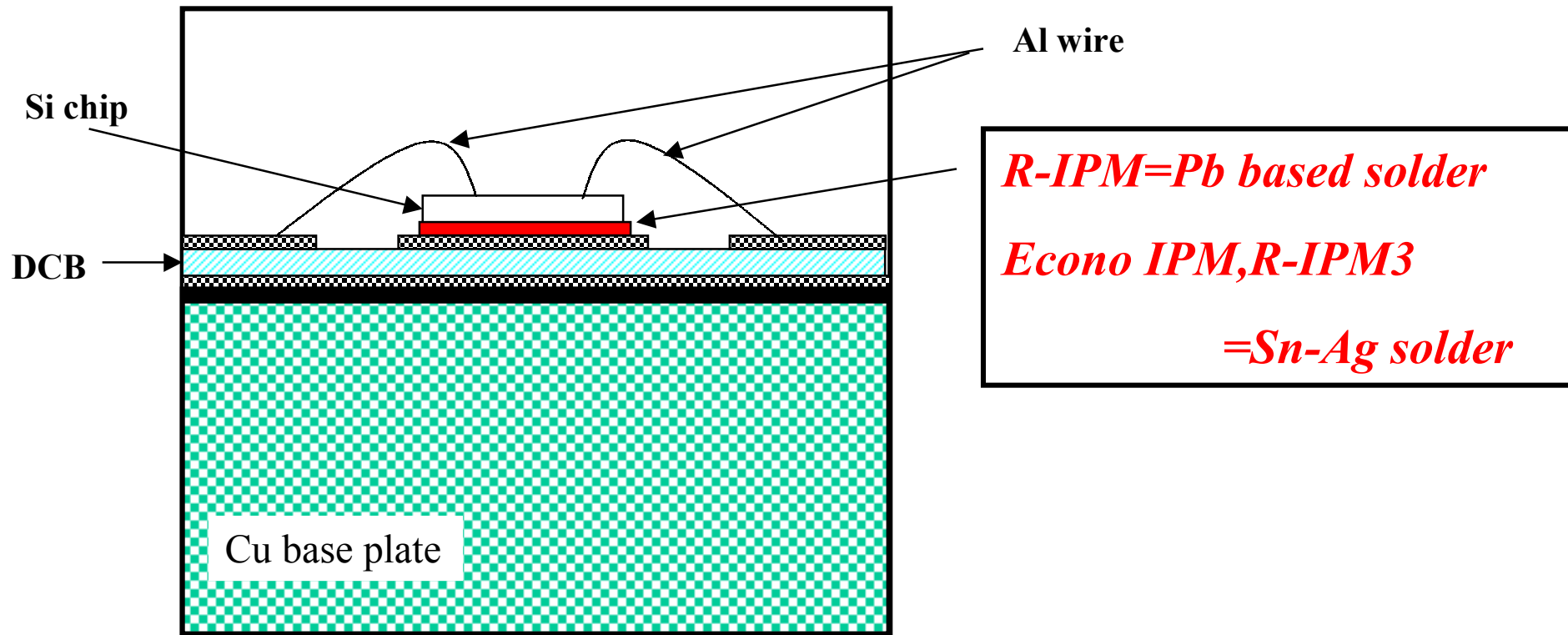
$dv/dt=9.8kV/\mu s$

MPS Diode

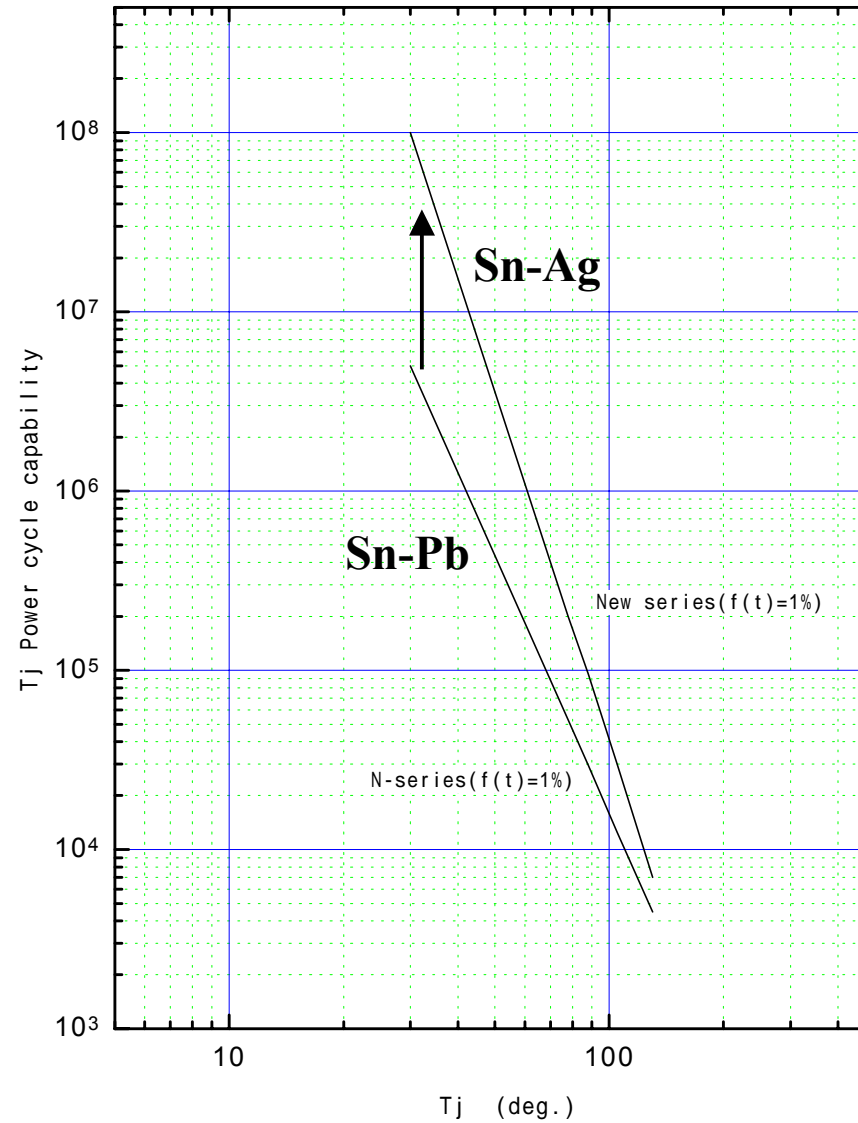


