



shaping tomorrow with you

# FUJITSU Component Relay Automotive Relays

June 2016

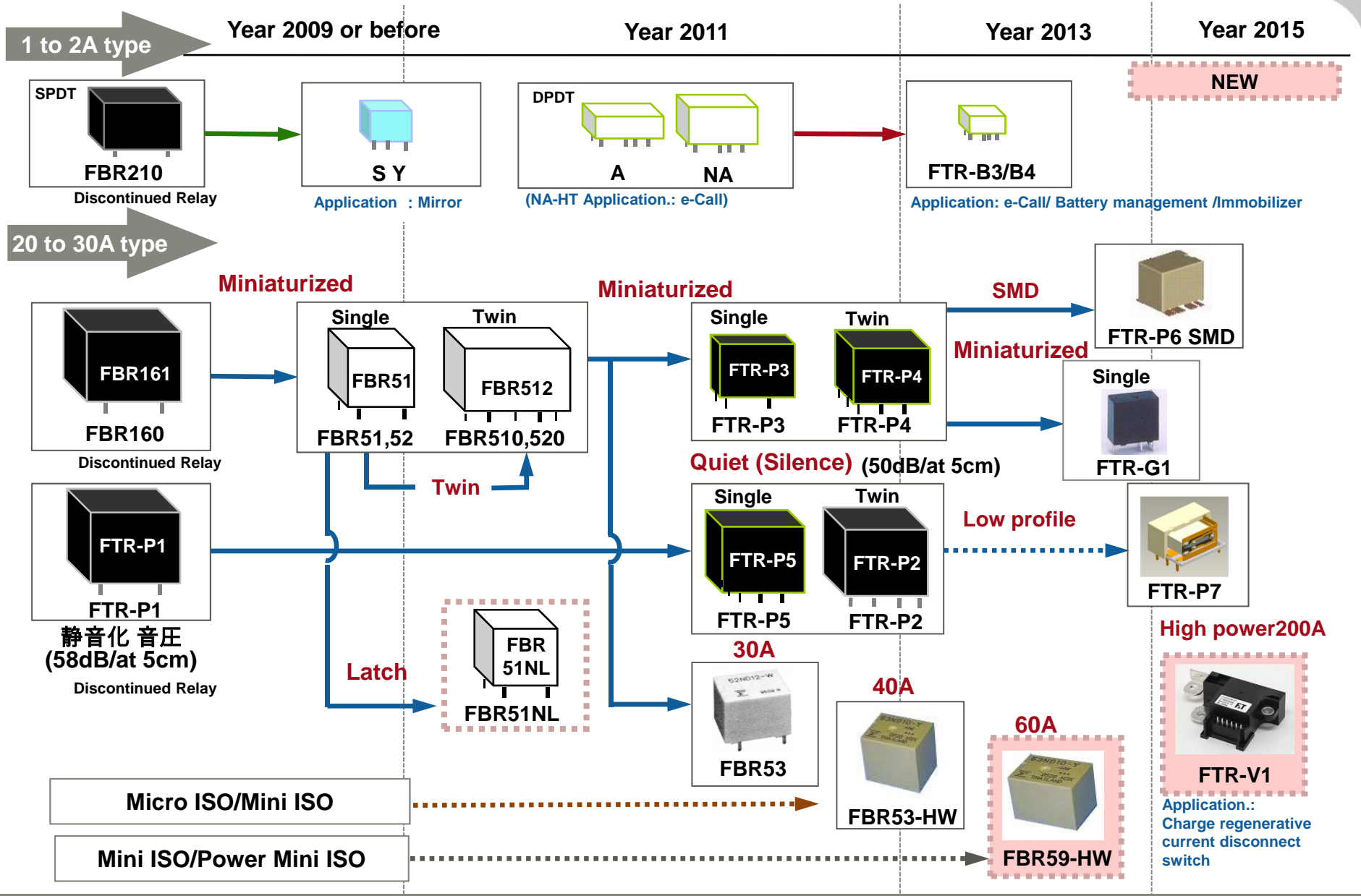
FUJITSU COMPONENT LIMITED

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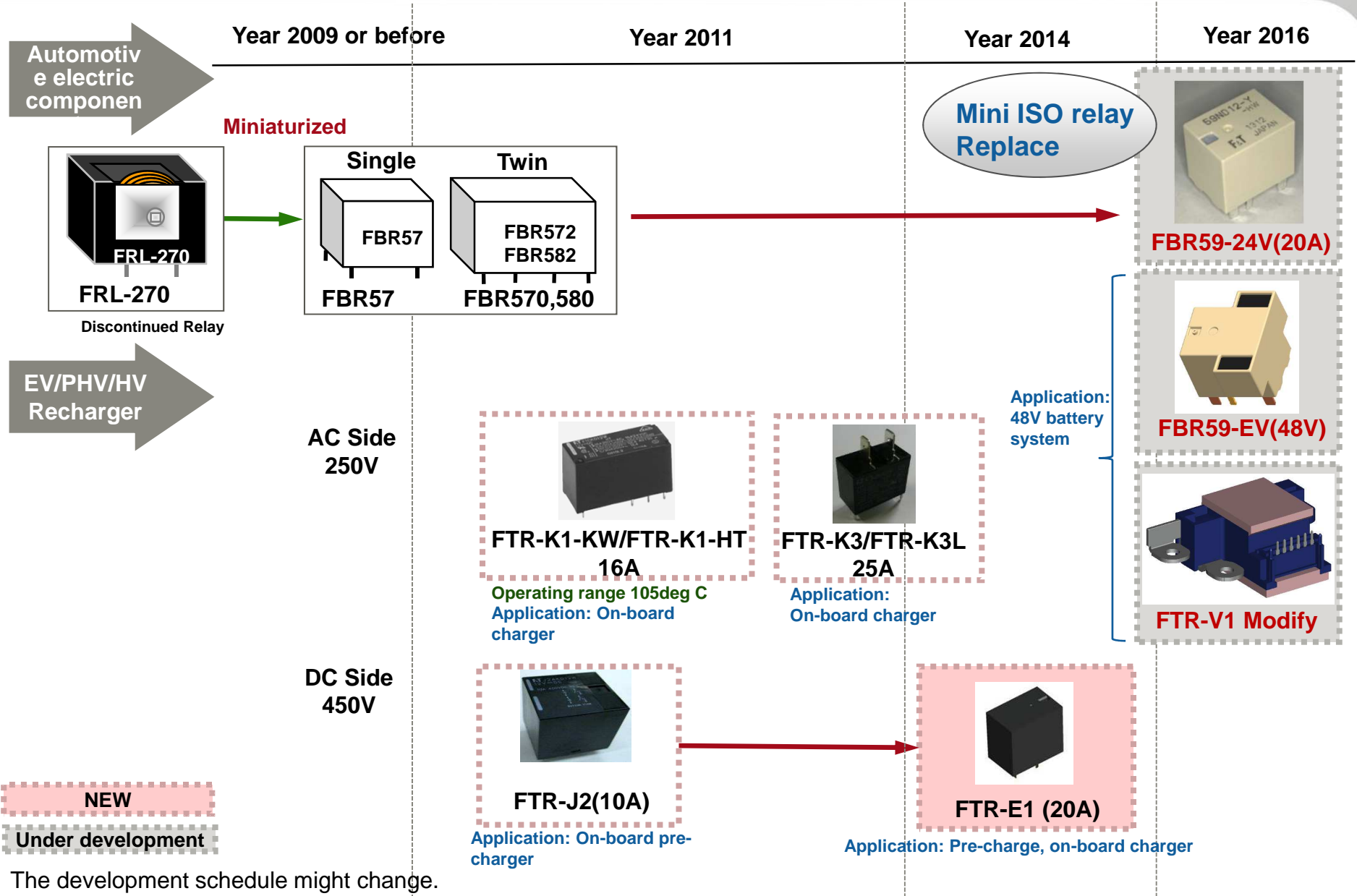
“FCL” in this document stands for FUJITSU COMPONENT LIMITED

1. Expand **higher-capacity relays for junction boxes** which are becoming smaller and lighter.  
(e.g. DC14V/60A class P.C.B relay).
2. Expand **ultra-quiet relays for cabins**: EVs and idling-cut trends require increased quietness (e.g. 45dB/5cm)
3. Expand relays for **regenerative energy systems** and **power supplies**.

