

NEW PRODUCTS 4

**4TH GENERATION SIGNAL RELAY
ULTRA HIGH DENSITY
UA2/UB2 RELAY**

Naoto Okihara

Introduction

Signal relays are one of the mechanical relays used in backbone telecom fields such as telephone exchangers and transmission equipment or in terminal telecom fields such as PC modems and terminal adapters. These days, considerable pressure is being placed on manufacturers to make their signal relays smaller and more efficient (less energy consuming). In particular, consumers demand conventional-sized boards that support more communication ports, and a greater range of services through an increase in the number of components. In order to satisfy such demands, relays need to be

further miniaturized and lighter. With this in mind, NEC has developed an ultra-high-density relay, the UA2/UB2, whose mounting space is 58% and weight about half that of conventional relays.

Technical Trends

The trend toward miniaturization in signal relays, as shown in Figure 1, is measured using an index in which miniaturization is defined as the product of coil power consumption (mW) multiplied by relay volume (cubic cm) divided by the number of contact sets. The vertical axis is the miniaturization index and the horizontal axis

is the relay development year (FY). In the ten years from the development of the MR22/24 relay to the development of the EA2/EB2/EC2/EE2 relay, known as a 3rd generation (3G) signal relay, the miniaturization index shows that relays decreased in size by more than 90%. Next generation relays, 4th generation (4G), are expected to register no more than 30 on the miniaturization index.

Relay Structure

1. Magnetic circuit

Figure 2 shows the basic relay structure. The magnetic circuit used is polarized with

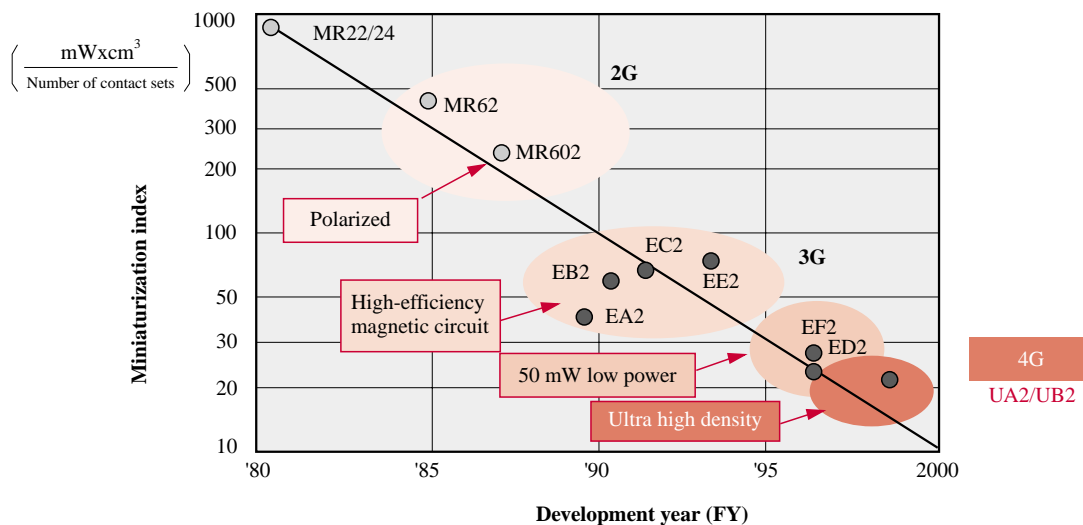


Fig. 1 Miniaturization Index

a seesaw balanced armature structure, and has a U-shaped core with a permanent magnet held between its two ends. The seesaw balanced armature structure is symmetrical and efficient because of the reduction in magnetic flux leak in the closed magnetic loop.

2. Basic relay structure

The relay can be broadly divided into three parts: an armature block assembly that has movable contacts and an armature, a coil assembly that has a core and a coil, and a base assembly that has stationary contacts and holds the coil assembly internally. The coil assembly is preset with the permanent magnet in the injection-mold die of the base assembly and is obtained from the same process as the base assembly injection molding. The technology is called double injection molding. The armature block assembly is mounted on the permanent magnet and operates like a seesaw with the protruding center of the armature acting as a fulcrum.