$dv/dt=6.8kV/\mu s$

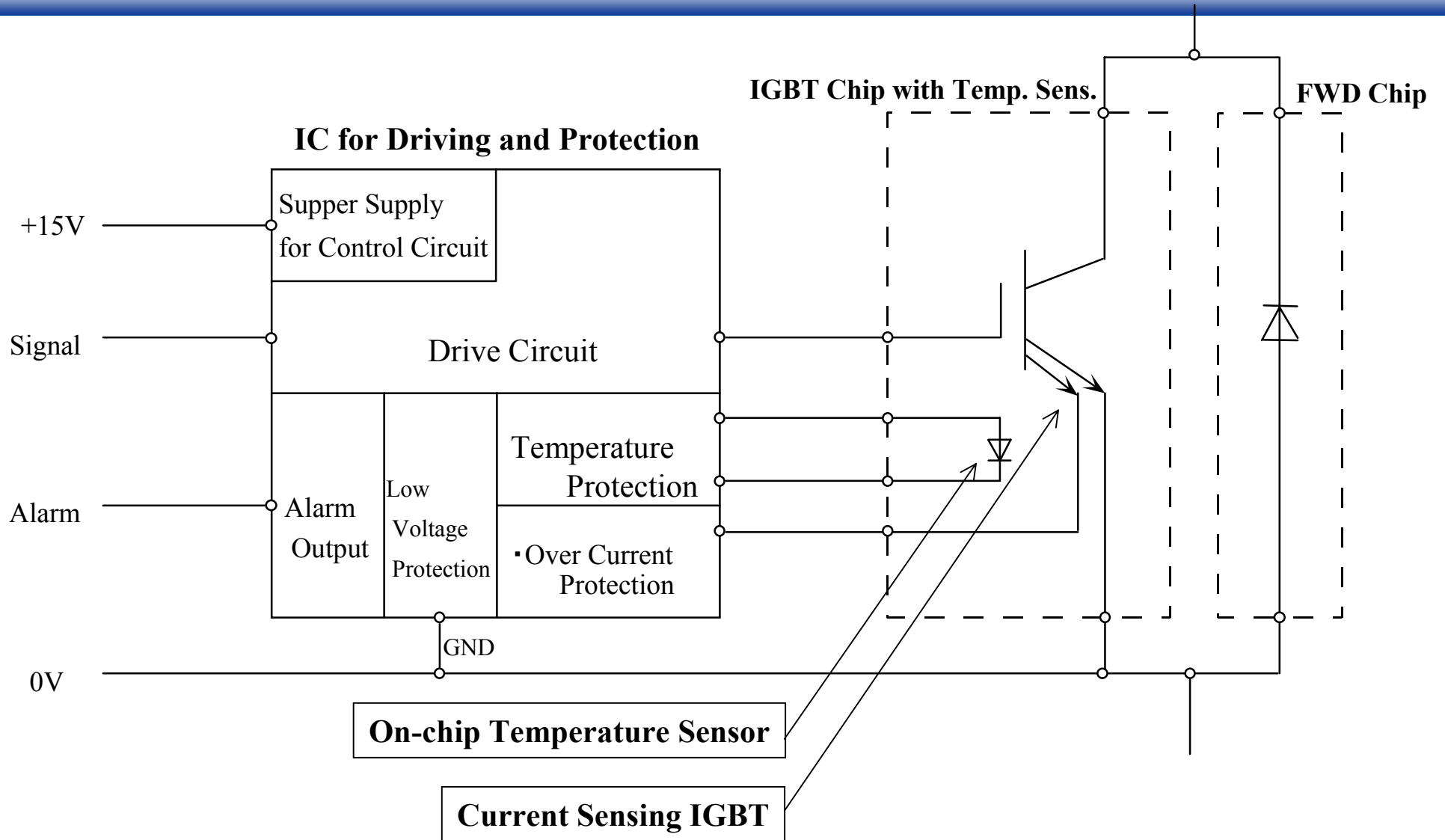
Improvement of power cycling withstand capability