# Automotive Relay Roadmap (1)

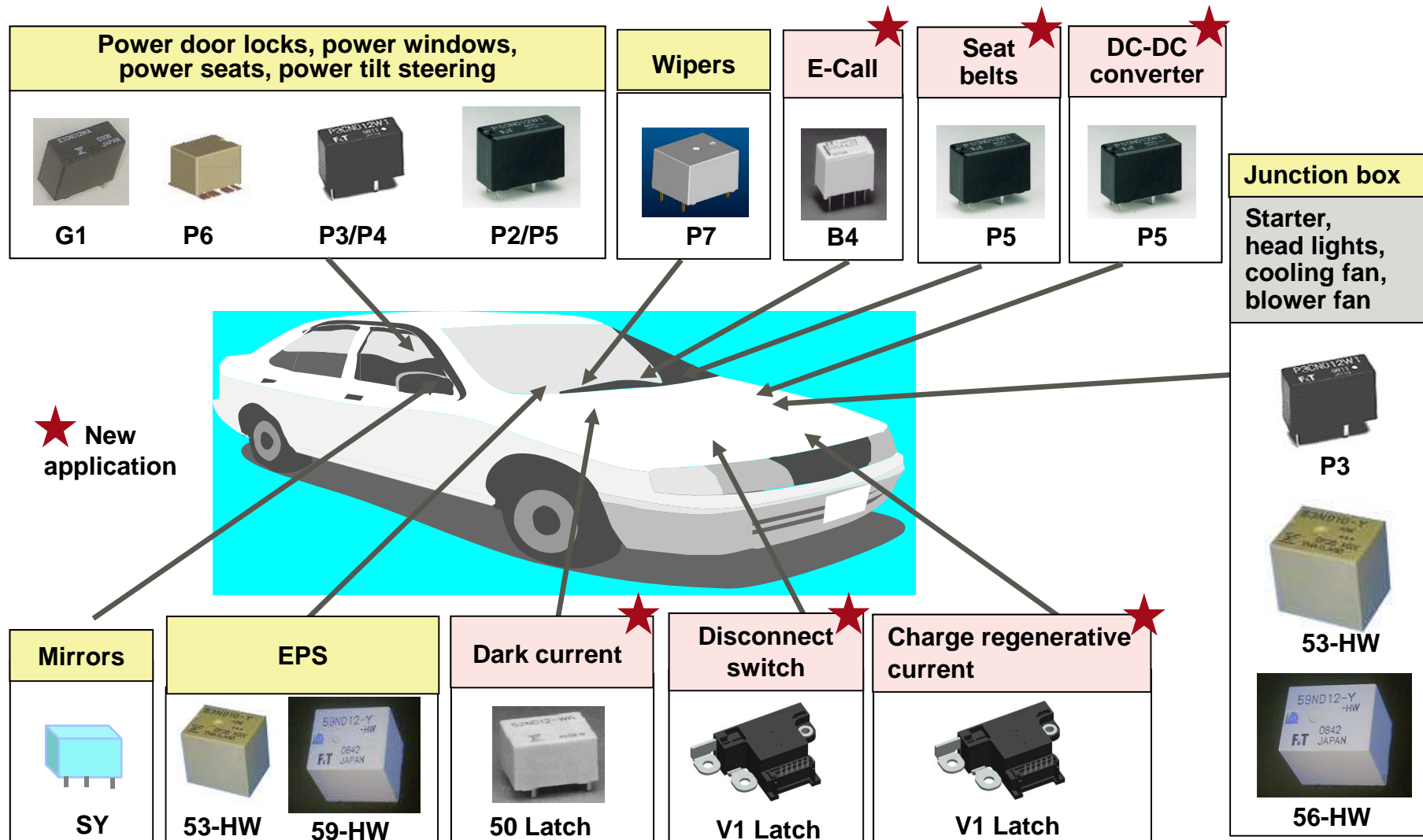


# Automotive Relay Roadmap (2)



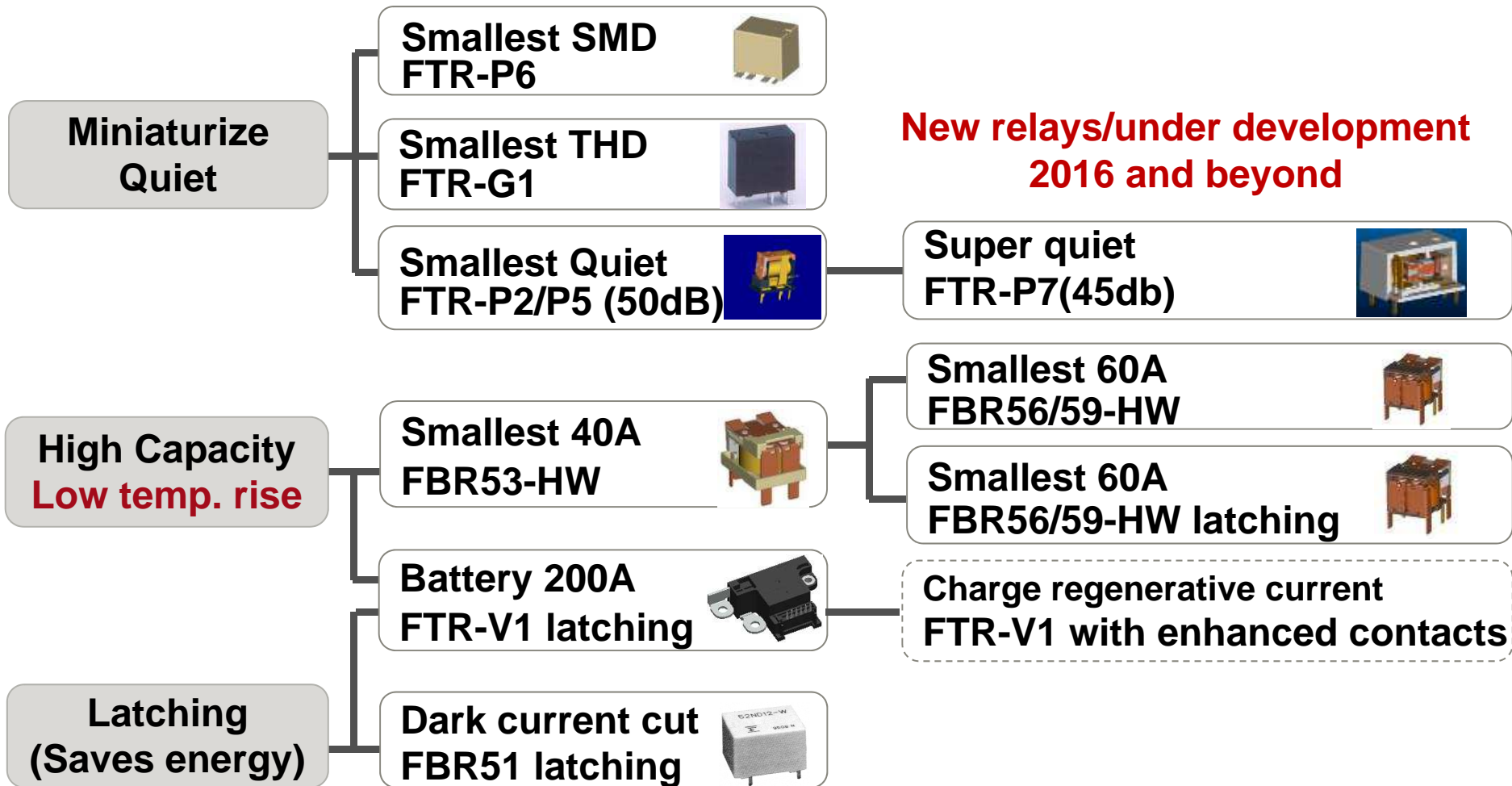
# Primary Applications for Automotive Relays