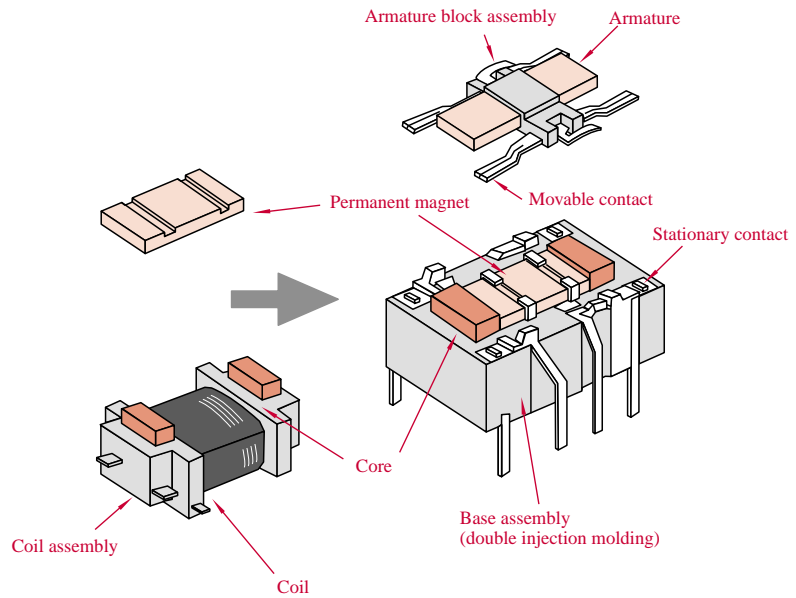


Fig. 2 Basic Relay Structure

3. Magnetic circuit design

In order to maintain a coil power consumption of 140 mW despite the small relay volume, a three-pole permanent magnet with the N pole at the center and S poles at the ends is adopted. The three-pole permanent magnet does not require a coil wound in the center of the core. Generally, a thinner, longer and more tightly wound coil can obtain better magnetic energy. The three-pole permanent magnet can therefore efficiently utilize the magnetic flux generated from the magnet. In a magnetic circuit design consisting of a permanent magnet, a core, and an armature, the important point is the determination of magnetic parameters such as the magnetic pole gap, the core cross section, the armature cross section, and the core pole area. In this circuit, these magnetic parameters were determined from the results of experiments carried out using magnetic simulation. With the UA2/UB2, it has been possible to obtain an electromotive force (which indicates the magnetic energy when the rated voltage is applied to the coil) that is almost the same as that of conventional relays, in spite of miniaturization.

4. Insulation design

(1) Contact gap

Because almost the same electromotive

Item		EC2	UA2
Mounting space (mm)		15 x 7.5	10.9 x 76.0
Mounting height (mm)		9.4	8.3
Coil power consumption (mW)		100 to 200	100 to 230
Max. switching current (A)		2	1
Max. switching power		30 W/125 VA	30 W/37.5 VA
Dielectric withstanding voltage (VAC)	Open contacts	1000	1000
	Adjacent contacts	1000	1000
	Coil to contacts	1500	1500
Surge withstanding voltage (coil to contacts)		2500	2500
Weight (g)		About 1.9	About 0.9

Table 1 Specification Comparison with Conventional Relay

force as that of conventional relays was obtained, a contact gap that could satisfy 1000 V AC for 1 minute was secured.

(2) Insulation distance between coil and contacts

In order to comply with the Bellcore requirement of a 2500 V surge under 2 x 10 μs, an insulation distance (creepage distance) of more than 2 mm is needed. The coil of the UA2/UB2 relay has a double flange structure and is molded with double injection molding technology. The double

flange structure allows a creepage distance of more than 2 mm, thus satisfying the Bellcore-prescribed 2500 V surge.

Major Specifications

There are two types of relays. The UA2 is a through-hole type and the UB2 is a surface type. The UA2 and UB2 only differ in their terminal shape. The major specifications for the UA2 are compared with those of the conventional EC2 relay in Table 1.

• Dimensions

The relay mounting space is 58% of EC2,

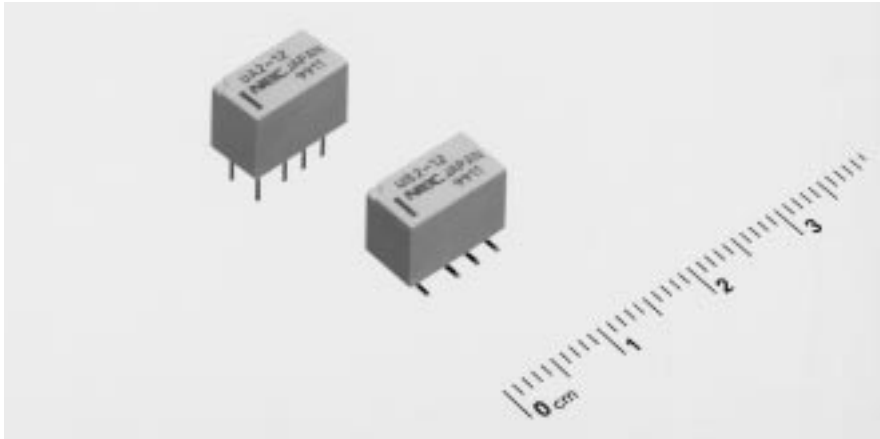


Photo 1 Relay Appearance

- and the relay volume is 51% of EC2.
- Coil power consumption
The standard coil power consumption is 140 mW; the same as EC2. The coil power consumption varies from 100 mW to 230 mW, depending on the series.
- Dielectric withstanding voltage
Between open contacts: AC 1000 V for 1 minute.
Between coil and contacts: 2500 V surge

- under $2 \times 10 \mu\text{s}$ (Bellcore requirement).
- Weight
About 0.9 g (about half of EC2's 1.9 g).

Summary

The ultra-high-density relay UA2/UB2 has been developed with the same dielectric withstanding voltage as that of conventional relays. The relay's small size and lightweight features facilitate coexistence

with electronic parts and semiconductor devices. Because the UA2/UB2 incorporates twice the number of communication ports on a conventional-sized board, and has realized an increase in mounted components due to its light weight, this product is expected to give users flexibility and broaden relay applications in this evolving multimedia telecom field.