Progress of Power cycle capability

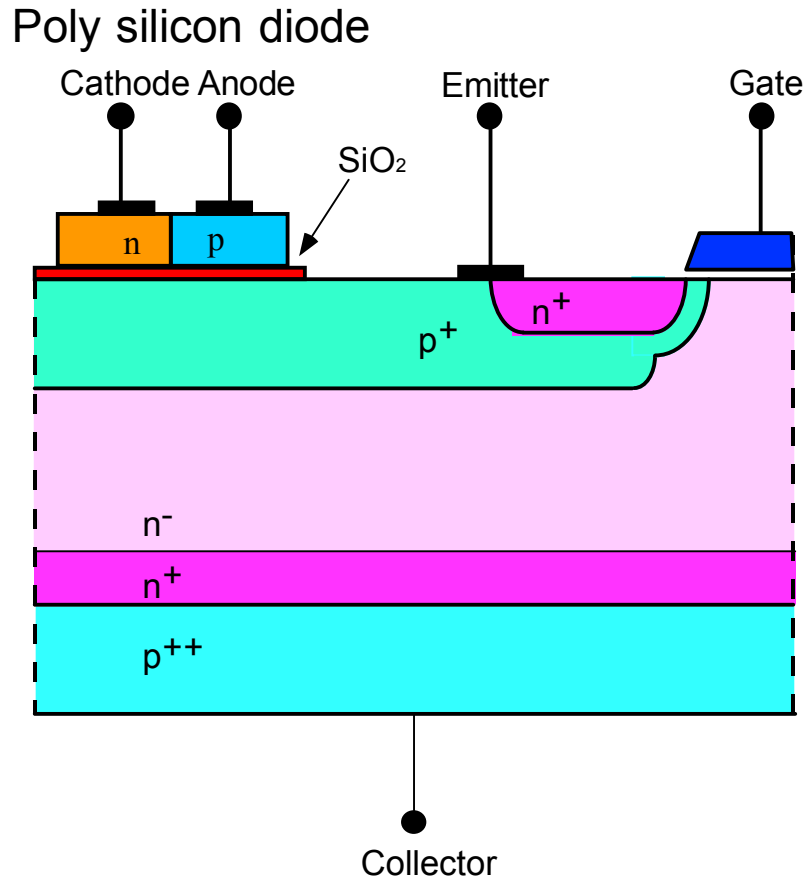


Function of the drive circuit in IPM

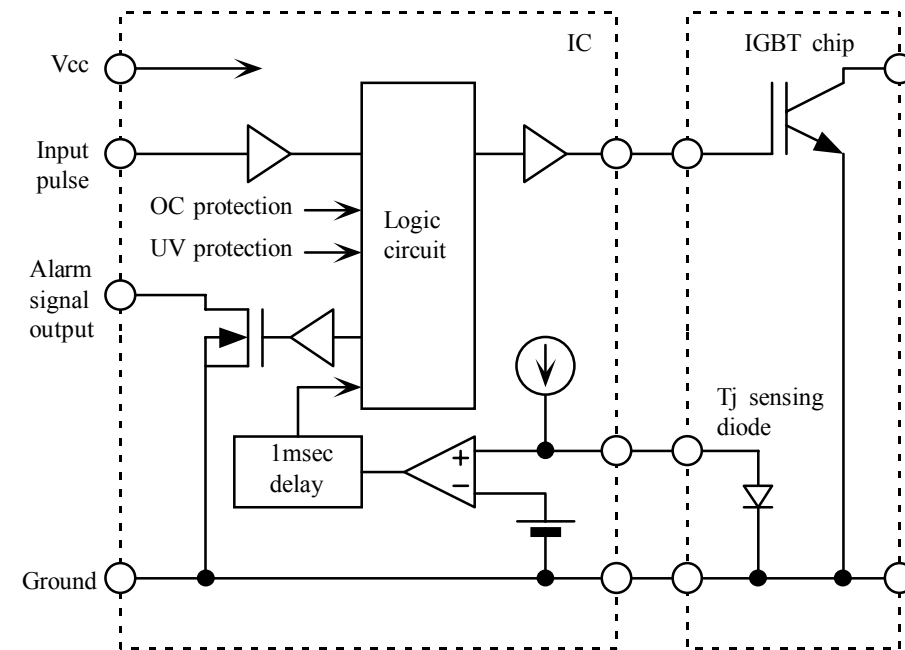


Tj Detecting Function

Cross section of IGBT chip

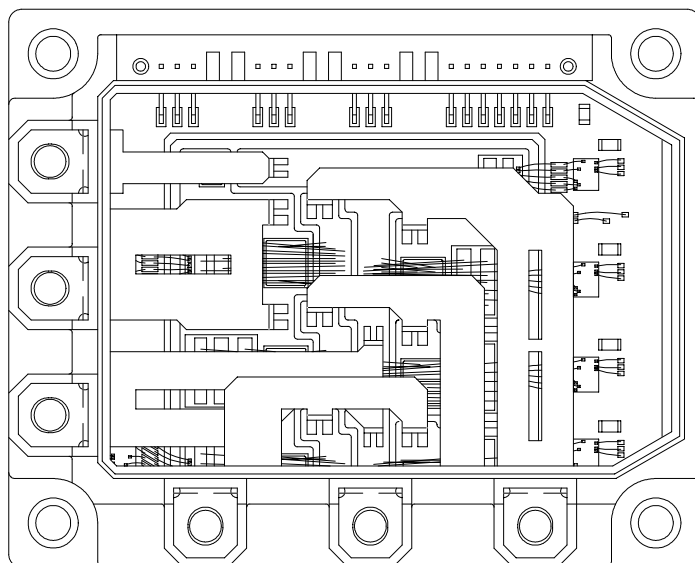