Environmental requirements & improvement of safety functions create new relay applications → **relay usage increases from 35pcs to 45pcs/vehicle**



# Roadmap of Automotive Relays

## Launched



# Fujitsu Automotive Relay Selection Table



Relay type	Current area	Contact form	Application				Fuse matching
			Motor	Lamp / Capacitor	Solenoid	Resistance	
FTR-V1 (Latching)	100A or more	1 Form A	○	○	○	○	60A or more
FBR59/56-HW	up to 60A	1 Form U / 1 Form C	○	○	○	○	60A
FBR53-HW	up to 40A	1 Form U	○	○	○	○	40A
FBR53	up to 30A	1 Form U	○	○	○	○	30A
FBR51	up to 25A	1 Form C	○	○	△	○	
FTR-P3 / P4		1 Form C / 1 Form C X 2	○	○	△	○	
FTR-G1		1 Form C	○	△	△	○	
FTR-P5 / P2 (Quiet relay)	up to 25A	1 Form C / 1 Form C X 2	○	△	△	○	25A
FTR-P7 (Quiet relay)		1 Form C	○	△	△	○	25A

○: Best for the application, △: Possible to use

# From Plug-in Relays to PCB Relays

For Miniaturization and Reduced Weight in ECUs & Power Distribution Boxes



# Trend of Relays for Junction Boxes, Relay Boxes



## FBR56/59-HW PCB relays for heavy duty applications

### Plug-in relays

Power Mini ISO



14,300mm<sup>3</sup> 32gr

Miniature  
Light weight

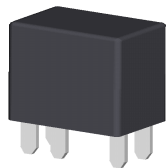
Mini ISO



14,300mm<sup>3</sup> 32gr

Miniature  
Light weight

Micro ISO



5,300mm<sup>3</sup> 15-20gr

Miniature  
Light weight

### Fujitsu PCB relays

FBR59-HW  
1Form U/A 60A



4,860 mm<sup>3</sup> 13gr

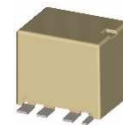
FBR56-HW  
1FormC 60A

FBR53-HW  
1Form U 40A



2,569 mm<sup>3</sup> 6gr

FTR-P6  
25A



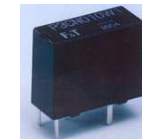
1,112mm<sup>3</sup>  
3gr

FTR-G1  
25A



1,220mm<sup>3</sup>  
3.5gr

FTR-P3  
25A



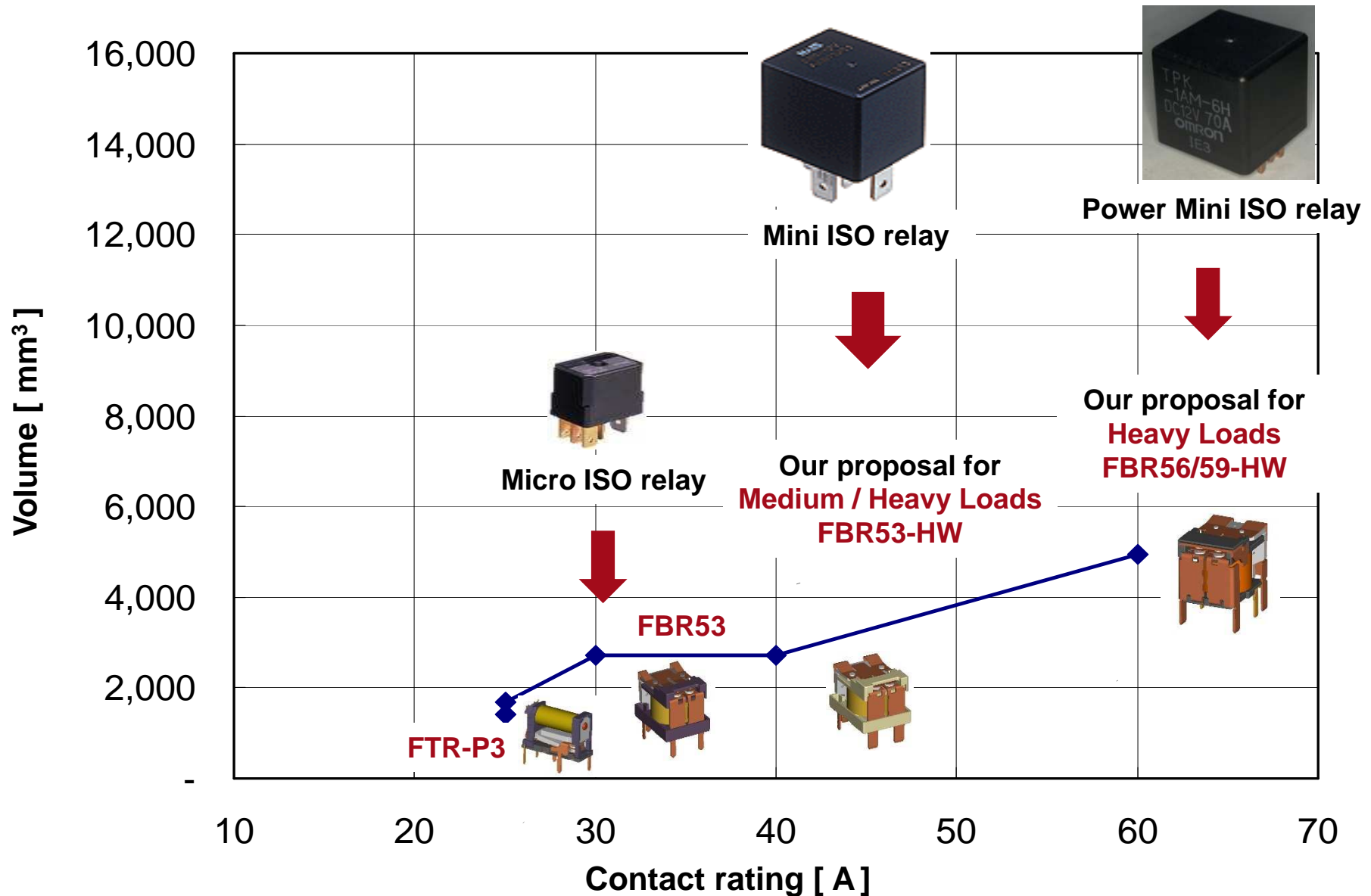
1,692mm<sup>3</sup>  
5gr

FBR53  
30A



2,569mm<sup>3</sup>  
6gr

# Position of New High-Power FBR56/59-HW Relays



# Recommended Relays for Junction Boxes & PDU's



## Junction Boxes & Relay Boxes

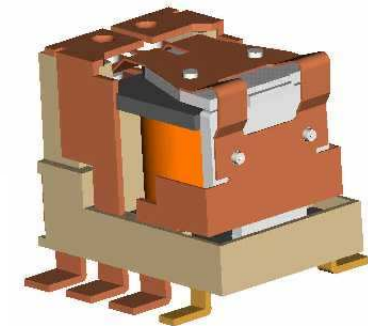
Application	Recommendation		Contact arrangement	Contact rating
	Dip solder type	Through hole reflow		
Horn	FTR-P3CN012W1	FTR-P3CN012W1-06	1 Form C	DC14V-25A
Cornering Light	FTR-P3CN012W1	FTR-P3CN012W1-06	1 Form C	DC14V-25A
