

IC Packages for Power Supply Systems

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1. Introduction

In recent years, accompanying the high density board assembly technology that enables the realization of smaller, lighter and higher performance electric products, development has continued for packaging technology, including IC assembly technology.

As such, an overview of Fuji Electric's IC package technology and IC packages for power supply systems will be presented below.

2. Overview of Fuji Electric's IC Package Technology

In 1981, Fuji Electric brought to market a DIP (dual in-line package), and thereafter has been providing fine pitch and low profile compatible SOP (small out-line package), QFP (quad flat package), SSOP (shrink small out-line package) and TSSOP (thin shrink small out-line package) packages. Additionally, Fuji Electric is planning a product line of their SON (small out-line non-lead) and QFN (quad flat non-lead) products, and in response to customer requests, can also provide BGA (ball grid array) and LGA (land grid array) packages. Figure 1 shows the QFN48 pin package.

Futhermore, Fuji Electric independently developed a clear resin mold package for autofocus ICs and has been providing this package as a finished product since 1988. At present, there is widespread utilization of

autofocus modules. In these modules, an optical lens system is precisely positioned and attached onto the clear resin mold package. Figure 2 shows the clear resin package and the AFM (autofocus module) product.

In addition to COB (chip on board) assembly technology with which the driver module is made into a finished product, Fuji Electric also possesses gold bump and solder bump processes, and can comply with CCB (controlled collapse bonding), COF (chip on film) and COG (chip on glass) assembly.

3. IC Packages for Power Supply Systems

Fuji Electric's power supply IC products can be roughly classified as either small-scale package products of 1 to 3 channels or middle-scale package products of 4 or more channels. At present, all packages being mass-produced for power supply ICs are plastic mold packages.

Small-scale packages are provided as DIP, SOP, SSOP and TSSOP, depending upon the application. Packages are available for proper types of small pin packages, from 6 pins to 20 pins. Middle-scale packages correspond to the package size, lead pitch and lead shape requested by the customer, and at present, mass production mainly centers on the vari-

Fig.1 QFN48 pin package

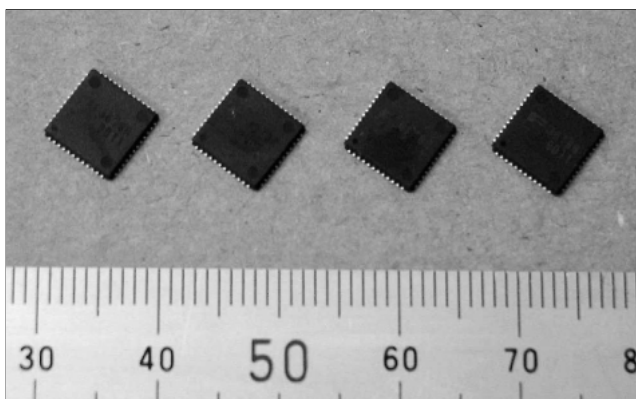


Fig.2 Clear mold package and AFM (autofocus module) products

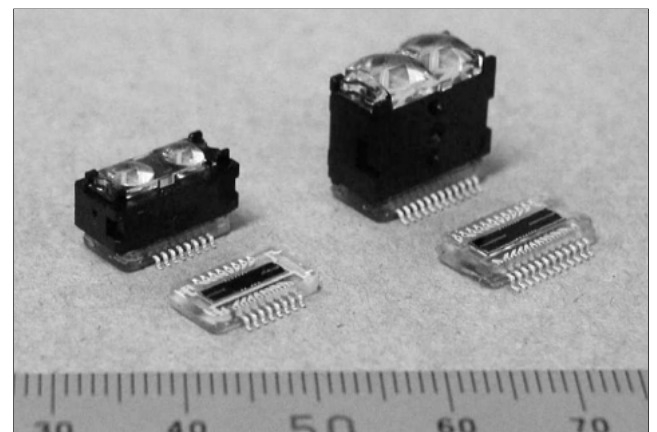


Table 1 Fuji Electric's main IC packages for power supply systems

Package	Lead pitch (mm)	Height (mm)	Pin count									
			6	8	16	20	28	32	48	56	64	80
DIP	2.54	4.30	●	●	●	●						
SOP	1.27	2.20		●	●							
SSOP	0.65	2.00			●	●						
TSSOP	0.65	1.10		●	●							
SON	0.50	0.85		▽	▽							
QFP	0.50	1.55						●	●		●	●
QFN	0.50	1.00					○		●	▽		
LGA	0.50	1.30										○

●: Currently mass produced and supplied ○: Under development ▽: Under consideration

ous types of QFPs. Product lines are being planned for QFN and LGA packages. Table 1 summarizes Fuji Electric's main IC packages for power supply systems.

Recently, various packaging technologies have emerged which enable the formation of packages near the chip size, known as CSP (chip size package). Also, customer demands are increasing for CSPs for use in mobile products. However, conflicting issues must be resolved such as the generation of heat that occurs as chips for power supply ICs are made more highly integrated, with higher efficiency and higher speed. Fuji Electric is carefully examining the following topics by considering which form of CSP can be utilized for power supply IC packages and whether there exists other assembly technology.

- (1) Realization of low impedance packages for low impedance products
- (2) Resolution of thermal problems caused by packaging and the assembly method
- (3) Cost merits for small scale power supply IC products

There are many problems in addition to the development of the package itself. In the newly developed packages where the assembly area is small and pitch is fine, development tools are often not commercially available as general components, and the IC socket that connects the electric terminal in the package and electric cell characteristic test system is especially problematic. Based on these conditions, at the development stage of a new package, a socket for measuring the electrical characteristics of the product and a measuring method are concurrently developed, and package engineers, test engineers and design engineers unite to realize stable product specifications.

4. Compliance With Pb-Free IC Packages for Power Supply Systems

There are basically the following two themes involved in making IC packages Pb-free.

- (1) Realizing high temperature performance of the package with raising the melting point of the Pb-free solder paste
- (2) Making the package Pb-free by utilizing Pb-free electronics finishing

At present, it has been verified that high temperature performance is realized for Fuji Electric's mass-produced power supply ICs under the assembly conditions of reflow 260°C peak/255°C for 10 seconds. Since their development stage, packages being prepared for mass production have been designed to realize high temperature performance characteristics.

Ti/Pd/Au, Sn-Ag, Sn-Bi and Sn-Cu plating materials are being considered for electronics finishing, and are being diligently promoted so that the mass production and supply of finished products will be Pb-free as of April 2001.

5. Conclusion

As discussed above, until now Fuji Electric's power supply ICs were supplied mainly as standard packages. However, with the future growth of mobile products and emergence of new electronic devices, various packages and assembly formats will also have to be supplied to the power supply IC field.

So as to be able to respond quickly to these types of market conditions and customer demands, Fuji Electric is committed to promote the development of technology for power supply ICs in consideration of the packaging format through assembly method.



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