Equivalent circuit

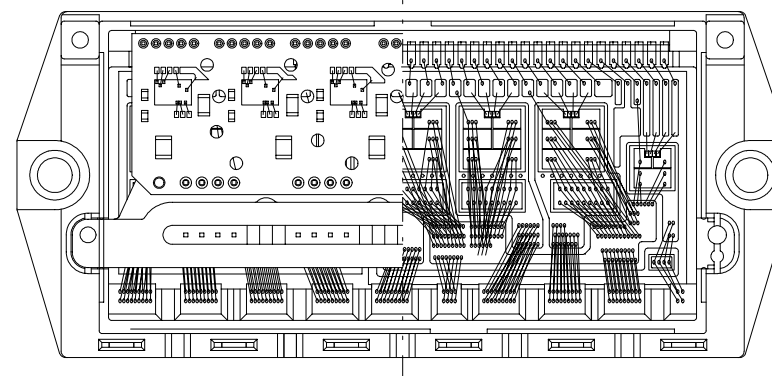


Internal Views of R-IPM3 and Econo IPM

R-IPM, R-IPM3



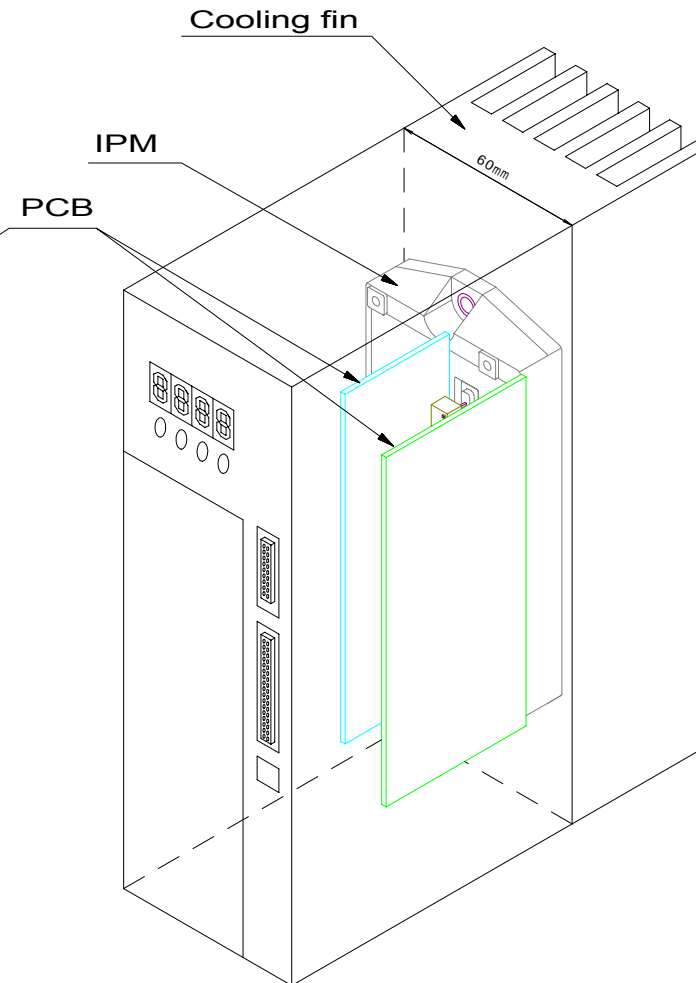
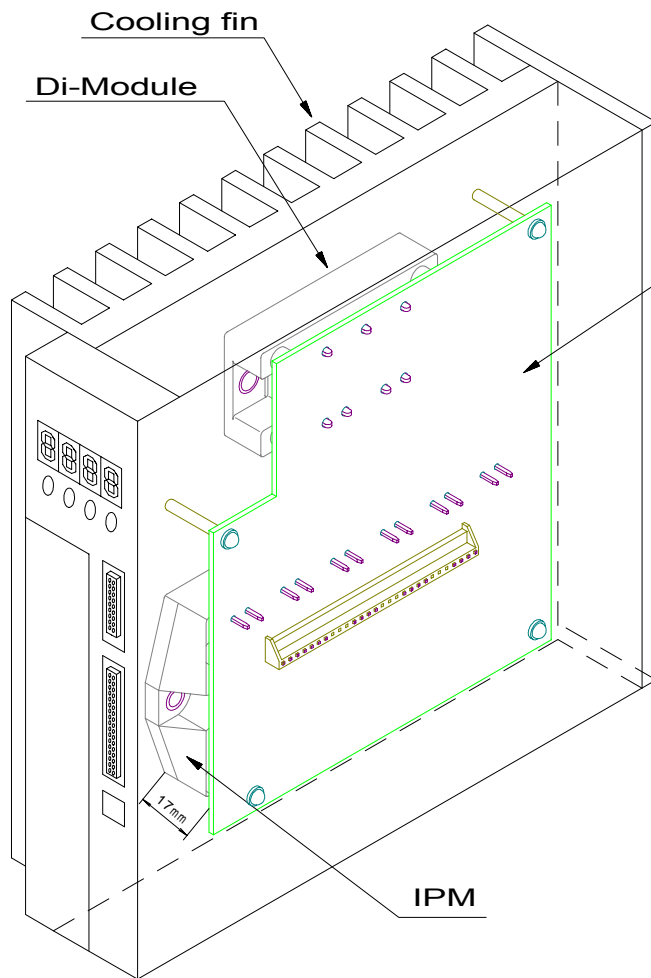
Econo-IPM