Head Light	FBR53ND12-Y	FBR53ND12-Y-RW	1 Form U	DC14V-30A
Fog Light	FBR53ND12-Y	FBR53ND12-Y-RW	1 Form U	DC14V-30A
Fuel Injection	FBR53ND12-Y	FBR53ND12-Y-RW	1 Form U	DC14V-30A
Defog	FBR53ND12-Y	FBR53ND12-Y-RW	1 Form U	DC14V-30A
Heater	FBR53ND12-Y-HW	FBR53ND12-Y-HW-RW	1 Form U	DC14V-40A
Ignition	FBR53ND12-Y-HW	FBR53ND12-Y-HW-RW	1 Form U	DC14V-40A
Starter	FBR53ND12-Y-HW	FBR53ND12-Y-HW-RW	1 Form U	DC14V-40A
Air Conditioning	FBR53ND12-Y-HW	FBR53ND12-Y-HW-RW	1 Form U	DC14V-40A
Cooling Fan	FBR59ND12-Y-HW	FBR59ND12-Y-HW-RW	1 Form U	DC14V-60A

## Power Distribution

Application	Recommendation		Contact arrangement	Contact rating
	Dip solder type	Through hole reflow		
DC-DC Convertor	FTR-P3CN012W1	FTR-P3CN012W1-06	1 Form C	DC14V-25A
Re-generative braking system	FBR59NL12-Y-HW	FBR59NL12-Y-HW-RW	1 Form U	DC14V-60A
	FTR-V1(Screw stop)	-	1 Form A or B	DC14V-200A

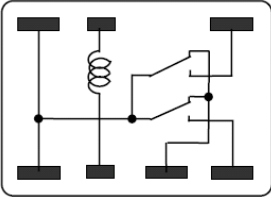
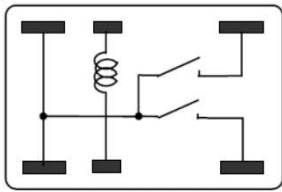
# Characteristics of FBR56-HW & FBR59-HW (1)

- **Smallest Heavy Load Relay**  
Dimension : **20x15x16.2 mm**  
Volume ratio is **23% of Mini ISO relay**
- **Large Carrying Current Capability**  
FBR56-HW (1 form C) : **60A**  
FBR59-HW (1 form U) : **60A**
- **Mounting**  
**Through hole reflow, SMD** is available to ES
- **Latching Type**  
**Latching type** (1 coil type) is available to ES
- **Schedule**  
ES: Now  
MP: Now (only FBR59-HW type)



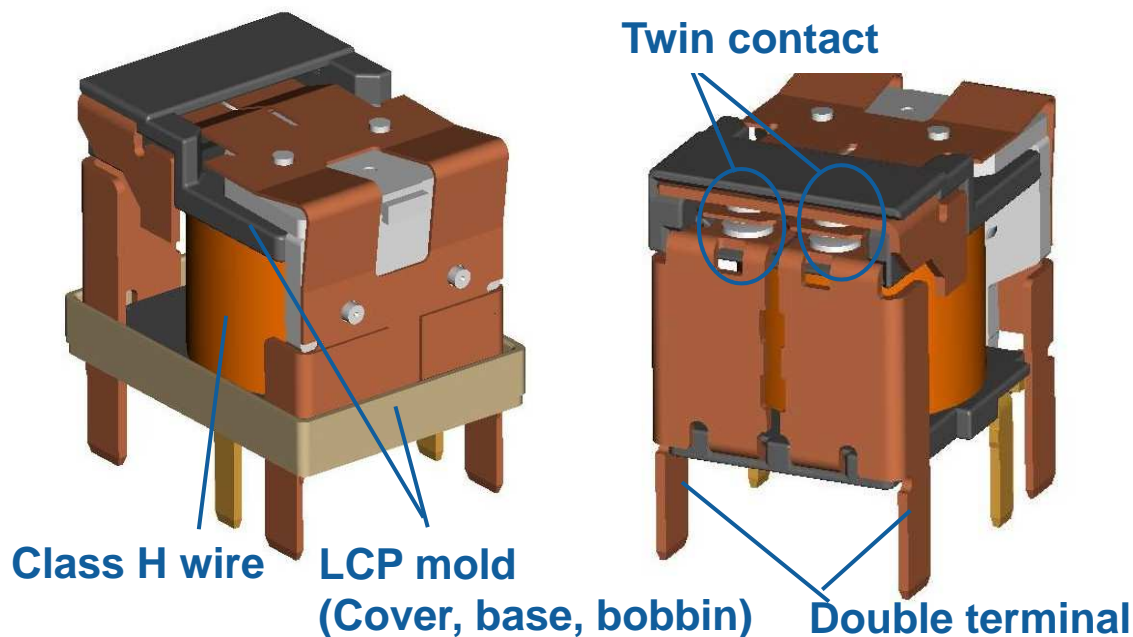
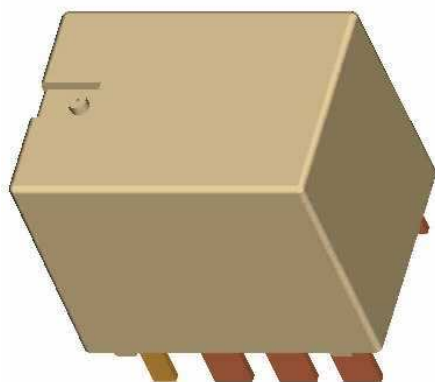
# Characteristics of FBR56-HW & FBR59-HW (2)



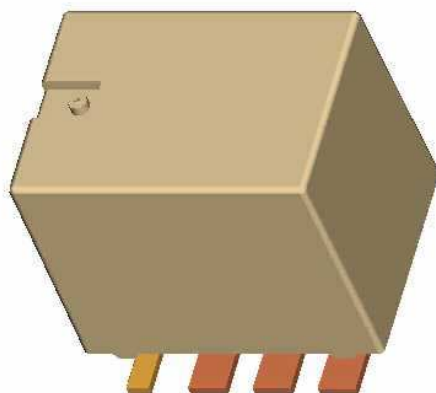
	FBR56-HW	FBR59-HW
<b>Dimension</b>	<b>L20 x W15 x H16.8</b>	<b>L20 x W15 x H16.8</b>
<b>Contact arrangement</b>	<b>1 Form C Double make, break contact</b>	<b>1 Form U Double make contact</b>
<b>Pin layout</b>		
<b>Mounting</b>	<b>Wave solder Through hole reflow, SMD</b>	<b>Same as FBR56-HW</b>
<b>Electrical life</b>	<b>DC14V 45A locked motor DC14V inrush 220A capacitor</b>	<b>Same as FBR56-HW</b>
<b>Acoustic Noise</b>	<b>Ave. 63dB/5cm</b>	<b>Same as FBR56-HW</b>
<b>Application</b>	<b>DC-DC converter Motor braking circuit</b>	<b>EPS, cooling fan blower heater main relay, outlet</b>

# Structure of FBR59-HW

## Through hole type



## SMD type






### Technologies

1. Double terminals
2. Twin contacts
3. High temperature mold materials (PBT to LCP)
4. High temperature coil wire (class F to class H)
5. Super low contact resistance: 1m ohm (average)

# Benchmark between Mini ISO and FBR56/59-HW



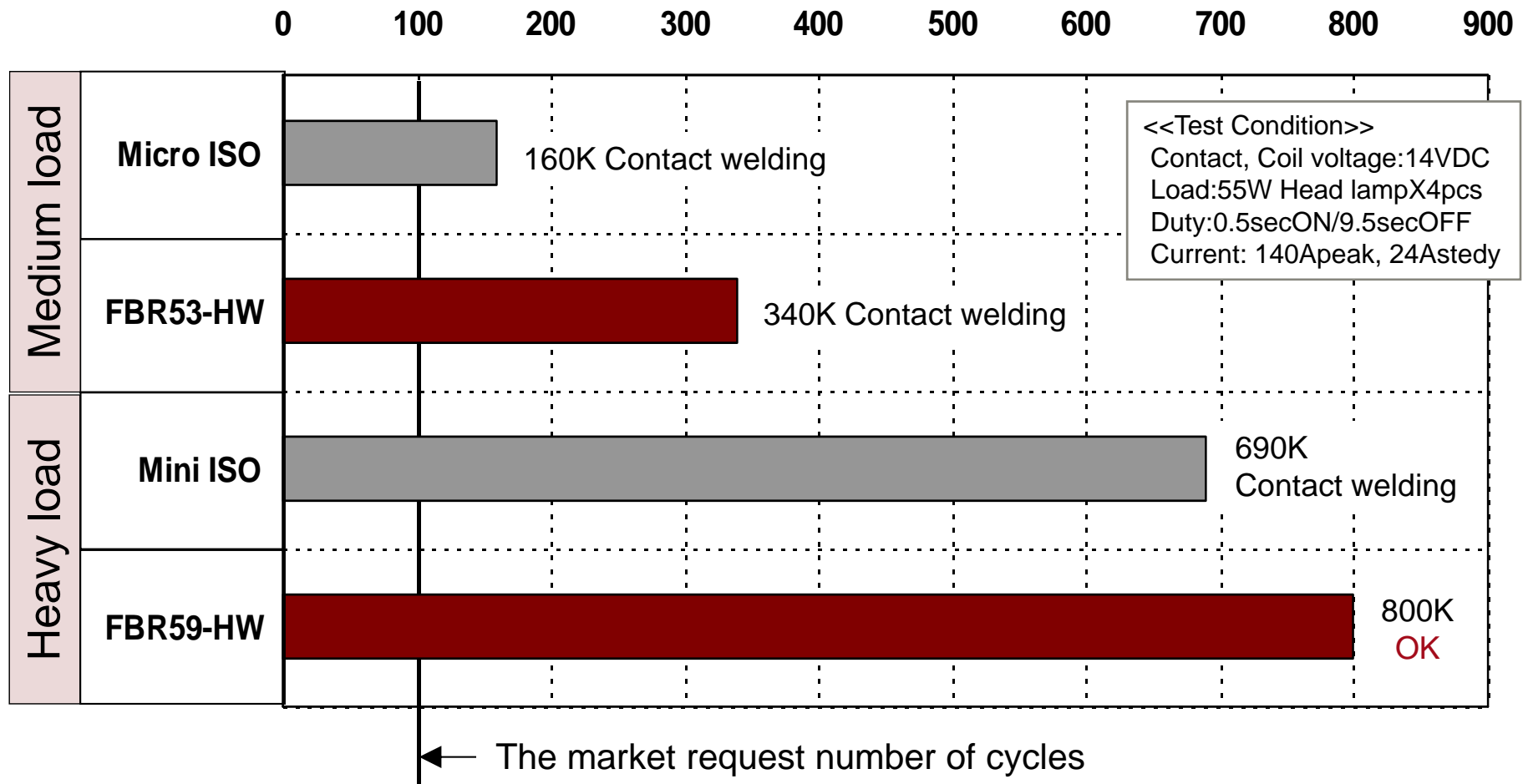
Item	Plug-in relay (Mini ISO type)	New	FBR53-HW
		FBR56/59-HW	
Dimensions	L26 x W22 x H25 	L20 x W15 x H16.5 	L15.5xW12.1xH13.7 
Volume	14,300mm <sup>3</sup>	4,950 mm <sup>3</sup>	2,569 mm <sup>3</sup>
Arrangement	1 form A, 1 form C	1 form C, 1 form U	1 form U
Operate voltage at 20deg.C	Max. 7.0VDC	Max. 7.3VDC	Max. 7.3VDC
Coil resistance	103 ohm	320 ohm	167 ohm
Coil current	117mA	38mA	71mA
Coil temperature rise (12VDC 20A at 25deg.C)	50 deg.C	15 deg.C	37 deg.C
Contact life	12VDC 40A 100K ops	12VDC 50A 100K ops	12VDC 40A 100K ops
Contact life (capacitive load)	--	12VDC 220A 100K ops	12VDC 200A 100K ops
Continuous current	--	12VDC 60A 1Hr (actual 100A)	12VDC 40A 1Hr (actual 80A)
Acoustic noise / 5cm	80dB	63dB	63dB
Weight	33g	13g	6g

# Comparison between Plug-in and PCB Relays (1)



## (1) 220W Lamp Load Test

Operation cycles (X 10<sup>3</sup> cycle)