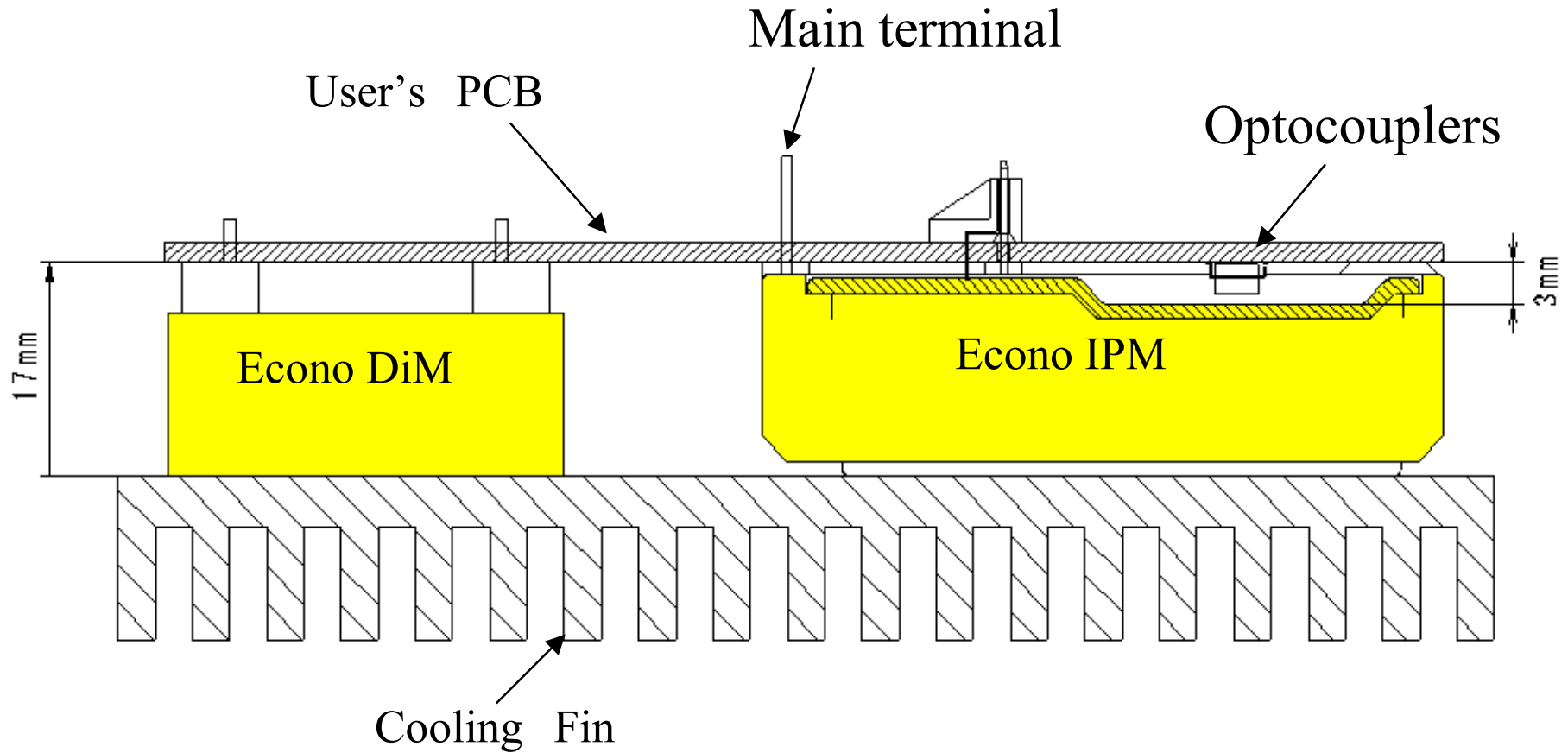
Installation of IPM in Servo Amp.