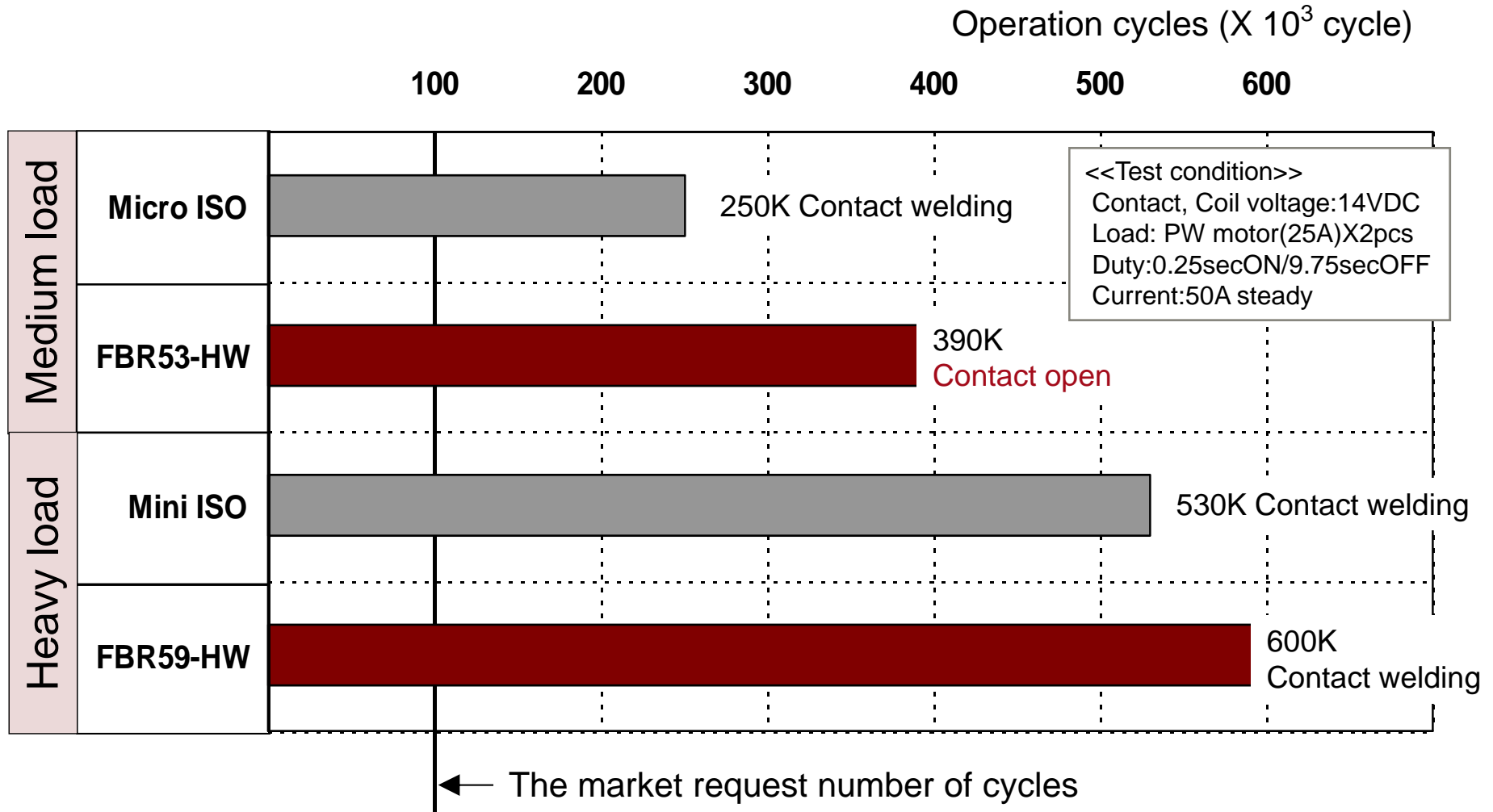




# Comparison between Plug-in and PCB Relays (2)



## (2) Motor Lock Load Test (50A)



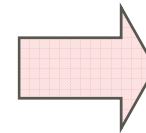
# Electric Power Steering (EPS) Relays

## Vehicle

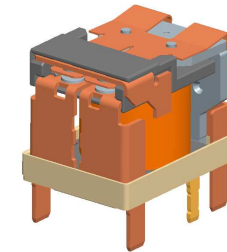
## Previous

## Current, Future

Large size  
80A- class



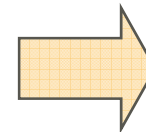
**New** FBR59-HW



4,860 mm<sup>3</sup>

Middle size  
50Aclass

Mini ISO  
14,300mm<sup>3</sup>

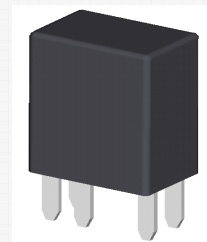


FBR53, FBR53-HW

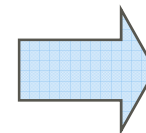


2,569 mm<sup>3</sup>

Compact size  
30Aclass



Micro ISO  
6,600mm<sup>3</sup>



FTR-P3



1,692mm<sup>3</sup>

FTR-P6



1,110 mm<sup>3</sup>

# DC-DC Convertors for Idling Cut

# Relays for DC-DC Convertors

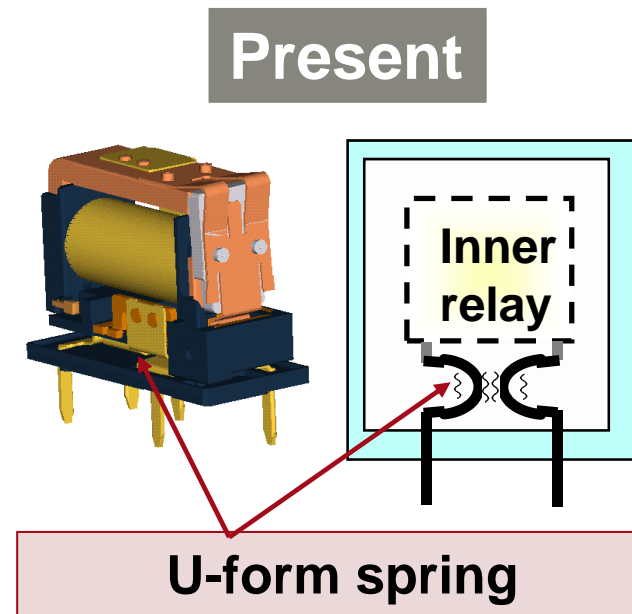
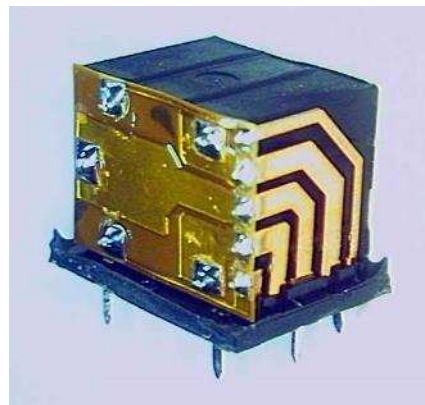
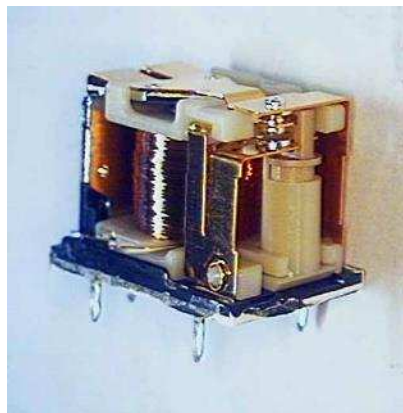
Vehicle	Recommended Relays	Contact Rating and Arrangement	Mounted Vehicles
Large size	<b>New</b> FBR56-HW 	1 form C 60A	
Middle size	FBR53-HW 	1 form A 40A	Subaru
	FTR-P5 Quiet relay 	1 form C 25A	Honda
	FTR-P3 	1 form C 25A	Nissan Hyundai Audi

# Fujitsu Quiet Relays

## 1. Features

- (1) 20 year history as a premier quiet relay manufacturer
- (2) Superior development capabilities

## 2. Quiet Relay Technology



Noise: 55 dB/5cm

55 dB

45-50dB

Method: Air damper

Gum cover + FPC

U form spring

# Low Profile Quiet Relay FTR-P7



**Low acoustic noise is indispensable for EV/PHV and idling cut**

## Features

Super low acoustic noise:  
45dB/5cm, 42dB/5cm with diode  
Low profile : Height 14mm

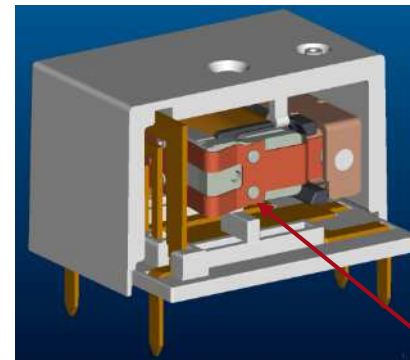
## Applications

Wiper, lamp etc.