A cooling fin at the side of amplifier

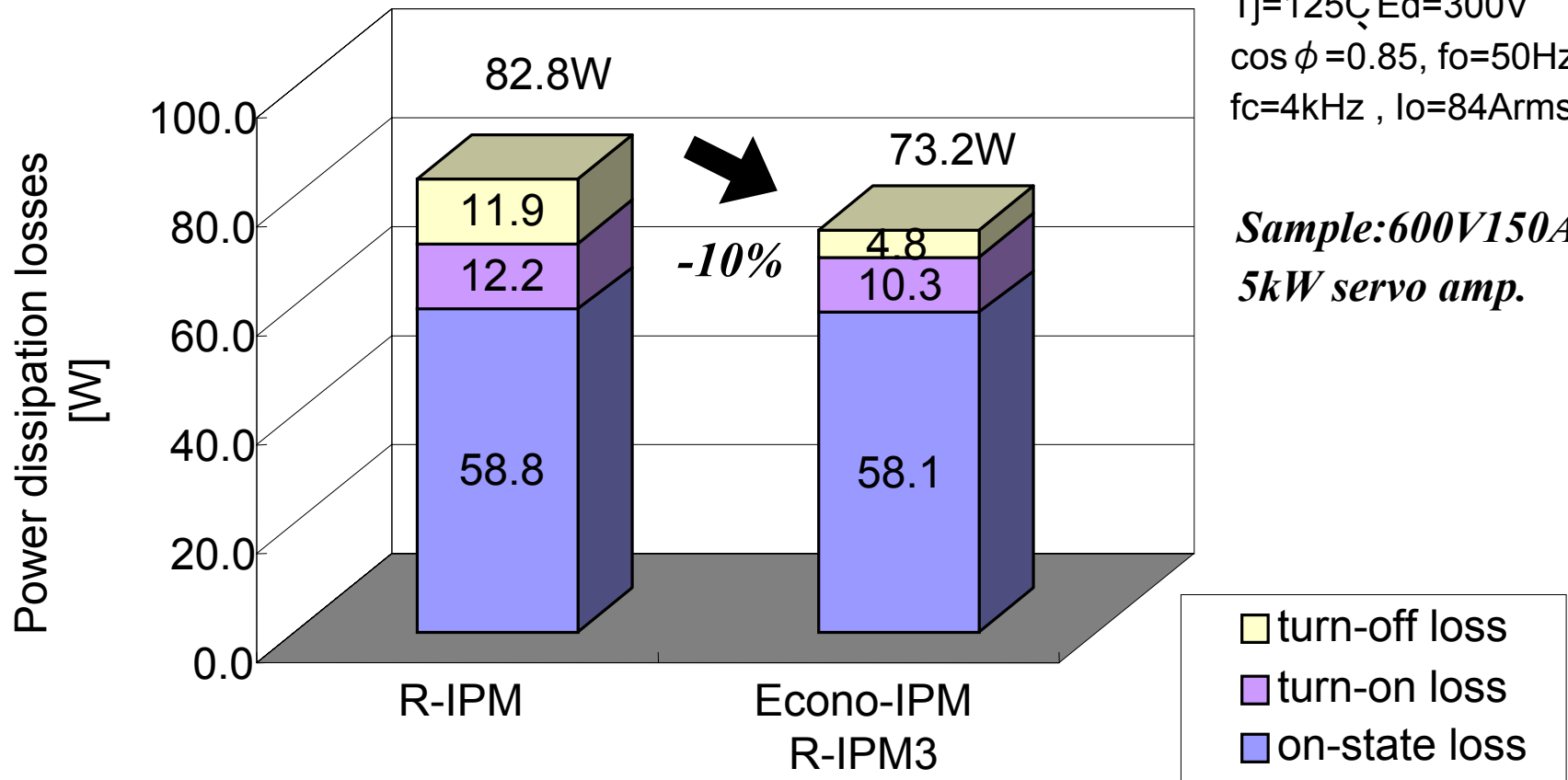
A cooling fin at the rear of amplifier



Installation image of IPM in side-fin

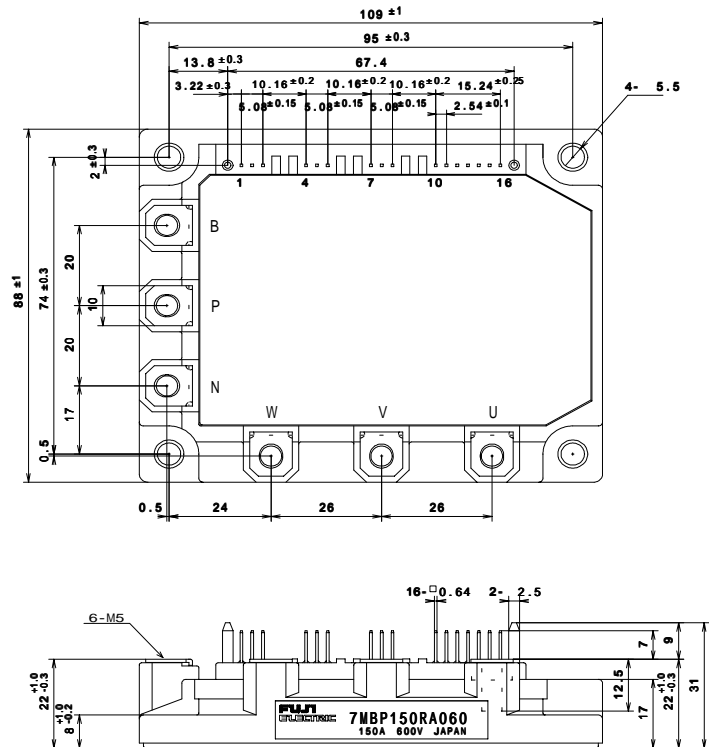


Improvement of Power dissipation loss

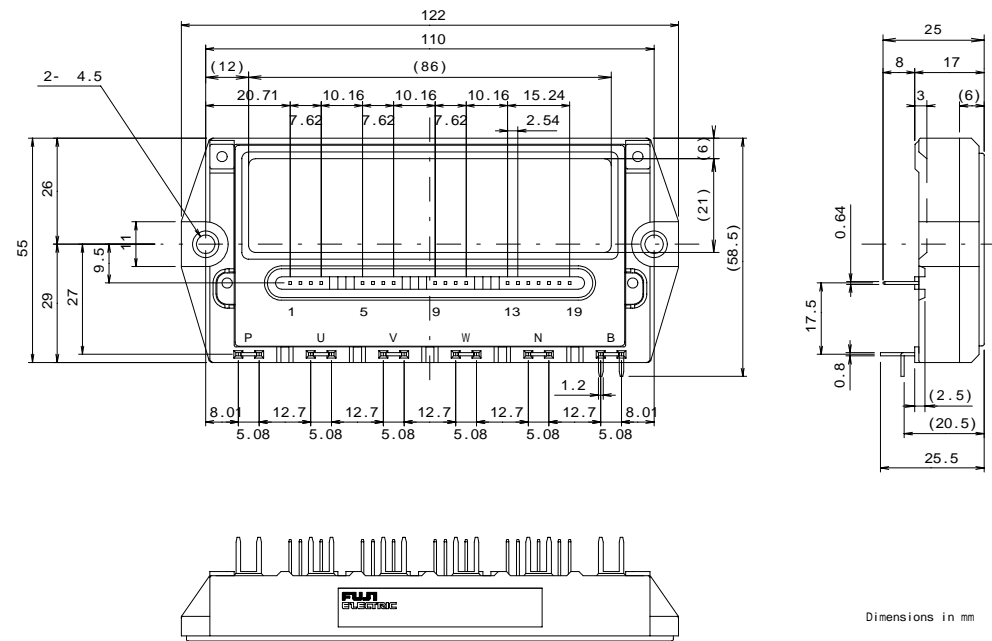


Package Comparison between R-IPM3 and Econo-IPM

< R-IPM, R-IPM3 >



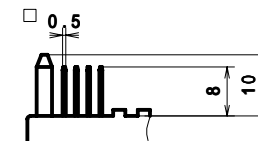
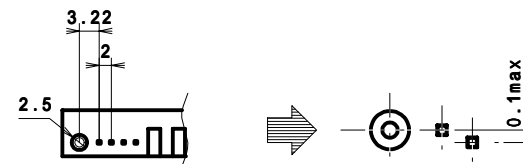
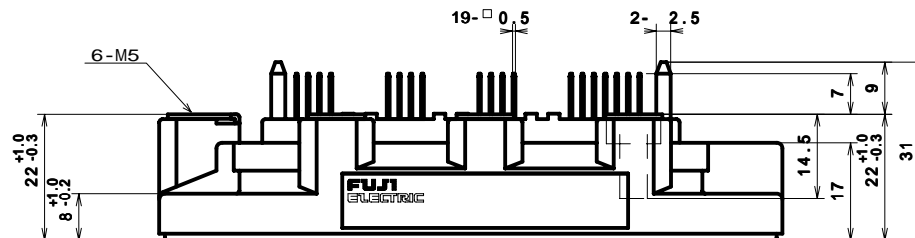
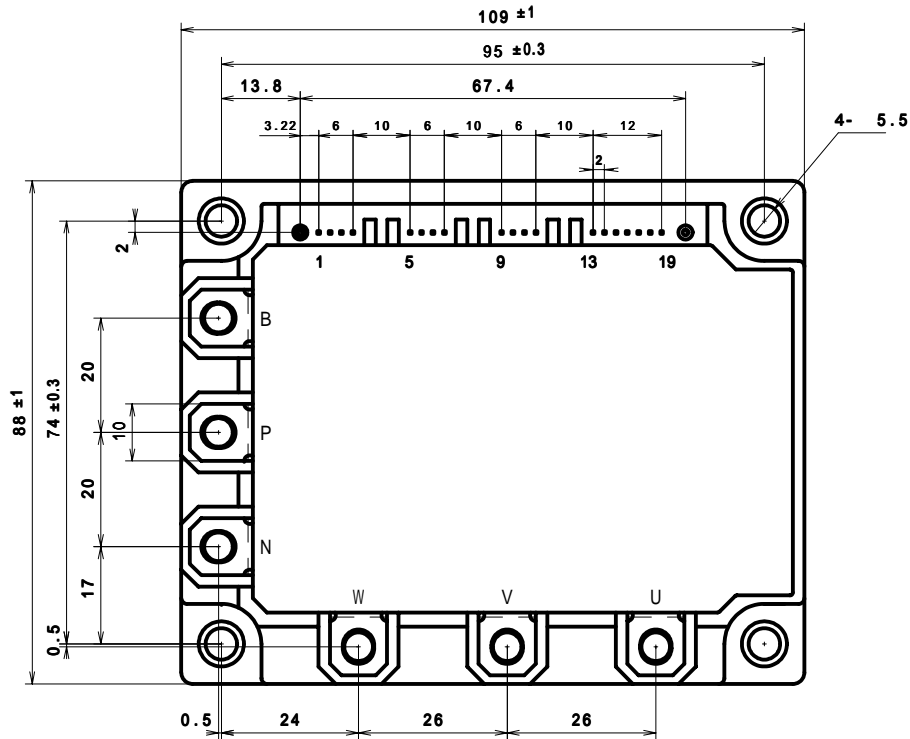
< Econo IPM >



Dimensions in mm

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R-IPM3 with upper arms alarm : Outline



Details of control terminals

Line-up of Econo IPM

		Econo-IPM		
		6in1	7in1	
600V	50A	6MBP50TEA060	7MBP50TEA060	
	75A	6MBP75TEA060	7MBP75TEA060	
	100A	6MBP100TEA060	7MBP100TEA060	
	150A	6MBP150TEA060	7MBP150TEA060	
1200V	25A	6MBP25UEA120	7MBP25UEA120	* 1
	50A	6MBP50UEA120	7MBP50UEA120	* 1
	75A	6MBP75UEA120	7MBP75UEA120	* 1

Note *1 1200V25A to 75A will be developed by April of 2003.

Line-up of R-IPM and R-IPM3



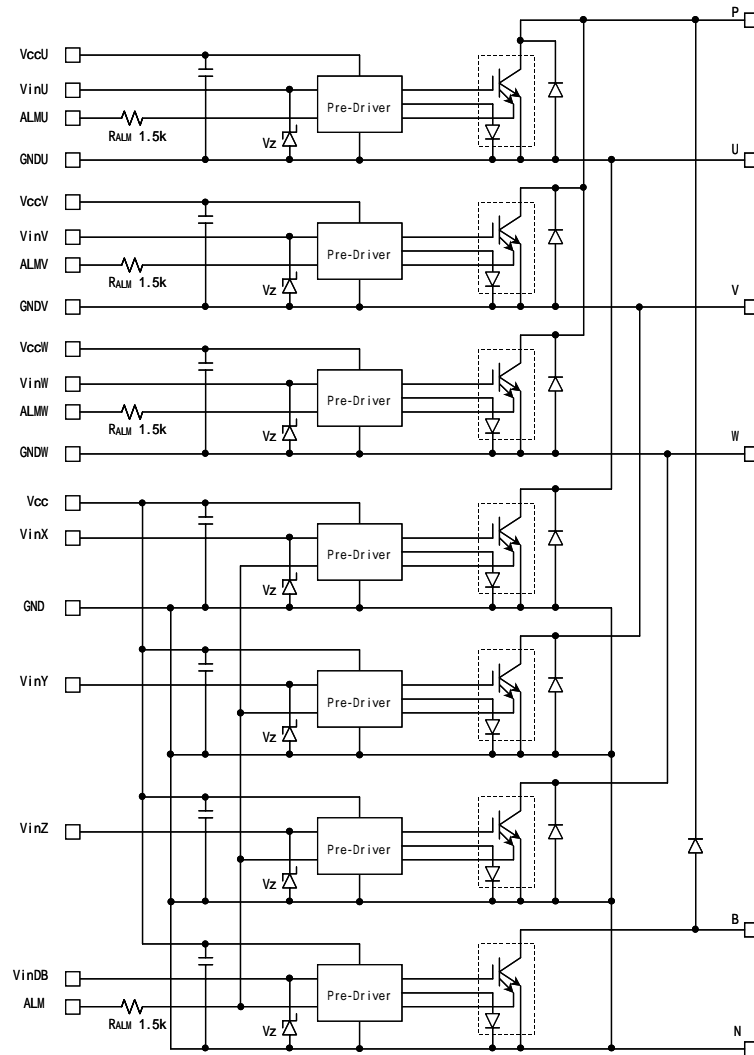
		R-IPM		R-IPM3		R-IPM3 with upper arm alarm	
		6in1	7in1	6in1	7in1	6in1	7in1
600V	50A	6MBP50RA060	7MBP50RA060	6MBP50RTB060	7MBP50RTB060	6MBP50RTJ060	7MBP50RTJ060
	75A	6MBP75RA060	7MBP75RA060	6MBP75RTB060	7MBP75RTB060	6MBP75RTJ060	7MBP75RTJ060
	100A	6MBP100RA060	7MBP100RA060	6MBP100RTB060	7MBP100RTB060	6MBP100RTJ060	7MBP100RTJ060
	150A	6MBP150RA060	7MBP150RA060	6MBP150RTB060	7MBP150RTB060	6MBP150RTJ060	7MBP150RTJ060
	200A	6MBP200RA060	7MBP200RA060				
	300A	6MBP300RA060	7MBP300RA060				

		R-IPM		R-IPM with upper arm alarm	
		6in1	7in1	6in1	7in1
1200V	25A	6MBP25RA120	7MBP25RA120	6MBP25RJ120	7MBP25RJ120
	50A	6MBP50RA120	7MBP50RA120	6MBP50RJ120	7MBP50RJ120
	75A	6MBP75RA120	7MBP75RA120	6MBP75RJ120	7MBP75RJ120
	100A	6MBP100RA120	7MBP100RA120		
	150A	6MBP150RA120	7MBP150RA120		

Quality is our message



IPM with upper alarm : Block Diagram & Terminal



Main circuit

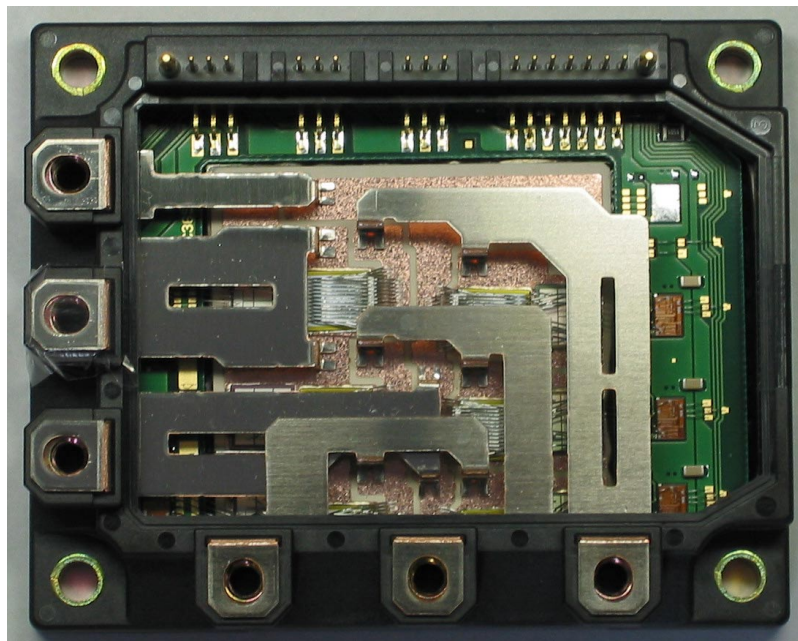
Symbol	Description
P	Positive input supply voltage.
U	Output (U).
V	Output (V).
W	Output (W).
N	Negative input supply voltage.
B	Collector terminal of Brake IGBT.

Control circuit

No.	Symbol	Description
①	GNDU	High side ground (U).
②	ALMU	High side alarm signal output (U).
③	VinU	Logic input for IGBT gate drive (U).
④	VccU	High side supply voltage (U).
⑤	GNDV	High side ground (V).
⑥	ALMV	High side alarm signal output (V).
⑦	VinV	Logic input for IGBT gate drive (V).
⑧	VccV	High side supply voltage (V).
⑨	GNDW	High side ground (W).
⑩	ALMW	High side alarm signal output (W).
⑪	VinW	Logic input for IGBT gate drive (W).
⑫	VccW	High side supply voltage (W).
⑬	GND	Low side ground.
⑭	Vcc	Low side supply voltage.
⑮	VinDB	Logic input for Brake IGBT gate drive.
⑯	VinX	Logic input for IGBT gate drive (X).
⑰	VinY	Logic input for IGBT gate drive (Y).
⑱	VinZ	Logic input for IGBT gate drive (Z).
⑲	ALM	Low side alarm signal output.

Internal Views of R-IPM3 and Econo IPM

R-IPM, R-IPM3



Econo-IPM