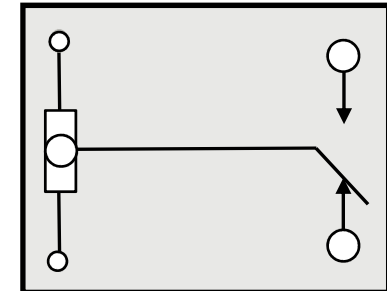
## Specifications

1. Coil power consumption: 0.64W
2. Electrical life: Wiper motor free  
Inrush 22A steady 5A  
1,500Kops

## Appearance



L21 x W17 x H14




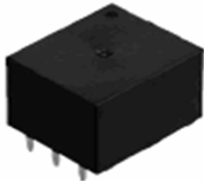

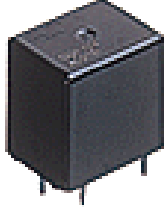
Inner relay: FTR-G1

## Schedule

ES : Now  
MP: Now



# Benchmark of Quiet Relays

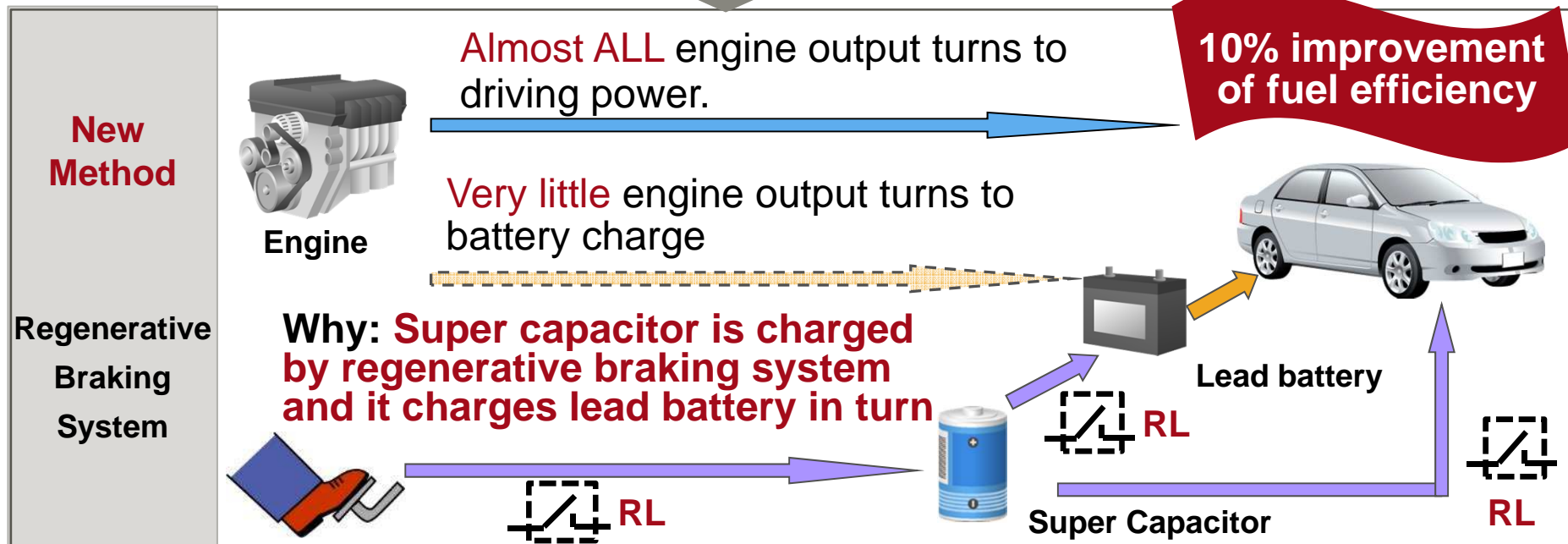
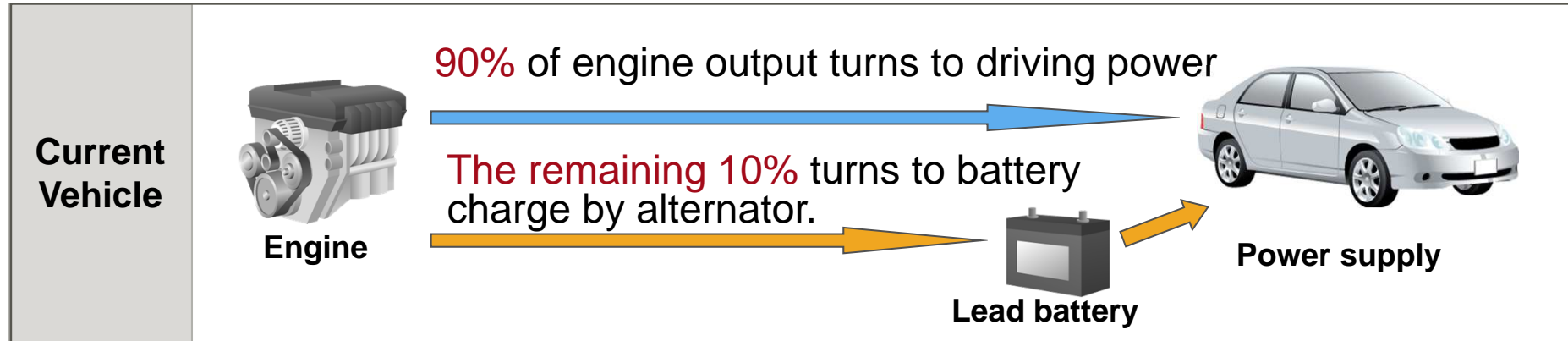
Item	Low profile type		Slim type	
	FCL FTR-P7	Company PT TA1	FCL FTR-P5	Company P CQ1
Dimensions L x W x H mm	20.8 x 17 x 14 	19.8 x 17 x 14 	20.4 x 9.7 x 16.7 	17 x 13 x 16.6 
Volume mm <sup>3</sup>	4,950 (100%)	4,712 (95%)	3,304 (100%)	3,669 (111%)
Coil power consumption	0.64	0.9 / 0.64	0.45	0.64
Carry current	25A 1H	20A 10min	30A 1H	25A 1H
Acoustic noise (5cm)	42-45dB	50-55dB	50dB	50dB
Electrical life Inrush: 22A Steady: 5A	1,500K ops. (Ability)		1,500K ops. (Ability)	
Compatibility	Compatible ↔ Compatible		P3 relay compatible	

# **Super High-Power Latching Relays**

for Disconnect Switch Charge Regenerative Current System

# Regenerative Braking Systems

To get high fuel efficiency, automobiles will change as follows.  
 New system **makes new demand of 60 - 200A latch relays (2-3pcs)**



# Super High Power Relays, FTR-V1 Series



## Applications

- (1) **Cuts the power supply** when vehicle is involved in an accident: for **fire prevention**
- (2) **Charge regenerative current system:**
  - Protect over charge
  - Supply electricity from capacitor to battery
  - Supply from capacitor to electronic application

## Visual



## Features

- |                          |   |
|--------------------------|---|
| (1) Coil                 | : Double winding latching   |
| (2) Carry current        | : 160A at 25 deg.C (Continuous)<br>110A at 120 deg.C (Continuous) |
| (3) Max. carry current   | : 1200A 0.2s at -40 deg. C  |
| (4) Contact life         | : 14VDC inrush 230A 100K ops.                                     |
| (5) Contact resistance   | : 600micro Ohm Max.   |
| (6) Ambient temp.        | : -40 to 120 deg.C  |
| (7) Terminal structure   | : Load > Screw stop terminal<br>Control > Press fit terminal      |
| (8) Small & light weight |   |

## Schedule

**ES: Now**  
**MP: Now**

# Relay for E-Call Applications

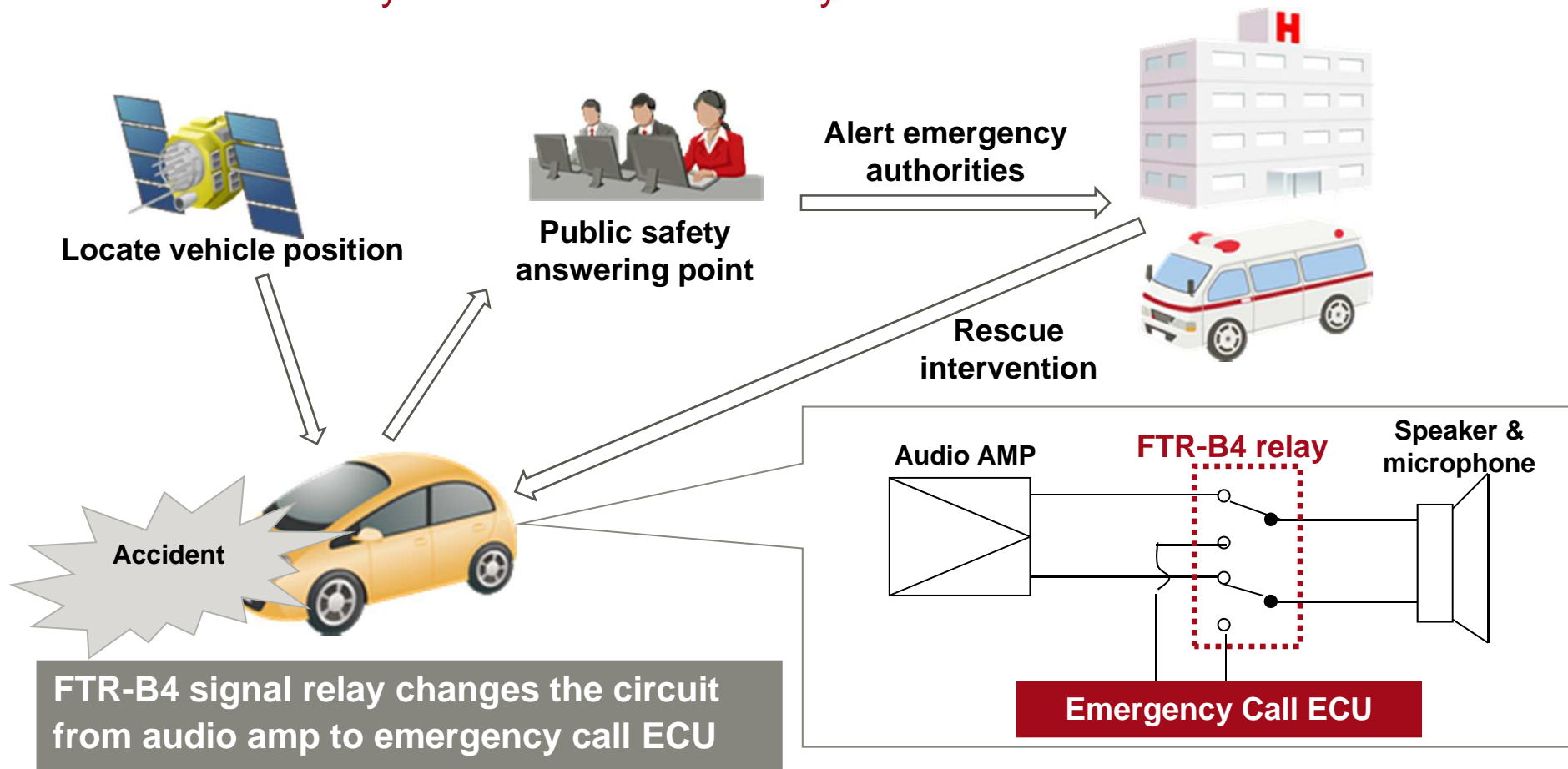
# FTR-B4 Signal Relay for E-Call Unit

New Application



In case of a traffic accident, the Emergency Call (E-Call) unit automatically transmits accident information, which identifies the vehicle location, enables emergency responders to speak with passengers, and greatly improves initial responsiveness to help save lives.

- Mandatory in the EU starting in April 2018
- This system will extend to many countries thereafter.

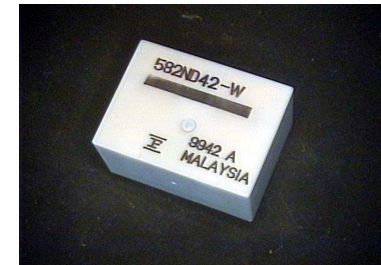


# **24V Battery Systems for Truck & Bus Applications**

# Application of 24V Battery Systems

## For Trucks & Buses

Necessary Spec: **Wide Contact Gap**



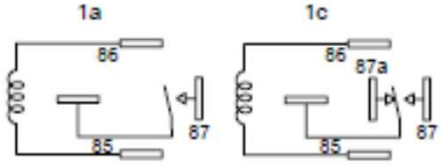
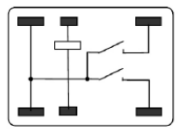


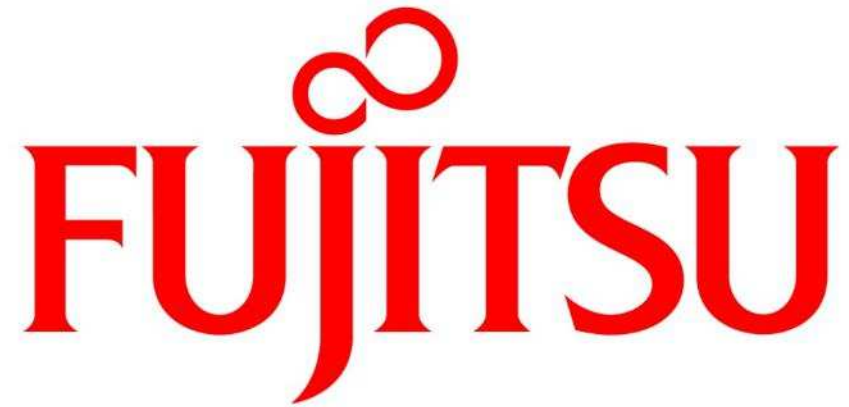
Application	Relay type	Contact Arrangement	Max. Switching	Contact Gap
Wiper	FBR57ND24-W	1 form C	28VDC 12A	0.8mm
Door lock-unlock	FBR572ND24-W (twin)	1 form C x 2	28VDC 12A	0.8mm
Window lift	FBR582ND24-W (twin)	1 form C x 2	32VDC 14A	1.4mm
Mirror	FBR582ND24-W (twin)	1 form C x 2	32VDC 14A	1.4mm
Sun roof	FBR52ND24-W	1 form C	28VDC 6A	0.6mm
Lamp	FBR59ND24-Y-HW (plan)	1 form U (A)	28VDC 20A	1.0mm
Disconnect SW	FTR-V1 (plan )	1 form A or B	28VDC 200A	



# Benchmark between Mini ISO & FBR59-HW 24V Relays



Items	Mini ISO CB1 -P-24V	NEW FBR59ND24-Y-HW	Advantage of FBR59-HW
Dimensions	L26.4 x W21.9 x H25.6 	L20 x W15 x H16.5 	
Volume	14,800 mm <sup>3</sup>	4,950 mm <sup>3</sup>	Volume to 1/3
Schematics			
Contact arrangement	1 Form C, A	1Form U (1Form A)	
Contact rating	N.O side 28VDC-20A N.C side 28VDC-10A	N.O side 28VDC-20A	
Coil resistance	320 ohms	680 ohms	Reduce driver costs
Coil current	75 mA	35 mA	
Weight	33 gr	13 gr	Weight to 1/3
Schedule	—	ES Dec 2015	



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